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PISCATIONES IN MAURETANIA TINGITANA: MARINE RESOURCE EXPLOITATION IN A ROMAN NORTH AFRICAN PROVINCE

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by

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ABSTRACT

FACULTY OF LAW, ARTS AND SOCIAL SCIENCES

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PISCATIONES IN MAURETANIA TINGITANA: MARINE RESOURCE EXPLOITATION IN A ROMAN NORTH AFRICAN PROVINCE

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This study determines the methods, products and areas of marine resource exploitation in the northwest Maghreb during the mid-1st to late 3rd centuries AD, when the region constituted the Roman province of *Mauretania Tingitana.* At the centre of this thesis are two data sets that are contextualised within the specific marine, lagoonal and riverine environments of the province: regional archaeological data (marine animal remains, fishing equipment, and finds related to fish-salting practices) and relevant descriptive data (written sources, iconography and ethnography). This material included in this study derives not only from the Roman period but also the preceding Punico-Mauretanian and subsequent Late Roman periods. Such a diachronic analysis identifies the ways in which the practice and role of fishing and consumption of its products were affected by the region's incorporation into the Roman Empire.

The region's maritime cultural landscape was conducive to a variety of exploitation methods, practised throughout all periods examined. However, the socio-cultural, economic and technological structures that were the consequences of inclusion into the Roman political system developed to a level that reached commercialisation of the resource. Thus, for the first three centuries AD, anthropogenic factors instituted a change in the way in which people moved through and related to the marine environment of the northwest Maghreb.

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DECLARATION OF AUTHORSHIP

I, ………………………………Athena L. Trakadas………………………………….,

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……*Piscationes in Mauretania Tingitana*: Marine resource exploitation in a …………..

……Roman North African province....................................……………………………

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  Trakadas, A., "Archaeological evidence for ancient fixed-net fishing in northern Morocco" in D. Bernal Casasola (ed.), *Workshop Internacional: Artes de pesca en la Antigüedad Clásica, in Cadiz, Spain, November, 2007* (Oxford, *in press*)

  Erbati, E., & A. Trakadas, *The Morocco Maritime Survey. An archaeological contribution to the history of the Tangier peninsula* (Oxford 2008)

Signed: ………………………………………………………………………..

Date:……………………………………………………………………………….

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Κάθε όνειρο στο χάρτη...

Abbreviations

Latin and Greek sources

AE	*L'Année épigraphique*
Astr.	Manilius, *Astronomica*
CIL II	Hüber, E., *Corpus Inscriptionum Latinarum* II: *Inschriften der drei Provinzen der iberischen Halbinsel: Hispania citerior, Baetica und Lusitrania* (Berlin 1869)
CIL IV	Zangemeister, C., & R. Schoene (eds), *Corpus Inscriptionum Latinarum* IV: *Inscriptiones parietariae Pompeianae Herculanenses Stabianae* (Berlin 1871)
CIL VIII	Mommse, T., *Corpus Inscriptionum Latinarum* VIII: *Inschriften Nordafrikas ohne Agypten und die Cyrenaica, d. h. der Provinzen Mauretaniae Tingitana, Caesariensis und Sitifensis, Numidia und Africa proconsularis* (Berlin 1881)
Cod. Just.	Blume, F.H. (trans.), & T. Kearley (ed.), *Annotated Justinian Code* (2nd edn, Laramie, WY 2009)
DRR	Columella, *De Re Rustica*
Geo.	Claudius Ptolemy, *The Geography*
HA	Aristotle, *Historia Animalium*
Hal.	Oppian, *Halieutica*
IAM 1	Galand, L., J. Février & G. Vajda, *Inscriptions antiques du Maroc,* 1. *Inscriptions libyques*, *inscriptions puniques et néopuniques*, i*nscriptions hébraïques des sites antiques* (Paris 1966)
IAM 2	Euzennat, M., J. Marion & J. Gascou, *Inscriptions antiques du Maroc,* 2: *Inscriptions Latines* (Paris 1982)
ILM	Chatelain, L., *Inscriptions latines du Maroc* (Paris 1942)
ItAnt	Anonymous, *Antonine Itinerary*
NA	Aelian, *De Natura Animalium*
Not. Dig. Occ.	*Notitia Dignitatum, Occidentalis*
Onom.	Pollux, *Onomasticon*
Pomp. Mela	Pomponius Mela*, De Chorographia*

Rav. Cosmog.	*Ravennatis Anonymi Cosmosgraphia*
RIB II	Collingwood, R.G., & R.P. Wright, *Volume* II. *Instrumentum Domesticum, Fasc. 6*. In S.S. Frere & R.S.O. Tomlin (eds), *The Roman Inscriptions of Britain* (Stroud 1994)
Var.	Cassiodorus, *Variae epistolae*
Wars	Procopius, *History of the Wars*

Arabic sources

al-Andalousi	Kamal, Y. (trans.), Abou Hamid al-Andalousi, *Touhfat al-Albāb*, in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* III, fas. 4 (Cairo 1934): 874
al-Bakrî	de Slane, M.G. (trans.), Abou Abdullah al-Bakrî, *Kitab al- Massālik wa-l-Mamālik* (*Description de l'Afrique septentrionale par Abour-Obeïd-el-Bekri)* (Paris 1965)
al-Housain	Kamal, Y. (trans.), Ishaq Ibn al-Housain, *Kitāb ākām al-mardjān fī dhikr al-madā'in al-machhōūra fī koll makōūn*, in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* III, fas. 2 (Cairo 1932): 623-624
al-Idrîsî	Hadj-Sadok, M. (trans.), Abu Abd Allah Muhammad al-Idrîsî, *Kitāb Nuzhat al-Mushtāq fi ikhtirāq al-āfāq (Le Maghrib 6^{e} siècle de l'hégire [12^{e} siècle après J.C.])* (Paris 1983)
al-Khwarezmi	Kamal, Y. (trans.), Moh. Ibn Mousa al-Khwarezmi, *Kitāb sōūrat al-Ard*, in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* III, fas. 1 (Cairo 1930): 519-523
al-Mas^{c}oudi	Kamal, Y. (trans.), al-Mas^{c}oudi, *Mourōūdj al-Dhahab wa Ma'ādin al-Djawāhir,* in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* III, fas. 2 (Cairo 1932): 625-629
al-Mukaddasî	Miquel, A. (trans.), Muh. ibn 'Abd al-Hadi al-Mukaddasî, *Ahsan at-Taqāsīm fī Ma'rifat al-Aqālīm (Le meilleure répartition pour la connaissance des provinces)* (Damascus 1963)
al-'Omarī	Gaudefroy-Demombynes, A.M. (trans.), Ibn Fadl Allah al-'Omarī, *Masālik el Absār fi mamālik el amsār (Vol. I: L'Afrique, moins l'Égypte)* (Paris 1927)
al-Sabtī	Lévi Provençal, E., "Une description de Ceuta musulmane au XV^{e} siècle (Moh. ibn al-Qāsim ibn 'Abd al-Malik al-Ansāri al-Sabtī, *Ikhtisār al-Akhbār*)," *Hespéris* 12 (1931): 145-176
al-Zouhri	Kamal, Y. (trans.), al-Zouhri, *Djoughrāfiya*, in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* III, fas. 3 (Cairo 1933): 801-803

Ibn H̲awk̲al	Kramers, J.H., & G. Weit (trans.), Moh. Abul-Kassem Ibn H̲awk̲al, *Kitāb Sūrat al Ard* (*Configuration de la terre*) (Paris, Beirut 1964)
Ibn Khaldun	Kamal, Y. (trans.), Ibn Khaldoun, *Kitāb al-'Ibar,* in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* IV, fas. 3 (Cairo 1938): 1340-1348
Ibn Sa'id	Kamal, Y. (trans.), 'Ali ibn Sa'id al-Maghribī al-Andalousī, *Kitāb Djōūghrafiyā fi 'l-Aqālim al-Sab,* in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* IV, fas. 1 (Cairo 1936): 1080-1091
Yâk̲ût	Kamal, Y. (trans.), Yâk̲ût al-H̲amawî, *Mu*^{c}*d̲jam al-Buldân*, in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* III, fas. 5 (Cairo 1935): 946-965

Historical sources

Chron. du Pierre	Kamal, Y., "Chronique du Pierre le cruel óu le Justicier, roi de Castille, AD 1350-1369," *Monumenta Cartographica Africae et Aegypti,* IV, fas. 2 (Cairo 1937): 1251-1252
Leo Africanus	Brown, R. (ed.), Leo Africanus, *The History and Description of Africa* (trans. John Pory, 1600) (London 1896)
Lo Conpasso	Kamal, Y. (trans.), *Lo Conpasso de navegare,* in Y. Kamal (ed.), *Monumenta Cartographica Africae et Aegypti,* IV, fas. 1 (Cairo 1936): 1108-1111
de Zurara	Kamal, Y., "Gommes Eannes de Zurara, Crónica da tomanda da cidade de Cepta por elrey Dom Joham o Primiero [end March 25, 1450]," *Monumenta Cartographica Africae et Aegypti,* IV, fas. 4 (Cairo 1939): 1387-1388

General abbreviations

AEspA	*Archivo Español de Arqueología*
L'Africa romana 5	Mastino, A. (ed.), *L'Africa romana. L'epigrafia e la storia delle province romane del Maghreb. Atti del V convegno di studio, Sassari, 11-13 dicembre 1987* (Sassari 1988)
L'Africa romana 10	Mastino, A., & P. Ruggeri (eds), *L'Africa romana. Civitas: l'organizzazione dello spazio urbano nelle province romane del Nord Africa e nella Sardegna. Atti del X convegno di studio, Oristano, 11-13 dicembre 1992* (Sassari 1994)
L'Africa romana 11	Khanoussi, M., P. Ruggeri & C. Vismara (eds), *L'Africa romana. La scienza e le techniche nelle province romane del Nord Africa e nel Mediterraneo. Atti dell'XI convegno di studio, Cartagine, 15-18 dicembre 1994* (Ozieri 1996)

L'Africa romana 12	Khanoussi, M., P. Ruggeri & C. Vismara (eds), *L'Africa romana. L'organizzazione dello spazio rurale nelle province del Nord Africa e nella Sardegna. Atti del XII convegno di studio, Olbia, 12-15 dicembre 1996* (Sassari 1998)
L'Africa romana 13	Khanoussi, M., P. Ruggeri & C. Vismara (eds), *L'Africa romana. Geografi, viaggiatori, militari nel Maghreb: alle origini dell'archeologia nel Nord Africa. Atti del XIII convegno di studio, Djerba, 10-13 dicembre 1998* (Rome 2000)
L'Africa romana 14	Khanoussi, M., P. Ruggeri & C. Vismara (eds), *L'Africa romana. Lo spazio marittimo del Mediterraneo occidentale: geografia storica ed economia. Atti del XIV convegno di studio, Sassari, 7-10 dicembre 2000* (Rome 2002)
L'Africa romana 15	Khanoussi, M., P. Ruggeri & C. Vismara (eds), *L'Africa romana. Ai confini dell'Impero: contatti, scambi, conflitti. Atti del XV convegno di studio, Tozeur 11-15 dicembre 2002* (Rome 2004)
L'Africa romana 16	Akerraz, A., P. Ruggeri, A. Siraj & C. Vismara (eds), *L'Africa romana. Mobilità delle persone e dei popoli, dinamiche migratorie, emigrazioni ed immigrazioni nelle province occidentali dell'Impero romano. Atti del XVI convegno di studio, Rabat, 15-19 dicembre 2004* (Sassari 2006)
L'Africa romana 17	González, J., P. Ruggeri, C. Vismara & R. Zucca (eds), *L'Africa Romana. Le ricchezze dell'Africa. Risorse, produzioni, scambi. Atti del XVII convegno di studio Sevilla, 14-17 dicembre 2006* (Rome 2008)
AJA	*American Journal of Archaeology*
AJP	*American Journal of Philology*
AntAfr	*Antiquités Africaines*
ASHM I	Bernal, D., B. Raissouni, J. Ramos & A. Bouzouggar (eds), *Actas del I seminario Hispano-Marroquí de especialización en arqueología* (Cádiz 2006)
ASHM II	Bernal, D., B. Raissouni, J. Ramos, M. Zouak & M. Parodi (eds), *En la orilla africana del Círculo del Estrecho. Historiografía y proyectos actuales. Actas del II seminario Hispano-Marroquí de especialización en arqueología* (Cádiz 2008)
BAM	*Bulletin d'Archéologie Marocaine*
BCTH	*Bulletin Archéologique du Comité des Travaux Historiques et Scientifiques*
CEIPAC	Centro para el Estudio de la Interdependencia Provincial en la Antigüedad Clásica (on-line database): http://ceipac.gh.ub.es/

Cetariae 2005	Lagóstena, L., D. Bernal & A. Arévalo (eds), *Cetariae 2005. Salsas y salazones de pescado en occidente durante la Antigüedad. Actas del Congreso Internacional (Cádiz, 7-9 de noviembre de 2005)* (Oxford 2007)
CIEG I	Ripoll Perelló, E. (ed.), *Actas del Congreso Internacional 'El Estrecho de Gibraltar' Ceuta 1987* (Madrid 1988)
CIEG II	Ripoll Perelló, E., & M.F. Ladero Quesada (eds), *Actas del II Congreso Internacional 'El Estrecho de Gibraltar' Ceuta 1990* (Madrid 1995)
CRAI	*Comptes rendus des séances Académie des inscriptions et belles-lettres*
DAI	Deutsches Archäologisches Institut
Ex Baetica Amphorae	A.A.V.V., *Congreso internacional Ex Baetica Amphorae*; *Conservas, aceite y vino de la Bética en el Imperio Romano. Sevilla – Écija, 17 al 20 de diciembre de 1998* (Écija 2000)
Histoire et archéologie de l'Afrique du Nord 6	Trousset, P. (ed.), *Histoire et archéologie de l'Afrique du Nord. Actes du VIe colloque international: L'Afrique du Nord antique et médiévale. Productions et exportations africaines, actualités archéologiques (Pau, octobre 1993)* (Aix-en-Provence 1995)
IJNA	*International Journal of Nautical Archaeology*
INSAP	Institut National des Sciences d'Archéologie et du Patrimoine
Inst. naut.	Service hydrographique de la marine. *Instructions nautiques: France (côte Sud et Corse), Algérie, Tunisie, Maroc (côte Nord)* (Paris 1932)
INRH	Institut National de Recherche Halieutique
JRA	*Journal of Roman Archaeology*
JRS	*Journal of Roman Studies*
Lixus Actes	A.A.V.V., *Lixus. Actes du colloque organisé par l'Institut des Sciences de l'Archéologie et du Patrimoine de Rabat avec le concours de l'École française de Rome, Larache, 8-11 novembre 1989* (Rome 1992)
Lixus-1	Aranegui Gascó, C. (ed.), *Lixus. Colonia fenicia y ciudad púnico-mauritana anotaciones sobre su ocupación medieval* (Valencia 2001)
Lixus-2	Aranegui, C., & M. Habibi (eds), *Lixus-2. Ladera Sur* (Valencia 2005)
MEFRA	*Mélanges de l'École Française de Rome, Antiquité*

NID I	Naval Intelligence Division, *Morocco,* I. BR 506A Geographical Handbook Series (Oxford 1941)
NID II	Naval Intelligence Division, *Morocco,* II. BR 506A Geographical Handbook Series (Oxford 1942)
NIMA 143	National Imagery and Mapping Agency Publication 143, *Sailing directions (en route): West Coast of Europe and Northwest Africa* (Bethesda, MD 1994)
NIMA 131	National Imagery and Mapping Agency Publication 131, *Sailing directions (en route): Western Mediterranean* (Bethesda, MD 2000)
NAP	*Nouvelles archéologiques et patrimoniales*
NIMA #52039	National Imagery and Mapping Agency, Chart #52039: *Strait of Gibraltar* (Bethesda, MD 1995)
PSAM	*Publications du Service des Antiquités du Maroc*
REA	*Revue des Études Anciennes*
UAM	Universidad Autónoma de Madrid
USNHO	U.S. Navy Hydrographic Office No. 134, *Sailing Directions for the West Coast of Spain, Portugal and NW Africa and Off-lying Islands* (6th edn, Washington D.C. 1952)
W. Div. Med.	Anonymous, "The Western Division of the Mediterranean – Navigation passages from West to East," *Nautical Magazine* 32 (1863): 460-461

Chapter 1.
Introduction

The northwest Maghreb region occupies a unique geographical position. Spanning the corner of the African continent, the region's coastlines border two major and diverse marine ecosystems, the Mediterranean Sea and Atlantic Ocean, which are joined by the narrow Straits of Gibraltar (Fig. 1.1). To the east and south-east, the Rif and Atlas ranges have acted as effective geo-political boundaries for much of the region's development, prohibiting terrestrial movement and contact between peoples and creating an 'island-like' orientation.[1] In antiquity, it was largely due to this orientation that populations looked to the sea to facilitate contact and provide sustenance. The rich waters of the region, Pliny's "*in Mauretaniae maritimis*", were exploited for fish, shellfish and other marine invertebrates.[2] These resources were not only consumed fresh but were also processed to manufacture salted dried foodstuffs, sauces and purple dyes.

The primary objective of this study is to determine the methods, areas and products of this marine resource exploitation within the particular environment of the northwest Maghreb during the mid-1st to late 3rd centuries AD, when the region constituted the Roman province of *Mauretania Tingitana.* By examining and contextualising relevant archaeological and descriptive data, this study identifies the ways in which the practice and role of fishing and consumption of its products were affected by the incorporation of the region into the Roman Empire. What emerges is a diverse portrait of an activity whose role in the social and economic life of the settlements of *Mauretania Tingitana* has been consistently underappreciated in archaeo-historical studies.

MATERIAL BASIS AND PROBLEMS

The first historical study of marine resources in the region was published by M. Ponsich and M. Tarradell in 1965, focusing on the evidence for the Roman-period fish-salting industry in northern Morocco. This publication deals almost exclusively with the chronology of seven coastal facilities of the province where fish and shellfish were salted and processed into dried foodstuffs, sauces and purple dyes: Sania e Torres, Ksar-es-Seghir, Zahara, Cotta, Tahadart, Kouass and *Lixus*. Ponsich and Tarradell's work remains a fundamental investigation and

[1] Shaw 1976: 144-145; Shaw 1986: 66-67
[2] Pliny, *NH* 9.56.115

important point of departure for such analyses of the industry.[3] Since this study, however, other publications have appeared on additional contemporary fish-salting facilities identified within *Mauretania Tingitana* at Metrouna, *Septem Fratres*, Dchar 'Askfane, *Banasa, Thamusida* and Essaouira.[4]

The above-outlined data provide an outstanding basis for an examination of ancient marine resource exploitation, but relate exclusively to the fish-salting industry of the province. Firstly, within this corpus of published works, there is no synthetic examination of all the fish-salting sites now known in *Mauretania Tingitana*. Secondly, there exists little examination of the methods and equipment by which the marine resources were extracted to supply this industry, nor of the location of fishing effort in the past marine environments, the species caught, the relationship between the fish-salting industry and other natural resources required for the processing, such as salt and fresh water.[5] Moreover, there are fundamental lacunae in these studies, such as the reconstruction of human actions within the maritime landscapes that impact upon accessibility and use of specific fishing technology. As is the case with the extant archaeologically-oriented regional analyses of the fish-salting industry in the Graeco-Roman world, such approaches ultimately prohibit any attempts to quantify the industry's varied products, even at a general level, and establish the role of these in the ancient economy.[6]

It is only recently that excavations in the region, at the sites of *Lixus* and *Septem Fratres*, have included the identification of icthyo-archaeological and malacological finds in their analyses. In addition, studies have been published on several recent kiln discoveries along the Atlantic coastal plain where amphorae used to trans-ship the salted-fish products were manufactured. In the last decade, maritime archaeological surveys in the Straits of Gibraltar region have also located areas and types of ancient fishing methods. Significantly, adjustments to ceramics chronologies and re-evaluations of excavated material have also affected the dating of some of the fish-salting sites that were previously investigated.[7] These developments, as well as the state of previous scholarship, demonstrate a clear need for

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[3] Ponsich & Tarradell 1965, selectively reprinted in Ponsich 1988.
[4] Rebuffat 1977; Jodin 1967; Hita Ruiz & Villada Paredes 1994; Akerraz & El Khayari 2005; Cheddad 2006b: Bernal Casasola & Pérez Rivera 1999; Bernal Casasola 2006b: 189; Bernal, *et al*. 2008b: 332-335; Cerri 2007a; Cerri 2007b
[5] Exceptions for specific sites include, for example, Bernal Casasola 2006a; Hesnard 1998.
[6] E.g., Curtis 1991; Lowe 1997; Edmondson 1987; Étienne & Mayet 2002; see discussion in Wilson 2002b.
[7] Fish bones and shellfish: Grau Almero, *et al.* 2001; Rodríguez Santana & Rodrigo García 2005; Sagrario Carrasco Porras 2005; Roselló 1992; Chamorro Moreno 1988; kilns: Limane & Rebuffat 2004; Mlilou 1991; Kbiri Alaoui 2007; Cerri 2007a; Cerri 2007b; Habibi 2007; underwater surveys: Trakadas 2004a; Erbati & Trakadas 2008; Trakadas, *in press*; re-evaluation of materials: Habibi 2007.

comprehensive re-evaluation and new approaches to analysing marine resource exploitation in *Mauretania Tingitana*.

THE PRESENT STUDY

This study's temporal focus is the Roman period in *Mauretania Tingitana*, when the province was annexed in AD 42/43 until the end of the last Imperial governorship at *Volubilis* (AD 277-280).[8] Through the chronological extension of the examined data sets to the preceding Punico-Mauretanian and following Late Roman periods, this study also explores the diachronic changes of the exploitation, from the 5th century BC to the 6th century AD. The analysis of pre- and post-Roman materials makes it possible to determine the impact of 'Romanisation' upon fishing practices, human use of and relationship to the environment, consumption patterns and the urbanisation of the region.[9]

A range of sources relating to marine resource exploitation during these periods are compiled and analysed. These include:

> 1) *Archaeological data:* marine animal remains from archaeological contexts, finds of fishing equipment from the region and fish-salting facilities (and related industries such as salt sources, kilns and salazón amphorae)
>
> 2) *Descriptive data:* written sources relating to fishing, marine life and salted products of the northwest Maghreb, pictorial representations of marine life and fishing from the same area and regional ethnographic examples of fishing techniques

These data are contextualised within the specific marine, estuarine/lagoonal and riverine environments of the province. Through regional characterisations and case studies of topographically-diverse sites, the species of resources sought, the methods used to obtain them and the areas of fishing effort are reconstructed and evaluated. In order to determine the role this exploitation played in the provincial diet/foodways and economy, seafood is compared to agricultural goods consumption and salting is compared to other foodstuff production activities.

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[8] See Chapter 4.3.

[9] 'Romanisation' is a term used to refer to events or concepts that take many different forms, and has previously been applied to mean not only the introduction of different material culture and urban structures in regions that are provinces or border these, but also the assumption of selected identity and language (see Fentress 2006: 31-33; Rhorfi 2004a; Fear 1996: 270-276; López Castro 1992: 161). 'Romanisation' is used in this study to refer to the introduction of the Latin language, material goods, governance, as well as intensified urbanisation and the establishment of distinct architecture and structures. See Chapter 4.3 for further elaboration of this term.

SIGNIFICANCE

This study does not seek to re-analyse the fish-salting industry of the province, nor aim to detail the ancient Roman economy of the northwest Maghreb. Rather, this work assesses the environmental, social and economic consequences of the Roman incorporation of *Mauretania Tingitana*, its ‘Romanisation’, through the lens of marine resource exploitation. Although other areas of North Africa have been subject to regional-geographical approaches in landscape and resource use in antiquity, such applications have yet to be realised fully in archaeological studies relating to the former province.[10] It is apparent, however, that with the unique geographical situation and wealth of marine resources, such approaches particularly relating to maritime analyses are warranted for furthering our understanding of the region’s past.

This study sheds light upon the links and patterns that existed between land and sea through human interaction with the marine environment. Using the landscapes, seascapes, and a diverse body of material culture as a foundation, this study illustrates synthetically the ways in which a key natural resource of *Mauretania Tingitana* was exploited prior to, during, and after the Roman period. The aim of this analysis is to clarify previous assumptions and misconceptions regarding the past marine environment and its exploitation, answer more accurately outstanding questions of the resource’s role and raise new paths of inquiry, ultimately affecting interpretations of Roman resource use and economy. It is hoped that the results of this comprehensive work will serve as a significant contribution to the environmental, social and economic history of Roman North Africa and perhaps provide a new and relevant theoretical approach not only for examining past anthropogenic impacts on marine life but also the evolution of ancient foodways and the urbanisation of the region.

[10] Some North African examples include Mattingly 1986; Slim, *et al*. 2004.

Chapter 2.
Methodology

2.1 Previous approaches to marine resources in antiquity

Marine resources in the Graeco-Roman world have been subject to increasing levels and approaches of scholarly inquiry over the last two centuries. Interest in the subject was initiated by philologists who focused upon the collection and decipherment of ancient textual references, treatises or epigraphy related to marine subjects. As early as 1832, studies appeared on the manufacture of dried, salted fish (*salsamenta*) and salted-fish sauces in antiquity within the Black Sea and Mediterranean.[1] Research was also undertaken into the identification of marine species known and sought in antiquity, with the most comprehensive Greek usages compiled by Wood in 1927-28 and the Latin usages by Thompson and de Saint-Denis in 1947.[2] Within this period, some ancient exploitation methods were discussed, with some studies, however, treating fishing more as a 'sport' than as a sustenance activity.[3]

Since the 1960s, archaeological studies have contributed greatly to research on marine resources in antiquity. At first, these studies were applicable almost solely to the state of knowledge of the fish-salting industry, sometimes with contemporary literary and iconographic sources incorporated as useful comparanda. The first major work in this area in the Mediterranean, published by M. Ponsich and M. Tarradell in 1965, identifies a large number of fish-salting facilities in southern Iberia and northern Morocco.[4] Following this precedent, other publications of similar sites have also appeared in the last four decades, primarily regarding the Iberian Peninsula but also southern France, Tunisia and the northern Black Sea.[5] Studies of the manufacture of purple dye from *Muricidae* (*murex* and *purpura*) shellfish have also appeared.[6]

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[1] E.g., Köhler 1832; Cuvier & Valenciennes 1832; Smidth 1876; Besnier 1907; Eberl 1892; Zahn 1910; Grimal & Monod 1952.
[2] E.g., Clarke 1888; Barbier 1925-26; Barbier 1927-28; Barbier 1933-36; Wood 1927; Wood 1928a; Wood 1928b; Cotte 1944; Thompson 1947; de Saint-Denis 1947; Andrews 1949; Gow 1968; see also Peurière 2003; Hünemörder 1998.
[3] E.g., Blümner 1869; Lafaye 1907; Bunamann 1910; Radcliffe 1921; Horn 1929; Butler 1931; Bohlen 1937; Concoran 1957; Concoran 1964.
[4] Ponsich & Tarradell 1965. The list for southern Iberia has been extensively revised, however; see Étienne & Mayet 1998a; Wilson 2006.
[5] García Vargas & Bernal Casasola 2009a; Trousset 1992; Trousset 1998; Étienne & Mayet 2002; Étienne & Mayet 2007; Arévalo & Bernal 2007a; Lagóstena 2001; summaries of regional publications presented in Wilson 2002a; Højte 2005; Sternberg 1998; Trakadas 2005; Curtis 1991.
[6] E.g., Fernández Uriel 1995; Alfaro Giner 2002.

Extending from the archaeological analyses, studies in the production events and economics of the fish-salting industry have also been presented. Topics include how processing was conducted, who was involved, where and how the products were shipped, who was involved in their transportation and the different scales of the trade. These studies make use of texts, epigraphy (stamps and *tituli picti* in particular, but also some inscriptions) and archaeological sources ranging from the sites themselves to kilns and amphorae distribution.[7]

Fortuitously, icthyo-archaeological studies have also been gradually incorporated within some of the fish-salting industry analyses.[8] These studies have helped not only to identify scientifically the species of fish found at the processing sites but also those found in transport amphorae, mainly preserved from shipwrecks particularly from southern Spain, southern France and the Straits of Bonifacio.[9]

Archaeology has also brought to light finds of Graeco-Roman fishing equipment and technology and a few examples of fishing boats that had previously been attested only in texts or iconography. Fishing equipment studies cover broad geographical regions due to the disparate distribution of the preserved evidence; there are, however, regional analyses of the types of equipment utilised in regions of Egypt, Tunisia and Italy.[10] Constructed shoreline features, such as weirs or catch basins, which trapped and kept fish and shellfish in lagoons or the tidal zone are also documented.[11] Related to these shoreline features are sea-water fish ponds (*piscinae salsa* or *maritimae*).[12] Roman fishing vessels are better understood from texts and iconography, as only a few archaeological finds of these are presently known in the Mediterranean.[13] Only a few studies, however, have examined fishing rights and who was allowed to use these techniques in the different marine environments.[14]

Recently, empirical studies have combined archaeological and ethnographic data to examine the levels of productivity of specific fishing techniques.[15] Through literary and

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[7] E.g., Étienne 1970; Ben Lazreg, *et al.* 1995; Étienne & Mayet 1998b; di Stefano 2002; Sternberg 2000; Edmondson 1987; Lowe 1997; Jardin 1961; Curtis 1984; Curtis 1984-86; Lagóstena, *et al.* 2007; Arévalo González, *et al.* 2004.

[8] See Desse-Berset & Desse 2000; Van Neer 1994; Larje 1995; Bernal, *et al.* 2007c.

[9] See Delussu & Wilkens 2000; de Grossi Mazzorin 2000; Sternberg 1998.

[10] General studies: Donati & Pasini 1997; Ayodeji 2004; Sahrhage 2002; Egypt: Brewer & Friedman 1990; Bates 1917; Darby, *et al.* 1977; Italy: Rustico 1999; Tunisia: Trousset 1998.

[11] Alves, *et al*. 1988-89; Moreno Páramo & Abad Casal 1971; Petriaggi 2004; Rustico 1999; Gazda & McCann 1987; McCann 1979; Trakadas 2006: 265-266

[12] Higginbotham 1997; Lafon 1998; Parslow 1998; Trakadas 2006: 261-264; Kuhn 2000

[13] E.g., Carlson 1999; Carlson 2002; see examples discussed in Chapter 3.2.2.

[14] Greek fishing rights: Höppener 1931; Lytle 2006: 6-36; Roman fishing rights: Peurière 2002; Ørsted 1998 14-17; Trakadas 2006: 259-260.

[15] See arguments contra Gallant 1985 in Bekker-Nielsen 2002b: 215; Bekker-Nielsen 2002a; Bekker-Nielsen 2005; Lund Jacobsen 2005; Purcell 1995.

archaeological data, scales of exploitation are also beginning to be correlated in order to determine the levels of consumption of seafood amongst communities in certain parts of the Graeco-Roman world; similar data are being correlated to determine the impact of fishing on past marine ecosystems.[16]

2.2 Present inquiry

The previous analyses outlined above largely treat the practice of fishing generally or primarily focus on facets of the ancient fish-salting industry. In regards to the former, the material is often treated similarly across regions that possess very different localised topographies and marine environments. In regards to the latter, the methods and logistical and environmental factors of extracting fish, shellfish and other marine species to supply the salting industry are often left unexamined and uncorrelated. Instead, the products are evaluated and quantified without consideration of the broader parameters associated with obtaining the resources. In this respect, illustrations of fishing in the Graeco-Roman world are also often initiated without consideration of the uniqueness of marine habitats or undertaken using assumed environmental and technological generalities. This present study considers first and foremost the coastal, riverine and lagoonal environments of the province of *Mauretania Tingitana* as the framework in which the evidence for marine resource exploitation can be contextualised and analysed.

2.2.1 Theoretical framework

People live at the edges of and move through the sea and littoral waterways for short or long periods, not only for transportation but also to obtain food by fishing for the animals that live in these waters; the environment, therefore, plays a key role in understanding these actions and relationships and their patterns.[17] It is within this assertion that the concepts significantly recognised by F. Braudel in historical analyses are inherent in this study: the environment has long-term and overriding importance. This *longue durée* is embodied by the coastal landscape and seascape, and it is within these that general conditions are established and are more influential than short-term, socio-political events (*courte durée* or *événements*) and medium-term structures (*moyenne durée*) of demographic cycles.[18]

[16] Trakadas 2006; Prowse, *et al*. 2004; Wilkins 1993
[17] Aptly stated in Cooney 2004: 323: “But in coastal areas the sea is not just the main means of contact between inhabited places, it is central to the way of human life.” See also Pálsson 1997: 14; Hewes 1948: 238-240.
[18] Braudel 1958; Braudel 1992

The spatial and material parameters most applicable to this present study and in line with Braudel's broader theme are the tenets outlined in the "maritime cultural landscape" concept by C. Westerdahl.[19] This approach specifically outlines examination of the sea and the interconnected waterways, the adjacent zones and the associated littoral (human) communities – the 'plot' where fishing took place in lagoons and rivers, from shore, inshore and offshore.[20] Although not intended originally as an analytical tool, however, the maritime cultural landscape concept significantly underscores and includes man-made features on land as much as the underwater environment of the coastal zone in its definition.[21] This present study considers the basic cognitive tenets of this approach whilst asserting that the 'landscape', in respect to fishing, does not necessarily include vessels (fishing can take place from a river bank, for example) or follow maritime transport and communication networks (as fishing offshore does not hold to these patterns or anthropologically-constructed corridors).

A further consideration is the ecological systems and particular habitats of animals within the environments of the maritime cultural landscape.[22] The ecological systems of marine life (such as daily, seasonal or annual feeding, migratory and spawning cycles), as well as established habitats (such as oceanic, inshore, lagoonal and riverine) are incorporated in this study as part of the parameters integral to analysing the past marine environment and their influence on the techniques possible and practical for exploitation.

2.2.2 Methodological approach and research questions

This study first examines the past human interaction with and use of marine resources from the surrounding seas and littoral waterways of Roman *Mauretania Tingitana*. The broader analysis of this study ultimately examines the ways in which the practice, products and role of marine resource exploitation was affected by the Roman incorporation of the province. Therefore, data also derive from the preceding Punico-Mauretanian and following Late Roman periods.

Whilst the historical background provides the socio-political, cultural and chronological context of this study (Chapter 4), the marine and littoral environments serve as the primary

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[19] Westerdahl 1992
[20] Parker 2001: 23
[21] Westerdahl 1992: 5-6; Westerdahl 1994: 266; Hunter 1994: 261-262; Adams 2006: 2; Parker 2001: 22
[22] For various definitions of the term 'ecology', see Lévi-Strauss 1974; Ingold 2000: 19; Butzer 1982: 5, 32. This study follows O. Rackham (1996: 16-17) in asserting that ecology is, quite simply, the study of living creatures within the environment.

framework for these *événements* (Chapter 5). Against this, the extensive archaeological and descriptive sources from or relating to the region (contextualised in Chapter 3 and catalogued as Appendices 1-6) constitute the comprehensive data sets that form the basis of this study's subsequent reconstructions and analyses. The archaeological data include marine animal remains, fishing equipment and fish-salting sites from the former province; the descriptive data include written sources, pictorial representations and ethnography. Because of lacunae and the inherent biases of preservation or media type, these sources are therefore intended to form complimentary data sets.

The catalogued archaeological and descriptive sources are first applied to broad characterisations of the region, focusing on the Mediterranean, Straits of Gibraltar and Atlantic littorals (Chapter 6). These address the following lines of inquiry:

1) Where did fishing take place: from shore, in rivers, or at sea? What amount of fishing took place where?

2) Where were marine resources and salted-fish products produced and consumed in *Mauretania Tingitana*?

3) What was the chronology of marine resource exploitation?

These characterisations serve as the introduction to and context around which the major case studies of the three sites in Chapter 7 are presented: *Tamuda*, *Septem Fratres* and *Lixus*, situated on the Mediterranean, Straits of Gibraltar and Atlantic coasts, respectively.[23] The following research questions are addressed:

1) What types/species of marine resources were exploited?

2) Based on the identified species, what were the habitats exploited and when did fishing take place (seasonality)?

4) What evidence is there for different fishing methods?

5) If fish-salting production took place, what were the processes involved and resources required?

6) What were the areas and methods of fishing effort?

7) What is the overall chronology and role of the exploitation?

The discussion of this study (Chapter 8) assesses the use and role of marine resources in *Mauretania Tingitana*. By including the Punico-Mauretanian and Late Roman evidence presented in the preceding two chapters, comparative analyses identify the patterns and

[23] The basis for the selection of the case studies is discussed in Chapter 7.1.

methods of fishing effort over time and contextualise these within a socio-cultural and economic perspective. Addressed in this chapter are the following questions:

1) What was the role of 'fresh' marine resources consumption, and how does this compare to other foodstuffs throughout the province?

2) What were the roles of processed marine resources (including salted-fish products, sauces and purple dye), and how do these compare to other forms of agricultural production throughout the province?

3) What was the impact of the incorporation of *Mauretania Tingitana* into the Roman Empire ('Romanisation') upon marine resource exploitation?

2.2.3 Chronology

As the aims of this study include the identification of changes and/or continuity of marine resource exploitation in *Mauretania Tingitana* in antiquity, evidence pertaining to the Roman period will be compared to that from earlier and later periods. However, a uniform chronology does not exist for the northwest Maghreb: some chronologies applied at certain archaeological sites are very refined, whilst others are more generalised.[24] In many cases, material included in this analysis was excavated and/or published when diagnostic ceramic chronologies were not as well established as they are at present. Therefore, to place the archaeological and descriptive data into comparable categories for the present study, the following chronology will be used:

Punico-Mauretanian	5th century BC – ca. AD 75
Roman	ca. AD 75 – late 3rd/early 4th centuries AD
Late Roman	late 3rd/early 4th centuries – 6th century AD
Context Unknown	5th century BC – 6th century AD

The first three periods are based on ceramic chronologies as representative of phases of the Roman socio-cultural influence or "cultural matrix" present in the northwest Maghreb (Table 2.1).[25] Another category, *Context Unknown*, is included to denote artefacts that cannot be more precisely assigned to fewer than three of these above-cited periods.[26] This study's chronological groupings, applied to the regional characterisations, case studies and appendices, compares to other chronologies previously applied to material from northern Morocco that are outlined in Table 2.2.

[24] See, for example at *Lixus*: Aranegui Gascó 2001; Aranegui Gascó 2005a; Aranegui Gascó 2005b; more generalised dates given in Euzennat 2000.

[25] Based upon the appearance of finewares and amphorae in the region. The period divisions used in Chapter 4, however, whilst generally applicable to this study's chronology, are based on specific historical events.

[26] Some finds cannot be assigned to any specific context other than a site, and in most cases these sites' chronology extends over all three periods.

2.2.4 Site types

In this study, the main body of archaeological finds directly related to marine resource exploitation are marine animal remains, fishing equipment and fish-salting sites (discussed in Chapter 3.2). These data derive from 26 sites in *Mauretania Tingitana*. In order to discuss and compare the material in the regional characterisations and case studies (Chapters 7-8), the sites are separated into three groups:

1) *Major sites*: permanent settlements, sometimes walled, and recognised/noted in antiquity as *coloniae*, *municipa* or *oppida* (Table 2.3)
2) *Minor sites*: ‘stations’ with a few buildings that could be occupied year-round or seasonally, built structures used to carry out fish-salting practices, or *villae* and *castella* (Table 2.4)
3) *Agglomerations*: sites with no permanent structures discernable but ceramics and other artefacts are present, or isolated necropoli (Table 2.5)[27]

Tables 2.3-2.5 also list the general topographic situation of the sites in relation to the marine systems and the reconstructed littoral, outlined in Chapter 5.5: coastal, riverine, lagoonal and inland (5 km or more from a major body of water). Some sites have dual topographical situations.

Sites *only* with finds of salazón amphorae are not included in Tables 2.3-2.5 as they represent the consumption of salted foodstuffs. However, *all* sites with archaeological finds discussed in this study are given a number listed in the ‘site list’ table at the beginning of the appendices. These numbers are used to identify sites throughout the text, in tables and on maps.

[27] ‘Agglomeration’ is a term used broadly in archaeological reports of the region to denote sites both with and without structures; e.g., see mentions throughout Ponsich 1970; Tarradell 1960.

Chapter 3.
Contexts, data sources and applications

3.1 Environmental context and data

Geographically, this study encompasses the area of the northwest Maghreb that was the fullest extent of the province of *Mauretania Tingitana*, from ca. AD 42/43 to ca. AD 280.[1] The provincial territory therefore included the northern portion of the present Kingdom of Morocco and the Spanish North African territories.

The sources utilised in describing this study's environmental context (Chapter 5) within this geographical area are varied. They include geological and palaeo-botanical studies, bathymetric and hydrographic data, as well as finds from underwater and terrestrial archaeological surveys. Complimenting these quantitative data are qualitative data: inscriptions from the province, ancient textual sources, such as Strabo, Pliny, Claudius Ptolemy, Pomponius Mela and the *Antonine Itinerary*, medieval Arab geographical treatises, and historical texts such as Portuguese navigational treaties and English travellers' accounts. Additionally, historical maps from the 17th-19th centuries are examined (Appendix 7).

In the environmental chapter and throughout the study, the source material and analyses are organised by the three main hydrographical and ecological systems that surround the former province: the Mediterranean Sea, Straits of Gibraltar and Atlantic Ocean. First, the present coastal geography, topography and offshore and littoral marine systems of *Mauretania Tingitana* are described (Chapter 5.3). In addition to the coastal terrestrial features, the marine systems and maritime conditions function as an environmental parameter, constituting the ecological habitats for marine life but also the seascape in which people navigated by boat or came in contact with the littoral zone. Weather patterns are also noted in order to determine the daily and seasonal possibilities of navigation to reach particular fishing grounds and return to shore; their effect on fishing practices are discussed again in the regional characterisations and case studies (Chapters 6-7).

Within this environmental context, it is maritime-related *moyenne durée* structures – such as ports, anchorages or landings – that can provide the framework for determining the logistics and spatial relationships of marine resource extraction and indicate points of land-sea

[1] For the limits of the province, see Chapter 5.1.

interface.[2] In some cases, these sites indicate not only navigation routes (coastal as well as riverine) but specific areas of fishing effort (safe harbours/landings in proximity to fishing grounds). Here, larger transit points and settlements, identified through their archaeological remains, are described in the maritime landscape; smaller agglomerations of archaeological finds are also included in this study to note other possible points of past land-sea interface or coastal-zone activities.

Second, these same sources are analysed to determine the causes and impacts of past sea-level and geo-morphological changes to the littoral over the last ca. 2,500-2,000 years. These changes, not fully considered in previous studies pertaining to the province's Roman period, can not only impact navigation, but also littoral topography, marine habitats and past fishing grounds.[3] From the data, a 'reconstructed' littoral is presented that serves as the study's base map (Chapters 5.4-5.5). Within this framework, the collated data from the archaeological and descriptive sources (described below) are analysed in order to assist in the visualisation of the coastal land- and seascapes, and the interpretations of ecological, spatial and social relationships.

3.2 Archaeological data

The archaeological material compiled in this study derives from publications of excavation finds within the former province of *Mauretania Tingitana*, as well as a large amount of unpublished artefacts from earlier excavations that are presently stored in museums and site dépôts of Morocco and Spain (Ceuta and Melilla).[4] The discussion of relevant sites derives from published information and site reconnaissance.[5]

3.2.1 Marine animal remains

The primary group of archaeological data examined in this study is comprised of the identified remains of marine resources: fish bones (and including marine mammals and cartilaginous fish) and marine invertebrates (shellfish and the remains of sea urchin and coral) (Fig. 3.1). The initial studies regarding marine resource exploitation in the province do not really address this body of evidence: fish bones and shellfish are only generally

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[2] Westerdahl 1992: 6; Parker 2001: 23

[3] Van Neer, *et al*. 2004: 12; for such previous studies in Morocco, see Luquet 1973-75b; Roget 1924; Euzennat 1962; Mauny 1970; Schmitt 1973; Euzennat 2000.

[4] In Morocco: Musée de la Kasbah (Tangier), Musée Archéologique (Tetouan), Musée Archéologique (Larache), Musée Archéologique (Rabat) and the dépôts at the sites of *Volubilis* and *Sala/Chellah* (Rabat); in the Spanish autonomous cities at Museo Municipal de Ceuta and Museo de Arqueología e Historia (Melilla). For unpublished artefacts that were not clearly labelled, chronology was assigned by associated ceramics stored with the material.

[5] Carried out by the author with kind permission of INSAP and Instituto de Estudios Ceutíes.

mentioned as present by M. Ponsich and M. Tarradell in their 1965 publication, and although *Muricidae* shells (*murex* and *purpura* species) are documented from A. Jodin's work at Essaouira, no quantities are given and specific contexts are lacking.[6] More recently, studies have been conducted on the faunal remains from the *Septem Fratres* fish-salting sites as well as from the Phoenician and Punico-Mauretanian levels at *Lixus*.[7] In this present study, this published and unpublished material is catalogued in Appendix 1.1 (fish bones) and Appendix 1.2 (marine invertebrates). These finds will first serve to identify which species were fished during different periods and at which sites in *Mauretania Tingitana*; their presence demonstrates not only human diets but other forms of consumption, such as species used as bait, or the remains used as tools, decoration, or pottery temper.[8]

By considering the specialised habitats and behaviour of the various marine species recovered it is possible to reconstruct the areas exploited by fishermen and determine the methods likely used to catch them. In turn, these finds can lead to inferences regarding seasonality (and thus human understanding of seasonal movements). [9] For example, shellfish, as relatively more sessile animals than fish, make their exploitation by humans somewhat easy.[10] There are species that live near the shoreline, in marine and estuarine environments, and in the intertidal zone (that is, to ca. 5 m depth).[11] Other species live in the infratidal zone, below 5 m depth and are not immediately accessible by humans from the shoreline.[12] For a short period of time each year in the spring, certain shellfish species, such as oysters and mussels, are deemed suitable for fresh consumption, before their spawning cycles. The optimal periods to catch *Muricidae* shellfish if used for dye are late winter or early summer, as these are times when the animals' hypobranchial glands produce desirable liquid.[13] The presence of such species in the archaeological record over time suggests that there was clearly human understanding of seasonality, 'consumability' and use, and this is also stated by ancient authors.[14]

[6] Ponsich & Tarradell 1965; Ponsich 1988; Jodin 1967; Desjacques & Koeberlé 1955
[7] Roselló Izquierdo 1992; Grau Almero, *et al.* 2001; Rodríguez Santana & Rodrigo García 2005; Sagrario Carrasco Porras 2005
[8] Wheeler & Jones 1989: 7-8; Karali 1999: 11, 43; Reitz & Wing 2008: 134
[9] Dincauze 2000: 460; Noe-Nygaard 1983; Cerón-Carrasco 1998: 75; Sternberg 2002: 98-99; Wheeler & Jones 1989: 4-6, 9-10
[10] Erlandson 2001: 293-295
[11] For example, as the tidal range at Larache is 2.1-2.9 m (NIMA 143: 200), ca. 5 m depth would allow for direct human access to intertidal species, obtainable at low tide.
[12] Karali 1999: 10
[13] Aristotle, *HA* 5.15.547a; Pliny, *NH* 9.62: 38-39; Cassiodorus, *Var.* 1.2; Ponsich 1970: 290; Vasconcelos, *et al.* 2008: 289. The *Muricidae* species found at sites in the province include spiny dye-murex, banded dye-murex and the two species of red-mouthed rock shell.
[14] Andrews 1948: 299-300; Aristotle, *HA* 607.b2; Pliny, *NH* 32.31.59-61

Compared to marine invertebrates, fish are much more mobile animals, in that there are littoral species, schooling species and open-water species that can go through trans-oceanic migrations and transition from shallow rivers to deep ocean waters. Occupation of habitats may change or expand during their daily, annual or life cycles.[15] In the northwest Maghreb, members of the *Scombridae* (tunnies, some mackerels, bonitos), *Carangidae* (dentex, some mackerels) and *Clupeidae* (herring, sardine, shad, menhaden) families pass along the shores during their oceanodromous migrations in the late spring and early summer. The return migration for the *Scombridae* is in late summer/early autumn. These migrations would also include pelagic predators that follow the fish, such as shark.[16] In the spring, some members of the *Clupeidae* (shads) and *Anguillidae* (eels) families migrate upriver.[17]

Species' specific habitats and behaviour were certainly understood in antiquity, and this accumulated knowledge was handed down through generations of fishermen. This understanding is demonstrable even in texts, as fish are classified by their environments by Aristotle in his 4th-century BC work *Historia Animalium*, and this importance is noted in the 1st century AD by Columella in Book 8 of *De Re Rustica*, and followed by Oppian in the 2nd century AD in the first book of *Haleutica*.[18] This ecological information often determines the fishing gear employed (discussed below).

PRESERVATION AND RECOVERY BIASES

Biases are present in the deposition and preservation of archaeological marine animal remains that in turn affect their analyses. Larger fish bones tend to be preserved, whereas small bones (and sometimes small fish) or scales are not; additionally, fish bones tend to survive in sediments only if they are quickly buried, but shells tend to be more durable in the archaeological record.[19] The preservation of shellfish over fish bones means that they are more likely to be collected in archaeological excavations – and this imbalance could lead to an interpretation that exaggerates their importance in the ancient diet and economy.[20]

[15] Wheeler & Jones 1989: 28; Reitz & Wing 2008: 89-91
[16] A. Morales (UAM), pers. com.
[17] Loukili & Belghyti 2007; Rodríguez, *et al.* 2006: 885-886, 892; Guennoun 2006: 1911-1912; Timoule 1985: 61; Srour & Abid 2002: 3; de la Serna, *et al.* 1999: 16-17
[18] Reitz & Wing 2008: 88; Columella, *DRR* 8.16.6-9; this arrangement is also demonstrable in a late 3rd-century BC inscription of fish tariffs from Akraiphia, Boeotia, where the species are organised by broader environments (ocean and fresh water), and there under by their specific habitats; see Lytle 2006: 196-227.
[19] Locker 2007: 141-142; Van Neer, *et al*. 2002: 61-62; Dincauze 2000: 433
[20] Bailey & Parkington 1988: 4

Recovery methods also can determine whether marine animal remains are retained for analyses.[21] In many cases, the collection of fish bones is done by hand, which is a method biased towards preserving larger species. Sieving, especially with a small-gauge mesh, will preserve small bones and even scales of a variety of sizes of fish. In some instances, it is very possible that fish were part of the diet of people inhabiting a particular site, but during excavation there was no sampling strategy that included the examination of dietary remains.[22]

The methods of collection and sampling of the unpublished finds from earlier excavations in *Mauretania Tingitana* are not indicated, so it is not possible to determine the sampling bias. In addition, the provenance of some finds from the museum collections is unknown, or only general find-sites are noted. At sites such as *Lixus*, recent excavations have included icthyo-faunal or malacological studies where sediment was sieved but these have focused only on Phoenician, Punico-Mauretanian and medieval layers; other Roman and Late Roman material from this site, far fewer in quantity, derives from earlier excavations where the sampling strategy is unknown. These recovery biases, as well as sample size, also affects how one interprets diversity at each site, and therefore comparison between sites.

QUANTIFICATION ISSUES

In this study, the finds of fish bones from various sites have been set into tables. The best-studied material derives from *Lixus* and *Septem Fratres* (Ceuta), where NISP (number of specimens) or MNI (minimum number of individuals) are given for a variety of species.[23] At other sites, the total number of all fish bones may be given, with no attempt made to determine individual specimens amongst these.[24] In many cases, mention is made in the published material only of “fish bones” or “fish scales”, with no mention of species or quantities. The differences in the data available for this study, therefore, make it extremely difficult to compare material that derives from one site or even between sites. In order to reconcile these disparate data, the NMI, NISP or bone count numbers are noted in the table; in the analyses, however, each species, regardless of this number, is treated simply as a

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[21] Amorosi, *et al*. 1996: 130; Wheeler & Jones 1989: 38-40
[22] Locker 2007: 141-142; Beech 2004: 178
[23] *Lixus* and *Septem Fratres*: Roselló Izquierdo 1992; Rodríguez Santana & Rodrigo García 2005; Grau Almero, *et al.* 2001; for discussion of MNI, see Desse & Desse-Berset 1994: 72-74; King 1999: 168-169; for NISP, see Reitz & Wing 2008: 156-157; for the debate between the application of MNI and NISP for the quantification of taxonomic abundance, see Marshall & Pilgram 1993; Rose 2000: 497.
[24] For example, “25 vertebrae bones” of tope shark are preserved from *Lixus*, but these do not indicate 25 different sharks as they all in fact derive from the spine of one shark. Bone counts can also result in the over-counting of a species if it has more bones than another; the approach to “tempering the eel effect” (a species with twice as many bones as average fish species) is generally accepted as using NISP; Locker 2007: 144.

singular occurrence in the chronological period to which it is assigned. This approach removes biases and discrepancies and makes it possible to compare between layers and sites, as the aim of the study is to give an indication of species presence and diversity.[25]

Shellfish data are less difficult to determine using NISP counts, with quantification focusing on non-repetitive elements. Gastropods are more easily quantified in publications, as identification derives from the apices or columella (the inner axis of the whorl of the shell). Bivalves, however, pose more difficulty as it is not known from many of the sites included here if the umbo fragments or hinge area were counted or identified to determine if the half-shells belonged to more than one specimen. As with fish bones, fragmentation is a possibility and can lead to false number counts.[26] Some published material from the region's sites is merely recorded as present, with specimen numbers or shell count not given. As with the unpublished fish bones, the sampling strategy is not known; it is likely that larger and intact shells were collected as examples, as opposed to incomplete and smaller shells types.[27] The numbers of marine invertebrate specimens are noted in the table, but each species is simply treated as one occurrence in the analyses.

PRESENT ANALYSES

Within the analyses of the marine animal remains, species are designated as living in three different habitats: marine, estuarine and freshwater environments.[28] However, some species can live in a broad range of salinity, and therefore can be found in a combination of these environments and several species can live in all three environments depending on the stage in their annual or life cycles; these are designated in the case studies and appendices tables as marine/estuarine and marine/estuarine/freshwater.

Vocabulary used throughout this study refers to various habitats and behaviour of fish; these definitions are given in Table 3.1. The marine invertebrates discussed here are divided into major and minor environments. The major environments follow those discussed above (marine, estuarine, freshwater) and generally describe where these species live; the minor environments are determined as intertidal and infratidal and specifically describe the depths at which these animals live (and therefore the possibility of human access to them). These

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[25] For discussion of this method of "heterogeneous approach", see Morales, *et al.* 2007: 119-120.
[26] Glassow 2000: 407-410
[27] Collecting only a few complete shells as representative "examples" was done at Dchar 'Askfane, for example; A. El Khayari (INSAP), pers. com.
[28] The specific habitats and behaviour of the fish and shellfish are given in the tables in App. 1.1-1.2. The sources for these data and the notations used in the tables are discussed in the metadata section at the beginning of App. 1.

definitions are given in Table 3.2. Marine invertebrates can also live in both habitats designated above, and these are noted throughout the analyses as intertidal/infratidal.

3.2.2 Fishing equipment

As marine species inhabit such diverse environments, specialised implements are needed for catching and collecting them; these also must be constructed in a particular way and made of materials adaptable to aquatic conditions.[29] Fishing equipment can encompass a broad range of artefacts of diverse manufacture used at different stages in the exploitation process: nets, net weights, portable traps, fish hooks, line sinkers, barbs, needles, navettes, purpose-built trap installations on shores or in rivers and estuaries and even fishing vessels. Often this equipment is constructed in a specialised manner so as to be used when targeting specific types of marine species, those that have a particular behaviour, are a specific size or live in specific habitats. Some of these implements could be used independently of each other or in combination. In addition, the types of apparatuses reveal whether fishing was an independent activity, practised by individual fishermen using simple or small devices, or a group activity that required cooperation between a few or numerous individuals.[30]

Fishing is today classified by active or passive techniques. Passive techniques, which require little human action, can be types of set nets or traps; active fishing includes the participation of the fisherman in operating the fishing gear, such as collecting, spearing and hand-lining. Plato, in his 5th-century BC work *Sophista*, first 'classified' fishing techniques by general active and passive methods ('striking' fish that included using hooks or 'enclosing' fish by the use of traps and nets).[31] Both of these approaches, in antiquity as well as today, rely on a human understanding of fish behaviour, habitat and the marine environment.[32]

Oppian, in the 2nd-century AD *Halieutica,* identified four main types of fishing methods: hook-and-line, nets, weels (traps) and tridents.[33] These divisions are followed by Aelian throughout his early 3rd-century treatise, *De Natura Animalium*. These and other methods are described below as are the material evidence for them, their preservation biases and the context of their application in this study.

[29] Hewes 1948: 238
[30] Cooperation of fishermen might be demonstrated by *piscatores* guilds (which are not known from *Mauretania Tingitana* but demonstrated in *Nova Carthago* and elsewhere), but fishermen did not necessarily have to work together to be members of these guilds. It is more likely that most fishermen weren't guild members, which have been demonstrated to have had more economic and social purposes (Augustan inscription at *Nova Carthago*: *CIL* II Suppl., no. 5929; Horsley 1989: 102).
[31] Plato, *Sophista* 219 ff.
[32] Powell 1996: 77-78; Ayodeji 2004: 72-73
[33] Specified in Oppian, *Hal*. 3.72-91.

HOOK-AND-LINE FISHING

The most common form of fishing was by hook-and-line (*piscatus hamatilis*, ἀγκιστρεία), where fishermen (*hamiotae*) used a line with a hook at its end that could be paid out by hand (hand-lining) or attached to a rod (angling) (Fig. 3.2).[34] Lines could be made of flax, esparto grass or horse-hair; rods could be made of cornel-wood, pine, juniper or reeds.[35] Fishing lines, as well as nets and traps, however, with few exceptions do not survive in the Mediterranean and North African climate.[36] Extant in the archaeological record instead are fish hooks (*hamus*, ἄγκιστρον), which are generally of bronze, although some larger examples were of iron.[37] The shape of hooks has remained fairly constant since prehistory: the basic form is a half-circular or "J" shape, with an eye at the top or a spade-shaped tip (through or under which the line is tied) and a straight shank which curves to a point with a barb (Fig. 3.3).[38] Large iron hooks are mentioned in relation to catching large fish such as tunny and even whales, whilst small hooks were for small-mouthed fish like grey mullet.[39] For this study's discussion, fish hooks are specifically broken down into three sizes: small (< 5 cm shank length), medium (5-7 cm shank length) and large (> 7 cm shank length).[40]

Hooks could be baited with small fish, molluscs, fish intestines and even sea grass; bait-less fishing also was practised.[41] Lines could be weighted with lead, stone or terracotta plummets (κάθετος, *perpendiculum*); some are round or pyramidal in shape with holes for the line to pass through at the top, but these can be hard to distinguish in the archaeological record from net weights (ethnographic studies indicate, however, that line weights are generally heavier than their net counterparts) (Fig. 3.4).[42] In addition, bone gorges were also used in place of hooks. With this method, a line would have been tied around the centre of the gorge, which

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[34] Aelian, *NA* 12.43; Plautus, *Rudens* 299, 310; Lafaye 1907: 490; Sahrhage 2002: 45-52

[35] Lines: Oppian, *Hal.* 3.72-78; flax, horse-hair: Aelian, *NA* 1.23, 12.43; rods: Aelian, *NA* 1.23, 12.43, 13.2; Oppian, *Hal*. 3.72-75.

[36] Bekker-Nielsen 2005: 84

[37] Pliny, *NH* 9.67.146-147; Ausonius, *Mosella* 126; Martial, *Epistulae* 2.40; Oppian, *Hal*. 3.73; 3.143, 3.174, 3.285-286; Aelian, *NA* 1.23, 13.16; Lafaye 1907: 489

[38] Ayodeji 2004: 87-90

[39] Large hooks: Aelian, *NA* 13.16; Oppian, *Hal*. 3.285, 5.135-138; small hooks: Oppian, *Hal*. 3.482-485.

[40] Modern fish hooks are classified by gape width (distance between the shank and tip of the barb; see Ayodeji 2004: 88); this study uses the length of the shank as a factor of determining possible fish size, as the gape distance only gives an indication of the mouth size of animal – and large fish can have small mouths and vice-versa (see discussion in Powell 1996: 127).

[41] Aelian, *NA* 14.22; list of fish as bait: Oppian, *Hal.* 3.184-193; bait-less fishing: Oppian, *Hal.* 3.173-174.

[42] Oppian, *Hal*. 3.76-77, 3.138; Kuniholm 1982: 308; Lafaye 1907: 489: a weight also referred to as μολίβου κύβος (Oppian, *Hal.* 4.221-222). Ethnographic comparison shows that some line sinkers can weigh up to 1 kg (Ayodeji 2004: 126).

was covered by bait; the intention was to have it swallowed whole so it would lodge in a fish's stomach or throat (Fig. 3.5).[43]

Hook-and-line fishing could take place from shore or from a boat, and is the only fishing gear that can operate at any depth. Hand-lining is mentioned in association with catching large fish from boats, although angling allows one to cast the line farther, which is ideal from shore.[44] In some instances, multiple hooks were attached to a single line (πολυάγκιστρον).[45] This technique, long-lining, requires shorter hooked "branch" lines called snoods to be set with hooks to a single main line. Small hooks are usually used for this method, and time and labour is involved in baiting them. Long lines can be set with weights on the sea bottom, or set vertically or horizontally in the water column from a boat, using floats and weights to suspend the lines (Fig 3.6). Trolling involves trailing a line with a hook or hooks from the stern of a vessel as it moves through the water.[46]

Hook-and-line fishing from shore (whether hand-lining or using a rod for angling) was a practice carried out by individual 'hook' fishermen (*hamiotae*).[47] From a fishing boat, however, the crew size could vary from an individual to a small group. For example, Aelian describes long-lining and hand-lining undertaken by a single fisherman who requires a crew of unknown size to man the oars of his vessel, whom the fisherman directs.[48] Then, as today, it was necessary to have enough people to operate the gear and navigate the vessel, but still have space inside the boat to hold the catch.

NETS

Nets, like fishing lines, are not generally preserved in the archaeological record; these are known to have been made of flax (*linea, linum*), esparto, hemp but also animal hair (θρίξ).[49] Generally, the material used for nets has to be durable in the marine environment, but also the specific gravity of the organic material is important: a low specific gravity is undesirable

43 Radcliffe 1921: 32-33; Powell 1996: 124

44 Oppian, *Hal*. 3.144-148, 3.205-280, 3.313-315; Aelian, *NA* 12.43; Homer, *Iliad* l.16.406; Arévalo González, *et al.* 2004: 277; Martínez Maganto 1992: 225; Ayodeji 2004: 101, 116

45 Long-lining attested by Sidonius, *Epistulae* 2.2.12; Oppian, *Hal*. 3.78, 3.465-481, Aristotle, *HA* 532b25; 621a15. See App. 6: *Cat. 3.10. Cap Sim.*

46 Kron 2008: 205; Powell 1996: 123; Sternberg 1998: 96. Trolling off the sides of a boat is described by Aelian as a method for catching pelamyds (tunny) (Aelian, *NA* 15.10).

47 Aelian, *NA* 12.43; Plautus, *Rudens* 299, 310; Lafaye 1907: 490; Sahrhage 2002: 45-52

48 Aelian, *NA* 15.10

49 Seneca, *Hercules Furens* 153; Pliny, *NH* 9.26.59, 19.2.10-11, 19.9.31, 19.56.173-175; Aelian, *NA* 1.2, 1.23, 12.43; Oppian, *Hal*. 1.54, 4.654-657; Grattius, *Cynegetica* 1.46-48, 34-35, Varro, *De Re Rustica* 3.5.11. Archaeological finds of nets: Herculaneum: Deiss 1966: 102; Pompeii: Radcliffe 1921: 235, n. 1; Egypt: Brewer & Friedman 1990; Red Sea: Wendrich & Van Neer 1994; Thomas, *in press*.

when a net is required to sink rapidly (such as cast nets). Other nets (such as gill nets) are required to be lighter so that there is greater net area compared to weight.[50]

Archaeological evidence for nets is based on the tools used to manufacture them, such as navettes and needles, as well as weights that lined their edges. A navette (χήλευμα, χηλή) is a bronze tool with tongs at both ends that are sometimes off-set 90º from those at the opposite end (Fig. 3.7).[51] Between these tongs, the line for the net was strung and then paid out as the net was being tied. Importantly, ethnographic studies have demonstrated that the space between the tangs of a tong end is the equivalent width of the mesh gauge.[52] This dimension is important as mesh size indicates the species of fish that the net is intended to target: with a large mesh, large fish are caught but small species can escape. The smaller the gauge, the more species a net will catch.[53] Light, small-meshed nets are required to catch schooling species such as sardine or anchovy; heavier nets with a larger mesh size are intended for catching large fish such as tunny.[54]

Bone and bronze needles, with double eyes, were also used to manufacture nets (Fig. 3.8). It has been suggested that needles were more usually used to repair nets, with the double eye used for threading different diameters of twine (Fig. 3.9). Unlike navettes, needles used for making and repairing fishing nets are much harder to identify in the archaeological record, as they are very similar to those used to work textiles. In these instances, the find-spot is of the utmost importance for establishing the needles' use. [55] Additionally, nets could also be made without tools, as reef-knotting by hand is a technique presently used; this technique and the use of needles, unlike navettes, do not allow for mesh gauges to be determined.[56]

Weights, made of terracotta, stone and lead, are used to sink a net rapidly or to anchor it in the water (as mentioned above, these can also weigh fishing lines, although net weights tend to be lighter than line sinkers) (Fig. 3.10). These weights can vary extensively in size and shape, and these criteria, as well as the number used, depend on the net, the type of waterway, and how the net is used and set. For example, due to density, fewer lead weights

[50] Ayodeji 2004: 136
[51] Pollux, *Onom.* 1.99, 7.83
[52] Ayodeji 2004: 151-152
[53] Examples from the Adriatic in the 19th century: the mesh of anchovy nets is 10 mm diagonal, sardine 15-20 mm diagonal, fry 8 mm diagonal and mullet 38 mm diagonal (Faber 1883: 107-110). Examples from the northeast coast of Tunisia in the late 20th century: the mesh of beach seine nets is 2.2-2.4 cm diagonal and cast nets are less than 1.6 cm diagonal (Romdhane 1998: 72-73).
[54] Oppian, *Hal.* 4.562-563; Ayodeji 2004: 128, 131
[55] Martínez Maganto 1992: 230; Arévalo González, *et al.* 2004: 114-115; Ayodeji 2004: 154
[56] Libert & Maucorps 1973: 4

are needed to weigh a net than those made of terracotta; the former are less bulky but likely more costly to produce, although the latter are used because they are light when dry, but absorb water quickly to sink.[57] Conical-shaped weights are never used for cast nets, but folded weights or lead strips and "split buckshot" types are, as an even distribution of weight around the edge allows the net to fall uniformly. Larger pulled nets, such as seines, can use a variety of weight types, including rocks that have line tied around them, attaching them to the net.[58]

Because of their specific applications, weights were made in a variety of shapes: some are doughnut-shaped with a central hole for a line to attach them to the net, trapezoidal or bun-shaped with several holes near the top for the lines, or small and disc-shaped with a central hole. Lead weights are of similar shapes but also were manufactured without holes (to be 'woven' into the outer edge of a net), or as narrow, folded-over strips that lined the outer edge. Stone weights can be simply a stone with a line tied around it, or again, 'woven' into the edges of nets.

The shapes discussed above can make it difficult to determine the artefact's use, as weights can be used for many other purposes, and materials are often reused. In many cases, textile loom weights, spindle whorls and certain fishing weights are identical, and one factor that can determine their use is find context.[59] In some cases, the date of the object might be helpful to identify its use, as warp-weighted looms went out of use possibly in the 1st century AD, but certainly by the 2nd century AD in the Mediterranean.[60] Also, the weight of loom weights is important: they are uniform and cannot be too heavy as they will pull the fibres in the cloth (although this uniformity is a similar requirement for net weights). Generally, Greek and Roman loom weights weigh between 70-250 g, with up to 70 used in a set for one loom.[61] Ethnographic comparison in northern Morocco indicates that terracotta and lead cast net weights weigh ca. 24 g each; lead rolls and stone weights used on the foot rope/lead line

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[57] Powell 1996: 106; Ayodeji 2004: 156-158

[58] Kuniholm 1982: 306-307; Ayodeji 2004: Table 8; for lead strips, see App. 6: *Cat. 4.2. Corrales de Rota, Spain;* for rocks, see App. 6: *Cat. 3.9. Essaouira (7).*

[59] For example, those found at fish-salting sites are thought to have been used for nets; see Davidson, *et al.* 1943: 65-79, 93-94; Wild 2002: 8; Wild 2003: 12, 15; Arévalo González, *et al.* 2004: 116-117, 222; Benoit 1959: 98; Sternberg 1998: 90. To my knowledge, there have been no analyses of textile manufacture within *Mauretania Tingitana*; no fulleries have been identified, although a fuller's guild has been identified at *Volubilis* (*IAM* 2, no. 581; Johannesen 1954: 158-159).

[60] For 1st-century date: Hoffman 1964: 321, 322-323; Davidson 1952: 147; for 2nd-century date: Wild 2002: 10-11. In Gaul and Spain, almost all datable loom weights are from the 1st century AD, and this might be the case for *Mauretania Tingitana* (see Alfaro Giner 1984: 99-102).

[61] Wild 2008: 471; F. Handly-Earl (Univ. of Southampton), pers. com.

of beach seine nets weigh between 190 g and 2-3 kg, respectively. Seine and set net weights can weigh between 100-250 g.[62]

This artefact type is the most tenuous identification within the archaeological group examined in this study due to its similarity in form to other artefacts not associated with fishing. The criteria for the inclusion of weights here are based on factors discussed above: shape, weight and find-spots (although some locations remain unknown, some are usually near other fishing equipment or in fish-salting facilities). It must be noted, however, that in many cases, these finds are included in order to demonstrate the types of weights possibly used for fishing; uncertain identifications are discussed in the case study analyses (Chapter 7). For this study, weights are classified as follows: disc, doughnut, bun, tombstone, trapezoid, truncated cone, sphendonoidal (pod), tube, strip and pyramidal.[63] The weights are categorised in three sizes: small (< 50 g), medium (50 g-250 g) and large (> 250 g).

Floats (*indicium*) are used to hold the top edge of a net (or suspend fishing lines) in the water.[64] As these are also made of organic material, they are not usually preserved in the archaeological record.[65] Iconography shows that floats were used, and they are mentioned by ancient authors: seine net floats were called φελλοί; ethnographic comparison demonstrates that they were likely made of bark or cork.[66]

Writers such as Oppian and Aelian provide a number of names for fishing nets used in antiquity. Oppian especially notes that there are a large number of nets, but he presumably lists what he considers to be the main ones, although it is hard to decipher some of his descriptions.[67] This study follows T. Bekker-Nielsen's identifications of the most-discussed of Oppian's net types: cast (ἀμφίβολον, ἀμφίβληστρον, *iaculum*, *funda)*, drag (γάγγαμον), cover (κάλυμμα), round bag (ὑποχὴ περιηγής), seine (σαγήνη, *sagena)*, draw (γρῖφος), ground (πέζα), gill/trammel (λίνοι, λίνον, πάναγρον) and pound nets.[68] The names, forms, use and manpower needed to operate these types are described in Table 3.3; they are illustrated in Figs 3.11-14 (see also Fig. 3.2).

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[62] Cast nets documented at Moulay Bouselham (Roullot & Fahfouhi 1984: 118) and are comparable to those used in Greece today, at ca. 25 g (Powell 1996: 107). Seine net weights ddocumented near Oued Laou (Roullot & Fahfouhi 1984: 59-60).
[63] Following Kuniholm 1982; Ayodeji 2004: 156.
[64] Lafaye 1907: 489; Ausonius, *Mosella* 253
[65] Some floats of wood and cork have been identified at *Myos Hormos* (Quseir al-Qadim, Egypt), on the Red Sea; see Thomas, *in press*.
[66] Aelian, *NA* 12.43; Pottier 1907: 852; Yacoub 1995: 239
[67] Oppian, *Hal.* 3.79-84; Bekker-Nielsen 2002a: 32
[68] Bekker-Nielsen 2002b

Nets are designed to catch specific species in specific environments. For example, cast nets can be used from a boat, but mainly in neritic waters (sandy shorelines and lagoons, but are rarely used in rocky areas) and have a small mesh gauge to target a wider range of fish size. Gill or trammel nets are set nets that function well in calm waters (such as in or at the mouth of a river), and are used to target migrating species.[69] Beach seines are restricted to sand and mud bottoms, and purse seines require calm waters and tend to target schooling fish. These non-mechanised nets are seldom used in water deeper than a few fathoms.[70]

OTHER METHODS

Tridents (*fuscina, tridens*) are three-pronged points usually of bronze but also of wood or iron attached to a wooden shaft and used in a jabbing or pushing motion by a fisherman. Harpoons, with a single point or point with barbs (and also smaller versions, referred to here as lances), are similar in construction, but are usually thrown by a fisherman and recovered by means of pulling in a line left attached to the projectile (Fig. 3.15, see Fig. 3.12).[71] Tridents as well as harpoons can be used by a single fisherman in a crewed boat in a variety of water depths to pursue and target individual fish; smaller examples can also be used along the shoreline by individuals to catch fish and shellfish in rocky and sandy littorals. As small fish are difficult to spear with such large apparatuses, this method of fishing will tend to target large fish.[72] Oppian notes that tridents are usually reserved for catching cephalopods, and this use is depicted in contemporary iconography, but they are also used for swordfish. With the latter fish, these tridents, like harpoons, might have had a line attached to the end of the shaft in order to retrieve the equipment and catch.[73]

Weels or creels (κυρτός, *nassa*) are used for trap fishing, where the most important feature is that the animal cannot escape once inside the contraption (see Fig. 3.2, left). These are passive fishing methods, set, checked occasionally and recovered after a day or several days by one or a few fishermen.[74] Weels can be made of Iberian broom or withies or staves, and can catch fish and shellfish alike.[75] Small weels are described by ancient authors as apparatuses used by *murex*-shell fishermen (*murileguli*, *conchylioleguli*, πορφυρεύς), who set bait inside the weel in order to attract the carnivorous shellfish. Pollux describes the *murex* weel as a baited "wallet line", where the shellfish enters but can't get out; Oppian

[69] Bekker-Nielsen 2005: 91; Romdhane 1998: 72; Powell 1996: 103; Ayodeji 2004: 179-181, 205
[70] Coull 1972: 44; Powell 1996: 33
[71] Ayodeji 2004: 258-259; Plautus, *Vidularia* 92; Pliny, *NH* 9.48.93; see App. 6: *Cat. 3.10. Cap Sim; Cat. 3.11. Oued Sous (2).*
[72] Lafaye 1907: 490; Sahrhage 2002: 43-44; Amorosi, *et al.* 1996: 149
[73] Oppian, *Hal*. 3.88-90, 3.552-554; Martínez Maganto 1992: 227
[74] Bekker-Nielsen 2002b: 219; Sahrhage 2002: 56-57; Powell 1996: 94-95
[75] Oppian, *Hal.* 3.85-86, 3.341-343, 3.400-401

notes that small traps (κυρτίδες) are the same, baited with clams and spiral shells, but the *murex* shellfish stays on the outside, attaching itself as it tries to get to the bait (this is similar to Aelian and Pliny's versions).[76] Aristotle notes that these traps were left in place over the course of several days in order to allow the animals to accumulate.[77]

Shellfish that live in shallow waters of sandy littorals could also be collected by shellfish fishermen (*conchitae*) by means of a rake-like tool (possibly *ferramenta*, σιδήριος).[78] In artisanal fisheries, the hand-held version of this tool is comprised of a metal bar in the form of a supporting comb of teeth with a pocket net attached. This tool is used for fishing on foot in the intertidal zone, and allows a fisherman to penetrate between 0.5-1.5 m past the low tide zone.[79] Other shellfish, such as limpets that live on rocks, can be pried off using what Aelian calls a "σιδήπω σχίζεται" ('iron saw'), although these are not known from the archaeological record.[80] Collecting shellfish also could be done without any tools, as Oppian describes fishermen hand-gathering shells from the beach or pulling them off rocks, and this type of collection by individuals on foot is ethnographically attested in the region.[81]

FISHING BOATS

That fishermen fished from boats (*naves piscatoriae*) is attested by ancient authors, contemporary iconography and a few archaeological finds of fishing vessels. Fishing boats were generally small, manned by an individual or several fishermen. Most vessels, as Oppian and Aelian describe, were propelled by oars, although some fishermen, Oppian says, put to sea with sails.[82] The extant iconographic evidence suggests that nets and boats were used together beginning in the 1st century AD, although textual and archaeological evidence suggests that they were likely used together earlier, possibly in the 5th century BC.[83]

Some names of the types of fishing boats are mentioned in texts; however, these are known largely from iconographic evidence deriving from central North Africa and Sicily.

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[76] Pollux, *Onom*. 1.47 ff; Oppian, *Hal.* 5.598-611; Pliny, *NH* 9.61.132; Aelian, *NA* 7.34; see App. 6: *Cat. 4.3. Ria Formosa, Portugal.*
[77] Aristotle, *HA* 546b 15-547a
[78] Plautus, *Rudens* 310; Pliny, *NH* 11.52.139; Aristotle, *HA* 535a 10-20, 547 b 13
[79] Shafee 1999: 33-34; see App. 6: *Cat. 1.8. Tetouan Bay.*
[80] Aelian, *NA* 6.55
[81] Oppian, *Hal*. 5.594-596; Bernal Casasola, *et al.* 2009: 243-244
[82] Boats and boats with oars: Oppian, *Hal.* 1.9-10, 1.41-42, 3.236-2339, 3.311-313, 3.427-429, 4.75-79; Aelian, *NA* 12.43 (6 oarsmen), 15.10; Sahrhage 2002: 120-122; boats with sails: Oppian, *Hal.* 3.66-67, 3.416-417, 3.425-428; Bekker-Nielsen 2005: 87-88; Bekker-Nielsen 2002a: 32.
[83] For nets used with boats in the 1st century AD, see Bekker-Nielsen 2005: 86; the Jules Verne 9 wreck (5th century BC) might be an example, if the coral fishing was done with nets, as it has been historically (see Chapter 7.3.5.1); in the late 3rd/early 2nd centuries BC, Plautus states: "*Mea opera, labore et rete et horia?*" (*Rudens* 1020) and this might offer evidence of the combination of the two.

Particularly good mosaic examples derive from the 3rd century AD at Piazza Armerina, Sicily, and in the 3rd-century AD ‘Catalog of Boats’ mosaic at Althiburus, Tunisia (where the boats are clearly labelled).[84] They include *horeia* (a term also used by Plautus to describe a small fishing boat, which may have had a blunt prow), as well as *cydarum* and possibly *vegeiia*.[85] From the 1st-century AD Pompeii wall paintings, *placida* and *scapha* are known (Fig. 3.16).[86] Epigraphy of the 1st and 2nd centuries AD from the Red Sea littoral suggests that small fishing vessels were called *schedia*, also depicted on the Althiburus mosaic.[87] These are all small vessels with one to four fishermen on board, propelled largely by oars.

Finds of fishing equipment amongst the remains of shipwrecks indicate that fishing took place from a variety of vessels.[88] However, purpose-built fishing boats are not as common in the archaeological record, and actually comprise the smallest find-group under discussion (five possible finds throughout the Graeco-Roman world). In the Mediterranean, these are generally small vessels that were rowed (in some cases it is not known if they had sails due to lack of preservation) (Table 3.4, Fig. 3.17).

Fishing boats could be used at any time, dependent on the weather and season. The difficulty in offshore fishing would have been navigating the marine environment and particular weather conditions whilst working a specific fishing ground. The most limiting factor in determining how far offshore or away from a landing site that a fisherman would venture, however, was dependent on the return voyage once fish had been caught. One would not want to fish too far offshore because the catch will most likely spoil in the time it takes to return to land.[89] If fishing with nets and targeting a schooling species, a large amount of fish could be caught in a relatively short period of time. Hand-lining for fish might take more time, but long-lining can also be efficient, as many hooks are set at once. There were various ways to counter-act this problem of spoilage in antiquity. One method was to fish at night, when the ambient temperature is cooler, and literary sources indicate that often fishing boats landed their catches at dawn after being out at night.[90] Additionally, shellfish and fish might

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[84] For a detailed study, see Pekáry 1999.
[85] *Horeia:* Plautus, *Rudens* 910, 1020; Carlson 2002; it is not wholly accepted that the *horeia* in the Althiburus mosaic represents a fishing boat, as the bundles in the hold, interpreted by some to be nets, could in fact be bundles of cargo (see Carlson 1999: 108); *cydarum* and *vegeiia:* Bekker-Nielsen 2002a: 32; Bekker-Nielsen 2005: 87-88.
[86] Sahrhage 2002: 120-122; Carlson 2002: fig. 8
[87] Bülow-Jacobsen, *et al*. 1994; Thomas, *in press*
[88] For example, the 7th-century AD Yassi Ada shipwreck (Kuniholm 1982); the 3rd-century AD Plemmirio shipwreck (Gibbins 1991).
[89] Bekker-Nielsen 2005: 88-89, 93; Bekker-Nielsen 2002a: 31; Powell 1996: 33; Lytle 2006: 137; Curtis 1991: 16
[90] Fishing boats return at dawn to Piraeus in the 4th century BC (Xenophon, *Hellenika* 5.1.23); Oppian, *Hal*. 3.50-52; Bekker-Nielsen 2005: 89.

be set in a well of a boat (*navis vivaria*) and kept alive to be transported over great distances.[91] It has been proposed that keeping a catch fresh was a factor that dictated the size of a fishing boat: small boats are ideal for keeping the right amount of catch fresh, whilst it would take longer to fill a large boat and cause the already-caught fish to spoil, rendering the endeavour fruitless.[92]

ECONOMICS OF FISHING

Small-scale fishing that was undertaken by individuals would have required very little in the way of initial investment; in some cases no tools were needed at all to collect shellfish. Small hand tools, rakes and even cast nets did not require large investment and in many instances the tools did not even need to be specially manufactured. Fish hooks and rod and lines also represented a small initial investment. These methods could have been used to obtain resources in small quantities for subsistence.[93]

However, with some of the large-scale fishing methods – those that required more manpower to operate the apparatuses – the initial economic investment and up-keep was much greater. Fishing offshore in particular required one of the larger economic investments – a fishing boat – which represented initial and repeated labour and resources as it had to be maintained.[94] Additionally, large apparatuses, such as pound nets and seines required an initial amount of labour to manufacture as more material is needed than for smaller lightweight types such as cast nets. Repairing these nets after every trip was a constant undertaking, as artisanal fishermen demonstrate today.[95] The benefit of investment in such large apparatuses, if used at the proper time, would have resulted in a yield large enough to be profitable (if delivered to markets or other consumers quickly) or that could have been can be divided as payment amongst the group of fishermen that operated the equipment.

SHORE-BASED ACIVITIES

Marine resources are fished to be consumed is some manner – whether eaten fresh, salted, or used as tools, decoration or even bait to catch other marine species. In these forms of exploitation, the resources are initially returned to and ‘processed’ on shore. The subsequent

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[91] In antiquity, some fish and shellfish species were kept alive whilst transported great distances: scarus fish were transported from the coast of Asia Minor to replenish Campanian waters in AD 50 and oysters were transported from the Adriatic to start beds in the Lucrine Lakes in the 1st and 2nd centuries AD (Macrobius, *Saturnalia* 3.16.10; Pliny, *NH* 32.31.61-62; Juvenal, *Satire 4* v. 140–143).
[92] Bekker-Nielsen 2005: 93
[93] Ayodeji 2004: 208; see also description of hook-and-line fishing kit requirements: Aelian, *NA* 12.43.
[94] Bekker-Nielsen 2002a: 31
[95] Bekker-Nielsen 2002a: 30; Ayodeji 2004: 131-133; see App. 6: *Cat. 1.5 Cala Iris*; *Cat. 3.9 Essaouira (4)*.

use of these resources, however, often determines how, when and where these catches are landed and are a major factor in determining spatial relationships and movement in the maritime cultural landscape. Regardless of the subsequent use, however, the most important pre-condition is to limit the extent of decomposition of a catch: the natural bacterial enzymes present in fish start to attack the muscle protein rapidly after death. The time it takes for the flesh of a fish to decompose beyond ‘consumability’ depends on the size and fat content of the specimen, the presence of innards (if a fish was not gutted) and ambient environmental temperature.[96]

Due to these factors, resources are often therefore consumed in the immediate vicinity where littoral fishing is practised, but further transhipment of landed catches did occur. Shellfish can be kept alive after being removed from seawater for several hours, and even longer if placed in a basin of replenished seawater. *Muricidae* can be kept alive for several weeks using the latter method; this was probably done on a regular basis as Pliny and Aristotle state that if these species are to be used for making dye, they must be kept alive until right before use (see Section 3.2.3).[97] Some shellfish species can be transported long distances after they are caught, if kept in seawater, and this is often the case with large bivalves, such as oysters and bittersweets.[98]

Boats landed their catches in order to deliver them to different types of consumption sites. This act could entail beaching the boat on shore or even docking at a port facility.[99] After the delivery to shore, the catches could be immediately sold or traded at the landing site. The catches could also be transferred, mostly likely as today in baskets or wooden trays, to nearby markets where catches were sold to the general consumer or traded (quite often for other foodstuffs to supplement one’s individual food supply), to the houses of the fishermen themselves or to fish-salting complexes (see Section 3.2.3).[100] Fish markets, *forum piscarium* or *piscatorum,* are mentioned in texts and are known to have existed in large coastal and

[96] Curtis 1991: 4, 16-17; Gram & Melchlorsen 1996: 589; Thurmond 2006: 229. An exception relates to sharks: the meat is usually only consumed several days after the fish is caught, after the post-mortem break down of urea in the flesh (Hamilton-Dyer 2001: 287; A. Morales [UAM], pers. com.).
[97] Pliny, *NH* 9.60.125-127; Aristotle *HA* 5.547a
[98] Demonstrated by shellfish finds at Mons Porphyrites and Mons Claudianus, Egypt (Hamilton-Dyer 2007: 156) and Sagalassos, Turkey (De Cupere 2001).
[99] No known port facilities have yet been identified in the province; however, there might have been such infrastructure at *Lixus* in the 1st century AD, as it is noted in some *tituli picti* as "*port[uensis] Lix[itana]*”; Tissot 1878: 211-212; Liou & Rodríguez Almeida 2000: 11, n. 1; see App. 4.2; Chapter 7.4.2.
[100] For baskets and trays, see App. 6: *Cat. 1.3 Al Hoceima*; *Cat. 3.9 Essaouira (3).*

riverine cities, such as Rome, Ostia, Pompeii and Corinth, but as yet there is no evidence of such markets in the northwest Maghreb.[101]

PRESENT STUDY

No remains of organic net or trap materials or fishing vessels are yet known from *Mauretania Tingitana*, but a variety of the non-organic evidence for fishing activities is preserved: fish hooks and gorges; terracotta, stone and lead net and line weights; bronze navettes and lances and bronze and bone needles. In this study, the few published and numerous unpublished finds of these, excavated at major and minor sites and agglomerations within the province, are presented in Appendix 2; their distribution is also mapped to determine spatially the location where fishing occurred and establish what methods were used where. Within this corpus, it must be noted that some find-spots are unknown for the unpublished finds, and in some instances general locations can only be assumed when an object is attributed to a site. As noted above, the lack of specific deposition of certain finds can also make their identification as fishing equipment difficult, and this is discussed specifically in the three case studies (Chapter 7).

3.2.3 Fish-salting production

SALSAMENTA AND FISH SAUCES

In antiquity, marine resources caught by fishermen were not only consumed fresh but could also be preserved for later consumption. Fish could be processed in two basic ways: the flesh could be cut up and salted, forming *salsamenta* with its liquid by-product *muria*, or the leftovers and/or small fry and other marine species could be macerated with salt and fermented, forming various sauces such as *garum*, *liquamen* and *allex* (or *hallex*).[102] These types of fish-based products served as an essential food item in antiquity, mainly as a source of protein but also as a salt substitute and for medicinal use.[103] Processing with salt was an innovative method for preserving a necessary food item in a world without any means of refrigeration, and made possible the trans-shipment of preserved fish and fish/seafood sauces in amphorae to distant locations.

The earliest archaeological evidence of fish processing in the western Mediterranean has been discovered in the Punic layers at *Gadir* (Cádiz). Four Punic fish-salting installations

[101] Plautus, *Curculio* 474; Sahrhage 2002: 123-130; the markets in Ostia and Pompeii also sold *garum*.
[102] Curtis 1991: 6-9; Curtis 2001: 312, 403, n. 19: these are the more common Latin terms, whereas Greek vocabulary included words for different types of cuts of meat. Only two types of fish sauce are known in Greek: γάρον and ἅλμη.
[103] Indeed, Pliny (*NH* 31.41.87-88) notes that the taste of salt is what is looked for in such sauces; Curtis 2001: 410.

have been identified through evidence of fish bones, other organic debris, and Mañá A4 and Mañá D-type amphorae containing fish remains.[104] At the Las Redes site in *Gadir*, rooms for cleaning fish (with a paved floor), fermentation (with organic debris and possibly a hearth), storage for amphorae and with fishing accoutrements such as fish hooks and line sinkers have been identified. These sites began to operate in late 5th century BC, with the height of activity occurring ca. 430-325 BC; eventually the sites ceased operation ca. 200 BC. Salting in the region, however, began to be practised again during the 1st century BC.[105]

The method for salting is preserved in only two 1st-century AD Latin sources, Manilius and Columella.[106] The process they describe entails fresh fish to be cleaned and gutted (removing all the blood, usually in a freshwater wash) and the heads removed. The pieces of flesh are then covered with salt and stacked alternately in a large vat or ceramic container. To ensure the salt's absorption into the meat, a weight was placed on the top-most layer. Some fish were packed with more salt than others (modern "slack salting" vs. "hard salting"), and for some products, the scales were left on the meat (Fig. 3.18).[107] The liquid derived from the *salsamenta*-making process, *muria*, was also consumed and sometimes packaged with the salted fish.[108]

Of the various fish sauces produced during the early Roman Empire, *garum* seems to have been the most common. The methods for the sauces' manufacture are preserved in some fragmented recipes as early as the 1st century BC; the most complete description is given in the *Geoponica*, a 10th-century Byzantine agricultural manual based on a lost 6th-century Latin treatise. The most basic recipe required pieces of eviscerated larger fish, sometimes including the scales and fins, to be set in a water-proof container or vat with salt.[109] On occasion, whole small fish, shellfish, other marine invertebrates and roe were used;

104 The sites are: Plaza de Asdrúbal, Avda. De Andalucía, Avdas. García de Sola y de Portugal and Las Redes.
105 Muñoz Vicente, *et al*. 1988: 488-496
106 Manilius, *Astr.* 5.656-681; Columella, *DRR* 12.55.4 (whose recipe is for curing pork but states that fish salting is done in the same manner); see Curtis 2001: 404.
107 "Slack salting" uses 10-20% salt-to-fish weight but preserves for only 7-20 days. "Hard salting" uses 30% salt by weight and preserves the fish indefinitely; like stockfish, the latter will have to be left in a water soak for several days in order to reconstitute itself (Thurmond 2006: 227); Curtis (1991: 10-11) thinks both cures were used in the Mediterranean in antiquity. Plautus (*Poenulus*. 240-243) describes stockfish so tough it had to be soaked in water for days and that Columella's salting description is for a "hard cure". Pliny (*NH* 9.18.47-48) describes *melandrya*, salted pelamydes (young tunny) that is so hard it is like wood.
108 Curtis 1991: 7-8, n. 8; Wilson 1999: 42
109 The *Geoponica* author suggests a mixture of one *modius* of fish for two *sextarii* of salt – a fish-to-salt ratio of 8:1 (see Curtis 2001: 406; Martínez Maganto 2005: 122); other possible 3rd-century AD recipes given in Ps-Rufius Festus, *Brev*. and Ps-Gargilius Martialis 62 (see Curtis 1991: 11-13, 192-193).

sometimes herbs and wine were added.[110] The mixture could then be artificially heated, in small jugs (*marmites*), reducing the liquid by two-thirds; or it could be left to ferment naturally in hot conditions for 27 days to three months, with occasional stirring after the seventh day.[111] Afterwards, a semi-transparent liquid was strained off the top of the mixture – this was *garum*. The remaining un-dissolved fish material was then leached with hot water to produce a second quality sauce called *liquamen. Allex*, the largest pieces of fish debris from the *garum*-making process, was also consumed.[112]

PURPLE DYE PRODUCTION

Another marine product sometimes processed alongside *salsamenta* and the sauces was purple textile dyes. In this process, specific *Muricidae* shellfish (*murex* and *purpura* species) that possess colourless dye precursors in their hypobranchial glands are used.[113] Pliny relates the process by which the glands are extracted (or collected with an iron tool, according to Vitruvius) from the just-killed shellfish and deposited in a lead or tin container with fresh water mixed with a proportion of salt.[114] This mixture is allowed to coagulate for up to three to ten days and is heated but not boiled to reach a temperature around 35º C; immediately afterwards, fibres or woven textiles are submerged in the liquid, which can quickly evaporate.[115] (In 6th century, a process was discovered to keep/maintain the dye mixture five or six months after heating, without altering its qualities – it was only necessary to revitalise with water.)[116]

As the individual shellfish produce so little dye, large quantities were required. Estimates suggest 12,000 *murex* and *purpura* shells are required to produce 1.4 g of dye – which is

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[110] Pliny (*NH* 31.44.95) lists mackerel, tunny, murry, oysters, sprat, mullet, smelt, sea urchins, sea anemones and other shellfish. Of the larger fish, it was imperative that all fats and gallbladders were removed (Thurmond 2006: 229).
[111] *Geoponica* 20.46.1-6
[112] Curtis 2001: 413-414
[113] *Murex* species*: Murex (bolinus) brandari, Murex trunculus/Hexaplex (truncalariopsis) trunculus, Murex erinaceua; Purpura* species: *Purpura (Thais) haemastoma, Stramonita haemastoma, lapillus*. Red-mouthed rock shell (*Purpura [Thais] haemastoma* and *Stramonita haemastoma*) cannot produce dye independently, and are only used in conjunction with other *murex* and *purpura* species; Ziderman 1990: 98-99; Reese 1979-80: 80.
[114] Pliny, *NH* 9.60.126-127: "from the larger purples they get the juice by stripping off the shell, but they crush the smaller ones alive with the shell, as that is the only way to make them disgorge their juice…"; Vitruvius, *de Architectura* 7.13.3: "when the shells have been collected, they are broken up with iron tools"; see also Fernández Uriel 1995: 311-314. The shells must be drilled in order to remove the veins (Ruscillo 2005: 103-104).
[115] Aelian, *NA* 16.1; Pliny, *NH* 9.62.38; Pollux, *Onom*. 1.49; Alfaro Giner 2002: 682-683; Drine 2007: 88; Wilson 2004: 160; experiments demonstrate that dying a textile is much easier than dying thread; see Ruscillo 2005: 104-105.
[116] This process is mentioned in the 6th century by Cassiodorus (*Variae* 1.2) although in the 1st century BC Vitruvius (*de Architectura* 7.13.3) says mixing the dye with honey also prevents the mixture from drying up, but does not state for how long. This also may explain the AD 615 report of private dye works at This, near Abydos, Egypt, as using purple dye so far inland (Reese 1979-80: 86).

only sufficient to colour the border of a piece of clothing; other studies suggest that ca. 1,000 shellfish are needed to dye an entire wool cloak, and that some species produce up to 50% more dye than others from their veins.[117] Certainly, the extensive shellfish mounds from sites such as Meninx in Tunisia attest to the large quantities necessary for this activity.[118]

FISH-SALTING AND PURPLE DYE FACILITIES

The salting of fish and/or marine invertebrates could take place in any waterproofed container, and amphorae, *pithoi* and *dolia* are mentioned by Manilius as being ideal for making *garum* and the latter have been identified at fish-salting sites.[119] The purpose-built facilities where fish-salting and purple dye production took place, however, provide the most extensive body of archaeological evidence that relate to the exploitation of marine resources in *Mauretania Tingitana*.[120] Some of these facilities are identified only through the presence of fish bones, shellfish, amphorae (particularly Mañá-Pascual A4 types) and *pithoi*.[121]

In the western Mediterranean during the 1st centuries BC/AD, more permanent installations began to be built that consist of square, rectangular and sometimes circular salting vats, called *cetariae*, usually built flush with the ground or slightly protruding, varying in size and depth. The walls of *cetariae* are constructed of bricks and/or rubble, faced with a sealing mortar mixture of lime and small fragments of tiles or ceramics (*opus signinum*) (Fig. 3.19). Groups or individual vats could be set outdoors, under shelters or inside buildings, the latter with windows and doors for ventilation. These installations often include a preparation floor where the marine resources could be gutted, washed, or shells and dye glands removed. Sometimes heating facilities were included in these buildings for artificially reducing the sauces during fermentation, for raising the temperature of the dying mixture, or possibly even for obtaining salt through evaporation, derived from beach sand and seawater (see description below).[122]

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117 Karali 2002: 106; Ruscillo (2005: 105) states that *Murex brandaris* species produce 50% less dye per individual than *Murux trunculus* species.
118 Drine 2007: 82-85; Slim, *et al*. 2004: 21, 35; Wilson 2004: 160-161
119 Manilius, *Astr*. 5.679; Curtis 1991: 92-94, fig. 6, 123, n. 55; *dolia* were likely used for fish-salting production at St. Blaise, France (Benoit 1959: 103), *Tipasa,* Algeria (Wilson 2007: 178), Seville (Amores, *et al*. 2007: 336), Pompeii and at sites in the Crimea (Trakadas 2005: 70-72; Højte 2005: 141-156); for *garum* production in amphorae, see Van Neer & Parker 2008.
120 See App. 3.1; Ponsich & Tarradell 1965; Ponsich 1988.
121 For example, amphorae but not salting vats are present at the 5th-century BC salting sites at Las Redes, in the Cádiz region (see Muñoz Vicente, *et al.* 1988: 488-496). It can be extremely difficult to identify certain types of fish salting or smoking facilities through the archaeological record as some of these are organic in nature (i.e., wooden structures such as racks and flakes for drying and salting); for discussion, see Beech 2004: 208-209; Højte 2005: 141-142.
122 Trakadas 2005: 70-72; Hesnard 1998: 182-190; it has also been proposed that these heating facilities were used to extract whale grease/fat (Bernal Casasola 2009b: 276-278).

Sites with various sizes and configurations of these salting *cetariae* are present on the Mediterranean, Straits of Gibraltar and Atlantic coasts of *Mauretania Tingitana*. A catalogue of these purpose-built installations and other possible salting sites that lack *cetariae* is presented in Appendix 3.1. The sites' topographical situations, based on published material and site reconnaissance is presented, as well as their chronology; the capacities of *cetariae* are given or estimated at those sites that possess them. Additionally, the proximity of available salt and freshwater resources and amphorae kilns (discussed below), derived from field reconnaissance by the author, published material, historical maps and texts, is included in the catalogue.

As these sites were established near marine, estuarine or riverine fishing grounds, an examination of their distribution, topographical situations and chronologies provides information regarding access as well as areas and periods of fishing effort. The maps of each geographical region (the Mediterranean, Straits of Gibraltar and Atlantic) will assist in determining the logistics of acquiring these resources and the role of the coastal landscape in facilitating or hindering their acquisition. This is especially relevant not only to marine resources, but the location and accessibility to salt and freshwater sources.

QUANTIFICATION ISSUES

The combined capacities of the extant *cetariae* from individual fish-salting sites are estimated in the catalogue. Their inclusion, however, is not an attempt at specific quantification, as there are far too many unknown variables inherent within the *Mauretania Tingitana* material for this determination.[123] For example, the poor level of preservation of many of the *cetariae*, inadequate or missing *cetariae* measurements from publications, or only measurements provided for the vat's initial stages of use (many were reduced, with false floors added, in the Late Roman period), contribute to this problem. Additionally, capacities are difficult to estimate even if *cetariae* are fully preserved, as it is not known if these were filled completely, used constantly, or designated for specific products (*salsamenta*, *garum* or keeping purple dye shellfish alive before use, for example). Compression also likely occurred during the salting process as the product was naturally reduced. In some cases, too, *cetariae* might have been used for salting other types of meat (e.g., pig bones have been found in the salting areas at *Baelo Claudia* and beef and mutton bones at *Iulia Traducta*, in southern Spain).[124] Moreover, as is the case at sites like *Septem Fratres*, extensive modern construction has severely damaged or completely destroyed sites,

[123] See discussion on the problems of quantification in fish-salting production in Wilson 2002b: 247-248.
[124] Hesnard 1998: 174; Bernal, *et al.* 2007c: 370-371; Arévalo González, *et al*. 2004: 286-287; García Vargas & Bernal Casasola 2009: 143

making it impossible to estimate how many more *cetariae* might have been in operation. The capacities, therefore, are given here in order to provide a very general baseline for comparing production output between sites; this is done to determine which facilities likely fulfilled local consumption needs or could provide a surplus of products for exportation.

SALT SOURCES

Salt was necessary for the production of *salsamenta*, sauces and purple dye. Salt could be obtained from salt mines, which are generally located at dried inland lakes, but more usually from the coastal zone: indeed, the Atlantic coast of *Mauretania* was considered "*patria salinarum*".[125] Several methods could be used to obtain the salt in this zone. One of these, using salt pans or *salinas*, is a common method practised today along the coast and also the least labour-intensive (Fig. 3.20). In this process, seawater is led by channels into very shallow pools during the wet season or seasonal high tides; the dryness of the subsequent summer months and exposure to winds assist in the salt-making process.[126] In these pans the salt is developed through evaporation: the brine is allowed to concentrate to saturation ("corn" or crystalise) in the same pond or in successive ponds, for a purer product. Sometimes fresh water is added to leach out bad salts.[127] The best quality of salt from these pans is the upper-most layer, or 'flower' of the salt, possibly the "*flos salis*" referred to by Pliny.[128] Salt could also be obtained from seawater that evaporates above the high-tide zone, such as that that collected on rocks: *"spuma salis"* ('froth salt').[129] Salt can also be obtained through the process called lixiviation, in which seawater or beach sand is artificially heated (much like in the *garum*-making process) and the salt is gained through evaporation.[130] This process, however, also requires controlled heating and a large amount of fresh water in order to remove bad salts.[131]

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[125] Salt mines: "ἁλός τε μέταλλον" in "Libya": Herodotus, 4.185; Fernández Uriel 1992: 333; *"patria salinarum"*: Rav. Cosmog. I.3, III.9.

[126] Fernández Uriel 2000: 346; Carrera Ruiz, *et al.* 2000: 58, 62; Moinier 1985: 76-77; Thurmond 2006: 239-244

[127] Hesnard 1998: 176; modern *salinas* use 17 kg of sea water to produce 1 kg of salt with this method (Moinier 1985: 77); channelling brine to successive pans is the process used today in *salinas*, and removes the "bad salts": residual sodium chloride and most of the magnesium salts (unrefined sea salt is not fit for consumption because it has large amounts of magnesium chloride, magnesium sulphate, calcium carbonate and calcium sulphate); see Alonso, *et al.* 2007: 320-324; Thurmond (2006: 242) identifies the moving salt between pans ca. AD 416: Rutilius Namatianus' *De Reditu Suo* I.478; for the addition of fresh water, see Pliny, *NH* 31.39.81.

[128] Pliny, *NH* 31.42.90; this might also be the salt referred to as "*Sal Facticius*", 'artificial salt' (Pliny, *NH* 31.39.81) – which in turn might refer to igniferous salt (from lixiviation); see discussion in Martínez Maganto 2005: 115-118.

[129] Pliny, *NH* 31.39.74

[130] Hesnard 1998: 183-184

[131] Nenquin 1961: 108-109; Thurmond 2006: 239-241

The evidence for salt sources in *Mauretania Tingitana* is compiled through historical maps (included in Appendix 7), historical texts and documentation, as well as 20th-century ethnographic studies and reconnaissance of salt production zones. The data for these salting areas are presented in a table and map in Appendix 3.2, providing an important basis for the contextualisation of the fish-salting sites in Appendix 3.1.

SALAZÓN AMPHORAE

As fishing indicates the supply aspect of the fish-salting process, and the salting sites and salt sources indicate the structures and methods for this processing, the amphorae used to transport sauces and *salsamenta* indicate a mechanism for the distribution of these products.[132] This study, therefore, includes an analysis of the presence and provincial diffusion of these specific ceramic types, referred to here as salazón amphorae.

As amphorae can be re-used or a particular type can be used to transport more than one agricultural product from a region, the identification of these types is not straightforward.[133] Generally, those included in the study have been previously identified as salazón types by finds of these containing the remains of salted-fish products, or by their proximity to fish-salting centres. In some cases, amphorae possess *tituli picti* that note their contents as salted products (see discussion below).[134] Here, the main Punico-Mauretanian salazón types of the western Mediterranean (those manufactured in Portugal, Spain and Morocco) are identified through these criteria;[135] the same is done for Roman and Late Roman types, following those listed as 'salazón' in the 'Amphora Project' on-line database.[136]

The chronologies of these salazón types are also difficult to fix, as the dating of material at some sites in the northwest Maghreb has been more refined than at other sites. Additionally, kilns operating in different regions (even in different provinces) produced nearly-identical types at slightly different periods; in some cases, these chronologies differ by more than a

[132] For the relationship between salting centres and kilns, and in particular in *Mauretania Tingitana*, see Bernal Casasola 2006a: 1368-1372, 1377-1380.
[133] See, for example, the difficulty in identifying the Africana II (Grande) type from *Africa* as a salazón amphorae: some have stamps *C(olonia) I(ulia) N(eapolis)*, that is the fish-salting site at Nabeul, where other stamps were found, but wine and olive oil have also been identified in these elsewhere (Monkachi 1988: 10-11; Ben Lazreg, *et al.* 1995: 119-122; Bonifay 2004; Panella 1973).
[134] Étienne 1990: 15-16; Martin-Kilcher 2000: 761; Bernal Casasola & Pérez Rivera 2000; Pons 2007; Villaverde Vega 2000
[135] Chronology also given in these references: Mañá-Pascual A4: Kbiri Alaoui & Mlilou 2007: 71-76; Villaverde Vega 2000: 901-902; Arangui Gascó, *et al.* 2004: 366-267; Mañá C2b: Aranegui, *et al.* 2007: 208; Aranegui Gascó 2005b: 273; Aranegui Gascó, *et al.* 2000: 17; Bonet Rosado, *et al.* 2005: 107.
[136] http://ads.ahds.ac.uk/catalogue/archive/amphora_ahrb_2005/cat_amph.cfm

half-century or century.[137] In this respect, the study of fabrics from specific kiln sites is of the utmost importance to determine not only chronology but also the supply and transhipment of packaging material. However, the geological similarity between the northwest Maghreb and southern Iberia make this distinction a difficult task, and there is no widely-utilised identification of fabric types for the former province's ceramics.[138] Additionally, it has been proposed that empty amphorae were transported to the province from southern Iberia.[139] These theses have been difficult to prove, especially due to the relative lack of survey work in Morocco to date.[140] Indeed, in the last few years, several kilns have come to light in northern Morocco and the Spanish territories that are transforming the existing theories.[141]

The comparison of these chronologies and analysis of fabrics leading to the determination of kiln sites, however, is an extensive undertaking and outside of the scope of this present study. In order to correlate these discrepancies at hand, a generally-accepted chronology will be followed for the Roman and Late Roman salazón types in this study, based on those given in the 'Amphora Project' database.[142] The chronologies of the Punico-Mauretanian salazón types are based on the general chronologies determined from the kiln at Kouass and the settlement at *Lixus*.[143] These amphorae are outlined in Table 3.5 and pictured in Fig. 3.21.

The tables and the distribution maps of these amphorae and kilns, presented in Appendix 3.3, are based on published material. These publications are not without discrepancies, however, and whilst some give the exact percentage of total fragments of a certain type from specific excavation campaigns, other publications only mention "numerous fragments" of amphorae or "a few sherds". Without studying the material firsthand, it is not possible to know which

[137] One example is the Mañá-Pascual A4 type, which was manufactured near Cádiz and Málaga (Sáez 2008), but also at Kouass, north of *Lixus*, between the mid-6th to late 5th centuries BC, and also at *Banasa* (Kbiri Alaoui & Mlilou 2007: 71-76; Villaverde Vega 2000: 901-902; Arangui Gascó, *et al.* 2004: 366-267; Villaverde Vega 2000: 902; Girard 1984a: 59-60). A variation of this type was made in the 2nd century BC, possibly into the 1st century BC at Kouass (based on finds from *Zilil*: Akerraz, *et al*. 1981-82; 202, Pl. 18; for revised date of *Zilil* layers, see Lenoir 2004: 270; Kbiri Alaoui 2007: 217, contra Kbiri Alaoui 2004).
[138] For example, the recent excavations at *Lixus* have identified two fabric types from southern Spain and *Mauretania* that represent similar amphorae types: Bonet Rosado, *et al.* 2005: 127; see also Izquierdo Peraile, *et al.* 2001: 159-161; see also material for Kouass (Stambouli, *et al.* 2004) and *Septem Fratres* (Bernal, *et al.* 2006; Bernal Casasola 1997: 94-98).
[139] Bernal 1999; Bernal Casasola 2006a: 1381-1384; Bernal Casasola & Pérez Rivera 2000; see history of this theory in Teichner & Pons Pujol 2008: 305-306.
[140] Teichner & Pons Pujol 2008
[141] E.g., Cerri 2007b; Limane & Rebuffat 2004; Bernal Casasola 2006a: 1361-1362, 1369; Aranegui Gascó, *et al.* 2004; F. Villada Paredes (Instituto de Estudios Ceutíes), pers. com.
[142] Given under each of the identified salazón types at http://ads.ahds.ac.uk/catalogue/archive/amphora_ahrb_2005/cat_amph.cfm. Alternate identification of typologies also following those given on the website.
[143] Kbiri Alaoui 2007: 198-205, 217; Ramón 1995: 237-238; Aranegui Gascó, *et al.* 2000: 19; Ponsich 1969-70

examples are repeatedly counted in different publications.[144] Due to these inconsistencies, it is impossible to quantify the material at hand and such an endeavour is again beyond the scope of this present study. Therefore, only the presence and provincial distribution of these types as indicating local consumption, distribution and chronology are presented and discussed.

3.3 Descriptive data

The descriptive material examined in this study derives from publications of artefacts from excavations within the former province of *Mauretania Tingitana*, as well as from outside the province. Other material derives from literature reviews and ethnographic fieldwork.

3.3.1 Written sources

Although uneven in their geographical treatment, a diverse body of ancient written sources discuss marine resources. As can be seen in the citations above used to illustrate the archaeological finds, this body of evidence describes fishing methods, fish behaviour, recipes and even attitudes regarding the consumption of fish in the Graeco-Roman world.[145] These qualitative sources must first be considered within their context or genre, however. Statements relayed in a comedy might elaborate certain details for satirical effect; at the same time, treatises might strive to be as scientific as possible, but the author might have compiled earlier works that can provide seemingly useful facts but is largely anecdotal and likely based on second- or third-hand information.[146] In addition, some information conveyed in these texts is generalised and with limited technical detail, making interpretation difficult.[147] The abundance of ancient written sources on these subjects can still be informative, however, but must be applied cautiously and in this study illustrate their agreement with and sometimes even contradiction of the archaeological data, particularly in the regional characterisations and case studies (Chapters 6-7).

On the general subjects of or relating to fish, fishing and fish-salting throughout the Graeco-Roman world that are particularly applicable to this study are the gastronomical work of Athenaeus, the dramas of Plautus, Martial and Horace, the poetry of Manilius, the agricultural manuals of Varro, Columella, the *Geoponica* and the dialogues, natural science treatises and geographical texts by Plato, Aristotle, Pliny, Strabo, Oppian and Aelian. These works, as already drawn upon in Sections 3.2.2-3.2.3, span a broad chronology, from the 5th

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[144] As they most certainly are, for example, in Hassini 1992; Girard 1984a.
[145] For more detailed surveys, see Donati Giacomini 1997; Curtis 1991; Rackham 1996: 22-24.
[146] Purcell 1995: 136, 141-143
[147] Nicholson 1979: 35; Bekker-Nielsen 2002b: 215-216

century BC to the 10th century AD, and are cited throughout the remainder of this study. The written sources contemporary to the Punico-Mauretanian, Roman and Late Roman periods that refer specifically to marine resource exploitation in *Mauretania Tingitana* and the nearby waters of the Mediterranean, Straits of Gibraltar and Atlantic are compiled in Appendix 4.1.

In addition to these contemporary written sources, there are a number of texts post-dating the Late Roman period that discuss the fishing methods and fisheries within the borders of the former province that are relevant to establishing and comparing areas of fishing effort, fishing techniques and species presence. These include medieval Arabic texts, 16th -century Portuguese treatises and 18th- and 19th-century French and English accounts. These are cited throughout the study.

Epigraphic sources also relate to marine resource exploitation. This evidence includes inscriptions and *tituli picti* that appear on salazón amphorae. *Tituli picti* can advantageously reveal aspects of the economics, scale and organisation of the fish-salting industry by describing products and naming those responsible for the shipping, manufacturing, and/or designated consignees. They can also identify the species used to make the products being transported. In combination with the type of amphora from which they derive, as well as its contents (if present) epigraphy can then be tied to chronologies and identify origin and product.[148] Although there is no epigraphic evidence of this nature present within *Mauretania Tingitana*, salazón amphorae with relevant *tituli picti* distributed throughout other Roman provinces and are catalogued in Appendix 4.2.[149]

3.3.2 Pictorial representations

Unlike other provinces in North Africa such as *Africa* and *Ægyptus*, the number of marine and fishing related pictorial representations from *Mauretania Tingitana* is extremely limited, with fewer than five examples.[150] The most common medium for these scenes, mosaic floors, provide a majority of the Roman-period fish or marine animal scenes in the province.[151] For the purposes of examining marine resource exploitation in this study, however, only the mosaic floors that depict scenes of fishing (two examples) will be included in this present

[148] Peacock & Williams 1991: 2, 9-16

[149] Epigraphic evidence from the region, however, does relate to salting during the Roman period: *M. SALINATOR QUADRATVS* (see App. 3.2: *Tangier Bay*).

[150] See Dunbabin 1978; Dunbabin 1999; Brewer & Friedman 1990. This situation is also similar to Iberia, where relevant mosaics are few and mostly from Galicia, Toledo and *Ampurias*; see Arévalo González, *et al.* 2004: 24-25.

[151] All the marine mosaics in the province derive from the inland sites of *Banasa* and *Volubilis*; see Chatelain 1935a; Chatelain 1935b; Limane, *et al.* 1997; Thouvenot & Luquet 1951a. Thouvenot 1977.

study (Fig 3.22). Other media on which related marine scenes or symbols are present include coins, a lamp and an amphora, and these are catalogued in Appendix 5.[152]

The application of these representations to this analysis cannot be made without caution. Often, features or details of fishing methods can be completely omitted for the sake of simplicity, the limitations of the medium, or as a result of artistic conventions.[153] The intent of an artistic piece can also pose problems in interpretation as fish and fishermen often can have symbolic representation. Marine life can sometimes serve as decorative motifs, and include species that were not present in the region where the piece was made. Likewise, in genre or thematic pieces, especially marine-scapes or Nilotic scenes, fishing methods may be portrayed as catching species that did not live the region or were not possible to catch with the method shown.[154]

As with written sources, however, contemporary iconography can at times reveal fishing methods described or alluded to in texts and even demonstrate previously undocumented activities. Qualitative in nature, iconographic data also are useful in that together with archaeological material, might demonstrate species' presence, the diversity of past resources and the understanding in antiquity of species' behaviour. This data will be applied in the regional characterisations and case studies (Chapters 6-7).

3.3.3 Ethnography

Fishing techniques used presently in small-scale or 'artisanal' (non-mechanised) fisheries can help form extremely useful comparisons when identifying earlier fishing grounds, tools and methods. Ethnographic studies can also illustrate human and marine life interactions, social organisation and communities, and can provide valuable insight about approaching the relationship between people and their resources.[155] The utility of forming comparisons between modern fisheries and those in antiquity has been demonstrated in Tunisia and Greece for lagoonal fishing and Egypt for riverine fishing.[156] Another example is the near-shore tunny fishing techniques practised today in Sicily, Spain and Morocco.[157]

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[152] Only *Lixus* coins are included in this study; fish also are thought to appear on the few early coins of *Babba*, but as this site has yet been convincingly identified, it is not included in this study (see Chapter 4.3); see Ripoll López 1988: 483-485.
[153] See discussion in Bekker-Nielsen 2002b: 218-222.
[154] Dunbabin 1978: 125-130; Drewer 1981: 533; Yacoub 1995: 14-18
[155] Hewes 1948: 238; McCay 1978: 401
[156] Greece: Guest-Papamanoli 1986; Tunisia: Trousset 1998; Romdhane 1998; Egypt: Brewer & Friedman 1990.
[157] Graziani 2002; Ponsich 1988: 34-38; Trakadas, *in press*

As with the other descriptive data discussed above, ethnographic comparison, however, cannot be applied to this study to investigate past fishing practices unless done so with caution and the attempt to explain or justify the proposed continuity.[158] In many cases the eating and demand patterns have changed over time; taboos and fashions, and the levels of material technology affects these fishing methods.[159] In addition, present fishing groups may be occupying “marginal resource zones”, and this might not have been the situation in the past.[160]

That ethnography can be applied to compliment the archaeological and descriptive material in the study of past fishing methods is largely due to the stability or near-consistency on a long-term basis of specific marine environments (such as estuaries, river mouths or rocky tidal pools) and fish behaviour (such as seasonal migrations and spawning or feeding grounds).[161] Although marine environments certainly do not represent static seascapes and can be subject to geo-morphological change over several millennia, perennial habitats and annual cycles can remain relatively consistent on a broader scale of the *longue durée*. Because of this consistency, and due to the unique nature of some marine environments, ethnographic comparison should be made only within the same region as the archaeological material under discussion derives.[162]

The published sources for artisanal fisheries in the northwest Maghreb originate from economic studies conducted in northern Morocco during the French and Spanish Protectorates (1912-1956), ethnographic fieldwork conducted during these years and recent statistics of semi-commercial fisheries operating within Morocco today.[163] Of particular importance is material collected prior to the early 1980s, when the ‘motorisation’ of artisanal fisheries began in Morocco.[164] Recent artisanal surveys have been conducted by the U.N.’s Food and Agricultural Organization (FAO) along the Mediterranean coast.[165] Other sources for this catalogue stem from fieldwork conducted and observations made by the author along the coastline, estuaries and rivers of Morocco and the coast of southern Spain between 1999-2009 (Fig. 3.23). Photographs and illustrations of these practices are catalogued in Appendix 6 and these and written ethnographic descriptions are referred to throughout the regional characterisations and case studies (Chapters 6-7).

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[158] Danforth 1984: 57
[159] Powell 1996: 80
[160] Yesner 1980: 727-728; Bolster 2006: 5
[161] Hewes 1948; Kirch & Dye 1979; Maigret 1985: 205-206; Powell 1996: 80; Slim, *et al*. 2004: 264
[162] Guest-Papamanoli 1986: 283-284
[163] E.g., Gruvel 1923; Rouch 1931; Timoule 1985; Miege 1996; Naji 2002
[164] Chaara 1996: 101-102
[165] COPEMED project: http://www.faocopemed.org/reports/artfish/start.html; Coppola 2003

Chapter 4.
Historical background

4.1 Prehistory

The earliest known human presence in the northwest Maghreb is confined to the Atlantic shoreline in the so-called Quaternary “Casablanca Sequence” of Late Lower Pleistocene deposits (Figs 4.1-4.2). Here, several present-day coastal sites between the modern cities of Casablanca and Rabat have revealed Acheulean (ca. 1 my~) to Middle Acheulean (ca. 0.6 my~) artefacts as well as *Homo erectus* remains.[1] The next sequence of human presence appears in the Epipalaeolithic (ca. 8,000-6,000 BC), in the coastal plain north of Casablanca; other populations were also dispersed into wider upland regions east of the Rif near the Mediterranean coast.[2]

During the Neolithic (ca. 6,000-ca. 2,000 BC), population groups continued to inhabit these regions, occupying open-air as well as cave sites between Rabat and Casablanca and further north in the Rharb and Saïss plains.[3] Other habitation sites are distributed in the alluvial valleys of the Oued Loukkos basin, and at Cap Spartel and Benzú at the western and eastern ends of the Straits of Gibraltar, respectively.[4] On the Mediterranean coast, habitation sites are located near the modern city of Tetouan in the Oued Martil basin and extend along the present shoreline and throughout the higher valleys of the eastern Rif and into the Oued Moulouya basin. In addition, large Neolithic sites have been found on the Îles Chafarinas near the mouth of Oued Moulouya.[5] No Neolithic settlements have been identified inland in the upper Atlas Ranges.[6]

The location of many of these sites in alluvial valleys suggests that in addition to hunting and gathering, more sedentary land-use systems could have been practised.[7] Many early sites are also located near extinct or modern river courses, lagoons and lakes as well as the sea,

[1] Raynal, *et al*. 2002; Sbihi-Alaoui, *et al*. 2004: 109-119; Nespoulet, *et al.* 2008
[2] Mikdad & Eiwanger 2000: 110-114; Souville 1973: 292-325; Jodin 1956; Nehren 1992: 51-53
[3] Roche 1956; Luquet 1967: 203-206; Souville 1984; Daugas, *et al.* 2006: 766; Nespoulet, *et al.* 2008
[4] Bokbot & Onrubia-Pintado 1995; Ponsich 1970: 28-66; Souville 1958-59: 315; Ponsich 1964b: 270, n. 40; Gilman 1974: 274-277; Souville 1973: 29-119; Ramos, *et al.* 2003
[5] Luquet 1967: 202-206; Mikdad, *et al.* 2004; Mikdad & Eiwanger 2000: 115-129; Rojo Guerra, *et al.* 2006; Daugas & El Idrissi 2008
[6] Gilman 1975: 3-4
[7] Zielhofer & Lindstädter 2006: 10-11

allowing for access to nearby marine fauna.[8] Many early coastal sites, however, have since been submerged by a large rise in sea level beginning ca. 6,000 BP.[9]

The similarity of the northwest Maghreb Neolithic impressed and incised ceramics to contemporary southern Iberian wares, and the similarity between burial practices between these regions suggest that these groups were somehow connected to or influenced by each other, forming a unique “Hispano-Mauritano Neolithic” or “Alboran” material culture, followed by a “Lusitanio-Moroccan” sequence.[10] However, it has also been argued that due to the similarity of the Maghreb flint industry to the distinct Oranian assemblages, there was an autochthonous character to the Neolithic development in northern Africa. It has been recently been proposed that in the early Neolithic, both Saharan and Mediterranean influences prevailed in the northwest Maghreb, contrary to early hypotheses of the region’s independent continuity from the Epipalaeolithic to Neolithic.[11]

The evidence of Bronze-Age activities north-west of the Atlas is not as abundant as that of the Neolithic and no settlements have yet been located although the ceramics remain very similar to those of the later Neolithic (and are similar to Iberian types). This period is distinguished regionally by the appearance of cist tombs, tumuli (or dolmens) and trapezoidal stone sepulchres in the flatter landscapes.[12] These structures started to appear before 2,000 BC near zones of riverine, marine and agricultural resources: the Rharb and Saïss plains, near Tangier and Cap Spartel, the Oued Laou valley on the Mediterranean coast and east of the Rif in the Oued Moulouya’s tributary valleys.[13] The largest of these is a circular, megalithic dolmen chamber tomb at M’zora, located on a low hillock north of the Oued Loukkos valley (Fig. 4.3, see Figs 4.1-4.2).[14] As in the Neolithic, there exists a similarity between the inhumation rites and constructional feature of the cist tombs to those that developed in southern Iberia. Some of the Bronze-Age funeral rites persist, particularly around Tangier, until the 7th century.[15]

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[8] Souville 1958-59; Posac Mon 1964
[9] See Flemming, *et al.* 2003: 67-68; Nehren 1992: 183; see also Chapter 5.4.1.
[10] Antoine 1937: 45-52; Renfrew 1967: 282-286; Jodin 1958-59; Ponsich 1970: 28; Souville 1973: 22-23
[11] Daugas & El Idrissi 2008; Gilman 1975: 6; Gilman 1974: 277-280; Nehren 1992: 172-177
[12] Souville 1986; Guerbabi 2006: 41-45
[13] Luquet 1967: 202-206; Bokbot & Onrubia-Pintado 1995: 225-226; Boudouhou 2006: 357-364; Ponsich 1970: 36-64; Ponsich 1975-76: 20-21
[14] Sbihi-Alaoui, *et al.* 2004: 120-121; Ponsich 1966a: 414-418; Souville 1973: 31-36; the monument might date between 3,000-4,000 BC although it has been proposed that the chamber tomb inside the mound was built later, sometime in the 4th century BC (Daugas, *et al.* 2006: 766).
[15] Ponsich 1970: 65-66

4.2 The western Phoenician and Punico-Mauretanian periods

During the late 8th and early 7th centuries BC, sea-borne Phoenician colonists from the eastern Mediterranean initiated contact with the autochthonous populations in the western Mediterranean. Crossing the Straits of Gibraltar from their newly-established colonies on the southern coast of the Iberian Peninsula, Phoenician groups established trading stations/settlements along the Mediterranean and Atlantic coasts of northwest Maghreb (Fig. 4.4). On a bluff overlooking the Atlantic above the Oued Loukkos floodplain, *Lixus* was likely their first west African settlement, founded in the late 8th century.[16] Shortly thereafter, a Phoenician presence is detectable 750 km south of the Straits of Gibraltar, where the trading station at the islands at Essaouira was established.[17] On the Mediterranean coast, the site at Sidi Driss was settled in the 7th century (Fig. 4.4).[18] Phoenician material culture and Levantine imports are present in the late 7th- and 6th-century layers along the Atlantic coast at *Banasa* (on the Oued Sebou), Azib Slaoui (on the Oued Loukkos), the large kiln site of Kouass, at Cap Spartel and nearby Tahadart, along the Straits of Gibraltar coast at Mogogha (in the Tangier region) and at Ceuta, and along the Mediterranean coast in the Oued Moulouya valley, at Bouhout (Berkane).[19] In the late 6th and 5th centuries, the settlement of Sidi Abdeselam del Behar was first occupied at the mouth of the Oued Martil near Tetouan as was Emsa, in the small alluvial valley near Cape Mazari (just south of the Oued Martil).[20]

The modern city of Tangier, in the western Straits of Gibraltar, was likely settled at this time and was certainly the port site: "Tingi" is mentioned in Hecataeus of Miletus' now-fragmentary *Periegesis*, written ca. 500 BC.[21] Other settlements followed in the 4th and 3rd centuries on the Mediterranean coast, at Kitzan and *Tamuda* in the Oued Martil valley, and on the eastern shores of the Guelaya peninsula, at *Rusaddir*.[22] At the southwestern edge of the Middle Atlas foothills, a settlement was built up at the site of *Volubilis*.[23] Contact also extended further south along the Atlantic coast, indicated by sporadic finds of ceramics and chamber tombs of this period identified at Azemmour to Cap Cantin (at modern El Jadida).[24]

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[16] Aranegui Gasco & Habibi 2004; Belén, *et al.* 1996; López Pardo 1996a: 254-257; Brouquier-Reddé, *et al.* 2006: 2160-2162
[17] Ponsich 1982: 434; Aubet 1993: 135-137, 219; Jodin 1966b; Jodin 1966c; López Pardo 1992a
[18] Kbiri Alaoui, *et al.* 2004; Akerraz, *et al.* 2003: 28-31
[19] López Pardo 1990a: 10-14, 16-18; Rouillard 1992; Villada Paredes, *et al.* 2007; Villada Paredes 2006: 273-274; Ponsich 1970: 185; López Pardo 1996a: 257-258; Kbiri Alaoui 2000; Jodin 1960; Jodin 1966a; Arharbi 2002a; Akerraz & El Khayari 2000: 1648-1657; Kbiri Aloui 2007: 222; Girard 1984a
[20] Tarradell 1957: 255-271; Tarradell 1960: 86-95; Kbiri Alaoui 2008
[21] Peet 1923
[22] Cravioto 1973: 17-19; Tarradell 1954b: 121-123; Tarradell 1960: 79-85; Tarradell 1966: 440-443; El Khayari 1996; Arharbi 2003: 66-67; Gozalbes Cravioto 1991: 83-85; Villaverde Vega 2004
[23] Luquet 1972: 3-5; Riße 2001: 16-24
[24] Luquet 1973-75a: 242-292

By the later 2nd century BC, the site of *Sala* on the Oued Bouregreg was occupied.[25] At the same time, *Zilil*, on a long ridge overlooking the floodplain of the Oueds Tahadart and Hachef, south of *Tingi*, was first settled.[26]

The material culture from these sites indicates that these first foreign settlers did remain in contact with their eastern Mediterranean homeland in the Levant and other groups in the eastern Mediterranean, but were more strongly linked with the western Phoenician populations of the southern Iberian Peninsula and the large colony at Carthage, founded in the 9th century BC.[27] The Phoenician entrance into northwest Africa was likely instigated by the search for new sources of trade goods, found in the Phoenician layers at these sites: metals (copper, lead and iron), bone, and *Muricidae* shellfish (sought after for its purple dye qualities).[28] These sites were closely linked into a wider social and commercial circuit around the Straits of Gibraltar and Sea of Alboran that included the Phoenician colonies of *Gadir* (modern Cádiz), *Sexi* (modern Almuñecar), at Toscanos and *Baria* (modern Villaricos) on the southern Iberian coast.[29]

Already by the 5th century BC, ceramics made in the Punic tradition were being manufactured in the north-west of Morocco with somewhat more 'local' or regionally distinct characteristics (Fig. 4.5).[30] Other Punic-influenced material culture also appears gradually in the course of the centuries following the initial Phoenician arrival. Called "Punico-Mauretanian," this period, in general terms, lasted in the northwest Maghreb from the 5th century until the Roman administrative annexation in the mid-1st century AD.[31] The Punico-Mauretanian culture likely included a population of indigenous Berber tribes (generally described by Classical writers as the "Mauri") and descendents of the earlier Phoenician colonists.[32]

The political geography of North Africa rapidly changed during the later Punico-Mauretanian period. With the annexation of Carthage by Rome at the end of the Third Punic War (146 BC), the Roman province of *Africa* encompassed Carthage's former territory comprising parts of modern Tunisia, Libya and Algeria. This sphere of influence was further

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[25] Boube 1984: 167; Kbiri Alaoui 2006: 148, n. 4
[26] Akerraz, *et al.* 1981-82; M. Lenoir 2004: 270, with corrections for the 4th-century date cited in Kbiri Alaoui 2004: 206-207; López Pardo 1990a: 21-23; Depeyrot 1999: 12; a 3rd-century date is given in Kbiri Alaoui 2006: 150; a 2nd-century date in Kbiri Alaoui 2007: 216.
[27] Maass-Lindemann 1992
[28] López Pardo 1990a: 16-36; Ponsich 1970: 76-81, 106-165; Fernández Uriel 1995
[29] Ruiz Mata 2002: 160-161; Aubet Semmler 2002: 80-88; Gozalbes Cravioto 1991: 57-61
[30] Habibi 2001b: 74-75
[31] Aranegui Gascó 2001: 253-254
[32] Brett & Fentress 1997: 24-25

extended south and west by Rome with the defeat of the Berber tribal leader Jurgurtha (in 105 BC) and the continued rise of King Bocchus I, whose Mauretanian territory eventually stretched west from *Africa* almost to *Rusaddir* (modern Melilla) on the Mediterranean coast.[33] Local tribal groups, however, continued to rule over the diverse populations of the northwest Maghreb.[34]

After the death of Bocchus I, the area called *Mauretania* west of *Africa* was divided through Roman intervention into separate kingdoms under indigenous control. The eastern half of *Mauretania* was ruled by Bocchus II, and the western half eventually came to be ruled by King Bogudes II, either from his seat at *Lixus* or *Volubilis*, in the Middle Atlas foothills.[35] Although Bogudes was officially recognised in 49 BC as the region's ruler by Caesar, the struggle for control of the region continued between the new kings of *Mauretania*. In 38 BC, Bogudes invaded Iberia and his subjects and Bocchus revolted against him; failing to suppress the uprising, he abandoned his kingdom and allied himself with Antony, dying in exile in 31 BC.[36] Octavian confirmed Bocchus as king of all *Mauretania*, and conferred Roman citizenship on the population of *Tingi*.[37] By 25 BC, western North Africa was then put under the Roman-appointed control of King Juba II, the son of a slain Mauretanian enemy of Rome who had been raised in the house of Caesar.[38] Now as the client-kingdom *Mauretania*, Juba's territory was loosely defined but certainly extended west from the Roman provinces, probably beginning at *Cirta*.[39] Coastal *Iol Caesarea* (in northern Algeria) was to serve as the eastern capital of Juba's territory, whilst *Volubilis* served as the western capital (receiving the epithet *regia Iubae)*.[40]

4.3 The Roman province of *Mauretania Tingitana*

As Rome began to assert itself more strongly in North Africa in the 1st century BC, it also sought to consolidate control of the Straits of Gibraltar and protect the southern flank of its Iberian territories. In this respect, *Tingi* had already been designated a Roman *municipe* in 38 BC by Octavian (also eventually entitled *regia Iubae*), as a form of reward for Bocchus' support in the war against Antony.[41]

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[33] Brett & Fentress 1997: 43-46; Roller 2003: 48-49
[34] For local tribal leaders ruling at *Tingi* after the usurper Askalis, see Plutarch, *Sertorius* 7-10; Carcopino 1943: 173-177; Rebuffat 2001: 26.
[35] Jodin 1987: 312; Ghazi-Ben Maïssa 1994; Riße 2001: 12; Coltelloni-Trannoy 1997: 19-22
[36] Dio Cassius, 41.42.7; Roller 2003: 57-58, 93-94
[37] Dio Cassius, 48.45.1-3
[38] Chaves Tristán, *et al.* 1998: 1315; Roller 2003
[39] Roller 2003: 39-41
[40] Jodin 1987: 26-29; Euzennat 1957a: 48-53; Coltelloni-Trannoy 1997: 33-34, 81-88
[41] Rebuffat 1999: 273

During this century, the impact of the Empire's emerging presence in the region becomes very apparent. This process, the 'Romanisation' of the province, is traceable through the influx into the region of foreign populations from other Roman territories, but also the introduction of the Latin language, governance, material goods and inclusion of the region into wider Mediterranean-wide markets. In addition, 'Romanisation' included aspects of urbanisation: within the pre-existing Punico-Mauretanian settlements, different architectural elements and buildings start to appear at the earlier sites (such as *fora*, *macella* and bath complexes), city planning is overlaid on these sites and agricultural production increases.[42] These influences spread south from *Tingi* to the hinterland and to other settlements on the northwest Atlantic coastal plain that were made *coloniae* between 33-25 BC: *Zilil* (*Col. Iulia Valentina Zilil*), *Babba* (*Babba Iulia Campestris*) and *Banasa* (*Col. Iulia Valentina Banasa*) (Fig. 4.6).[43] These colonies had close interaction with those in southern Iberia and were likely initially administered from there.[44] A garrison was stationed at *Tingi* to facilitate communication between the two regions and control the piracy from the Rif coast that had become a problem in the Straits.[45]

The Mauretanian dynasty continued with the reign of Juba II's son, Ptolemaios, who ascended the throne in AD 23/24 but was killed at the behest of Caligula AD 39/40.[46] This event led to a revolt against Roman control of the region led by a freedman, Aedemon, who was loyal to the former Mauretanian line of rulers. Over the next several years, troops sent by Claudius sought to subdue the region's rebellion.[47] At almost every settlement in the region except *Volubilis* there is evidence of fire destruction dating to this period, usually associated with the revolt. The lack of damage at *Volubilis* is probably due to its leader remaining loyal to Rome.[48] With the success of the Roman military campaign, the territory north-west of the Atlas was fully annexed by Claudius in AD 42/43.[49] *Tingi* became a *colonia* and the capital of the western-most Roman African province, *Mauretania Tingitana*. To the east was established the province of *Mauretania Caesariensis*; the limits between the

[42] See discussion of 'Romanisation' as the term is applied in this study, in Chapter 1. The process is comparable to that experienced in southern Iberia; see Fear 1996: 27-37, 268-269; Fentress 2006: 31-33.
[43] Cherry 1998: 77, 82-96; Ponsich 1970: 183-194; Desanges 1960: 437; Février 1989: 103, 109; Euzennat 1990: 569; Boube 1983-84a; Euzennat 1989b; Rebuffat, *et al.* 1986: 223-232. *Babba* has yet to be convincingly re-located; for identification as *Oppidum Novum* (Ksar-el-Kebir), see El Hasroufi 2006; Euzennat 1990.
[44] Mackie 1983: 352
[45] Gonzalbes Cravioto 1988: 769-770; Strabo, 3.2.5
[46] Dio Cassius, 59.25.1; *CIL* VIII, no. 8630; Fishwick 1971; Coltelloni-Trannoy 1997: 55-59
[47] Pliny, *NH* 5.1.11-12; Riße 2001: 26-27; Roxan 1973: 839
[48] *IAM* 1, no. 448; Gonzalbes Cravioto 1996: 256-258
[49] Whittaker 1994: 92; Montero 2000; Fishwick 1971: 484

two were established east of *Rusaddir*, following the Oued Moulouya valley.[50] The southern-most extent of regular Roman occupation followed the Oued Bouregreg south of *Sala* on the Atlantic coast, where, at the end of the 1st century an earthwork system was built south of the river. The eastern frontier zone followed the Atlas foothills.[51]

Volubilis, as *municipium* and *oppidum*, now became the seat of the Roman procurator who administered over a diverse population of semi-autonomous and client Berber tribes, Roman citizens, and Iberian and Jewish groups (Figs 4.7-4.8).[52] By the 2nd century AD, it is estimated that *Volubilis* had ca. 10,500-12,000 inhabitants; the province's population likely numbered as high as 30,000.[53]

Although *Mauretania Tingitana* neighboured *Mauretania Caesariensis*, it seems that no routine overland contact between the two territories was ever established due to the mountainous topography and un-allied indigenous groups in the Middle Atlas and along the Oued Moulouya valley to the east.[54] No Imperial roads have ever been delineated and no Roman-period finds have been identified between the two provinces or at the Taza pass, the most natural passage between the Rif and Middle Atlas leading into the Rharb plain.[55] The only recorded crossing of the Atlas by Romans took place in AD 41, when the legionary commanders C. Seutonius Paulinus and Cn. Hosidius Geta pursued remnant factions of the Aedemon revolt into the Sahara, possibly as far as the Oued Guir.[56]

Within the province's limits, however, eight *coloniae* and ca. 30 nucleated settlements developed.[57] In the hinterland around these centres the agricultural wealth of the region was harvested. Particularly in the Tangier countryside, in the Atlantic coastal plain and around *Volubilis*, numerous *villae rusticae* complimented the urban centres. These regions, where the cities of *Zilil*, *Lixus*, *Banasa*, *Babba*, *Thamusida*, *Sala* and *Volubilis* were sited, produced grains, olive oil and possibly wine. From the Rif and Atlas Mountains, wood was culled and exotic animals such as ostriches and elephants were captured for export to Rome's Coliseum; lead and copper were possibly mined from the Rif.[58]

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[50] Marion 1960: 447; Rebuffat 1999: 265
[51] Euzennat 1989a: 288-292; Akerraz 2002; Frézouls 1980: 70; Riße 2001: 16-24; see Chapter 5.1 for a detailed discussion regarding the limits of the province.
[52] Roller 2003: 42; Jodin 1987: 21-32; Sigman 1977: 418; Shaw 1986: 83, n. 10; *ILM*, no. 116
[53] Thouvenot 1949: 3; Euzennat 1989a: 201-210; Courtois 1955: 108
[54] Marion 1960: 447; Euzennat 2000: 458; Sherwin-White 1944: 5
[55] Marion 1960: 442; Euzennat 1957b: 228
[56] Dio Cassius, 60.9.1-5; Pliny, *NH* 5.1.14; Sigman 1977 : 417, 425-426
[57] *Geo.* 4.1; Rebuffat 1999: 265-269
[58] Strabo, 17.3.4; Ponsich 1964a; Ponsich 1966c; Gozalbes Cravioto 1997: 54-55. *Thamusida:* evidence for elephant and lion bones along the Oued Sebou: Wilson 2002b: 251, 253; Papi &

On the coasts and coastal rivers of the province, settlements such as *Rusaddir*, *Septem Fratres*, *Tamuda*, *Tingi*, *Lixus* and *Sala* served as ports, facilitating the export of the region's products and the import of goods from throughout the Mediterranean. These ports were also encircled by small but productive agricultural hinterlands.[59] These and other coastal, estuarine and riverine establishments at Essaouira, Kouass, Tahadart and Cotta (both near *Zilil*), Zahara, Ksar-es-Seghir and Dchar 'Askfane (in the Straits of Gibraltar) and Sania e Torres (south of *Septem Fratres*) were built in order to exploit the littoral zone for a variety of resources such as fish, shellfish and salt.[60]

The *oppida* and settlements of *Mauretania Tingitana* were established within an area populated by sedentary indigenous groups whose identities had been variously amalgamated within Punico-Mauretanian and subsequent Roman culture. Indeed, the situation of some of the Roman cities, such as *Lixus*, *Banasa*, *Thamusida*, *Sala* and *Volubilis*, also took advantage of the local social and topographical situations and succeeded indigenous settlements, overlaying new city plans and structures.[61] Of these groups, the Masaisuli occupied the eastern Tangier peninsula, a group referred to as the Verbicae occupied the northwest Atlantic coastal zone, the Kaunoi lived east of *Volubilis* and the Salenses tribe north of *Sala*.[62]

Other Berber groups, nomadic and semi-nomadic, permeated or bordered the limits of the province.[63] The Zegrenses were a semi-nomadic group that occupied the southern Rif foothills, east of *Banasa*. A series of treaties between them and the Roman administration, in which the ruling family of the tribe was granted citizenship, are preserved in the *Tabula Banasitana* recorded during AD 168-177.[64] The Baquates, semi-nomadic peoples based around the area of *Volubilis*, made periodic treaties with the Roman administration beginning in the second half of the 2nd century AD, when they annually entered Volubilian territory for winter pasturing. They also managed to attack the city on occasion, and the last recorded peace treaty dates to AD 280.[65] The Autotoles were a nomadic or semi-nomadic group

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Martorella 2007. *Banasa*: remission of taxes granted by Caracalla in exchange for wild animals: *IAM* 1, no. 100. For discussion on wood exports, see Chapter 5.4.2.

[59] Gozalbes 1998: 350-358; Gozalbes Cravioto 1997: 46-47

[60] See App. 3.1. Other small coastal sites include the "farm and fishery" at the mouth of Oued Liam (Tarradell 1966: 431) and the site of Ghassasa (Gozalbes Cravioto 1991: 128).

[61] Euzennat 1957a: 50; Boube 1967; Boube 1984; Rebuffat 1968-72: 56; Jodin 1987: 33-38; Callu, *et al*. 1965: 61-111

[62] Gozalbes Cravioto 1994; Gozalbes Cravioto 1997: 111; *Geo*. 4.1.5; *IAM* 2, no. 304a

[63] Pomp. Mela, 3.103-104; Eadie 1977: 68

[64] *Geo.* 4.1.5; *AE* 1971.534; Sherwin-White 1973; Shaw 1986: 74-75; Christol 1988

[65] Sigman 1977: 430; Shaw 1986: 74; Février 1989: 80; Frézouls 1957; Christol 1988

considered beyond Roman taxation whose territory was south of *Sala*.[66] Further south, near Essaouira on the Atlantic coast, were desert nomads, the Gaetuli, whose seacoast was praised for its *murex* dye.[67] In the Rif were the Sokossioi, who had attacked *Tamuda* sometime after the mid-1st century AD.[68] To the east of the Rif, other nomadic groups traversed the Oued Moulouya valley, between the Mediterranean coast and eastern Atlas steppes, following a natural corridor that also served as the provincial boundary.[69]

Political stability within the province appears to have degraded by the late Antonine period. An inscription from *Sala* dating to the mid-2nd century laments how the farmers were under constant attack from the local indigenous tribal group, likely the Autotoles.[70] Most likely in reaction to these events, earthwork constructions and watch towers south of *Sala* were modified and re-enforced in the 2nd century, only to be abandoned in the early 3rd century.[71] A group of military camps were established during the 1st and 2nd centuries around *Volubilis*,[72] and more substantial walls encircling the city were built AD 168/169.[73]

By the end of the 2nd century AD, even the series of peace treaties instigated between the Roman administration and indigenous groups could not suppress the increasingly frequent tribal uprisings that were occurring throughout *Mauretania Tingitana* or the bordering provincial limits.[74] At this time, five additional cohorts had been transferred to the territory, bringing the total amount of military personnel to between 9,000-12,000 men, making it one of the most heavily-armed Roman provinces. Some of these troops were distributed in new camps, whilst one-third were established around *Volubilis* and some near *Banasa*.[75] At the beginning of Caracalla's reign in the early 3rd century, *Mauretania Tingitana* and *Mauretania Caesariensis* were united under the single military governorship of the procurator Quintus Sallustius Macrianus. This administrative unification was also short-lived and the provinces were separated during the reign of Severus Alexander (AD 222-235),

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[66] Pliny, *NH* 5.1.5-6, 5.1.9 (referred to here as "*Gaetulos Autoteles*" – 'Gaetulian Free state'), 6.36.201; Pomp. Mela, 3.104; Sigman 1977: 426-427; Euzennat 1984a: 276-379; Naïmi 1994: 65-66.
[67] Contemporary texts mentioning this dye: App. 4.1: *Text 1.a, 3.a, 4.a, 6.a, 6.b, 6.i, 7.a*; Tejera Gaspar & Chávez Álvarez 2004; Gattefossé 1957; Jodin 1987: 26; Naïmi 1994: 68-69. Pliny (*NH* 6.36.201), however, describes the *Insulae Purpurariae* (Essaouira) in the territory of the Autotoles.
[68] See Chapter 7.2.1; *IAM* 2, no. 55; Rhorfi 2004b: 561; Mastimo 1991; Villaverde Vega 1995: 350-351.
[69] Fishwick 1971: 476-477
[70] *IAM* 2, no. 307; Pliny, *NH* 5.1.6
[71] Rebuffat 1979-80; Euzennat 1989a: 129-153, 167-169; Napoli 1997: 397-407
[72] *ItAnt* 23.1; Akerraz & Lenoir 1990: 226, 228; Euzennat 1989a: 240-272, 277, fig. 201; Thouvenot 1962: 84
[73] The Punico-Mauretanian settlement appears to have been walled; Roxan 1973: 840; Rebuffat 1974b: 510; Behel 1992.
[74] Shaw 1986: 69-71, 77-78
[75] Frézouls 1980: 76-86; Eadie 1977: 69; Lenoir 1983-84: 223; Euzennat 1969: 126-127; Euzennat 1989a: 61-69

underscoring the difficulty presented by the topographical divisions of the region experienced since Mauretanian times.[76]

The uprisings had developed into further raids on Roman settlements and farms by AD 250. The lack of new construction and later coinage, as well as evidence from inscriptions, suggest that by ca. AD 280 the Roman provincial government and legions were withdrawing northwards in response to these uprisings, moving slowly towards the Tangier peninsula. The last recorded governor/*praeses* of *Mauretania Tingitana*, Clementius Valerius Marcellinus, held the post from AD 277-280; the last imperial dedication at *Volubilis* is dated to AD 282-284.[77] The withdrawal was initially to the Oued Loukkos, although the now-walled settlement at *Sala* remained under Roman administration with a military contingent. *Volubilis* as well as *Thamusida* were abandoned for the north by the administration and military, whose exit seems to have been peaceful and the sites continued to be occupied by mixed populations for some time afterwards.[78] However, a raid on *Banasa* during this period resulted in the Imperial administration's immediate departure.[79]

4.4 The Late Roman province

By the beginning of the 4th century, indigenous uprisings continued not only in the province but throughout North Africa, forcing the Emperor Diocletian to institute drastic military reforms. At this time, *Tingi* and possibly *Rusaddir* were the only remaining Roman *coloniae* of *Mauretania Tingitana,* whilst *Septem Fratres* likely held the status of *civitas*.[80] The legion *Comitatus Tingitanae* was stationed at several small *centenaria* that were rapidly built along the constructed series of earthworks that now isolated the Roman provincial government on the Tangier peninsula.[81] At the southern extent of the former province, however, a garrison of unknown size remained at *Sala* until Constantine's reign (see Fig. 4.6).[82] By the middle of the 4th century a large portion of the military presence was evacuated and the administration of the remaining settlements, referred to now as *Nova Hispana Ulterior Tingitana*, was conducted from the southern Iberian province of *Baetica.*[83] However, ca. AD 367, a *praeses*

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[76] Elton 1996: 33-34; Euzennat 1990: 577-579; Thouvenot 1962: 83
[77] *IAM* 2, nos 360, 361, 419; Akerraz 1992: 379; Shaw 1986: 86, n. 64; Rebuffat 2001: 30; Février 1982: 54
[78] Rebuffat 1965: 176, 186-187; Rebuffat 1974b: 502-506; Luquet 1964b: 300; Rebuffat, *et al.* 1970: 342-343; Février 1989: 121
[79] Thouvenot 1941: 64
[80] Villaverde Vega 1999: 313; *Rusaddir* was likely made a *colonia* in the 2nd century (Gozalbes Cravioto 1991: 142-143).
[81] *Not. Dig. Occ*. XXVI; Arce 2005: 345-346; Villaverde Vega 1995
[82] *IAM* 2, no. 304b; Février 1982: 54; Villaverde Vega 1999: 315
[83] Arce 2005: 346; Février 1989: 147

Tingitane was present in the new province and a *comes Tingitane* existed between AD 378-381 and AD 383-388.[84]

At the end of the 4th century, the few remaining Roman settlements in northwest Africa were re-organised under and administered by the Byzantine dioceses of *Hispaniae* based across the Straits of Gibraltar.[85] Although it is difficult to determine the level of occupation of these cities at this time, it seems that *Tingi*'s earlier importance under the Empire waned, and *Fratres* emerged as a strategic port at the eastern entrance of the Straits.[86]

On their way from Iberia to conquer Carthage in AD 439, Vandalic forces under Geiseric occupied *Septem Fratres* beginning in AD 426 after crossing the Straits.[87] In AD 533, after their defeat in *Africa Proconsularis*, *Byzacena* and *Tripolitania* by Belisarius, some of the remaining Vandal troops fled to *Tingitana*.[88] Determined to pursue the fragmented forces, the Emperor Justinian in AD 534 had Belisarius entrust the re-occupation of *Septem Fratres* to a tribune who then held command over a small garrison with *dromon* galley warships that patrolled the Straits.[89] Although the Vandals in the region never materialised as a threat, Visigothic forces from Iberia challenged the Byzantine legion of *Tingitana,* occupying *Septem Fratres* in AD 546-547. The city was quickly regained by Imperial forces, who re-asserted Byzantine control over the region.[90] By Justinian's death in AD 565, both coasts of the Straits had been administratively re-drawn as the diocese of *Mauretania Gaditana*.[91]

The diocese functioned as such until the late 7th century, with military affairs controlled by a commanding governor, *dux et praeses provinciae Mauretaniae et Caesariensis*, likely stationed at *Iol Caesarea* and Carthage.[92] In AD 709, the campaign of the Islamic Umayyed army, after occupying *Africa* and *Caesariensis,* reached the former western-most African Roman province. Led by Ibn Nusayr, the army managed to seize *Septem Fratres* from a "Count Julian" or a regional Byzantine governor bearing the title *comes julianus*. From here, the Umayyeds advanced rapidly throughout the northwest Maghreb and into southern Iberia.[93]

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[84] Pallu de Lessert 1896: 367; *CIL* II, no. 4911; Demougeot 1975
[85] Polemius Silvius, *Laterculus Veronensis* 4.7; Warmington 1954: 3-26; Euzennat 1989a: 173, 263
[86] Villaverde Vega 1999: 313
[87] Procopius, *Buildings of Justinian* 6.7.14; Courtois 1955: 157-159; Villaverde Vega 2001: 214; Schwarcz 2004: 50
[88] Rav. Cosmog. I.3, III.1
[89] *Cod. Just.* I.27.2.2; Procopius, *Wars* 4.5.6
[90] Arce 2005: 350; Blázquez 2001: 402
[91] Rav. Cosmog. I.3; Pringle 1981: 65, n. 156
[92] Pringle 1981: 65
[93] Villaverde Vega 2001: 99-100, 367-368; Glick 2005: 20

Whilst the Late Roman Empire experienced serious socio-political and economic trials throughout its remaining western provinces beginning in the late 3rd century, it still controlled Mediterranean commerce for a time and had no immediate challenge to its maritime dominance. Forms of 'Romanisation' continued within the region: material goods were readily imported into the ports of the former province as were new religious beliefs. Christian basilicas were established in the mid-4th century at *Zilil* and *Septem Fratres* (Fig. 4.9). Churches may also have existed in *Tingi* and *Rusaddir* as Episcopal seats were located in the cities in the later 5th century. [94]

A mixed "Romano-Berber" population continued to occupy settlements such as *Volubilis*, *Sala*, *Lixus* and Essaouira well into the 6th and 7th centuries, although on a reduced scale. Land was farmed, agricultural goods were produced and natural resources acquired.[95] The rulers of small Berber tribes in the Middle Atlas foothills made use of the previous Roman socio-cultural influence in the region, some styling themselves as '*rex*' of their kingdoms, as evidenced by indigenous Latin inscriptions at *Volubilis* that date as late as AD 655.[96] This "Mauretanian-Roman" period persisted well into the 7th century and is also characterised by the importation of Byzantine Christian and even Iberian Visigothic beliefs and material culture into the region.[97] Small Christian settlements even remained in the Middle Atlas foothills and at *Volubilis* after the Umayyed incursions into the region in the late 7th century.[98] The introduction of Islamic beliefs from the east, however, soon penetrated the region, as demonstrated by the 8th-century mosque that was erected at *Lixus*.[99]

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[94] E. Lenoir 2004; Blázquez 2001: 402. *Zilil*: M. Lenoir 2004: 272-273; Depeyrot 1999:13, 62; Villaverde Vega 1999: 313. For *Septem*'s basilica, see Chapter 7.3.1; Bernal Casasola 2006b: 188-189; Fernández Sotelo 2000; Villaverde Vega 1999: 315. *Tingi*: a paleo-Christian "edifice" and associated necropolis, dating to the early 4th century is present 700 m south-east of the Grand Soco, bordering Rue Belgique (Euzennat 1974: 187-190 and discussion in Ponsich 1998: 171-173); numerous 4th-century Christian epitaphs have also been found in area (Ponsich 1970: 359-362).
[95] Lenoir 1985: 425; Akerraz 1996: 1435-1437; Rebuffat, *et al.* 1986: 219; Février 1982: 54
[96] *IAM* 2, no. 68; Pringle 1981: 14, n. 68; Carcopino 1943: 231-304; Luquet 1972: 9-10
[97] Villaverde Vega 2003: 232-234; Ponsich 1961; Boube 1983-84b; Ponsich 1970: 359-394
[98] At *Volubilis*, Chrisitan funerary inscriptions are present in a cemetery near the Arch of Caracalla dating to AD 599-655 (see Akerraz 1988; Euzennat 1974: 181-187; Limane & Fentress 2006: 2220-2221).
[99] E. Lenoir 2004; Akerraz 1992

Chapter 5.
Environmental context

5.1 The western-most African province[1]

When the northwest Maghreb was annexed as *Mauretania Tingitana* under Emperor Claudius in AD 42/43, the new Roman province encompassed a topographically diverse territory. The region included wide agricultural plains and forested hills but bordered imposing mountain ranges and two oceans. The limits of the Roman-administered area were sometimes made apparent by constructed features; in other areas, it is assumed that the natural topography was intended to serve as a frontier zone and such features are sometimes outlined in contemporary texts.[2]

With annexation, the *municipium* port city of *Tingi* (modern Tangier) at the western Straits of Gibraltar was granted the status of *colonia* and made capital of the province; the surrounding Tangier peninsula was included in the new Roman acquisition.[3] Incorporated also was the Rharb plain bordering the Atlantic coast north-west of the Atlas, with its major settlements: the *coloniae Zilil*, *Babba* and *Banasa*, the seat of government at *Volubilis* and the riverine ports of *Lixus* (near modern Larache), *Thamusida* and *Sala* (modern Rabat), on the modern Oueds Loukkos, Sebou and Bouregreg, respectively.[4] On the northeast Mediterranean coast, *Rusaddir* (modern Melilla), the "*oppidum et portus*" noted by Pliny on the Guelaya peninsula, was also incorporated into the province (Fig. 5.1).[5]

South of *Sala*, an earthwork system delineated the province's southern frontier zone.[6] Beginning at the watch tower at Seguia Faraoun, on the Atlantic coast ca. 7 km south of the mouth of the Oued Bouregreg, the system extended roughly eastward for ca. 11 km to the watch tower at Dar Daqios on the west bank of the Oued Bouregreg. The earthworks, built at the end of the 1st century AD, consisted of *agger* and *fossa* construction (ditch and mound).

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[1] Ancient place-names that are correlated to sites or topographical features in the northwest Maghreb in some cases cannot be applied with certainty due to confusion or discrepancies amongst the sources themselves. Those mentioned in this chapter, however, are generally accepted as the most probable identifications, unless otherwise noted; see further Tissot 1878; Besnier 1904; Roget 1924; Desanges 1978: 17-147; Pastor Muñox 1987; Siraj 1995: 273 ff.
[2] Elton 1996: 33
[3] Rebuffat 1999: 273
[4] Pliny, *NH* 5.1.2-5; *Geo.* 4.1; Ponsich 1970: 183-194; Luquet 1966a; Luquet 1973-75a: 242-292; Desanges 1980: 96, 110-112; Euzennat 1984b: 379-380
[5] Pliny, *NH* 5.1.18-19; for other interpretations of the shape of the province, see Euzennat 2000; Mattingly & Hitchner 1995: 178, fig. 1; Thouvenot 1973-75.
[6] Such border systems were referred to as *limes* beginning in the 4th century; see Isaac 1988.

This was modified in the 2nd century with stone *vallum* construction (palisade/wall) before the network was abandoned in the early 3rd century.[7] A military camp of the same chronology, identified as *Exploratio Ad Mercurios,* was situated north of the earthworks, some 6 km south-east of *Sala* and overlooking the Oued Bouregreg valley (Fig. 5.2).[8] The southern frontier zone of the province likely continued directly east from this camp.[9]

Volubilis, the seat of the provincial procurator, was sited in the western slopes of the Middle Atlas foothills at the base of the 1,118 m-high Jebel Zerhoun massif, ca. 115 km east of *Sala* (see Figs 4.7-4.8). The city, as the southeastern-most major settlement of the province, commanded a westerly overlook of a fertile and elevated valley traversed by the Oueds Khoumane and Rdom which join the Oued Beth, a tributary of the Oued Sebou.[10] Guarding the settlement at the northern, southern and western edges of the valley were military camps established during the 1st and 2nd centuries: *Tocolosida* and those at Sidi Saïd, Aïn Schkour and Sidi Moussa.[11] An additional ten watch towers enclosed the eastern and southern flanks of the *Volubilis* territory, with most of these situated to the south, overlooking the pass to the Saïss plain.[12] Just east of *Volubilis*, the Middle Atlas physically formed the southeast frontier zone of the province.[13]

The eastern 'boundary' of the province, and the shared border with *Mauretania Caesarensis,* was identified only near the Mediterranean coast at the *Malva fl.* (or *Mulva/Mulucha/ Molochath fl.*).[14] Following the landmarks and routes laid out by Claudius Ptolemy, Pliny, Pomponius Mela, Strabo and in the *Antonine Itinerary*, this feature can be identified with the largest watercourse on the northeast coast, the modern Oued Moulouya.[15] This river's mouth lies 70 km east of the port settlement of *Rusaddir*, and its long northeast/southwest course marks the eastern terminus of the Rif chain.

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7 Rebuffat 1979-80; Euzennat 1989a: 129-153, 167-169; Napoli 1997: 397-407; Chatelain 1968: 10-18

8 *ItAnt* 6.4; Akerraz 2002: 198-204; Euzennat 1989a: 153-154

9 Shaw 1986: 84, n. 37; Chatelain 1968: 18-20

10 Limane & Makdoun 1998: 326-328; Luquet 1964b

11 *ItAnt* 23.1; Akerraz & Lenoir 1990: 226, 228; Euzennat 1989a: 240-272, 277, fig. 201; Thouvenot 1962: 84

12 Limane & Rebuffat 1992: 459-463, 471-472, 477, fig. 6; Rebuffat, *et al.* 1986: 223-232. No Roman sites have yet been found south of *Volubilis* in the Saïss (see Shaw 1986: 78). For the identification of Annoceur as a "faux poste romaine", see Euzennat 1960; Akerraz 1997a.

13 Rebuffat 1999: 280; Riße 2001: 28; *Geo*. 4.1

14 *Geo*. 4.1; Pliny, *NH* 5.1.18-19; Pomp. Mela, 1.29; *ItAnt* 11.6-12.2; Strabo, 17.3.6

15 Marion 1960: 447; Chatelain 1968: 22, 135-136; Rebuffat 1999: 265; Euzennat 1990: 569; Rahmoune 1999: 85. Sallust (*Jugurthine War* XCII) also names this river as the division between the territories of Jurgurtha and Bocchus in the 1st century BC (see Chapter 4.2).

The roughly triangular-shaped province of *Mauretania Tingitana* during the first three centuries AD therefore encompassed "distinct geographical zones": the mountainous Mediterranean coastline, the Tangier peninsula and the Atlantic coastal plain inside the Atlas. [16] The earthwork system south of *Sala* denoted a southern boundary by the end of the 1st century AD, and the Atlas ranges indicated the inland, southeast limits of the provincial administration.

However, isolated sites or even provincial 'outposts' existed beyond these man-made and natural constructs (see Fig. 5.1).[17] A walled site in the Middle Atlas on the Oued Bou Hellou might be the military camp identified as *Trisidis* mentioned by Ptolemy.[18] This site lies just east of the Taza Pass, the lowest defile between the Rif and Middle Atlas and the one possible inland route for traversing between the Rharb and the Oued Moulouya valley, close to *Rusaddir* and the province of *Mauretania Caesariensis*. [19] And despite the boundary established near *Sala*, *Bovalica/Bobalica* (possibly modern Azemmour on the Oued Oum-er-Rbia, 160 km south of *Sala*) and *Insulae Purpurariae* (the islands at modern Essaouira, 430 km south of *Sala*) were included in the Roman cultural and economic sphere and noted by Pliny as part of the province.[20] It is these latter settlements' distances south of the *Sala-Volubilis* limits, and the position of *Rusaddir* in the eastern Rif, which made vital to their existence a maritime connection to the more nucleated fertile heartland of the province, the "*djezira al Maghreb*," or 'island of the west' noted by medieval Arab geographers.[21]

5.2 The geology of the northwest Maghreb

The defining geological features of northwest Maghreb are the Atlas and Rif Mountains. These ranges separate the region from the high arid steppes of the pre-Sahara and the Saharan depression of central Africa and isolate the fertile plains present on the Mediterranean and Atlantic coasts (Fig. 5.3).

The Atlas, consisting of the Middle, High and Anti-Atlas Mountains, are the western and most elevated extensions of the over 2,000 km-long Saharan Atlas and Aurès massif that

[16] Shaw 1986: 68
[17] Rebuffat 1971: 54
[18] *Geo.* 4.1; Euzennat 1957b: 228; Thouvenot 1962: 86; Thouvenot 1973-75: 399-400; Roxan 1973: 839-840; Rhorfi 2004b: 563-564, n. 50. For a Latin inscription found here dating to reigns of Marcus Aurelius, Caracalla or Elagabalus, see Euzennat 1957c: 232; *IAM* 2, no. 841.
[19] Lawson 1931: 98
[20] Rav. Cosmog. III.11; V.4; Pliny, *NH* 6.37.203; Jodin 1967: 3; Rebuffat 1999: 266, n. 5; see also Schmitt (1977-78: 85) who suggests *Bovalica* is at Bouznika (ca. 20 km south of Rabat on the coast).
[21] Shaw 2003; Houston 1964: 646

originate in western Tunisia and continue through northern Algeria.[22] In the northwest Maghreb, the topography is dominated by the ca. 800 km-long High Atlas, oriented slightly north-east/south-west and meeting the Atlantic coast north of Agadir at the dramatic headland of Cap Guir (Cap Ghir).[23] This range forms a 100 km-wide belt with an average elevation between 3,500-4,000 m.[24] Parallel to the High Atlas is the southern Anti-Atlas range, separated by the Oued Souss depression. Reaching the Atlantic Ocean at Sidi Ifni and joining the High Plateau of the Aurès massif to the east**,** these mountains comprise a 500 km-long southeastern border to the Saharan plateau with average peak elevations of ca. 2,700 m.[25] The Middle Atlas is a ca. 400 km-long, northeast/southwest extension protruding from the northern flank of the High Atlas. This range possesses limestone peaks of ca. 4,000 m elevation; along the northeast face of the range are volcanic deposits.[26]

Abutting the Middle Atlas to the north are the Rif Mountains which frame the region's Mediterranean coastline for ca. 350 km, from the Straits of Gibraltar to Ras el Ma (Cap de l'Eau).[27] The Rif are geologically distinct from the Atlas ranges, and are part of the Betico-Rifean or Gibraltar Arc that encircles the Sea of Alboran.[28] The mountains of the Rif are mainly of Jurassic limestone, and compared to the Atlas, are extremely folded with narrow interfluves.[29] Several peaks reach over 2,400 m elevation.[30]

Alluvial flatlands are present in the lower reaches and wider valleys enclosed by the mountain ranges of the northwest Maghreb (see Fig. 4.2). The largest of these, the Rharb, lies on the Atlantic coast between the southern foothills of the Rif and western foothills of the Middle Atlas. The plain is naturally delineated to the north by the Rif foothills and the Oued Loukkos basin and to the south by the lower Oued Bouregreg valley.[31] The Oued Sebou and its tributaries, the Oueds Beth and Ouerrha**,** originate in the upper reaches of the Rif and in the High Atlas where they traverse through the Saïss plain near Fés and Meknes before flattening in the Rharb.[32] South of the Rharb is the triangular-shaped Meseta plateau,

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22 Lawless 1972: 128-129; Michel 1997: 37-41; Despois & Raynal 1967: 359-370
23 Vita-Finzi 1969: 59-60; Gomez, *et al.* 2000: 775; Branigan & Jarrett 1969: 355
24 Lawless 1972: 128-129; Michel 1997: 37-41; Despois & Raynal 1967: 359-370; Branigan & Jarrett 1969: 355-356; Teixell, *et al.* 2003: 10
25 Leblanc & Lancelot 1980: 142-143; Ennih & Liégeois 2001: 290-291; Michard 1976: 41
26 Giese & Jacobshagen 1992: 249-250; Brede, *et al.* 1992: 127
27 Lawson 1931: 98; Mikesell 1961: 12
28 Longeran & White 1997: 504; Michard 1976: 231, 337-339; Moratti, *et al.* 2003: 308; Gomez, *et al.* 2000: 775; André 1971: 58-59
29 Mikesell 1961: 12, 15; NID I: 22; Longeran & White 1997: 504-505
30 André 1971: 62-63; Rey & Nouet 1958: 14-16
31 André 1971: 57; Despois & Raynal 1967: 266-267; Branigan & Jarrett 1969: 356; André 1971: 58-59; Michard 1976: 183-184, 328
32 Buckle 1978: 87-88, fig. 5.8

ave. 300 m elevation, which extends along the coast between Rabat and Essaouira and inland to the base of the Atlas range.[33]

5.3 Coastal topography and marine environment

5.3.1 The Mediterranean coast: Oued Moulouya to Ceuta

The Mediterranean coastline of what was the northern shore of the province of *Mauretania Tingitana* is dominated by the abrupt rise and undulating relief of the Rif foothills from Ras el Ma in the east, to Ceuta on the Peninsula de la Almina in the west (Fig. 5.4). This ca. 350 km-long shoreline predominately consists of jagged and sheer Palaeozoic limestone cliffs in the west and is sandstone- and schist-faced in the east.[34] Sandy beaches that are a result of alluvial deposition are present at perennial river mouths; several large alluvial deposits have formed broad coastal plains, some with extensive estuaries.[35]

At the eastern edge of the ancient province lies the 520 km-long Oued Moulouya (*Malva/Mulva/Mulucha fl.*) (Fig. 5.5).[36] This river drains from the eastern slopes of the High Atlas, at an elevation of 1,700 m, following a northeast course to the Mediterranean Sea. In its lower course it divides the eastern Rif from the western High Plateaux/Oran Meseta, emerging into a sandy, deltaic coastal plain 4 km wide and 20 km long.[37] In the lower valley, fragments of Phoenician, Punic and Roman ceramics and some "pre-Islamic" sites have been recently identified; in the eastern floodplain of the river Roman coins and some re-used Roman stones have been found.[38] The closest settlement in *Mauretania Caesarensis* was the inland fort at *Numerus Syrorum*, ca. 75 km east of the riverine border.[39]

Five kilometres north-west of the mouth of the Moulouya, after a stretch of beach and sandstone cliffs, is Ras el Ma (Cap de l'Eau), a 40 m-high petrified sandstone plateau. Lying 3.5 km offshore of this headland are the volcanic Îles Chafarinas (Islas Chafarinas; possibly *Ad Tres Insulas*).[40] Inland from the Ras el Ma promontory rises the 35 km-long limestone Kebdana range which reaches 932 m elevation. This range follows the Mediterranean

[33] Gomez, *et al.* 2000: 775; Michard 1976: 25, 85, 321; Raynal 1961: 93-94; Branigan & Jarrett 1969: 355-356; Moratti, *et al.* 2003: 310
[34] Snoussi & Tabet Aoul 2000: 1034; Rey & Nouet 1958: 14-15; Moore, *et al.* 1998: 354-356
[35] Tarradell 1966: 428-431; André 1971: 63; Raynal 1961: 209-211
[36] *Geo*. 4.1; Pliny, *NH* 5.1.19; *ItAnt* 11.6-12.2
[37] Snoussi, *et al.* 2002: 6; Branigan & Jarrett 1969: 357; Rey & Nouet 1958:18-19
[38] J. Bellevar Garrido (Museo de Arqueología e Historia, Melilla), pers. com.; Akerraz, *et al*. 2003: 29; Thouvenot 1973-75: 402-403; Boudouhou 2006: 365-366; Akerraz 1997b; Kbiri Alaoui, *et al*. 2004: 581-582
[39] The fort was built during the Severan period; Février 1989: 121.
[40] *ItAnt* 11.5; the islands consist of Isla del Congreso, to the west (137 m), Isla de Isabel II (40 m) and Isla del Rey, to the east (31 m); Rojo Guerra, *et al*. 2006: 14-17; NID I: 78-80.

coastline to the south-west of the cape, separating the Oued Moulouya valley from the Bou Areg plain.[41] Some Punico-Mauretanian and Roman amphorae fragments have been found along the coastline.[42]

The Bou Areg is a broad, flat expanse ca. 400 km^2 that lies behind the 115 km^2 Sebkha bou Areg (Mar Chica), a 24 km x 7 km lagoon with a maximum depth of ca. 7 m; on its northwest, inland shore is the city of Nador (Fig. 5.6). The lagoon is separated from the sea by a 200-400 m-wide and sandbar that has been deposited over a ridge of now-submerged petrified dunes. The Bokhana, the modern entrance to the lagoon, is a man-made feature cut through the sandbar. The southern edges of the lagoon are marshy with some salt flats; it is here that several small rivers empty.[43] Deposits of Roman coins have been found around the lagoon and a Punico-Mauretanian amphora was recovered in front of the sandbar.[44]

The volcanic dome of Jebel Gourougou (ca. 900 m), west of Nador, forms the base of the 25 km-long basaltic Guelaya peninsula.[45] The peninsula's northern tip is 100 m-high Cap Trois Fourches or Ras Tleta Madhuri (ancient *Promunturio Rusaddi*), which forms the most conspicuous headland on the Mediterranean coast of the northwest Maghreb.[46] On the peninsula's eastern shore, 12 km north of Nador, is the Spanish autonomous city of Melilla (the ancient "*oppidum et portus*" of *Rusaddir* or *Rissadirum*) (Fig. 5.7).[47] The Punico-Mauretanian to Late Roman settlement was centred on a small, 30 m-high promontory joined to the mainland by a small isthmus. A small bay into which the Rio de Oro empties lies to the south.[48] The western coast of the Guelaya peninsula is faced by basalt outcrops descending steeply to the water, broken by narrow stream courses. The largest of these is 25 m-high Punta Negri, just north of which, on the northern bank of the Oued Haduba, is the site of Ghassasa (or Cazaza), where remains identified as Punico-Mauretanian and Roman have been located under a medieval settlement (Fig. 5.8).[49]

Between Punta Negri and Ras Sidi Chaib (Ras Tarf or Cabo Quilates), ca. 50 km to the west, the Mediterranean coastline consists of highly eroded sandstone- and schist-layered plateaus

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[41] Jamous 1981: 12
[42] Amphorae date to the 2nd century BC-1st centuries AD; Kbiri Alaoui, *et al.* 2004: 582-583.
[43] Ruiz, *et al.* 2006: 216, 222; Fernandez de Castro y Pedrera 1945: 60-62
[44] Fernandez de Castro y Pedrera 1945: 234-235: amphorae date to the 3rd century BC; Gozalbes Cravioto 1991: 129.
[45] Jamous 1981: 14-15; Michard 1976: 239-240
[46] *ItAnt* 11.3; NID I: 24; André 1971: 63
[47] Pliny, *NH* 5.1.18; *Geo*. 4.1; *ItAnt* 4.2; 11.4
[48] Tarradell 1954a: 1-2; Tarradell 1960: 63-73; Gozalbes Cravioto 2005: 19-20; Villaverde Vega 2004: 1839-1844: finds from Melilla date from the 5th century BC-4th century AD.
[49] "Roman" material tentatively dated to the 2nd century AD; Laoukili 2005: 109-111; Laoukili 2008: 44-45; Fernandez de Castro y Pedrera 1945: 127-128; Gozalbes Cravioto 1991: 128.

up to 450 m in elevation, intersected by highly eroded alluvial gullies. Inland, these layers are capped by weathered deposits of limestone.[50] The largest river on this coast, the confluence of the Oueds Tifasor and Kert, empties into Azanen Bay (see Fig. 5.8).[51] On this coast are traces of "pre-Islamic walls" (believed to be Phoenician or Roman) just east of Cape Afraou. A Phoenician and Punico-Mauretanian settlement, dated from the 7th-4th centuries BC, is present at Sidi Driss, situated on a schist and sandstone bluff above the Oued Amekrane valley (Fig. 5.9).[52]

The volcanic igneous dome of Ras Sidi Chaib forms the eastern headland of the semi-circular Al Hoceima Bay, opposite the western headland of calcareous Punta Morro Nuevo (Ras el Abid or Cap Nuevo), where the modern city of Al Hoceima is sited.[53] The bay is ca. 15 km broad and 7 km deep, faced on both its western and eastern shores by high rock cliffs; three islets lie inside the bay.[54] The base of the bay is a broad sandy beach, broken by the mouths of the Oueds Ghis and Nekor which water the 21 km-long fertile coastal plain (Fig. 5.10).[55] On a hill on the west side of the valley is a small 1st-century BC necropolis and agricultural agglomeration.[56]

Between Punta Morro Nuevo and Cape Mazari, ca. 150 km to the west, the coastline consists of sheer limestone metamorphic and igneous cliffs, some over 300 m in elevation. A few limestone-plinth islands lie just offshore.[57] Opposite the largest of these, Peñon de Velez de la Gomera, is the site of Badis (possibly *Parietina*), where some sporadic finds of Late Roman and Visigothic material have been made; *terra sigillata* fragments have also been found at Cala Iris (Fig. 5.11).[58] Further west is Pointe des Pêcheurs, the distinct white-rock headland of this coast, where 150 m-high cliffs nearly enclose a small circular cove (Fig.

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50 André 1971: 63
51 Gauché 2005: 50; NID I: 74
52 Cape Afraou: Moran Bardon 1949: 35; Siraj 1995: 300; Gozalbes Cravioto 1991: 126. Sidi Driss: Akerraz, *et al*. 2003: 28-31; Kbiri Alaoui, *et al*. 2004: 584-586, 588-600.
53 Michard 1976: 239
54 The islets are Penon de Alhucemas (27 m), Islote del Mar (3 m) and Islote de Tierra (3 m); NIMA 131: 65-66.
55 Michard 1976: 244, fig. 155; Mikesell 1961: 17, 19
56 At Dchar 'Alla Boukar (Kbiri Alaoui, *et al*. 2004: 588).
57 Isoltes del Topo (20 m), Peñon de Velez de la Gomera (86 m) and Iris Island (38 m): NID I: 66-67, 70-71; NIMA 131: 65; Paskoff 1994: 41.
58 *ItAnt* 10.5; Rav. Cosmog. III.11. Badis: 3rd-5th centuries Late Roman material and 6th-7th-centuries Visigothic material (Quintero Atauri and Gimenez Bernal 1944: 26, fig. 15; Villaverde Vega 2001: 246-249, n. 1984, 1085). Cala Iris: Tarradell (1960: 77) notes finds, but see contra Siraj (1995: 308) for Montalbán's claim of locating a Roman enclosure here that Cressier's survey has not found; this survey also did not identify any Roman ceramics.

5.12).[59] At the small bay just west of the promontory, where the modern city of Jebha (possibly *Cubucla*) is located, "Roman pottery" has been reportedly found.[60]

The limestone-faced coast westwards is intersected by narrow river valleys that have deposited alluvia forming small, flat beaches at heads of the valleys. Some of the larger examples of these are at the Targa, Tiguisas and the Oued Laou valleys; the latter is formed by the 55 km-long drainage (the ancient and "navigable" *Laud fl*. possibly emptying through the beach of *Taenia Longa*).[61] Pre-Roman and Roman materials have been reported at the mouth of Oued Bouchia at Tiguisas, and a small Punico-Mauretanian site is located 2 km upstream on Oued Emsa in the small valley east of Cape Mazari.[62]

After 91-m high Cap Mazari lies the Quaternary alluvium-fill valley of Oued Martil (*Tamuda*/*Tumuada fl*.), which forms the broadest break in this lithic coastline and marks the beginning of the Tangier peninsula (Fig. 5.13).[63] The Oued Martil, extending ca. 30 km into the Rif, runs east-west through a valley several kilometres across with its mouth on the Mediterranean shore forming an estuary.[64] Fifteen kilometres upstream on a small bluff on the south bank of the Oued Martil, near the modern city of Tetouan, is the Punico-Mauretanian settlement and later Roman military camp (*castellum*) of *Tamuda*.[65] Slightly down river, and ca. 9 km from the present coast, is the small Punico-Mauretanian site at Kitzan, above which, in the Rif foothills, is the cave site of Caf Taht el Gar, where Phoenician and Punico-Mauretanian ceramics are present.[66] At the southern extent of the river's mouth, on a small rise on the edge of an old oxbow, is the Phoenician, Punico-Mauretanian and Roman site at Sidi Abdeselam del Behar across from which is the Roman purple-dye manufacturing site at Metrouna.[67]

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59 NID I: 68; NIMA 131: 65

60 *ItAnt* 10.4; Tarradell 1960: 77; Siraj 1995: 311; Villaverde Vega 2001: 246

61 Pliny, *NH* 5.1.18; *ItAnt* 10.3; *Geo.* 4.1; NID I: 24; Mikesell 1961: 12; Brückner 1986a: 86

62 Tiguisas: Siraj 1995: 313. Emsa: Tarradell 1954b: 121-123; for late 4th-2nd centuries BC dates, see Tarradell 1960: 79-85; until 3rd century BC, see Tarradell 1966: 440-443; see App. 3.1: *Site 7*.

63 Pliny, *NH* 5.1.18; Pomp. Mela, 1.29; Brückner 1986a: 97; NID I: 65

64 André 1971: 68; Vita-Finzi 1969: 62

65 *Not. Dig. Occ*. XXVI; El Khayari 1996; Arharbi 2003: 66-67; Tarradell 1949; Tarradell 1956; Tarradell 1960: 97-119

66 Kitzan: Gozalbes 1978: 17-19: 3rd century BC or earlier date; Tarradell 1954b: 108; Tarradell 1957: 262-264: 2nd-1st centuries BC date; Bernal, *et al*. 2008b: 321: new dates of late 6th-5th centuries identified. Caf Taht el Gar: Tarradell 1955b; Bernal, *et al*. 2008b: 315-321: from the 8th-7th centuries and 4th-3rd centuries BC.

67 See App. 3.1: *Sites 8-9*. Sidi Abdeselam del Behar: Tarradell 1954b: 121-123; Tarradell 1957: 255-262; Tarradell 1960: 86-95; Tarradell 1966: 437, Pl. II: 5th-1st centuries BC; Villaverde Vega 2001: 237-239; Majdoub 2004: 272-274; Bernal, *et al.* 2008b: 317-319, 336: new dates of late 6th-1st centuries BC to late 1st-3rd centuries AD and AD 320-late 5th century AD; Metrouna: Bernal, *et al.* 2008b: 332-335.

The Rif range continues north of the Oued Martil valley as the north/south Jebel Haouz limestone ridge, likely the ancient *Septem Fratres Montes*.[68] This ridge rises dramatically to over 800 m elevation; to the east is a sloping coastal plain up to 9.5 km broad that terminates in a wide beach.[69] The low coastline is broken by the 120 m-high limestone headland of Rasel el Aswad (Cabo Negro) (possibly *Aquilia Maior Pr.*).[70] To the south of the headland is Tetouan Bay and to the north is Ensenada de Ceuta. North of Rasel el Aswad, the low sandy shoreline continues for ca. 22 km until the Peninsula de la Almina (described in Section 5.3.2). At the southern edge of the beach, adjacent to Rasel el Aswad, a small agglomeration of Punico-Mauretanian ceramics and fishing-related finds has been located.[71] Further north on this shore is the Oued Smir estuary which traverses through small coastal dunes before emptying into the bay (Fig. 5.14).[72] One kilometre north of the river's present outlet is the small Roman fish-salting site at Sania e Torres; ca. 7 km north of this site on the banks of the Oued Negrón is an agglomeration of Roman ceramics associated with some walls.[73]

5.3.1.1 The Mediterranean marine system

The Rifean coast of the northwest Maghreb faces the western-most of the Mediterranean sub-basins, the Sea of Alboran. This sea lies between the southern Iberian Peninsula and northwest Africa, and extends for ca. 350 km from the Straits of Gibraltar to the Almería-Oran sill. The sea's bathymetry is divided into eastern and western sub-basins (Fig. 5.15).

The bowl-shaped western basin descends from the eastern Straits of Gibraltar (the Gibraltar sill) and ends abruptly north of the Guelaya peninsula where there is a series of submerged, steep-sided volcanic plateaus oriented north-east/south-west. The largest of these, Xauen Bank, is only 15 km north of Jebha at 200 m depth. The highest of these is the small Isla de Alborán, 55 km north of Cap Trois Fourches, exposed 15 m above sea level.[74] The North African continental margin in the western basin is very narrow and generally has a rocky bottom. From the Ceuta peninsula to Punta Morro Nuevo, the western headland at Al Hoceima Bay, the 100 m isobath is ca. 10-11 km offshore. Past Al Hoceima Bay, the shelf widens to ca. 18.5 km.[75] The continental slope sharply gives way to the basin bottom, which does not exceed ca. 1,400 m depth.[76]

[68] *ItAnt* 9.3; *Geo.* 4.1; Pomp. Mela, 1.29; Pliny, *NH* 5.1.18
[69] Tarradell 1966: 428
[70] *ItAnt* 10.1; NIMA 131: 64; NID I: 24; André 1971: 63
[71] Tarradell 1966: 435-437
[72] NID I: 64; André 1971: 64; NIMA 131: 64
[73] Ponsich & Tarradell 1965: 75-77; Tarradell 1966: 435; Ponsich 1988: 166-168; App. 3.1: *Site 15*
[74] Carter, *et al.* 1972; Purdy 1841: 14; Gensous, *et al.* 1986: 346, 358, fig. 3
[75] Gensous, *et al.* 1986: 346, 358, 361 figs. 3, 6, 9
[76] Gascard & Richez 1985: 159, fig. 2

The eastern basin of the Sea of Alboran extends from the volcanic plateaus to the Almería-Oran sill. This basin's continental shelf ca. 12 km wide, with an extremely sandy bottom until the 100 m isobath; this is likely due to sedimentation run-off from the Sebkha bou Areg, Kebdana range and Oued Moulouya.[77] At the edge of the shelf, the bathymetry drops rapidly to form a narrow V-shaped canyon. This canyon runs north-east/south-west, with a maximum of a depth of 2,000 m. This bathymetry deepens to meet the South Baleric Basin of the western Mediterranean past the Almería-Oran sill.[78]

Through the Straits of Gibraltar, a 200-300 m-thick layer of cold water, the Atlantic Surface Water (ASW), is introduced into the Sea of Alboran. As it travels through the sea, it becomes Modified Atlantic Water (MAW), mixing with the more saline and deeper-flowing Levantine Intermediate Water (LIW).[79] The Western Alboran Gyre (WAG) is formed by the ASW as it enters from Straits. This surface current immediately runs north along the Iberian coast, following an anticyclonic (clock-wise) circle, turning south in line with the Guelaya peninsula and weakening as it follows the coastline west until reaching the Ceuta peninsula (Fig. 5.16).[80] The eastern basin has an anticylonic gyre (the Eastern Alboran Gyre [EAG]), which breaks off the WAG just near the Guelaya peninsula and follows a clock-wise circle that turns south before Oran and can flow westward along the Moroccan coast until it turns north again at the peninsula.[81] This same gyre system also has a more dominant cyclonic circulation, however, with currents from the WAG breaking off north of Al Hoceima and travelling eastward along the Moroccan coast from the Guelaya peninsula. Between Almería and Oran, these processes are met by a stronger north/south Mediterranean current, the Almería-Oran Front (AOF) which then continues eastwards along the Algerian coast.[82]

5.3.1.2 Mediterranean maritime conditions

The northwest Maghreb's Mediterranean coast generally possesses pronounced longshore drift currents following the EAG and WAG which can be influenced by winds. In summer, the prevailing offshore winds are from the north-east and east and in winter from the west and north-west.[83] The tidal regime is between 0.3-0.9 m.[84]

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[77] Gensous, *et al.* 1986: 346, 358, 361, figs. 3, 9
[78] Viúdez, *et al.* 1998: 291
[79] Viúdez, *et al.* 1998: 291, 306; Tintore, *et al*. 1988: 1384
[80] Herbaut, *et al*. 1996: 70; Farmer & Armi 1988: 20-21
[81] Tintore, *et al*. 1988: 1384-1385, fig. 1; Fabres, *et al.* 2002: 431-433
[82] Herbaut, *et al.* 1996: 65, 73
[83] NIMA 131: 63; Paskoff 1994: 24-27
[84] Snoussi 2000: 20

In the western basin of the Sea of Alboran, a 19th-century piloting account relates that, "In summer, calms are frequent on the Riff coast, and if there is any wind … it is generally light from the E or SE, even while in the offing a fresh levanter may be blowing. Sometimes a NE sea will be running on the coast, which contributes to set vessels down upon it that may be becalmed … it is easy to get becalmed even at twenty to thirty miles from the Morocco coast, and be drawn by the current [WAG] towards Cape Tres Forcas [Cap Trois Fourches]".[85] Near the cape, however, the inshore current follows the WAG west and is weak, averaging under 1 knot.[86] Between Cap Trois Fourches and Ras Sidi Chaib, heavy and dangerous seas are sometimes present due to offshore east winds.[87] However, Ibn Khaldun in the 14th century indicates that Ghassasa on the west coast of the Guelaya peninsula was a port, and in the 19th century this was a base for the pirates of the Beni Said tribe.[88]

Further west, Al Hoceima Bay offers sheltered anchorage from different winds due to its high cliff faces on each side; a vessel can move around the bay to seek appropriate shelter, and the sea floor is generally flat and sandy.[89] In the 10th century, the geographer Ibn Hawkal describes a port, Mazamma, behind a peninsula near the mouth of the Oued Nekor, as a good place to anchor vessels; this place is also described by al-Idrîsî in the 12th century.[90]

Between Al Hoceima Bay and Cape Mazari, anchorages offshore in good weather can be made. During east or northeast gales, some headlands, such as Pointe des Pêcheurs, and the several small islands provide anchorages in their western lees, although inshore currents can sometimes reach 2 knots.[91] In the 16th century, Leo Africanus notes that Cala Iris is a good anchorage in all types of "tempestuous weather".[92] The remains of several medieval sites on this coastline testify to the utility of protected ports, usually at river mouths framed by large headlands: Badis at the mouth of the alluvial Oued al-Ansar valley, in the sheltered lee of Peñon de Velez de la Gomera, Mastasa at Oued Mastasa and Tiguisas at Oued Bouchia.[93] The 11th-century geographer al-Bakrî lists the ports of Badis, Marsâ Bakkûya (unlocated) and Marsâ Bâlish (Cala Iris) to the west of Mazamma;[94] in the 12th century, the geographer al-Idrîsî mentions that stations along this coast usually had a half-day's sail between them.[95]

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85 *W. Div. Med*. 1863: 460-461
86 Pennell 1991: 74; Herbaut, *et al*. 1996: 70; NIMA 131: 63
87 NID I: 73-76
88 Ibn Khaldun: 1344; Pennell 1991: 72
89 Mikesell 1961: 63; NID I: 72-73; NIMA 131: 65-66
90 Ibn Hawkal: 75; al-Idrîsî: §190; Siraj 1995: 99
91 NID I: 66-71; NIMA 131: 65; Purdy 1841: 246; *Inst. naut.* 1932: 222
92 Leo Africanus: 519
93 Cressier 1983-84: 457-460; Cressier, *et al.* 1992: 398-399
94 Al-Bakrî: 181-183; Siraj 1995: 307-308
95 Al-Idrîsî: §170, §187, §189; Siraj 1995: 309, 311

Past Cape Mazari, east winds can bring large swells from across the Sea of Alboran that buffet the north/south facing shore of the Tangier peninsula.[96] However, the Jebel Haouz ridge offers protection to this coast from westerly winds. In the 17th-19th centuries, wide and sandy-bottomed Tetouan Bay was recorded or depicted on maps as an ideal anchorage for ships when the wind is in the west, usually in the winter, and this is the case for Ensenada de Ceuta, which also offers shelter from north winds. However, if there is an east wind, vessels cannot anchor along this coast.[97] Between these two bays, off the cape of Rasel el Aswad (Cabo Negro), are strong tidal currents and rocks extending as much as 1.5 km offshore, around which eddies form.[98]

In the eastern basin of the Sea of Alboran, coastal drift currents are due to the cyclonic circulation that breaks off of the WAG; from Cap Trois Fourches, these follow the Guelaya peninsula shoreline south to the sand barrier of the Sebkha bou Areg and then eastward past Ras el Ma, sometimes reaching a velocity of over 1 knot.[99] Although calms are frequent in summer, winds do come from the east and north-east and form strong swells that create heavy seas inshore.[100] Northwest and west gales occur here in winter and these latter winds leave the sea near the lagoon calm, but create strong chop past Ras el Ma.[101]

Vessels can seek shelter near or at the sandy mouth of the Oued Moulouya, although the three Îles Chafarinas, off the headland of Ras el Ma, possess natural and well-protected anchorages.[102] The small harbour south of the Melilla promontory offers protected anchorage of 6-12 m depth. In the early 7th century, Isidore of Seville noted that the harbour here offers good protection from winds, and is particularly safe for boats in the winter.[103] Anchorage is possible outside the harbour but exposed to eastern winds.[104] In antiquity, however, this area had been utilised for mooring, as evidenced by the Roman anchors recovered here.[105]

Navigation along this shore in antiquity likely followed the coastline, with vessels seeking shelter when necessary, as in the medieval and historical periods. Routes included those from the east, as Strabo describes that after sailing through the Straits, "one comes … to several

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[96] Merry del Val 1920: 39
[97] Chenier 1788, I: 18-19; NIMA 131: 64; Pennell 1994: 277
[98] NIMA 131: 64; Purdy 1841: 246
[99] Herbaut, *et al*. 1996: 72-74
[100] Ruiz, *et al.* 2006: 216; NIMA 131: 63, 66; NID II: 119
[101] NIMA 131: 67
[102] NID I: 79-80; Purdy 1841: 247
[103] Isidore of Seville, *Etymologiae* 14.8.39-40
[104] NID I: 76
[105] Cardalliaguet 2004

cities and rivers – and then the Molochath river (Oued Moulouya)”.[106] In the *Antonine Itinerary,* 11 ‘points’ (geographical features and possibly settlements) are listed in an east-to-west route between *Septem Fratres* (modern Ceuta) and *Rusadder colonia* (modern Melilla).[107]

Reverse routes were also utilised: lateen-rigged vessels in the mid-19th century that engaged in the coasting trade between Oran, Algeria and Tetuan, sailed close to this shore, as did Spanish *faluchas* from Peñon de Velez de la Gomera to Tangier.[108] In the 14th century, Ibn Khaldun writes that it took five days to sail from Ghassasa, along various ports on the Mediterranean coast, until reaching Tangier.[109] Routes from this coast across the Sea of Alboran to *Malaca* (modern Málaga) in southern Spain are also mentioned by Strabo.[110]

5.3.2 The Straits of Gibraltar coast: Ceuta to Cap Spartel

The northern shoreline of the Tangier peninsula forms the southern terrestrial boundary of the Straits of Gibraltar (ancient *Fretum Gaditanum*). The ca. 60 km-long maritime channel between Africa and Iberia is widest (45 km) at its western entrance, between Cape Trafalgar and Cap Spartel, and narrowest (15 km) between Tarifa and Ras Cires.[111] Although rocky and mountainous in areas, the ca. 80 km-long African coast of the Straits is not comprised of homogenous limestone geology, but changes in character and composition in its western reaches (Fig. 5.17).

The 4 km-long Peninsula de la Almina, where the Spanish autonomous city of Ceuta is situated (ancient *Septem Fratres,* also *Septemvenam*),[112] forms the eastern-most edge of the Straits’ southern coastline (Fig. 5.18). This peninsula, extending east from the Jebel Haouz ridge (ancient *Septem Fratres Montes*), forms the boundary between Ensenada de Ceuta, to the south, and the Straits, to the north. The dominant feature of the peninsula is the 212 m-high igneous dome of Monte Hacho (possibly *Abila Mons*) which is connected to the mainland by a narrow and low sandy spit, the areas La Ciudad and Almina.[113] Centred in La Ciudad were Phoenician, Roman and Late Roman settlements and fish-salting factories.[114]

[106] Strabo, 17.3.6
[107] *ItAnt* 9.3-11.4
[108] Pennell 1994: 275-277; Pennell 1991: 71
[109] Ibn Khaldun: 1344
[110] Strabo, 3.4.2
[111] Ponsich 1970: 7; Houston 1964: 37-38
[112] Rav. Cosmog. I.3; III.9; Procopius, *Wars* III.i.6; IV.v.6; Villada Paredes & Hita Ruiz 1994
[113] *ItAnt* 9.4; *Geo.* 4.1; Procopius, *Wars* III.i.6; NID I: 24; André 1971: 63
[114] Villada Paredes, *et al.* 2007; Bravo Pérez, *et al.* 1995; App. 3.1: *Site 16.*

The Peninsula de la Almina is overlooked by Montaña del Renegado (328 m), a lower foothill of the Jebel Haouz (see Fig. 7.19). The coastline of the eastern Straits, however, is dominated by the Jebel Haouz's highest and most northerly peak, Jebel Musa (850 m).[115] Lying 15 km west of Ceuta, Jebel Musa is matched across the Straits by the other Betico-Rifean plinth, the Rock of Gibraltar. Jebel Musa's seaward extension is the limestone promontory of Ras Leona (71 m) which juts out into the Straits (Fig. 5.19). Between the promontory and Montaña del Renegado and Ras Leona is the Bay of Benzú; to the west of Ras Leona is the small, limestone plateau islet of Île Perekhil (73 m), lying only ca. 100 metres offshore. West of Île Perekhil, several small inlets with sandy beaches are present; these include Almanca Bay, Dhalia and Er Rmel Bay.[116] Punico-Mauretanian and Roman amphorae have been found under water in the Bay of Benzú and off Île Perekhil; on the beach at Almanca Bay, late Punico-Mauretanian and Roman walls and ceramics have been identified at the site of El Marsa and similar remains are also on the beach in Er Rmel Bay.[117]

A sheltered, sandy bay lies 9 km west of Er Rmel Bay, at Ksar-es-Seghir (Fig. 5.20). This bay is protected to the west by the 30-m promontory of Punta del Alcazar. The Oued El Kazar empties into the bay here.[118] The Roman fish-salting site of Ksar-es-Seghir (possibly *Turbice*) is present on the eastern beach of the bay; 1 km upstream on a small hillock on the east bank of Oued El Kazar, at Dchar 'Askfane, is a small Punico-Mauretanian settlement, Roman villa with fish-salting vats and Late Roman military fort. Approximately 3 km west of Punta del Alcazar was the small Roman fish-salting site of Zahara.[119]

The geology of the Straits coastline changes west of Ksar-es-Seghir: the limestone ridges of the Jebel Haouz give way to elevated terraces of sedimentary flysch, averaging ca. 275 m elevation. Sandstone becomes more prevalent in the coastal landscape, forming yellow-white cliffs along the Straits.[120] Small beaches are formed by annual water run-off, and a few wider valleys with seasonal or perennial streams are present. Along the eastern bank of one of these, Oued Liam, a small Roman-period agricultural site has been located facing a wide beach, Cala Grande.[121]

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[115] André 1971: 58; NIMA 131: 13; Michard 1976: 234
[116] NIMA 131: 13; NID I: 59-63
[117] Trakadas & Claesson 2001: 8-10; Villaverde Vega & López Pardo 1995: 462; Tarradell 1960: 123-124; Tarradell 1966: 435
[118] NID I: 61
[119] *Turbice*: Rav. Cosmog. III.9; see App. 3.1: *Sites 19-21*; Ponsich & Tarradell 1965: 68-75; Ponsich 1988: 159-165; Tarradell 1966: 431-435; H. Limane & A. El Khayari (INSAP), pers. com.; Tarradell 1960: 124-126; Zahara is now destroyed, see Section 5.5.2.
[120] NID I: 61; André 1971: 66; Mikesell 1961: 13-14
[121] Tarradell 1966: 431: "fishery and farm"; Tarradell 1960: 126.

Ten kilometres west of the Oued Liam valley is the rounded nappe flysch sandstone cliff of Cap Malabata (Ras el Mnar), 235 m elevation.[122] The cape forms the eastern point of semi-circular Tangier Bay, ca. 5 km x 2.5 km, open to the north-west (Fig. 5.21).[123] At the foot of the bay's western sandstone headland, the Marshan plateau (62 m), is the modern port of Tangier (ancient *Tingi*) (Fig. 5.22).[124] The base of the bay is lined by a wide, flat sandy beach through which Oueds el Mogogha and el Melaleh empty.[125] The low marshy ground behind the beach continues inland for ca. 15 km forming a broad valley with small hillocks, which is the northern extent of the Jbala region that extends to the south-west to meet the Atlantic.[126] On the southeast shore of Tangier Bay are the remains of a Punico-Mauretanian necropolis, Roman brick kilns and the Late Roman military fort at Gandori. In the valley south of the bay are several Roman olive-oil presses and a *villa rustica*.[127] On the southern shore of the bay are Roman-period agglomerations and a necropolis; and on the Marshan plateau, east of the ancient city of *Tingi*, are several Phoenician and Punico-Mauretanian necropoli.[128]

West of the Marshan plateau, the nappe-flysch ridge of Jebel es Slokia follows the east/west coast of the Straits (see Fig. 5.21). The ridge's northern slopes give way to high sandstone coastal cliffs, forming wave-cut terraces 50-65 m high, broken occasionally by small streams.[129] Thirteen kilometres west of Tangier, the Jebel es Slokia ridge culminates in the limestone dome of 326 m-high Jebel Kebir, which overlooks the western meeting point of the Straits and Atlantic.[130] The headland of Jebel Kebir is Cap Spartel (ancient *Ampelusia pr./Soloeis*).[131]

5.3.2.1 The Straits of Gibraltar marine system

The unique situation of the proximity of the European and African continents has created an unusual hydrographic situation in the Straits of Gibraltar. The extreme bathymetry of the Straits, combined with such a narrow passage between land masses, creates diverse exchanges between the two marine systems of the eastern Atlantic and the Sea of Alboran (Fig. 5.23).[132]

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[122] NID I: 59; Purdy 1841: 6; Michard 1976: 271
[123] Ponsich 1970: 8
[124] Hecataeus of Miletus, *Periegesis* (Peet 1923); Pomp. Mela, 1.22, 1.26; *ItAnt* 4.1, 8.4, 9.1; Ponsich 1970: 10
[125] Paskoff 1994: 47-48; Ponsich 1970: 15-16; App. 7: *Map 14*
[126] NID I: 59; André 1971: 65
[127] Ponsich 1964b: 278-282; Ponsich 1970: 264-283, 345-352
[128] Ponsich 1967b
[129] Lawson 1931: 101; Michard 1976: 231, fig. 147
[130] Mikesell 1961: 13, 15; Ponsich 1970: 13-14; NIMA 131: 10
[131] Pliny, *NH* 5.1.2; Herod. 2.32.1; Hanno, *Periplus* §3; *"Soleil"* is used by the 9th-century geographer al-Khwarezmi (al-Khwarezmi: 522).
[132] Margalef 1985: 1-4

The bathymetry of the 60 km-long Straits is oriented to the north-east/south-west. At the eastern end (the Gibraltar sill), the channel reaches its greatest depths of ca. 1,000 m, slightly elevated from the western basin of the Sea of Alboran (ca. 1,400 m max. depth).[133] The continental margin here on the African shore is very sheer, dropping 500 m within 1 km of the tip of the Ras Leona. On the Iberian margin, the 500 m isobath is ca. 2.5 km from the southern tip of the Rock of Gibraltar. The narrow shelves stay within these limits west to the Tarifa Narrows, between Tarifa and Ras Cires. Further west, the depth of the Straits decreases to its shallowest, ca. 500 m, centred in the channel at the Camarinal sill between Punta Camarinal and Bou Mazza.[134] It is here also that the continental margins become wider, with the 100 m isobath 7.5 km from the north coast and 4.7 km from the south. At the western extent of the Straits, this margin widens greatly to the north, off Cape Trafalgar. At Cap Spartel, the 100 m isobath is just over 1 km off the headland.[135]

The complex transfer of waters through the Straits is driven by the differences in salinity, water densities through the channel's bathymetry and tidal regimes between the Atlantic (which can be in excess of 3 m) and Mediterranean (less than 1 m).[136] On the surface, the 200-300 m-thick band of warmer (ave. 15º C) and fresher Atlantic Surface Water (ASW) passes from west to east (see Fig. 5.16). The more saline and colder (ave. 13º C) Deep Western Mediterranean Water (DWMW) flows west out of the Straits below this band.[137]

The dominant easterly surface current of the ASW can reach a maximum of 4 knots through the Straits, if aided by west winds and barometric gradients, increasing after it has passed through the Tarifa Narrows.[138] The velocity of the lower DWMW, as it enters the eastern Straits, is only slightly less than the entering ASW, decreasing as it transits through the channel. Through these marine bands, sporadic upwelling of deeper, colder waters occurs from the extreme depths of the Straits. These events are accompanied by strong inshore tides that have a small range but great velocity, running up to ca. 3 knots parallel to the coasts. Tides flow to the west during rising tide and to the east during falling tide.[139]

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[133] Viúdez, *et al.* 1998: 291; Bormans & Garrett 1989: 1544
[134] Farmer & Armi 1988: 14, 16
[135] Farmer & Armi 1988: 14-15, 41, fig. 2.1
[136] Candela, *et al*. 1990: 7313; Bryden, *et al*. 1994: 203
[137] Dardis & Smith 1997: 274-275; Fabres, *et al*. 2002: 433-434
[138] Farmer & Armi 1988: 13, 19; Houston 1964: 38; Candela, *et al*. 1990: 7334-7335
[139] Dardis & Smith 1997: 275; Chbaatou 2002: 8-9; Houston 1964: 38; Gascard & Richez 1985: 166; NIMA 131: 3; Purdy 1841: 9

5.3.2.2 Maritime conditions in the Straits

Navigation through and across the Straits is affected by the eastward-flowing surface currents in the centre of the channel, propelled by the ASW, and the alternating inshore tides. Strong tidal races occur off Cap Spartel, with overfalls (or isolated breakers) appearing in deep water north of Tangier Bay, especially off Cap Malabata, Ras Cires and Monte Hacho.[140] The tidal regime at Ceuta is between 0.9-1 m and at Tangier is between 1.9-2.76 m.[141]

Winds can appear in the Straits from all directions, but usually in winter dominate from the west with Levanters or *chegui* winds more common in the summer, with occasional westerlies or *gharbi* winds.[142] *Chegui*, which can persist for several days, can counter-act localised marine events, sometimes also affecting the dominant surface current.[143] At changes of equinox, in mid-March and mid-September, extremely strong *chegui* winds occur.[144]

The waters around the Peninsula de la Almina can offer shelter to smaller vessels, with most of the anchorage being sandy bottom.[145] Montaña del Renegado, to the west of the peninsula, protects vessels from westerlies, as does Monte Hacho; if strong winds are from the east, however, it is difficult to anchor around the peninsula.[146] The most protected anchorage is slightly north of the modern port of Ceuta, on the north shore. Finds of Punico-Mauretanian and Roman lead anchor stocks have been recovered from here as well on the northeast side of Monte Hacho.[147]

In the 10th century, Ibn Hawkal lists Ceuta as a good port and lots of fresh water, and in the 12th century, Ceuta native al-Idrîsî mentions the peninsula as a good port where boats can safely anchor in all kinds of wind and this is echoed by Yâkût in the 13th century.[148] The 16th-century Portuguese sailing guide *Esmeraldo De Situ Orbis* by Duarte Pacheco Pereira notes that even when there is an east wind, it is possible for large vessels to anchor on the north

[140] NIMA 131: 3
[141] NIMA 131: 11, 13; Amharrak 2006: 18
[142] Dorman, *et al.* 1995: 1903-1904; Anfuso, *et al*. 2007: 935
[143] López Pardo 1996a: 264-265
[144] Known to Ceutí fishermen as the *suresta de San José* and the *cordonazo de San Francisco* (Gómez Barceló 2003: 9). The same events are noted by Ali Bey (1816: 38) and are noted during a passage through the Straits on the 29th September in the 12th-century *Narratio itineris navalis ad Terram Sanctam* (Chroust 1928: 195).
[145] Chenier 1788, I: 20; Purdy 1841: 7
[146] NIMA 131: 13
[147] Bravo Pérez 1988: fig. 2; Bravo & Muñoz 1965
[148] Ibn Hawkal: 75; al-Idrîsî: §172; Yâkût: 957

shore of the Almina at 20 'arms' depth; when the wind is from the west, it is best to anchor east of Monte Hacho. This is echoed by the 15th-century Portuguese chronicler de Zurara.[149]

Between Montaña del Renegado and Ras Leona, the Bay of Benzú also offers protection from all winds except those from the north.[150] The finds of numerous Punico-Mauretanian and Roman lead anchor stocks indicate that vessels did seek shelter here.[151] The 10th-century geographer al-Warrâk locates the port of "Balyûnash" in this bay near "Mâ'al-Hayât" ('water of life'), a place to take on fresh water, and in the 14th and 15th centuries, the abundance of water is echoed by the geographers al-'Omarī and al-Sabtī, respectively.[152]

To the west of Ras Leona, vessels can also find protection in the narrow channel behind Île Perekhil but Ensenada del Almansa is reported to be one of the best sheltered anchorages along the coast.[153] This bay is likely the "Marsâ Mûsâ" listed by al-Warrâk and the "Marçamucça" according to the Italian *Lo Conpasso de navegare* (AD 1296); Ibn Hawkal notes that this is the second most important anchorage after Ksar-es-Seghir on this coast, and even a good anchorage in winter.[154]

The sandy bay at Ksar-es-Seghir is safe from east-west winds, and is noted as an ideal anchorage and port called "Marsâ Bâb al-Yam" by al-Warrâk in the 10th century, and "Madîinat al-Yam" by al-Bakrî in the 11th century and al-Idrîsî in the 12th century.[155] Pacheco Pereira's 16th-century sailing guide notes that larger vessels will have to anchor further out in the bay here, although smaller vessels can approach the beach.[156] Additionally, temporary anchorage can be found near Cala Grande at the mouth of Oued Liam valley further west, but there is no shelter from offshore winds and extremely strong tidal currents.[157]

In Tangier Bay, the local wind regimes include prevailing west and southeast winds in the winter and north and north-east winds in the summer. If there is a severe *chegui* wind through the Straits, a strong swell can arise across the bay, affecting vessels trying to leave the modern port. In the 11th century, al-Bakrî notes that only small vessels can come and go in the bay because anchorage is dangerous when there are eastern winds and this is echoed in

[149] Ricard 1927: 232; de Zurara: 1387-1388
[150] Purdy 1841: 7
[151] Bravo Pérez 1988: fig. 2; Bravo & Muñoz 1965
[152] Siraj 1995: 329, 338; al-'Omarī: 197; Torres Balbás 1957; al-Sabtī: 173-174
[153] NIMA 131: 12-13
[154] Siraj 1995: 325; Ibn Hawkal: 75; *Lo Conpasso:* 1110-1111
[155] Siraj 1995: 326; al-Bakrî: 205-206; al-Idrîsî: §175; NIMA 131: 12
[156] Ricard 1927: 232-233
[157] NIMA 131: 12

the 14th and 19th centuries by al-'Omarī and Ali Bey, respectively.[158] Eighteenth- and 19th-century accounts note that the bay is not very safe in the winter when there is a west wind, and that the best anchorage for larger vessels is in the eastern bay.[159] Although submerged rock pinnacles are present near Cap Malabata, the southeast bay offers sandy purchase and this is also the area where, during the 18th century, the Moroccan sultan's galleys would be laid up in winter (see Fig. 5.22).[160] In fair weather, it is possible to anchor all over the bay. Just outside the modern mole at the eastern side of the bay, where modern freighters anchor to await entrance into the port, a Roman anchor stock has been recovered.[161]

Navigation within or through the narrow Straits is subject to tidal currents and winds. In antiquity, Livy remarks upon the dominant and almost controlling role of currents and contra-currents against vessels, and Strabo notes that there is "certain difficulty" in passing through the Straits.[162] Despite this, piracy seems to have been a regular hazard in the Straits until the 1st and 2nd centuries AD, and was revived in the historical period.[163]

To sail west through the Straits, 19th-century accounts recommend setting out at high tide following the inshore tidal current along the Spanish coast, then anchoring off Tarifa; when the tide changes, it is then possible to sail south-west. It was then recommended that, "after passing through the central current [going east] toward the Cala Grande, on the south shore, short tacks must be made, within and near the edge of the line of tide, so as to avoid the several rocks lying off, or extending from, shore. After weathering the western point of the cove, Cala Grande… it is necessary to tack, comparatively at a farther distance, owing to the great vortexes of the sea running rapidly to the NW. By working in this manner until after weathering Cape Malabat [Cap Malabata], you may then work out at pleasure."[164]

To sail east through the Straits, it is possible to follow the prevailing surface current in the middle of the channel, although passage can still be made if there is an east wind. In the 18th century, it was recommended in this latter instance to follow the inshore ebb tide going east from Tangier Bay, into the main channel, and then to make way to the inshore tide on the Spanish side, following the coast from Tarifa to Gibraltar. However, if the departure is timed poorly in regards to inshore tides, a vessel can end up in the Atlantic and have to work back

[158] Al-Bakrî: 214; al-'Omarī: 199; Ali Bey 1816: 14
[159] Chenier 1788, I: 22; Richardson 1860: 40
[160] App. 7: *Map 14*; NIMA 131: 11-12; Purdy 1841: 6-7; López Pardo 1996a: 264-265; Chenier 1788, I: 21. The spot is also mentioned in the 19th century: Richardson 1860: 40.
[161] Trakadas & Claesson 2001: 12-13
[162] Livy, 28.30.6-12; Strabo, 3.2.5
[163] Gonzalbes Cravioto 1988: 770; Chron. du Pierre: 1251-1252; see also Cheddad 2006a.
[164] Purdy 1841: 12-13

into the Straits.[165] This difficulty is noted by Cicero, when relating Balbus' voyage from *Gades* (Cádiz) to the southern coast of the Straits, from where it takes him three days to reach *Calpe* (Gibraltar) due to the strong tempests.[166]

Navigating along the coast was possible, as al-Warrâk's marine itinerary follows the southern shore from west to east; he also notes that the journey between Tangier and Ksar-es-Seghir takes half a day.[167] Al-Bakrî notes that it takes half a day from Tangier to "Madîinat al-Yam".[168] Strabo describes a sailing route east through the Straits following an itinerary from beyond Cap Spartel (near 'Zelis' or *Zilil*) to 'Tinx', or *Tingi*, and then to *Septem;* the same is given in the *Antonine Itinerary*.[169]

Direct crossings of the Straits are also attested: Strabo and Plutarch note that a sailing route existed between *Baelo Claudia* in Spain and the port of *Tingi*, and Ksar-es-Seghir was the port from which Tariq Ibn Ziyad in AD 711 sailed to attack Gibraltar, and this port later served as a trade base with Iberia under the Almoravids and Almohavids.[170] Tangier is noted by the geographer al-Mukaddasî in the 10th century as an effective place to start such a crossing to Iberia.[171] Ceuta is mentioned as a starting point for crossing the Straits as well by Ishaq Ibn al-Housain in the 10th century.[172] In the 19th century, it was noted that it was possible to sail directly north/south across the Straits at slack tide and this assisted greatly the contraband trade between Gibraltar and Tetouan.[173]

5.3.3 The Atlantic coast: Cap Spartel to Essaouira

The Atlantic coastline of the northwest Maghreb possesses a different character than those of the Mediterranean and Straits of Gibraltar. The shore is generally long and straight for much of its length, from Cap Spartel to Cap Sim (near Essaouira), a distance of over 650 km. This line generally progresses in a south/southwesterly direction for 210 km to Rabat where it turns more south-west; after Cap Magazan at the city of El Jadida, a series of capes give the coast a more north/south orientation past Cap Sim. The shoreline is generally comprised of

[165] More 1761-62: 452
[166] Cicero, *Epistulae ad Familiares* 10.32.1
[167] Siraj 1995: 326
[168] Al-Bakrî: 206
[169] Strabo, 17.3.6; *ItAnt* 9.1-3; for *Portus Divinus*, in Argelia, associated with the idea of *Tingi*, see Gozalbes Cravioto 2002: 551.
[170] Strabo, 3.1.8; Plutarch, *Sertorius* 9; Redman 1983: 372-73; Redman, *et al.* 1979: 2-3
[171] Al-Mukaddasî: §35
[172] Al-Housain: 623-624
[173] Purdy 1841: 9-10; Pennell 1991: 71

low, sandy beaches, some faced with rock outcrops or ancient dunes, interrupted by riverine and lagoonal inlets or schorres (Fig. 5.24).[174]

At the limestone rise of Jebel Kebir in the north, the jagged cliff faces of Cap Spartel (ancient *Ampelusia pr./Soloeis*), continue for a distance south on the Atlantic shore (Fig. 5.25). Along the cape, steep cliffs splinter and become stretches of submerged rock pinnacles marking the long, stone ridges that extend west from the coastline. The pinnacles are exposed only at low tide and their frequency decreases 1.6 km south of the promontory as the landscape changes to lowlands and wide, sandy flat beaches backed by headlands no more than 60 m high.[175] This area is the southwest extent of the Jbala region of the Tangier peninsula, joined to the small valley and rolling hills that lie south and south-west of Tangier Bay.[176] Marking the southern edge of Jebel Kebir is the low sandstone promontory of Ras Achakar; here are late 8th-century BC Phoenician burials and later Punico-Mauretanian necropoli.[177] South of this promontory are the remains of the Roman fish-salting site of Cotta (*Cotes, Cotte* or *Gytte*?).[178] Other Punico-Mauretanian necropoli are present at Djebila and Roman-period sites, mainly *villae rusticae*, are located just further inland.[179]

The lowlands on the coast south of Cap Spartel are a swath of Quaternary alluvium and extend 35 km southward to the modern city of Asilah; they extend inland ca. 9.5 km until the rise of the El Had des Rharbia (Cuesta Colorada), a 230 m-high plateau foothill of the western Rif.[180] The lowlands, prone to extensive flooding and marshy conditions in winter but dry in summer, are drained by the tidal Oued Tahadart and its main tributary, the Oued Hachef (possibly ancient *Zilia/Zilil fl*.), which form the Tahadart estuary in their lower reaches, ca. 36 km south of Cap Spartel.[181] On the southern banks of the estuary, on a low sandy spit 1.5 km from the ocean, are six Roman fish-salting factories.[182] The Oueds Tahadart and Hachef extend 25 km into the western Rif foothills creating a large seasonal flood plain, over which looks from the south the Punico-Mauretanian and Roman settlement of *Zilil*, from an 82 m-high plateau.[183]

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[174] Guilcher & Joly 1954: 106-109
[175] NID I: 80
[176] Walker 1960: 296; André 1971: 63
[177] Aubet 1993: 135-137, 219; Ponsich 1970: 65-222
[178] Pseudo-Scylax, *Periplus* §112; Pliny, *NH* 5.1.2; Hanno, *Periplus* §5. See App. 3.1: *Site 24.*
[179] Ponsich & Tarradell 1965: 55-68; Ponsich 1970: 271-299; Ponsich 1988: 150-159; Ponsich 1964b: 262-268
[180] André 1971: 68; Ponsich 1964b: 282
[181] *Geo*. 4.1; Howe 1967: 1; NID I: 81
[182] Ponsich & Tarradell 1965: 40-45; Ponsich 1988: 139-150; Ponsich 1964b: 270. See App. 3.1: *Site 28*.
[183] Akerraz, *et al.* 1981-82: 169-170

Ca. 5 km south of Oued Tahadart's mouth and 7 km north of Asilah is the outlet of Oued Garifa, another tidal river that extends a dozen kilometres inland, creating a narrow alluvial valley through eroded plateaus (Fig. 5.26). On the north bank of the river, at Kouass, several Roman fish-salting basins have been identified. On the plateau 15 m above the river bank are the remains of a Roman aqueduct and enclosure, identified as a "camp". Behind these are the remains of a large kiln that functioned between the 6th and 1st centuries BC.[184] The Atlantic façade continues south of Asilah for ca. 175 km south to Rabat: here wide, sandy beaches are backed by high Pleistocene fossil dunes covered by active sand, ca. 50-60 m elevation (Fig. 5.27).[185] Ca. 20 km south of Asilah, behind this façade, there are at least 15 late Punico-Mauretanian and Roman sites, likely small farms.[186]

The shoreline formation is broken through by the meandering Oued Loukkos (ancient *Lixus*/*Lixos fl.*), which enters the Atlantic 70 km south of Cap Spartel.[187] This drainage delimits the southern Jbala region and Tangier peninsula and the northern extent of the Rharb plain.[188] The river and its tributaries begin their courses 180 km inland in the western Rif foothills; ca. 32 km from the coast, the river begins a meandering course through a Quaternary alluvial plain 6-12 km wide. The lower run of the river and Atlantic tidal fluctuations create an estuarine environment within this plain (see Fig. 7.51).[189] On the river's north bank, 4 km east of its mouth, is a 85 m-high limestone dome on which is situated the ancient Punico-Mauretanian, Roman and Late Roman settlement of *Lixus*. At the base of the hill are at least ten Roman fish-salting factories (see Fig. 7.37).[190] On top of the 50 m-high sandstone ridge at the southern bank of the river mouth is the modern city of Larache.[191]

Forty kilometres south of the Oued Loukkos mouth, at the shrine of Moulay Bou Selham, a narrow channel breaks through the coastline of the fossilised and 70 m-high, active dunes leading to the lagoon of Merja Zerga (possibly ancient *Sagigi kolpos*).[192] Merja Zerga is a

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[184] Ponsich & Tarradell 1965: 38; Ponsich 1988: 136-139; Ponsich 1964b: 270-271; Ponsich 1967a; Kbiri Alaoui 2004; Kbiri Alaoui 2007; Arharbi 2003: 73-74. See App. 3.1: *Site 29.*
[185] Carmona González 2001: 9; Michard 1976: 331; Stearns 1967: 21-22; Snoussi 1980: 5
[186] Ponsich 1966a: 394-414
[187] Psuedo-Scylax, *Periplus* §112; Hanno, *Periplus* §6; Pomp. Mela, 3.107; 3.92; Pliny, *NH* 5.1.2-5.1.4
[188] Moore, *et al.* 1998: 359
[189] Snoussi 1980: 5-6; Carmona González 2001: 9, 11-13; Tejera de Leon 1980: 20-23
[190] *ItAnt* 7.4; Carmona González 2001: 9; Ponsich 1981: 20; Ponsich & Tarradell 1965: 9-37; Ponsich 1988: 103-136. See App. 3.1: *Site 36.*
[191] Carmona González 2001: 9; NID I: 83
[192] Pliny, *NH* 5.1.9; the geography becomes confused here, however; Despois & Raynal 1967: 313-314; NIMA 143: 200; NID I: 85.

37 km^2 shallow estuarine lake extending 8 km inland.[193] The coastal façade that continues for 75 km south of Moulay Bou Selham to the mouth of the Oued Sebou is comprised of 9 m-high sandstone cliffs that front palaeo-dunes that widen to 3.2 km and reach an elevation of over 100 m. Each winter, the sand ridge is usually bordered on the east by extensive marshes several kilometres long. These marshes on the western edge of the Rharb usually dry out completely or are severely reduced in summer.[194]

The meandering Oued Sebou (ancient *Sububus fl.*) is the main drainage for the Rharb plain and one of the largest rivers of northern Morocco, with its Atlantic outlet eroding a wide channel through a 137 m-high palaeo-dune (Fig. 5.28).[195] The river stretches 600 km from its Middle Atlas source near Fés to the ocean, generally flowing through the wide Rharb plain that curves northwards before turning south-west to meet the sea.[196] During the winter and spring, the river is subject to annual flooding events and small marshes form in the Rharb along the course of the river's main tributary, Oued Beth, and smaller tributaries in the spring.[197] Several kilometres upstream from the mouth of the river, a small agglomeration of Punico-Mauretanian material has been located; ca. 40 km upstream is the Roman settlement and military camp of *Thamusida*, surrounded by some small military posts and farms.[198]

Thirty kilometres separate the Oued Sebou mouth and that of the Oued Bouregreg (ancient *Salat/Sala fl.*).[199] Here, a forested inland zone, the Mamora, serves as the transition between the Rharb plain and the higher Meseta to the south.[200] The Oued Bouregreg originates in the Middle Atlas at an elevation of 1,627 m, running 240 km in a northwest direction to meet the Atlantic (Fig. 5.29; see also Fig. 5.2).[201] The river cuts through deep gorges in the Middle Atlas foothills, whereas its lower course meanders through a narrow Quaternary alluvial valley, cutting through a Miocene and Villafranchian red sandstone plateau 55-60 m in elevation.[202] On a low plateau on the western bank of the Oued Bouregreg floodplain, 5 km upstream from the river's mouth, is the Punico-Mauretanian and Roman settlement of *Sala* (Fig. 5.30).[203] The river's mouth, like those of the Loukkos and Sebou, passes through a high dune zone near shore. A 30 m-high sandstone promontory, upon which is the present Kasbah

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[193] Ponsich 1975-76: 19; Appleby, *et al*. 2001: 349, 351
[194] Flower, *et al*. 2001: 373; Aberkan 1993
[195] Pliny, *NH* 5.1.5; Branigan & Jarrett 1969: 358-359; Michard 1976: 32, fig. 13
[196] Snoussi, *et al.* 2002: 7; Buckle 1978: 87-89; NID I: 28
[197] Vita-Finzi 1969: 60-62
[198] Cintas 1954: 18-19; Luquet 1966a: 375; Euzennat 1989a: 97: "agglomeration" at mouth is finds of coins and pottery.
[199] *Geo*. 4.1
[200] Rey & Nouet 1958: 15-17; Vita-Finzi 1969: 61
[201] Cherkaoui, *et al.* 2003: 339-340
[202] Michard 1976: 30; Choubert & Roche 1956: 9-11
[203] *ItAnt* 6.4; Boube 1984

des Oudaias section of the modern city of Rabat, marks the southern mouth whilst the city of Salé is situated on alluvial fill to the north.[204]

The coastline from Rabat to Cap Magazan at El Jadida extends in a more southwest direction and consists of Neogene and more recent sandstone along the shore, backed by the Meseta plateau. The palaeo-dunes here are sometimes covered by active dunes and bordered by long shallow lagoons or schorres that form in the depression on their eastern edge; these lagoons parallel the orientation of the coast, and are usually present during the winter. The shore is very rocky, and in the spray zone erosion has created tidal pools.[205] The largest watercourse to empty along this coast is the Oued Oum-er-Rbia, which runs from the Middle Atlas for 555 km.[206] At Azemmour (possibly ancient *Bovalica*), 4 km inland, the river has eroded the sandstone banks so that the city sits on a cliff 36 m above the riverbed (Fig. 5.31).[207]

The Atlantic coastal morphology changes at the headland of Cap Magazan, formed by a Cretaceous limestone outcrop.[208] South of the cape, the coastline turns in a more southerly direction to Cap Cantin (Cap Bedouzza), and the geology consists first of rolling palaeo-dunes between El Jadida and the ca. 10 km-long narrow coastal lagoon at Oualidia to sheer sandstone cliffs that rise to 120 m elevation near Cap Cantin (Fig. 5.32).[209] Past Cap Cantin and the city of Safi, the high coastline is north/south in orientation. Punico-Mauretanian, Roman and Late Roman pottery, coins and fragmentary inscriptions have been located between the Oued Oum-er-Rbia and Safi. Rock-cut chambers are also present along this coast, but their date is unclear.[210] Seventy-five kilometres north of Essaouira, at the mouth of Oued Tensift, this high sandstone coastal plateau descends to a low, sandy shore lined by active dunes (Fig. 5.33). Ca. 20 km north of Essaouira, the beach widens to 800 m, behind which is an extensive 200 m-high sand-dune belt. This belt is 6.5 km wide and continues behind the shoreline at Essaouira to Cap Sim.[211]

The city of Essaouira occupies a flat sandstone promontory that emerges from the sandy foreshore into the Atlantic, protecting a small sand-edged bay to the south into which the Oued Ksob empties. In the bay lie several islands, the largest of which is the 760 m x 600 m plateau of Essaouira (Mogador) Island (Fig. 5.34). Possibly identified as ancient *Cerne* or

[204] NID II: 96; Michard 1976: 30-31, fig. 11
[205] Guilcher & Joly 1954: 17; Michard 1976: 30, fig. 9
[206] NID I: 93; NIMA 143: 204; Michard 1976: 86
[207] Rebuffat 1999: 266, n. 5; NID II: 87
[208] NID I: 33
[209] NIMA 143: 207
[210] Rebuffat 1974a: 30-39: Luquet 1973-75a: 261-290; Cintas 1954: 22-32; Thouvenot 1973-75: 392-396
[211] NID I: 33; 98-99; El Khayari, *et al.* 2001b: 8

collectively as the *Insulae Purpurariae* of Juba II, these are the first major islands on the Atlantic coast south of Cap Spartel. [212] Like much of the Atlantic coastline, the ca. 28 m-high islands are fossilised sand dunes (Fig. 5.35).[213] Remains of a Phoenician trading site, some Punico-Mauretanian material and a Roman villa with fish-salting vats are present on the largest island.[214]

5.3.3.1 The Atlantic marine system

The hydrography of the northwest Maghreb's Atlantic coast differs considerably from those of the Mediterranean and Straits of Gibraltar. In place of the narrow shelves and deep underwater canyons in the Sea of Alboran and Straits is a broad and gently sloping continental margin. The margin, which is generally coated with alluvial and bioclastic sediments, has a very low relief, with small areas of 10-30 m rises of sand and lithified ancient beaches broken by marine canyons.[215] This Atlantic continental margin is a continuation of the geology of the alluvial plains and plateaus north-west of the Atlas Mountains. The bathymetry parallels the northeast/southwest orientation of the shoreline beginning at Cap Spartel and continues past Cap Guir, north of Agadir (Fig. 5.36).[216]

The bathymetric transition between the Straits and the Atlantic is dramatic: less than 1 km south of the Cap Spartel headland, the 50 m isobath is less than several hundred metres off the coast. West of the mouth of the Oued Loukkos, 70 km south of Cap Spartel, the 50 m isobath increases to its maximum width of 11 km offshore, whilst the 100 m isobath is 26 km offshore. South from here, the 150 m isobath averages a distance of ca. 40 km from shore; its widest extent is 80 km. The extent of the continental margin, the 200 m isobath, can be as wide as 250 km particularly offshore of the Rharb.[217] Past the 200 m isobath, the bathymetry drops steeply, particularly near Cap Cantin. This slope, however, is less abrupt and almost flattens out near Cap Magazan, forming a seaward extension of the terrestrial Meseta. This plateau averages 1,000 m depth, and forms almost a secondary continental margin. To the west, ca. 90 km from the coastline, the plateau drops sharply to 4,000 m depth.[218]

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212 *Cerne*: Hanno, *Periplus* §8-11; Pliny, *NH* 6.36.199 (separates *Cerne* from the *Insulae Purpurariae*); see also Millán León 2000: 862-863; *Insulae Purpurariae*: Pliny, *NH* 6.36.202, 6.37.203; Jodin 1967: 3.
213 Jodin 1967: 13, 18, fig. 4; NIMA 143: 209
214 Jodin 1967; El Khayari, *et al*. 2001b; Trakadas 2005: 64-66. See App. 3.1: *Site 57*.
215 Naji 2002: 328-332; Hinz, *et al.* 1982: 35; Jaadi 1981: 42-53; Seibold 1982: 7
216 Maldonado, *et al.* 1999: 12, fig. 2; Seibold 1982: 6-7
217 Trakadas 2004a: 5-7; Snoussi 1980: 8; Tejera de Leon 1980: figs 13-14; Hinz, *et al.* 1982: 36-38, fig. 1
218 Hinz, *et al.* 1982: 36-38, 45, figs 1, 5

The surface currents in the Atlantic are dominated by the southward-flowing Canary Current, which is a slow moving surface band extending to ca. 500 m depth (see Fig. 5.16). Inshore, the movement of water is carried to the south-west with a mean velocity of less than 1 knot.[219] In the Gulf of Cádiz, between the Algarve and Huelva coasts of Iberia and the northern Morocco coast to Cap Cantin, a large eddy off the eastern edge of the Canary Current is formed by North Atlantic Central Water (NACW), circulating to depths of 100-700 m. This Eastern Boundary Current (EBC) is a broad, anticyclonic (clock-wise) eddy. As it circulates, ASW forms the warmer, upper-most layer of water. Extensions of this eddy break off to the east and ASW then enters the Straits. The Mediterranean Outflow (MO) water exiting the Straits at depth flows under this eddy, westwards along the southern Iberian coast. [220]

The Azores High sub-tropical pressure system consistently blows towards the equator and assists in forming upwelling from off the continental margin through the Canary Current as it follows the Moroccan coast southward.[221] Within this process, upwelling brings colder, NACW bands to the surface near shore. The upwelling has spatial and temporal variability. Related to the seasonal movements of trade winds, the inshore occurrences prevail in summer and in autumn between Cap Spartel and the mouth of Oued Sebou and between Cap Cantin and Cap Guir.[222]

5.3.3.2 Atlantic maritime conditions

The dominant offshore current along the Atlantic coast is influenced by the EBC, following the long, flat continental margin to the south. There is a weak inshore counter-current to the north, but this event is usually overridden by tides. Tidal runs along this coast, as in the Straits, alternate direction and parallel the shore; at times they can regularly reach up to 5 knots.[223] In addition, there are strong permanent swells along this shore from the south-west and north-west. These swells are due to continuous winds from variable directions, slow displacements of the cold bodies of water and the Azores pressure system. Weak swells (with amplitude up to 1.5 m) are most frequent, occurring almost two-thirds of the year. The strongest swells can reach 7-9 m amplitude and occur several times a year. The swell can induce littoral drift currents with high sediment transport that extends to 100 m depth,

[219] Batteen, *et al*. 2000: 14173; Chbaatou 2002: 8-9; Rouch 1931: 17-18
[220] Mittelstaedt 1991; Ambar & Howe 1979: 552-553; Gascard & Richez 1985: 160
[221] Batteen, *et al*. 2000: 14173-14175; Hagen 2001: S114-S115
[222] Gascard & Richez 1985: 160-161; Agoumi & Orbi 1992; Hagen 2001: S117, fig. 3
[223] NIMA 143: 1999; Hagen 2001: S117, fig. 3

making it very difficult for a vessel to make a port, harbour or river anchorage.[224] The tidal regime along the coast is 2.1-3.7 m, increasing in range from north to south.[225]

The Azores High pressure system produces offshore winds of variable strength off the Moroccan coast that blow towards the equator.[226] Inshore, however, prevailing winds alternate from the west and south-west in summer but are also common from the north or north-west; northwest winds are particularly frequent and strong in winter. In summer *chegui* winds blow off the land.[227] Fog is frequent offshore this coast in the summer and Strabo, citing Eratosthenes, relates that the air on this coast is 'salty' and can be thick and misty in the mornings and evenings.[228]

Jebel Kebir, at a distance out at sea can appear as an island, as the Jbala region and its shore to the south are so low and sometime mistaken as the Straits of Gibraltar.[229] Although there are hazardous rocks here at the cape, some of which are submerged at low tide, transiting vessels can find some protection nearby from easterlies in the western lee of the promontory.[230] A large anchorage of Punico-Mauretanian, Roman, Byzantine and historical anchors has been located here, and its placement is noted on historical charts and mentioned in Pacheco Pereira's 16th-century nautical instructions as sheltering from the east winds.[231]

Numerous sandy shoals are present off the coast, specifically between Asilah and Larache, creating shallows of under 5 m depth and extending between 1.6-8 km offshore.[232] Numerous shoals and reefs are also present within 3 km of the coast between Point Dar Bouazza, just south of Casablanca, and the mouth of the Oued Oum-er-Rbia, and some are as shallow as 3.7 m.[233]

South of Cap Spartel, shelter for vessels is difficult until the first of the larger tidal rivers along this coast, the Oued Loukkos.[234] Here, shelter from the constant swells (less strong in

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[224] Snoussi 2000: 20; Furnestin 1959: 5-13; Gain 1920; Leared 1870: 55; Luquet 1973-75b: 299
[225] NID I: 80; USNHO 1952: 216-228
[226] Branigan & Jarrett 1969: 357; Mauny 1955: 95
[227] Luquet 1973-75b: 297; Batteen, *et al*. 2000: 14174, fig. 2; Merry del Val 1920: 340; Snoussi 1980: 21; Rouch 1931: 7-10
[228] NIMA 143: 199; Strabo, 17.3.8
[229] Purdy 1841: 6
[230] NIMA 143: 199
[231] Trakadas 2003: 16-19; Trakadas 2004a: 5-8; Erbati & Trakadas 2008: 67-71; Ricard 1927: 234
[232] NID I: 82; NIMA 143: 200; Rouch 1931: 1
[233] NIMA 143: 204; Cunninghame Graham 1898: 29
[234] Asilah is noted as a difficult anchorage, even when a walled basin was built, open to the north, sometime 10th or 11th centuries. Al-Bakrî (al-Bakrî: 218-220) notes the sea wall; al-Mas^coudi (al-Mas^coudi: 628-629) notes that Asilah was last place where ships from Andalous would anchor, not daring to go further south.

the summer) can be found just inside its mouth.[235] However, anchoring near the mouth is difficult during southeast, west and northwest winds.[236] In the 13th century, Ibn Sa'id notes that the Loukkos' mouth has "sufficient depth of water" for anchoring larger vessels.[237] In the 18th century Corsairs used this place, and slightly upriver, larger vessels of the Sultan wintered due to the sufficient depths.[238] A sandbar projecting from the north side of the river mouth is present and can change its position, and as Leo Africanus notes in the 16th century, "makes it dangerous to enter [the harbour]"; this is noted on historical maps.[239] However, this bar is passable at high tide, which fluctuates between 2.1-2.9 m.[240]

A similar situation is present at Moulay Bou Selham, 40 km south of Oued Loukkos. In the summer, anchorage can be found offshore of the channel leading to the Merja Zerga estuarine lake, where there is a mixed sandy and rock bottom at 15-18 m depth. Although the channel can be obstructed by a moving sandbar, it can be crossed at high tide.[241] Once inside the lake, it is a wide and calm anchorage. In the 10th century, Ibn Hawkal notes that vessels from Iberia anchored here in the "Lake of Ariag", and it served as a port for the cities of Fés and al-Basra.[242] The same is said by Yâkût in the 13th century.[243] However, in the 16th century, Pacheco Pereira notes that only small boats could enter the lake.[244]

Shelter again can be found just at the mouth of Oued Sebou, although a sandbar extending from the north bank is present here. In the 15th century, it was noted that vessels should wait until high tide before entering the river.[245] In the 16th century, Leo Africanus notes that Portuguese and Spanish ships "of great burden" anchored inside the "very deep, broad [and] navigable" river mouth but also were in danger of running aground on shoals.[246] Pacheco Pereira 16th-century guide also notes this anchorage but states that vessels here can be exposed to northwest winds.[247] The tidal influxes on this river, however, are very strong: the modern city of Kenitra, 14.5 km upstream, experiences a fluctuation between 2.9-3.6 m. The tide is noted ca. 80 km from the river's mouth, where the outgoing current can be 3-4

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235 Ricard 1927: 237; Carmona González 2001: 13, fig. 2; noted as a port for al-Basra in the 10th century by Ibn Hawkal (Ibn Hawkal: 76); NIMA 143: 200; Montagne 1923: 178-179; Merry del Val 1920: 338.
236 Cunninghame Graham 1898: 8; NID I: 83; NID II: 106
237 Ibn Sa'id: 1086
238 Chenier 1788, I: 23-24
239 Leo Africanus: 495-496; App. 7: *Maps 7, 9, 12*
240 Montagne 1923: 186
241 NIMA 143: 201; NID I: 87
242 Ibn Hawkal: 77-78
243 Yâkût: 952
244 Ricard 1927: 237
245 NIMA 143: 202; de Zurara: 1391-1392
246 Leo Africanus: 410-411, 930
247 Ricard 1927: 238

knots.[248] Pliny notes that this river is *"magnificus et navigabilis"*, and in the 16th century, Pacheco Pereira states that in winter, small vessels can navigate this river as far as Fés.[249] In the beginning of the 20th century, it was still possible for boats to navigate the Sebou for 120 km upstream and its main tributary, Oued Beth, to be followed by vessels of 20 tons up to Sidi Slimane, in the southern Rharb.[250]

Similarly, the mouth of the Oued Bouregreg at modern Rabat can also be used as an anchorage in summer when there is a southern or western wind.[251] In winter, this anchorage too is exposed to swells and the best anchorage is found ca. 1.5 km upriver on the southern bank, well behind the Kasbah des Oudaias promontory.[252] In the 12th century, al-Idrîsî notes that ships from the ports of Andalucía anchor at the mouth of the river.[253] But al-Idrîsî and Leo Africanus both indicate that, like the other rivers, it is best to enter at high tide to pass over the sand bar at the entrance.[254] The dangers of the sandbar were noted in the 18th and 19th centuries, with transport between ship and shore conducted by lighter.[255] The sandbar at the river's mouth is more exposed in the summer, and makes the river impassable except by small boats. However, the 13th-century geographer Yâk̲ût claims that the river is easily navigable and boats can sail up to Salé.[256] The Bouregreg in the mid-20th century was still navigable for ca. 9.5 km upriver, where the way was blocked by islands and shoals.[257]

The ca. 175 km of coast between the mouth of the Oued Bouregreg and Cap Magazan, at the modern city of El Jadida, is almost devoid of well-sheltered anchorages and subject to winter fogs and extremely strong swells.[258] Although 4 km upriver, Azemmour, on the Oued Oum-er-Rbia, was considered a decent harbour since the 12th century; again, however, the numerous shifting sandbars at the river's mouth made entrance difficult.[259]

South of Cap Magazan, Pacheco Pereira's guide and the 13th-century *Lo Conpasso de navegare* indicate that the seas are full of dangerous reefs and shallows; the lagoon at Oualidia can serve as a large protected anchorage, although the narrow entrance is

[248] NIMA 143: 201; NID 1: 88
[249] Pliny, *NH* 5.1.5; Ricard 1927: 238
[250] Luquet 1966a: 375; Rouch 1931: 2
[251] NIMA 143: 202
[252] Chenier 1788, I: 33-34; Montagne 1923: 186-187
[253] Al-Idrîsî: §40
[254] Al-Idrîsî: §40; Leo Africanus: 929
[255] Chenier 1788, I: 33-34; Cunninghame Graham 1898: 11
[256] Yâk̲ût: 958
[257] NID II: 99
[258] NIMA 143: 203-205. Only the small islands at Fedala, 10 km south of Sala, are mentioned as a possible anchorage in *Lo Conpasso de navegare* (AD 1296) (*Lo Conpasso:* 1110-1111).
[259] Al-Zouhri: 803 (12th century); Ibn Sa'id: 1086 (13th century); Ricard 1927: 242-243; Chenier 1788, I: 37; Leared 1870: 207; Cunninghame Graham 1898: 28.

exposed.[260] At Safi, south of Cap Cantin, safe anchorage can be found behind the high cliff faces that shelter from the northern and eastern winds. In winter, when winds blow from the south or south-west, it is unsafe for ships to anchor here due to the strong swell.[261]

The next anchorage is at Essaouira, which has a tidal range between 2.7-3.5 m. In the spring, there are 3-5 m high swells here, and storms come from the south and south-west. In the summer, strong north winds create chop of up to 2 m amplitude, but the autumn experiences a period of calm and flatter seas.[262] Vessels here must first navigate around the islands into the bay; the north channel can be dangerous in the spring and is exposed to southwest storms in the winter, although this is a better entry for large vessels.[263] Pacheco Pereira's guide also mentions entry into the bay by the south channel, on the other side of the island, but this passage can be dangerous on account of submerged rocks.[264] Vessels can shelter east of the islands, where there is a sandy bottom.[265] In the 16th century, Pacheco Pereira recommended mooring here with an anchor as well as a cable attached to the island.[266]

The strong swells and the inshore sediment transport along this coast, as well as the noted marine fog, must have been the reason behind al-Idrîsî and al-Andalousi calling the Atlantic "*al-bahr al-Muzlîm*," 'the dark sea' (al-Muk̲addasî and al-Khwarezmi call it *"al-bahr al muhīt"*, 'sea of darkness').[267] However, safe passage could be made if sailing offshore and avoiding the shallow reefs and sandbars, and protection from strong wind and waves could be found at the various river mouths that line the coast. Indeed, voyages were made in this ocean: crossings were made between *Baelo Claudia* to *Tingi* (and possibly *Lixus* and *Gades*) according to Strabo, and the Gaditanian navigators frequented the coast of *Mauretania Tingitana* according to Pliny.[268] In the *Periplus* of Pseudo-Scylax, ventures even further south were undertaken, and the voyage from the Straits to *Cerne* (Essaouira?) was noted as taking 12 days.[269] A winter voyage with fog was documented in the 19th century, when a small Genoese brig took four days to sail from Gibraltar to Essaouira.[270]

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[260] Ricard 1927: 246; Chenier 1788, I: 39-40; *Lo Conpasso:* 1110-1111
[261] Chenier 1788, I: 41-42; Ricard 1927: 247; NIMA 143: 207
[262] NIMA 143: 208; Leared 1870: 67, 70
[263] NIMA 143: 209; Chenier 1788, I: 46; Richardson 1860: 83-92
[264] Ricard 1927: 249
[265] NID I: 98; Cunninghame Graham 1898: 33
[266] Ricard 1927: 249
[267] Al-Idrîsî: §167; al-Muk̲addasî: §35; al-Khwarezmi: 521; al-Andalousi: 874
[268] Strabo, 3.1.8, 17.3.2; Pliny, *NH* 2.67.168
[269] For *Cerne*, see Pseudo-Scylax, *Periplus* §112; see also Pliny's identification, following Polybius: *NH* 6.36.199.
[270] Richardson 1860: 83-92

5.4 Changes affecting the coastal environment

The general marine systems of winds and currents, described above, have remained relatively constant since antiquity over the large bodies of water they affect: the Mediterranean, Straits and Atlantic. At the same time, although a majority of the geographical features of the northwest Maghreb described above have remained comparatively static, portions of the coastal topography have been subject to geo-morphological alteration since antiquity. These alterations therefore mean that during the Punico-Mauretanian and Roman periods, 2,500-2,000 BP, some areas of the coastal environment were different than at present, affecting the ways people moved through and related to the marine littoral. Some of these changes were slow in taking place and are part of much larger and longer-term geologic and climatic trends, whilst others are the result of more recent human activities and interventions. The variables at play can be independent or interdependent and of a localised, regional or global scale.[271]

5.4.1 Sea-level change

Fluctuations in relative sea level are caused by a combination of eustatic changes in sea surface height due to climatic events, growth and decay of ice sheets, and the shift in land levels due to tectonic movement and/or isostatic rebound.[272] At the end of the last glacial maximum (ca. 18,000 BP), until the beginning of the Holocene (10,000-9,000 BP), sea level rose from -120 m to -35 m relative to present; between ca. 6,000-2,000 BP, sea level continued to rise with some oscillations. Over the last two millennia, sea levels have remained fairly stable, rising at an estimated rate of 1-2 mm/year in the Mediterranean. World-wide, relative sea-level rise is estimated to be ca. 0.1 m over the last century.[273]

Several coastal archaeological sites in the western Mediterranean and eastern Atlantic clearly display evidence of relative sea-level change since antiquity, ca. 2,500 years ago.[274] This change, however, is not uniform amongst the sites, which exhibit both sea level transgression and regression. This variation is due to regional tectonic vertical displacements and deltaic,

[271] Delano Smith 1979: 338-339
[272] Church, *et al.* 2001: 643, 675; Pirazzoli 1996: 11-13; Paskoff 1994: 3-13
[273] Gornitz, *et al*. 1982; Pirazzoli 1987: 174, Table 5.1; Church, *et al.* 2001: 641; Flemming 1969: 85-86; Hindson, *et al*. 1999: 318; see also Tsimplis 2005.
[274] Provençal and Tyrrhenian coasts: ca. 2,000 BP at +0.3-0.7 m (Pirazzoli 1976); Marseilles: ca. 2,500 BP at -0.65 m (Morhange, *et al*. 2001); Ampurias: ca. 2,000 BP at -1 m (Nieto, *et al*. 2005); Cherchel: ca. 2,000 BP at +0.5 m (Yorke & Davidson 1968: 13, fig. 3); Gulf of Gabes: ca. 2,000 BP at +0.1 m to +2 m (Paskoff & Oueslati 1991: 159-161); Cádiz: ca. 2,000 BP at +0.5 m (Arteaga 2006: 69-73); Algarve: ca. 500 BP at +1 m (Hindson, *et al*. 1999: 319-320).

volcanic or seismic activity. Relative sea level, therefore, cannot be examined on a broad scale and must take into account localised phenomena.[275]

Since the early Holocene, the Mediterranean coast of the northwest Maghreb has experienced isostatic subsidence, overlain in places by tectonic uplift movements caused by collision or subduction phenomena.[276] In the more recent Holocene, since ca. 2,500 BP, the relative sea level has been 'quiet', with a small range and rate of displacement compared to other Mediterranean regions.[277] Here, as in the Straits of Gibraltar, the relative sea level has been vertically stable to within ±0.3 m.[278]

Along the Atlantic coast, variations in tectonic uplift have been present since the Quaternary (1.8 my~), with extreme uplift at Agadir whilst there is gradual continual uplift along the coastal Meseta, north of Cap Guir (where the High Atlas meet the sea).[279] As the African west coasts were remote from Quaternary ice sheets, the region underwent only minor isostatic vertical movements. However, due to tectonic uplifting, P. Pirazzoli and G. de Librias believe that a relative sea-level fall of approximately 2 m has occurred along the West African coast over the last 6,000 years**.** North-west of the Atlas, N. Flemming and C. Webb argue that the localised relative sea-level fluctuation, when corrected with curves for displacement and tectonics, is more likely to be ca -0.02 m over the last 2,000 years.[280] Since the Punico-Mauretanian period at least, the evidence from archaeological sites present on the Atlantic coast correspond more closely to Flemming and Webb's hypothesis.

5.4.2 Geo-morphological changes

Despite the limited relative sea-level change along the coasts of the northwest Maghreb over the last two and a half millennia, the region's sandy shorelines, coastal plains and river valleys, particularly those of the Atlantic, have been subject to geo-morphological transformation. These changes are largely due to sedimentation processes that are the result of a combination of climatic, environmental and anthropogenic factors.[281] A combination of a drier and warmer climate, deforestation (creating unsettled or a complete lack of vegetation cover) and human action (settlement contraction, expansion and their related agricultural or

[275] Pirazzoli 1987: 152-155, 175; Flemming 1969: 86
[276] Pirazzoli 1991: 88-89; Brùckner 1986a: 84, 89
[277] Flemming 1969: 71
[278] Flemming & Webb 1986: 11, 26
[279] Giresse 1987: 252-256, Table 8.2
[280] Pirazzoli 1991: 105; de Librias 1974; Flemming & Webb 1986: 18-19; see also Giresse 1987: 252-255, Fig. 8.2.
[281] Bintliff 2002: 420-421; Bintliff 1992: 125-126, 129

pastoral activities on relatively steep and unstable schists) has led to growth of valley alluvia and coastal plains.[282]

CLIMATE

The northwest Maghreb possesses a different recent climatological history than other parts of North Africa and southern Europe. The climate at present is subhumid in the Jbala, humid in Middle Atlas foothills, semiarid in the Rharb and northern Meseta and arid along the Meseta coast and east of the Rif. The Rif, Middle and High Atlas have always sheltered the 'core' of the country, the moister Rharb and Meseta, which receive winter westerly storms but are protected from Mediterranean influences and Saharan aridity. Rain falls mainly on the western slopes of the ranges, and is greatest in Tangier and progressively decreases to the south; the Mediterranean coast receives one-third of the annual rainfall of Tangier.[283]

During the last two millennia, the region inside the Rif and Atlas experienced wetter and drier episodes.[284] Sediment cores show that, compared to the 20th century, a wetter period was experienced after the 8th century.[285] Tree-ring chronologies of cedar (*Cedrus atlantica)* in the Rif, Middle and High Atlas reveal that between the 12th and 19th centuries, the region experienced periods of dryness (precipitation below that of today's normal) that lasted an average of 48 years every century; 12 episodes of drought, lasting a maximum of six years, occurred every century.[286] Contrary to broader climatic re-constructions, it appears that the Little Ice Age in Europe (AD 1300-1900) corresponds to a period in the northwest Maghreb that was drier and warmer than today.[287] Although more recent data are lacking for outside the Rif and Atlas belt, sediments from the Oued Moulouya basin show an arid climate similar to the present existed in the region ca. 4,000 BP; a short humid interlude of increased rainfall occurred between 3,000 and 2,000 BP.[288]

VEGETATION

The amount of arboreal coverage and its diversity within the northwest Maghreb has changed since antiquity, contributing to episodes of erosion. Pollen analyses have demonstrated that the Rharb and Meseta had forests of cork oak (*Quercus suber*) as far back as +/- 6500 BP. During the Phoenician period along the coastal Rharb, eight species of trees

[282] Bintliff 2002: 426; Brückner 1986b: 11; Delano Smith 1996: 159-160
[283] Branigan & Jarrett 1969: 357, 360; Till & Guiot 1990: 341, Table 1; Zielhofer & Lindstädter 2006: 5
[284] Till & Guiot 1990: 347
[285] Nicholson 1979: 40
[286] Till & Guiot 1990: 347, 349, Table 5
[287] Soon & Baliunas 2003: 95, fig. 1
[288] Wengler & Vernet 1992: 164; Snoussi 2005: 2

were present, the most dominant being holm or holly oak (*Quercus ilex*), mastic (*Pistacia lentiscus*), ash (*Fraxinus sp.*), olive (*Olea europaea*) and cork oak. Holly oak was the dominant species during the Punico-Mauretanian period, growing alongside large amounts of olive, pine (*Pinus pinea*) and temperate fruit trees (*Rosaceae sp.*).[289] During the 1st centuries BC/AD, Pliny and Strabo mention the abundance of trees of the Rif coastline and the forests that cover "Mt. Abila" (Monte Hacho or Jebel Musa in the eastern Straits) down to the sea.[290] Arab geographers echo these 'observations': in the 11th century, al-Bakrî mentions the forest near Ksar-es-Seghir and in the 15th century, al-Sabtī mentions "an abundance of trees" near Ceuta.[291]

However, Pliny also claims that some forests in *Mauretania* were already being 'exhausted' in the 1st century AD.[292] The cause for this was the exportation to Rome of wood from the *citrus* (*Atlantis silva*), as well as *thuyon* (*Callistris quadravalvis*) trees, valued for use in furniture.[293] In the 13th century, the geographer Ibn Sa'id notes that Rif forests provided a large amount of wood for shipbuilding and the sultans' palaces.[294] In the 16th century Leo Africanus states that the great store of wood near Badis (Peñon de Velez de la Gomera) was "very commodious" for shipbuilding and near Larache, charcoal was produced from the forests.[295]

In addition, agricultural activities have affected indigenous vegetation. In the valleys near *Volubilis*, plant cover was removed to make way for olive groves which likely blanketed the landscape beginning in the 1st centuries BC/AD. Grain must have been grown in the Rharb and Jbala as milling was practised at *Thamusida*, *Banasa*, *Tamuda* and near Tangier.[296] In the Punico-Mauretanian, Roman and Late-Roman periods, between ca. 2,500-1,500 BP, pollen analysis from the Middle Atlas shows that ash (*Fraxinus sp.)*, pine (*Pinus sp.*), Algerian oak (*Quercus canariensis*) and cedar (*Cedrus sp.*) nearly disappeared whilst pastoral and arable grasses increased. This change is largely assigned to anthropogenic factors: populations undertook wide-spread pastoralism and cleared land for stock grazing and agriculture. In the

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289 Damblon 1991: 171; Nafaa & Watfeh 2000; Grau Almero 2005; Grau Almero, *et al.* 2001: 191-196; Aranegui Gascó & Habibi 2004: 136-138
290 Pliny, *NH* 13.29.91; Strabo, 17.3.6
291 Al-Bakrî: 205-206; al-Sabtī: 150-151
292 Pliny, *NH* 5.1.12, 13.29.95
293 See also Lucullus, X.144; Vitruvius, 2.9.13; Martial, *Epigrams* 14.89; Lassère 1979: 79-80; see discussion for identification of these types in Semple 1919: 20, 32; Meiggs 1982: 286-291.
294 Ibn Sa'id: 1086; Mikesell 1961: 97
295 Leo Africanus: 495-496, 517-518
296 Reille (1977: fig. 3.4) cites later dates (ca. 1,000 BP) for the introduction of *olea* to the northwest Maghreb, which contradicts *Lixus* data and archaeological finds of olive oil presses at major Punico-Mauretanian and Roman settlements: over 50 olive oil presses are present at *Volubilis* (Akerraz & Lenoir 1990). For olive oil presses and mills, see Ponsich 1970: 278; Gozalbes Cravioto 1997: 49, 94.

medieval period, cultivation combined with episodes of extreme aridity continued to contribute to the loss of forest cover.[297] Cores taken near Larache and in the western Rif also indicate a continued reduction of forests and increase in pasturage grasses, cacti and cereals in the last 900 years and a continued increase in olive (*Olea sp.*) in the last 450 years.[298]

R. Neboit's post-Roman land-tenure hypothesis, "le modèle maghrébin", notes population pressure in certain areas force the increased cultivation of slopes up to 50°, which are easily eroded.[299] Particularly in the Rif, during the 19th century and period of Spanish colonial rule (1905-1956), deforestation due to increased pressures for agricultural production and timber harvesting was observable. In the 1960s, agricultural endeavours again increased in the Rif, but were largely abandoned in the 1980s, leading to extensive erosion (Fig. 5.37).[300]

Presently, the arboreal coverage is less diverse than it was ca. 2,000 BP in the northwest Maghreb: reduced stands of holm or holly oak (*Quercus ilex*) occupy coastal hills, with forests consisting more of low shrubs.[301] Cork oak (*Quercus suber*) grows in isolated groves in the Rharb, with large stands still in the Mamora area near Rabat, and throughout the coastal Rif foothills. In the latter region grow maritime pine and Aleppo pine (*Pinus pinaster* and *P. halepensis*), with their range extending from 0-2,000 m elevation. Isolated stands of cedar (*Cedrus atlantica*), Spanish fir (*Abies pinsapo*) and Spanish juniper (*Juniperus thurifera*) grow in the mid to upper elevations (1,500-2,500 m) in the Rif and Atlas (Fig. 5.38). In the more arid valleys of the Atlas grows a type of thuya (*Tetraclinis articulata*).[302]

ALLUVIAL VALLEYS

C. Vita-Finzi outlines two episodes of alluvial fill present in valleys throughout the Mediterranean and observable in Atlantic Morocco and Spain.[303] Fill I occurred between 50,000-10,000 BP; afterwards erosion and downcutting took place until 2,000 BP, followed

[297] Brückner 1986b: 10, 15; Cheddadi, *et al.* 1998: 886; Lamb, *et al*. 1989: 70-73; Lamb, *et al.* 1991: 530-531, Tab. 4; Till & Guiot 1990. For medieval texts referring to agriculture practised around *Volubilis*, see Limane & Makdoun 1998: 339-340, fig. 4; see also Chapter 8.2.
[298] Cores at Krimda and Sakh Sokh: Damblon 1991: 178-181; cores at Marzine: Reille 1977: fig. 3.4; Lamb, *et al.* 1991: 530-531, Tab. 4.
[299] Neboit 1984: 323-326. Davis (2005; 2007: 137-155) argues that deforestation was in fact a built-up narrative of the French colonial powers, who based their arguments on taking Classical authors at face value and erroneous sampling or identification of "remnant vegetation"; only one scientific modern pollen study is cited in these arguments.
[300] Moore, *et al.* 1998: 357-359; McNiell 1992: 99-101; Gauché 2005: 55-56; Jamous 1981: 15. Historical observations between the late 1700s and late 1800s note deforestation in the Rif; during the Spanish colonial period, the major deforestation occurred between Al Hoceima and Oued Kert (Mikesell 1961: 97).
[301] Lamb, *et al*. 1991; Mikesell 1961: 97
[302] Carrión, *et al.* 2000: 30, fig. 1, 33; Till & Guiot 1990: 337; Lamb, *et al*. 1989: 65
[303] For Andalusia, see Hoffman & Schulz 1988: 53, 59; for the Guadalquivir valley, see Martín-Consuegra, *et al*. 1998: 528, 530.

by the formation of Fill II (younger valley alluvium) between 2,000-300 BP.[304] Originally, Fill II was thought to be due to pan-Mediterranean climate change, but it has since been shown that some regional alluvia do not fit into this proposed Roman or post-Roman chronology, and can have factors other than climate affecting deposition.[305]

An example of this variation is present in the regional Fill II alluvia identified in the Rharb, where a distinct layer of alluvial sediments, the so-called "Rharbian deposit", was identified. These layers, sometimes 8-9 m thick, were first thought to be "Neolithic pluvial" sedimentation laid down during the Quaternary. However, subsequent finds of archaeological materials and radiocarbon analysis have assigned a date of ca. 2,500 BP for the earliest evidence of this sedimentation and layers were still deposited ca. 200 BP.[306] Rharbian deposits with Roman material have since been identified in the Oueds Martil and Laou valleys on the Mediterranean coast. Other deposits are present in the Oueds Sebou, Mellah, Tensift, Tamrhakht and Sous valleys on the Atlantic coast.[307]

More recently, dams have had an impact on alluvial deposition processes and the paths of river courses in the region. In the period 1961-1981, the Oueds Moulouya, Nekor, Nakhla (near Tetouan), M'harhar (near Tahadart), Loukkos, Inaouene (a tributary of the Oued Sebou), Beth, Bouregreg and Oum-er-Rbia have had dams constructed in their upper reaches.[308] The construction of these has reduced the water discharge of rivers in Morocco by ca. 60-70%, and their sediment fluxes by almost 100%. The damming of rivers also had a profound effects on coastal zones. Rivers, now with such reduced sedimentation, have become more estuarine-like in their lower stretches with higher levels of salinity, negatively impacting the habitats of many riverine fish and shellfish species as well as navigation.[309] This is compounded by water-diversion schemes for agricultural purposes, which have resulted in altered or dried-out lower river channels.[310] Eventually, the topography of the rivers' mouths has altered and coastal stability negatively impacted.[311]

COASTAL PROCESSES

Aside from sedimentation processes derived from terrestrial-based phenomena, oscillations in coastal dynamics result from agents within the marine environment: waves, tides, currents

304 Vita-Finzi 1969: 91-102; see also Delano Smith 1979: 328-335.
305 Delano Smith 1996: 161-162; Horden & Purcell 2000: 314-328. For discussion of theory that catastrophic events of a climatic origin are responsible for most erosion, see Shiel 2000: 71, 75.
306 Vita-Finzi 1969: 61-62; Le Coz 1960
307 Vita-Finzi 1968: 485-486
308 Fox, *et al.* 1997: 234-235; Arnoldus 1977
309 Ahterton & Korateng 2006: 171; Davis 2006: 97-98; Probst & Amiotte Suchet 1992: 623, 634-635
310 Drain, *et al*. 1971: 67, 75-76; Fox, *et al.* 1997: 233-234; Fox & Moore 1993
311 Snoussi, *et al*. 2002: 5

and wind, each subject to seasonal variation. These agents combine to cause lithic degradation and sediment erosion and deposition, dependent on the littoral morphology and composition.[312] In certain regions of the northwest Maghreb, some of these dynamics have greater and more continual impact, particularly along the sandy Atlantic coast with its great tidal amplitude, than along the limestone facies that dominate the nearly tide-less Mediterranean coast.

Along the region's littoral, erosion is the present general trend affecting sandy beaches.[313] This process is in some respects due to natural wave action on the shore and more significantly due to lack of sediment deposition from rivers that have been dammed in the last century. Active dredging and beach sand mining for construction are also responsible for this regression. Accretion, however, is occurring in limited areas of the shoreline as a result of marine processes interacting with relatively static structures such as jetties and breakwaters.[314]

On the Mediterranean coast longshore sand transport occurs at beaches and river mouths and bordering lagoons. In combination with storm events and wave action, these can cause the movement of the embouchure and the formation of sandbars and spits.[315] Lonsghore transport is a constant event on the Atlantic shoreline, which, along with wind and wave action, causes the formation and fluctuation of the particular southward-facing sandbars at rivers' mouths. The estuaries located on both coasts are mesotidal areas with moderate wave action, but still subject to river currents, tides, waves and longshore sediment transport.[316]

5.5 Changes in the northwest Maghreb littoral

Geo-morphological changes in the coastal landscape or in the littoral nature of certain geological features can impact the ways in which humans interact with this environment over time. The placement of settlements or constructed features can be affected by these changes; mobility through or access to the land-sea interface is also impacted. Navigation to or from particular terrestrial sites may appear prohibitive at present given their topographical setting, but maritime access may have been possible in the past. In *Mauretania Tingitana*, travelling by vessel to sites such as those located upriver, like *Lixus*, *Thamusida*, *Banasa*, *Tamuda* or *Sala*, may appear difficult at present whilst in antiquity such voyages were achievable. Additionally, some sites today might appear more accessible than previously possible. In

[312] Paskoff 1994: 15-33
[313] Chaouq 2004
[314] Anfuso, *et al.* 2007: 942-943; Benali 2003; Arid, *et al*. 2003
[315] Anfuso, *et al.* 2007: 934
[316] Paskoff 1994: 24-26, fig. 9, 155-165

many cases, such as with *Tingi* (Tangier) and *Septem Fratres* (Ceuta), man-made features can completely remove evidence of earlier constructions, obscuring our understanding of the sites' past maritime relationships.

Aside from alterations in the way that humans move through or relate to the land- and seascape, the habitats of marine life, particularly inshore, estuarine, diadromous and potamodromous species, are affected by environmental change. Reduction in river flow, sediment deposition or removal in rivers or along shores, pollution, dredging, fluctuations in salinity, temperature and water movement, or loss of oxygen can degrade marine habitats.[317] These factors can compound to impact riverine and littoral biodiversity, spawning grounds and food sources, reducing populations or forcing temporary or permanent migrations.[318] In this respect, areas where human populations go to fish from boat or by shore also can shift or be temporarily or permanently altered.

5.5.1 The Mediterranean shoreline

Sea-level changes along the Mediterranean shoreline have been negligible since antiquity; additionally, as a majority of the coast is lined by limestone cliffs, only isolated areas have undergone geo-morphological change over the past 2,500 years. Of the few coastal plains and river deltas that have been impacted, some have undergone measurable transformations only within the 20th and 21st centuries.

The morphology of the 4 km-wide and 20 km-long Oued Moulouya deltaic coastal plain, at the eastern edge of the ancient province, has been greatly affected since antiquity: Pliny calls the river "navigable" and the 12th century geographer al-Zouhri considers it larger than the Oued Sebou.[319] Prior to the later 20th century, the Moulouya was characterised by a more meandering course than at present and deltaic deposits formed at the eastern mouth of the river due to the easterly longshore drift along this part of the Mediterranean coast. However, dams, since their initial construction in 1967, have reduced the river's flow by 47%.[320] Intensified agriculture in the plain has been supported by the construction of canals below the lowest dam, further reducing the amount of water flow in the river's lower channel. These factors, in combination with droughts experienced in the region since the 1990s, have reduced the sedimentation transport along the river's course by 93%.[321] The river's transformation is evident through aerial photographs taken between 1958 and 1988: after the

317 Rabeni & Jacobson 1993: 211; Kifani 1998: 236; Hewes 1948: 242; Loukili & Belghyti 2007: 683
318 Gueguen 1992: 207; Buzzelli, *et al*. 2002: 103-104
319 Pliny, *NH* 5.1.19; al-Zouhri: 803
320 Snoussi, *et al.* 2002: 6; Snoussi 2005: 3-5, fig. 1
321 Fox, *et al.* 1997: 235; Snoussi, *et al.* 2002: 8-10; Snoussi 2005: 3, 7-9

dams' construction, the mouth was more affected by marine processes, causing it to migrate ca. 2 km west and reduce in size. Sandbars accumulate around the mouth and the west bank is accreting whilst the east bank is eroding due to lack of fluvial inputs.[322]

The environment and morphology of the Sebkha bou Areg, the lagoon at Nador, has also fluctuated. The sandbar that forms the barrier to the Mediterranean is formed by sediments transported in the easterly longshore current and made higher by the east and northeast swells that bring heavy seas inshore during summer storms.[323] These storm events and seismic activity in the region can form openings or closures of the sandbar, causing a semi-open and closed lagoonal environment.[324] Beginning in the 18th century, the lagoon appears on maps as both open and closed; in the early 1980s, the present Bokhana channel was dredged and secured with retaining walls.[325]

The oscillation between a semi-open and closed environment has affected the amounts of sediment in the lagoon and the quality and salinity of its water. At present, the lagoon has a depth between 5-7 m, but is strongly subject to marine currents and waters entering through the Bokhana.[326] Historical maps from 1655 and 1764 show saltworks on the coast here, suggesting a more closed lagoonal environment; in the early 20th century, salt flats existed in the southern portion of the lagoon, most likely developing when the sandbar was closed.[327] Presently there is extensive water pollution as sewage is allowed to drain into the lagoon.[328] However, recent studies show that when it is open to the sea, there is a qualitative increase of the Sebkha's mollusc species and the increase in the size of their shells.[329]

To the north of the Nador lagoon, the small bay adjacent to the modern Spanish enclave of Melilla has filled in due to siltation and recent infrastructural development. Sediment studies suggest that during the Punico-Mauretanian period, the Rio de Oro, which flows into the bay, had a wide mouth which was situated further inland and to the west than its present outlet, meeting the sea south-west of the promontory. Since 1956, a large commercial and military port has been built, filling in the bay.[330]

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[322] Snoussi, *et al.* 2002: 11, fig. 6
[323] Ruiz, *et al.* 2006: 216; NIMA 131: 63, 66; NID II: 119
[324] Paskoff 1994: 128, fig. 56; Fernandez de Castro y Pedrera 1945: 60-61
[325] App. 7: *Map 8*: 1728 (salt pans/*salinas*); *Map 15*: 1786 (open inlet); *Map 16*: 1787 (open inlet); *Map 18*: 1859 (closed lagoon); *Map 20*: 1867 (opening to south); NID I: 77, fig. 40; Mikesell 1961: figs. 4-6; Clanzig 1989: 71.
[326] Ruiz, *et al.* 2006: 216, fig. 1
[327] App. 7: *Maps 4, 12*; J. Bellevar Garrido (Museo de Arqueología e Historia, Melilla), pers. com.
[328] Ruiz, *et al*. 2006: 216-217
[329] Clanzig 1989
[330] J. Bellevar Garrido (Museo de Arqueología e Historia, Melilla), pers. com.

The Oued Nekor valley, lined by steep hills and unstable schists, has undergone alluvial processes which have deposited fill at the base of Al Hoceima Bay. An excavated loam pit along the river's course, 4.5 km from the present shoreline, has alternating layers of gravel and silt clay that represent several episodes of fill. On top of these deposits is a fireplace with charcoal radiocarbon dated to 1,920 ± 55 BP; this fireplace was overlain by a 3.5 m-thick deposit of sediments.[331] The thickness of the alluvia suggests that, although the distance is not known, the southern shoreline of the bay has migrated north since antiquity whilst the construction of a dam in 1981 has checked sediment deposition.[332]

Further west of Al Hoceima Bay, a 100 m-wide and 200 m-long tombolo, or sand spit, connects the limestone island of Peñon de Velez de la Gomera to the mainland (see Fig. 5.11). The tombolo developed due to a combination of wave refraction caused by the island and these movements carried longshore drift deposits of sand to where the waves met behind the island.[333] This spit developed relatively recently, as it is absent from an 1814 map and aerial photograph from 1922 but appears in a photo from 1928.[334]

Geo-morphological change is also extensive along the coastal plain of the eastern Tangier peninsula. The meandering Oued Martil, in its upper course west of Tetouan near *Tamuda*, contains a Rharbian deposit, first laid down in the pre-Roman period. However, the river channel has trenched to 5 m depth and sandbars presently line its course due to the construction of a small dam.[335] In the 1st century AD, Pliny states that the river was navigable; in the 11th century, al-Bakrî states that the river was navigable for "small boats" as far as Tetouan, ca. 5 km to the east of *Tamuda* and 10 km from the present coast.[336] The lower course of the river has shifted since antiquity: oxbow scars, once prominent meanders, exist in the coastal floodplain whilst the present river course is straighter (see Fig. 7.1).[337] The ancient outlets of the river are traceable ca. 1 km to the north and ca. 1.8 km south of the present river mouth. In the 16th century, the cause of one of these changes was instigated by a Spanish contingent that sunk old vessels at the river mouth so pirates were prevented from using the river as a port of refuge.[338] Eighteenth-century maps, however, show a still-wide

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[331] Brückner 1986b: 11, fig. 4
[332] Fox, *et al*. 1997: 235, Table 1
[333] Paskoff 1994: 41-42
[334] App. 7: *Map 17*; Villaverde Vega 2001: figs 162-163
[335] Vita-Finzi 1969: 62
[336] Pliny, *NH* 5.1.18; al-Bakrî: 210; García y Bellido 1950: 400, fig. 8
[337] Buckle 1978: 86
[338] Gozalbes Cravioto 2002: 559-560

course up to Tetouan and mark the large mouth as a good anchorage.[339] The present mouth is held open by a breakwater on its north bank, but shifting sandbars can impede entrance to the river.[340] The strong current in the river, particularly in the winter, also causes sedimentation at the mouth and the port of Al Martil was closed in the early 20th century because of this.[341]

On the southern bank of the old Oued Martil mouth is the coastal Phoenician and Punico-Mauretanian site of Sidi Abdeselam del Behar. The site, now covered by a cemetery and marabout, is being damaged by wave action. An aerial photograph taken before 1966 shows a 25 m-wide beach. Survey in the spring of 2007 revealed the beach here to be ca. 10 m wide, and in 2008 the hillock is degrading on the sea-facing side.[342]

The construction of a dam in 1961 on the Oued Nakhla has impacted the coastal plain between the Ceuta peninsula and Rasel el Aswad (Cabo Negro).[343] The lower courses of this river join the Oued Smir and historical maps depict these rivers as forming a large open coastal lagoon fronted by a barrier beach.[344] Extensive sedimentation of the reservoir behind the dam and land infilling from rapid development in the last 20 years has caused the lagoon to shrink extensively, with flooding occurring only during winter rains.

The beach between Ceuta and Rasel el Aswad is subject to wave action and some longshore drift from north to south. Dunes several metres high back the beach, but due to construction and sand mining, these are eroded. Winter storms also can impact the formation of the beach, and such an event in 1953 revealed the Roman fish-salting site of Sania e Torres, located in the dune zone just north of the outlet of Oued Smir.[345] The construction of two marinas along this coast since 1989 has also created points where the longshore transport is affected, creating areas of sediment accretion south of man-made jetties.[346]

5.5.2 The Straits of Gibraltar shoreline

In the Straits of Gibraltar, the most dynamic geo-morphological processes affecting the southern coast have been alluvial fill (in an area previously forested and now under agricultural terracing) and marine action (waves and wind). Most beaches that face north are

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[339] App. 7: *Maps 6, 7, 9, 12*
[340] App. 7: *Maps 6, 10*
[341] NID I: 65; NIMA 131: 64
[342] Tarradell 1966: Pl. II; see App. 3.1: *Site 8;* Anfuso, *et al.* 2007: 943-944; Bernal, *et al.* 2008b: 317, 332-335
[343] Fox, *et al.* 1997: 235
[344] App. 7: *Map 6*; Tissot 1878: Pl. II; Tarradell 1966: 436, fig. 5
[345] Ponsich 1988: 167; see App. 3.1: *Site 15*.
[346] Anfuso, *et al.* 2007: 941-943, fig. 8; El Kassimi 2006: 34-35

sheltered from these latter effects, but the several that open to the west have undergone alteration. Historical and modern construction activity also underlines the recent human impact upon this coastline.

A large portion of the 4 km-long Peninsula de la Almina (modern Ceuta) is densely built-over, particularly on the narrow and low La Ciudad area. The modern edifices have hindered interpretations of the extent of the settlement and landscape here in antiquity, but it has been postulated that the La Ciudad area was a low and sandy ridge during the Punico-Mauretanian and Roman periods. In the 11th century, al-Bakrî writes of a sandy beach on the north side of the peninsula.[347] This area is filled in at present and modern jetties and breakwaters extend from the north shore (Fig. 5.39). Through the western portion of La Ciudad, a canal was present in the 11th century, and enlarged under successive Portuguese and Spanish occupations since the early 15th century.[348]

In Er Rmel Bay, between the promontories of Ras Cires to Punta Kaluli, a new commercial harbour, Tanger-Med Port, is currently under construction.[349] Large amounts of the coastal hills behind here have been levelled in the path of rail and motorway links and the small perennial stream is now dammed and extensive breakwaters are being constructed. Due to the prevailing westward current of the Straits, constant dredging is needed in the harbour basin to keep it free of sediment (Fig. 5.40).[350]

At Ksar-es-Seghir, in the middle of the Straits, sediments carried by the Oued El Kazar have covered over the archaeological site of Dchar 'Askfane with approximately 0.5 m of sand and gravel.[351] Although the flood plain of this river is several hundred metres wide, it has an extremely reduced flow. Al-Bakrî writes that the Oued El Kazar used to be navigable in the 11th century and ships would pull up to the walls of the fort at the river's mouth.[352] Here also, the sea gate of the Portuguese fort (built in the late 15th century) has been covered by an encroaching beach (see Fig. 5.20).[353] In the eastern shore of the bay, the Roman-period fish-salting site of Ksar-es-Seghir has been covered by beach dunes several metres high.[354] Just to the west of this bay was the site of Zahara, a small Roman-period agglomeration where two

[347] Arévalo González, *et al.* 2004: 42; al-Bakrî: 202-203
[348] Al-Bakrî: 202-203; Hess 1978: 4-30; Ricard 1955: 95-99; App. 7: *Map 10*
[349] http://www.tmsa.ma/port_tanger_med/presentation.php
[350] N. Mhammdi (Dept. of Geology, University Mohamed V), pers. com.; A. Elboujaday (Délégation de la Culture, Tangier), pers. com.
[351] H. Limane (INSAP), pers. com.; see App. 3.1: *Site 20.*
[352] Al-Bakrî: 206
[353] Redman, *et al.* 1979: 3
[354] See App. 3.1: *Site 19.*

salting *cetariae* were identified. In April 2008 this site was bulldozed completely in order to build a new naval port.[355]

The most prominent geo-morphological change on this coast has occurred in Tangier Bay. The wide and flat beach at the base of the bay is retreating despite active sediment suspension.[356] Comparison of aerial photographs between 1958 and 1996 shows that the beach at the eastern edge of the bay has retreated 160 m.[357] This erosion is likely due to a recent change in hydro-dynamics in the bay. The area in front of the kasbah on the western shore of the bay has served as an anchorage for millennia, but was modified with built structures, first in 1664 during the British occupation of the city when a large mole was established. Although razed in 1684, the rubble still formed a breakwater afterwards.[358] Modern additions of jetties and breakwaters that extend over 1 km into the centre of the bay have affected the dominant westerly wave action and sediment transport. As a consequence, dredging in the port and along the southern beach is common.

In the middle of the eastern beach of Tangier Bay, the much-reduced Oueds el Mogogha and el Melaleh empty into the sea.[359] The low-lying area behind the beach into historical times flooded regularly in the winter along these rivers' lower courses, and it is likely that this area once formed an estuary.[360] This theory is supported by the fact that in the early 20th century, salt pans operated here; indeed the name "Oued el Melaleh" comes from *mellah,* 'salt' in Arabic.[361] The reduction of these rivers has been due to development, re-direction of the courses through artificial channels, and pollution from sewage outflow.

5.5.3 The Atlantic shoreline

More so than the other northwest Maghreb littorals, the dynamic regional terrestrial and marine processes have impacted swaths of the Atlantic coastal plain and shoreline. Although there has been limited sea-level change over the past 2,500 years, the wide Atlantic tidal amplitude and alluvial events have transformed the geo-morphology of the shoreline, particularly along river courses and in estuaries.

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355 Observation, April 2009; A. Elboujaday (Délégation de la Culture, Tangier), pers. com.; see App. 3.1: *Site 21.*
356 Paskoff 1994: 47-48, Photo 8
357 El Moumni, *et al.* 2002; Snoussi & Long 2002
358 The mole was 110 feet broad and 1436 feet long; de La Véronne 1972: 17-19; Routh 1912; see App. 7: *Map 14.*
359 Paskoff 1994: 47-48; Ponsich 1970: 15-16
360 Ponsich 1970: 10; Tissot 1878: Pl. II
361 Ponsich 1970: 284; A. Elboujaday (Délégation de la Culture, Tangier), pers. com.

Thirty-six kilometres south of Cap Spartel, the Oueds Tahadart and Hachef extend 25 km inland through wide valleys. The tidal rivers are prone to flooding in winter, but these events have been greatly affected by dams on each tributary, the first constructed in 1977.[362] The southern tributary, Oued Hachef, flows through a large flood plain north of an 82 m-high plateau on top of which is the site of *Zilil*; this river almost certainly can be identified as the ancient *Zilia/Zilil fl*.[363] The river has had reduced flow since construction of the dam, and the recent additions of an elevated railway line and 4-lane motorway across the valley have impeded water movement, particularly during winter floods. A map from the late 19th century depicts a large lagoon here as do photos from the early 20th century.[364] It is possible that due to the earlier lagoonal environment of the Oued Hachef, it might also be identified as the ancient lake *Kephisia* mentioned by Scylax.[365]

Further to the south, the larger drainages of the Rharb plain have been subject to geo-morphological change, particularly along their lower reaches and embouchures. Sedimentological cores from the Oued Loukkos basin show that a wide lagoon existed here prior to 2,500 BP, extending possibly as far as Doukkala, presently 10 km from the ocean. After this, considerable geo-morphological changes occurred: pro-gradation of the river mouth westward and evolution of the marine lagoon into a fluvial estuary. By the 8th century BC, the river mouth was adjacent to the acropolis of *Lixus* and opened onto a large lagoon several metres deep which likely were the same conditions during the Roman period. An increase in siltation near this outlet has gradually moved the mouth westward and created a more estuarine environment in the former embayment.[366] The rate of migration of the river mouth since antiquity is unknown but maps from the 17th to 19th centuries show a meandering lower course that extends west of *Lixus*.[367] In the past, a sandbar has extended south into the river's mouth from a line of dunes on the coast.[368]

In the 20th century, tidal river fluxes, inshore transport to the north and wave action from the west have interacted with the natural topography and built waterfront structures. Since the construction of a dam upriver on the Loukkos in 1979, however, the river mouth is widening, due to lack of sediment transport downstream.[369] Along the wide beach to the north of the river mouth, erosion is occurring in the tidal zone whilst sediments are being deposited

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[362] Fox, *et al.* 1997: 235, Table 1
[363] *Geo*. 4.1
[364] Amharrak 2006: 35-41; Tissot 1878: Pl. V; Ponsich 1964b: Pl. XI
[365] Pseudo-Scylax, *Periplus* §112
[366] Carmona González 2005: 10-11; Aranegui Gascó 2005b: 272, fig. 2; see Chapter 7.4.2.
[367] App. 7: *Maps 1-4, 7, 9, 12, 16, 19*
[368] Tissot 1878: 213; Leo Africanus also notes the migrating sandbar (Leo Africanus: 495-496).
[369] Fox, *et al.* 1997: 235, Table 1; Tejera de Leon 1980: 27; Gueguen 1992: 24

immediately below this zone. Erosion is also occurring along the seawalls that now retain the northern and southern banks of the mouth. Accretion is occurring in the main channel and immediately outside the mouth.[370] At present, the basin of the port of Larache, just inside the southern mouth of the river, requires constant dredging.[371]

The mid-coast of the Rharb is characterised by a series of estuarine lakes, the largest and more permanent of which is Merja Zerga. This 37 km^2 lake lies behind the ridge of coastal dunes and empties into the Atlantic through a narrow channel with migrating sandbars. In the middle of the last century, it was possible to walk across the channel on sandbars at low tide.[372] In the 10th century, Ibn Hawkal notes that the lake was navigable by vessels from Iberia, when it served as a port for al-Basra and Fés.[373] In 17th- and 19th-century maps the lake is depicted with islands and surrounding marshland; a system of freshwater lakes are present to the south behind the dune ridge and include the Sidi Bou Rhaba and Merja Bokka.[374] The lakes were permanent in the Rharb plain throughout the year, but greatly swelled in size during winter and spring floods. The lakes primarily were utilised as collection basins for human use and to ease winter flooding of agricultural lands.[375]

In the last century, these lakes have been strongly affected by human activity.[376] An extensive flood experienced in the spring of 1917 resulted in the land works commission of the French Protectorate to develop hydraulic schemes, such as canals and levees, in order to alleviate the flooding cycles and make the region more regular agricultural land.[377] Recent sedimentation analyses of the lakes reveal an increase over the past century in their salinity due to evaporation and negative water budget, and an accumulation of dry matter is elevating their beds.[378] In 1998, Merja Bokka became completely dry because of increased siltation and low water availability, brought about by an increase in agriculture.[379] At present, the former lake bed is under cultivation unless during heavy rains (Fig. 5.41).[380]

In the southern Rharb, the Oued Sebou basin has also been impacted by the same processes that regulate the cycles of the Rharbian lakes. Winter and spring flooding events create an

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[370] Tejera de Leon 1980: 32-39, figs 20, 24-25
[371] Gueguen 1992: 34-37
[372] Ponsich 1975-76: 18-19
[373] Ibn Hawkal: 77-78
[374] App. 7: *Maps 3-4, 19*
[375] Flower, *et al.* 2001: 383-385
[376] Flower, *et al.* 2001: 369
[377] 1,500,000 m^3 of land was under water during these floods; Célérier 1922: 109; Sonnier 1935: 119.
[378] Appleby, *et al*. 2001: 349
[379] Appleby, *et al*. 2001: 367; Flower, *et al.* 2001: 369
[380] Flower, *et al.* 2001: 386

extremely high level of discharge in the river's tributaries, which originate high in the Rif and Middle Atlas foothills. The amount of water flow usually causes the main channel of the Sebou and its main tributary, Oued Beth, to overrun their banks.[381] With high precipitation events, large amounts of sediment used to be carried downstream, due to steep slopes that cause landslides and mudflows and erodible sedimentary rocks in the drainage area.[382] As a result, thick layers of alluvial deposits blanket the Rharb: historical fill events, the Rharbian deposits, cover the river-side archaeological site of *Banasa* (Fig. 5.42). Since the 5th century BC, 8-9 m of fill has covered the site; 1.5 m of fill overly the Roman remains.[383] Similar deposits are also found along the banks of the Oued Beth: the Punico-Mauretanian levels at the site of Rirha, dating to the 2nd century BC, are overlain by 6 m of alluvia and elsewhere on this river, 2 m of alluvia overly vegetal material radiocarbon-dated to ca. 200 BP.[384]

Such flood events and sediment movement along the meandering channel of the Sebou has caused lateral movement of the river channel near *Banasa*: the site is ca. 300 m from its present course.[385] Downriver from *Banasa*, the main channel appears to have remained relatively static over two millennia, with only two oxbow scars traceable in the landscape. Below the confluence of the Oueds Beth and Sebou, the archaeological site of *Thamusida* is still adjacent to the present river channel.[386]

Construction of dams upriver on Oueds Beth (1938) and Inaouene (1973) has reduced the water flow on the Sebou and its tributaries by 70%.[387] This reduction has greatly affected riverine navigation: whereas vessels could voyage from the sea to Fés in winter during the 16th century, and vessels of 20 tons to Sidi Slimane in the beginning of the 20th century, they are now restricted to the modern port of Kenitra, 17 km from the sea.[388]

Dams have also reduced the sediment deposition along the river's course by 95%; as a result, there has been less dredging at the inland port of Kenitra.[389] At the mouth of the river, lack of sediment input from upriver has been compounded by sand mining from the beach and shore dunes. Sand mining, in addition to degradation of the littoral forest field (visible in satellite

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[381] Snoussi, *et al.* 2002: 8
[382] Snoussi, *et al.* 2002: 9, 11
[383] Vita-Finzi 1969: 61-62; Vita-Finzi 1968; Le Coz 1960; Girard 1984a: 16-17; Girard 1984b: 149; Arharbi & Lenoir 2004: 242-243
[384] Girard 1985: 98-99; Le Coz 1960
[385] Brown 1997: 26-27
[386] Akerraz & Papi 2003: 12
[387] Fox, *et al*. 1997: 235, Table 1; Snoussi, *et al.* 2002: 8
[388] Ricard 1927: 238; Luquet 1966a: 375
[389] Snoussi, *et al.* 2002: 9, 11

images taken between 1987 and 1992) are causing dunes and sandbars to migrate.[390] The orientation of the Sebou's embouchure, combined with longshore currents and tidal regimes interaction with parallel breakwaters, is causing sedimentation along the northern bank.[391] Shoals in the river mouth have also been a constant presence: Leo Africanus in the 16th century notes the danger to the large Portuguese and Spanish ships that anchor in the river mouth.[392] In the 18th century, the presence of shoals here made the entrance to the river "difficult and dangerous".[393]

Fill events and processes similar to those of the Oueds Loukkos and Sebou have also impacted the Oued Bouregreg basin. Sediments carried downstream from the Middle Atlas and Meseta form fill in the lower river valley near Rabat. Here, charcoal from fireplaces radiocarbon-dated to 800 ± 200 BP underlie Rharbian deposits along the river's banks.[394] The meandering lower course of the Bouregreg, like the Sebou and Loukkos, has undergone channel movement. Ca. 8 km upriver, oxbow scars are present in the floodplain, and ca. 5 km upriver the present channel runs ca. 700 m from the Roman site of *Sala*, separated by marsh and reed beds (see Fig. 5.30). Before a dam was built upriver in 1974, regulating water flow and sediment deposition, the Bouregreg was still navigable for ca. 9.5 km upriver. Mid-channel bars are now extensive.[395]

The effects of Rharbian depositional events, as well as marine processes on the morphology of the river's mouth, have been historically documented. Most prevalent here are the migrating sandbars: in the 16th century, Leo Africanus notes the Bouregreg's shoals are a hazard.[396] A 1680 map details the mouth with sandbars on both banks as well as an inlet behind Kasbah des Oudaias.[397] When a large earthquake struck Lisbon in November 1755, the impact affected the coastal Atlantic: the water depth at the mouth of the Bouregreg "increased … to nearly thirty feet at flood time."[398] Within 30 years, however, sandbars had built up again, choking the entrance.[399] In the last century, extensive dredging and breakwater and jetty construction has changed the morphology of the embouchure. The inlet behind Kasbah des Oudaias has filled in, and a wide sand bench, ca. 500-800 m broad, now extends from the walls of Salé on the north bank. Inside these walls in the southeast corner

[390] Arid, *et al.* 2003
[391] Gueguen 1992: 7-8
[392] Leo Africanus: 410-411
[393] Chenier 1788, I: 26
[394] Vita-Finzi 1969: 61
[395] NID II: 99; Fox, *et al*. 1997: 235, Table 1
[396] Leo Africanus: 929
[397] App. 7: *Map 5*
[398] Chenier 1788, I: 316
[399] Chenier 1788, I: 27, 313

of the city was the Dār as-Sinā'a, a maritime arsenal. Canals led from inside the arsenal through two sea gates to the river, which passed just outside the city's walls. These gates, built by during the Marinid Dynasty in the late 13th century, were large enough for ships to pass through.[400] A new marina is currently under development here, with new breakwaters and yacht basins (see Fig. 5.29).[401]

The lower reaches of the Oued Oum-er-Rbia have also been affected by the presence of sandbars at the river's mouth. A 1728 map shows a wide inlet, lined by sandbars or rocks, up to Azemmour, but by the late 19th century the harbour of the city had silted up.[402] The construction of a dam in 1979 has reduced the water flow and sediment deposition along the river channel, creating high benches along the banks and nearer to Azemmour, floodplains several hundred metres wide.[403] At present, a wide, undulating sandbar extends from the southern bank of the embouchure.

The morphology of the landscape at Essaouira, at the southern edge of the ancient province, has been greatly impacted by strong marine processes. The islands and the northern shore of the bay, under the modern city, consist of a base of eroding, fossilised sand dunes.[404] Longshore transport from north to south, strong westerly winds, wave swell and tides interact with the rock-faced littoral so that sediment is being carried along the rocky open coast northwest of the city and past the western shore if the island. However, sediment is forced though the channel between the port and island and into the semi-circular bay. The wide flat beach of the bay and the area south of Essaouira Island are undergoing accretion; the seasonal outflow from the Oued Ksob and residual longshore current are eroding the southeast portion of the bay.[405]

A shallow ridge of sand is present at the south edge of the bay, extending between the southeast extent of the beach below Oued Ksob and the southern tip of the island. Historical, 18th-century plans show and a more elevated shoal here;[406] at times in the last century, a sandbar would be exposed here at low tide.[407] Sediment cores indicate that ca. 2,500-2,000 BP, a tombolo did extend between the island and the southern bay, with the Oued Ksob meeting the sea south of here. A similar scenario might be ascribed to the geo-morphological

[400] Brown 1971: 29-31
[401] http://www.bouregreg.com/
[402] App. 7: *Map 8*; Cunninghame Graham 1898: 28
[403] Fox, *et al*. 1997: 235, Table 1
[404] Snoussi 2000: 21
[405] Belasus 2007: 5-7
[406] App. 7: *Maps 11, 13*
[407] A. El Bertai (Délégation de la Culture, Essaouira), pers. com.

development of the northern reaches of the bay: sediments cores also show that the elevated fossilised sand base upon which lies the modern city of Essaouira was once an island. The deposition of sand carried by the north/south longshore transport over time built-up a tombolo to connect the island to the mainland.[408]

5.5.4 Conclusions: the 'reconstructed' ancient littoral

In the past, maritime conditions of currents and wind patterns of the northwest Maghreb broadly followed the same regimes as they do at present. However, the morphology of some of the littorals, coastal plains and river valleys of the region are presently different than during the Roman period. Due to a myriad of environmental and anthropogenic factors, river courses have moved, river mouths have migrated and deltaic plains have expanded. The natural progression of sediment deposition (the Rharbian deposits), once quite extensive in the region's valleys throughout antiquity, has been checked. Reduction of river flow through damming and canalisation for agriculture have meant lower water levels, hindering and in some cases prohibiting navigation of waterways that were accessible in the past and reducing the size of river-mouth anchorages. Lagoons and estuarine lakes have been reduced or even dried out completely, eliminating water resources, anchorages and especially affecting marine habitats.

Some of these changes, such as deforestation and sedimentation in alluvial valleys, were gradual processes, occurring over several hundred years or even millennia. Episodes of the repeated deposition of alluvia in the Rharb were almost certainly observed during the Punico-Mauretanian and Roman periods as they affected sites whilst they were occupied, but they also increased since the Late Roman period. However, some of the most dramatic impacts have taken place during the 20th and 21st centuries, largely due to the construction of dams, excessive pollution and coastal construction. The reconstructed littoral of *Mauretania Tingitana*, 2,500-2,000 BP, is based on the data presented above. This reconstruction serves as the environmental basis in which this study's evidence for marine resource exploitation during the Punico-Mauretanian, Roman and Late Roman periods will be analysed (Fig. 5.43).

[408] Brückner & Lucas 2008; Jodin (1967: 5-6, figs 4-5) proposed that two large islands were present here during the 8th century BC.

Chapter 6.
Regional characterisations

6.1 Introduction

In this chapter, the types of marine resources sought in the northwest Maghreb, the methods used for their exploitation, areas of fishing effort and subsequent terrestrial-based activities such as fish-salting practices are presented. Consumption of products is also mentioned. The sources for these characterisations are largely archaeological data (marine animal remains, fishing equipment and fish-salting sites) but also some descriptive data (written sources, pictorial representations and ethnography).[1] This chapter's summaries are separated by the littorals of the major marine systems outlined in Chapter 5: the Mediterranean, Straits of Gibraltar and Atlantic.

These summaries characterise the exploitation within the regions by providing an overview of the finds, their distribution and chronology. This background will contextualise the material presented in the case studies (Chapter 7) and serve as the basis for discussion (Chapter 8).

Although the main chronological periods of Punico-Mauretanian, Roman and Late Roman are followed here, some artefacts cannot be more precisely assigned to fewer than two of these periods and are designated, for example, as "Roman/Late Roman" (see Table 2.2). For the types of sites discussed here, see Tables 2.3-2.5. The marine environmental vocabulary applied here is described in Tables 3.1-3.2.

6.2 The Mediterranean littoral

The Mediterranean littoral of *Mauretania Tingitana* extends for ca. 350 km, from the Oued Moulouya to Ceuta. Within this region's coastal zone formed by the foothills of the Rif Mountains are seven sites with finds directly relevant to marine resource exploitation.[2] Although there are some finds from the Guelaya peninsula, these sites are concentrated on the southeast shore of the Tangier peninsula.

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[1] Outlined in Chapter 3.2-3.3.

[2] For the Mediterranean and other regions, this number of sites includes only those with marine animal remains, fishing equipment and/or fish-salting sites. Evidence of consumption of processed/salted goods through salazón amphorae distribution is not included here, but mentioned later in the summary.

6.2.1 Finds

Three sites have finds of fish bones, with four species of fish represented amongst them. The most common fish (found at most sites) is bluefin tuna (Tables 6.1-6.2; Fig. 6.1). Six sites have finds of marine invertebrates, with 19 species represented. The most common marine invertebrate species are banded dye-murex and ribbed Mediterranean limpet (each found at four sites during the Punico-Mauretanian period); rayed Mediterranean limpet and cockle are the species found in most periods (Tables 6.1, 6.3; Fig. 6.2).

Four sites have fishing equipment finds. Three sites demonstrate evidence of both hook-and-line fishing (with finds of fish hooks) and net fishing (with finds of net weights and fishing net needles). One site has evidence of net fishing only (Table 6.4; Fig. 6.3).

There are four fish-salting sites along the Mediterranean littoral and six *cetariae* present in the region (Table 6.5; Fig. 6.4). The consumption of salted products is demonstrated by finds of salazón amphorae, identified at 14 sites (Fig. 6.5).

6.2.2 Summary

The seven sites that exploited marine resources in the Mediterranean region are all situated on the coast, with the exception of *Tamuda* (ca. 15 km inland on a river, the Oued Martil) and Emsa (ca. 2 km inland, on a stream, the Oued Emsa). The fish and marine invertebrates found in this region are mostly marine species, although there are some species that can live in marine or estuarine environments. The finds demonstrate that sites on the coast exploited nearby littoral and lower riverine resources, but these resources were also transported inland to the settlement of *Tamuda* and the fish-salting site of Emsa.

During the Punico-Mauretanian period a large number of species of fish and marine invertebrates were caught and consumed in this region compared to later periods (all species found in the Punico-Mauretanian period are also found in subsequent periods). Fishing took place offshore (as the fish remains of oceanodromous and pelagic species demonstrate) and fishing for marine invertebrates mainly took place on the Mediterranean coastline and possibly in the lower reaches of some of the rivers/streams, where the environment is estuarine-like. Three species of shellfish (spiny dye-murex, Algarve volute and common periwinkle) live in the infratidal zone and can only be fished offshore. The methods for fishing in the region at this time include the use of nets, but at *Tamuda* and Costa Rincon there is also evidence for hook-and-line fishing.

Fish-salting took place at two different sites during the Punico-Mauretanian period: at Emsa upstream on the Oued Emsa and at Sidi Abdeselam del Behar on coast, at the mouth of the Oued Martil. Salted-fish products were consumed in these areas (finds largely derive from the Oued Martil valley), and in the eastern Mediterranean coast, at sites such as Sidi Driss and *Rusaddir* and in the area around Ras el Ma.

During the Roman period, fishing efforts focused on the shoreline in order to collect marine invertebrates. However, finds of spiny-dye murex (an infratidal species) from Metrouna indicate that fishing also took place offshore. At this time, fish-salting activities had ceased at Emsa and Sidi Abdeselam del Behar and had begun at the coastal sites of Sania e Torres (also near an estuary, the Oued Smir) and at Metrouna (on the Oued Martil, a few hundred metres from Sidi Abdeselam del Behar). Salted products were consumed mainly in the Oued Martil valley, but also in the eastern part of the province, around *Rusaddir* and Ras el Ma.

There is comparatively little evidence for marine resource exploitation during the Late Roman period along this coastline; the extant evidence only demonstrates that net fishing was practised.

6.3 The Straits of Gibraltar littoral

The Straits of Gibraltar littoral of *Mauretania Tingitana* extends for ca. 60 km, from Ceuta to Cap Spartel. Within this region lined by the foothills of the northern extent of the Rif Mountains are five sites with finds directly relevant to marine resource exploitation. A majority of these sites are concentrated in the centre of the Straits although most finds derive from *Septem Fratres*, at the eastern end of the region.

6.3.1 Finds

Three sites have finds of fish bones and one site is associated with a fish species through *tituli picti* (describing a salted fish product); 11 species of fish are represented amongst these sites. The most common fish (found at most sites) is the *Scombridae* family (mackerel, tuna, bonito) (Tables 6.6-6.7; Fig. 6.6). Four sites have finds of marine invertebrates, with 21 species represented. The most common marine invertebrate species are rayed Mediterranean limpet, red-mouthed rock shell and oyster (*Ostrea sp.)* (all found in more than one period) (Tables 6.6, 6.8; Fig. 6.7).

Two sites have fishing equipment finds, demonstrating evidence of hook-and-line fishing (finds of fish hooks) and net fishing techniques (finds of net weights and navettes) (Table 6.9; Fig. 6.8).

There are four fish-salting sites along the Straits of Gibraltar littoral and a minimum of 30 *cetariae* present in the region (Table 6.10; Fig. 6.9). The consumption of salted products is demonstrated by finds of salazón amphorae, identified at six sites in this region (Fig. 6.10).

6.3.2 Summary

The four sites in the Straits of Gibraltar region that exploited marine resources are all situated on the coast, with the exception of Dchar ‘Askfane (which is less than 1 km upstream on the Oued El Kazar). Extant evidence shows that mainly marine and two species of marine/estuarine fish were caught along this littoral. The marine invertebrates are mostly marine species, although there are some species that can live in marine or estuarine environments. The finds demonstrate that the littoral and lower riverine resources were exploited.

During the late Punico-Mauretanian and early Roman periods, four species of marine invertebrates and three species of fish were caught and consumed in this region (including evidence derived from *tituli picti*). Fishing took place offshore (as most of the fish are oceanodromous and pelagic species) although fishing for marine invertebrates mainly took place on the coastline. It is possible that some lower reaches of streams were also fished for shellfish that can live in estuarine-like environments. There are no preserved finds of fishing equipment from this period, however.

Fish-salting took place at two sites in the central Straits during the late Punico-Mauretanian period and early Roman periods: at Ksar-es-Seghir on the coast and at nearby Dchar ‘Askfane, located upstream on the Oued El Kazar. Salted products were also likely processed at *Tingi*, as *tituli picti* indicate, although there is no archaeological evidence of this processing yet identified here.[3] Salted-fish products were consumed in the areas where processing took place (and can also demonstrate evidence of packaging), and also at *Tingi*. Salazón amphorae finds from underwater contexts (Île Perekhil, Bay of Benzú and offshore of *Septem Fratres*) clearly reveal evidence of marine transhipment of salted products through the Straits.

[3] See App. 4.2.

By the Roman and combined Roman/Late Roman periods, a larger number of fish species are present (eight species, found at *Septem Fratres*); these species were not the same as those caught in the Punico-Mauretanian period. A majority of these are oceanodromous pelagic species that can be caught offshore or when they come in close to the shore (e.g., whale, mackerel, tunny, tope). A few are coastal neritic and pelagic fish such as seabream and dusky grouper. The number of species of marine invertebrates caught in the region also increases during this period, and most of these are found at *Septem Fratres*. Most of these species were fished along the littoral of the Straits, although three infratidal species (spiny cockle, spiny dye-murex and coral) can only be fished offshore. At this time, there is evidence for the use of both hook-and-line and net fishing methods.

Fish salting also increased during these two latter periods: processing continued at the two sites of Ksar-es-Seghir and Dchar ‘Askfane but also begins at the coastal sites of *Septem Fratres* and Zahara. Similarly, evidence of salted product consumption and/or transhipment is present at *Septem Fratres* and Ksar-es-Seghir.

By the end of the Roman period, fish-salting ceased to be conducted at all the sites in the Straits except one: although a few of the processing areas at *Septem Fratres* cease to be used at this time, some *cetariae* operated here until the end of the Late Roman period.

6.4 The Atlantic littoral

The Atlantic littoral of *Mauretania Tingitana* extends for ca. 650 km, from Cap Spartel to Essaouira. Within this plain and plateau region enclosed by the Atlas Mountains are 15 sites with finds directly relevant to marine resource exploitation. A majority of these sites are concentrated along the northern coast and river systems of the Rharb.

6.4.1 Finds

Seven sites have finds of fish bones and one site, *Lixus*, is also associated with a fish species through *tituli picti* (describing a salted fish product);[4] 42 species of fish are represented amongst these sites. The most common fish species (found at most sites) are whale and the *Scombridae* family (mackerel, tuna, bonito), but these derive from unknown contexts and could in fact be modern finds. The most common species with secure dating is tope shark (Tables 6.11-6.12; Fig. 6.11). Twelve sites have finds of marine invertebrates, with 31 species represented. The most common marine invertebrate species is red-mouthed rock shell (found throughout all periods) (Tables 6.11, 6.13; Fig. 6.12).

[4] See App. 4.2.

Fishing equipment finds derive from 13 sites. Eight sites demonstrate evidence of both hook-and-line fishing (finds of fish hooks and gorges), net fishing (finds of net weights, fishing net needles and navettes) and other forms of fishing (lances); five sites have evidence of only hook-and-line fishing (Table 6.14; Fig. 6.13).

There are seven fish-salting sites along the Atlantic littoral and a minimum of 215 *cetariae* present in the region (Table 6.15; Fig. 6.14). The consumption of salted products is demonstrated by finds of salazón amphorae, identified at 34 sites (Fig. 6.15).

6.4.2 Summary

The 15 sites of the Atlantic littoral that exploited marine resources are largely situated on the coast (five sites: Cotta, Djebila, Tahadart, Kouass and Essaouira) and coastal lagoons (*Lixus* and *Zilil*). Other sites that show evidence of exploitation are riverine (*Banasa*, *Thamusida*, Sidi Slimane and *Sala*) and inland (Suiar, *Tabernae*, *Volubilis*, Volubilis valley). Of the inland sites, some are located close to the coast (*Tabernae* is ca. 5 km inland, Suiar is ca. 17 km inland) whilst others are a considerable distance from the Atlantic (*Volubilis* and the Volubilis valley site are ca. 115 km inland). Of these inland sites, there are small freshwater streams nearby (which may have been fished, and fishing equipment finds – fish hooks – are present at these sites as well). However, the extant evidence show that the resources are mainly marine, with some species that can live in combined marine/estuarine and marine/estuarine/freshwater environments. The Atlantic Ocean and the coastal lagoons and tidal rivers were the main areas of fishing effort in this region, and these coastal resources were transported far inland, in the case of *Volubilis*.

During the Punico-Mauretanian period a variety of fish and marine invertebrates species were caught and consumed in this region compared to later periods (however, none of the species found in the Punico-Mauretanian period are found in subsequent periods except members of the *Scombridae* family). Fishing took place offshore (as some of the fish are oceanodromous and pelagic species) but also inshore and in the lagoons and major tidal rivers of the coast (as some species are neritic littoral and diadromous species). There are more species of marine invertebrates caught during this period than in the following periods, and many of the same species are caught in later periods. Fishing for the marine invertebrates mainly took place along the Atlantic coast and in the coastal lagoons and lower reaches of the tidal rivers (there are 20 species present that live in these environments). Four species of shellfish (carpet-shelled clam, smooth venus clam, spiny-dye murex and tuberculate cockle) inhabit the infratidal zone and can only be fished offshore.

Fishing in the region at this time includes the use of nets and hook-and-line methods, and the finds are present at comparatively more sites during this and the combined Punico-Mauretanian/Roman periods. Additionally, finds from *Lixus* and Cotta demonstrate that the use of gorges (on a line) was a technique practised during this period but was not used in subsequent periods.

At the end of this period, fish-salting began to be practised in purpose-built *cetariae* at five sites: Tahadart on a coastal lagoon, Cotta on the coast, Kouass on a coastal river, *Lixus* on a coastal lagoon and possibly Essaouira on the coast. Salted products are known at *Lixus* from this period due to *tituli picti*. Salazón amphorae show that salted-fish products were consumed in the areas where processing took place (and can also demonstrate evidence of packaging), but are also present at every major site along the Atlantic coast and throughout the Rharb.

During the Roman period, three different types of fish were caught, all in offshore waters: shark, skate and dentex. However, 19 species of marine invertebrates were caught, and this diversity is almost as great as in the Punico-Mauretanian period. Littoral species of shellfish dominate, but some marine invertebrates were sought offshore: coral and spiny dye-murex. The methods for fishing in the region at this time include nets and hook-and-line techniques.

Fish-salting continued into this period, with the addition of more complexes and *cetariae* at the five already existing sites, and small groups of *cetariae* were installed at the riverine settlements of *Banasa* and *Thamusida*. As during the previous period, salted products were consumed at all the major sites along the Atlantic coast and in the Rharb.

During the Late Roman period, there is no extant evidence of fish species in archaeological contexts from sites along the Atlantic littoral. A relatively small number of marine invertebrates were caught at this time compared to the previous periods. During this time, fishing for some shellfish took place offshore due to the presence of tuberculate cockle (an infratidal species). Hook-and-line and net fishing techniques are evidenced during this period, but at two different sites; interestingly, these are both inland sites that are *castella* (camps of Suiar and *Tabernae*) that are relatively close to the Atlantic coast (ca. 17 km and 5 km distant, respectively).

Fish salting continued to be practised at the complexes at Tahadart, Kouass, *Lixus* and Essaouira, but on a much reduced scale in the case of *Lixus* (the complex at Cotta is not used after the Roman period, and the *cetariae* at *Thamusida* and *Banasa* do not appear to be used after the Roman period). Consumption of salted products appears to continue much as it did during the previous two periods, with finds of salazón amphorae distributed at major settlements, although it appears that these were no longer imported into sites in the middle of the Rharb.

6.5 Discussion

The material discussed in this chapter provides an overview of marine resource exploitation in the Mediterranean, Straits of Gibraltar and Atlantic littorals of the northwest Maghreb. A majority of finds related to this exploitation derives from the northern Atlantic region of *Mauretania Tingitana*: the ‘island-like’ area inside the Atlas Mountains that encloses the fertile Rharb plain and its major tidal rivers such as the Oueds Loukkos, Sebou and Bouregreg.[5] Such a distribution is perhaps not surprising, as a majority of known sites of *Mauretania Tingitana* are situated in this region and therefore also reflect the limits of the province.[6] Additionally, this region reflects the main focus of previous archaeological work in the northwest Maghreb, although new surveys are beginning to reveal occupation along the Mediterranean coast, particularly in the Punico-Mauretanian period.[7]

The general character of marine resource exploitation is similar amongst the three littoral regions: in the Punico-Mauretanian, Roman and Later Roman periods, fishing takes place along the shoreline but also offshore. Additionally, similar marine invertebrate species were caught in all regions and migrating pelagic fish were also sought. The latter scenario underscores the province’s position at the southern edge of a channel between the two major marine systems of the Atlantic and Mediterranean, where migrating species are drawn close to shore as they pass through the Straits of Gibraltar. Fresh consumption of these resources likely took place in the coastal regions and perhaps even at inland sites, particularly along the Atlantic coast but also on the Mediterranean coast. The salting of these resources was also practised in all three regions although such foodstuffs had been consumed, and maybe even salted, since the early Punico-Mauretanian period. The salting of fish and marine invertebrates into *salsamenta* and sauces using purpose-built *cetariae* was widely initiated along all three littorals in the 1st century AD or just slightly earlier at some sites.

[5] Shaw 1976: 144-145; Shaw 1986: 66-67
[6] See Chapter 5.1.
[7] Euzennat 2000: 457-458; Akerraz, *et al.* 2003; Laoukili 2008

There is, however, variation within the exploitation of marine resources amongst the three littoral regions. The extant evidence suggests that the areas of fishing effort in the Mediterranean and Straits of Gibraltar were almost exclusively in the ocean (some shellfish might have been sought in the mouths of rivers and streams but these species can also live in marine environments). Along the Atlantic coast, fishing techniques included not just hook-and-line and nets but also lances and gorges used with a line. A larger number of species were caught along the Atlantic coast, compared to the other two regions, and these include diadromous species, which move between marine, estuarine and freshwater environments. These species' presence reflects the marine topography of this littoral and the lagoonal and riverine situations of nearby sites throughout the Rharb plain.

One site from each of the three littorals is subject to the case studies presented in the next chapter: *Tamuda*, *Septem Fratres* and *Lixus*. The in-depth analyses of these sites reveal the variety of finds present in the material record in the region as well as the determining factors that different types of marine environments can have on the species caught and fishing methods used. Additionally, each site serves to illustrate the general trends of exploitation along their respective littorals. These sites clearly demonstrate the diachronic exploitation of the varied marine resources, providing a means by which the 'Romanisation' of the region can be examined.

Chapter 7.
Case Studies

7.1 Introduction

The sites that are the subjects of the three case studies presented in this chapter are *Tamuda*, *Septem Fratres* and *Lixus*. These have been selected due to five factors:

1) The sites are each located near or adjacent to one of the three different oceanic-marine systems that border the northwest Maghreb: the Mediterranean, Straits of Gibraltar and Atlantic.

2) The topographical situations of the three sites differ from each other: *Tamuda* is a riverine site, *Septem Fratres* is a coastal site and *Lixus* is a lagoonal site. By examining sites with such situations, it will be possible to examine the variety of fishing techniques used and diversity of marine life exploited within the different marine environments.

3) *Tamuda*, *Septem Fratres* and *Lixus* represent different types and sizes of sites; these were selected in order to present and compare the seasonal and annual chronologies of the exploitation as well as the overall role of fishing at contrasting site types.

4) Each site possesses an extended chronology (occupied prior to and after the province's Roman period); these data are necessary in order to determine the impact and scale that 'Romanisation' had upon marine resource exploitation.

5) The archaeological and descriptive sources relating to these sites provide an adequate amount of data from which answers to the specific research questions, stated in Chapter 2.2.2, can be formulated.

In addition to the data related to marine resource exploitation, each case study is contextualised with a discussion of its particular topographical situation and surrounding marine environment. The history of each site as well as the history of their archaeological investigations are also presented. The conclusions of each case study focus upon the chronology and areas of exploitation and ultimately the role of fishing at each site.

7.2 *Tamuda*

7.2.1 The history of the site

Tamuda is centrally located in the Oued Martil valley, which extends east-west for some 30 km and forms a narrow break in the Rif Mountains on the southeast edge of the Tangier peninsula.[1] The site is located on an oblong-shaped bluff above a bend in the Oued Martil (ancient *Tamuda* or *Tumuada fl.*),[2] approximately 15 km inland from the Mediterranean coast (Fig. 7.1; see Fig. 5.13). The bluff rises ca. 10 m above the southern bank of the river and is bordered to the east and north-east by a small stream, the Oued Souiar. The archaeological remains cover over 5 ha; the most visible features are of a Roman camp, or *castellum* (Figs 7.2-7.3).

Archaeological investigations at *Tamuda* were initiated by C. Montalbán in 1921 and 1922; in 1922 some exploration was conducted by D.M. Gómez Moreno (Fig. 7.4). During 1940-1945, P. Qunitero Atauri excavated in the western, southwestern and southern sectors of the site as well as the parts of the *castellum*, followed in 1946 by P. César Moran and C. Jiménez, who excavated the southwest and southern sectors and north of the *castellum*.[3] M. Tarradell, working during the years 1948-1954 and 1962, initially opened trenches in the eastern sector, with some investigation in the southwest sector, north of the city walls in the garbage dump; Tarradell's later excavations focused mainly on the *castellum*.[4] In the early 1990s, A. El Khayari opened a trench on north side of the *castellum* walls.[5] A team from the Universities of Cádiz, Huelva and Tetouan began excavations at the western gate of the *castellum* in 2008.[6]

Although a few finds dating to the 7th and 6th centuries BC have been found on the bluff, it was not permanently occupied until the late 4th/early 3rd centuries BC. During this, the Punico-Mauretanian period, ceramics were imported from Iberia but also from Kouass on the Atlantic coast, and the first structures appeared.[7] By the 2nd century BC, more coherent

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[1] Tarradell 1960: 101
[2] Pliny, *NH* 5.1.18; Pomp. Mela, 1.29; Brückner 1986a: 97
[3] Gozalbes 2008: 51; Parodi 2008: 72-74, 83; Ghottes 2008: 463; Morán & Giménez Bernal 1948: 15-16; Tarradell 1949: 87; Tarradell 1958: 378-379; Verdugo Santos, *et al.* 2008: 61; incorrect dates are cited by Tarradell 1966: 440; Mastimo 1990: 250; García y Bellido 1950: 401.
[4] Verdugo Santos, *et al.* 2008: 61; Ghottes 2008: 464; Tarradell 1966: 440; Tarradell 1956: 73-74; the material from the 1962 excavations, stored in the Musée Archéologique, Tetouan, is unpublished.
[5] El Khayari 1996
[6] Bernal, *et al.* 2008a; Bernal, *et al.* 2008b: 325-336
[7] Early material includes a vase, amphora and a bronze fibula: Boube-Piccot 1995: 68; Bernal Casasola 2006b: 186; Kbiri Alaoui 2007: 217; El Khayari 1996: 196-197. Kouass table wares: Kbiri Alaoui 2004: 207. See earlier levels discussed in Bernal, *et al.* 2008a: 574; Ghottes 2008: 461-462.

structures were built on the southern edge of the bluff, organised with regular thoroughfares and oriented roughly on a east-west plan. By the late 2nd/early 1st centuries BC, at the southwest extent of the site, an open area – the so-called "Gran Plaza" that is ca. 27 m wide and of unknown length – was laid out. This area could be identified as a *forum*, although excavations have thus far revealed no evidence of monumental buildings. Around the open space are situated a number of small rooms, that due to their orientation and the amount of amphorae present, have been identified as shops (Fig. 7.5).[8] At about the same time, structures were built at the northern and western parts of the site. At the eastern extent of the bluff houses were organised into *insulae* plans.[9]

Present throughout the excavated portions of *Tamuda* are finewares from the Italic peninsula and Iberian and local amphorae, as well as coins from *Gadir* and *Tingi*, but also some that were struck in *Tamuda* itself.[10] Grain and olive mills made of basalt are present and two small ovens, thought to be for bread, have been identified.[11] Water was supplied to the Punico-Mauretanian settlement through an intricate series of channels and reservoirs originating in the foothills of the Rif to the south. Sections of an enclosure wall have been traced south of the Gran Plaza area and at the eastern and western edges of the bluff.[12]

As at other sites in the region, there is evidence that the settlement was affected by fire sometime in the 1st century BC. This destruction is thought to relate to the struggles between King Bogudes II and Bocchus II in 38 BC.[13] Many of the structures in the southwest sector of the site were rebuilt after this period, but none of the houses in the *insulae* of the eastern sector of the site appear to have undergone subsequent modification. The settlement of *Tamuda* was affected by fire again in ca. 40 AD, most likely in conjunction with the revolt of Aedemon against the Roman forces that were sent into the region after Ptolemaios' murder.[14] The revolt was suppressed by a series of military campaigns that ended with the annexation of the province of *Mauretania Tingitana* during the reign of Claudius. Shortly thereafter, a stone-walled *castellum* was built in the northern section of the settlement.[15] This camp, ca.

[8] Tarradell 1949: 88-89; Tarradell 1956: 75; Tarradell 1960: 104-105
[9] El Khayari 1996: 207; Arharbi 2003: 66-67; Tarradell 1949: 94-95; Tarradell 1956; Tarradell 1960: 97-119
[10] El Khayari 1996: 113-126; Tarradell 1949: 92; Tarradell 1956: 80; coins with "TMT" (*Tamuta*?), "TMD", "TAD", "TMA"; Mazard 1955: 178, nos 581-588.
[11] The ovens are not well described by Montalbán, and their chronology is not clear; Rebuffat 1998: 213; Morán & Giménez Bernal 1948: 19-21.
[12] Tarradell 1949: 94-95; Tarradell 1956: 77, 79; Morán & Giménez Bernal 1948: 19-21, 23-27; Tarradell 1960: 105, 107
[13] See Chapter 4.2.
[14] See Chapter 4.3; Tarradell 1949: 98; Tarradell 1956: 78-79; Arharbi 2003: 94; Ghottes 2008: 462.
[15] The construction dates to the reign of Tiberius or immediately afterwards: Bernal, *et al.* 2008a: 545-599; for various construction dates proposed previously, see Bernal, *et al*. 2008a: 543, fig. 4.

100 x 92 m, had interior towers and was laid out with a *cardo* and *decumanus* plan on a slightly irregular north-south/east-west orientation. The Punico-Mauretanian settlement was abandoned, but the earlier water supply system was modified to include a large cistern in the middle of the *castellum* and baths built south of its walls.[16] The southwest sector of the former settlement was used as a necropolis (possibly also used during the late Punico-Mauretanian period), and burials are present in similar layers in the eastern sector. Another necropolis has been identified on a small hillock ca. 500 m south-east of the site.[17] In the early 2nd century, the western gate of the *castellum* was blocked and there is evidence of localised incendiary destruction; it has been proposed that this event was related to on-going conflicts with local indigenous groups.[18]

The reduction and re-organisation of the province in the 3rd century is reflected by more substantial modifications to the *castellum*. At this time, 20 semi-circular towers were built projecting from its walls and the gates were restructured (Figs 7.6-7.7).[19] In the second half of the 3rd century, the *castellum* was temporarily abandoned likely due to military movements and continued indigenous uprisings in the province.[20] By the end of this century, however, the camp was re-occupied in conjunction with the campaigns instigated by Emperor Maximian and its northeast and southwest towers were made into larger semi-circular structures.[21] By the end of the 4th century, there was a reduction in occupation and re-enforcement of the walls. No coinage dating to after AD 411-415 has been identified at the site, signalling the final period of abandonment of the *castellum*.[22]

7.2.2 The marine environment

The situation of *Tamuda*, on the Oued Martil, was most probably very much the same during the Punico-Mauretanian, Roman and Late Roman periods as at present, but changes have occurred in the nature of the river itself (Fig. 7.8). In the 1st century AD, Pliny states that the *Tamuda*/*Tumuada fl*. was navigable.[23] In the 11th century, al-Bakrî notes that "small boats"

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[16] Tarradell 1966: 440; Morán & Giménez Bernal 1948: 23-27; Cheddad 2000: 1804; Lenoir 1991: 355-360, figs 1-2; Mastimo 1990: 253

[17] Tarradell 1966: 440, no. 17; García y Bellido 1950: 402; Tarradell 1949: 94-95

[18] Bernal, *et al.* 2008a: 605

[19] Lenoir 1991: 361. The blocked western gate at this time was re-opened (Bernal, *et al*. 2008a: 541-598).

[20] No coinage from between AD 270-305 has been identified at the site; Villaverde Vega 2001: 231, 233.

[21] See Campos, *et al.* 2008; Lenoir 1991: 355-360, figs 1-2. The re-occupation and pacification is made clear in an inscription: *IAM* 2, no. 55: "*Barbaros [qui T]amudam inrupe[rant] fugavit et in pacem [re]stituit"*. Noted in *Not. Dig. Occ*. XXVI, 2-4, 13: "*Tumucus castellum, Praefectus alae Herculeae, Tamuco"*.

[22] Roxan 1973: 844; Villaverde Vega 2001: 235. ARSW C and D found at site; Khatib 1964: 376-378.

[23] Pliny, *NH* 5.1.18; García y Bellido 1950: 400, fig. 8

were able to reach the city of Tetouan, ca. 5 km to the east of *Tamuda* and ca. 10 km from the coast, and this was still possible with Spanish and Portuguese ships (of unknown size) in the 16th century (see Fig. 7.1).[24] In the middle of the 20th century, the Oued Martil was noted as being full of water even in the summer.[25] However, there are sandbars in the river channel today near the site due to a dam (built downstream from *Tamuda* in the late 20th century) that hinders the transport of riverine sediment to the ocean and navigation upriver to the site.[26]

The distance of *Tamuda* from the Mediterranean was likely the same as today as it was in the past, although the river's mouth has moved several kilometres north and south from its present embouchure into Tetouan Bay. These shifts are indicated by the presence of some dead oxbow mouths whose chronology are unknown.[27] The presence of the sites Sidi Abdeselam del Behar and Metrouna (occupied from the Punico-Mauretanian to Late Roman periods), on the coast adjacent to the southern-most of the extinct mouths, also indicates that the shoreline has not undergone progradation over the last two millennia. However, the beach-facing part of the hillock of Sidi Abdeselam del Behar is being eroded by wave action (see Fig. 7.1).[28]

The former and present mouths of the Oued Martil empty into the Mediterranean at Tetouan Bay between the headlands of Rasel el Aswad (Cabo Negro) to the north and Cape Mazari to the south. The bay is lined by a sandy beach, and this topography extends offshore to a shallow and sandy-bottomed continental shelf (the 50 m isobath is ca. 5 km offshore, and the 100 m isobath is over 10 km offshore) (Fig. 7.9).[29] The sea is usually very calm in the bay, as it is protected from westerlies by the Jebel Haouz ridge, the continuation of the Rif range in the Tangier peninsula. Swells can arise in the bay, however, during infrequent periods of easterly *chegui* winds.[30] No remains of harbours or port facilities are known at *Tamuda* or near the river's mouths, but beaching small vessels is certainly possible and practised today on the Mediterranean shore.[31]

[24] Al-Bakrî: 210; Bennis 1996: 53
[25] Tarradell 1960: 89
[26] André 1971: 68; Vita-Finzi 1969: 62; NID I: 65; NIMA 131: 64
[27] See Chapter 5.5.1; Buckle 1978: 86; Tarradell 1960: 101
[28] See App. 3.1: *Site 8*; Chapter 5.5.1; erosion comparable to that of Ensenada de Ceuta, north of Rasel el Aswad (see Anfuso, *et al.* 2007: 943-944); Bernal, *et al.* 2008b: 317, 332-335.
[29] Shafee 1999: 44; NIMA #52039
[30] Merry del Val 1920: 39; Dorman, *et al.* 1995: 1903-1904; Anfuso, *et al*. 2007: 935
[31] Chaara 1996: 99-100; Malouli Idrissi, *et al.* 1999: 8-10

7.2.3 Evidence of marine resource exploitation

The evidence related to marine exploitation during the Punico-Mauretanian to Late Roman periods at *Tamuda* is derived almost solely from archaeological sources: finds of fish bones, shellfish and fishing equipment (see Fig. 7.4, Table 7.1). No known icthyo-faunal or malacological evidence has been preserved from the earliest excavations, conducted by C. Montalbán, D.M. Gómez Moreno and P. César Moran. General mention is made of some shellfish finds in publications of P. Quintero Atauri's excavations.[32] From M. Tarradell's excavations are preserved the remains of two species of fish and some shellfish.[33] Fishing equipment is preserved from Quintero Atauri's and Tarradell's excavations and some of this material has been mentioned briefly in publications. Relevant material from A. El Khayari's excavation and the recent Hispano-Moroccan excavation is not known.[34]

Descriptive evidence from the periods under examination derives from one pictorial depiction from the site. Related material from the region derives from medieval, historical and modern observations on navigation, marine species presence, regional fishing methods and salt production (see Table 7.1).

7.2.3.1 Marine species exploited

Two different species of fish are present at *Tamuda*, with evidence deriving from finds of fish bones (Tables 7.2-7.3). These represent two families: *Lamnidae* and *Scombridae*.[35] Fourteen different species of marine invertebrates are present, with evidence deriving from archaeological finds (Tables 7.4-7.5, Fig. 7.10). These represent bivalves and gastropods.

7.2.3.2 Habitats

The two fish present at *Tamuda* are marine species (see Table 7.2, Fig. 7.11). These are neritic, pelagic and oceanodromous species that occupy coastal waters to the upper continental shelf with the deepest habitat extending to 740 m, but usually ca. 150 m (represented by shortfin mako shark, *Isurus oxyrinchus,* one of the possible identifications of the *Lamnidae* bones).

[32] Morán & Giménez Bernal 1948: 15-16; Tarradell 1949: 87-89; Tarradell 1966: 440
[33] Unpublished material presented in this thesis; for excavations see Tarradell 1949; Tarradell 1956; Tarradell 1957; Tarradell 1960: 97-119; Tarradell 1966: 440.
[34] El Khayari 1996; Bernal, *et al*. 2008a
[35] Three of the vertebrae belong to a *Lamnidae* species, but cannot be identified more precisely than shortfin mako shark (*Isurus oxyrinchus*) or porbeagle shark (*Lamna nasus*); A. Morales (UAM), pers. com.

Of the major environments in which the 14 different species of shellfish present at *Tamuda* inhabit, the most common for all periods is marine (Figs 7.12-7.13). Of the minor environments, during the Punico-Mauretanian period, most species inhabit both the intertidal/infratidal zones, whilst in the Roman and Late Roman periods, the same number of species inhabit both intertidal/infratidal and solely intertidal zones. These species are also distributed amongst a wide variety of bottom types: sandy, hard mud and gravel as well as on rocks.

7.2.3.3 Seasonality

The fish species identified at *Tamuda* undergo annual migratory cycles (see Table 7.2). Bluefin tuna, whose remains are found at the site in Punico-Mauretanian layers, begin their oceanodromous migration from the Atlantic to the Mediterranean in the late spring/early summer and return in the later summer/early autumn. This period of migration for the species is noted by Strabo, Oppian and Athenaeus.[36] Presently, the modern *al-madraba* (pound) net for catching tunny during the cycle is set annually north of Rasel el Aswad (at the northern end of Tetouan Bay) between late June/early July to late October/early November.[37] The *Lamnidae* shark species can be present during similar periods, as they sometimes follow *Scombridae* species.[38]

Species of *murex* shellfish (spiny dye-murex, banded dye-murex and unspecified members of the *Muricidae* family), found at *Tamuda* in the Punico-Mauretanian period, are fished year-round in modern artisanal fisheries. However, Pliny, Cassiodorus and Aristotle note that if using them for dye, autumn late winter and early summer are preferable fishing seasons.[39] Presently, some shellfish fishermen in Tetouan Bay focus their efforts on cockles during the later spring and summer, from March and August, but these also can be caught year-round.[40] Oysters, as today, are also noted by Classical writers as being best when collected during the spring or early summer, before spawning.[41]

[36] See App. 4.1: *Text 2.b, 8.a, 9.a*; Strabo, 3.2.7; Oppian, *Hal.* 3. 620-624; Athenaeus, *Deipnosophistae* 7.302c.
[37] Set off of M'diq, north of Rasel el Aswad (Cabo Negro); Timoule 1985: 61; Srour & Abid 2002: 3.
[38] A. Morales (UAM), pers. com.
[39] Vasconcelos, *et al.* 2008: 289; Pliny, *NH* 9.60.125-127, 9.62: 38-39; Aristotle, *HA* 5.15.547a; Cassiodorus, *Var*. 1.2
[40] Shafee 1999: 10-14, 33-34
[41] Andrews 1948: 299-300; Aristotle, *HA* 607.b2; Pliny, *NH* 32.31.59-61

7.2.3.4 Fishing methods

Ninety-four artefacts related to fishing activities have been preserved from excavations at *Tamuda* (Table 7.6). This archarological find-group indicates two main types of fishing methods: hook-and-line fishing (evidenced by bronze fish hooks) and net fishing (evidenced by terracotta and lead net weights and bronze and bone needles, used for making and repairing nets). Evidence for hook-and-line fishing derives from the Punico-Mauretanian period; there is evidence for net fishing in all periods (Table 7.7).

The 61 bronze hooks from the site clearly indicate fishing activity. The 16 bronze and bone needles and 17 terracotta and lead weights are more difficult to assign specifically to fishing activity as some lack known contexts or contexts clearly associated with marine exploitation (such as being found in fish-salting complexes). The latter group are included here, however, due to close parallels from fishing contexts elsewhere.[42]

In addition to the archaeological finds of equipment, one pictorial representation of fishing derives from the Punico-Mauretanian period at the site. This image, on a terracotta disc, shows a mythical scene of a man fishing with a harpoon from the back of a sea creature, surrounded by fish.[43]

7.2.3.5 Fish-salting practices

Fish-salting activities have been proposed as taking place at the site due to the presence of a rectangular vat with *opus signinum* lining, similar in construction to salting *cetariae* (Fig. 7.14).[44] This structure lies amongst Punico-Mauretanian houses in the eastern section of the settlement and is identified by excavators, however, as part of *Tamuda*'s water supply system as it is connected by channels to other reservoirs (see Fig. 7.4).[45]

Fish-salting, however, could have been done at *Tamuda* using other basins, as the process does not necessarily require built structures such as *cetariae*: salting was described in antiquity as being carried out in other types of water-proof containers such as *dolia* and larger amphorae.[46] "Large and fat" amphorae were found at the site, and although not

[42] See discussion in Chapter 3.2.2. For the use of other weights from the site being comparable to textile loom weights, see Villaverde Vega 2001: 237; Morán & Giménez Bernal 1948: 42, Pl. VIII, A; Hoffman 1964: 311; Bundrick 2008: 312-314.
[43] See App. 5: *Cat. 1*; Tarradell 1960: 112-114, fig. 31; Fumadó Ortega 2006; Bernal Casasola 2009b: 271-272, fig. 5.
[44] Proposed by Cerri 2007b: 35.
[45] Morán & Giménez Bernal 1948: 26, Lam. IV,A; Quintero Atauri & Gimenez Bernal 1945: 10-11; Tarradell 1956: fig. 1
[46] For using *dolia* and amphorae, see Manilius, *Astr.* 5.679; Chapter 3.2.3.

described with clear contexts other than deriving from the Punico-Mauretanian layers, they are identified as providing storage for grain and flour.[47] If salting did take place at *Tamuda*, local sources of salt are historically attested at the mouth of the Oued Martil at Beni Madden, where salt pans (*salinas*) have been present since at least the mid-20th century.[48] Notably these salt pans are adjacent to the Punico-Mauretanian fish-salting site of Sidi Abdeselam del Behar and the Roman purple-dye factory at Metrouna, suggesting continuity in the practice of obtaining salt here.[49]

At present there is no definitive evidence for the salting of marine resources at *Tamuda*. However, finds of salazón amphorae at the site indicate the importation and consumption of salted-fish products. These include finds from the Punico-Mauretanian to Late Roman periods: Mañá-Pascual A4, Mañá C2b, Dressel 7-11 and Almagro 51c amphorae (Table 7.8).

7.2.4 Discussion

SHARK FINDS

One of the fish species identified at *Tamuda* belongs to the *Lamnidae* family (possibly shortfin mako or porbeagle shark), and its presence at an inland site is not unusual. The flesh of most shark species contains high levels of urea that break down to ammonia upon death; this process usually takes ca. 48 hours and renders the meat undesirable for consumption until this period has passed. *Laminade* sharks, however, do not have as high urea content as other shark species and are edible in slightly less time. As shark usually tastes better several days after the fish is caught, it is quite conceivable that the meat could be transported overland for a distance and not spoil.[50] Similarly, shellfish are also not unusual to find at inland sites. Large bivalves, such as oysters and bittersweets, in particular might be preferred for overland transport because they can be kept alive longer.[51]

The transportation of shark as well as bluefin tuna inland to *Tamuda* during the Punico-Mauretanian period is indicative of a process called *tahammort* that still takes place along the Mediterranean coast of Morocco. Fish (usually sardine) are wrapped in palm leaves

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[47] Morán & Giménez Bernal 1948: 20

[48] See App. 3.2: *Beni Madden.*

[49] See App. 3.1: *Sites 8-9.*

[50] In *Mauretania Tingitana*, shark bones are also present at the lagoonal site of *Zilil*, ca. 6 km from the Atlantic (see App. 1.1.3: *Cat. 15-16*); elsewhere shark bones have been found at sites ca. 50 km from the sea (e.g., from the Red Sea to Mons Claudianus in the eastern desert of Egypt); Hamilton-Dyer 2001: 287; A. Morales (UAM), pers. com.

[51] Examples from Mons Porphyrites and Mons Claudianus, Egypt (Hamilton-Dyer 2007: 156) and Sagalassos, Turkey (De Cupere 2001).

sprinkled with salt and transported inland up into the Rif using mules or donkeys.[52] In this manner, fish are sold at markets 20-25 km away from the coast, with the mules travelling by night and taking 10-12 hours for the journey.[53] As *Tamuda* lies only 15 km distant from the Mediterranean and in the Martil valley, the transportation of marine fish to the site for consumption would not have been improbable, as the river could also have been used to facilitate the movement of these foodstuffs.

OTHER FORMS OF EXPLOITATION

Exploitation of marine resources that does not involve consumption for eating is also demonstrable through the *Tamuda* finds: 18 bittersweet shellfish from the Punico-Mauretanian period have holes drilled through their hinges.[54] These shells also possess highly eroded surfaces, indicating that after the animal died naturally the shells were present in the surf zone for a time before being collected on the beach.[55] These types of finds indicate that shells were used for other purposes, such as tools or for decoration, although the specific use of these bittersweets is not known.[56]

7.2.5 Summary

Presently, the expansive Punico-Mauretanian settlement and Roman/Late Roman *castellum* at *Tamuda* have not been fully excavated. Despite this situation, it is possible to note generally the chronology, past application of fishing methods and role marine resources once played at the inland site through the extant finds of marine animal remains, fishing equipment, salazón amphorae, texts, pictorial evidence and ethnography.

7.2.5.1 Areas and methods of fishing effort

The location of *Tamuda* gives direct access to the Oued Martil, although the extant icthyo-faunal and malacological evidence indicates that this freshwater environment was not exploited; instead it was in the marine waters of the Mediterranean, in Tetouan Bay, where fishing effort was largely concentrated.[57] Fishing equipment finds at the site suggest the possibility of riverine fishing, however.

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[52] Chaara 1996: 93
[53] Bresc 2001: 531
[54] Table 7.4: nos 11, 31
[55] Seven of the bittersweets from Sidi Abdeselam del Behar, on the Mediterranean coast at on old mouth of the Oued Martil, also have holes in their hinges: App. 1.2.1: *Cat. 17.*
[56] Chamorro Moreno 1988: 476, 488. For discussion of drilled bivalves in the Mediterranean, see Karali 1999: 33-35.
[57] The distance between *Tamuda* and the coast (15 km), the low tidal regime in the Mediterranean (less than 1 m), and the elevation of the river channel at the site (13 m), suggest that the Oued Martil was mainly fresh water near the site; Bryden, *et al*. 1994: 203.

FISHING FROM SHORE

Almost all shellfish found at the site are marine species, although four species (unspecified species in the *Muricidae* family, oyster, scallop and spiny dye-murex) can also live in estuaries, and therefore might also have been found in the lower and saline reaches of the Oued Martil. Indeed, ancient authors cite river mouths as the locations for finding the best oysters.[58]

Twelve of the 14 shellfish present are littoral species, living in the intertidal or both the intertidal/infratidal zones and are therefore possible to fish from the shoreline (see Table 7.4, Fig. 7.13). As the tidal regime along the Mediterranean coast is minimal (less than 1 m), however, there was no optimal period during the day in which fishing or collecting shellfish was more practicable.[59]

A majority of the shellfish species prefer sandy, hard mud and gravel bottom habitats such as found in Tetouan Bay: these include cockle, bittersweet, oyster, scallop, clam and Mediterranean bonnet. They can be collected by hand or using simple drag devices or rakes specifically designed to pull up slightly-buried species like scallops, which are found at the site.[60] Artisanal fishermen here today comb the seafloor with rakes comprised of metal teeth attached to a semi-circular reinforcement that holds open a net bag. Such a tool is used by a single fisherman on foot in the intertidal zone, who can penetrate between 0.5-1.5 m past the low tide zone and this might be similar to raking tools called σιδήριος or *ferramenta* by Aristotle and Pliny.[61]

Other shellfish species recovered from *Tamuda*, however, live in rocky habitats: ribbed Mediterranean limpet, rayed Mediterranean limpet and red-mouthed rock shell. A few small rock outcrops are present along the shore of Tetouan Bay, but these species can certainly be found on the limestone headlands framing the bay: Rasel el Aswad and Cape Mazari.[62] Limpets can be collected manually or pried off their attached surfaces using a knife. This method is described by Aelian and similar to that utilised today by artisanal fishermen, who, at low tide, obtain shellfish with a "crochet"-like hook (*elganjou*).[63] Banded dye-murex can be found in both sandy and rocky habitats and can be caught with a method described by

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[58] Pliny, *NH* 32.31.61-61; Strabo, 3.2.7
[59] Snoussi 2000: 20
[60] Chamorro Moreno 1988: 489
[61] Shafee 1999: 33-34; App. 6: *Cat. 1.8. Tetouan Bay*; Pliny, *NH* 11.52.139; Aristotle, *HA* 535a 10-20, 547 b 13
[62] See Chapter 5.3.1.
[63] Aelian, *NA* 6.55; Guerra-García, *et al.* 2004: 325; Chamorro Moreno 1988: 489; Timoule 1985: 12. Compare to App. 6: *Cat. 3.11. Oued Sous (3).*

Pliny and Aelian.[64] This method, practised in antiquity by a *murex* fisherman (πορφυεύς), required the setting of baited baskets or weels that attract *murex*; such traps (κυρτίδες) are described by Oppian and Pollux and similar techniques are used presently at Essaouira on the Atlantic coast and in the Algarve.[65]

Finds of 16 bronze and bone needles could demonstrate the manufacture of fishing nets, although net types and mesh size cannot be determined from these finds.[66] Eleven of the 17 terracotta weights found at *Tamuda* are relatively light (between 20-90 g), and could have been used by a single fisherman to line the edges of cast nets (ἀμφίβολον, ἀμφίβληστρον*, funda, iaculum*) used in shallow waters from the shore to catch littoral fish.[67] The sandy bottom of Tetouan Bay is certainly an ideal location to use this method of fishing. It might also have been possible to use such a method near *Tamuda* in the Oued Martil.

Additionally, the numerous medium to small hooks from the Punico-Mauretanian period could be used for hook-and-line fishing, likely using a rod from shore or the river bank to target littoral or freshwater species. Of the 59 fish hooks that have been recorded, most (48 examples) are small and thin. Nine medium hooks are also present.[68] The limited extant icthyo-faunal evidence, however, does not provide an indication as to which small to medium littoral or freshwater species could have been targeted with these.

FISHING WITH A BOAT

The marine animal remains from *Tamuda* also indicate that fishing took place offshore from a boat or boats, or by a boat used in conjunction with fishermen on shore. Although there are no indications of what local fishing boats might have been like in antiquity, they were probably similar to the small *horeia*, *cydarium, placida* and *scapha* and possibly *vegeiia* and *schedia* types known from texts and iconography.[69] Historical and modern fishing boats used in regional artisanal fisheries are comparable to these at least in size, function and organisation of fishing effort. For example, in the 1950s, the rowed boats used for beach

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[64] Pliny, *NH* 9.61.132; Aelian, *NA* 7.34; see App. 6: *Cat. 3.11 Oued Sous (3).*
[65] Pollux, *Onom*. 1.47 ff; Oppian, *Hal.* 5.598-611; Pliny, *NH* 9.61.132; Aelian, *NA* 7.34; Ziderman 1990: 99; see App. 6: *Cat. 3.9. Essaouira (5); Cat. 4.3. Ria Formosa, Portugal*; see also Ruscillo 2005 for experiments with this trapping technique in Crete.
[66] Table 7.6: nos 2-3, 7-8, 16-18; Libert & Maucorps 1973: 4; see Chapter 3.2.2.
[67] Table 7.6: nos 10, 21-22; Oppian, *Hal*. 3.80-82; Virgil, *Georgics* 1.141; Plautus, *Truculentus* 35-36; App. 6: *Cat. 4.2 Corrales de Rota, Spain (1-2).*
[68] Table 7.6: nos 1, 4-6, 9, 11-13; two additional hooks are known but not described in the publications (Table 7.6: no. 14)
[69] See Chapter 3.2.2.

seining between the Oued Martil and Oued Laou, called *qârəb*, were 6-8 m long (some with small lateen sails); larger oared boats, ca. 15 m-long *chebbaks* (some also with sails), could be used for offshore fishing but also in conjunction with a beach seine.[70] In the late 1990s, rowed boats 3-6 m long and 1-1.5 m wide were used by fishermen; presently, the same types of boats are used for seining, but with the addition of outboard motors.[71] A fishing boss (*raïs)* is in charge of the fishermen *(bahris*) in the boat and directs the fishing effort.[72] Beach seining in artisanal fisheries in the same region today use smaller vessels (less than 5 m long), but are still directed by a *raïs* who is based on shore, and calls out directions to the *bahris* paying out the net in the boat and those on shore that pull in the net. In this scenario, around 15 *bahris* are involved.[73]

Two shellfish species caught during the Punico-Mauretanian period live exclusively in the infratidal zone (that is, below the low-tide zone): Algarve volute (depths between 60-150 m) and spiny dye-murex (10-150 m depth). These would have to be sought from a boat, as could many of the mixed intertidal/infratidal species since their habitats extend past the tidal zone (for example, the knobbed triton's habitat extends down to 200 m, a depth not reached until 15 km offshore Tetouan Bay).[74] Artisanal fishermen in the area fish offshore for clams, scallops (both found during the Punico-Mauretanian period) and cockles (found in all periods) using a dredge from a boat or a towed rake with net, similar to those used from shore.[75]

The marine fish found at *Tamuda* (bluefin tuna and the *Lamnidae* shark) are large pelagic species that could be caught from a boat using hook-and-line methods, either by hand line and rod and line. Based on the description made by Oppian, the two large fish hooks found at the site (over 8 cm long) were likely used to target these species: the length of the shank prevents these large-mouthed fish from biting past the hook through the fishing line once caught.[76] The terracotta disc from Punico-Mauretanian layers at the site, although portraying a mythical sea creature, could also depict fishing with a harpoon.[77] The fish being sought in this scene have been interpreted as shark and whale, but it is not unlikely that tunny might

[70] See App. 6: *Cat. 1.7. Oueds Laou/Martil*; Chaara 1996: 93-94. In the 1940-50s, non-native types of fishing boats began to be used along the Mediterranean coast as a consequence of the Spanish Protectorate influence (1905-56). Spanish fishermen introduced smaller, 8- to 10-person *lamparo* fishing boats and small 3-person boats called *plateras* (Chaara 1996: 98-100; Sbaï 1999: 65-66); see App. 6: *Cat. 1.2. Ras el Ma; Cat. 1.4. Badis*; *Cat. 1.5. Cala Iris.*
[71] Shafee 1999: 35, 39, 53; see App. 6: *Cat. 1.6. Amtar.*
[72] Chaara 1996: 93-94
[73] Montagne 1923: 191, 194; see App. 6.1: *Cat. 1.6. Amtar.*
[74] NIMA #52039
[75] Shafee 1999: 10-14, 25-26, 29, 34; App. 6: *Cat. 1.8. Tetouan Bay*
[76] See Table 7.6: no.1; Oppian, *Hal.* 3.144-148.
[77] App. 5: *Cat. 1.*

also have been intended.[78] Fishing with a spear apparatus – such as a harpoon or trident – from a boat was a method for catching tunny, shark and whales, known from descriptions made by Oppian.[79]

The numerous smaller hooks also from the Punico-Mauretanian period suggest that species not as large as tunny and shark were also sought, and these could have been used to fish from a boat, although the fish-bone finds do not indicate which species these might have been. Modern offshore hook-and-line fisheries here seek pandora, mullet, seabream and grouper, and grey mullet is mentioned by Oppian as being caught by small hooks.[80] Long-lining (where multiple hooks are attached to a single line) might also have been a technique practised using these hooks, but this is not certain.[81]

Four larger terracotta and lead weights (between 180 g-1.15 kg) indicate that fishing nets larger than cast nets, such as seines (σαγήνη, *sagena)*, could have been used.[82] Today, beach seining is the dominant fishing method on the Mediterranean coast, and these artefacts could have been used as weights on the lower edge of such nets.[83] The maximum depth that a seine net along this coast today is used is ca. 24 m.[84] In artisanal fisheries near Oued Laou on the Mediterranean coast, larger stone weights of up to 2-3 kg are tied to the foot rope/lead line of the net, and smaller weights of up to 190 g (usually lead) are frequently spaced if the large stone weights aren't used.[85] The sandy shoreline and infratidal zone of Tetouan Bay is an ideal location for this technique, and was still practised here by fishermen called *tabahrit* ('seine net fishermen') from the inland city of Tetouan at the beginning of the 20th century.[86] This method is similar to that described by Oppian, and is also attested by Manilius in order to catch tunny during their annual migrations.[87]

Aside from using shore-based methods, net fishing is historically attested as taking place at sea. In the 19th century, Moroccan boats would fish using nets up to 3 km off the coast between Tetouan and Emsa.[88] Fishing boats have used purse seines offshore here since the

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[78] Bernal Casasola 2009b: 271-272
[79] Oppian, *Hal.* 4.531-554, 5.150-153, 5.358-364
[80] Chaara 1996: 100; these are fished in March-May; Oppian, *Hal.* 3.482-485.
[81] Long-lining attested by Sidonius, *Epistula* 2.2.12; Aelian, *NA* 15.10.
[82] See Table 7.6: nos 10, 15; Aelian, *NA* 12.43.
[83] In Morocco, beach seines are used in the Mediterranean by almost 80% of fishermen year round; Malouli Idrissi, *et al*. 1999: 18; App. 6: *Cat. 1.6. Amtar.*
[84] Malouli Idrissi, *et al.* 1999: 18; Roullot & Fahfouhi 1984: 59-60
[85] Roullot & Fahfouhi 1984: 59-60
[86] "Pescadores con jábega"; Ibn Azzuz Haquim 1953: 64.
[87] Oppian, *Hal.* 4.491-501; Manilius, *Astr*. 5.676-679
[88] According to the English consul in Tangier, John Drummond Hay; Guennoun 2006: 1011.

1950s to catch smaller sizes of tunny and also sardines; it is not known if perhaps boats also went similar distances offshore in antiquity and used nets to catch the same species.[89]

7.2.5.2 The chronology of exploitation

PUNICO-MAURETANIAN PERIOD

During this period, marine resources that were found at *Tamuda* were sought from the shore of Tetouan Bay and offshore in the Mediterranean. Equipment finds indicate that the fish and shellfish were sought by hook-and-line and net fishing techniques, but the species' habitats, contemporary texts and ethnographic comparison with regional artisanal fisheries suggest that the resources were also likely collected by hand or with the use of small implements.

From the shoreline, 12 of the 14 shellfish species present during this period could be sought (see Table 7.4; Fig. 7.13). Eighteen examples of one species, bittersweets, are pierced, indicating their use as decorations or tools. These specimens are worn, revealing that the animals died and were awash in the tide zone and later collected by hand.[90]

Bluefin tuna, finds of which are present during this period, come near shore during annual migrations in the early and late summer. The presence of the *Lamnidae* shark, usually oceanic, can possibly be attributed to the species' behaviour of sometimes following tunny.[91] These fish could have been caught by beach seine nets, and the large cylindrical weights (560 g-1.15 kg) could have been used to weight these net types.[92] In addition, based on the general theme displayed in the iconographic evidence of the terracotta disc from the site, it is possible that the shark species (and possibly even the tunny species) were sought by the use of harpoon (or spear-like object) from a boat, offshore in the Mediterranean.[93]

Hook-and-line fishing might also have been conducted from the shoreline or riverbank, as demonstrated during this period by the finds of 57 small- and medium-sized hooks.[94] No icthyo-faunal evidence of species other than the two discussed above, however, is yet known from *Tamuda* to clarify this.

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[89] INRH 2002: 131; Timoule 1985: 52

[90] Chamorro Moreno 1988: 488

[91] That shark bones are associated with tunny bones in archaeological contexts is not unusual, as sharks often follow tunny during their migrations. Remains of these two species are present in southern Spain: the 6th-century BC Tartessic sites of Cabezo de San Pedro (near Huelva), La Tiñosa and Calle de Puerto No. 10 (Huelva) and Toscanos (Phoenician layers); see Roselló & Morales 1992: 19-20.

[92] The three lead weights are only described in the publication as "cylindircial": Quintero Atauri & Gimenez Bernal 1944: 11, 1; Table 7.6: no. 15.

[93] App. 5: *Cat. 1*

[94] Table 7.6: nos 1, 4-6, 9, 11-13

That fishermen during the Punico-Mauretanian period went offshore in boats to fish is indicated by the presence of Algarve volute and spiny dye-murex shellfish that live in the infratidal zone (see Table 7.4). In addition, two large fish hooks (8.2 cm and 9 cm long), could indicate that larger fish such as tunny and shark were sought by hook-and-line methods from a boat, in addition to the beach seine method.[95] The maximum possible distance offshore that fishermen ventured to fish is indicated by the usual habitat depth of the *Lamnidae* shark at 150 m (if identified as shortfin mako; see Table 7.2) and the maximum habitat depth of the knobbed triton at 200 m (see Table 7.4).

Fishing from shore for most shellfish is an activity that can be practised year-round, as seen in artisanal fisheries. However, spring would be better suited for oysters and autumn, winter and early summer for the *Muricidae* shellfish (if used for dye). Late spring/early summer or late summer/early autumn is the period in which the migratory tunny and possibly also the shark were caught. However, other offshore marine resources, indicated by the infratidal shellfish, would be accessible year-round, except for periods when the east wind blows and creates large swells in Tetouan Bay, making it unsafe for navigation. That marine resources for consumption could be available on a more consistent basis is demonstrated by the finds of salazón amphorae at *Tamuda*: Mañá-Pascual A4, Mañá C2b and Dressel 7-11 amphorae (see Table 7.8).

PUNICO-MAURETANIAN/ROMAN PERIOD[96]

Eight terracotta weights demonstrate further evidence of net fishing during this combined period. Two large examples are doughnut-shaped (weighing 200 g and 180 g), possibly suggesting use on a type of larger cast or seine net.[97] Six are small and medium disc-shaped weights (between 20 g and 90 g), and could be used to line the edge of a cast net.[98]

ROMAN/LATE ROMAN PERIOD[99]

During this combined period, shellfish were sought from along the shores of Tetouan Bay, and finds of weights indicate that net fishing techniques were practised as well. As in the Punico-Mauretanian period, the shellfish were also likely collected by hand or with the use of small implements (see Table 7.4).

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95 Table 7.6: no. 1

96 These two periods at *Tamuda* are treated together, as some finds are only noted by the site and are dated by their association with 1st-century ceramics in the Musée Archéologique, Tetouan.

97 Table 7.6: nos 19-20

98 Table 7.6: no. 21

99 These two periods at *Tamuda* are treated together, as some finds are only noted as coming from the *castellum*, whose chronology extends from the mid-1st-early 5th centuries AD.

From the shoreline, cockles, oysters and limpets present during this period could be sought. In addition, cast nets could have been used for littoral or even riverine fish, as evidenced by the five disc-shaped terracotta weights of small dimensions (between 15 g and 50 g).[100]

The extant finds of shellfish at *Tamuda* from this period suggest that fishing along the shores of Tetouan Bay could take place throughout the year, with the possible exception of oysters being sought in spring and early summer. Finds of Dressel 7-11 amphorae (present to the end of the 1st century AD) indicate that a more consistent supply of salted-fish products could be obtained (see Table 7.8). No salazón amphorae types dating to the 2nd century AD have yet been identified at *Tamuda*, suggesting that importation of salted products ceased temporarily; it was at this time that the *castellum* is thought to have undergone modifications due to incursions from local tribal groups (see Section 7.2.1). (It is also quite possible that the Dressel 7-11 amphorae chronology extends into the 2nd century in this region.)[101]

LATE ROMAN PERIOD

During this period, cockles and limpets were sought from the shoreline and rocky headlands around Tetouan Bay (see Table 7.4, Fig. 7.1). As in the two preceding periods, these shellfish were likely collected by hand or with the use of small implements. These species of shellfish could be sought throughout the year, and the presence of finds of Almagro 51c amphorae (appearing in the 3rd century AD) indicate more regular consumption of resources that continued until the *castellum* was abandoned in the early 5th century (see Table 7.8).

7.2.6 Conclusions: the role of fishing at *Tamuda*

The extant archaeological remains demonstrate that there was a clear difference in the role that marine resource exploitation played in the periods of occupation at *Tamuda*. In all periods, however, the presence of marine fish and shellfish finds indicate that these resources were transported ca. 15 km overland from the Mediterranean to the site, closely paralleling the *tahammort* system practised today. As these resources came from the sea, the settlement and *castellum* at *Tamuda* likely had contact with contemporary settlements at the mouth of the Oued Martil, Sidi Abdeselam del Behar and Metrouna, where fishermen were also likely based.[102] The river could certainly serve as a means of transportation for these and other goods to *Tamuda*. The presence of fishing equipment at the site, however, indicates that at

[100] Table 7.6: no. 22
[101] The 1st-century date follows the 'Amphora Project' chronology, see Chapter 3.2.3.
[102] No fishing equipment has been yet published from Metrouna but it is clearly a purple-dye factory (Bernal, *et al*. 2008b: 332-335). For fishing equipment finds from Sidi Abdeselam del Behar, see App. 2.1: *Cat. 5-7.*

least some of the population of the settlement and *castellum* fished, in the river, along the Mediterranean shoreline and even offshore.

The role that these resources played in the Punico-Mauretanian settlement seems to be more significant than in later periods, as more species of shellfish (14 species) and the only fish remains (two species) are present (see Tables 7.2, 7.4). All the fish hooks found at the site belong to this period as well, as do some weights possibly used for cast and seine nets (other weights are present in the Punico-Mauretanian/Roman periods). This body of evidence suggests that the population of *Tamuda* exploited the sea, from the shoreline of Tetouan Bay but also using vessels to obtain species in the Mediterranean, possibly several kilometres offshore. It cannot be ruled out, however, that the river was fished in antiquity, as it is today.[103] Fish hooks at inland sites are not unusual in *Mauretania Tingitana*, as a few finds each have also been recovered from *Volubilis*, *Thamusida*, Sidi Slimane, *Banasa*, *Zilil* and the *castella* of Suiar (possibly *Ad Novas*) and *Tabernae*.[104] All these sites, except *Tabernae*, are located on rivers, streams (Suiar and *Volubilis*) and lagoons (*Zilil*) and these finds could indicate fishing in the local waterways. Additionally, it is not unusual for fish hooks to be lost inside a fish once caught: as they are essentially "swallowed" they often are transported with the fish to its final destination.[105] This certainly could have happened at *Tamuda*.

Undoubtedly there was a relationship between the Punico-Mauretanian settlement at *Tamuda* and Sidi Abdeselam del Behar, at the mouth of the Oued Martil. The latter was occupied initially from late 6th/early 5th to the 1st centuries BC, and the abundance of marine resources and some fishing equipment finds identify it as a fish-salting station.[106] Finds of Mañá-Pascal A4 and Mañá C2b salazón amphorae are also present, as at *Tamuda*, and could serve as further evidence of a connection between the two.[107] Similarly, pierced bittersweet shells are also found here as at *Tamuda*.[108]

During the Roman and into the Late Roman periods, when the settlement of *Tamuda* was supplanted by a *castellum*, the evidence for exploiting marine resources is comparatively reduced. Fewer species of shellfish (four species; all caught in the Punico-Mauretanian periods as well) are present, and equipment finds suggest that only cast nets were used. The importation of salted-fish products in Dressel 7-11 salazón amphorae continued at the

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[103] See Bernal, *et al.* 2008c: 253, fig. 15: fishing in the lower Oued Martil demonstrated by checking a trap net ('hoop-net') from a boat.
[104] See App. 2.
[105] Hamilton-Dyer 2001: 287
[106] See App. 3.1: *Site 8*.
[107] See App. 3.3.2.1.
[108] See App. 1.2.1: *Cat. 17.*

beginning of this period, with a pause in the 2nd century, and then continued in the 3rd century with Almagro 51c amphorae.

A relationship might have continued to exist between the *castellum* at *Tamuda* and the sites at the Oued Martil mouth: Sidi Abdeselam del Behar demonstrates occupation from the late 1st-3rd centuries and between ca. AD 320-late 5th century, and the purple-dye factory at Metrouna functioned between ca. AD 75-150.[109] It is interesting to note that although *Muricidae* (*murex*) shells are found at *Tamuda* during the Punico-Mauretanian period, none are present during the Roman and Late Roman periods (see Table 7.4). During the Roman period, however, these were abundant at Metrouna.

Perhaps the difference in exploitation between the periods can be seen as a reflection of excavation practices or sampling techniques at the site (see Section 7.2.1). This difference might also be ascribed to the change in function of the site, from a Punico-Mauretanian population centre that was a focus of the Martil valley to a Roman *castellum* plagued by tribal uprisings into the Late Roman period. Fishing at the Punico-Mauretanian settlement probably fulfilled a subordinate role to other activities such as agriculture, much as it does today in the coastal Rif.[110] In this way, little investment was needed to fish or collect shellfish; however, some investment (not necessarily at *Tamuda*) was placed on fishing in order to obtain the larger migratory fish with a boat and beach seine or boats needed for offshore shellfish and hook-and-line fishing. These latter types of techniques also require more man power and organisation and, as today, the catch would have been sold at market or shared amongst those that participate.[111]

Marine resources do not seem to have made a large contribution to the diet of the military troops stationed at the *castellum* during the Roman and Late Roman periods. This situation might not be unusual: faunal analyses in *castella* north of the Alps and in Britain during the 1st century AD demonstrate a "military pattern" or "Gallicization/Germanization" of the diet, which was more centred on pork. This is thought to indicate the preferences and origins of the soldiers who lived in camps: Gaul, northern Italy and northern Spain.[112] Although no detailed faunal analyses of the material from *Tamuda* has been undertaken, a similar

[109] See App. 3.1: *Sites 8-9.*
[110] Chaara 1996: 93
[111] Bekker-Nielsen 2002a: 29-31
[112] King 1999: 189. Fish bones are not frequently found at northern Roman fort sites in Britain compared to other types of sites (Locker 2007: 147-149).

situation could be cautiously suggested here.[113] Inscriptions and artefacts dating from the 3rd century, if not earlier, indicate that the *uexillatio* troops stationed at *Tamuda* were of Britannic or northern Iberian origins.[114] Additionally, animal bones found in the trash dump on the north side of the *castellum* included wild boar (and those of horse and camel). At the western gate, pig bones (and horse) have been identified in the 4th-century layers.[115] Wild boar is native to the region (and wild boar teeth have been located inside the Punico-Mauretanian houses), and therefore would have been game that was hunted locally. Perhaps this animal's consumption was also indicative of the dietary preferences of the population of the *castellum* as a main source of protein.[116] This preference appears to have continued though the Late Roman period until the definitive abandonment of the site.

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[113] The recent excavations at Ladera Sur area at *Lixus* are perhaps the major exception for faunal analyses in *Mauretania Tingitana* (Grau Almero, *et al*. 2001; Iborra Eres 2005).
[114] Mastimo 1991; Rebuffat 1998: 215-221; Villaverde Vega 2001: 237, n. 1021: troops identified as cavalry of *ala Herculea* (*Not. Dig. Occ*. XXVI, 2-4, 13) with interpretation of their origins based on finds of fibulae and at least one inscription attesting a soldier's origins: "*Attianus…ex Breitonibus*" (*IAM* 2, no. 56).
[115] Morán & Giménez Bernal 1948: 38; Bernal, *et al.* 2008a: 600
[116] Dobson 1998: 81-82; Morán & Giménez Bernal 1948: 20

7.3 *Septem Fratres*

7.3.1 The history of the site

The site of *Septem Fratres* occupies the low-lying area in the middle of the 4 km-long Peninsula de la Almina at the eastern entrance of the Straits of Gibraltar. The peninsula extends east from the Jebel Haouz ridge (*Septem Fratres Montes*) with its headland formed by 212 m-high Monte Hacho (possibly the ancient *Abila Mons*).[117] To the south is a wide and shallow bay, Ensenada de Ceuta. The remains of *Septem*, covering and area ca. 15 ha, lie in the narrowest part of the peninsula in a section called "La Ciudad" that was enclosed by later Portuguese and Spanish fortification walls (Figs 7.15-7.16).[118] The topography here in antiquity likely consisted of a small ridge running east-west, lined to the north and south by sandy beaches. The canal that presently cuts through the peninsula at the western edge of La Ciudad might have followed a natural depression. The opening of this and an eastern canal dates to the 11th century; these were enlarged in the mid-16th century although the eastern canal was filled in 1931 (Fig. 7.17).[119] The city of Ceuta occupies the central peninsula, which is densely built over with the northern shore extended by harbour works.

Due to the major development of Ceuta in the last century, much of the archaeological investigation has been urban in nature and conducted on a rescue basis, prior to and sometimes during and after construction works.[120] Investigations in Ceuta's present territory were initiated by C. Posac Mon, who began in 1954 to conduct salvage work and collect finds uncovered at various sites throughout the peninsula. In the late 1950s, Posac Mon and J. Bravo Pérez excavated within the Parque de Artillería (later the Hotel La Muralla), at the western edge of the La Ciudad area.[121] At this time, Bravo Pérez also began recovering finds from the immediate waters surrounding the isthmus and in the Bay of Benzú, west of Ceuta on the Straits of Gibraltar coast.[122] In the late 1970s rescue work was undertaken in a small area of the Paseo de las Palmeras site and along the Gran Vía on the northeastern shore and central section of La Ciudad. From 1987-1991, E. Fernández Sotelo investigated the central and southeastern sections of La Ciudad, at Av. Sánchez Prados, and in 1989 N. Villaverde Vega and F. López Pardo began to excavate the Calle Hermanos Gómez Marcelo site in the

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[117] Rav. Cosmog. I.3, III.9; Procopius, *Wars* 3.1.6, 4.5.6; *ItAnt* 9.4; *Geo.* 4.1; Villada Paredes & Hita Ruiz 1994; Villaverde Vega & López Pardo 1995: 468-472; Marín Díaz, *et al*. 1995: 474, n. 2; Tissot 1878: 162-165. Jebel Musa has also been proposed as a possible candidate for identification as *Abila Mons*.
[118] Bernal Casasola 2002; Villada Paredes & Hita Ruiz 1994: 1219; Villada Paredes 2006: 271-272
[119] See Chapter 5.3.2; Arévalo González, *et al.* 2004: 42; al-Bakrî: 202-203; Hess 1978: 4-30; Ricard 1955: 95-99; F. Villada Paredes (Instituto de Estudios Ceutíes, Ceuta), pers. com.; App. 7: *Map 10.*
[120] Hita Ruiz & Villada Paredes 2007: 17-20
[121] Villada Paredes & Hita Ruiz 1994: 1211; Aróstegui 1998; Posac Mon 1962
[122] Bravo Pérez 1968; Bravo & Muñoz 1965; Bernal 2004

north-central area of La Ciudad.[123] During the late 1980s and early 1990s, a University of Granada team conducted a series of small-scale excavations throughout the La Ciudad area.[124] A larger portion of the Paseo de las Palmeras site was excavated by D. Bernal Casasola and J. Pérez Rivera between 1996-2000.[125] Recent work since 1996 has included excavations at different sites throughout the peninsula, mainly of layers dating to the Islamic period, led by members of Instituto de Estudios Ceutíes and the city of Ceuta. Some of the most recent pre-Islamic period investigations have included the study of prehistoric sites in the Bay of Benzú in 2002-2006 led by J. Ramos Muñoz and D. Bernal Casasola; additionally, in 2003-2005 and 2008-2009, excavations led by F. Villada Paredes have revealed Roman layers at the Puerta Califal site. In 2004, Phoenician layers were recorded for the first time at the Plaza de la Catedral site and in 2006, Roman layers were investigated at the Plaza de África site.[126]

Faunal remains and ceramics indicate that the top of the ridge in the La Ciudad area (the Plaza de la Catedral site) was occupied during the late 8th and 7th centuries BC. By the mid-7th century, several domestic structures had been built and a small street had been laid out; this was followed by an "industrial" phase with mud-lined pits and traces of fire. Phoenician ceramics from the central and eastern Mediterranean and Iberian Peninsula, as well Aegean ceramics, have been found in these layers.[127] Presently there is no evidence on the peninsula of occupation immediately following this Phoenician period. However, Mañá-Pascal A4 amphorae (ca. late 5th/early 4th to 2nd centuries BC) have been recovered under water along the north and south coasts of the peninsula but also the Bay of Benzú to the west.[128] Stone and lead anchors (ca. 5th-1st centuries BC) and Mañá C2b amphorae (2nd-1st centuries BC) have also been found in the peninsula's waters (see Fig. 7.30).[129] The only other finds from

[123] Moreno León 1995; Fernández Sotelo 1994; Fernández Sotelo 1995; Fernández Sotelo 2000; Villaverde Vega & López Pardo 1995; Villada Paredes 2009: 55; Villada Paredes 2006: 271, 274-275; Bernal Casasola 1994a: 158

[124] Villada Paredes & Hita Ruiz 1994; Bernal Casasola 1994a: 158-159

[125] Pérez Rivera & Bernal Casasola 1995; Bernal Casasola & Pérez Rivera 1999; Hita Ruiz & Villada Paredes 2007: 51

[126] Villada Paredes, *et al.* 2007; Villada, *et al.* 2007; Villada Paredes 2006: 275-276; Hita Ruiz & Villada Paredes 2004; Hita Ruiz & Villada Paredes 2007: 51-54; Ramos, *et al.* 2003; Bernal Casasola 2007: 77; Bernal Casasola 2009b: 267-270; F. Villada Paredes (Instituto de Estudios Ceutíes, Ceuta), pers. com.

[127] Ceramics finds from these levels: fragments of Ramón T-10.1.1.1/T-10.1.2.1 amphorae, red-glaze jars, jugs and tablewares, gray-slip ware and possibly an East Greek painted transport amphora: Villada Paredes, *et al.* 2007; Villada, *et al.* 2007: 487; Villada Paredes 2006: 273-274; Hita Ruiz & Villada Paredes 2007: 34.

[128] Mañá-Pascal A4 variants (Ramón T-12 and T-11 types); Bravo & Muñoz 1965; Ramón Torres 2004; Bernal 2000: 1139-1140; Bravo Pérez & Villada Paredes 1993.

[129] Bernal 2000: 1140, Table 1; Bravo & Muñoz 1965: 37, 41-43, fig. 31; Bravo Pérez 1988: 5-7. The dates refer to the chronology of the lead anchor finds; for the difficulties of dating the stone anchors, see Erbati & Trakadas 2008: 59-67.

this period are a few coins from *Gadir* and *Malaka*, dating to the 3rd-1st centuries BC, which derive from unknown terrestrial contexts.[130]

At the end of the Punico-Mauretanian period, in the late 1st century BC and early 1st century AD, the central peninsula was resettled. This is demonstrated by the establishment of a work area in the western La Ciudad region (the Hotel la Muralla and Puerta Califal sites).[131] The activities here centred on fishing and salting, possibly supporting a small population of seasonal fishermen.[132] During this period, coins as well as finewares were imported from Gaul, Iberia and the Italic peninsula, indicating contact with both Mauretanian and Roman settlements.[133] By the 2nd century, four additional salting complexes and three preparation areas had been installed in the La Ciudad area, east of the original establishments at the La Muralla and Puerta Califal sites (along the Gran Vía and at the Plaza de África and Paseo de las Palmeras sites).[134]

During the 2nd and 3rd centuries, it is clear that the settlement on the peninsula increased in size, although its structures and general character are difficult to discern. Finds of inscriptions, coins, imported finewares and amphorae, and the presence of an aqueduct and possibly also baths and a *sacellum* dedicated to Isis are indicative of economic and social activity of a settlement with a permanent population.[135] Since the early 2nd century, *Septem* was likely designated a *municipium*, and an inscription suggests that an *Ordo Decurionum* probably existed in the city by the mid-2nd century. Although not proven, it is thought that around the mid-3rd century, if not by the 4th century, *Septem* was designated or considered a *civitas*.[136]

The settlement of the peninsula in the Late Roman period is especially difficult to understand, due to overlying periods of occupation. However, it is clear that some of the salting installations and preparation areas temporarily ceased operation in the 3rd century but

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[130] Posac Mon 1958; Bernal 2000: 1142

[131] Arévalo González, *et al*. 2004: 289; Villada Paredes 2006; Villada, *et al.* 2007; Bernal Casasola & Pérez Rivera 1999: 28; Hita Ruiz & Villada Paredes 2004

[132] Villada Paredes 2006; Villada, *et al.* 2007

[133] Daura Jorba 1988; Villaverde Vega 2000: 905; Villada Paredes & Hita Ruiz 1994: 1217-1218

[134] App. 3.1: *Site 16*; Bernal Casasola & Pérez Rivera 1999; Bravo Pérez, *et al.* 1995; Villaverde Vega & López Pardo 1995; Bernal Casasola 2009b: 267-270

[135] Pérez Rivera & Bernal Casasola 1995: 182-185, 196; Villada Paredes & Hita Ruiz 1994: 1220-1224, 1227; Villaverde Vega 2001: 206-207; Bernal Casasola 1994b: 68-69; Bernal Casasola 2006b: 188; Moreno León 1995; Hita Ruiz & Villada Paredes 1994: 60-62. Finewares include ARSW C & D (Bernal Casasola, *et al*. 1999: 306-307).

[136] Bernal Casasola & Pérez Rivera 1999: 56; Villaverde Vega & López Pardo 1995: 468-471; Hita Ruiz & Villada Paredes 2002: 484; Hita Ruiz & Villada Paredes 2007: 38-39, 89; *Septem* is mentioned as a *civitates* by ca. AD 700 (Rav. Cosmog. V.305-306).

were subsequently refurbished.[137] A necropolis existed several hundred metres west of the La Ciudad region, beyond the Hotel La Muralla and Puerta Califal sites; the burials largely date between the late 3rd and mid-5th centuries.[138] In the eastern La Ciudad region, a necropolis and basilica are present whose chronologies are complex. A necropolis might have existed in the area in the early 3rd century, as attested by a sarcophagus that dates to reign of Gallienus.[139] However, it appears that the basilica with a *martyrium* was built up sometime in the 4th century, with burials then being set inside and outside its walls by the late 4th or early 5th centuries.[140]

The Vandals arrived on the peninsula after crossing the Straits of Gibraltar in AD 426 and were eventually removed during a campaign led by General Belisarius in AD 534, who re-claimed the peninsula for the Byzantine Empire.[141] At the beginning of the 5th century, some of the salting areas display evidence of incendiary destruction, and four of the fish-salting complexes ceased operation. However, some residential and industrial areas of *Septem* demonstrate continued occupation.[142] By the early 6th century, however, the eastern-most fish-salting complex, Paseo de las Palmeras, ceased operation, as did the preparation area at the Plaza de África site.[143]

After the Byzantine re-conquest of *Septem* in AD 534, the peninsula continued to serve as a military and naval base, and civic re-organisation is discernable: houses were built in the eastern section over a former the fish-salting site at Paseo de las Palmeras, and there is evidence of food production and other domestic activities.[144] The basilica was likely abandoned by the end of the 6th or early 7th centuries; a church is attested by written sources as being present in *Septem* during the Emperor Justinian I's reign in the 6th century but it is

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[137] Paseo de la Palmeras site and Hotel la Muralla preparation area (see below); Villada Paredes 2006; Villada, *et al.* 2007; Bernal Casasola & Pérez Rivera 2000: 865.
[138] "Las Puertas del Campo" site; Bernal Casasola 1994b: 64-67; Vázquez Bodas 1995: 540-549; Villaverde Vega 2001: 212.
[139] Villada Paredes 2009: 58-59
[140] Fernández Sotelo 2000; Fernández Sotelo 1995; Villada Paredes & Hita Ruiz 1994: 1228; Blázquez 2001: 393-399; Bernal Casasola 2008: 45; Villada Paredes 2009; Villaverde Vega 1999: 315
[141] See Chapter 4.4; *Cod. Just.* I.27.2.2; Procopius, *Wars* 4.5.6; Schwarcz 2004: 50; Bernal Casasola & Pérez Rivera 1996: 23-24.
[142] Fire destruction visible at Nos 12/13 Av. Sánchez Prados and No. 13 Calle Hermanos Gómez Marcelo but not at the Paseo de las Palmeras site; Villada Paredes & Hita Ruiz 1994: 1231; Villaverde Vega 2001: 214, n. 900; Bernal Casasola & Pérez Rivera 1999: 82.
[143] Bernal Casasola & Pérez Rivera 2000: 865-875; Bernal Casasola 2009b: 267-268
[144] Bernal Casasola & Pérez Rivera 1996: 22-25; Bernal Casasola & Pérez Rivera 1999: 86-87; Bernal Casasola, *et al.* 1999: 306-307; Villaverde Vega & Lopez Pardo 1992: 455-472; Hita Ruiz & Villada Paredes 2002: 486-487. A "fort" at *Septem* is mentioned by Procopius (*Wars* 3.1.6, 4.5.6), and a wall adjacent to the No. 20/21 Av. Sánchez Prados site has been proposed as part of a *castellum* by Fernández Sotelo (1994); however, this feature most likely dates to the 9th century, during the Umayyed period (Hita Ruiz & Villada Paredes 2002: 485-489).

unclear if it can be associated with this basilica.[145] After the temporary occupation of the peninsula by Visigothic forces in AD 546-547, *Septem* was brought under the Byzantine diocese of *Mauretania Gaditana,* until it was occupied by Islamic Umayyed forces in AD 709.[146]

7.3.2 The marine environment

As today, the La Ciudad area of *Septem* was the narrowest part of the Peninsula de la Almina during the Punico-Mauretanian, Roman and Late Roman periods (and certainly was even narrower as port and seawall construction in the last century has extended the shoreline to the north) (see Fig. 7.16).[147] The topography in antiquity likely consisted of an east-west ridge, reaching its highest elevation, ca. 10 m, following the southern shore. A low area and sandy beach probably extended to the north with a beach-lined cliff to the south (see Fig. 7.17).[148] It has been proposed that during the settlement's development, probably in the 2nd or 3rd centuries, two "port zones" were established, although no remains of such facilities have been identified. These are thought to have been located on the north shore of the La Ciudad area: one to the east, near the Roman and Late Roman salting complex at the Paseo de las Palmeras site and a second to the west, north of the La Muralla and Puerta Califal sites.[149] The first textual mention of a port at Septem ("*Septitanum portum"*) is in AD 740, although *dromon* galleys were based here in the 6th century, and probably some built facilities existed at the time to harbour them or facilitate their on- and off-loading.[150] Aside from this central settlement area, the majority of the shoreline of Monte Hacho, the south coast and shores west of La Ciudad are rock-faced.[151]

The marine environment surrounding the Ceuta peninsula acts as a boundary zone between the Mediterranean and Straits of Gibraltar systems, which possess different current regimes,

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[145] Procopius, *Buildings of Justinian* 6.6.14; Serrano Ramos 1995: 556-557; Bernal Casasola, *et al*. 1999: 307; Hita Ruiz & Villada Paredes 1994: 65-68; Villada Paredes & Hita Ruiz 1994: 1233-1235. Some finds at the basilica date to the 7th century, showing a continued, if not limited presence in this part of the settlement. Some scholars have identified the basilica as the only church on the isthmus whilst others suggest that another church, not yet found, was Justinian's church; see Hita Ruiz & Villada Paredes 2002: 486-487; Villada Paredes 2009: 58.
[146] Rav. Cosmog. I.3; Pringle 1981: 65, n. 156; Villaverde Vega 2001: 99-100, 218-220; Blázquez 2001: 402
[147] Guerra-García, *et al.* 2004: 320
[148] Villaverde Vega & López Pardo 1995: 463, fig. 6; Arévalo González, *et al.* 2004: 41-42
[149] The possible western port is proposed based on finds of Late Roman amphorae fragments and a coin of Theodosius in this area; Villaverde Vega 2001: 212-214; Bravo Pérez & Bravo Soto 1984: 61, fig. 11; Gozalbes Cravioto 2008: 251.
[150] Port at *Septem*: *Crónica Mozárabe de 754*, see Gozalbes Cravioto 2008: 230; *dromons* and naval base: *Cod. Just.* I.27.2.2; Procopius, *Wars* 4.5.6.
[151] Guerra-García, *et al.* 2004: 320

temperatures and salinities.[152] The continental margin north of the Peninsula de la Almina is at first shallow (the 100 m isobath at ca. 4 km offshore), but then drops rapidly, as the bathymetry of the 60 km-long Straits reaches its greatest depth (over. 1,000 m). To the south is the wide and sandy-bottomed Ensenada de Ceuta, where the 20 m isobath extends 2 km offshore, not reaching 100 m until 7 to 10 km offshore (Fig. 7.18).[153] Navigation through and across the Straits is affected by the eastward-flowing surface currents in the centre of the channel and the alternating inshore tides. Strong tidal races cause isolated breakers to appear the waters off Monte Hacho.[154]

The best anchorage for vessels is usually on the north side of the peninsula, as Montaña del Renegado and Jebel Musa protect vessels from westerlies, and anchor finds dating from the 5th century BC to 1st century AD in this area confirm the use of this area (Fig. 7.19).[155] During occasional periods of the strong east *chegui* winds in the summer and at mid-March and mid-September, however, it is not possible to anchor around the peninsula as its waters are too exposed. These winds can sometimes last for up to a week, and during that time it is impossible for any vessels to go to sea.[156] Additionally, the sandy shoreline on the north coast of the La Ciudad area, as well as that lining the Ensenada de Ceuta to the south, would permit small boats to beach.[157]

7.3.3 Evidence of marine resource exploitation

The evidence related to marine resource exploitation during the Punico-Mauretanian to Late Roman periods at *Septem Fratres* is derived from both archaeological and descriptive sources (Fig. 7.20, Table 7.9). Of the archaeological material, the largest group is comprised of published finds of salazón amphorae and the five fish-salting complexes and three preparation areas in the La Ciudad area. Some icthyo-faunal and malacological material from the earliest excavations by C. Posac Mon and J. Bravo Pérez at the Hotel la Muralla site has been re-studied and published.[158] The marine animal remains from the excavations at No. 13 Calle Hermanos Gómez Marcelo, No. 20/21 Av. Sánchez Prados and Paseo de la Palmeras

[152] See Chapter 5.3.1.1-5.3.1.2 (Mediterranean systems) and 5.3.2.1-5.3.2.2 (Straits systems).
[153] Viúdez, *et al.* 1998: 291; Bormans & Garrett 1989: 1544; Farmer & Armi 1988: 14, 16
[154] NIMA 131: 3
[155] Bravo & Muñoz 1965: fig. 1; Villada, *et al.* 2007: fig. 1; Gozalbes Cravioto 2008: 242-243; Erbatí & Trakadas 2008: 60-70
[156] The mid-March and mid-September *chegui* are known to Ceutí fishermen as the *surestá de San José* and the *cordonazo de San Francisco*; Gómez Barceló 2003: 9; NIMA 131: 13.
[157] Boats beach on the Ensenada de Ceuta shore; Chaara 1996: 99-100; Malouli Idrissi, *et al.* 1999: 8-10.
[158] Roselló 1992; Hita Ruiz & Villada Paredes 1994

have also been published.[159] Additionally, shellfish, fish bones and fishing equipment from excavations at the basilica and Plaza de África No. 3 and fishing equipment from the Paseo de las Palmeras and No. 20/21 Av. Sánchez Prados excavations have been published.[160] Published material and unpublished relevant finds from the earlier excavations, displayed in the Museo Municipal, Ceuta, are included in this catalogue. Materials relating to fishing practices and seafood consumption from previous and current excavations in Ceuta are being studied under the *SAGENA* project.[161]

The descriptive evidence relating to marine resources at the site is nearly as abundant as the archaeological material (see Table 7.9). General references are made to the area and its marine life in the texts of Pliny, Strabo, Columella and Athenaeus. These are supplemented by medieval, historical and modern observations on species presence and abundance and regional fishing techniques.

7.3.3.1 Marine species exploited

Ten species of fish are present at *Septem*, with evidence deriving from archaeological finds of fish bones (Tables 7.10-7.11, Fig. 7.21). These represent five families and one order (*Cetacea*), the most common being the *Scombridae* family (mackerel, tuna, bonito) (Fig. 7.22).[162] Nineteen species of shellfish and marine invertebrates are present at *Septem*, with evidence deriving from archaeological finds (Tables 7.12-7.13, Fig. 7.23). The shellfish represent bivalves and gastropods, and coral and sea urchin are also present (Fig. 7.24).

7.3.3.2 Habitats

The most common environment inhabited by the ten species of fish present at *Septem* is marine (during the combined Roman/Late Roman periods, two fish species are present that can live in both marine and estuarine environments; Fig. 7.25). The fish present at *Septem* are pelagic, epipelagic, oceanodromous and neritic species. They live over rocky and sandy bottoms, occupying coastal waters and the upper continental shelf with the deepest habitat extending to 400 m (represented by John Dory).

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[159] Villaverde Vega & López Pardo 1995; Roselló 1992; Hita Ruiz & Villada Paredes 1994; Bernal Casasola & Pérez Rivera 1999; Chamorro Moreno 1988

[160] Bernal Casasola & Pérez Rivera 1999; Hita Ruiz & Villada Paredes 1994: 68, n. 2; Bernal Casasola, *et al.* 2007; Bernal Casasola 2009b: 267-268

[161] Bernal Casasola 2009. *SAGENA* project, Universidad de Cádiz: this includes, for example, new material from the Puerta Califal site (F. Villada Paredes [Instituto de Estudios Ceutíes, Ceuta], pers. com.; D. Bernal Casasola [Universidad de Cádiz], pers. com.; Bernal Casasola 2007: 77).

[162] Finds of fish bones that have been noted but not identified are included here, but not discussed further in regards to species, fishing effort, etc.

Of the major environments in which the 19 species of shellfish and marine invertebrates present at *Septem* inhabit, the most common for all periods is marine (Figs 7.26-7.27). Of the minor environments, most species in all periods with data inhabit both the intertidal/infratidal zones, with the second most common environment being intertidal. During the Roman period, three species derive from the infratidal zone: spiny dye-murex, spiny cockle and coral. The shellfish, coral and urchin species present at *Septem* occupy a range of habitats, from rocky shorelines, gravel and hard mud bottoms to sandy littorals and sea grass bottoms. The deepest habitat extends to 200 m (represented by knobbed triton and Atlantic/Mediterranean scallop).

7.3.3.3 Seasonality

Six of the fish species present at *Septem* undergo annual migrations; these include members of the *Scombridae* (five species) and *Carangidae* (one species) families. Strabo, Oppian and Athenaeus note the migration pattern of one of the largest *Scombridae*, tunny, near the Pillars of Hercules: generally, these species enter the Mediterranean in the late spring/early summer and exit in the late summer/early autumn.[163] In the 18th century, a pound net (*al-madraba*) was used to target *Scombridae,* amongst other species: the net was set annually off Ceuta in July and then removed in August in order to catch fish from the return (feeding) migration.[164] The modern *al-madraba* net off the southern coast of Ceuta specifically targets bluefin tuna on the return migration, as does the *al-madraba* net off M'diq (at the southern end of Ensenada de Ceuta), set every year between late June/early July and removed between late October/early November.[165]

Long-lining from a boat for tunny in the Mediterranean waters here by Moroccan artisanal fishermen takes place at nearly the same time as the setting of the nets, between June and September.[166] However, in the Straits of Gibraltar, tunny are presently fished every year by hand-lining and long-lining from a boat between March and July, targeting the fish entering the Mediterranean to spawn.[167]

The summer months would have been largely given over to fishing, as six of the nine species found at *Septem* would have been in the waters surrounding the peninsula only at this

[163] See App. 4.1: *Text 2.b, 8.a, 9.a*. The period when the fish enter the Mediterranean is called "*fase de derecho*" – the genetic migration towards spawning grounds; the exiting period is called "*fase de revés*" – the feeding migration (de la Serna, *et al.* 1999: 16-17; Carrera Ruiz, *et al*. 2000: 44-45).
[164] Srour & Abid 2002: 3; Cámara del Río 1988: 189-190
[165] De la Serna, *et al.* 1999: 16-17, 36; Timoule 1985: 61; Srour & Abid 2002: 3
[166] Malouli Idrissi, *et al*. 1999: 19; INRH 2002: 130-132
[167] Srour & Abid 2002: 3; INRH 2002: 131; de la Serna, *et al.* 1999: 35-36

migratory time. The three other species, John Dory, common seabream and dusky grouper, are present in these waters year-round.[168] The seabream and grouper found at *Septem*, however, were also associated with migrating species at the No. 13 Calle Hermanos Gómez Marcelo site, indicating that these particular specimens were caught between late summer and early autumn (see Table 7.10).

The *Muricidae* shellfish (spiny dye-murex and banded dye-murex), found at *Septem* in the Roman and Late Roman periods, are fished year-round in artisanal fisheries (as are cockles, *Cardidae*).[169] Pliny, Cassiodorus and Aristotle, however, note that if used for dye, *murex* shellfish are best when fished in the autumn, late winter and early summer.[170] Oysters, present at *Septem* in the Roman and Late Roman periods, are also noted by Pliny and Aristotle as being best when collected during the late spring or early summer.[171]

7.3.3.4 Fishing methods

Thirteen artefacts related to fishing activities have been published or put on display at museums in Ceuta. The find-group includes bronze fish hooks, terracotta, lead and stone net weights (Tables 7.14-7.15, see Fig. 7.20), representing hook-and-line and net fishing techniques. Evidence for hook-and-line fishing is present in all periods except the Punico-Mauretanian period; evidence for net fishing is present only in the combined Roman/Late Roman period.

As at *Tamuda*, the fish hook finds clearly indicate fishing activity. In addition, nine terracotta, lead and stone weights were found at *Septem*. One terracotta weight derives from the Paseo de las Palmeras fish-salting complex, strongly indicating the artefact's use for weighting fishing nets. The other finds are associated with fishing activities due to their forms (they are indicative of modern net weights), close parallels from fishing contexts elsewhere and the presence of marine growth on some examples.[172]

7.3.3.5 Fish-salting practices

The evidence for fish-salting practices at *Septem* derives from the installations of salting vats, or *cetariae,* and preparation areas present throughout the La Ciudad area. Finds of

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[168] The John Dory is cited by Columella and Pliny as being the first-rank of fish in *Gades*; see App. 4.1: *Text 5.a*., *6.e.*
[169] Vasconcelos, *et al.* 2008: 289; Shafee 1999: 10-14, 33-34
[170] Pliny, *NH* 9.60.125-127, 9.62.38-39; Aristotle, *HA* 5.15.547a; Cassiodorus, *Var*. 1.2
[171] Andrews 1948: 299-300; Aristotle, *HA* 607.b2; Pliny, *NH* 32.31.61-62
[172] See discussion in Chapter 3.2.2.

salazón amphorae at *Septem* and in the surrounding waters also indicate the transhipment of salted-fish products.[173]

SALTING COMPLEXES

Five different groups of at least 14 *cetariae* have been recorded throughout the La Ciudad section of the peninsula. The finds extend throughout an area of 15 ha and include the Hotel la Muralla, Palacio de la Asamblea, No. 13 Calle Hermanos Gómez Marcelo, No. 20/21 Av. Sánchez Prados and Paseo de las Palmeras sites (see Fig. 7.20).[174] Some of the *cetariae* were destroyed during building works and were not archaeologically investigated, and limited information regarding the sites' layout and chronology is known (Fig. 7.28). It is clear, however, that the *cetariae*, lined with *opus signinum*, are sometimes associated with cleaning and preparation areas. Preparation areas that lack *cetariae* have been documented at No. 12 and No. 13 Av. Sánchez Prados, No. 3 Plaza de África and the Puerta Califal sites and their chronologies suggest other areas with *cetariae,* as yet unknown, were likely. The minimum, combined *cetariae* capacity of these extant complexes is estimated at a little over 26 m^3. Some of the complexes began operating in the late 1st century BC, with a reduction in processing output in the 3rd century AD; the last *cetariae* ceased operation in the late 5th/early 6th centuries (Table 7.16).

RESOURCES

Aside from fresh fish and shellfish, the most necessary resources for salting are fresh water, to clean the animals before processing, and salt. Subterranean channels that directed water from a spring to a cistern were found amongst the preparation area at the Paseo de las Palmeras complex and hydraulic channels are present at the Puerta Califal site.[175] Springs are also known on Monte Hacho and in the Almina and La Ciudad areas, and the abundance of fresh water on the peninsula is cited by medieval Arab geographers such as Ibn H̲awk̲al, al-Idrîsî and al-Bakrî.[176]

The salt supply is more difficult to fix at *Septem*. The Oueds Negron and Smir, which meet the sea 10 km and 17 km south of the peninsula, respectively, are presently estuary-like in their lower reaches; *salinas* are also historically attested in the Beni Madden area, at the mouth of Oued Martil (35 km to the south) and in the Straits of Gibraltar region at the base

[173] See Chapter 3.2.3.
[174] App. 3.1: *Site 16*; Villaerde Vega 2000: 904; Villada Paredes & Hita Ruiz 1994: 1219
[175] Bernal Casasola & Pérez Rivera 1999: 37-40, Pl. IX-X; Hita Ruiz & Villada Paredes 2004: 222-225
[176] Ibn H̲awk̲al: 78-79; al-Idrîsî: §170, 172; al-Bakrî: 102-103

of Tangier Bay, at Tarifa and in the Bay of Algeciras.[177] It has also been suggested that salt was shipped from southwestern Iberia to *Septem* using amphorae that could then be re-used for packaging salted fish products.[178] Obtaining salt from seawater using artificial heat, or lixiviation, could have been practised; this process, however, requires large amounts of fresh water and furnaces (which have not yet identified on the peninsula).[179]

AMPHORAE

There is evidence for the transportation of salted-fish products at and near *Septem* from the Punico-Mauretanian period (prior to the construction of salting *cetariae*) to the Late Roman period. This evidence derives from underwater and terrestrial finds of salazón amphorae: Mañá-Pascual A4, Mañá C2b, Dressel 7-11, Beltrán IIA, Beltrán IIB, Dressel 14, Beltrán 72 and Almagro 50 and 51 types (Table 7.17). At the La Muralla preparation site, a possible kiln has been found; it might be associated with Dressel 7-11 amphorae due to the presence of some over-fired examples.[180] Petrographic analyses also indicate the possibility of a kiln for manufacturing Almagro types near *Septem*, although no such facility has yet been identified.[181]

7.3.4 Discussion

SALTED PRODUCTS

Although fish bones were found inside some *cetariae* from the fish-salting sites at *Septem*, in two instances fish bones were found in the bases of amphorae. This situation is thus far unique within in the body of material from *Mauretania Tingitana*.[182]

One example comes from the Hotel La Muralla site, and dates to the 1st-2nd centuries AD; the identification of these bones, if known, has not been published. The second example comes from the No. 13 Calle Hermanos Gómez Marcelo site, and the bones, found in the base of an Almagro 51a amphora, have been identified as Atlantic chub mackerel.[183]

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177 See App. 3.2: *Beni Madden, Tangier Bay*. Spanish salt sources: Arévalo González, *et al*. 2004: 302.
178 Shipment of salt in this way is attested from the medieval to historical periods (Bernal Casasola 2006a: 1386; Villada, *et al.* 2007: 492).
179 Hesnard 1998: 183-184; Nenquin 1961: 108-109; see Chapter 3.2.3. The presence of a thermal complex – at the very least a *caldarium* – has been proposed due to the re-use of particular types of bricks in the Las Puertas del Campo necropolis (see Bernal Casasola 1994b: 68).
180 Unpublished; F. Villada Paredes (Instituto de Estudios Ceutíes, Ceuta), pers. com.; see Hita Ruiz & Villada Paredes 2004 for earlier stages of excavation.
181 Villaverde Vega & Lopez Pardo 1995: 472; Bernal Casasola 1996: 1213-1224; Bernal Casasola 1997: 92. 97, 103
182 Mussels were found in an amphora at *Lixus,* however; see Chapter 7.4.4.
183 Table 7.10: no. 14; Villaverde Vega & López Pardo 1995: 460

Pliny mentions that "scomber [mackerel] is caught also in Mauretania… but it is used only for making *garum*."[184] He then subsequently describes that the product *allex* (or *hallex*) "is [the] sediment of *garum*, the dregs neither whole nor strained".[185] These statements indicate that *allex* in the province was made of mackerel. The context of these bones, in the base of an amphora, indicates that they are the remains of *allex*.[186] This is clear evidence that *allex* of mackerel was being made in the province certainly between the late 3rd and 5th centuries AD, and if following Pliny, possibly as early as the 1st century AD.

However, the faunal remains from the *cetariae* at the No. 13 Calle Hermanos Gómez Marcelo site indicate that mackerel were also at times mixed with other species. For example, in "Pileta II" were found the bones of Spanish/chub mackerel and common seabream; in "Pileta III" were found Atlantic horse mackerel and common seabream; in "Pileta IV" were found dusky grouper, common seabream and Atlantic horse mackerel.[187] The evidence from these *cetariae* indicates that although mackerel may have been used for *garum* and other sauce derivatives, it could also be mixed with other species. The mixture of bones from the site could indicate that different types of products were made here: some solely of mackerel, others of a combination of species. These combinations both produce *allex*, and are attested elsewhere in the Mediterranean based on fish bones finds from salazón amphorae.[188]

OTHER FORMS OF EXPLOITATION

Exploitation of marine resources that did not result in fresh or salted products for consumption is demonstrable through the *Septem* finds, as with those from *Tamuda*.[189] Uniquely in a dated context in *Mauretania Tingitana*, whale bones were recovered from the Plaza de África site. As whale bones have been identified at other fish salting sites across the Straits of Gibraltar, it seems that the salting of these large mammals was also conducted alongside fish and marine invertebrates.[190] However, a fragment of a rib bone from the Late Roman layers shows traces of burning, and this might indicate that whale grease/oil was being extracted through the heating of blubber. It has been proposed that the hypocaust systems present at some of the other fish-salting sites in the region (notably at Cotta and

184 Pliny, *NH* 31.43.94; see App. 4.1: *Text 6.j.*
185 Pliny, *NH* 31.44.95. Other scomber in *garum* evidence includes the Pompeii sauce of A. Umbricius Scaurus: *G(ari) F(los) Scombri* (Curtis 1988-89).
186 For the production of the different types of salted fish sauces, see Chapter 3.2.3.
187 Table 7.10: nos 7-13; Villaverde Vega & López Pardo 1995: 456-460
188 Lernau, *et al.* 1996: 39; Bruschi & Wilkins 1996
189 Discussed in Chapter 7.2.4.
190 Whale bones have been found at *Baelo Claudia* and *Iulia Traducta* (Bernal Casasola 2009b: 265-267).

Tahadart) could have been used for similar practices, although no such system has been identified yet at *Septem*.[191]

One of the two infratidal species of shellfish identified from the peninsula, spiny cockle, has eroded surfaces.[192] The four specimens of this species, recovered from Roman layers, indicate that after the animals died, their shells were awash in the surf zone where they were then collected. Eroded surfaces are also visible on other Roman-period shell finds of mixed intertidal/infratidal species: pilose bittersweet, European thorny oyster, knobbed triton and red-mouthed rock shell.[193] These were likely collected in the same manner as the cockles.

The eroded shells suggest that these five species were not eaten (or their glands used for dye, as in the case of the rock shell). However, they were all found at the Paseo de las Palmeras salting complex, which clearly was a site where fresh marine resources were needed in order to be processed for *salsamenta* or salted sauces. Their intended purpose at the salting complex is not clear. However, the three specimens of pilose bittersweets, like those from *Tamuda* (and also Sidi Abdeselam del Behar) have drilled holes at their hinges. These also show traces of burning, and it has been suggested that they were used as lamps.[194] It might also be possible that these shells were intended as aggregate for flooring.[195]

Other infratidal marine invertebrates were recovered from the Roman layers of the Paseo de las Palmeras site: a sea urchin (*Strongylocentrotus sp*.) and a type of red coral (*Dendrophillia ramea*) (see Table 7.12).[196] The presence of these species demonstrates that not just fish and shellfish were used to make salted sauces, and Pliny does mention that sea urchin was also an ingredient.[197] It is not unusual that the red coral would be present at *Septem*, as coral was specifically referenced in the medieval period as being sought in the peninsula's waters for its decorative qualities. Ibn H̲awk̲al, in the 10th century, mentions the good quality coral from the peninsula; in the 12th century, al-Idrîsî also mentions the incomparable quality of coral from *Sabta* (*Septem*), with workshops for processing and a special coral market in the city.[198] That coral was known as being in the waters off *Mauretania Tingitana* is possibly demonstrated by its depiction in a mosaic at *Volubilis*.[199]

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[191] Bernal Casasola 2009b: 276-278
[192] Table 7.12: no. 12
[193] Table 7.12: nos 1, 5, 9-10
[194] Table 7.12: no. 10; Chamorro Moreno 1988: 488
[195] Reese 1979-80: 90-92; Wilson 2002b: 254-259; Wilson 2004: 162-163; Wilson 1999: 42-44
[196] Table 7.12: nos 13-14. A similar specimen of coral was also recovered at *Lixus*; see Chapter 7.4. Coral has also been identified at southern Spanish salting sites (see Bernal 2007: 101-102).
[197] See Chapter 3.2.3; Pliny, *NH* 31.44.95; Curtis 1991: 7.
[198] Ibn H̲awk̲al: 75; al-Idrîsî: § 174
[199] See App. 5: *Cat. 6.*

7.3.5 Summary

The history of the Roman and Late Roman fishing station, salting site and settlement on the Peninsula de la Almina is not entirely well understood due to sporadic excavations and extensive urban development. However, it is possible to note, through the extant finds of marine animal remains, fishing equipment and presence of fish-salting complexes, the past application of fishing methods and the role marine resources once played at the peninsular site.

7.3.5.1 Areas and methods of fishing effort

The situation of *Septem*, on a peninsula, gives direct access to two major marine systems, the Straits of Gibraltar and the Mediterranean. The extant icthyo-faunal and malacological evidence indicates that the immediate marine environment was exploited. Some shellfish species, however, might have been sought in the small river-mouth estuaries to the south of the peninsula, along the shores of Ensenada de Ceuta.

FISHING FROM SHORE

Septem's immediate littoral was an ideal location for fishing. The 19 species of shellfish and other invertebrates from the peninsula live in marine habitats, and a majority are littoral species, living in the intertidal zone or both the intertidal/infratidal zones (see Table 7.12; Fig. 7.27).[200] Fourteen of these species are possible to fish from the shoreline. As the tidal regime along the Ceuta peninsula is minimal (0.8-1 m), there was no optimal period during the day in which collecting shellfish or fishing was more practicable, although more shellfish would be exposed at low tide.[201]

Some of these species can be sought along sandy or muddy bottoms that lie to the north and in the bay south of the peninsula: pilose bittersweet, Atlantic/Mediterranean scallop, knobbed triton and Mediterranean bonnet. These can be hand-collected or by using a simple metal drag device or rake with bag attached. This last tool perhaps resembles that called *ferramenta* or σιδήριος, and is presently used by artisanal fishermen in Ensenada de Ceuta.[202]

[200] Two of the shellfish species, oysters and spiny dye-murex, can also live in estuarine environments.
[201] NIMA 131: 13
[202] Plautus, *Rudens* 310; Pliny, *NH* 11.52.139; Aristotle, *HA* 535a 10-20, 547 b 13. Similar to those used in Tetouan Bay (App. 6: *Cat. 1.8. Tetouan Bay*) and described in Section 7.2.5.1; Chamorro Moreno 1988: 489; Shafee 1999: 33-34, 43.

Some of these species can be sought along the rocky shoreline of the peninsula, especially of the Almina and Monte Hacho areas (Fig. 7.29), the south shoreline and to the west of La Ciudad: oyster, European thorny oyster, thorny/spiny oyster, knobbed triton (which can also live in sandy areas), banded dye-murex, China limpet, Safian limpet, other limpets (*Patella sp*.), red-mouthed rock shell and sea urchin. The method for prying limpets off rocks using a knife (iron saw: σιδήπω σχίζεται), and for baiting baskets for banded dye-murex is similar to that described for the limpets and *murex* species from *Tamuda*.[203] Both techniques are mentioned by ancient authors and practised by artisanal fishermen.[204]

The six terracotta weights dating to the combined Roman/Late Roman periods are relatively small and light doughnut- and rounded disc-shaped examples. A smaller, thin lead weight has also been recovered from this period. These could have lined the edges of cast nets (ἀμφίβολον, ἀμφίβληστρον, *funda, iaculum*) used in sandy shallows.[205] The shoreline immediately north of the La Ciudad area of the isthmus would have been an ideal location for using this fishing method, as well as the sandy shallows of Ensenada de Ceuta.

In addition, the fish hooks from the Roman and Late Roman periods could be used for hook-and-line fishing from the shore, either hand-lining or with a rod, to target the littoral fish species present at *Septem*: common seabream, dusky grouper and perhaps some of the mackerels if they pass close to the coastline.[206]

FISHING WITH A BOAT

Fishing from a boat, or using a boat in conjunction with fishermen on shore, also is indicated by the fishing equipment finds and marine animal remains from *Septem*. Although specific examples of the types of vessels used in the region in antiquity are not known, it can be conjectured that they were most likely small oared types, such as the *horeia*, *cydarium*, *vegeiia*, *placida* and *scapha*.[207] Modern non-motorised artisanal fishing boats are also comparable. As discussed in the pervious section relating to Tetouan Bay, the *qârəb* (between 6-8 m long) and *chebbak* (ca. 15 m long) types have been employed by fishermen

[203] Aelian, *NA* 6.55; see Section 7.2.5.1; see App. 6: *Cat. 3.9. Essaouira (5); Cat. 3.11. Oued Sous (3).*
[204] Aelian, *NA* 6.55; Guerra-García, *et al.* 2004: 325; Chamorro Moreno 1988: 489
[205] Table 7.14: nos 2-4, 6; Bernal Casasola & Pérez Rivera 1999: 68, Fig. 30A; Oppian, *Hal*. 3.80-82; Virgil, *Georgics* 1.141; Plautus, *Truculentus* 35-36.
[206] Table 7.14, no. 1. Seabreams are mentioned by Oppian as being caught with hooks: Oppian, *Hal*. 3.465-470, 4.364. No fish hook measurements are given in publications; three of these, on display in the Museo Municipal, Ceuta, are ca. 5 cm long (see also Hita Ruiz & Villada Paredes 1994: 26-27).
[207] See Chapter 3.2.2.

further south along the Mediterranean coast and presently ca. 5-6 m long *platera* types are used off of F'nideq, just south of the peninsula.[208]

Two shellfish species found during the Roman period at *Septem* live exclusively in the infratidal zone: spiny dye-murex (10-150 m depth) and spiny cockle (5-25 m depth) (specimens of the latter species, however, were collected on shore, see Section 7.3.4). The *murex* species would have been sought from a boat, as could many of the mixed intertidal/infradtidal shellfish species since their habitats extend past the tidal zone. Artisanal fishermen in Ensenada de Ceuta presently use a small bag dredge or towed rake with a net in sandy and muddy bottoms to catch cockles offshore between 10-20 m depth; scallops (found during the Roman period) are sought with this method from shallows to ca. 80 m depth (their maximum habitat depth).[209]

The terracotta and stone weights, found during the Roman/Late Roman periods, might also indicate that nets larger than cast nets were used from the beach (see Table 7.14). The stone weights, heavier and larger than the terracotta types, might have lined the base of seine nets (σαγήνη, *sagena*).[210] The sandy shores of Ensenada de Ceuta, and the north shore of the La Ciudad area are ideal locations for implementing the beach seine technique.[211] Oppian, Manilius and Aelian particularly describe this method for catching tunnies during their annual migrations, but mackerel may also be caught.[212]

These weights could also have been used to hold the bottom of a gill net (λίνοι), described by Oppian as a method by which mackerel are caught.[213] Gill nets today are used off the Mediterranean coast to catch small tunny as well.[214] The use of purse seines in the region to catch migrating species is also presently practised by artisanal fisheries; this method, or at least the use of nets with boats, might have been used in the region in antiquity.[215]

In addition to the beach and purse seines, another technique for catching oceanodromous species was a fixed net, such as a pound net. These could have been installed annually in the near-shore paths of migrating species found at *Septem* in the Roman and Late Roman layers:

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208 Rackow 1958: 36-37, Pl. XLIX; Shafee 1999: 35, 39, 53; Chaara 1996: 99-100; Malouli Idrissi, *et al*. 1999: 8-10; Villaverde Vega 2001: 136; see App. 6: *Cat. 1.9. F'nideq.*
209 Shafee 1999: 10-14, 25-26, 29, 34, 43; see also App. 6: *Cat. 1.8. Tetouan Bay*.
210 Table 7.14: nos 2-4, 6; Aelian, *NA* 12.43; Oppian, *Hal*. 3.80-82; Manilius, *Astr.* 5.678
211 Chenier 1788, I: 20; Purdy 1841: 7; Chaara 1996: 91-92; also used at Ksar-es-Seghir, in the Straits (H. Limane [INSAP], pers. com.).
212 Oppian, *Hal.* 4.491-501, 3.576-609; Manilius, *Astr*. 5.676-679; Aelian, *NA* 15.5
213 Oppian, *Hal*. 3.577-605
214 INRH 2002: 132
215 INRH 2002: 131; Timoule 1985: 52

Atlantic horse mackerel, Atlantic chub mackerel, Spanish/chub mackerel, Atlantic bonito and bluefin tuna (see Table 7.10).[216]

Modern fixed pound nets are referred to as *al-madraba*. These are attested as being used in Ensenada de Ceuta since the 15th century by al-Sabti, who also describes the *madāreb* as a long-standing method, used in nine locales around the peninsula, including Ensenada de Ceuta and one in the north bay, at a place called "*Madrid al Sabaka*".[217] In the 18th century, these nets were used not just to catch tunny but also smaller *Scombrides*, among other species.[218] Since the 19th century, a net has been set south of Monte Hacho, where is is established today; since 1947, a net has been set annually off Oued Smir (near M'diq), in the southern part of Ensenada de Ceuta north of Rasel el Aswad.[219] In the past, other *al-madraba* nets have been set closer to the Ceuta peninsula in the bay, one off Oued Negron and two just south of La Ciudad, off F'nideq. These were set in waters between 15-50 m depth.[220]

Additionally, fixed pound nets were set off the north shore of the peninsula, as mentioned by al-Sabti. This might have also been the case in antiquity, as lead anchor stocks, dating between 2nd century BC-1st century AD, have been recovered ca. 2 km off Punta Bernieja (Fig. 7.30).[221] These stocks were found in ca. 20 m water, and their position could certainly indicate an anchorage in the eastern lee of Montaña del Renegado. However, these anchors might also have been used, as in historical and modern times, to anchor pound nets. Similar finds are present in the Atlantic at Ras Achakar (in the western lee of Jebel Kebir, the headland of Cap Spartel) and offshore the site of *Baelo Claudia*, in Spain. Both sites could certainly be anchorages, but it is also significant that these sites are nearby Roman-period fish-salting complexes and modern *al-madraba* nets.[222]

Nine of the species of oceanodromous, pelagic and neritic fish found at *Septem*, recovered from the Roman to Late Roman layers, could also be caught from a boat using hook-and-line techniques. The finds of fish hooks from these periods, although of unknown size, suggest

[216] Alciphron, *Epistulae* 1.17.1; Manilius, *Astr.* 5.659-666; Oppian *Hal*. 3. 631-648; see Chapter 3.2.2.
[217] Al-Sabtī: 146-176; Hammam 1995: 155-157; Villada Paredes 2007: 8-9. A net is also referred to as a *sabaka* in the medieval period; it is not clear if this is a reference to a pound net, however; see Cherif 1990: 258.
[218] Cámara del Río 1988: species included bullet tuna, Atlantic bonito, chub mackerel, Albacore, as well as meagre and swordfish.
[219] Chaara 1996: 95; de la Serna, *et al.* 1999: 16-17; Cámara del Río 2007: 85
[220] INRH 2002: 130-132; NIMA #52039
[221] Bravo & Muñoz 1965; Villada, *et al*. 2007: fig. 3; Erbati & Trakadas 2008: 51; Kapitän 1984
[222] Trakadas, *in press*; Erbati & Trakadas 2008: 69; Ponsich 1976; Gianfrotta 1999: 19

that this method was practised.[223] Angling with a rod might have been possible, but hand-lining, described by Oppian, might have also been practised, as it is today in the Straits of Gibraltar off Ksar-es-Seghir to target larger tunny (ca. 3 m long).[224] It is also quite possible that draw nets (γρῖφοι) were used from boats to capture the smaller migrating species such as bonito and mackerel.[225]

Although dead whales can wash up on the shores of the Straits of Gibraltar and be exploited from the beach, the deep offshore and near-shore waters of the region were fished for these mammals.[226] Pliny identifies whales and fishing grounds near *Gades*, and Oppian describes whales passing through and being fished in the Straits and Sea of Alboran.[227] The method for capturing the marine mammals is described by Oppian as including harpoons used from vessels; such an apparatus is possibly depicted in the terracotta disc from *Tamuda*.[228] Other equipment used for whale fishing described by Oppian includes tridents and an elaborate hook with chains and goat-skin floats to keep the line aloft after the animal has been hooked.[229]

Specific offshore areas were fished during the Roman and Late Roman periods. The coral species present at *Septem*, *Dendrophillia ramea*, grows at 40-110 m depth, and such beds would only be accessible by boat.[230] Even if this particular specimen had been obtained accidentally, coral did become an important resource in the region, mentioned as being fished from small boats by Ibn H̲awk̲al in the 10th century.[231] Specific "coral grounds" in the Straits near Jebel Musa are mentioned in the 12th century by al-Idrîsî, and in the last century, 20-man boats would fish these banks by dropping a line tied to a large wooden cross with bag nets attached at the end of each arm (coral harvesting 'machine').[232] This method is attested by equipment finds from Graeco-Roman contexts in the Mediterranean; the fragmentary remains of a 5th-century BC boat that fished coral has been identified at Marseilles, possibly indicating early exploitation specialisation.[233]

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223 Table 7.14: nos l, 5, 7-9. Two hooks are ca. 5 cm long, from No. 20/21 Av. Sánchez Prados site (Hita Ruiz & Villada Paredes 1994: 26-27), another similar-sized hook, from one of the fish-salting sites, is on display in the Museo Municipal, Ceuta.
224 Oppian, *Hal.* 3.313-315; Srour & Abid 2002: 3-4; INRH 2002: 131; Carrera Ruiz, *et al*. 2000: 45
225 Oppian, *Hal*. 3.80-82; Bekker-Nielsen 2002b: 220-221
226 Personal observation on the beach in front of the Marshan plateau near Tangier Bay, July 2002.
227 Pliny, *NH* 9.5.12; Oppian, *Hal.* 5.56-61; see App. 4.1: *Text 6.d, 8.b.*
228 See Sections 7.2.3.4; see App. 5: *Cat. 1.* Some of the fish surrounding the "fisherman" have been interpreted as whales (see Bernal Casasola 2009b: 271-272).
229 Oppian, *Hal.* 5.121-315
230 Zibrowius 1980: 5, 169-172
231 Ibn H̲awk̲al: 75
232 Cherif 1990: 259-260; al-Idrîsî: §174
233 Gianfrotta 1999: 16; Galili & Rosen 2008b: 290-292; Pomey 2000; see Chapter 3.2.2.

7.3.5.2 The chronology of exploitation

PUNICO-MAURETANIAN PERIOD

The presence of salazón amphorae during the Punico-Mauretanian period indicates the transportation of salted products around, if not to and from the Peninsula de la Almina, beginning in the 5th and 4th centuries BC. The earliest examples include Mañá-Pascual A4 types followed by Mañá C2b types; it should be noted, however, that at present these amphorae have only been located under water off the northern shore of the La Ciudad area and in the Bay of Benzú.[234]

That marine resources were sought locally at *Septem* is clearly demonstrable at the end of the Punico-Mauretanian period, however. At this time, one *cetaria* at the Hotel la Muralla site began to operate (see Fig. 7.20, Table 7.16). In the 1st century AD, other areas for salting preparation began to be used at Nos 12 /13 Av. Sánchez Prados.[235] It is not known, however, what species were being processed during this period (see Table 7.10).[236] More directly related to fish-salting production on the peninsula at the transition of the 1st centuries BC/AD are the terrestrial salazón amphorae finds of Dressel 7-11 types (and its variants) and Dressel 14 types (see Table 7.17). The possible kiln of Dressel 7-11 types might also date from this period.[237]

ROMAN PERIOD

During the Roman period, fish and shellfish were sought along the shores of the Ceuta peninsula and possibly Ensenada de Ceuta, and were also sought offshore in the waters of the Straits and Mediterranean. Equipment finds indicate that fish were sought by hook-and-line techniques, and the marine species' habitats, contemporary texts and ethnographic comparison with regional artisanal fisheries suggest that the resources were also collected by hand, with small implements, by nets and possibly even by harpoon or using a coral harvesting 'machine'. At this time, fish-salting production also increased throughout the peninsula.

From the shoreline, ten shellfish species present during this period could be sought as their habitats include the intertidal zone: Mediterranean bonnet, knobbed triton, bittersweets, banded dye-murex, oysters, China and Safian limpets, scallops, red-mouthed rock shell and

[234] Bernal 2000: 1139-1140; Bravo Pérez & Villada Paredes 1993; Villaverde Vega & López Pardo 1995: 462; Bravo & Munoz 1965: 37, fig. 31; for Bay of Benzú finds, see also App. 3.3: no. 41.
[235] Bernal Casasola & Pérez Rivera 1999: 29
[236] Unknown species are found in the base of an amphora from the Hotel la Muralla site, and date to the 1st-2nd centuries AD, and are therefore also assigned to the Roman period; see Table 7.10: no. 1.
[237] See Section 7.3.3.5.

thorny oysters. In addition, sea urchin was also collected from the shoreline (see Table 7.12). However, some of the shellfish that inhabit the intertidal/infratidal and solely the infratidal zones were collected in beach surf zone as erosion on their shells indicate: pilose bittersweet, European thorny oyster, knobbed triton, red-mouthed rock shell and spiny cockle. The drilled pilose bittersweets seem also to have used as lamps.[238] Hook-and-line fishing might also have been practised from the shoreline, as demonstrated during this period by the finds of two medium-sized fish hooks.[239]

That fishermen went offshore to fish during the Roman period is indicated by the presence of spiny dye-murex shellfish and red coral that live in the infratidal zone (see Table 7.12). In addition, finds of bones of *Cetacea* (whale) and *Scombridae* (tunny, mackerel and bonito; see Table 7.10) suggest fishing methods that utilised boats for their capture. Whales may be caught by harpoon from a boat. The *Scombridae* could be sought during their near-shore oceanodromous migrations by hook-and-line techniques from a boat, or even by using a net from a boat, such as a draw net. Other possible methods could have been a beach seine drawn away from the shoreline by a boat, or a set pound net established slightly offshore. The maximum possible distance offshore that fishermen could fish to obtain these species found at *Septem* is indicated by the maximum habitat depth of the knobbed triton and Atlantic/Mediterranean scallop at 200 m (see Table 7.12). However, the *Scombridae* and *Cetacea* bones suggest that fishermen as today in the Straits, ventured farther offshore to deeper waters.

Fishing from shore is an activity that could have been practised year-round for most of the shellfish present during this period (as done by artisanal fisheries). However, spring would be a season better suited for oysters, and autumn, late winter and early summer for capturing *murex* (if used for dye). Late spring/early summer and late summer/early autumn would have been the period in which the migratory members of the *Scombridae* family were caught. Other offshore marine resources, such as the infratidal species of coral and spiny-dye murex, would be accessible year-round except during periods when the east *chegui* wind blows in the summer and in mid-March and mid-September.[240]

In the mid-1st century, a preparation area was developed at the Puerta Califal site, north-west of the extant *cetariae* at the La Muralla site. By the first half of the 2nd century, four additional salting complexes began to operate in the central and eastern parts of the La

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[238] See Section 7.3.4.
[239] Table 7.14: no. 1; no dimensions are given in the publication of these finds (Hita Ruiz & Villada Paredes 1994: 26-27); they are on display at the Museo Municipal, Ceuta.
[240] Gómez Barceló 2003: 9; NIMA 131: 13

Ciudad area: the Palacio de la Asamblea, No. 13 Calle Hermanos Gómez Marcelo, No. 20/21 Av. Sánchez Prados and Paseo de las Palmeras sites. A total of ca. 14 *cetariae* are known to have been used at the same time (for a minimum estimated capacity of 26 m^3), although the preparation areas and scale suggest more *cetariae* were almost certainly in use. In the 3rd century, the preparation area at the Hotel la Muralla site underwent some modifications and the *cetariae* at the Paseo de las Palmeras site went out of use (see Fig. 7.20, Table 7.16).[241]

Salazón amphorae are present during this period and largely associated with the fish-salting sites, serving as transport containers for these products. These types include Beltrán IIA/IIB types and the continued presence of Dressel 7-11 (and its variants) and Dressel 14 types. Towards the end of this period in the 3rd century, Almagro 50 and 51a-c types appear, and in the mid-3rd century, Beltrán 72 types appear (see Table 7.17).

ROMAN/LATE ROMAN PERIOD[242]

During this combined period, fish could have been sought from the shore but were mainly sought offshore in the Straits and the Mediterranean, and finds of fishing equipment indicate that hook-and-line and net fishing techniques were practised.

The fish hook finds from Paseo de las Palmeras site indicate that hook-and-line fishing took place, and these could have been used for shore-based or boat-based fishing.[243] In addition, six terracotta doughnut-shaped weights of small dimensions and one small lead weight could be used to line the edge of casting nets that could be used from shore or from a boat.[244]

That fishermen went offshore to fish is indicated by the habitats of the six species of fish found at *Septem* during these periods (see Table 7.10): John Dory, Atlantic bonito, Atlantic horse mackerel, common seabream, dusky grouper and Spanish/chub mackerel. The two stone weights are larger and heavier than those of terracotta, and could have been used to line seine nets or serve as footrope (or leadline) weights for a fixed net slightly offshore.[245]

The extant finds of fish species indicate that fishing was possible throughout the year, although the Atlantic bonito and mackerel species follow oceanodromous migration as other

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[241] See App. 3.1: *Site 16.*

[242] Some fish bones and fishing equipment finds are treated in both periods here as they are noted as coming from the fish-salting complexes assigned a broad date of 2nd-5th centuries.

[243] Table 7.14: no. 7; no dimensions are given in the publication of these finds (Bernal Casasola & Pérez Rivera 1999: 65).

[244] Table 7.14: nos 2-3, 6; Bernal Casasola & Pérez Rivera 1999: 68, Fig. 30A

[245] Table 7.14: no. 4; Galili, *et al.* 2002: 195. Stone weights are attested prior to the advent of terracotta and lead weights in Lattes, France (Sternberg 1998: 90).

Scombriade and *Carangidae*, entering the Mediterranean and passing by the Ceuta peninsula in the late spring/early summer, returning to the Atlantic in late summer/early autumn. These particular specimens of seabream and grouper, as noted above (see Section 7.3.4), were found with *Scombridae* remains, indicating that these fish were caught at the same time.

LATE ROMAN PERIOD

During this period, marine resources that were found at *Septem* were sought from the shoreline and offshore. Equipment finds indicate that hook-and-line fishing took place, and as in the previous periods, shellfish were likely collected by hand or with the use of small implements. At this time, salt-fishing continued on the peninsula.

From the shoreline, all seven species of shellfish present during this period could be collected: oyster, *Ostrea sp., Spondylus sp., Patella sp*., ribbed Mediterranean limpet, rayed Mediterranean limpet and banded dye-murex (see Table 7.12). Additionally, hook-and-line fishing could have been practised from the shoreline and from boats, as evidenced by finds of fish hooks from the No. 20/21 Av. Sánchez Prados and Plaza de África sites.[246]

Fishermen would venture offshore, however, to catch the three species of marine fish that are present during this period: whales and the oceanodromous species of Atlantic chub mackerel and bluefin tuna (see Table 7.10).[247] The larger species could have been caught by using a harpoon or hook-and-line methods, and the smaller species by cast nets. Beach seine nets could also be used to catch the mackerel and tunny species and gill nets also could have specifically targeted the mackerel species. It is also very likely that fixed pound nets were utilised to capture the tunny; there is no archaeological evidence to demonstrate that this method was used at this time, however (see Section 7.3.5.1).

As in the previous period, the annual migrations of the *Scombridae* would mean that the mackerel and tunny species were sought between late spring and early autumn. The shellfish could be sought year-round, except for oysters, which are best when caught in the late spring or early summer.

Fish-salting continued during this period at *Septem*, albeit on a different scale than previously. After a period of disuse in the 3rd century, the salting area at the Paseo de las Palmeras site began to operate again in the 4th century but the preparation area at the Puerta

[246] Table 7.14: nos 8-9. No dimensions are given in the publication of these finds (Hita Ruiz & Villada Paredes 1994: 47).
[247] Unidentified bones are also present during this period.

Califal site ceased to operate, after being refurbished in the 3rd century. By the 5th century, the *cetaria* and associated preparation area at the Hotel la Muralla site ceased to operate as did the *cetariae* at the Palacio de la Asamblea site, and the preparation areas at the No. 12/13 Av. Sánchez Prados site. In the late 5th/early 6th century, the Paseo de las Palmeras site ceased to operate as did the preparation area at the Plaza de África site; in the early 6th century, the *cetariae* at the No. 13 Calle Hermanos Gómez Marcelo and No. 20/21 Av. Sánchez Prados sites ceased to operate as well (see Fig. 7.20, Table 7.16).

The products of these fish-salting centres were transported in Beltrán 72, Almagro 50 and 51a-c salazón amphorae, which are present during this period and are associated with the salting sites (see Table 7.17).

7.3.6 Conclusions: the role of fishing at *Septem Fratres*

The archaeological evidence demonstrates the evolving role that marine resource exploitation played in the periods of occupation of *Septem Fratres*. It is possible that *Septem* was first settled due to its proximity to diverse and rich fishing grounds and marine species' migratory routes through the Straits of Gibraltar. The Phoenician-period occupation in the La Ciudad area (the Plaza de la Catedral site) has revealed the presence of shellfish, fish bones and fish hooks in the 7th century BC layers, indicating that marine resources were already sought, most likely for fresh consumption, at this time.[248]

An apparent hiatus occurred in relation to terrestrial activities until the late 1st century BC, when the re-occupation of the peninsula was initiated with the installation of a fishing enclave and salting site. By the 2nd century AD, the centre of the peninsula was occupied by at least five salting complexes. The relative number of shellfish and other invertebrates present is highest during the Roman period (14 species; see Fig. 7.23); the relative number of fish species is highest during the Roman/Late Roman period (six species; see Fig. 7.21). The extant evidence for fishing equipment (published material) is at present limited, but the finds do indicate the continued use of hook-and-line and net fishing during the Roman and Late Roman periods (see Table 7.14).[249]

Even though the fish species at *Septem* are not as numerous as at some sites in *Mauretania Tingitana*, such as *Lixus*, this may be a reflection of the immediate topography and perhaps

[248] Villada, *et al.* 2007: 487; Villada Paredes, *et al.* 2007: 133
[249] These include published finds and those on display at the Museo Municipal, Ceuta. The *SAGENA* project is documenting earlier material that will include other finds of fishing equipment and marine animals.

also the focus of fishing effort.[250] The Peninsula de la Almina is surrounded by marine waters and there are no nearby estuaries or rivers, except those that empty into Ensenada de Ceuta such as Oueds Negron and Smir, ca. 10 and 17 km to the south, respectively.[251] It might have been that due to the peninsula's location that less effort was required to target the abundant migratory species that passed by. Probably from the initial establishment of the salting sites, the main species sought were various types of mackerel, possibly to make *garum* and *allex*, as proscribed by Pliny.[252] If this is the case, the main period of fishing activities would be more concentrated in the summer months, from June/July to August or even October/early November.[253] However, the species of shellfish present at *Septem*, ethnographic comparison of artisanal fisheries and the historical placement of pound nets, indicate that shoreline and shallower near-shore waters of Ensenada de Ceuta were also targeted as fishing grounds.

It is possible that the local population consumed fresh marine resources. However, the early presence of the processing sites in the centre of *Septem* suggests that salting was a significant aspect of the settlement's activities, if not central to its existence. It is certain that the salting complexes were larger and possibly more numerous than the extant archaeological finds of 14 *cetariae*: the differing chronology of the salting sites and preparation areas suggests that there are other areas, as yet unexcavated or perhaps destroyed, that could demonstrate processing activities (see Table 7.16). The disparate archaeological evidence and urban nature of the peninsula, however, makes it difficult to ascertain the full extent of the industry.

The presence of salazón transport amphorae, a tentatively-identified kiln and the dominance of salting factories on the peninsula over other types of structures suggest that the salted products were made in quantities in excess of local needs, and during the Roman and Late Roman periods at *Septem*, these products were exported. In this case, the relationship between the peninsula and southern Iberia, seen in imported finewares and other material goods and particularly in similar salazón amphorae types, is significant for providing evidence of a trade connection. *Septem*'s products could also have been exported beyond the Straits of Gibraltar region.[254]

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[250] For *Lixus*, see Chapter 7.4.
[251] At the mouth of Oued Smir is situated a series of *cetariae* at the Sania e Torres site (see App. 3.1: *Site 15*).
[252] Pliny, *NH* 31.43.94
[253] See Section 7.3.3.3.
[254] Amphorae might have been supplied to *Septem* from southern Iberia, particularly those with SOC/SOCI stamps found at Ceuta and Puente Melchor, southern Spain; also Almagro 51 types connected with kilns at Huerta del Rincón (Torremolinos, Málaga): Pérez Rivera & Bernal Casasola

The fish-salting industry was perhaps affected by the political changes taking place in the province and region in the 5th century; in particular, the incursion of the Vandals into *Septem* in AD 426 might have meant a cessation in production. Certainly three of the salting sites went out of use during this century as did three preparation areas. However, two of the salting sites continued to function into the 6th century (see Table 7.16).

Marine resource exploitation, however, continued to play a significant role in the occupation of the peninsula after the Late Roman and even Byzantine periods. This is demonstrated by the repeated mention of *Septem* (now *Sabta*) as a large fishing port by medieval Arab geographers such as al-Bakrî and al-Idrîsî in the 11th and 12th centuries.[255] Generally, these descriptions are echoed in the 16th century, as the waters of the peninsula are referred to as containing "hundreds" of fish species.[256] The focus of these descriptions during the medieval period, however, is not on mackerel species (as it appears to have been during the Roman and late Roman periods), but mainly on tunny and also coral.[257] Icthyo-faunal finds of bluefin tuna from this period in the La Ciudad area support this identified fishing effort.[258] The salting of these resources, initiated during the Late Punico-Mauretanian period, also continued to be practised well into the medieval period. Medieval *cetariae* are present at the No. 12 Av. Sánchez Prados site, and the geographer al-Zouhri writes of tunny being salted (as a product called *moxama*) and exported to other Maghreb and Christian lands in the 12th century.[259]

1998: 261; Bernal Casasola & Pérez Rivera 1999: 65; Bernal Casasola & Pérez Rivera 2000: 862-865, 870-871; Baldomero, *et al.* 1997; Villaverde Vega & López Pardo 1995: 468, 471-472; Bernal Casasola 1996; Villaverde Vega 2001: 297; contra Teichner & Pons Pujol 2008; Pons 2007. Iberian finewares: Roca Roumens & Fernández García 1988.

255 Al-Idrîsî: §172-173; al-Bakrî: 208-209; for al-Qazwini, see Hammam 1995: 155; Siraj 1995: 478; Trakadas 2008: 31.

256 In a 16th-century Portuguese navigational treatise (Ricard 1927: 231-232).

257 Al-Idrîsî, §173; al-Zouhri: 801-803; Hammam 1995: 153; see Villada Paredes 2007: 7-14.

258 Bluefin tuna (*Thunnus thynnus*) bones found between Calles Gran Vía & Jáudenes date to the 10-11th centuries (Chamorro Moreno 1988: 480).

259 Al-Zouhri: 801-803; Hita Ruiz & Villada Paredes 1994: 20-24; Gozalbes Cravioto 2008: 247; F. Villada Paredes (Instituto de Estudios Ceutíes, Ceuta), pers. com.

7.4 *Lixus*

7.4.1 The history of the site

The site of *Lixus* is presently located ca. 4 km inland from the Atlantic coast, at the northern extent of the Rharb plain (Fig. 7.31-7.33). The archaeological remains cover ca. 75 ha and extend over the summit, northern, southern and eastern slopes of an 85 m-high limestone plateau. This plateau is presently bordered to the west and south by the winding course of the tidal Oued Loukkos (ancient *Lixus* or *Lixos fl.*), which empties into the Atlantic through a break in the coastal sandstone ridge, north of the modern city of Larache. In antiquity, a large open lagoon filled the present river basin between the site and the Atlantic coast (see Section 7.4.2).[260]

The Loukkos valley and the plateau, called Chumis (or Tchemmich) locally, were first proposed by H. Barth in 1849 to be the *Lixus* region mentioned by ancient authors.[261] The Chumis plateau was more solidly identified as *Lixus* in 1878 by C. Tissot, who investigated the visible remains and mapped the site's extent.[262] Archaeological investigations were initiated at the site 1889 by H. de La Martinière, who focused on exposing the enclosure walls and confirmed the early occupation of the site with the discovery of a "Phoenician" inscription and the recovery of Roman-period material.[263] Excavations were conducted on the eastern face and southern foot of the plateau by C. Montalbán during various campaigns between 1923 and 1936.[264] Systematic excavations of the site were begun by M. Tarradell in 1947-48, continuing until 1964. Initially these investigations focused on the large structures on the summit of the plateau and its southern foot where fish-salting complexes were identified. Later investigation included the southeast edge of the summit, where two main trenches were opened: Sondeo del Olivo and Sondeo del Algarrobo (Fig. 7.34).[265] In the late 1950s and early 1960s, M. Ponsich collaborated with Tarradell, with excavations focused upon the summit and the public structures at the east of the site and the remainder of the fish-salting area.[266] Between 1995-2005, the main excavations at the site were renewed by an INSAP/University of Valencia team, working in the Sondeos del Olivo and Algarrobo

[260] Carmona González 2005: 10-11; Aranegui Gascó 2005b: 272, fig. 2
[261] *Lix* and *Lixos*: Psuedo-Scylax, *Periplus* §112; Hanno, *Periplus* §6; Pomp. Mela, 3.92, 3.107; Pliny, *NH* 5.1.2-5.1.4; Aranegui Gascó & Tarradell-Font 2001: 15; Gozalbes 2008: 49.
[262] Tissot 1878: 203-221
[263] De La Martinière 1890
[264] Aranegui Gascó & Tarradell-Font 2001: 18; M. Lenoir 1992: 274
[265] Aranegui Gascó & Tarradell-Font 2001: 19-26; Tarradell 1958: 372-378; Habibi 2001a: 6
[266] Ponsich 1981; Ponsich 1966a: 394; Ponsich 1966b; Ponsich & Tarradell 1965: 9-37; Ponsich 1988: 103-136; Aranegui, *et al.* 1992; Aranegui Gascó & Tarradell-Font 2001: 26

trenches, with a new trench opened between them, Ladera Sur.[267] Since 2005, the same team has renewed excavations at the southwest plateau summit.[268]

During the late 8th and early 7th centuries BC, small structures were built along the southern edge of the *Lixus* plateau including a house with a metallurgy workshop.[269] The material culture associated with these structures is western Phoenician (Iberian); at the same time, the presence of local pottery attests to an indigenous presence, or at least occupation of the plateau prior to the Phoenician arrival.[270] After a hiatus in occupation, imported wares from Iberia, Greece, the Italic peninsula and Africa appeared in the 6th century, the beginning of the Punico-Mauretanian period. At this time, a series of storage rooms were built on the southwestern edge of the plateau summit.[271] Additionally, three necropoli were established several hundred metres north-west of the plateau.[272]

By the end of the 3rd century or possibly in the early 2nd century, a wall was built to enclose the summit.[273] At this time, ceramics are represented by imported Iberian, Attic and Italic finewares, and local amphorae and imitation finewares made at Kouass.[274] By the early 1st century, more structures appeared on the summit, including a portico building and houses built over the earlier storage rooms. During the period of Juba II's reign (25 BC-AD 23/24), a large hemi-cycle structure (Structure H) was built at the northern side of the main plateau.[275] Some destruction by fire is discernable on the plateau in the early 1st century AD, and this has been linked to the revolt of Aedemon, after the murder of Ptolemaios, ca. AD 40.[276]

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[267] Aranegui Gascó 2001; Aranegui & Habibi 2005; Habibi 2001a
[268] Aranegui & Mar 2008; Hassini & Aranegui 2007
[269] Aranegui & Mar 2008: 430-431; López Pardo 1990a: 16-18; Rouillard 1992; Aranegui Gascó 2007: 376. See Chapter 2.2.3 and Table 2.2 for comparable chronologies applied at this site for the pre-Roman layers.
[270] Ceramics include beaked lamps, red-slip plates and oenochoes; Brouquier-Reddé, *et al*. 2006: 2160-2162; Aranegui, *et al.* 1992: 11; Habibi 1992: 146-147; Aranegui Gascó & Habibi 2004: 136; Maass-Lindemann 1992; Belén, *et al.* 1996: 342-352; López Pardo 1992b.
[271] Material includes black-glaze Attic ceramics, Italic finewares and amphorae from Iberia, the Italic peninsula and Africa; Rouillard 1992; Aranegui Gascó 2005b: 273-274; Bonet-Rosado, *et al.* 2005: 107-132; Hassini & Aranegui 2007.
[272] At Rekkada; H. Hassini (Musée Archéologique, Larache), pers. com.; A. Elboujaday (Délégation de la Culture, Tangier), pers. com.
[273] Behel 1992: 244-247; Tarradell 1958: 372, 375
[274] Kouass amphorae include Mañá-Pascual A4, Mañá C2b, Ramòn T-8.1.1.2; Aranegui Gascó & Habibi 2004: 142; Aranegui Gascó 2005b: 274; Aranegui Gascó, *et al.* 2000: 15-16.
[275] Brouquier-Reddé, *et al*. 2006: 2162-2164; Habibi 2001b: 74-76; Ponsich 1981: 82-88; Ponsich 1966b:18-20; Aranegui & Mar 2008: 430-437
[276] Dio Cassius, 59.25.1; *CIL* VIII, no. 8630; M. Lenoir 1992: 271-272; Gozalbes Cravioto 2005; Gonzalbes Cravioto 1996: 256-258; see Chapter 4.3.

After the revolt was suppressed throughout the region by Roman military campaigns, *Lixus* was made a *colonia* under Claudius, and the settlement experienced a period of urbanisation and expansion in the latter half of the 1st century AD.[277] On the summit, or the so-called "temple quarter", larger structures were built, such as the central portico temple (Structure F) and a semi-circular temple (Structure G) and their annexes and courtyards; a bath complex was constructed near Structure H (Fig. 7.35).[278] The domestic area extended to the north and north-east of the temple quarter and to the east of the plateau a theatre-amphitheatre and adjoining baths were built; these new constructions were enclosed by a perimeter wall (Fig. 7.36).[279]

At this time, fish-salting complexes were built, lining a strip of land between the present riverbank and the foot of the plateau (Fig. 7.37, see Fig. 7.34). Four of these complexes are possible to date to the mid- or second half of the 1st century (Complexes 1, 6, 9, and 10) and five can be no more securely assigned a foundation date other than the 1st century (Complexes 3, 4, 5, 7 and 8); Complex 2 was established at the end of this century.[280]

Peristyle houses with mosaic floors, the so-called houses of "Mars and Rhea", "Helios" and "Three Graces" were built probably in the 2nd century – the first two on the summit behind the temple quarter, and the third to the south-east of the plateau close to the river.[281] In the middle to later part of this century, salting Complex 2 was remodelled. In the 2nd and 3rd centuries, modifications too were made to the temple quarter, with Structure H being altered into a large bath complex.[282]

The reduction of the size of the province towards the end of the 3rd century is reflected in the more extensive modifications to the city's layout. The city remained under Roman governance, but now lay at the southern edge of the administered province, possibly with a cohort stationed here.[283] At this time, the houses of Mars and Rhea and the Three Graces also suffered destruction by fire.[284] A new circuit wall that reduced the size of the city was built at this time or in the early 4th century. It enclosed the north end of the temple quarter and

277 Rebuffat 1999: 265-269; Pliny, *NH* 5.1.2
278 Brouquier-Reddé, *et al*. 2006: 2162-21266. See also Ponsich 1981 for early analysis of structures.
279 Some areas of the plateau were not occupied, however; i.e., at Sondeo del Algarrobo very little Roman material has been found (Aranegui Gascó & Habibi 2004: 131-132; Tarradell 1960a: 153; Belén 1996). For the theatre-amphitheatre, see Hallier 2003: 352-354, 364-367; it has been argued that the theatre could have been built during the reign of Juba II; see M. Lenoir 1992: 278.
280 See App. 3.1: *Site 36*; Ponsich & Tarradell 1965: 9-37; Ponsich 1988: 103-136; Trakadas 2005: 65-66; new dates given in Habibi 2007; see also Bernal Casasola 2008: 42.
281 M. Lenoir 1992: 275-276
282 Brouquier-Reddé, *et al*. 2006: 2166; E. Lenoir 1992: 295-298
283 *Not. Dig. Occ*. XXVI; Villaverde Vega 2001: 62, 117-119; Rebuffat 1992; Hallier 2003: 367-371
284 M. Lenoir 1992: 272-273

possibly encircled the top of the plateau to the south. Another wall extended south-east from the plateau to the river to the east of the fish-salting complexes. The theatre-amphitheatre was left outside the new walls and turned into a necropolis and burials were also placed at the western edge of the plateau.[285]

Four of the fish-salting complexes (Complexes 3, 5, 6 and 7) went through a period of disuse by the late 3rd or in the early 4th centuries; most underwent remodelling so that *cetariae* were reduced (false floors or division walls inserted) or filled-in completely and paved over. By the later part of the 4th century, Complexes 4, 5, and 7 were abandoned, with the rest ceasing operations in the early 6th century. Complexes 6 and 9 possibly still functioned into the 7th century.[286]

Inside the city walls, structures were modified or reduced in the 4th century, and the presence of very little material from the 5th and 6th centuries is thought to signify a period of abandonment.[287] The introduction of Islam into the region is demonstrated by the presence of a small mosque erected on the southeastern edge of the plateau in the 8th century. Subsequent occupation is demonstrated by the occasional finds of medieval material dating to the 12th-15th centuries, suggesting a small population occupied the plateau prior to establishment of Larache at the mouth of the Loukkos.[288]

7.4.2 The marine environment

Geological coring studies have contributed to the reconstruction of the immediate marine environment surrounding *Lixus* during antiquity, indicating that the Oued Loukkos basin ca. 2,500 BP was a large open lagoon. This lagoon, estimated to be ca. 2,700 ha with a depth of several metres, extended from the base of the *Lixus* plateau to the present Atlantic coastline, a distance of ca. 4 km (Fig. 7.38). The river emptied into this lagoon just south-east of the *Lixus* plateau, and its embouchure has migrated further west during the medieval and historical periods.[289] The connection between the reconstructed lagoon and the Atlantic is not well understood; it has been identified as the narrow opening between the fossil dune ridge

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285 Akerraz 1992: 379-380; Brouquier-Reddé, *et al*. 2006: 2166-2169; Aranegui, *et al.* 2007: 205; Ponsich 1966b: 20; Villaverde Vega 2001: 122-125; E. Lenoir 1992: 289-292; Hallier 2003: 365-366
286 Ponsich & Tarradell 1965: 9-37; Ponsich 1988: 103-136; revised in Habibi 2007.
287 LR 2 amphorae present at the site. Aranegui Gascó (2005b: 274) and Villaverde Vega (2001: 122-125) cite 5th-century material present in the temple quarter.
288 Akerraz 1992: 382-383; Aranegui Gascó 2005b: 274; Elboudjay 2002
289 Pliny (*NH* 5.1.2-5.1.4) describes the situation at *Lixus* as "an arm of the sea stretching inland here with a winding channel…", at least indicating that the extant river had a meandering course.

(the present mouth of the Loukkos).[290] This lagoonal situation is very similar to that of the estuarine lake of Merja Zerga, at Moulay Bou Selham (40 km south of the Loukkos).[291]

The Loukkos in antiquity was tidal, with a regime likely close to that at present, between 2.1-2.9 m.[292] In the last century, prior to the construction of dams upriver, the Loukkos' lower course (up to the site) was navigable by small vessels under 8 m; the river's lower reaches ca. 2,500 BP were also possibly navigable, although the character of the channel is not known.[293]

Inside the river mouth would have been a safe anchorage, and vessels historically and at present anchor here (Fig. 7.39).[294] Although there has been no archaeological investigation regarding possible areas of land-sea interface, it has been postulated that two harbouring zones were present at the site. One was on the western side of the plateau during the Punico-Mauretanian or even Phoenician periods. Another was likely situated south of the plateau inside the river mouth, in front of the later fish-salting complexes.[295] This second area was also probably used in subsequent periods as it would have been easy for fishermen to deliver their catches directly to the salting complexes that developed during the Roman period.[296] In the 1st century AD, a *titulus pictus* notes "*port(uensis) Lix(itana)*", 'port of *Lixus*', suggesting the character of the site at this time.[297]

C. Tissot, during his investigations at the end of the 19th century, identified this second area as a fluvial harbour basin from the Claudian period (Fig. 7.40). Tissot outlines a polygonal basin over 50 m in length, with jetties and moles, just above the modern (19th century) high-tide zone of the river.[298] During H. de La Martinière's excavations in 1889, several test trenches are noted as being made in the "port de Tissot", located on his map, but no finds are mentioned (Fig. 7.41).[299] The basin has not been identified since, and at present the Larache-Tangier road runs through the area as well as over some fish-salting complexes.[300]

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[290] See Chapter 5.5.3; Carmona González 2005: 10-11; Aranegui Gascó 2005b: 272, fig. 2; Aranegui Gascó 2007: 373.
[291] See Chapter 5.3.3; App. 6: *Cat. 3.4. Merja Zerga.*
[292] Evidence of tides in sediment cores: Carmona González 2005: 10; modern tidal regime: NIMA 143: 200.
[293] Rouch 1931: 2
[294] Montagne 1923: 178-179; Merry del Val 1920: 338
[295] Aranegui Gascó 2007: 373-374; Aranegui Gascó 2005b: 271, 273; Aranegui Gascó 2007: 375
[296] A process generally described by Manilius, *Astr*. 5.656-681; Trakadas 2005: 69.
[297] Tissot 1878: 211-212; Liou & Rodríguez Almeida 2000: 11, n. 1; see App. 4.2: no. 30.
[298] Tissot 1878: 211-212; Ponsich 1966a: 390-393, Pl. VII; Ponsich 1981: Pl. IV, Pl. IX; Villaverde Vega 2001: 126; Aranegui Gascó 2005b: 274-274bis
[299] De La Martinière 1890: Pl. VII
[300] De La Martinière 1890; Aranegui Gascó & Tarradell-Font 2001: 16-17, fig. 3

A small opening in the coastal sand dune ridge, to the west of the site, connected the lagoon to the Atlantic Ocean. Just offshore this stretch of sandy beach and cliff-faced coast, the bathymetry is flat and sandy-bottomed with very little relief as it consists of lithified ancient beaches.[301] The 50 m isobath is an average of ca. 11 km offshore, whilst the 100 m isobath is 26 km offshore (Fig. 7.42).[302] Navigation in this area is affected by the dominant, southward-flowing Canary Current which joins the anti-cyclonic Eastern Boundary Current; a week northward flowing counter-current is overrun by the very strong north-south tidal runs.[303]

The near-shore winds from the west, north-west and south-west and persistent large swells out of the north-west can affect vessels in these coastal waters. This is especially the case during the winter months when the swells' amplitude increase (September to April).[304] At Larache particularly, it is a difficult obstacle for small fishing boats to try to navigate in and out of port as these arrive without warning, and without change in the weather. Generally artisanal fishermen shelter their boats by drawing them on shore.[305]

7.4.3 Evidence of marine resource exploitation

The evidence related to marine resource exploitation during the Punico-Mauretanian to Late Roman periods at the site of *Lixus* is derived from both archaeological and descriptive sources (see Fig. 7.34, Table 7.18). Of the archaeological material, the largest group derives from the published finds of salazón amphorae and the fish-salting complexes at the southern foot of the plateau. These complexes were excavated in the 1920s-30s and again in the late 1950s;[306] recent re-analysis of the ceramic material has altered the original chronology proposed for these.[307] The earliest excavations at the site of *Lixus* have preserved little icthyo-faunal or malacological evidence. Only ceramic and metal finds from de La Martinière's excavations appear to be preserved.[308] Montalbán's campaigns of the plateau and fish-salting complexes have preserved no relevant material; in Ponsich and Tarradell's publication of the complexes, a few fish bones and shellfish are noted without context.[309] From Tarradell's excavations of the site are the unpublished remains of two fish and numerous shellfish species. The publications of the recent excavations by the INSAP/University of Valencia team at Sondeos del Algorrobo and Olivo and Ladera Sur,

[301] Hinz, *et al.* 1982: 35; Jaadi 1981: 42-50
[302] Snoussi 1980: 8; Tejera de Leon 1980: figs 13-14
[303] Batteen, *et al*. 2000: 14173-14175; Hagen 2001: S114-S117, fig. 3; NIMA 143: 1999
[304] NIMA 143: 200; Montagne 1923: 178-179; Merry del Val 1920: 338; Rouch 1931: 18-21
[305] Montagne 1923: 178-179
[306] Ponsich & Tarradell 1965: 9-37; Ponsich 1988: 103-136
[307] Habibi 2007
[308] De La Martinière 1890. The amount of material from his excavations is very small and stored at the Louvre, see Aranegui Gascó & Tarradell-Font 2001: 17.
[309] Aranegui Gascó & Tarradell-Font 2001: 18; Ponsich & Tarradell 1965; Ponsich 1988

document abundant icthyo-archaeological and malacological remains.[310] Fishing equipment from the earlier excavations remains unpublished and some of it derives from unknown contexts; similar material from the excavation of fish-salting Complex 5 in the late 1950s has been cursorily published.[311]

The descriptive evidence relating to marine resources at the site is not as abundant as the archaeological material. General indications are made of the area and its marine life by Pliny and Strabo; more specific evidence derives from *tituli picti* on amphorae found outside *Mauretania Tingitana* in the western Mediterranean and Central Europe. Pictorial evidence derives from coins that were minted at *Lixus*. Additional material is supplemented by medieval, historical and modern observations on species presence and regional fishing and salt production techniques.

7.4.3.1 Marine species exploited

Thirty-eight different species of fish are present at *Lixus*, with evidence deriving from finds of fish bones (37 species; Table 7.19) and *tituli picti* (one species; Table 7.20) (compiled in Table 7.21, Fig. 7.43).[312] These represent 14 families (and orders), the most common being *Sparidae* (Fig. 7.44). Twenty-seven different species of shellfish and one species of coral are present at *Lixus*, with evidence deriving solely from archaeological finds (Tables 7.22-7.23, Fig. 7.45). The shellfish represent bivalves and gastropods (Fig. 7.46).

7.4.3.2 Habitats

Of the 38 species of fish present at *Lixus*, the most common environment is marine for all periods; the second most common environment is marine/freshwater/estuarine (Fig. 7.47). Species that are very common to Atlantic-Mediterranean lagoonal environments are also well represented: European eel, European seabass, flathead mullet and gilthead seabream.[313] The fish at *Lixus* are benthopelagic, neritic, pelagic, oceanodromous and demersal species that occupy coastal waters to the upper continental shelf with the deepest habitat extending to 700 m (represented by European eel).

Of the major environments in which the 28 species of marine invertebrates present at *Lixus* inhabit, the most common is marine (except those from unknown contexts) (Figs. 7.48-7.49).

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[310] Grau Almero*, et al.* 2001; Rodríguez Santana & Rodrigo García 2005; Aranegui Gascó, *et al*. 2006; Aranegui, *et al*. 2007
[311] Ponsich & Tarradell 1965: 24
[312] For identification of "COD" in *tituli picti* as *cordyla* (young tunny: probably bluefin tuna, *Thunnus thynnus*), see App. 4: *metadata*; see below Section 7.4.4.
[313] Pérez-Ruzafa, *et al*. 2007: 112

Of the minor environments, most species inhabit the intertidal/infratidal zones. These species are also distributed amongst a variety of bottom types: rocky shorelines, gravel and hard mud bottoms, to sandy littorals and sea grass bottoms.

7.4.3.3 Seasonality

Many fish species that are present at *Lixus* undergo migrations, either as part of the diadromous life cycle, moving between freshwater and saltwater environments, or passing by the region during oceandromous movements or seasonal upwelling events.

During the spring are the migrations of the anadromous members of the *Clupeidae* family (herring, sardine, shad, menhaden), present at the site in the Punico-Mauretanian layers. In May, shad migrate from the ocean upstream to spawn in the tidal rivers of Morocco's Atlantic coast. This species' migrations were noted at Larache in the 19th century, and in the early 20th century this species was noted as abundant, migrating extremely long distances upriver.[314] Another member of the *Clupeidae* family, European pilchard, present during the Punico-Mauretanian period, are most abundant in spring when they come inshore.[315]

Also beginning in the late spring, and extending through the summer months are the oceanodromous migrations of members of the *Scombridae* and *Carangidae* families. The mackerel species of these families (Atlantic horse mackerel, Spanish/chub mackerel, and *Scomber sp*.), found at *Lixus* during the Punico-Mauretanian period (with one examples from context unknown) arrive on the Atlantic coast of Morocco in April/May, disappearing by September.[316]

The larger members of the *Scombridae* family, bluefin tuna, begin their oceanodromous migration from the Atlantic to the Mediterranean in the late spring as well, arriving off the coast the Larache beginning in May/June. These are thought to be better than when they return after they spawn, at the end of July/September.[317] During this return period, the young tunny under a year old, known as *cordyla*, also appear; these fish are known from *tiutli picti* to have been a product of *Lixus*, and therefore must have been caught only in the late

[314] Leared 1870: 315; Gruvel 1923: 119; Ponsich 1981: 20; see also App. 6: *Cat. 3.5. Oued Sebou.*
[315] Furnestin & Furnestin 1959: 82; Kifani 1998: 237, 245; Wheeler & Locker 1985: 100
[316] Rodríguez, *et al.* 2006: 885-886, 892. The British consul in Tangier in the 19th century recorded when Spanish and Portuguese fishermen came to the Atlantic Moroccan coast to fish for mackerel (Guennoun 2006: 1911-1912).
[317] Gruvel 1923: 43; Timoule 1985: 61; Ponsich 1981: 20, n. 13; Ponsich 1966a: 394

summer or early autumn (see Table 7.20).[318] Also in the summer, common pandora come near shore, moving to deeper water in winter.[319]

In autumn, diadromous European eels present during the Punico-Mauretanian period at *Lixus,* migrate down river. The juveniles enter estuarine and upstream freshwater environments in the spring, where they mature before returning to the open ocean as adults later in the autumn. This species is caught in artisanal fisheries in the Oued Sebou, a tidal river to the south of the Loukkos, in the summer, however.[320] It is also in the autumn that shad and pilchard can be captured, according to Oppian.[321]

Mussels, present in the Punico-Mauretanian and Late Roman periods at *Lixus*, are found in large quantities throughout the year, but are best in September and March/April.[322] Species of *murex* shellfish (banded dye-murex, spiny due-murex and unspecified members of the *Murcidae* family), found at *Lixus* in every period except Late Roman, are thought to be at their optimum for obtaining dyes if caught during the autumn, late winter and early summer. However, as a foodstuff, these are fished year-round in modern artisanal fisheries.[323] Oysters, found during the Punico-Mauretanian and Roman periods (and also from context unknown) are suggested by Classical sources as being best when collected during the spring or early summer.[324]

7.4.3.4 Fishing methods

Fifty artefacts related to fishing activities have been preserved from excavations at *Lixus* (Table 7.24, see Fig. 7.34). The find-group from *Lixus* represents two main types of fishing methods: hook-and-line fishing (evidenced by bronze fish hooks, a bone gorge and lead line weight) and net fishing (evidenced by terracotta, lead and stone net weights and the tools for making and repairing nets: bronze and bone needles and navettes). Archaeological evidence for hook-and-line fishing is present in all periods except Late Roman; evidence for net fishing is present in all periods except Late Roman (Table 7.25).

Twenty-one terracotta, lead and stone weights were found at *Lixus*. Although it is difficult to ascribe all of these finds as being used for fishing as some lack known contexts or contexts

[318] Pliny, *NH* 9.18.47; see also 32.53.146-147; see Section 7.4.4.
[319] Gruvel 1923: 60
[320] Gruvel 1923: 169-170; Loukili & Belghyti 2007: 683-684
[321] Oppian, *Hal.* 3.398-399
[322] Gruvel 1923: 87
[323] Aristotle, *HA* 5.15.547a; Pliny, *NH* 9.60.125-127, 9.62: 38-39; Cassiodorus, *Var.* 1.2; Ponsich 1970: 290; Vasconcelos, *et al.* 2008: 289
[324] Andrews 1948: 299-300; Aristotle, *HA* 607.b2; Pliny, *NH* 32.31.61-62

clearly associated with fishing activities (such as the fish-salting complexes), they are included here due to comparanda from fishing contexts elsewhere.[325]

7.4.3.5 Fish-salting practices

The evidence for salted-fish products at *Lixus* derives from the installations of *cetariae* adjacent to the Oued Loukkos. Finds of salazón amphorae at the site also indicate salted products were present, representing too the importation and exportation of goods.

SALTING COMPLEXES

Ten extant complexes comprised of at least 142 *opus signinum*-lined *cetariae* are present at the southern base of the *Lixus* plateau; certainly more lie under the Larache-Tangier road that now runs between the site and the river (see Fig. 7.37). The extant working area extends for ca. 180 m east/west and ca. 30 m north/south. Each of the complexes adheres to a rather generalised plan of a central work area, some with small depressions in the corner of the paved floors for collecting liquid refuse. The *cetariae* are set in the ground and are flush with the floor or set just slightly above (Fig. 7.50). The *cetariae* capacity for the ten complexes is estimated to be at least 1,013 m^3. These complexes began operating in the 1st century AD and the last complexes are believed to have ceased operating in the early 7th century (Table 7.26).[326]

There might be evidence of *salsamenta* production in Complex 9, as one of the *cetariae* was found to contain roof tiles. These have been found at other sites in France and the Black Sea region, interpreted as being used as weights in the *salsamentum*-making process described by Manilius and Columella. Alternatively, these could simply be the remains of the roof that may have covered the complex.[327] In addition, small ceramic pots called *marmites* (or *caccabi*) were found in the preparation room of Complex 1, and they could have been used in the *garum*-making process, as some recipes call for artificially reducing the mixture over heat.[328] Unlike the fish-salting complexes at Cotta and Tahadart on this coast, there are no known hypocaust/heating facilities at *Lixus* to suggest that this occurred. However, this does not preclude the possibility that the heating could have happened elsewhere at the site.[329]

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[325] See discussion in Chapter 3.2.2.
[326] See App. 3.1: *Site 36.*
[327] Ponsich & Tarradell 1965: Pl. VII; see salting process described in Chapter 3.2.3. Roof tiles have been found in vats in the Bay of Douarnenez in Gaul and in the Black Sea at Tyritake (Curtis 1991: 75, 122; Curtis 2001: 413-414).
[328] Finds: Ponsich & Tarradell 1965: 11-15; Ponsich 1988: 103-105; Ponsich 1970: 287-288. Recipes: Ps.-Rufius Festus (*Brev.*), and in the *Geoponica* (20.46.1-6).
[329] Ponsich & Tarradell 1965: 37

RESOURCES

The most necessary resources for salting, aside from fresh marine resources, were fresh water for cleaning before processing, and salt. There are numerous wells throughout *Lixus* and four cisterns are present amongst the salting complexes. A well with canals is also present between Complexes 6 and 10.[330]

The salt supply is more difficult to fix at *Lixus*. Although the Oued Loukkos basin is presently a centre of salt production, with a large number of *salinas*, the area where these are located is thought to have been an open lagoon in antiquity (Fig. 7.51; see Fig. 7.38).[331] It is possible that *salinas* may have been established further upriver (to the east) in almost the same manner as at present, or salt was transported from nearby sources, such as the *salinas* thought to have been situated at coastal plain of the Oued Garifa, at Kouass, 40 km north on the Atlantic coast.[332] Obtaining salt from seawater using artificial heat, or lixiviation, was a possible method practised at *Lixus*. However, this process also requires large amounts of fresh water, and, as noted above, no heating facilities have been identified in the complexes.[333] The process, however, could have been carried out elsewhere in the Loukkos basin.

AMPHORAE

There is evidence for the transhipment of salted-fish products at *Lixus* from the Punico-Mauretanian to Late Roman periods. This evidence derives from finds of salazón amphorae: Mañá-Pascual A4, Mañá C2b, Dressel 7-11 (and variant 12), Beltrán IIB, Almagro 50, Almagro 51a, 51c and Keay LVIIB types, dating from the 4th century BC to the late 5th/6th centuries AD (Table 7.27).[334]

No kilns have been identified at the site or in the immediate vicinity. Kilns that manufactured salazón amphorae found at the site have been identified as southern Iberian manufacture, mainly from the Cádiz and Málaga regions, but also there were more local sources: Kouass and *Banasa*, especially for the early types such as Mañá-Pascual A4 (and

[330] A cistern is present in Complex 6 of 39 m^3, one is in Complex 8 of 22 m^3 and two are in Complex 10 of 49 m^3 and 62 m^3, fed by an *impluvium* (El Khatib-Boujibar 1992).
[331] See App. 3.2: *Larache*; the Loukkos is described as the ancient salt source by Ponsich & Tarradell (1965: 101).
[332] See App. 3.2: *Kouass.*
[333] Hesnard 1998: 183-184; Nenquin 1961: 108-109; see Chapter 3.2.3 for discussion.
[334] Sala I amphorae are thought to contain olive oil (Boube 1987-88; Bonet Rosado, *et al.* 2005: 117-118, 131), although Rodriguez Santana & Rodrigo García (2005: 25) and Aranegui Gascó, *et al.* (2004: 373) suggest it is a salazón type; Keay LVIIB are included here as salazón amphorae based on their presence near fish-salting sites around Algeciras (Fumadó Ortega & Mlilou 2005: 81-82).

variants).[335] Mañá C2b types were locally made, at Kouass and *Banasa*.[336] Dressel 7-11 types were manufactured at *Thamusida* and a kiln site in the northern Rharb on the Oued Mdâ.[337] Beltrán IIB types were also made locally at *Thamusida* (see Fig. 7.31).[338]

7.4.4 Discussion

SALTED PRODUCTS

The fish-salting complexes of *Lixus* have generally been associated with the exploitation of tunny, based on the conclusions of Ponsich and Tarradell.[339] The association is difficult to verify, however, as no tunny bones have yet been identified at the site, except from an unknown context (see Table 7.19).[340]

The importance of tunny might be demonstrated by pictorial evidence, as fish appear on Punico-Mauretanian coins of *Lixus* (assumed to be tunny based on comparison with those from *Gades*, *Abdera* and *Sexi*).[341] In addition, ancient authors discuss the migration of tunny through the Straits of Gibraltar, 70 km north of *Lixus*. Certainly, the modern pound nets for tunny fishing (*al-madraba* nets), set off of the coast of Larache, indicate this species' close proximity to *Lixus*.[342]

The clearest association of tunny with *Lixus*, however, is derived from *tituli picti*, where a product, "COD" is noted on salazón amphorae found outside of the province; these *picti* date to the Punico-Mauretanian and Roman periods (see Table 7.20). This abbreviation has generally been accepted by epigraphers to mean *cordyla*, or young tunny.[343] The *tituli* also note that the product as "*vetus*", 'aged'. Several lines below, a number is sometimes given: "*AIIIA*" (*annorum trium*) or even "*AIIIIA*" (*annorum quadrum*), suggesting to some scholars

[335] Iberian manufacture: Bonet Rosado, *et al.* 2005: 127; Kouass: Kbiri Alaoui & Mlilou 2007: 71-76; Villaverde Vega 2000: 901-902; Aranegui Gascó, *et al.* 2004: 366-267; *Banasa*: Villaverde Vega 2000: 902; Girard 1984a: 59-60.
[336] Also thought to have been manufactured at Sala and *Volubilis*; López Pardo 1990a: 22; Ramón Torres 1995: 99; Aranegui Gascó, *et al.* 2004: 363-366; Domergue 1960: 499. There has been no analysis of fabrics to determine specific kilns, however (Kbiri Alaoui 2007: 219).
[337] Izquierdo Peraile, *et al.* 2001: 159-161; Oued Mdâ (sites AR 26, AR 40): Limane & Rebuffat 2004; *Thamusida*: Cerri 2007b: 40-41, fig. 7.
[338] Cerri 2007b: 40-41, fig. 7
[339] Ponsich & Tarradell 1965: 9-37; Ponsich 1988: 103-136
[340] Mentioned as "on the beach"; these in fact could even be modern in date; Ponsich 1988: 138; Ponsich & Tarradell 1965: 39.
[341] App. 5: *Cat. 2*; Aranegui Gascó, *et al.* 2000: 23; Ponsich & Tarradell 1965: Pl. XXIV; Trakadas 2005: 47-48
[342] Strabo, 3.2.7; Oppian, *Hal.* 3. 620-624; Athenaeus, *Deipnosophistae* 7.302c; see App. 4.1: *Text 2.b, 8.a, 9.a*; App. 6: *Cat. 3.3. Oued Loukkos (2).*
[343] See App. 4.1: *metadata* for identification discussion.

that the product was aged for three or four years.[344] If this is the case, it is possible that these products were 'aged' and stored in amphorae until ready for transport. No storage facilities have been noted adjacent to the fish-salting complexes, although a magazine of Dressel 7-11 amphorae (contemporary to the dating of the *tituli*) was located near the summit of the plateau. This structure has been identified as a storage area for amphorae waiting to be packaged for exportation.[345]

Other marine products that can be associated with *Lixus* are *garum* and *allex* (or *hallex*). Pliny does mentions that "the scomber [mackerel] is caught also in Mauretania…but it is used only for making *garum*."[346] He also mentions that "*allex* is sediment of *garum*, the dregs neither whole nor strained", and this can be taken to mean that *allex* could be made of mackerel.[347] Unlike at *Septem*, however, there is no direct evidence that mackerel was used for making *garum* in *Lixus*' *cetariae*, although several species of mackerel (Atlantic horse mackerel, Spanish/chub mackerel and *Scomber sp.*) were found at the site in the Punico-Mauretanian layers on the edge of the plateau (see Table 7.19).

The production of *allex* at *Lixus* is suggested by the connection of Pliny's statement, but also the find of a Mañá C2b amphora with a fish graffito on its neck.[348] Elsewhere in the Mediterranean, the Mañá C2a type is thought to contain *allex* based on *tituli picti*; a similar container, the western variant, therefore might have been used for a similar product in *Mauretania Tingitana*.[349] In addition, another Mañá C2b amphora was found at *Lixus* containing 28 mussel shells and grape seeds; this find has been suggested as the remains of a shellfish dish seasoned or preserved with vinegar.[350]

AMPHORAE PRESENCE

Some of the *tituli picti* found on amphorae in Central Europe, Spain and the Italic Peninsula denote young salted tunny, *cordyla,* from *Lixus*. However, the amphorae type upon which some of the *picti* are found are rare at *Lixus*. Some of the *picti* appear on Dressel 12 amphorae (see Table 7.20), but a majority are found on Beltrán IIA and IIB types, poorly represented at *Lixus*: only a few Beltrán IIB fragments have been identified from the

[344] Liou 1993: 140-143; Martínez Maganto 2000: 1212
[345] Aranegui Gascó, *et al*. 2004: 370, 372, figs 14, 19
[346] Pliny, *NH* 31.43.94; App. 4.1: *Text 6.j*
[347] Pliny, *NH* 31.44.95. Other evidence for scomber as an ingredient in *garum*: the Pompeii sauce of A. Umbricius Scaurus: *G(ari) F(los) Scombri* (Curtis 1988-89).
[348] App. 5: *Cat. 3*
[349] The contents of the African variant of this type (Mañá C2a/Dressel 18) are known to be *allex* based on *tituli picti* from the Praetorian camp in Rome (Aranegui, *et al.* 2007: 208; Aranegui Gascó 2005b: 273; Aranegui Gascó, *et al.* 2000: 17; Bonet Rosado, *et al*. 2005: 107).
[350] Aranegui Gascó, *et al*. 2006: 362; Sagrario Carrasco Porras 2005: 256-257, 259-260; Aranegui, *et al*. 2007: 208-209; Bonet Rosado, *et al*. 2005: 119, fig. 13

previous excavations at the site and less than 2% of all the amphorae fragment finds from the INSAP/University of Valencia excavations are this type.[351]

As there are no amphorae kilns as yet identified at *Lixus*, empty amphorae (or amphorae carrying other products that were then re-used for salted products) must have been imported to the site (see Section 7.4.3.5). Near the summit of the plateau, in addition to the magazines of Dressel 7-11 amphorae, another one of Mañá C2b amphorae has also been identified. These both have been proposed as storehouses of imported types that were intended for packaging and exporting *Lixus* products.[352] However, the lack of Beltrán II types at the site is curious; a kiln area recently identified at *Thamusida*, on the Oued Sebou, approximately 100 km south-east of *Lixus*, which operated from the 1st century BC to the first half of the 1st century AD, manufactured these types (see Fig. 7.31).[353] Like the Mañá C2b and Dressel 7-11 types, however, also imported to the site, a storage area might be expected as well as more finds of this type.

7.4.5 Summary

The history of the Punico-Mauretanian, Roman and Late Roman salting site and settlement at *Lixus* is relatively well understood compared to other sites within *Mauretania Tingitana*. Archaeological finds of marine animal remains, fishing equipment and fish-salting complexes, as well as contemporary texts, iconography and ethnography make it possible to note generally the past application of fishing methods, fishing effort and the role marine resources once played at the earlier lagoonal site.

7.4.5.1 Areas and methods of fishing effort

The reconstructed situation of *Lixus* would have allowed for direct access to a river and an open lagoon, with the Atlantic Ocean beyond. The extant icthyo-faunal and malacological evidence, predominantly of marine species, indicates, however, that the Atlantic was where the fishing effort was most concentrated during all periods (see Fig. 7.47-7.48).[354] Many of the species of fish found at *Lixus*, however, are diadromous species, and would have migrated between the different marine environments near the site, from the ocean to the less saline and fresh waters of the Loukkos upstream.

[351] Earlier excavations: Hassini 2001: 48-49, 81, 96-103, 160-163 (Tables 5-8); INSAP/University of Valencia excavations: found in the "Mauritania reciente" layer, AD 10-50; Bonet Rosado, *et al.* 2005: 123-125.
[352] Aranegui Gascó, *et al*. 2004: 370, 372, figs 14, 19
[353] Cerri 2007b: 40-41, fig. 7; Aranegui Gascó, *et al*. 2006: 359
[354] Except shellfish from context unknown.

FISHING FROM SHORE

The riverine and lagoonal environment immediately surrounding the site of *Lixus* would have been an ideal location for fishing.[355] Of the 28 species of shellfish and other marine invertebrates found at *Lixus*, a majority (21 species) live in a combination of marine/estuarine environments (see Table 7.22), and could have been caught in the lagoon's waters and the lower reaches of the river, as well as in the Atlantic. Of these 28 species, 22 live in the intertidal zone or both the intertidal/infratidal zones and are therefore possible to fish from the shoreline. As the tidal regime along the coast here is 2.1-2.9 m, low tide would have been an ideal period in which to obtain these catches.[356]

Some of these species can be sought along sandy or muddy bottom of the lagoon, river and ocean littoral: bittersweets, knobbed triton, striped Venus clam, cockles, scallops and Mediterranean bonnet. These can be hand-collected or by using a simple metal drag device or rake with bag attached. This last tool perhaps resembles a *ferramenta* or σιδήριος, similar to a rake used by artisanal fishermen in the Mediterranean, but is not presently known to be used along the Atlantic coast of northern Morocco.[357] Some of these shellfish species inhabit rocky shorelines: knobbed triton (which can also live in sandy areas), snails, mussels, banded dye-murex, the limpet species, red-mouthed rock shell and cowries. These species can be hand-collected or pried off hard surfaces using a knife (such as that described for *Tamuda* and *Septem*), mentioned by ancient authors and practised by artisanal fishermen.[358]

Hook-and-line techniques and small cast nets could have been used from the shoreline to target such inshore species as European eel, meagre, bogue, some of the mullet, seabass and seabream, pandora, bluefish and mackerel (see Table 7.19). Hook-and-line techniques, whether hand-lining, angling or even long-lining might be the most common methods used, as indicated by the many finds of fish hooks from the Punico-Mauretanian and Roman

[355] It is unclear how saline the lagoonal waters would have been at *Lixus* in the past. Coastal lagoons can have variable levels of salinity depending on river inflow and connectivity with the ocean (Pérez-Ruzafa, *et al*. 2007: 107-108). A marine shellfish species, *Tapes decussates* (checkered carpet shell) was found in cores in the basin, dated to ca. 5,000 BP, indicating an open ocean environment at this time; however, progradation of the river mouth, and the closing in of the lagoonal mouth was already taking place by ca. 2,500 BP, suggesting a more lagoonal/estuarine type of salinity (Carmona González 2005: 7-8).

[356] Evidence of tides in sediment cores: Carmona González 2005: 10; modern tidal regime: NIMA 143: 200.

[357] Similar to those used in Tetouan Bay and described in Chapter 7.2.5.1; Chamorro Moreno 1988: 489; Shafee 1999: 33-34, 43; Plautus, *Rudens* 310; Pliny, *NH* 11.52.139; Aristotle, *HA* 535a 10-20, 547 b 13.

[358] Aelian, *NA* 6.55; Guerra-García, *et al.* 2004: 325; Chamorro Moreno 1988: 489

periods.[359] Fishing with a rod (angling) might also have been a familiar method in this region of *Mauretania Tingitana*, as it is depicted on a mosaic from the inland site of *Volubilis* and on a lamp from *Thamusida* and is done here today.[360] A pyramidal lead line weight, or plummet (κάθετος, *perpendiculum*), found at the site in the Punico-Mauretanian layers, would have had a fishing line off tied to it or strung through its hole. The plummet would have rested on sea bed to keep the fishing line taut, or used at the end of the line, with hooks tied off to this, as a ground line.[361]

In addition, fishing with small cast nets (ἀμφίβολον, ἀμφίβληστρον, *funda, iaculum*), used in sandy shallows, are indicated by the small lead and terracotta weights, also found during the Punico-Mauretanian and Roman periods.[362] It is very possible that, in the same mosaic from *Volubilis* mentioned above, a cast net might also be portrayed.[363]

Trapping fish during their migratory cycles might also have been possible in the transition between the lagoon and river environments, aimed at targeting diadromous species present in the faunal record: *Clupeidae*, *Mugilidae*, European eel, meagre, thicklip grey mullet, European seabass, *Dicentrarchus sp.,* flathead mullet, bluefish and gilthead seabream (see Table 7.19). In the 16th, 19th and 20th centuries, shad (*Clupeidae)* were noted as migrating in the spring months up the Loukkos and fished at this time.[364] In the Oued Sebou south of the Loukkos, shad were caught and exported in the 13th century; presently nets are set by artisanal fishermen across the river to catch these fish and also *Sciaenidae* (meagre) species on their way upstream.[365] Gill nets are often strung across the migratory paths of these fish, set and retrieved at low tide, and these are set in the Oued Loukkos today.[366] Oppian

[359] Eels are presently caught in the littoral zone by artisanal fishermen using long-lines (Gruvel 1923: 169-170). See also App. 6: *Cat. 3.10. Cap Sim.*
[360] App. 5: *Cat. 4-5;* App. 6: *Cat. 3.3. Oued Loukkos (2)*
[361] Table 7.24: no. 14; Kuniholm 1982: 308. Comparable to examples from Israel, Turkey, Italy and France that date from the 5th century BC to 7th century AD (Galili, *et al.* 2002: fig. 2; Oleson, *et al*. 1994: 69; Kuniholm 1982: 297-298; Eiseman & Ridgway 1987: 33, G-17-18; Riccardi 2001: 144, Abb. 16; Benoit 1959: 98-99).
[362] Table 7.24: nos 11, 17, 22, 24, 26-27; Oppian, *Hal*. 3.80-82; Virgil, *Georgics* 1.141; Plautus, *Truculentus* 35-36. Cast nets, in artisanal fisheries in Tunisia, are used in river mouths, lagoons and the shallow coastlines, and are made with a mesh size of less than 1.6 cm (Romdhane 1998: 72).
[363] See App. 5: *Cat. 5*: a fisherman holds the net at his side before it is thrown (which may be the activity shown in the damaged right portion of the scene).
[364] Bennis 1996: 54; Leared 1870: 315; Brown 1896, II: 615; Ponsich 1981: 20; Gruvel 1923: 119; Ponsich 1981: 20
[365] App. 6: *Cat. 3.5. Oued Sebou*. In the 13th century: Ibn Sa'id: 1086; Gruvel 1923: 68, 160-163; Thouvenot 1941: 54. Shad are also noted as salted and dried and "carried far into the interior" (Leared 1870: 315). Artisanal fisheries in Tunisia use lift nets in lagoons and rivers for *Clupeidae* species (Romdhane 1998: 72-73).
[366] App. 6: *Cat. 3.3. Oued Loukkos (3)*; Ayodeji 2004: 180

describes this period for setting nets and also the type of net, used as an ambush (λόχοιο) so that the fish are "pinned" to the sides.[367]

The diadromous European eel can be trapped by nets. In the summer months, these fish are presently caught on the Oued Sebou using bow nets; Leo Africanus states that they were also fished well upriver.[368] Among other species, eels are caught in modern artisanal fisheries on the southern Atlantic coast of Morocco by hook-and-line and tridents.[369] Piercing with a trident was certainly a fishing technique known in antiquity in the region, as it is depicted in a poorly-preserved mosaic from *Volubilis*; Oppian also mentions it as fishing method from the shore.[370]

A weir-like weel or trap (φϱένα) made of reeds or withies is described by Oppian to catch seabream; along the Atlantic coast of Morocco in the Oued Bourereg in the early 20th century, this technique with traps, called *bechkira,* was used in lagoonal environments with high tidal regimes.[371] Although there is no extant evidence of this method at *Lixus*, the environment would have been ideal for its use.

FISHING WITH A BOAT

Boats are certainly known to have been offshore of *Lixus* in antiquity, although specific types are not discussed. Pliny, quoting Trebius Niger (ca. 150 BC), states: "…off the place in Mauretania called Cottae, not far from the river *Lixus*…the *lolligines* [cuttle fish] flies out of the water in such numbers as to sink a vessel."[372] Fishing vessels in the area are noted by Strabo (in relating story of Eudoxus of Cyzicus, ca. 130 BC): "horse-protome ships are from *Gades*, and poor men fit out small ships with these protomes on their fishing voyages around the coast of Maurusia as far as the river *Lixus*."[373] The vessels in these descriptions would appear to be types that can sail in the open Atlantic, and perhaps some of these were present near *Lixus*. Small fishing boats, such as *horeia* or *cydarium,* amongst other types, might have been used locally.[374]

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367 Oppian, *Hal*. 3.577-605
368 Loukili & Belghyti 2007: 683-684; Thouvenot 1941: 54; see App. 6: *Cat. 3.5. Oued Sebou*; Leo Africanus: near Ksar el-Kebir (Brown 1896, II: 496).
369 See App. 6: *Cat. 3.8. Moulay Abdallah (3)*; Gruvel 1923: Pl. III, figs 5-6; Miege 1996: 19.
370 See App. 5: *Cat. 6*; Oppian, *Hal*. 3.88-89; see also App. 6: *Cat. 3.10. Cap Sim.*
371 Oppian. *Hal*. 3.85, 4.164-171, 4.380-382; Brunot 1920: 199
372 Pliny, *NH* 32.6.15; see App. 4.1: *Text 6.k*.
373 Strabo, 2.3.4; see App. 4.1: *Text 2.a*.
374 See Chapter 3.2.2.

The open lagoon of *Lixus*, as mentioned above, was likely very similar to that of the estuarine lake at Merja Zerga, 40 km to the south of the Loukkos' mouth. In the 18th and 19th centuries, fishing methods used in this lagoon were documented and might be comparable to that used in *Lixus*' lagoon. Fishermen here used boats made of reeds and rushes, "about six feet long and two broad" and these were guided by a pole.[375] Making riverine vessels out of reeds was still done on the Loukkos in the 20th century.[376]

Small fishing boats used in Larache today are ca. 5-6 metres long, and along the Atlantic coast small boats used by artisanal fishermen, not exceeding 20 tons, are called *floukas* and *qârəb*. *Floukas*, at the beginning of the 20th century could be used with oars or sail when they were long-lining.[377] These boats focus on inshore and nearshore fishing but do not venture upriver in the Loukkos. Some of the *floukas* made in Larache today are built with small wells that can be filled with seawater to keep catches fresh, much as in the *navis vivaria* described by Macrobius.[378]

If vessels were used to fish the lagoonal waters, wallet lines could be set from them to catch banded dye-murex or spiny dye-murex, as done in artisanal fisheries in the Algarve and at Essaouira.[379] Small boats, and even the ones made of reeds in the 18th century (described above), would be used to fish in Merja Zerga for eels, as a fishermen could stand in the boat in calm waters and use a trident to spear the animal in a manner similar to that described by Oppian.[380]

Shellfish at *Lixus* that live in infratidal zone and therefore must be caught by a fisherman in a boat (in the manner as described at *Tamuda* and *Septem*) include tuberculate cockle, smooth Venus clam, lurid cowrie, spiny dye-murex, carpet-shelled clam and the coral species, *Dendrophillia ramea* (see Table 7.22). The same coral species was also present at *Septem*, and coral is possibly depicted on a fishing-themed mosaic from *Volubilis*.[381]

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375 Chenier 1788, I: 25; see also Sonnier 1935: 119.
376 App. 6: *Cat. 3.3. Oued Loukkos (1)*
377 Timoule 1985: 11, 13
378 App. 6: *Cat. 3.2. Larache*; A. Elboujaday (Délégation de la Culture, Tangier), pers. com. *Navis vivaria*: Macrobius, *Saturnalia* 3.16.10; find of a 2nd century-AD fishing vessel from Fiumicino: Testaguzza 1970: 132; Boetto 2006.
379 Oppian, *Hal*. 5.598-611; Ziderman 1990: 99; App. 6: *Cat. 3.9. Essaouira (5); Cat. 4.3. Ria Formosa, Portugal.*
380 Chenier 1788, I: 25; Oppian, *Hal*. 3.88-89
381 See App. 5: *Cat. 6*. Coral is also present at a few southern Spanish salting sites (Bernal 2007: 101-102).

One bone gorge (ca. 6 cm long and 0.5 cm wide), from the Punico-Mauretanian layers, would also have been utilised with hand-lining to catch species that had large mouths, such as tunny.[382]

From the shore, beach seines (σαγήνη, *sagena*) were used only in areas where it is a smooth and sandy bottom so they will not be caught when dragged ashore.[383] Plutarch and Oppian mention this type of net specifically to catch gilthead seabream and other seabreams but also like at *Tamuda* and *Septem*, they could be used for migratory species, such as mackerel and tunny.[384]

Fixed-net fishing, such as the method of using a pound net similar to the ones described near *Septem*, was possibly used near Larache as well. Tunny come near to the coast, as they are on their way to enter the Straits of Gibraltar to the Mediterranean in early summer. In the middle of the 20th century, several *al-madraba* nets were still set offshore of Larache, as well as to the north and south. Today two such nets are set along this stretch of the Atlantic coast between April and June to catch the fish during the spawning migrations on their way to the Mediterranean.[385]

7.4.5.2 The chronology of exploitation

PUNICO-MAURETANIAN PERIOD

During this period at *Lixus*, fish and shellfish were caught from the shore and offshore, in the river, lagoon and Atlantic Ocean. Equipment finds indicate that they were sought by hook-and-line and net techniques. The marine species' habitats, contemporary texts and ethnographic comparison with regional artisanal fisheries suggest that the resources were collected by hand, small implements and possibly even traps. At the end of this period, fish salting took place at the site.

From the shoreline, 19 shellfish species present during this period could be sought as their habitats include the intertidal zone (see Table 7.22, see Fig. 7.49). Hook-and-line fishing

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382 Table 7.24: no. 16; the only other site with similar finds is Cotta: App. 2.3: *Cat. 10*. Aranegui Gascó, *et al.* 2006: 363-364, Fig. 22b; Radcliffe 1921: 32-33; Powell 1996: 124.
383 Ayodeji 2004: 205
384 Plutarch, 977e; Oppian, *Hal.* 3.124
385 Five *al-madrabas* were set off coast of Larache until the 1960s. The present nets are "Punta Negra" and "Los Cenizos", both in Larache province (de la Serna, *et al.* 1999: 35-36, fig. 24). A net is also set annually on the Atlantic coast near Cap Spartel (at Ras Achakar), where they might have also been used in antiquity; see Erbati & Trakadas 2008: 69; Trakadas, *in press*; App. 6: *Cat. 3.1. Ras Achakar*. Nets were also set near Casablanca, at Fédhala (Ponsich 1981: 20, n. 13; Ponsich 1966a: 394; Timoule 1985: 61); see App. 6: *Cat. 3.7. Fédhala; Cat. 3.3. Oued Loukkos (2).*

might also have been practised from the shoreline, as demonstrated during this period by the finds of three small-medium fish hooks and the lead line weight or plummet.[386] Narrow and small fish hooks are described by Aelian and Oppian as being used for fishing mullet and saddled seabream; rounded, narrow baited hooks are described by Plutarch for catching small-mouthed fish like bonito (or mackerel types) and grey mullet.[387] During this period, three species of mullet are present at *Lixus*: unspecified members of the *Mugilidae* family, flathead mullet and thicklip grey mullet. In addition, three species of mackerel are present: Atlantic horse mackerel, Spanish/chub mackerel and *Scomber sp.* (see Table 7.19).

Net fishing might have been conducted from the shoreline as demonstrated by the navette and eight bone needles, all used in net manufacture. The tong end of the navette is broken; it is therefore not possible to determine the mesh size of the nets made with this tool.[388] A small circular terracotta net weight, ca. 7 cmø, could be used to weigh the edge of a cast net, and also indicates this fishing method.[389]

That fishermen went offshore to fish during the Punico-Mauretanian period is indicated by the presence of carpet-shelled clam, tuberculate cockle, smooth Venus clam and spiny dye-murex that live in the infratidal zone (see Table 7.22; see Fig. 7.49). In addition, finds of bones of *Chrondricthys*, mackerel, seabreams, tunny, pilchards and pandoras (amongst others) suggest that boats were utilised for their capture as they are not necessarily littoral species (see Table 7.19). Some species could be caught during their near-shore oceanodromous or diadromous migrations by hook-and-line techniques from a boat with single hooks or long-lining (as described by Aelian for tunny);[390] the bone gorge would have been used for larger-mouthed fish, such as tunny.[391] Although there are no bones of tunny preserved at *Lixus* during this period, *tituli picti* suggests the presence of this species (bluefin tuna; see Table 7.20). It is also possible that beach seine nets and fixed pound nets were set offshore to catch these species, although there is no definite archaeological evidence for these methods.

The maximum possible distance offshore that fishermen fished these species is indicated by the maximum habitat depth of the European eel at 700 m (see Table 7.19); these species, however, are more often caught during their migrations in lagoons and rivers. However, the

[386] Table 7.24: nos 12-14
[387] Aelian, *NA* 13.16; Oppian, *Hal*. 3.78; 3.465-468, 3.470, 3.483, 4.364; Plutarch 977a
[388] Based on the spacing between the tangs on the tong end; Table 7.24: no. 15; see Chapter 3.2.2.
[389] Table 7.24: no. 17; Aranegui Gascó, *et al*. 2006: 363-364, Fig. 21
[390] Aelian, *NA* 15.10
[391] Table 7.24: no. 16

Scombridae and *Chondricthys* bones suggest that fishermen could have ventured farther offshore, although some *Scombridae* do come in close to shore during their migrations.

Fishing could be practised year-round for most of the shellfish species present at *Lixus* during this period. Mussels, however, would be best sought in early autumn and late spring. The *murex* species, if sought for dye, would be best if caught in autumn, late winter and early summer and oysters would be caught in spring or early summer. The migratory fish species (*Scombridae* and *Carangidae*) would also be fished in the open ocean but also in the lagoon and river in late spring and early summer, and then again in early autumn, as would members of the *Clupeidae* family. The late summer/early autumn would also be the only period in which the *cordyla*, identified by *tituli picti*, were fished. The summer season would also be better for offshore voyages as the winter swells along this coast can be strong.

The presence of salazón amphorae during this period also indicates that marine products were consumed at the site. In the 4th century BC, these include Mañá-Pascual A4 types with its variants, and are present until the 2nd century BC, or possibly even the early 1st century BC.[392] These were followed by the Mañá C2b type in the 2nd century BC.[393] The Mañá C2b type is identified with salted products such as *allex* (one example was found with a fish graffito inscribed on the neck) and also vinegared mussels.[394] Between the late 1st century BC and late 1st century AD, Dressel 7-11 (and variant 12) amphorae are present, and at the beginning of the 1st century AD, a few Beltrán IIB amphorae are present (Table 7.27).

The above-mentioned *cordyla* might have been produced at the site in the first *cetariae* that were established in the 1st century AD (possibly Complexes 3, 4, 5, 7, and 8), if they operated at this time (see Table 7.26).

ROMAN PERIOD

During this period at *Lixus*, fish and marine invertebrates were sought along the shores of the river and lagoon, as well as in the open waters of the Atlantic Ocean. As in the Punico-Mauretanian period, equipment finds indicate that fish were sought by hook-and-line and net techniques. The marine habitats of the species, contemporary texts and ethnographic comparison suggest that the marine resources were caught by hand, using small tools, or

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392 Ramón Torres 1995: 237-238; Aranegui Gascó, *et al.* 2000: 19

393 Specific dates at *Lixus*: 150-50/30 BC; Bonet Rosado, *et al*. 2001: 65; Kbiri Alaoui & Mlilou 2007: 80-83; Aranegui Gascó, *et al.* 2004: 372-373.

394 See Section 7.4.4; Aranegui, *et al.* 2007: 208; Aranegui Gascó 2005b: 273; Aranegui Gascó, *et al.* 2000: 17; Bonet Rosado, *et al*. 2005: 107,119, fig. 13; Aranegui Gascó, *et al*. 2006: 362; Sagrario Carrasco Porras 2005: 256-257, 259-260.

even a coral harvesting 'machine'. At this time, marine resources were salted in purpose-built facilities that lined the water's edge.

From the shoreline, the 11 species of shellfish present at *Lixus* could be obtained, as they inhabit the intertidal and intertidal/infratidal zones (see Table 7.22). Hook-and-line fishing might have also been done from the shoreline during this period, as demonstrated by the finds of eight small fish hooks.[395] These might have been used to target a small-mouthed fish caught during this period, common dentex (see Table 7.19). Fishing with nets from the shoreline or in the river might also have been practised as nine bone and bronze needles were recovered from Complex 5 in the fish-salting quarter; these indicate the manufacture of fishing nets.[396] Additionally, two small and medium lead and terracotta doughnut-shaped weights, a tube terracotta weight and small cone-shaped terracotta weight (25-100 g), could have weighed the edge of cast nets.[397]

That fishermen went offshore is indicated by the presence of the infratidal species of coral (*Dendrophillia ramea*) (see Table 7.22). This species could have been caught by accident (i.e., caught in a net), or it could have been caught intentionally by a harvesting 'machine', like that at *Septem*.[398] Until the last few decades of the 20th century, red coral was sought at beds near Asilah, ca. 30 km north of the Loukkos; there are no known beds near Larache, however, so the presence of this species at *Lixus* can indicate the distance or range that a fishing boat ventured. As the coral's habitat is 40-110 m depth, this depth is reached approximately 11 to 25 km offshore from *Lixus*.[399] In addition, the offshore oceanodromous species of tunny, and the shark species that might follow them, could be caught with the use of boat.[400] As in the Punico-Mauretanian period, hook-and-line techniques, as demonstrated by the presence of two large hooks (8 cm, 8.8 cm) might have been used for fishing larger species such as tunny or shark, as Oppian describes.[401] The presence of hammerhead or tope shark is evidenced at the site during this period by icthyo-faunal finds; bluefin tuna is attested at the site during this period by *tituli picti* (see Table 7.20).

In addition, a beach seine or a fixed pound net could have been used to target the tunny and shark species; the large trapezoidal terracotta weight (290 g) could be used for establishing a

[395] Table 7.24: nos 18, 21, 23
[396] Table 7.24: nos 19-20
[397] Table 7.24: nos 22, 24, 26-27; Aranegui Gascó, *et al*. 2006: 363-364, fig. 21
[398] See Section 7.3.5.1.
[399] A. Meshbahi (coral diver, Tangier), pers. com.; Zibrowius 1980: 5, 169-172; Snoussi 1980: 8; Tejera de Leon 1980: figs 13-14
[400] Roselló & Morales 1992: 20; one fused vertebra has been identified as shark, either tope (*Galeorhinus galeus*) or great hammerhead (*Sphyrna mokarran*).
[401] Table 7.24: no. 18; Oppian, *Hal*. 3.144-148; see also Aelian, *NA* 13.16.

set net in midwater, but also function as the bottom weights on a beach seine net used in sandy areas.[402] The distance offshore that fishermen might fish is dictated by a species of shellfish, knobbed triton (extends down to 200 m depth), but the oceanodromous pelagic species might be more representative of areas of fishing effort, as might the red coral.

Fishing at *Lixus* during this period was not necessarily regulated to a certain season by the shellfish finds, except for the oysters, best when caught in spring or early summer. The late summer/early autumn would also be the only period in which the *cordyla*, identified by *tituli picti*, were fished. Again, strong offshore swells might make offshore fishing less appealing in the winter season.

During this period, there is definitive evidence for processing of marine resources.
Five of the fish-salting complexes were built sometime in the 1st century, possibly at the beginning (Complexes 3, 4, 5, 7 and 8); five can be assigned more secure establishment dates in the later half of this century (Complexes 1, 2, 6, 9 and 10). At the highest point of operation, a total of ca. 142 *cetariae* (representing slightly over 1,000 m^3), were used at these complexes. In the mid- to late 2nd century, Complex 2 was remodelled and in the late 3rd/early 4th centuries, Complexes 5 and 6 underwent a period of disuse before they were remodelled and their *cetariae* capacity reduced; in the early 4th century, Complex 7 was remodelled and reduced. Salazón amphorae present at this time include Dressel 7-11 (12 variant) type and a few examples of Beltrán IIB type (see Table 7.27).

LATE ROMAN PERIOD
No fish remains are preserved from this period at *Lixus*, and evidence for fishing equipment is also lacking. However, finds of shellfish and salazón amphorae are present, and some fish-salting complexes operated at this time.

From the shoreline, most of the shellfish species could be sought: red-mouthed rock shell, mussel and knobbed triton (see Table 7.22). However, two species live in the infratidal zone and must be sought offshore: lurid cowrie and tuberculate cockle.

Marine resources continued to be processed during this period in the water-front complexes but some of these ceased to operate and underwent remodelling that reduced their capacities. Complexes 3, 6 and 7 had reduced *cetariae* capacities; in the case of Complex 6, a cistern was added.

[402] Table 7.24: no. 25

In the 3rd century, salazón amphorae finds at the site consist of examples of Almagro 50 types (see Table 7.27). From the end of the 3rd to the mid-5th century, Almagro 51a and 51c amphorae are present; Keay LVII B types are present at the latest stages of the fish-salting complexes operations, in the 5th-6th centuries.[403] In the 5th century, Complexes 4, 9 and 10 also underwent periods of disuse and remodelling. A majority of the complexes stopped operating in the late 4th and early 5th centuries; Complexes 6 and 9 continued to be used until the early 7th century (see Table 7.26).

CONTEXT UNKNOWN

Evidence of marine resource exploitation at *Lixus* that cannot be assigned a secure chronology includes finds of fish bones, shellfish and fishing equipment.

Of the two fish bone finds, both are marine species: *Cetacea* (order) and *Scombrida*e (family). In general, *Cetacea* (whale) live in offshore environments; some *Scombridae* species, such as tunny, are pelagic but do come inshore during their annual migrations (see Table 7.19). These finds could be modern as they are identified as found “on the beach”.

Five species of shellfish are included in this category (see Table 7.22); four species can be caught from the shoreline: bittersweet, *Muricidae* (family), oyster and rayed Mediterranean limpet. Spiny dye-murex lives in the infratidal zone, and has to be sought from a boat. Of these, the deepest habitat extends to 150 m (spiny dye-murex).

As with the three other periods, finds of fishing equipment demonstrate evidence of hook-and-line and net fishing. These include one fish hook, two bronze navettes and a series of weights.[404] The dimensions of the space between the tangs of the recovered navettes are 0.40 cm and 0.30 cm, indicating that nets made with these had very small mesh sizes.[405] Such nets would be used to catch a large variety of species, as they are around the size to target anything as small as fry (usually ca. 0.80 cm mesh) and anything larger.[406] Net fishing evidence is also provided by one lead sphendonoidal (pod) shaped weight; if used as a weight it would have been braided into the edge of a net.[407] Two medium bun-shaped net

[403] For identification of Keay LVII B amphorae as a salazón type, see Fumadó Ortega & Mlilou 2005: 81-83; Aranegui Gascó, *et al.* 2006: 359.
[404] Table 7.24: nos 1-10
[405] Table 7.24: no. 2
[406] Faber 1883: 107-110
[407] Table 7.24: no. 8. Similar finds are known from the fish-salting site of Cotta, on the north Atlantic coast of Morocco (see App. 2.3: *Cat. 1*). Types are also found in Israel and Turkey (Galili*, et al.* 2002: fig. 2; Kuniholm 1982: 300-301).

weights (120-130 g) could also be used to line or weigh the edge of a small net.[408] Twelve large bun, trapezoidal and tombstone weights – more heavy than the other terracotta weights found at the site (250-880 g) – are generally perforated by two holes.[409] These can be used for establishing a set net in midwater, but also serve as the bottom weights on a beach seine. The two large stone weights, if used for fishing, are much heavier than the terracotta weights (2.22 kg and 1.59 kg). These could have been used as end sinkers for fixed or set nets, but more likely due to their weight were footrope (or leadline) weights.[410]

7.4.6 Conclusions: the role of fishing at *Lixus*

The lagoonal and riverine environments that surrounded *Lixus* in antiquity contributed to the exploitation of marine resources, aptly demonstrated by the archaeological finds at the site from the Punico-Mauretanian to Late Roman periods. Although *Lixus* is a more fully excavated site compared to the previous two case studies of *Tamuda* and *Septem Fratres*, only certain areas have been the primary foci of campaigns. Despite this situation, however, the extant finds, textual references to exploitation in the region and ethnographic comparison make it possible to obtain a glimpse of the diversity of the exploitation and the role it played at the settlement and fish-salting site.

Continuity in the exploitation of marine resources at the site can be seen as relevant finds are present in all periods of occupation of the site. The majority of the fish and marine invertebrates especially are species that inhabit the marine environment, suggesting that exploitation mainly took place in the Atlantic waters; the presence and abundance of these marine species, however, could also verify the hypothesis that the waters of the Loukkos basin were indeed an open lagoon.[411]

When a Punico-Mauretanian settlement was concentrated on the summit of the plateau, a diverse amount of fish and shellfish species indicate a rather varied fishing effort, both from the littoral and offshore. The number of species present during this period is higher than in subsequent periods (see Tables 7.21, 7.23). The most common fish belong to the *Sparidae* family (bream, porgy, dentex) indicating small-scale coastal fishing with nets and hook-and-line.[412] Additionally, more diverse types of fishing equipment finds are present during this time (see Table 7.24). This body of evidence might be the result of the excavations carried

[408] Table 7.24: no. 3
[409] Table 7.24: nos 3-7
[410] Table 7.24: nos 9-10; Galili, *et al.* 2002: 195. Attested prior to terracotta and lead weight use in Lattes, France (Sternberg 1998: 90). See also App. 6: *Cat. 3.9. Essaouira (7).*
[411] Except for shellfish from context unknown.
[412] Powell 1996: 49

out specifically on the southeastern edge of the plateau (where sieving was conducted). This part of the site also has not revealed much Roman or Late Roman material.

It is believed that the icthyo-faunal and malacological remains from this period demonstrate local consumption.[413] Certainly, the fact that some mussels show signs of burning also demonstrates that shellfish were being cooked at this time, presumably for immediate consumption. However, it is clear that resources were also being salted by the 2nd or 1st centuries BC, or at least preserved for later consumption. This is evidenced first by the Mañá C2b amphora that has a graffito of a fish on its neck, possibly associated with *allex* made from mackerel. Another Mañá C2b amphora containing vinegared mussels, very precisely dated to 50-20 BC, also suggests preservation/packaging for later consumption.[414] Additionally, the *tituli picti* evidence indicates that *cordyla* was being salted and shipped from the site by the very end of the 1st century BC. The lack of salting facilities such as *cetariae* at *Lixus* at this time obviously does not preclude the practice of salting. As demonstrated archaeologically at other sites such as those in the Cádiz region in the 5th century BC, and textually by Manilius, fish and shellfish could certainly be salted in any waterproofed container.[415]

Evidence for the transhipment of these salted/preserved products is demonstrated by the Dressel 7-11 and Beltrán II amphorae types found with *picti* of *Lixus* products in Central Europe, Italy and Spain (see Table 7.20). Transhipment is also possibly indicated by the storage magazine of Mañá C2b amphorae identified in the Ladera Sur area.[416] As Mañá C2b types were locally made at Kouass and *Banasa*, examples of these could have been brought to the site for packaging with transhipment of these goods beyond *Lixus*.[417]

The transition that the settlement of *Lixus* underwent in the 1st century AD once it was incorporated into the Roman province is also very clearly demonstrated by the material related to marine resource exploitation. At this time, purpose-built salting complexes were established along the water's edge. The number of the *cetariae* at these complexes, totally over 1,000 m^3, comprises the largest site for salting yet known in *Mauretania Tingitana*.

413 Grau Almero, *et al*. 2001: 220; Aranegui Gascó, *et al*. 2006: 374-377
414 Aranegui Gascó, *et al.* 2006: 358, 362; Sagrario Carrasco Porras 2005: 256-257, 259-260
415 Manilius, *Astr*. 5.679; Muñoz Vicente, *et al*. 1988: 488-496; Trakadas 2005: 70-72; Curtis 1991: 92-94, fig. 6, 123, n. 55. *Dolia* also suggested for fish-salting at St. Blaise, France (Benoit 1959: 103).
416 Aranegui Gascó, *et al*. 2004: 370, 372, figs 14, 19
417 Also thought to have been manufactured at *Sala* and *Volubilis*, see App. 3.3.1; López Pardo 1990a: 22; Ramón Torres 1995: 99; Aranegui Gascó, *et al.* 2004: 363-366; Domergue 1960: 499. There has been no analysis of fabrics to determine specific kilns, however (Kbiri Alaoui 2007: 219). It has also been suggested that some salazón amphorae present at *Lixus* were imported into *Mauretania Tingitana* from southern Iberia (Pons Pujol 2006: 74-77).

These were all established within a relatively short period of time – less than one century. This large presence, and lack of other agricultural processing facilities at *Lixus*, suggest that salting became the most important industry practised at the site during the Roman period. This can also be indicated by a storage magazine for Dressel 7-11 salazón amphorae on the summit of the plateau.[418] Other storage areas might be present near the fish-salting complexes, but the excavations in this area were not well documented; in addition, part of this area lies under the Larache-Tangier road and remains inaccessible.[419] The finds of southern Iberian and Italic wine and olive oil amphorae at the site could also indicate that *Lixus* was a "redistribution port", in that wine was brought in with salted products exported.[420]

Certainly the fishing for the resources to supply the industry would also have increased during the Roman period, although at present there is no archaeological evidence for this. The fish species caught during this period are far fewer and different that those caught in Punico-Mauretanian period, with the exception of tunny (noted solely from *tituli picti*). However, the marine resources indicate that littoral and offshore fishing effort was still continued; the coral find demonstrates even long-distance voyages to fishing grounds, kilometres offshore in the Atlantic.

The find-sites of material from this period is significant: shellfish finds are from houses, and some are even identified as coming from the kitchens of these, so local consumption of at least these species continued (see Table 7.22). Some fishing equipment comes from the fish-salting complexes; however, some derives from houses, suggesting that fishing activity was carried out by the local population in different sectors of the site.

By the end of the 3rd and beginning of the 4th centuries, as the province was reduced, the salting production at the site underwent modifications and reductions, and in the 4th century, three of the complexes were no longer used (see Table 7.26). The Late Roman period at the site therefore seems to be characterised by a general decline in salting activities; in addition, the evidence for fish species and fishing equipment is completely lacking. Only a few species of shellfish are present, but these do indicate that fishing still took place along the littoral as well as offshore (see Table 7.22).

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[418] Tarradell's "Cata Alta"; Caruana, *et al.* 2001: 181-182, fig. 2; Aranegui Gascó, *et al.* 2004: 370.
[419] Aranegui Gascó, *et al.* 2004: 370
[420] Amphorae types include Dressel 20, Haltern 70, Dressel 1, Dressel 2-4 (Izquierdo Peraile, *et al.* 2001: 159-161, 168).

During this time, southern Iberian Almagro 50, 51a, 51c and Keay LVII B salazón amphorae types, utilised between the 3rd and 6th centuries, are present at the site, but in very small quantities (see Table 7.27). No kilns of these types are yet known in *Mauretania Tingitana*.[421] Therefore it is not clear if these represent the importation of salted products to *Lixus* from southern Iberia, brought empty for re-use and transhipment from the site, or like the earlier salazón types, were made in local kilns, brought to the site and exported.

However, some of the *cetariae* continue to function into the 7th century (Complexes 6 and 9), whilst the extant amphorae types only extend to the 6th century. This might be due to the fact that the reduction of the salting complexes indicates instead that salting continued after the 4th century for local consumption only, with additional products being imported from southern Iberia. The last two salting complexes are thought to have been used into the 7th century, with no evidence of salted products being imported from Iberia. Perhaps the late use of the *cetariae* was not for marine products but for other meats, such as demonstrated at salting sites in southern Spain.[422]

After the decline of exploitation of marine resources in the Late Roman period, fishing in the Loukkos basin and offshore of Larache continued through the medieval period and historical periods, with many species mentioned in contemporary texts and found in the archaeological record. During the medieval period, *Sparidae* are present at the site, dominating as they did during the Punico-Mauretanian period, but also *Haemulidae*, *Moronidae*, *Cyprinidae* and *Clupeidae*, indicating the diverse variety of species sought.[423] In the 16th century, the Loukkos was noted for its fish; in the 19th century, shad, mackerel and bonito were sought by fishermen off Larache.[424] Locally-caught shad were salted, and these were carried into the interior, much like the *tahammort* system along the Mediterranean and southern Atlantic coasts.[425] At present, sardines, mackerel, pandora and eels are the major catches of the modern Larache fishery.[426]

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[421] Petrographic analysis suggest that kilns of the Almagro types might be present in northern Morocco, possibly near *Septem,* but these have not yet been located (Villaverde Vega & Lopez Pardo 1995: 472; Bernal Casasola 1996: 1213-1224; Bernal Casasola 1997: 92. 97, 103; see also Teichner & Pons Pujol 2008).
[422] Pig bones have been found in the salting areas at *Baelo Claudia* and beef and mutton bones at *Iulia Traducta* (Bernal, *et al.* 2007c: 370-371; Arévalo González, *et al*. 2004: 286-287; García Vargas & Bernal Casasola 2009: 143; A. Morales [UAM], pers. com.).
[423] Rodríguez Santana & Rodrigo García 2005: 242-245; Aranegui Gascó, *et al*. 2006: 369-371
[424] Ricard 1927: 237; Brown 1896, II: 615; Guennoun 2006: 1011
[425] Leared 1870: 315; see also App. 6: *Cat. 3.9. Essaouira (3).*
[426] Furnestin & Furnestin 1959: 82; Kifani 1998: 237, 245; Gruvel 1923: 49-50, 60, 169-170; Timoule 1985: 50

Chapter 8.
Discussion

8.1 Introduction

Through the compilation and examination of archaeological data that include marine animal remains, fishing equipment and finds related to fish-salting production, specific aspects of marine resource exploitation in the northwest Maghreb in antiquity have been determined. These data are occasionally complimented and sometimes contested by the descriptive information derived from written sources (including *tituli picti*), iconography and ethnographic comparison from or discussing the region.

The synthesis of these findings, contextualised within the specific littoral environments of the region, also reveal the temporality, organisation of fishing, and spatial relationships within the maritime cultural landscape. The biological cycles of marine animals dictate the seasonality of fishing, as do the specific daily and seasonal marine conditions of the region that can facilitate or prohibit fishing along the coast and offshore. These conditions, as well as the catch methods used, dictate the manpower needed to operate certain fishing apparatuses as well as where the resources are landed to be consumed/processed. These aspects, contextualised in Chapter 3 and investigated in the case studies of Chapter 7, are of fundamental importance and serve as the parameters in which the roles and consumption patterns of marine resources can be analysed.

In this chapter, fresh seafood and salted products in the region are first examined with regards to their place in the diet of the populations of the northwest Maghreb. Salted fish products are then compared and placed within the processes and economy of general foodstuff production, particularly during the Roman period. Finally, the compiled data of this study are reviewed temporally, in order to understand the diachronic change in the regional population’s use of and relationship to the environment, thereby underscoring the social and economic consequences of the ‘Romanisation’ of *Mauretania Tingitana*.

8.2 The role of marine resources in *Mauretania Tingitana*

8.2.1 'Fresh' consumption

The discussion of consumption of 'fresh' marine resources considers not only species that were part of the diet, but also those that were used as bait or whose remains were made into tools or used as decoration.[1] Evidence of this type of consumption includes finds of marine animal remains from contexts outside identified salting areas (the latter are agglomerations of *cetariae*, or sites identified through the presence of marine animal debris associated with large amphorae such as Mañá-Pascual A4 types). At some larger settlements ('major sites', see Chapter 2.2.4), where both fresh consumption and salting occurred, it is difficult to distinguish archaeologically the uses of these remains. This is the case with some of the material from *Banasa*; as the find-spots of the material are not clearly indicated near the identified *cetariae*, they have been included here as evidence of fresh consumption. The pierced shells from the salting sites of Sidi Abdeselam del Behar and the worn and burnt shells from *Septem* also are evidence of non-salting consumption.[2] At *Lixus*, some finds were located in houses (and in some cases, kitchens) and buildings not associated with the ten salting complexes, and these are assumed to represent the remains of fresh consumption.[3]

The finds included in this category reveal an extremely varied diet of fresh marine resources: 38 fish species and 40 marine invertebrate species (Tables. 8.1-8.4). Fish species include large offshore pelagic fish such as bluefin tuna and shark, as well as riverine and lagoonal species such as eels, seabreams and sturgeon. The remains of these species are found at coastal agglomerations, and inland, riverine and lagoonal settlements. The largest number of species derives from the settlement at *Lixus*: this major site's situation on an Atlantic coastal lagoon and adjacent to a tidal river, the Oued Loukkos, is reflected in the diverse number of fish species but also those that live in a combination of marine/estuarine/freshwater environments, such as mullet and seabass.

The marine invertebrates that were consumed fresh are numerous, and similar species are repeatedly present throughout the Punico-Mauretanian, Roman and Late Roman layers at a variety of sites. Some mussel shells from the Punico-Mauretanian layers at *Lixus* have traces of burning, almost certainly demonstrating cooking. Bittersweet shells from the riverine

[1] This and the following section only include data of identified species, families or orders; 'Context Unknown' finds are not included.
[2] See App. 3.1: *Site 46*, for *Banasa* discussion – the material recovered from the southwest quarter is clearly not near the proposed *cetariae* (Thouvenot & Luquet 1951b; Cerri 2007a). For Sidi Abdeselam del Behar, see App. 3.1: *Site 8*, and mention of these shells in Chapter 7.2.6. For *Septem* see App. 3.1: *Site 16*, and discussion in Chapter 7.3.4. It must be noted that the find from Djebila is considered 'fresh' in that it was not salted.
[3] Grau Almero, *et al*. 2001: 220; Aranegui Gascó, *et al*. 2006: 374-377

Punico-Mauretanian settlement at *Tamuda* are pierced and could have been used as decoration or tools.[4] Rayed Mediterranean limpets are eaten but also used as bait in artisanal fisheries, and this might have been the case at sites such as *Lixus* during the Punico-Mauretanian and Roman periods as well as at Suiar during the Roman/Late Roman period.[5] Knobbed triton specimens were found in the Punico-Mauretanian period at the settlement of *Tamuda* and in all periods at the settlement of *Lixus*; this species is noted as a preferred food by Athenaeus in the 2nd-3rd centuries AD.[6] Oysters are also well represented at almost all sites during the three periods. Most notably, *Muricidae* shellfish are present at sites that do not demonstrate salting activities: inland riverine settlements, as well as coastal settlements and agglomerations.[7] This suggests that, like today, they were consumed as food and might not necessarily have been caught in late winter or early summer, the normal season for obtaining them if used for dye (see Section 8.2.2.2).[8]

8.2.1.1 Marine resources and other foodstuffs

As it can be difficult to assess accurately the dietary contribution of fresh marine resources due to fish remains usually being underrepresented in archaeological assemblages, this makes comparison with other meats difficult.[9] This problem may be further compounded in that an equal number of fish and large mammal bones are not equivalent in the reconstruction of past diets due to the comparatively larger mass of terrestrial animals.[10] Additionally, there have been no inter-site analyses of the dietary patterns that include meat and agricultural goods in *Mauretania Tingitana*. This disparity allows for only general statements to be made regarding the content and diversity of the overall diet of the province's population. Nevertheless, it is clear that aside from fish and marine invertebrates, other sources of protein were part of the regional diet of the northwest Maghreb.

In houses of the Punico-Mauretanian riverine settlement at *Tamuda*, teeth of native wild boar have been identified, and wild boar bones have been found in the trash dump of the Roman *castellum* (Table 8.5).[11] At the *castellum*'s western gate, pig bones have been identified in

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[4] See Chapter 7.2.5.2.
[5] Guerra-García, *et al.* 2004: 325
[6] Athenaus, *Deipnosophistae* 3.85d
[7] Also at *Volubilis* in Context Unknown, but not included here as only dated material is examined.
[8] *Muricidae* shellfish are eaten today in the region, see App. 6: *Cat. 4.1. El Puerto de Santa María, Spain*.
[9] See Chapter 3.2.1.
[10] Rose 2000: 514-515; Bekker-Nielsen 2002a: 35
[11] Morán & Giménez Bernal 1948: 20, 38; Dobson 1998: 81-82. Gozalbes Cravioto (1997: 110) also states goat and oxen as being found in the Punico-Mauretanian layers at *Tamuda*, although he does not cite a source.

the 4th-century layers.[12] In the Punico-Mauretanian lagoonal settlement at *Lixus*, cattle bones are the most dominant, followed by pig and sheep bones.[13] This is similar to the finds in the Punico-Mauretanian levels at *Banasa* of wild boar, cow and sheep.[14] At the riverine settlement and camp at *Thamusida*, cattle bones are the most dominant, followed by pig and then sheep/goat in the 3rd century; the latter two reverse their importance in the 4th century.[15] Sheep/goat bones have been found at the inland settlement of *Volubilis,* although of unknown context.[16] Wild boar remains are "numerous" in the Roman levels at Essaouira, but are "very rare" in the earliest levels. In the Punico-Mauretanian and Roman layers on the island are also cow, sheep and goat bones.[17]

At *Lixus*, where numerous marine species are present, terrestrial domesticated animals also made a contribution to the diet. This is the case for the data examined, which date to the Punico-Mauretanian period, and it is not yet known if these dietary preferences continued into the Roman period. The dietary contribution of marine resources is also difficult to assess at the other sites, although it must be noted that marine/estuarine species of shellfish were found at the riverine and inland settlements of *Thamusida* (during the Roman period) and *Volubilis* (but from 'Context Unknown').[18] Very few marine resources were identified in the Roman *castellum* layers at *Tamuda*, although numerous species were found in the earlier Punico-Mauretanian settlement. In the last example, this situation might be comparable to that at *castella* north of the Alps and in Britain during the 1st century AD. The diet was centred on pork, indicating the preferences and origins of the soldiers who lived in the camps: Gaul, northern Italy and northern Spain.[19] Similarly, Roman fort sites in northern England in general produce less fish remains than other types of sites in the region.[20] It is argued that in the 3rd century, the *uexillatio* troops stationed at *Tamuda* were of Britannic or northern Iberian origins and might have preferred pork (or wild boar) or other meats over seafood (see Table 8.5).[21]

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[12] Bernal, *et al.* 2008a: 600
[13] Iborra Eres 2005; compare to earlier conclusions in Grau Almero, *et al*. 2001: 200-204.
[14] Girard 1984a: 28, 70
[15] Papi & Martorella 2007: 94, fig. 9
[16] Personal observation of materials in the site dépôt.
[17] Earliest levels here are referred to as "Phoenician ", and this might refer to the 7th-6th century BC layers; Jodin 1967: 227-228, Pl. CVIII.
[18] See App. 1.2.3.
[19] King 1999: 189
[20] Locker 2007: 147-149
[21] Villaverde Vega 2001: 237. Troops identified as cavalry of *ala Herculea* (*Not. Dig. Occ*. XXVI, 2-4, 13); Mastimo 1991; Rebuffat 1998: 215-221. Britannic or northern Iberian origins for the auxiliary is stated by Villaverde Vega (2001: 237, n. 1021) due to finds of fibulae and at least one inscription attesting a soldier's origins: "*Attianus…ex Breitonibus*" (*IAM* 2, no. 56).

The relative importance of pork in the Punico-Mauretanian diet of the populations at *Lixus* is similar to its placement in the dietary analyses of Iberian sites during the 3rd-2nd centuries BC.[22] At other North African sites like *Lepcis Magna* and those located in the Libyan valleys, the arid environment was not conducive to raising cattle and pigs, whereas further west at Cherchel (*Iol Caesarea*), the picture is very different: cattle appear to dominate in the early Empire and Late Roman assemblages, followed by sheep/goat and pig. By the 5th century, sheep/goat bones dominate the assemblages, pig bones are common, but cattle bones less so.[23] Based on the extant material, this general observation seems to hold true in the northwest Maghreb at the same time, where the Rharb and lower Atlas and Rif chains were conducive to livestock raising.

In addition to meat, cereals, vegetables and fruits were consumed by the populations of the region.[24] Grain mills, ovens and olive oil presses have been identified at almost all the major settlements in *Mauretania Tingitana*; in some cases, however, evidence of wheat, honey and grapes derives only from depictions on Punico-Mauretanian coinage (Table 8.6). Together, however, these findings seem to indicate that by the 1st century BC and into the Roman period, the hinterlands of settlements and rural sites were beginning to be more widely cultivated. The increase in olive oil presses in the 2nd and 3rd centuries AD, particularly around the major inland settlement of *Volubilis* and the hinterland of *Tingi*, clearly demonstrate a rise in agriculture during this period.[25]

8.2.1.2 Discussion

In the regional diet, the extant evidence indicates that fresh marine resources were a vital component in certain coastal sites and a supplemental component at other sites that were both inland and coastal. Diverse and more numerous species of seafood were consumed along the coasts, particularly during the Punico-Mauretanian period, but were not the sole source of protein (as subsisting on fish alone would result in gout).[26] These resources seem to have been combined with other meats, cereals, vegetables and fruits. However, fresh seafood was not limited in its distribution simply to the coastal zone, as some inland sites demonstrate the consumption of marine shellfish and fish during the Punico-Mauretanian

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[22] Iborra Eres 2005: 239

[23] King 1999: 187-188. King notes, however, that the North African data are very limited.

[24] Wilkins 1993: 194; Bekker-Nielsen 2002a: 30

[25] Akerraz & Lenoir 1981-82; Limane & Makdoun 1998: 335-336; Ponsich 1964a; Ponsich 1970: 204-206, 215-217, 273-283

[26] See Bekker-Nielsen 2002a: 32. Gallant (1985: 16, 31-35) argues that fish provided insufficient caloric intake in ancient Athens, concluding that it therefore had little if any significance in the diet and the ancient economy; for some of the many arguments against his conclusions see Bekker-Nielsen 2002a; Purcell 1995: 133, 138-139; Wilkins 1993: 191-192, 197; Lund Jacobsen 2005.

and Roman periods. No solely freshwater species of shellfish or fish have yet been identified from the periods under consideration within the province. Diadromous fish are present, but a majority of these were identified in the Punico-Mauretanian layers at the coastal lagoonal site of *Lixus*, with the exception of sturgeon from the Roman period at the riverine site of *Thamusida*.[27] Transportation of the marine species inland is indicative of the *tahammort* system practised today in the Atlantic and Mediterranean regions of northern Morocco.[28] However, numerous finds of fish hooks at inland sites such as *Tamuda* and *Volubilis* suggest that although no faunal remains have been preserved or recovered, fishing most probably took place in the rivers and streams adjacent to these settlements.[29]

Some sites, however, like the Roman-period *castellum* at *Tamuda*, where foreign (Britannic or northern Iberian) groups resided, had different dietary preferences that appear to have included only occasionally shellfish and salted-fish products, based on the presence of salazón amphorae. Nonetheless, there appears to have been a broad distribution of seafood throughout the settlements and small agglomerations of the province, albeit in more transportable and less perishable forms: *salsamenta* and fish sauces. This is demonstrated by the distribution at 54 sites in the province of salazón amphorae carrying these products.[30]

The supply of these marine resources for fresh consumption derived largely from coastal and lagoonal fisheries, but possibly also riverine fisheries. The importance of landing catches quickly in the coastal fisheries meant that in many instances, like today, fishermen – or even those who fished occasionally – occupied the littoral zone or river banks, near the resources themselves. In this manner, small fishing communities likely developed near settlements or agricultural and market centres in the region, such as at might be conceivable at *Tamuda* during the Punico-Mauretanian period. In this scenario, such fisheries had a much more local “character and scope”, and were more likely to be part of part of an “*oikos*-based economy”.[31] These would be subsistence-based, small-scale fisheries in which only simple gear was used and food was provided to the fishermen and immediate community.[32] More permanent or semi-permanent artisanal fisheries, perhaps related to special markets might have developed, orientated around major settlements; this scenario might have occurred at *Lixus* during the Punico-Mauretanian period as well, and certainly had direct relevance to the fish-salting industry during the Roman period (see Section 8.2.2).

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[27] See App. 1.1.3.
[28] See Chapter 7.2.4.
[29] There are 61 fish hook finds at *Tamuda* (see Chapter 7.2.3.4, Chapter 7.2.4); 10 hooks have been located at the so-called “boutique” on the *cardo* at *Volubilis* (see Étienne 1960: 42-44; App. 2.3).
[30] See App. 3.3; Chapter 6.2-6.4; see Section 8.2.2.
[31] Bekker-Nielsen 2002a: 30
[32] Gabriel, *et al.* 2005: 3

The species that are indicative of fresh consumption are those that are generally present year-round in the waters of the region, although there are a few migratory fish species and shellfish that were sought in the later winter, spring and early summer (see Tables 8.1-8.4). Fishing along these shores could be practised full-time by fishermen, but more probably was undertaken occasionally by people who were engaged in other subsistence activities such as farming, who would fish when their time allowed or needs dictated. Along the coasts of northern Morocco today, fishing generally compliments the October/November planting work and June/July harvesting and threshing cycles.[33] Fishing as a secondary or supplemental occupation in the past would have fit around such agricultural schedules.[34]

8.2.2 Processing

8.2.2.1 Fish salting

The finds included in this section are marine animal remains from sites that demonstrate or assume evidence of salting practices (that is, sites with *cetariae*, large amphorae such as Mañá-Pascual A4 types, and indications of salting by *tituli picti* as at *Lixus* and *Tingi*).[35]

The finds reveal that a very specific group of fish appear to have been targeted for salting production: 13 fish species and 23 marine invertebrate species (Tables 8.7-8.10). These are largely migratory fish, such as tunny, mackerel and bonito; pelagic species of shark that can follow these and oceanic whales are also present. Along with these, non-migratory fish (seabream, grouper and John Dory) are only present at coastal *Septem*, where migratory species dominate. At the same time, a diverse number of shellfish and marine invertebrates are present at all salting sites except two (*Tingi* and Tahadart). This is significant as molluscs, even though mentioned as an ingredient in sauces by Pliny, are often overlooked in discussions of fish-salting, and the finds here reveal their regular inclusion in salted products.[36] That shellfish were also processed for later consumption prior to the Roman period in the province is demonstrated by the finds from Emsa, Sidi Abdeselam del Behar

[33] Chaara 1996: 92-93
[34] Rose 2000: 516; see also Wagstaff, *et al.* 1982.
[35] Some finds from the earlier excavations at *Lixus* that are not assigned clear find-spots might in fact derive from the fish-salting complexes; as this is not clear, however, they are listed in Table 8.9 in parenthesis.
[36] Pliny, *NH* 31.44.95. See the discussion of shellfish use in salting in relation to the finds from *Carteia*, where 33 species have been identified at factories at c/ San Nicolás de Algeciras (Bernal Casasola, *et al.* 2007: 96; Vázquez, *et al*. 2004: 84-85) and 19 species at Villa Victoria (Bernal Casasola, *et al*. 2009).

and Dchar ‘Askfane. It might also be noted that the Mañá C2b amphora at *Lixus* contained 28 mussel shells and grape pits (suggesting seasoning or preservation with vinegar).[37]

The fish bone finds also indicate that specific types of salted products were made throughout the province. Pliny mentions that *scomber* [mackerel] from *Mauretania* was used for making *garum*; *liquamen* as well as *allex,* the sediment of *garum*, would therefore also consist of mackerel.[38] At *Septem,* mackerel was almost certainly used to make *garum,* as there are remains of Spanish/chub mackerel, Atlantic horse mackerel and Atlantic chub mackerel associated with *cetariae*. Products made from these specific species might be comparable to, or at the very least, indicative of the well-known *garum sociorum* from *Carthago Nova* made of mackerel.[39] At *Lixus*, however, several species of mackerel (Atlantic horse mackerel, Spanish/chub mackerel and *Scomber sp*.) were found in the Punico-Mauretanian layers on the edge of the plateau and not near the Roman-period *cetariae* adjacent to the river. In this latter case, the find context has been interpreted as being indicative of fresh consumption (see Table 8.3).[40] However, a fish graffito present on the neck of a Punico-Mauretanian Mañá C2b amphora from *Lixus* has been proposed, through comparison, as indicating *allex* (made of unknown species).[41] Studies of fish bones from salazón amphorae throughout the Mediterranean indicate, however, that in practice *allex* was made of two kinds of mixtures: 1) limited number of fish of similar sizes (such as mackerel), or 2) from many different types of fish of different sizes.[42] In this sense, the finds at *Septem* that include a mix of mackerel with other species (seabream, grouper and John Dory) could demonstrate *garum*, *liquamen* and *allex* production as well.[43]

The importance of tunny in the northwest Maghreb in antiquity has been based largely on ancient pictorial evidence and written sources, including *tituli picti*, but also the modern tunny fisheries that operate in the region. Tunny is not well documented archaeologically, however, and evidence of its presence derives from only a few sites. At both *Tingi* and *Lixus*, a product containing *cordyla*, young tunny, is indicated only by late Punico-

[37] Aranegui Gascó, *et al*. 2006: 362; Sagrario Carrasco Porras 2005: 256-257, 259-260; Aranegui, *et al*. 2007: 208-209; Bonet Rosado, *et al*. 2005: 119, fig. 13; see Chapter 7.4.4.
[38] Pliny, *NH* 31.43.94, 31.44.95; App. 4.1: *Text 6.j*. Other evidence for *scomber* as an ingredient in *garum*: the Pompeii sauce of A. Umbricius Scaurus: *G(ari) F(los) Scombri* (Curtis 1988-89).
[39] Pliny, *NH* 31.43. 94; Étienne 1970
[40] See Chapter 7.3.4; Grau Almero, *et al*. 2001: 220; Aranegui Gascó, *et al*. 2006: 374-377.
[41] Based on *tituli picti* on Mañá C2a found at Rome; see discussion in Chapter 7.4.4; Aranegui, *et al.* 2007: 208; Aranegui Gascó 2005b: 273; Aranegui Gascó, *et al.* 2000: 17; Bonet Rosado, *et al*. 2005: 107; see also App. 5: *Cat. 3*.
[42] Lernau, *et al.* 1996: 39; Bruschi & Wilkins 1996
[43] From the *cetariae* at the No. 13 Calle Hermanos Gómez Marcelo site; see Chapter 7.3.4.

Mauretanian/early Roman *tituli picti*.[44] (The only finds of tunny bones at *Lixus* were found "on the beach" and therefore could be modern remains.[45]) The presence of bluefin tuna bones in Late Roman layers at *Septem* might be connected to the *cordyla* product; if this is the case, this type of product would have been produced in the region for at least three centuries.[46]

8.2.2.2 Purple dye production

Of the 12 salting sites with extant marine animal remains, *Muricidae* shellfish species (*murex* and *purpura*) were found at eight of these (see Tables 8.7-8.9). These shellfish could have been consumed fresh as other species were, or mixed in salting vats to make sauces as Pliny notes.[47] Their presence might also indicate that purple dye manufacture took place, and this might be so where only these shellfish species were found with fish bones, at Cotta and Essaouira.[48] At sites where only these shellfish species were found, such as Metrouna, on the Mediterranean coast, and in an area just north of riverine *Thamusida* near the Atlantic coast, dye manufacture might have been the sole salting activity conducted (although *cetariae* were located inside the settlement at *Thamusida*).

Purple dye manufacture is often cited as a significant industry of the region, most likely due to several ancient textual references: Horace, Ovid, Pomponius Mela, Silius Italicus and Pliny all mention the 'Gaetulian purple' and its high quality.[49] This importance has been re-iterated in previous studies, but these statements are supported almost solely by the textual mentions and based on little archaeological evidence.[50]

Although the difficulty in establishing the quantification of salted resources has been addressed previously (see Chapter 3.2.3), the volume of supply of this industry is an integral part of the evidence demonstrating the manufacturing process. In this process, numerous shellfish are necessary to produce the liquid dye (somewhere between 1,000 to 12,000 hypobranchial glands, equalling the same number of shells, needed to colour a single textile).[51] This production, even at a modest scale, would therefore result in an extremely large amount of *Muricidae* shell debris. Such remains are clearly visible at production sites

[44] See Chapter 7.4.4; see App. 4.2.
[45] Ponsich 1988: 138; Ponsich & Tarradell 1965: 39
[46] See App. 4: *metadata*.
[47] Pliny, *NH* 31.44.95
[48] This is the case for the Punico-Mauretanian/Roman and Roman layers at Essaouira; see App. 1.1.3, App. 1.2.3.
[49] See App. 4.1: *Text 1.a, 3.a, 4.a, 6.a-b, 6.i, 7.a*. For the location of the Gaetuli tribe on the Atlantic coast, see Chapter 4.3.
[50] Ponsich & Tarradell 1965: 39, 102; Desjacques & Koeberlé 1955; Gattefossé 1957; Jodin 1967: 253-255; Tejera Gaspar & Chávez Álvarez 2004; Curtis 1991: 65-66; Pons Pujol 2000: 1253
[51] For disagreement over these production quantities, see Karali 2002: 106; Ruscillo 2005: 105.

such as Meninx (Tunisia) and Benghazi/*Berenice* (Libya).[52] Obvious remains of this process are lacking at the sites in *Mauretania Tingitana*, although the recent identification of Metrouna and the manufacturing area at *Thamusida* have yet to be investigated fully.[53] At Essaouira, the site identified as the *Insulae Purpurariae* of Juba II, there is shell debris on the main island that includes many different types of species, in addition to those from the *Muricidae* family. Shell middens have been identified on the mainland coast near here, most notably north of the modern city where pierced red-mouthed rock shell (*Purpura [Thais] haemastoma*) is the dominant species; other middens are identified on the beach further north, between Safi and Essaouira. The size of these deposits, as well as their chronology, however, remains unknown.[54]

At other North African sites, mounds of *Muricidae* (*murex*) shells left over from dye manufacturing have been reduced due to the re-use of the shells: at Benghazi/*Berenice*, Sabratha and *Lepcis Magna* shells were crushed and used for flooring, fired in kilns to make lime, used as pottery temper or as construction fill.[55] These uses might explain the lack of shells in the northwest Maghreb sites. At Dchar ‘Askfane near the coast of the Straits, broken *murex* shells appear to have been incorporated into the flooring of some rooms.[56] At *Lixus*, numerous lime kilns are noted by de La Martinière on his 1890 site plan, some of these are in the fish-salting area; he also notes that modern lime kilns have permanently destroyed some of the ancient vestiges of the site, perhaps residual shell mounds, if present, were exploited (see Fig. 7.41).[57] *Murex* shells are also associated with an area of kilns adjacent to *Thamusida*.[58]

Another facet and associated industry of dye manufacture is textile production. As the process for preserving the liquid dye was not discovered until the 6th century, the dye at this time could not be transported once it was made, and the requisite textile or fleece had to be immediately dipped in the same location.[59] This would mean that facilities such as fulleries for processing wool for such textiles would likely be present at these sites or in their

[52] Drine 2007: 82-85; Slim, *et al.* 2004: 21, 35; Wilson 2004: 160-161; Wilson 2002b: 251-253
[53] Preliminary information in Bernal, *et al.* 2008b: 332-335, fig. 20; Papi, *et al.* 2000; Wilson 2002b: 251-253.
[54] Desjacques & Koeberlé 1955: 197-199, on “Safi beach”. These middens, however, have been difficult to re-locate during recent surveys; J. Eiwanger (DAI), pers. com.
[55] Reese 1979-80: 90-92; Wilson 2002b: 254-259; Wilson 2004: 162-163; Wilson 1999: 42-44
[56] Personal observation during excavations, April 2005.
[57] Aranegui Gascó & Tarradell-Font 2001: 17; de La Martinière 1890: Pl. VII: “four à chaux”.
[58] Wilson 2004: 162; Papi, *et al.* 2000
[59] Wilson 2002b: 249; Wild 2002: 7; Drine 2007: 88; Reese 1979-80: 86, 90; see Chapter 3.2.3.

vicinities, consisting of shallow treading vats and tubs.[60] At present, the only excavated structure that might have been used for fulling is a small basin at Essaouira, situated in the southern part of the Roman/Late Roman *villa* complex, which dates to the 3rd-5th centuries AD.[61]

The production of dye at Essaouira, however, is often associated with the reign of Juba II (25 BC-AD 23/24). However, the main evidence for the possible dye production is based on the association of a possible kiln area and the remains of a large amount of lead, which could have been part of the containers used to heat the mixture, as described by Pliny and Vitruvius.[62] These features, as does the above-mentioned possible fulling basin, are identified in the later 3rd-5th century AD *villa* complex, and post-date the main period of the dye processing identified in texts.[63] (The two *cetariae* at the site, however, are difficult to date and might belong to the Punico-Mauretanian period, for salting fish or even keeping the *Muricidae* species alive before use, as also described by Pliny.[64])

No other such fulling basins have yet been identified in the province. This might simply be oversight or the result of limited excavation, as finds of textile weights at the very least suggest the weaving of cloth on warp-weighted looms. At *Tamuda*, for example, over 100 bun-shaped and trapezoidal weights were recovered from the eastern residential *insulae* of the Punico-Mauretanian settlement; these weights most likely belonged to looms.[65] Additionally, although no fulling facilities have been yet identified at *Volubilis,* a fuller's guild, *vestiarii*, is known through an inscription to have existed in the city during the Roman period.[66] The Baquates, semi-nomadic peoples based around the area of *Volubilis,* annually entered Volubilian territory for winter pasturing, and could provide sheep wool for fulling, as could other farms in the area.[67]

Another explanation for the comparatively few numbers of the remains of *Muricidae* shellfish in the region might be due to the possibility that they were consumed fresh or used in salted sauces, which would result in fewer quantities being consumed. This might be

[60] Fulleries are identified at Timgad, and are differentiated from dye vats as they lack heating facilities and are relatively shallow; some vats are round; see Wilson 2004: 155; Wilson 2002b: 237.
[61] See App. 3.1: *Site 57*; Jodin 1967: 30-31, 61-66, figs 9, 12, Pl. XXIV.
[62] Pliny, *NH* 9.60.126-127; Vitruvius, *de Architectura* 7.13.3
[63] Jodin (1967: 256-257) mixes the chronology of evidence in his discussion of dye manufacture.
[64] Pliny, *NH* 9.60.36
[65] Documentation of finds conducted in Musée Archéologique, Tetouan, April 2007; see also mention of some of these in Villaverde Vega 2001: 237; Morán & Giménez Bernal 1948: 42, Pl. VIII, A.
[66] *CIL* VIII, 21848 (see also *IAM* 2, no. 581). The guild formed a *collegium Mercurium*, and paid for the tombstone of a boy, probably belonging to one of the members (Johannesen 1954: 158).
[67] Sigman 1977: 430; Shaw 1986: 74; Frézouls 1957

demonstrated by the fact that many of the extant shells recovered from these sites are not pierced, which is a feature that indicates the removal of the hypobranchial gland for the due making process in the manner related by Pliny and Vitruvius.[68] Additionally, the five sites identified as having evidence of fresh consumption (and no evidence of salting production) also have finds of *Muricidae* species (see Tables 8.1-8.3). Specimens of red-mouthed rock shell (*Purpura [Thais] haemastoma* and *Stramonita haemastoma*) are also found at four sites not associated with salting practices. This *purpura* type is often used with *murex* in the dye process, but in fact cannot produce dye on its own and is more often consumed as a foodstuff or used as bait in artisanal fisheries.[69] It is possible that for most of the sites in *Mauretania Tingitana*, especially at inland riverine sites like *Tamuda* and *Banasa, Muricidae* shells are more indicative as food, or even trade goods and ornaments.[70]

The importance placed on the dye industry of the province by ancient authors does not seem to translate to a large industry visible in the extant archaeological record. Dye manufacture most likely occurred at sites such as Essaouira, *Thamusida* and Metrouna, but the lack of debris and other associated industries, such as textile manufacture, has not been addressed in previous studies. The material from the region demonstrates that the presence of *Muricidae* species at sites does not necessarily indicate dye manufacture, as these were certainly used as an ingredient for salted sauces and consumed fresh.[71]

8.2.2.3 Marine resource and agricultural production

The processing of marine resources into *salsamenta*, salted sauces and purple dye played a role in both the urban and rural economies of the Punico-Mauretanian territory and kingdom and later Roman province. Other agricultural goods such as grapes, olives and grains were 'processed' in the same sense as fresh seafood: the foodstuff underwent a conversion process to be consumed in a different form. Marine resources and these products are generally

[68] Pliny, *NH* 9.60.126-127: "from the larger purples they get the juice by stripping off the shell, but they crush the smaller ones alive with the shell, as that is the only way to make them disgorge their juice…"; Vitruvius, *de Architectura* 7.13.3: "when the shells have been collected, they are broken up with iron tools"; see also Fernández Uriel 1995: 311-314; Ruscillo 2005: 103-104; Reese 1979-80: 83. For example, the percentage of complete *Muricidae* shells at the Villa Victoria site at *Carteia* is extremely low compared to those that are fractured or remains of parts such as columellas; see Bernal Casasola, *et al.* 2009: 232-239.
[69] Pliny, *NH* 9.62.38-39; Ziderman 1990: 99; Karali 2002: 105; contra Reese (1979-80: 79-80), who states that *purpura* are not used as fish bait (they are avoided by marine life, possibly due to their dye gland). This species is presently collected for food along the littoral at Essaouira and historically along the coast south of here; App. 6: *Cat. 3.9. Essaouira (5)*; *Purpura haemastoma* collected near Agadir and around the mouths of the Oueds Sous and Massa in the 1950s (Desjacques & Koeberlé 1955: 198-199).
[70] *Murex* shells have been found at the Hellenistic site of Tell Rifa'at in Syria, ca. 100 km from the sea, and the shells themselves are thought to have been traded as 'exotic' goods (Reese 1979-80: 85).
[71] App. 6: *Cat. 4.1. El Puerto de Santa María, Spain*

examined here, in order to form a broad overview of the use of the landscape and waterways of the region and determine the relative importance of the processing of marine resources in the province's economy.

The two sites of Emsa and Sidi Abdeselam del Behar functioned as probable salting centres in the Punico-Mauretanian period. These sites, however, lack *cetariae* as the salting was most likely done in large amphorae (Mañá-Pascual A4 types found at the site). Because of this, it is only possible to note the general evidence of salting activities: the sites' locations, chronology and the extant shellfish finds (see Table 8.7).[72]

A majority of the sites that processed marine resources in the province are identified by the presence of *cetariae*, and date to the late Punico-Mauretanian/early Roman, Roman and Late Roman periods. Determining the quantities of products manufactured in these *cetariae* is difficult due not only to the incomplete nature of the remains (in some cases only the bases of the *cetariae* are preserved), but also due to a myriad of unknown processing factors: the level of compression of the product as it is salted, periods of usage and types of products and their processing times.[73] Additionally, other meats may have been salted in the *cetariae*, affecting production output.[74] In this section, the numbers of *cetariae* and general capacities (if known) are included in order to indicate only the possible production capabilities at any one time. Contextualising these data within each site type will allow for the general determination of scale: which centres were likely producing products for local subsistence or surplus production for export (locally, throughout the province and beyond its borders).

RURAL PRODUCTION

The rural landscape of the province of *Mauretania Tingitana* consisted of the hinterlands of settlements/cities (as identified as 'major sites' in Chapter 2.2.4) – that is, the areas not inside or immediately adjacent to these that are comprised of minor sites and agglomerations.[75] In this rural landscape are at least 86 *cetariae* (minimum ca. 800 m^3 capacity), forming nine groups (Table 8.11).

[72] See App. 3.1: *Sites 7-8*
[73] See discussion in Chapter 3.2.3; Wilson 2002b: 247-248.
[74] At *Baelo Claudia*, pork bones were found in *cetariae* and beef and mutton bones at *Iulia Traducta*; Columella's salting recipe is for pork (*DRR* 12.55.4). See Hesnard 1998: 174; Bernal, *et al.* 2007c: 370-371; Arévalo González, *et al.* 2004: 286-287; García Vargas & Bernal Casasola 2009: 143.
[75] Edmondson (1987: 129) proposes a three-tiered hierarchy of fish-salting sites based on evidence from *Lusitania*: urban, rural and *villae*; this has been argued against archaeologically, see García Vargas & Bernal Casasola 2009: 160-162. In this study only urban and rural production are identified.

Groups of these *cetariae* are located adjacent to small settlements or agglomerations: Metrouna on the Mediterranean coast, Ksar-es-Seghir and possibly Zahara on the Straits of Gibraltar coast and Cotta (during its earliest phase) on the Atlantic coast.[76] These settlements are most probably where those who worked at the salting sites and fishermen who supplied them lived, and in this sense can still be considered rural production sites, perhaps occupied only seasonally.

Two *cetariae* are present at Essaouira, 430 km south of the southern limits of the province. These might have been established in the 1st centuries BC/AD, but perhaps were also used when a *villa* was established on the island, between the 3rd-5th centuries AD. At Dchar 'Askfane a *villa* with at least two *cetariae* also operated during the Roman period, and a peristyle house was built into the complex at Cotta in the late 3rd century.[77] These three sites are indicative of rural production due to their topographical isolation, and as such perhaps functioned as part of a localised economy, primarily fulfilling the consumption needs of the residents and dependents of the *villa* or converted complex, in the case of Cotta.[78] Similar situations of *cetariae* associated with or part of *villae* complexes are found on the Algarve and Andalucían coasts (between Málaga and Almuñécar) on the Iberian Peninsula.[79] This does not preclude that any surplus products could not be "exported" from these sites, however. This would certainly be the case at Cotta, where the *cetariae* do not appear to have been reduced when the peristyle house was built; the 258 m^3 capacity would seem too large amount for one household to consume, especially if fresh resources were readily available next to the site in the Atlantic. At Essaouira, the ca. 14 m^3 capacity of the *cetariae* would be much more in line with small-scale needs of a *villa*. It is likely that if purple dye manufacturing took place, however, this industry's products, of high value, were exported beyond the *villa*.

Other *cetariae* groupings are located near major sites (urban centres), and might conceivably have been considered part of the settlements' coastal and riverine hinterland production. This

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[76] See App. 3.1: *Sites 9, 19, 21, 24*; Metrouna could have been associated with the Roman-period occupation (camp?) at Sidi Abdeselam del Behar (Villaverde Vega 2001: 237-239), see also Chapter 7.2.
[77] See App. 3.1: *Sites 20, 24, 57*. Two *villae*/peristyle houses were associated with the salting complexes inside the city walls in an "industrial zone" at *Baelo Claudia* in Spain (Bernal, *et al.* 2007a; Bernal, *et al*. 2007b).
[78] Gil Mantas 1999: 151
[79] Algarve coast: Boca do Rio, Mexilhoeira Grande, Ferragudo, Cerro da Vila, Quarteira, Olhão, Paul, and Caecela, but also at the isolated site of Praia de Angeiras on the north Atlantic coast (Gorges 1979: 480-483; Gil Mantas 1999: 147, 151; Étienne & Mayet 1998a: 42-45). Andalucían coast: *Calpe*, San Pedro de Alcántara, Punta de l'Arenal and *Torrox*; a *villa* is also present at the large site of *Carteia* (Gorges 1979: 181; Martin & Serres 1970: 18; Étienne & Mayet 2002: 62-63; Bernal Casasola 2006b: 180-181; García Vargas & Bernal Casasola 2009: 153).

might have been the situation of the apparently isolated or "autonomous *cetariae*" at Sania e Torres on the Mediterranean coast in relation to *Septem* in the Straits of Gibraltar, ca. 20 km distant.[80] The same may be stated about the isolated groups of at least four *cetariae* at Kouass and the larger six complexes (with a minimum of 42 *cetariae*) at Tahadart on the Atlantic coast in relation to *Zilil*, ca. 5 km and 8 km distant, respectively.[81]

At present, there is no extant evidence in the province for wine making.[82] It is clear, however, that other contemporary foci of rural agricultural production in *Mauretania Tingitana* were the pressing of olive oil and milling of grain (Table 8.12). Most of the olive oil and grain/flour production areas are located throughout *villae rusticae* in the Rharb bordering the Atlantic and also around *Tingi*, adjacent to the Straits. Some agricultural activity took place in the Oued Martil valley near the Mediterranean. In the case of Cotta, the pressing of olive oil and processing of salted products were combined in the late 3rd century when the complex was refurbished.[83] At Essaouira, too, milling grain might also have taken place alongside salting activities.[84]

URBAN PRODUCTION

Urban production of the province of *Mauretania Tingitana* is defined here as the processing of agricultural foodstuffs inside or immediately adjacent to settlements (as identified as 'major sites' in Chapter 2.2.4). In this group are at least 186 *cetariae* (minimum ca. 1,047 m^3 capacity), present at four sites (Table 8.13).

At *Lixus*, the ten salting complexes are concentrated at the base of the plateau, outside the city walls and away from the residential areas (see Fig. 7.34). This area likely comprised an urban production zone, associated with the proposed Roman lagoonal port and shops (*tabernae*).[85] This situation is comparable to sites in southern Spain, especially *Carteia*, *Iulia Traducta*, *Gades* and to some extent, the "industrial zone" at *Baelo Claudia*, and also in Algeria at *Cartenna*.[86]

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[80] For "autonomous *cetariae*" see Bernal Casasola 2006a: 1372-1373; for the Roman periods and perhaps the Late Roman period, see chronology and late finds discussion for Sania e Torres in App. 3.1: *Site 15*.
[81] See App. 3.1: *Sites 28-29.*
[82] Wine production has been interpreted only from the depiction of grapes on Punico-Mauretanian coins and grape seeds in a Punico-Mauretanian amphora with mussels at *Lixus,* suggesting vinegar (Sagrario Carrasco Porras 2005: 256-257, 259-260).
[83] See App. 3.1: *Site 24.*
[84] Jodin 1967: 220, Pl. CVI
[85] See App. 3.1: *Site 36*; Chapter 7.4.
[86] Bernal Casasola 2006b: 177-182, 185; Bernal 2007; Expósito 2007. *Baelo Claudia*: there are two areas of salting, one outside and one inside the city walls (Arévalo & Bernal 2007b; Bernal, *et al.* 2007a; Bernal, *et al*. 2007b; Ponsich & Tarradell 1965: 86-87); *Cartenna*: Curtis 1991: 67.

At *Septem*, the five groupings of *cetariae* and four preparation areas (suggesting other possible areas of as-yet-unidentified *cetariae*) are distributed throughout the La Ciudad area, which eventually was surrounded by necropoli and amongst which a basilica was established. This situation is comparable to the distribution of *cetariae* at Tróia in western Portugal, where urban infrastructure and houses were built amongst and sometimes adjacent to salting complexes.[87]

At *Thamusida*, the proposed *cetariae* are inside the city walls on the banks of the Oued Sebou, adjacent to which is a bath complex and a temple. Additionally, north of the city walls there is an area identified for the manufacture of purple dye.[88] At *Banasa*, the six proposed *cetariae* are distributed throughout the site in four groups, situated in houses or shops inside the city walls, along the *cardo*. This distribution is comparable to the sporadic urban salting *cetariae* proposed at Sabratha.[89] Generally, salting inside the walls of a city was unusual due to the strong odour, but there are exceptions in Iberia, North Africa and the Black Sea.[90]

At *Thamusida* and *Banasa*, where there was a comparatively smaller amount of urban salting production (nine *cetariae* combined), other agricultural goods were processed inside or adjacent to the settlements (Table 8.14).[91] At *Thamusida* grain was milled and stored in the city; at *Banasa*, olive oil was pressed. However, at the major urban production sites of *Lixus* and *Septem* (156 *cetariae* combined), fish-salting appears to have been the sole urban agricultural industry.

8.2.2.4 Discussion

The role of salted and processed marine resources in the economy of the northwest Maghreb is difficult to determine precisely during the Roman period. Aside from the different products that could be produced, there are inherent variables in the processing methods of these. Additionally, there are disparate levels of preservation of the facilities' remains that make it difficult to tally capacities. Additionally, other provincial agricultural production such as olive oil pressing and grain milling has not been fully examined, rendering it nearly impossible to attempt more than a general level of comparison between the industries of

[87] Gil Mantas 1999: 147; Étienne & Mayet 1998a: 44-45
[88] See App. 3.1: *Site 47*.
[89] See App. 3.1: *Site 46*; Wilson 2002b: 242-250; Wilson 1999: 29-42.
[90] At Lisbon, *Baelo Claudia*, Seville, Barcelona, *Tipasa* in Algeria, *Neapolis* (Nabeul) in Tunisia, possibly Pompeii and Tyritake and Chersonesos in the northern Black Sea (Bernal, *et al.* 2007a: 91-101; Slim, *et al*. 2007; Wilson 2007: 178-180; Amores, *et al.* 2007; Beltrán de Heredia 2007; Curtis 1991: 67, n. 105; Schleiermacher 1965; Højte 2005: 142-148, 150-152).
[91] Grau Almero, *et al*. 2001: 229

these foodstuffs.[92] Compounding these issues are other difficulties when comparing production volumes. Salted sauces were consumed as condiments or flavourings (or used medicinally), and in this manner not as much volume was consumed compared to grains, wine and olive oil on a daily basis.[93] Because of these factors, only the general scale and role of the industry's contribution to the province's economy can be assessed here. The rather rough determination of this scale, and therefore the broad concept of subsistence and surplus applied in this discussion, is based on the number and capacities of *cetariae* present in the region: sites with less than 20 m^3 capacity are considered as producing "subsistence" goods whilst any number of *cetariae* and volume over these are considered as producing "surplus" goods.[94]

During the Roman period, the number of *cetariae* and therefore general scale of production at the urban centres (165 *cetariae*, ca. 1,047 m^3 capacity) is comparatively larger than those at rural sites (86 *cetariae*, ca. 800 m^3 capacity). At *Lixus* and *Septem*, these numbers demonstrate that there was surplus production of salted goods (combined, 156 *cetariae*, ca. 1,039 m^3 capacity). (*Septem* might also have been associated with the five *cetariae* at Sania e Torres, see above.)

Processing within the urban centres does not necessarily indicate surplus production, however: at the riverine sites of *Banasa* and *Thamusida*, the nine *cetariae* (ca. 8 m^3 minimum capacity) probably were used only seasonally for fish-salting (perhaps when the shad or sturgeon migrations occurred in the spring on the Oued Sebou).[95] The capacities of these *cetariae* would have meant that the products made were intended to provide for the local population of the military camp and settlement at *Thamusida* and the residents of the *colonia* of *Banasa*. Although it is not yet clear, the purple dye production at *Thamusida* could have been an industry that, because of the value of its products, exported goods beyond the settlement.

Alternately, rural production centres could produce goods not just to fulfil the local needs of the small adjacent settlements which were most likely occupied by fishermen and workers at the complexes. The centres at Ksar-es-Seghir (12 *cetariae*; possibly associated with Zahara and its two *cetariae*), Cotta (16 *cetariae*) and Tahadart (42 cetariae) most likely produced a

[92] Wilson 2002b: 235
[93] Ejstrud 2005
[94] These numbers of course, become problematic when discussing sites such as Metrouna, which at present possesses one *cetaria*, but might in fact have been a purple dye production site.
[95] Although sturgeon was found at the site (see App. 1.1.3), it is not clear if this species was salted; see also App. 6: *Cat. 3.5. Oued Sebou.*

volume of goods that far exceeded local needs: these sites combined had ca. 709 m^3 capacity at any one time. This is comparable to the rural production of olive oil in the hinterland of *Volubilis*, estimated to have been for the consumption of the city (population estimated to be ca. 15,000-20,000); it is proposed that any surplus was sold in the city, or within the confines of the province, whose overall population during the provincial period is estimated at 30,000.[96]

Tahadart might have functioned as part of the rural productive hinterland associated with the settlement at *Zilil*, but its output (42 *cetariae,* ca. 400 m^3 capacity) seems in excess of the needs of the population of the Roman *colonia* (although unknown), and would suggest surplus production for distribution outside of *Zilil* and its hinterland. The same could be inferred from the productive outputs at Cotta and Ksar-es-Seghir, which together had a minimum of 28 *cetariae* with a minimum capacity of 298 m^3 (see Table 8.11). These latter sites are also not obviously situated in the ‘marine hinterland’ of any major settlement in the province, although *Tingi* and *Septem*, respectively, might be tentatively proposed. It might be the sites of Cotta and Ksar-es-Seghir (and possibly even Zahara) were part of a network of production sites that produced goods for *Tingi* and *Septem*.

It is clear that the surplus products of some of these fish-salting sites were not only consumed locally within the northwest Maghreb, but exported outside the province. This is demonstrated in the late Punico-Mauretanian and early Roman periods with the distribution throughout the western Mediterranean and in Central and Northern Europe of amphorae with *tituli picti* describing products of *Lixus* and *Tingi*.[97]

The exportation is also relevant to the close connection *Mauretania Tingitiana* had to *Baetica,* across the Straits of Gibraltar. The proximity of these provinces around the “Circle of the Straits” is reflected in the similarity between the material culture, and particularly during the late Punico-Mauretanian and Roman periods, the nearly-identical construction of *cetariae* and salting site layout and the types of salazón amphorae produced in each region.[98]

It has been proposed that by the 1st century AD, the surplus products of the Mauretanian fish-salting centres were transhipped to consortia, companies (*societas*) or cooperatives in

[96] Akerraz & Lenoir 1981-82: 93-95; Gozalbes Cravioto 1997: 96-103. Population estimates: Thouvenot 1949: 3; Euzennat 1989a: 201-210; Courtois 1955: 108; see Chapter 4.3.
[97] See App. 4.2.
[98] The layout of the sites in some cases is a nearly identical “U” shape of *cetariae* around a preparation floor such as at Cotta, Tahadart, *Gades* (Teatro Andalucía), *Iulia Traducta*/Algeciras (c/ San Nicolás I-II), Troía (Factories I, II) and Ilha do Pessegueiro (García Vargas & Bernal Casasola 2009: 154-157; Étienne & Mayet 2007: 8-9; App. 3.1: *Sites 24, 28*). For salazón amphorae, see Chapter 3.2.3.

Baetica, for further re-distribution throughout the Roman Empire. In this scenario, the small number of early Roman-period kilns in *Mauretania Tingitana* would mean that in order to fulfil the volume requirements of these centres, additional empty salazón amphorae were shipped to the province from *Baetica*. These amphorae were shipped probably from the major port of *Gades* or the surrounding kiln regions, where extremely high numbers of kilns that manufactured salazón types are sited. These amphorae were then filled in *Mauretania Tingitana* with "local" products, shipped back, and further transhipped throughout the Mediterranean as "Baetican" products, in clearly-identifiable "Baetican" amphorae.[99] This relationship has been proposed for the products of Cotta, Kouass and *Lixus*, due in large part to the high number of Baetican amphorae types at these sites, amongst other Baetican wares.[100] This has also been proposed at *Septem*, as some salazón amphorae found here have been proven to originate from Baetican kilns.[101]

The nature of the relationship between *Baetica* and *Mauretania Tingitana* in respect to salted-fish products is still very much an open question and there is strong evidence to support external as well as internal, independent industry. The recent discovery of early Roman-period kilns in *Mauretania Tingitana* which fired Baetican salazón types, at Oued Mdâ, *Thamusida* and *Septem*, provide evidence that argues against the "anti-economic" transport of empty amphorae to the province.[102] However, petrographic analyses indicate that amphorae manufactured in southern Iberia were very much present at the Mauretanian fish-salting centres.[103] Certainly, the social and economic relationships around the "Circle of the Straits" are demonstrable even in the Punico-Mauretanian period, and these developed further when the regions were both Roman provinces. The level of organisation for distribution of the salted products may not have been isolated in each province but included economic relationships that extended beyond the provincial boundaries.

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[99] Ponsich 1988: 61, 65; Ponsich 1970: 336; Ponsich & Tarradell 1965: 99; Ponsich 1975: 672, 677, 680; Étienne 1970; Étienne & Mayet 1998a; reviewed in Bernal Casasola & Pérez Rivera 2000: 862-865; Pons 2007: 453-454; Pons Pujol 2000: 1253; Trakadas 2005: 75; Arévalo González, *et al.* 2004: 310; Bernal Casasola 2006a: 1381-1384.

[100] Ponsich 1988: 51; Villaverde Vega 2001: 336; Hassini (2008:436-437) proposes that the high number of Beltrán IIB types at Cotta reflects contacts with *Gades* and the Huelva region.

[101] The importation of Baetican finewares at *Septem* also has led to the suggestion of this relationship of importation (Roca Roumens & Fernández García 1988). Additionally, epigraphy (SOC/SOCI) is similar on *Septem* finds of Puerto Real I types (derivatives of Beltrán IIA types) as those from Punta Melchor (Bay of Cádiz), and petrographic studies have confirmed the origins of these types (Bernal Casasola & Pérez Rivera 1999: 65; Bernal Casasola & Pérez Rivera 2000: 870-871).

[102] See discussion on this theory in Teichner & Pons Pujol 2008; Pons Pujol 2000: 1258-1261; Cerri 2007a; Cerri 2007b; F. Villada Paredes (Instituto de Estudios Ceutíes, Ceuta), pers. com. For petrographic analyses of Almagro types manufactured near *Septem*, see Villaverde Vega & López Pardo 1995: 472; Bernal Casasola 1996: 1213-1224; Bernal Casasola 1997: 92, 97, 103.

[103] Bernal Casasola & Pérez Rivera 1999: 65; Bernal Casasola & Pérez Rivera 2000: 870-871

Two of the purple dye sites in *Mauretania Tingitana*, Metrouna and Essaouira, also have significance for export production, even though much smaller than the rural centres cited above. Although the facilities at Essaouira were part of a *villa*, the two *cetariae* possibly used for fish salting would certainly have contributed to the local consumption needs of the *villa* itself, although purple dye production might have played a larger economic role in that dyed goods, as highly-valued commodities, were manufactured for export. The evidence for such a role at Metrouna, however, is less clear at present. Like at *Carteia* across the Straits of Gibraltar, *Thamusida* might be considered a "double urban model", where an area for manufacturing the dye was present just adjacent to the walled settlement whilst salting *cetariae,* for fish and possibly shellfish, were also present inside the settlement.[104]

Although salted-fish products were exported beyond the province, these foodstuffs were consumed locally as the 54 sites with finds of salazón amphorae attest.[105] Some of these goods were produced in the province for regional consumption, as discussed above. (This does not preclude, however, the importation of salazón products from outside the province as well, demonstrated by the Lusitanian amphorae types.[106]) The production levels of the Roman period, however, were reduced greatly by the Late Roman period. At urban centres like *Lixus* and *Septem* and the rural complexes at Tahadart, *cetariae* went out of use and others were re-built with reduced capacities, indicating reduced production and a likely change to supplying only local needs. Consumption levels of salted products also declined in the region at this time, as reflected in the comparatively fewer number of sites where salazón amphorae are present (Fig. 8.1).

The supply of these marine resources for processing derived largely from coastal fisheries, but riverine fisheries also functioned, based on the situation of the *cetariae* at *Thamusida* and *Banasa*. More permanent or semi-permanent artisanal fisheries, perhaps related to special markets might have developed in the region, and fish-salting centres would have especially formed such markets. In order to reduce the time of transportation after catching (especially for tunny, which deteriorate faster than other species), salting sites in *Mauretania Tingitana* and elsewhere were normally situated as close as possible to the fishing grounds where migratory or schooling species would pass.[107] Salting in purpose-built *cetariae* was the best way to immediately "consume" catches of such fish when large quantities were involved.[108] Fishermen, as Manilius describes in the 1st century AD, would land their boats on the shore

[104] García Vargas & Bernal Casasola 2009: 162
[105] See App. 3.3.2.
[106] Specifically the Almagro types; see Chapter 3.2.3.
[107] Ayodeji 2004: 207; see App. 3.1.
[108] Curtis 2001: 409

near salting centres, where the catch was immediately cleaned, or it was brought to the preparation area of the centre and gutted and rinsed. It then could be processed as *salsamenta* or fish sauces.[109]

The proximity between the areas of fishing effort and salting centres suggest that the fishermen who supplied them lived nearby, close to the consumers of their catches (and indeed, might even have been part of a larger economic and social organisation of these centres). This might be the case for settlements such as *Lixus* and *Septem,* but also at the riverine sites of *Banasa* and *Thamusida*. However, some Roman-period fish-salting sites in *Mauretania Tingitana* were not located near large settlements. This would indicate that at least during the operation of these sites (which could in fact be only part of the year, in late spring and possibly the autumn when the migratory species were present), the fishermen who serviced them occupied a social 'margin' of society, living away from urban institutions.[110] This marginality can perhaps be seen at *Septem* in the 1st century AD as no permanent structures have as yet been located from this time aside for the *cetariae* themselves (by the next century, however, this situation had changed).[111] A similar situation was possible at Cotta, where a small settlement was likely situated nearby, as demonstrated by the presence of baths, a temple and necropolis; a small settlement was situated next to the complex at Ksar-es-Seghir.[112] The marginality of the occupation of fishing might have been less apparent at settlements where the scale of fish-salting was larger, such as *Lixus* and *Septem* (after the 1st century AD), although this is not yet possible to prove archaeologically.

The presence of migratory species at the region's Roman-period salting sites indicates that specific fishing methods were used to catch them. Such methods could include hook-and-line fishing that for the larger species could entail offshore hand-lining (specifically mentioned for catching tunny by Aelian) or long-lining, where multiple hooks were attached to a single line.[113] The latter is a good method for catching smaller migratory and schooling fish such as mackerel and sardine.[114] In addition, seine net fishing, from a boat or boats offshore, or the use of a beach seine, was most probably practised, as described by Oppian and Aelian.[115] It is highly probable that even fixed nets were established at certain sites. At the seven sites

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[109] Manilius, *Astr.* 5.656-681; Curtis 2001: 413-414. For the organisation and legal context of salting centres and ownership by private individuals or *socii* in the western Mediterranean, see Bekker-Nielsen 2002a: 33; Edmondson 1987: 128-136; Étienne 1970: 306-307; contra Ørsted 1998: 21-26.
[110] Ørsted 1998: 22-23
[111] See Chapter 7.3.1; Villaverde Vega 2001: 206.
[112] See App. 3.1: *Sites 19, 24.*
[113] Aelian, *NA* 15.10; long-lining attested by Sidonius, *Epistulae* 2.2.12; Oppian, *Hal*. 3.78, 3.465-481, Aristotle, *HA* 532b25; 621a15.
[114] Kron 2008: 205; Powell 1996: 123; Sternberg 1998: 96
[115] See Chapter 3.2.2.

where migratory fish, whale and shark bone are present or inferred by *tituli picti* (see Tables 8.7-8.9), equipment for hook-and-line fishing of large species (large fish hooks) and net fishing (heavier weights than those used for cast nets) were also found.[116] These methods indicate that fishing to supply these sites was not an individual pursuit (whilst fishing for the shellfish might have been). The fishing apparatuses described above require collective manpower, whether pulling in nets or handling a vessel whilst another fisherman or fishermen use hook-and-lines or nets. This suggests that there was offshore fishing at the salting sites around the province's littoral, and groups of fishermen were working together to supply their catches directly to these sites.

Due to the annual migratory cycles, the cooperative fishing effort offshore would only occur at certain times of the year: the periods of late spring/early summer and late summer/early autumn. By extension, the salting sites would have been busiest with their production at these times. Due to the large size of the fish and the number of catches arriving simultaneously, perhaps the technique used for making salted sauces was altered somewhat. The *Geoponica*, the most complete description for the process, specifies that the mixture is to ferment naturally in hot conditions for 27 days to three months. Alternately, the mixture could also be quickly and artificially reduced by heating in small pots (*marmites*), to speed up the time it took to process the sauces.[117] These pots are found at the complexes at Cotta and Tahadart, which also have small thermal facilities. Additionally, these two sites on the north Atlantic coast are near the migration paths of the *Scombridae* species. It is a strong possibility that artificial reduction was used to make the fish sauces from these particular sites, in order to accommodate large catches.[118]

The three non-migratory fish species found at *Septem* could demonstrate year-round production at these salting sites; the remains, however, were associated with migratory species, suggesting that they were caught at the same time of year. Such production periods might be different for shellfish, as almost all species could be consumed year-round except for oysters, mussels and some *Muricidae* species, which are 'consumable' for dye only in the winter, spring and early summer.[119]

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[116] See Tables 6.4, 6.0, 6.14; App. 2.
[117] *Geoponica* 20.46.1-6; see Chapter 3.2.3.
[118] Curtis 1991: 67; see App. 3.1: *Sites 24, 28*. *Septem* might also have a thermal facility and *marmites* are present (see App. 3.1: *Site 16*); heating whale blubber for grease/oil is also proposed (Bernal Casasola 2009b: 276-278). *Marmites* but no thermal facilities are present in the salting complexes at Zahara, Kouass and *Lixus* (see App. 3.1: *Sites 21, 29, 36*). Essaouira possess a thermal facility but this is likely related to purple dye production (see Section 8.2.2.2; App. 3.1: *Site 57*).
[119] See Chapter 3.2.1.

8.3 'Romanisation' and marine resource exploitation

The exploitation of the marine environment of the northwest Maghreb examined in this study includes material from the Punico-Mauretanian, Roman and Late Roman periods. Within this broad chronology from the 5th century BC to the 6th century AD, the methods and role of fishing, as well as the consumption of this activity's products differed after the incorporation of the region as the Roman province of *Mauretania Tingitana* (AD 42/43). After the reduction of the province towards the end of the 3rd century AD, further change can be detected in the material record relating to the exploitation of the region's diverse marine environments.

8.3.1 Punico-Mauretanian period

The settlements that emerged after the Phoenician and Punic contact with the populations of the northwest Maghreb were distributed primarily on the coasts and coastal lagoons of the region in the 8th and 7th centuries BC. By the 5th century BC and in the following centuries, a local material culture that demonstrated a mix of these foreign and indigenous influences emerged, and settlements such as *Rusaddir*, *Tingi*, *Lixus* and *Banasa* were established on the coast and along large rivers in the coastal plains. The area of cultural influence extended from the eastern Mediterranean coast at *Rusaddir* to Essaouira on the southern Atlantic coast. The indigenous Berber tribal rule of the region gave way to the establishment of a Roman-influenced client kingdom of *Mauretania* and the establishment of three *coloniae* in the Rharb plain in the 1st century BC. After the region was annexed by Rome in AD 42/43, a series of rebellions were ultimately suppressed by the third quarter of the 1st century AD, and the province of *Mauretania Tingitana* was brought into the Roman hegemony.[120]

During this period in the northwest Maghreb, there is extant evidence for the exploitation of 36 fish species and 34 marine invertebrate species (Table 8.15, Fig. 8.2). (Three fish and seven shellfish species are present in the combined Punico-Mauretanian/Roman period; all but one of these, tope shark, is found in the Punico-Mauretanian period.) These numbers represent a larger and more diverse group of marine resources than were caught in the subsequent Roman and Late Roman periods. This diversity is especially evident at sites along the Mediterranean and Atlantic littorals, where the indigenous Punico-Mauretanian riverine and lagoonal settlements of *Tamuda* and *Lixus* provide evidence of a high number of species.[121] Very few finds related to fishing derive from the Straits of Gibraltar region in this period.

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[120] See Chapter 4.2.
[121] See Chapter 7.2, 7.4.

During this period, the fishing effort included a diversity of methods. These probably entailed hand collection, or the use of small hand-held tools (such as an iron saw, σιδήπω σχίζεται), rakes (*ferramenta*, σιδήριος), harpoons and the setting of weels (κυρτός, *nassa*) or small traps (κυρτίδες). Hook-and-line fishing, with various-sized fish hooks (*hamus*, ἄγκιστρον) and net fishing with cast nets (ἀμφίβολον, ἀμφίβληστρον, *iaculum*, *funda*) and probably seines (σαγήνη, *sagena*) also took place (Table 8.16). These methods are evidenced by the marine species themselves, finds of fish hooks and fishing net weights, the needles and navettes used in the manufacture of fishing nets, and limited iconography. Line weights, gorges and lances are also present in this period and were used at the coastal and lagoon sites of Cotta, Tahadart, *Lixus* and *Thamusida* on the Atlantic coast; a line weight was also found at Sidi Abdeselam del Behar on the Mediterranean coast (some of these finds date to the Punico-Mauretanian/Roman period).[122] The immediate littoral of the northwest Maghreb, the lagoons and lower reaches of the tidal rivers were the major areas of fishing effort. The species found during this period also indicate that fishing was practised year-round. The methods were used by individuals but also groups of fishermen, working together in fishing boats to fish with hook-and-line, possibly harpoon, but probably also seine net techniques.

The species caught during this period primarily were for immediate 'fresh' consumption and some were also made into tools or used for decoration, especially at sites on the Mediterranean coast such as *Tamuda* and Sidi Abdeselam del Behar (see Table 8.1). Marine resources were also salted, however, and this practice, conducted in large salazón amphorae or perhaps even *dolia*, began possibly as early as the 6th century on the Mediterranean coast at the sites of Emsa and Sidi Abdeselam del Behar and in the Straits of Gibraltar at Dchar 'Askfane (Fig. 8.3). These sites, in the northern reaches of the region could have been influenced by the contemporary salting practices taking place across the Straits of Gibraltar at *Gadir*.[123] The extant archaeological evidence shows that these products consisted of shellfish species; *tituli picti* indicates that by the end of this period, tunny was also being salted in the Straits at *Tingi*, and also *Lixus*. It is also likely that purple dye was manufactured at Essaouira at the end of this period. Salted products were also consumed, mainly along all three coastlines and in the Atlantic region also at sites along the major tidal rivers (see Figs 6.5, 6.10, 6.15; Fig. 8.1).

[122] See Table 6.9, 6.14; see also App. 2.1, 2.3.
[123] See Chapter 3.2.3.

8.3.2 Roman period

The establishment of three Roman *coloniae* in the Rharb in the 1st century BC (at *Zilil*, *Banasa* and *Babba*) laid the foundations for the influx into the region of the Latin language, material culture from the Italic peninsula and the wider Mediterranean. After the incoproration of the northwest Maghreb during the reign of Claudius, and the suppression of the indigenous revolt of Aedemon, Imperial administration was established at *Volubilis* and *Tingi* served as the capital of the province of *Mauretania Tingitana*. In addition to the instigation of Roman governance and the importation of material goods, Roman city planning and architecture styles were introduced. Military camps were established and settlements were primarily built over earlier Punico-Mauretanian sites in the Rharb plain and Straits coast. Other sites, like *Septem*, were established and some settlements, like *Tamuda*, were re-oriented around defensive measures.[124]

During this period, fewer species of marine resources were caught than in the previous period. There is extant evidence for the exploitation of eight fish species and 26 marine invertebrate species (see Table 8.15). (Six fish and four shellfish species are present in the combined Roman/Late Roman period; the fish species and one of the shellfish species were not present in the Roman period.) These resources were mainly caught along the Atlantic and Straits of Gibraltar littorals, where Punico-Mauretanian settlements had developed into Roman *coloniae* (such as *Zilil*, *Lixus* and *Banasa*), and new stations and *civitas* (such as *Septem* and *Thamusida*) had been established.[125] Very few finds relating to fishing derive from the Mediterranean coast, but some material is present at the *castellum* of *Tamuda* and the settlement at *Rusaddir*.

During this period, the fishing effort included similar methods to those utilised in the Punico-Mauretanian period: hand collection and possibly hand-held tools or rakes, harpoons, tridents and the setting of weels (see Table 8.16). Archaeological finds reveal that hook-and-line fishing, with various-sized fish hooks and net fishing with cast nets and probably seines. It is also possible that fixed pound nets were utilised in coastal waters offshore of *Septem* and Cotta.[126] These methods are evidenced by the marine species themselves, textual descriptions, ethnographic comparison and finds of fish hooks, net weights, lead anchors, and the needles and navettes used in the manufacture of fishing nets.

[124] See Chapter 4.3.
[125] See Chapter 7.3.
[126] See Chapter 7.3.5.1; Trakadas, *in press*; Erbati & Trakadas 2008: 69; Ponsich 1976; Gianfrotta 1999: 19.

The immediate littoral of the northwest Maghreb and lower reaches of the tidal rivers were the major areas of fishing effort during the Roman period. As in the Punico-Mauretanian period, fishing seems to have been practised year-round, and was conducted by individuals but also groups of fishermen. The extant finds of the eight species of fish from this period indicate that the major fishing effort was offshore, targeting pelagic migratory species but also including shark and whale. This would necessitate the organisation of groups of fishermen, in boats, using hook-and-line techniques and possibly seine and even fixed pound nets and harpoons. The focus of this fishing effort for the migratory species would be in the late spring and later summer.

The species caught during this period primarily were for salted consumption and some were also made into tools, as demonstrated by finds at *Septem*. The sites that had salted/processed shellfish during the earlier period ceased operation except for Dchar ‘Askfane where a *villa* with *cetariae* was built. By the end of the 1st century AD, 13 sites had purpose-built *cetariae* established for salting: Metrouna, Sania e Torres, *Septem*, Ksar-es-Seghir, Dchar ‘Askfane, Zahara, Cotta, Tahadart, Kouass, *Lixus, Banasa* and *Thamusida*.[127] Purple dye manufacture also continued in the region, but at Metrouna on the Mediterranean coast, and in the Atlantic region at *Thamusida* on the Oued Sebou; by the end of this period, in the 3rd century, the process may have been continued once again at Essaouira. At this time, very little salting was practised on the Mediterranean coast (six *cetariae*), but this production increased on the Straits of Gibraltar coast (30 *cetariae*), which seems to have been wholly focused on salting activities at this time. The largest grouping of salting production was along the Atlantic littoral (215 *cetariae*). The salting was conducted at small coastal agglomerations, but also in urban centres, such as at *Septem, Lixus, Banasa* and *Thamusida*. The extant archaeological evidence shows that these products consisted of shellfish and other marine invertebrates such as coral and sea urchin and possibly whale oil. The fish salted were migratory species and could have been made to produce *salsamenta* made of *Scombridae*/tunny, such as *cordyla,* known from the late Punico-Mauretanian and early Roman periods in the region (*allex*, made of mackerel might also have been produced at this time, if the Roman/Late Roman period species are considered). Salted products were also consumed in almost the same distribution as during the Punico-Mauretanian period; however, the number of sites with finds of salazón amphorae increased along all three coastlines, and in the Atlantic region at sites along the major tidal rivers (see Figs. 6.5, 6.10, 6.15; Fig. 8.1).[128]

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[127] See App. 3.1.
[128] Included here are the salazón amphorae from the combined Punico-Mauretanian/Roman period.

8.3.3 Late Roman period

By the end of the 3rd and beginning of the 4th centuries AD, after a series of indigenous uprisings, the Roman provincial government and military troops began to withdraw from the region. Cohorts and legions moved north through the Rharb plain, first establishing a 'boundary' at *Lixus*, then moving even further north to the Tangier peninsula. Although settlements were not abandoned outright, the military presence was absent (except for *Sala*) and the urban population declined. Indigenous and 'Romanised' populations inhabited some of the major sites on a small scale, even into the 6th and 7th centuries in the cases of *Volubilis* and *Lixus*. Material goods and agricultural products were still imported from the Mediterranean and beyond, as well as new religious beliefs. *Tingi* and *Septem* (and perhaps *Rusaddir*) were the remaining outposts of the Roman province and closely tied to *Baetica*.[129]

This period provides the most limited evidence for marine resource exploitation of all the periods examined. There is extant evidence for the exploitation of three fish species and 13 marine invertebrate species (see Table 8.15). (Material also derives from the Roman/Late Roman period, discussed above, with six different fish species different than those caught in the Late Roman period.) The evidence for the diversity of species for this period is based almost entirely on finds from *Septem*.[130]

During this period, the fishing effort included similar methods that were practised in the Punico-Mauretanian and Roman periods: hand collection and possibly hand-held tools, the use of harpoons, hook-and-line and net fishing methods (see Table 8.16). These methods are evidenced by the marine species themselves, textual descriptions and finds only of fish hooks and net weights, deriving only from three sites: *Tamuda, Septem* and Suiar.[131]

The immediate littoral of the northwest Maghreb and lower reaches of the tidal rivers were the major areas of fishing effort during the Late Roman period. The types of shellfish species indicate that some fishing took place year-round, and was conducted by individuals. The extant fish species during this period, however, also indicate a continued but limited focus of fishing offshore for the migratory and oceanic species present; this is demonstrated solely at *Septem*. Here, groups of fishermen likely worked together in fishing boats to fish with hook-and-line but probably also seine net techniques, if not also using fixed pound nets and possibly even harpoons. The main focus of this fishing effort would be in the late spring and later summer.

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[129] See Chapter 4.4.
[130] See Chapter 7.3.
[131] See Tables 6.4, 6.9, 6.14.

As during the Roman period, the fish and marine invertebrate species caught during this period were primarily intended for salted consumption and possibly the extraction of whale grease/oil (see Tables 8.7-8.9). Of the 13 sites that had earlier processed salted products, nine ceased operation. Four sites continued fish salting, but with periods of disuse of *cetariae* and refurbishment or reduction of these: *Septem*, Tahadart, *Lixus*, and for a short time, Essaouira. The extant archaeological evidence shows that these products consisted of shellfish and other marine invertebrates. As in the previous period, the fish salted were largely migratory species and could have been made to produce *salsamenta* (possibly *cordyla*) and sauces (*garum, liquamen* and *allex*). Salted products were also consumed in almost the same general distribution as during the Punico-Mauretanian and Roman periods: salazón amphorae are present along the Straits coast and Atlantic (also at sites along the major tidal rivers), but at far fewer sites than previously and apparently not along the Mediterranean littoral (see Figs 6.5, 6.10, 6.15; Fig. 8.1).

8.3.4 Discussion

Marine resource exploitation in the ancient northwest Maghreb was not static, but a dynamic and nuanced activity, differing in its function between regions, sites and periods. It is clear that the changing role of the resource and the effects of ‘Romanisation’ of *Mauretania Tingitana* are traceable through the use of and relationship to the marine environment and the social and economic organisation of the fishing industry.

The annexation of the northwest Maghreb region as the province of *Mauretania Tingitana* in AD 42/43 introduced a variety of changes into the area. In addition to an influx of material culture, which had already begun to be channelled earlier through the Roman *coloniae* during the later Punico-Mauretanian period, the annexation also introduced facets of urbanisation: new forms of governance, architecture, city planning and types of settlements. These transformations also clearly affected the ways in which marine resources were sought and consumed.

During the Punico-Mauretanian period, a variety of fishing practices were used to catch marine resources for fresh consumption and some shellfish for salting. At this time, fishing was “first nature”, that is, part of an “*oikos*-based” subsistence economy that was conducted part-time, year-round in conjunction with agricultural cycles. During the Roman period, “second nature” exploitation developed, with changes in fishing effort and types of products consumed.[132] This is discernable in the socio-economic and cultural transformations that were brought about by the 'Romanisation' of the northwest Maghreb. The fishing effort was more focused as fewer species and mainly migratory types were targeted. These species, however, could be caught in large quantities at very specific periods: during the late spring and late summer. The focused fishing effort also meant that the activity required two levels of organisation. The first involved the greater social cooperation of fishermen, in order to obtain the manpower necessary to operate the larger offshore fishing gear or shore-based apparatuses. At the same time, economic initiative was taken, in order to invest in these larger fishing gears, but also to establish the specialised *cetariae* at complexes situated throughout the region. The obtainment of salt sources for processing and amphorae for the products' transhipment were also necessary aspects of this organisation.

This investment and fishing focus during the Roman period was directed almost specifically on obtaining fish for salting in order to generate a surplus of products. At the most basic level, this transformation, with its general increase in scale assumed from the presence of complexes with *cetariae*, is indicative of commercialisation.[133] This transformation was a facet of the urbanisation that the province underwent, and lasted until the Roman administration began to withdraw from the region.

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[132] "First and second nature" discussion based on the conversion of marine resources into human "natural capital"; the first as pre-industrial local subsistence products and the second as commercial capital assets, with associated changes in production, diet and foodways; see discussion in Perdikaris 1996: 22.
[133] For definitions of commercialisation in early fisheries, see Perdikaris 1996: 21-22.

Chapter 9.
Conclusions

Previous approaches to marine resource exploitation in antiquity have often focused upon the production activities of and trade of goods processed within the fish-salting industry. The practice of fishing to supply fresh seafood to this industry is often overlooked or cursorily treated, based on broad generalisations regarding its technologies and organisation. In many instances, the marine environment in relation to navigational logistics and the specific habitats of the marine species are not addressed. As a result, the practice and its potential products are often marginalised or under-estimated in studies of the ancient economy. This impacts the interpretation of the role of the resources in the economy, as well as their significance as consumed fresh foodstuffs or salted products.[1]

This study demonstrates that there exists a diverse body of evidence that makes it possible to determine the methods, products, and areas of marine resource exploitation within the northwest Maghreb, when the region formed the Roman province of *Mauretania Tingitana*.[2] These data sets, comprised of archaeological materials from the Mediterranean, Straits of Gibraltar and Atlantic littorals, are contextualised by descriptive data that are both complimentary and contradictory. By also including data from the preceding Punico-Mauretanian and Late Roman periods, the diachronic change of this exploitation and the effects of 'Romanisation' are clearly revealed. This corpus of data from the region has not previously been synthesised, and the analysis applied in this study represent a new methodological approach.

Within the archaeological find-group compiled in this study there are inherent lacunae in the preservation of the material; additionally, excavation biases exist that prohibit the types of analyses that could be conducted.[3] Due to these factors, this study does not attempt to quantify the material in order to determine the percentage of species present or the intricate scales of fish-salting production, nor analyse the local and regional levels of trade in salted goods. Instead, the extant materials are analysed to determine the presence, distribution and

[1] Horden & Purcell 2000: 192; Bekker-Nielsen 2002b: 215; see previous approaches discussed in Chapter 2.1.
[2] See Chapter 2.2.3; Chapter 4.3.
[3] In relation to marine resource exploitation, the methodical excavation and sampling at sites has been recently demonstrated across the Straits of Gibraltar, revealing many interesting facets; see García Vargas & Bernal Casasola 2009.

chronology of species, technologies and installations. Combined, these findings reveal the nuanced social and economic impacts of 'Romanisation' of the province through the lens of fishing.

The archaeological data in this study are contextualised within the coastal and marine environments of the northwest Maghreb. Additionally, the geographical scope of this study considers the Roman province as a whole, from the Oued Moulouya on the Mediterranean coast to Essaouira on the Atlantic coast, including the 'island-like' regions of the Rharb and Tangier peninsula which have traditionally been the focus of archaeological studies.[4] The types of marine, estuarine and freshwater environments of the regions indicate the variety of marine species that may have been present, as much as they dictate what fishing methods could have been utilised and at what periods. These include the more permanent features of the coastal topography and marine bathymetry and seafloor types (established on the basis of the reconstructed littoral), but also the larger maritime daily and annual cycles of winds, currents and tides of the Mediterranean, Straits of Gibraltar and Atlantic.[5] These factors in turn affect and determine the ways in which humans interacted with the marine environment. Within this maritime cultural landscape, human utilisation of the land- and seascapes by shore and boat determine the spatial relationships of this exploitation.[6]

Although some areas of the northwest Maghreb have undergone geo-morphological change, during this study's chronological focus, the period between the 5th century BC and 6th century AD, the littoral topography was relatively stable, with major changes occurring only in the 20th-21st centuries.[7] The consistency of the coastal land- and seascape of the northwest Maghreb during the period examined embodies the *longue durée*. Within this context, this study demonstrates that short-term socio-political events (*courte durée* or *événements*), that is, the period of 'Romanisation' of the region, affected the way people moved through and related to the maritime cultural landscape.[8]

The specific findings of this study indicate that there was a diversity of marine species exploited in antiquity in the region. These included shark species, found in different periods and at different types of sites. In addition, shellfish species are extremely numerous and present throughout all periods but also at a variety of site types, including those far inland. In particular, some of the marine species identified here are often not noted in studies of marine

[4] Shaw 1976: 144-145; Shaw 1986: 66-67; see Chapter 5.1, Chapter 6.5.
[5] Cooney 2004: 323; Sturt 2006: 128; see Chapter 5.
[6] Westerdahl 1992: 5
[7] See Chapter 5.4-5.5.
[8] Braudel 1958; Braudel 1992; see Chapter 2.2.1.

resources but in fact illustrate the varied fishing effort that also included offshore techniques, particularly the finds of coral, whale and shark.

The extant finds also indicate that within the region, there might have been a preference for marine species over freshwater species. As this finding might be a result of preservation biases and excavation sampling, it unfortunately cannot be stated conclusively. Additionally, the lack of evidence for large-scale purple dye production suggests that its importance was possibly overstated by ancient authors in antiquity and therefore misrepresented in modern scholarship. This scenario might also be similar to the finds of tunny, which are not widely distributed at sites in the region, despite the numerous ancient textual references to and pictorial depictions of these species.[9]

The broader findings of this study show that prior to the Roman period, the temporality and organisation of fishing was more a subsistence activity, practised to compliment the annual agricultural cycles. The resources are diverse and demonstrate that a variety of inshore fishing techniques were used (small equipment like gorges and lances as well), and whilst some of these were used by individual fishermen, small groups also cooperated, especially for occasional offshore fishing (which may have included the use of hooks, nets and harpoons). The spatial relationships of the maritime cultural landscape at this time was more focused on the rivers, lagoons and shores of the region, particularly the Mediterranean and Atlantic coasts, where those who fished lived, providing daily or occasional sources of food for themselves and/or community.

During the Roman period, the variety of resources obtained was less diverse. At the same time, however, the volume of resources increased and the technology used to catch and consume these changed. Fishing methods almost certainly included the use of large apparatuses that required the cooperation of individuals, based on the shore but also fishing offshore. This led to fishing being almost solely a subsistence activity to creating a "permanent artisanal fishery" that was related to the special markets of fish-salting centres with purpose-built *cetariae*. Small-scale coastal fisheries likely still existed, but at this time fishing effort focused on going further afield for larger species and increased catches, which necessitated larger gear and more manpower.[10] The temporality of fishing was then focused on late spring and late summer, although this still complimented the regional agricultural cycles. The spatial relationships of the maritime cultural landscape at this time focused on the Straits of Gibraltar and Atlantic coasts, along the shoreline and in offshore waters.

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[9] See discussion in relation to *Lixus*, Chapter 7.4.4.
[10] Gabriel, *et al.* 2005: 4

After the Roman period, the variety of resources obtained was even less than during the Roman period. Extant finds of fishing equipment are also extremely limited. The species present indicate, however, that offshore exploitation continued. These catches were salted, but the reduction in the *cetariae* at the few salting sites still operating indicate that, at a very general level, production was reduced from the previous period. The spatial relationships of the maritime cultural landscape at this time continued to focus on the Straits of Gibraltar and Atlantic littorals. Salting only continued in these two regions, and the products were most likely oriented towards local consumption, which was also reduced. The temporality of fishing still focused on late spring and late summer, complimenting the agricultural cycles.

The role that marine resources played in *Mauretania Tingitana* differed between fresh and salted products. The majority of species caught during the Punico-Mauretanian period were consumed fresh (with a few shellfish species being salted); the distribution of this consumption extended from not only coastal settlements but also those inland. Fresh fish and shellfish consumption complimented the meat diet, which during the Punico-Mauretanian and Roman periods included wild boar, cattle, sheep/goat and pig. The dietary requisites also included grains as well as fruits. The occupants of the military camps of the region, however, did not appear to have been large consumers of fresh fish, and seemed to prefer to obtain their protein from other sources.

Marine resources were first salted in the region possibly as early as the 5th century BC, and these products may have consisted wholly of salted shellfish. The development of purpose-built *cetariae* in the late Punico-Mauretanian and early Roman periods created the means to preserve and thus consume marine resources at sites far from the coast, and also allowed for the transhipment of these goods far beyond the province's borders. The processing industry was a mixed economy, however, as some centres likely manufactured products for local consumption whilst a majority produced an amount in surplus of local needs, with goods intended for export.

The region of the northwest Maghreb was incorporated fully into the Roman Empire as a province from the mid-1st to third quarter of the 3rd century AD. Previously there had existed urban centres within the Punico-Mauretanian area, and material goods were locally produced and exchanged. With the annexation of *Mauretania Tingitana*, however, a variety of Roman institutions were overlaid on this system that included different forms of material culture and city planning, as well as social institutions and economic structures.

This period of 'Romanisation' in the northwest Maghreb in the first three centuries AD impacted marine resource exploitation, implementing and introducing economic, technological and social changes. These changes are detectable in the types of resources caught, the areas of fishing effort, the technology used, the temporality of fishing, consumption and diet patterns and the overall scale of the exploitation. Previously, during the Punico-Mauretanian period, localised, year-round fishing had provided sustenance for the local populations of the region (diversity but low yield). During the Roman period, this effort developed to target fewer but specific marine species that could be landed in large numbers in a relatively short period (high yield but higher fishing effort).[11]

The case study sites of *Tamuda* and *Lixus* reflect this early diversity of the exploitation, which principally consisted of inshore fishing during the Punico-Mauretanian period. By the Roman period, the sites of *Septem Fratres* and *Lixus* demonstrate that the focus of fishing effort had shifted and large-scale facilities with *cetariae* for the preservation of seafood were established. These latter two sites were well-situated and had the pre-existing infrastructure of *cetariae* to continue this method of exploitation and processing into the Late Roman period. However, the demand for these resources was reduced, along with the reduction of the province that was under Roman administration and the dissipation of relationships to other markets abroad.

Within the northwest Maghreb, the exploitation of marine resources during the Roman period signalled a change in the way in which the unique maritime environments of the Mediterranean, Straits of Gibraltar and Atlantic were accessed. The region's maritime cultural landscape was conducive to a variety of exploitation methods, practised from the Punico-Mauretanian period to well after the reduction of the Roman province, thus demonstrating a consistency resulting from the stable littoral environments. Instead, the socio-cultural, economic and technological structures that were the consequences of inclusion into the Roman political system developed to a level that reached commercialisation of the resource. Thus, for the first three centuries AD, anthropogenic factors instituted a change in the way in which people moved through and related to "*Mauretaniae maritimis*", the rich waters of the northwest Maghreb.

[11] Gabriel, *et al.* 2005: 2

Figures

Chapter 1. Introduction

Figure 1.1. The modern geo-political area of this study: the northwest Maghreb, encompassing the Kingdom of Morocco and the Spanish North African territories. Image: ALT

Chapter 3. Contexts, data sources and applications

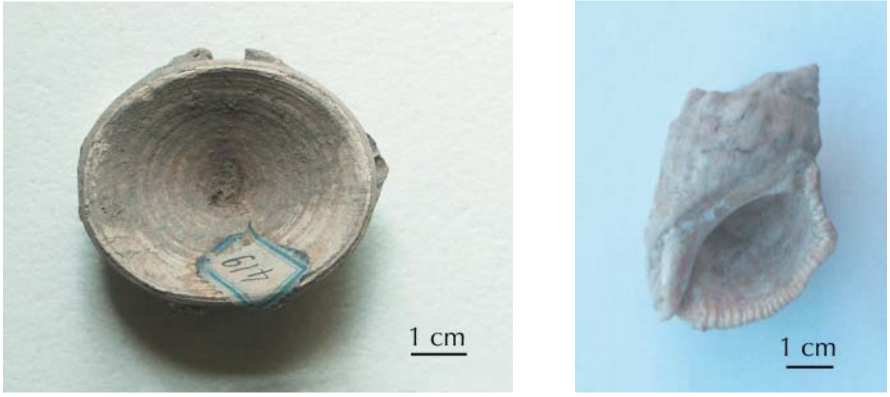


Figure 3.1. Left: Fish bone (bluefin tuna, *Thunnus thynnus*) from Punico-Mauretanian layers at *Tamuda*. Right: shellfish (red-mouthed rock shell, *Purpura [Thais] haemastoma)* from Roman layers at *Volubilis*. Photos: ALT

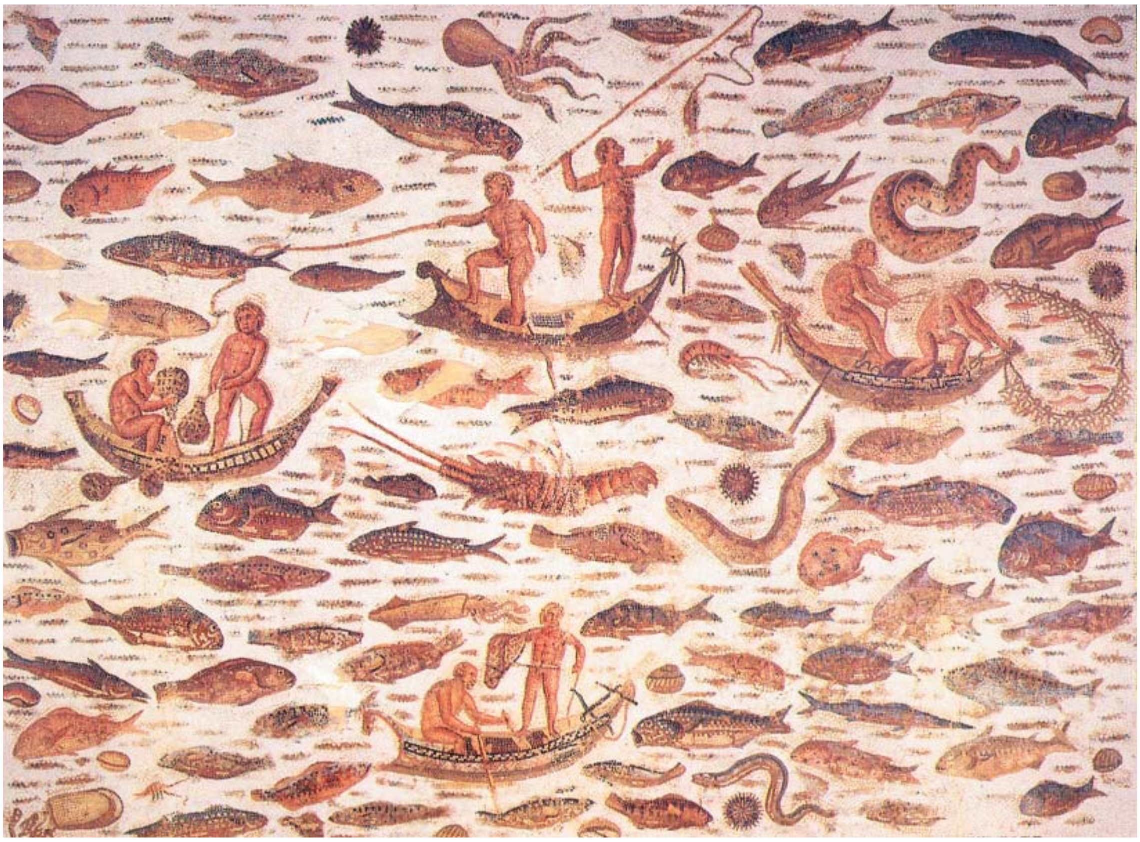


Figure 3.2. Angling, using nets and creels from boats. Depicted in a 3rd-century AD mosaic from Sousse, Tunisia, now at the Musée de Sousse (after Yacoub 1995: fig. 121).

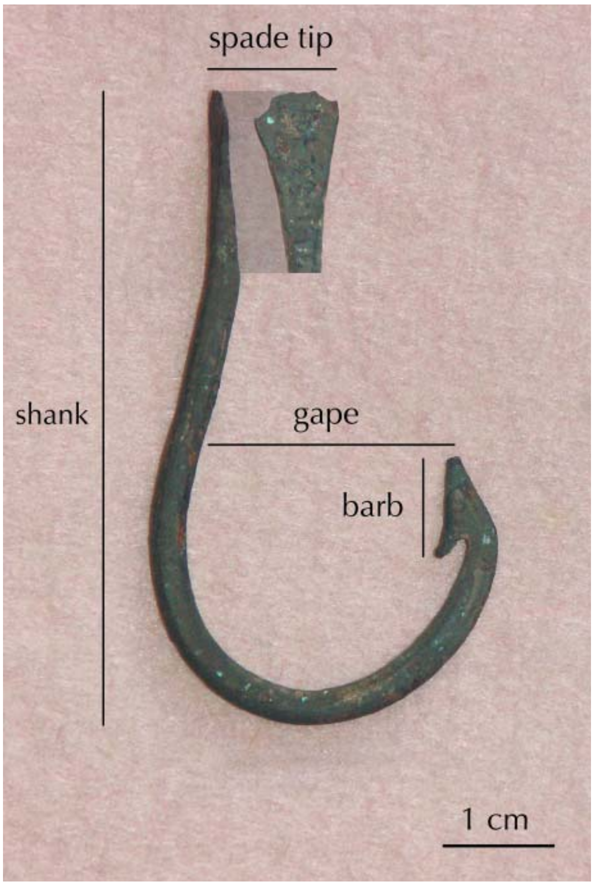
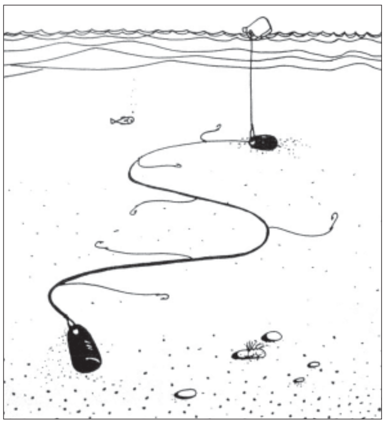


Figure 3.3. A fish hook from Roman layers at *Banasa.* Photos: ALT

Figure 3.4. A lead weight, likely a line sinker, from the Roman/Late Roman layers at Essaouira. Photo: ALT

Figure 3.5. Example of a gorge rigged to a line (after Powell 1996: fig. 79a).



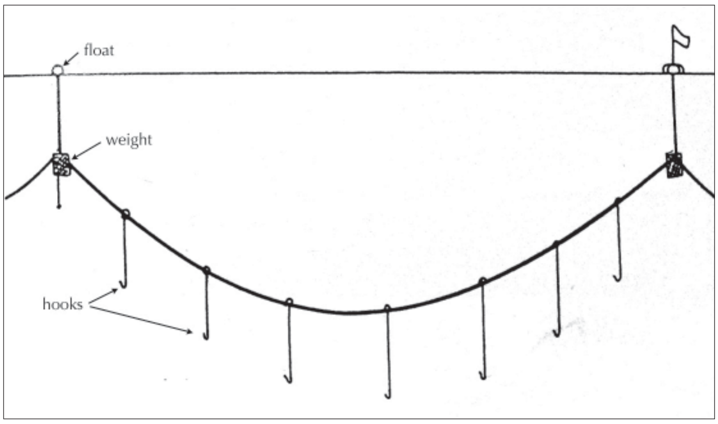


Figure 3.6. Left: a long-line weighted on the seabed. Right: a floating long-line (after Powell 1996: fig. 84).

Figure 3.7. Three bronze navettes from the storage magazine at the Musée Archéologique, Tetouan. The provenance of these artefacts is unknown: they may be from Tarradell's excavations at *Lixus* in the 1950-60s, *Tamuda* in the 1940s or *Zilil* in 1950. Photo: ALT

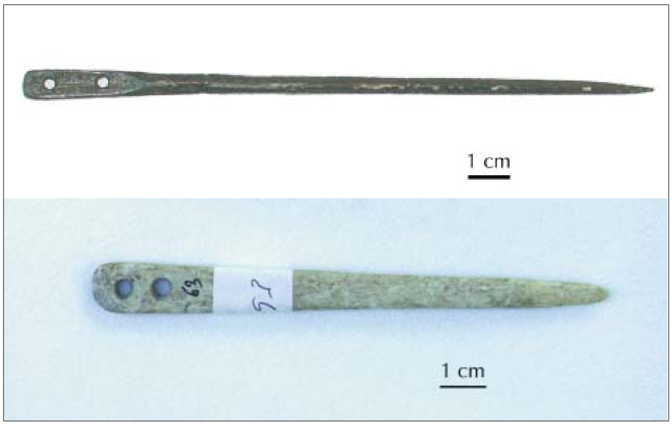


Figure 3.8. Top: A bronze double-eyed needle from the Punico-Mauretanian layers at *Tamuda*. Bottom: A bone double-eyed needle from the Punico-Mauretanian layers at *Tamuda*. Photo: ALT

Figure 3.9. A 2nd- or 3rd-century grave stele showing net and boat repair, from Ilot St. Jacques (Sahrhage 2002: Abb. 28).

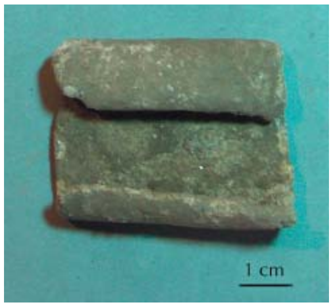


Figure 3.10.

Different types of net weights: Top left: doughnut-shaped weights from Roman layers at *Rusaddir*. Top right: lead strip weight from Punico-Mauretanian/ Roman layers at Tahadart. Bottom: tombstone- and trapezoidal-shaped weights from Context unknown, *Lixus*. Photos: ALT

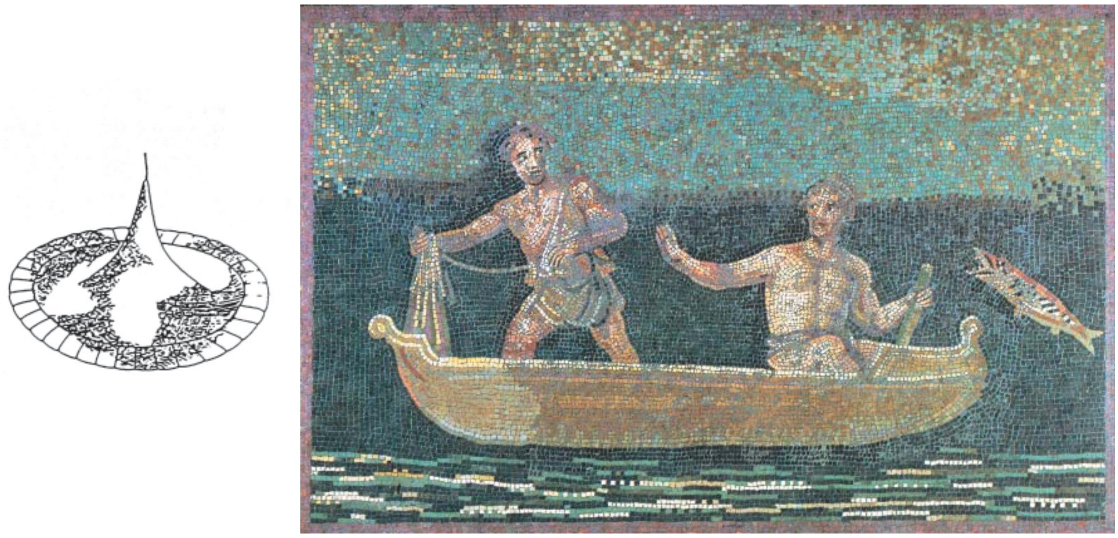


Figure 3.11. Left: the shape of a cast net (after Powell 1996: Fig. 60b). Right: a 3rd-century AD mosaic depicting a fisherman about to throw a cast net from a boat. Rome, Galleria Borghese (after Donati Giacomini 1997: 56). See also App. 6: *Cat. 4.2. Corrales de Rota, Spain (2).*

Figure 3.12. A beach seine net depicted in a 2nd-century AD Nilotic mosaic from El Alia, Tunisia, now in the Musée du Bardo (after Yacoub 1995: fig. 2a). Notice the floats and weights in the net. See also App. 6: *Cat. 1.6. Amtar*.

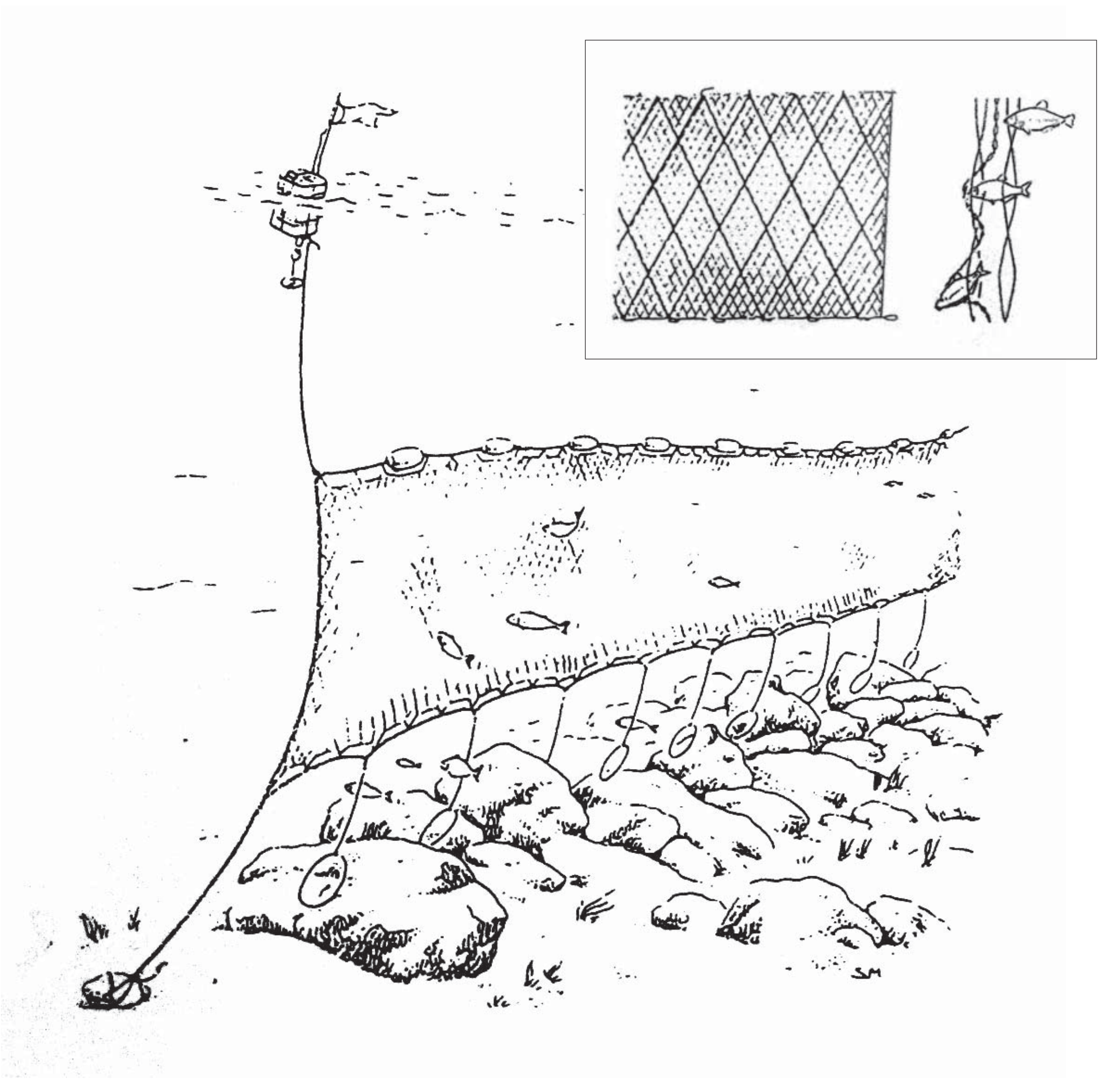
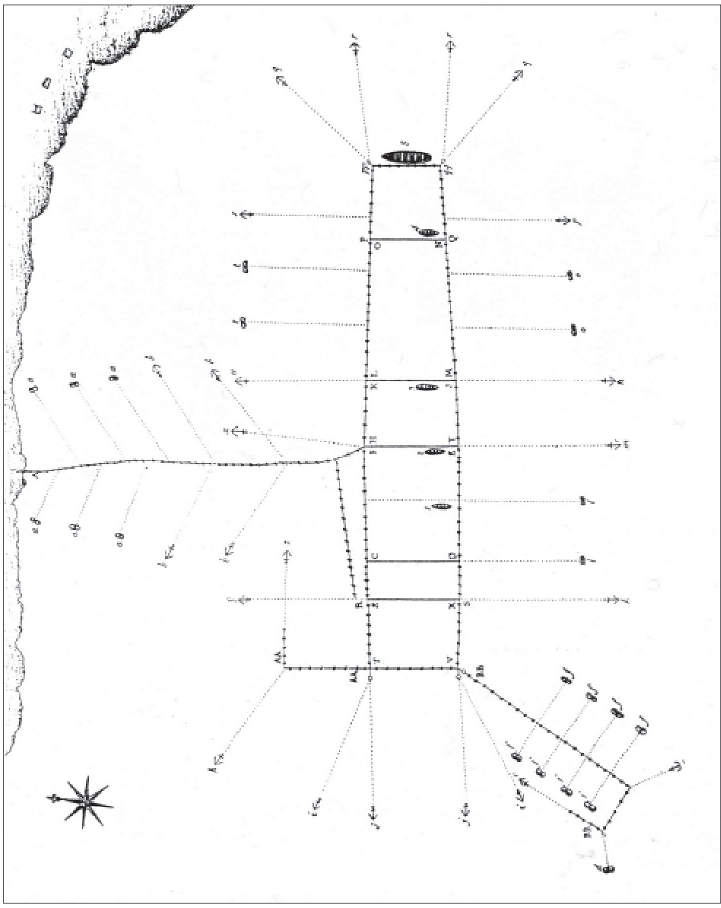


Figure 3.13. A set gill net with weights; see also App. 6: *Cat. 3.3. Oued Loukkos (3), Cat. 3.11. Oued Sous (4)*. Inset: a trammel net and detail (after Powell 1996: Fig. 60e, Fig. 77).



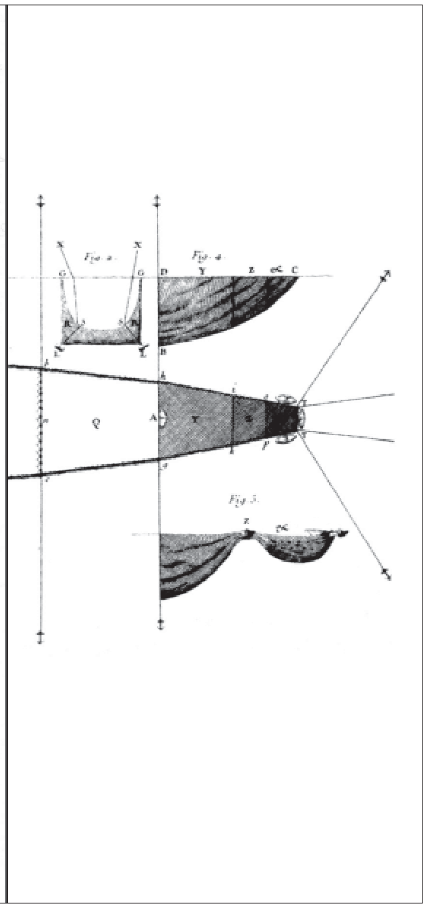


Figure 3.14. Top: An early 3rd-century AD mosaic from Sousse, Tunisia, shows a fish (presumably tunny) captured inside a net depicted with small brown objects attached – possibly representing floats or weights. The fisherman appears to be about to hit the tunny with a club, echoing Manilius' statement that the fish were killed in the water (from Yacoub 1995: Fig. 3a). Bottom: On the left, a plan of an 18th-century *al-madraba* net with anchors, used off southern Spain (from Ponsich, 1988, Fig. 11); on the right, detail of the lift net contraption in the *chambre de la mort* from a 1777 plan (after Étienne & Mayet 2002: Fig. 8). See also App. 6: *Cat. 3.1. Ras Achakar.*

Figure 3.15. Fishing with a trident. Left: part of a 5th-century AD mosaic from Sidi Abdellah, near Bizerte, Tunisia. Below: part of a late 4th-century AD mosaic from Carthage. Now in the Musée du Bardo (after Yacoub 1995: figs 115a-b, 175).

Figure 3.16. Types of fishing boats. The *vegeiia*, *horeia, placida* and *cydarum* are depicted in the late 3rd-century AD Althiburus mosaic, Tunisia, now in the Musée du Bardo; the *scapha* is reproduced from a wall painting in Pompeii, perhaps 1st-centuries BC/AD (after Sahrhage 2002: Abb. 57; Bekker-Nielsen 2005: fig. 4).

Figure 3.17. The Fiumicino 5 boat during excavations. The fish well has led to the boat being identified as a *navis vivaria* (after Testaguzza 1970: 132).

Figure 3.18. *Salsamentum*: a piece of salted seabass with scales still present. From the "Punic Building" at Corinth; now in the Archaeological Museum at Ancient Corinth. Photo: ALT

Figure 3.19. Some of the large *cetariae* of Complex 8 at *Lixus*; each has a full capacity of almost 11 m^3. The *opus signinum* lining can be seen cracking away from the wall in the top left (April, 2009). Photo: ALT

Figure 3.20. Top: modern *salinas* and salt pile in the lagoon at Sidi Abed. Middle: the brine corning in the pan at Sidi Abed. Bottom: rock-cut salt pits at Moulay Abdallah. Both sites are on the Atlantic coast south of El Jadida (October, 2007); see also App. 3.2. Photos: L. Huff, ALT

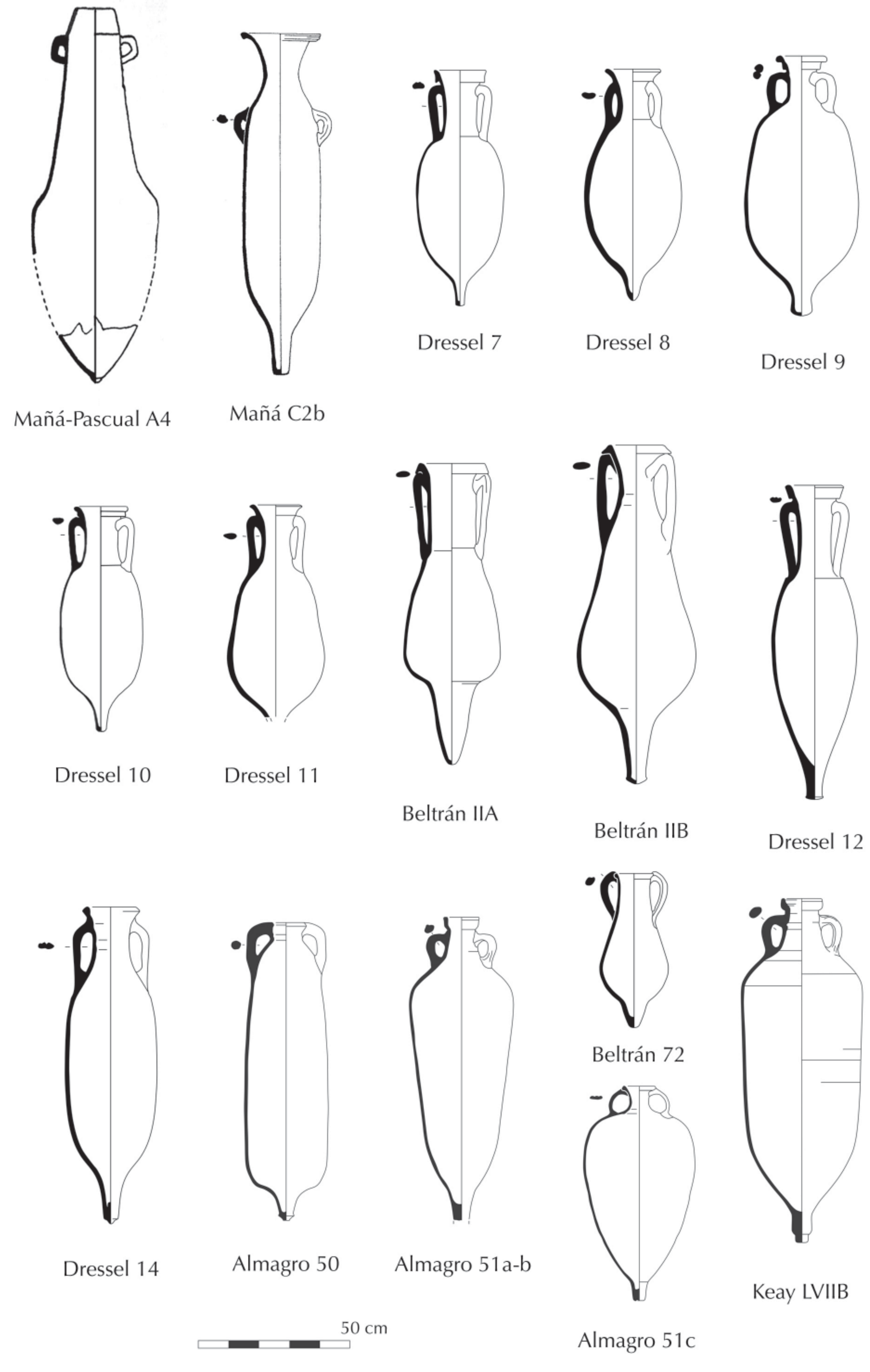


Figure 3.21. Punico-Mauretanian, Roman and Late Roman salazón amphorae from the northwest Maghreb (compiled from the 'Amphora Project' website [drawings by Penny Copeland] and after Ponsich 1969-70: Fig. 2)

Figure 3.22. Detail of fishing mosaic from *Volubilis*, from “Maison de Desultor”, 1st-2nd century AD (see App. 5: *Cat. 5*).

Figure 3.23. A fisherman repairs a seine net with a navette and line. Photographed in the port of Essaouira, Morocco (October, 2007). Photo: ALT

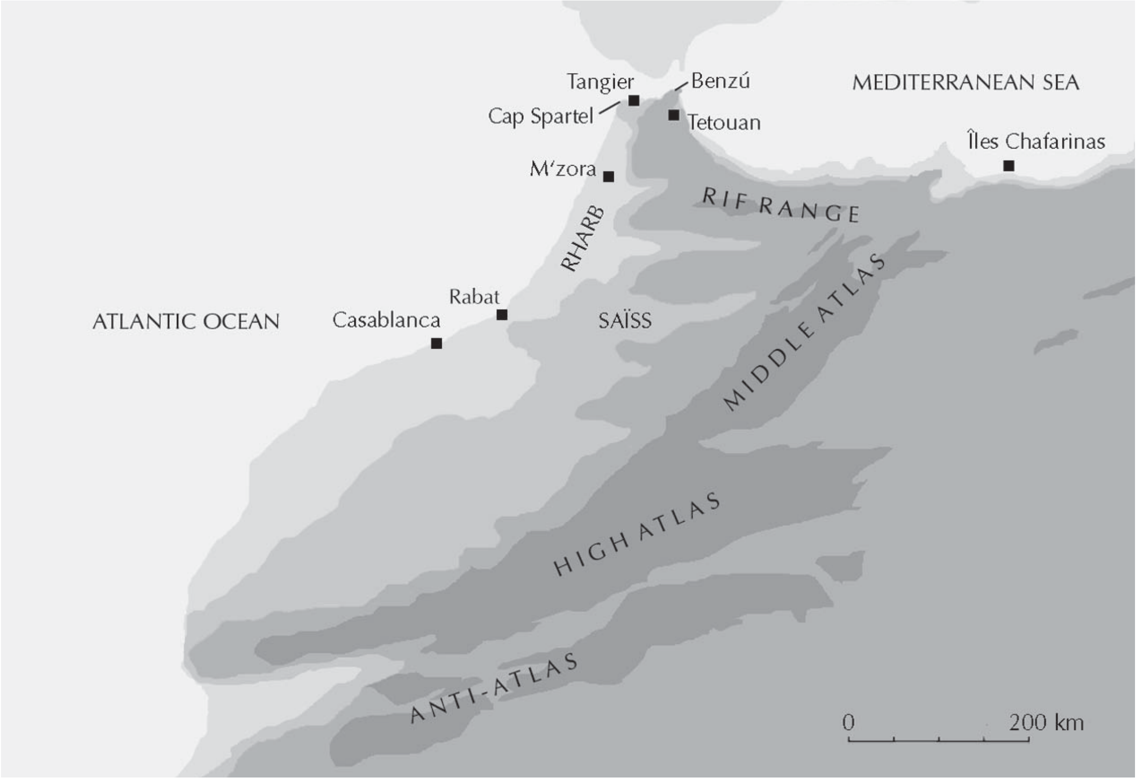


Figure 4.1. The Pleistocene, Epipalaeolithic, Neolithic and Bronze-Age sites of the northwest Maghreb. Image: ALT

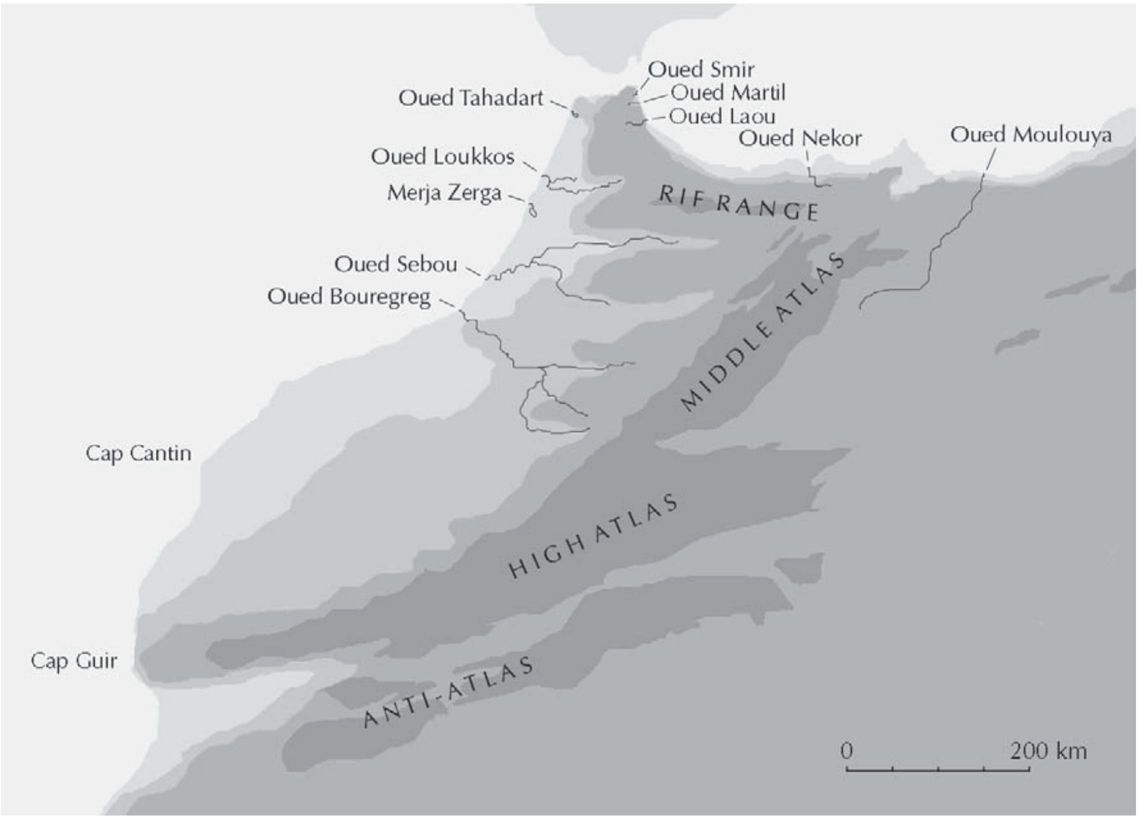


Figure 4.2. The river systems of the northwest Maghreb. Image: ALT

Figure 4.3. The megalithic dolmen chamber tomb at M'zora, in the Oued Loukkos basin, during excavations in the 1960s (from Ponsich 1966a: Pl. XVII).

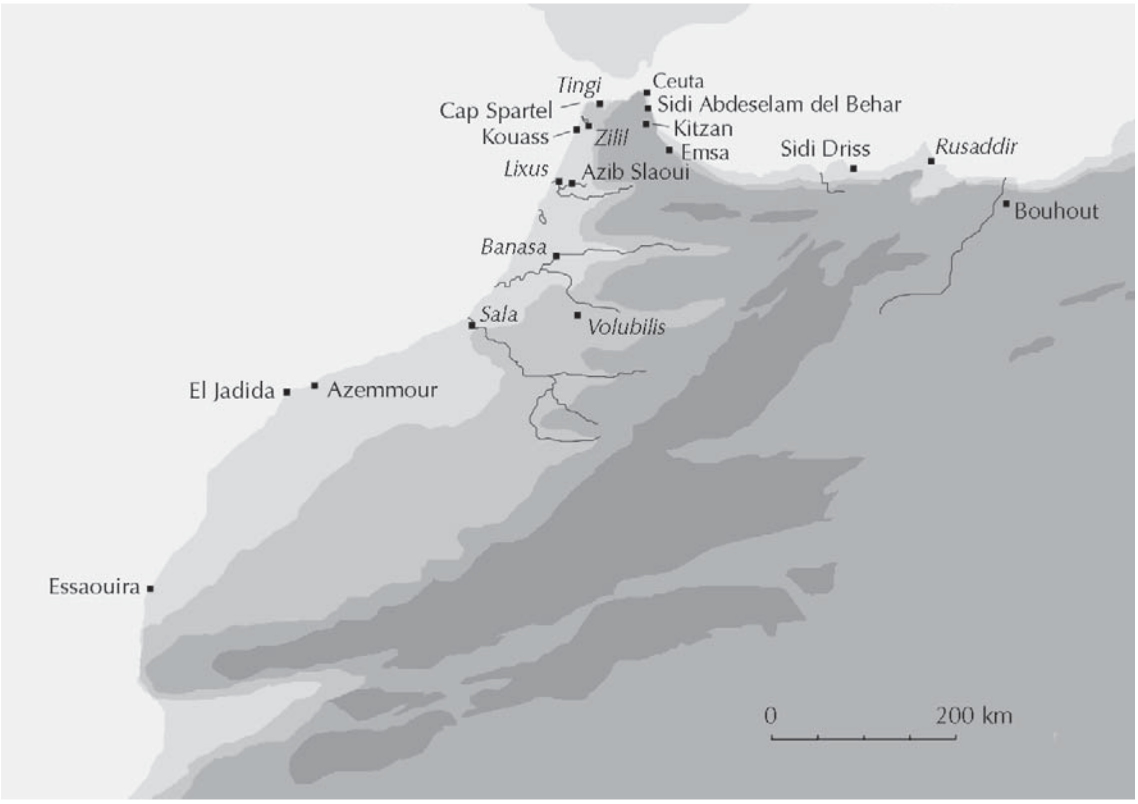


Figure 4.4. The western Phoenician and Punico-Mauretanian sites of the northwest Maghreb. Image: ALT

Figure 4.5. A fish-graffito pot from Kouass, 5th century BC (from Ponsich 1969-70: Pl. IV).

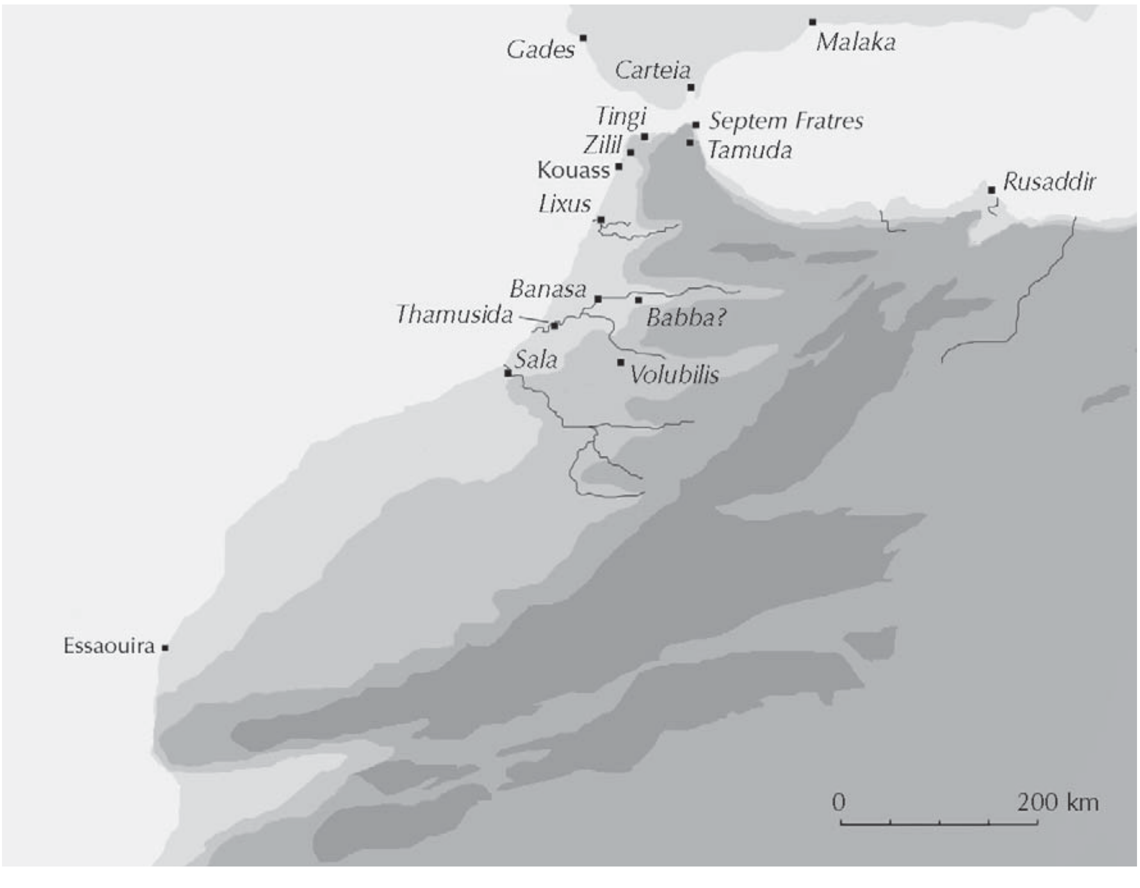


Figure 4.6. The colonies and settlements of the province of *Mauretania Tingitana*. Image: ALT

Figure 4.7. *Volubilis*: looking east over houses towards the forum area with the Middle Atlas foothills (Jebel Zerhoun) in the background (February, 2004). Photo: ALT

Figure 4.8. *Volubilis*: looking north from the forum area to the cardo and Tangier gate (February, 2004). Photo: ALT

Figure 4.9. The 4th-century basilica at *Zilil* (from Bernal Casasola 2006b: fig. 11).

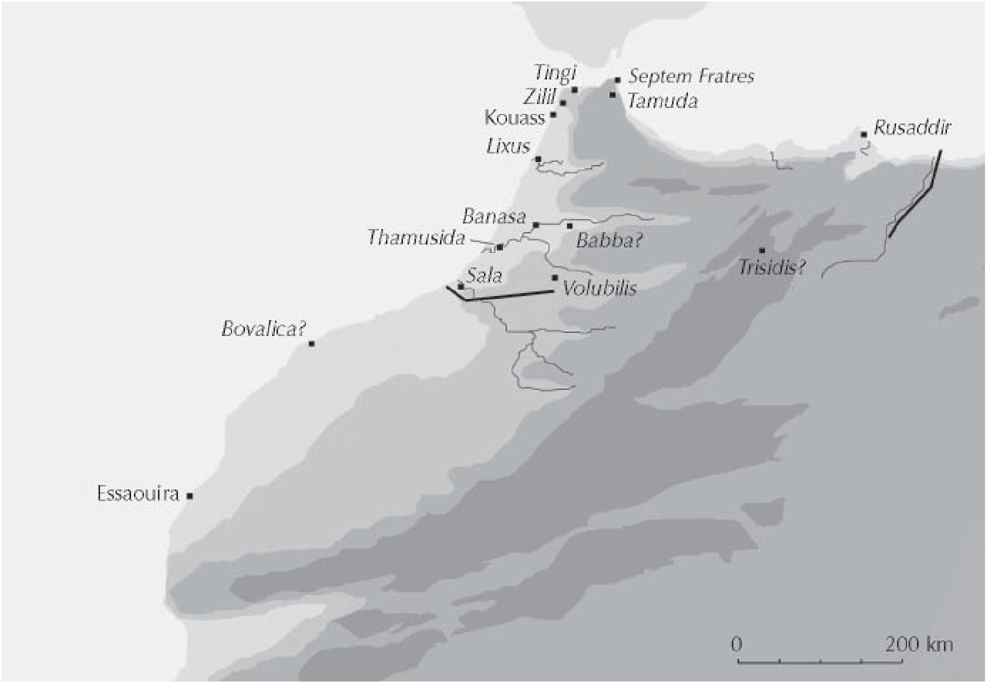


Figure 5.1. The province of *Mauretania Tingitana* with major settlements and sites relevant to this study. The known limits of the province are delineated by black lines. Image: ALT

Figure 5.2. The earthwork system south of *Sala*, delineating a frontier zone during the late 1st-3rd centuries AD. The circles are watch towers, and the squares are larger sites (based on data from Akerraz 2002: 212; Rebuffat 1979-80: fig. 1).

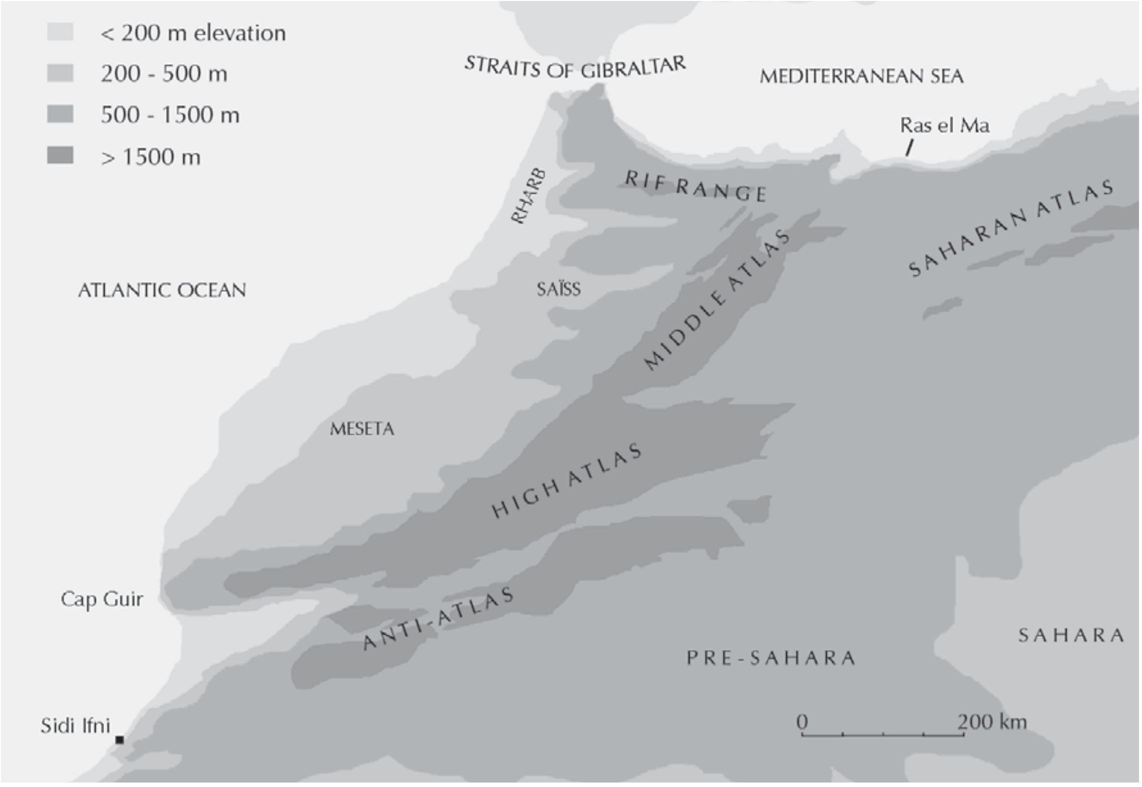


Figure 5.3. The topography of the northwest Maghreb. Image: ALT

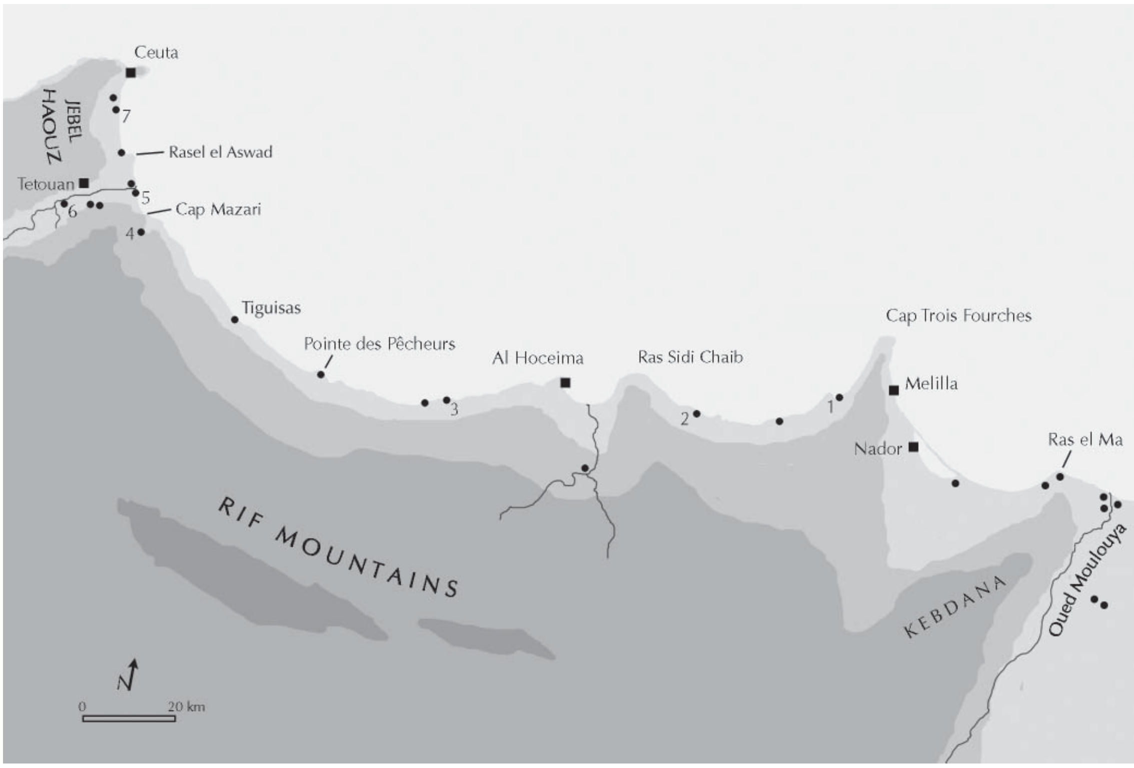


Figure 5.4. The Mediterranean coast of the province, from the Oued Moulouya in the east to Ceuta in the west. Find-spots of Phoenician, Punico-Mauretanian, Roman and Late Roman material are noted by black dots; larger agglomerations or sites are noted by the following numbers: 1) Ghassasa , 2) Sidi Driss, 3) Badis (possibly *Parietina*?), 4) Emsa, 5) Sidi Abdeselam del Behar, 6) *Tamuda*, 7) Sania e Torres. Image: ALT

Figure 5.5. Looking west across the mouth of the Oued Moulouya to Ras el Ma (white arrow) and the Îles Chafarinas (to the right) (March, 2007). Photo: ALT

Figure 5.6. The Sebkha bou Areg, looking south from the Guelaya peninsula. The sandbar separating the lagoon from the Mediterranean follows the line of white waves at the middle; the Kebdana Mountains are in the background. The city of Melilla is indicated by the arrow on the left; the city of Nador by the arrow on the right (March, 2007). Image: ALT

Figure 5.7. Cap Trois Fourches, looking north from the fortification at *Rusaddir*/Melilla (March, 2007). Photo: ALT

Figure 5.8. The Rif coast, looking south-west from the Guelaya peninsula. Punta Negri is indicated by white arrow, behind this Azanen Bay (March, 2007). Photo: ALT

Figure 5.9. The Phoenician and Punico-Mauretanian settlement at Sidi Driss, on a bluff above the Oued Amekrane valley. In the background is the dark volcanic dome of Jebel Gourougou, at the base of the Guelaya peninsula (March, 2007). Photo: ALT

Figure 5.10. Al Hoceima Bay, looking south-east. In the foreground are the islets of Penon de Alhucemas, Islote del Mar and Islote de Tierra (March, 2007). Photo: ALT

Figure 5.11. Badis, situated along the dry riverbed, and offshore, Peñon de Velez de la Gomera. The white arrow indicates Cala Iris (from Akerraz, *et al.* 2003: 26-27).

Figure 5.12. Pointe des Pêcheurs is the white headland (in the middle of the photo) that juts out from the Mediterranean coastline (March, 2007). Photo: ALT

Figure 5.13. (Above) The Oued Martil valley, looking south from Rasel el Aswad. The arrow indicates Cape Mazari (March, 2007). Photo: ALT

Figure 5.14. (Right) The Oued Smir coast, looking north to the Ceuta peninsula (indicated by the arrow) (March, 2007). Photo: ALT

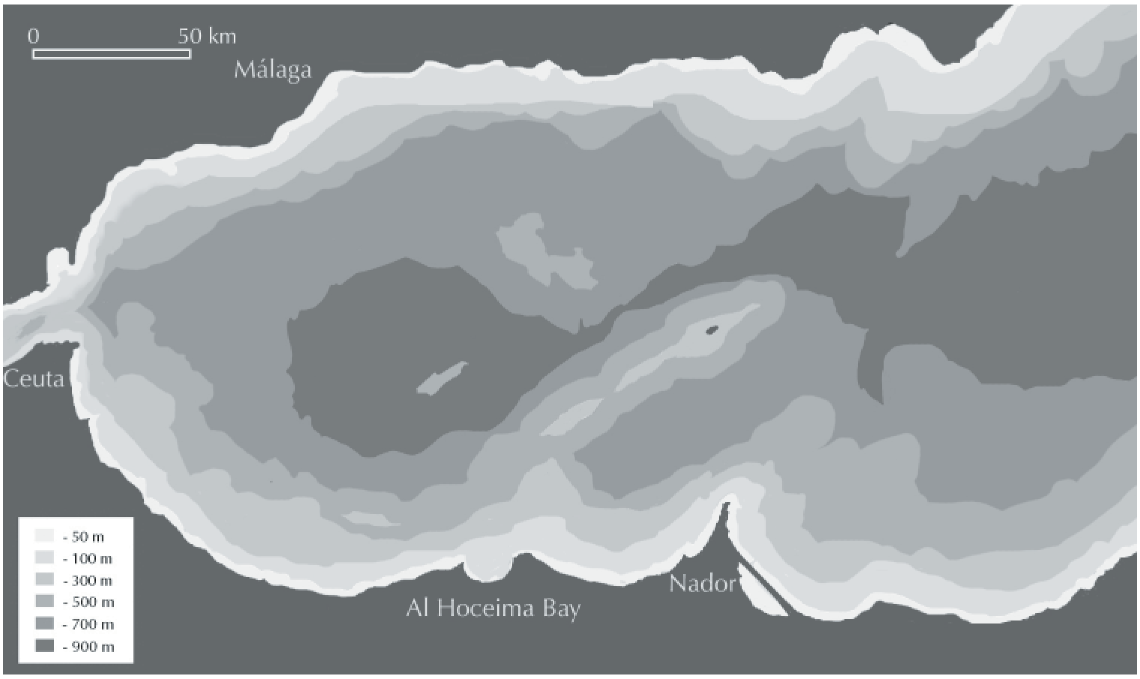


Figure 5.15. The bathymetry of the Sea of Alboran (based on data from Fabres, *et al.* 2002: 432). Image: ALT

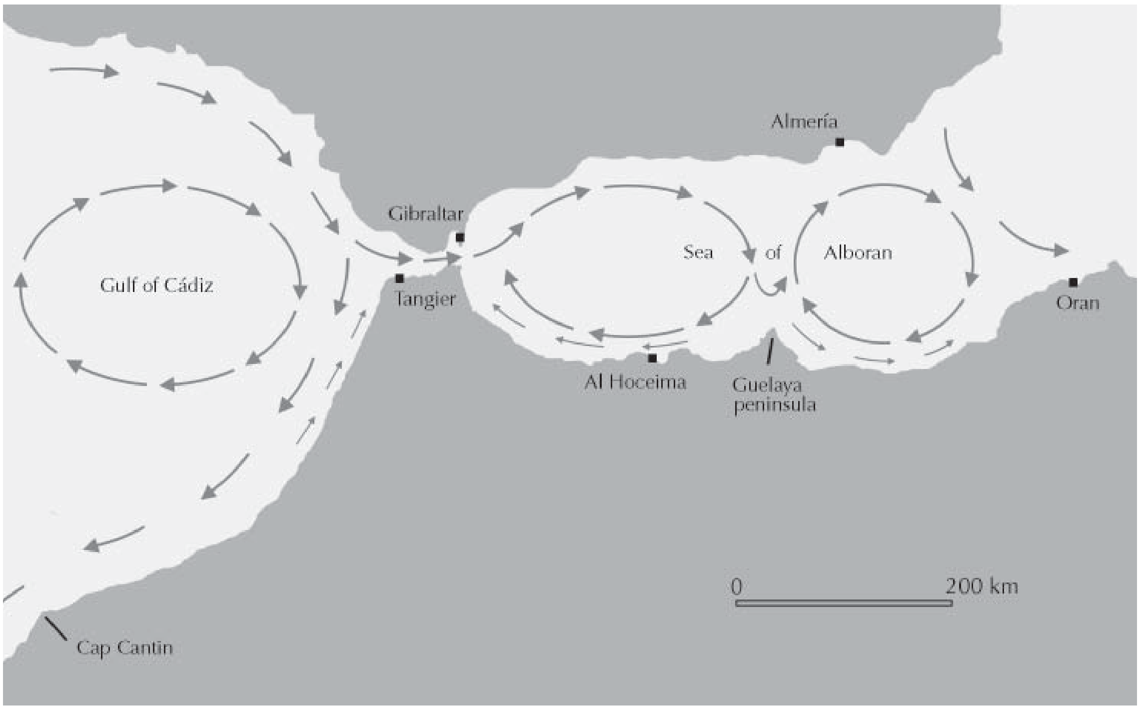


Figure 5.16. Surface currents of the Gulf of Cádiz, Straits of Gibraltar and Sea of Alboran. Dominant currents are shown as large arrows; inshore currents are shown as small arrows (based on data from Fabres, *et al.* 2002; Bormans & Garrett 1989; Batteen, *et al.* 2000; Tintore, *et al.* 1988). Image: ALT

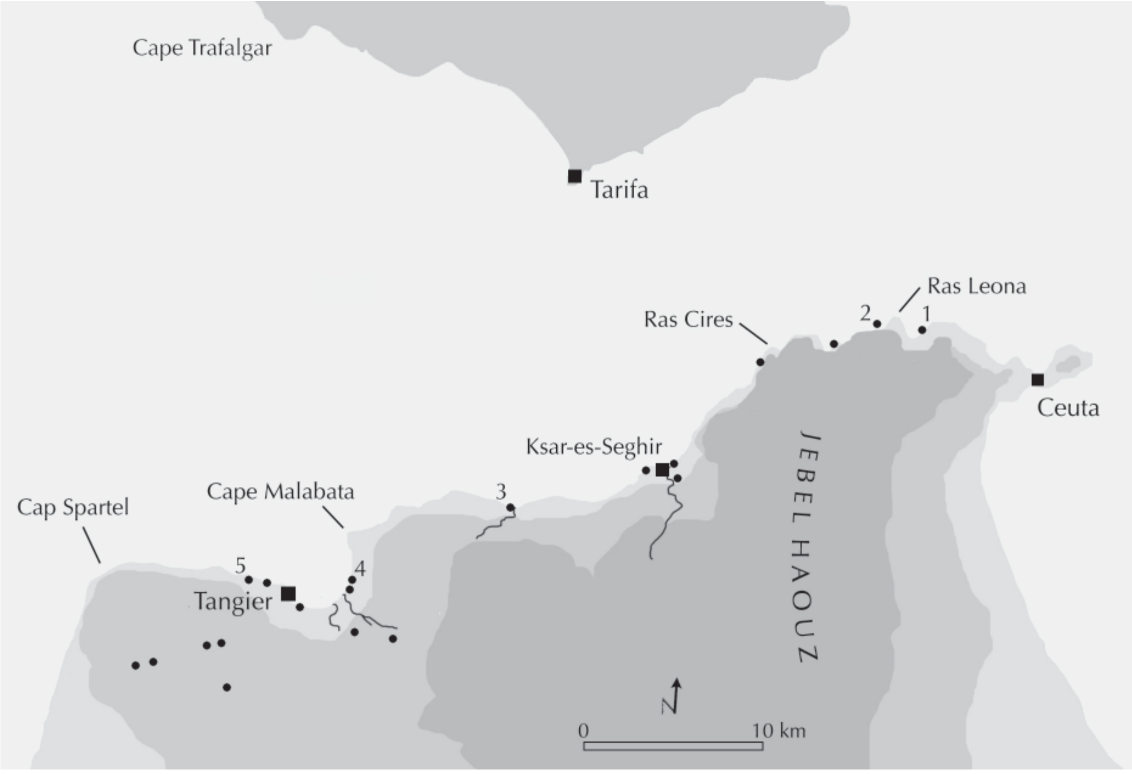


Figure 5.17. The Straits of Gibraltar coastline of the province, from Ceuta in the east to Cap Spartel in the west. Find-spots of Phoenician, Punico-Mauretanian, Roman and Late Roman material is noted by black dots; larger agglomerations or sites are noted by the following numbers: 1) Bay of Benzú, 2) Île Perekhil, 3) Oued Liam, 4) Gandori, 5) the Marshan. Image: ALT

Figure 5.18. The Peninsula de la Almina from the south, looking across the northern end of Ensenada de Ceuta towards Monte Hacho (April, 2009). Photo: ALT

Figure 5.19. Looking west through the Straits of Gibraltar. Jebel Musa and its seaward extension, Ras Leona, dominate the coastline. Île Perekhil is indicated by the arrow and the western promontory of Er Rmel Bay is the dark headland to the right of this (in the centre of the photo) (November, 2005). Photo: ALT

Figure 5.20. The bay at Ksar-es-Seghir. The remains of a medieval Islamic and Portuguese fort are present amongst the trees at the centre-right and the Oued El Kazar to the right of this. The Roman fish-salting site is present just above the beach to the centre-left of the photo (March, 2007). Photo: ALT

Figure 5.21. Looking east through the Straits from the Jebel es Slokia ridge (west of Tangier). Jebel Musa can be seen in the distant right, in front of which are Cap Malabata (arrow) and the entrance to Tangier Bay. Tarifa, across the Straits, is visible at the centre-left of the photo (March, 2007). Photo: ALT

Figure 5.22. Looking west across Tangier Bay at the modern city and port of Tangier (*Tingi*). The Marshan bluff rises behind the city (April, 2009). Photo: ALT

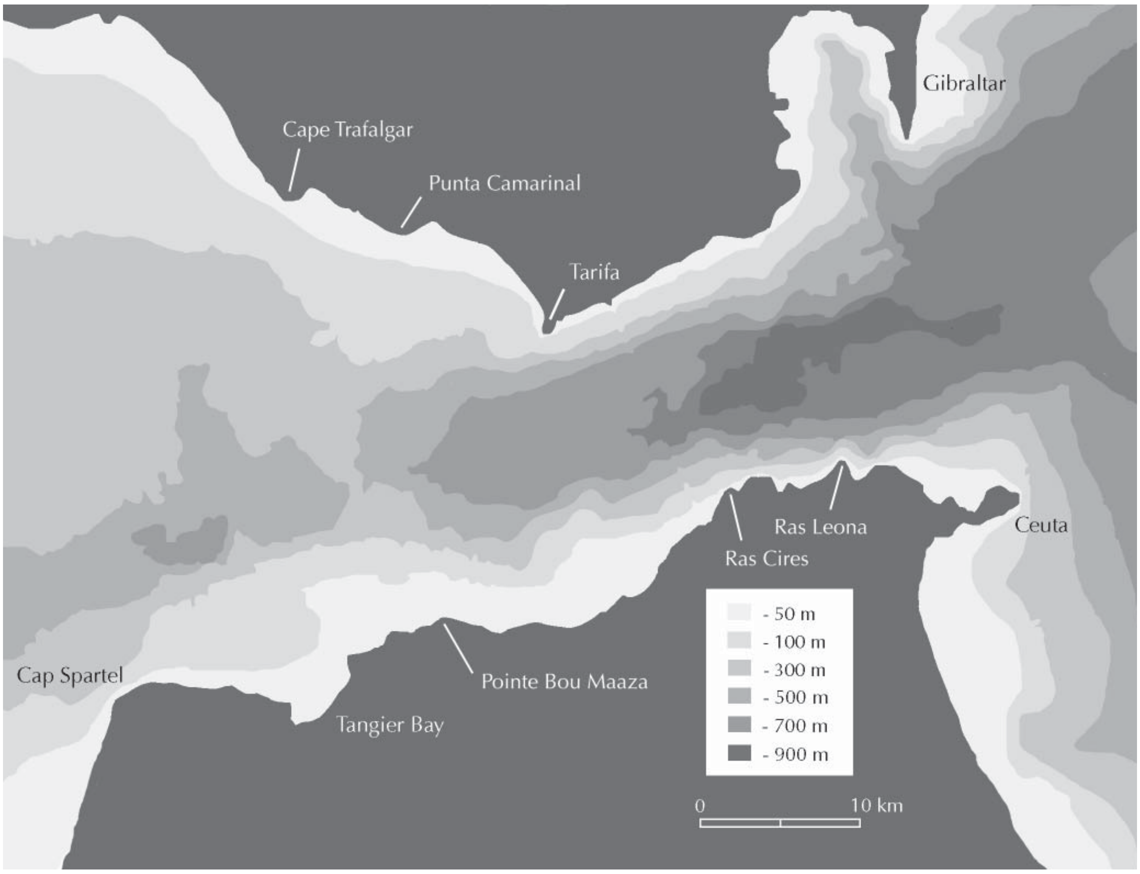


Figure 5.23. The bathymetry of the Straits of Gibraltar (based on data from Maldonado, *et al.* 1999: Figs 1-2; Fabres, *et al.* 2002: 432; Bormans & Garrett 1989: Fig. 1).

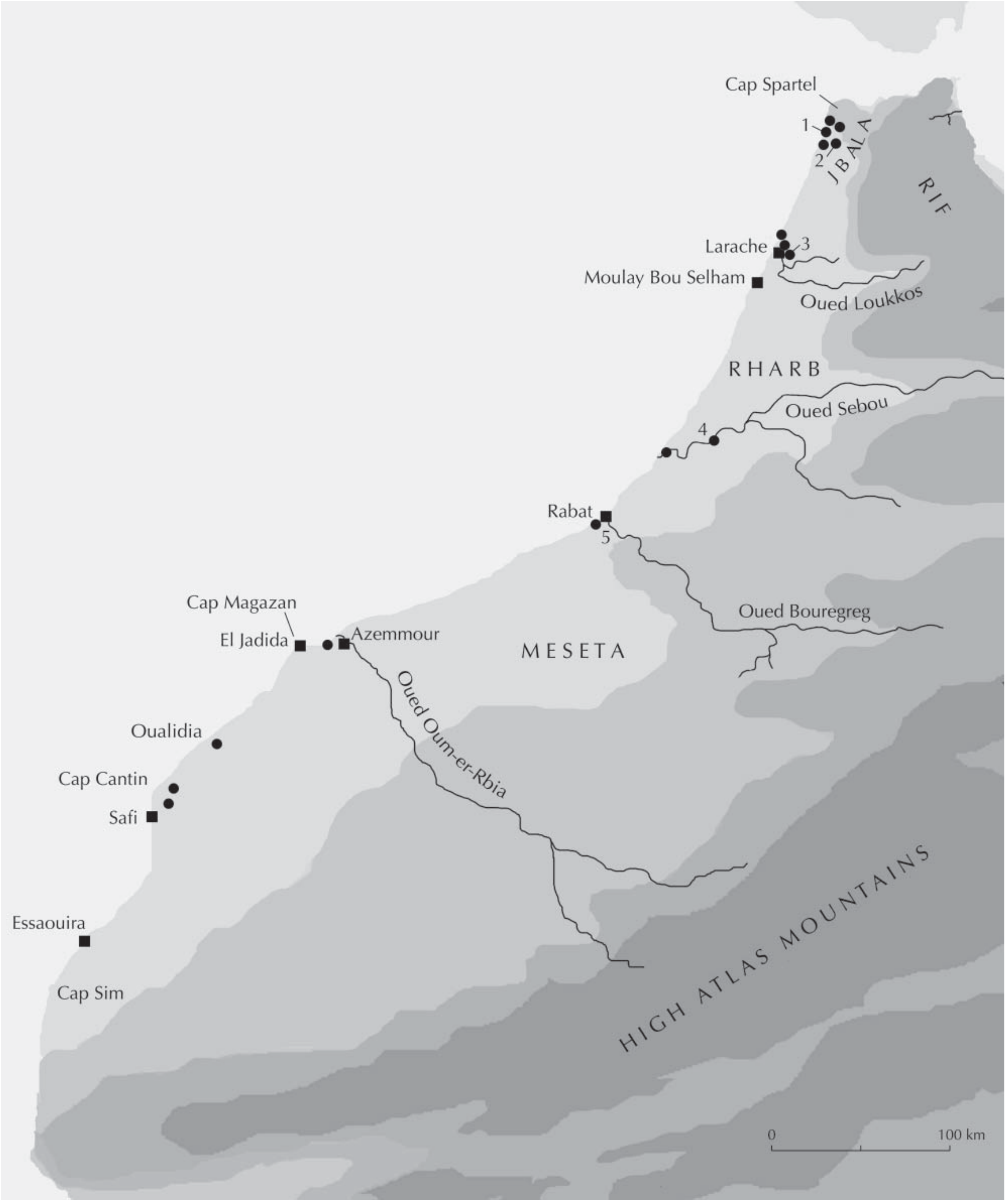


Figure 5.24. The Atlantic coastline of the province, from Cap Spartel in the north to Essaouira in the south. Find-spots of Phoenician, Punico-Mauretanian, Roman and Late Roman material is noted by black dots; larger agglomerations or sites are noted by the following numbers: 1) Cotta, 2) *Zilil*, 3) *Lixus*, 4) *Thamusida,* 5) *Sala*. Image: ALT

Figure 5.25. Looking north towards Cap Spartel from the wide beach that lines much of Morocco's Atlantic coast. The left arrow indicates Cotta; the right arrow indicates Djebila (March, 2007). Photo: ALT

Figure 5.26. The Oued Garifa, near the site of Kouass. The arrow indicates the modern city of Asilah (March, 2007). Photo: ALT

Figure 5.27. The Atlantic coastal façade north of the mouth of the Oued Loukkos: wide beaches backed by fossil dunes (April, 2007). Photo: ALT

Figure 5.28. The mouth of the Oued Sebou breaks through the Atlantic façade palaeo-dune (white arrow) (looking north just inside the river mouth) (March, 2005). Photo: ALT

Figure 5.29. The modern cities of Rabat (right) and Salé (left) lie opposite each other on the banks of the Oued Bouregreg. Looking east upriver at the flood plain from the Kasbah des Oudaias (March, 2007). Photo: ALT

Figure 5.30. The site of *Sala* (partially inside the Merinid-period walls of the site of Chellah, centre-left) sits above the Oued Bouregreg floodplain. The city of Rabat is on the plateau behind *Sala* (October, 2007). Photo: ALT

Figure 5.31. The city of Azemmour on the south bank of the Oued Oum-er-Rbia, looking west to the Atlantic (April, 2007). Photo: ALT

Figure 5.32. The lagoon and *salinas* at Oualidia, in the depression between the palaeo-dune ridge (foreground) and the Atlantic active dune ridge (in distance) (October, 2007). Photo: ALT

Figure 5.33. The high sandstone cliffs (foreground) give way to a low sandy coastline (in distance) near Oued Tensift, ca. 75 km north of Essaouira (October, 2007). Photo: ALT

Figure 5.34. The islands at Essaouira, in the southern lee of the modern city (October, 2007). Photo: ALT

Figure 5.35. The islands at Essaouira are fossilised sand dunes, and the striations of the dunes can be clearly seen in the profile of the north island (Pharouan). Looking north, with Essaouira city in the distance (February, 2004). Photo: ALT

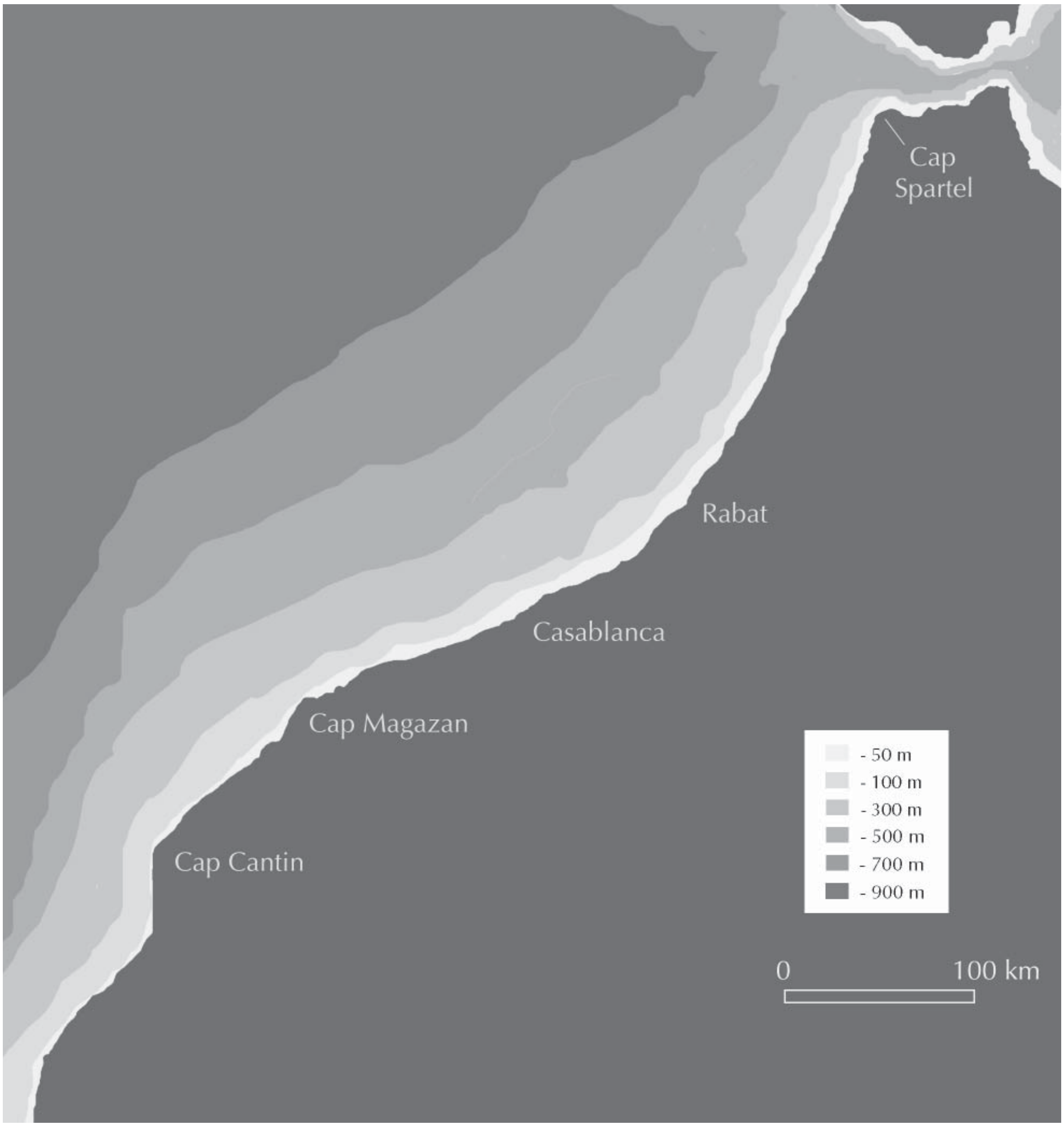


Figure 5.36. The bathymetry of the eastern Atlantic (based on data from Maldonado, *et al.* 1999: 12, fig. 2; Seibold 1982: 6-7). Image: ALT

Figure 5.37. Examples of terracing on steep slopes in the Rif Mountains, just east of Pointe des Pêcheurs. The alluvial valley mouth below is common along the narrow valleys of this coastline (March, 2004). Photo: ALT

Figure 5.38. The arboreal coverage of fir and cedar in the Middle Atlas (near Ifrane) is visibly reduced even from the historical periods (February, 2004). Photo: ALT

Figure 5.39. The modern port constructions on the north shore of Ceuta (April, 2009). Photo: ALT

Figure 5.40. The Tanger-Med port in the Straits of Gibraltar (March, 2007). Photo: ALT

Figure 5.41. In the winter of 2008-2009, extremely heavy rainfall in the northwest Maghreb allowed for temporary lakes (merjas) to form behind the mid-Atlantic coastal dune ridge, here south of Merja Zerga (April, 2009). Photo: ALT

Figure 5.42. The Rharbian layers deposited over the Roman levels at *Banasa*, on the Oued Sebou (October, 2007). Photo: ALT

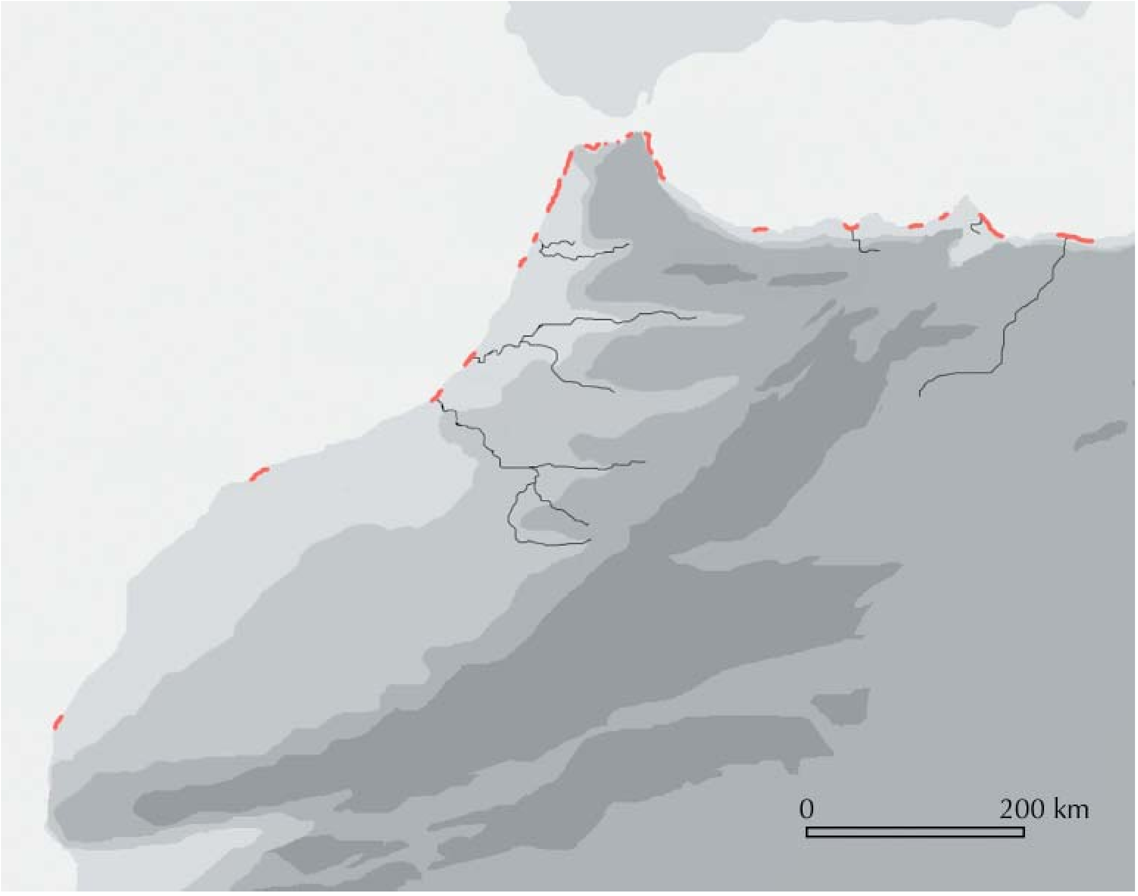


Figure 5.43. The littoral of the northwest Maghreb, indicating areas of geo-morphological change (in red).The unmarked zones represent relatively stable shorelines (based on data presented in Chapter 5.5). Image: ALT

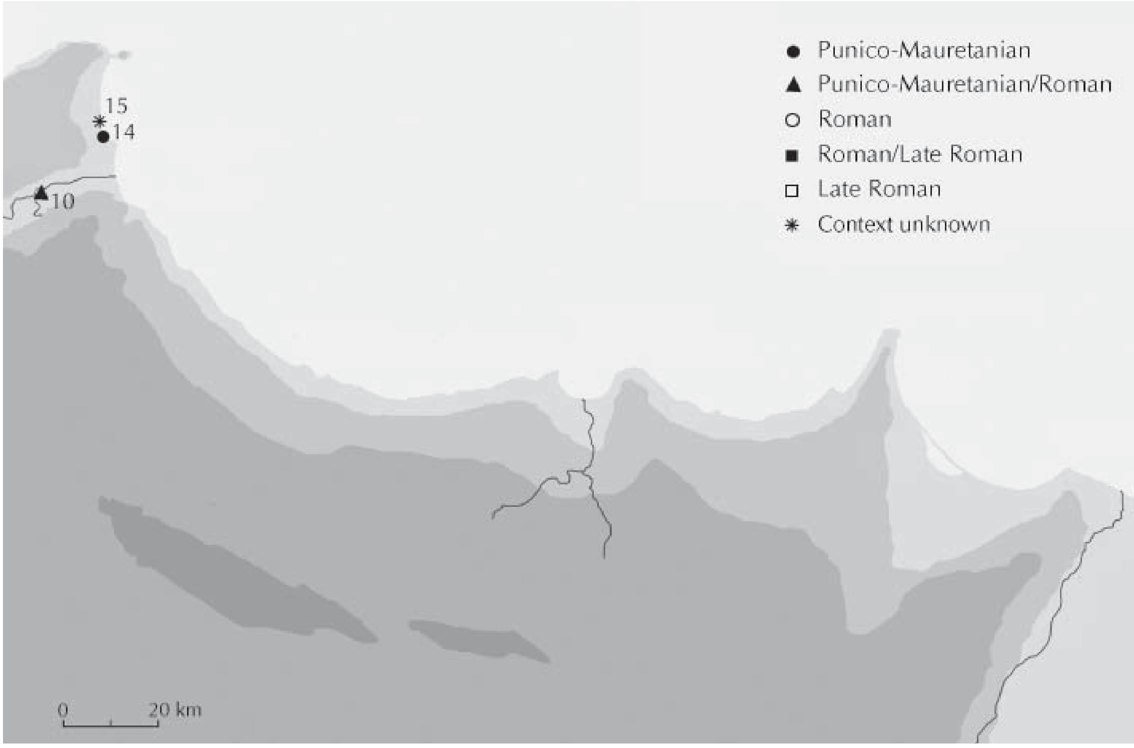


Figure 6.1. Distribution and chronology of fish species from the Mediterranean littoral (for source data, see App. 1.1.1; for site numbers, see site list at the beginning of the appendices).

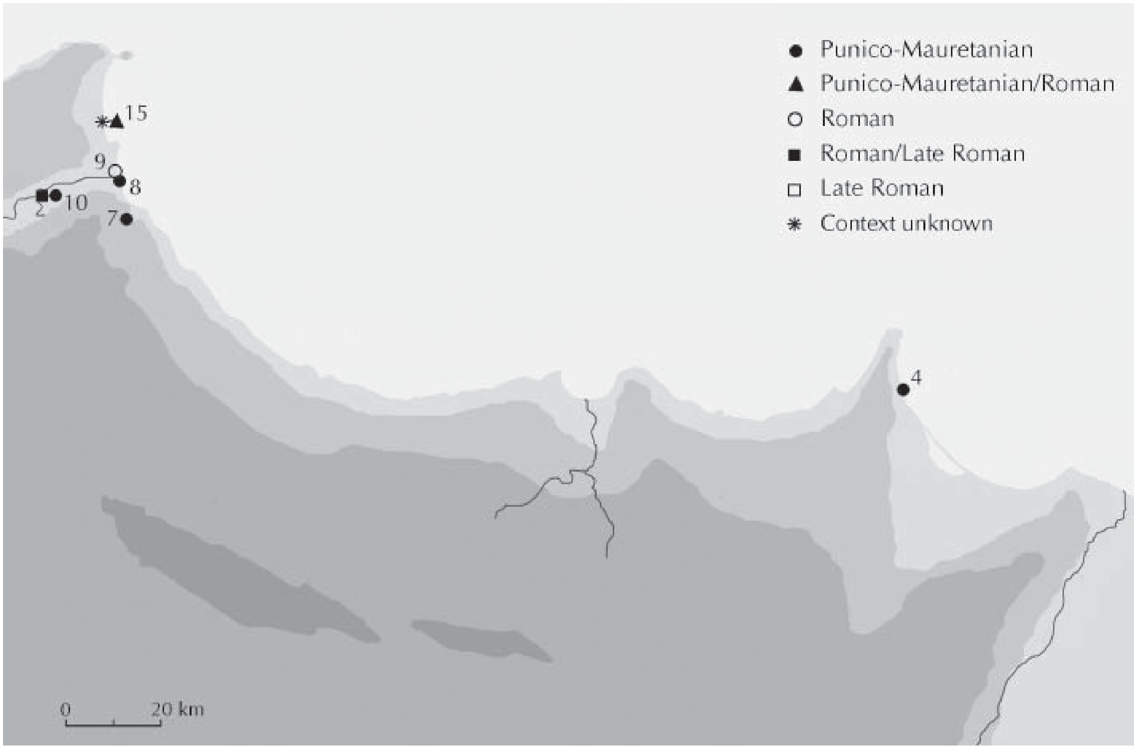


Figure 6.2. Distribution and chronology of marine invertebrates from the Mediterranean littoral (for source data, see App. 1.2.1; for site numbers, see site list at the beginning of the appendices).

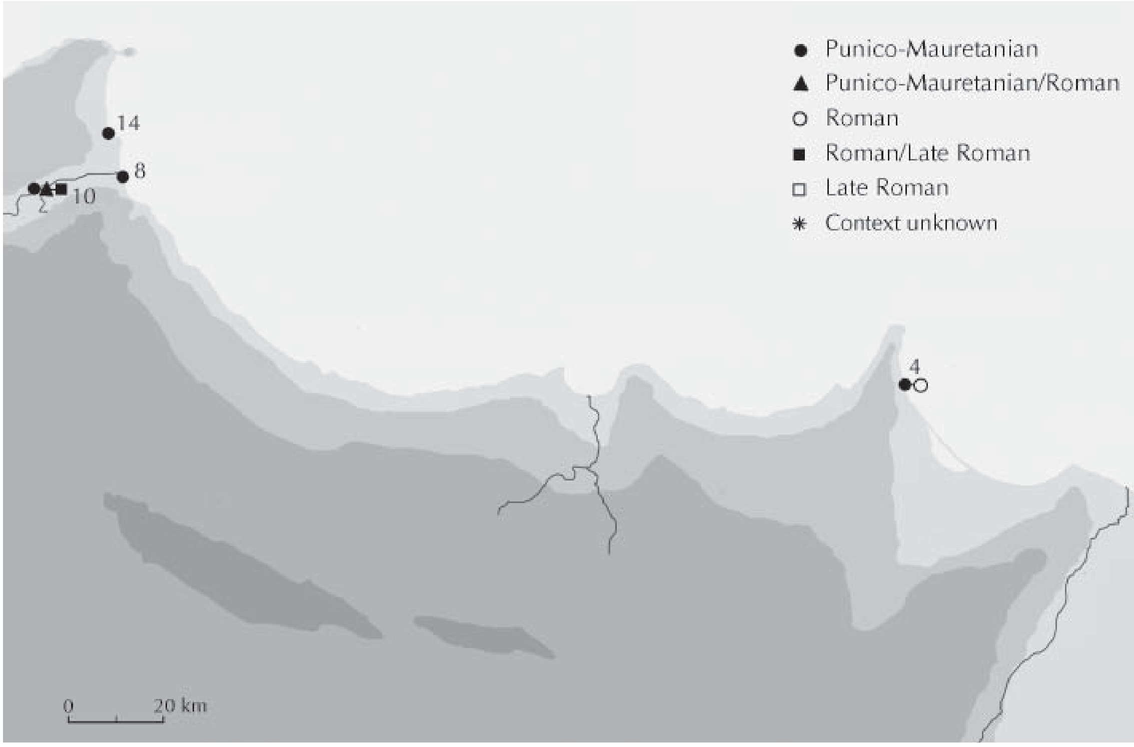


Figure 6.3. Distribution and chronology of fishing equipment finds from the Mediterranean littoral (for source data, see App. 2.1; for site numbers, see site list at the beginning of the appendices).

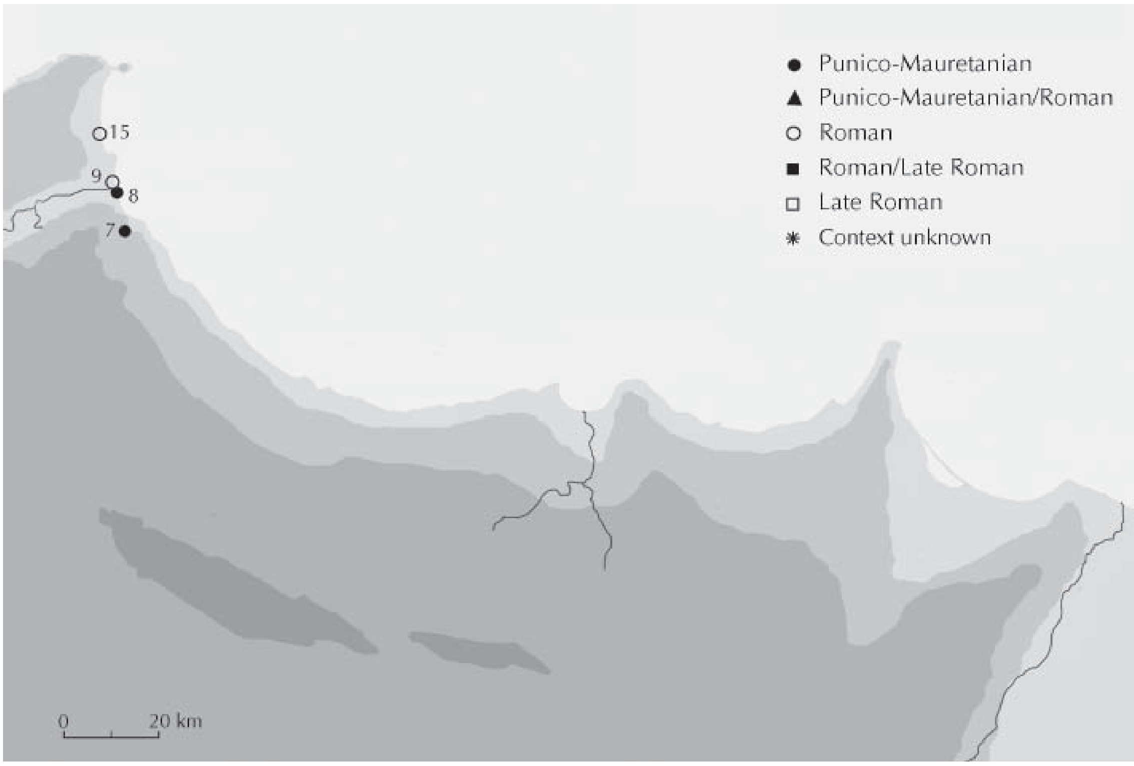


Figure 6.4. Distribution and chronology of fish-salting facilities along the Mediterranean littoral (for source data, see App. 3.1; for site numbers, see site list at the beginning of the appendices).

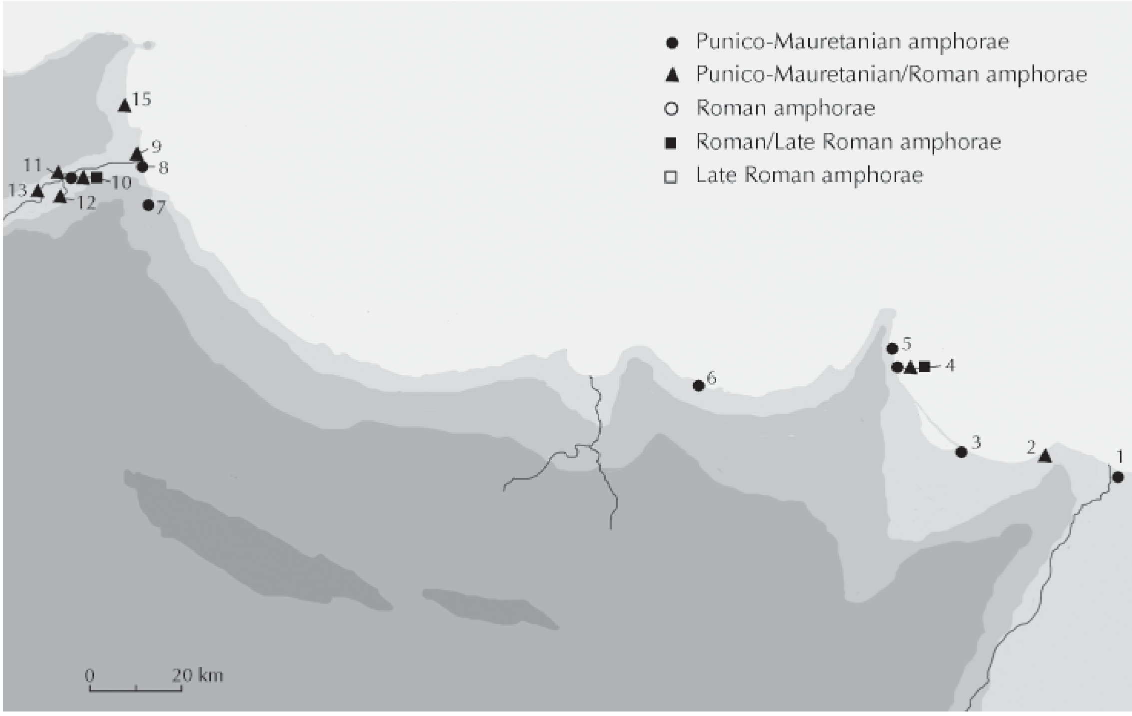


Figure 6.5. Distribution and chronology of salazón amphorae finds along the Mediterranean littoral (for source data, see App. 3.3.2.1; for site numbers, see site list at the beginning of the appendices).

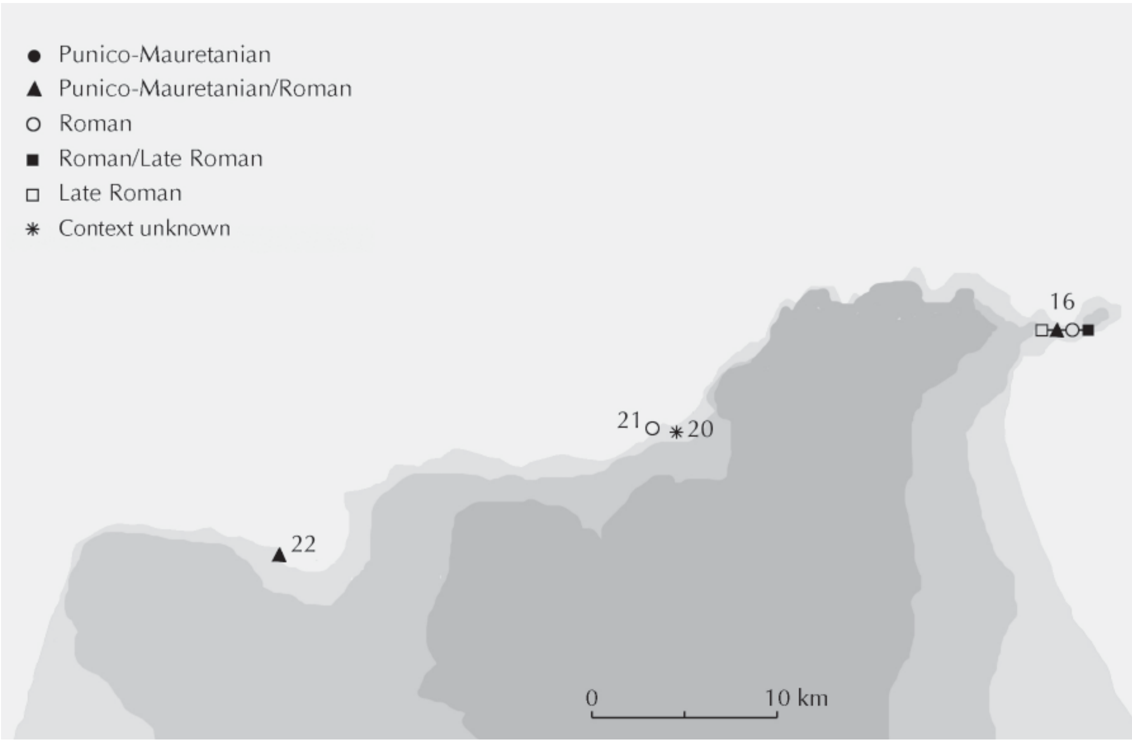


Figure 6.6. Distribution and chronology of fish species from the Straits of Gibraltar littoral (for source data, see App. 1.1.2, App. 4.2; for site numbers, see site list at the beginning of the appendices).

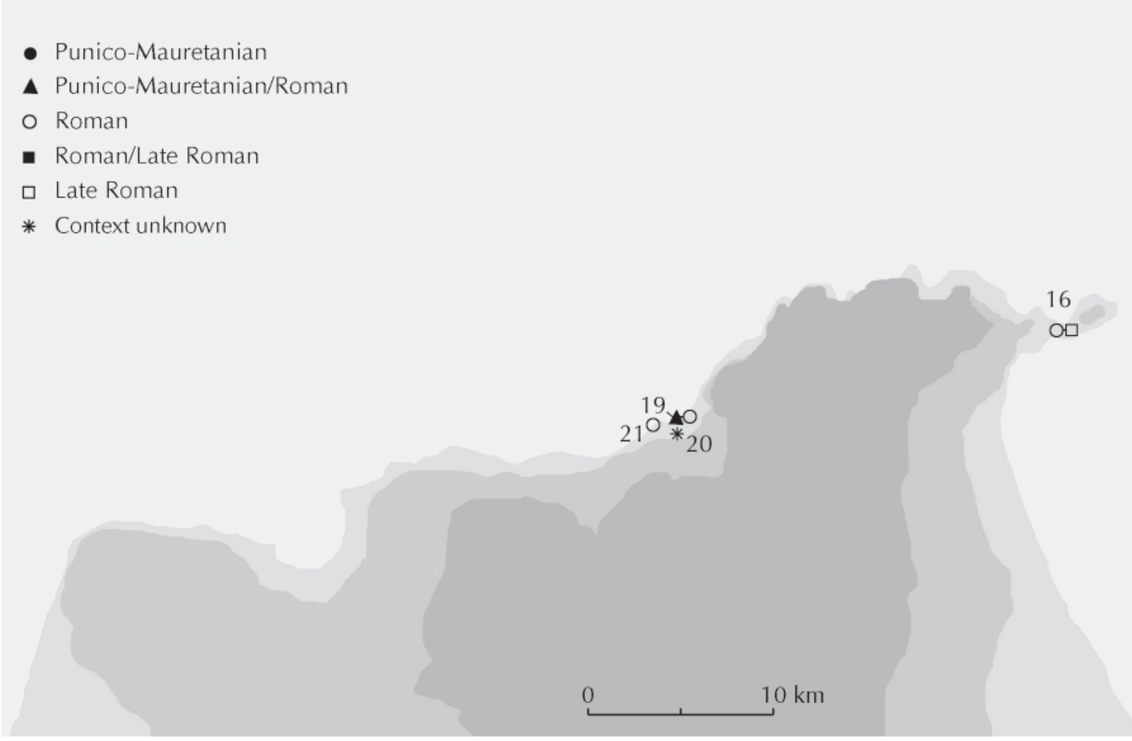


Figure 6.7. Distribution and chronology of marine invertebrates from the Straits of Gibraltar littoral (for source data, see App. 1.2.2; for site numbers, see site list at the beginning of the appendices).

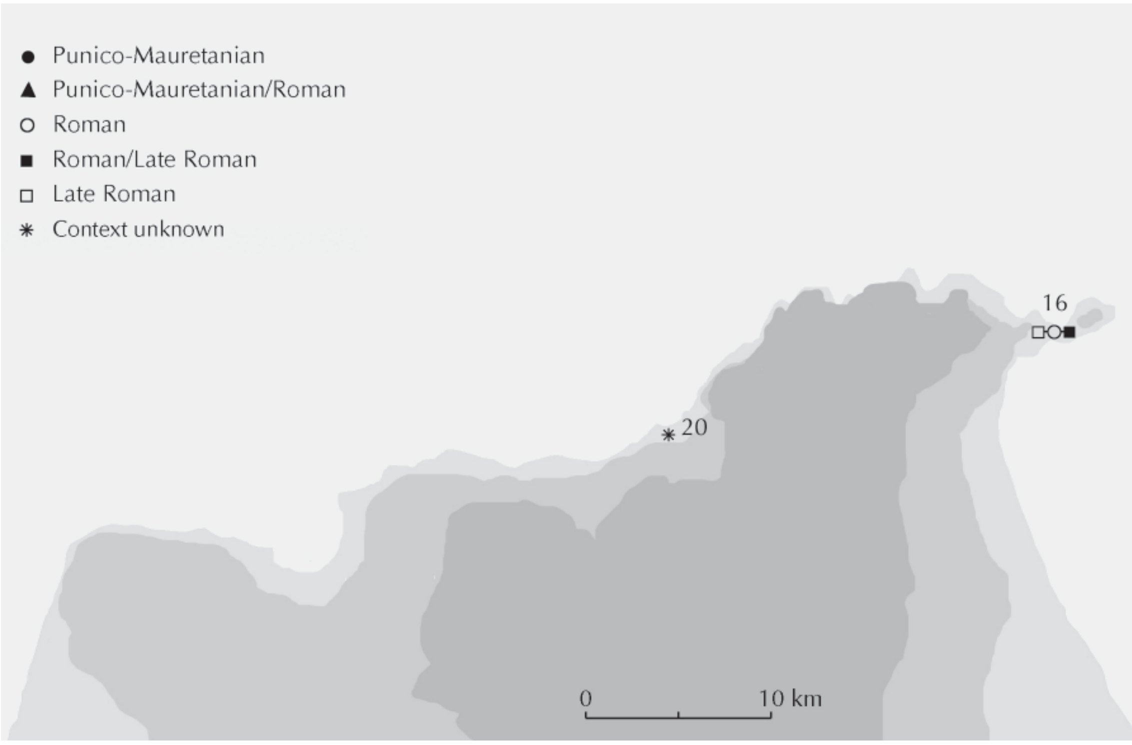


Figure 6.8. Distribution and chronology of fishing equipment finds from the Straits of Gibraltar littoral (for source data, see App. 2.2; for site numbers, see site list at the beginning of the appendices).

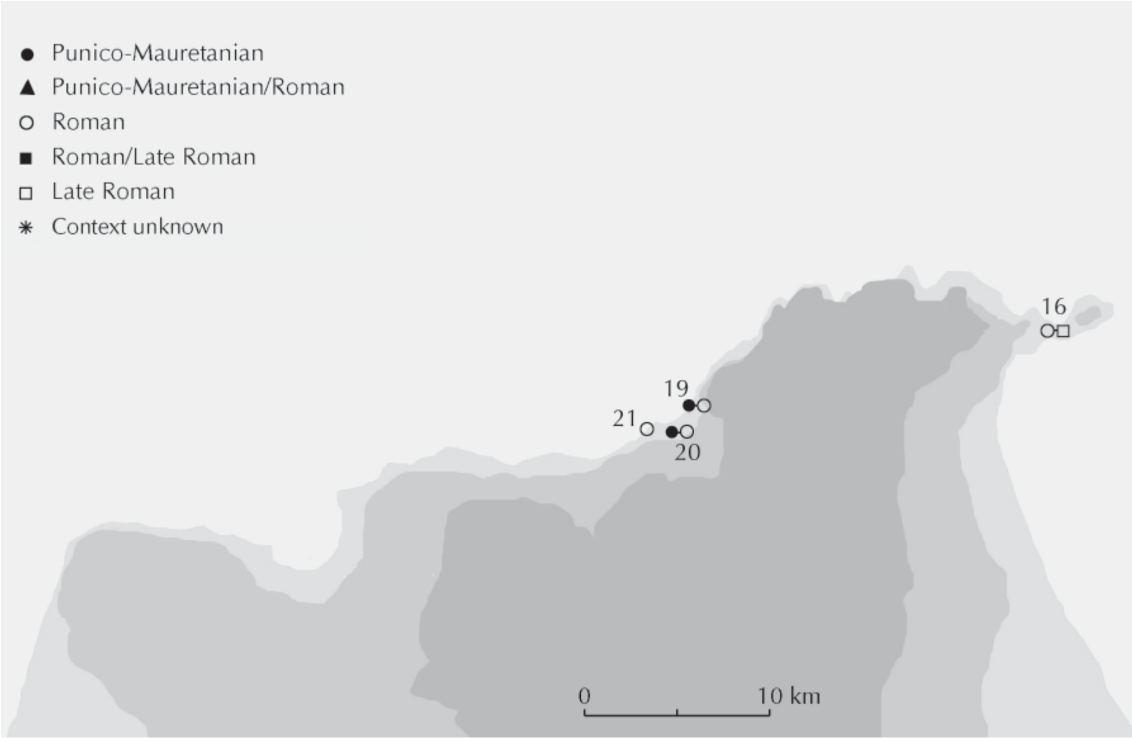


Figure 6.9. Distribution and chronology of fish-salting facilities along the Straits of Gibraltar littoral (for source data, see App. 3.1; for site numbers, see site list at the beginning of the appendices).

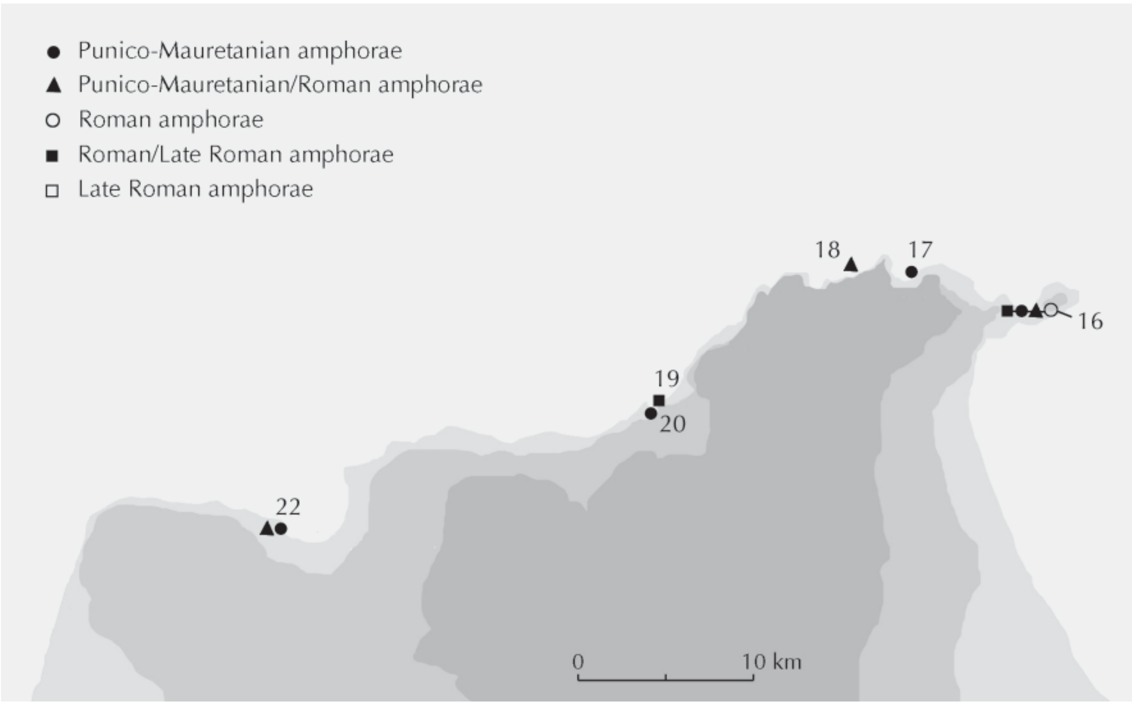


Figure 6.10. Distribution and chronology of salazón amphorae finds along the Straits of Gibraltar littoral (for source data, see App. 3.3.2.2; for site numbers, see site list at the beginning of the appendices).

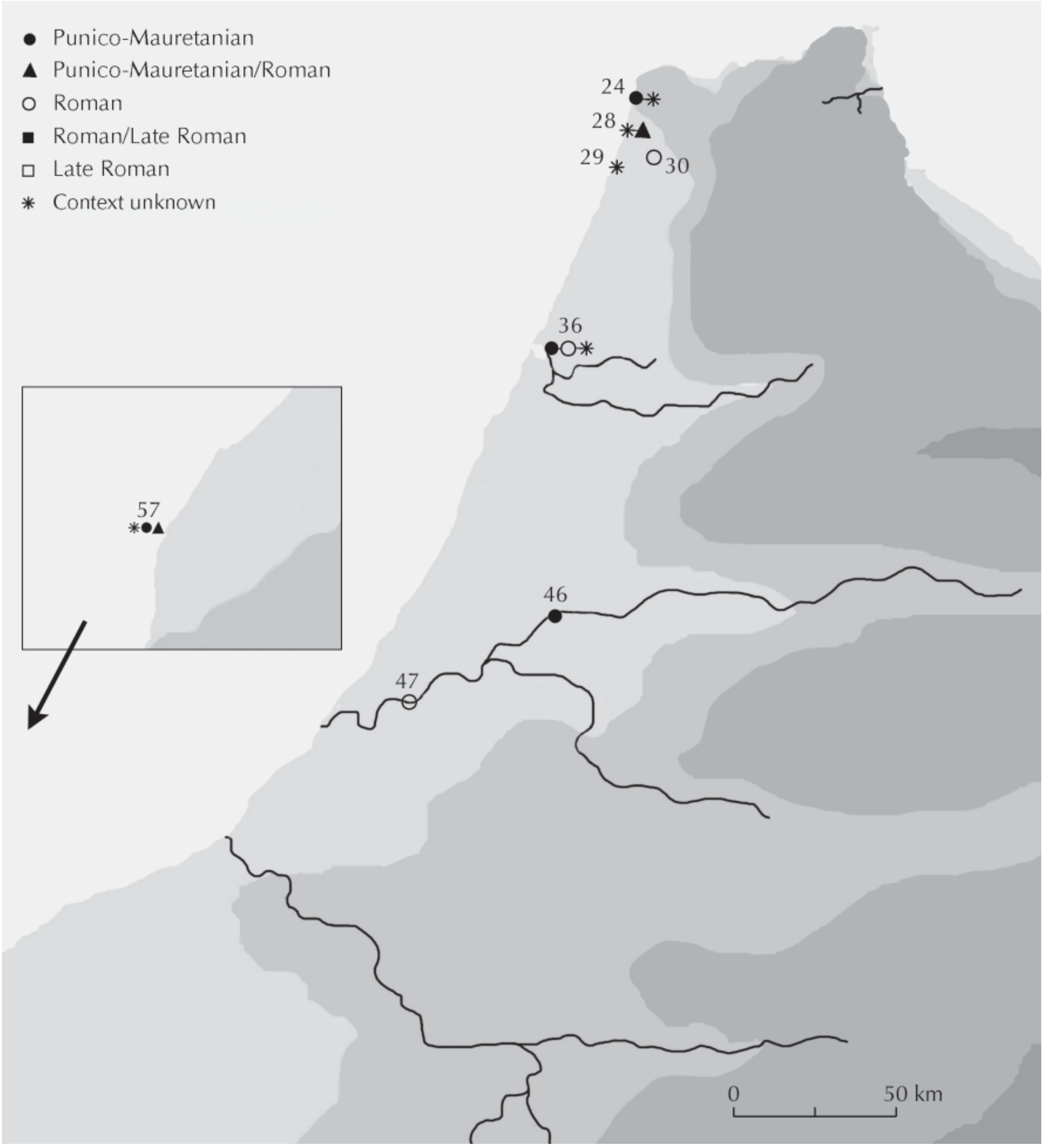


Figure 6.11. Distribution and chronology of fish species from the Atlantic littoral (for source data, see App. 1.1.3; for site numbers, see site list at the beginning of the appendices).

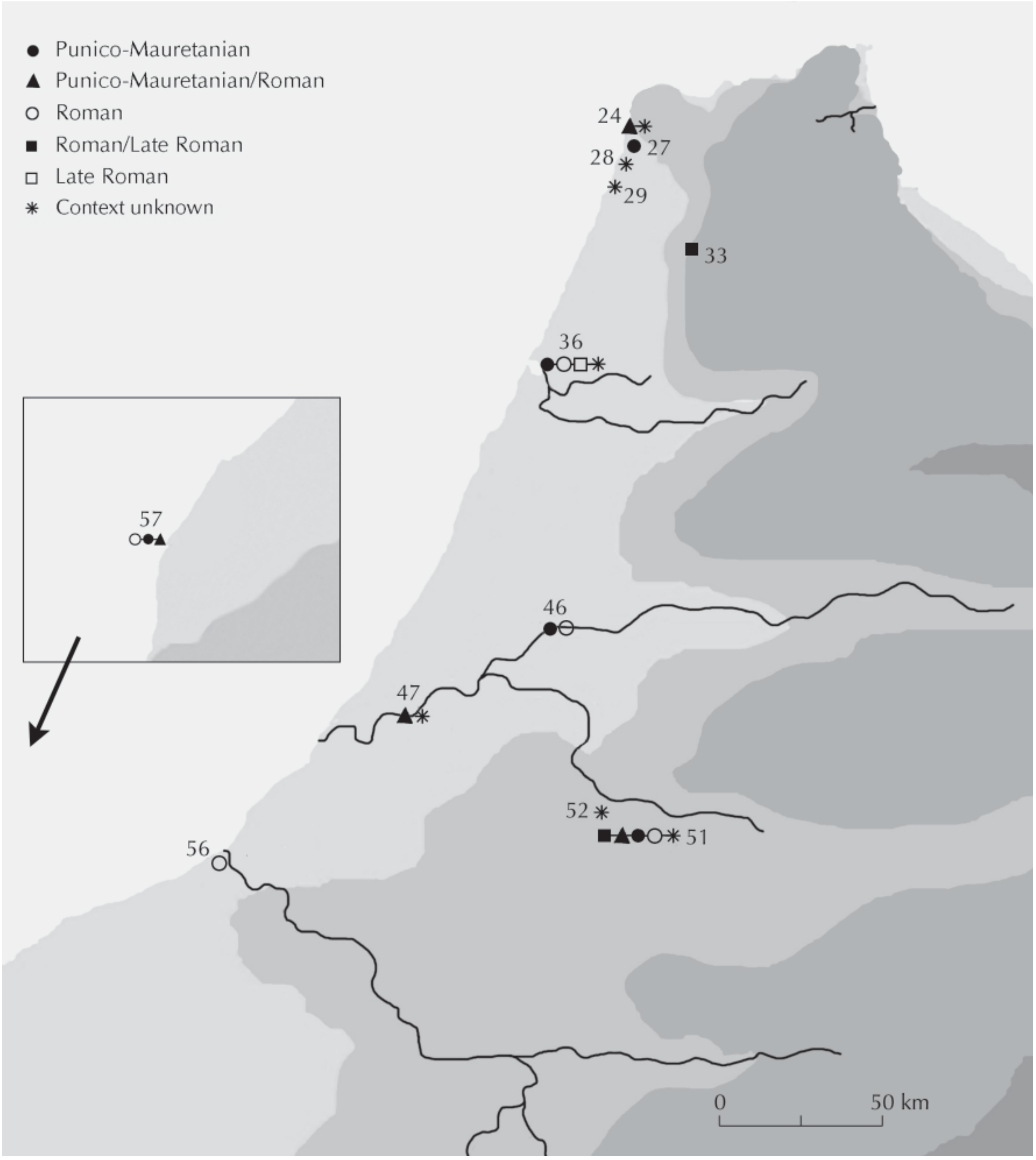


Figure 6.12. Distribution and chronology of marine invertebrates from the Atlantic littoral (for source data, see App. 1.2.3; for site numbers, see site list at the beginning of the appendices).

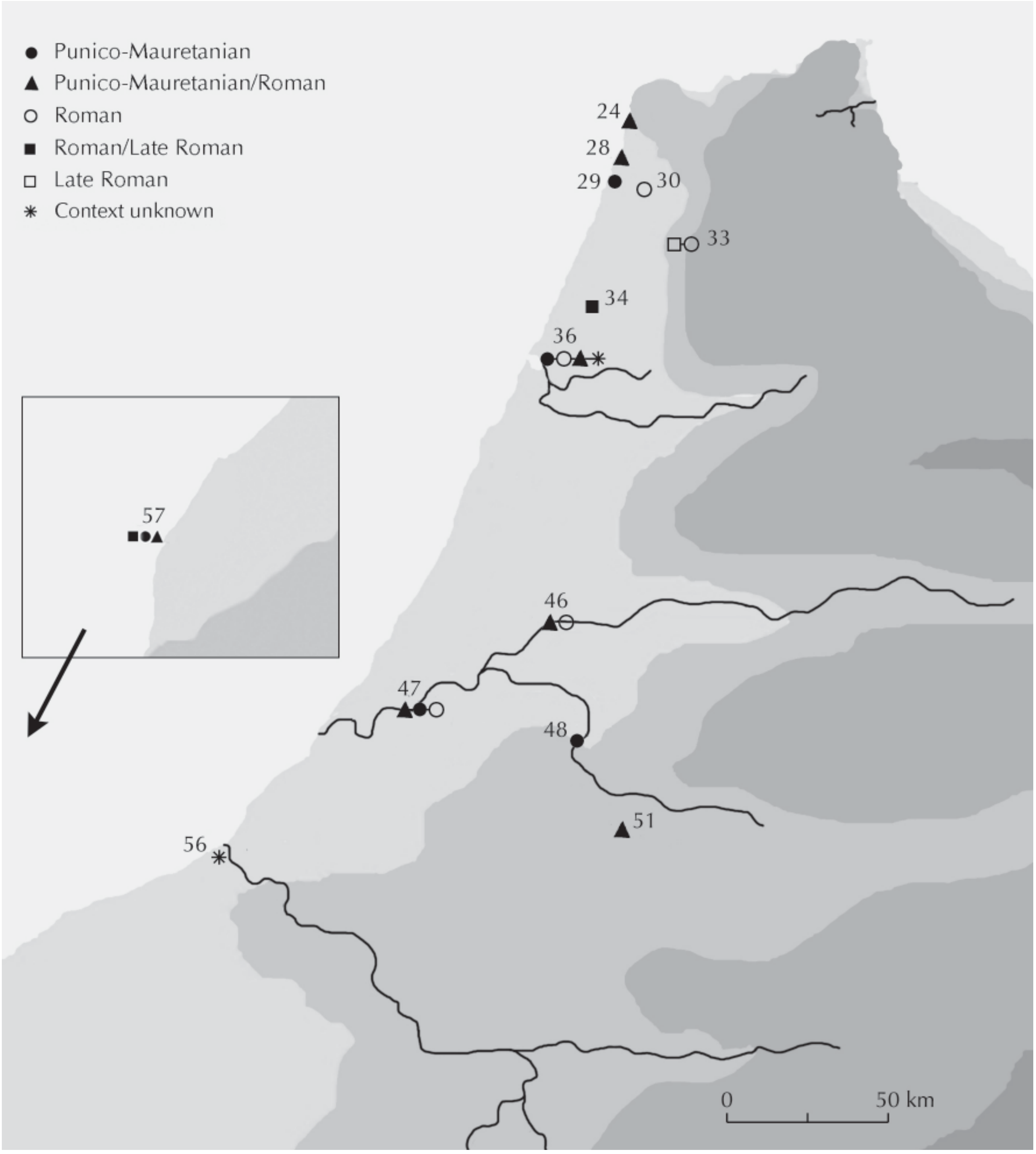


Figure 6.13. Distribution and chronology of fishing equipment finds from the Atlantic littoral (for source data, see App. 2.3; for site numbers, see site list at the beginning of the appendices).

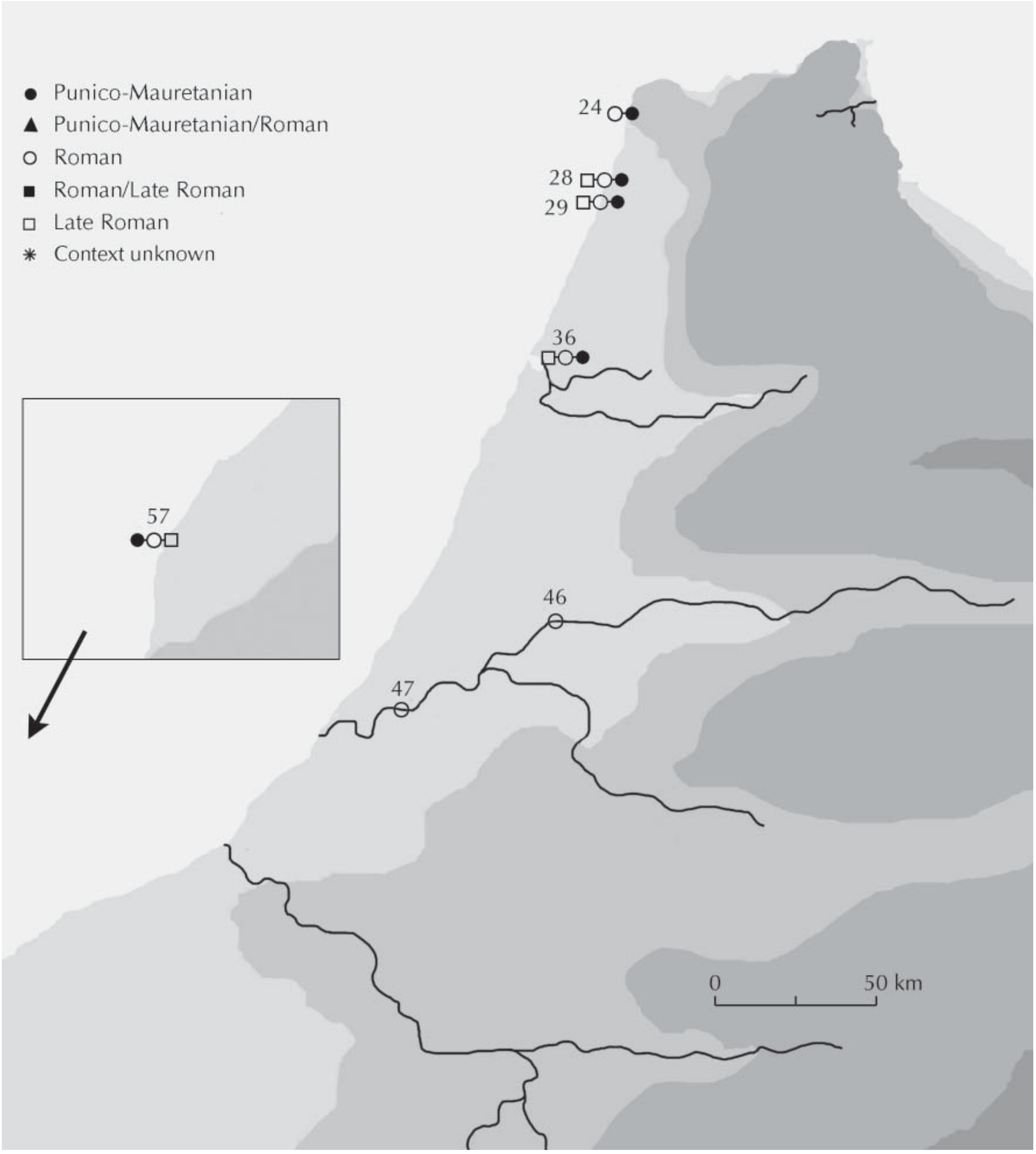


Figure 6.14. Distribution and chronology of fish-salting facilities along the Atlantic littoral (for source data, see App. 3.1; for site numbers, see site list at the beginning of the appendices).

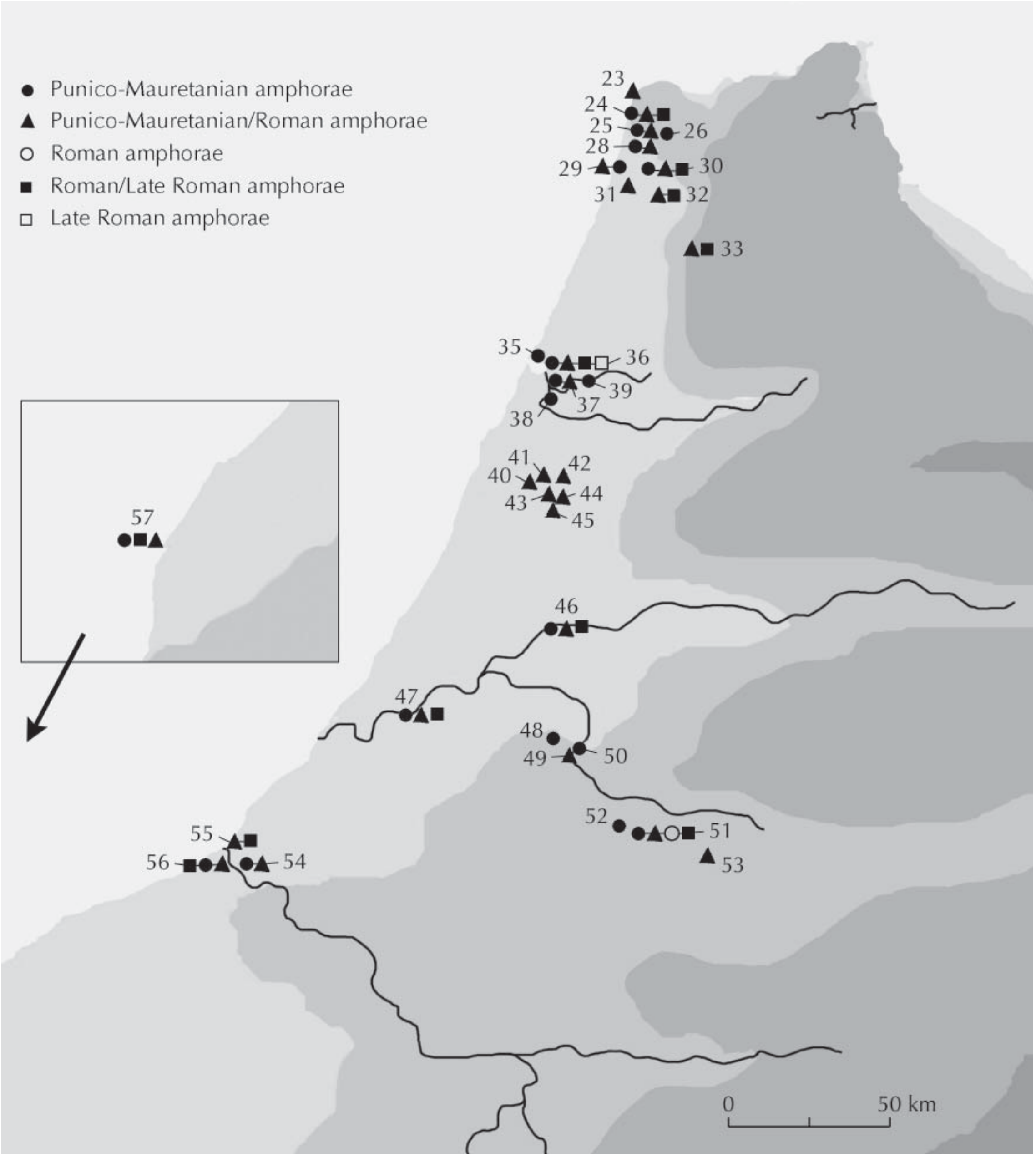


Figure 6.15. Distribution and chronology of salazón amphorae finds along the Atlantic littoral (for source data, see App. 3.3.2.3; for site numbers, see site list at the beginning of the appendices).

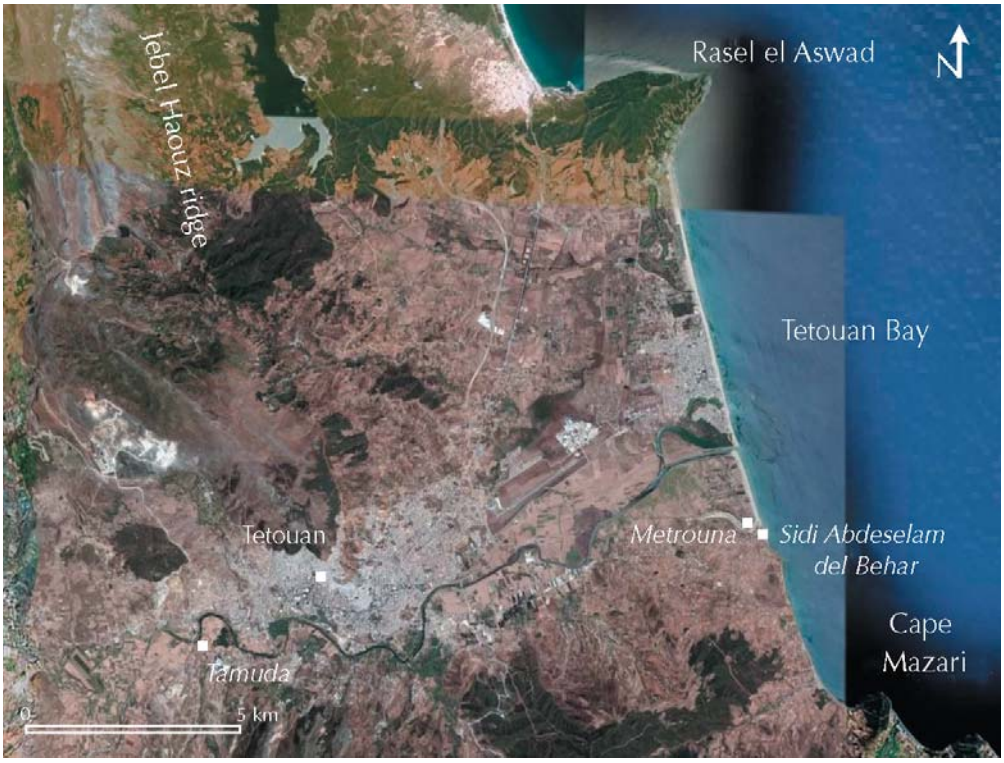


Figure 7.1. *Tamuda* and other relevant locations in the Oued Martil valley. (Archaeological sites are noted in italics.)

Figure 7.2. The site of *Tamuda* on the southern bank of the Oued Martil, with the square *castellum* visible in the centre of the site.

Figure 7.3. Aerial view of *Tamuda*, looking to the south-east. Photo taken in 1949 (from Villaverde Vega 2001: 146 [Servicio Geográfico y Cartográfico del Ejército del Aire, 1.a AC 8925]).

Figure 7.4. Composite site plan of the excavated areas of *Tamuda* (based on plans from Tarradell 1949: fig. 1; Tarradell 1956: fig. 1; Lenoir 1991: fig. 1; Bernal, *et al*. 2008a: figs 10, 12; Villaverde Vega 2001: fig. 148). The final stage of the *castellum* is shown. The areas of shellfish and fishing equipment finds, if known, are shown (the find locations of the fish bones are not known for this site). The coloured dots only indicate the general area of the excavated site where the finds were made; they do not indicate specific find-spots.

Figure 7.5. View from the southwest corner of the site, with the Punico-Mauretanian structures that line the western end of the "Gran Plaza" in the foreground; the *castellum* is the small hillock in the background (July, 2002). Photo: ALT

Figure 7.6. The western gate of the *castellum*, from the exterior. The final stage of *castellum*'s construction resulted in semi-circular projecting towers and gates (July, 2002). Photo: ALT

Figure 7.7. The western gate during excavations by the Universities of Cádiz, Huelva and Tetouan in 2008 (after Bernal, *et al.* 2008a: fig. 5).

Figure 7.8. View south-east across the Oued Martil (ancient *Tamuda* or *Tumuada fl.*) to the bluff of *Tamuda*, behind the stand of trees. The continuation of the Rif Mountains is in the background (March, 2007). Photo: ALT

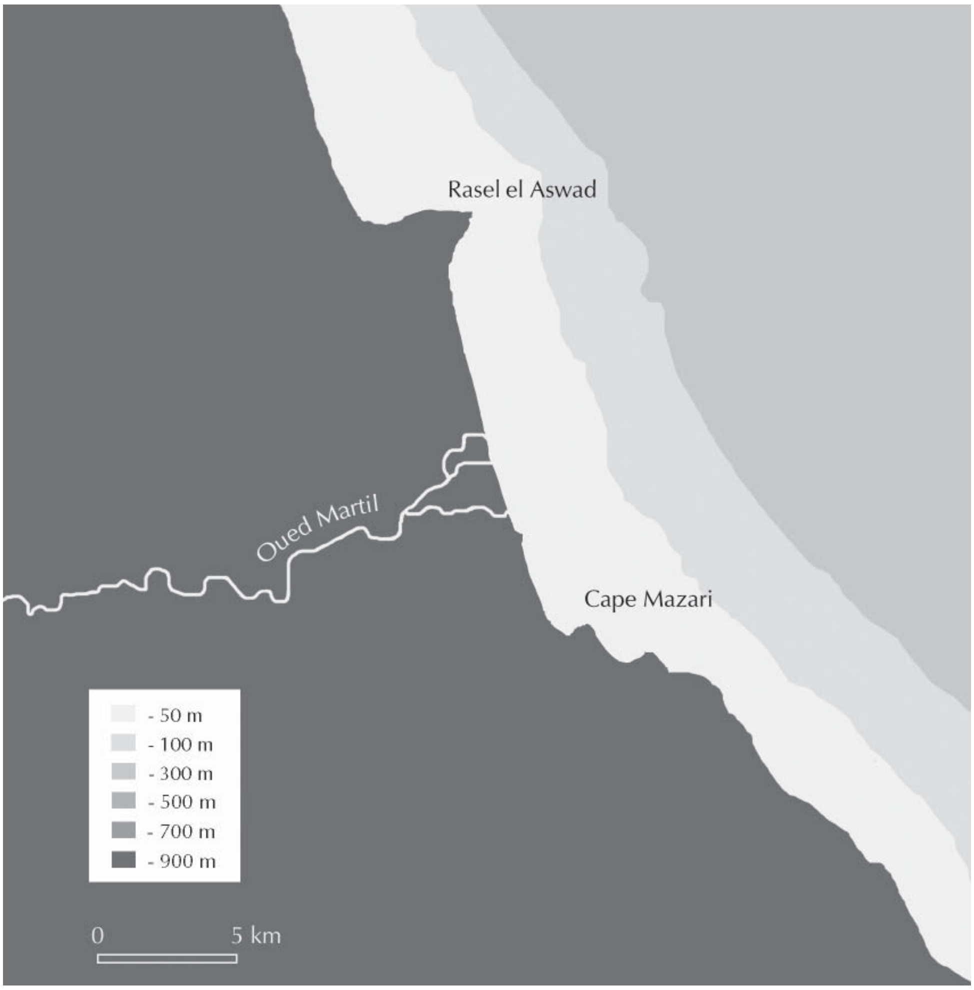


Figure 7.9. Bathymetry of Tetouan Bay (based on data from Maldonado, *et al.* 1999: Figs 1-2; Fabres, *et al.* 2002: 432; Bormans & Garrett 1989: Figure 1; Shafee 1999: 43-44; NIMA #52039).

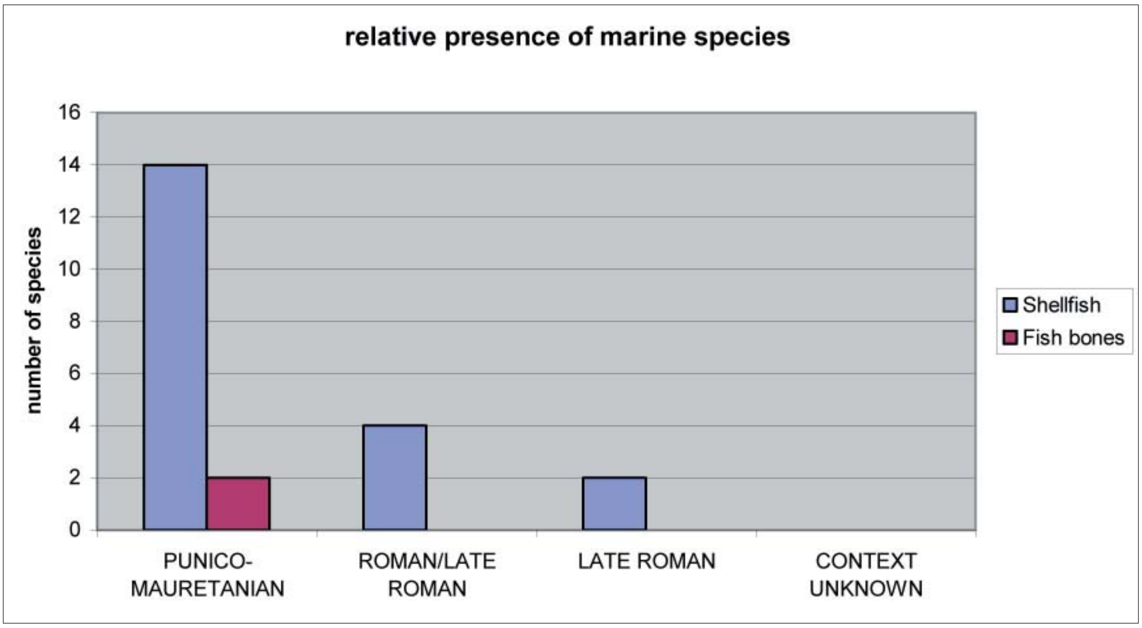


Figure 7.10. Relative presence of fish and shellfish species at *Tamuda* by period, from archaeological finds.

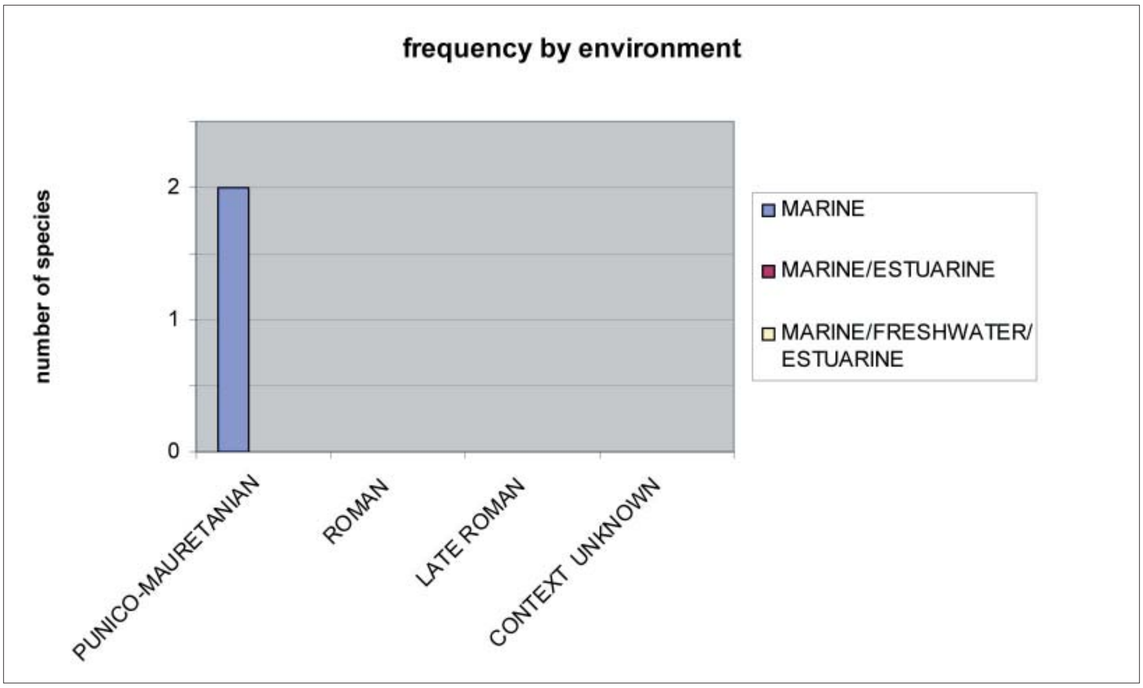


Figure 7.11. Relative number of fish species from *Tamuda* and their environments, by period.

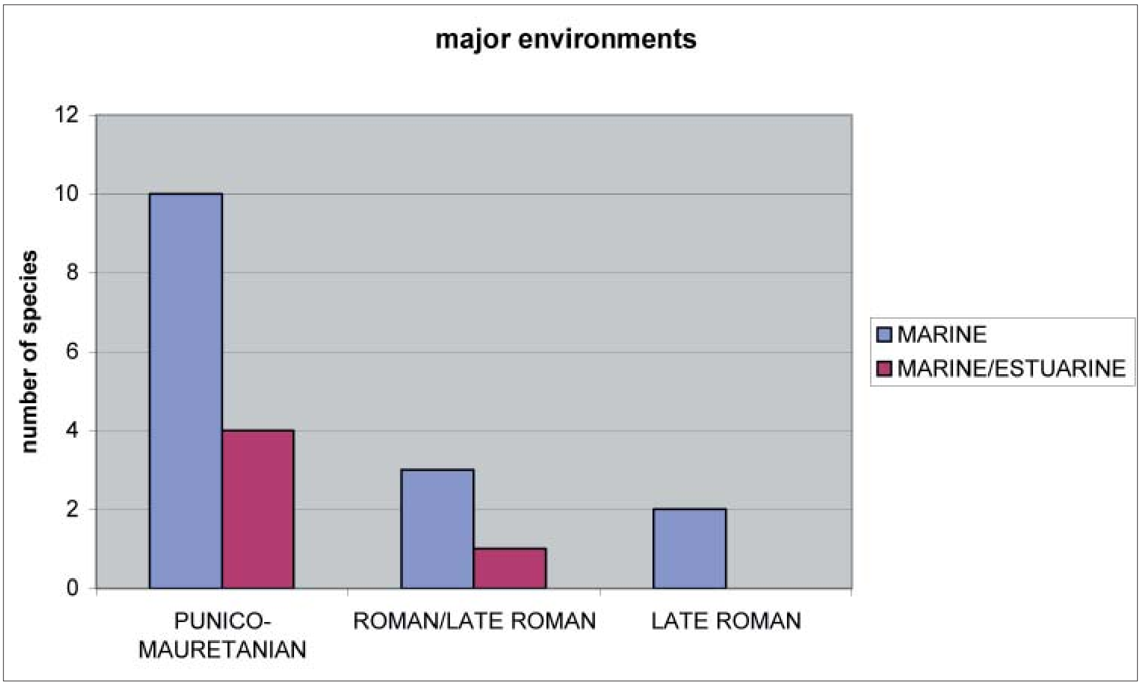


Figure 7.12. Relative number of shellfish species at *Tamuda*, by major environment.

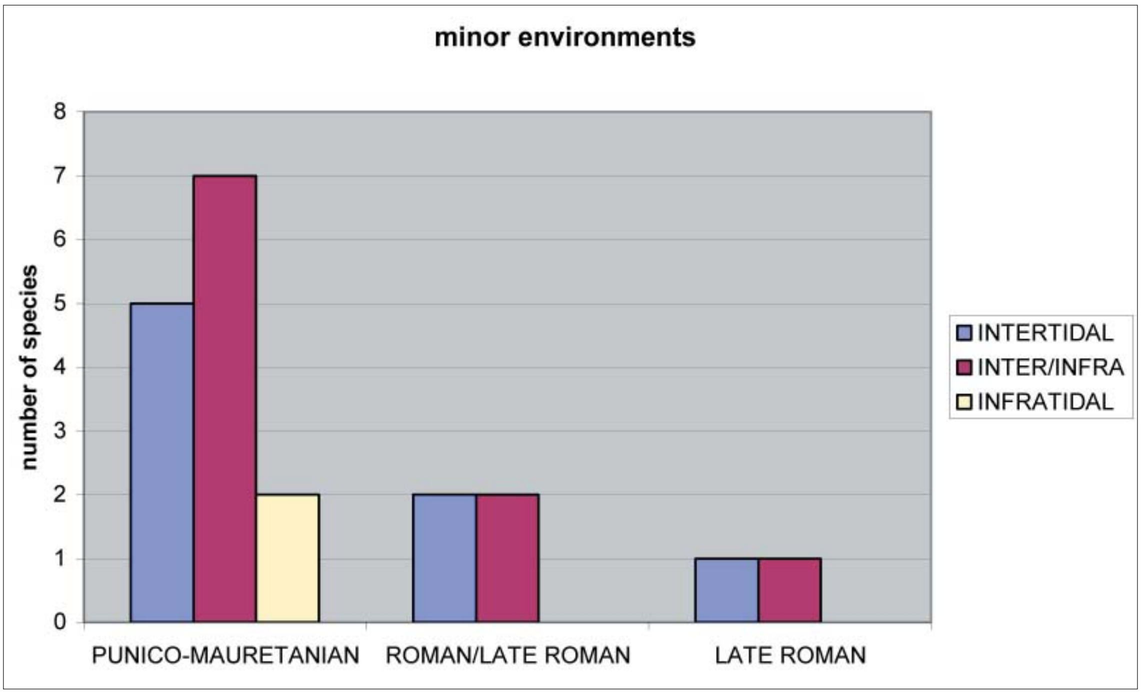


Figure 7.13. Relative number of shellfish species at *Tamuda*, by minor environment.

Figure 7.14. Vat lined with *opus signinum*, from the eastern section of the site (after Morán & Giménez Bernal 1948: Lam. IV,A).

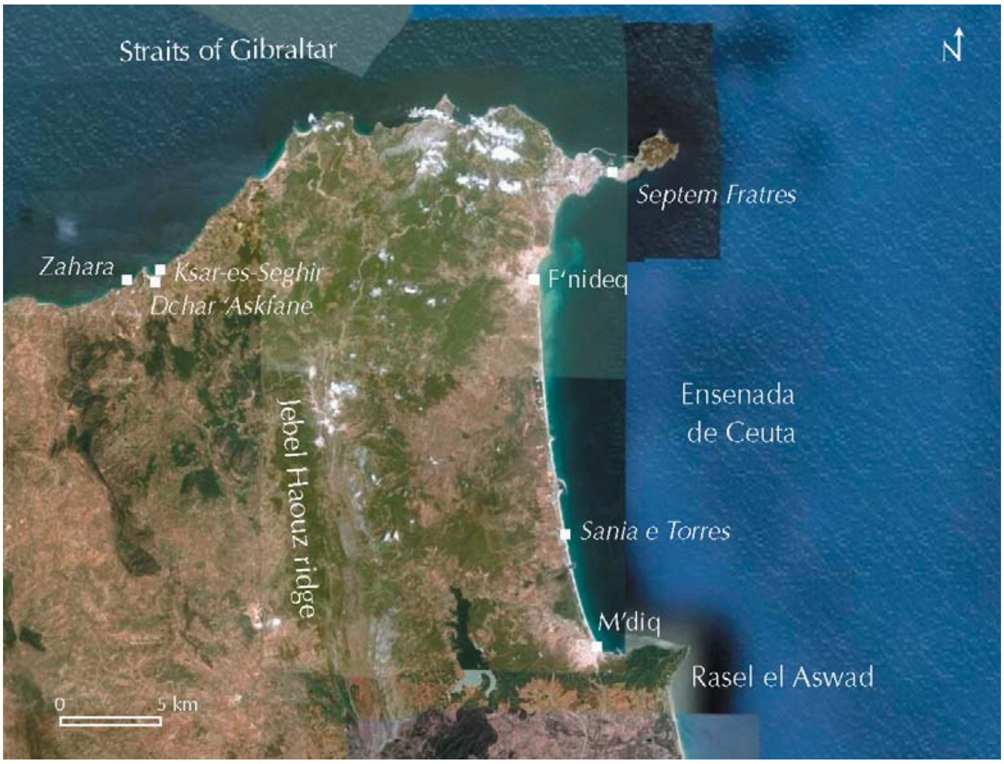


Figure 7.15. *Septem Fratres* and other relevant locations at the eastern edge of the Straits of Gibraltar. (Archaeological sites are noted in italics.)

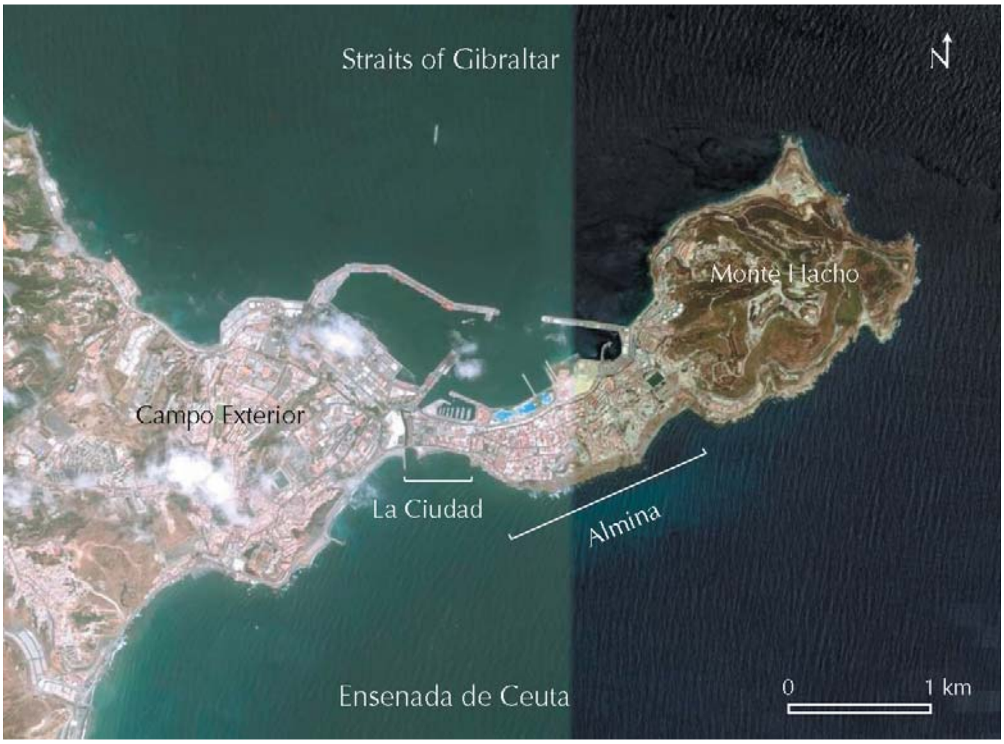


Figure 7.16. The site of *Septem Fratres* is located in the La Ciudad region of the Peninsula de la Almina, where Portuguese and Spanish fortifications were later built.

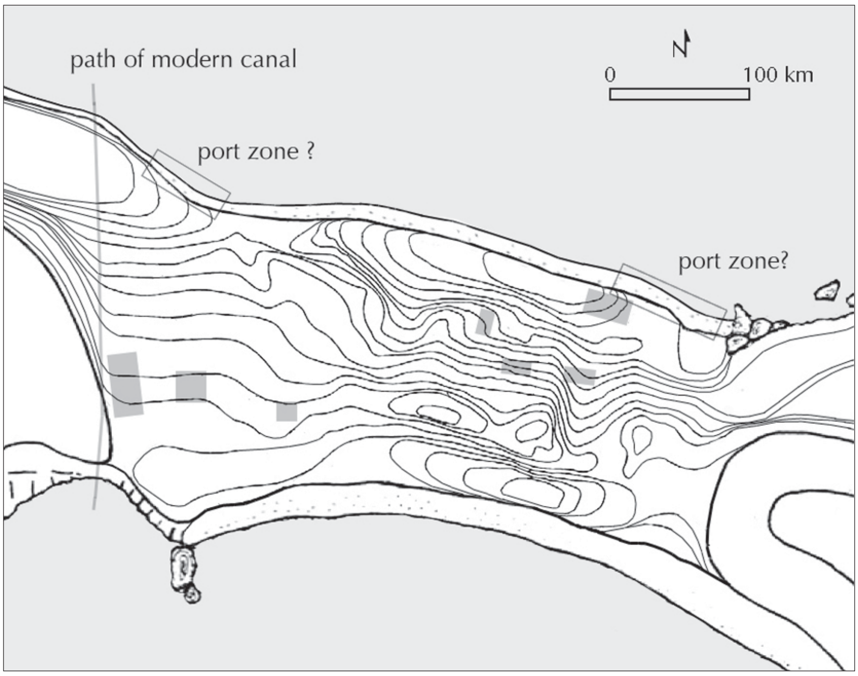


Figure 7.17. Reconstruction of the topography of the La Ciudad area of the peninsula, with the grey areas showing major areas of excavation (based on maps from Villaverde Vega & López Pardo 1995: fig. 6; Villada, *et al.* 2007: fig. 5; Villaverde Vega 2001: 119). 1 m contours.

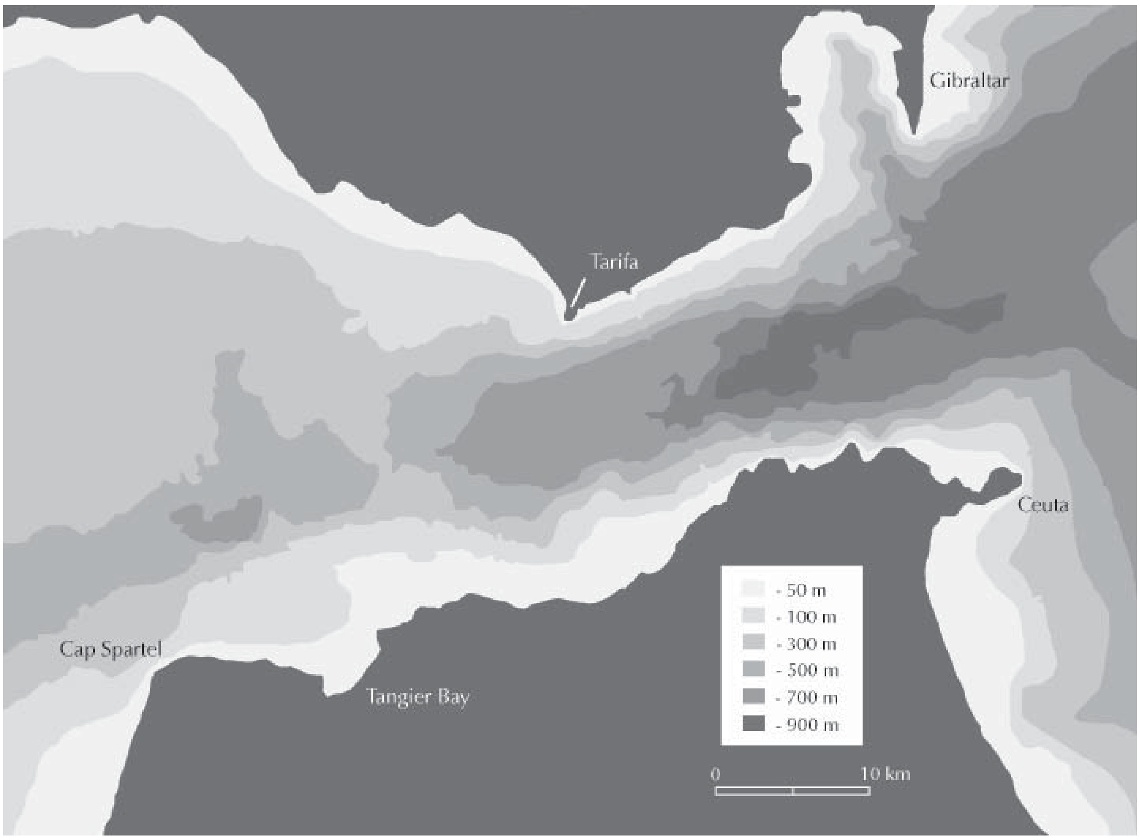


Figure 7.18. The bathymetry of the waters surrounding the Ceuta peninsula (based on data from Maldonado, *et al.* 1999: Figs 1-2; Fabres, *et al.* 2002: 432; Bormans & Garrett 1989: Fig. 1).

Figure 7.19. The northern shore of the Ceuta peninsula is sheltered from westerlies by Montaña del Renegado (white arrow), and also by Jebel Musa (the highest limestone ridge behind Montaña del Renegado) (after Villada Paredes, *et al*. 2007: fig. 2).

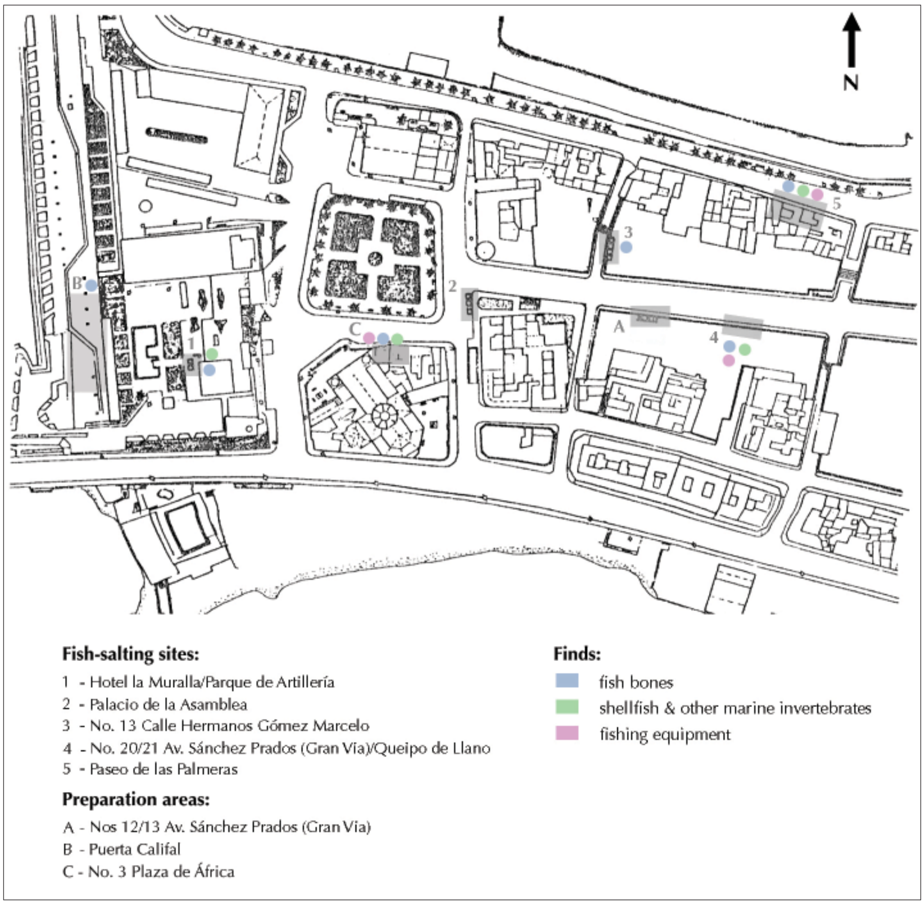


Figure 7.20. Site plan of *Septem Fratres* (La Ciudad section of Ceuta) with areas where fish-bone, shellfish and equipment finds are known (based on data from Villaverde Vega & López Pardo 1995: fig. 1; Villada, *et al.* 2007: fig. 5; Hita Ruiz & Villada Paredes 1994: 17; Hita Ruiz & Villada Paredes 2004: fig. 1; Bernal Casasola 2009: 267-268).

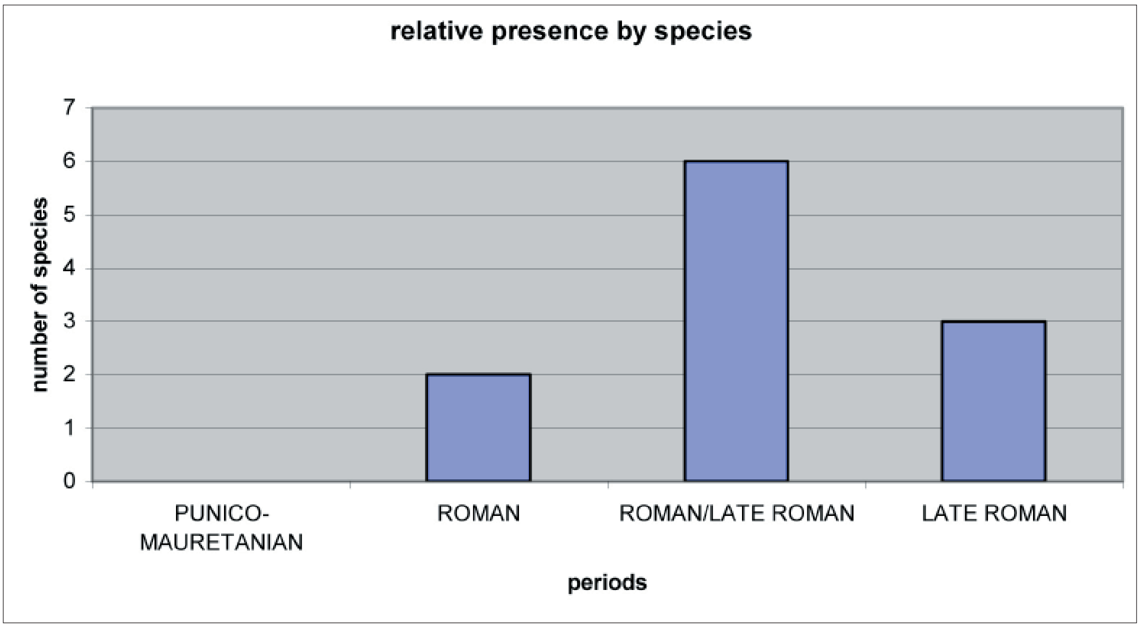


Figure 7.21. Relative presence of fish species at *Septem Fratres* based on finds of fish bones.

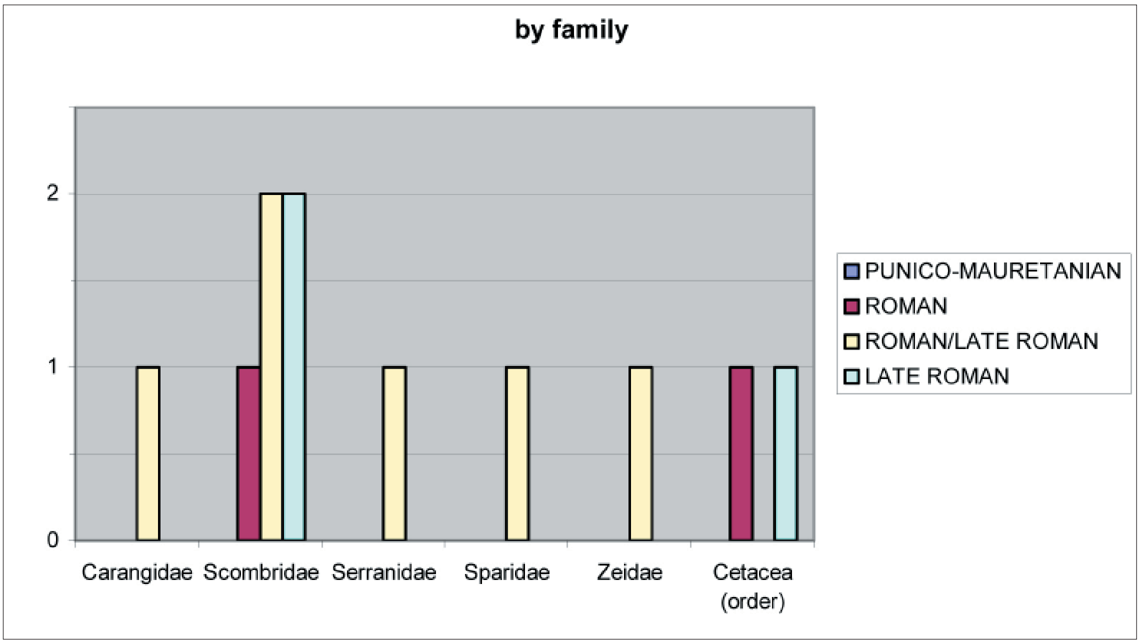


Figure 7.22. Relative frequency by family of fish species at *Septem Fratres*, by period.

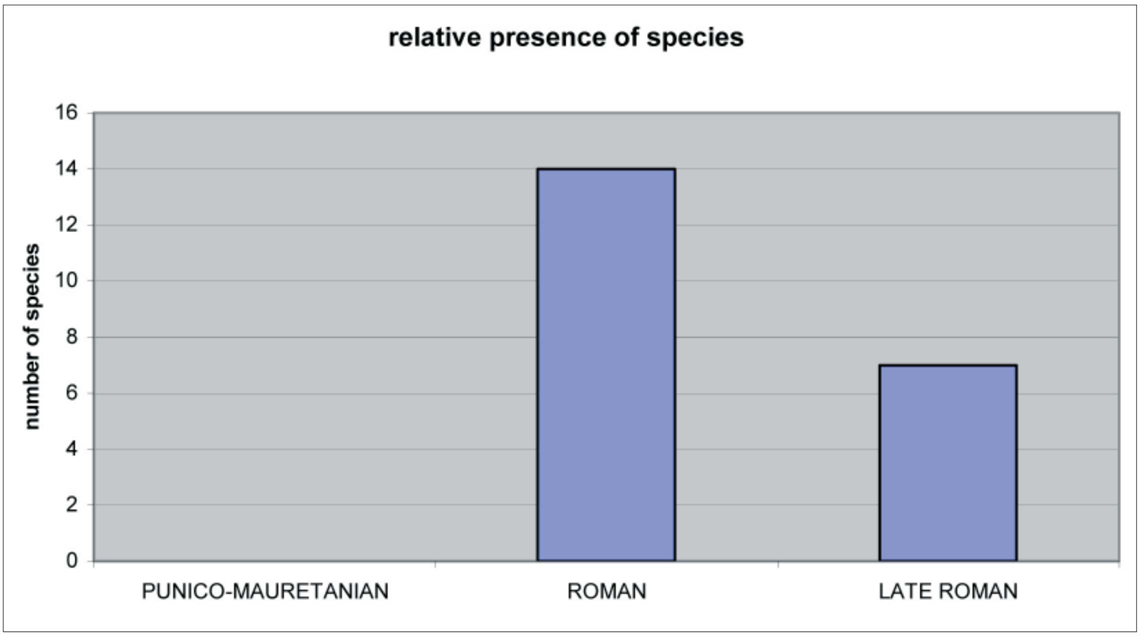


Figure 7.23. Relative presence of shellfish species and marine invertebrates at *Septem Fratres* by period.

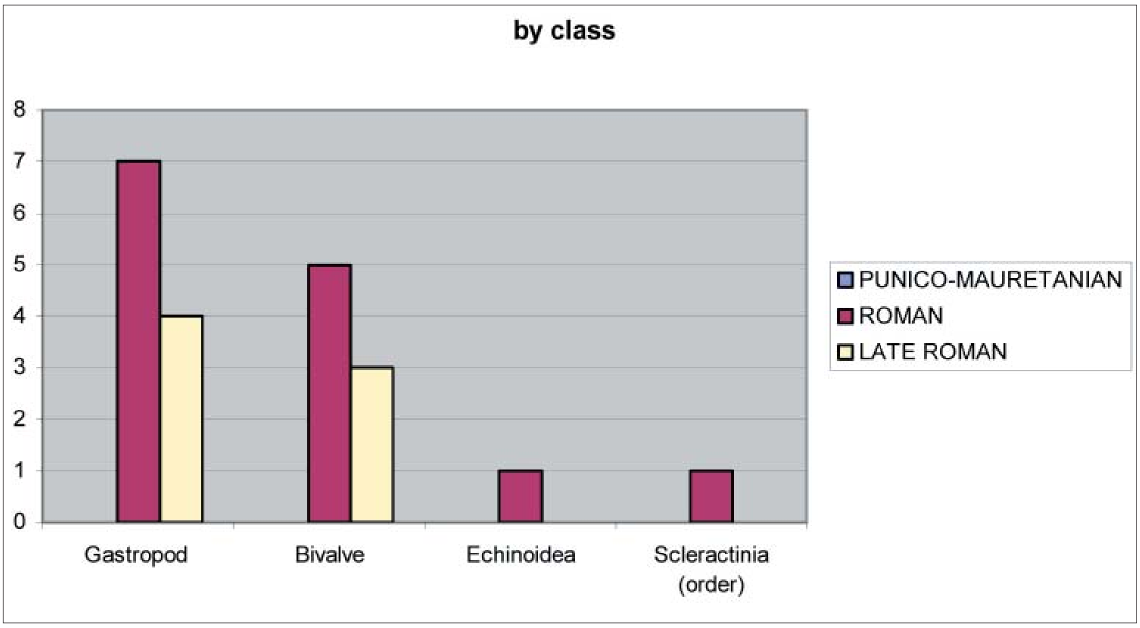


Figure 7.24. Relative frequency by class/order of shellfish and marine invertebrates at *Septem Fratres*, by period.

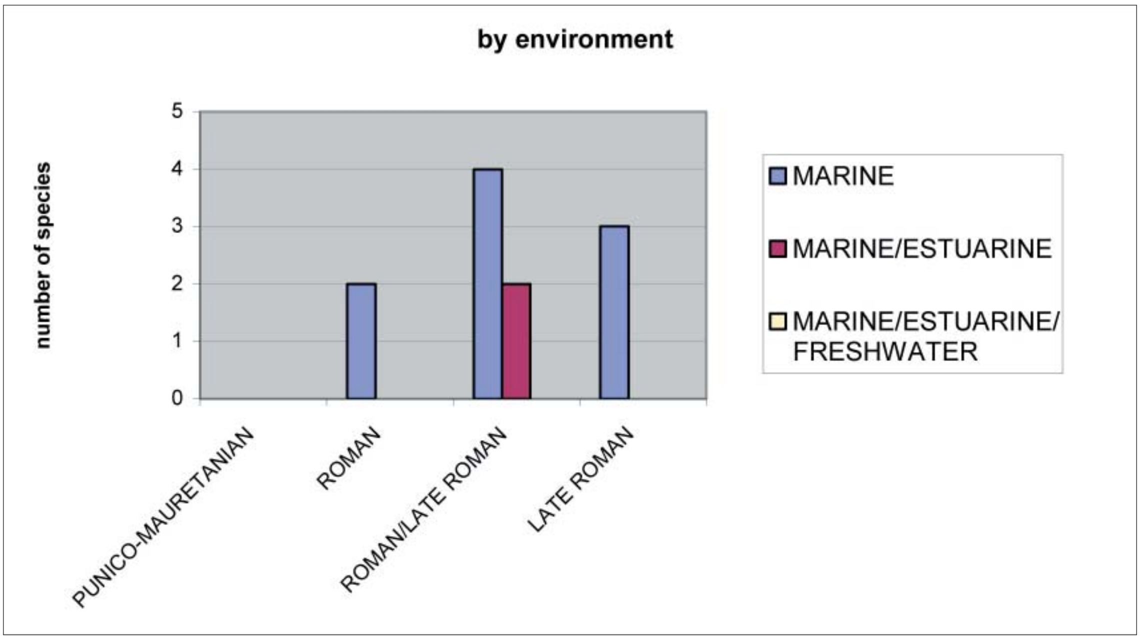


Figure 7.25. Relative number of fish species from *Septem Fratres* that live in the two environments, by period.

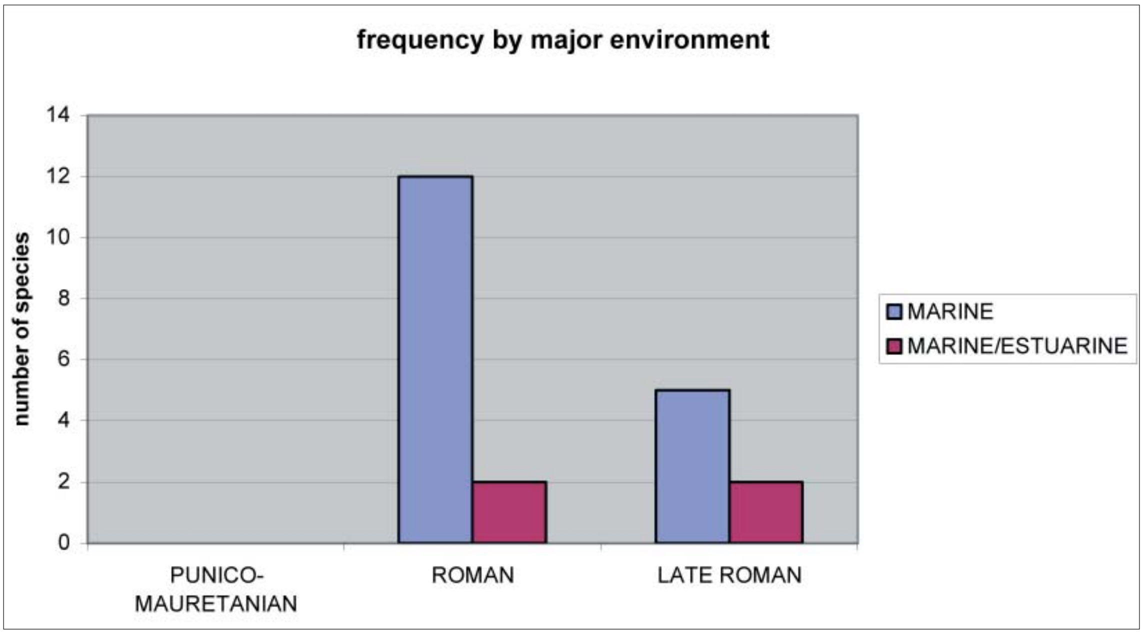


Figure 7.26. Relative number of shellfish and marine invertebrate species at *Septem Fratres*, by major environment.

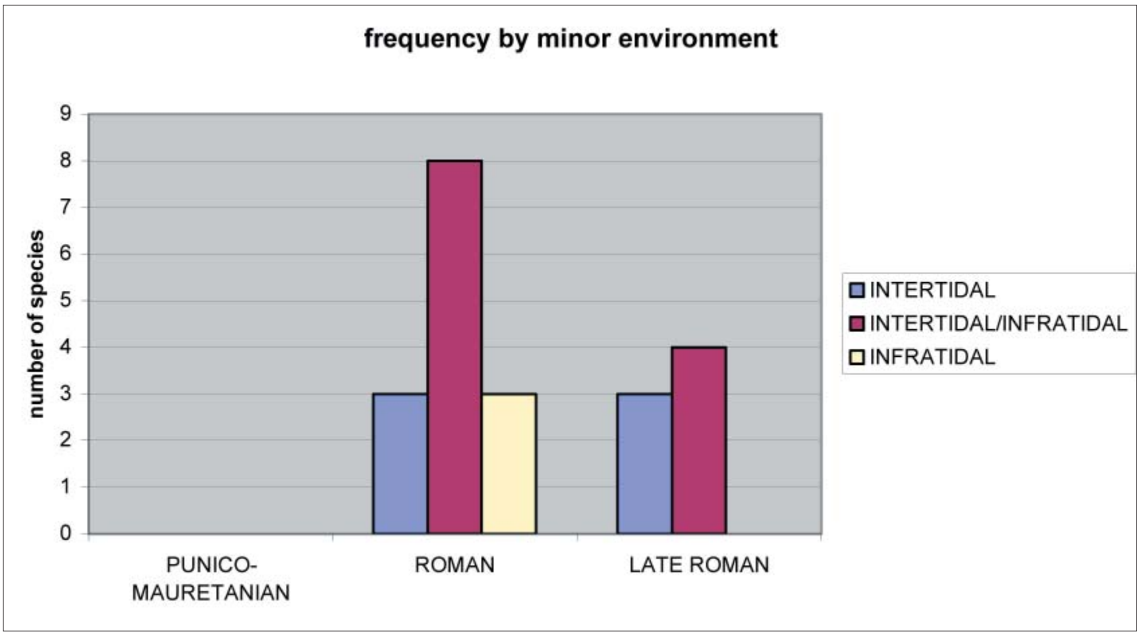


Figure 7.27. Relative number of shellfish and marine invertebrate species at *Septem Fratres*, by minor environment.

Figure 7.28. The *cetariae* found during works in front of the Hotel Meliá, at No. 13 Calle Hermanos Gómez Marcelo (after Bernal Casasola & Pérez Rivera 1999: Pl. IIIB).

Figure 7.29. In the foreground is the southern rocky shoreline of the Almina section of the Ceuta peninsula, overlooking Ensenada de Ceuta. The arrow indicates the sandy shoreline that continues further to the right, to the La Ciudad area (April, 2009). Photo: ALT

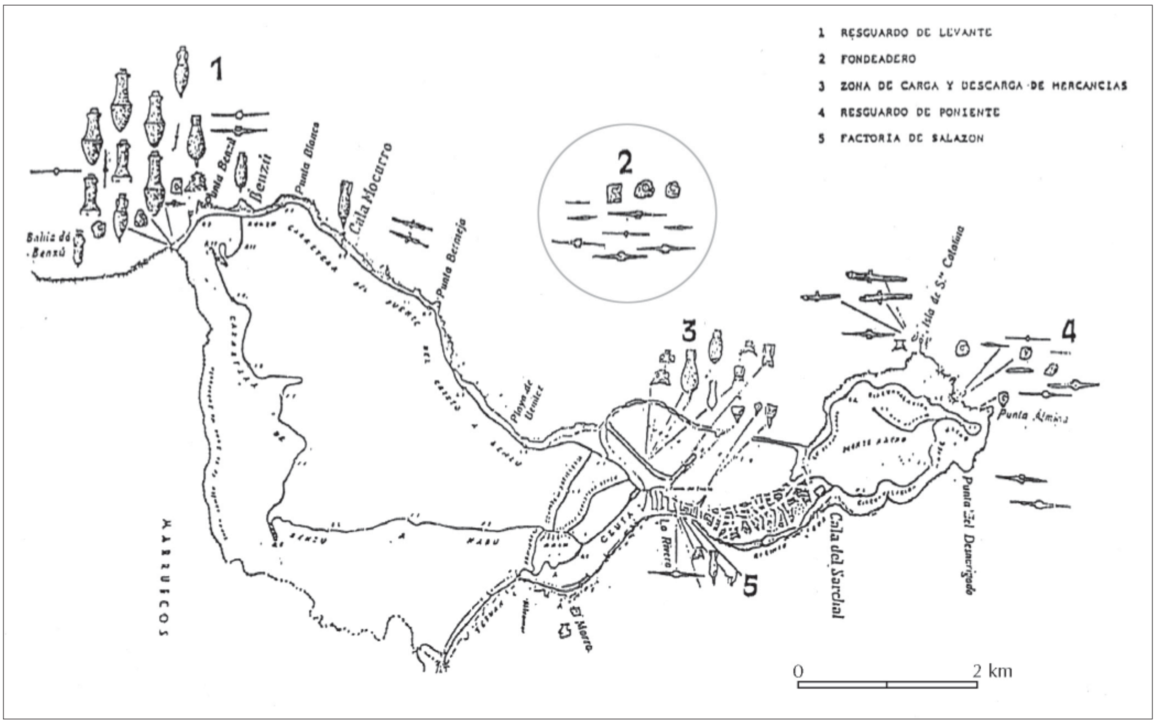


Figure 7.30. Map of finds recovered from the waters surrounding the Ceuta peninsula. Zone 2 (circled) might be an area where a pound net was set during the 2nd century BC-1st century AD (J. Bravo, after Villada, *et al.* 2007: fig. 3).

Figure 7.31. *Lixus* and other relevant locations at the eastern edge of the northern Atlantic coast. (Archaeological sites are noted in italics.)

Figure 7.32. Aerial view of the site of *Lixus*, looking to the north-east. Photo taken in 1950 (from Villaverde Vega 2001: 120 [Servicio Geográfico y Cartográfico del Ejército del Aire, 1.a AC 8934]).

Figure 7.33. The *Lixus* plateau, on the shores of the Oued Loukkos, looking to the south-east (April, 2007). The arrow points to the temple quarter. Photo: ALT

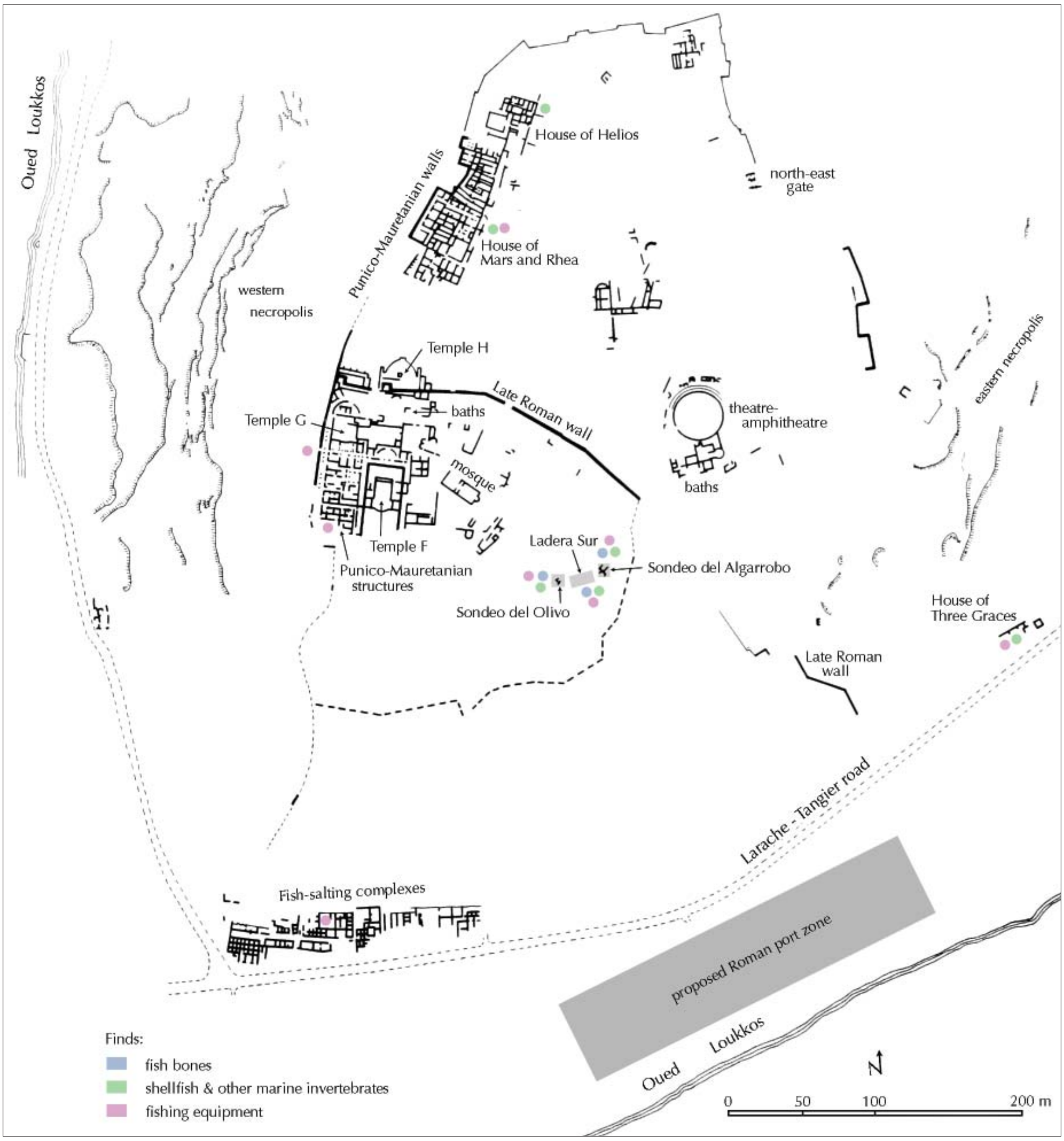


Figure 7.34. Composite site plan of the excavated areas of *Lixus* (based on plans from *Lixus Actes* 1992: 417; Pascual & de Madaria 2001: 45). The areas of fish bones, shellfish and fishing equipment finds, if known, are shown. The coloured dots only indicate the general area of the excavated site where the finds were made; they do not indicate specific find-spots.

Figure 7.35. The “temple quarter” on the plateau summit at the site, with Structures G and F (April, 2009). Photo: ALT

Figure 7.36. The theatre-amphitheatre and bath complex at the eastern edge of the site (April, 2009). Photo: ALT

Figure 7.37. View south-west of the fish-salting complexes (high-lighted), near the present course of the Oued Loukkos (April, 2007). Photo: ALT

Figure 7.38. Reconstruction environment of the Oued Loukkos lagoonal basin, ca. 2,500 BP (based on data and maps from Carmona González 2005: 10-11; Aranegui Gascó 2005: 272, fig. 2).

Figure 7.39. Boats anchored in the lower run of the Oued Loukkos, in front of the plateau of *Lixus* (far right distance) (March, 2005). Photo: ALT

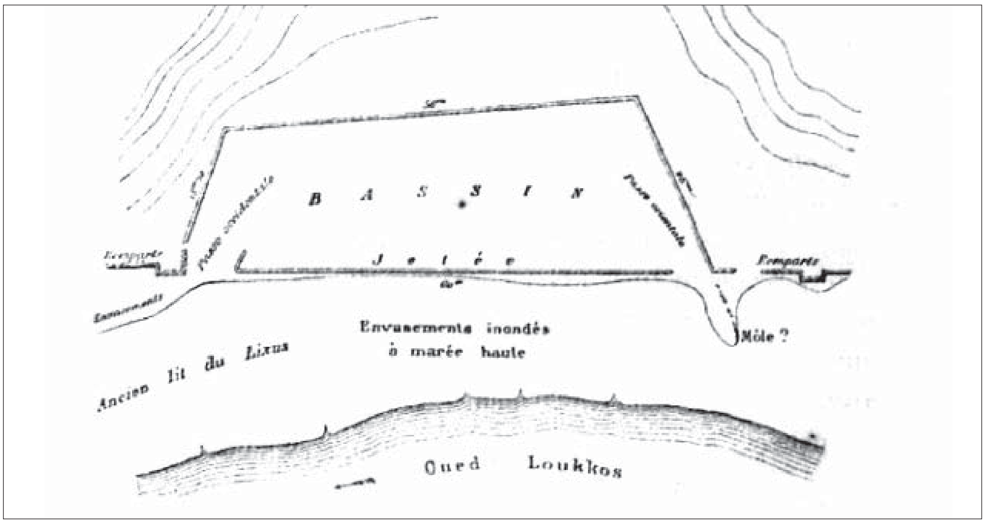


Figure 7.40. The Claudian port as mapped by C. Tissot (from Tissot 1878: 211).

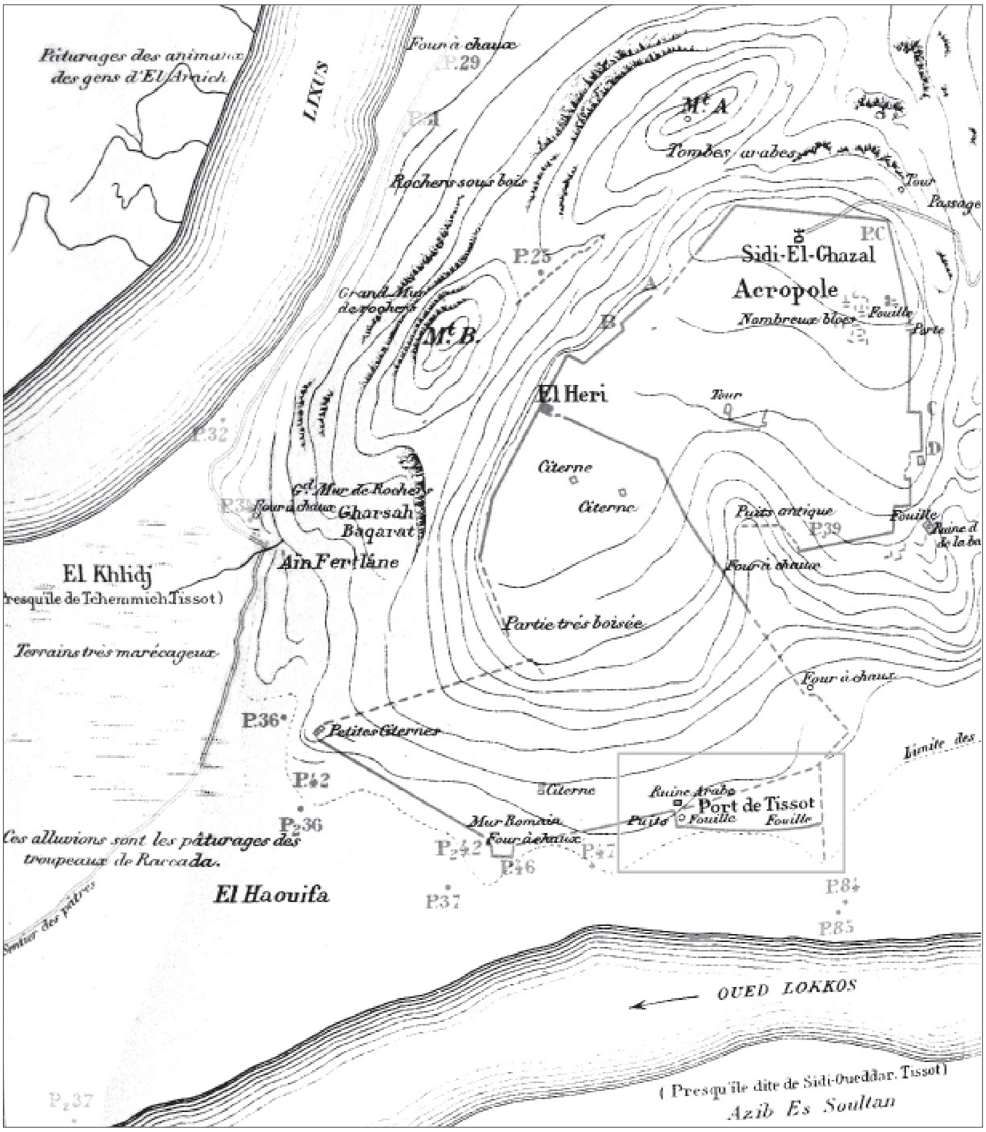


Figure 7.41. A portion of H. de La Martinière's plan of *Lixus*, showing his excavations in "port de Tissot", high-lighted in the grey box (from de La Martinière 1890: Pl. VII).

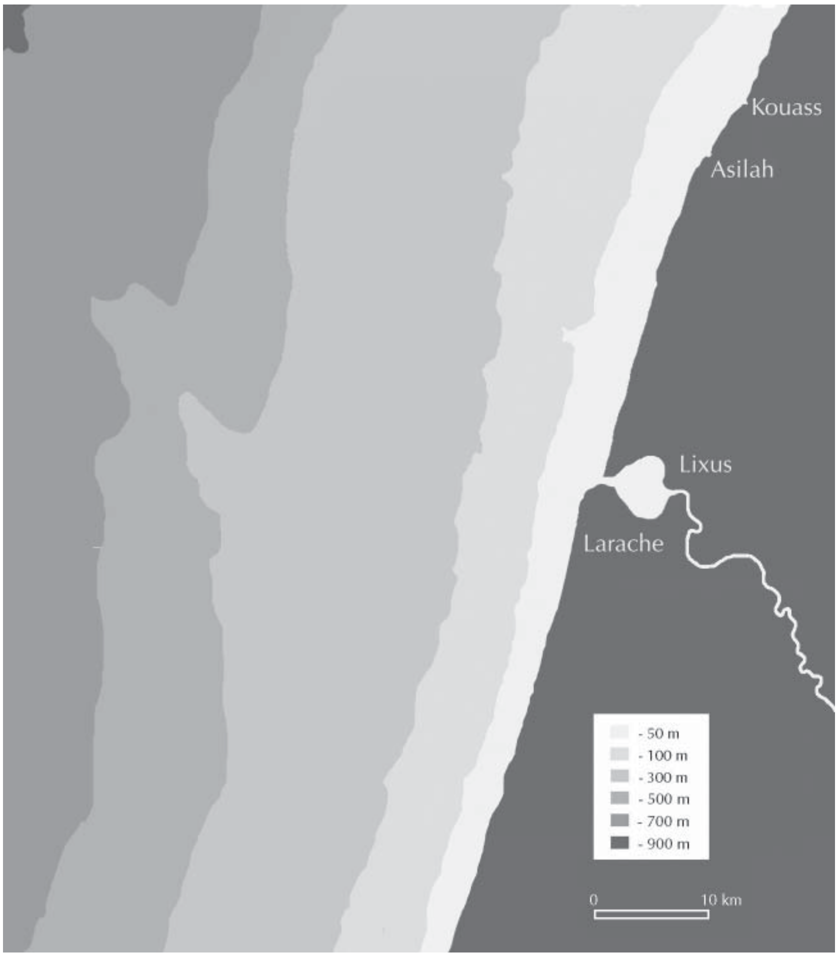


Figure 7.42. The bathymetry of the waters surrounding the mouth of the Loukkos (based on data from Kassini 2006: fig. 6; Maldonado, *et al.* 1999: figs 1-2; Amharrak 2006: fig. 11).

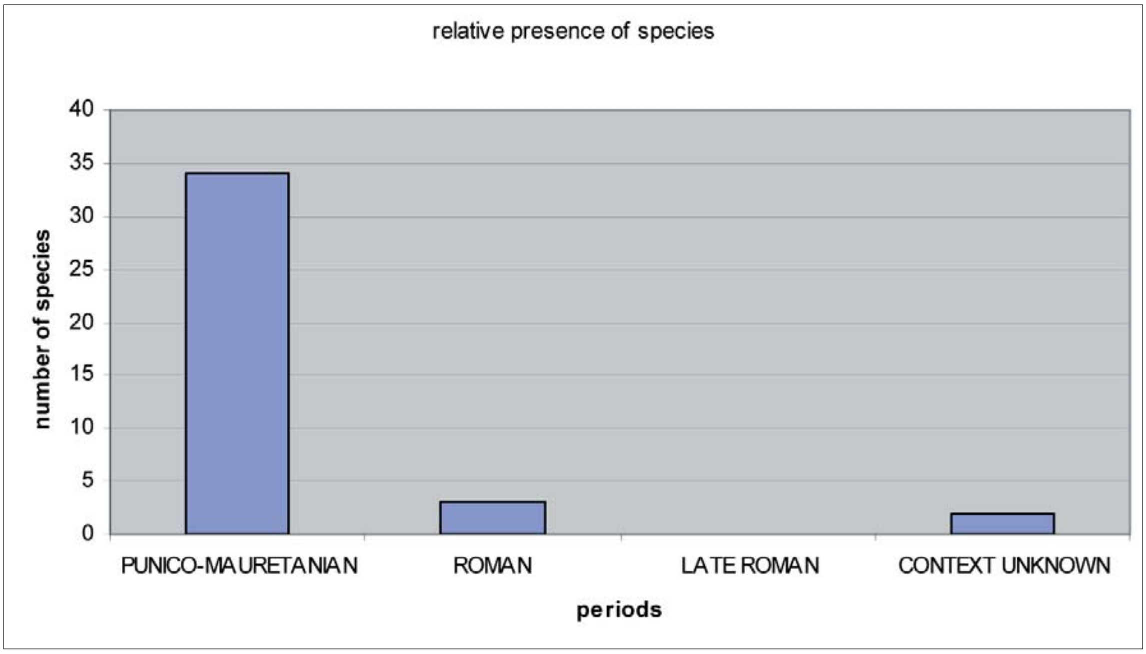


Figure 7.43. Relative presence of fish species at *Lixus,* based on finds of fish bones and *tituli picti*.

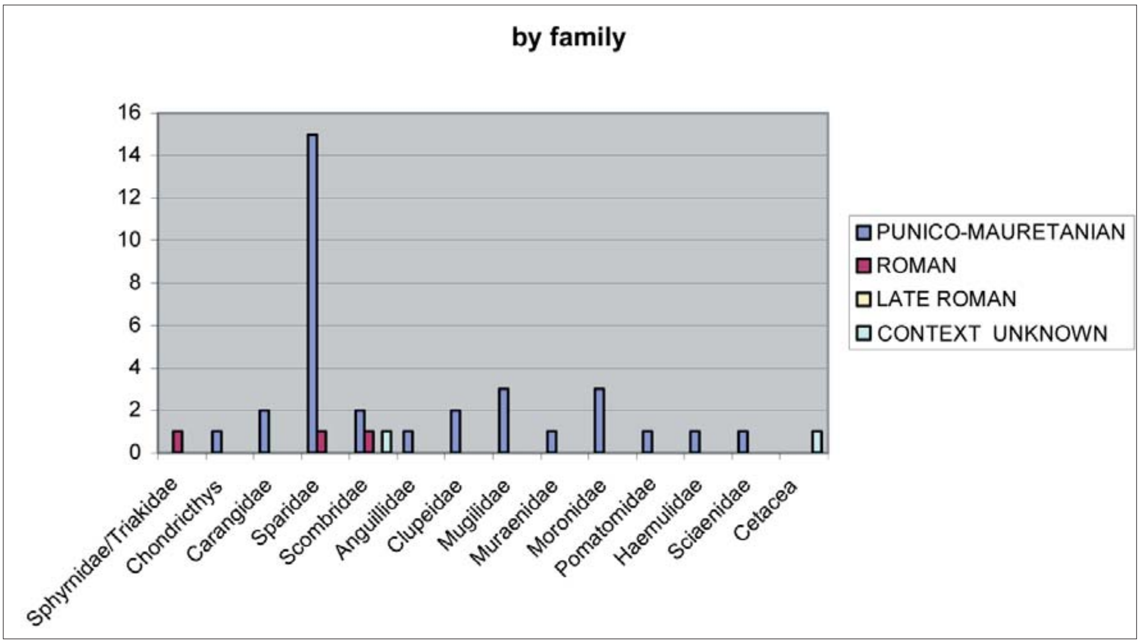


Figure 7.44. Relative frequency by family (and order) of fish species at *Lixus,* by period.

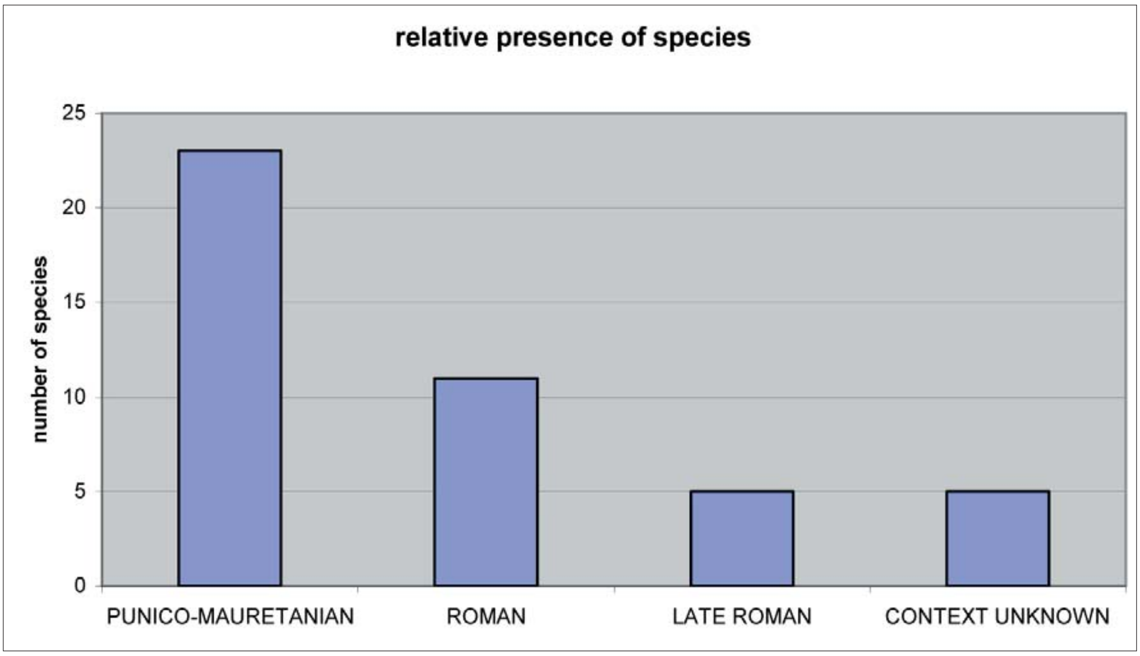


Figure 7.45. Relative presence of shellfish and marine invertebrate species at *Lixus,* by period.

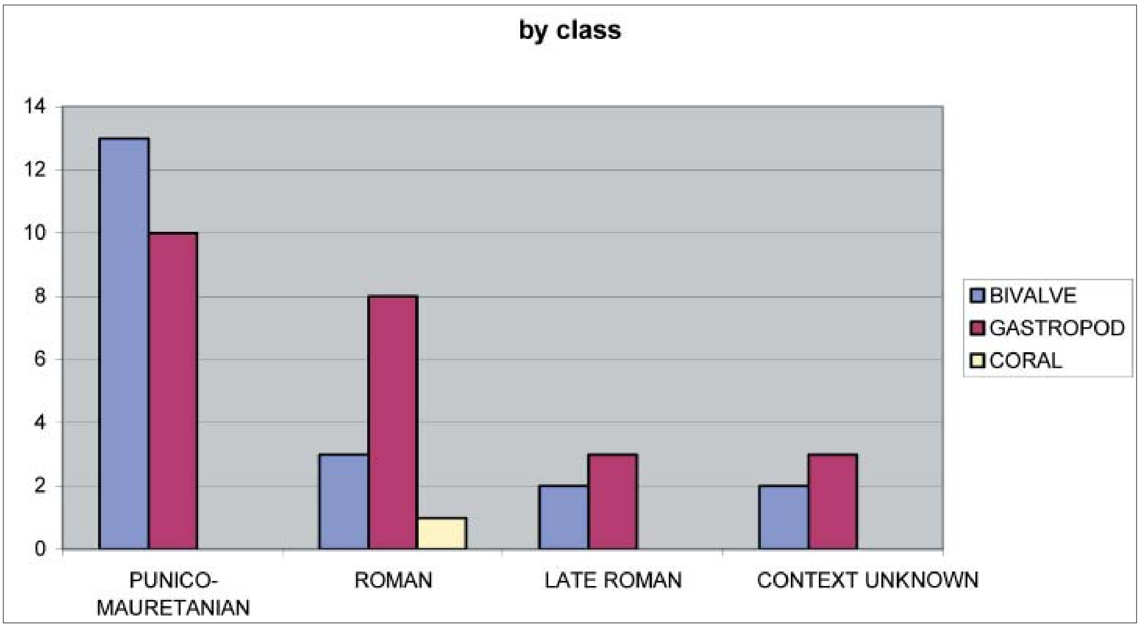


Figure 7.46. Relative frequency by class of marine invertebrates at *Lixus*, by period.

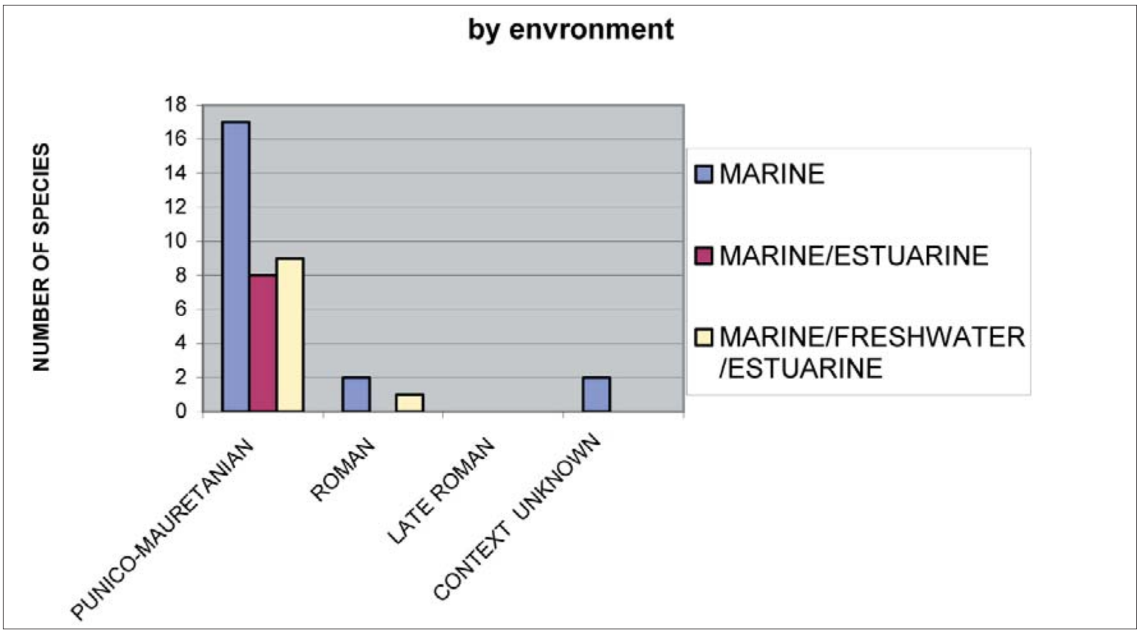


Figure 7.47. Relative number of fish species from *Lixus* that live in the three environments, by period.

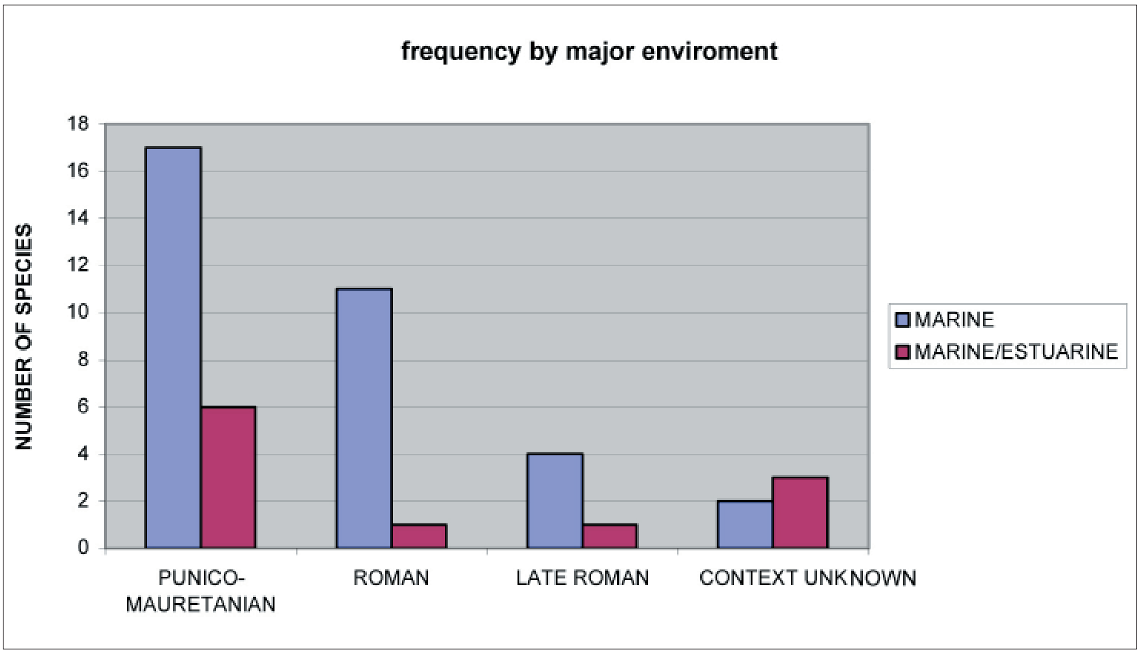


Figure 7.48. Relative number of marine invertebrate species at *Lixus*, by major environment.

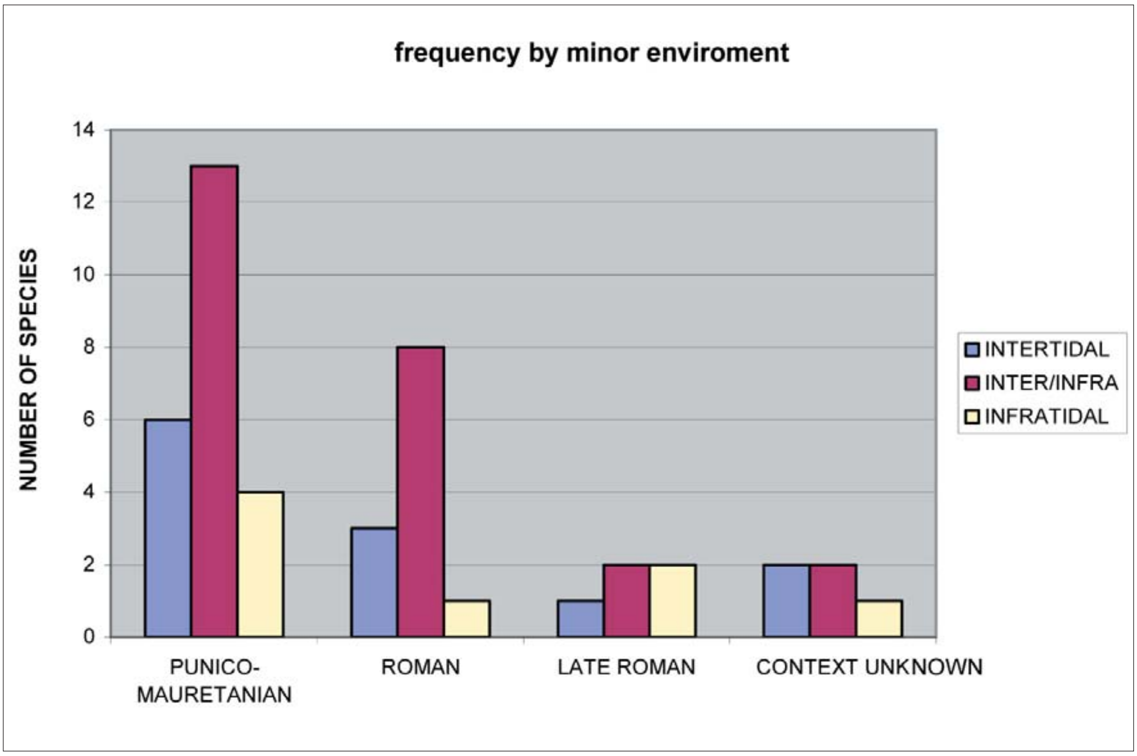


Figure 7.49. Relative number of marine invertebrate species at *Lixus*, by minor environment.

Figure 7.50. The preparation floor (foreground) and slightly raised *cetariae* of Complex 1 (April, 2009). Photo: ALT

Figure 7.51. The modern *salinas* in the Loukkos basin, looking west from the *Lixus* plateau; the city of Larache can be seen in the far left, south of the river's mouth (indicated by the arrow) (April, 2009). Photo: ALT

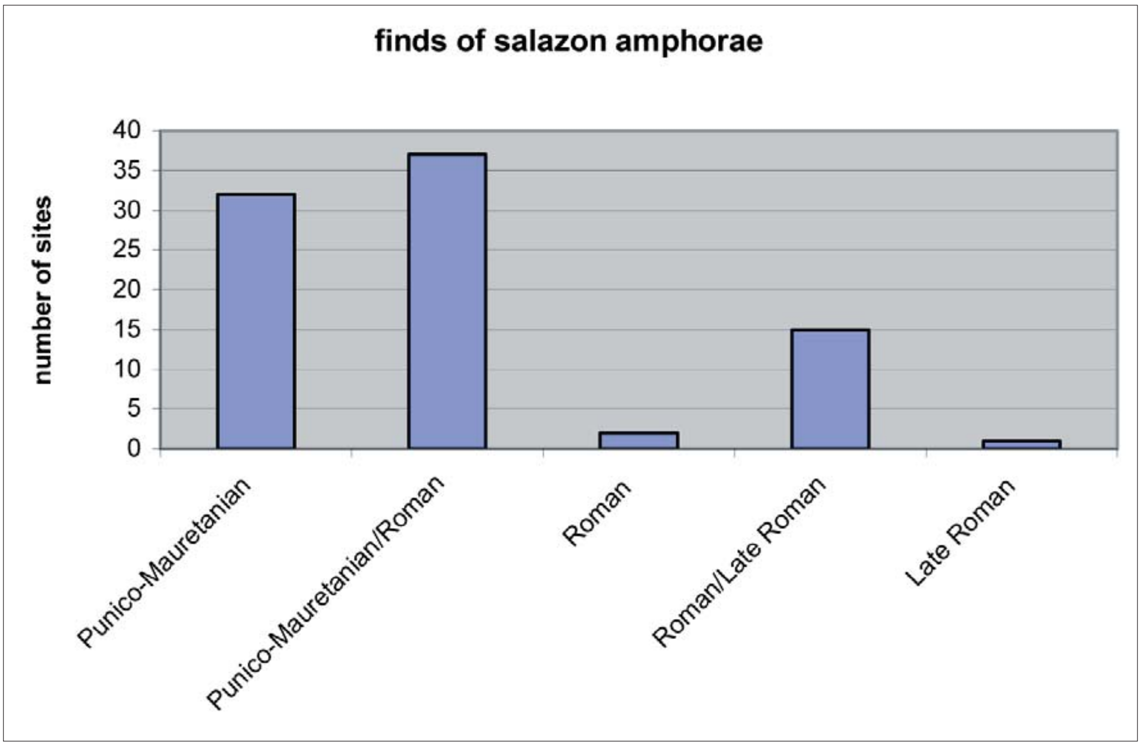


Figure 8.1. The distribution of salazón amphorae of the region, by number of sites and period (based on data from App. 3.3.2).

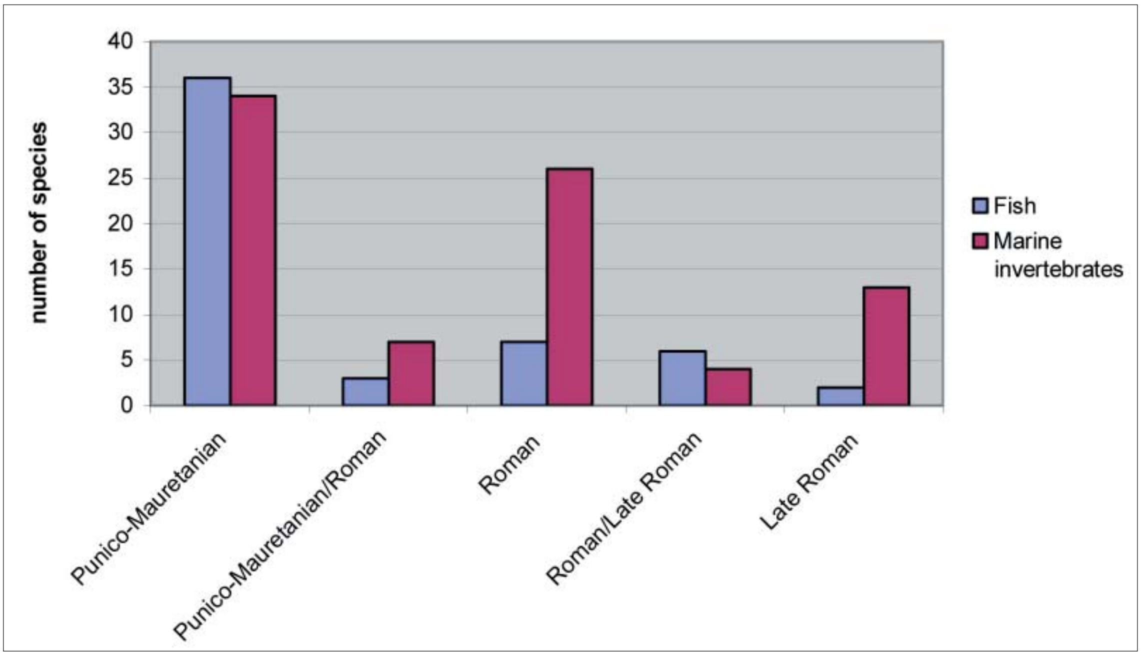


Figure 8.2. Number of marine species exploited, by period, in the northwest Maghreb (based on data from App. 1.1-1.2).

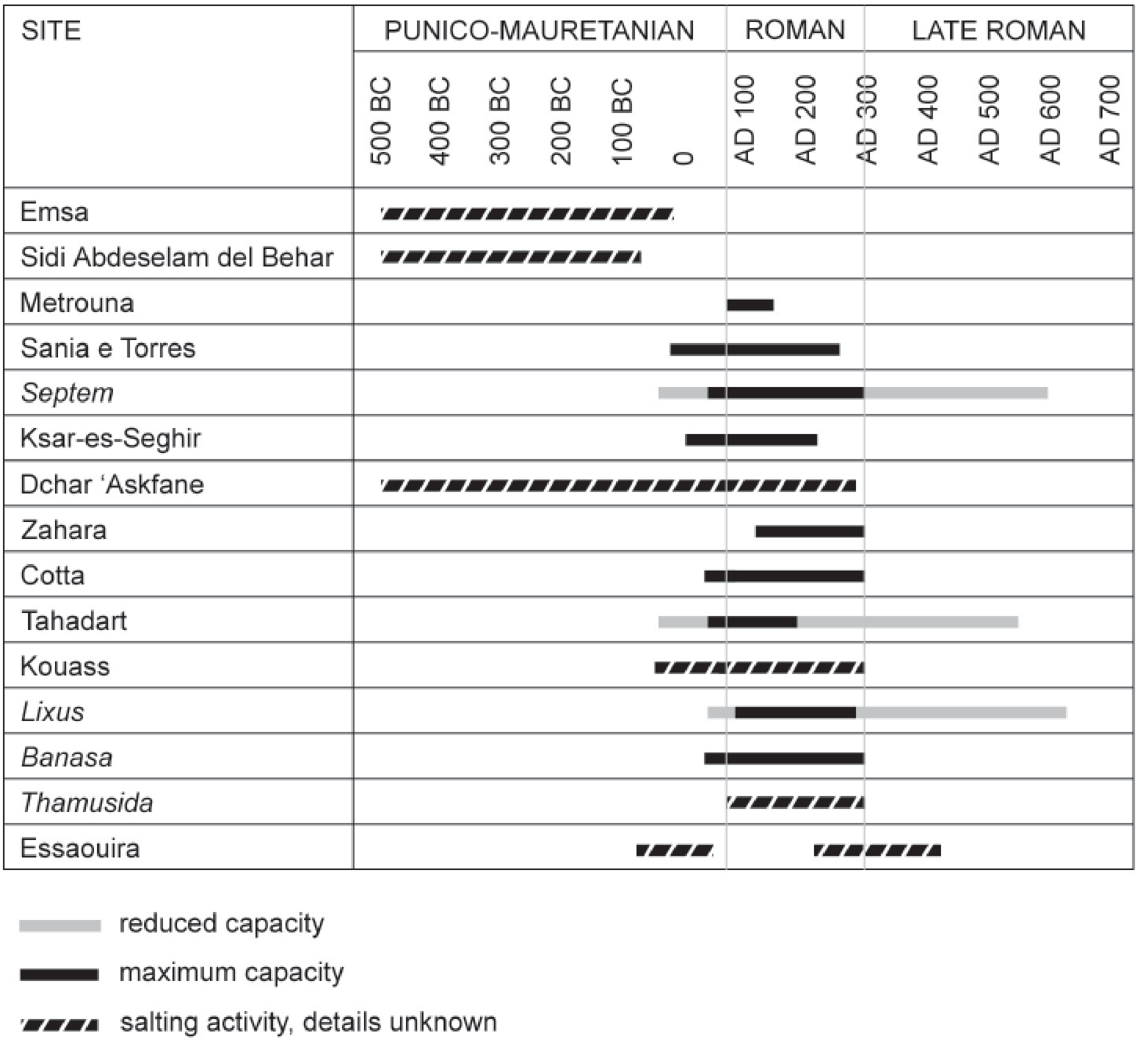


Figure 8.3. The chronologies of the fish-salting centres of the northwest Maghreb (based on data from App. 3.1).

Tables

Chapter 2. Methodology

PERIOD	INDICATIVE CERAMICS
PUNICO-MAURETANIAN	*Amphorae:* Mañá-Pascual A4, Mañá C2a-b, Sala 1, Haltern 70, Greco-Italic, Dressel 1-1b, Dressel 7-11, Dressel 20a
	Finewares: Campanian A, first TS *italicas*, black glaze imitations made at Kouass, southern Gaul TS
ROMAN	*Amphorae:* Beltrán IIA-IIB, Dressel 12, Dressel 14
	Finewares: ARSW, TS *hispanica*
LATE ROMAN	*Amphorae:* Almagro 51a-c, Beltrán 72
	Finewares: ARSW D

Table 2.1. Ceramics indicative of the chronological periods of this study. TS = terra sigillata, ARSW = African red slip ware (sources: Fentress & Perkins 1988; Peacock & Williams 1991; Hayes 1972; Hayes 1980; Villaverde Vega 1992; *Lixus-1; Lixus-2*; Kbiri Alaoui 2007).

<table>
<tr><td>PERIOD (this study)</td><td>Aranegui Gascó 2005a</td><td>Ponsich 1970</td><td>Rebuffat 2001</td></tr>
<tr><td rowspan="6">PUNICO-MAURETANIAN
(5th c. BC-AD 75)</td><td>Punic (325-175 BC)</td><td rowspan="2">Punico-Mauretanian
(late 5th/early 4th c. BC-146 BC)</td><td rowspan="6">Mauretanian
(12th c. BC-AD 40)</td></tr>
<tr><td>Ancient Mauretanian 1
(175-130 BC)</td></tr>
<tr><td>Ancient Mauretanian 2
(130-80 BC)</td><td rowspan="4">Mauretanian
(146 BC-AD 40)</td></tr>
<tr><td>Ancient Mauretanian 3
(80 BC-50 BC)</td></tr>
<tr><td>Middle Mauretanian
(50 BC-AD 10)</td></tr>
<tr><td>Recent Mauretanian
(AD 10-50)</td></tr>
<tr><td>ROMAN
(AD 75-late 3rd/early 4th c.)</td><td>Roman
(1st-3rd c. AD)</td><td>Roman
(AD 40-late 3rd/ early 4th c. AD)</td><td>First Roman provincial period
(AD 40-285)</td></tr>
<tr><td rowspan="2">LATE ROMAN
(late 3rd/early 4th c.- 6th c. AD)</td><td rowspan="2">Late Roman
(3rd-6th c. AD)</td><td rowspan="2">Late Empire
(late 3rd/early 4th-5th c. AD)</td><td>Second Roman provincial period
(AD 285-429)</td></tr>
<tr><td>Vandalo-Byzantine period
(AD 429-681)</td></tr>
</table>

Table 2.2. Other chronologies applied to archaeological finds in the northwest Maghreb compared to this study's outlined chronology.

SITE	SITE #	SITUATION	SITE DESCRIPTION
Rusaddir	4	coastal	Punico-Mauretanian settlement/port; Roman port on the Mediterranean coast – possibly an *oppidum* – likely made a *colonia* in the 2nd century AD[1]
Tamuda	10	riverine	Walled Punico-Mauretanian settlement with subsidiary agricultural sites on the Oued Martil off the Mediterranean coast; Roman and Late Roman *castellum*[2]
Septem Fratres	16	coastal	Phoenician agglomeration; Roman fishing station/port on the Straits of Gibraltar coast, developing into a settlement and possibly a *municipium* by the 3rd century[3]
Tingi	22	coastal	Phoenician and Punico-Mauretanian settlement (*oppidum*)/port on the Straits of Gibraltar coast; Roman *colonia* and Late Roman settlement[4]
Zilil	30	lagoonal	Walled Punico-Mauretanian settlement near the Oued Hachef on the Atlantic coast; Roman *colonia;* Late Roman activity[5]
Lixus	36	lagoonal	Walled Phoenician and Punico-Mauretanian settlement/port on the Oued Loukkos on the Atlantic coast; Roman *colonia* and Late Roman settlement[6]
Banasa	46	riverine	Walled Punico-Mauretanian settlement on the Oued Sebou near the Atlantic coast, Roman *colonia*[7]
Thamusida	47	riverine	Punico-Mauretanian site; walled Roman settlement and military camp on the Oued Sebou near the Atlantic coast[8]
Volubilis	51	inland	Walled Punico-Mauretanian settlement, Roman *colonia* and seat of provincial government in the Atlas foothills[9]
Sala	56	riverine	Walled Roman *colonia* on the Oued Bouregreg on the Atlantic coast; Late Roman military camp[10]

Table 2.3. “Major sites” in *Mauretania Tingitana* that have evidence of marine resource exploitation.

[1] Gozalbes Cravioto 1991: 142-143; Gozalbes Cravioto 2005: 24-25
[2] Morán & Giménez Bernal 1948; Tarradell 1949; Tarradell 1956; Bernal, *et al.* 2008a
[3] Hita Ruiz & Villada Paredes 1994; Bernal Casasola & Pérez Rivera 1999
[4] Ponsich 1970; Ponsich 1998: 169-173
[5] Akerraz, *et al.* 1981-82; Depeyrot 1999
[6] M. Lenoir 1992; Aranegui Gascó & Habibi 2004
[7] Euzennat 1957a: 50; Arharbi & Lenoir 2004; Thouvenot 1954
[8] Rebuffat 1968-72: 56; Callu, *et al.* 1965; Rubuffat 1977
[9] Jodin 1987: 33-38; Étienne 1960
[10] Boube 1966; Boube 1999

SITE	SITE #	SITUATION	SITE DESCRIPTION
Emsa	7	riverine	Punico-Mauretanian station/small settlement (likely fish-salting activity) on the Oued Emsa[11]
Sidi Abdeselam del Behar	8	coastal/riverine	Punico-Mauretanian station (likely fish-salting facility) on the Mediterranean coast at an old mouth of the Oued Martil, Roman and Late Roman station (possible fortification?)[12]
Metrouna	9	coastal/riverine	Roman fish-salting and purple-dye facility on the Mediterranean coast at an old mouth of the Oued Martil[13]
Sania e Torres	15	coastal	Roman fish-salting facility on the Mediterranean coast[14]
Ksar-es-Seghir	19	coastal	Roman fish-salting facility on the Straits of Gibraltar coast, small Roman and Late Roman settlement nearby[15]
Dchar ‘Askfane	20	riverine	Punico-Mauretanian fish-salting facility on the Oued El Kazar; Roman *villa* and fish-salting facility; Late Roman *centenarius*[16]
Zahara	21	coastal	Roman-period building with fish-salting activities on the Straits of Gibraltar coast[17]
Cotta	24	coastal	Roman fish-salting complex with possible small attached settlement on the Atlantic coast; Late Roman agricultural production site with peristyle house[18]
Tahadart	28	coastal/lagoonal	Six late Punico-Mauretanian, Roman and Late Roman fish-salting complexes on the Oued Hachef adjacent to the Atlantic coast[19]
Kouass	29	coastal/riverine	Punico-Mauretanian kiln site, Roman fish-salting complexes, watering station and camp on the Oued Garifa adjacent to the Atlantic coast[20]
Suiar	33	inland	Roman and Late Roman *castellum* (*Ad Novas*?)[21]
Tabernae	34	inland	Roman and Late Roman *castellum*[22]
Essaouira	57	coastal (island)	Island Phoenician station and small Punico-Mauretanian settlement, Roman *villa* and purple-dye/fish-salting facility on the Atlantic coast[23]

Table 2.4. “Minor sites” in *Mauretania Tingitana* that have evidence of marine resource exploitation.

[11] Kbiri Alaoui 2008; Tarradell 1960: 79-85; Tarradell 1966: 440-443
[12] Tarradell 1960: 86-95; Villaverde Vega 2001: 237-239; Bernal, *et al.* 2008b: 317-319, 336
[13] Bernal, *et al.* 2008b: 332-335
[14] Ponsich & Tarradell 1965: 75-77; Tarradell 1966: 435
[15] Ponsich & Tarradell 1965: 71-75
[16] Akerraz & El Khayari 2005: 37-38; Cheddad 2008: 395
[17] Ponsich & Tarradell 1965: 68-71; Tarradell 1966: 431; Ponsich 1988: 159-160
[18] Ponsich 1964b: 266-267; Ponsich & Tarradell 1965: 55-68; Ponsich 1970: 206-212, 276-290, 319-335
[19] Ponsich & Tarradell 1965: 40-45; Arharbi 2002a; Arharbi 2002b
[20] Ponsich & Tarradell 1965: 38-40; Ponsich 1968; Kbiri Alaoui 2008
[21] Villaverde Vega 2001: 111-114
[22] Ponsich 1966a: 418
[23] Jodin 1966c; Jodin 1967

SITE	SITE #	SITUATION	SITE DESCRIPTION
Costa Rincon	14	coastal	Small agglomeration of Punico-Mauretanian artefacts on the Mediterranean coast; no structures[24]
Djebila	27	coastal	Phoenician and Punico-Mauretanian necropolis on the Atlantic coast[25]
Sidi Slimane	48	riverine	Punico-Mauretanian necropolis on the Oued Beth[26]

Table 2.5. "Agglomerations" in *Mauretania Tingitana* that have evidence of marine resource exploitation.

Chapter 3. Contexts, data sources and applications

Amphidromous	moving between fresh and salt water during some part of life cycle, but not for breeding
Anadromous	ascending rivers from the sea for breeding
Benthopelagic	occurring on the bottom or midwaters
Catadromous	living in fresh water and going to the sea to spawn
Demersal	living near the sea bottom
Diadromous	travelling between salt and fresh water
Epipelagic	inhabiting the top layer of the ocean zone to 200 m depth
Euryhaline	able to live in waters with a wide range of salinity
Mesopelagic	of or relating to oceanic depths from about 200 to 1000 m
Neritic	region of shallow water adjoining seacoast
Oceanodromous	migrating within the seas only
Pelagic	living and feeding in the open sea; associated with the surface or middle depths of a body of water, not the bottom
Potamodromous	migrating within fresh water only

Table 3.1. Vocabulary used throughout this study referring to fish habitats and behaviour. Source: FishBase Glossary, http://filaman.ifm-geomar.de/search.php.

Intertidal	Shore area between high- and low-water marks (ca. 5 m below mean high water); shallow areas along the shore and in estuaries that are alternately exposed and covered by the tides (can also be referred to as 'interlittoral').
Infratidal	The zone below the lowest tide (from ca. 5 m below mean high water); always inundated by water, often used to refer to substrata of the continental shelf which reaches depths between 150 and 300 m (can also be referred to as 'infralittoral')

Table 3.2. Vocabulary used throughout this study referring to habitats of marine invertebrates. Source: FishBase Glossary, http://filaman.ifm-geomar.de/search.php; SeaLifeBase Glossary, http://www.sealifebase.org/

[24] Located at M'diq ("Rincon de el Medik"), see Tarradell 1966: 435-437.
[25] Ponsich 1967b: 141-222; Ponsich 1970: 72-79
[26] Luquet 1973-75a: 254-257

MODERN TYPE	GREEK/LATIN NAME	DESCRIPTION
Cast net	ἀμφίβολον, ἀμφίβληστρον *iaculum, funda*[1]	A round net with outer edges lined by weights with a line attached to the middle, used by an individual fisherman, usually in littoral shallows, but sometimes used from a boat in shallow water. Plautus tells of a fisherman who "throws a casting net in a fish pond, and when it goes to the bottom, tightens the rope" (Fig. 3.11, see Fig. 3.2, bottom).[2]
Drag net	γάγγαμον	This net shape is unknown, but it is described by Strabo and Aristotle as being dragged on the sea bed to catch scallops.[3]
Cover net	κάλυμμα	Possibly a small mesh net made of fine material that is a small version of a cast net, but maybe any net that lightly floats in the water and operated by a single fisherman.[4]
Round bag net	ὑποχὴ περιηγής	Oppian describes this net as small, and 'pulled' through the water. It is thought to resemble a small hand-held net on a circular frame, used by a single fisherman to scoop fish out of the water next to a boat or from shore.[5]
Seine net	σαγήνη *sagena*	These nets could include a purse seine, which is a single, rectangular-shaped net weighted by lead or stones (μολυβίθρες) and its top line floatline (σαρδούνας) held up by corks (φελλοί). The ends of the net can be held upright by a wooden spreader (σταλίκια). The net is set out usually from a boat in a circle, with the bottom drawn together and up as the net is pulled in. Beach seines, mentioned by various authors to catch certain types of fish (tunny, mullet),[6] require one end of a rectangular-shaped net to be anchored by a group of fishermen on the beach. The other end is dragged up and against the direction of the current in a semi-circle several hundred metres from shore by a small boat that turns back to the beach, bringing the other end to another group of waiting fishermen on shore. The ca.10-15 fishermen together draw in the ends to the beach (Fig. 3.12).[7]
Draw net	γρῖφος	A generic term for a seine net used by Oppian, but described as used alongside a seine by Plutarch; thought to be a small seine operated by two or four people.[8] As with the larger seines, the rectangular net is weighted and has floats; some-times wooden spreaders at each end of the net hold it open (see Fig. 3.2, right).[9]
Ground net	πέζα	A stationary net.[10]

Table 3.3. The identified types of nets used in the Graeco-Roman world *(continued on next page)*.

[1] **᾿Αμφίβολον, αμφίβληστρον**: Pollux, *Onom.* 1.97, 10.132; Oppian, *Hal.* 3.80; known from Herodotus, 1.64, 2.95; *iaculum:* Plautus, *Truculentus* 35; *funda:* Virgil, *Georgics* 1.141.
[2] Plautus, *Truculentus* 35-36; for an ethnographic example use from a boat, see Bekker-Nielsen 2005: fig. 3a-b.
[3] Bekker-Nielsen 2002b: 216; Strabo 7.3.18; Aristotle, *HA* 528a 30, 603a 20-24
[4] Oppian, *Hal.* 3.82; Bekker-Nielsen 2002b: 217, 219
[5] Bekker-Nielsen 2002b: 216-217
[6] Oppian, *Hal.* 3.81-82; Aelian, *NA* 12.43; Manilius, *Astr.* 5.676-679; Philo, *Vita Mosis* 2
[7] Even more fisherman could be involved if the net is large; Ayodeji 2004: 169; Kuniholm 1982: 307.
[8] Oppian, *Hal.* 3.80; Plutarch 471 d
[9] Kuniholm 1982: 307; mosaics from Bizerte, Sousse and *Tuburbo Majus* show two to four people operating such nets, see Yacoub 1995: Figs 115, 121-122; Oppian, *Hal.* 3.80; Plutarch 471 d.
[10] Oppian, *Hal.* 3.83; Bekker-Nielsen 2002b: 218

MODERN TYPE	GREEK/LATIN NAME	DESCRIPTION
Gill/trammel net	λίνοι (λίνον πάναγρον)	This net is thought to be a gill net as Oppian describes it as trapping fish in its mesh and Homer describes it as an "all-catching net" and "many-meshed snare".[11] These are stationary rectangular nets set out at night by one or two fishermen and checked in the morning after tidal changes; their mesh size is just wide enough to let the head of a fish protrude, before it gets stuck by its gills when trying to back out. Trammel nets are similar, but with several layers of net of different mesh gauges (Fig. 3.13).[12]
Pound net	no known Gr./L. equivalent; modern: *al-madraba* (Sp.), *madrague* (Fr.), *tonnara* (It.), *armação* (Por.)	Nets for catching tunny are mentioned by Alciphron as being heavy and held up by cork floats on the surface and weighted on the bottom by lead.[13] Manilius describes a network of meshes of the net that trap the fish, which are then killed by a knife in the water.[14] Oppian describes a tunny net with a series of gates, gate wardens and inner courts.[15] Modern pound nets are fixed nets that are set just offshore; they consist of a series of chambers and are held on the surface by floats and on the seabed by large anchors. A leading line of net, fixed from the shore to the main net, guides the fish into the first chamber. The fish are then moved or herded through a series of chambers by opening and closing gates in the net walls until they reach the final chamber. This last chamber, the so-called "*chambre de la mort*" in modern fishing, has a floor that consists of a lift net. This net is drawn up by fishermen in boats that encircle the last chamber; the fish are speared and clubbed within the net and brought aboard the waiting boats.[16] Possibly ca. 60 fishermen are involved in harvesting the catch, if not more (Fig. 3.14).[17]

Table 3.3. The identified types of nets used in the Graeco-Roman world *(continued from previous page)*.

[11] Oppian, *Hal.* 3.577-605; Homer, *Iliad* 5.487; Kuniholm 1982: 307; Bekker-Nielsen 2002b: 218
[12] The identification of this net not agreed upon: Gallant (1985: 20-21) identifies it as a gill net, whereas Powell (1996: 103, 107-108) identifies it as a trammel net. See App. 6: *Cat. 3.3. Oued Loukkos (3).*
[13] Alciphron, *Epistulae* 1.17.1
[14] Manilius, *Astr.* 5.659-666
[15] Oppian, *Hal.* 3. 631-648
[16] Ponsich & Tarradell 1965: 93-97; Moreno Páramo & Abad Casal: 1971: 212-213; Ponsich 1988: 34-36; Carrera Ruiz, *et al.* 2000: 44-45; Étienne & Mayet 2002: 31-34
[17] Following Aelian's description of the use of large fixed and seine nets to catch tunny in the Black Sea (Aelian, *NA* 15.5), see also Lytle 2006: 56-60; an inscription from Parium in Asia Minor also suggests a large group of men needed for fishing offshore (Lytle 2006: 68-92). Between 80 and 150 fishermen were needed in the 18th and 19th centuries to operate the *al-madraba* off Ceuta (Cámara del Río 2007: 85) and there are also large numbers needed off Ras Achakar (Étienne & Mayet 2002: 34l; see App. 6: *Cat. 3.1. Ras Achakar*).

FISHING BOAT-FIND and LOCATION	DATE	DESCRIPTION
Jules Verne 9 (Marseille, France)	5th c. BC	The bow section of a small boat, estimated to be ca. 9 m long, was found with coral in it in the old harbour. Excavators conclude it was a coral fishing boat.[18]
Kinneret boat (Tiberias, Israel)	1st c. BC – 1st c. AD	An 8-m long lacustrine fishing boat found on the shores of the Sea of Galilee.[19]
Herculaneum boat (Naples Bay, Italy)	ca. AD 79	A 9 m-long shallow and open boat; this might be a fishing boat due to its size, although this identification is very tenuous. No fishing gear found.[20]
Fiumicino 5 (Ostia, Italy)	2nd c. AD	A 6-m long *navis vivaria* (a small boat with a well inside for keeping marine species alive and described by Macrobius, *Saturnalia* 3.16.10). Found at Portus, Rome's Imperial harbour (Fig. 3.17).[21]
"Dor south anchorage" (Dor, Israel)	mid-7th c. AD	A compact agglomeration of fishing gear was identified and certainly represents the remains of a wreck of a fishing vessel. No hull has yet been found, just nails to indicate "a medium-sized vessel".[22]

Table 3.4. Archaeological finds of Graeco-Roman fishing-boat assemblages in the Mediterranean.

[18] Pomey 2000; Pomey 1998: 148-150
[19] Wachsmann 1990; Carlson 1999: 108
[20] Steffy 1985
[21] Boetto 2006; Testaguzza 1970: 132
[22] Galili & Rosen 2008a

AMPHORA TYPE	PERIOD (this study)	DATE
Mañá-Pascual A4 (Ramón T-11, T-12 series, Ponsich III)	Punico-Mauretanian	late 6th/5th – 2nd c. BC
Mañá C2b (Dressel 18, Ramón T-7.4.3.3, Ponsich IV)	Punico-Mauretanian	2nd – mid-1st c. BC
Dressel 7	Punico-Mauretanian	30 BC – AD 75
Dressel 8 (Pompeii VII)	Punico-Mauretanian/Roman	ca. 15 BC – AD 69/96
Dressel 9	Punico-Mauretanian/Roman	start of the 1st c. AD – AD 69/96
Dressel 10	Punico-Mauretanian/Roman	start of the 1st c. AD – AD 69/96
Dressel 11	Punico-Mauretanian/Roman	start of the 1st c. AD – AD 69/96
Beltrán IIA (Dressel 38, Pélichet 46, Pompeii VII)	Punico-Mauretanian/Roman	ca. AD 15 – mid-2nd c. AD
Beltrán IIB (Pompeii VII)	Punico-Mauretanian/Roman	AD 14/54 – late/mid-2nd c. AD
Dressel 12 (Beltrán III)	Punico-Mauretanian/Roman	mid-1st c. BC – late 2nd c. AD
Dressel 14 (Beltrán IVA)	Roman	mid-1st – late 2nd/early 3rd c. AD
Almagro 50	Roman/Late Roman	3rd – 5th c. AD
Almagro 51a (Keay XIX)	Roman/Late Roman	3rd – 6th c. AD
Almagro 51b (Keay XIX)	Roman/Late Roman	3rd – mid-5th c. AD
Almagro 51c (Keay XIX)	Roman/Late Roman	3rd – mid-5th c. AD
Beltrán 72	Roman/Late Roman	mid-3rd – 5th c. AD
Keay LVIIB[23]	Late Roman	5th – 6th c. AD

Table 3.5. Types of salazón amphorae included in this study and their respective chronologies (Sources: http://ads.ahds.ac.uk/catalogue/archive/amphora_ahrb_2005/cat_amph.cfm; Kbiri Alaoui 2007: 198-205, 217; Ramón 1995: 237-238; Aranegui Gascó, *et al.* 2000: 19; Ponsich 1969-70).

Chapter 6. Regional characterisations

Site #	Site	Punico-Mauretanian		Punico-Maure-tanian/Roman		Roman		Roman/Late Roman		Late Roman		Context unknown	
		F	MI	F	MI	F	MI	F	MI	F	MI	F	MI
4	*Rusaddir* (C)		7										
7	Emsa (R)		8										
8	Sidi Abdeselam del Behar (C/R)		7										
9	Metrouna (C/R)						2						
10	*Tamuda* (R)	2	14						4		2		
14	Costa Rincon (C)	1											
15	Sania e Torres (C)				1							2	1

Table 6.1. The Mediterranean littoral: number of species of fish (F) and marine invertebrates (MI) present at sites, by period (for source data, see App. 1.1.1 and App. 1.2.1). Site types: R = riverine, C = coastal, L = lagoonal, I = inland.

[23] Not normally identified as a salazón type but included here due to its presence at fish-salting sites in southern Spain and found at *Lixus*; see basis for this in Fumadó Ortega & Mlilou 2005: 81-82.

		Punico-Mauretanian	Context unknown
1	bluefin tuna	2	
2	bottle-nose whale		1
3	“tunny” (*Scombridae*)		1
4	shortfin mako or porbeagle shark	1	
TOTAL SPECIES PRESENT		2	2

Table 6.2. The Mediterranean littoral: number of sites with fish species present, by period (for source data, see App. 1.1.1).

		Punico-Mauretanian	Roman	Roman/Late Roman	Late Roman	Context unknown
1	“murex” (*Muricidae*)	2				1
2	rayed Mediterranean limpet	3		1	1	
3	“scallop” (*Pectinidae*)	2				
4	oyster (*Ostrea sp*.)	3		1		
5	clam (*Veneridae*)	1				
6	knobbed triton	3				
7	red-mouthed rock shell (1)	1				
8	banded dye-murex	4	1			
9	spiny dye-murex	1	1			
10	Algarve volute	1				
11	bittersweet	3				
12	cockle	2		1	1	
13	Mediterranean bonnet	1				
14	ribbed Mediterranean limpet	4		1		
15	Mediterranean mussel	1				
16	common periwinkle	1				
17	“marine snails”	1				
18	“limpets”	1				
19	“venus clams”	1				
TOTAL SPECIES PRESENT		19	2	4	2	1

Table 6.3. The Mediterranean littoral: number of sites with marine invertebrate species present, by period (for source data, see App. 1.2.1).

Site #	Site	Punico-Mauretanian		Punico-Mauretanian/ Roman		Roman		Roman/Late Roman	
		HL	N	HL	N	HL	N	HL	N
4	*Rusaddir* (C)		w				w		
8	Sidi Abdeselam del Behar (C/R)		w, nd						
10	*Tamuda* (R)	h	w, nd		w				w
14	Costa Rincon (C)	h	w						

Table 6.4. The Mediterranean littoral: the two main fishing techniques and types of equipment from the sites (for source data, see App. 2.1). HL = hook-and-line fishing, N = net fishing, h = fish hook, w = weight, nd = needle.
Site types: R = riverine, C = coastal, L = lagoonal.

SITE #	SITE	PERIOD	DESCRIPTION/SIZE
7	Emsa (R)	Punico-Mauretanian	unknown size (no *cetariae*)
8	Sidi Abdeselam del Behar (C/R)	Punico-Mauretanian	unknown size (no *cetariae*)
9	Metrouna (C/R)	Roman	unknown size (1 *cetaria* not yet published)
15	Sania e Torres (C)	Roman	5 *cetariae* (ca. 78 m^3)

Table 6.5. The Mediterranean littoral: fish-salting sites (based on data from App. 3.1).
Site types: R = riverine, C = coastal.

Site #	Site	Punico-Mauretanian/ Roman		Roman		Roman/Late Roman		Late Roman		Context unknown	
		F	MI	F	MI	F	MI	F	MI	F	MI
16	*Septem Fratres* (C)			2		6	14	3	7		
20	Dchar 'Askfane (R)									1	
21	Zahara (C)			1							
22	*Tingi* (C)	1									

Table 6.6. The Straits of Gibraltar littoral: number of species of fish (F) and marine invertebrates (MI) present at sites and mentioned in *tituli picti*, by period (based on data from App. 1.1.2, App. 1.2.2 and App. 4.2). Site types: R = riverine, C = coastal.

		Punico-Mauretanian/ Roman	Roman	Roman/Late Roman	Late Roman	Context unknown
1	John Dory			1		
2	Atlantic bonito			1		
3	common seabream			1		
4	Spanish/chub mackerel			1		
5	Atlantic horse mackerel			1		
6	dusky grouper			1		
7	Atlantic chub mackerel				1	
8	bluefin tuna	1			1	
9	"tunny" (*Scombridae*)		1			1
10	tope shark		1			
11	"whale" (*Cetacea*)		1		1	
TOTAL SPECIES PRESENT		1	3	6	3	1

Table 6.7. The Straits of Gibraltar littoral: number of sites (including those mentioned in *tituli picti*) with fish species present, by period (for source data, see App. 1.1.2 and App. 4.2).

		Punico-Mauretanian/ Roman	Roman	Late Roman	Context unknown
1	"murex" (*Muricidae*)				1
2	bittersweet (*Glycymeridae*)	1			
3	rayed Mediterranean limpet	1	1	1	
4	ribbed Mediterranean limpet	1		1	
5	red-mouthed rock shell (1)	1	2		
6	oyster (*Ostrea sp.*)		1	1	
7	spiny cockle		1		
8	European thorny oyster		1		
9	Safian limpet		1		
10	China limpet		1		
11	knobbed triton		1		
12	spiny dye-murex		1		
13	banded dye-murex		1	1	
14	Mediterranean bonnet		1		
15	pilose bittersweet		1		
16	Atlantic/Mediterranean scallop		1		
17	sea urchin (*Strongylocentrotus sp.*)		1		
18	thorny/spiny oyster (*Spondylus sp.*)			1	
19	oyster			1	
20	limpet (*Patella sp.*)			1	
21	coral		1		
TOTAL SPECIES PRESENT		4	15	7	1

Table 6.8. The Straits of Gibraltar littoral: number of sites with marine invertebrate species present, by period (for source data, see App. 1.2.2).

Site #	Site	Roman		Roman/ Late Roman		Late Roman		Context unknown	
		HL	N	HL	N	HL	N	HL	N
16	*Septem Fratres* (C)	h		h	w	h			
20	Dchar 'Askfane (R)							h	w, nv

Table 6.9. The Straits of Gibraltar littoral: the two main fishing techniques and types of equipment from the sites (for source data, see App. 2.2). HL = hook-and-line fishing, N = net fishing; h = fish hook, w = weight, nv = navette.
Site types: R = riverine, C = coastal.

SITE #	SITE	PERIOD	DESCRIPTION/SIZE
16	*Septem Fratres* (C)	Roman, Late Roman	minimum 14 *cetariae* (26.1625 m^3)
19	Ksar-es-Seghir (C)	Punico-Mauretanian, Roman	minimum 12 *cetariae* (40.728 m^3)
20	Dchar 'Askfane (R)	Punico-Mauretanian, Roman	minimum 2 *cetariae* (not yet published)
21	Zahara (C)	Roman	2 *cetariae* (10.26 m^3)

Table 6.10. The Straits of Gibraltar littoral: fish-salting sites with their maximum capacities before periods of reduction (based on data from App. 3.1).
Site types: R = riverine, C = coastal.

Site #	Site	Punico-Mauretanian		Punico-Mauretanian/ Roman		Roman		Roman/ Late Roman		Late Roman		Context unknown	
		F	MI	F	MI	F	MI	F	MI	F	MI	F	MI
24	Cotta (C)			1	1							2	1
27	Djebila (C)		1										
28	Tahadart (C/L)			3								2	
29	Kouass (C/R)											2	1
30	*Zilil* (L)					3							
33	Suiar (I)								1				
36	*Lixus* (L)	34	23	1		3	11				5	2	5
46	*Banasa* (R)		1				3						
47	*Thamusida* (R)				1	1							
51	*Volubilis* (I)		4		1		6		1				11
52	Volubilis valley (I)												1
56	*Sala* (R)						1						
57	Essaouira (C)	2	3		2		2					1	

Table 6.11. The Atlantic littoral: number of species of fish and marine invertebrates present at sites, by period (based on data from App. 1.1.3 and App. 1.2.3).
Site types: R = riverine, C = coastal, L = lagoonal, I = inland.

		Punico-Mauretanian	Punico-Mauretanian/ Roman	Roman	Context unknown
1	“whale” (*Cetacea*)				6
2	“tunny” (*Scombridae*)	1	1		4
3	*Chondricthys*		2		
4	tope shark		2	2	
5	common dentex			1	
6	great hammerhead or tope shark			1	
7	sturgeon			1	
8	skate (*Raja sp.*)			1	
9	shortfin mako or porbeagle shark			1	
10	“swordfish” (*Xiphiidae*)	1			
11	European eel	1			
12	Atlantic horse mackerel	1			
13	white trevally	1			
14	European pilchard	1			
15	*Clupeidae* (herring, sardine, shad, menhaden)	1			
16	bastard grunt	1			
17	European seabass	1			
18	spotted seabass	1			
19	seabass (*Dicentrarchus sp.*)	1			
20	thicklip grey mullet	1			
21	mullet (*Mugilidae*)	1			
22	flathead mullet	1			
23	Mediterranean moray	1			
24	bluefish	1			
25	meagre	1			
26	Spanish/chub mackerel	1			
27	mackerel (*Scomber sp.*)	1			
28	bogue	1			
29	pink dentex	1			
30	Canary dentex	1			
31	*Dentex sp.*	1			
32	saddled seabream	1			
33	common two-banded seabream	1			
34	annular seabream	1			
35	white seabream	1			
36	seabream (*Diplodus sp.*)	1			
37	gilthead seabream	1			
38	common seabream	1			
39	common pandora	1			
40	*Pagellus sp.* (bream, porgy, pandora)	1			
41	*Sparidae* (porgy)	1			
42	*Pagrus sp.* (seabream)	1			
TOTAL SPECIES PRESENT		34	3	6	2

Table 6.12. The Atlantic littoral: number of sites with fish species present, by period (for source data, see App.1.1.3).

		Punico-Mauretanian	Punico-Mauretanian/ Roman	Roman	Roman/ Late Roman	Late Roman	Context unknown
1	“murex” (*Muricidae*)	2	3	1			4
2	limpet (*Patella sp.*)	2		2			
3	Atlantic/Mediter-ranean scallop			1			
4	“mussel” (*Mytilidae*)	2		2			
5	“oyster” (*Ostrea sp.*)	3	1	3			2
6	spiny dye-murex	2		1			1
7	banded dye-murex	2		2			1
8	bittersweet (*Glycymeridae*)			2			2
9	China limpet	1		1			
10	common mussel	1				1	1
11	knobbed triton	1		1		1	1
12	rayed Mediterranean limpet	1		2	1		2
13	striped venus clam	1					
14	violet bittersweet (1)	1					
15	violet bittersweet (2)	1					
16	cockle (*Cardium*)	1		1	1		1
17	cowrie (*Cyprea sp.*)	1		1			1
18	carpet-shelled clam	1					
19	checkered carpet shell	1					
20	marine snail	1					
21	Safian limpet	1		1			
22	smooth venus clam	1					
23	tuberculate cockle	1				1	
24	clam (*Veneridae*)	1		1			1
25	scallop (*Pectinidae*)	1					1
26	Mediterranean bonnet			1			
27	lurid cowrie					1	
28	coral			1			
29	“venus clams” (*Veneridae*)	1		1			
30	red-mouthed rock shell (1)	2	1	2			2
31	red-mouthed rock shell (2)	1				1	
TOTAL SPECIES PRESENT		25	3	19	2	5	13

Table 6.13. The Atlantic littoral: number of sites with marine invertebrate species present, by period (for source data, see App. 1.2.3).

Site #	Site	Punico-Mauretanian		Punico-Mauretanian/ Roman			Roman		Roman/ Late Roman			Late Roman		Context unknown	
		HL	N	HL	O	N	HL	N	HL	O	N	HL	N	HL	N
24	Cotta (C)			h, g		w, nd, nv									
28	Tahadart (C/L)			h	l	w, nd, nv									
29	Kouass (C/R)	h													
30	*Zilil* (L)						h	w							
33	Suiar (I)						h						w		
34	*Tabernae* (I)								h						
36	*Lixus* (L)	h, g	w, nv	h		nd	h	w						h	w, nv
46	*Banasa* (R)			h			h	w, nd, nv							
47	*Thamusida* (R)	h	w	h		w, nd	h								
48	Sidi Slimane (R)	h													
51	*Volubilis* (I)			h											
56	*Sala* (R)													h	
57	Essaouira (C)	h				nd			h	l	w, nd				

Table 6.14. The Atlantic littoral: the main fishing techniques and types of equipment from the sites (for source data, see App. 2.3). HL = hook-and-line fishing, N = net fishing, O = other fishing techniques; h = fish hook, g = gorge, l = lance, w = weight, nd = needle, nv = navette. Site types: R = riverine, C = coastal, L = lagoonal, I = inland.

SITE #	SITE	PERIOD	DESCRIPTION/SIZE
24	Cotta (C)	Punico-Mauretanian, Roman	16 *cetariae* (258 m^3)
28	Tahadart (C/L)	Punico-Mauretanian, Roman, Late Roman	minimum 42 *cetariae* (ca. 400 m^3)
29	Kouass (C/R)	Punico-Mauretanian, Roman	minimum 3 or 4 *cetariae* (dimensions unpublished)
36	*Lixus* (L)	Punico-Mauretanian, Roman, Late Roman	minimum 142 *cetariae* (ca. 1,013 m^3)
46	*Banasa* (R)	Roman	6 *cetariae* (ca. 8 m^3)
47	*Thamusida* (R)	Roman	2 or 3 *cetariae* (dimensions unpublished)
57	Essaouira (C)	Punico-Mauretanian, Roman, Late Roman	2 *cetariae* (13.61 m^3)

Table 6.15. The Atlantic littoral: fish-salting sites with their maximum capacities before periods of reduction (based on data from App. 3.1).. Site types: R = riverine, C = coastal, L = lagoonal

	Punico-Mauretanian	Punico-Mauretanian/Roman	Roman/Late Roman	Late Roman	Medieval	Historical	Modern
Fish bones	*						
Shellfish	*		*	*			
Fishing equipment	*	*	*				
Fish-salting complexes							
Salazón amphorae	*		*				
Texts					*		
Pictorial evidence	*						
Ethnography						*	*

Table 7.1. The source evidence related to marine exploitation at *Tamuda*, including data on navigation and salt production.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD #	COMMENTS
1	Tamuda		3	Punico-Mauretanian		shortfin mako shark or porbeagle	Isurus oxyrinchus or Lamna nasus	Lamnidae	Mako: marine; Porbeagle: marine	Mako: Oceanic, but also coastal. Usually in surface waters to ca.150 m depth, but can go to 740 m depth. Porbeagle: Most abundant on continental offshore fishing banks and occasionally close inshore. Neritic.	unpub.	P1: 1-3	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan, Inv. #9, #12, #13. Found in tray with Campanian ware (?)
2	Tamuda		1	Punico-Mauretanian		bluefin tuna	Thunnus thynnus	Scombridae	marine	Oceanic-pelagic, oceanodromous, seasonally coming close to shore. Usually 0-100 m depth.	unpub.	P2: 4	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan, Inv. #416. Found in tray with Campanian ware (?)

Table 7.2. Fish bones finds from *Tamuda*.

	ID (common name)	ID (scientific name)	Punico-Mauretanian	Roman	Late Roman	Context unknown
1	shortfin mako or porbeagle shark	*Lamnidae* (family)	*			
2	bluefin tuna	*Thunnus thynnus*	*			
TOTAL: 2			2	0	0	0

Table 7.3. Fish species from *Tamuda*, by period.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
1	Tamuda	South sector	*	Punico-Mauretanian		"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Quintero Atauri & Gimenez Bernal 1944: 7 (for excavations: Tarradell 1956: 73 & Tarradell 1960: 104)	-	"Murex" mentioned, no species, find area or date given (settlement chronology gives date here). Excavations near the wall that runs E-W.
2	Tamuda	South sector	32	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P9: 53-58	(Only 6 recorded in photo.) Present location: Musée Archéologique, Tetouan.From Taradell's or Morán & Giménez Bernal's excavations? Largest over 15 cm L.
3	Tamuda	South sector	2	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P10: 59-60	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? excavations? Largest 12.2 cm L.
4	Tamuda	South sector	2	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P10: 61-62	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
5	Tamuda	South sector	1	Punico-Mauretanian		clam (?)	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P10: 63	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?

Table 7.4. Marine invertebrate finds from *Tamuda (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
6	Tamuda	South sector	3	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 64	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? Ca 19.5 cm L.
7	Tamuda	South sector	2	Punico-Mauretanian		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 65	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
8	Tamuda	South sector	3	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 66	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
9	Tamuda	South sector	2	Punico-Mauretanian		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 67	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's excavations?
10	Tamuda	South sector	13	Punico-Mauretanian		Algarve volute	Cymbium olla	Gastropod	marine, infratidal	depths between 60-150 m	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 68	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? This species indigenous to Alboran sea, W. Med.

Table 7.4. Marine invertebrate finds from *Tamuda (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
11	Tamuda	South sector	18	Punico-Mauretanian		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P12: 69-71	(Only 3 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? Four of these have holes pierced near their hinges - largest over 10 cm W.
12	Tamuda	South sector	1	Punico-Mauretanian		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P12: 72	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
13	Tamuda	East sector	1	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P13: 73	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 50) "T-51 Alrededores calle 2 section W". 12 cm W.
14	Tamuda	East sector	4	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P14: 74-77	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 45).
15	Tamuda	East sector	1	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P14: 78	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 45).
16	Tamuda	East sector	1	Punico-Mauretanian		clam	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P14: 79	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 45).

Table 7.4. Marine invertebrate finds from *Tamuda (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
17	Tamuda		1	Punico-Mauretanian		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P15: 80	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda (Box 8) "Tamuda 1962 II".
18	Tamuda		1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub.	P15: 81	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda (Box 8) "Tamuda 1962 II".
19	Tamuda	East sector	1	Punico-Mauretanian		Mediterranean bonnet	Cassis undulata	Gastropod	marine, intertidal, infratidal	offshore sandy bottoms	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P16: 82	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda Este" (Box 35).
20	Tamuda	East sector	1	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P17: 83	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda Este" (Box 35).
21	Tamuda	East sector	1	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P18: 84	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "barrio este" (Box 44). Has small hole up near where vein may have been removed (?). Over 20 cm L.
22	Tamuda	East sector	1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P18: 85	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "barrio este" (Box 44).

Table 7.4. Marine invertebrate finds from *Tamuda (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
23	Tamuda	SE sector	1	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P19: 86	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "S este" (Box 41).
24	Tamuda	SE sector	1	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P20: 87	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "S este" (Box 42).
25	Tamuda	East sector	1	Punico-Mauretanian		clam	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P21: 88	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrios este" T-49 (1949) (Box 39).
26	Tamuda	East sector	1	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P21: 89	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrios este" T-49 (1949) (Box 39).
27	Tamuda	East sector	1	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P21: 90	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrios este" T-49 (1949) (Box 39).
28	Tamuda	East sector	1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P22: 91	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33).
29	Tamuda	East sector	2	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P22: 92-93	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33).

Table 7.4. Marine invertebrate finds from *Tamuda (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
30	Tamuda	East sector	2	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P22: 94-95	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33).
31	Tamuda	East sector	16	Punico-Mauretanian		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P23: 96-111	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33); 14 of these have holes drilled near their hinges. Appear worn.
32	Tamuda	"castro"	1	Roman/Late Roman		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P24: 112	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 51).
33	Tamuda	"castro"	1	Roman/Late Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P24: 113	Very worn. Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 51),
34	Tamuda	"castro"	1	Roman/Late Roman		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P25: 114	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 53).
35	Tamuda	"castro"	2	Roman/Late Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P25: 115-116	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 53).

Table 7.4. Marine invertebrate finds from *Tamuda (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
36	Tamuda	"castro"	1	Roman/Late Roman		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P25: 117	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 53).
37	Tamuda	castellum	3	Late Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (Villaverde Vega 1995: 350-351 for *castellum* chronology)	P26: 118-120	Present location: Musée Archéologique, Tetouan. Labelled: Late Roman "VII – 1962", from castellum.
38	Tamuda	castellum	2	Late Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (Villaverde Vega 1995: 350-351 for *castellum* chronology)	P26: 121-122	Present location: Musée Archéologique, Tetouan. Labelled: Late Roman "VII – 1962", from castellum.

Table 7.4. Marine invertebrate finds from *Tamuda.*

	ID (common name)	ID (scientific name)	Punico-Mauretanian	Roman/Late Roman	Late Roman
1	cockle	*Cardium* (*Cardidae* family)	*	*	*
2	Mediterranean bonnet	*Cassis undulata*	*		
3	knobbed triton	*Charonia lampas*	*		
4	Algarve volute	*Cymbium olla*	*		
5	bittersweet	*Glycymeridae* (family)	*		
6	spiny dye-murex	*Murex (bolinus) brandaris*	*		
7	banded dye-murex	*Murex trunculus*	*		
8	murex	*Muricidae* (family)	*		
9	oyster	*Ostrea sp.*	*	*	
10	rayed Mediterranean limpet	*Patella caerulea*	*	*	*
11	ribbed Mediterranean limpet	*Patella ferruginea*	*	*	
12	scallop	*Pectinidae* (family)	*		
13	red-mouthed rock shell (1)	*Purpura (Thais) haemastoma*	*		
14	clam	*Veneridae* (family)	*		
TOTAL: 14			14	4	2

Table 7.5. Marine invertebrate species from *Tamuda*, by period.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
1	Tamuda		9	Punico-Mauretanian		fish hook	bronze	fishing	Quintero Atauri & Gimenez Bernal 1945: 17, Pl. 17	P7: 8-16	Possibly some of these (T-78 & T-79) might be the "ca. 10 cm L fish hooks" found in the necropolis. 8 small hooks; 2 large hooks. Present location: Musée Archéologique, Tetouan, Inv. T-78 - T-86.
2	Tamuda		4	Punico-Mauretanian		needle	bone	net making/ repair	unpub.	P8: 17-20	Double-holes needles. Present location: Musée Archéologique, Tetouan, Inv. T-91, T-93 - T-94, T-96
3	Tamuda		6	Punico-Mauretanian		needle	bronze	net making/ repair	unpub.	P9: 21-26	Double-holes needles. One needle has loop eye. Present location: Musée Archéologique, Tetouan, Inv. T-87 - T-92.
4	Tamuda	SW sector	10	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Quintero Atauri & Gimenez Bernal 1945: 15; Tarradell 1956: 73-74 for excavations)	P10: 27-36	7 medium hooks; 3 small hooks. Labelled "EXC. QUINTERO, Retirado sala – museo". Present location: Musée Archéologique, Tetouan.
5	Tamuda	SW sector	10	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Quintero Atauri & Gimenez Bernal 1945: 15; Tarradell 1956: 73-74 for excavations)	P11: 37-46	9 small hooks; 1 medium hook. Labelled "EXC. QUINTERO, Retirado sala – museo". Present location: Musée Archéologique, Tetouan.
6	Tamuda	SW sector	6	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Quintero Atauri & Gimenez Bernal 1945: 15; Tarradell 1956: 73-74 for excavations)	P12: 47-52	6 small hooks. Labelled "EXC. QUINTERO, Retirado sala – museo". Present location: Musée Archéologique, Tetouan.
7	Tamuda	SW sector	1	Punico-Mauretanian		needle	bronze	net making/ repair	unpub. (see Tarradell 1956: 73-74 for excavations)	P13: 53	Looped needle. Labelled "EXC. QUINTERO". Present location: Musée Archéologique, Tetouan.

Table 7.6. Fishing equipment finds from *Tamuda (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
8	Tamuda	SW sector	2	Punico-Mauretanian		needle	bone	net making/ repair	unpub. (see Tarradell 1956: 73-74 for excavations)	P14: 54-55	Labelled "EXC. QUINTERO". Present location: Musée Archéologique, Tetouan.
9	Tamuda	"Gran Plaza"	1	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Tarradell 1956: 73-75 & Taradell 1949: 88-89 for excavations)	P15: 56	1 medium hook. Labelled "Gran Plaza" - this are in SW sector of city. Present location: Musée Archéologique, Tetouan.
10	Tamuda	"Gran Plaza"	1	Punico-Mauretanian		net weight	terracotta	fishing	unpub. (see Tarradell 1956: 73-75 & Taradell 1949: 88-89 for excavations)	P16: 57	Bun-shaped medium weight. Labelled "Gran Plaza" - this are in SW sector of city. Bun weight. Present location: Musée Archéologique, Tetouan.
11	Tamuda		2	Punico-Mauretanian		fish hook	bronze	fishing	Morán & Giménez Bernal 1948: 47, Pl. XVI	P17: 58-59	2 small hooks. Mounted on boards from old display. Present location: Musée Archéologique, Tetouan.
12	Tamuda	S sector	4	Punico-Mauretanian		fish hook	bronze	fishing	Quinteri Atuari 1945: Fig. 9	P18: 60-63	3 small hooks; 1 medium hook. From 1944 excavations. Mounted on board from old display. Present location: Musée Archéologique, Tetouan.
13	Tamuda		17	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Tarradell 1956: 73-74 for excavtions by Quintero)	P19: 64-80	14 small hooks; 3 medium hooks. Mounted on board from old display (probably 1944 excavation material). Present location: Musée Archéologique, Tetouan.
14	Tamuda	SW sector necropolis	2	Punico-Mauretanian		fish hook	bronze	fishing	Quintero Atauri & Gimenez Bernal 1944: 17, Lam. 1 (see Tarradell 1958: 379 for date)	-	From 1939/40-45 excavations. Unknown lengths.
15	Tamuda	SW sector	3	Punico-Mauretanian		weight	lead	fishing	Quintero Atauri & Gimenez Bernal 1944: 11, 17 (see Tarradell 1958: 379 for date)	-	From 1940-44 excavations. Described as "cylindrical, 560 g, 1.149 kg & 1.150 kg."

Table 7.6. Fishing equipment finds from *Tamuda (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
16	Tamuda	SW sector	1	Punico-Mauretanian		needle	bronze	net making/ repair	Morán & Giménez Bernal 1948: 45-46, Pl. XIV.B	-	From 1946 excavations (not present in Musée Archéologique, Tetouan).
17	Tamuda	SW sector necropolis	1	Punico-Mauretanian		needle	bronze	net making/ repair	Quintero Atauri & Gimenez Bernal 1944: 17, Lam. 1 (see Tarradell 1958: 379 for date)	P20: 81	From 1939/40-45 excavations.
18	Tamuda	SE sector	1	Punico-Mauretanian		needle	bronze	net making/ repair	unpub.	P21: 82	Very bent bronze needle with 2 eyes. Labelled: "S este" (Box 41). Present location: Musée Archéologique, Tetouan.
19	Tamuda		1	Punico-Mauretanian/ Roman		net weight	terracotta	fishing	unpub.	P22: 83	Doughnut-shaped medium weight with central hole. Present location: Musée Archéologique, Tetouan, Inv. 102.
20	Tamuda		1	Punico-Mauretanian/ Roman		net weight	terracotta	fishing	unpub.	P23: 84	Doughnut-shaped medium weight. Present location: Musée Archéologique, Tetouan, Inv. 291.
21	Tamuda		6	Punico-Mauretanian/ Roman		net weight	terracotta	fishing	unpub.	P24: 85-90	Disc-shaped weights with central hole. 3 medium;3 small weights. Present location: Musée Archéologique, Tetouan, Inv. 298, 292-293 (3 without numbers).
22	Tamuda	"castro"	5	Roman/Late Roman		net weight	terracotta	fishing	unpub.	P25: 91-95	All disc-shaped small weights. Labelled ""Tamuda castro" (Box 51)". Present location: Musée Archéologique, Tetouan.

Table 7.6. Fishing equipment finds from *Tamuda*.

HOOK-AND-LINE FISHING	Punico-Mauretanian	Punico-Mauretanian/ Roman	Roman/Late Roman	Late Roman
fish hook	*			
NET FISHING				
net weight	*	*	*	
needle	*			

Table 7.7. Fishing equipment finds from *Tamuda* by period.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
1	*Tamuda*	"on tell"		Mañá C2b/Dressel 18	Punico-Mauretanian	*	frags.	Morán & Giménez Bernal 1948: 41, fig. 7; Tarradell 1954b: 122; Tarradell 1960: 113, fig. 29; Tarradell 1966: 440	No indication of numbers, only that a "great quantity" were found at the site.
2	*Tamuda*	"Mauretanian settlement"	rubbish heap	Mañá-Pascual A4	Punico-Mauretanian	1	nearly whole?	Kbiri Alaoui 2007: 217; Kbiri Alaoui 2004: 207; El Khayari & Kbiri Alaoui 1998: 10-11	In reference to the Carmona type found in same layer.
3	*Tamuda*	western gate		Mañá C2b/Dressel 18	Punico-Mauretanian	*	frags.	Bernal, et al. 2008a: 556-557	From new excavations.
4	*Tamuda*	western gate		Dressel 7-11	Punico-Mauretanian/Roman	*	frags.	Bernal, et al. 2008a: 556-557	From new excavations.
5	*Tamuda*	SW sector, east part		Dressel 7-11	Punico-Mauretanian/Roman	*	frags.	Morán & Giménez Bernal 1948: 41, fig. 8; Tarradell 1956: Pl. II.1	
6	*Tamuda*	SW sector, east part		Almagro 51c	Roman/Late Roman	*	frags.	Morán & Giménez Bernal 1948: 41, fig. 6; Villaverde Vega 2001: 237	

Table 7.8. Finds of salazón amphorae from *Tamuda.*

	Punico-Mauretanian	Roman	Roman/ Late Roman	Late Roman	Medieval	Historical	Modern
Fish bones	*	*	*	*			
Shellfish		*		*			
Fishing equipment		*	*	*			
Fish-salting complexes	*	*		*			
Salazón amphorae	*	*		*			
Texts	*				*		
Pictorial evidence							
Ethnography						*	*

Table 7.9. The source evidence related to marine exploitation at *Septem Fratres*, including data on navigation.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
1	Septem/Ceuta	Hotel La Muralla	*	Punico-Mauretanian/ Roman	1st-2nd c. AD	unknown	unknown	unknown	-	-	unpub. (for site: Villada Paredes & Hita Ruiz 1994: 1211)	P4: 6	Fragments of fish bones (unidentified) found in the base of an amphora. On display at Museo Municipal de Ceuta, Inv. 3.080.
2	Septem/Ceuta	Hotel la Muralla	*	Roman	1st-2nd c. AD	unknown	unknown	unknown	-	-	Villada, *et al.* 2007: 487	-	General mention of "fish bones", to be published.
3	Septem/Ceuta	Plaza de África no. 3	*	Roman	2nd c. AD	"whale"		Cetacea (order)	marine	marine	Bernal Casasola 2009b: 267-268	-	Sponge-like examples and in very poor state of preservation.
4	Septem/Ceuta	Paseo de las Palmeras	*	Roman	2nd-3rd c. AD	(mackerel, tuna, bonito)	-	Scombridae	marine	Oceanodromous; epipelagic; some species occur in coastal waters, others far from shore.	Bernal Casasola & Pérez Rivera 1999: 68	-	"Scombriads" generally mentioned.
5	Septem/Ceuta	Hotel la Muralla (Parque de Artillería)	8	Roman/Late Roman	2nd-5th c. AD	John Dory	Zeus faber	Zeidae	marine, estuarine	Oceanodromous, found close to the sea bed, 5-400 m depth, usually 5-150 m.	Roselló Izquierdo 1992: 24	-	
6	Septem/Ceuta	Hotel la Muralla (Parque de Artillería)	7	Roman/Late Roman	2nd-5th c. AD	Atlantic bonito	Sarda sarda	Scombridae	marine, estuarine	Pelagic, neritic, oceanodromous and schooling species that may enter estuaries. Between 80-200 m depth.	Roselló Izquierdo1992: 25-26	-	

Table 7.10. Fish bones finds from *Septem Fratres (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
7	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo, Pileta II	3	Roman/Late Roman	2nd-5th c. AD	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Roselló Izquierdo1992: 26	-	Pileta II showed evidence of burning.
8	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo, Pileta II	24	Roman/Late Roman	2nd-5th c. AD	Spanish/chub mackerel	Scomber japonicus	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Roselló Izquierdo1992: 26	-	Pileta II showed evidence of burning.
9	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo, Pileta III	1	Roman/Late Roman	2nd-5th c. AD	Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Roselló Izquierdo1992: 28	-	
10	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo, Pileta III	5	Roman/Late Roman	2nd-5th c. AD	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Roselló Izquierdo1992: 28	-	

Table 7.10. Fish bones finds from *Septem Fratres (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
11	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo, Pileta IV	2	Roman/Late Roman	2nd-5th c. AD	Dusky grouper	Epinephelus guaza	Serranidae	marine	Also refered to as Epinephelus marginatus. Prefers rocky bottoms. Lives between 8-300 m depth; usually 8-50 m depth.	Roselló Izquierdo1992: 28	-	
12	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo, Pileta IV	1	Roman/Late Roman	2nd-5th c. AD	Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Roselló Izquierdo1992: 29	-	
13	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo, Pileta IV	4	Roman/Late Roman	2nd-5th c. AD	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Roselló Izquierdo1992: 29	-	
14	Septem/Ceuta	No. 13 Calle Hmns Gómez Marcelo	*	Late Roman	late 3rd-mid 5th c. AD	Atlantic chub mackerel	Scomber colias	Scombridae	marine	Coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope. 0-300 m depth.	Villaverde Vega & López Pardo 1995: 460; Ceuta Photo 3	-	Spines found in the base of a Almagro 51/Keay XIX amphora.
15	Septem/Ceuta	No. 20/21 Av. Sánchez Prados	*	Late Roman	4th-5th c. AD	unknown	unknown	unknown	-	-	Hita Ruiz & Villada Paredes 1994: 26-27	-	General mention of "Late Antique fish bones".
16	Septem/Ceuta	Paseo de las Palmeras	1	Late Roman	5th c. AD	Bluefin tuna	Thunnus thynnus	Scombridae	marine	Oceanic-pelagic, oceanodromous, seasonally coming close to shore. Usually 0-100 m depth.	Bernal Casasola & Pérez Rivera 1999: 70, fig. 32	-	"Tunny vertebrae" mentioned generally; shown in bottom of vat. Thought to be from end of use of site.
17	Septem/Ceuta	Plaza de África no. 3	*	Late Roman	late 5th/early 6th c. AD	"whale"		Cetacea (order)	marine	marine	Bernal Casasola 2009b: 267-268	-	These bones have evidence of possible burning/heating.

Table 7.10. Fish bones finds from *Septem Fratres*.

	ID (common name)	ID (scientific name)	Punico-Mauretanian	Roman	Roman/Late Roman	Late Roman
1	(mackerel, tuna, bonito)	*Scombridae*		*		
2	Atlantic bonito	*Sarda sarda*			*	
3	Atlantic chub mackerel	*Scomber colias*				*
4	Atlantic horse mackerel	*Trachurus trachurus*			*	
5	common seabream	*Pagrus pagrus*			*	
6	dusky grouper	*Epinephelus guaza*			*	
7	John Dory	*Zeus faber*			*	
8	Spanish/chub mackerel	*Scomber japonicus*			*	
9	bluefin tuna	*Thunnus thynnus*				*
10	“whale”	*Cetacea*		*		*
TOTAL: 10			0	2	6	3

Table 7.11. Fish species from *Septem Fratres*, by period.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
1	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	22	Roman	3rd c. AD	European thorny oyster	Spondylus gaederopus	Bivalve	marine, intertidal, infratidal	rocky shorelines	Chamorro Moreno 1988: 474; Hita Ruiz & Villada Paredes 1994: 49-50	-	Most abundant specis found in this area. Evidence of erosion - collected after animal died.
2	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	4	Roman	3rd c. AD	Safian limpet	Patella nigra	Gastropod	marine, intertidal, infratidal	hard surfaces	Chamorro Moreno 1988: 474; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	Also referred to as *Patella safiana* .
3	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Chamorro Moreno 1988: 475; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	
4	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	22	Roman	3rd c. AD	oyster	Ostrea edulis	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Chamorro Moreno 1988: 476; Hita Ruiz & Villada Paredes 1994: 49-50	-	
5	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	7	Roman	3rd c. AD	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Chamorro Moreno 1988: 475; Hita Ruiz & Villada Paredes 1994: 49-50	-	Evidence of erosion - collected after animal died.
6	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	2	Roman	3rd c. AD	spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	Chamorro Moreno 1988: 475	-	
7	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	banded dye-murex	Hexaplex (truncularіopsis) trunculus [murex trunculus]	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Chamorro Moreno 1988: 475; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	

Table 7.12. Marine invertebrate finds from *Septem Fratres (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
8	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	2	Roman	3rd c. AD	Mediterranean bonnet	Cassis undulata	Gastropod	marine, intertidal, infratidal	offshore sandy bottoms	Chamorro Moreno 1988: 475	-	
9	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Chamorro Moreno 1988: 476; Hita Ruiz & Villada Paredes 1994: 49-50	-	Evidence of erosion - collected after animal died.
10	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	3	Roman	3rd c. AD	Pilose bittersweet	Glycimeris glycimeris	Bivalve	marine, intertidal, infratidal	mud and sandy habitats, lower to sub-tidal zone to 150 m depth	Chamorro Moreno 1988: 476, 488	-	These have perforated holes near their hinges. Evidence of erosion - collected after animal died. Evidence of burining. Possibly used as a lamp?
11	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	Atlantic/ Mediterranean scallop	Pecten jacobaeus	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 200 m depth	Chamorro Moreno 1988: 476	-	Same species as *Pecten maximus.*
12	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	4	Roman	3rd c. AD	spiny cockle	Acanthocardia aculeata	Bivalve	marine, infratidal	muddy, sandy bottoms, 5-25 m depth	Chamorro Moreno 1988: 476; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	Evidence of erosion - collected after animal died.
13	Septem/Ceuta	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	(sea urchin)	Strongylocentrotus sp.	Echinoidea	marine, intertidal	low intertidal zone, on rocks	Hita Ruiz & Villada Paredes 1994: 49-50	-	Identified by A. Morales, UAM
14	Septem/Ceuta	Paseo de las Palmeras	1	Roman	2nd-3rd c. AD	coral	Dendrophillia ramea	Scleractinia (order)	marine, infratidal	attached to rocks, usually around 40 - 110 m depth	Bernal Casasola & Pérez Rivera 1999: 68, fig. 33	-	No common name for this coral type. Trunk is red/red-orange colour when alive.
15	Septem/Ceuta	Mirador (Hotel la Muralla)	*	Late Roman		(oyster)	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.

Table 7.12. Marine invertebrate finds from *Septem Fratres (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
16	Septem/Ceuta	Mirador (Hotel la Muralla)	*	Late Roman		(thorny/spiny oyster)	Spondylus sp.	Bivalve	marine, intertidal, infratidal	rocky shorelines	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
17	Septem/Ceuta	Mirador (Hotel la Muralla)	*	Late Roman		(limpet)	Patella sp.	Gastropod	marine, intertidal	fixed on rocks	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
18	Septem/Ceuta	Basilica (near 20/21 Av. S. Prados)	*	Late Roman		(oyster)	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
19	Septem/Ceuta	Basilica (near 20/21 Av. S. Prados)	*	Late Roman		(thorny/spiny oyster)	Spondylus sp.	Bivalve	marine, intertidal, infratidal	rocky shorelines	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
20	Septem/Ceuta	Basilica (near 20/21 Av. S. Prados)	*	Late Roman		(limpet)	Patella sp.	Gastropod	marine, intertidal	fixed on rocks	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
21	Septem/Ceuta	Plaza de África no. 3	*	Late Roman	5th c.	Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	Bernal Casasola, *et al.* 2007: 96-97	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana
22	Septem/Ceuta	Plaza de África no. 3	*	Late Roman	5th c.	oyster	Ostrea edulis	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Bernal Casasola, *et al.* 2007: 96-97	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana
23	Septem/Ceuta	Plaza de África no. 3	*	Late Roman	5th c.	banded dye-murex	Hexaplex (truncülariopsis) trunculus [murex trunculus]	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Bernal Casasola, *et al.* 2007: 96-97; Bernal Casasola 2009b: 267-268	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana

Table 7.12. Marine invertebrate finds from *Septem Fratres (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
24	Septem/Ceuta	Plaza de África no. 3	*	Late Roman	5th c.	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	fixed on rocks	Bernal Casasola, *et al.* 2007: 96-97	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana

Table 7.12. Marine invertebrate finds from *Septem Fratres*.

	ID (common name)	ID (scientific name)	Punico-Mauretanian	Roman	Late Roman
1	spiny cockle	*Acanthocardia aculeata*		*	
2	Mediterranean bonnet	*Cassis undulata*		*	
3	knobbed triton	*Charonia lampas*		*	
4	coral	*Dendrophillia ramea*		*	
5	pilose bittersweet	*Glycimeris glycimeris*		*	
6	banded dye-murex	*Hexaplex (truncilariopsis) trunculus*		*	*
7	spiny dye-murex	*Murex (bolinus) brandaris*		*	
8	oyster	*Ostrea edulis*		*	*
9	oyster	*Ostrea sp.*			*
10	China limpet	*Patella aspera*		*	
11	Safian limpet	*Patella nigra*		*	
12	ribbed Mediterranean limpet	*Patella ferruginea*			*
13	rayed Mediterranean limpet	*Patella caerulea*			*
14	(limpet)	*Patella sp.*			*
15	Atlantic/ Mediterranean scallop	*Pecten jacobaeus*		*	
16	red-mouthed rock shell (1)	*Purpura (Thais) haemastoma*		*	
17	European thorny oyster	*Spondylus gaederopus*		*	
18	(thorny/spiny oyster)	*Spondylus sp.*			*
19	(sea urchin)	*Strongylocentrotus sp.*		*	
TOTAL: 19 SPECIES			0	14	7

Table 7.13. Marine invertebrate species from *Septem Fratres,* by period.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
1	Septem/Ceuta	No. 20/21 Av. Sánchez Prados	2	Roman	beginning 2nd c. AD	fish hook	bronze	fishing	Hita Ruiz & Villada Paredes 1994: 26-27.	P28: 100-101	2 medium hooks; On display at Museo Municipal, Ceuta.
2	Septem/Ceuta		1	Roman/Late Roman	2nd-5th c. AD	net weight	lead	fishing	unpub.	-	Lead strip used for weighting net edge. Weight unknown. Present location: Museo Municipal, Ceuta.
3	Septem/Ceuta		5	Roman/Late Roman	1st-5th c. AD	net weight	terracotta	fishing	unpub.	P29: 102-106	Doughnut-shaped weight. Weight unknown. Present location: Museo Municipal, Ceuta. (Not from Paseo de las Palmeras excavations.)
4	Septem/Ceuta		2	Roman/Late Roman	1st-5th c. AD	net weight	stone	fishing	unpub.	P29: 107-108	Doughnut-shaped weight. Weight unknown. Present location: Museo Municipal, Ceuta.
5	Septem/Ceuta		2	Roman/Late Roman	2nd-5th c. AD	fish hook	bronze	fishing	unpub.	P30: 109-110	No provenance given other than fish-salting factory. No measurements taken. Both hooks on display in Museo Municipal, Ceuta, in 2004; one on display in 2007.
6	Septem/Ceuta	Paseo de las Palmeras	1	Roman/Late Roman	2nd-5th c. AD	net weight	terracotta	fishing	Bernal Casasola & Pérez Rivera 1999: 68, Fig. 30A	-	Disc-shaped weight – 8 cmø. No weight given.
7	Septem/Ceuta	Paseo de las Palmeras	*	Roman/Late Roman	2nd-5th c. AD	fish hook	bronze	fishing	Bernal Casasola & Pérez Rivera 1999: 65	-	Unknown number mentioned; no sizes given.
8	Septem/Ceuta	No. 20/21 Av. Sánchez Prados	*	Late Roman	late 4th c. AD	fish hook	bronze	fishing	Hita Ruiz & Villada Paredes 1994: 47	-	Unknown number mentioned; no sizes given.
9	Septem/Ceuta	Plaza de África no. 3	*	Late Roman	late 5th/early 6th c. AD	fish hook	bronze	fishing	Bernal Casasola 2009b: 267-268	-	Unknown number mentioned; no sizes given.

Table 7.14. Fishing equipment finds from *Septem Fratres*.

HOOK-AND-LINE FISHING	Punico-Mauretanian	Roman	Roman/Late Roman	Late Roman
fish hook		*	*	*
NET FISHING				
net weight			*	

Table 7.15. Fishing equipment finds from *Septem Fratres,* by period.

COMPLEXES:	CHRONOLOGY:
Hotel la Muralla/Parque de Artillería	late 1st c. BC – 5th c. AD[1]
Palacio de la Asamblea	2nd – 5th c. AD[2]
No. 13 Calle Hermanos Gómez Marcelo	2nd – 6th c. AD[3]
No. 20/21 Av. Sánchez Prados (Gran Via)/ Queipo de Llano	2nd – early 6th c. AD; period of reduction/ abandonment in the 5th century. At least three medieval *cetariae* were built here.[4]
Paseo de las Palmeras	mid-2nd – 3rd c. AD; a pause then restructuring in 3rd c., re-use from the 4th – late 5th/early 6th c. AD[5]

PREPARATION AREAS:	CHRONOLOGY:
No. 12 Av. Sánchez Prados (Gran Via)	1st – 5th c. AD; second phase: 5th c. to medieval period
No. 13 Av. Sánchez Prados (Gran Via)	1st – 5th c. AD[6]
Puerta Califal	trash dump (mid-1st c. AD); preparation area (early 2nd c. AD); restructured in the 3rd c. AD; continued use until 4th c. AD[7]
No. 3 Plaza de África	2nd - late 5th/early 6th c. AD[8]

Table 7.16. Chronologies of the fish-salting complexes and preparation areas at *Septem Fratres.*

[1] Bravo Pérez, *et al.* 1995; Villada, *et al*. 2007; Villada Paredes 2006: 274-276
[2] Bernal Casasola & Pérez Rivera 1999: Pl. IIIB; Bravo Pérez, *et al.* 1995
[3] Bravo Pérez, *et al.* 1995; Villaverde Vega & López Pardo 1995: 456-460; Bernal Casasola 1996: 1195-1196; 6th century terminus, as opposed to 5th century, is proposed by Bernal Casasola 2008: 41.
[4] Hita Ruiz & Villada Paredes 1994: 25-30; Bernal Casasola & Pérez Rivera 1999: Pl. IIID; Bernal Casasola 2008: 42
[5] Bernal Casasola & Pérez Rivera 1999; Bernal Casasola, *et al.* 1999; Bernal Casasola & Pérez Rivera 2000: 865-875; Bernal Casasola 2008: 41-42
[6] Hita Ruiz & Villada Paredes 1994: 18-24, 30-32; Bernal Casasola & Pérez Rivera 1999: 29; Marín Díaz, *et al.* 1995; Bernal Casasola 1996: 1194-1195
[7] Villada Paredes 2006; Villada, *et al.* 2007; Villada Paredes 2006: 274-276; Hita Ruiz & Villada Paredes 2004
[8] Bernal Casasola 2009b: 267-270

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
1	*Septem* /Ceuta	no provenience noted		Dressel 7	Punico-Mauretanian	1	nearly complete amphora	Martínez Maganto & García Giménez 1997: 14, fig. 4	Inv. 508. Missing part of toe and some body.
2	*Septem* /Ceuta			Mañá C2b/Dressel 18	Punico-Mauretanian	6	amphorae	Villaverde Vega & López Pardo 1995: 462; Bravo & Munoz 1965: 37. fig. 31	Found under water, but not on land around Ceuta peninsula.
3	*Septem* /Ceuta			Mañá-Pascual A4	Punico-Mauretanian	*		Bernal 2000: 1139-1140; Blázquez 2001: 400	
4	*Septem* /Ceuta	Conjunto 1		Beltran II	Punico-Mauretanian/ Roman	1	nearly complete amphora	Hita Ruiz & Villada Paredes 1994: 60; Bravo Perez 1968: 40; Fernández Garcia 1983: 96	Possible local production, but there is not really much evidence to go on (Bravo Perez 1968: 40; Fernández Garcia 1983).
5	*Septem* /Ceuta			Dressel 7-11/Beltran I	Punico-Mauretanian/ Roman	29	amphorae	Bravo & Munoz 1965: figs. 29-30; Fernández García 1983: figs. 11-15, p. 53-73.	Beltran I is a very difficult example because it is found underwater all around Ceuta, but not on land. Bravo & Munoz call it Dr. 24. Hassini sees it as Dr. 7-11.
6	*Septem* /Ceuta	parcel 20/21	Sector I, Period IV, phase 3	Dressel 7-11/Beltran I	Punico-Mauretanian/ Roman	*		Hita Ruiz & Villada Paredes 1994: 25-30, 45	No description of numbers. Site interpreted as a "packaging area" for shipments.
7	*Septem* /Ceuta	no provenience noted		Dressel 7-11/Beltran I	Punico-Mauretanian/ Roman	10	9 rim/neck frags; 1 toes frag.	Martínez Maganto & García Giménez 1997: 20, 22-26, figs 15, 17-19, 21	Inv. 534; Inv. 535; Inv. 545; Inv. 548; Inv. 549; Inv. 550; Inv. 551; Inv. 552; Inv. 553; Inv. 561
8	*Septem* /Ceuta	no provenience noted		Dressel 8	Punico-Mauretanian/ Roman	3	1 nearly complete amphora;2 fragmentary amphorae	Martínez Maganto & García Giménez 1997: 12, 16-17, figs 2, 8-9	Inv. 501; Inv. 518; Inv. 519
9	*Septem* /Ceuta	no provenience noted		Dressel 9	Punico-Mauretanian/ Roman	14	6 nearly complete amphora; 6 fragmentary amphorae; 2 rim/neck frags.	Martínez Maganto & García Giménez 1997: 12-22, figs 2-3, 5-7, 9, 11-12, 14	Inv. 502; Inv. 506; Inv. 510; Inv. 512; Inv. 515 (this example has a graffito); Inv. 516; Inv. 520; Inv. 527; Inv. 529; Inv. 533; Inv. 540; Inv. 541; Inv. 542; Inv. 543

Table 7.17. Finds of salazón amphorae from *Septem Fratres (continued on next page)*.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
10	*Septem* /Ceuta	no provenience noted		Dressel 9 or 11	Punico-Mauretanian/ Roman	3	fragmentary amphora	Martínez Maganto & García Giménez 1997: 17-19, figs 10, 12	Inv. 521; Inv. 522; Inv. 528. Mouth, neck, handles, and shoulder frags. Difficult to establish this type because of state. May be a transitional type, but no enough to know.
11	*Septem* /Ceuta	Hotel La Muralla		Beltran II	Punico-Mauretanian/ Roman	*		Villaverde Vega & López Pardo 1995: 462-463	
12	*Septem* /Ceuta	Hotel La Muralla		Dressel 7-12	Punico-Mauretanian/ Roman	*		Villada Paredes 2006: 275	
13	*Septem* /Ceuta	Hotel La Muralla		Beltran IIA	Punico-Mauretanian/ Roman	*		Villada Paredes 2006: 275; Villada, et al. 2007: 499	
14	*Septem* /Ceuta	Hotel La Muralla		Beltran IIB	Punico-Mauretanian/ Roman	*		Villada Paredes 2006: 275; Villada, et al. 2007: 499	
15	*Septem* /Ceuta	Hotel La Muralla		Dressel 7-11	Punico-Mauretanian/ Roman	*		Villada, et al. 2007: 499	
16	*Septem* /Ceuta	no provenience noted		Beltan IIA/Pompeii VII	Punico-Mauretanian/ Roman	3	1 fragmentary amphora; 2 handles	Martínez Maganto & García Giménez 1997: 17-18, figs 10, 19	Inv. 523. Mouth, neck, handles, and shoulder frags. Difficult to establish this type because of state. Parallel to Inv. 509; Inv. 524 (possibly identified as this type); Inv. 526.
17	*Septem* /Ceuta	no provenience noted		Dressel 7 or 9/Beltran I	Punico-Mauretanian/ Roman	1	toe	Martínez Maganto & García Giménez 1997: 25, fig. 20	Inv. 558. Most probably Beltran I.
18	*Septem* /Ceuta	no provenience noted		Dressel 7/8, 12, or 17	Punico-Mauretanian/ Roman	1	fragmentary amphora	Martínez Maganto & García Giménez 1997: 19, fig. 13	Inv. 531. Mouth, neck, handles, and some shoulder frags. Type has characteristics of Dr. 7/8 from Tour Sainte Marie, Lyon (Augustan-1st half, 1st c. AD). But also resemble Dr. 12, but also Dr. 17, from Lavezzi 3 (mid-1st c. AD).

Table 7.17. Finds of salazón amphorae from *Septem Fratres (continued on next page)*.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
19	*Septem* /Ceuta	no provenience noted		Beltran II	Punico-Mauretanian/ Roman	6	1 fragmentary amphora; 1 toe frag.; 4 rim/handle frags.	Martínez Maganto & García Giménez 1997: 16, 22, 24, figs 8, 17, 19-20	Inv. 517 (could be Beltran IIB, and is very similar to Inv. 507 & 511); Inv. 544; Inv. 546; Inv. 554; Inv. 555; Inv. 556.
20	*Septem* /Ceuta	no provenience noted		Beltran II/Pompeii VII	Punico-Mauretanian/ Roman	2	1 rim/neck frag.; 1 frag. amphora	Martínez Maganto & García Giménez 1997: 15, 19, fig. 6, 13	Inv. 514; Inv. 530 (a transitional type between Pompeii VII/Beltran II. Parallels of thi type from Sud-Lavezzi 1)
21	*Septem* /Ceuta	Paseo de las Palmeras		Beltran IIA	Punico-Mauretanian/ Roman	*		Bernal Casasola & Pérez Rivera 2000: 868-869; Bernal Casasola & Pérez Rivera 1999: 62, Lam. XX	Variants of BIIA found in Paseo excavations, originally they resemble Puerto Real I but later they resemble Keay XVI.
22	*Septem* /Ceuta		Sector I, Period IV, phase 3	Beltran IIA	Punico-Mauretanian/ Roman	*		Hita Ruiz & Villada Paredes 1994: 25-30, 45	No description of numbers. See Hita Ruiz & Villaverde Vega 1994: 60.
23	*Septem* /Ceuta	no provenience noted		Beltran IIA/Pompeii VII	Punico-Mauretanian/ Roman	6	4 rim/neck frags.; 2 incomplete amphorae	Martínez Maganto & García Giménez 1997: 13-14. 20-21, figs 4, 15-17	Inv. 536; Inv. 537; Inv. 538; Inv. 539; Inv. 505; Inv. 509.
24	*Septem* /Ceuta		Sector I, Period IV, phase 3	Beltran IIB	Punico-Mauretanian/ Roman	*		Hita Ruiz & Villada Paredes 1994: 25-30, 45	No description of numbers. See Hita Ruiz & Villaverde Vega 1994: 60.
25	*Septem* /Ceuta	no provenience noted		Beltran IIB	Punico-Mauretanian/ Roman	4	1 nearly complete amphora; 2 frag. Amphorae; 1 rim	Martínez Maganto & García Giménez 1997: 14-15, 18, figs 3, 5-6, 11	Inv. 507; Inv. 511; Inv. 525; Inv. 513
26	*Septem* /Ceuta	no provenience noted		Dressel 11/Pompeii VII transition	Punico-Mauretanian/ Roman	1	nearly complete amphora	Martínez Maganto & García Giménez 1997: 13	Inv. 503. Lacking mouth, so makes identification difficult. Similar to Sud Lavezzi 1 & 2.
27	*Septem* /Ceuta	no provenience noted		Dressel 12	Punico-Mauretanian/ Roman	3	2 toe frags; 1 rim/neck frag.	Martínez Maganto & García Giménez 1997: 23, 25-26, figs 17, 20-21	Inv. 559; Inv. 562; Inv. 547.
28	*Septem* /Ceuta	no provenience noted		Dressel 12/Beltran III	Punico-Mauretanian/ Roman	1	nearly complete amphora	Martínez Maganto & García Giménez 1997: 13	Inv. 504. Lacking mouth.

Table 7.17. Finds of salazón amphorae from *Septem Fratres (continued on next page)*.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
29	*Septem* /Ceuta	under water		Dressel 14 (Beltran IV)	Roman	*		Hita Ruiz & Villada Paredes 1994: 60; Bravo & Muñoz 1965: fig. 37	No mention of numbers of this type.
30	*Septem* /Ceuta	no provenience noted		Dressel 14/Beltran IVa	Roman	1	fragmentary amphora	Martínez Maganto & García Giménez 1997: 19-20, fig. 14	Inv. 532. Mouth, neck, handles, and some shoulder frags. Parallels to Sud-Lavezzi 1, and also Almeria. Similarity between this type's rim and Keay XXVI, especially the C variant.
31	*Septem* /Ceuta	Hotel La Muralla		Dressel 14B	Roman	*		Villada, et al. 2007: 499	
32	*Septem* /Ceuta			Almagro 50	Roman/Late Roman	1	toe frag., w/ lower part of amphora	Bernal Casasola 1996: 1196, 1198, fig. 13	Inv: MMC/FA/RM/ANF/315.
33	*Septem* /Ceuta	La Calle Hermano Gómez Marcelo	abandonment level	Almagro 51a-b/ Keay XIX	Roman/Late Roman	2	amphorae bases	Villaverde Vega & López Pardo 1995: 460, 471-472, fig. 3a-b	Found "under the first level of abandonment." Authors think that this type was made in Tingitana.
34	*Septem* /Ceuta		abandonment period	Almagro 51a-b/ Keay XIX	Roman/Late Roman	*		Villaverde Vega & López Pardo 1995: 468	No number of finds given. Necropolis located near basilica. See Vázquez Bodas 1995
35	*Septem* /Ceuta	North Bay		Almagro 51a-b/ Keay XIX	Roman/Late Roman	6	handles	Bernal Casasola 1996: 1196, 1198, fig. 10	Inv: MMC/FA/RM/ANF/292-96. Bernal Casasola (1996: 1211-1217) offers that these types were made around the Straits region, if not Ceuta area.
36	*Septem* /Ceuta			Almagro 51a-b/ Keay XIX	Roman/Late Roman	2	1 handle; 1 rim/handle frag.	Bernal Casasola 1996: 1196, 1198, fig. 9-10; Bernal Casasola 1997: 97-98 (Table 4), 119	Inv: MMC/FA/RM/ANF/291; Inv: MMC/FA/RM/ANF/281.

Table 7.17. Finds of salazón amphorae from *Septem Fratres* *(continued on next page)*.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
37	*Septem* /Ceuta	North Bay		Almagro 51a-b/ Keay XIX	Roman/Late Roman	14	nearly complete amphora	Bernal Casasola 1996: 1196, 1198, fig. 8, 10-11; Bernal Casasola 1997: 97-98 (Table 4), 117-119; Bernal, et al. 1996: 88	Inv: MMC/FA/RM/ANF/297; Inv: MMC/FA/RM/ANF/270; Inv: MMC/FA/RM/ANF/268-269 (analysed petrographically, and believed to have been made in *Maueretania Tingitana* ([Bernal Casasola 1997: 94-98]); Inv: MMC/FA/RM/ANF/271-276; Inv: MMC/FA/RM/ANF/282-283, 285-286.
38	*Septem* /Ceuta	North Bay		Almagro 51a-b/ Keay XIXa	Roman/Late Roman	10	4 toe frags., w/ lower part of amphorae; 6 rin/neck frags.	Bernal Casasola 1996: 1196, 1198, fig. 9-10; Bernal, et al. 1996: 88; Bernal Casasola 1997: 97-98 (Table 4), 119	Inv: MMC/FA/RM/ANF/288-290; Inv: MMC/FA/RM/ANF/277-280, 284; Inv: MMC/FA/RM/ANF/287.
39	*Septem* /Ceuta	parcel 20/21		Almagro 51c	Roman/Late Roman	*		Hita Ruiz & Villada Paredes 1994: 44-45; Bernal Casasola 1997: 92	No numbers given.
40	*Septem* /Ceuta			Beltran 72	Roman/Late Roman	1	upper part of amphora	Bernal Casasola 1996: 1196, 1198, fig. 12; Bernal Casasola 1997: 99-100 (Table 4), 122	Inv: MMC/FA/RM/ANF/314. Like those from Sud-Lavezzi 1 wreck. Beltran 72 also identified by author as Almagro 50.

Table 7.17. Finds of salazón amphorae from *Septem Fratres*.

	Punico-Mauretanian	Roman	Late Roman	Context unknown	Medieval	Historical	Modern
Fish bones	*	*		*			
Shellfish	*	*	*	*			
Fishing equipment	*	*		*			
Fish-salting complexes		*	*				
Salazón amphorae	*	*	*				
Texts	*	*			*		
Pictorial evidence	*						
Ethnography						*	*

Table 7.18. The source evidence related to marine exploitation at *Lixus*, including data on navigation and salt production.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
1	Lixus	"on beach"	*	Context unknown	?	"whale"	-	Cetacea (order)	marine	marine	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Whale vertebrae" are mentioned as being on the beach, but their date is unclear.
2	Lixus	"on beach"	*	Context unknown	?	"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Tunny vertebrae" are mentioned as being on the beach, but their date is unclear.
3	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		European eel	Anguilla anguilla	Anguillidae	marine, freshwater, estuarine	Diadromous. Elvers mature in estuaries and continental waters before moving into freshwater basins. Adults migrate to ocean, found 0-700 m depth.	Grau Almero, *et al.* 2001: 206; Aranegui, *et al*. 2007: 210-211	-	
4	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
5	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	White trevally	Caranx dentex	Carangidae	marine, estuarine	Occur in bays, coastal waters and estuaries. School on surface, in mid-water and on the bottom; often associated with reefs and rough bottom, 10-238 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus* *(continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
6	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Grau Almero, *et al.* 2001: 207; Aranegui, *et al.* 2007: 210-211	-	
7	Lixus	Ladera sur	21	Punico-Mauretanian	50 BC-AD 50	European pilchard	Sardina pilchardus	Clupeidae	marine, freshwater, estuarine	Littoral species, pelagic and neretic. Form schools, usually at depths of 25 to 55 or even 100 m by day, rising to 10 to 35 m at night.	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371;Aranegui, *et al.* 2007: 210-211	-	
8	Lixus	Sondeos del Algarrobo y Olivo	7	Punico-Mauretanian		(herring, sardine, shad, mehaden)	-	Clupeidae	marine, freshwater, estuarine	Marine coastal, some freshwater species.	Grau Almero, *et al.* 2001: 206; Aranegui, *et al.* 2007: 210-211	-	
9	Lixus	Ladera sur	6	Punico-Mauretanian	50 BC-AD 50	Bastard grunt	Pomadacys incisus	Haemulidae	marine, estuarine	Demersal, over hard bottoms and sand, 10-100 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
10	Lixus	Ladera sur	6	Punico-Mauretanian	50 BC-AD 50	European seabass	Dicentrarchus labrax	Moronidae	marine, freshwater, estuarine	Adults inhabit coastal waters down to ca. 100 m depth but more common in shallow waters. Demersal in the littoral zone: bottoms on estuaries, lagoons and occasionally rivers.	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
11	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Spotted seabass	Dicentrarchus punctatus	Moronidae	marine, estuarine	Coastal species. Occurs on various kinds of bottoms. Occasionally occurring in rivers, 30 - ? m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
12	Lixus	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	(seabass)	Dicentrarchus sp.	Moronidae	marine, estuarine	Coastal species. Occurs on various kinds of bottoms. Occasionally occurring in rivers, 30 - ? m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
13	Lixus	Ladera sur	5	Punico-Mauretanian	50 BC-AD 50	Thicklip grey mullet	Chelon labrosus	Mugilidae	marine, freshwater, estuarine	Occur inshore, enters brackish lagoons. Demersal and catadromous.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
14	Lixus	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	(mullet)	-	Mugilidae	marine, freshwater, estuarine	Some species enter freshwater and are catadromous.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al*. 2006: 369-371	-	
15	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Thicklip grey mullet	Chelon labrosus	Mugilidae	marine, freshwater, estuarine	Occur inshore, enters brackish lagoons. Demersal and catadromous.	Grau Almero, *et al.* 2001: 213; Aranegui, *et al.* 2007: 210-211	-	
16	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Flathead mullet	Mugil cephalus	Mugilidae	marine, freshwater, estuarine	Diadromous coastal species that often enters estuaries and rivers. Usually in schools over sand or mud bottom, 0-120 m depth.	Grau Almero, *et al.* 2001: 213; Aranegui, *et al.* 2007: 210-211	-	
17	Lixus	Sondeos del Algarrobo y Olivo	3	Punico-Mauretanian		(mullet)	-	Mugilidae	marine, freshwater, estuarine	Some species enter freshwater and are catadromous.	Grau Almero, *et al.* 2001: 213; Aranegui, *et al.* 2007: 210-211	-	
18	Lixus	Ladera sur	2	Punico-Mauretanian	50 BC-AD 50	Mediterranean moray	Muraena helena	Muraenidae	marine	Rocks or corals, 15-50 m depth.	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
19	Lixus	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	Bluefish	Pomatomus saltator	Pomatomidae	marine, estuarine	Oceanic and coastal waters (up to 200 m depth). They are most common along surf beaches and rock headlands, although adults can also be found in estuaries and into brackish water. Small fish may be found in shallow coastal waters at least 2 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
20	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Meagre	Argyrosomus regius	Sciaenidae	marine, estuarine	Inshore and shelf waters, close to bottom as well as in surface and mid-waters, 15-300 m depth. Juveniles and sub-adults enter estuaries and coastal lagoons.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
21	Lixus	Ladera sur	13	Punico-Mauretanian	50 BC-AD 50	Spanish/chub mackerel	Scomber japonicus	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
22	Lixus	Sondeos del Algarrobo y Olivo	12	Punico-Mauretanian		Spanish/chub mackerel	Scomber japonicus	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Grau Almero, *et al*. 2001: 214; Aranegui, *et al.* 2007: 210-211	-	
23	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		(mackerel)	Scomber sp.	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Grau Almero, *et al.* 2001: 214; Aranegui, *et al*. 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
24	Lixus	Ladera sur	2	Punico-Mauretanian	50 BC-AD 50	Bogue	Boops boops	Sparidae	marine	Demersal. Found on the shelf or coastal pelagic on various bottoms (sand, mud, rocks and seaweeds), 0-350 m depth, usually 0-100 m.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
25	Lixus	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	Pink dentex	Dentex gibbosus	Sparidae	marine	Occur on the shelf on rocky and rubble bottoms and sand. Young are close to shore; adults offshore near continental slope, 20-220 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
26	Lixus	Ladera sur	5	Punico-Mauretanian	50 BC-AD 50	Canary dentex	Dentex canariensis	Sparidae	marine	Inhabit inshore waters, demersal on various substrates (specially rocky) to 150 m depths.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
27	Lixus	Ladera sur	5	Punico-Mauretanian	50 BC-AD 50	(dentex)	Dentex sp.	Sparidae	marine	Inhabit inshore waters, demersal on various substrates (specially rocky) to 150-220 m depths.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
28	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Saddled seabream	Oblada melanura	Sparidae	marine	Benthopelagic; over rocky bottoms or seagrass beds (*Zostera* and seaweeds), 0-30 m depth.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus* *(continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
29	Lixus	Ladera sur	10	Punico-Mauretanian	50 BC-AD 50	Common two-banded seabream	Diplodus vulgaris	Sparidae	marine	Benthopelagic, euryhaline species over rocky and sandy bottoms to 160 m; more common in less than 50 m. Young are sometimes found in seagrass beds.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
30	Lixus	Ladera sur	2	Punico-Mauretanian	50 BC-AD 50	Annular seabream	Diplodus annularis	Sparidae	marine, estuarine	Benthopelagic; Inhabit *Zostera* seagrass beds but also *Posidonia* beds and sandy bottoms, 0-90 m depth.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
31	Lixus	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	White seabream	Diplodus sargus	Sparidae	marine	Demersal, over coastal rocky reefs and *Posidonia oceanica* beds. Very active and frequents the surf zone, 0-30 m depth.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
32	Lixus	Ladera sur	9	Punico-Mauretanian	50 BC-AD 50	(seabream)	Diplodus sp.	Sparidae	marine, freshwater, estuarine	A euryhaline demersal species inhabiting rocky and sometimes sandy bottoms to depths of 160 m, but more commonly in less than 50 m. The young are sometimes found in seagrass beds.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
33	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Gilthead seabream	Sparus aurata	Sparidae	marine, estuarine	Demersal. Found in seagrass beds and sandy bottoms as well as in the surf zone to 30 m, but adults may occur to 150 m depth. In spring, present in coastal lagoons and estuaries.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
34	Lixus	Ladera sur	4	Punico-Mauretanian	50 BC-AD 50	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
35	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Common pandora	Pagellus erythrinus	Sparidae	marine	Found on inshore waters, on various bottom (rock, gravel, sand, mud and grass) to 200 m (Mediterranean) or 300 m (Atlantic) and move to deeper waters during winter.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, et al. 2006: 369-371; Aranegui, et al. 2007: 210-211	-	
36	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	(bream, porgy, pandora)	Pagellus sp.	Sparidae	marine	Found on inshore waters, on various bottom (rock, gravel, sand, mud and grass) to 200 m (Mediterranean) or 300 m (Atlantic) and move to deeper waters during winter.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
37	Lixus	Ladera sur	9	Punico-Mauretanian	50 BC-AD 50	(porgy)	-	Sparidae	marine	Rarely found in brackish and freshwater environments.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al*. 2006: 369-371	-	
38	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Bogue	Boops boops	Sparidae	marine	Demersal. Found on the shelf or coastal pelagic on various bottoms (sand, mud, rocks and seaweeds), 0-350 m depth, usually 0-100 m.	Grau Almero, *et al.* 2001: 208; Aranegui, *et al.* 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
39	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Common two-banded seabream	Diplodus vulgaris	Sparidae	marine	Benthopelagic, euryhaline species over rocky and sandy bottoms to 160 m; more common in less than 50 m. Young are sometimes found in seagrass beds.	Grau Almero, *et al.* 2001: 209; Aranegui, *et al.* 2007: 210-211	-	
40	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		(seabream)	Diplodus sp.	Sparidae	marine, freshwater, estuarine	A euryhaline demersal species inhabiting rocky and sometimes sandy bottoms to depths of 160 m, but more commonly in less than 50 m. The young are sometimes found in seagrass beds.	Grau Almero, *et al.* 2001: 209; Aranegui, *et al.* 2007: 210-211	-	
41	Lixus	Sondeos del Algarrobo y Olivo	3	Punico-Mauretanian		Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Grau Almero, *et al*. 2001: 210; Aranegui, *et al.* 2007: 210-211	-	
42	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		(seabream)	Pagrus sp.	Sparidae	marine, freshwater, estuarine	Demersal. Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, often above 150 m.	Grau Almero, *et al*. 2001: 210; Aranegui, *et al.* 2007: 210-211	-	

Table 7.19. Fish bones finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
43	Lixus	Sondeos del Algarrobo y Olivo	3	Punico-Mauretanian		Common pandora	Pagellus erythrinus	Sparidae	marine	Found on inshore waters, on various bottom (rock, gravel, sand, mud and grass) to 200 m (Mediterranean) or 300 m (Atlantic) and move to deeper waters during winter.	Grau Almero, *et al*. 2001: 211; Aranegui, *et al.* 2007: 210-211	-	
44	Lixus	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Gilthead seabream	Sparus aurata	Sparidae	marine, estuarine	Demersal. Found in seagrass beds and sandy bottoms as well as in the surf zone to 30 m, but adults may occur to 150 m depth. In spring, present in coastal lagoons and estuaries.	Grau Almero, *et al*. 2001: 212; Aranegui, *et al.* 2007: 210-211	-	
45	Lixus	Sondeos del Algarrobo y Olivo	5	Punico-Mauretanian		(porgy)	-	Sparidae	marine	Rarely found in brackish and freshwater environments.	Grau Almero, *et al*. 2001: 212	-	
46	Lixus	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	(shark, ray, chimaera)	Chondricthys		marine	marine	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
47	Lixus	Sondeos del Algarrobo y Olivo	11	Punico-Mauretanian		(shark, ray, chimaera)	Chondricthys		marine	marine	Grau Almero, *et al*. 2001: 206; Aranegui, *et al.* 2007: 210-211	-	
48	Lixus	"superficial"	2	Roman	1st-3rd c. AD	Common dentex	Dentex dentex	Sparidae	marine, freshwater, estuarine	Demersal; mainly a marine fish, but sometimes brackish and freshwater. Found between 20-500 m depth; usually 5-50 m depth.	unpub.	P9: 22 23	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Found in a box with Roman ceramics, from Tarradell excavations.

Table 7.19. Fish bones finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
49	Lixus	Sondeo del Algarrobo	25	Roman		Great hammerhead or tope shark	Sphyrna mokarran or Galeorhinus galeus	Sphyrnidae or Triakidae	Hammerhead: marine, estuarine; Tope: marine	Hammerhead: coastal-pelagic, semi-oceanic, found inshore and offshore, over the continental shelves and in lagoons. Often bottom and reef associated at 1-80 m depth but up to 300 m depth. Tope: mainly demersal on continental and insular shelves, but also on the upper slopes, from near shore to 550 m.	unpub. (see Arangegui Gasco & Tarradell-Font 2001: 21-22; Belén, *et al.* 2001: 83-84 for date of this layer)	P10: 24-48	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Labelled: "Algarr. Estrat 7, 1'25-1'55 (1957)". This is a fused spine of 25 vertebrae.

Table 7.19. Fish bones finds from *Lixus*.

	ORIGIN	FIND LOCATION	PERIOD	PRODUCT	TITULUS PICTUS	READ AS	AMPHORA TYPE	REFERENCE
1	Lixus	Pompeii	Punico- Mauretanian/ Roman	Cordula	COD LIX VE EXCEL M. VALERI ABINNERICI	*Co(r)d(ula) Lix(itana) ve(tus)* *excel(lens)* *M(arci) Valeri Abinnerici*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5630; Cerri 2006: Cat. 2; Cerri 2007a: Fig. 7, no. 15; Liou & Rodríguez Almeida 2000: 13, n. 15; Manacorda 1977: 126 for amphorae type
2	Lixus	Pompeii	Punico- Mauretanian/ Roman	Cordula	COD LIX VET A[---]	*Co(r)d(ula) Lix(itana) ve(tus)* *a(nnorum) [---]*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5631; Cerri 2006: Cat. 3; Cerri 2007a: Fig. 7, no. 11; Liou & Rodríguez Almeida 2000: 13, n. 15; Manacorda 1977: 126 for amphorae type
3	Lixus	Pompeii	Punico- Mauretanian/ Roman	Cordula	C[---] LIX VE EXCELL SVMMA XXXX [---] [---]	*C[ordula] Lix(itana) ve(tus)* *excell(ens)* *summa(rum ?)* *XXXX* *[---]* *[---]*	Dressel 12 (Pompeii XIV)	*CIL* IV, 5632; Cerri 2006: Cat.4; Cerri 2007a: Fig. 7, no. 12; Liou & Rodríguez Almeida 2000: 13, n. 15
4	Lixus	Pompeii	Punico- Mauretanian/ Roman	Cordula	SVMMA EXCEL X[---] XXXX M. COSCONI SATVRNIN	*Co(r)d(ula) Lix(itana) v(etus)* *summa(rum)* *excel(lens)* *X[---]* *XXXX* *M(arci) Cosconi Saturnin(i)*	Dressel 12 (Pompeii XIV)	*CIL* IV, 5633; Cerri 2006: Cat. 5
5	Lixus	Pompeii	Punico- Mauretanian/ Roman	Cordula	COD LIXS EXCELL SVMMAR AIIIIA XXV C. PAPINI PLANTAES	*Co(r)d(ula) Lix<s>(itana)* *excell(ens)* *summar(um)* *(annorum trium)* *XXV* *C(ai) Papini Plantaes*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5636; Cerri 2006: Cat. 6; Cerri 2007a: Fig. 7, no. 13; Liou & Rodríguez Almeida 2000: 13, n. 15; Manacorda 1977: 126 for amphorae type
6	Lixus	Pompeii	Punico- Mauretanian/ Roman	Laccatum	LAC BES LIX A VET SVMMAR AAA CXL C. TERENTI PAVL[--]	*Lac(catum?) BES Lix(itanum)* *a(rgutum) vet(us)* *summar(rum?)* *(annorum trium)* *CXL* *C(ai) Terenti Paul(li)*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5648; Cerri 2006: Cat. 8; Cerri 2007a: Fig. 7, no. 19; Manacorda 1977: 126 for amphorae type
7	Lixus	Pompeii	Punico- Mauretanian/ Roman	Cordula	[---]D LIX VE [---]AR [---]II [---]VM LXXXX PROCVLI ET URBICI	*[Cor]d(ula) Lix(itana) ve(tus)* *[sum]ar(um?)* *[annorum duorum?]* *[---]um?* *LXXXX* *Procvli et Urbici*	Beltrán IIA (Pompeii VII)	*CIL* IV, 9369; Cerri 2006: Cat. 9; Cerri 2007a: Fig. 7, no. 9); Manacorda 1977: 126 for amphorae type

Table 7.20. Finds of *tituli picti* indicating *Lixus* products *(continued on next page)*.

	ORIGIN	FIND LOCATION	PERIOD	PRODUCT	TITULUS PICTUS	READ AS	AMPHORA TYPE	REFERENCE
8	Lixus	Pompeii	Punico-Mauretanian/ Roman	Cordula	CORD L ARG VE PENVAR SVMMAR AXIIIA CC ASPASIA POLIDDORI	*ve(tus)* *penuar(um)* *summar(um)* *(annorum) XIII* *CC* *Aspasia Poli<d>dori*	Beltrán IIA (Pompeii VII)	*CIL* IV, 9370; Cerri 2006: Cat. 10; Liou 1987: 66-67; Manacorda 1977: 126 for amphorae type
9	Lixus	Pompeii	Punico-Mauretanian/ Roman	Cordula (?)	CONDT ARG LI PENVAR CI AAA TRII	*Li(xitanum)* *penuar(um)* *CI* *(annorum trium?)*	Beltrán IIA (Pompeii VII)	*CIL* IV, 10286a; Cerri 2006: Cat. 12; Cerri 2007a: Fig. 7, no. 18; Liou & Rodríguez Almeida 2000: 13, n. 19; Manacorda 1977: 126 for amphorae type
10	Lixus	Pecio Gondolfo wreck	Punico-Mauretanian/ Roman	Cordula	COD PORT LIX VET EXCEL SVMMVR AIIIA	*Co(r)d(ula) port(uensis)* *Lix(itana) vet(us)* *excel(lens)* *summ(arum?)* *(annorum trium)*	Beltrán IIB	Liou & Rodríguez Almeida 2000: 11, n. 1; Cerri 2006: Cat. 15; Cerri 2007a: Fig. 7, no. 1; Liou 1987: 69
11	Lixus	Augst	Punico-Mauretanian/ Roman	Cordula	CORD LIX VET [---] SVM[-] EXCEL LXX M[---]	*Cord(ula) Lix(itana) vet(us)* *[penuarum]* *sum(marum)* *summa(rum)* *LXX* *M[---]*	Beltrán IIB	Martin-Kilcher 1994: P27 (4179), p. 404; Cerri 2006: Cat. 18; Cerri 2007a: Fig. 7, no. 10
12	Lixus	Mainz	Punico-Mauretanian/ Roman	Cordula	COD LIX VE EXCELL [---]M LXX PROCVLI ET VRB[-	*Co(r)d(ula) Lix(itana) ve(tus)* *excell(ens)* *[---]m(arum)?* *LXX* *Proculi et Urbici*	Indeterminate	Martin-Kilcher 1994: 564-565, n. 991, fig. 272.1; Cerri 2006: Cat. 21; Cerri 2007a: Fig. 7, no. 5
13	Lixus	Aquileia	Punico-Mauretanian/ Roman	Cordula	CORDL[...	*Cord(ula) L(ixitana)?*	Indeterminate	Liou & Rodríguez Almeida 2000: 13, n. 16; Cerri 2006: Cat. 23; Cerri 2007a: Fig. 7, no. 14; Liou 1987: 68, n. 25)
14	Lixus	Pecio Gondolfo wreck	Punico-Mauretanian/ Roman	?	..] ARG LIX VET EXCEL SUMM AIIIA [-] [---]M[---]	*...] Arg(uta) Lix(itana) vet(us)* *excel(lens)* *summ(arum)* *(annorum trium)* *[-]* *[tria nomina?]*	Beltrán IIA	Martínez Maganto 2007: 394-395, fig. 4; Cerri 2007a: Fig. 7, no. 2

Table 7.20. Finds of *tituli picti* indicating *Lixus* products *(continued on next page)*.

	ORIGIN	FIND LOCATION	PERIOD	PRODUCT	TITULUS PICTUS	READ AS	AMPHORA TYPE	REFERENCE
15	Lixus	Ladenburg	Punico-Mauretanian/ Roman	Cordula	CODLIX VET AIIIIA LXXX QFABIPHILARGYRI MAVRI	*Co(r)d(ula) Lix(itani)* *vet(us)* *(annorum quadrum ?)* *LXXX* *Q. Fabi Philargyri* *Mavri*	Beltrán IIA	CEIPAC no. 12020; Hahn 1988: 267 ff; Cerri 2007a: Fig. 7, no. 3
16	Lixus	Mainz	Punico-Mauretanian/ Roman	Cordula	CODLIXVET EXCELL SUM AAAA LXX PROCULI ET URBICI DOMESTICUS [---]IV LXXV	*Co(r)d(ula) Lix(itana) vet(us)* *excell(ens)* *summ(arum)* *(annorum quadrum ?)* *LXX* *Procvli et Urbici* *Domesticus* *[---]IV LXXV*	Beltrán IIA	Ehmig 2003: 257, n. 50; Cerri 2007a: Fig. 7, no. 4
17	Lixus	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD LIXDEM EXSCELL IIII LXXXIV PROCULIETURBICI	*co(r)d(ula) Lix(itani) dem?* *exscell(ens)* *IIII* *LXXXIV* *Procili et Urbici*	Beltrán IIA (Pompeii VII)	*CIL* IV, 9368; Liou & Rodríguez Almeida 2000: 13, n. 15; Cerri 2007a: Fig. 7, no. 8; Manacorda 1977: 126 for amphorae type

Table 7.20. Finds of *tituli picti* indicating *Lixus* products.

	ID (common name)	ID (scientific name)	Punico-Mauretanian	Roman	Late Roman	Context unknown
1	European eel	*Anguilla anguilla*	*			
2	meagre	*Argyrosomus regius*	*			
3	bogue	*Boops boops*	*			
4	white trevally	*Caranx dentex*	*			
5	"whale"	*Cetacea*				*
6	thicklip grey mullet	*Chelon labrosus*	*			
7	(shark, ray, chimaera)	*Chondricthys*	*			
8	(herring, sardine, shad, mehaden)	*Clupeidae*	*			
9	common dentex	*Dentex dentex*		*		
10	Canary dentex	*Dentex canariensis*	*			
11	pink dentex	*Dentex gibbosus*	*			
12	(dentex)	*Dentex sp.*	*			
13	European seabass	*Dicentrarchus labrax*	*			
14	spotted seabass	*Dicentrarchus punctatus*	*			
15	(seabass)	*Dicentrarchus sp.*	*			
16	annular seabream	*Diplodus annularis*	*			
17	white seabream	*Diplodus sargus*	*			
18	(seabream)	*Diplodus sp.*	*			
19	common two-banded seabream	*Diplodus vulgaris*	*			
20	flathead mullet	*Mugil cephalus*	*			
21	(mullet)	*Mugilidae*	*			
22	Mediterranean moray	*Muraena helena*	*			
23	saddled seabream	*Oblada melanura*	*			
24	common pandora	*Pagellus erythrinus*	*			
25	(bream, porgy, pandora)	*Pagellus sp.*	*			
26	common seabream	*Pagrus pagrus*	*			
27	(seabream)	*Pagrus sp.*	*			
28	bastard grunt	*Pomadacys incisus*	*			
29	bluefish	*Pomatomus saltator*	*			
30	European pilchard	*Sardina pilchardus*	*			
31	spanish/chub mackerel	*Scomber japonicus*	*			
32	(mackerel)	*Scomber sp.*	*			
33	"tunny"	*Scombridae*				*
34	(porgy)	*Sparidae*	*			
35	gilthead seabream	*Sparus aurata*	*			
36	great hammerhead or tope shark	*Sphyrna mokarran* or *Galeorhinus galeus*		*		
37	bluefin tuna	*Thunnus thynnus*	*	*		
38	Atlantic horse mackerel	*Trachurus trachurus*	*			
TOTAL: 38 SPECIES			34	3	0	2

Table 7.21. Fish species (and *tituli picti*-associated species) from *Lixus*, by period.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
1	Lixus	on beach	*	Context unknown	?	"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Murex" are mentioned as being found frequently on the beach, but no species or chronology is given.
2	Lixus		1	Context unknown		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P32: 138	Present location: Musée Archéologique, Tetouan.
3	Lixus		1	Context unknown		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub.	P32: 139	Present location: Musée Archéologique, Tetouan.
5	Lixus		1	Context unknown		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	unpub.	P32: 140	Present location: Musée Archéologique, Tetouan.
4	Lixus		2	Context unknown		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub.	P33: 141-142	Present location: Musée Archéologique, Tetouan. Labelled: "Lixus, material that was on display in Larache."
6	Lixus		1	Context unknown		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P34: 143	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, 1955. In box with mixed ceramics.
7	Lixus	Sondeo del Olivo	1	Punico-Mauretanian	80/50 BC-AD 17	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Grau Almero, *et al.* 2001: 224	-	
8	Lixus	Ladera sur	1	Punico-Mauretanian	AD 10-40	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Sagrario Carrasco Porras 2005: 256-257	-	UE 2025; dating for this level was taken from p. 31, fig. 50

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
9	Lixus	Ladera sur	4	Punico-Mauretanian	80-10 BC	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Sagrario Carrasco Porras 2005: 256-257	-	UE 2033, UE 2035; dating for this level was taken from p. 31, fig. 50
10	Lixus	Sondeo del Olivo	1	Punico-Mauretanian	80/50 BC-AD 16	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Grau Almero, *et al.* 2001: 224-225	-	some have evidence of being burned
11	Lixus	Ladera sur	146	Punico-Mauretanian		common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Aranegui Gascó, *et al.* 2006: 362; Sagrario Carrasco Porras 2005: 256-257, 259-260	-	In UE 3033, a Mana C2b amphora was found with shells of this species preserved (count: 28 - UE 3033 dated 50-20 BC) Was found with grape seeds in amphora, so maybe vinegar was used as preservative and this represents a type of salted product. Shells have discoloration similar to that produced by vinegar, and this technique is mentioned by Apicus (I,XII). Some have evidence of being burned.
12	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Sagrario Carrasco Porras 2005: 256-257, 261	-	here thinks it might also be a part of a musical instrument (por la truncadura del ápice)
13	Lixus	Ladera sur	1	Punico-Mauretanian	AD 10-40	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	Sagrario Carrasco Porras 2005: 256-257	-	UE 2025; dating for this level was taken from p. 31, fig. 50
14	Lixus	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Striped venus clam	Chamelea gallina	Bivalve	marine, intertidal infratidal	sand and muddy sand from the lower shore to ca. 55 m depth	Sagrario Carrasco Porras 2005: 256-257	-	

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
15	Lixus	Sondeo del Olivo	1	Punico-Mauretanian	80/50 BC-AD 18	Violet bittersweet (1)	Glycymeris gaditanus	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Grau Almero, *et al.* 2001: 224, 226	-	Publication indicates these were not for food - at least one example had performation (hole) near its hinge
16	Lixus		1	Punico-Mauretanian		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P35: 144	Present location: Musée Archéologique, Tetouan. Labelled: "Lixus (Box 16 [?])". Found with early ceramics, sigillatas.
17	Lixus		1	Punico-Mauretanian		cowrie	Cyprea sp.	Gastropod	marine, intertidal, infratidal	rocky shorelines, reefs	unpub.	P36: 145	Present location: Musée Archéologique, Tetouan. Labelled: "Lixus (Box 14 [?]). Bag 90 '86'". Found in bag with lots of terra sigillata.
18	Lixus		1	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub.	P37: 146	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 1958 "costal muralla angulo muros 2º, camara 11". In box with lots of terra sigillata.
19	Lixus		1	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub.	P38: 147	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 1958 "camara 13". In box with lots of terra sigillata.
20	Lixus	Ladera sur	1	Punico-Mauretanian	1st c. AD	Violet bittersweet (2)	Glycymeris violacescens	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Sagrario Carrasco Porras 2005: 256-257	-	

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
21	Lixus	Ladera sur	1	Punico-Mauretanian	200-175/150 BC	carpet-shelled clam	Venerupis decussata	Bivalve	marine, infratidal	sandy and gravel bottoms in coastal zones and coastal lagoons from low tide to 40 m	Sagrario Carrasco Porras 2005: 256-257	-	from UE 3003; dating of this level taken from Fig. 54, p. 32
22	Lixus	Ladera sur	1	Punico-Mauretanian	130-80 BC	Checkered carpet shell	Tapes decussatus	Bivalve	marine, estuarine, intertidal	mud and rocky habitats, lower to sub-tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	
23	Lixus	Sondeo del Algarrobo	8	Punico-Mauretanian	175/159 BC-80/50 BC	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Grau Almero, et al. 2001: 224	-	
24	Lixus	Ladera sur	6	Punico-Mauretanian	325-225 BC	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Sagrario Carrasco Porras 2005: 256-257	-	UE 3006, UE 3012, UE 3015, UE 3024; dating for this level was taken from p. 30, fig. 49, p. 31, fig. 51, p. 32, fig. 54
25	Lixus	Sondeo del Algarrobo	18	Punico-Mauretanian	175/159 BC-80/50 BC	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Grau Almero, et al. 2001: 224-225	-	some have evidence of being burned
26	Lixus	Sondeo del Algarrobo	5	Punico-Mauretanian	175/159 BC-80/50 BC	marine snail	Monodonta turbinata	Gastropod	marine, intertidal, infratidal	rocky littorals below the level of low tide	Grau Almero, et al. 2001: 224	-	
27	Lixus	Ladera sur	1	Punico-Mauretanian	3rd-4th c. AD	marine snail	Monodonta turbinata	Gastropod	marine, intertidal, infratidal	rocky littorals below the level of low tide	Sagrario Carrasco Porras 2005: 256-257	-	
28	Lixus	Ladera sur	24	Punico-Mauretanian	2nd c. BC-1st c. AD	marine snail	Monodonta turbinata	Gastropod	marine, intertidal, infratidal	rocky littorals below the level of low tide	Sagrario Carrasco Porras 2005: 256-257	-	

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
29	Lixus	Ladera sur	1	Punico-Mauretanian	325-225 BC	oyster	Ostrea edulis	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Sagrario Carrasco Porras 2005: 256-257	-	UE 3016; dating was taken from p. 31, fig. 50
30	Lixus	Ladera sur	2	Punico-Mauretanian	200-175/150 BC	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	Sagrario Carrasco Porras 2005: 256-257	-	UE 3010; dating for this level was taken from p. 32, fig. 54
31	Lixus	Sondeo del Algarrobo	1	Punico-Mauretanian	175/159 BC-80/50 BC	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Grau Almero, *et al.* 2001: 224-225	-	this is identified as Pliny's "trumpet shell" (buccinum) that did not yield a fast dye alone and was mixed with other murex species (pelagia) for dying (Ziderman 1990: 99) Some were fractured at Lixus, indicating use of their dye gland
32	Lixus	Ladera sur	1	Punico-Mauretanian	4th-3rd c. BC	Safian limpet	Patella nigra	Gastropod	marine, intertidal, infratidal	hard surfaces	Sagrario Carrasco Porras 2005: 256-257, 259	-	
33	Lixus	Ladera sur	1	Punico-Mauretanian	4th-3rd c. BC	Smooth venus clam/Callista	Callista chione	Bivalve	marine, infratidal	sandy and muddy bottoms, from below infralittoral to 180 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
34	Lixus	Sondeo del Algarrobo	1	Punico-Mauretanian	175/159 BC-80/50 BC	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Grau Almero, *et al.* 2001: 224	-	several pierced for decoration
35	Lixus	Ladera sur	1	Punico-Mauretanian	4th c. BC-175 BC	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Sagrario Carrasco Porras 2005: 256-261	-	some of these has a hole near their hinge

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
36	Lixus	Ladera sur	1	Punico-Mauretanian	2nd c. BC	Violet bittersweet (2)	Glycymeris violacescens	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
37	Lixus	Ladera sur	11	Punico-Mauretanian	4th c. BC-175 BC	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Sagrario Carrasco Porras 2005: 254, 256-257	-	some have evidence of being burned
38	Lixus	Ladera sur	1	Punico-Mauretanian	4th c. BC - 175 BC(?)	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Sagrario Carrasco Porras 2005: 256-257, 261	-	
39	Lixus	Ladera sur	3	Punico-Mauretanian	4th c. BC-175 BC	Red-mouthed rock shell (2)	Stramonita haemastoma	Gastropod	marine, intertidal, infratidal	rocky shores to below the tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	
40	Lixus		1	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Tarradell 1958: 372-375 (for date)	P39: 148	Present location: Musée Archéologique, Tetouan. Labelled: Lixus (Box 17 [?]), "Lixus 1957, C-2, Estr. 19/20".
41	Lixus	Ladera sur	18	Punico-Mauretanian	2nd c. BC-1st c. AD	Red-mouthed rock shell (2)	Stramonita haemastoma	Gastropod	marine, intertidal, infratidal	rocky shores to below the tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	
42	Lixus	Ladera sur	13	Punico-Mauretanian	2nd c. BC-1st c. AD	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Sagrario Carrasco Porras 2005: 256-260	-	some of these has a hole near their hinge
43	Lixus		2	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub.	P40: 149-150	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
44	Lixus		1	Punico-Mauretanian		China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	unpub.	P40: 151	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
45	Lixus		1	Punico-Mauretanian		clam	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub.	P40: 152	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
46	Lixus		1	Punico-Mauretanian		common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	unpub.	P40: 153	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
47	Lixus		1	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub.	P40: 154	Present location: Musée Archéologique, Tetouan. Kown as food (Athenaus, Dein. III, 85 D). Found in box with lots of black glaze ceramics.
48	Lixus		1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub.	P40: 155	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
49	Lixus		1	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub.	P40: 156	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
50	Lixus		1	Punico-Mauretanian		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	unpub.	P41: 157	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, 1978 (?). Found in a box with blaze glaze ceramics. Large example - over 20 cm L.
51	Lixus	Ladera sur	1	Punico-Mauretanian	1st c. BC	Violet bittersweet (2)	Glycymeris violacescens	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
52	Lixus	"Habitacion No. 3 mas bajo que la roeda"..	1	Roman		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P42: 158	Present location: Musée Archéologique, Tetouan. Labelled: Lixus "Habitacion No. 3 mas bajo que la roeda".. (Likely Maison des Trois Grâces under the Tangier-Larache road)
53	Lixus	"cata peristilo MyR nivel cocina"	1	Roman		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 159	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
54	Lixus	"cata peristilo MyR nivel cocina"	1	Roman		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 160	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
55	Lixus	"cocina 2º dep 1er nivel" Mars y Rea (?)	1	Roman		China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P45: 171	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations), "cocina 2º dep 1er nivel". (Assumed same as house of Mars and Rea).
56	Lixus	"cata peristilo MyR nivel cocina"	1	Roman		China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 161	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
57	Lixus	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 167	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
58	Lixus		1	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P46: 175	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, “Box 12j”; box has much Roman material.
59	Lixus	casa “Helios”	2	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 176-177	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124. Labelled: Lixus, “Helios” (Likely house with Helios mosaic. Also house 50?).
60	Lixus	“cata peristilo MyR nivel cocina”	1	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 162	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) “cata peristilo MyR nivel cocina” (house of Mars and Rea). (Peristyle feature Flavian).
61	Lixus		1	Roman		cowrie	Cyprea sp.	Gastropod	marine, intertidal, infratidal	rocky shorelines, reefs	unpub.	P46: 173	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, “Box 12j”; box has much Roman material.
62	Lixus	casa “Helios”	1	Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 178	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124 .Lixus, “Helios” (Likely house with Helios mosaic. Also house 50?).

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
63	Lixus	"cata peristilo MyR nivel cocina"	2	Roman		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 163-164	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
64	Lixus	"cata peristilo MyR nivel cocina"	1	Roman		Mediterranean bonnet	Cassis undulata	Gastropod	marine, intertidal, infratidal	offshore sandy bottoms	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 165	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
65	Lixus	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		oyster	ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 168	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).
66	Lixus	casa "Helios"	1	Roman		oyster	ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 179	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124. Labelled: Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
67	Lixus	"cata peristilo MyR nivel cocina"	1	Roman		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 166	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
68	Lixus	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 169	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).
69	Lixus	casa "Helios"	1	Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 180	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124. Labelled: Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).
70	Lixus	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 170	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
71	Lixus	"cocina 2º dep 1er nivel" Mars y Rea (?)	1	Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P45: 172	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations), "cocina 2º dep 1er nivel". (Assumed same as house of Mars and Rea).
72	Lixus	casa "Helios"	1	Roman		Safian limpet	Patella nigra	Gastropod	marine, intertidal, infratidal	hard surfaces	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 181	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124 .Lebelled: Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).
73	Lixus		1	Roman		coral	Dendrophillia ramea (?)	Scleractinia (order)	marine, infratidal	attached to rocks, usually around 40 - 110 m depth	unpub.	P46: 174	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Box 12j"; box has much Roman material. Coral fragment, possibly similar to type found at Ceuta: *Dendrophillia Ramea* (no common name). No common name for this coral type. Trunk is red/red-orange colour when alive.
74	Lixus	Ladera sur	6	Late Roman	3rd-4th c. AD	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Sagrario Carrasco Porras 2005: 254, 256-257	-	some have evidence of being burned
75	Lixus	Ladera sur	1	Late Roman	3rd-4th c. AD	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Sagrario Carrasco Porras 2005: 256-257, 261	-	

Table 7.22. Marine invertebrate finds from *Lixus (continued on next page).*

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
76	Lixus	Ladera sur	1	Late Roman	3rd-4th c. AD	Lurid cowrie, Fallow cowrie	Luria lurida	Gastropod	marine, infratidal	rocky depths	Sagrario Carrasco Porras 2005: 256-257	-	
77	Lixus	Ladera sur	6	Late Roman	3rd-4th c. AD	Red-mouthed rock shell (2)	Stramonita haemastoma	Gastropod	marine, intertidal, infratidal	rocky shores to below the tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	
78	Lixus	Ladera sur	3	Late Roman	3rd-4th c. AD	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Sagrario Carrasco Porras 2005: 256-259	-	some of these has a hole near their hinge

Table 7.22. Marine invertebrate finds from *Lixus.*

	ID (common name)	ID (scientific name)	Punico-Mauretanian	Roman	Late Roman	Context unknown
1	tuberculate cockle	*Acanthocardia tuberculata*	*		*	
2	smooth venus clam/Callista	*Callista chione*	*			
3	cockle	*Cardium* (*Cardidae* family)	*	*		
4	Mediterranean bonnet	*Cassis undulata*		*		
5	striped venus clam	*Chamelea gallina*	*			
6	knobbed triton	*Charonia lampas*	*	*	*	
7	cowrie	*Cyprea sp.*	*	*		
8	bittersweet	*Glycymeridae* (family)		*		*
9	violet bittersweet (1)	*Glycymeris gaditanus*	*			
10	violet bittersweet (2)	*Glycymeris violacescens*	*			
11	lurid cowrie	*Luria lurida*			*	
12	marine snail	*Monodonta turbinata*	*			
13	spiny dye-murex	*Murex (bolinus) brandaris*	*			*
14	banded dye-murex	*Murex trunculus*	*	*		
15	“murex”	*Muricidae* (family)				*
16	common mussel	*Mytilus edulis*	*		*	
17	oyster	*Ostrea edulis*	*			
18	oyster	*Ostrea sp.*	*	*		*
19	China limpet	*Patella aspera*	*	*		
20	rayed Mediterra-nean limpet	*Patella caerulea*	*	*		*
21	Safian limpet	*Patella nigra*	*	*		
22	scallop	*Pectinidae* (family)	*			
23	red-mouthed rock shell (1)	*Purpura (Thais) haemastoma*	*	*		
24	red-mouthed rock shell (2)	*Stramonita haemastoma*	*		*	
25	checkered carpet shell	*Tapes decussatus*	*			
26	clam	*Veneridae* (family)	*			
27	carpet-shelled clam	*Venerupis decussata*	*			
28	coral	*Dendrophillia ramea* (?)		*		
TOTAL: 28 SPECIES			23	12	5	5

Table 7.23. Marine invertebrate species from *Lixus*, by period.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
1	Lixus		1	Context unknown		fish hook	bronze	fishing	unpub.	P59: 242	1 medium hook. Present location: Musée Archéologique, Tetouan.
2	Lixus		2	Context unknown		navette	bronze	net making/ repair	unpub.	P60: 243-244	Tang widths: 0.4 cm, 0.3 cm. Present location: Musée Archéologique, Larache, Inv. LR.79.138 (both examples).
3	Lixus		3	Context unknown		net weight	terracotta	fishing	unpub.	P61: 245-247	Labelled "viejos fundos". Bun-shaped medium (2) and large (1) weights with two holes. Present location: Musée Archéologique, Tetouan.
4	Lixus		1	Context unknown		net weight	terracotta	fishing	unpub.	P62: 248	Labelled "viejos fundos". Trapezoida-shaped large l weight. Present location: Musée Archéologique, Tetouan.
5	Lixus		5	Context unknown		net weight	terracotta	fishing	unpub.	P63: 249-253	Trapezoidal- and tombstone-shaped large (4) and incomplete (1) weights. Present location: Musée Archéologique, Tetouan.
6	Lixus		1	Context unknown		net weight	terracotta	fishing	unpub.	P64: 254	Bun-shaped large weight. Present location: Musée Archéologique, Larache, Inv. LR.79.131.
7	Lixus		1	Context unknown		net weight	terracotta	fishing	unpub.	P65: 255	Trapezoidal-shaped large weight. Present location: Musée Archéologique, Larache, Inv. LR.79.131.
8	Lixus		1	Context unknown		net weight	lead	fishing	unpub.	P66: 256	Lead sphendonoidal (pod)- shaped medium weight. Material that was on display in Larache. Present location: Musée Archéologique, Tetouan.
9	Lixus		1	Context unknown		net weight	stone	fishing	unpub.	P67: 257	Bun-shaped large weight of stone with single hole, labelled "viejos fundos". Present location: Musée Archéologique, Tetouan.

Table 7.24. Fishing equipment finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
10	Lixus		1	Context unknown		net weight	stone	fishing	unpub.	P68: 258	Doughnut-shaped large weight of marble with single hole, labelled "viejos fundos". Present location: Musée Archéologique, Tetouan.
11	Lixus	"cata pie muralla romana oeste"	1	Punico-Mauretanian		net weight	terracotta	fishing	unpub. (see Tarradell 1958: 372, 375 for dates)	P69: 259	Labelled "cata pie muralla romana oeste". Doughnut-shaped medium weight. Present location: Musée Archéologique, Tetouan.
12	Lixus	"Cata la Muralla"	2	Punico-Mauretanian	ca. 2nd c. BC	fish hook	bronze	fishing	unpub. (see Tarradell 1958: 372, 375; Belén, *et al.* 1996: 341; Arharbi 2003: 80 for dates)	P70: 260-261	2 small hooks. Labelled "Cata de la Muralla de grandes bloques, 1955". Present location: Musée Archéologique, Tetouan.
13	Lixus	"hab. 20 y 21"	1	Punico-Mauretanian		fish hook	bronze	fishing	Tarradell 1959: 65-66; Ponsich 1981: 62, fig. 15; Brouquier-Reddé, *et al.* 2006: 2162 for date	P71: 262	1 medium hook. Labelled "hab. 20 y 21". Present location: Musée Archéologique, Tetouan.
14	Lixus	"Muralla – cota 1º, 2º nivel 2º"	1	Punico-Mauretanian	ca. 2nd c. BC	weight	lead	fishing	unpub. (see Tarradell 1958: 372, 375 for dates)	P72: 263	Labelled "Muralla – cota 1º, 2º nivel 2º". Lead pyramidal-shaped large weight. Present location: Musée Archéologique, Tetouan, Inv. 78-2-01.
15	Lixus	"hab. 20 y 21"	1	Punico-Mauretanian		navette	bronze	net making/ repair	unpub. (see Tarradell 1959: 65-66; Ponsich 1981: 62, fig. 15; Brouquier-Reddé, *et al.* 2006: 2162 for date)	P73: 264	Tongs not preserved. Labelled "hab. 20 y 21". Present location: Musée Archéologique, Tetouan.
16	Lixus	Sondeo del Olivo/ Sondeo del Algarrobo	1	Punico-Mauretanian	90/80 BC - 10 AD	gorge	bone	fishing	Aranegui Gascó, *et al.* 2006: 363-364, Fig. 22b	-	Identified as a fish hook, type is a gorge. Ca. 5.5 cm L.
17	Lixus	Sondeo del Olivo/ Sondeo del Algarrobo	1	Punico-Mauretanian	90/80 BC - 10 AD	net weight	terracotta	fishing	Aranegui Gascó, *et al.* . 2006: 363-364, Fig. 21	-	Doughnut-shaped weight, 7 cmø. Inv. Lix. 2.01.2008.269. No weight given.
18	Lixus	Complex 5	8	Roman	1st c.- 4th c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 24 (see Habibi 2007: 186 for date of complex only up to 4th c. AD)	P74: 265-272	5 small hooks; 1 medium hook; 2 large hooks. Present location: Musée Archéologique, Larache, Inv. LR.79.136 (all 8).

Table 7.24. Fishing equipment finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
19	Lixus	Complex 5	1	Roman	1st c.- 4th c. AD	needle	bronze	net making/ repair	Ponsich and Tarradell 1965: 24	P75: 273	Present location: Musée Archéologique, Larache, Inv. LR.79.137. Inventoried as "fisherman's needle".
20	Lixus	Complex 5	8	Roman	1st c.- 4th c. AD	needle	bone	net making/ repair	Ponsich & Tarradell 1965: 24	P76: 274-281	Square-headed and pointed needles. Present location: Musée Archéologique, Tetouan, Inv. L- 44 - L-47, L-49 - L-50, L-52 - L-53. See Habibi (2007: 186) for date of complex only up to 4th c. AD
21	Lixus		2	Roman		fish hook	bronze	fishing	unpub.	P77: 282-283	2 small hooks. Material that was on display in Larache. Present location: Musée Archéologique, Tetouan.
22	Lixus		1	Roman		net weight	terracotta	fishing	unpub. (no photo)	-	Truncated cone-shaped small weight. Material that was on display in Larache. Present location: Musée Archéologique, Tetouan.
23	Lixus	"Habitacion No. 3"	1	Roman		fish hook	bronze	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P78: 284	1 small hook. Labelled "Habitacion No. 3 mas bajo que la roeda" (Likely Maison des Trois Grâces under the Tangier-Lixus road). Present location: Musée Archéologique, Tetouan.
24	Lixus		1	Roman		net weight	terracotta	fishing	unpub.	P79: 285	In box labelled "12j". Tube-shaped small weight. Box has much Roman material in it. Present location: Musée Archéologique, Tetouan, Inv. 55j.
25	Lixus	"Habitacion No. 3"	1	Roman		net weight	terracotta	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P80: 286	Labelled "Habitacion No. 3 mas bajo que la roeda" (Likely Maison des Trois Grâces under the Tangier-Lixus road). Trapezoidal-shaped large weight with two holes. Present location: Musée Archéologique, Tetouan.

Table 7.24. Fishing equipment finds from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
26	Lixus	"Habitacion No. 3"	1	Roman		net weight	lead	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P81: 287	Labelled "Habitacion No. 3 mas bajo que la roeda" (Likely Maison des Trois Grâces under the Tangier-Lixus road). Lead doughnut-shaped medium weight. Present location: Musée Archéologique, Tetouan.
27	Lixus	"cata peristilo M y R nivel hogar"	1	Roman		net weight	terracotta	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P82: 288	Labelled "cata peristilo M y R nivel hogar". Disc-shaped medium weight with central hole. Inv. 154/607. Present location: Musée Archéologique, Tetouan.

Table 7.24. Fishing equipment finds from *Lixus*.

HOOK-AND-LINE FISHING	Punico-Mauretanian	Roman	Late Roman	Context unknown
fish hook	*	*		*
line weight	*			
gorge	*			
NET FISHING				
net weight	*	*		*
needle		*		
navette	*			*

Table 7.25. Fishing equipment finds from *Lixus,* by period.

COMPLEXES:	CHRONOLOGY:
Complex 1	AD 40/60 – early 6th c. AD[1]
Complex 2	late 1st/early 2nd – 4th/5th c. AD; mid-to late 2nd c. for remodelling[2]
Complex 3	1st – mid-6th c. AD; remodelling in 4th c. AD[3]
Complex 4	1st – 4th c. AD[4]
Complex 5	1st – 4th c. AD; hiatus and reduction in the late 3rd c. AD[5]
Complex 6	Late 1st – late 6th/early 7th c. AD; reduction of vats and additions of cisterns in late 3rd/early 4th c. AD[6]
Complex 7	1st – late 4th c. AD; remodelling and reduction in the early 4th c. AD[7]
Complex 8	1st – 6th c. AD[8]
Complex 9	AD 60 – 7th c. AD; several phases of remodelling and reduction beginning in first half of the 5th c. AD[9]
Complex 10	second half of 1st – 6th c. AD; hiatus and re-use in the 5th c. AD[10]

Table 7.26. Chronologies of the fish-salting complexes at *Lixus*.

[1] Ponsich &Tarradell (1965: 11-15) and Ponsich (1988: 103-105) give date of construction as late 1st century BC; Habibi (2007: 184) gives construction date in 1st century AD; Villaverde Vega (1992: 346) gives date of abandonment as 4th/5th centuries.

[2] Ponsich &Tarradell 1965: 15; Ponsich 1988: 105-107; coin of Trajan under floor, so *terminus post quem* for remodelling (Habibi 2007: 184).

[3] Ponsich & Tarradell 1965: 17-18; Ponsich 1988: 107-108; Habibi 2007: 184-185 for re-analysis.

[4] Initial dates given in Ponsich & Tarradell (1965: 18-22) are 1st century BC-6th century AD; in Ponsich (1988: 108-110), dates given as 1st-6th/7th centuries AD. 1st century AD date also given by Habibi (2007: 185), who also states that most recent material dates to the 4th century AD.

[5] Ponsich & Tarradell 1965: 22-24; Ponsich (1988: 110-112) gives a date of use until the 6th century AD; Habibi (2007: 186) dates material up to 4th century AD. Villaverde Vega (1992: 346) gives date of abandonment as 6th century.

[6] Ponsich & Tarradell 1965: 24-27; Ponsich (1988: 112-12) dates abandonment to 5th/early 6th centuries; Habibi (2007: 186) extends occupation until late 6th/early 7th centuries. Villaverde Vega (1992: 346) gives date of abandonment as late 5th/early 6th centuries.

[7] Ponsich (1988: 121) gives dates of 1st-5th/6th centuries AD; Habibi (2007: 186) believes complex was abandoned in the late 4th century (see do Ponsich & Tarradell 1965: 28-30), on account of old chronology of ARSW D (but not known if this is D1 or D2 – dated to 6th century in any event, see Bernal, *et al.* 2002: 56); for this chronology extending to the 6th century with *Lixus* finds from Lader Sur, see Fumadó Ortega & Mlilou 2005: 75-77. Villaverde Vega (1992: 346) gives date of abandonment as early 6th century.

[8] Ponsich & Tarradell 1965: 31-32; Ponsich 1988: 121-129; Habibi 2007: 186

[9] Ponsich & Tarradell (1965: 33-35) give dates of operation as 1st-6th centuries AD; Ponsich (1988: 129) gives dates of 1st century BC-7th century, with modifications in the late 2nd/early 3rd centuries AD. Habibi (2007: 188-189) gives construction date of ca. AD 60, with modifications in first half of the 5th century.

[10] Ponsich & Tarradell (1965: 35-37) give date of re-use/remodelling in the 3rd century. Ponsich (1988: 129-133) compares this complex to chronology of Complex 6. Habibi (2007: 189) gives date of re-use of *cetariae* in the 5th century.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
1	*Lixus*	Factory no. 6	floor near vats	"amphoras"	Context unknown	*	"fragments"	Ponsich & Tarradell 1965: 27	No mention of exact type or how many.
2	*Lixus*	"Sondeo del Olivio"	punico-mauretanian III	Dressel 18	Punico-Mauretanian	24	24 rim frags. (= 12 complete amphorae)	Caruana, *et al.* 2001: 182, Table 1, fig. 4	This represents 21.81% of amphorae in the punico-mauretanian III layer. Date for these finds from authors, who date the layer specifically.
3	*Lixus*			Dressel 18	Punico-Mauretanian	120	complete amphorae; number based on fragments	Hassini 2001: 41-44 (D. no. 222-241), 160-163 (Tables 5-8)	Kouass certain production site (mis-fire, Inv. Kos. 2215) in kiln 3 (Mlilou 1991: 67-68), but Boube (1987-88: 191) notes a mis-fire in Volubilis and in level D at Sala as evidence of other production locations. Probably also made in the Tanger region or at Banasa (Ponsich 1970: 187). Represents 18.75% of amphorae from site. Fragment numbers unclear in Table 8 to make breakdown.
4	*Lixus*	acropolis, temple F	cistern	Dressel 18	Punico-Mauretanian	*		Ponsich 1981: 82, fig. 26; Brouquier-Reddé, et al. 2006: 2164	These are called by Ponsich "tete de cheval" or Kouass IV types (8 rims are shown in fig. 26).
5	*Lixus*	"Sondeo del Algarrobo"	punico-mauretanian levels, foundation trenches	Mañá C2a	Punico-Mauretanian	2	"possible examples"	Bonet Rosado, et al. 2001:: 66-67	Aka Ramon T-7-4-2-1, T-7.4.3.1. Origin identified as central Mediterranean by petrographic analysis. Distributed before the fall of Carthage. Presence at Lixus signifies contacts with city to authors.
6	*Lixus*	Ladera Sur		Mañá C2b/Dressel 18	Punico-Mauretanian	304	frags.	Bonet Rosado, *et al*. 2005: 107, 109, 112, 114-115, 123-125	One of these, from the "Mauritania media " level (50 BC-AD 10) has a fish graffito on its shoulder
7	*Lixus*	"Sondeos del Algarrobo/Olivo "	punico-mauretanian II	Mañá C2b/Dressel 18	Punico-Mauretanian	5	rim frags.	Izquierdo Peraile, *et al*. 2001: 159, fig. 2	No exact numbers given for these, derived from figure 2. Not clear if these are C2b or C2a types. Seem to be the former, given the figures, and they call them this in the concluding remarks. Is this in Olive tree trench?

Table 7.27. Finds of salazón amphorae from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
8	*Lixus*	"Sondeo del Algarrobo"	punico-mauretanian levels, foundation trenches	Mañá C2b/Dressel 18	Punico-Mauretanian	3	"examples"	Bonet Rosado, et al. 2001: 65-66	Aka Ramon T-7.4.3.3, Munoz F1. 3 examples at Lixus total. Say fabrication in other places in Morocco other than Kouass not really known (Ponsich 1968; Mlilou 1991: 60-71). Production of this type not attested at Lixus.
9	*Lixus*	"Sondeo del Algarrobo"	"occupation layers"	Mañá C2b/Dressel 18	Punico-Mauretanian	2	"examples"	Bonet Rosado, et al. 2001:68	Represent 7.6% (of amphorae found in this layer?).
10	*Lixus*	unknown		Mañá-Pascual A4	Punico-Mauretanian	110	frags.	Hassini 2001: 32 (D no. 169-171; D no. 172-180), 96-103, 160-163 (Tables 5-8); Ponsich 1981: 80	Ramon T-11.2.1.6 sub-type. Ramon Torres 1995: 237. Mana types represent 15.93% of amphorae at site (102 Mana amphorae based on frags.).
11	*Lixus*	Ladera Sur		Mañá-Pascual A4	Punico-Mauretanian	70	frags.	Bonet Rosado, *et al*. 2005: 107, 112, 114-115	Identified as Ramon G-12.1.0.0 (Mañá-Pascual A4).
12	*Lixus*	"Sondeos del Algarrobo/Olivo"	punico-mauretanian I	Mañá-Pascual A4	Punico-Mauretanian	1	rim frag.	Izquierdo Peraile, *et al*. 2001: 159	From excavations between 1995-1999. Says this one is found in this punico-mauretanian level, bringing the level's date into the 2nd c. BC. Identified as Ramon T-12.1.1.1 sub-group. Is this in Olive tree trench?
13	*Lixus*	"Sondeo del Algarrobo"	"occupation layers"	Dressel 7	Punico-Mauretanian	1	"example"	Bonet Rosado, *et al.* 2001:68	"Inagural type" of the Dr. 7-11 type. Dr. 7a made in Cadiz area. This example is considered an intrusion into the excavated layers.
14	*Lixus*	"Sondeo del Olivio"	punico-mauretanian III	Mañá-Pascual A4	Punico-Mauretanian	3	3 rim/neck frags. (= 2 complete amphorae)	Caruana, *et al.* 2001: 182, Table 1, fig. 5	This represents 3.63% of amphorae in the punico-mauretanian III layer. Date for these finds from authors, who date the layer specifically. No mention of why these types are thought to be present in layer.

Table 7.27. Finds of salazón amphorae from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
15	*Lixus*	"Sondeo del Algarrobo"	punico-mauretanian levels, foundation trenches	Mañá-Pascual A4	Punico-Mauretanian	*		Bonet Rosado, et al. 2001: 63-65, 68	"Largely represented", and these correspond to Ramon T-11.2.1.0 sub-group (Ponsich III). Some made into 1st c. BC, according to authors (Ramon Torres 1995: 238-239). No exact numbers given, just that the fragments represent 34% (of amphorae found in this layer?).
16	*Lixus*			Beltran IIB	Punico-Mauretanian/Roman	9	complete amphorae; number based on fragments	Hassini 2001: 48-49, 81 (D. no. 350-351), 96-103, 160-163 (Tables 5-8)	Represents 1.40% of amphorae from site. Rare type at site.
17	*Lixus*	Ladera Sur		Beltran IIB	Punico-Mauretanian/Roman	*		Bonet Rosado, *et al.* 2005: 125, 129, fig. 23	No exact numbers given, but mentioned as very rare type at site: "1-2% of finds from Roman layers"
18	*Lixus*	"Sondeo del Olivio"	punico-mauretanian III	Dressel 7-11	Punico-Mauretanian/Roman	54	41 rim/neck frags.; 8 handles; 5 toes (= 21 complete amphorae)	Caruana, *et al.* 2001: 182, Table 1, fig. 3	This represents 38.18% of amphorae in the punico-mauretanian III layer. Date for these finds from authors, who date the layer specifically.
19	*Lixus*	"Sondeos del Algarrobo/Olivo"	punico-mauretanian II	Dressel 7-11	Punico-Mauretanian/Roman	41	rim frags.	Izquierdo Peraile, *et al*. 2001: 160-161, fig. 6	Speculate that these were made at Lixus. Is this in Olive tree trench?
20	*Lixus*	Ladera Sur		Dressel 7-12	Punico-Mauretanian/Roman	*		Bonet Rosado, *et al.* 2005: 117, 123-125	No numbers given: 14% of 352 of "Mauritania media " level (50 BC-AD 10); 32% of 247 of "Mauritania reciente" level (AD 10-50).
21	*Lixus*	acropolis, temple F	cistern	Dressel 9	Punico-Mauretanian/Roman	*		Ponsich 1981: 82	These are likely included in Hassini's numbers for Dr. 7-11 type. Ponsich describes "numerous frags. Of bodies and rims."
22	*Lixus*			Dressel 7-11	Punico-Mauretanian/Roman	160	complete amphorae; number based on fragments	Hassini 2001: 45-47 (D. no. 257-270), 96-103, 160-163 (Tables 5-8)	In photo of Lixus vats from earlier excavations, a great quantity of Dr. 7-11 are shown in a magazine (Caruana, *et al.* 2001: 182, fig. 2). Represents 25% of amphorae from site, especially from 1996 excavations. Breakdown of frags. unclear in Table 8.

Table 7.27. Finds of salazón amphorae from *Lixus (continued on next page)*.

	PROVENANCE	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
23	*Lixus*			Almagro 50	Roman/Late Roman	5	handles (= 4 complete amphorae)	Hassini 2001: 50-51 (D no. 368-370), 96-103, 160-163 (Tables 5-8)	Represents 0.62% of amphorae from site.
24	*Lixus*	Ladera Sur		Almagro 50	Roman/Late Roman	11	frags.	Fumadó Ortega & Mlilou 2005: 81-82; Aranegui Gascó, *et al.* 2006: 359	
25	*Lixus*	Ladera Sur		Almagro 51a	Roman/Late Roman	15	frags.	Fumadó Ortega & Mlilou 2005: 81-82; Aranegui Gascó, *et al.* 2006: 359	
26	*Lixus*			Almagro 51a-b	Roman/Late Roman	35	complete amphorae; number based on fragments	Hassini 2001: 52-53 (D no. 371-373), 96-103, 160-163 (Tables 5-8)	All Almagro 51 types represent 5.46% of amphorae from site.
27	*Lixus*			Almagro 51c	Roman/Late Roman	35	complete amphorae; number based on fragments	Hassini 2001: 52-53, 96-103, 160-163 (Tables 5-8)	All Almagro 51 types represent 5.46% of amphorae from site.
28	*Lixus*	Ladera Sur		Keay LVIIB	Late Roman	6	frags.	Fumadó Ortega & Mlilou 2005: 81-82; Aranegui Gascó, *et al*. 2006: 359	Identified as salazon type by other finds near fish-salting complexes at Algeciras.

Table 7.27. Finds of salazón amphorae from *Lixus*.

SITE	PERIOD	MARINE SPECIES	
		FISH	MARINE INVERTEBRATES
Rusaddir	Punico-Mauretanian		banded dye-murex, Mediterranean mussel, common periwinkle, marine snail, limpet, Venus clam, ribbed Mediterranean limpet (7)
Costa Rincon	Punico-Mauretanian	bluefin tuna (1)	
Tamuda	Punico-Mauretanian	*Lamnidae* shark (shortfin mako or porbeagle shark), bluefin tuna (2)	*Muricidae*, Algarve volute, banded dye-murex, bittersweet, clam, cockle, knobbed triton, Mediterranean bonnet, oyster, rayed Mediterranean limpet, red-mouthed rock shell, ribbed Mediterranean limpet, scallop, spiny dye-murex (14)
	Roman/Late Roman		rayed Mediterranean limpet, ribbed Mediterranean limpet, cockle, oyster (4)
	Late Roman		rayed Mediterranean limpet, cockle (2)
Sidi Abdeselam del Behar	Punico-Mauretanian		bittersweet (1)

Table 8.1. The evidence for fresh marine resource consumption from Mediterranean sites (based on data from App. 1.1-1.2). Total species noted in parenthesis.

SITE	PERIOD	MARINE SPECIES	
		FISH	MARINE INVERTEBRATES
Septem Fratres	Roman		spiny cockle, pilose bittersweet, European thorny oyster, knobbed triton, red-mouthed rock shell (5)

Table 8.2. The evidence for fresh marine resource consumption from Straits of Gibraltar sites (based on data from App. 1.2). Total species noted in parenthesis.

SITE	PERIOD	MARINE SPECIES	
		FISH	MARINE INVERTEBRATES
Djebila	Punico-Mauretanian		*Muricidae* (1)
Banasa	Punico-Mauretanian		*Muricidae* (1)
	Roman		*Muricidae, Patella sp.,* Atlantic/ Mediterranean scallop (3)
Thamusida	Roman	sturgeon (1)	
Zilil	Roman	*Raja sp*., tope shark, *Lamnidae* shark (shortfin mako or porbeagle shark) (3)	
Lixus	Punico-Mauretanian	*Pagellus sp., Dentex sp., Clupeidae, Scomber sp., Mugilidae, Sparidae, Dicentrarchus sp., Diplodus sp., Pagrus sp., Chondricthys*, annular seabream, Atlantic horse mackerel, bastard grunt, bluefish, bogue, Canary dentex, common pandora, common two-banded seabream, European eel, European pilchard, European seabass, flathead mullet, gilthead seabream, meagre, Mediterranean moray, pink dentex, saddled seabream, Spanish/ chub mackerel, spotted seabass, thicklip grey mullet, white seabream, white trevally (33)	banded dye-murex, carpet-shelled clam, checkered carpet shell, China limpet, common mussel, cowrie, knobbed triton, marine snail, oyster, rayed Mediterranean limpet, red-mouthed rock shell, Safian limpet, smooth Venus clam, spiny dye-murex, striped Venus clam, tuberculate cockle, violet bittersweet (17)
	Roman	common dentex, shark (great hammerhead or tope shark) (2)	banded dye-murex, bittersweet, China limpet, cockle, knobbed triton, Mediterranean bonnet, oyster, rayed Mediterranean limpet, red-mouthed rock shell, Safian limpet (10)
	Late Roman		common mussel, knobbed triton, lurid cowrie, red-mouthed rock shell, tuberculate cockle (5)
Sala	Roman		banded dye-murex (1)
Suiar	Roman/Late Roman		rayed Mediterranean limpet (1)
Volubilis	Punico-Mauretanian		*Ostreidae, Mytilidae*, limpet, Venus clam (4)
	Punico-Mauretanian/ Roman		*Ostrea sp.* (1)
	Roman		limpet, *Mytilidae*, Venus clam, bittersweet, clam, common mussel, *Ostrea sp*., rayed Mediterranean limpet, red-mouthed rock shell (9)

Table 8.3. The evidence for fresh marine resource consumption from Atlantic sites (based on data from App. 1.1-1.2). Total species noted in parenthesis.

FISH SPECIES	MARINE INVERTEBRATE SPECIES
bluefin tuna	Mediterranean mussel
sturgeon	spiny cockle
Raja sp.	cockle
tope shark	tuberculate cockle
Lamnidae shark	oyster
Pagellus sp.	*Ostreidae*
Dentex sp.	*Ostrea sp.*
Clupeidae	scallop
Scomber sp.	Atlantic/Mediterranean scallop
Mugilidae	cowrie
Sparidae	lurid cowrie
Dicentrarchus sp.	knobbed triton
Diplodus sp.	checkered carpet shell
Pagrus sp.	common periwinkle
Chondricthys	marine snail
annular seabream	Mediterranean bonnet
Atlantic horse mackerel	European thorny oyster
bastard grunt	pilose bittersweet
bluefish	common mussel
bogue	*Mytilidae*
Canary dentex	limpet
common Pandora	ribbed Mediterranean limpet
common two-banded seabream	rayed Mediterranean limpet
European eel	Safian limpet
European pilchard	China limpet
European seabass	*Patella sp.*
flathead mullet	Venus clam
gilthead seabream	*Muricidae*
meagre	spiny dye-murex
Mediterranean moray	banded dye-murex
pink dentex	red-mouthed rock shell (2 species)
saddled seabream	Algarve volute
Spanish/chub mackerel	bittersweet
spotted seabass	violet bittersweet (2 species)
thicklip grey mullet	clam
white seabream	smooth Venus clam
white trevally	striped Venus clam
common dentex	carpet-shelled clam
TOTAL: 38 species	TOTAL: 40 species

Table 8.4. Species of fish and marine invertebrates determined to be for fresh consumption.

SITE	PERIOD	FOODSTUFF	EVIDENCE
Tamuda	Punico-Mauretanian	wild boar	bones, teeth[1]
	Late Roman	wild boar, pig	bones[2]
Lixus	Punico-Mauretanian	cattle, pig, sheep	bones, teeth[3]
Banasa	Punico-Mauretanian	wild boar, cattle, sheep	bones, teeth[4]
Thamusida	Roman	cattle, sheep, goat	bones
	Late Roman	cattle, goat, sheep	bones[5]
Volubilis	Roman	sheep/goat	bones, teeth[6]
Essaouira	"Phoenician"	wild boar	bones[7]
	Punico-Mauretanian, Roman	wild boar, cattle, sheep, goat	bones, teeth[8]

Table 8.5. Evidence of other foodstuffs (meat) consumed in the province, listed in general order of frequency of finds.

[1] Morán & Giménez Bernal 1948: 20, 38; Dobson 1998: 81-82
[2] Bernal, *et al.* 2008a: 600
[3] Iborra Eres 2005; see Grau Almero, *et al.* 2001: 200-204.
[4] Girard 1984a: 28, 70
[5] Papi & Martorella 2007: 94, fig. 9
[6] Personal observation of materials in the site dépôt.
[7] Jodin 1967: 227, Pl. CVIII
[8] Jodin 1967: 227-228

SITE	PERIOD	FOODSTUFF	EVIDENCE
Rusaddir	Punico-Mauretanian	grains, grapes, honey	heads of wheat, clusters of grapes and bees appear on 1st-century BC coins of *Rusaddir*[9]
Tamuda	Punico-Mauretanian, Roman, Late Roman	grains, grapes, olives	heads of wheat and clusters of grapes on Punico-Mauretanian coins of *Tamuda*; a number of grain and olive mills at the settlement and large storage amphorae for grain and flour;[10] grain *horrea* in *castellum*;[11] possible milling site identified in Oued Martil valley[12]
Tingi	Punico-Mauretanian, Roman	grains, olives	heads of wheat appear on 1st-centuries BC/AD coins of *Tingi*;[13] 15 olive oil presses in region[14]
Zilil	Punico-Mauretanian, Roman	grains, olives	heads of wheat appear on 1st-century BC coins of *Zilil*;[15] 2 olive oil presses found in environs[16]
Lixus	Phoenician, Punico-Mauretanian, Late Roman	grains, grapes, figs, olives	wheat and barley grains and grape seeds recovered during excavation; heads of wheat and cluster of grapes on Punico-Mauretanian coins of *Lixus*;[17] pollen evidence of figs and olive trees[18]
Banasa	Roman	grains, olives	grain mills found here; at least two bakeries;[19] 11 olive oil presses present[20]
Thamusida	Roman	grains	identified grain *horrea*[21]
Sala	Punico-Mauretanian, Roman (?)	grains, olives, grapes	head of wheat and cluster of grapes on 1st-century BC coins of *Sala*;[22] 4 olive oil presses present;[23] indirect mention in inscription[24]
Volubilis	Roman	grains, olives	numerous fixed mills at *Volubilis*; ca. 10 ovens;[25] ca. 58 olive oil presses in houses in city;[26] 20 olive oil presses in hinterland[27]
Essaouira	Roman	grains (?)	millstone found in Roman *villa*[28]

Table 8.6. Evidence for agricultural consumption in the province.

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[9] Gozalbes Cravioto 1991: 77-82; Gozalbes Cravioto 1997: 89-90; Fernández Uriel 1992: 329; Arévalo González 2007: 61

[10] Gozalbes Cravioto 1997: 49, 89-93; Arévalo González 2007: 61; Morán & Giménez Bernal 1948: 19-21

[11] *Horrea* suggested for structures in southwest section of *castellum*; Pons Pujol 2004: 1672.

[12] Series of *villae*, or agricultural sites, surrounding *Tamuda* in 2nd century BC-early 1st century AD; at Krira d-Jouimec I (late 1st-2nd century AD), evidence of *dolia* and *opus signinum* suggests milling activities; Bernal, *et al.* 2008b.

[13] Gozalbes Cravioto 1997: 52, 89-90; Ponsich 1998: 169

[14] Two sites have olive oil presses in 3rd century BC and these became *villae rusticae* in Roman period; 13 sites (including a 'fortified farm' and Cotta) also begin making olive oil in the Roman period (Ponsich 1964a; Ponsich 1970: 204-206, 215-217, 273-283); see also Mueden 2008: 418-419.

[15] Gozalbes Cravioto 1997: 52, 89-90

[16] Akerraz, *et al.* 1981-82: 215-216, PL. XXII

[17] Grau Almero, *et al.* 2001: 229; Pérez Jordà 2005; Alexandropoulos 1992: 253; Arévalo González 2007: 61; Boube 1992: 258; Tarradell-Font 2001; see App. 5: *Cat. 2*; for grape seeds found in Mañá C2b amphora with mussels, see Sagrario Carrasco Porras 2005: 256-257, 259-260; for argument that area east of *Lixus*, around *Oppidum Novum*, was farmland, see El Hasroufi 2006.

[18] Olives (*olea europaea*) found in Phoenician layers, but not thought to have been cultivated until 2nd century BC; Pérez Jordà 2005; Grau Almero, *et al.* 2001: 229.

[19] Thouvenot 1941: Pl. VI, fig. 19; Alaioud 2004: 1900-1901; Thouvenot & Luquet 1951b: 72-74, 96

[20] Akerraz & Lenoir 1981-82: 95, n. 75; Thouvenot & Luquet 1951b: 88-90 ; Alaioud 2004: 1900-1901

[21] Papi & Martorella 2007

(continued on next page)

SITE	PERIOD	MARINE SPECIES	
		FISH	MARINE INVERTEBRATES
Emsa	Punico-Mauretanian		banded dye-murex, bittersweet, cockle, knobbed triton, oyster, rayed Mediterranean limpet, ribbed Mediterranean limpet, scallop (8)
Metrouna	Roman		banded dye-murex, spiny dye-murex (2)
Sidi Abdeselam del Behar	Punico-Mauretanian		*Muricidae*, bittersweet, ribbed Mediterranean limpet, rayed Mediterranean limpet, knobbed triton, oyster, banded dye-murex (7)

Table 8.7. The evidence for salted marine resource consumption from Mediterranean sites (based on data from App. 1.1-1.2). Total species noted in parenthesis.

SITE	PERIOD	MARINE SPECIES	
		FISH	MARINE INVERTEBRATES
Septem Fratres	Roman	*Scombridae*, *Cetacea* (2)	coral, Safian limpet, China limpet, oyster, spiny dye-murex, banded dye-murex, Mediterranean bonnet, Atlantic/ Mediterranean scallop, sea urchin (9)
	Roman/Late Roman	John Dory, Atlantic bonito, common seabream, Spanish/chub mackerel, Atlantic horse mackerel, dusky grouper (6)	
	Late Roman	Atlantic chub mackerel, bluefin tuna, *Cetacea* (3)	*Ostrea sp., Spondylus sp., Patella sp.*, banded dye-murex, oyster, rayed Mediterranean limpet, ribbed Mediter-ranean limpet (7)
Tingi	Punico-Mauretanian/ Roman	bluefin tuna (1)	
Zahara	Roman	tope shark (1)	banded dye-murex, red-mouthed rock shell (2)
Ksar-es-Seghir	Punico-Mauretanian/ Roman		bittersweet, rayed Mediterranean limpet, ribbed Mediterranean limpet, red-mouthed rock shell (4)
	Roman		rayed Mediterranean limpet, oyster (2)

Table 8.8. The evidence for salted marine resource consumption from the Straits of Gibraltar sites (based on data from App. 1.1-1.2; App. 4.2). Total species noted in parenthesis.

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[22] Gozalbes Cravioto 1997: 89-91
[23] Akerraz & Lenoir 1981-82
[24] In the Roman period, farmers at *Sala* are recorded in an inscription as being attacked by the local tribal groups, and it is assumed that they continued the Punico-Mauretanian agricultural practices; *IAM* 2, no. 307.
[25] Luquet 1966b; Leduc 2008
[26] Akerraz & Lenoir 1981-82
[27] Limane & Makdoun 1998: 335-336
[28] Jodin 1967: 220, Pl. CVI

SITE	PERIOD	MARINE SPECIES	
		FISH	MARINE INVERTEBRATES
Cotta	Punico-Mauretanian/ Roman	tope shark (1)	*Muricidae* (1)
Tahadart	Punico-Mauretanian/ Roman	*Chondricthys*, tope shark (2)	
Lixus	Punico-Mauretanian		common mussel (1) (scallop, rayed Mediterranean limpet, oyster, knobbed triton, cowrie, cockle, clam, China limpet?)[29] (8)
	Punico-Mauretanian/ Roman	bluefin tuna (1)	
	Roman		(cockle, cowrie, coral?)[30] (3)
Thamusida	Punico-Mauretanian/ Roman		*Muricidae* (1)
Essaouira	Punico-Mauretanian	*Scombridae, Xiphiidae* (2)	*Mytilidae*, limpet, *Ostrea sp.*, red-mouthed rock shell, *Muricidae* (5)
	Punico-Mauretanian/ Roman		red-mouthed rock shell, spiny dye-murex (2)
	Roman		red-mouthed rock shell, banded dye-murex (2)

Table 8.9. The evidence for salted marine resource consumption from the Atlantic sites (based on data from App. 1.1-1.2, App. 4.2). Total species noted in parenthesis.

[29] No clear find-spot; might be from the salting complexes.
[30] No clear find-spot; might be from the salting complexes.

FISH SPECIES	MARINE INVERTEBRATE SPECIES
John Dory	banded dye-murex
Atlantic bonito	spiny dye-murex
common seabream	*Muricidae*
Spanish/chub mackerel	red-mouth rock shell (1 species)
Atlantic horse mackerel	bittersweet
dusky grouper	cockle
Xiphiidae	knobbed triton
bluefin tuna	oyster
Chondricthys	*Ostrea sp.*
tope shark	scallop
Atlantic chub mackerel	Atlantic/Mediterranean scallop
Scombridae	*Mytilidae*
Cetacea	common mussel
	Patella sp.
	limpet
	ribbed Mediterranean limpet
	rayed Mediterranean limpet
	Safian limpet
	China limpet
	Spondylus sp.
	Mediterranean bonnet
	coral
	sea urchin
TOTAL: 13 species	TOTAL: 23 species

Table 8.10. Species of fish and marine invertebrates determined to be for salted consumption.

REGION	SITES	NUMBER OF *CETARIAE* (min.)	ESTIMATED FULL CAPACITIES (min.)
Mediterranean	Metrouna	1	unknown
	Sania e Torres	5	78.006 m^3
Straits of Gibraltar	Ksar-es-Seghir	12	40.728 m^3
	Dchar ‘Askfane	2	unknown
	Zahara	2	10.26 m^3
Atlantic	Cotta	16	258 m^3
	Tahadart	42	ca. 400 m^3
	Kouass	4	unknown
	Essaouira	2	13.61 m^3
TOTALS:		86 *cetariae*	800.604 m^3 (min.)

Table 8.11. Rural fish-salting production at sites with *cetariae* (based on data from App. 3.1).

AREA	PERIOD	FOODSTUFF	EVIDENCE
Tamuda region	Roman	flour	possible milling site identified in Oued Martil valley[31]
Tingi region	Punico-Mauretanian, Roman	olive oil	15 oil presses in region, from north Atlantic coast to Tangier Bay[32]
Zilil region	Punico-Mauretanian, Roman	flour, olive oil	heads of wheat appear on 1st-century BC coins of *Zilil*;[33] 2 oil presses found at Roman farms sites outside *Zilil*[34]
Lixus region	Punico-Mauretanian, Roman	olive oil, wine (?)	grape seeds recovered during excavation of Punico-Mauretanian layers; cluster of grapes on Punico-Mauretanian coins of *Lixus*;[35] pollen evidence of olive trees from the Punico-Mauretanian to Late Roman periods;[36] 14 Roman-period oil presses found in region[37]
Rirha region	Punico-Mauretanian, Roman	flour	mills at *villae rusticae* in region[38]
Volubilis region	Roman	olive oil, flour	20 oil presses identified in region; cereal production likely[39]
Essaouira	Roman	flour (?)	one millstone found in *villa*[40]

Table 8.12. Rural agricultural production areas.

REGION	SITES	NUMBER OF *CETARIAE* (min.)	ESTIMATED FULL CAPACITIES (min.)
Straits of Gibraltar	*Septem Fratres*	14	26.1625 m^3
Atlantic	*Lixus*	142	ca. 1,013 m^3
	Banasa	6	ca. 8 m^3
	Thamusida	3	unknown
TOTALS:		165 *cetariae*	1,047.1625 m^3 (min.)

Table 8.13. Urban fish-salting production at sites with *cetariae* (based on data from App. 3.1).

[31] Series of *villae* (*villae rusticae*?) surrounding *Tamuda* in 2nd century BC-early 1st century AD; at Krira d-Jouimec I site (late 1st-2nd century AD), evidence of *dolia* and *opus signinum* suggests milling activities; Bernal, *et al.* 2008b.
[32] Two sites have olive oil presses in 3rd century BC and these become *villae rusticae* in Roman period; 13 sites (including a 'fortified farm' and Cotta) also begin making olive oil in the Roman period (Ponsich 1964a; Ponsich 1970: 204-206, 215-217, 273-283).
[33] Gozalbes Cravioto 1997: 52, 89-90
[34] Akerraz, *et al.* 1981-82: 215-216, PL. XXII
[35] Grau Almero, *et al.* 2001: 229; Pérez Jordà 2005; Alexandropoulos 1992: 253; Boube 1992: 258; Tarradell-Font 2001; see App. 5: *Cat. 2*; for grape seeds found in Mañá C2b amphora with mussels, see Sagrario Carrasco Porras 2005: 256-257, 259-260; for argument that area east of *Lixus*, around *Oppidum Novum*, was farmland, see El Hasroufi 2006.
[36] Olives (*olea europaea*) found in Phoenician layers, but not thought to have been cultivated until 2nd century BC; Pérez Jordà 2005; Grau Almero, *et al.* 2001: 229.
[37] Akerraz & Lenoir 1981-82: 95, n. 75; no evidence of oil or wine presses at *Lixus* (Grau Almero, *et al.* 2001: 229).
[38] Gozalbes Cravioto 1997: 60
[39] Akerraz & Lenoir 1981-82: 95, n. 75; Limane & Makdoun 1998: 335-336
[40] Jodin 1967: 220, Pl. CVI

SITE	PERIOD	FOODSTUFF	EVIDENCE
Rusaddir	Punico-Mauretanian	flour, honey, wine	heads of wheat, clusters of grapes and bees appear on 1st-century BC coins of *Rusaddir*[41]
Tamuda	Punico-Mauretanian, Roman	flour, wine, olive oil	heads of wheat and clusters of grapes on Punico-Mauretanian coins of *Tamuda*; a number of grain and olive mills at the settlement and large storage amphorae for grain and flour;[42] grain *horrea* in *castellum*[43]
Septem Fratres	Punico-Mauretanian, Roman, Late Roman	salted fish	5 groupings of at least 14 different *cetariae*[44]
Tingi	Punico-Mauretanian/ Roman	flour, salted fish (?)	heads of wheat appear on 1st-centuries BC/AD coins of *Tingi*;[45] *cordyla* from *tituli picti*[46]
Lixus	Punico-Mauretanian, Roman, Late Roman	salted fish, purple dye (?)	10 fish-salting complexes[47]
Banasa	Roman	olive oil, salted fish	11 olive oil presses present;[48] 6 *cetariae* in city[49]
Thamusida	Roman	flour, salted fish, purple dye (?)	identified grain *horrea*;[50] two *cetariae* inside of city; purple dye area northwest of city (?)[51]
Sala	Punico-Mauretanian, Roman (?)	wine, olive oil	cluster of grapes on 1st-century BC coins of *Sala*;[52] 4 olive oil presses present in city[53]
Volubilis	Roman	olive oil, textiles	58 olive oil presses in houses in city;[54] fuller's guild[55]

Table 8.14. Urban agricultural production sites.

[41] Gozalbes Cravioto 1991: 77-82; Gozalbes Cravioto 1997: 89-90; Fernández Uriel 1992: 329
[42] Gozalbes Cravioto 1997: 49, 89-93; Morán & Giménez Bernal 1948: 19-21
[43] Horrea suggested for structures in southwest section of *castellum*; Pons Pujol 2004: 1672.
[44] See App. 3.1: *Site 16.*
[45] Gozalbes Cravioto 1997: 52, 89-90
[46] See App. 4.2.
[47] See App. 3.1: *Site 36.*
[48] Akerraz & Lenoir 1981-82: 95, n. 75; Thouvenot & Luquet 1951b : 88-89; Alaioud 2004: 1900-1901
[49] See App. 3.1: *Site 46.*
[50] Papi & Martorella 2007
[51] See App. 3.1: *Site 47.*
[52] Gozalbes Cravioto 1997: 89-91
[53] Akerraz & Lenoir 1981-82: 95, n. 75; Pons Pujol 2000: 1266
[54] Akerraz & Lenoir 1981-82: 93-98
[55] *CIL* VIII, 21848 (see also *IAM* 2, no. 581).

PERIOD	FISH	MARINE INVERTEBRATES
PUNICO-MAURETANIAN	bluefin tuna	*Muricidae*
	Lamnidae shark	banded dye-murex
	Pagellus sp.	spiny dye-murex
	Dentex sp.	red-mouthed rock shell (2 species)
	Clupeidae	*Ostreidae*
	Scomber sp.	oyster
	Mugilidae	*Ostrea sp.*
	Sparidae	*Mytilidae*
	Dicentrarchus sp.	Mediterranean mussel
	Diplodus sp.	common mussel
	Pagrus sp.	common periwinkle
	Chondricthys	marine snail
	Scombridae	Venus clam
	Xiphiidae	smooth Venus clam
	annular seabream	striped Venus clam
	Atlantic horse mackerel	carpet-shelled clam
	bastard grunt	checkered carpet shell
	bluefish	Algarve volute
	bogue	bittersweet
	Canary dentex	violet bittersweet (2 species)
	common Pandora	knobbed triton
	common two-banded seabream	Mediterranean bonnet
	European eel	limpet
	European pilchard	ribbed Mediterranean limpet
	European seabass	rayed Mediterranean limpet
	flathead mullet	Safian limpet
	gilthead seabream	China limpet
	meagre	clam
	Mediterranean moray	cockle
	pink dentex	scallop
	saddled seabream	tuberculate cockle
	Spanish/chub mackerel	cowrie
	spotted seabass	
	thicklip grey mullet	
	white seabream	
	white trevally	
SPECIES TOTAL:	36	34

Table 8.15. Marine resources from the northwest Maghreb, by period *(continued on next page)*.

PERIOD	FISH	MARINE INVERTEBRATES
PUNICO-MAURETANIAN/ ROMAN	bluefin tuna	*Ostrea sp.*
	tope shark	bittersweet
	Chondricthys	rayed Mediterranean limpet
		ribbed Mediterranean limpet
		red-mouthed rock shell
		Muricidae
		spiny dye-murex
SPECIES TOTAL:	3	7
ROMAN	sturgeon	spiny cockle
	Raja sp.	cockle
	tope shark	pilose bittersweet
	Lamnidae shark	bittersweet
	common dentex	European thorny oyster
	shark (great hammerhead or tope shark)	knobbed triton
		red-mouthed rock shell
	Scombridae	banded dye-murex
	Cetacea	spiny dye-murex
		Muricidae
		Patella sp.
		limpet
		China limpet
		Safian limpet
		rayed Mediterranean limpet
		Mediterranean bonnet
		oyster
		Ostrea sp.
		Mytilidae
		Venus clam
		clam
		common mussel
		coral
		sea urchin
		cowrie
		Atlantic/Mediterranean scallop
SPECIES TOTAL:	8	26

Table 8.15. Marine resources from the northwest Maghreb, by period *(continued on next page)*.

PERIOD	FISH	MARINE INVERTEBRATES
ROMAN/LATE ROMAN	John Dory	rayed Mediterranean limpet
	Atlantic bonito	ribbed Mediterranean limpet
	common seabream	cockle
	Spanish/chub mackerel	oyster
	Atlantic horse mackerel	
	dusky grouper	
SPECIES TOTAL:	6	4
LATE ROMAN	Atlantic chub mackerel	rayed Mediterranean limpet
	bluefin tuna	ribbed Mediterranean limpet
	Cetacea	cockle
		common mussel
		knobbed triton
		lurid cowrie
		red-mouthed rock shell
		tuberculate cockle
		Ostrea sp.
		Spondylus sp.
		Patella sp.
		banded dye-murex
		oyster
SPECIES TOTAL:	3	13

Table 8.15. Marine resources from the northwest Maghreb, by period.

PERIOD	FISHING METHODS: ARCHAEOLOGICAL EVIDENCE		
	Hook-and-line	Net	Other
PUNICO-MAURETANIAN	h, g	w, nv, nd	
PUNICO-MAURETANIAN/ ROMAN	h, g	w, nd, nv	l
ROMAN	h	w, nd, nv	
ROMAN/LATE ROMAN	h	w, nd	l
LATE ROMAN	h	w	
	FISHING METHODS: OTHER EVIDENCE		
PUNICO-MAURETANIAN	hand collection, harpoons, small hand-held tools, rakes, weels		
ROMAN	hand collection, harpoons, tridents, small hand-held tools, rakes, weels		
LATE ROMAN	hand collection, harpoons, small hand-held tools		

Table 8.16. Fishing equipment from the northwest Maghreb, by period: h = fish hook, g = gorge, l = lance, w = weight, nd = needle, nv = navette (archaeological evidence based on data from App. 2, Tables 6.4, 6.9, 6.14; other evidence based in part on data from App. 4, App. 5 and App. 6).

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Appendices

Site list

The sites with relevant archaeological finds cited in this study are listed below. These site numbers are referred to throughout the text and appendices and noted on relevant maps.

NUMBER	SITE	REGION
1	Bouhout	Mediterranean
2	Ed Dahar Taifant	Mediterranean
3	El Aabid	Mediterranean
4	*Rusaddir*/Melilla	Mediterranean
5	Sidi Moulay Baghdad	Mediterranean
6	Sidi Driss	Mediterranean
7	Emsa	Mediterranean
8	Sidi Abdeselam del Behar	Mediterranean
9	Metrouna	Mediterranean
10	*Tamuda*	Mediterranean
11	Loma Amarilla	Mediterranean
12	Zbar d'Akwizan	Mediterranean
13	Krira d-Jouimec I	Mediterranean
14	Costa Rincon	Mediterranean
15	Sania e Torres	Mediterranean
16	*Septem Fratres*/Ceuta	Straits of Gibraltar
17	Bay of Benzú	Straits of Gibraltar
18	Île Perekhil	Straits of Gibraltar
19	Ksar-es-Seghir (Alcazarsegher)	Straits of Gibraltar
20	Dchar 'Askfane	Straits of Gibraltar
21	Zahara (Sahara)	Straits of Gibraltar
22	*Tingi*/Tangier	Straits of Gibraltar
23	Cap Spartel	Atlantic
24	Cotta	Atlantic
25	Jorf el Hamra	Atlantic
26	Petit Bois	Atlantic
27	Djebila	Atlantic
28	Tahadart	Atlantic
29	Kouass	Atlantic
30	*Zilil*/Dechar Jedid	Atlantic
31	En Nkhella	Atlantic
32	Kridissa bir Mitkal	Atlantic
33	Suiar	Atlantic
34	*Tabernae*	Atlantic
35	Bled Riat el Khemis-Ras Remel	Atlantic
36	*Lixus*	Atlantic
37	"Property of Ben Driss Islami"	Atlantic
38	Mbarec	Atlantic
39	Azib Slaoui	Atlantic
40	Oued Mdâ	Atlantic
41	Nzalet Bin Ammar area	Atlantic
42	Oued Riahi	Atlantic
43	Ouled Aïssa area	Atlantic
44	Sidi Yahia del Gharb area	Atlantic
45	Sidi Slimane Arbaoua	Atlantic
46	*Banasa*	Atlantic
47	*Thamusida*	Atlantic
48	Sidi Slimane	Atlantic

(continued)

NUMBER	SITE	REGION
49	Sidi Kacem	Atlantic
50	Rirha	Atlantic
51	*Volubilis*	Atlantic
52	Volubilis valley	Atlantic
53	Mhaya	Atlantic
54	*Exploratio Ad Mercurios/*Khedis	Atlantic
55	Rabat	Atlantic
56	*Sala*	Atlantic
57	Essaouira (Îles Purpuraires)	Atlantic

Appendix 1.
Marine animal remains

Metadata

FISH REMAINS

Appendix 1.1 presents finds of fish bones from the northwest Maghreb. Unpublished finds were recorded in March-April 2007 in Morocco at Musée de la Kasbah (Tangier) and Musée Archéologique (Tetouan). These finds were identified by Prof. A. Morales (Laboratorio de Arqueozoología, Universidad Autónoma de Madrid, Spain).

The published icthyofaunal material from *Lixus* that was excavated in 1995 and 1999 was obtained by sieving (5 mm, 1 mm, 0.5 mm). The sampling methods for the published *Septem* material are unknown.[1] No other collection or sampling methods are known for the unpubished material from other excavations presented here.

The data source for the fish environment/habitat information cited in this appendix is primarily FishBase and publications of Institut National de Recherché Halieutique (INRH), amongst others.[2] Vocabulary used here is defined in Table 3.1.

MARINE INVERTEBRATE REMAINS

Appendix 1.2 presents finds of shellfish remains from the northwest Maghreb. Unpublished finds were recorded in March-April and October 2007 in Morocco at Musée Archéologique (Tetouan) and the finds dépôt at the archaeological site of *Volubilis.* These finds were identified by the author. No sampling or collection methods are known.

The data source for the marine invertebrate habitat/ecosystem information cited in this appendix is primarily SeaLifeBase, Marine Life Information Network for Britain and Ireland (MARLIN) and specific publications.[3] Vocabulary used here is defined in Table 3.2.

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[1] Grau Almero, *et al.* 2001: 191; Roselló Izquierdo 1992

[2] FishBase: http://filaman.ifm-geomar.de/search.php; INRH: Chbaatou 2002; others include Stanford, *et al.* 2001; Gruvel 1923; specific tunny data: Morales, *et al.* 2007: 132-134; specific whale data: OBIS-SEAMAP (Ocean Biogeographic Information System - Spatial Ecological Analysis of Megavertebrate Populations): http://seamap.env.duke.edu/.

[3] SeaLifeBase: www.sealifebase.org; MARLIN: http://www.marlin.ac.uk/; Grau Almero, *et al.* 2001; Shafee 1999; Ziderman 1990; *Murex trunculus:* Spanier & Karmon 1987: 180-181; *Murex (bolinus) brandaris*: Vasconcelos, *et al*. 2008; Bañón, *et al.* 2008; *Patella ferruginea*: Guerra-García, *et al.* 2004: 325; coral: Zibrowius 1980.

GENERAL

In the following tables, the fish bone and marine invertebrate finds are presented by region (Mediterranean, Straits of Gibraltar and Atlantic). Maps showing general distribution and chronology of the finds are presented at the beginning of each region, followed by a table of finds. Within these regions sites are listed in geographical orientation from east to west and north to south. Site numbers follow those given in the site list at the beginning of the appendices.

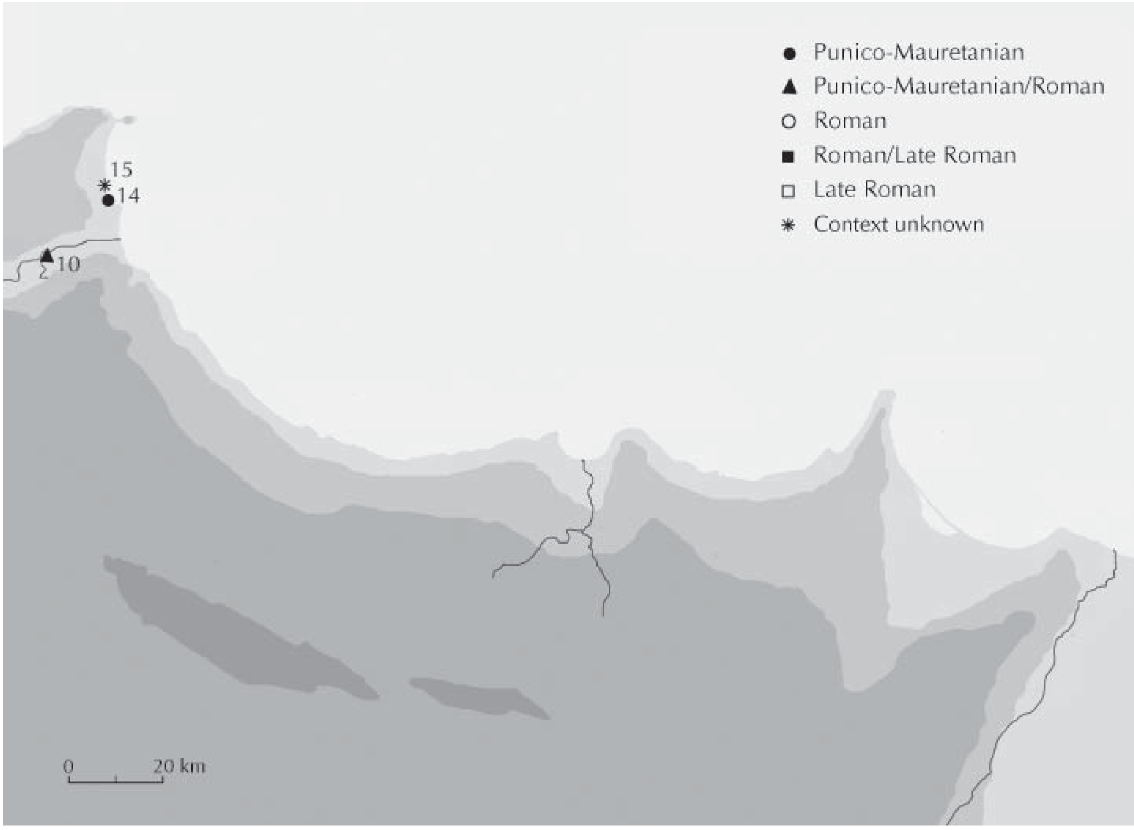
Photos of the recorded artefacts are noted in the column “Photo CD #” in the tables, which refers to the *Folder 2: Photo catalogue* file on the CD included with this study. The numbers in the tables here correspond to folders within this main folder, titled *App. 1.1: Fish remains* and *App. 1.2: Marine invertebrate remains*. For example, in the App. 1.2 table, “P30: 136” refers to the file in the *Photo catalogue* folder titled “Shells_P30”; artefact 136 is then labelled in the photo.

ABBREVIATIONS

( )	Denotes the types of species within a certain family if the faunal remains can only be identified to the family level.
“ “	In “Common Name” column, denotes general species if only noted generically in publications.
*	In “No.” (number) column, denotes fish bones or marine invertebrates not quantified in publications but only noted as present at site (for quantification discussion, see Chapter 3.2.1).

Appendix 1.1.
Fish remains

1.1.1 Mediterranean

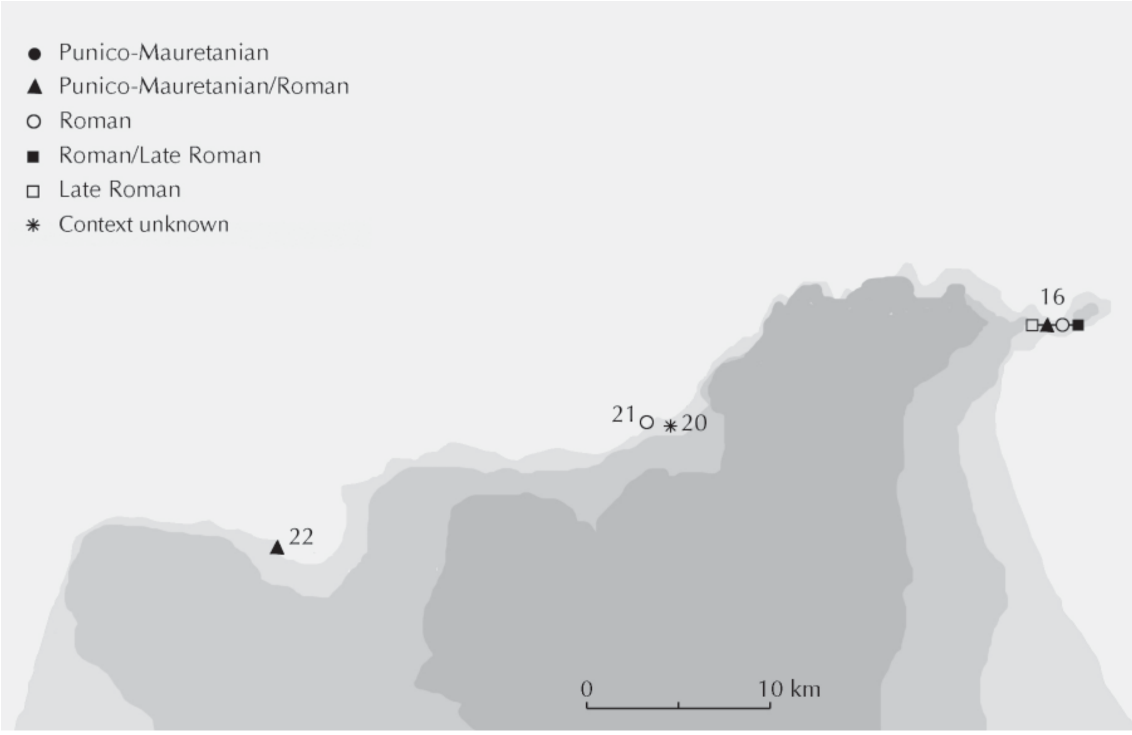


FIND-SITES:

10. *Tamuda*
14. Costa Rincon
15. Sania e Torres

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD #	COMMENTS
1	*Tamuda*	10		3	Punico-Mauretanian		shortfin mako shark or porbeagle	Isurus oxyrinchus or Lamna nasus	Lamnidae	Mako: marine; Porbeagle: marine	Mako: Oceanic, but also coastal. Usually in surface waters to ca.150 m depth, but can go to 740 m depth. Porbeagle: Most abundant on continental offshore fishing banks and occasionally close inshore. Neritic.	unpub.	P1: 1-3	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan, Inv. #9, #12, #13. Found in tray with Campanian ware (?)
2	*Tamuda*	10		1	Punico-Mauretanian		bluefin tuna	Thunnus thynnus	Scombridae	marine	Oceanic-pelagic, oceanodromous, seasonally coming close to shore. Usually 0-100 m depth.	unpub.	P2: 4	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan, Inv. #416. Found in tray with Campanian ware (?)
3	Costa Rincon	14		1	Punico-Mauretanian		bluefin tuna	Thunnus thynnus	Scombridae	marine	Oceanic-pelagic, oceanodromous, seasonally coming close to shore. Usually 0-100 m depth.	unpub. (for site: Tarradell 1966: 435-437)	P3: 5	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan (from a box of material with terra sigilatta and black glaze ware fragments); labelled: "Costa Rincon - Negro V - 1954".
4	Sania e Torres	15	"on beach"	*	Context unknown	?	North Atlantic bottle-nosed whale	Hyperoodon rostratus	Ziphiidae	marine	cold and temperate subartic whale found in deep waters, seaward of the continental slope.	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39, 94	-	whale vertebrae are mentioned as being on the beach, but their date is unclear. P&T 1965: 94 says that these are bottle-nose whales at Sania e Torres, and were certainly exploited in antiquity
5	Sania e Torres	15	"on beach"	*	Context unknown	?	"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Tunny vertebrae" are mentioned as being on the beach, but their date is unclear.

1.1.2 Straits of Gibraltar



FIND-SITES:

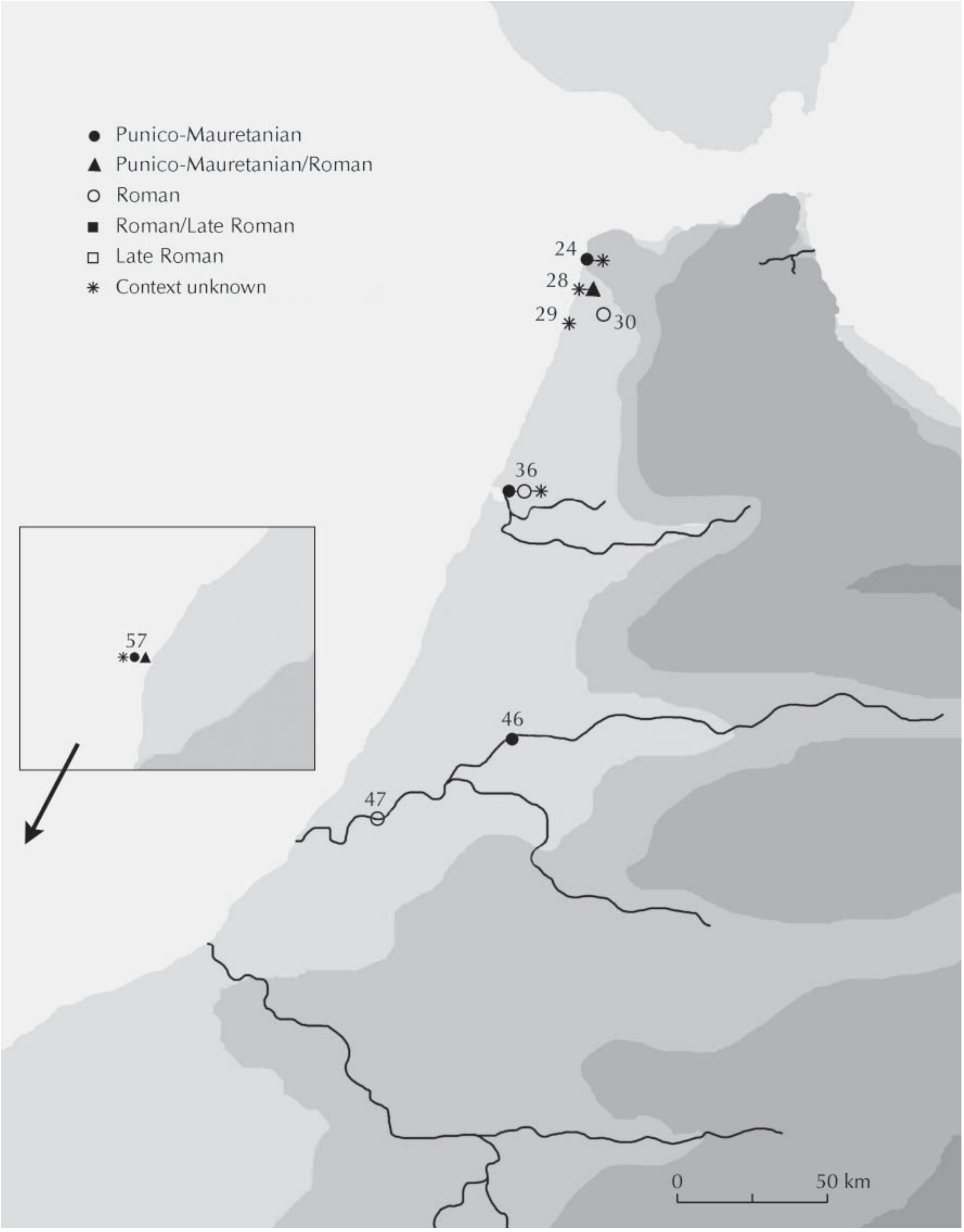
16. *Septem Fratres*
20. Dchar 'Askfane
21. Zahara
22. *Tingi*

Cat#	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
1	*Septem* /Ceuta	16	Hotel La Muralla	*	Punico-Mauretanian/ Roman	1st-2nd c. AD	unknown	unknown	unknown	-	-	unpub. (for site: Villada Paredes & Hita Ruiz 1994: 1211)	P4: 6	Fragments of fish bones (unidentified) found in the base of an amphora. On display at Museo Municipal de Ceuta, Inv. 3.080.
2	*Septem* /Ceuta	16	Hotel la Muralla	*	Roman	1st-2nd c. AD	unknown	unknown	unknown	-	-	Villada, *et al.* 2007: 487	-	General mention of "fish bones", to be published.
3	Septem/Ceuta	16	Plaza de África no. 3	*	Roman	2nd c. AD	"whale"		Cetacea (order)	marine	marine	Bernal Casasola 2009b: 267-268	-	Sponge-like examples and in very poor state of preservation.
4	*Septem* /Ceuta	16	Paseo de las Palmeras	*	Roman	2nd-3rd c. AD	(mackerel, tuna, bonito)	-	Scombridae	marine	Oceanodromous; epipelagic; some species occur in coastal waters, others far from shore.	Bernal Casasola & Pérez Rivera 1999: 68	-	"Scombriads" generally mentioned.
5	*Septem* /Ceuta	16	Hotel la Muralla (Parque de Artillería)	8	Roman/Late Roman	2nd-5th c. AD	John Dory	Zeus faber	Zeidae	marine, estuarine	Oceanodromous, found close to the sea bed, 5-400 m depth, usually 5-150 m.	Roselló Izquierdo 1992: 24	-	
6	*Septem* /Ceuta	16	Hotel la Muralla (Parque de Artillería)	7	Roman/Late Roman	2nd-5th c. AD	Atlantic bonito	Sarda sarda	Scombridae	marine, estuarine	Pelagic, neritic, oceanodromous and schooling species that may enter estuaries. Between 80-200 m depth.	Roselló Izquierdo1992: 25-26	-	
7	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo, Pileta II	3	Roman/Late Roman	2nd-5th c. AD	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Roselló Izquierdo1992: 26	-	Pileta II showed evidence of burning.
8	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo, Pileta II	24	Roman/Late Roman	2nd-5th c. AD	Spanish/chub mackerel	Scomber japonicus	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Roselló Izquierdo1992: 26	-	Pileta II showed evidence of burning.
9	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo, Pileta III	1	Roman/Late Roman	2nd-5th c. AD	Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Roselló Izquierdo1992: 28	-	

Cat#	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
10	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo, Pileta III	5	Roman/Late Roman	2nd-5th c. AD	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Roselló Izquierdo1992: 28	-	
11	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo, Pileta IV	2	Roman/Late Roman	2nd-5th c. AD	Dusky grouper	Epinephelus guaza	Serranidae	marine	Also refered to as Epinephelus marginatus. Prefers rocky bottoms. Lives between 8-300 m depth; usually 8-50 m depth.	Roselló Izquierdo1992: 28	-	
12	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo, Pileta IV	1	Roman/Late Roman	2nd-5th c. AD	Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Roselló Izquierdo1992: 29	-	
13	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo, Pileta IV	4	Roman/Late Roman	2nd-5th c. AD	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Roselló Izquierdo1992: 29	-	
14	*Septem* /Ceuta	16	No. 13 Calle Hmns Gómez Marcelo	*	Late Roman	late 3rd-mid 5th c. AD	Atlantic chub mackerel	Scomber colias	Scombridae	marine	Coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope. 0-300 m depth.	Villaverde Vega & López Pardo 1995: 460; Ceuta Photo 3	-	Spines found in the base of a Almagro 51/Keay XIX amphora.
15	*Septem* /Ceuta	16	No. 20/21 Av. Sánchez Prados	*	Late Roman	4th-5th c. AD	unknown	unknown	unknown	-	-	Hita Ruiz & Villada Paredes 1994: 26-27	-	General mention of "Late Antique fish bones".
16	*Septem* /Ceuta	16	Paseo de las Palmeras	1	Late Roman	5th c. AD	Bluefin tuna	Thunnus thynnus	Scombridae	marine	Oceanic-pelagic, oceanodromous, seasonally coming close to shore. Usually 0-100 m depth.	Bernal Casasola & Pérez Rivera 1999: 70, fig. 32	-	"Tunny vertebrae" mentioned generally; shown in bottom of vat. Thought to be from end of use of site.
17	*Septem* /Ceuta	16	Plaza de África no. 3	*	Late Roman	late 5th/early 6th c. AD	"whale"		Cetacea (order)	marine	marine	Bernal Casasola 2009b: 267-268	-	These bones have evidence of possible burning/heating.

Cat#	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
18	Dchar 'Askfane	20		*	Context unknown		"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	unpub. (for site see Akerraz & El Khayari 2005)	-	Information provided by A. El Khayari (INSAP), 10/2007: "There are lots of fish bones. Difficult to date these because there are many phases of occupation within each period." Information provided by H. Limane (INSAP), 11/04/2007: "Fish bones, tunny, maybe different types."
19	Zahara (Sahara)	21		1	Roman	2nd-3rd c. AD	tope shark	Galeorhinus galeus	Triakidae	marine	Mainly demersal on continental and insular shelves, but also on the upper slopes, from near shore to 550 m.	unpub. (for site see Ponsich & Tarradell 1965: 68-71)	P5: 7	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan.

1.1.3 Atlantic



FIND-SITES:

24. Cotta
28. Tahadart
29. Kouass
30. *Zilil*
36. *Lixus*
46. *Banasa*
47. *Thamusida*
57. Essaouira

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
1	Cotta	24	"outside factory"	*	Context unknown	?	"whale"	-	Cetacea (order)	marine	marine	Ponsich 1970: 211; Ponsich & Tarradell 1965: 101	-	"Some whale vertebrae" generally mentioned; not clear if these are contemporary to factory.
2	Cotta	24	"on beach"	*	Context unknown	?	"whale"	-	Cetacea (order)	marine	marine	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39; Ponsich 1970: 211	-	"Whale vertebrae" generally mentioned on beach; not clear if these are contemporary to factory.
3	Cotta	24	"on beach"	*	Context unknown	?	"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Tunny vertebrae" are mentioned as being on the beach, but their date is unclear.
4	Cotta	24		1	Punico-Mauretanian/ Roman	1st-3rd c. AD	unknown	unknown	unknown	-	-	unpub.	P6: 8	Identification: A. Morales, UAM; present location: Musée de la Kasbah, Tangier
5	Cotta	24		2	Punico-Mauretanian/ Roman	1st-3rd c. AD	tope shark	Galeorhinus galeus	Triakidae	marine	Mainly demersal on continental and insular shelves, but also on the upper slopes, from near shore to 550 m.	unpub.	P6: 9-10	Identification: A. Morales, UAM; present location: Musée de la Kasbah, Tangier
6	Tahadart	28	on beach	*	Context unknown	?	"whale"	-	Cetacea (order)	marine	marine	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Whale vertebrae" are mentioned as being on the beach, but their date is unclear.
7	Tahadart	28	on beach	*	Context unknown	?	"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Tunny vertebrae" are mentioned as being on the beach, but their date is unclear.
8	Tahadart	28	Complex I	3	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	(shark, ray, chimaera)	Chondricthys	-	marine	marine	Ponsich & Tarradell 1965: 48 (?)	P7: 11-13	Identification: A. Morales, UAM; present location: Musée de la Kasbah, Tangier. Possibly bones referenced as "vertebrae of fish, from 5 to 35 mm diam".
9	Tahadart	28	Complex I	1	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	tope shark	Galeorhinus galeus	Triakidae	marine	Mainly demersal on continental and insular shelves, but also on the upper slopes, from near shore to 550 m.	Ponsich & Tarradell 1965: 48 (?)	P7: 14	Identification: A. Morales, UAM; present location: Musée de la Kasbah, Tangier. Possibly bones referenced as "vertebrae of fish, from 5 to 35 mm diam".

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
10	Tahadart	28	Complex I	2	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	(shark)	Chondricthys	Lamnidae	marine	Found between 0-715 m depth.	Ponsich & Tarradell 1965: 48 (?)	P7: 15-16	Identification: A. Morales, UAM; present location: Musée de la Kasbah, Tangier. Possibly bones referenced as "vertebrae of fish, from 5 to 35 mm diam".
11	Kouass	29	"on beach"	*	Context unknown	?	"whale"	-	Cetacea (order)	marine	marine	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Whale vertebrae" are mentioned as being on the beach, but their date is unclear.
12	Kouass	29	"on beach"	*	Context unknown	?	"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Tunny vertebrae" are mentioned as being on the beach, but their date is unclear.
13	*Zilil* /Dechar Jedid	30		1	Roman	1st-3rd c. AD	(skate)	Raja sp.	Rajidae	marine, estuarine	Some species enter brackish water, usually on sandy bottoms. Live between 0-170 m depth. Demersal.	unpub. (for site: Akerraz, *et al.* 1981-82: 170-172)	P8: 17	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Found in box with later sigillatas and Roman glass. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot. Re-location of site as Zilil, see Akerraz, et al. 1981-82: 170-172; Gozalbes 2008: 49.
14	*Zilil* /Dechar Jedid	30		1	Roman	1st-3rd c. AD	unknown	unknown	unknown	-	-	unpub. (for site: Akerraz, *et al.* 1981-82: 170-172)	P8: 18	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Found in box with later sigillatas and Roman glass. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot. Re-location of site as Zilil, see Akerraz, et al. 1981-82: 170-172; Gozalbes 2008: 49.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
15	*Zilil* /Dechar Jedid	30		2	Roman	1st-3rd c. AD	tope shark	Galeorhinus galeus	Triakidae	marine	Mainly demersal on continental and insular shelves, but also on the upper slopes, from near shore to 550 m.	unpub. (for site: Akerraz, *et al.* 1981-82: 170-172)	P8: 19-20	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Found in box with later sigillatas and ROman glass. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot. Re-location of site as Zilil, see Akerraz, et al. 1981-82: 170-172; Gozalbes 2008: 49.
16	*Zilil* /Dechar Jedid	30		1	Roman	1st-3rd c. AD	shortfin mako shark or porbeagle	Isurus oxyrinchus or Lamna nasus	Lamnidae	Mako: marine; Porbeagle: marine	Mako: Oceanic, but also coastal. Usually in surface waters to ca.150 m depth, but can go to 740 m depth. Porbeagle: Most abundant on continental offshore fishing banks and occasionally close inshore. Neritic.	unpub. (for site: Akerraz, *et al.* 1981-82: 170-172)	P8: 21	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Found in box with later sigillatas and Roman glass. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot. Re-location of site as Zilil, see Akerraz, et al. 1981-82: 170-172; Gozalbes 2008: 49.
17	*Lixus*	36	"on beach"	*	Context unknown	?	"whale"	-	Cetacea (order)	marine	marine	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Whale vertebrae" are mentioned as being on the beach, but their date is unclear.
18	*Lixus*	36	"on beach"	*	Context unknown	?	"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Tunny vertebrae" are mentioned as being on the beach, but their date is unclear.
19	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		European eel	Anguilla anguilla	Anguillidae	marine, freshwater, estuarine	Diadromous. Elvers mature in estuaries and continental waters before moving into freshwater basins. Adults migrate to ocean, found 0-700 m depth.	Grau Almero, *et al.* 2001: 206; Aranegui, *et al* . 2007: 210-211	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
20	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
21	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	White trevally	Caranx dentex	Carangidae	marine, estuarine	Occur in bays, coastal waters and estuaries. School on surface, in mid-water and on the bottom; often associated with reefs and rough bottom, 10-238 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
22	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Atlantic horse mackerel	Trachurus trachurus	Carangidae	marine	Pelagic, oceanodromous. Adults form large schools in coastal areas with sandy substrate. Usually found 0-150 m depth but up to 250 m depth.	Grau Almero, *et al.* 2001: 207; Aranegui, *et al.* 2007: 210-211	-	
23	*Lixus*	36	Ladera sur	21	Punico-Mauretanian	50 BC-AD 50	European pilchard	Sardina pilchardus	Clupeidae	marine, freshwater, estuarine	Littoral species, pelagic and neretic. Form schools, usually at depths of 25 to 55 or even 100 m by day, rising to 10 to 35 m at night.	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371;Aranegui, *et al.* 2007: 210-211	-	
24	*Lixus*	36	Sondeos del Algarrobo y Olivo	7	Punico-Mauretanian		(herring, sardine, shad, mehaden)	-	Clupeidae	marine, freshwater, estuarine	Marine coastal, some freshwater species.	Grau Almero, *et al.* 2001: 206; Aranegui, *et al.* 2007: 210-211	-	
25	*Lixus*	36	Ladera sur	6	Punico-Mauretanian	50 BC-AD 50	Bastard grunt	Pomadacys incisus	Haemulidae	marine, estuarine	Demersal, over hard bottoms and sand, 10-100 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
26	*Lixus*	36	Ladera sur	6	Punico-Mauretanian	50 BC-AD 50	European seabass	Dicentrarchus labrax	Moronidae	marine, freshwater, estuarine	Adults inhabit coastal waters down to ca. 100 m depth but more common in shallow waters. Demersal in the littoral zone: bottoms on estuaries, lagoons and occasionally rivers.	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
27	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Spotted seabass	Dicentrarchus punctatus	Moronidae	marine, estuarine	Coastal species. Occurs on various kinds of bottoms. Occasionally occurring in rivers, 30 - ? m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
28	*Lixus*	36	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	(seabass)	Dicentrarchus sp.	Moronidae	marine, estuarine	Coastal species. Occurs on various kinds of bottoms. Occasionally occurring in rivers, 30 - ? m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
29	*Lixus*	36	Ladera sur	5	Punico-Mauretanian	50 BC-AD 50	Thicklip grey mullet	Chelon labrosus	Mugilidae	marine, freshwater, estuarine	Occur inshore, enters brackish lagoons. Demersal and catadromous.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	
30	*Lixus*	36	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	(mullet)	-	Mugilidae	marine, freshwater, estuarine	Some species enter freshwater and are catadromous.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al*. 2006: 369-371	-	
31	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Thicklip grey mullet	Chelon labrosus	Mugilidae	marine, freshwater, estuarine	Occur inshore, enters brackish lagoons. Demersal and catadromous.	Grau Almero, *et al.* 2001: 213; Aranegui, *et al.* 2007: 210-211	-	
32	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Flathead mullet	Mugil cephalus	Mugilidae	marine, freshwater, estuarine	Diadromous coastal species that often enters estuaries and rivers. Usually in schools over sand or mud bottom, 0-120 m depth.	Grau Almero, *et al.* 2001: 213; Aranegui, *et al.* 2007: 210-211	-	
33	*Lixus*	36	Sondeos del Algarrobo y Olivo	3	Punico-Mauretanian		(mullet)	-	Mugilidae	marine, freshwater, estuarine	Some species enter freshwater and are catadromous.	Grau Almero, *et al.* 2001: 213; Aranegui, *et al.* 2007: 210-211	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
34	*Lixus*	36	Ladera sur	2	Punico-Mauretanian	50 BC-AD 50	Mediterranean moray	Muraena helena	Muraenidae	marine	Rocks or corals, 15-50 m depth.	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
35	*Lixus*	36	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	Bluefish	Pomatomus saltator	Pomatomidae	marine, estuarine	Oceanic and coastal waters (up to 200 m depth). They are most common along surf beaches and rock headlands, although adults can also be found in estuaries and into brackish water. Small fish may be found in shallow coastal waters at least 2 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
36	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Meagre	Argyrosomus regius	Sciaenidae	marine, estuarine	Inshore and shelf waters, close to bottom as well as in surface and mid-waters, 15-300 m depth. Juveniles and sub-adults enter estuaries and coastal lagoons.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
37	*Lixus*	36	Ladera sur	13	Punico-Mauretanian	50 BC-AD 50	Spanish/chub mackerel	Scomber japonicus	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Rodríguez Santana & Rodrigo García 2005: 246; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
38	*Lixus*	36	Sondeos del Algarrobo y Olivo	12	Punico-Mauretanian		Spanish/chub mackerel	Scomber japonicus	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Grau Almero, *et al*. 2001: 214; Aranegui, *et al.* 2007: 210-211	-	
39	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		(mackerel)	Scomber sp.	Scombridae	marine	A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope, 0-300 m depth.	Grau Almero, *et al.* 2001: 214; Aranegui, *et al*. 2007: 210-211	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
40	*Lixus*	36	Ladera sur	2	Punico-Mauretanian	50 BC-AD 50	Bogue	Boops boops	Sparidae	marine	Demersal. Found on the shelf or coastal pelagic on various bottoms (sand, mud, rocks and seaweeds), 0-350 m depth, usually 0-100 m.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
41	*Lixus*	36	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	Pink dentex	Dentex gibbosus	Sparidae	marine	Occur on the shelf on rocky and rubble bottoms and sand. Young are close to shore; adults offshore near continental slope, 20-220 m depth.	Rodríguez Santana & Rodrigo García 2005: 243; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
42	*Lixus*	36	Ladera sur	5	Punico-Mauretanian	50 BC-AD 50	Canary dentex	Dentex canariensis	Sparidae	marine	Inhabit inshore waters, demersal on various substrates (specially rocky) to 150 m depths.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
43	*Lixus*	36	Ladera sur	5	Punico-Mauretanian	50 BC-AD 50	(dentex)	Dentex sp.	Sparidae	marine	Inhabit inshore waters, demersal on various substrates (specially rocky) to 150-220 m depths.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
44	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Saddled seabream	Oblada melanura	Sparidae	marine	Benthopelagic; over rocky bottoms or seagrass beds (*Zostera* and seaweeds), 0-30 m depth.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
45	*Lixus*	36	Ladera sur	10	Punico-Mauretanian	50 BC-AD 50	Common two-banded seabream	Diplodus vulgaris	Sparidae	marine	Benthopelagic, euryhaline species over rocky and sandy bottoms to 160 m; more common in less than 50 m. Young are sometimes found in seagrass beds.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
46	*Lixus*	36	Ladera sur	2	Punico-Mauretanian	50 BC-AD 50	Annular seabream	Diplodus annularis	Sparidae	marine, estuarine	Benthopelagic; Inhabit *Zostera* seagrass beds but also *Posidonia* beds and sandy bottoms, 0-90 m depth.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
47	*Lixus*	36	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	White seabream	Diplodus sargus	Sparidae	marine	Demersal, over coastal rocky reefs and *Posidonia oceanica* beds. Very active and frequents the surf zone, 0-30 m depth.	Rodríguez Santana & Rodrigo García 2005: 244; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
48	*Lixus*	36	Ladera sur	9	Punico-Mauretanian	50 BC-AD 50	(seabream)	Diplodus sp.	Sparidae	marine, freshwater, estuarine	A euryhaline demersal species inhabiting rocky and sometimes sandy bottoms to depths of 160 m, but more commonly in less than 50 m. The young are sometimes found in seagrass beds.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
49	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Gilthead seabream	Sparus aurata	Sparidae	marine, estuarine	Demersal. Found in seagrass beds and sandy bottoms as well as in the surf zone to 30 m, but adults may occur to 150 m depth. In spring, present in coastal lagoons and estuaries.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
50	*Lixus*	36	Ladera sur	4	Punico-Mauretanian	50 BC-AD 50	Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al.* 2006: 369-371; Aranegui, *et al*. 2007: 210-211	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
51	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Common pandora	Pagellus erythrinus	Sparidae	marine	Found on inshore waters, on various bottom (rock, gravel, sand, mud and grass) to 200 m (Mediterranean) or 300 m (Atlantic) and move to deeper waters during winter.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, et al. 2006: 369-371; Aranegui, et al. 2007: 210-211	-	
52	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	(bream, porgy, pandora)	Pagellus sp.	Sparidae	marine	Found on inshore waters, on various bottom (rock, gravel, sand, mud and grass) to 200 m (Mediterranean) or 300 m (Atlantic) and move to deeper waters during winter.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
53	*Lixus*	36	Ladera sur	9	Punico-Mauretanian	50 BC-AD 50	(porgy)	-	Sparidae	marine	Rarely found in brackish and freshwater environments.	Rodríguez Santana & Rodrigo García 2005: 245; Aranegui Gascó, *et al*. 2006: 369-371	-	
54	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Bogue	Boops boops	Sparidae	marine	Demersal. Found on the shelf or coastal pelagic on various bottoms (sand, mud, rocks and seaweeds), 0-350 m depth, usually 0-100 m.	Grau Almero, *et al.* 2001: 208; Aranegui, *et al.* 2007: 210-211	-	
55	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Common two-banded seabream	Diplodus vulgaris	Sparidae	marine	Benthopelagic, euryhaline species over rocky and sandy bottoms to 160 m; more common in less than 50 m. Young are sometimes found in seagrass beds.	Grau Almero, *et al.* 2001: 209; Aranegui, *et al.* 2007: 210-211	-	

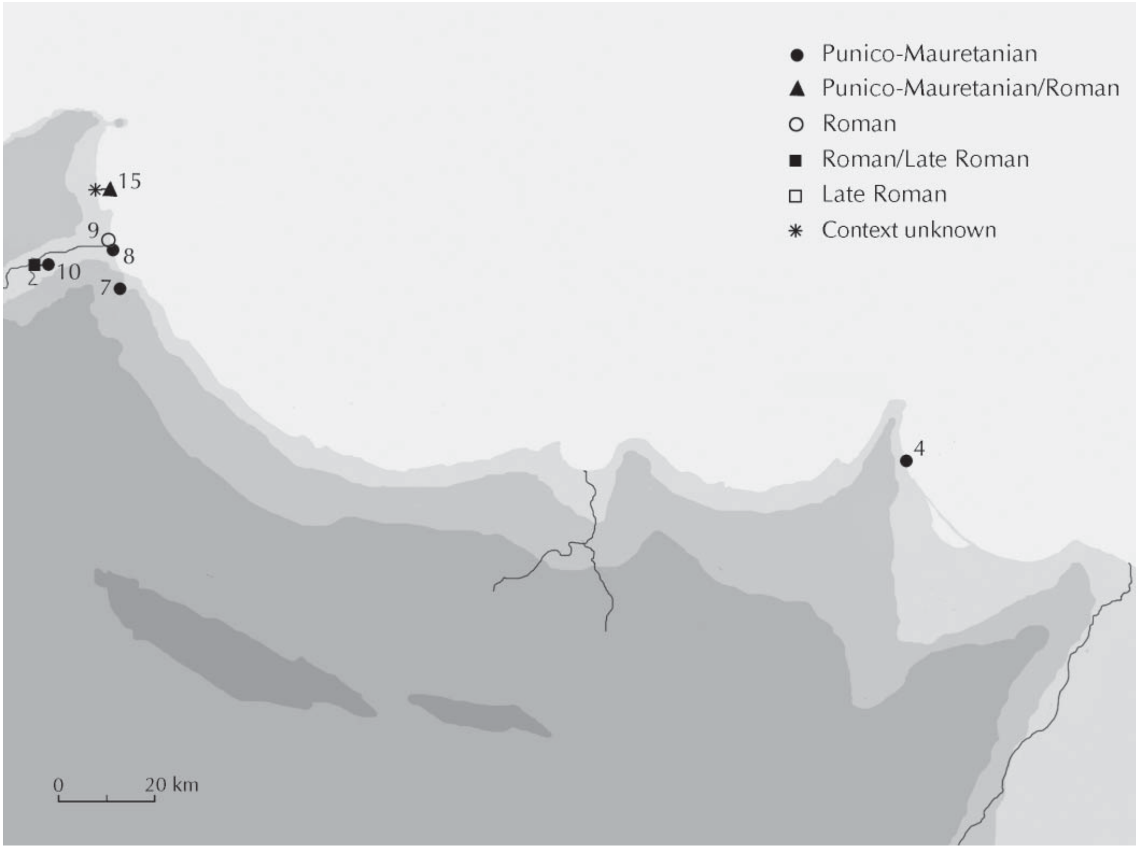
Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
56	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		(seabream)	Diplodus sp.	Sparidae	marine, freshwater, estuarine	A euryhaline demersal species inhabiting rocky and sometimes sandy bottoms to depths of 160 m, but more commonly in less than 50 m. The young are sometimes found in seagrass beds.	Grau Almero, *et al.* 2001: 209; Aranegui, *et al.* 2007: 210-211	-	
57	*Lixus*	36	Sondeos del Algarrobo y Olivo	3	Punico-Mauretanian		Common seabream	Pagrus pagrus	Sparidae	marine	Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, usually 10-80 m	Grau Almero, *et al* . 2001: 210; Aranegui, *et al.* 2007: 210-211	-	
58	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		(seabream)	Pagrus sp.	Sparidae	marine, freshwater, estuarine	Demersal. Found over rock, rubble, or sand bottoms (young frequently found on seagrass beds and the continental shelf down to about 250 m depth, often above 150 m.	Grau Almero, *et al* . 2001: 210; Aranegui, *et al.* 2007: 210-211	-	
59	*Lixus*	36	Sondeos del Algarrobo y Olivo	3	Punico-Mauretanian		Common pandora	Pagellus erythrinus	Sparidae	marine	Found on inshore waters, on various bottom (rock, gravel, sand, mud and grass) to 200 m (Mediterranean) or 300 m (Atlantic) and move to deeper waters during winter.	Grau Almero, *et al* . 2001: 211; Aranegui, *et al.* 2007: 210-211	-	
60	*Lixus*	36	Sondeos del Algarrobo y Olivo	1	Punico-Mauretanian		Gilthead seabream	Sparus aurata	Sparidae	marine, estuarine	Demersal. Found in seagrass beds and sandy bottoms as well as in the surf zone to 30 m, but adults may occur to 150 m depth. In spring, present in coastal lagoons and estuaries.	Grau Almero, *et al* . 2001: 212; Aranegui, *et al.* 2007: 210-211	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
61	*Lixus*	36	Sondeos del Algarrobo y Olivo	5	Punico-Mauretanian		(porgy)	-	Sparidae	marine	Rarely found in brackish and freshwater environments.	Grau Almero, *et al*. 2001: 212	-	
62	*Lixus*	36	Ladera sur	3	Punico-Mauretanian	50 BC-AD 50	(shark, ray, chimaera)	Chondricthys		marine	marine	Rodríguez Santana & Rodrigo García 2005: 242; Aranegui Gascó, *et al*. 2006: 369-371; Aranegui, *et al.* 2007: 210-211	-	
63	*Lixus*	36	Sondeos del Algarrobo y Olivo	11	Punico-Mauretanian		(shark, ray, chimaera)	Chondricthys		marine	marine	Grau Almero, *et al*. 2001: 206; Aranegui, *et al.* 2007: 210-211	-	
64	*Lixus*	36	"superficial"	2	Roman	1st-3rd c. AD	Common dentex	Dentex dentex	Sparidae	marine, freshwater, estuarine	Demersal; mainly a marine fish, but sometimes brackish and freshwater. Found between 20-500 m depth; usually 5-50 m depth.	unpub.	P9: 22-23	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Found in a box with Roman ceramics, from Tarradell excavations.
65	*Lixus*	36	Sondeo del Algarrobo	25	Roman		Great hammerhead or tope shark	Sphyrna mokarran or Galeorhinus galeus	Sphyrnidae or Triakidae	Hammerhead: marine, estuarine; Tope: marine	Hammerhead: coastal-pelagic, semi-oceanic, found inshore and offshore, over the continental shelves and in lagoons. Often bottom and reef associated at 1-80 m depth but up to 300 m depth. Tope: mainly demersal on continental and insular shelves, but also on the upper slopes, from near shore to 550 m.	unpub. (see Arangegui Gasco & Tarradell-Font 2001: 21-22; Belén, *et al.* 2001: 83-84 for date of this layer)	P10: 24-48	Identification: A. Morales, UAM; present location: Musée Archéologique, Tetouan. Labelled: "Algarr. Estrat 7, 1'25-1'55 (1957)". This is a fused spine of 25 vertebrae.
66	*Banasa*	46	Luquet, Sondage C (1955c), Niveau III	*	Punico-Mauretanian		unknown	unknown	unknown	-	-	Girard 1984a: 31	-	"Fish scales" generally mentioned in material found at 3.65 m depth, referred to generally as "pre-Roman" levels.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	FAMILY	ENVIRONMENT	HABITAT	REFERENCE	Photo CD#	COMMENTS
67	*Thamusida*	47	Area VII	2	Roman	3rd c. AD	sturgeon	Acipenser sturio	Acipenserid ae	marine, estuarine, freshwater	Mainly demersal, but frequent littoral zones; potamodromous fish that return to rivers to spawn.	Papi & Martorella 2007: 94	-	Only "Storione" mentioned - no specific species; ID here based on distribution of fish - only species known to be offshore of Morocco.
68	*Thamusida*	47	Area VII	2	Roman	3rd c. AD	unknown	unknown	unknown	-	-	Papi & Martorella 2007: 94	-	Bones only identified as "*Pisces s* p."
69	Essaouira	57	island	*	Context unknown		"whale"	-	Cetacea (order)	marine	marine	Jodin 1966c: 187	-	"Whale vertebrae" mentioned generally, amongst other bones, such as elephant vertebrae and tibias.
70	Essaouira	57	Coupe J-K, Couche IV, SE part of island	*	Punico-Mauretanian		unknown	unknown	unknown	-	-	Jodin 1957: 15-16	-	"Marine animal remains" found during 1957 excavations along with terrestrial animal remains, .5-1.0 m depth (layer designated "pre-Roman" with painted ceramics), on top of a level of sterile soil.
71	Essaouira	57	Couche IVd, SE part of the island	*	Punico-Mauretanian		"tunny"	-	Scombridae	marine	Oceanic but seasonally coming close to shore.	Jodin 1957: 19; Jodin 1967: 68, 227-228	-	General statement: in this level thoughout trenches were "tunny bone/vertebrae" remains.
72	Essaouira	57	Couche IVd, SE part of the island	*	Punico-Mauretanian		"swordfish"	-	Xiphiidae	marine	oceanic but sometimes in coastal waters; 0-800 m depth.	Jodin 1957: 19	-	General statemen: in this level thoughout trenches were "swordfish bones".
73	Essaouira	57		*	Punico-Mauretanian/ Roman		unknown	unknown	unknown	-	-	Jodin 1967: 68, 227-228	-	General statement saying that numerous vestiges of "fish bones" found in all levels.
74	Essaouira	57		*	Punico-Mauretanian/ Roman		unknown	unknown	unknown	-	-	Jodin 1967: 68, 227-228	-	General statement saying that numerous vestiges of "fish bones" found in all levels.

Appendix 1.2.
Marine invertebrate remains

1.2.1 Mediterranean



FIND-SITES:

4. *Rusaddir*/Melilla
7. Emsa
8. Sidi Abdeselam del Behar
9. Metrouna
10. *Tamuda*
15. Sania e Torres

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
1	*Rusaddir* /Melilla	4	Jardines del Gobernador	1	Punico-Mauretanian	1st c. BC	banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Aragon Gómez, *et al.* 2007: 115-116, fig. 22	-	
2	*Rusaddir* /Melilla	4	Jardines del Gobernador	1	Punico-Mauretanian	1st c. BC	Mediterranean mussel	Mylitus galloprovincialis	Bivalve	marine, estuarine, intertidal, infratidal	fixed to rocks and piers	Aragon Gómez, *et al.* 2007: 115-116, fig. 22	-	
3	*Rusaddir* /Melilla	4	Jardines del Gobernador	45	Punico-Mauretanian	1st c. BC	Common periwinkle	Littorina littorea	Gastropod	marine, estuarine, infratidal	rocky coastlines	Aragon Gómez, *et al.* 2007: 115-116, fig. 22	-	
4	*Rusaddir* /Melilla	4	Jardines del Gobernador	32	Punico-Mauretanian	1st c. BC	"marine snails"	Monodonta turbinata	Gastropod	marine, intertidal, infratidal	rocky littorals below the level of low tide	Aragon Gómez, *et al.* 2007: 115-116, fig. 22	-	
5	*Rusaddir* /Melilla	4	Jardines del Gobernador	4	Punico-Mauretanian	1st c. BC	"limpets"	-	Gastropod	marine, intertidal, infratidal	rocky and hard sand bottoms	Aragon Gómez, *et al.* 2007: 115-116, fig. 22	-	
6	*Rusaddir* /Melilla	4	Jardines del Gobernador	3	Punico-Mauretanian	1st c. BC	"venus clams"	Veneridae (family)	Bivalve	marine, intertidal, infratidal	rocky and hard bottoms down to 20 m	Aragon Gómez, *et al.* 2007: 115-116, fig. 22	-	
7	*Rusaddir* /Melilla	4	San Lorenzo necropolis	1	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	Fernandez de Castro y Pedrera 1945: 232-233	-	
8	Emsa	7		7	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	Rayed Mediterranean limpet	Patella caerulea (?)	Gastropod	marine, intertidal	hard surfaces	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P1: 1-7	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
9	Emsa	7		6	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P1: 8-13	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations.
10	Emsa	7		5	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P2: 14-18	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations.
11	Emsa	7		11	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P2: 19-29	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations.
12	Emsa	7		1	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P3: 30	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations.
13	Emsa	7		1	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P3: 31	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations.
14	Emsa	7		3	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P4: 32-34	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
15	Emsa	7		1	Punico-Mauretanian	late 4th-late 3rd/early 2nd c. BC	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	shallow rocks and corals	unpub. (for site excavations, see Tarradell 1954b: 120-121; Tarradell 1960: 79-80)	P4: 35	Present location: Musée Archéologique, Tetouan. Labelled "Emsa 1952" - from Taradell's excavations. This is a large example (17.5 cm L).
16	Sidi Abdeselam del Behar	8		*	Punico-Mauretanian	4th-3rd c. BC	"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Tarradell 1953: 162-163; Tarradell 1957: 255-271	-	In the foundation level - says there are many "murex" and that purple dye production was likely done here. No species given.
17	Sidi Abdeselam del Behar	8		8	Punico-Mauretanian		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for site: Tarradell 1960: 86-95, figs 17-18)	P5: 36 43	Material labelled “S.A. 1952 A”. 7 have hole drilled in their hinges. Present location: Musée Archéologique, Tetouan.
18	Sidi Abdeselam del Behar	8		1	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for site: Tarradell 1960: 86-95, figs 17-18)	P6: 44	Material labelled “primer nivel”. Present location: Musée Archéologique, Tetouan
19	Sidi Abdeselam del Behar	8		17	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for site: Tarradell 1960: 86-95, figs 17-18)	P6: 45 49	(Only 5 recorded examples in photo.) Material labelled “primer nivel”. Present location: Musée Archéologique, Tetouan
20	Sidi Abdeselam del Behar	8		1	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (for site: Tarradell 1960: 86-95, figs 17-18)	P7: 50	Material labelled “primer nivel”. Present location: Musée Archéologique, Tetouan

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
21	Sidi Abdeselam del Behar	8		1	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (for site: Tarradell 1960: 86-95, figs 17-18)	P8: 51	Material labelled "primer nivel". Present location: Musée Archéologique, Tetouan
22	Sidi Abdeselam del Behar	8		1	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for site: Tarradell 1960: 86-95, figs 17-18)	P8: 52	Material labelled "primer nivel". Present location: Musée Archéologique, Tetouan
23	Metrouna	9		*	Roman	ca. AD 75-150	banded dye-murex	Hexaplex (truncularioopsis) trunculus [murex trunculus]	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Bernal, *et al.* 2008b: 332-335, fig. 20	-	Shells are mentioned in text as being broken or pierced to extract dye gland, but those shown in Fig. 20 appear to be whole.
24	Metrouna	9		*	Roman	ca. AD 75-150	spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	Bernal, *et al.* 2008b: 332-335, fig. 20	-	Shells are mentioned in text as being broken or pierced to extract dye gland, but those shown in Fig. 20 appear to be whole.
25	*Tamuda*	10	South sector	*	Punico-Mauretanian		"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Quintero Atauri & Gimenez Bernal 1944: 7 (for excavations: Tarradell 1956: 73 & Tarradell 1960: 104)	-	"Murex" mentioned, no species, find area or date given (settlement chronology gives date here). Excavations near the wall that runs E-W.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
26	*Tamuda*	10	South sector	32	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P9: 53 58	(Only 6 recorded in photo.) Present location: Musée Archéologique, Tetouan.From Taradell's or Morán & Giménez Bernal's excavations? Largest over 15 cm L.
27	*Tamuda*	10	South sector	2	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P10: 59-60	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? excavations? Largest 12.2 cm L.
28	*Tamuda*	10	South sector	2	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P10: 61-62	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
29	*Tamuda*	10	South sector	1	Punico-Mauretanian		clam (?)	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P10: 63	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
30	*Tamuda*	10	South sector	3	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 64	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? Ca 19.5 cm L.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
31	*Tamuda*	10	South sector	2	Punico-Mauretanian		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 65	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
32	*Tamuda*	10	South sector	3	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 66	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
33	*Tamuda*	10	South sector	2	Punico-Mauretanian		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 67	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's excavations?
34	*Tamuda*	10	South sector	13	Punico-Mauretanian		Algarve volute	Cymbium olla	Gastropod	marine, infratidal	depths between 60-150 m	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P11: 68	(Only 1 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? This species indigenous to Alboran sea, W. Med.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
35	*Tamuda*	10	South sector	18	Punico-Mauretanian		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P12: 69-71	(Only 3 recorded in photo.) Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations? Four of these have holes pierced near their hinges - largest over 10 cm W.
36	*Tamuda*	10	South sector	1	Punico-Mauretanian		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for excavations: Morán & Giménez Bernal 1948: 38, Plano 1)	P12: 72	Present location: Musée Archéologique, Tetouan. From Taradell's or Morán & Giménez Bernal's excavations?
37	*Tamuda*	10	East sector	1	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P13: 73	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 50) "T-51 Alrededores calle 2 section W". 12 cm W.
38	*Tamuda*	10	East sector	4	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P14: 74-77	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 45).
39	*Tamuda*	10	East sector	1	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P14: 78	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 45).

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
40	*Tamuda*	10	East sector	1	Punico-Mauretanian		clam	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P14: 79	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrio este" (Box 45).
41	*Tamuda*	10		1	Punico-Mauretanian		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P15: 80	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda (Box 8) "Tamuda 1962 II".
42	*Tamuda*	10		1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub.	P15: 81	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda (Box 8) "Tamuda 1962 II".
43	*Tamuda*	10	East sector	1	Punico-Mauretanian		Mediterranean bonnet	Cassis undulata	Gastropod	marine, intertidal, infratidal	offshore sandy bottoms	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P16: 82	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda Este" (Box 35).
44	*Tamuda*	10	East sector	1	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P17: 83	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda Este" (Box 35).

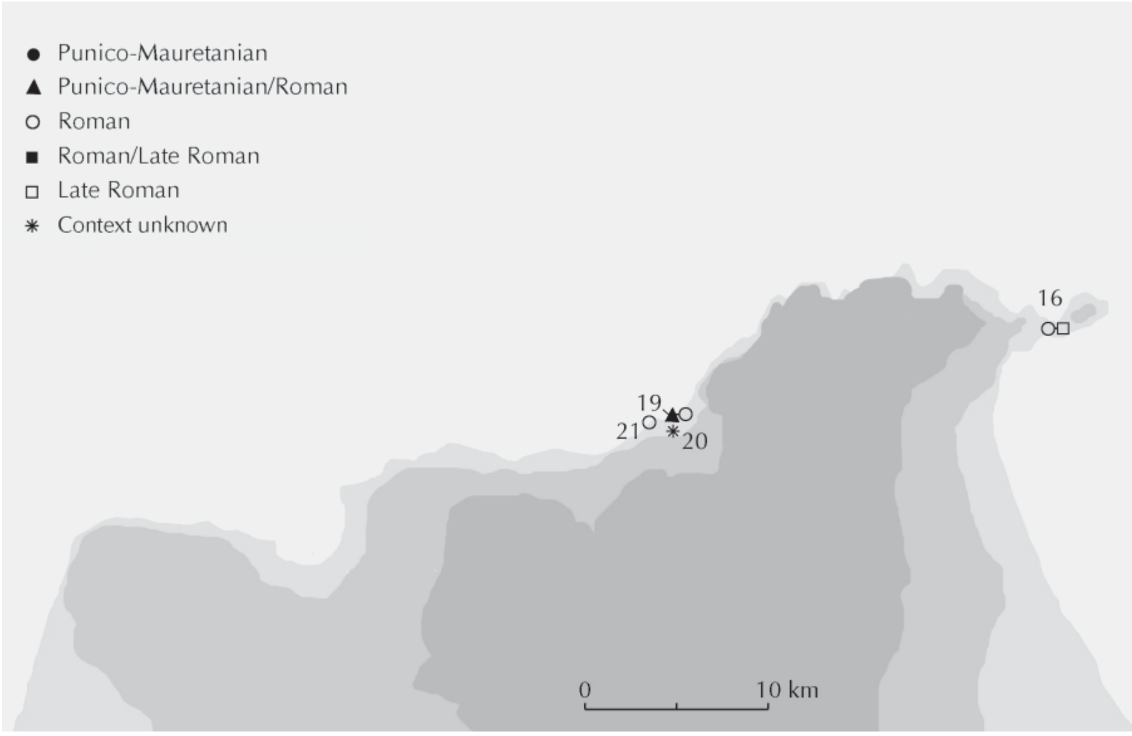
Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
45	*Tamuda*	10	East sector	1	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P18: 84	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "barrio este" (Box 44). Has small hole up near where vein may have been removed (?). Over 20 cm L.
46	*Tamuda*	10	East sector	1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P18: 85	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "barrio este" (Box 44).
47	*Tamuda*	10	SE sector	1	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P19: 86	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "S este" (Box 41).
48	*Tamuda*	10	SE sector	1	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P20: 87	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda "S este" (Box 42).
49	*Tamuda*	10	East sector	1	Punico-Mauretanian		clam	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P21: 88	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrios este" T-49 (1949) (Box 39).
50	*Tamuda*	10	East sector	1	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P21: 89	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrios este" T-49 (1949) (Box 39).

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
51	*Tamuda*	10	East sector	1	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P21: 90	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "barrios este" T-49 (1949) (Box 39).
52	*Tamuda*	10	East sector	1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P22: 91	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33).
53	*Tamuda*	10	East sector	2	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P22: 92-93	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33).
54	*Tamuda*	10	East sector	2	Punico-Mauretanian		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P22: 94-95	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33).
55	*Tamuda*	10	East sector	16	Punico-Mauretanian		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for excavations: Tarradell 1956: 74, 80 & Tarradell 1960: 104-111)	P23: 96-111	Present location: Musée Archéologique, Tetouan. Labelled: Tamuda, "Este" (Box 33); 14 of these have holes drilled near their hinges. Appear worn.
56	*Tamuda*	10	"castro"	1	Roman/Late Roman		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P24: 112	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 51).

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
57	*Tamuda*	10	"castro"	1	Roman/Late Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P24: 113	Very worn. Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 51).
58	*Tamuda*	10	"castro"	1	Roman/Late Roman		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P25: 114	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 53).
59	*Tamuda*	10	"castro"	2	Roman/Late Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P25: 115-116	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 53).
60	*Tamuda*	10	"castro"	1	Roman/Late Roman		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (Tarradell 1958: 378-379 & Villaverde Vega 1995: 350-351 for *castellum* chronology)	P25: 117	Present location: Musée Archéologique, Tetouan. Labelled: "Tamuda castro" (Box 53).
61	*Tamuda*	10	castellum	3	Late Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (Villaverde Vega 1995: 350-351 for *castellum* chronology)	P26: 118-120	Present location: Musée Archéologique, Tetouan. Labelled: Late Roman "VII – 1962", from castellum.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
62	*Tamuda*	10	castellum	2	Late Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (Villaverde Vega 1995: 350-351 for *castellum* chronology)	P26: 121-122	Present location: Musée Archéologique, Tetouan. Labelled: Late Roman "VII – 1962", from castellum.
63	Sania e Torres	15	on beach	*	Context unknown	?	"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"great number of Murex qith broken ends" are mentioned as being found frequently on the beach, but no species or chronology is given.
64	Sania e Torres	15		*	Punico-Mauretanian/ Roman	1st c. BC-3rd c. AD	"shells"	unknown	-	-	-	Ponsich 1988: 168; Ponsich & Tarradell 1965: 77	-	general mention of "shells" found between stones in the vat walls

1.2.2 Straits of Gibraltar



FIND-SITES:

16. *Septem Fratres*
19. Ksar-es-Seghir
20. Dchar 'Askfane
21. Zahara

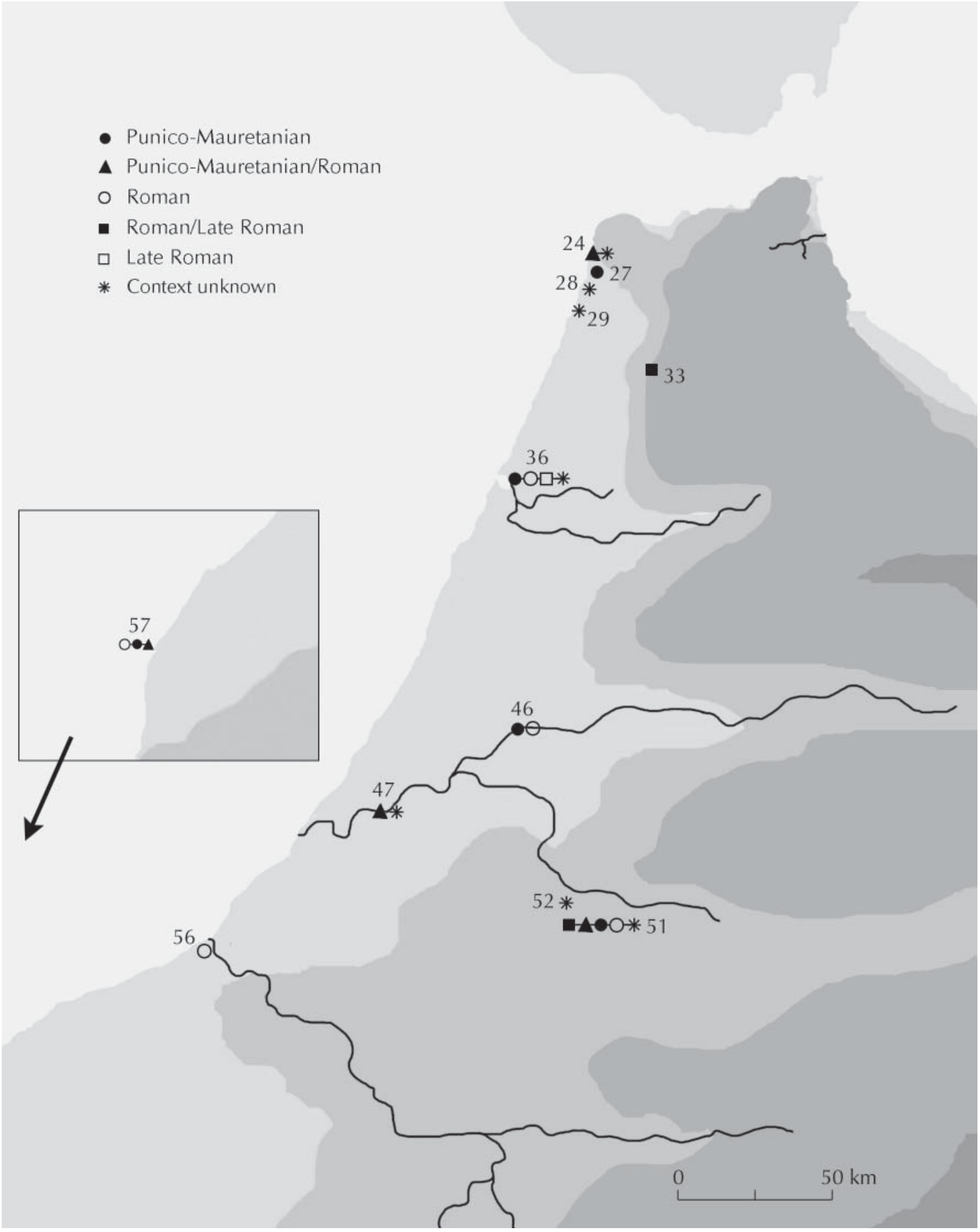
Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
1	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	22	Roman	3rd c. AD	European thorny oyster	Spondylus gaederopus	Bivalve	marine, intertidal, infratidal	rocky shorelines	Chamorro Moreno 1988: 474; Hita Ruiz & Villada Paredes 1994: 49-50	-	Most abundant specis found in this area. Evidence of erosion - collected after animal died.
2	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	4	Roman	3rd c. AD	Safian limpet	Patella nigra	Gastropod	marine, intertidal, infratidal	hard surfaces	Chamorro Moreno 1988: 474; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	Also referred to as *Patella safiana* .
3	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Chamorro Moreno 1988: 475; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	
4	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	22	Roman	3rd c. AD	oyster	Ostrea edulis	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Chamorro Moreno 1988: 476; Hita Ruiz & Villada Paredes 1994: 49-50	-	
5	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	7	Roman	3rd c. AD	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Chamorro Moreno 1988: 475; Hita Ruiz & Villada Paredes 1994: 49-50	-	Evidence of erosion - collected after animal died.
6	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	2	Roman	3rd c. AD	spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	Chamorro Moreno 1988: 475	-	
7	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	banded dye-murex	Hexaplex (trunculariopsis) trunculus [murex trunculus]	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Chamorro Moreno 1988: 475; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	
8	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	2	Roman	3rd c. AD	Mediterranean bonnet	Cassis undulata	Gastropod	marine, intertidal, infratidal	offshore sandy bottoms	Chamorro Moreno 1988: 475	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
9	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Chamorro Moreno 1988: 476; Hita Ruiz & Villada Paredes 1994: 49-50	-	Evidence of erosion - collected after animal died.
10	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	3	Roman	3rd c. AD	Pilose bittersweet	Glycimeris glycimeris	Bivalve	marine, intertidal, infratidal	mud and sandy habitats, lower to sub-tidal zone to 150 m depth	Chamorro Moreno 1988: 476, 488	-	These have perforated holes near their hinges. Evidence of erosion - collected after animal died. Evidence of burining. Possibly used as a lamp?
11	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	Atlantic/ Mediterranean scallop	Pecten jacobaeus	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 200 m depth	Chamorro Moreno 1988: 476	-	Same species as *Pecten maximus.*
12	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	4	Roman	3rd c. AD	spiny cockle	Acanthocardia aculeata	Bivalve	marine, infratidal	muddy, sandy bottoms, 5-25 m depth	Chamorro Moreno 1988: 476; Bernal Casasola & Pérez Rivera 1999: 69, fig. 31b	-	Evidence of erosion - collected after animal died.
13	*Septem* /Ceuta	16	Paseo de las Palmeras/floor near Conjunto 3	1	Roman	3rd c. AD	(sea urchin)	Strongylocentrotus sp.	Echinoidea	marine, intertidal	low intertidal zone, on rocks	Hita Ruiz & Villada Paredes 1994: 49-50	-	Identified by A. Morales, UAM
14	*Septem* /Ceuta	16	Paseo de las Palmeras	1	Roman	2nd-3rd c. AD	coral	Dendrophillia ramea	Scleractinia (order)	marine, infratidal	attached to rocks, usually around 40 - 110 m depth	Bernal Casasola & Pérez Rivera 1999: 68, fig. 33	-	No common name for this coral type. Trunk is red/red-orange colour when alive.
15	*Septem* /Ceuta	16	Mirador (Hotel la Muralla)	*	Late Roman		(oyster)	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
16	*Septem* /Ceuta	16	Mirador (Hotel la Muralla)	*	Late Roman		(thorny/spiny oyster)	Spondylus sp.	Bivalve	marine, intertidal, infratidal	rocky shorelines	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
17	*Septem* /Ceuta	16	Mirador (Hotel la Muralla)	*	Late Roman		(limpet)	Patella sp.	Gastropod	marine, intertidal	fixed on rocks	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
18	*Septem* /Ceuta	16	Basilica (near 20/21 Av. S. Prados)	*	Late Roman		(oyster)	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
19	*Septem* /Ceuta	16	Basilica (near 20/21 Av. S. Prados)	*	Late Roman		(thorny/spiny oyster)	Spondylus sp.	Bivalve	marine, intertidal, infratidal	rocky shorelines	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
20	*Septem* /Ceuta	16	Basilica (near 20/21 Av. S. Prados)	*	Late Roman		(limpet)	Patella sp.	Gastropod	marine, intertidal	fixed on rocks	Hita Ruiz & Villada Paredes 1994: 68, n. 2	-	Identified by C. Lalueza Fox.
21	*Septem* /Ceuta	16	Plaza de África no. 3	*	Late Roman	5th c.	Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	Bernal Casasola, *et al.* 2007: 96-97	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana
22	*Septem* /Ceuta	16	Plaza de África no. 3	*	Late Roman	5th c.	oyster	Ostrea edulis	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	Bernal Casasola, *et al.* 2007: 96-97	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana
23	*Septem* /Ceuta	16	Plaza de África no. 3	*	Late Roman	5th c.	banded dye-murex	Hexaplex (trunculariopsis) trunculus [murex trunculus]	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Bernal Casasola, et al. 2007: 96-97; Bernal Casasola 2009b: 267-268	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana
24	*Septem* /Ceuta	16	Plaza de África no. 3	*	Late Roman	5th c.	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	fixed on rocks	Bernal Casasola, *et al.* 2007: 96-97	-	From new excavations; Exhibit Inv. 11.795; Museo de la basílica tardorromana
25	Ksar-es-Seghir	19	"poblacion"	1	Punico-Mauretanian/ Roman		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (for site see Ponsich & Tarradell 1965: 71-75)	P27: 123	Present location: Musée Archéologique, Tetouan. Found in box with terra sigillata, sigillata claire and broze oenochoe. (Site, however, occupied/re-occupied 1st-5th c. AD)

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
26	Ksar-es-Seghir	19	"poblacion"	2	Punico-Mauretanian/ Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for site see Ponsich & Tarradell 1965: 71-75)	P27: 124-125	Present location: Musée Archéologique, Tetouan. Found in box with terra sigillata, sigillata claire and broze oenochoe. (Site, however, occupied/re-occupied 1st-5th c. AD)
27	Ksar-es-Seghir	19	"poblacion"	4	Punico-Mauretanian/ Roman		Ribbed Mediterranean limpet	Patella ferruginea	Gastropod	marine, intertidal	fixed on rocks	unpub. (for site see Ponsich & Tarradell 1965: 71-75)	P27: 126-129	Present location: Musée Archéologique, Tetouan. Found in box with terra sigillata, sigillata claire and broze oenochoe. (Site, however, occupied/re-occupied 1st-5th c. AD)
28	Ksar-es-Seghir	19	"poblacion"	1	Punico-Mauretanian/ Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma (?)	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (for site see Ponsich & Tarradell 1965: 71-75)	P27: 130	Possible ID. Present location: Musée Archéologique, Tetouan. Found in box with terra sigillata, sigillata claire and broze oenochoe. (Site, however, occupied/re-occupied 1st-5th c. AD)
29	Ksar-es-Seghir	19	fish-salting factory	2	Roman	1st-3rd c. AD	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for site see Ponsich & Tarradell 1965: 71-75)	P28: 131-132	Present location: Musée Archéologique, Tetouan. Labelled: Alksarseghir S "depositos salazón".
30	Ksar-es-Seghir	19	fish-salting factory	1	Roman	1st-3rd c. AD	oyster	ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (for site see Ponsich & Tarradell 1965: 71-75)	P28: 133	Present location: Musée Archéologique, Tetouan. Labelled: Alksarseghir S "depositos salazón". Large example - ca. 15 cm W.
31	Dchar 'Askfane	20		*	Context Unknown		"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	unpub. (for site: Akerraz & El Khayari 2005)	-	Information provided by A. El Khayari (INSAP), 10/2007: "There are murex but not that many. Difficult to date these because there are many phases of occupation within each period."
32	Zahara (Sahara)	21		2	Roman	2nd-3rd c. AD	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (for site see Ponsich & Tarradell 1965: 68-71)	P29: 134-135	Present location: Musée Archéologique, Tetouan. Example 9.2 cm L, and has break in side where vein was removed.

1.2.3 Atlantic



FIND-SITES:

24. Cotta
27. Djebila
28. Tahadart
29. Kouass
33. Suiar
36. *Lixus*
46. *Banasa*
47. *Thamusida*
51. *Volubilis*
52. Volubilis valley
56. *Sala*
57. Essaouira

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
1	Cotta	24	on beach	*	Context unknown	?	"murex'"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	these are mentioned generally as "murex" and as being found frequently on the beach, but no chronology is given.
2	Cotta	24	around factory	*	Punico-Mauretanian/ Roman		"murex'"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1970: 290; Arharbi 2003: 72 for these areas	-	No specifics on species; only "murex" mentioned. No find area or date given. Date here given represents factory use and site occupation. Could be from other periods, however.
3	Djebila	27	necropolis, tomb no. 77	*	Punico-Mauretanian	7th-5th c. BC	(murex)	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1967b: 142, 207	-	Species given as "murex polis", but seems to be a mis-identification as this does not exist.
4	Djebila	27	necropolis, tomb no. 86	*	Punico-Mauretanian	7th-5th c. BC	(murex)	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1967b: 142, 211	-	Species given as "murex polis", but seems to be a mis-identification as this does not exist.
5	Tahadart	28	on beach	*	Context unknown	?	"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Murex" are mentioned as being found frequently on the beach, but no species or chronology is given.
6	Kouass	29	on beach	*	Context unknown	?	"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	a "great numbner of Murex with their ends broken" are mentioned as being found frequently on the beach, but no species or chronology is given.
7	Suiar	33		1	Roman/Late Roman	2nd-5th c. AD	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for site, aka *Ad Novas* or *Duga*, see Tarradell 1960: 117; see Villaverde Vega 2001: 111-112 for further discussion)	P30: 136	Present location: Musée Archéologique, Tetouan.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
8	Suiar	33		1	Roman/Late Roman	2nd-5th c. AD	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (for site, aka *Ad Novas* or *Duga*, see Tarradell 1960: 117; see Villaverde Vega 2001: 111-112 for further discussion)	P31: 137	Present location: Musée Archéologique, Tetouan.
9	*Lixus*	36	on beach	*	Context unknown	?	"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Ponsich 1988: 138; Ponsich & Tarradell 1965: 39	-	"Murex" are mentioned as being found frequently on the beach, but no species or chronology is given.
10	*Lixus*	36		1	Context unknown		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P32: 138	Present location: Musée Archéologique, Tetouan.
11	*Lixus*	36		1	Context unknown		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20	unpub.	P32: 139	Present location: Musée Archéologique, Tetouan.
13	*Lixus*	36		1	Context unknown		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	unpub.	P32: 140	Present location: Musée Archéologique, Tetouan.
12	*Lixus*	36		2	Context unknown		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub.	P33: 141-142	Present location: Musée Archéologique, Tetouan. Labelled: "Lixus, material that was on display in Larache."
14	*Lixus*	36		1	Context unknown		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P34: 143	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, 1955. In box with mixed ceramics.
15	*Lixus*	36	Sondeo del Olivo	1	Punico-Mauretanian	80/50 BC-AD 17	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Grau Almero, *et al.* 2001: 224	-	
16	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	AD 10-40	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Sagrario Carrasco Porras 2005: 256-257	-	UE 2025; dating for this level was taken from p. 31, fig. 50
17	*Lixus*	36	Ladera sur	4	Punico-Mauretanian	80-10 BC	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Sagrario Carrasco Porras 2005: 256-257	-	UE 2033, UE 2035; dating for this level was taken from p. 31, fig. 50

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
18	*Lixus*	36	Sondeo del Olivo	1	Punico-Mauretanian	80/50 BC-AD 16	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Grau Almero, *et al.* 2001: 224-225	-	some have evidence of being burned
19	*Lixus*	36	Ladera sur	146	Punico-Mauretanian		common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Aranegui Gascó, *et al.* 2006: 362; Sagrario Carrasco Porras 2005: 256-257, 259-260	-	In UE 3033, a Mana C2b amphora was found with shells of this species preserved (count: 28 - UE 3033 dated 50-20 BC) Was found with grape seeds in amphora, so maybe vinegar was used as preservative and this represents a type of salted product. Shells have discoloration similar to that produced by vinegar, and this technique is mentioned by Apicus (I,XII). Some have evidence of being burned.
20	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Sagrario Carrasco Porras 2005: 256-257, 261	-	here thinks it might also be a part of a musical instrument (por la truncadura del ápice)
21	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	AD 10-40	Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	Sagrario Carrasco Porras 2005: 256-257	-	UE 2025; dating for this level was taken from p. 31, fig. 50
22	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	50 BC-AD 50	Striped venus clam	Chamelea gallina	Bivalve	marine, intertidal infratidal	sand and muddy sand from the lower shore to ca. 55 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
23	*Lixus*	36	Sondeo del Olivo	1	Punico-Mauretanian	80/50 BC-AD 18	Violet bittersweet (1)	Glycymeris gaditanus	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Grau Almero, *et al.* 2001: 224, 226	-	Publication indicates these were not for food - at least one example had performation (hole) near its hinge
24	*Lixus*	36		1	Punico-Mauretanian		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P35: 144	Present location: Musée Archéologique, Tetouan. Labelled: "Lixus (Box 16 [?])". Found with early ceramics, sigillatas.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
25	*Lixus*	36		1	Punico-Mauretanian		cowrie	Cyprea sp.	Gastropod	marine, intertidal, infratidal	rocky shorelines, reefs	unpub.	P36: 145	Present location: Musée Archéologique, Tetouan. Labelled: "Lixus (Box 14 [?]). Bag 90 '86'". Found in bag with lots of terra sigillata.
26	*Lixus*	36		1	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20	unpub.	P37: 146	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 1958 "costal muralla angulo muros 2º, camara 11". In box with lots of terra sigillata.
27	*Lixus*	36		1	Punico-Mauretanian		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20	unpub.	P38: 147	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 1958 "camara 13". In box with lots of terra sigillata.
28	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	1st c. AD	Violet bittersweet (2)	Glycymeris violacescens	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
29	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	200-175/150 BC	carpet-shelled clam	Venerupis decussata	Bivalve	marine, infratidal	sandy and gravel bottoms in coastal zones and coastal lagoons from low tide to 40 m	Sagrario Carrasco Porras 2005: 256-257	-	from UE 3003; dating of this level taken from Fig. 54, p. 32
30	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	130-80 BC	Checkered carpet shell	Tapes decussatus	Bivalve	marine, estuarine, intertidal	mud and rocky habitats, lower to sub-tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	
31	*Lixus*	36	Sondeo del Algarrobo	8	Punico-Mauretanian	175/159 BC-80/50 BC	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Grau Almero, et al. 2001: 224	-	
32	*Lixus*	36	Ladera sur	6	Punico-Mauretanian	325-225 BC	China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	Sagrario Carrasco Porras 2005: 256-257	-	UE 3006, UE 3012, UE 3015, UE 3024; dating for this level was taken from p. 30, fig. 49, p. 31, fig. 51, p. 32, fig. 54
33	*Lixus*	36	Sondeo del Algarrobo	18	Punico-Mauretanian	175/159 BC-80/50 BC	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Grau Almero, et al. 2001: 224-225	-	some have evidence of being burned

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
34	*Lixus*	36	Sondeo del Algarrobo	5	Punico-Mauretanian	175/159 BC-80/50 BC	marine snail	Monodonta turbinata	Gastropod	marine, intertidal, infratidal	rocky littorals below the level of low tide	Grau Almero, et al. 2001: 224	-	
35	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	3rd-4th c. AD	marine snail	Monodonta turbinata	Gastropod	marine, intertidal, infratidal	rocky littorals below the level of low tide	Sagrario Carrasco Porras 2005: 256-257	-	
36	*Lixus*	36	Ladera sur	24	Punico-Mauretanian	2nd c. BC-1st c. AD	marine snail	Monodonta turbinata	Gastropod	marine, intertidal, infratidal	rocky littorals below the level of low tide	Sagrario Carrasco Porras 2005: 256-257	-	
37	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	325-225 BC	oyster	Ostrea edulis	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20	Sagrario Carrasco Porras 2005: 256-257	-	UE 3016; dating was taken from p. 31, fig. 50
38	*Lixus*	36	Ladera sur	2	Punico-Mauretanian	175/150 BC	Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	Sagrario Carrasco Porras 2005: 256-257	-	UE 3010; dating for this level was taken from p. 32, fig. 54
39	*Lixus*	36	Sondeo del Algarrobo	1	Punico-Mauretanian	175/159 BC-80/50 BC	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Grau Almero, *et al.* 2001: 224-225	-	this is identified as Pliny's "trumpet shell" (buccinum) that did not yield a fast dye alone and was mixed with other murex species (pelagia) for dying (Ziderman 1990: 99) Some were fractured at Lixus, indicating use of their dye gland
40	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	4th-3rd c. BC	Safian limpet	Patella nigra	Gastropod	marine, intertidal, infratidal	hard surfaces	Sagrario Carrasco Porras 2005: 256-257, 259	-	
41	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	4th-3rd c. BC	Smooth venus clam/Callista	Callista chione	Bivalve	marine, infratidal	sandy and muddy bottoms, from below infralittoral to 180 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
42	*Lixus*	36	Sondeo del Algarrobo	1	Punico-Mauretanian	175/159 BC-80/50 BC	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Grau Almero, *et al.* 2001: 224	-	several pierced for decoration
43	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	4th c. BC-175 BC	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Sagrario Carrasco Porras 2005: 256-261	-	some of these has a hole near their hinge

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
44	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	2nd c. BC	Violet bittersweet (2)	Glycymeris violacescens	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
45	*Lixus*	36	Ladera sur	11	Punico-Mauretanian	4th c. BC-175 BC	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Sagrario Carrasco Porras 2005: 254, 256-257	-	some have evidence of being burned
46	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	4th c. BC - 175 BC(?)	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Sagrario Carrasco Porras 2005: 256-257, 261	-	
47	*Lixus*	36	Ladera sur	3	Punico-Mauretanian	4th c. BC-175 BC	Red-mouthed rock shell (2)	Stramonita haemastoma	Gastropod	marine, intertidal, infratidal	rocky shores to below the tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	
48	*Lixus*	36		1	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Tarradell 1958: 372-375 (for date)	P39: 148	Present location: Musée Archéologique, Tetouan. Labelled: Lixus (Box 17 [?]), "Lixus 1957, C-2, Estr. 19/20".
49	*Lixus*	36	Ladera sur	18	Punico-Mauretanian	2nd c. BC-1st c. AD	Red-mouthed rock shell (2)	Stramonita haemastoma	Gastropod	marine, intertidal, infratidal	rocky shores to below the tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	
50	*Lixus*	36	Ladera sur	13	Punico-Mauretanian	2nd c. BC-1st c. AD	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Sagrario Carrasco Porras 2005: 256-260	-	some of these has a hole near their hinge
51	*Lixus*	36		2	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub.	P40: 149-150	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
52	*Lixus*	36		1	Punico-Mauretanian		China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	unpub.	P40: 151	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.

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53	*Lixus*	36		1	Punico-Mauretanian		clam	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub.	P40: 152	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
54	*Lixus*	36		1	Punico-Mauretanian		common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	unpub.	P40: 153	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
55	*Lixus*	36		1	Punico-Mauretanian		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub.	P40: 154	Present location: Musée Archéologique, Tetouan. Kown as food (Athenaus, Dein. III, 85 D). Found in box with lots of black glaze ceramics.
56	*Lixus*	36		1	Punico-Mauretanian		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub.	P40: 155	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
57	*Lixus*	36		1	Punico-Mauretanian		scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub.	P40: 156	Present location: Musée Archéologique, Tetouan. Found in box with lots of black glaze ceramics.
58	*Lixus*	36		1	Punico-Mauretanian		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	unpub.	P41: 157	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, 1978 (?). Found in a box with blaze glaze ceramics. Large example - over 20 cm L.
59	*Lixus*	36	Ladera sur	1	Punico-Mauretanian	1st c. BC	Violet bittersweet (2)	Glycymeris violacescens	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 40 m depth	Sagrario Carrasco Porras 2005: 256-257	-	
60	*Lixus*	36	"Habitacion No. 3 mas bajo que la roeda"..	1	Roman		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P42: 158	Present location: Musée Archéologique, Tetouan. Labelled: Lixus "Habitacion No. 3 mas bajo que la roeda".. (Likely Maison des Trois Grâces under the Tangier-Larache road)

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
61	*Lixus*	36	"cata peristilo MyR nivel cocina"	1	Roman		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 159	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
62	*Lixus*	36	"cata peristilo MyR nivel cocina"	1	Roman		bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 160	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
63	*Lixus*	36	"cocina 2º dep 1er nivel" Mars y Rea (?)	1	Roman		China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P45: 171	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations), "cocina 2º dep 1er nivel". (Assumed same as house of Mars and Rea).
64	*Lixus*	36	"cata peristilo MyR nivel cocina"	1	Roman		China limpet	Patella aspera	Gastropod	marine, intertidal	rocky coastlines, sometimes on port facilities	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 161	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
65	*Lixus*	36	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 167	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).
66	*Lixus*	36		1	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P46: 175	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Box 12j"; box has much Roman material.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
67	*Lixus*	36	casa "Helios"	2	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 176-177	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124. Labelled: Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).
68	*Lixus*	36	"cata peristilo MyR nivel cocina"	1	Roman		cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 162	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
69	*Lixus*	36		1	Roman		cowrie	Cyprea sp.	Gastropod	marine, intertidal, infratidal	rocky shorelines, reefs	unpub.	P46: 173	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Box 12j"; box has much Roman material.
70	*Lixus*	36	casa "Helios"	1	Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 178	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124 .Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).
71	*Lixus*	36	"cata peristilo MyR nivel cocina"	2	Roman		Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 163-164	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
72	*Lixus*	36	"cata peristilo MyR nivel cocina"	1	Roman		Mediterranean bonnet	Cassis undulata	Gastropod	marine, intertidal, infratidal	offshore sandy bottoms	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 165	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
73	*Lixus*	36	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		oyster	ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 168	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).
74	*Lixus*	36	casa "Helios"	1	Roman		oyster	ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 179	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124. Labelled: Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).
75	*Lixus*	36	"cata peristilo MyR nivel cocina"	1	Roman		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P43: 166	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations) "cata peristilo MyR nivel cocina" (house of Mars and Rea). (Peristyle feature Flavian).
76	*Lixus*	36	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 169	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).
77	*Lixus*	36	casa "Helios"	1	Roman		Rayed Mediterranean limpet	Patella caerulea	Gastropod	marine, intertidal	hard surfaces	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 180	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124. Labelled: Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
78	*Lixus*	36	"Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)"	1	Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P44: 170	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Cata peristilo (casa de) Marta y Rea cocina (nivel – inmediamente superior)" L-50 (1950).
79	*Lixus*	36	"cocina 2º dep 1er nivel" Mars y Rea (?)	1	Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P45: 172	Present location: Musée Archéologique, Tetouan. Labelled: Lixus 49 (1949 excavations), "cocina 2º dep 1er nivel". (Assumed same as house of Mars and Rea).
80	*Lixus*	36	casa "Helios"	1	Roman		Safian limpet	Patella nigra	Gastropod	marine, intertidal, infratidal	hard surfaces	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P47: 181	Present location: Musée Archéologique, Tetouan, Inv. Lix. 124 .Lebelled: Lixus, "Helios" (Likely house with Helios mosaic. Also house 50?).
81	*Lixus*	36		1	Roman		coral	Dendrophillia ramea (?)	Scleractinia (order)	marine, infratidal	attached to rocks, usually around 40 -110 m depth	unpub.	P46: 174	Present location: Musée Archéologique, Tetouan. Labelled: Lixus, "Box 12j"; box has much Roman material. Coral fragment, possibly similar to type found at Ceuta: *Dendrophillia Ramea* (no common name). No common name for this coral type. Trunk is red/red-orange colour when alive.
82	*Lixus*	36	Ladera sur	6	Late Roman	3rd-4th c. AD	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Sagrario Carrasco Porras 2005: 254, 256-257	-	some have evidence of being burned
83	*Lixus*	36	Ladera sur	1	Late Roman	3rd-4th c. AD	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	Sagrario Carrasco Porras 2005: 256-257, 261	-	
84	*Lixus*	36	Ladera sur	1	Late Roman	3rd-4th c. AD	Lurid cowrie, Fallow cowrie	Luria lurida	Gastropod	marine, infratidal	rocky depths	Sagrario Carrasco Porras 2005: 256-257	-	
85	*Lixus*	36	Ladera sur	6	Late Roman	3rd-4th c. AD	Red-mouthed rock shell (2)	Stramonita haemastoma	Gastropod	marine, intertidal, infratidal	rocky shores to below the tidal zone	Sagrario Carrasco Porras 2005: 256-257	-	

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
86	*Lixus*	36	Ladera sur	3	Late Roman	3rd-4th c. AD	Tuberculate cockle	Acanthocardia tuberculata	Bivalve	marine, infratidal	from 10 -80 m depth in sandy and rubble bottoms	Sagrario Carrasco Porras 2005: 256-259	-	some of these has a hole near their hinge
87	*Banasa*	46	Niveau IV	24	Punico-Mauretanian	1st c. BC	unknown	unknown	"Bivalve"	-	-	Arharbi & Lenoir 2004: 226, 228	-	No specific given other than "bivalve".
88	*Banasa*	46	Niveau V	41	Punico-Mauretanian	3rd c.-early 2nd c. BC	unknown	unknown	"Bivalve"	-	-	Arharbi & Lenoir 2004: 231, 233; Girard 1984a: 34	-	No specific given other than "bivalve".
89	*Banasa*	46	Niveau V	1	Punico-Mauretanian	3rd c.-early 2nd c. BC	"murex"'	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Arharbi & Lenoir 2004: 231, 233; Girard 1984a: 34	-	No specific species given other than "murex".
90	*Banasa*	46	Niveau VI	2	Punico-Mauretanian	4th-3rd c. BC	unknown	unknown	"Bivalve"	-	-	Arharbi & Lenoir 2004: 234-235	-	No specific given other than "bivalve".
91	*Banasa*	46	Niveau II	2	Roman	1st c. AD	"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Arharbi & Lenoir 2004: 221, 224; Girard 1984a: 28	-	No specific species given other than "murex".
92	*Banasa*	46	Niveau II	95	Roman	1st c. AD	unknown	unknown	"Bivalve"	-	-	Arharbi & Lenoir 2004: 221, 224	-	No specific given other than "bivalve".
93	*Banasa*	46	east side of Kardo	*	Roman	post-AD 24	(limpet)	Patella sp.	Gastropod	marine, intertidal	fixed on rocks	Thouvenot & Luquet 1951b: 76	-	States that here are houses of lesser quality, and a very large number of shells found here, along with bone implements and terracotta weights. Date given by coin of Philip (ca. AD 244)
94	*Banasa*	46	east side of Kardo	*	Roman	post-AD 24	Atlantic/ Mediterranean scallop	Pecten jacobaeus	Bivalve	marine, intertidal, infratidal	sandy bottoms from the shore to ca. 200 m depth	Thouvenot & Luquet 1951b: 76	-	Same species as *Pecten maximus*. Says that here are houses of lesser quality, and a very large number of shells found here, along with bone implements and terracotta weights. Date given by coin of Philip (ca. AD 244)
95	*Thamusida*	47	surface	1	Context unknown	?	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (observation at site, 2005)		Surface find, March 2005.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
96	*Thamusida*	47		*	Punico-Mauretanian/ Roman		"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Papi, *et al.* 2000; Wilson 2002b: 251-253	-	"Murex" shells are mentioned as being found around the furnaces/hearths here - identiifed as kiln area as well.
97	*Volubilis*	51		2	Context unknown	?	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P48: 182-183	Present location: Volubilis site dépôt, Inv. 14088. Unknown stratigraphy.
98	*Volubilis*	51	maison sans nom/6'	5	Context unknown	?	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	unpub.	P49: 184-188	Present location: Volubilis site dépôt, Inv. 86 2403 (5 fragments)
99	*Volubilis*	51	decumanus maximus (?)	3	Context unknown	?	cowrie	Cyprea sp.	Gastropod	marine, intertidal, infratidal	rocky shorelines, reefs	unpub.	P50: 189-191	Present location: Volubilis site dépôt, Inv. 14443. One cowrie has a manufactured hole; one has two manufactured holes.
100	*Volubilis*	51	decumanus maximus (?)	1	Context unknown	?	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P50: 192	Present location: Volubilis site dépôt, Inv. 14443
101	*Volubilis*	51		1	Context unknown	?	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P51: 193	Present location: Volubilis site dépôt, Inv. 14860. Unknown stratigraphy.
102	*Volubilis*	51		1	Context unknown	?	banded dye-murex	Hexaplex (truncularopsis) trunculus [murex trunculus] (?)	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub.	P52: 194	Possible ID. Present location: Volubilis site dépôt, Inv. 14721. Broken at top, very worn. Unknown stratigraphy.
103	*Volubilis*	51		1	Context unknown	?	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub.	P52: 195	Present location: Volubilis site dépôt, Inv. 14721. Unknown stratigraphy.
104	*Volubilis*	51		1	Context unknown	?	clam (?)	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub.	P52: 196	Present location: Volubilis site dépôt, Inv. 14721. Possiby a carpet shell clam (Ruditapes decussatus). Unknown stratigraphy.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
105	*Volubilis*	51		1	Context unknown	?	scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub.	P53: 197	Present location: Volubilis site dépôt, Inv. 13180. Unknown stratigraphy.
106	*Volubilis*	51	Insula 40	1	Context unknown	?	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	unpub. (Jodin 1987: 50-51 for these excavations)	P54: 198	Present location: Volubilis site dépôt, Inv. Vol. 12204 "Jodin 1971 Insula 40"
107	*Volubilis*	51	Insula 40	1	Context unknown	?	Rayed Mediterranean limpet	Patella caerulea (?)	Gastropod	marine, intertidal	hard surfaces	unpub. (Jodin 1987: 50-51 for these excavations)	P54: 199	Possible ID. Present location: Volubilis site dépôt, Inv. Vol. 12204 "Jodin 1971 Insula 40".
108	*Volubilis*	51	Quartier Bas	1	Context unknown	?	Knobbed triton	Charonia lampas	Gastropod	marine, intertidal, infratidal	rocky and sandy littorals from tidal zone to 200 m depth	unpub.	P55: 200	Present location: Volubilis site dépôt, Inv. 13681. Labelled: "Quartier Bas 1962". Very large example (over 15 cm L).
109	*Volubilis*	51	Secteur G13 – temples	1	Context unknown	?	banded dye-murex (?)	Hexaplex (truncularìopsis) trunculus [murex trunculus] (?)	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	unpub. (see Euzennat 1957a, Jodin 1987:163-172 for dates of temple areas)	P56: 201	Present location: Volubilis site dépôt, Inv. Vol. 87-618. Labelled: "Vol. 82 Secteur G13 – temples coquillages". Possibly Hexaplex trunculus? Very worn.
110	*Volubilis*	51	Secteur G13 – temples	3	Context unknown	?	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (see Euzennat 1957a, Jodin 1987:163-172 for dates of temple areas)	P56: 202-204	Present location: Volubilis site dépôt, Inv. Vol. 87-740 (Scallop broken in half); Inv. Vol. 87-813 (Scallop broken at top); Inv. Vol. 87-786 (complete scallop). Labelled: "Vol. 82 Secteur G13 – temples coquillages".
111	*Volubilis*	51	Insulae 7 + 8	4	Context unknown	?	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (see Jodin 1987: 130-134 for these excavations)	P57: 205-208	Present location: Volubilis site dépôt, one shell is Inv. Vol. 12162. Three nearly complete and one fragmentary. Assortment of Jodin's 1970 excavations from Insulae 7+8.
112	*Volubilis*	51	Insulae 7 + 8	1	Context unknown	?	cowrie	Cyprea sp./Cypraeidae (family)	Gastropod	marine, intertidal, infratidal	rocky shorelines, reefs	unpub. (see Jodin 1987: 130-134 for these excavations)	P57: 209	Present location: Volubilis site dépôt, Inv. Vol. 11394.5. Assortment of Jodin's 1970 excavations from Insulae 7+8.

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
113	*Volubilis*	51	Insulae 7 + 8	5	Context unknown	?	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	unpub. (see Jodin 1987: 130-134 for these excavations)	P57: 210-214	Present location: Volubilis site dépôt, Inv. Vol. 12162. Assortment of Jodin's 1970 excavations from Insulae 7+8.
114	*Volubilis*	51	Insulae 7 + 8	2	Context unknown	?	clam (?)	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (see Jodin 1987: 130-134 for these excavations)	P57: 215-216	Present location: Volubilis site dépôt, Inv. Vol. 12162. Assortment of Jodin's 1970 excavations from Insulae 7+8.
115	*Volubilis*	51	Insulae 7 + 8	1	Context unknown	?	oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (see Jodin 1987: 130-134 for these excavations)	P57: 217	Present location: Volubilis site dépôt, Inv. Vol. 12162. Assortment of Jodin's 1970 excavations from Insulae 7+8.
116	*Volubilis*	51	Insula 46	1	Context unknown	?	cowrie	Cyprea sp./Cypraeidae (family)	Gastropod	marine, intertidal, infratidal	rocky shorelines, reefs	unpub. (see Jodin 1987: 51-52 for these excavations)	P58: 218	Present location: Volubilis site dépôt, Inv. Vol. 12035. Jodin 1976, "Insula 46".
117	*Volubilis*	51	Insula 46	2	Context unknown	?	scallop	Pectinidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	littorals, coastal lagoons	unpub. (see Jodin 1987: 51-52 for these excavations)	P58: 219-220	Present location: Volubilis site dépôt, Inv. Vol. 12035. Jodin 1976, "Insula 46". Both fragmentary - possibly manufactured hole in one.
118	*Volubilis*	51	Insula 46	1	Context unknown	?	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	unpub. (see Jodin 1987: 51-52 for these excavations)	P58: 226	Present location: Volubilis site dépôt, Inv. Vol. 12035. Jodin 1976, "Insula 46".
119	*Volubilis*	51	Insula 46	2	Context unknown	?	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (see Jodin 1987: 51-52 for these excavations)	P58: 221-222	Present location: Volubilis site dépôt, Inv. Vol. 12035. Jodin 1976, "Insula 46".
120	*Volubilis*	51	Insula 46	1	Context unknown	?	bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (see Jodin 1987: 51-52 for these excavations)	P58: 223	Present location: Volubilis site dépôt, Inv. Vol. 12035. Jodin 1976, "Insula 46".
121	*Volubilis*	51	Insula 46	2	Context unknown	?	clam (?)	Veneridae (family) (?)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (see Jodin 1987: 51-52 for these excavations)	P58: 224-225	Present location: Volubilis site dépôt, Inv. Vol. 12035. Jodin 1976, "Insula 46".

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122	*Volubilis*	51	Insula 16, S of capitol	4	Context unknown	?	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub.	P59: 227-230	Present location: Volubilis site dépôt, Inv. Vol. 11242-3. Labelled: Jodin 1968 "Insula 16 S of capitole" Two complete, two fragmentary.
123	*Volubilis*	51		*	Punico-Mauretanian	"pre-Claudian"	"oysters"	Ostreidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt.	Jodin 1987: 274	-	"Oysters" generally mentioned - found in the "course of excavations" - found in abundance and dated "pre-Claudian".
124	*Volubilis*	51		*	Punico-Mauretanian	"pre-Claudian"	"mussels"	Mytilidae (family)	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Jodin 1987: 274	-	"Mussels" generally mentioned - found in the "course of excavations" - found in abundance and dated "pre-Claudian".
125	*Volubilis*	51		*	Punico-Mauretanian	"pre-Claudian"	"limpets"	-	Gastropod	marine, intertidal, infratidal	fixed on rocks	Jodin 1987: 274	-	"Limpets" generally mentioned - found in the "course of excavations" - found in abundance and dated "pre-Claudian".
126	*Volubilis*	51		*	Punico-Mauretanian	"pre-Claudian"	"venus clams"	Veneridae (family)	Bivalve	marine, intertidal, infratidal	rocky and hard bottoms down to 20 m	Jodin 1987: 274	-	"Venus clams" generally mentioned - found in the "course of excavations" - found in abundance and dated "pre-Claudian".
127	*Volubilis*	51	Maison au compas'	4	Punico-Mauretanian/ Roman		oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (see Jodin 1987: 142-146 for area)	P60: 231-234	Present location: Volubilis site dépôt, Inv. 10394.4 (3 pieces); Inv. 10436.3 (1 piece)
128	*Volubilis*	51		*	Roman		"oysters"	Ostreidae (family)	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt.	Jodin 1987: 274	-	"Oysters" generally mentioned - found in the "course of excavations" - found in abundance and date to Roman layers

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
129	*Volubilis*	51	Maison au compas'	1	Roman	?	Rayed Mediterranean limpet	Patella caerulea (?)	Gastropod	marine, intertidal	hard surfaces	unpub. (see Jodin 1987: 142-146 for area)	P61: 235	Possible ID. Present location: Volubilis site dépôt, Inv. Vol. 1301. Labelled: "Maison au compas 1983". My ID.
130	*Volubilis*	51	Maison au compas'	2	Roman	?	bittersweet	Glycymeridae (family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (see Jodin 1987: 142-146 for area)	P61: 236-237	Present location: Volubilis site dépôt, Inv. Vol. 1644 (small one complete), Vol. 1809 (fragment of larger example). Labelled: "Maison au compas 1983".
131	*Volubilis*	51	Maison au compas'	1	Roman	?	oyster	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt no deeper than 20 m.	unpub. (see Jodin 1987: 142-146 for area)	P61: 238	Present location: Volubilis site dépôt, Inv. Vol. 1728. Labelled: "Maison au compas 1983".
132	*Volubilis*	51	Maison au compas'	2	Roman	?	common mussel	Mytilus edulis	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	unpub. (see Jodin 1987: 142-146 for area)	P61; 239-240	Present location: Volubilis site dépôt, Inv. Vol. 1769, Vol. 1901. Labelled: "Maison au compas 1983".
133	*Volubilis*	51	Maison au compas'	1	Roman	?	clam	Veneridae (family)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (see Jodin 1987: 142-146 for area)	P61: 241	Present location: Volubilis site dépôt, Inv. Vol. 1749. Labelled: "Maison au compas 1983".
134	*Volubilis*	51	Maison au compas'	4	Roman	?	Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	unpub. (see Jodin 1987: 142-146 for area)	P62: 242-245	Present location: Volubilis site dépôt, Inv. Vol. 1849, Vol. 1965, Vol. 1894.. Labelled: "Maison au compas 1983".
135	*Volubilis*	51		*	Roman		"mussels"	Mytilidae (family)	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Jodin 1987: 274	-	"Mussels" generally mentioned - found in the "course of excavations" - found in abundance and date to Roman layers
136	*Volubilis*	51		*	Roman		"limpets"	-	Gastropod	marine, intertidal, infratidal	fixed on rocks	Jodin 1987: 274	-	"Limpets" generally mentioned - found in the "course of excavations" - found in abundance and date to Roman layers

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
137	*Volubilis*	51		*	Roman		"venus clams"	Veneridae (family)	Bivalve	marine, intertidal, infratidal	rocky and hard bottoms down to 20 m	Jodin 1987: 274	-	"Venus clams" generally mentioned - found in the "course of excavations" - found in abundance and date to Roman layers
138	*Volubilis*	51		2	Roman/Late Roman	late 1st-4th	cockle	Cardium (Cardidae family)	Bivalve	marine, intertidal, infratidal	sand and gravel bottoms, can be found past 80 m depth	unpub. (see Luquet & Jodin 1976 for date based on associated finewares)	P63: 246-247	Present location: Volubilis site dépôt, Inv. Vol. 14908; Found with note: "CER R-S Vol. 14932-14955 publieé BAM X p. 73.127". Larger example has manufactured hole near hinge, and is extremely worn.
139	Volubilis valley	52	QC site	1	Context unknown	?	clam (?)	Veneridae (family) (?)	Bivalve	marine, intertidal	sandy or muddy bottoms	unpub. (for general Volubilis territory survey information, see Rebuffat, *et al.* 1986)	P64: 248	From site QC prospection in Volubilis region. Present location: Volubilis site dépôt, Inv. QC 86.227 22.
140	*Sala*	56	necropolis, burial no. 29	1	Roman	2nd c. AD	banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Boube 1999: 231	-	dated by Hadrian coin
141	Essaouira	57	Coupe B, Couche IV	*	Punico-Mauretanian		"shells"	unknown	unknown	-	-	Jodin 1957: 14	-	General mention of "shells" - found at .50-.80 m depth in "pre-Roman" layers with painted ceramics..
142	Essaouira	57	Coupe J-K, Couche IVd	*	Punico-Mauretanian		"mussels"	Mytilidae (family)	Bivalve	marine, estuarine, intertidal	fixed to rocks or piers	Jodin 1957: 19	-	General mention of "mussels" spread throughout this layer
143	Essaouira	57	Coupe J-K, Couche IVd	*	Punico-Mauretanian		"limpets"	-	Gastropod	marine, infratidal, intertidal	fixed on rocks	Jodin 1957: 19	-	General mention of "limpets" - spread throughout this layer
144	Essaouira	57	Coupe J-K, Couche IVd	*	Punico-Mauretanian		"oysters"	Ostrea sp.	Bivalve	marine, estuarine, intertidal, infratidal	fixed on firm bottoms of mud, rocks, muddy sand, muddy gravel with shells and hard silt.	Jodin 1957: 19	-	General mention of "oysters" - spread throughout this layer. Described as "pied de cheval" type (very large - over 1kg)

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
145	Essaouira	57		*	Punico-Mauretanian		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Jodin 1967: 224, Pl. CIX, 228	-	general mention that these are found throughout the excavation
146	Essaouira	57		*	Punico-Mauretanian		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	Jodin 1967: 224, Pl. CIX, 228	-	general mention that "murex" are found throughout the excavation (species identified in Pl. CIX)
147	Essaouira	57		2	Punico-Mauretanian		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Desjacques & Koeberlé 1955: Pl. III	-	
148	Essaouira	57		2	Punico-Mauretanian		banded dye-murex	Murex trunculus	Gastropod	marine, intertidal, infratidal	rocks, coarse sandy and pebble bottoms normally between 2-15 m depth, but found to 130 m depth	Desjacques & Koeberlé 1955: Pl. III	-	
149	Essaouira	57		*	Punico-Mauretanian/ Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Jodin 1967: 224, Pl. CIX, 228	-	general mention that these are found throughout the excavation
150	Essaouira	57		*	Punico-Mauretanian/ Roman		"murex"	Muricidae (family)	Gastropod	marine, estuarine, intertidal	rocky shores	Jodin 1967: 228	-	general mention that "murex" are found throughout the excavation, but no species given.
151	Essaouira	57	Coupe B, Couche II	*	Punico-Mauretanian/ Roman		"shells"	unknown	unknown	-	-	Jodin 1957: 14, 19; Jodin 1966c: 35; Jodin 1967: 75 (for villa date)	-	General mention of "shells" - found at .40-.60 m & .80-.90 m depth. This is villa layer.
152	Essaouira	57		*	Roman		Red-mouthed rock shell (1)	Purpura (Thais) haemastoma	Gastropod	marine, intertidal	on rocks or littoral vegetation in waters between 1-5 m	Jodin 1967: 224, Pl. CIX, 228	-	general mention that these are found throughout the excavation

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ID (common name)	ID (scientific name)	CLASS	HABITAT	ENVIRONMENT	REFERENCE	Photo CD #	COMMENTS
153	Essaouira	57		*	Roman		spiny dye-murex/ purple dye-murex	Murex (bolinus) brandaris	Gastropod	marine, estuarine, infratidal	sandy, silty and muddy bottoms from 10-150 m depth	Jodin 1967: 224, Pl. CIX, 228	-	general mention that "murex" are found throughout the excavation (species identified in Pl. CIX)

Appendix 2.
Fishing equipment

Metadata

This catalogue contains published and unpublished finds of fishing equipment from *Mauretania Tingitana*. The unpublished artefacts were recorded in March-April and October 2007 in Morocco at Musée de la Kasbah (Tangier), Musée Archéologique (Tetouan), Musée Archéologique (Larache), Musée Archéologique (Rabat), the site dépôts at *Volubilis* and Chellah (*Sala* [Rabat]) and in the Spanish autonomous cities at Museo Municipal de Ceuta and Museo de Arqueología e Historia (Melilla).

The artefacts are grouped by geographic region (Mediterranean, Straits of Gibraltar and Atlantic). Maps showing general distribution and chronology of the finds are presented at the beginning of each region, followed by a table of the finds. Within these regions sites are listed in geographical orientation from east to west and north to south. Site numbers follow those given in the site list at the beginning of the appendices.

Weight shapes are described by the following terminology: disc, doughnut, bun, tombstone, trapezoid, truncated cone, sphendonoidal (pod), tube, strip and pyramidal. (For further description of the types of equipment finds, see Chapter 3.2.2.) A * denotes finds not quantified in publications but only noted as present. The following general measurement groupings are used in the tables:

FISH HOOK SIZE:

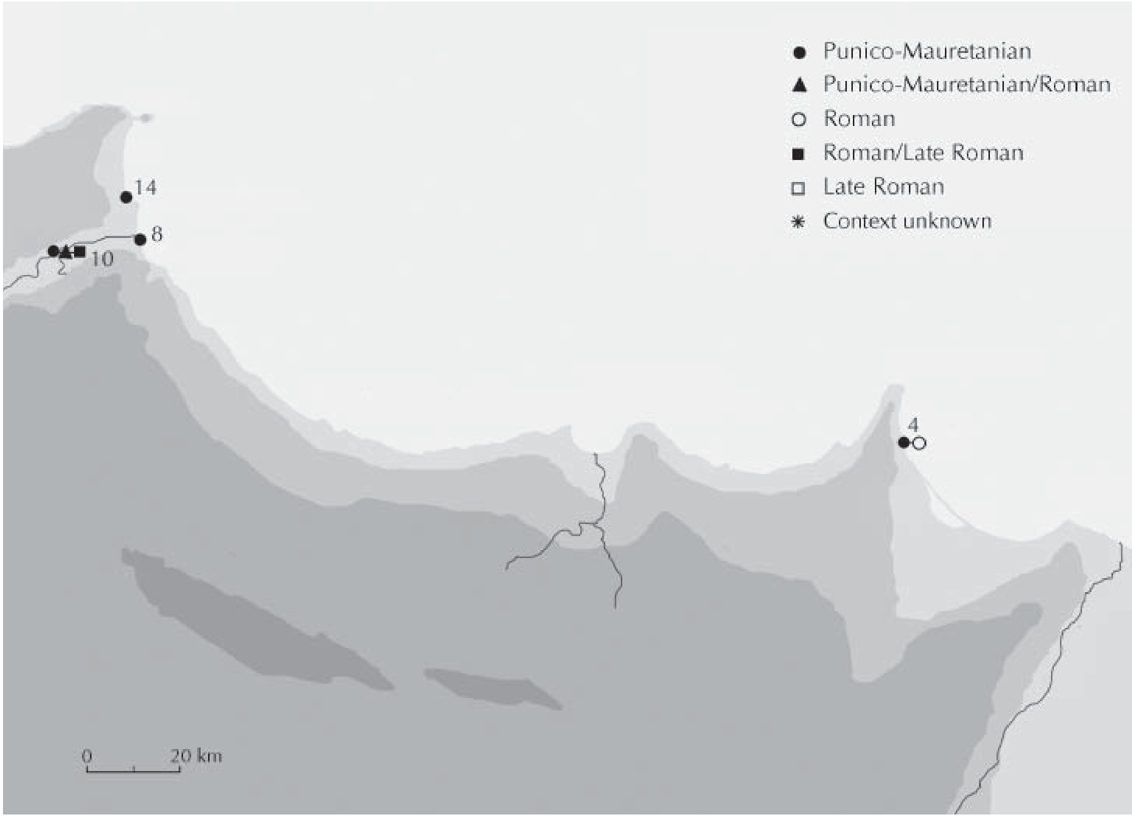
Small	< 5 cm shank (overall) length
Medium	5-7 cm shank (overall) length
Large	> 7 cm shank (overall) length

WEIGHTS:

small	< 50 g
medium	50 g - 250 g
large	> 250 g

Photos of the recorded artefacts are noted in the column "Photo CD #" in the tables, which refers to the *Folder 2: Photo catalogue* file on the CD included with this study. The numbers in the tables here correspond to a folder within this main folder, titled *App. 2: Fishing equipment*. For example, "P34: 132-138" refers to the file in the *Photo catalogue* folder titled "Equip_P34"; artefacts 132-138 are then labelled in the photo.

2.1 Mediterranean



FIND-SITES:

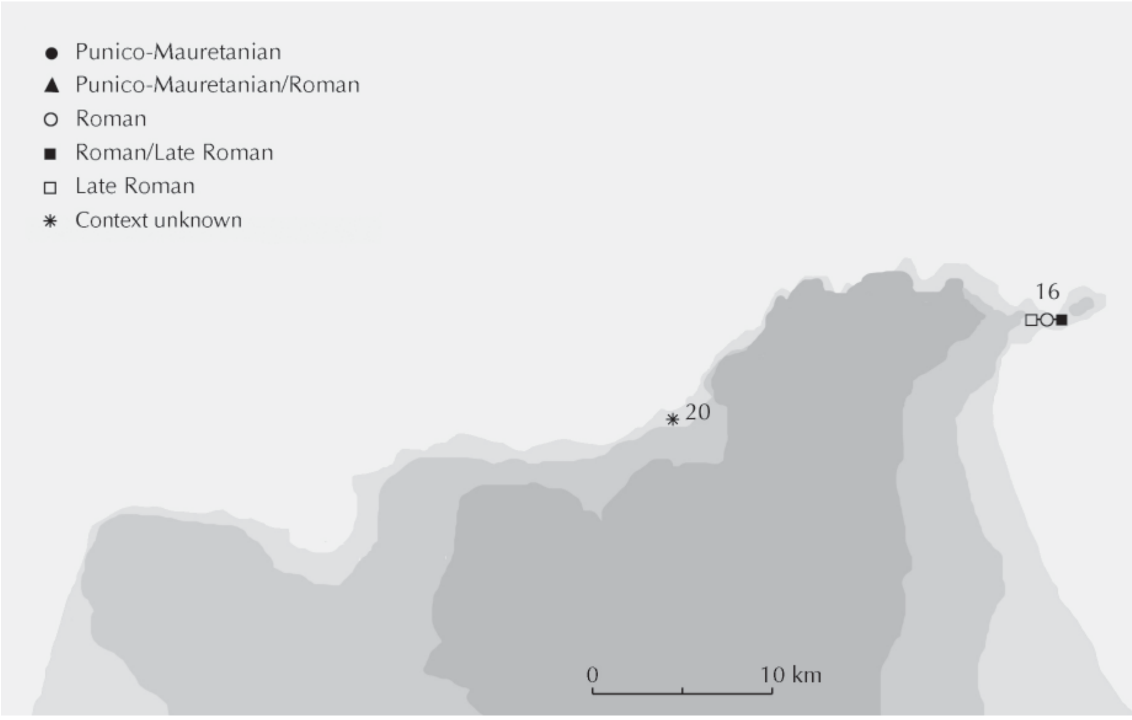
4. *Rusaddir*
8. Sidi Abdeselam del Behar
10. *Tamuda*
14. Costa Rincon

Cat. #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
1	*Rusaddir* /Melilla	4	"necropolis del Cerro de San Lorenzo"	1	Punico-Mauretanian		net weight	terracotta	fishing	unpub. (see Fernandez de Castro y Pedrera 1945: 221-237 for site; Tarradell 1954a for date)	P1: 1	Labelled "cerámica procédente de la necropolis del Cerro de San Lorenzo – Mélilla". Doughnut-shaped medium weight. Present location: Musée Archéologique, Tetouan. Inv. No. 350/78.
2	*Rusaddir* /Melilla	4	"necropolis del Cerro de San Lorenzo"	1	Punico-Mauretanian		weight	terracotta	fishing	unpub. (see Fernandez de Castro y Pedrera 1945: 221-237 for site; Tarradell 1954a for date)	P2: 2	Labelled "cerámica procédente de la necropolis del Cerro de San Lorenzo – Mélilla". Rounded pyramidal-shaped medium weight. Present location: Musée Archéologique, Tetouan. Inv. No. 350/78.
3	*Rusaddir* /Melilla	4	Jardines del Gobernador	2	Punico-Mauretanian	1st c. BC	net weight	terracotta	fishing	Aragon Gómez, *et al.* 2007: 112, figs. 11-12	-	Disc-shaped weights, one flatter than the other. Inv. ML-CGB-06-537-176-52 & ML-CGB-06-537-82-26. No weight given.
4	*Rusaddir* /Melilla	4	Casa del Gobernador	2	Roman	2nd c. AD	net weight	terracotta	fishing	unpub. (see Villaverde Vega 2004 for site location)	P3: 3-4	Doughnut-shaped medium weights. Present location: Museo de Arqueología e Hístoria, Melilla, Inv. 27-248-69-842-23 & 15-9L1-LE3-90-21.
5	Sidi Abdeselam del Behar	8		1	Punico-Mauretanian		weight	lead	fishing	unpub. (see Tarradell 1966: 437 for date)	P4: 5	Pyramidal-shaped medium weight. Material labelled "S.A. 1" (Nivel 1). Present location: Musée Archéologique, Tetouan
6	Sidi Abdeselam del Behar	8		1	Punico-Mauretanian		net weight	terracotta	fishing	unpub. (see Tarradell 1966: 437 for date)	P5: 6	Doughnut-shaped medium weight. Material labelled "1952 - Niveau I, 1 superficial". Present location: Musée Archéologique, Tetouan
7	Sidi Abdeselam del Behar	8		1	Punico-Mauretanian		needle	bronze	net making/ repair	unpub. (see Tarradell 1966: 437, Pl. II ; Tarradell 1960: 86-95, figs 17-18 for dates)	P6: 7	No levels indicated, but only two levels discussed by Tarradell, both Punico-Mauretanian. Present location: Musée Archéologique, Tetouan
11	*Tamuda*	10		9	Punico-Mauretanian		fish hook	bronze	fishing	Quintero Atauri & Gimenez Bernal 1945: 17, Pl. 17	P7: 8-16	Possibly some of these (T-78 & T-79) might be the "ca. 10 cm L fish hooks" found in the necropolis. 8 small hooks; 2 large hooks. Present location: Musée Archéologique, Tetouan, Inv. T-78 - T-86.
12	*Tamuda*	10		4	Punico-Mauretanian		needle	bone	net making/ repair	unpub.	P8: 17-20	Double-holes needles. Present location: Musée Archéologique, Tetouan, Inv. T-91, T-93 - T-94, T-96
13	*Tamuda*	10		6	Punico-Mauretanian		needle	bronze	net making/ repair	unpub.	P9: 21-26	Double-holes needles. One needle has loop eye. Present location: Musée Archéologique, Tetouan, Inv. T-87 - T-92.

Cat. #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
14	*Tamuda*	10	SW sector	10	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Quintero Atauri & Gimenez Bernal 1945: 15; Tarradell 1956: 73-74 for excavations)	P10: 27-36	7 medium hooks; 3 small hooks. Labelled "EXC. QUINTERO, Retirado sala – museo". Present location: Musée Archéologique, Tetouan.
15	*Tamuda*	10	SW sector	10	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Quintero Atauri & Gimenez Bernal 1945: 15; Tarradell 1956: 73-74 for excavations)	P11: 37-46	9 small hooks; 1 medium hook. Labelled "EXC. QUINTERO, Retirado sala – museo". Present location: Musée Archéologique, Tetouan.
16	*Tamuda*	10	SW sector	6	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Quintero Atauri & Gimenez Bernal 1945: 15; Tarradell 1956: 73-74 for excavations)	P12: 47-52	6 small hooks. Labelled "EXC. QUINTERO, Retirado sala – museo". Present location: Musée Archéologique, Tetouan.
17	*Tamuda*	10	SW sector	1	Punico-Mauretanian		needle	bronze	net making/ repair	unpub. (see Tarradell 1956: 73-74 for excavations)	P13: 53	Looped needle. Labelled "EXC. QUINTERO". Present location: Musée Archéologique, Tetouan.
18	*Tamuda*	10	SW sector	2	Punico-Mauretanian		needle	bone	net making/ repair	unpub. (see Tarradell 1956: 73-74 for excavations)	P14: 54-55	Labelled "EXC. QUINTERO". Present location: Musée Archéologique, Tetouan.
19	*Tamuda*	10	"Gran Plaza"	1	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Tarradell 1956: 73-75 & Taradell 1949: 88-89 for excavations)	P15: 56	1 medium hook. Labelled "Gran Plaza" - this are in SW sector of city. Present location: Musée Archéologique, Tetouan.
20	*Tamuda*	10	"Gran Plaza"	1	Punico-Mauretanian		net weight	terracotta	fishing	unpub. (see Tarradell 1956: 73-75 & Taradell 1949: 88-89 for excavations)	P16: 57	Bun-shaped medium weight. Labelled "Gran Plaza" - this are in SW sector of city. Bun weight. Present location: Musée Archéologique, Tetouan.
21	*Tamuda*	10		2	Punico-Mauretanian		fish hook	bronze	fishing	Morán & Giménez Bernal 1948: 47, Pl. XVI	P17: 58-59	2 small hooks. Mounted on boards from old display. Present location: Musée Archéologique, Tetouan.
22	*Tamuda*	10	S sector	4	Punico-Mauretanian		fish hook	bronze	fishing	Quinteri Atuari 1945: Fig. 9	P18: 60-63	3 small hooks; 1 medium hook. From 1944 excavations. Mounted on board from old display. Present location: Musée Archéologique, Tetouan.
23	*Tamuda*	10		17	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Tarradell 1956: 73-74 for excavtions by Quintero)	P19: 64-80	14 small hooks; 3 medium hooks. Mounted on board from old display (probably 1944 excavation material). Present location: Musée Archéologique, Tetouan.
24	*Tamuda*	10	SW sector necropolis	2	Punico-Mauretanian		fish hook	bronze	fishing	Quintero Atauri & Gimenez Bernal 1944: 17, Lam. 1 (see Tarradell 1958: 379 for date)	-	From 1939/40-45 excavations. Unknown lengths.

Cat. #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
25	*Tamuda*	10	SW sector	3	Punico-Mauretanian		weight	lead	fishing	Quintero Atauri & Gimenez Bernal 1944: 11, 17 (see Tarradell 1958: 379 for date)	-	From 1940-44 excavations. Described as "cylindrical, 560 g, 1.149 kg & 1.150 kg."
26	*Tamuda*	10	SW sector	1	Punico-Mauretanian		needle	bronze	net making/ repair	Morán & Giménez Bernal 1948: 45-46, Pl. XIV.B	-	From 1946 excavations (not present in Musée Archéologique, Tetouan).
27	*Tamuda*	10	SW sector necropolis	1	Punico-Mauretanian		needle	bronze	net making/ repair	Quintero Atauri & Gimenez Bernal 1944: 17, Lam. 1 (see Tarradell 1958: 379 for date)	P20: 81	From 1939/40-45 excavations.
28	*Tamuda*	10	SE sector	1	Punico-Mauretanian		needle	bronze	net making/ repair	unpub.	P21: 82	Very bent bronze needle with 2 eyes. Labelled: "S este" (Box 41). Present location: Musée Archéologique, Tetouan.
8	*Tamuda*	10		1	Punico-Mauretanian/ Roman		net weight	terracotta	fishing	unpub.	P22: 83	Doughnut-shaped medium weight with central hole. Present location: Musée Archéologique, Tetouan, Inv. 102.
9	*Tamuda*	10		1	Punico-Mauretanian/ Roman		net weight	terracotta	fishing	unpub.	P23: 84	Doughnut-shaped medium weight. Present location: Musée Archéologique, Tetouan, Inv. 291.
10	*Tamuda*	10		6	Punico-Mauretanian/ Roman		net weight	terracotta	fishing	unpub.	P24: 85-90	Disc-shaped weights with central hole. 3 medium;3 small weights. Present location: Musée Archéologique, Tetouan, Inv. 298, 292-293 (3 without numbers).
29	*Tamuda*	10	"castro"	5	Roman/Late Roman		net weight	terracotta	fishing	unpub.	P25: 91-95	All disc-shaped small weights. Labelled ""Tamuda castro" (Box 51)". Present location: Musée Archéologique, Tetouan.
30	Costa Rincon	14		1	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (see Tarradell 1966: 435-437 for site)	P26: 96	Size: small. Present location: Musée Archéologique, Tetouan.
31	Costa Rincon	14		3	Punico-Mauretanian		net weight	terracotta	fishing	unpub. (see Tarradell 1966: 435-437 for site)	P27: 97-99	Disc-shaped small weights. Present location: Musée Archéologique, Tetouan. From a box of material that is mixed with terra sigillata and black glaze ware fragments.

2.2 Straits of Gibraltar

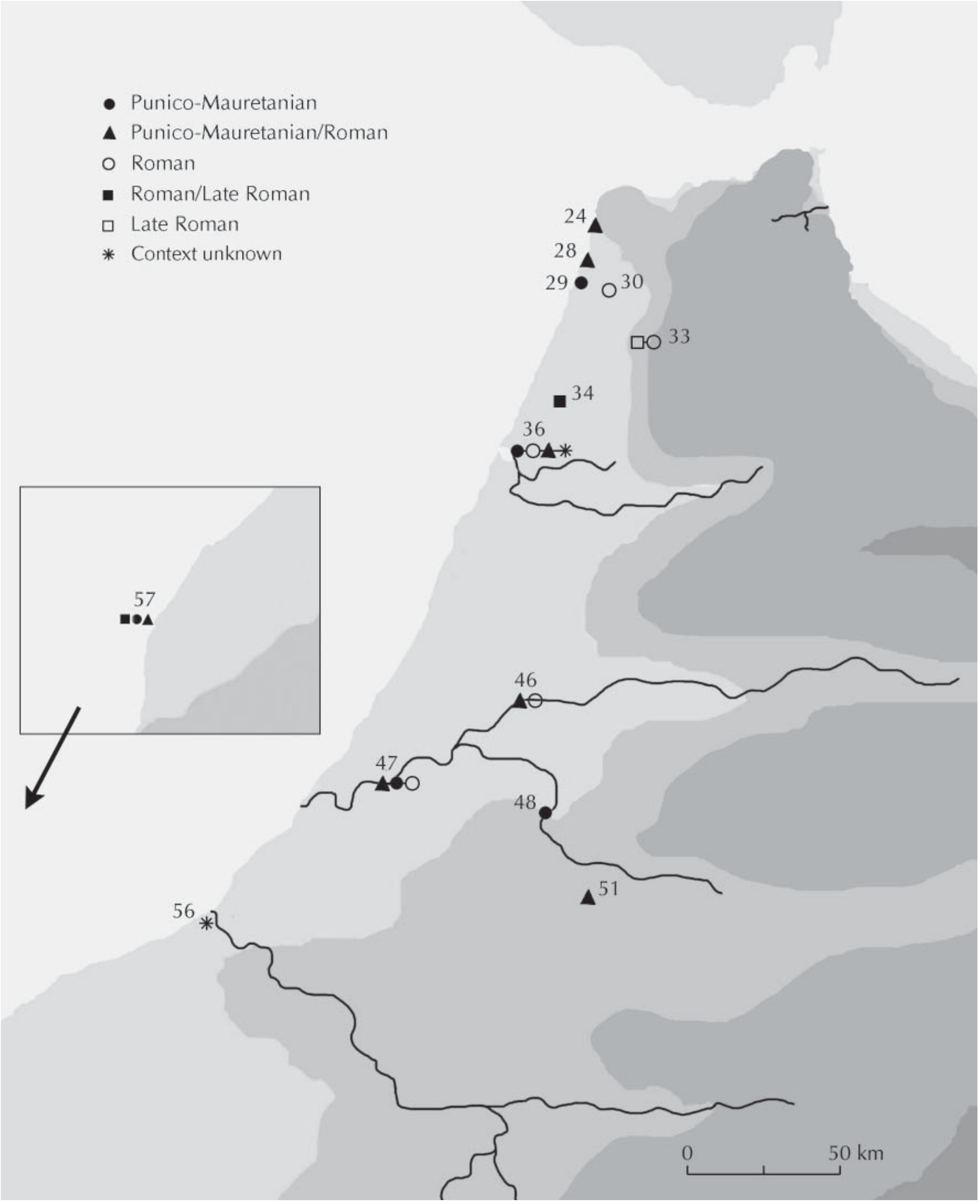


FIND-SITES:

16. *Septem Fratres*
20. Dchar ‘Askfane

Cat #	PROVENANCE	Site #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
1	*Septem* /Ceuta	16	No. 20/21 Av. Sánchez Prados	2	Roman	beginning 2nd c. AD	fish hook	bronze	fishing	Hita Ruiz & Villada Paredes 1994: 26-27.	P28: 100-101	2 medium hooks; On display at Museo Municipal, Ceuta.
2	*Septem* /Ceuta	16		1	Roman/Late Roman	2nd-5th c. AD	net weight	lead	fishing	unpub.	-	Lead strip used for weighting net edge. Weight unknown. Present location: Museo Municipal, Ceuta.
3	*Septem* /Ceuta	16		5	Roman/Late Roman	1st-5th c. AD	net weight	terracotta	fishing	unpub.	P29: 102-106	Doughnut-shaped weight. Weight unknown. Present location: Museo Municipal, Ceuta. (Not from Paseo de las Palmeras excavations.)
4	*Septem* /Ceuta	16		2	Roman/Late Roman	1st-5th c. AD	net weight	stone	fishing	unpub.	P29: 107-108	Doughnut-shaped weight. Weight unknown. Present location: Museo Municipal, Ceuta.
5	*Septem* /Ceuta	16		2	Roman/Late Roman	2nd-5th c. AD	fish hook	bronze	fishing	unpub.	P30: 109-110	No provenance given other than fish-salting factory. No measurements taken. Both hooks on display in Museo Municipal, Ceuta, in 2004; one on display in 2007.
6	*Septem* /Ceuta	16	Paseo de las Palmeras	1	Roman/Late Roman	2nd-5th c. AD	net weight	terracotta	fishing	Bernal Casasola & Pérez Rivera 1999: 68, Fig. 30A	-	Disc-shaped weight – 8 cmø. No weight given.
7	*Septem* /Ceuta	16	Paseo de las Palmeras	*	Roman/Late Roman	2nd-5th c. AD	fish hook	bronze	fishing	Bernal Casasola & Pérez Rivera 1999: 65	-	Unknown number mentioned; no sizes given.
8	*Septem* /Ceuta	16	No. 20/21 Av. Sánchez Prados	*	Late Roman	late 4th c. AD	fish hook	bronze	fishing	Hita Ruiz & Villada Paredes 1994: 47	-	Unknown number mentioned; no sizes given.
9	*Septem* /Ceuta	16	Plaza de África no. 3	*	Late Roman	late 5th/early 6th c. AD	fish hook	bronze	fishing	Bernal Casasola 2009b: 267-268	-	Unknown number mentioned; no sizes given.
10	Dchar 'Askfane	20		*	Context unknown		fish hook	bronze	fishing	unpub. (H. Limane, INSAP, pers. com.; for site see Akerraz & El Khayari 2005)	-	
11	Dchar 'Askfane	20		*	Context unknown		navette	bronze	fishing	unpub. (H. Limane, INSAP, pers. com.; for site see Akerraz & El Khayari 2005)	-	
12	Dchar 'Askfane	20		*	Context unknown		net weight	terracotta	fishing	unpub. (H. Limane, INSAP, pers. com.; for site see Akerraz & El Khayari 2005)	-	

2.3 Atlantic



FIND-SITES:

24. Cotta
28. Tahadart
29. Kouass
30. *Zilil*
33. Suiar
34. *Tabernae*
36. *Lixus*
46. *Banasa*
47. *Thamusida*
48. Sidi Slimane
51. *Volubilis*
56. *Sala*
57. Essaouira

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
1	Cotta	24		4	Punico-Mauretanian/ Roman		net weight	lead	fishing	Ponsich & Tarradell 1965: Pl. XX	P31: 111-114	Present location: Musée de la Kasbah, Tangier. Four sphendonoidal (pod)-shaped large weights with no holes for lines.
2	Cotta	24		10	Punico-Mauretanian/ Roman		fish hook	bronze	fishing	Ponsich & Tarradell 1965: Pl. XX	P32: 115-124	9 small hooks; 1 incomplete. Present location: Musée de la Kasbah, Tangier.
3	Cotta	24		7	Punico-Mauretanian/ Roman		navette	bronze	net making/ repair	Ponsich & Tarradell 1965: Pl. XX	P33: 125-131	Tong widths: 1 cm, 1 cm, 0.9 cm, 0.9 cm. 0.8 cm, 2 incomplete. Present location: Musée de la Kasbah, Tangier.
4	Cotta	24		7	Punico-Mauretanian/ Roman		navette	bronze	net making/ repair	Ponsich & Tarradell 1965: Pl. XX	P34: 132-138	Tong widths: 1.4 cm, 1 cm, 0.4 cm, 0.6 cm, 0.9 cm, 0.5 cm, 0.4 cm. Present location: Musée de la Kasbah, Tangier.
5	Cotta	24		1	Punico-Mauretanian/ Roman		weight	bronze	fishing	Ponsich & Tarradell 1965: Pl. XX	P35: 139	Trapezoidal-shaped large weight with two holes at top. Present location: Musée de la Kasbah, Tangier. Inv. #355.
6	Cotta	24		12	Punico-Mauretanian/ Roman		fish hook	bronze	fishing	unpub.	P36: 140-152	6 small hooks; 3 medium hooks; 2 large hooks; 1 incomplete. Present location: Musée de la Kasbah, Tangier. From pre-Ponsich excavations by C. Montalbán.
7	Cotta	24		1	Punico-Mauretanian/ Roman		navette	bronze	net making/ repair	unpub.	P37: 153	Tongs not preserved. Present location: Musée de la Kasbah, Tangier.
8	Cotta	24		1	Punico-Mauretanian/ Roman		needle	bronze	net making/ repair	unpub.	P38: 154	Present location: Musée de la Kasbah, Tangier.
9	Cotta	24		8	Punico-Mauretanian/ Roman		fish hook	bronze	fishing	Ponsich & Tarradell 1965: Pl. XX	P39: 155-162	4 large hooks; 4 small hooks. Present location: Musée de la Kasbah, Tangier.
10	Cotta	24		7	Punico-Mauretanian/ Roman		gorge	bone	fishing	Ponsich 1988: 86, fig. 32.5; Ponisich & Tarradell 1965: Pl. XX.1	-	Some appear to be broken in half; and some have grooves or holes around their centres. Appear to be made of animal (boar?) tusks. Could be used as gorges for fishing. Lengths unpublished.
11	Tahadart	28	Complex 2	8	Punico-Mauretanian/ Roman	1st c. BC - late 3rd c. AD	net weight	terracotta	fishing	Ponsich & Tarradell 1965: 48, Pl. XIV	P40: 163-170	Truncated cone weights. All incomplete but large. Present location: Musée de la Kasbah, Tangier.
12	Tahadart	28	Complex 5	1	Punico-Mauretanian/ Roman		navette	bronze	net making/ repair	Ponsich & Tarradell 1965: 53	P41: 171	Tang width: 0.3 cm. Present location: Musée de la Kasbah, Tangier.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
13	Tahadart	28	Complex 5	11	Punico-Mauretanian/ Roman		fish hook	bronze	fishing	Ponsich & Tarradell 1965: 53	P42: 172-182	11 small hooks. Present location: Musée de la Kasbah, Tangier.
14	Tahadart	28	Complex 2	6	Punico-Mauretanian/ Roman	1st c. BC - late 3rd c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 48; Ponsich 1988: 147-148	P43: 183-188	6 small hooks. Present location: Musée de la Kasbah, Tangier.
15	Tahadart	28	Complex 2	1	Punico-Mauretanian/ Roman	1st c. BC - late 3rd c. AD	net weight	lead	fishing	Ponsich & Tarradell 1965: 48; Ponsich 1988: 147-148	P44: 189	A thin lead strip that is rolled over at one end. Present location: Musée de la Kasbah, Tangier.
16	Tahadart	28	Complex 1	15	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 48; Ponsich 1988: 148-149	P45: 190-204	15 small hooks. Possibly these finds are mis-described by Ponsich 1988. He describes these finds in tombs sayng they are near Complex 4, but they are first noted as near Complex 1 (he cites Ponsich & Taradell 1965: 40-45). Present location: Musée de la Kasbah, Tangier.
17	Tahadart	28	Complex 1	2	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 48	-	18 total found in this complex mentioned in reference. No dimensions given.
18	Tahadart	28	Complex 1	1	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 48	P46: 205	1 medium hook. Present location: Musée de la Kasbah, Tangier.
19	Tahadart	28	Complex 1	2	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	navette	bronze	net making/ repair	Ponsich & Tarradell 1965: 48	P47: 206-207	Three navettes are mentioned by Ponsich & Tarradell, but only two found in museum. Tang width: 0.4 cm; other unpreserved. Present location: Musée de la Kasbah, Tangier.
20	Tahadart	28	Complex 1	4	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	needle	bronze	net making/ repair	Ponsich & Tarradell 1965: 48	P48: 208-211	One of these specifically mentioned in text. Present location: Musée de la Kasbah, Tangier.
21	Tahadart	28	Complex 4	1	Punico-Mauretanian/ Roman	1st c. BC - 3rd c. AD	navette	bronze	net making/ repair	Ponsich & Tarradell 1965: 53	P49: 212	Tange width: 0.3 cm. Present location: Musée de la Kasbah, Tangier.
22	Tahadart	28	Complex 4	11	Punico-Mauretanian/ Roman	1st c. BC - 3rd c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 53; Ponsich 1988: 148-149	P50: 213-223	7 small hooks; 4 incomplete. Present location: Musée de la Kasbah, Tangier.
23	Tahadart	28	Complex 4	7	Punico-Mauretanian/ Roman	1st c. BC - 3rd c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 53	-	Nine total hooks mentioned in ref., and three more are nails made into fish hooks. No sizes given.
24	Tahadart	28	Complex 1	1	Punico-Mauretanian/ Roman	1st c. BC - early 4th c. AD	lance	bronze	fishing	Ponsich & Tarradell 1965: 48	-	Fish hook transformed into a lance.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
25	Tahadart	28	Complex 6, necropolis	*	Punico-Mauretanian/ Roman	1st c. BC - 3rd c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 53-55; Ponsich 1988: 149	-	no specific number or sizes given; found in tombs 1, 2 and 4.
26	Kouass	29	kiln area	5	Punico-Mauretanian		fish hook	bronze	fishing	Kbiri Alaoui 2007: 211-212	-	Found in habitations near the the kiln area. No dimensions given.
27	*Zilil* /Dechar Jedid	30		4	Roman	1st-3rd c. AD	fish hook	bronze	fishing	unpub. (re-location of site as *Zilil* , see Akerraz, *et al* . 1981-82: 170-172)	P51: 224-227	3 small hooks; 1 medium hook. Present location: Musée Archéologique, Tetouan. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot.
28	*Zilil* /Dechar Jedid	30		4	Roman		net weight	terracotta	fishing	unpub. (re-location of site as *Zilil* , see Akerraz, *et al* . 1981-82: 170-172)	P52: 228-231	Doughnut- and disc-shaped medium (2) and small (2) weights with central hole. Present location: Musée Archéologique, Tetouan. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot.
29	*Zilil* /Dechar Jedid	30		2	Roman		fish hook	bronze	fishing	unpub. (re-location of site as *Zilil* , see Akerraz, *et al* . 1981-82: 170-172)	P53: 232-233	2 small hooks. Present location: Musée Archéologique, Tetouan. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot.
30	*Zilil* /Dechar Jedid	30		1	Roman		fish hook	iron	fishing	unpub. (re-location of site as *Zilil* , see Akerraz, *et al* . 1981-82: 170-172)	P54: 234	1 medium hook. Present location: Musée Archéologique, Tetouan. Site identified as "Ad Mercuri" - this is from Tarradell's excavations in 1950 (of Roman layers) and identification by Tissot.
31	Suiar	33	"castilla"	1	Roman	2nd AD	fish hook	bronze	fishing	unpub. (for site, aka *Ad Novas* or *Duga* , see Tarradell 1960: 117; see Villaverde Vega 2001: 111-112 for further discussion of *castellum* chronology)	P55: 235	1 small hook. Labelled “Cota central, castilla debajo muro C1”. Present location: Musée Archéologique, Tetouan.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
32	Suiar	33	"castro"	1	Late Roman	4th-5th c. AD	net weight	terracotta	fishing	unpub. (for site, aka *Ad Novas* or *Duga*, see Tarradell 1960: 117; see Villaverde Vega 2001: 111-112 for further discussion of *castellum* chronology)	P56: 236	Labelled "castro 6 – 1 nivel B3". Disc-shaped small weight with central hole. Found in a box with many fragments of sigillata. TSA D also found at site. Present location: Musée Archéologique, Tetouan.
33	Suiar	33	"B3, 1 & 2 nivels"	1	Late Roman	4th-5th c. AD	net weight	terracotta	fishing	unpub. (for site, aka *Ad Novas* or *Duga*, see Tarradell 1960: 117; see Villaverde Vega 2001: 111-112 for further discussion of *castellum* chronology)	P57: 237	Labelled "B3, 1 & 2 nivels". Disc-shaped small weight with central hole. Present location: Musée Archéologique, Tetouan.
34	*Tabernae*	34	Roman camp	4	Roman/Late Roman		fish hook	bronze	fishing	unpub. (see Rebuffat 1973-75: 367-368 & Villaverde Vega 2001: 134 for date of Roman camp)	P58: 238-241	1 small hook; 3 medium hooks. Present location: Musée Archéologique, Tetouan, Inv. C9-C10, C13, C21.
35	*Lixus*	36		1	Context unknown		fish hook	bronze	fishing	unpub.	P59: 242	1 medium hook. Present location: Musée Archéologique, Tetouan.
36	*Lixus*	36		2	Context unknown		navette	bronze	net making/ repair	unpub.	P60: 243-244	Tang widths: 0.4 cm, 0.3 cm. Present location: Musée Archéologique, Larache, Inv. LR.79.138 (both examples).
37	*Lixus*	36		3	Context unknown		net weight	terracotta	fishing	unpub.	P61: 245-247	Labelled "viejos fundos". Bun-shaped medium (2) and large (1) weights with two holes. Present location: Musée Archéologique, Tetouan.
38	*Lixus*	36		1	Context unknown		net weight	terracotta	fishing	unpub.	P62: 248	Labelled "viejos fundos". Trapezoida-shaped large l weight. Present location: Musée Archéologique, Tetouan.
39	*Lixus*	36		5	Context unknown		net weight	terracotta	fishing	unpub.	P63: 249-253	Trapezoidal- and tombstone-shaped large (4) and incomplete (1) weights. Present location: Musée Archéologique, Tetouan.
40	*Lixus*	36		1	Context unknown		net weight	terracotta	fishing	unpub.	P64: 254	Bun-shaped large weight. Present location: Musée Archéologique, Larache, Inv. LR.79.131.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
41	*Lixus*	36		1	Context unknown		net weight	terracotta	fishing	unpub.	P65: 255	Trapezoidal-shaped large weight. Present location: Musée Archéologique, Larache, Inv. LR.79.131.
42	*Lixus*	36		1	Context unknown		net weight	lead	fishing	unpub.	P66: 256	Lead sphendonoidal (pod)- shaped medium weight. Material that was on display in Larache. Present location: Musée Archéologique, Tetouan.
43	*Lixus*	36		1	Context unknown		net weight	stone	fishing	unpub.	P67: 257	Bun-shaped large weight of stone with single hole, labelled "viejos fundos". Present location: Musée Archéologique, Tetouan.
44	*Lixus*	36		1	Context unknown		net weight	stone	fishing	unpub.	P68: 258	Doughnut-shaped large weight of marble with single hole, labelled "viejos fundos". Present location: Musée Archéologique, Tetouan.
45	*Lixus*	36	"cata pie muralla romana oeste"	1	Punico-Mauretanian		net weight	terracotta	fishing	unpub. (see Tarradell 1958: 372, 375 for dates)	P69: 259	Labelled "cata pie muralla romana oeste". Doughnut-shaped medium weight. Present location: Musée Archéologique, Tetouan.
46	*Lixus*	36	"Cata la Muralla"	2	Punico-Mauretanian	ca. 2nd c. BC	fish hook	bronze	fishing	unpub. (see Tarradell 1958: 372, 375; Belén, *et al.* 1996: 341; Arharbi 2003: 80 for dates)	P70: 260-261	2 small hooks. Labelled "Cata de la Muralla de grandes bloques, 1955". Present location: Musée Archéologique, Tetouan.
47	*Lixus*	36	"hab. 20 y 21"	1	Punico-Mauretanian		fish hook	bronze	fishing	Tarradell 1959: 65-66; Ponsich 1981: 62, fig. 15; Brouquier-Reddé, *et al.* 2006: 2162 for date	P71: 262	1 medium hook. Labelled "hab. 20 y 21". Present location: Musée Archéologique, Tetouan.
48	*Lixus*	36	"Muralla – cota 1º, 2º nivel 2º"	1	Punico-Mauretanian	ca. 2nd c. BC	weight	lead	fishing	unpub. (see Tarradell 1958: 372, 375 for dates)	P72: 263	Labelled "Muralla – cota 1º, 2º nivel 2º". Lead pyramidal-shaped large weight. Present location: Musée Archéologique, Tetouan, Inv. 78-2-01.
49	*Lixus*	36	"hab. 20 y 21"	1	Punico-Mauretanian		navette	bronze	net making/ repair	unpub. (see Tarradell 1959: 65-66; Ponsich 1981: 62, fig. 15; Brouquier-Reddé, *et al.* 2006: 2162 for date)	P73: 264	Tongs not preserved. Labelled "hab. 20 y 21". Present location: Musée Archéologique, Tetouan.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
50	*Lixus*	36	Sondeo del Olivo/ Sondeo del Algarrobo	1	Punico-Mauretanian	90/80 BC - 10 AD	gorge	bone	fishing	Aranegui Gascó, *et al.* 2006: 363-364, Fig. 22b	-	Identified as a fish hook, type is a gorge. Ca. 5.5 cm L.
51	*Lixus*	36	Sondeo del Olivo/ Sondeo del Algarrobo	1	Punico-Mauretanian	90/80 BC - 10 AD	net weight	terracotta	fishing	Aranegui Gascó, *et al.* . 2006: 363-364, Fig. 21	-	Doughnut-shaped weight, 7 cmø. Inv. Lix. 2.01.2008.269. No weight given.
52	*Lixus*	36	Complex 5	8	Roman	1st c. - 4th c. AD	fish hook	bronze	fishing	Ponsich & Tarradell 1965: 24 (see Habibi 2007: 186 for date of complex only up to 4th c. AD)	P74: 265-272	5 small hooks; 1 medium hook; 2 large hooks. Present location: Musée Archéologique, Larache, Inv. LR.79.136 (all 8).
53	*Lixus*	36	Complex 5	1	Roman	1st c. - 4th c. AD	needle	bronze	net making/ repair	Ponsich and Tarradell 1965: 24	P75: 273	Present location: Musée Archéologique, Larache, Inv. LR.79.137. Inventoried as "fisherman's needle".
54	*Lixus*	36	Complex 5	8	Roman	1st c. - 4th c. AD	needle	bone	net making/ repair	Ponsich & Tarradell 1965: 24	P76: 274-281	Square-headed and pointed needles. Present location: Musée Archéologique, Tetouan, Inv. L- 44 - L-47, L-49 - L-50, L-52 - L-53. See Habibi (2007: 186) for date of complex only up to 4th c. AD
55	*Lixus*	36		2	Roman		fish hook	bronze	fishing	unpub.	P77: 282-283	2 small hooks. Material that was on display in Larache. Present location: Musée Archéologique, Tetouan.
56	*Lixus*	36		1	Roman		net weight	terracotta	fishing	unpub. (no photo)	-	Truncated cone-shaped small weight. Material that was on display in Larache. Present location: Musée Archéologique, Tetouan.
57	*Lixus*	36	"Habitacion No. 3"	1	Roman		fish hook	bronze	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P78: 284	1 small hook. Labelled "Habitacion No. 3 mas bajo que la roeda" (Likely Maison des Trois Grâces under the Tangier-Lixus road). Present location: Musée Archéologique, Tetouan.
58	*Lixus*	36		1	Roman		net weight	terracotta	fishing	unpub.	P79: 285	In box labelled "12j". Tube-shaped small weight. Box has much Roman material in it. Present location: Musée Archéologique, Tetouan, Inv. 55j.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
59	*Lixus*	36	"Habitacion No. 3"	1	Roman		net weight	terracotta	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P80: 286	Labelled "Habitacion No. 3 mas bajo que la roeda" (Likely Maison des Trois Grâces under the Tangier-Lixus road). Trapezoidal-shaped large weight with two holes. Present location: Musée Archéologique, Tetouan.
60	*Lixus*	36	"Habitacion No. 3"	1	Roman		net weight	lead	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P81: 287	Labelled "Habitacion No. 3 mas bajo que la roeda" (Likely Maison des Trois Grâces under the Tangier-Lixus road). Lead doughnut-shaped medium weight. Present location: Musée Archéologique, Tetouan.
61	*Lixus*	36	"cata peristilo M y R nivel hogar"	1	Roman		net weight	terracotta	fishing	unpub. (date for house from M. Lenoir 1992: 275-276, 286)	P82: 288	Labelled "cata peristilo M y R nivel hogar". Disc-shaped medium weight with central hole. Inv. 154/607. Present location: Musée Archéologique, Tetouan.
62	*Banasa*	46		10	Punico-Mauretanian/ Roman		fish hook	bronze	fishing	Thouvenot 1941: 54	-	From pre-1940 excavations. Dimensions unknown.
63	*Banasa*	46	east side of Kardo	1	Roman	post-AD 244	net weight	terracotta	fishing	Thuvenot & Luquet 1951b: 76	P83: 289	Possible ID for fishing? Trapezoidal-shaped large weight. Present location: Musée Archéologique, Rabat, Inv. 99.3.32.823 (B-592). Possibly the weight mentioned by Thuvenot & Luquet. Date given by coin of Philip (ca. AD 244).
64	*Banasa*	46	east side of Kardo	1	Roman	post-AD 244	net weight	terracotta	fishing	Thuvenot & Luquet 1951b: 76	P84: 290	Doughnut-shpaed medium weight with 6 incisions. Possible ID for fishing? Present location: Musée Archéologique, Rabat, Inv. 99.3.32.830 (B-566). Possibly the weight mentioned by Thuvenot & Luquet. Date given by coin of Philip (ca. AD 244).
65	*Banasa*	46	east side of Kardo	5	Roman	post-AD 244	needle	bone	net making/ repair	Thuvenot & Luquet 1951b: 76	P85: 291-295	Four round-headed and one square-headed needles. Single hole needles - possibly for fishing? Present location: Musée Archéologique, Rabat, Inv. 99.15.32.820 (E62), 99.15.32.824 (E60), 99.15.32.817 (B-526), 99.15.32.818 (B-526), Inv. 99.15.32.819 (B-526). Possibly the needles mentioned by Thuvenot & Luquet. Date given by coin of Philip (ca. AD 244).

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
66	*Banasa*	46		1	Roman		needle	bronze	net making/ repair	Thuvenot & Luquet 1951b: 76	P86: 296	Flat-headed needle, almost spatula-like. Present location: Musée Archéologique, Rabat, Inv. B-174. Possibly one of the needles mentioned by Thuvenot & Luquet. Date given by coin of Philip (ca. AD 244).
67	*Banasa*	46		2	Roman		needle	bronze	net making/ repair	Thuvenot & Luquet 1951b: 76	P87: 297-298	Round-headed needles, one with two eyes. Present location: Musée Archéologique, Rabat, Inv. 99.1.32.822 (B-169) & 99.1.32.815 (B-171). Possibly some of the needles mentioned by Thuvenot & Luquet. Date given by coin of Philip (ca. AD 244).
68	*Banasa*	46		1	Roman		navette	bronze	net making/ repair	unpub.	P88: 299	Tong width: 0.9 cm. Present location: Musée Archéologique, Rabat, Inv. 99.1.23.700 (B-177).
69	*Banasa*	46		4	Roman		fish hook	bronze	fishing	unpub.	P89: 300-303	From 1946 excavations. Medium hooks. One has a main shaft forms a loop/eye at top of hook. Others have spade ends. Present location: Musée Archéologique, Rabat, Inv. 99.1.23.701 (B-128), 99.1.23.712/713 (373), 99.1.23.707 (376), 99.1.23.710 (142).
70	*Thamusida*	47	northwestern part of city	2	Punico-Mauretanian	150-70 BC	fish hook	bronze	fishing	Callu, *et al.* 1965: 103, Pl. LXVIII,5	-	Inv. Br.7-1065, Br. 8-1101.; Rebuffat (1965b: 5) mentions "large number of fish hooks" at site, citing Morel's section. No sizes given.
71	*Thamusida*	47	northwestern part of city	1	Punico-Mauretanian	150-70 BC	net weight	terracotta	fishing	Callu, *et al.* 1965: 105, Pl. LXIX,1	-	Inv. Tc.1-787. Bun-shaped weight. Two holes in middle section, 7.3 cm ø, 2.1 cm deep. Found near fish hooks. No weight given.
72	*Thamusida*	47	northwestern part of city	2	Punico-Mauretanian	150-70 BC	net weight	terracotta	fishing	Callu, *et al.* 1965: 105, Pl. LXIX,2	-	Inv. Tc.2-1094, Tc.3-195. Doughnut-shaped weights with central hole (Tc 2: 3.5 cmø; 2.3 cm deep; central hole .5 cmø; Tc 3: 3 cmø; 2.4 cm deep; central hole .5 cmø). No weights given.
73	*Thamusida*	47	northwestern part of city	1	Punico-Mauretanian	150-70 BC	net weight	terracotta	fishing	Callu, *et al.* 1965: 106, Pl. LXIX,5	-	Inv. Tc.4-786. Doughnut-shaped weight with groove at top (5.8-6.5 cmø; 1.2 cm deep; central hole: 1.5 cmø). No weight given.
74	*Thamusida*	47	northwestern part of city	1	Punico-Mauretanian	150-70 BC	net weight	terracotta	fishing	Callu, *et al.* 1965: 106, Pl. LXIX,3 & 4	-	Inv. Tc.5-1093. Sphendonoidal-shaped pierced weight (L: 4.5 cm, max width: 1.6 cm, weight: 9.1 gr). No weight given.

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75	*Thamusida*	47	northwestern part of city	2	Punico-Mauretanian	150-70 BC	net weight	terracotta	fishing	Callu, *et al.* 1965: 106, Pl. LXX,1 & 2	-	Inv. Tc.6-783, Tc.7-784. Pyramidal-shaped pierced weights. Found with numerous fragments of others (H: 15 cm; base: 15-19 cm; top: 12 cm; weight: 2,600 g; holes: 2 cmø). No weight given.
76	*Thamusida*	47	near Thermes du Fleuve	1	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 207	-	1 small hook. Inv. no. 874. Broken shank, 2.1. cm L.
77	*Thamusida*	47	"temple à trois Cellae"	2	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 213	-	Inv. no. 375-376 (6 x 3, the other 5.8 x 3).
78	*Thamusida*	47	"Grand temple"	4	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 213	-	Inv. no. 381. "Dimensions max. 5.5; 5.5; 3.6; 2.5". 2 medium hooks; 2 small hooks.
79	*Thamusida*	47	"Maison du dallage ; contre la facade, on the exterior"	1	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 219	-	Inv. no. 638: 4.8 cm L. 1 small hook.
80	*Thamusida*	47	"quartier est"	8	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 224	-	Inv. no. 122. From earlier excavations. Max. dimensions: 5 - 1.6 cm. 8 small hooks.
81	*Thamusida*	47	"quartier est"	8	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 231	-	Inv. no. 328. From earlier excavations. No sizes given.
82	*Thamusida*	47	"Insula aux Tambours"	1	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 237	-	Inv. no. 642. 3 cm L. Surface find. 1 small hook.
83	*Thamusida*	47	"Insula du Versant, sondage III, cote 330 à 360"	1	Punico-Mauretanian/ Roman	1st-3rd c. AD	fish hook	bronze	fishing	Rebuffat 1977: 248	-	Inv. no. 1069 "in many frags., 2 cm L.". 1 small hook.
84	*Thamusida*	47	"Grand temple"	1	Punico-Mauretanian/ Roman	1st-3rd c. AD	weight	bronze & lead	fishing	Rebuffat 1977: 214, Pl. 86	-	Inv. no. 398. 2.7 cmø lead ball, pierced by a bronze wire that is folded back to form loops at each end. Entire piece: 5.7 cm.
85	*Thamusida*	47	"quartier est"	1	Punico-Mauretanian/ Roman	1st-3rd c. AD	needle	bronze	net making/ repair	Rebuffat 1977: 229	-	Inv. no. 242: L: 10.5 cm.

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86	*Thamusida*	47	"quartier est"	4	Punico-Mauretanian/ Roman	1st-3rd c. AD	needle	bronze	net making/ repair	Rebuffat 1977: 230, Pl. 84	-	With two holes: Inv. no. 248: 14 cm L; 13 cm L; 8.7 cm L . With one hole: Inv. no. 1451: 6.8 cm L.
87	*Thamusida*	47	"quartier est"	7	Punico-Mauretanian/ Roman	1st-3rd c. AD	net weight	terracotta	fishing	Rebuffat 1977: 264	-	Inv. no. 316. Disc-shaped weights pierced with small central hole. 3.5-5.5 cmø. No weights given.
88	*Thamusida*	47	"Sondage V", south of "Thermes du fleuve"	1	Roman		fish hook	bronze	fishing	Rebuffat, *et al.* 1970: 228	-	No sizes given.
89	Sidi Slimane	48		1	Punico-Mauretanian		fish hook	bronze	fishing	unpub. (for site see Luquet 1973-75a: 254-257)	P90: 304	1 small hook. Present location: Musée Archéologique, Rabat, Inv. 99.1.23.725.
90	*Volubilis*	51	"boutique on the façade of la maison au Bain des Nymphes"	10	Punico-Mauretanian/ Roman		fish hook	bronze	fishing	Étienne 1960: 42-44	P91: 305-314	8 small hooks; 1 medium hook; 1 large hook. Possibly the hooks described by Étienne, in boutique with "numerous fish hooks". Present location: dépôt, site archéologique de Chellah (Rabat).
91	*Sala*	56		3	Context unknown		fish hook	bronze	fishing	unpub.	P92: 315-317	3 small hooks. Present location: dépôt, site archéologique de Chellah (Rabat).
92	Essaouira	57	Coupe F-G, Couche IV	*	Punico-Mauretanian		fish hook	bronze	fishing	Jodin 1957: 17, 19; Jodin 1967: 228	-	Found at depth of 0.20-1 m. No specific number given.
93	Essaouira	57		*	Punico-Mauretanian		fish hook	bronze	fishing	Cintas 1954: 40, 53, fig. 67	-	No amounts or dimensions given. "Some fish hooks: found in Punic burial; fish hooks "in quantity and different sizes found". Figure shows two poorly corroded examples.
94	Essaouira	57		10	Punico-Mauretanian/ Roman		needle	bronze	net making/ repair	Jodin 1967: 210-212, Pl. C	-	Broken and complete needles of various styles from all over the site. All have one eye. Largest is 13 cm L.
95	Essaouira	57	Couche II, villa	6	Roman/Late Roman		fish hook	bronze	fishing	Jodin 1967: 228, 48-66, 75 (for villa; Jodin 1957: 13, 19)	P93: 318-323	6 small hooks, corroded. Labelled "Mog. 57, M.531, CII (villa)". Could be the hooks (of "copper" mentioned by Jodin 1957, but probably means bronze [copper alloy]). Present location: Musée Archéologique, Rabat.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
96	Essaouira	57	Couche II, villa	20	Roman/Late Roman		fish hook	bronze	fishing	Jodin 1967: 228, 48-66, 75 (for villa; Jodin 1957: 13, 19)	P94: 324-343	20 small hooks. Labelled "Mog. 57, M.531, CII (villa)". Could be the hooks (of "copper" mentioned by Jodin 1957, but probably means bronze [copper alloy]). Present location: Musée Archéologique, Rabat.
97	Essaouira	57	villa	16	Roman/Late Roman		fish hook	bronze	fishing	Jodin 1967: 227-228, Pl. CXIb (Jodin 1967: 48-66, 75 for villa)	P95: 344-359	15 small hooks; 1 medium hook. 13 of these are present in Jodin 1967: Pl. CXIb. At museum, labelled "Mog. 58 - villa". Present location: Musée Archéologique, Rabat.
98	Essaouira	57	villa	1	Roman/Late Roman		weight	lead	fishing	Jodin 1967: 227, Pl. CXIb (Jodin 1967: 48-66, 75 for villa)	P96: 360	Strip-shaped small weight. Appears in Jodin 1967 on top of a bronze fish hook. Labelled "Mog. 58 - villa". Present location: Musée Archéologique, Rabat.
99	Essaouira	57	villa	1	Roman/Late Roman		weight	lead	fishing	unpub. (see Jodin 1967: 48-66, 75 for villa)	P97: 361	Trapezoidal-shaped medium weight with hole at top. Labelled ""Mogador 57 – villa – plomb". Present location: Musée Archéologique, Rabat, Inv. M532.
100	Essaouira	57	Couche II, villa	1	Roman/Late Roman		weight	lead	fishing	unpub. (Jodin 1967: 48-66, 75 for villa)	P98: 362	Strip-shaped medium weight. Labelled "Mogador – C2 Romain: plomb" "J + K". (Coupe J+K?). Present location: Musée Archéologique, Rabat.
101	Essaouira	57	villa	1	Roman/Late Roman		weight	lead	fishing	unpub. (Jodin 1967: 48-66, 75 for villa)	P99: 363	Tube-shaped large weight. Labelled "Mogador 57 – villa – plomb". Present location: Musée Archéologique, Rabat, Inv. 532.
102	Essaouira	57	villa	1	Roman/Late Roman		weight	lead	fishing	Jodin 1967: 203, 48-66, 75 for villa	P100: 364	Piece of lead (medium weight) with hole. For weighting lines or nets? Perhaps amongst material described on p. 203. In museum, labelled "Mogador 57 – villa – plomb". Present location: Musée Archéologique, Rabat, Inv. 532.
103	Essaouira	57	villa	24	Roman/Late Roman		fish hook	bronze	fishing	unpub. (Jodin 1967: 228, 48-66, 75 for villa)	P101: 365-388	24 small hooks. Labelled "Mog.58 – villa Hameçons. Aiguille. Cure-oreille". Present location: Musée Archéologique, Rabat, Inv. M1004.
104	Essaouira	57	villa	5	Roman/Late Roman		fish hook	bronze	fishing	unpub. (Jodin 1967: 228, 48-66, 75 for villa)	P102: 389-393	4 small hooks; 1 medium hook. Labelled "Mog.58 – villa Hameçons. Aiguille. Cure-oreille". Present location: Musée Archéologique, Rabat, Inv. M1004.

Cat #	PROVENANCE	SIte #	LOCATION	NO.	PERIOD	DATE	ITEM	MATERIAL	USE	REFERENCE	Photo CD #	COMMENTS
105	Essaouira	57	villa	5	Roman/Late Roman		lance	bronze	fishing	unpub. (Jodin 1967: 48-66, 75 for villa)	P103: 394-398	Barbed lances for harpooning on small scale? Labelled "Mog.58 – villa Hameçons. Aiguille. Cure-oreille". Present location: Musée Archéologique, Rabat, Inv. M1004.
106	Essaouira	57	villa	2	Roman/Late Roman		fish hook	bronze	fishing	unpub. (Jodin 1967: 228, 48-66, 75 for villa)	P104: 399-400	1 medium hook; 1 small hook. Labelled "Mog. 57-58". Present location: Musée Archéologique, Rabat.
107	Essaouira	57	villa	1	Roman/Late Roman		needle	bronze	net making/ repair	unpub. (Jodin 1967: 228, 48-66, 75 for villa)	P105: 401	Labelled "Mog. 57-58". Present location: Musée Archéologique, Rabat.
108	Essaouira	57	Chambre IV du bâtiment Nord	4	Roman/Late Roman		net weight	terracotta	fishing	Jodin 1967: 190-191, Pl. LXXXVII	-	Trapezoidal-shaped weights. Dimensions are relatively the same (p. 191, n. 115): Height: 102 mm, base: 79 mm, top : 63 cm, thickness : 26 mm. Each have 2 holes at the top. No weights given.
109	Essaouira	57	Chambre XV	3	Roman/Late Roman		weight	lead	fishing	Jodin 1967: 203-205, Pl. XCIV	-	Elongated pyramidal-shaped weights, found side-by-side. Dimensions (p. 203, n. 138-141) Mog. 1160: h: 62 mm, l: 24 mm, L: 22 mm; Mog. 1161: h: 44 mm, l: 26 mm, L: 22 mm; Mog. 1162: h: 59 mm, l: 28 mm, L: 28 mm. No weights given.

Appendix 3.
Fish-salting production

Metadata

FISH-SALTING FACILITIES

Appendix 3.1 is a catalogue of established and proposed fish-salting facilities within the borders of *Mauretania Tingitana* from the Punico-Mauretanian to Late Roman periods. Three groups of facilities are included: 1) sites that possess *opus signinum*-lined vats (*cetariae*) and were clearly used for salting due to their contexts (see Chapter 3.2.3); 2) sites that have been identified with *cetariae* but have not been preserved or appropriately published; 3) sites where fish-salting activities likely occurred but did not take place in *cetariae* (generally these are identified by their proximity to marine environments, the presence of the remains of marine resources, and early large salazón amphorae, such as Mañá-Pascual A4 types).[1] A * after a site name indicates the latter two types of facilities in this catalogue.

If site plans of *cetariae* are published their capacities have been measured and included here. If possible, some *cetariae* were recorded during reconnaissance in 2007 and 2009. However, in a majority of cases, the dimensions of these are not given or not fully given in publications due to the extant remains (for example, some publications do not include depth measurements or can not provide them as only the base of a *cetaria* is preserved). In these instances, the measurements listed in this catalogie were estimated conservatively, based on comparison to other *cetariae* at the site or nearby sites where dimensions are known. These capacity measurements are indicated inside parentheses in the catalogue. At some sites, the capacity figures are only representative of a complex's initial stages of operation; when modifications/ reductions occurred, the new capacities are not usually indicated in publications except with Complex 1 at *Lixus*.

[1] Other sites have been proposed as having fish-salting activity, but these are not included here as in almost all cases, the only evidence cited for this identification is ceramic fragments or the presence of modern *salinas* (see discussion in Bernal Casasola 2006a: 1359). These are: El Negrón/Sidi Bou Hayel (Tarradell 1966: 435; Gozalbes Cravioto 1997: 130) on the Mediterranean coast; El Marsa (Tarradell 1960: 123-124; Tarradell 1954b: 108-109; Tarradell 1966: 435; Gozalbes Cravioto 1997: 127), Er Rmel (Tarradell 1954b: 108-109; Tarradell 1960: 124; Tarradell 1966: 435; Gozalbes Cravioto 1997: 127; Euzennat 2000: 461), Oued Liam (Tarradell 1966: 431) and Tanja el-Balia (Cheddad 2008: 391) on the Straits of Gibraltar coast; Jorf al Hamra (Ponsich 1964a: 247-248), Sidi Kacem (Gozalbes Cravioto 1997: 127), Asilah (Cheddad 2008: 396) Sidi Bou Nouar and Lalla Safia (Cerri 2007b: 34, n. 10; Villaverde Vega 2001: 108; Akerraz, *et al.* 1981-82: 213; Ponsich 1964b: 270, nos 42-43) on the Atlantic coast. The proposal that a *cetaria* functioned at *Tamuda* is discussed in Chapter 7.2.3.5.

There are 15 sites included in this catalogue and their numbers follow the site numbers given at the beginning of the appendices. The dates cited refer to the likely period of salting activities at each site, and not necessarily the overall chronology of the site.

SALT SOURCES

Appendix 3.2 presents the ancient, historical and modern types of salt sources distributed throughout the northwest Maghreb. The data source for this table includes epigraphy, medieval and historical written sources, historical maps (cross-referenced in App. 7) and modern observations, including those made by the author between 1999-2009.

A map presents the distribution of the sites, followed by a table of the sources. The sites are listed in geographical orientation from east to west and north to south.

SALAZÓN AMPHORAE

Appendix 3.3 lists the published finds of salazón amphorae present throughout the northwest Maghreb from the Punico-Mauretanian to Late Roman periods. The types of amphorae included in this catalogue are those designated as salazón types by the Amphora Project on-line database.[2] The chronology assigned to these types are based on published sources of the kiln at Kouass and the settlement at *Lixus* for the Punico-Mauretanian period and on the Amphora Project database chronologies for the Roman and Late Roman types.[3] (For discussion on chronology and types, see Chapter 3.2.3.)

Appendix 3.3.1 is comprised of a map showing the distribution and chronology of the known kilns that produced salazón types within the northwest Maghreb, followed by a table of the finds.

Appendix 3.3.2 is comprised of the salazón types throughout the region are grouped by geographic region (Mediterranean, Straits of Gibraltar, Atlantic). Maps showing the general distribution and chronology of the finds are presented at the beginning of each region, followed by a table of the finds; within these regions sites are listed in geographic orientation from east to west and north to south. Site numbers follow those given in the site list at the beginning of the appendices.

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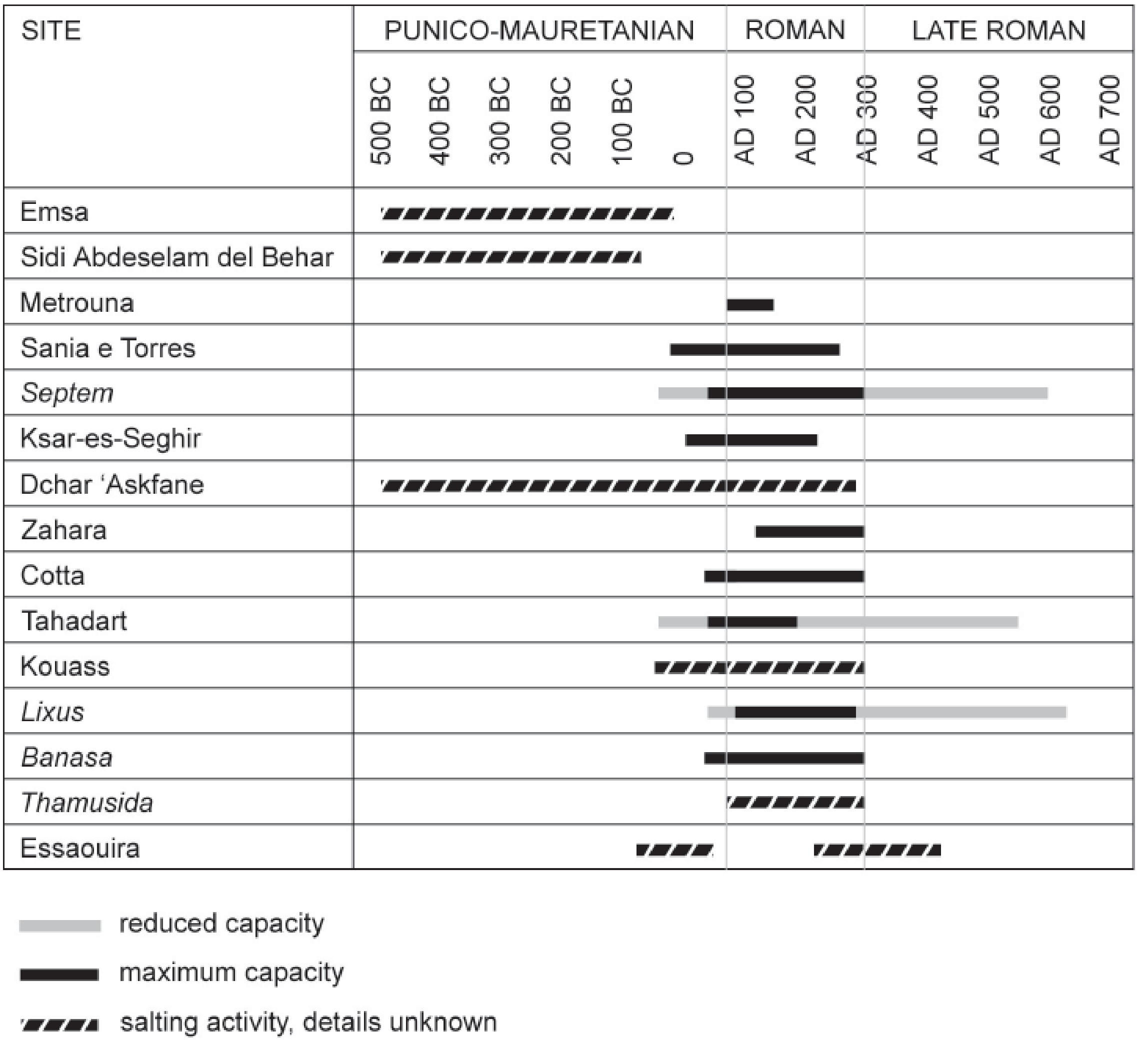
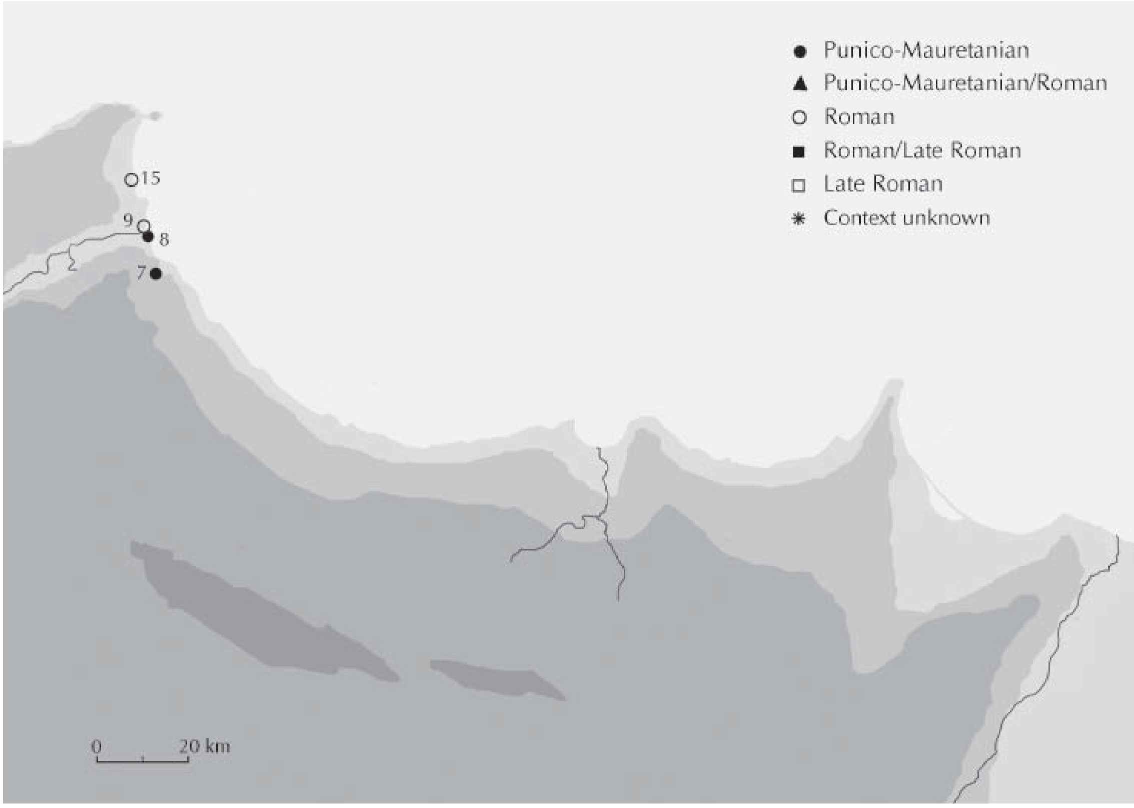
[2] See: http://ads.ahds.ac.uk/catalogue/archive/amphora_ahrb_2005/cat_amph.cfm
[3] Kbiri Alaoui 2007: 198-205, 217; Ramón 1995: 237-238; Aranegui Gascó, *et al.* 2000: 19; Ponsich 1969-70

Appendix 3.1.
Fish-salting facilities

General chronology of fish-salting sites included in this catalogue:



Mediterranean coast



Site 7. Emsa*
Small agglomeration or settlement on a hillock (also referred to as Kubia Tebmain), ca. 30 m high on the east bank of the Oued Emsa, 2 km from the present Mediterranean coastline in the small alluvial valley east of Cape Mazari. Excavated area covers 80 x 40 m with eight rooms identified; thought to be a small "station" with some exterior walls.[2] Numerous Mañá-Pascual A4 salazón amphorae fragments found here during M. Tarradell's excavations in 1951-52. Shellfish were also recovered during these excavations but not published (see App. 1.2.1). The ceramic finds have been recently re-examined by M. Kbiri Alaoui, who assigns earlier and later dates of occupation (previously thought 4th-2nd centuries BC). He identifies three phases: 1) western Phoenician ceramics (6th-5th century BC), 2) Mañá-Pascual A4 types (5th-2nd century BC), 3) Italic finewares and Republican amphorae (late 2nd-late 1st century BC). Reconnaissance in spring 2007 located no visible remains of the site.

Location of Emsa in grey (after Tarradell 1966: fig. 7).

[2] A. Jodin (1966c: 41) states that site was occupied by fishermen and there are "some Roman fish-salting basins present" – no basins are mentioned by the excavators.

Resources: Salt sources not known nearby; historical and modern salt exploitation (*salinas*) at Beni Madden, at the mouth of the Oued Martil (see App. 3.2: *Beni Madden*). Site located on the banks of Oued Emsa (fresh water). Modern wells surrounding base of hillock.
Date: Punico-Mauretanian (6th-1st centuries BC)

No site plan published.
References: Kbiri Alaoui 2008; Tarradell 1954b: 120-121; Tarradell 1960: 79-85; Tarradell 1966: 440-443; López Pardo 1990a: 39-41; Majdoub 2004: 271-272

Hillock site of Emsa, looking south-east across Oued Emsa (March, 2007). Photo: ALT

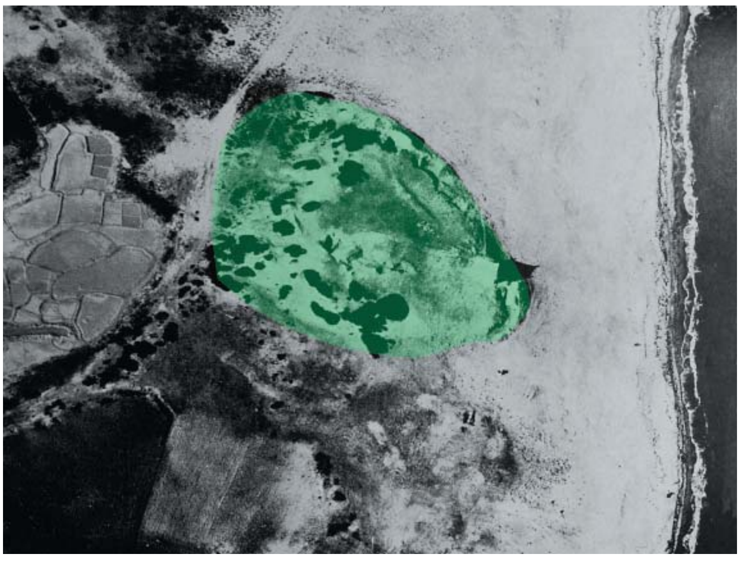
Site 8. Sidi Abdeselam del Behar*

The site consists of a small beach-side hillock, ca. 95 x 85 m, on top of which are an Islamic cemetery, marabout shrine and gendarme station. The hillock is situated on the southern bank of an old oxbow mouth of the Oued Martil. Archaeological strata are visible on the eastern side of the site (facing the beach) and appear to be ca. 2 m deep. M. Tarradell excavated the site in 1951, and identified two occupation layers (Phoenician trading station and later Punico-Mauretanian settlement) and evidence of destruction by fire. Numerous finds of Mañá-Pascual A4 and Mañá C2b/Dressel 18 salazón amphorae and marine animal remains (see App. 1.2.1) have led Tarradell and other archaeologists to conclude that fish-salting took place here.

N. Villaverde Vega identifies other material from the site, unpublished and stored at the Musée Archéologique (Tetouan), as including Roman and Late Roman ceramics.[3] This subsequent occupational phases dates from the end of the 1st-mid-3rd centuries AD and AD 320-late 5th century AD. Villaverde Vega also states that there is a square construction, 60 x 60 m, with remains of towers which is thought to date to the late 3rd/early 4th centuries. Reconnaissance of the site in March 2007 did not locate this feature. The site was re-investigated in 2008 by a Hispano-Moroccan team, providing new dates for the fire destruction in the early 2nd century BC.

Resources: Numerous *salinas* are present just west of site, inside the old river bed at Beni Madden (see App. 3.2: *Beni Madden*);

Aerial photograph of site in 1951. Salinas *of Beni Madden are at left; north is at top of photo (after Taradell 1966: Pl. II).*



[3] From excavations by Tarradell and unpublished excavations of Montalbán; Bernal, *et al.* 2008b: 319.

it is possible that the same activity was conducted here in antiquity, although the chronology of the river's embouchure here is not known. Existing wells in this area were noted as brackish during the excavations of the site, although they were freshwater wells at one point. If the Oued Martil did pass by the site in antiquity, is was likely brackish for a distance upstream as well.
Date: Punico-Mauretanian (late 6th/early 5th-1st centuries BC)

The situation of the Sidi Abdeselam del Behar on the coast; cultural layers are eroding out of the beach side of the hillock (March, 2007). Photo: ALT

No site plan published.
References: Tarradell 1954b: 121-123; Tarradell 1957: 255-262; Tarradell 1960: 86-95, figs 17-18; Tarradell 1966: 437, Pl. II; López Pardo 1996a: 267; Villaverde Vega 2001: 237-239; Majdoub 2004: 272-274; Bernal, *et al.* 2008b: 317-319, 336

Site 9. Metrouna

The site is located in the sand dunes on the northern bank of an old oxbow mouth of the Oued Martil, ca. 500 north-west of Sidi Adbeselam del Behar and ca. 400 m from the Mediterranean coast. The site has been affected by modern agricultural activity. Shellfish fragments are abundantly present on the surface of the site, and the most common finds are specimens of the *Muricidae* family (banded dye-murex, *Murex/hexaplex trunculus,* and spiny dye-murex/purple dye-murex*, Murex [bolinus] brandaris*). Also identified at the site is a large stone slab with a central depression, possibly used as a crusher for extracting the dye glands from the shellfish, and some flints. Fragments of Dressel 7-11 amphorae are also present at the site. A test trench opened at the site in October 2008 by a Hispano-Moroccan team revealed a *cetaria*, suggesting that salting activities took place here and specifically the site functioned as a purple-dye factory.

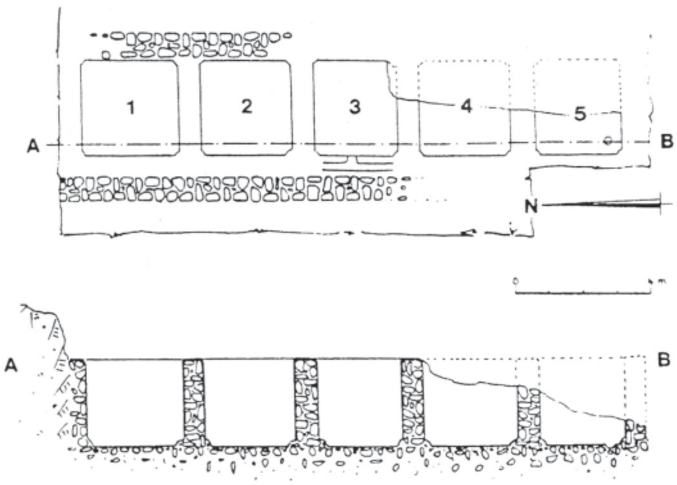
Resources: Ca. 30 m from the site are the modern *salinas* of Beni Madden (see App. 3.2: *Beni Madden*). As noted with Site 8, existing wells in this area were brackish in the mid-20th century. They were certainly freshwater wells at one point.
Date: Roman (ca. AD 75-150)

The excavated cetaria *at Metrouna (after Bernal,* et al. *2008b: fig. 23).*

No site plan published.
References: Bernal, *et al.* 2008b: 332-335

Site 15. Sania e Torres

A small unit of *cetariae* located in a dune at the edge of the beach of Ensenada de Ceuta, ca. 1 km north of the mouth of Oued Smir. There are five conjoined vats lying in a row parallel to the sea, excavated quickly in 1953-54 after they were revealed during a storm. Excavation uncovered an area of ca. 20 x 10 m. Dressel 7-11 amphorae present, as well as "late" amphorae that were difficult to identify. M. Ponsich suggests the possibility of another row of vats closer to the bay. During the present author's reconnaissance in summer 2002, the extant basins appeared to be painted over and made into beach-side huts near one of the many resort hotels in the area. They were no longer visible during reconnaissance in spring 2007 due to new construction.



Plan of site (after Ponsich 1988: fig. 94).

During excavation, the five basins were found in various stages of preservation: three were in good condition and only half of the other two were preserved. The *cetariae* have ovolos (quarter-rounds) lining their bottom edges; the southern-most basin has a small circular depression in its bottom, or cuvet, to ease cleaning. The central basin had a drain leading from its base to assist with cleaning.

Situation of the remaining basins above the beach, looking south (July, 2002). Photo: ALT

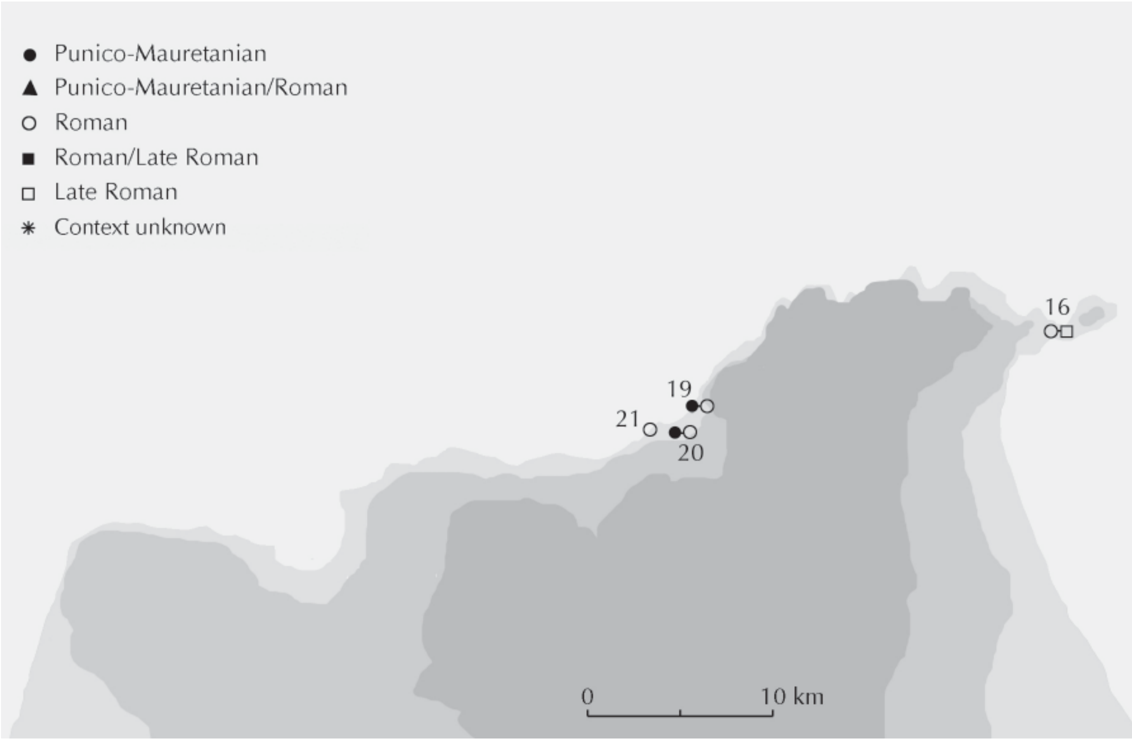
Total capacity: ca. 78 m^3

Resources: Oued Smir estuary 1 km south of site may have been a source of salt, although this area was not utilised historically. Beni Madden *salinas*, near Sidi Abdeselam del Behar, are 18 km distant (see App. 3.2: *Beni Madden*). Fresh water may have been obtained north of the mouth of Oued Smir in a place called "Sania e Torres" or "La Aguada"; there are presently deep wells here of potable water, apparently rare in the region.

Date: Roman (ca. late 1st century BC-3rd century AD [?])

References: Ponsich & Tarradell 1965: 75-77; Tarradell 1966: 435, fig. 5; Ponsich 1988: 166-168; Gozalbes Cravioto 1997: 130; Cheddad 2007: 191; Villaverde Vega 2001: 226-228

Straits of Gibraltar coast



Site 16. *Septem Fratres*/Ceuta
Five different groupings of at least 14 *cetariae* were found in various states of preservation throughout the narrow La Ciudad section of the peninsula of Ceuta. The sites are 1) Hotel la Muralla/Parque de Artillería, 2) Palacio de la Asamblea, 3) No. 13 Calle Hermanos Gómez Marcelo, 4) No. 20/21 Av. Sánchez Prados (Gran Via)/Queipo de Llano, and 5) Paseo de las Palmeras. Associated preparation areas have also been excavated adjacent to some of these sites; larger preparation areas are at Nos. 12/13 Av. Sánchez Prados (Gran Via), No. 3. Plaza de África and to the west and north-west of the Hotel la Muralla, at the Puerta Califal site. Finds include salazón amphorae, marmites, fish bones, shellfish, fish hooks and net weights. These sites, spread throughout an area of ca. 10 ha, were excavated between 1960-99; the Puerta Califal site has been under investigation since 2003 and the Plaza de África site was excavated in 2006.

Only a few of the *cetariae* have been preserved in *Septem* whilst others were either found in a poor state of preservation and/or destroyed during construction works in the last century. These basins have ovolos lining their bottom edges. Two complete *cetariae* were moved from their original find place in El Paseo de las Palmeras in 2004 and are on exhibit in the Museo Basilica Tardoromana.

Cetariae *finds:*
Hotel la Muralla/Parque de Artillería: One *cetaria* identified as well as associated preparation area, with salazón amphorae finds (destroyed upon construction of hotel; amphorae lost). Functioned late 1st century BC-5th century AD.[4]
Palacio de la Asamblea: Two *cetariae* identified (destroyed upon construction of a parking lot). Functioned from 2nd-5th centuries AD.[5]

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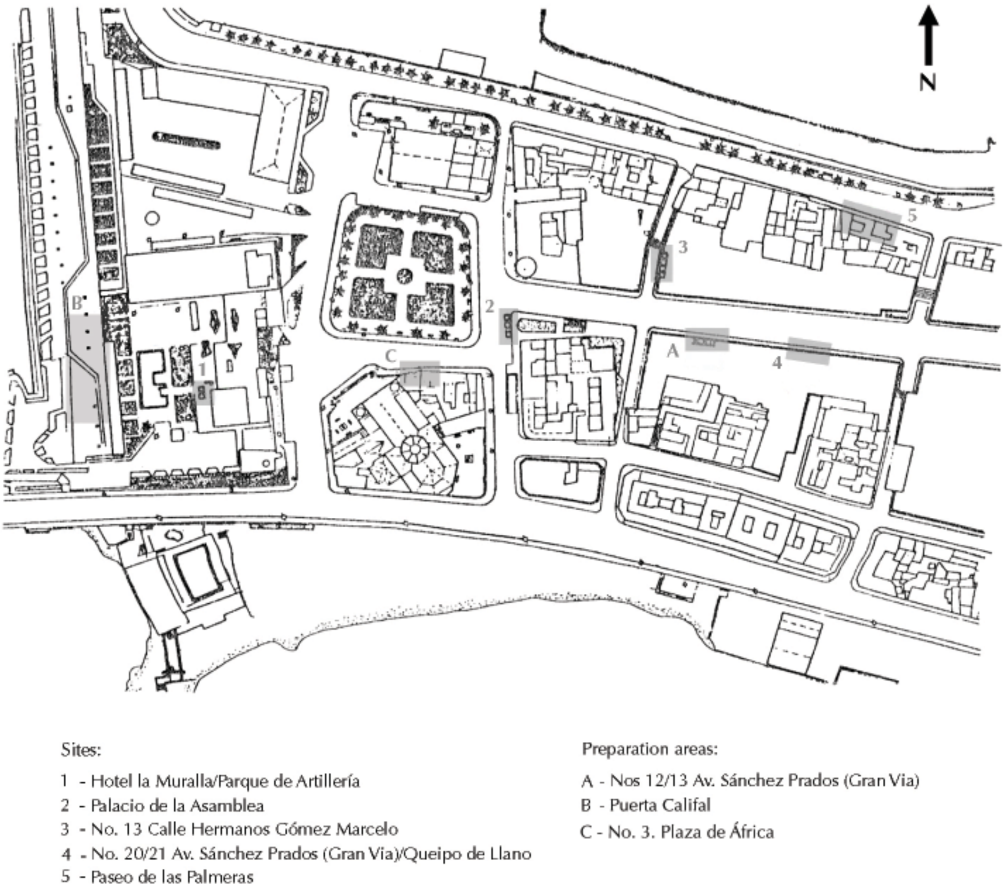
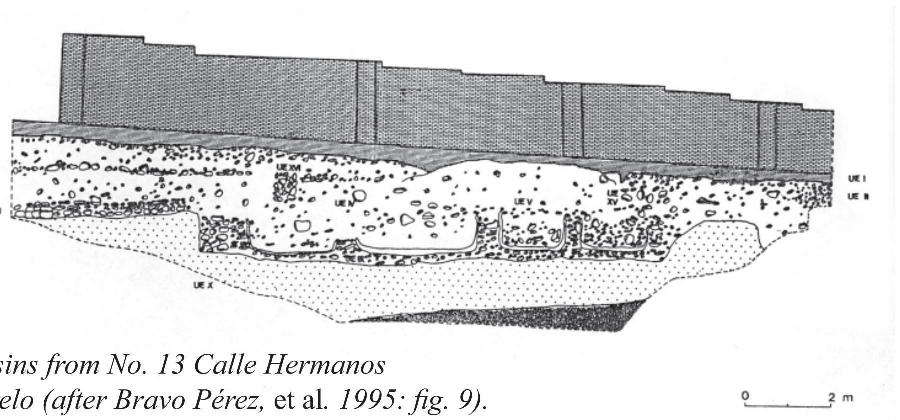
[4] Bravo Pérez, *et al.* 1995; Villada, *et al.* 2007; Villada Paredes 2006: 274-276
[5] Bernal Casasola & Pérez Rivera 1999: Pl. IIIB; Bravo Pérez, *et al.* 1995



Site plan of the cetariae *and preparation areas of* Septem *(after Bravo Pérez,* et al. *1995: fig. 2).*

No. 13 Calle Hermanos Gómez Marcelo: Four *cetariae* found, incomplete. Adjoining area where "shipments" were prepared. Functioned 2nd-6th centuries AD.[6]
No. 20/21 Av. Sánchez Prados (Gran Via)/Queipo de Llano: at least five *cetariae* excavated at this site. Functioned from 2nd-early 6th centuries AD; period of reduction/abandonment in the 5th century. At least three medieval *cetariae* were built here.[7]
Paseo de las Palmeras: At least two basins in 300 m² of "factory" excavated on north shore of La Ciudad. Functioned mid-2nd-3rd centuries AD; abandonment then restructuring in 3rd centuries/re-use from the 4th-late 5th/early 6th centuries AD.[8]



Profile of basins from No. 13 Calle Hermanos Gómez Marcelo (after Bravo Pérez, et al. *1995: fig. 9).*

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[6] Bravo Pérez, *et al.* 1995; Villaverde Vega & López Pardo 1995: 456-460; Bernal Casasola 1996: 1195-1196; 6th century terminus, as opposed to 5th century, is proposed by Bernal Casasola 2008: 41.
[7] Hita Ruiz & Villada Paredes 1994: 25-30; Bernal Casasola & Pérez Rivera 1999: Pl. IIID; Bernal Casasola 2008: 42
[8] Bernal Casasola & Pérez Rivera 1999; Bernal Casasola, *et al.* 1999; Bernal Casasola & Pérez Rivera 2000: 865-875; Bernal Casasola 2008: 41-42

Preparation areas:
No. 12 Av. Sánchez Prados (Gran Via): Paved flooring and large holes (pozos) present in floor. Functioned from 1st-5th centuries AD; second phase 5th century to medieval period.
No. 13 Av. Sánchez Prados (Gran Via): Opus signinum flooring, identified as preparation area for one of the factories. Functioned 1st-5th centuries AD.[9]
Puerta Califal: Related preparation area ca. 30-40 m to the west and north-west of the Hotel La Muralla site (possibly extending factory all the way west to the Foso Real). The area originally was a trash dump for the nearby salting site (in the mid-1st century AD); then made into a preparation area at the beginning of the 2nd century AD. In the 3rd century there was restructuring and use until the 4th century. Later periods are not discernable due to subsequent construction.[10]
No. 3. Plaza de África: Recent excavations reveal remains of whale bones from 2nd century layers; more whale bones and *murex* shells were found in late 5th/early 6th century layers, just before the site was abandoned. It is possible the purple dye and whale oil was obtained here.[11]

The extant basin remains at No. 20/21 Av. Sánchez Prados, with its length delineated by the red line. The wall behind is formed by mediaeval basins. Scale is 20 cm. Photo: ALT

It is not clear if the five sites with *cetariae* were connected to each other and comprise one extended "factory" that was added on to at different periods, or comprise groups of factories (such as at *Lixus* on the Atlantic coast [see Site 36 below] or Troía [Portugal]). If they are related to one another, then *Septem* potentially could be one of the larger fish-salting sites in *Mauretania Tingitana.* Reconstruction of the past occupation of the city has been greatly hampered by the density of modern buildings throughout the enclave.

Capacities:
Hotel la Muralla:[12] (1 m^3)
Palacio de la Asamblea:[13] (2 m^3)
No. 13 Calle Hermanos Gómez Marcelo:[14] (5.5 m^3)
No. 20/21 Av. Sánchez Prados (Gran Via):[15] (15.4575 m^3)
El Paseo de las Palmeras:[16] (2.205 m^3)
Total combined capacity: 26.1625 m^3 (minimum)

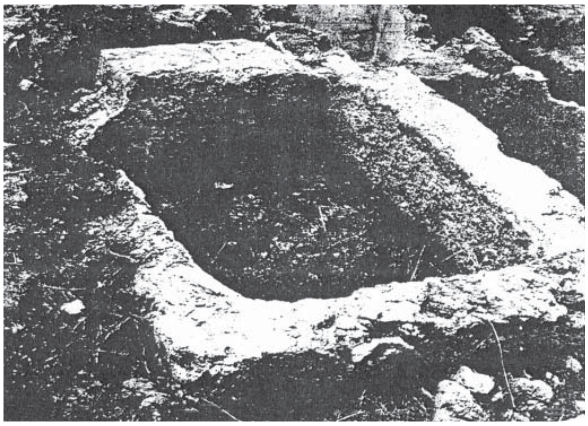
[9] Hita Ruiz & Villada Paredes 1994: 18-24, 30-32; Bernal Casasola & Pérez Rivera 1999: 29; Marín Díaz, *et al*. 1995; Bernal Casasola 1996: 1194-1195
[10] Villada, *et al.* 2007; Villada Paredes 2006: 274-276; Hita Ruiz & Villada Paredes 2004
[11] Bernal Casasola 2009b: 267-270; Bernal Casasola, *et al.* 2007: 96-97
[12] *Cetaria* is comparable to those from Paseo de las Palmeras in size. Minimum measurements given here; taken from photo, Bernal Casasola & Pérez Rivera 1999: Pl. IIIA.
[13] *Cetariae* appear comparable to those from Paseo de las Palmeras in size. Minimum measurements given here; taken from photo, Bernal Casasola & Pérez Rivera 1999: Pl. IIIB.
[14] No length dimensions available; assumed 1 m (minimum).
[15] Only bases are present. Dimensions of these given in Fernández Sotelo 2004; Bernal Casasola 2008: fig. 9. Height estimated at 1 m.
[16] Dimensions taken from Bernal Casasola & Pérez Rivera 1999: 18, fig. 20 and scaled photos.

Cetariae *from El Paseo de las Palmeras in the Museo Basilica Tardoromana. Scale is 20 cm. Photo: ALT*

Resources: Oued Smir estuary ca. 17 km south may have been a source of salt, as possibly Beni Madden area at the mouth of Oued Martil, ca. 35 km south (see App. 3.2: *Beni Madden*). Possibly furnaces were used to remove salt from seawater through lixiviation; a thermal area has been proposed by the presence of bricks.[17] It has also been suggested that salt was shipped from southern Iberia to *Septem* using amphorae that could then be re-used for salted products.[18] Springs are also known on Monte Hacho and in the Almina and La Ciudad areas, and the abundance of fresh water on the peninsula is cited by mediaeval Arab geographers Ibn Hawkal, al-Idrîsî and al-Bakrî.[19] Subterranean channels that brought water from a spring to a cistern were found amongst the preparation areas during excavations at Paseo de las Palmeras site; water channels and a basin were also found at the Puerta Califal site. A kiln has been identified for Dressel 7-11 amphorae at the Puerta Califal site (see App. 3.3.1).[20]
Date: Roman, Late Roman (late 1st century BC-early 6th century AD)

References: Bravo Pérez 1968; Hita Ruiz & Villada Paredes 1994: 17-48, 60-61; Bravo Pérez, *et al.* 1995; Villaverde Vega & López Pardo 1995; Bernal Casasola & Pérez Rivera 1996; Bernal Casasola 1996: 1195-1196; Pérez Rivera & Bernal Casasola 1998; Bernal Casasola & Pérez Rivera 1999: 28-46; Bernal Casasola, *et al.* 1999; Bernal Casasola & Pérez Rivera 2000; Villaverde Vega 2001: 295-298; Villada Paredes 2006: 275-276; Villada, *et al.* 2007; Marín Díaz, *et al*. 1995; Bernal Casasola 2008: 41-42; Hita Ruiz & Villada Paredes 2004

Site 19. Ksar-ed-Seghir (Alcazarsegher)
An establishment of at least 12 conjoined *cetariae* located on eastern shore of bay at Ksar-es-Seghir. The *cetariae* lie at the eastern-most extent of beach, at the base of hills that form the eastern promontory of the bay. The site was found eroding out onto the beach and partially excavated in 1953. The remains cover an area of



A cetaria *at Ksar-es-Seghir. Photo taken in 1953 (after Ponsich 1988: fig. 91).*

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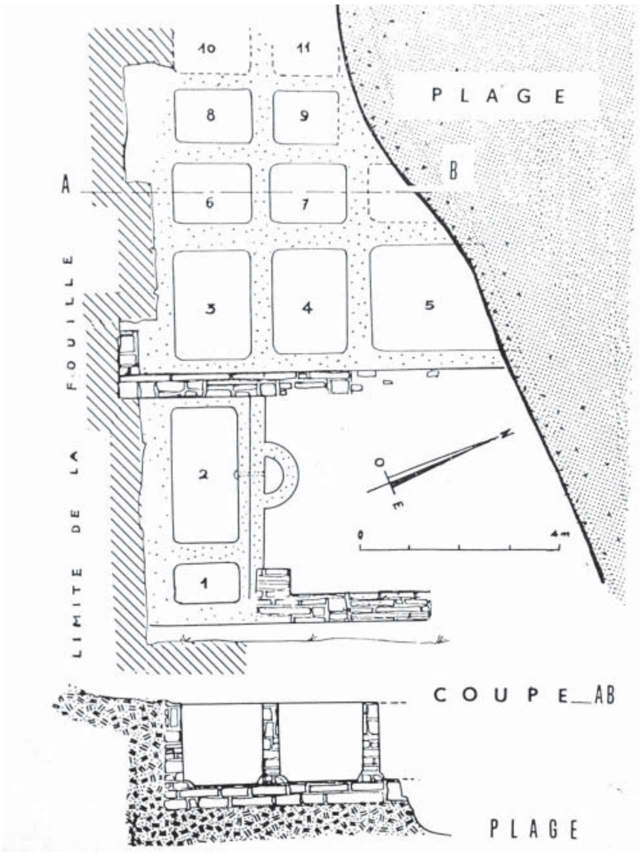
[17] Bernal Casasola 1994b
[18] Shipment of salt in this way is attested from the medieval to historical periods; Bernal Casasola 2006a: 1386.
[19] Ibn Hawkal: 78-79; al-Idrîsî: §164-165; al-Bakrî: 102-103
[20] Kiln information: F. Villada Paredes (Instituto de Estudios Ceutíes, Ceuta), pers. com.

ca. 7 x 12 m: two *cetariae* are present along the south side of this room and ten *cetariae* of various sizes and states of preservation are to the west. This arrangement seems to equal one small "factory"; a small Roman-period "settlement"was located nearby. The *cetariae* area began to function during the Imperial period and ceased in the late 2nd/early 3rd centuries; finewares and salazón amphorae (Almagro 51a and b types) indicate that the settlement continued to be frequented until the 4th century, or possibly even the 5th century.

The site, in the summer of 2002, was buried under sand, and some of the remains at the western edge seem to have eroded along the beach. By spring 2007, a house appears to have been built near or on the western edge of site.

During excavation, eight of the *cetariae* were found complete, whilst four were eroding out into the beach. These have ovolos lining the bottom edges of the basins. *Cetariae* 2 has a drainage channel in the base of its northern face that empties into a semi-circular basin.

Total capacity:[21] 40.728 m³ (minimum)



Plan of the site (after Ponsich & Tarradell 1965: fig. 48).

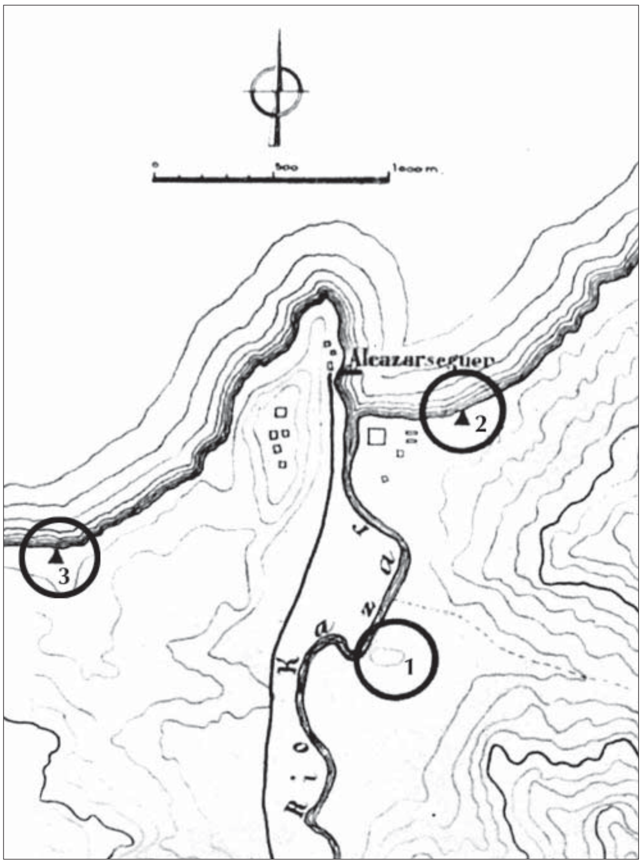
The situation of the factory at Ksar-es-Seghir (March, 2007). Photo: ALT

[21] C*etaria* 1 is indicated as "1.38 sur 1.3, un autre de meme largeur, long de 2.30 [*cetaria* 2]" – these measurements do not correspond to the plan's scale. The measurements here are determined from the scaled site plan (Ponsich & Tarradell 1965: 72).

Resources: Tangier Bay has been proposed as a source of salt (see App. 3.2: *Tangier Bay*). Site is located ca. 800-900 m away from Oued El Kazar which possesses fresh water but is saline in its lower reaches. Wells and a hammam are present in the medieval Islamic fort and later Portuguese fort next to the river, indicating that fresh water was available from here or from groundwater sources.[22]
Date: Punico-Mauretanian, Roman (1st-late 2nd/early 3rd centuries AD)

References: Ponsich & Tarradell 1965: 71-75; Ponsich 1988: 161-164; Cheddad 2007: 192; Villaverde Vega 2001: 200

Site 20. Dchar 'Askfane
The ca. 2 ha site occupies a hillock on the east bank of the Oued El Kazar, less than 1 km south from the bay at Ksar-es-Seghir. It was first identified as an archaeological site in 1943 by P. Quintero and cursorily excavated; another excavation was undertaken by M. Tarradell in 1953 that delineated the extent of the site and provided some preliminary dating. Excavations were renewed in 2005-2006 under the direction of A. El Khayari and H. Limane (INSAP). Site is mainly occupied by a Roman *villa* (1st-3rd centuries AD). In the late 3rd century, a *centenarius* was built on the southern slope of hillock with traces of occupation until the 5th century. Early Islamic remains are present (8th-11th centuries).



Location of the fish-salting sites in the middle of the Straits. 1: Dchar 'Askfane, 2: Ksar-es-Seghir, 3: Zahara (after Tarradell 1966: fig. 2).

Fish-salting activity likely extends from the Punico-Mauretanian period (ca. 5th century BC) as there are many Mañá-Pascual A4 amphorae fragments found at the site as well as debris of marine resources. "Preparation" or cleaning floors are present on top of the hill; these have some *murex* shells imbedded in their pavement. Tunny bones were also found during excavations. Analyses of these have not yet been undertaken. During the Roman period, there were two basins lined with *opus signinum* in use on top of hill (likely *cetariae*), near the *villa*. It might be that modifications were later made to a cistern for the baths in order to create more *cetariae*.[23]

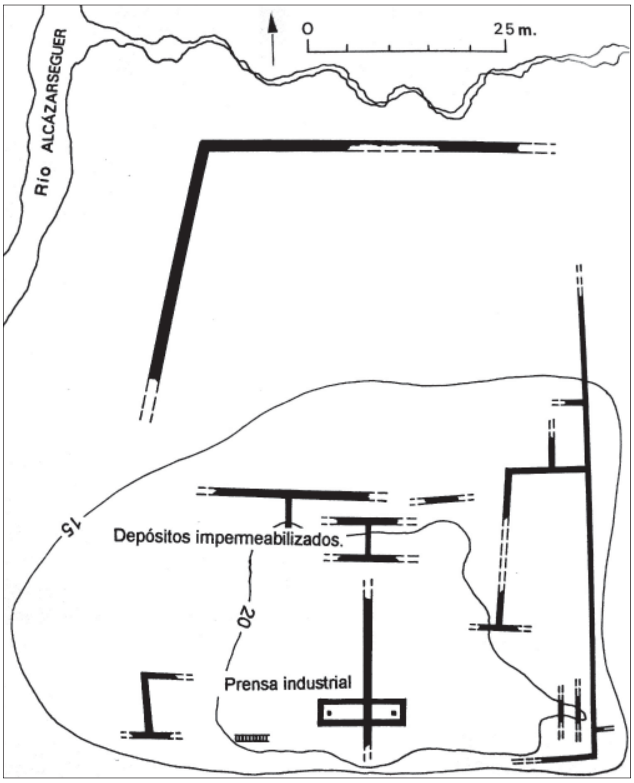
In spring 2007, the site was capped by cement and covered by a new toll road leading to the Tanger-Med port on the Straits coast, ca. 7 km to the east.

[22] Redman, *et al*. 1979
[23] The *cetariae* are hard to identify because only traces of their bases (fragments of *opus signinum*) remain, although at least two are suggested; A. El Khayari (INSAP), pers. com.

Total capacity: Unknown at present.

Resources: Tangier Bay might have been a source of salt (see App. 3.2: *Tangier Bay*). Site is on the banks of the Oued El Kazar which is fresh water at this point in the valley. Wells and a hammam are present in the medieval Islamic fort and later Portuguese fort next to the river, ca. 800 m away, indicating that fresh water was available from here or from groundwater sources.[24] There are five cisterns of "great capacity" at the site. Lime, brick and ceramics kilns have been tentatively identified at or near the site.
Date: Punico-Mauretanian, Roman (5th century BC-late 3rd century AD)

References: Quintero Atauri & Gimenez Bernal 1944: 25; Tarradell 1954b: 108-109; Tarradell 1955a: 85-86; Tarradell 1960: 124-125; Tarradell 1966: 432-435, figs 2-4; Bernal Casasola 2006b: 189; Akerraz & El Khayari 2005: 37-38; Cheddad 2006b: 202; Cheddad 2007: 192; Cheddad 2008: 395; Villaverde Vega 2001: 197-199; A. El Khayari & H. Limane (INSAP), pers. com.



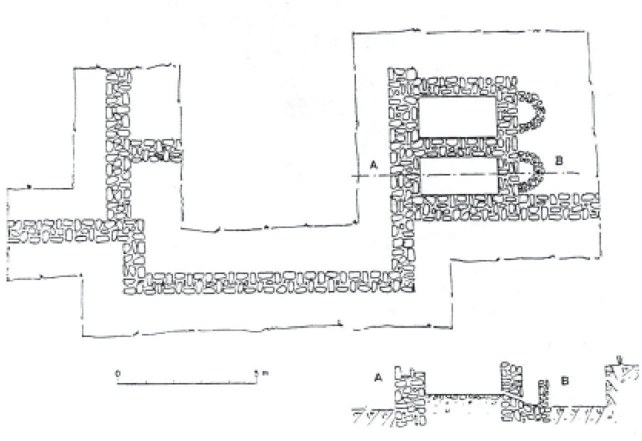
Plan of the site, after the earlier investigations by M. Tarradell in 1953 (after Villaverde Vega 2001: fig. 108).

Dchar 'Askfane during excavations in 2005. The arrow points to site, behind which can be seen the pilings for the toll road that now covers the site (March, 2005). Photo: L. Huff

[24] Redman, *et al*. 1979

Site 21. Zahara (Sahara)

The site is located ca. 3 km west of Punta del Alcazar, and consists of a ca. 5-m high bluff above the beach that was cut on its western edge by a stream. The site was excavated in the early 1950s and remained relatively intact until early 2008 (see below). During excavations, two small adjacent *cetariae* were identified, but the larger coherent structure (ca. 9 x 5 m) to which they were attached was not fully excavated. Marmites were also found at this site. The *cetariae* had semi-circular catch basins abutting their south wall; these were connected to the basins by a long drain (like *Cetariae* 2 at Ksar-es-Seghir without a lead tube). Their full height was not been preserved.



Site plan of Zahara (after Ponsich 1988: fig. 88).

Situation of Zahara's basins, looking to the east over a small stream (in foreground) (March, 2007). Photo: ALT

The site in recent years was overgrown by low vegetation. In 2002, it was observed that the stream channel to the west was eroding the hillock and walls could be seen falling out of the side of the hill. This erosion continued until the most recent observation, in the spring of 2007. The basins were not visible at any time in the past five years and appear to have been covered over. The site was destroyed in April 2008 when it was bulldozed during the construction of a new naval port facility.

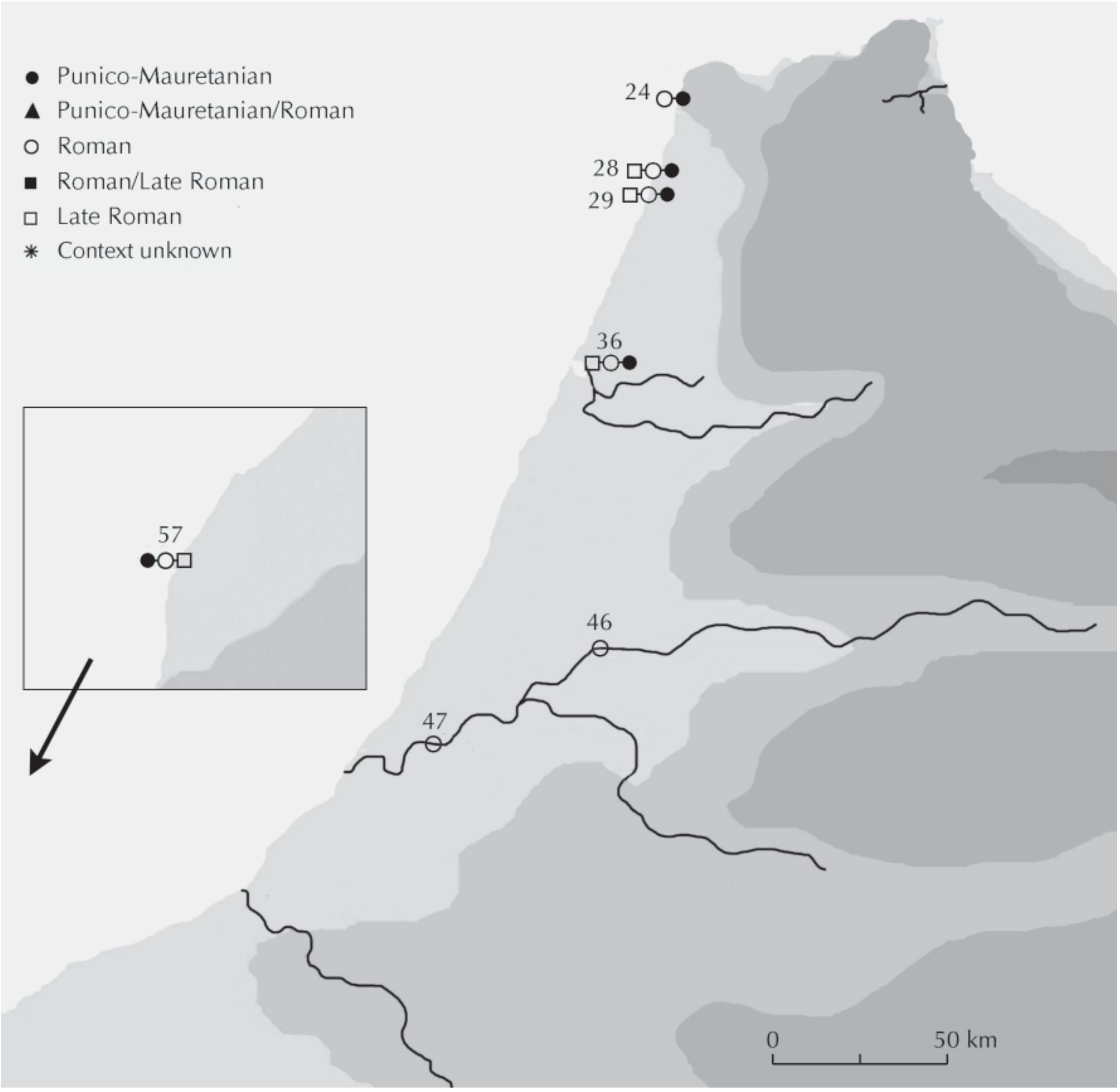
Total capacity:[25] ca. 10.26 m^3 (minimum)

Resources: Tangier Bay might have been a source of salt (see App. 3.2: *Tangier Bay*).
The site was adjacent to a small perennial stream that empties onto the beach. Other freshwater resources are located in the bay at Ksar-es-Seghir, 3 km to the east (see Sites 19-20 above).
Date: Roman (early 2nd-3rd centuries AD)

References: Ponsich & Tarradell 1965: 68-71; Tarradell 1966: 431; Ponsich 1988: 159-160; A. Elboujaday (Délégation de la Culture, Tangier), pers. com.

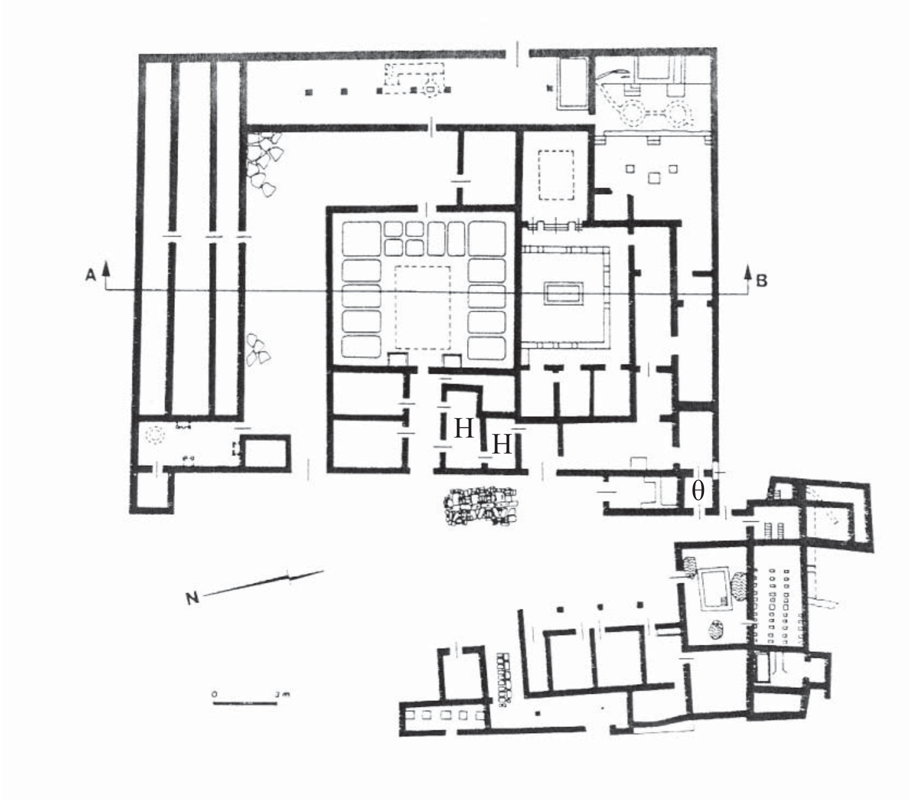
[25] Length/width measurements of the *cetariae* published; minimum depth established from scaled drawing.

Atlantic coast



Site 24. Cotta
A complete fish-salting complex sited above the beach, just south of the bluff of the Caves of Hercules/Ras Achakar on north Atlantic coast, 3 km south of Jebel Kebir headland. The Oued Khil flows between complex and bluff, north of site. This site was originally identified as Phoenician by C. Montalbán in the 1950s; the test pits made by M. Ponsich in 1959 and excavation in the early 1960s identified no Phoenician material. The complex consists of a central processing building 56 x 40 m.

Aerial view of the site during excavations (after Ponsich 1964b: Pl. IV).



Plan of Cotta during its second phase, 3rd century AD. 'H' marks hypocaust rooms; θ marks the proposed watch-tower (after Ponsich 1988: fig. 83).

A view of the cetariae *and central preparation floor, now fallen away and showing the domed roof of the cistern (July, 2002). Photo: ALT*

A small temple lies to the south and a necropolis beyond that, extending the site to cover ca. 2.5 ha. A nearby settlement, as yet unidentified, has been proposed. The extant site is now enclosed by walls of a royal villa.

The factory building's main entrance faces the ocean to the west. The central processing area, to which this entrance opens onto, is 25 x 19 m. A central workroom/preparation area overlies a cistern. Sixteen vats of different sizes and depths surround the preparation room on the north, east and south. These have small circular depressions in their bottoms, or cuvets, to ease cleaning. The four small basins (total 23 m^3 capacity) are thought to be specifically for the manufacture of *garum*. In front of this room, near the building's main entrance, is a heating facility with hypocaust system (possibly for artificially reducing the sauce mixtures as marmites also found here [discussed in *Geoponica* 20.46.1-6] or for evaporating salt). A covered drainage channel (*cloaca*) leads from the central preparation area through the main entrance and west, down towards the sea. Around this central processing area, to the east and south are storage magazines, another magazine or preparation area is to the north. Marmites and wide bowls were found around hypocaust area and in central processing area.

Situation of Cotta looking south-west from the Ras Ackahar bluff. The beach of Sidi Kacem extends to the south (April, 2007). Photo: ALT

During a second phase of the factory (ca. late 3rd centruy AD), a peristyle house was built in the southern magazine; to the east of this is an olive oil press. A bath complex was added off the south-west of the building with rooms built facing the front of the processing building.

It is thought that the complex had a θυννοσκοπεῖον (a tunny watch-tower described by Strabo, 5.2.6-8, 17.3.16) on its southwest corner. In publications, the depth of the tower foundation is not mentioned, although the foundations around the *cetariae* in the central part of the complex are ca. 2.10 m deep.[26] Subsequent scholars have often cited this number as a reason for the interpretation of a tower, although this appears to be the consistent foundation depth throughout the building. The high bluff of Ras Achakar, however, is right next to the site (ca. 22 m elevation), and juts out into the sea; as such it forms a much better look-out position that does not require construction, and perhaps this alone served to form a lookout or a platform on which to build a watch-tower.

Total capacity:[27] 258 m^3

Resources: Tangier Bay and Oued Tahadart might have been sources of salt (see App. 3.2: *Tangier Bay; Tahadart*). Lixiviation also proposed at this site, by the presence of the small furnace at the entrance to the complex.[28] Under the central processing floor of the complex is a cistern of 86 m^3 capacity that was fed by an *impluvium* in the centre of the processing floor (rain water source). A deep, lined pit is also present in the northern storage magazine, and this has been tentatively identified as a well. Basins are also generally described as being around the site, to collect water than came down a channel from Mediouna (a small hill north-east of Ras Achakar). Less than 100 m north of the site is the perennial Oued Khil where there is a modern water-treatment plant. A canal, likely pre-Roman, has also been located on the southern slopes of Jebel Kebir, directing water from springs southwards. A kiln supposedly lies on banks of Oued Khil.[29]
Date: Punico-Mauretanian, Roman (ca. AD 40-late 3rd century AD)[30]

References: Ponsich 1964b: 266-267; Ponsich & Tarradell 1965: 55-68; Ponsich 1970: 206-212, 276-290, 319-335; Ponsich 1988: 150-159; Trakadas 2005: 66-68; Hassini 2008

[26] Ponsich & Tarradell 1965: 55-68; Ponsich 1988: 150-159
[27] Given in Ponsich & Tarradell 1965: fig. 36
[28] Hesnard 1998
[29] Ponsich 1964b: 267; A. Elboujaday (Délégation de la Culture, Tangier), pers. com.
[30] Re-assessment of material by Hassini suggests no occupation of site in general earlier than the second half of the 1st century BC (Hassini 2008); contra Ponsich & Tarradell (1965: 55-68) and Ponsich (1970: 206-212, 276-290, 319-335), the date of the factory's construction has been re-assigned to the Claudian period, see Étienne & Mayet 2002: 75; Gozalbes Cravioto 2008: 248.

Site 28. Tahadart

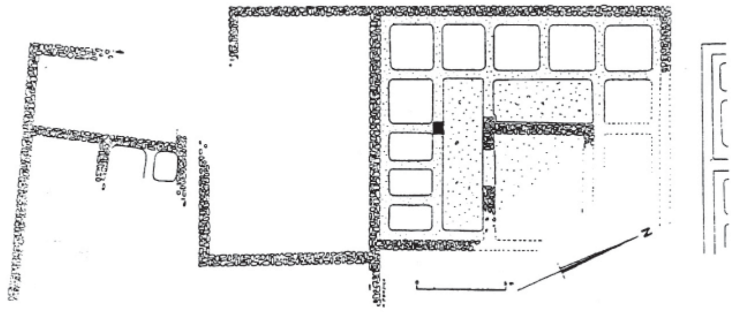
Six separate complexes located slightly inland, on a low sandy spit on the southern bank of a tidal lagoon formed by the Oueds Tahadart and Hachef, 18 km south of Cotta. The separate buildings extend for ca. 250 m along an elevated edge of the tidal flat. There are some burials at the site, and fish hooks are mentioned as being found in these.

Situation of the six Tahadart complexes on the eastern edge of the estuary. North is at top of photo (after Ponsich 1964b: Pl. V).

These complexes were surveyed and cleaned but not fully excavated by M. Ponsich in the early 1960s. Pottery has been re-examined recently by students at INSAP, confirming Punico-Mauretanian to late Roman occupation of the general area. In 1990, a Neolithic site was discovered in the sandy spit area. In a square structure ca. 325 m to the north of the six buildings (in the middle of the spit), numerous Islamic and "ancient" ceramics found. Inside the structure, A. Siraj notes that there was ancient material and proposes that another factorywas once here and has since been rebuilt as a house. Examination in the spring of 2007 did not locate and remains of *cetariae*, but some of the lower walls have different construction techniques than those built above.

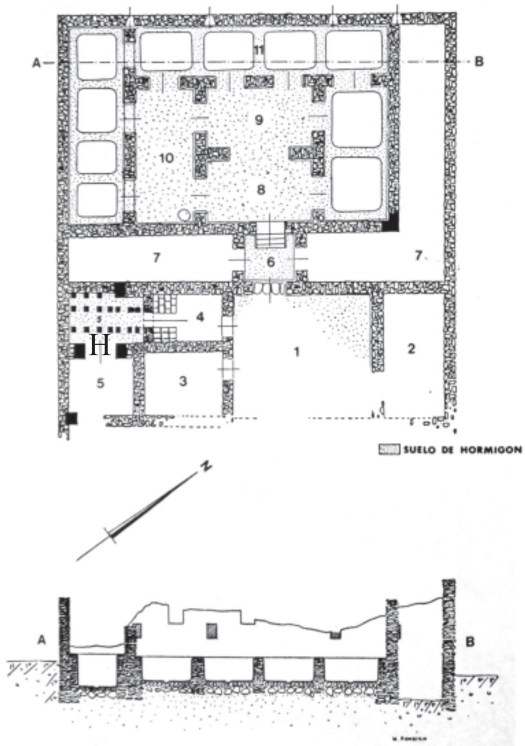
During reconnaissance in the spring of 2007, it was noted that a dirt road now goes through the southwest edge of Complex 1, the northern-most building. Complexes 4 and 5 are being used as trash dumps, and the integrity of the sites is being affected by the extension of salt pans on the western bank of the estuary.

View across Complex 1 to the salinas on the Oued Hachef (March, 2007). Photo: ALT



Complex 3 at Tahadart (after Ponsich 1988: fig. 79).

The complexes are relatively uniform in their construction, with a central cleaning and preparation area and *cetariae* of various capacities lining the walls. These each have a small heating facility with hypocaust systems (likely for artificially reducing the sauce mixtures, discussed in *Geoponica* [20.46.1-6], or for evaporating salt). Small rooms, likely storage areas, are also present in the complexes.



Complex 1 with hypocaust marked by an 'H' (after Ponsich 1988: fig. 76).

Complex 1: Northern-most complex, ca. 17.5 x 18.5 m. Ten basins are present around a central floor. Heating facilities. Marmites and glass bases excavated.[31] Functioned 1st century BC-6th century AD.[32]
Complex 2: Located ca. 40 m south of Complex 1, with similar layout, ca. 23 x 20 m. Functioned 1st century BC-late 3rd century AD.
Complex 3: Located 33 m south of Complex 2, ca. 19 x 10.7 m. Nine extant basins exposed but excavations were not finished here. Marmites and glass excavated.[33] Functioned 1st century BC-early 4th century AD.[34]
Complex 4: The largest of the complexes, measuring 24 x 23 m. Located ca. 2 m south of Complex 3. In publication, 18 basins are stated, but plan only delineates 14. The largest basins are noted to have a capacity of 8 m^3; in between these are three smaller basins, noted to be for *garum* production. Marmites excavated here.[35] Functioned 1st-late 2nd/early 3rd centuries AD.[36]
Complex 5: Located south of Complex 4. This site was not thoroughly excavated and no plan was made.
Complex 6: Located south of Complexes 4 & 5. This was not possible to excavate. A "necropolis" of four burials was excavated here (assumed to be buried after factory went out of use – "period of abandonment"). Functioned 1st century BC-3rd century AD.

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31 Ponsich & Tarradell 1965: 48, Pl. XII, XIII

32 Ponsich & Tarradell (1965: 43-48) give the date of abandonment as early 4th century; Ponsich (1988: 145) gives 6th century date, based on new dates of ARSW D.

33 Ponsich & Tarradell 1965: 51; Ponsich 1988: 148

34 Ponsich & Tarradell (1965: 51-53) give the date of abandonment as late 3rd century; Ponsich (1988: 148) gives early 4th century date.

35 Ponsich & Tarradell 1965: 53

36 Ponsich & Tarradell (1965: 53) note the presence of a coin of Constantine and lamps of types Ponsich IIIA, B and perhaps C (late 2nd-early 3rd for A-B; throughout the 3rd for C: see Ponsich 1961: fig. 2), but Ponsich (1988: 148) cites only a coin of Geta (AD 209-212) as the latest monetary evidence.

Capacities:
Complex 1:[37] (32.615 m^3)
Complex 2:[38] (61.6 m^3) minimum
Complex 3:[39] (60.775 m^3)
Complex 4:[40] (88.25 m^3)
Complex 5: no dimensions
Complex 6: no dimensions
Total combined capacity: 243.24 m^3 (of 42 extant *cetariae*), ca. 400 m^3 given for all complexes.[41]

Resources: Salinas are now present in the estuary (see App. 3.2: *Tahadart*), and it might be that the same activity occurred here in the past, as the flat river banks and high tidal range of the estuary are ideal for evaporative salt-pan production. Lixiviation also proposed at these complexes, by the presence of the small furnaces at the entrances to the buildings.[42] No wells are known in the area.

Complex 2: one of the exposed cetaria *with damaged floor (March, 2007). Photo: ALT*

Complex 4: filled-in cetariae *along the south wall of the complex (March, 2007). Photo: ALT*

Date: Punico-Mauretanian, Roman, Late Roman (1st century BC-4th/5th/6th centuries AD – different complexes ceased production at different times)

References: Ponsich 1964b: 268; Ponsich & Tarradell 1965: 40-45; Ponsich 1982: 434; Ponsich 1988: 139-50; Siraj 1995: 346; Arharbi 2002a; Arharbi 2002b

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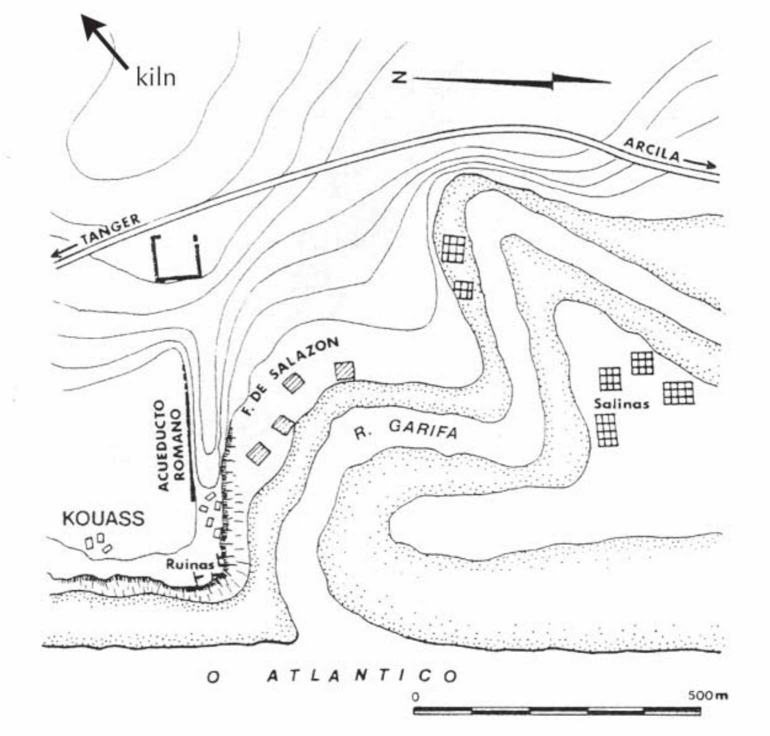
[37] Plan of this complex lacks scale, but walls in plans are assumed to be ca. 0.50 m thick, as they are in other plans and these are used for scale
[38] Total capacity of the nine extant *cetariae,* assuming 1 m depth: 36.6 m^3; plus five more *cetariae* (not excavated) at ave. 5 m^3 = additional 25 m^3.
[39] Total capacity of the nine extant *cetariae,* assuming 1 m depth: 44.775 m^3; plus four more *cetariae* (not excavated) at ave. 4 m^3 = additional 16 m^3.
[40] Minimum capacity (measurements taken from the 14 extant *cetariae* in plan, assuming 1 m depth and incorporating 8 m^3 capacity for larger *cetariae*).
[41] Ponsich 1988: 139
[42] Hesnard 1998

Site 29. Kouass*

This site is located in the river plain of the Oued Garifa, 4.5 km south of the mouth of the Oued Tahadart and 7 km north of Asilah. M. Ponsich examined this site in 1960s, and identified fish-salting vats in the northern tidal flats of the river, right below a high bluff where an aqueduct was identified. Four separate installations are mapped by Ponsich and described as similar in layout as those at Tahadart.[43] Ponsich states that there are only vestiges of these basins remaining, along with remains of amphorae and worked blocks.[44] Marmites also found in area as well as coarseware. A 200 m^2 enclosure is situated to the north-east of the aquaduct, on the bluff to the north of the river valley; it is identified as a "camp" or "refuge". Behind this feature to the east is a large kiln that operated during the Punico-Mauretanian and early Islamic periods.



Plan of the cetariae, *modern salinas and aqueduct at Kouass (after Ponsich 1988: fig. 70).*

The present author has conducted repeated reconnaissance at this site since 2002, and it has not been possible to locate any structures in this river plain. A. Cheddad proposes that the *cetariae* have not been found possibly because houses have been built over them.[45]

View looking north-west over the Oued Garifa to the Atlantic. The black arrow indicates the catch basin at the end of the aqueduct that runs down the hill from the east. The white arrow indicates the general area of proposed cetariae *(April, 2007). Photo: ALT*

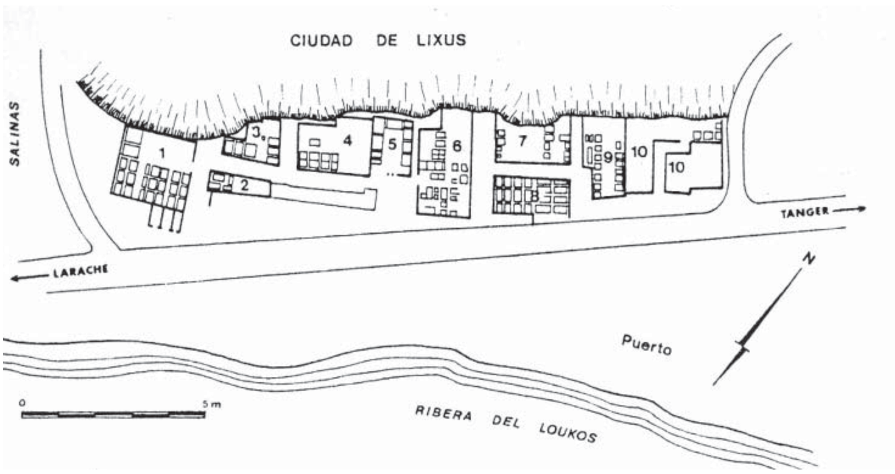
[43] Only three complexes mentioned in Akerraz, *et al.* 1981-82: 214; Ponsich 1964b: 270.
[44] Ponsich 1988: 136-139
[45] Cheddad 2007: 193

Resources: Modern *salinas* are present in the floodplain of the Oued Garifa; it is unknown if this area was a source of salt in antiquity (see App. 3.2: *Kouass*). The remains of an aqueduct, identified as "Roman", are traceable for over 300 m along the northern bluff overlooking the Oued Garifa (an incorporated into the wall of some houses here). A square collection basin, ca. 2 x 2 m, is at its western terminus, at the west edge of the bluff. The kiln located several hundred metres inland from the "camp" is a major source for salazón amphorae (especially Mañá-Pascual A4 types) in the Punico-Mauretanian period (kiln ceases operation in 1st century BC and is used again in the early Islamic period).[46]
Date: Punico-Mauretanian, Roman (1st century BC-ca. 3rd century AD)[47]

References: Ponsich 1964b: 270; Ponsich & Tarradell 1965: 38-40; Ponsich 1967a; Ponsich 1968; Ponsich 1988: 136-139; López Pardo 1990b; Kbiri Alaoui 2004; Akerraz, *et al.* 1981-82: 214; Cheddad 2007: 193; Kbiri Alaoui 2007: 43-45

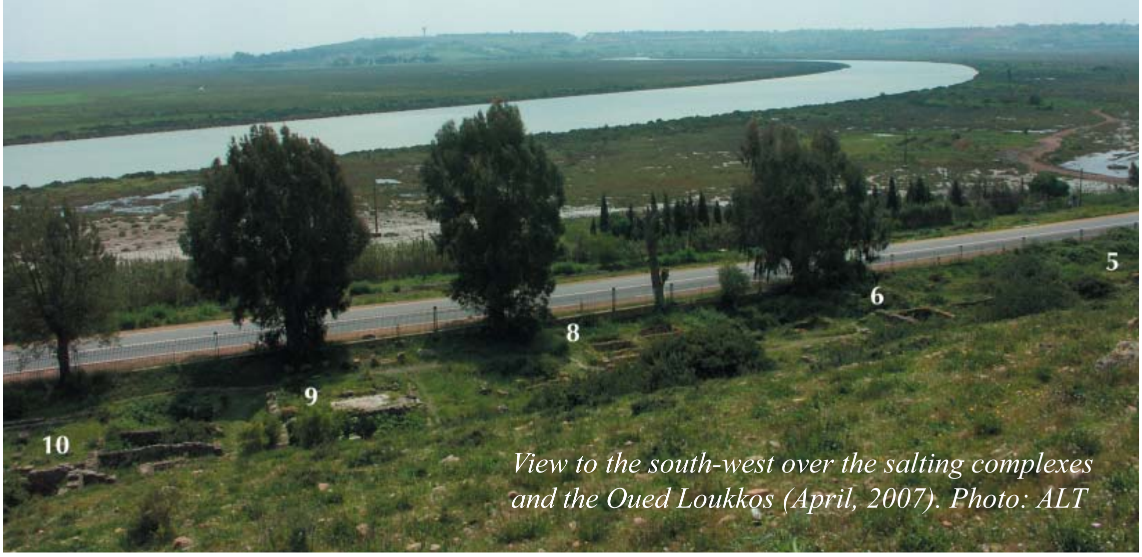
Site 36. *Lixus*
The site presently lies ca. 4 km inland on a plateau on the northern bank of the Oued Loukkos. Geological studies indicate that the area between the plateau and ocean was a large lagoon in antiquity. The Phoenician, Punico-Mauretanian and Roman settlements are located on top of the plateau, with fish-salting facilities situated at its southern base, adjacent to the present course of the Oued Loukkos, now ca. 100 m south of the complexes. There are ten extant complexes comprised of at least 142 *cetariae*, but there are certainly more that lie under the Larache-Tangier road that now runs between the site and the river. The fish-salting area extends for ca. 180 m east/west and ca. 30 m north/south (cut off by the road).[48]

Excavations at *Lixus* were undertaken by H. de La Martinière (1889), C. Montalbán (1923-36), M. Tarradell (1948-64), and, beginning in the late 1950s, M. Ponsich. Both Tarradell's and Montalbán's trenches on the acropolis were re-opened by INSAP/Univ. of Valencia team in the late 1990s and continuing today. Excavations of the fish-salting Complexes 8 and 10 were conducted by Montalbán, but none of this material has been published. The remaining



Plan of the ten complexes at Lixus *(after Ponsich 1988: fig. 44).*

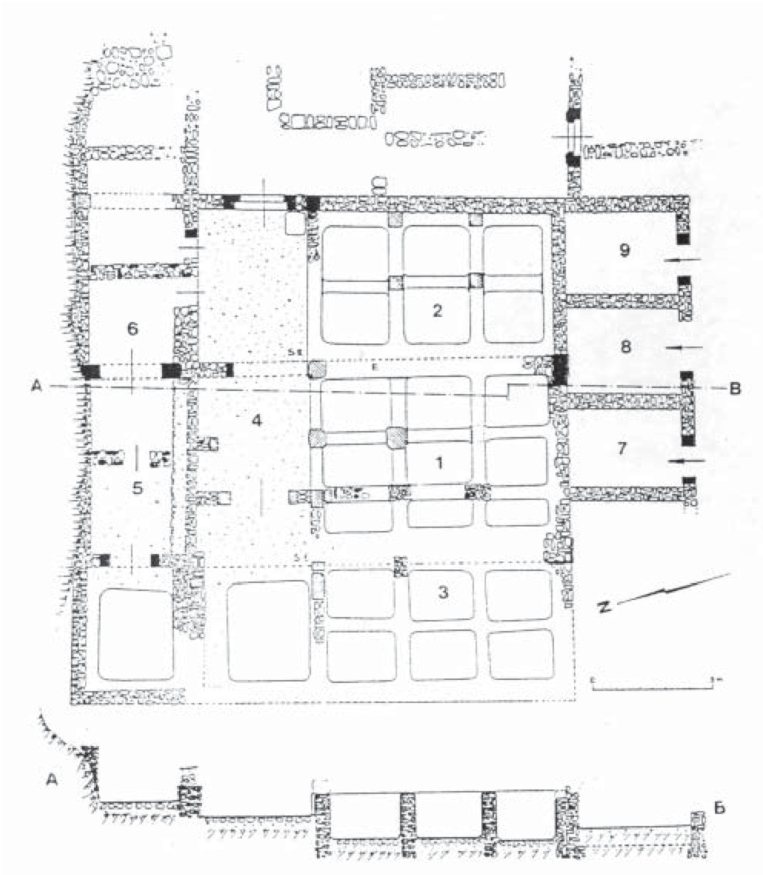
[46] Mlilou 1991: 18-71; Kbiri Alaoui 2007
[47] Ponsich (1967a: 375) gives dates of operation until the 3rd century AD; Villaverde Vega (2001: 108, n. 287) notes presence of ARSW D, extending date or occupation into 5th century (these types also mentioned in Ponisch 1988: 136-138; Ponsich & Tarradell 1965: 39, although with incorrect chronologies). Arharbi (2003: 73-74) dates fish-salting activity only to 1st-2nd centuries AD. Kbiri Alaoui (2007: 44) dates initial activity to the 1st century BC, based on *terra sigillata*, with it continuing into the "High Empire". Kbiri Alaoui's dates are followed here.
[48] Aranegui (Aranegui, *et al.* 2007: 205) note that there are 12 complexes, but show Ponsich's plan of ten complexes; also state that Ponsich and Tarradell (1965: 9-37) date pottery to 130-80 BC. However, Habibi's re-examination of material (Habibi 2007) does not note anything this early at this part of the site.



View to the south-west over the salting complexes and the Oued Loukkos (April, 2007). Photo: ALT

complexes were excavated beginning in 1958 by Tarradell and Ponsich. The ceramic material from Ponsich & Tarradell's excavations has been recently re-examined by M. Habibi, and his reassessment changes the original proposed chronology.[49]

Each of the complexes seems to follow a general layout of a central work area, some with small depressions in the floor in a corner for collection liquid refuse. The *cetariae* are oriented around this central area. None of these complexes have hypocaust systems or furnaces. Cisterns and wells are present in some of the complexes (see below).



Complex 1 at Lixus *(after Ponsich 1988: fig. 45).*

Complex 1: Cetariae were subdivided at various stages; in the latest phase there are 23 extant vats and central area for preparation/cleaning. Fragments of marmites and glass jar found during excavations. Three rooms (Nos. 7-9) identified as *tabernae* by M. Ponsich, line the back side of this building. Functioned AD 40/60-early 6th century AD.[50]

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[49] The affected chronology has to do with the extension of ARSW D into the 6th century, and the find material in general indicates more ceramic material dating to the late 5th century and first decades of the 6th century (Hayes 1980: lii; Habibi 2007).

[50] Ponsich &Tarradell (1965: 11-15) and Ponsich (1988: 103-105) give date of construction as late 1st century BC; Habibi (2007: 184) gives construction date in 1st century AD.

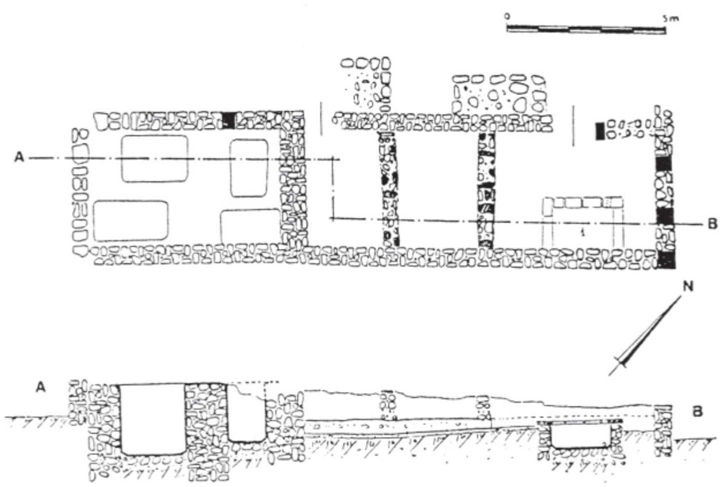
Complex 2: Five *cetariae* are extant in this building, originally divided between two rooms. In a later remodelling stage, one of the rooms was divided into three parts. Functioned late 1^{st}/early 2^{nd} - 4^{th}/5^{th} centuries AD; mid-to late 2^{nd} century for remodelling.[51]

Complex 3: Seven *cetariae*, some of irregular shape, and a preparation area and three adjoining rooms, carved into side of plateau. Functioned 1^{st}-mid-6^{th} centuries AD; remodelling in 4^{th} century.[52]

Complex 4: Twelve *cetariae* were originally established in this complex, which is situated against the base of the plateau. One of the *cetaria* is unusually circular. One room houses eight *cetariae*, and has column bases and a separate entrance, one preparation room has three *cetariae* and a shallow pan in the paved floor that opens out to the main corridor of the complex area, and another room an individual *cetaria* until it was remodelled. At the latest stage, with modifications, there were seven rooms of various sizes for storage and preparation. Functioned 1^{st}-4^{th} century AD.[53]

Complex 1, looking to the north-east across Area 1 noted in site plan (April, 2007). Photo: ALT

Complex 2 at Lixus *(after Ponsich 1988: fig. 48).*



Complex 5: Initially this complex had ten *cetariae*, oriented in a 'U' shape around a central preparation area. When the complex began to be used again after a hiatus in the late 3^{rd} century, six of the *cetariae* were filled in, a wall built through the main room, separating the four remaining *cetariae* that continued to be used. Functioned 1^{st}-4^{th} centuries AD; hiatus and reduction in the late 3^{rd} century.[54]

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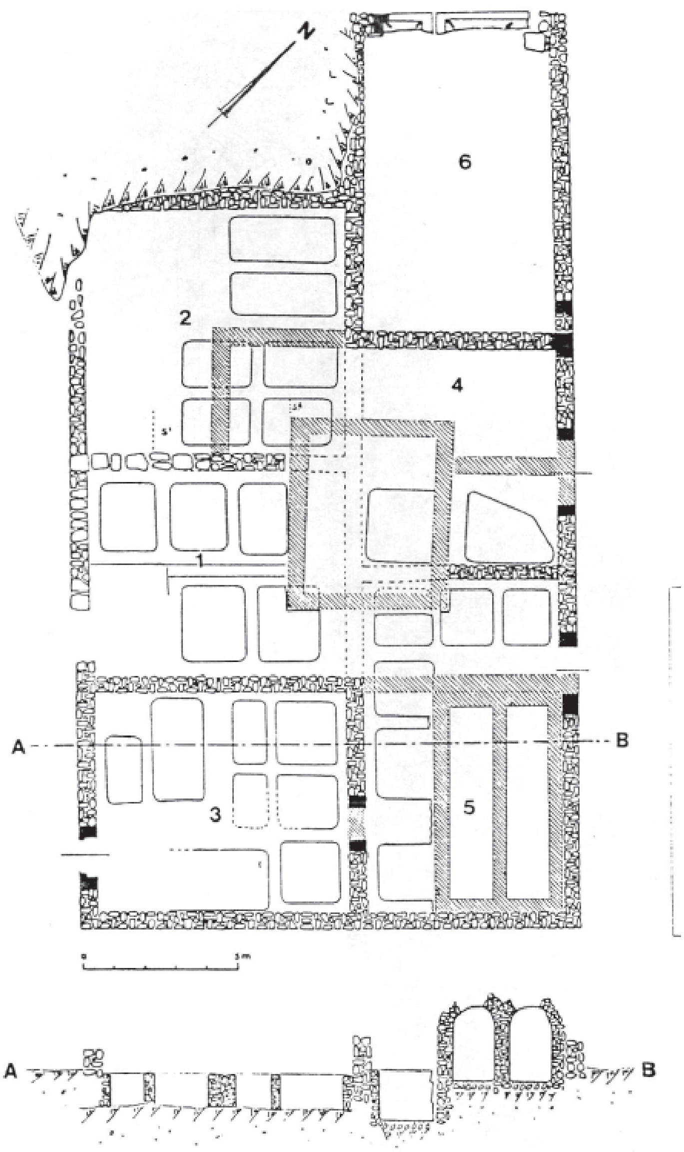
[51] Ponsich &Tarradell 1965: 15: Ponsich 1988: 105-107; Trajanic coin under floor (Habibi 2007: 184).
[52] Ponsich & Tarradell 1965: 17-18; Ponsich 1988: 107-108; Ponsich & Tarradell cite 5^{th}-6^{th} centuries for period of re-occupation; Habibi (2007: 184-185) states 4^{th} century for this event, citing re-analysis of material and also Ponsich & Tarradell's own statement (1965: 18).
[53] Initial dates given in Ponsich & Tarradell (1965: 18-22) are 1^{st} century BC-6^{th} century AD; in Ponsich (1988: 108-110), dates given as 1^{st}-6^{th}/7^{th} centuries AD. 1^{st} century AD date also given by Habibi (2007: 185), who also states that most recent material dates to the 4^{th} century AD.
[54] Ponsich & Tarradell 1965: 22-24; Ponsich (1988: 110-112) gives dates from 1^{st} century BC until the 6^{th} century AD; Habibi (2007: 186) notes material as being very homogenous and dates up to the 4^{th} century.

Complex 6: This complex is actually two separate buildings, with access on the east and west sides. There were initially 27 *cetariae*, separated into four groups. In some of the rooms, *cetariae* were paved over during the late 3rd/early 4th centuries AD or walls built over them; two large cisterns were built in the east end of this complex after the 3rd century. Bases of glass containers found in this complex. Functioned late 1st-late 6th/early 7th centuries AD; reduction of *cetariae* and additions of cisterns in late 3rd/early 4th centuries.[55]

Complex 7: There are 12 *cetariae* in this complex, divided into five groups. The northern side of this complex is covered by 4 m of sediment as it abuts the plateau behind, and was not completely excavated. Functioned 1st-late 4th centuries AD; remodelling and reduction in the early 4th century.[56]

Complex 8: Most of this complex lies underneath a road. Twenty *cetariae* are extant. This was excavated in 1930 by Montalbán, and the find material is unknown. Three of the *cetariae* are connected by small arched passages in their shared walls. Chronology of complex is though to be similar to others, functioning 1st-6th centuries AD.[57]

Complex 9: Twenty-two *cetariae* are divided into three groups with a long central preparation area. Five *cetariae* in one of the rooms were reduced in depth by 30 cm at some point, and then later covered over. In the other rooms, some of the *cetariae* were reduced when walls were built during later modifications. A small well is in one of the exterior rooms here. Functioned AD 60-7th century AD; several phases of remodelling and reduction beginning in first half of the 5th century.[58]



Complex 6 at Lixus*, showing initial construction and remodelling phases (after Ponsich 1988: fig. 56).*

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[55] Ponsich & Tarradell 1965: 24-27; Ponsich (1988: 112-12)1: dates abandonment to 5th/ early 6th centuries; Habibi (2007: 186) extends occupation until late 6th/early 7th centuries.

[56] Ponsich (1988: 121) gives dates of 1st-5th/6th centuries AD; Habibi (2007: 186) believes complex was abandoned in the late 4th century (so do Ponsich & Tarradell 1965: 28-30), on account of chronology of ARSW D.

[57] Ponsich & Tarradell 1965: 31-32; Ponsich 1988: 121-129; Habibi 2007: 186

[58] Ponsich & Tarradell (1965: 33-35) give dates of operation as 1st-6th centuries AD; Ponsich (1988: 129) gives dates of 1st century BC-7th century AD, with modifications in the late 2nd/early 3rd centuries AD. Habibi (2007: 188-189) gives construction date of ca. AD 60, with modifications in first half of the 5th century.

Complex 10: This complex was partially excavated by Montalbán, and nothing is known of this material. After initial construction, remodelling has reduced the size and interior walls re-arranged the original layout of the rooms. Four *cetariae* are extant, all in one room in the back of the complex. This complex has two cistern chambers. After remodelling, six rooms were created but only one of these has *cetariae*. Functioned second half of 1st-6th centuries AD; hiatus and re-use in the 5th century.[59]

Capacities:
Complex 1: 175 m³ (at latest stage)
Complex 2: 21 m³
Complex 3: 60 m³
Complex 4: 67 m³ (during initial phase)
Complex 5: (75 m³) (during initial phase)
Complex 6: (176 m³) (during initial phase)
Complex 7: (61 m³)
Complex 8: (199 m³)
Complex 9: (152 m³)
Complex 10: 27 m³
Total combined capacity: 1,013 m³ (min.) of 142 extant *cetariae*

Looking west across Complex 10; the cisterns are the arched structures in the upper centre of the photo (April, 2007). Photo: ALT

Resources: Salinas presently exist in the flood plain of the Oued Loukkos west of the site (see App. 3.2: *Larache*); however, in antiquity the area is thought to have been a large lagoon. It might be possible that *salinas* existed further upriver at the time the *cetariae* at *Lixus* functioned. Oued Loukkos is saline near the site of *Lixus*. Freshwater resources are demonstrated by four cisterns amongst the complexes (one in Complex 6 [39 m³ capacity], on in Complex 8 [22 m³ capacity] and two in Complex 10 [49 m³ and 62 m³ capacity] fed by an *impluvium*). A well with canals is also present between Complexes 8 and 9.[60]

Date: Punico-Mauretanian, Roman, Late Roman (1st-7th century AD, for entire industrial quarter)
References: Tarradell 1958: 376-378; Ponsich & Tarradell 1965: 9-37; Ponsich 1966a: 394; Ponsich 1988: 103-136; Belén, *et al.* 1996; *Lixus-1*; *Lixus-2*; El Khatib-Boujibar 1992; Habibi 2007; Aranegui, *et al.* 1992; Bernal Casasola 2008: 42

[59] Ponsich & Tarradell (1965: 35-37) give date of re-use/remodelling in the 3rd century. Ponsich (1988: 129-133) compares this complex to chronology of Complex 6. Habibi (2007: 189) gives date of re-use of basins in the 5th century.
[60] Re-studied by El Khatib-Boujibar 1992.

Site 46. *Banasa*

The settlement and colony of *Banasa* is located on the southern bank of the Oued Sebou in the middle of the Rharb plain, ca. 26 km directly east of the Atlantic coast. Fish-salting production is not mentioned in early publications of the site, although Punico-Mauretanian salazón amphorae were made here (see App. 3.3.1); a magazine of Mañá C2b amphorae was also identified at the site.[61] L. Cerri, in a new study, proposes that fish-salting occurred here during the Roman period. There are basins present throughout the city that are lined with *opus signinum* and are not associated with bath complexes. It is very possible that these functioned as salting *cetariae*. These are distributed in four groups of six *cetariae* in buildings inside the city walls, generally lining the *cardo*.

(Above) Banasa*, with the groups of proposed* cetariae*, following Cerri's numbering (after Cerri 2007a: fig. 2)*

(Below) 'Group 1' double cetariae *at* Banasa *(April, 2009). Photo: ALT*

Cerri proposes six groups of *cetariae* with single and double basins.[62] Reconnaissance of the site in April 2009 by the present author identified different groupings and uses for some basins: *Cerri # 6* is likely an olive oil press due to channels and drains in the basins; *Cerri # 3* is difficult to identify and appears to be small octagonal basin of unknown depth. *Cerri # 5* is listed as a single *cetaria*, when in fact there are two basins.

Capacities:
(Following Cerri 2007a numbering with new measurements):
Group 1: 3.5 m^3 (double *cetariae*)
Group 2: 2.3 m^3 (single *cetaria*)
Group 4: ca. 1 m^3 (single *cetaria*)
Group 5: ca. 1.3 m^3 (double *cetariae*)
Total combined capacity: ca. 8.1 m^3

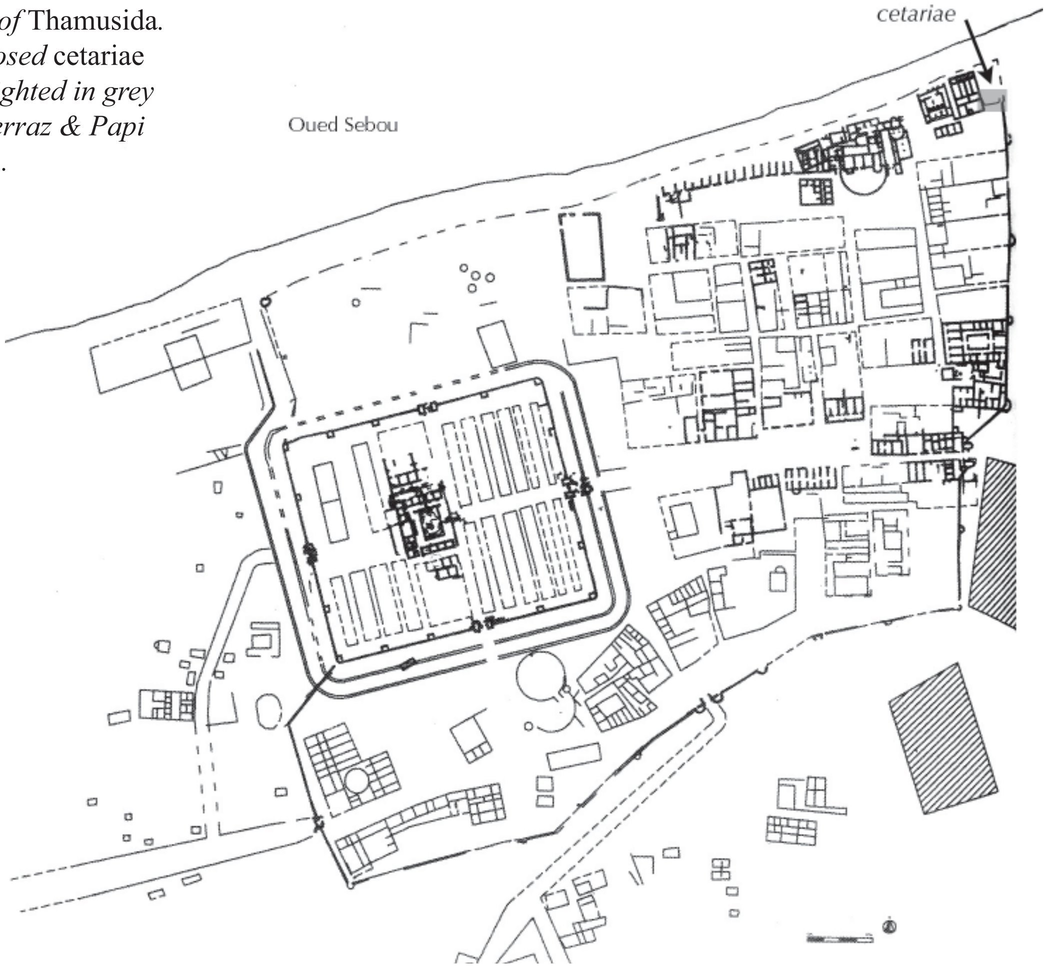
[61] Thouvenot 1954: fig. 4; Aranegui Gascó, *et al*. 2004 : 364, fig. 365
[62] Cerri 2007a: 196, fig. 2

Resources: A modern salt source is identified at Souk-el-Arba, a few kilometres from *Banasa* (see App. 3.2: *Souk-el-Arba du Rharb*).[63] The Oued Sebou is near the site, although here it is still tidal and slightly saline. Wells and cisterns are present throughout the walled site, and five large bath complexes functioned during the Roman period, drawing upon these supplies. Kilns present in pre-Roman layers (for Mañá-Pascual A4 and Mañá C2b/Dressel 18 types). No Roman-period kilns identified although some have been identified at Oued Mdâ and closer downriver at *Thamusida* (see App. 3.3.1).[64]
Date: Roman (1st-3rd centuries AD?)

References: Cerri 2007a; Cerri 2007b; Wilson 2006: 529; Wilson 2007: 178-180

Site 47. *Thamusida**
The settlement sits on a small, 3-m high hillock adjacent to the Oued Sebou, ca. 20 km upriver from the Atlantic. This area of the Rharb plain was frequented since prehistoric times. A military garrison was established here probably during the late Punico-Mauretanian period and functioned as a Praetorian camp since the Flavian period. Inscriptions from AD 79 note that veterans also resettled here, and it appears a Romanised Berber town developed around the camp, which was enclosed by circuit walls ca. AD 170. The camp was re-designed in the third quarter of the 3rd century, although it appears to have been abandoned by the military shortly thereafter, around AD 280.[65] Univ. of Sienna/INSAP team has been excavating at site for past seven years after large-scale French excavations in the late 1960s-70s.

Site plan of Thamusida. *The proposed* cetariae *are highlighted in grey (after Akerraz & Papi 2003: 16).*



[63] Cerri 2007b: 35, n. 13
[64] Arharbi & Lenoir 2006
[65] Euzennat 1989a: 70-79

Area of the cetariae *at* Thamusida*, looking north over the Oued Sebou. The bains have been covered over (March, 2007). Photo: ALT*

A "salting factory" of two or three *cetariae* was located inside the walls of the city, at the north-east corner, adjacent to the river's bank.[66] This area is associated with the "*Temple à trois cellae*", adjacent to the "*Insula aux deux Amphores*". In this latter area, directly behind the temple, but possibly separated by an alley, is a building of four conjoined rooms. These were first identified as *tabernae*, but recently it has been proposed that in this building marine products were first cleaned and storage containers housed, waiting for transshipment.[67] The *cetariae* were apparently re-buried after excavation, and it is not possible to identify these basins as being used for salting production. R. Rebuffat does not describe the *cetariae* in any detail and they are generally referenced on the site plan.[68]

It has also been proposed that salting took place in *dolia* at *Thamusida*: in the "*Insula aux dolia*" (north-east of the camp), two *dolia defossa* were identified with traces of *opus signinum*. These are undergoing testing to identify traces of food remains.[69]

North of the city walls, an area with kilns has been identified, associated with numerous fragments of *Muricidae* shellfish. These kilns produced salazón amphorae and it is also proposed that purple dye was manufactured here.[70]

Resources: The closest source of salt is perhaps the Atlantic Ocean, although a salt mine is historically known on the Oued Beth and a modern salt source exists at Souk-el-Arba (see App. 3.2: *Souk-el-Arba du Rharb; Oued Beth*). The Oued Sebou is adjacent to the area of the *cetariae*, and is still tidal here and slightly saline. Wells are present throughout the walled site, and water movement must have been planned, as there are large baths. In the "kiln quarter" north-west of the site, five kilns have been identified, of which three have been excavated. These operated from the end of the 1st century BC to the first half of the 1st century AD and produced salazón amphorae: Dressel 7-11 and Beltrán IIB types.
Date: Roman (late 1st-3rd centuries AD, for use of *cetariae*)

No plan of basins published.
References: Callu, *et al.* 1965: 5; Rebuffat 1968-72: 52-53; Rebuffat 1977: 284-285; Cerri 2007b; Bernal Casasola 2006a: 1359; Rebuffat, *et al.* 1970: 249; Euzennat 1989a: 89; Papi, *et al.* 2000; Wilson 2002b: 251-253; Wilson 2007: 178-180; Akkeraz & Papi 2003

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[66] Rebuffat (1977: 284-285) identifies two basins; Wilson (2007: 178) three basins.
[67] Rebuffat, *et al.* 1970: 239-245
[68] Rebuffat 1977: 284-285
[69] Area: Rebuffat 1977: 294-295; salting: Cerri 2007b: 35, 37.
[70] Cerri 2007b: 35, 37; Papi, *et al.* 2000; Wilson 2002b: 251-253

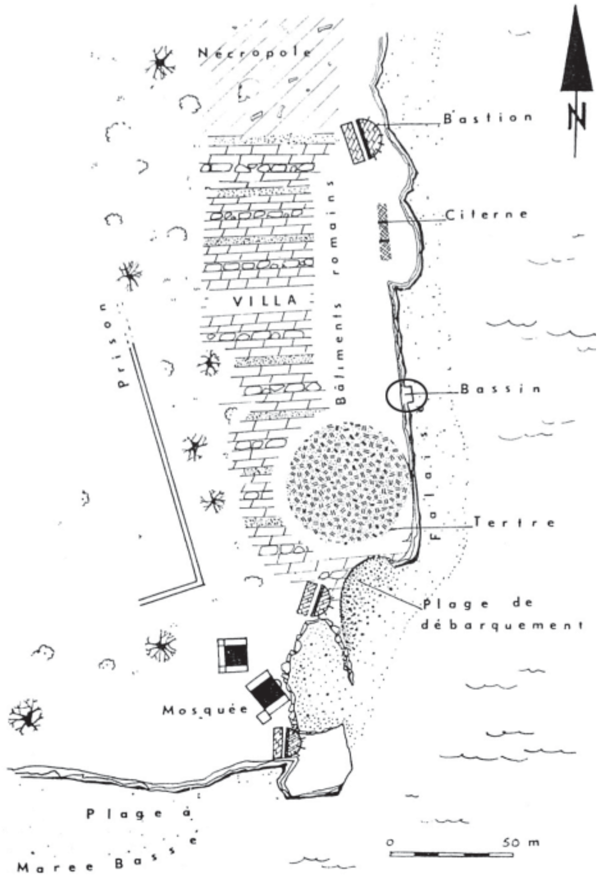
Site 57. Essaouira (Îles Purpuraires)

This site consists of two plateau-like islands on the south Atlantic coast, ca. 430 km south of the provincial boundaries of *Mauretania Tingitana*. The islands are situated in the southern lee of mainland promontory where the city of Essaouira presently lies. The islands are in the centre of a small bay in to which the Oued Ksob flows, directly east of the islands. The island has served as a quarantine station, military outpost and prison during the last few centuries, and some of the buildings from these activities are still standing.

The southwestern section of the southern island was excavated in 1960s by A. Jodin. Excavations revealed Attic and Ionian pottery as well as Cypriot and Syrian flasks from late 7th-6th centuries BC, but there appears to have been a lacuna in occupation during the Punico-Mauretanian period. Finds of Mañá-Pascual A4 types, however, indicate that the place was perhaps occasionally frequented since the 5th century BC.[71] In 1st century BC, the island was occupied before being abandoned in the 1st century AD. In the early 3rd century (from the Severan period), the island was resettled. A building with mosaic floor, identified as a *villa,* was built on the eastern side of the main island at this time and the area was inhabited until the early 5th century. A nearby necropolis dates from this latter period.

A Hispano-Moroccan team conducted small-scale excavations on the island in 2000; a DAI/INSAP team began excavations at the southeastern part of the island in 2006 that will continue for five years. Already these excavations have revealed pre-historic occupation on the islands and in the area and Phoenician material has been found on the northern island.[72]

The first period of salting activity and purple dye production on the island has



Plan of the excavations on the eastern face of the island. The cetariae *are circled (after Jodin 1967: fig. 7).*

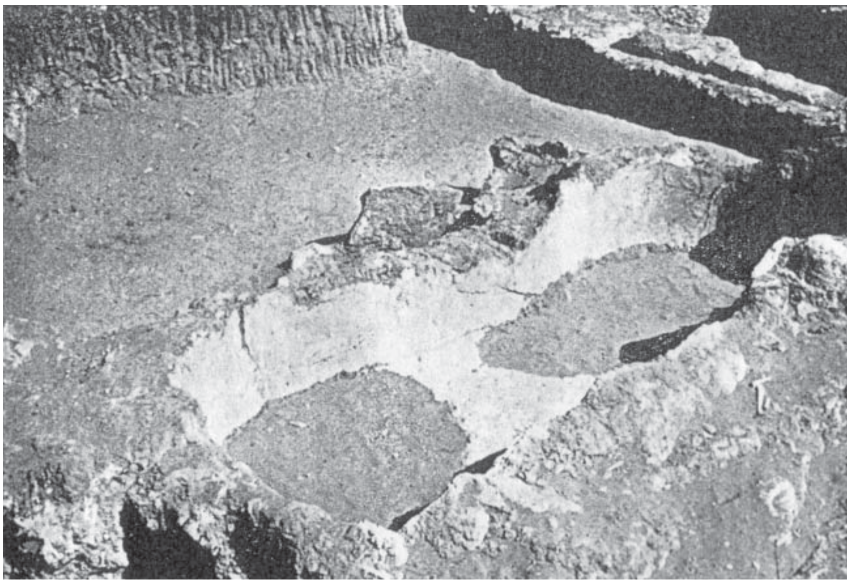
Photograph taken of the basins before erosion in 1955 (after Jodin 1967: Pl. XXVII).

[71] Jodin 1957: 16, 36, figs. 13a; López Pardo 1992a: 289
[72] D. Marzoli & J. Eiwanger (DAI), pers. com; A. El Khayari (INSAP), pers. com.

View of the remains of the cetariae *and beach zone at low tide, looking north to the modern city of Essaouira across the bay (March, 2004). Photo: ALT*

The remains of the rock-cut basins with the eroded pieces lying in front (October, 2007). Photo: ALT

been dated to the short period of occupation between the 1st centuries BC/AD and the islands have been connected with the *Insulae Purpurariae* of Juba II. Fish hooks have been recovered from excavations, and many *Muricidae* shells have been found on the island. Two *cetariae* are present on the eastern cliff face of island, cut into the limestone of the plateau and faced with *opus signinum* and stonework around the upper edges. (These were still intact at the beginning of the 20th century, but had eroded and broken apart by the time of Jodin's excavations in the early 1960s. Jodin states that the *cetariae* were connected to each other by "small openings" at the bottom and top. During recording of the basins by present author in March 2004, it was clear that one of the holes [in eroded piece now lying on beach] is the result of natural erosion.) It is not easy to establish the chronology of these *cetariae*, but perhaps they were used both during the Punico-Mauretanian and Roman periods.



The basin in Ch. XVIII south of the villa; a water channel can be seen in the background (after Jodin 1967: Pl. XXIV).

Within the buildings south of the *villa*, there are remains of ash and burnt bone, suggesting a kiln or oven/thermal area. In addition, water channels are present near the large room in this building (Ch. XVIII) in which there is a plaster-lined basin that has two deeper indentations. Lead sheeting has also been identified in the *villa*.[73] These finds have been suggested as evidence of purple dye manufacturing, with the facilities to heat the dye in lead containers. It is not clear if these basins are connected to the water channels, and may in fact be basins for fulling wool, which would also be indicative of dyeing production.

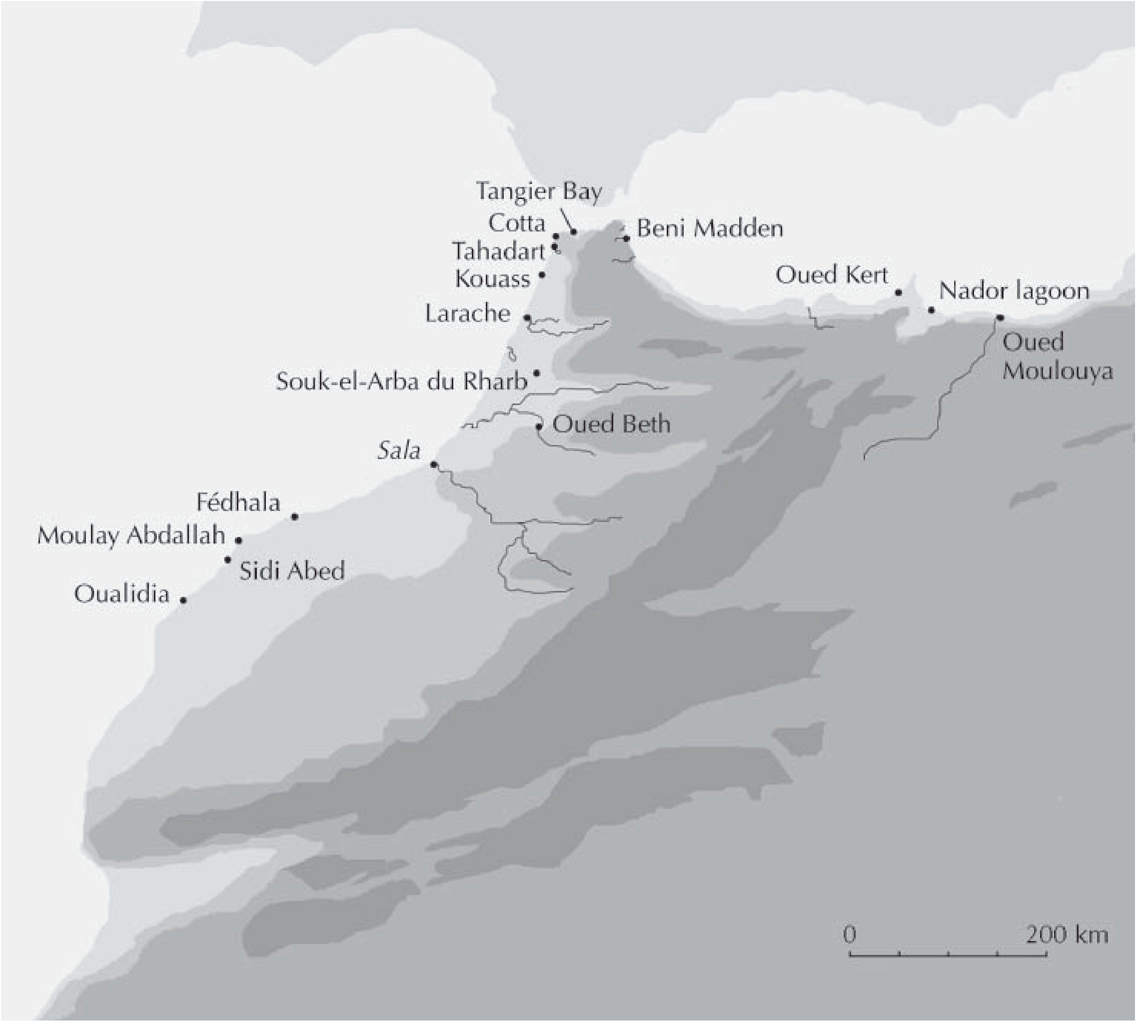
Total capacity: 13.61 m^3

Resources: The closest identified source of salt is the modern *salinas* at the lagoon at Oualidia, ca. 185 km north of the islands (see App. 3.2: *Oualidia*). A triple-chambered cistern of 139.2 m^3 capacity is located along the eastern cliff face of the island, ca. 50 m north of the *cetariae*. This is dated early 2nd-mid 3rd century AD. P. Cintas mentions finding "Punic" wells on the island, although their location is not known.
Date: Punico-Mauretanian, Roman, Late Roman (1st centuries BC/AD; 3rd-5th centuries AD)

No plan of basins published.
References: Cintas 1954: 57; Jodin 1957; Jodin 1966c; Jodin 1967; López Pardo 1992a; López Pardo 1996b; El Khayari, *et al*. 2001a; El Khayari, *et al*. 2001b; Villaverde Vega 2001: 49, n. 101; D. Marzoli & J. Eiwanger (DAI), pers. com; A. El Khayari (INSAP), pers. com.

[73] Jodin 1967: 61-66, 64, Pl. XXIV; Fernández Uriel 1995: 325; Curtis 1991: 67

Appendix 3.2.
Salt sources

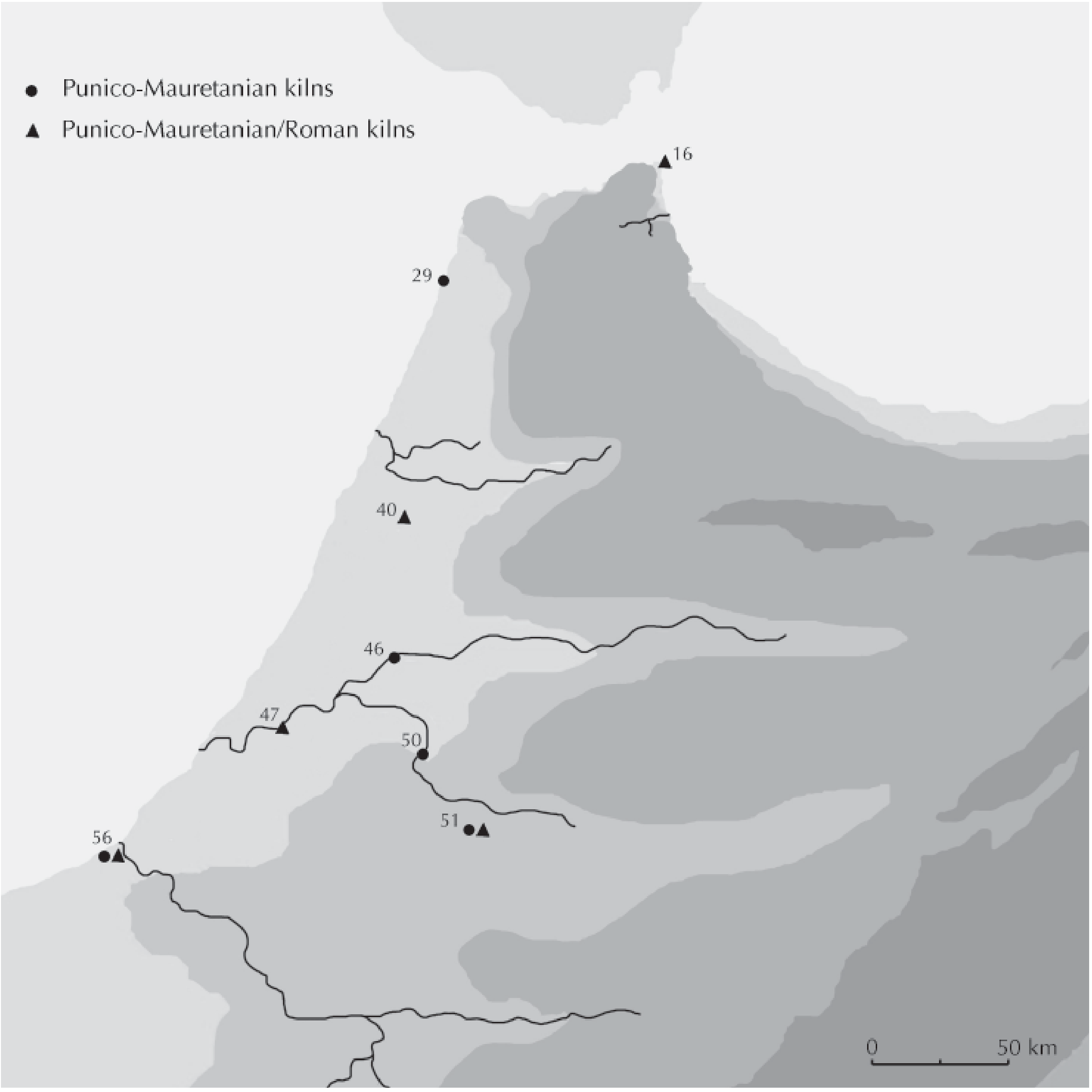


LOCATION	TYPE OF SOURCE	PERIOD	REFERENCE	COMMENTS
Oued Moulouya	unknown	unknown	Besnier 1906: 282	‘Mulucha’ or ‘Molochath’ is from the semitic *melach* or *malach*, "salt".
Nador lagoon	unknown	unknown	Fernandez de Castro y Pedrera 1945: 62-63; Gozalbes Cravioto 1991: 170	Nador lagoon is a source of salt in antiquity due to the periodic closing of the lagoon and periods fo dryness, lots of salt here.
Nador lagoor	*salinas*	modern	observation, April 2007	Salt pans in southern edge of Nador lagoo
Nador lagoor	*salinas*	ca. 1635	App. 7: Map 3	“Saline chafafa” noted south of Melilla
Nador lagoor	*salinas*	1764	App. 7: Map 12	“Salines” at position of Nado
Nador lagoor	*salinas*	1655	App. 7: Map 4	“Saline”marked at Nado
Nador lagoor	*salinas*	1728	App. 7: Map 8	“Salina” noted next to pans at Nador
Nador lagoon	*salinas* (?)	1209-1218	Gervase of Tilbury, *Otia imperialia* (*Decisiones* I), Ch. XXIII: 905	“*Lacum salinarum* between Russiada, the mountains of Azan, which are the origins of the Malvis….”
Oued Kert	unknown	1854	French consul Jagerschmidt, August 10, 1854 (quoted in Pennell 1991: 72)	“The village of Azanen [at the mouth of the Oued Kert]….is extremely poor. The main resource of the inhabitants is fishing; they are a miserable people, generally lazy and only cultivate the land to the extent that they need to; some undertake a bit of commerce in wood or salt, which abounds in the country”
Beni Madden	*salinas*	1925	Villaverde Vega 2001: 239, fig. 153	Salt piles shown in 1925 aerial photo (Servicio Geográfico y Cartográfico del Ejército del Aire, 1.a AC 3052: 13/10/1925)
Beni Madden	*salinas*	1957-1966	Tarradell 1966, Pl. II; Tarradell 1957: 257	*Salinas* are present next to Sidi Abdeselam de Behar – "using the indigenous technique".
Tangier Bay	unknown	unknown	Ponsich 1970: 284	"Oued el Melaleh in Tangier Bay is a place where they got salt, *mellah* being salt in Arabic."
Tangier Bay	*salinas*	1905	Le Clerc 1905: 276-277	Eastern part of Tangier Bay, around mouth of Oued el-A’lek. There is a superficial lagoon that is ca. 2 ha here. Lagoon is connected to river during high tide. Saliniers called *ma’allem el-melah*.
Tangier Bay	*salinas*	1941	NID I: 1941: 61	Salt pans present near *Tanja el-Balia* (the old Tangier hill near the Portuguese fort on the SE side of the bay)
Tangier Bay	*salinas*	17th c.	Cheddad 2008: 391	*Tanja el-Balia* - mouth of Oued el-Mlalah - for salting
Tangier Bay	unknown	1st-3rd c. AD	*CIL* VIII, no. 10986 (*ILM*, no. 7); Ponsich 1970: 284	M. SALINATOR QUADRATVS funerary inscription found in modern Tangier - possible salt merchant?

LOCATION	TYPE OF SOURCE	PERIOD	REFERENCE	COMMENTS
Cotta	lixiviation	1st-3rd c. AD	Hesnard 1998: 170-171	Hesnard proposes that salt was artifically evaportated from seawater based on presence of thermal facilities in fish-salting complex.
Tahadart	*salinas*	11th c.	al-Bakrî: 221-222	"At Tahadart, there is a large village, and also a *salina*."
Tahadart	*salinas*	1st-3rd c. AD	Hesnard 1998: 170-171	Hesnard proposes that salt was artifically evaportated from seawater based on presence of thermal facilities in the fish-salting complexes.
Tahadart	*salinas*	modern	observations, 1999-2009; Amharrak 2006: 22; see App. 3.1: Site 28 this study	Tahadart *salinas* operatie between April until September. There are two groups on the Oued Hachef and two groups on Oued Tahadart
Kouass	*salinas*	modern	observations, 1999-2009	Modern salt pans along Oued Garifa
Kouass	*salinas*	1965	Ponsich & Tarradell 1965: 101	Modern salt pans noted along banks of Oued Garifa
Larache	*salinas*	modern	observations, 1999-2009; see Fig. 7.51 this study	Fishermen of port here say that pans begin operating in late April.
Larache	*salinas*	1965	Ponsich & Tarradell 1965: 101	Modern salt pans noted along the banks of the Oued Loukkos.
Souk-el-Arba du Rharb	unknown	modern	Cerri 2007b: 35, n. 13	"Modern source of salt here, a few kilometres from *Banasa*"
Oued Beth	salt mine	1937	Ruhlmann 1937: 7	Modern salt mine exploited here
Oued Beth	salt mine	1961	Nenquin 1961: 113	Modern salt mine exploited here
Sala	*salinas*	1956	Choubert & Roche 1956: fig. 1, Pl. 1	*Salinas* documented in Oued Bouregreg banks north-east of *Sala*.
Sala	*salinas*	1923	Gruvel 1923: 208-210	River flood plain called "merdja", and this is where the *salinas* are established in Rabat and Salé. These are rectangular pans, about 1 to 1.5 m depth
Fédhala	*salinas*	1923	Gruvel 1923: 208, 210-211	"Artificial *salinas*" established in the flood zone of Oued Mellah. 25 ha of *salinas* producing ca. 3,000-3,500 tons of salt per year.
Moulay Abdallah	salt "pits"	modern	observations, April & October 1007; see Fig. 3.20 this study	Ca. 10 rectangular pits cut in the rock along the beach (ca. 1.5 m x 0.5 m) south of El Jadida;local fishermen say they were used to evaporate salt although no one could say when they had been cut. Pictured in Luquet 1973-75: 273-75, PL. VII.
Sidi Abed	*salinas*	modern	observation October, 2007; see Fig. 3.20 this study	One large operation in coastal lagoon.
Oualidia	*salinas*	modern	observation October, 2007; see Fig. 5.32 this study	At least four groups of *salinas* line the lagoon of Oualidia.

Appendix 3.3.
Salazón amphorae

3.3.1 Kilns



FIND-SITES:

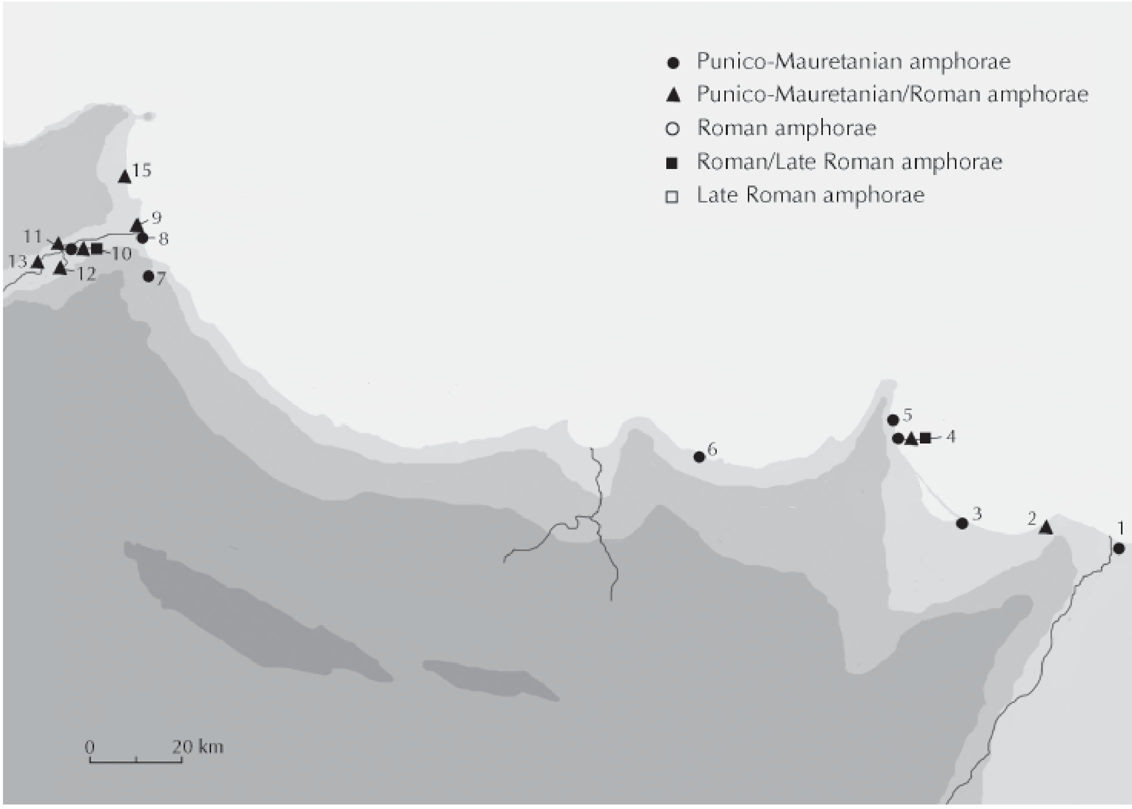
16. *Septem Fratres*/Ceuta
29. Kouass
40. Oued Mdâ
46. *Banasa*
47. *Thamusida*
50. Rirha
51. *Volubilis*
56. *Sala*

	PROVENANCE	LOCATION	AMPHORA TYPE	PERIOD	REFERENCE	COMMENTS
1	Banasa	S sector, kilns 1-2	Mañá-Pascual A4	Punico-Mauretanian	Girard 1984a: 92; Aranegui Gascó, et al. 2004: 363-366; Kbiri Alaoui & Mlilou 2007: 71-76; Villaverde Vega 2000: 901-902	Three kilns identified in this part of the site. For this type, started operating in the 6th c.-3rd c.BC and 3rd c.-2nd c. BC.
2	Banasa	S sector, kiln 1	Dressel 18	Punico-Mauretanian	Arharbi & Lenoir 1998: 8; Kbiri Alaoui & Mlilou 2007: 65	Three kilns identified in this part of the site.
3	Kouass	kilns 2, 3, 5	Dressel 18	Punico-Mauretanian	Kbiri Alaoui & Mlilou 2007:65; Mlilou 1991: 67-68	Mis-fire in kiln 3 identifies production here
4	Kouass	kilns 1,2, 4	Mañá-Pascual A4	Punico-Mauretanian	López Pardo 1990a: 22; Kbiri Alaoui 2007: 217	First variation made in the 4th and 3rd c. BC, possibly made until 1st c. BC, but definitely in 2nd c. BC
5	Oued Mdâ	on the Oued Mdâ (Rharb)	Dressel 7-11	Punico-Mauretanian/ Roman	Limane & Rebuffat 2004; Hassini 2001: 45-47	Site AR 40. Also Haltern 70 made here. Operated from late 1st c. BC – to mid-1st c. AD.
6	Oued Mdâ	on the Oued Mdâ (Rharb)	Belltran IIB	Punico-Mauretanian/ Roman	Limane & Rebuffat 2004; Hassini 2001: 45-47	Site AR 40. Also Haltern 70 made here. Operated from late 1st c. BC – to mid-1st c. AD.
7	Rirha	unknown	Mañá-Pascual A4	Punico-Mauretanian	Euzennat 1957b: 206-207; Girard 1985: 87-107	Occupation of site in 3rd c. BC; kilns into second half of 2nd c. BC.
8	Sala	unknown	Dressel 18	Punico-Mauretanian	Boube 1987-88: 183, n. 1	Kilns have not been located; identified by mis-fires of these types.
9	Sala	unknown	Dressel 7-11	Punico-Mauretanian/ Roman	Boube 1987-88: 183, n. 1; Boube 1973-75: 227	Kilns have not been located; identified by mis-fires of these types. These date to second half of 1st c. BC.
10	Septem/Ceuta	La Muralla site	Dressel 7-11	Punico-Mauretanian/ Roman	unpublished (F. Villada Paredes [Instituto de Estudios Ceutíes, Ceuta], pers. com.)	Mis-fires and small kiln in this area has led to tentative identification.

	PROVENANCE	LOCATION	AMPHORA TYPE	PERIOD	REFERENCE	COMMENTS
11	Thamusida	northwest of site	Dressel 7-11	Punico-Mauretanian/ Roman	Cerri 2007b: 40-41, fig. 7	Functioned from the end of the 1st c. BC to first half 1st c. AD.
12	Thamusida	northwest of site	Belltran IIB	Punico-Mauretanian/ Roman	Cerri 2007b: 40-41, fig. 7	Functioned from the end of the 1st c. BC to first half 1st c. AD.
13	Volubilis	"quartier est"	Dressel 7-11	Punico-Mauretanian/ Roman	Behel 1998: 344-347; Domergue 1960: 491, 499; Khatib-Bougibar 1966: 544	Also Dressel 20 thought to be made here, but unclear. Kiln was used ca. 50 BC – late 1st c. AD
14	Volubilis	"quartier est"	Dressel 18	Punico-Mauretanian	Behel 1998: 344-347; Domergue 1960: 491, 499; Khatib-Bougibar 1966: 544	Also Dressel 20 thought to be made here, but unclear. Kiln was used ca. 50 BC – late 1st c. AD
15	Volubilis	"southern sector", near Oued Khroumane	Dressel 18	Punico-Mauretanian	Behel 1998: 344-347; Domergue 1960: 491, 499; Khatib-Bougibar 1966: 544; Aranegui Gascó, et al. 2004: 367-368	Kiln possibly also produced Lamboglia 2c. No exact dates given for this kiln.

3.3.2 Amphorae

3.3.2.1 Mediterranean



FIND-SITES:

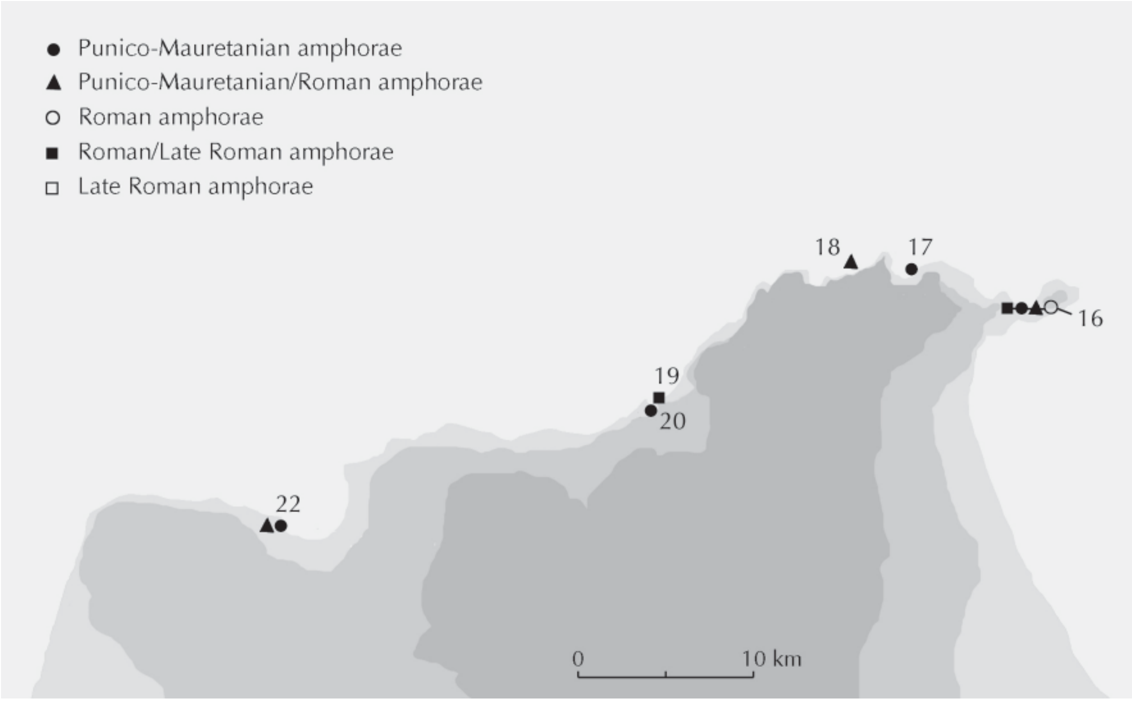
1. Bouhout (Berkane)
2. Ed Dahar Taifant (Berkane)
3. El Aabid (Berkane)
4. *Rusaddir* (Melilla)
5. Sidi Moulay Baghdad
6. Sidi Driss
7. Emsa
8. Sidi Abdeselam del Behar
9. Metrouna
10. *Tamuda*
11. Zbar d'Akwizan
12. Loma Amarilla
13. Krira d-Jouimec I
15. Sania e Torres

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
1	Bouhout	1			Mañá-Pascual A4	Punico-Mauretanian	*		Kbiri Alaoui, *et al.* 2004: 582; 600	site on east bank of Oued Moulouya; "Phoenician period" occupation suggested
2	Ed Dahar Taifant	2			Dressel 7-11	Punico-Mauretanian/ Roman	*		Kbiri Alaoui, *et al.* 2004: 583	site just west of Ras el Ma, on coast
3	El Aabid	3			Dressel 18	Punico-Mauretanian	*		Kbiri Alaoui, *et al.* 2004: 583	site east of Nador lagoon, on coast
4	*Rusaddir* /Melilla	4			Mañá-Pascual A4	Punico-Mauretanian	*		Villaverde Vega 2000: 906	
5	*Rusaddir* /Melilla	4	on tell "Cerro de San Lorenzo"		Dressel 18	Punico-Mauretanian	20 (?)	amphorae	Tarradell 1960: 67-69; Fernandez de Castro y Pedrera 1945: 223-230, illus. between pages 224-225, 226-227, 228-229, 230-231, 236-237; Tarradell 1954a: 261, pls. II, IX	Numbers identified from photos; no exact amount given in publication. 3 are shown with stamps in another photo; not sure if these are different from the ones in other photos. Tarradell 1954a: some types are older than others: one piece in the museum at Melilla has the mark "BA", while another has "Punic letters" (older example), also thinks this can be seen by fabric, make.
6	*Rusaddir* /Melilla	4			Dressel 9, 10	Punico-Mauretanian/ Roman	*		Villaverde Vega 2000: 903	
7	*Rusaddir* /Melilla	4			Almagro 51a	Roman/Late Roman	*	frags.	Villaverde Vega 2001: 256, fig. 174	
8	*Rusaddir* /Melilla	4			Almagro 51b	Roman/Late Roman	*	frags.	Villaverde Vega 2001: 256, fig. 174	
9	Sidi Moulay Baghdad	5			Dressel 18	Punico-Mauretanian	*		Kbiri Alaoui, *et al.* 2004: 583	site just north of Melilla
10	Sidi Driss	6			Mañá-Pascual A4	Punico-Mauretanian	*		Aranegui Gascó, *et al.* 2004: 369; Kbiri Alaoui, *et al.* 2004: 588-597	
11	Emsa	7	amongst habitations		Mañá-Pascual A4c	Punico-Mauretanian	*	amphorae	López Pardo 1990a: 39-41; Tarradell 1966: fig. 1, fig. 7, 440, 443; Tarradell 1960: 79-85, fig. 11; López Pardo 1996a: 269	"Great quantity" or "hundreds of fragments" found at site, no numbers given. Type manufactured in kiln 3 at Kouass, but López Pardo (1996a: 269) says that maybe this site could be associated with the manufacture of these, and also that site dates to 3rd - 2nd c. BC(?)

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
12	Sidi Abdeselam del Behar	8	amongst habitations on loma	layer II (here)	Dressel 18	Punico-Mauretanian	3(?)	amphorae frags. (body + 2 rim/necks)	Tarradell 1960: 94, fig. 17-18; Tarradell 1966: 437, pl. II; Bernal, et al. 2008b: 319	no number of amphorae are given, so amount taken from illustrations. Calls them Cintas 312, 313
13	Sidi Abdeselam del Behar	8	near wall below loma next to ancient river bed	layer II (here)	Mañá-Pascual A4 (?)	Punico-Mauretanian	*	amphorae	Tarradell 1960: 92-93; López Pardo 1996a: 267; Tarradell 1966: 437, pl. II; Tarradell 1954b: 121-122; Bernal, et al. 2008b: 319	Tarradell does not give a type, but notes that these are different than those found at Emsa, and that neither types are described by Cintas, although the type is found in the earlier layers of *Lixus* --and compares that the earliest occupation here was exaclty like that at *Lixus* . López Pardo (1990a): they are like Mañá-Pascual A4, although notes that this type is not present here, unlike at Emsa.
14	Metrouna	9			Dressel 7-11	Punico-Mauretanian/ Roman	*		Bernal, et al. 2008b: 332	Some fragments of amphorae found at site.
15	*Tamuda*	10	"on tell"		Mañá C2b/Dressel 18	Punico-Mauretanian	*	frags.	Morán & Giménez Bernal 1948: 41, fig. 7; Tarradell 1954b: 122; Tarradell 1960: 113, fig. 29; Tarradell 1966: 440	No indication of numbers, only that a "great quantity" were found at the site.
16	*Tamuda*	10	"Mauretanian settlement"	rubbish heap	Mañá-Pascual A4	Punico-Mauretanian	1	nearly whole?	Kbiri Alaoui 2007: 217; Kbiri Alaoui 2004: 207; El Khayari & Kbiri Alaoui 1998: 10-11	In reference to the Carmona type found in same layer.
17	*Tamuda*	10	western gate		Mañá C2b/Dressel 18	Punico-Mauretanian	*	frags.	Bernal, et al. 2008a: 556-557	From new excavations.
18	*Tamuda*	10	western gate		Dressel 7-11	Punico-Mauretanian/ Roman	*	frags.	Bernal, et al. 2008a: 556-557	From new excavations.
19	*Tamuda*	10	SW sector, east part		Dressel 7-11	Punico-Mauretanian/ Roman	*	frags.	Morán & Giménez Bernal 1948: 41, fig. 8; Tarradell 1956: Pl. II.1	
20	*Tamuda*	10	SW sector, east part		Almagro 51c	Roman/Late Roman	*	frags.	Morán & Giménez Bernal 1948: 41, fig. 6; Villaverde Vega 2001: 237	
21	Loma Amarilla	11			Dressel 7-11	Punico-Mauretanian/ Roman	*		Bernal, et al. 2008b: 330	This is site near the river - probably agricultural site. See also Tarradell 1966: 437, no. 15.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
22	Zbar d'Akwizan	12			Dressel 7-11	Punico-Mauretanian/ Roman	1	toe frag.	Bernal, et al. 2008b: 330	This site is on the Chefchauen-Tetouan road near *Tamuda*.
23	Krira d-Jouimec I	13			Dressel 7-11	Punico-Mauretanian/ Roman	*		Bernal, et al. 2008b: 331-332	Large agricultural site at confluence of the Kh'mis and Chekkour rivers on the Tangier-Tetouan road in the Martil valley. Site date late 1st c. BC-mid-2nd c. AD.
24	Sania e Torres	15	site		Dressel 7-11	Punico-Mauretanian/ Roman	*		Ponsich 1988: 166-168	No mention of how many found.

3.3.2.2 Straits of Gibraltar



FIND-SITES:

16. *Septem* (Ceuta)
17. Bay of Benzú
18. Île Perekhil
19. Ksar-es-Seghir
20. Dchar ‘Askfane
22. *Tingi* (Tangier)

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
1	*Septem* /Ceuta	16	no provenience noted		Dressel 7	Punico-Mauretanian	1	nearly complete amphora	Martínez Maganto & García Giménez 1997: 14, fig. 4	Inv. 508. Missing part of toe and some body.
2	*Septem* /Ceuta	16			Mañá C2b/Dressel 18	Punico-Mauretanian	6	amphorae	Villaverde Vega & López Pardo 1995: 462; Bravo & Munoz 1965: 37. fig. 31	Found under water, but not on land around Ceuta peninsula.
3	*Septem* /Ceuta	16			Mañá-Pascual A4	Punico-Mauretanian	*		Bernal 2000: 1139-1140; Blázquez 2001: 400	
4	*Septem* /Ceuta	16	Conjunto 1		Beltran II	Punico-Mauretanian/ Roman	1	nearly complete amphora	Hita Ruiz & Villada Paredes 1994: 60; Bravo Perez 1968: 40; Fernández Garcia 1983: 96	Possible local production, but there is not really much evidence to go on (Bravo Perez 1968: 40; Fernández Garcia 1983).
5	*Septem* /Ceuta	16			Dressel 7-11/Beltran I	Punico-Mauretanian/ Roman	29	amphorae	Bravo & Munoz 1965: figs. 29-30; Fernández García 1983: figs. 11-15, p. 53-73.	Beltran I is a very difficult example because it is found underwater all around Ceuta, but not on land. Bravo & Munoz call it Dr. 24. Hassini sees it as Dr. 7-11.
6	*Septem* /Ceuta	16	parcel 20/21	Sector I, Period IV, phase 3	Dressel 7-11/Beltran I	Punico-Mauretanian/ Roman	*		Hita Ruiz & Villada Paredes 1994: 25-30, 45	No description of numbers. Site interpreted as a "packaging area" for shipments.
7	*Septem* /Ceuta	16	no provenience noted		Dressel 7-11/Beltran I	Punico-Mauretanian/ Roman	10	9 rim/neck frags; 1 toes frag.	Martínez Maganto & García Giménez 1997: 20, 22-26, figs 15, 17-19, 21	Inv. 534; Inv. 535; Inv. 545; Inv. 548; Inv. 549; Inv. 550; Inv. 551; Inv. 552; Inv. 553; Inv. 561
8	*Septem* /Ceuta	16	no provenience noted		Dressel 8	Punico-Mauretanian/ Roman	3	1 nearly complete amphora;2 fragmentary amphorae	Martínez Maganto & García Giménez 1997: 12, 16-17, figs 2, 8-9	Inv. 501; Inv. 518; Inv. 519
9	*Septem* /Ceuta	16	no provenience noted		Dressel 9	Punico-Mauretanian/ Roman	14	6 nearly complete amphora; 6 fragmentary amphorae; 2 rim/neck frags.	Martínez Maganto & García Giménez 1997: 12-22, figs 2-3, 5-7, 9, 11-12, 14	Inv. 502; Inv. 506; Inv. 510; Inv. 512; Inv. 515 (this example has a graffito); Inv. 516; Inv. 520; Inv. 527; Inv. 529; Inv. 533; Inv. 540; Inv. 541; Inv. 542; Inv. 543

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
10	*Septem* /Ceuta	16	no provenience noted		Dressel 9 or 11	Punico-Mauretanian/ Roman	3	fragmentary amphora	Martínez Maganto & García Giménez 1997: 17-19, figs 10, 12	Inv. 521; Inv. 522; Inv. 528. Mouth, neck, handles, and shoulder frags. Difficult to establish this type because of state. May be a transitional type, but no enough to know.
11	*Septem* /Ceuta	16	Hotel La Muralla		Beltran II	Punico-Mauretanian/ Roman	*		Villaverde Vega & López Pardo 1995: 462-463	
12	*Septem* /Ceuta	16	Hotel La Muralla		Dressel 7-12	Punico-Mauretanian/ Roman	*		Villada Paredes 2006: 275	
13	*Septem* /Ceuta	16	Hotel La Muralla		Beltran IIA	Punico-Mauretanian/ Roman	*		Villada Paredes 2006: 275; Villada, et al. 2007: 499	
14	*Septem* /Ceuta	16	Hotel La Muralla		Beltran IIB	Punico-Mauretanian/ Roman	*		Villada Paredes 2006: 275; Villada, et al. 2007: 499	
15	*Septem* /Ceuta	16	Hotel La Muralla		Dressel 7-11	Punico-Mauretanian/ Roman	*		Villada, et al. 2007: 499	
16	*Septem* /Ceuta	16	no provenience noted		Beltan IIA/Pompeii VII	Punico-Mauretanian/ Roman	3	1 fragmentary amphora; 2 handles	Martínez Maganto & García Giménez 1997: 17-18, figs 10, 19	Inv. 523. Mouth, neck, handles, and shoulder frags. Difficult to establish this type because of state. Parallel to Inv. 509; Inv. 524 (possibly identified as this type); Inv. 526.
17	*Septem* /Ceuta	16	no provenience noted		Dressel 7 or 9/Beltran I	Punico-Mauretanian/ Roman	1	toe	Martínez Maganto & García Giménez 1997: 25, fig. 20	Inv. 558. Most probably Beltran I.
18	*Septem* /Ceuta	16	no provenience noted		Dressel 7/8, 12, or 17	Punico-Mauretanian/ Roman	1	fragmentary amphora	Martínez Maganto & García Giménez 1997: 19, fig. 13	Inv. 531. Mouth, neck, handles, and some shoulder frags. Type has characteristics of Dr. 7/8 from Tour Sainte Marie, Lyon (Augustan-1st half, 1st c. AD). But also resemble Dr. 12, but also Dr. 17, from Lavezzi 3 (mid-1st c. AD).
19	*Septem* /Ceuta	16	no provenience noted		Beltran II	Punico-Mauretanian/ Roman	6	1 fragmentary amphora; 1 toe frag.; 4 rim/handle frags.	Martínez Maganto & García Giménez 1997: 16, 22, 24, figs 8, 17, 19-20	Inv. 517 (could be Beltran IIB, and is very similar to Inv. 507 & 511); Inv. 544; Inv. 546; Inv. 554; Inv. 555; Inv. 556.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
20	*Septem* /Ceuta	16	no provenience noted		Beltran II/Pompeii VII	Punico-Mauretanian/ Roman	2	1 rim/neck frag.; 1 frag. amphora	Martínez Maganto & García Giménez 1997: 15, 19, fig. 6, 13	Inv. 514; Inv. 530 (a transitional type between Pompeii VII/Beltran II. Parallels of thi type from Sud-Lavezzi 1)
21	*Septem* /Ceuta	16	Paseo de las Palmeras		Beltran IIA	Punico-Mauretanian/ Roman	*		Bernal Casasola & Pérez Rivera 2000: 868-869; Bernal Casasola & Pérez Rivera 1999: 62, Lam. XX	Variants of BIIA found in Paseo excavations, originally they resemble Puerto Real I but later they resemble Keay XVI.
22	*Septem* /Ceuta	16		Sector I, Period IV, phase 3	Beltran IIA	Punico-Mauretanian/ Roman	*		Hita Ruiz & Villada Paredes 1994: 25-30, 45	No description of numbers. See Hita Ruiz & Villaverde Vega 1994: 60.
23	*Septem* /Ceuta	16	no provenience noted		Beltran IIA/Pompeii VII	Punico-Mauretanian/ Roman	6	4 rim/neck frags.; 2 incomplete amphorae	Martínez Maganto & García Giménez 1997: 13-14. 20-21, figs 4, 15-17	Inv. 536; Inv. 537; Inv. 538; Inv. 539; Inv. 505; Inv. 509.
24	*Septem* /Ceuta	16		Sector I, Period IV, phase 3	Beltran IIB	Punico-Mauretanian/ Roman	*		Hita Ruiz & Villada Paredes 1994: 25-30, 45	No description of numbers. See Hita Ruiz & Villaverde Vega 1994: 60.
25	*Septem* /Ceuta	16	no provenience noted		Beltran IIB	Punico-Mauretanian/ Roman	4	1 nearly complete amphora; 2 frag. Amphorae; 1 rim	Martínez Maganto & García Giménez 1997: 14-15, 18, figs 3, 5-6, 11	Inv. 507; Inv. 511; Inv. 525; Inv. 513
26	*Septem* /Ceuta	16	no provenience noted		Dressel 11/Pompeii VII transition	Punico-Mauretanian/ Roman	1	nearly complete amphora	Martínez Maganto & García Giménez 1997: 13	Inv. 503. Lacking mouth, so makes identification difficult. Similar to Sud Lavezzi 1 & 2.
27	*Septem* /Ceuta	16	no provenience noted		Dressel 12	Punico-Mauretanian/ Roman	3	2 toe frags; 1 rim/neck frag.	Martínez Maganto & García Giménez 1997: 23, 25-26, figs 17, 20-21	Inv. 559; Inv. 562; Inv. 547.
28	*Septem* /Ceuta	16	no provenience noted		Dressel 12/Beltran III	Punico-Mauretanian/ Roman	1	nearly complete amphora	Martínez Maganto & García Giménez 1997: 13	Inv. 504. Lacking mouth.
29	*Septem* /Ceuta	16	under water		Dressel 14 (Beltran IV)	Roman	*		Hita Ruiz & Villada Paredes 1994: 60; Bravo & Muñoz 1965: fig. 37	No mention of numbers of this type.

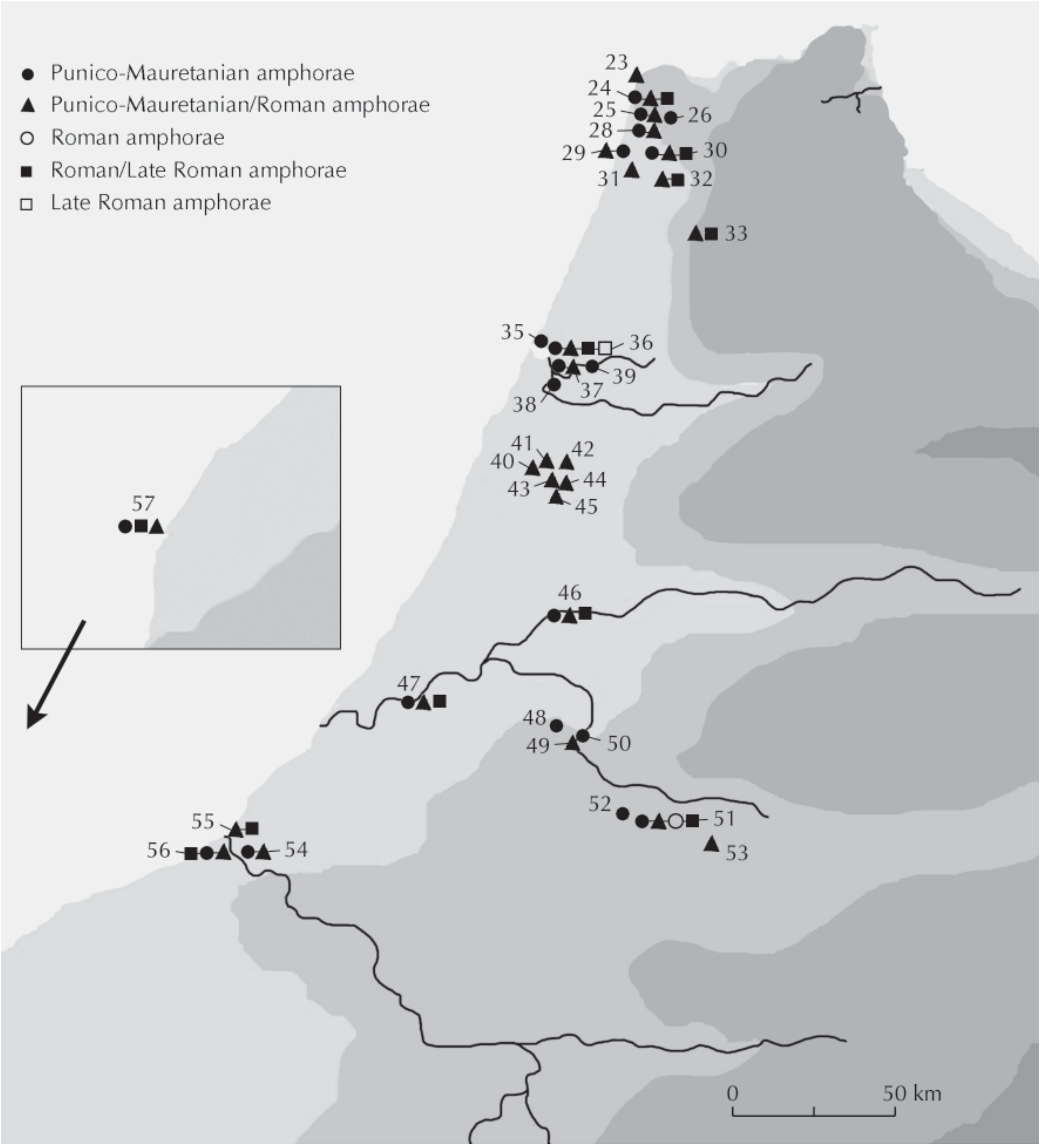
Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
30	*Septem* /Ceuta	16	no provenience noted		Dressel 14/Beltran IVa	Roman	1	fragmentary amphora	Martínez Maganto & García Giménez 1997: 19-20, fig. 14	Inv. 532. Mouth, neck, handles, and some shoulder frags. Parallels to Sud-Lavezzi 1, and also Almeria. Similarity between this type's rim and Keay XXVI, especially the C variant.
31	*Septem* /Ceuta	16	Hotel La Muralla		Dressel 14B	Roman	*		Villada, et al. 2007: 499	
32	*Septem* /Ceuta	16			Almagro 50	Roman/Late Roman	1	toe frag., w/ lower part of amphora	Bernal Casasola 1996: 1196, 1198, fig. 13	Inv: MMC/FA/RM/ANF/315.
33	*Septem* /Ceuta	16	La Calle Hermano Gómez Marcelo	abandonment level	Almagro 51a-b/ Keay XIX	Roman/Late Roman	2	amphorae bases	Villaverde Vega & López Pardo 1995: 460, 471-472, fig. 3a-b	Found "under the first level of abandonment." Authors think that this type was made in Tingitana.
34	*Septem* /Ceuta	16		abandonment period	Almagro 51a-b/ Keay XIX	Roman/Late Roman	*		Villaverde Vega & López Pardo 1995: 468	No number of finds given. Necropolis located near basilica. See Vázquez Bodas 1995
35	*Septem* /Ceuta	16	North Bay		Almagro 51a-b/ Keay XIX	Roman/Late Roman	6	handles	Bernal Casasola 1996: 1196, 1198, fig. 10	Inv: MMC/FA/RM/ANF/292-96. Bernal Casasola (1996: 1211-1217) offers that these types were made around the Straits region, if not Ceuta area.
36	*Septem* /Ceuta	16			Almagro 51a-b/ Keay XIX	Roman/Late Roman	2	1 handle; 1 rim/handle frag.	Bernal Casasola 1996: 1196, 1198, fig. 9-10; Bernal Casasola 1997: 97-98 (Table 4), 119	Inv: MMC/FA/RM/ANF/291; Inv: MMC/FA/RM/ANF/281.
37	*Septem* /Ceuta	16	North Bay		Almagro 51a-b/ Keay XIX	Roman/Late Roman	14	nearly complete amphora	Bernal Casasola 1996: 1196, 1198, fig. 8, 10-11; Bernal Casasola 1997: 97-98 (Table 4), 117-119; Bernal, et al. 1996: 88	Inv: MMC/FA/RM/ANF/297; Inv: MMC/FA/RM/ANF/270; Inv: MMC/FA/RM/ANF/268-269 (analysed petrographically, and believed to have been made in *Maueretania Tingitana* ([Bernal Casasola 1997: 94-98]); Inv: MMC/FA/RM/ANF/271-276; Inv: MMC/FA/RM/ANF/282-283, 285-286.
38	*Septem* /Ceuta	16	North Bay		Almagro 51a-b/ Keay XIXa	Roman/Late Roman	10	4 toe frags., w/ lower part of amphorae; 6 rin/neck frags.	Bernal Casasola 1996: 1196, 1198, fig. 9-10; Bernal, et al. 1996: 88; Bernal Casasola 1997: 97-98 (Table 4), 119	Inv: MMC/FA/RM/ANF/288-290; Inv: MMC/FA/RM/ANF/277-280, 284; Inv: MMC/FA/RM/ANF/287.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
39	*Septem* /Ceuta	16	parcel 20/21		Almagro 51c	Roman/Late Roman	*		Hita Ruiz & Villada Paredes 1994: 44-45; Bernal Casasola 1997: 92	No numbers given.
40	*Septem* /Ceuta	16			Beltran 72	Roman/Late Roman	1	upper part of amphora	Bernal Casasola 1996: 1196, 1198, fig. 12; Bernal Casasola 1997: 99-100 (Table 4), 122	Inv: MMC/FA/RM/ANF/314. Like those from Sud-Lavezzi 1 wreck. Beltran 72 also identified by author as Almagro 50.
41	Bay of Benzú	17			Mañá-Pascual A4c, e	Punico-Mauretanian	14	amphorae	Villaverde Vega & López Pardo 1995: 462	Found under water by J. Bravo in the 60s/70s and presently in Museo Municipal, Ceuta. These are very similar to types C&E of Munoz Vicente, de Frutos Reyes and Berriatua Hernandez
42	Île Perekhil	18	southwestern side of island	LEO023	Dressel 7-11	Punico-Mauretanian/Roman	1	toe fragment	Trakadas 2004b; Erbati & Trakadas 2008: 66-67	Found at purported shipwreck site on southwestern face of Île Perekhil. Associated with lead anchor cores, and other amphorae located in the 1960s.
43	Ksar-es-Seghir	19			Almagro 51a	Roman/Late Roman	*	frags.	Villaverde Vega 2001: 200	
44	Ksar-es-Seghir	19			Almagro 51b	Roman/Late Roman	*	frags.	Villaverde Vega 2001: 200	
45	Dchar 'Askfane	20			Mañá-Pascual A4	Punico-Mauretanian	*	frags.	Unpublished (A. El Khayari [INSAP], pers. com.)	
46	*Tingi* /Tangier	22			Mañá-Pascual A4	Punico-Mauretanian	14	3 rim/neck frags.; 11 handles (= 6 complete amphorae)	Hassini 2001: 85, 158 (Table 2)	This is the Ramon T-12.1.1.1 variant. Table 2 is for the entire Tanger region; not sure if this means other sites there as well, like the necropoli, etc.
47	*Tingi* /Tangier	22			Dressel 18	Punico-Mauretanian	12	8 rim/neck frags.; 1 handle; 3 feet (= 4 complete amphorae)	Hassini 2001: 85, 158 (Table 2)	Table 2 is for the entire Tangier region; not sure if this means other sites there as well, like the necropoli, etc.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
48	*Tingi* /Tangier	22			Dressel 18	Punico-Mauretanian	*		Hassini 2001: 41-44, 85	Site dated 1st - 2nd c. AD (Ponsich 1970: 240), but these amphorae push date back earlier (Hassini 2001: 87). Kouass certain place of production (mis-fire, Inv. Kos. 2215) in kiln 3 (Mlilou 1991: 67-68), but Boube (1987-88: 191) notes a mis-fire in Volubilis and in level D at Sala as evidence of other production locations. Probably also made in the Tangier region or at *Banasa* (Ponsich 1970: 187). This site might be included under Hassini's "Tangier" tally.
49	*Tingi* /Tangier	22			Beltran IIB	Punico-Mauretanian/Roman	*		Hassini 2001: 48-49 (D. no. 335-339)	Beltran, Jodin say production started 256 BC, but everyone else ways 42 AD (Mayet 1978: 362). Other finds from Tangier region may be doubled in this database.
50	*Tingi* /Tangier	22			Dressel 7-11	Punico-Mauretanian/Roman	105	61 rim/neck frags.; 12 handles; 10 feet; 18 body frags. (= 31 complete amphorae)	Hassini 2001: 48-49, 85, 158 (Table 2)	Table 2 is for the entire Tangier region; not sure if this means other sites there as well, like the necropoli, etc.
51	*Tingi* /Tangier	22			Dressel 7-11	Punico-Mauretanian/Roman	4	amphorae	Hassini 2001: 85, 158 (Table 2)	Table 2 is for the entire Tangier region; not sure if this means other sites there as well, like the necropoli, etc.
52	*Tingi* /Tangier	22			Beltran IIB	Punico-Mauretanian/Roman	59	32 rim/neck frags.; 4 handles; 18 body frags (= 16 complete amphorae)	Hassini 2001: 85, 158 (Table 2)	Table 2 is for the entire Tangier region; not sure if this means other sites there as well, like the necropoli, etc.
53	*Tingi* /Tangier	22			Beltran IIB	Punico-Mauretanian/Roman	5	amphorae	Hassini 2001: 85, 158 (Table 2)	Table 2 is for the entire Tangier region; not sure if this means other sites there as well, like the necropoli, etc.
54	*Tingi* /Tangier	22			Dressel 7-11	Punico-Mauretanian/Roman	*		Hassini 2001: 85	Site dated 1st - 2nd c. AD (Ponsich 1970: 240), but these amphorae push date back earlier (Hassini 2001: 87).

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
55	*Tingi* /Tangier	22			Beltran IIB	Punico-Mauretanian/Roman	*		Hassini 2001: 85	Site dated 1st - 2nd c. AD (Ponsich 1970: 240), but these amphorae push date back earlier (Hassini 2001: 87). This site might be included under Hassini's "Tangier" tally.
56	*Tingi* /Tangier	22			Dressel 7-11	Punico-Mauretanian/Roman	*		Hassini 2001: 85	

3.3.2.3 Atlantic



FIND-SITES:

23. Cap Spartel
24. Cotta
25. Jorf el Hamra
26. Petit Bois
28. Tahadart
29. Kouass
30. *Zilil*
31. En Nkhella
32. Kridissa bir Mitkal
33. Suiar
35. Bled Riat el Khemis-Ras Remel
36. *Lixus*
37. "Property of Ben Driss Islami"
38. Mbarec
39. Azib Slaoui
40. Oued Mdâ
41. Nzalet Bin Ammar area
42. Oued Riahi
43. Ouled Aïssa area
44. Sidi Yahia del Gharb area
45. Sidi Slimane Arbaoua
46. *Banasa*
47. *Thamusida*
48. Sidi Slimane
49. Sidi Kacem
50. Rirha
51. *Volubilis*
52. Volubilis valley
53. Mhaya
54. *Exploratio Ad Mercurio*
55. Rabat
56. *Sala*
57. Essaouira

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
1	Cap Spartel	23	anchorage	CSP064	Beltran IIB	Punico-Mauretanian/ Roman	1	amphorae rim/neck/shoulders/handle	Trakadas 2003; Erbati & Trakadas 2008: 50	Found nearby 1 lead stock, a pair of lead stock cores, and 1 stone anchor.
2	Cotta	24			Dressel 18	Punico-Mauretanian	1	rim/neck frag. (= 1 complete amphora)	Hassini 2001: 41-44, 90-92 (D. no. 242), 159 (Table 3)	Mis-fire (Inv. Kos. 2215) in kiln 3 (Mlilou 1991: 67-68), but Boube (1987-88: 191) notes a mis-fire in Volubilis and in level D at Sala as evidence of other production locations. Probably also made in the Tangier region or at Banasa (Ponsich 1970: 187). Represents 0.62% of amphora at site. Date for this type is given by Hassini. Site occupied in 3rd-2nd c. BC, but factory appeared in 1st c. BC (Ponisch & Tarradell 1965: 68, n. 1; Ponsich 1970).
3	Cotta	24			Dressel 7-11	Punico-Mauretanian/ Roman	1	amphora	Ponisch 1988: 154	Ponsich cites this type here, although Hassini (2001: 45-47) says that this type is not found here.
4	Cotta	24			Beltran IIB	Punico-Mauretanian/ Roman	236	215 rim/neck frags.; 5 handles; 10 body frags. (= 117 complete amphorae)	Hassini 2001: 48-49 (D. no. 340-349), 90-92, 159 (Table 3); Ponsich & Tarradell 1965: 60, pl. XVIII/2	Site occupied 3rd-2nd c. BC, but factory appeared in 1st c. BC (Ponsich & Tarradell 1965: 68, n. 1; Ponsich 1970: 207). Here, 76.39% are this type (Hassini 2001: 91). With complete amphorae, 76.39% of amphorae found at site. Numerous amphorae found in magazine C (south side of building) and one in chaufferie.
5	Cotta	24			Beltran IIB	Punico-Mauretanian/ Roman	6	amphorae	Hassini 2001: 48-49 (D. no. 340-349), 90-92, 159 (Table 3); Ponsich & Tarradell 1965: 60, pl. XVIII/2	Site occupied 3rd-2nd c. BC, but factory appeared in 1st c. BC (Ponsich & Tarradell 1965: 68, n. 1; Ponsich 1970: 207). Here, 76.39% are this type (Hassini 2001: 91). With complete amphorae, 76.39% of amphorae found at site. Numerous amphorae found in magazine C (south side of building) and one in chaufferie.
6	Cotta	24			Almagro 50	Roman/Late Roman	1	rim/neck frag. (1 complete)	Hassini 2001: 50-51 (D no. 367), 159 (Table 3)	Date here because they were found at Cotta, which was abandoned before the end of the 3rd C. AD (Ponsich & Tarradell 1965: 55-56). Represents 0.62% of amphorae found at site.
7	Jorf el Hamra	25		first period	Mañá-Pascual A4	Punico-Mauretanian	1	"amphora"	Hassini 2001: 32-35; Ponsich 1964a: 243-244	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon Torres 1995: 237-238 (date), but this type does not appear during the 1st c. BC. Ponsich calls these "punic" and says that they date 3-2nd c. BC.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
8	Jorf el Hamra	25	Courtyard of farm building "Sondage A"		Dressel 18	Punico-Mauretanian	*	frags.	Hassini 2001: 41-44 (D. no. 201-204), 85; Ponsich 1964a: 250, fig. 5	Kouass is the only place in Morocco where it is certain that these types were made (mis-fire, Inv. Kos. 2215) in kiln 3 (Mlilou 1991: 67-68), but Boube (1987-88: 191) notes a mis-fire in Volubilis and in level D at Sala as evidence of other production locations. Probably also made in the Tanger region or at Banasa (Ponsich 1970: 187). Ponsich (1964a: 250) says " a large quantitiy of amphorae frags. found, especially rims with the 'tete de cheval' profile, typical of the end of the 1st c. BC." Date given for this type by finds at site, by Hassini. But site operated from 3rd/2nd c. BC - 3rd c. AD (p. 86). Material stored in Kasbah Museum (p. 87).
9	Jorf el Hamra	25			Dressel 7-11	Punico-Mauretanian/ Roman	*		Hassini 2001: 85	Date given for this type by finds at site, by Hassini. But site operated from 3rd/2nd c. BC - 3rd c. AD (p. 86). Material stored in Kasbah Museum (p. 87).
10	Petit Bois	26		first period	Mañá-Pascual A4/Mañá D	Punico-Mauretanian	5	3 rim/neck frags; 2 handes	Lopez Pardo 1990a: 36; Ponsich 1964a: 239-240, pl. II; Ponsich 1970: 169, 204	Lopez Pardo sees these as early MPA4 types. Mana D is what Hassini (2001: 36) calls "obus" types.
11	Petit Bois	26		first period	Mañá-Pascual A4	Punico-Mauretanian	*		Hassini 2001: 32-35; Ponsich 1970: 204	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon Torres 1995: 237-238 (date), but this type does not appear during the 1st c. BC.
12	Tahadart	28			Dressel 18	Punico-Mauretanian	*		Brouquier-Reddé, et al. 2006: 2164	
13	Tahadart	28	unknown		Mañá-Pascual A4	Punico-Mauretanian	*		Hassini 2001: 32-35, 85, 158 (Table 2)	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon Torres 1995: 237-238 (date), but this type does not appear during the 1st c. BC. But site occupied before 1st c. BC? Ponsich & Tarradell 1965: 55. Table 2 for entire Tanger region, might include this site in its numbers. 4th - 2nd c. BC given as date range elsewhere.
14	Tahadart	28			Dressel 7-11	Punico-Mauretanian/ Roman	*		Hassini 2001: 85	
15	Tahadart	28			Beltran IIB	Punico-Mauretanian/ Roman	*		Hassini 2001: 85	

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
16	Kouass	29	unknown		Mañá-Pascual A4	Punico-Mauretanian	*		Hassini 2001: 32, 159 (Table 4); Ponsich 1969-70: 83; Mlilou 1991: 30-38, 40, 52, 67-68	Aka de Frutos L, de Florido VI.1, Ponsich II, III. Ramon T-11.2.1.3 (older type), this was the type found at Corinth. 355 Mana fragments at Kouass (78.8% of amphorae).
17	Kouass	29	unknown		Mañá-Pascual A4	Punico-Mauretanian	*		Hassini 2001: 32-35, 159 (Table 4); Monkachi 1988: 43-53	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon 1995: 237-238 (date), but this type is found in 4th-3rd c. BC layers (Mlilou 1991: 46). Misfires of this type found at Kouass, Mlilou 1991: 52 (Inv. Kos. 2238). 355 Mana fragments at Kouass (78.8% of amphorae).
18	Kouass	29	kiln III, aquaduct, camp		Dressel 18	Punico-Mauretanian	51	frags.	Mlilou 1991: 60-72, figs 20-23, 91, Table 1	3rd c. BC date given because of kiln III; production likely began in 2nd c. BC. Represents 11.4% of amphorae from site.
19	Kouass	29			Dressel 18	Punico-Mauretanian	51	frags.	Hassini 2001: 41-44, 93-95, 159 (Table 4); Mlilou 1991: 60-71	Kouass certain production place (mis-fire, Inv. Kos. 2215) in kiln 3 (Mlilou 1991: 67-68), but Boube (1987-88: 191). Represents 11.4% of amphorae from site.
20	Kouass	29			Dressel 7-11	Punico-Mauretanian/ Roman	10	frags.	Hassini 2001: 45-47, 93-95, 159 (Table 4); Mlilou 1991: 80	Found at all sites in Morocco except Cotta. Boube (1987-88: 192, n. 66) points to a mis-fire at Sala as being evidence of production here, but Hassini says production at other sites like Lixus and Volubilis is possible. Represents 2.2% of amphorae from site.
21	Kouass	29			Beltran IIB	Punico-Mauretanian/ Roman	6	frags.	Hassini 2001: 48-49, 93-95, 159 (Table 4); Mlilou 1991: 78	Represents 1.3% of amphorae from site.
22	Kouass	29	kiln IV		Beltran IIB	Punico-Mauretanian/ Roman	6	frags.	Mlilou 1991: 78-79, fig. 27, 91, Table 1	Represents 1.4% of amphorae from site. These are though tnot to have been made here (Ponsich 1969-70: 77). Considered by Mlilou to be imported (Table 4, p. 93).
23	Kouass	29	camp		Dressel 7-11	Punico-Mauretanian/ Roman	10	frags.	Mlilou 1991: 80-81, fig. 28, 91, Table 1	Represents 2.2% of amphorae from site. Considered by Mlilou to be imported (Table 4, p. 93).
24	*Zilil* /Dechar Jedid	30	near west wall of habitation	"Mauretanian 1"	Mañá-Pascual A4	Punico-Mauretanian	1	body frags.	Akerraz, et al. 1981-82: 194-195	In middle trench, in square A5/B5, called "Kouass III" in report.
25	*Zilil* /Dechar Jedid	30	habitation on "Citadelle"	"Mauretanian 1"	Mañá-Pascual A4	Punico-Mauretanian	2 (?)	amphora	Akerraz, et al. 1981-82: 202-203, Pl. 18	"Kouass II-III" type, but this level considered by excavators to end ca. 100 BC. Lopez Pardo (1990a): 22-23, states that these types were made before Kouass kiln #5 began operating, in 2nd c. BC. Places first abandonment of Zilil in the first part of the 4th c. BC, because of these and other ceramics.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
26	*Zilil* /Dechar Jedid	30		"mauretanian 1"	Mañá-Pascual A4	Punico-Mauretanian	*		Hassini 2001: 32-35; Akerraz, *et al*. 1981-82: 202	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon Torres 1995: 237-238 (date), but appear in layers pre-dating 1st c. BC, "mauretanian 1" (Akerraz, *et al*. 1981-82: 202).
27	*Zilil* /Dechar Jedid	30	habitation on "Citadelle"	"Mauretanian 2"	Dressel 18	Punico-Mauretanian	5(?)	amphorae	Akerraz, et al. 1981-82: 197, 205-206, Pls. 17, 20; Lopez Pardo 1990a: 22	Many nearly whole types appear in first plate, and are broken, but exact number unknown (number here based on counting rims in first photo). Also called "Kouass IV".
28	*Zilil* /Dechar Jedid	30	in plain below site	Roman	Dressel 9	Punico-Mauretanian/ Roman	1	rim/neck frag.	Akerraz, et al. 1981-82: 170	Found digging for a well on plain near Oued Kharroub near the site (8 m. deep)
29	*Zilil* /Dechar Jedid	30	habitation on "Citadelle"	"Mauretanian 2"	Dressel 9	Punico-Mauretanian/ Roman	6(?)	amphorae	Akerraz, et al. 1981-82: 197, Pl. 17	Buried complete in ground (exact number derived from photo)
30	*Zilil* /Dechar Jedid	30		"Mauretanian 2"	Dressel 7-11	Punico-Mauretanian/ Roman	*		Hassini 2001: 45-47	Abundant in this level, destroyed in 38 BC.
31	*Zilil* /Dechar Jedid	30			Beltran IIB	Punico-Mauretanian/ Roman	*		Hassini 2001: 48-49; Akkeraz, *et al*. 1981-82: 209, n. 86	
32	*Zilil* /Dechar Jedid	30	unknown		Almagro 50	Roman/Late Roman	*	unknown	Hassini 1994: 63	Hassini says this type found in great numbers at recent excavations at Zilil. No numbers given.
33	*Zilil* /Dechar Jedid	30			Almagro 50	Roman/Late Roman	*		Hassini 2001: 50-51	After recent excavations, but no reference or numbers given.
34	*Zilil* /Dechar Jedid	30			Almagro 51a-b	Roman/Late Roman	*		Hassini 2001: 52-53; Akerraz, *et al.*, 1981-82: 209, n. 86	Found in "great quantities" at site. Type thought to be introduced to Morocco at the end of the 3rd c. AD or beginning of the 4th c. AD, because it is absent from sites like Cotta, Thamusida, and Kouass (Hassini 2001: 53).
35	*Zilil* /Dechar Jedid	30			Almagro 51c	Roman/Late Roman	*		Hassini 2001: 52-53; Akerraz, *et al.*, 1981-82: 209, n. 86	Type thought to be introduced to Morocco at the end of the 3rd c. AD or beginning of the 4th c. AD, because it is absent from sites like Cotta, Thamusida, and Kouass (Hassini 2001: 53).
36	En Nkhella	31			Dressel 7-13	Punico-Mauretanian/ Roman	*		Brouquier-Reddé, et al. 2006: 2164; Akerraz, et al. 1981-82: 214, no. 12	Sit several kms upreiver on Oued Gharifa, between Kouass and Zilil.
37	Kridissa bir Mitkal	32			Dressel 7-13	Punico-Mauretanian/ Roman	*	frags.	Akerraz, et al. 1981-82: 217, no. 31	Site on small hill 8 kms south of Zilil.
38	Kridissa bir Mitkal	32			Almagro 50	Roman/Late Roman	*	frags.	Akerraz, et al. 1981-82: 217, no. 31	Site on small hill 8 kms south of Zilil.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
39	Suiar	33			Dressel 18	Punico-Mauretanian	*	frags.	Akerraz, et al. 1981-82: 216, no. 34	
40	Suiar	33			Dressel 7-13	Punico-Mauretanian/ Roman	*	frags.	Akerraz, et al. 1981-82: 216, no. 34	
41	Bled Riat el Khemis-Ras Remel	35			Dressel 18	Punico-Mauretanian	*	"col" frags.	Ponsich 1966a: 397	Ponsich not clear on what this site is, possibly a necropolis. Site is located on the north bank of the Loukkos, halfway between the mouth and Lixus.
42	Bled Riat el Khemis-Ras Remel	35	inside tomb		Mañá-Pascual A4	Punico-Mauretanian	1	amphora	Ponsich 1966a: 399, 420, pls. XI, XIX, fig. 7; Ponsich 1969-70: 85	Site located near early necropolis northwest of Lixus, in hills above river on north. Date is given by Ponsich from the construction technique of the tomb compared to Lixus. Ponsich 1964b: tomb was used in 1c. BC, and that he found 2 handles of Lamboglia 48. In 1969-1970, Ponsich identifies this amphorae as Kouass III type.
43	*Lixus*	36	Factory no. 6	floor near vats	"amphoras"	Context unknown	*	"fragments"	Ponsich & Tarradell 1965: 27	No mention of exact type or how many.
44	*Lixus*	36	"Sondeo del Olivio"	punico-mauretanian III	Dressel 18	Punico-Mauretanian	24	24 rim frags. (= 12 complete amphorae)	Caruana, *et al.* 2001: 182, Table 1, fig. 4	This represents 21.81% of amphorae in the punico-mauretanian III layer. Date for these finds from authors, who date the layer specifically.
45	*Lixus*	36			Dressel 18	Punico-Mauretanian	120	complete amphorae; number based on fragments	Hassini 2001: 41-44 (D. no. 222-241), 160-163 (Tables 5-8)	Kouass certain production site (mis-fire, Inv. Kos. 2215) in kiln 3 (Mlilou 1991: 67-68), but Boube (1987-88: 191) notes a mis-fire in Volubilis and in level D at Sala as evidence of other production locations. Probably also made in the Tanger region or at Banasa (Ponsich 1970: 187). Represents 18.75% of amphorae from site. Fragment numbers unclear in Table 8 to make breakdown.
46	*Lixus*	36	acropolis, temple F	cistern	Dressel 18	Punico-Mauretanian	*		Ponsich 1981: 82, fig. 26; Brouquier-Reddé, et al. 2006: 2164	These are called by Ponsich "tete de cheval" or Kouass IV types (8 rims are shown in fig. 26).
47	*Lixus*	36	"Sondeo del Algarrobo"	punico-mauretanian levels, foundation trenches	Mañá C2a	Punico-Mauretanian	2	"possible examples"	Bonet Rosado, et al. 2001:: 66-67	Aka Ramon T-7-4-2-1, T-7.4.3.1. Origin identified as central Mediterranean by petrographic analysis. Distributed before the fall of Carthage. Presence at Lixus signifies contacts with city to authors.
48	*Lixus*	36	Ladera Sur		Mañá C2b/Dressel 18	Punico-Mauretanian	304	frags.	Bonet Rosado, *et al*. 2005: 107, 109, 112, 114-115, 123-125	One of these, from the "Mauritania media " level (50 BC-AD 10) has a fish graffito on its shoulder

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
49	*Lixus*	36	"Sondeos del Algarrobo/Olivo"	punico-mauretanian II	Mañá C2b/Dressel 18	Punico-Mauretanian	5	rim frags.	Izquierdo Peraile, *et al*. 2001: 159, fig. 2	No exact numbers given for these, derived from figure 2. Not clear if these are C2b or C2a types. Seem to be the former, given the figures, and they call them this in the concluding remarks. Is this in Olive tree trench?
50	*Lixus*	36	"Sondeo del Algarrobo"	punico-mauretanian levels, foundation trenches	Mañá C2b/Dressel 18	Punico-Mauretanian	3	"examples"	Bonet Rosado, et al. 2001: 65-66	Aka Ramon T-7.4.3.3, Munoz F1. 3 examples at Lixus total. Say fabrication in other places in Morocco other than Kouass not really known (Ponsich 1968; Mlilou 1991: 60-71). Production of this type not attested at Lixus.
51	*Lixus*	36	"Sondeo del Algarrobo"	"occupation layers"	Mañá C2b/Dressel 18	Punico-Mauretanian	2	"examples"	Bonet Rosado, et al. 2001:68	Represent 7.6% (of amphorae found in this layer?).
52	*Lixus*	36	unknown		Mañá-Pascual A4	Punico-Mauretanian	110	frags.	Hassini 2001: 32 (D no. 169-171; D no. 172-180), 96-103, 160-163 (Tables 5-8); Ponsich 1981: 80	Ramon T-11.2.1.6 sub-type. Ramon Torres 1995: 237. Mana types represent 15.93% of amphorae at site (102 Mana amphorae based on frags.).
53	*Lixus*	36	Ladera Sur		Mañá-Pascual A4	Punico-Mauretanian	70	frags.	Bonet Rosado, *et al*. 2005: 107, 112, 114-115	Identified as Ramon G-12.1.0.0 (Mañá-Pascual A4).
54	*Lixus*	36	"Sondeos del Algarrobo/Olivo"	punico-mauretanian I	Mañá-Pascual A4	Punico-Mauretanian	1	rim frag.	Izquierdo Peraile, *et al*. 2001: 159	From excavations between 1995-1999. Says this one is found in this punico-mauretanian level, bringing the level's date into the 2nd c. BC. Identified as Ramon T-12.1.1.1 sub-group. Is this in Olive tree trench?
55	*Lixus*	36	"Sondeo del Algarrobo"	"occupation layers"	Dressel 7	Punico-Mauretanian	1	"example"	Bonet Rosado, *et al.* 2001:68	"Inagural type" of the Dr. 7-11 type. Dr. 7a made in Cadiz area. This example is considered an intrusion into the excavated layers.
56	*Lixus*	36	"Sondeo del Olivio"	punico-mauretanian III	Mañá-Pascual A4	Punico-Mauretanian	3	3 rim/neck frags. (= 2 complete amphorae)	Caruana, *et al.* 2001: 182, Table 1, fig. 5	This represents 3.63% of amphorae in the punico-mauretanian III layer. Date for these finds from authors, who date the layer specifically. No mention of why these types are thought to be present in layer.
57	*Lixus*	36	"Sondeo del Algarrobo"	punico-mauretanian levels, foundation trenches	Mañá-Pascual A4	Punico-Mauretanian	*		Bonet Rosado, et al. 2001: 63-65, 68	"Largely represented", and these correspond to Ramon T-11.2.1.0 sub-group (Ponsich III). Some made into 1st c. BC, according to authors (Ramon Torres 1995: 238-239). No exact numbers given, just that the fragments represent 34% (of amphorae found in this layer?).
58	*Lixus*	36			Beltran IIB	Punico-Mauretanian/ Roman	9	complete amphorae; number based on fragments	Hassini 2001: 48-49, 81 (D. no. 350-351), 96-103, 160-163 (Tables 5-8)	Represents 1.40% of amphorae from site. Rare type at site.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
59	*Lixus*	36	Ladera Sur		Beltran IIB	Punico-Mauretanian/ Roman	*		Bonet Rosado, *et al.* 2005: 125, 129, fig. 23	No exact numbers given, but mentioned as very rare type at site: "1-2% of finds from Roman layers"
60	*Lixus*	36	"Sondeo del Olivio"	punico-mauretanian III	Dressel 7-11	Punico-Mauretanian/ Roman	54	41 rim/neck frags.; 8 handles; 5 toes (= 21 complete amphorae)	Caruana, *et al.* 2001: 182, Table 1, fig. 3	This represents 38.18% of amphorae in the punico-mauretanian III layer. Date for these finds from authors, who date the layer specifically.
61	*Lixus*	36	"Sondeos del Algarrobo/Olivo"	punico-mauretanian II	Dressel 7-11	Punico-Mauretanian/ Roman	41	rim frags.	Izquierdo Peraile, *et al*. 2001: 160-161, fig. 6	Speculate that these were made at Lixus. Is this in Olive tree trench?
62	*Lixus*	36	Ladera Sur		Dressel 7-12	Punico-Mauretanian/ Roman	*		Bonet Rosado, *et al.* 2005: 117, 123-125	No numbers given: 14% of 352 of "Mauritania media " level (50 BC-AD 10); 32% of 247 of "Mauritania reciente" level (AD 10-50).
63	*Lixus*	36	acropolis, temple F	cistern	Dressel 9	Punico-Mauretanian/ Roman	*		Ponsich 1981: 82	These are likely included in Hassini's numbers for Dr. 7-11 type. Ponsich describes "numerous frags. Of bodies and rims."
64	*Lixus*	36			Dressel 7-11	Punico-Mauretanian/ Roman	160	complete amphorae; number based on fragments	Hassini 2001: 45-47 (D. no. 257-270), 96-103, 160-163 (Tables 5-8)	In photo of Lixus vats from earlier excavations, a great quantity of Dr. 7-11 are shown in a magazine (Caruana, *et al.* 2001: 182, fig. 2). Represents 25% of amphorae from site, especially from 1996 excavations. Breakdown of frags. unclear in Table 8.
65	*Lixus*	36			Almagro 50	Roman/Late Roman	5	handles (= 4 complete amphorae)	Hassini 2001: 50-51 (D no. 368-370), 96-103, 160-163 (Tables 5-8)	Represents 0.62% of amphorae from site.
66	*Lixus*	36	Ladera Sur		Almagro 50	Roman/Late Roman	11	frags.	Fumadó Ortega & Mlilou 2005: 81-82; Aranegui Gascó, *et al.* 2006: 359	
67	*Lixus*	36	Ladera Sur		Almagro 51a	Roman/Late Roman	15	frags.	Fumadó Ortega & Mlilou 2005: 81-82; Aranegui Gascó, *et al.* 2006: 359	
68	*Lixus*	36			Almagro 51a-b	Roman/Late Roman	35	complete amphorae; number based on fragments	Hassini 2001: 52-53 (D no. 371-373), 96-103, 160-163 (Tables 5-8)	All Almagro 51 types represent 5.46% of amphorae from site.
69	*Lixus*	36			Almagro 51c	Roman/Late Roman	35	complete amphorae; number based on fragments	Hassini 2001: 52-53, 96-103, 160-163 (Tables 5-8)	All Almagro 51 types represent 5.46% of amphorae from site.
70	*Lixus*	36	Ladera Sur		Keay LVIIB	Late Roman	6	frags.	Fumadó Ortega & Mlilou 2005: 81-82; Aranegui Gascó, *et al* . 2006: 359	Identified as salazon type by other finds near fish-salting complexes at Algeciras.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
71	"Property of Ben Driss Islami"	37	on plateau		Dressel 18	Punico-Mauretanian	*	rim frags.	Ponsich 1966a: 397	Site located directly east of Lixus, on a small plateau that "dominates the valley," right to the east of the toll road. "Numerous rim fragments" of this type found.
72	"Property of Ben Driss Islami" (Raouda Sidi Moulay Abdeslam)	37	north of the ancient walls under the sanctuary of SM Abdelslam		Dressel 7	Punico-Mauretanian	*	frags.	Ponsich 1966a: 397	No numbers given by Ponisch, but he gives this date for the remains ("augustan"). Found near walls with tile frags. and Dr. 9 frags. Site in an islamic sanctuary, just south of "Property of Ben Driss Islami" site on plateau east of Lixus.
73	"Property of Ben Driss Islami" (Raouda Sidi Moulay Abdeslam)	37	north of the ancient walls under the sanctuary of SM Abdelslam		Dressel 9	Punico-Mauretanian/ Roman	*	frags.	Ponsich 1966a: 397	No numbers given by Ponisch, but he gives this date for the remains ("augustan"). Found near walls with tile frags. and Dr. 7 frags. Site in an islamic sanctuary, just south of "Property of Ben Driss Islami" site on plateau east of Lixus.
74	Mbarec	38			Dressel 18	Punico-Mauretanian	*	frags.	Carmona Gonzales 2005: 7	In Oued Loukkos valley, across from Lixus.
75	Azib Slaoui	39		Phase II	Mañá-Pascual A4 (Ramon T-11.2.1.3/ Ramon T-11.2.1.6)	Punico-Mauretanian	2	rim/neck frags.	Akerraz & El Khayari 2000: 1654-1657, figs. 5-6	These two types are representative of what was found at site. T-11.2.1.6 is cited as being also the type found at Corinth. Site is 5 km northwest of Ksar-el-Kebir.
76	Azib Slaoui	39		Phase II	Mañá-Pascual A4 (Ramon T-12.1.1.1)	Punico-Mauretanian	*	rim/neck frags.	Akerraz & El Khayari 2000: 1654-1657, figs. 5-6	There is no mention in text of exact number of fragments of this type found; 7 rim frags. shown in figures. Site is 5 km northwest of Ksar-el-Kebir.
77	Oued Mdâ	40	on the Oued Mdâ (Rharb)		Dressel 7-11	Punico-Mauretanian/ Roman	*	unknown	Limane & Rebuffat 2004; Hassini 2001: 45-47	Site AR 40. Kiln for this type recently discovered on banks of Oued Mdâ. Site also manufactued Haltern 70 types.
78	Oued Mdâ	40	on the Oued Mdâ (Rharb)		Beltran IIB	Punico-Mauretanian/ Roman	*	unknown	Limane & Rebuffat 2004; Hassini 2001: 45-47	Site AR 40. Kiln for this type recently discovered on banks of Oued Mdâ. Site also manufactued Haltern 70 types.
79	Nzalet Bin Ammar area	41			Dressel 7-11	Punico-Mauretanian/ Roman	1	rim frag.	Limane & Rebuffat 2004: 7	Near Arbaoua, on Nzalet Bin Ammar topographic map.
80	Oued Riahi	42	plateau on banks of Oued Mdâ		Dressel 7-11	Punico-Mauretanian/ Roman	110	rim/neck fragments	Limane & Rebuffat 2004: 1-2, 5	(AR 26) AR = Carte d'Arbaoua. 5 types of rims are identified within this group, 3 of which are divisible into variants. However, the entire lot can be ascribed to the same kiln. Site believed to be a storage area where these were imported, not made at site. 1 find is an incomplete rim; 108 identifiable rims; 1 "over-baked" (surcuite).

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
81	Oued Riahi	42	plateau on banks of Oued Mdâ		Beltran IIB	Punico-Mauretanian/ Roman	1	rim frag.?	Limane & Rebuffat 2004: 1	(AR 26) AR = Carte d'Arbaoua. Site believed to be a magazine, where amphorae were stored. This was found with 110 Dr. 7-11 frags., but not clear what part of amphora it is.
82	Ouled Aïssa area	43			Dressel 7-11	Punico-Mauretanian/ Roman	3	rim frags.	Limane & Rebuffat 2004: 7	Near Arbaoua, on Ouled Aïssa topographic map. From surveys of the region.
83	Sidi Yahia del Gharb area	44			Dressel 7-11	Punico-Mauretanian/ Roman	2	rim frags.	Limane & Rebuffat 2004: 7	Near Arbaoua, on Sidi Yahia del Gharb topographic map. From surveys of the region.
84	Sidi Slimane Arbaoua	45			Dressel 7-11	Punico-Mauretanian/ Roman	2	rim frags.	Limane & Rebuffat 2004: 7	Near Arbaoua, on Sidi Slimane topographic map. From surveys of the region.
85	*Banasa*	46	kiln 2	level III	Mañá-Pascual A4	Punico-Mauretanian	1	rim/neck frag. w/ handles	Girard 1984a: 60, no. 129, fig. 30; Lopez Pardo 1990a: 11-14; Luquet 1964a: 121, 128	Inv. 56B, 139b, 140B. Pre-Roman stratigraphy at Banasa very confused, and these types are mixed throughout levels. Girard cites Luquet reconstrution for this type and calls them Guasch B, but Lopez Pardo 1990a and 1990b believes that these are an incorrect reconstruction (of the Ponsich II-III types) and are in fact all Mañá-Pascual A4. One of these types is also cited by Luquet 1973-75a: 248, fig. 5.5.
86	*Banasa*	46	Secteur 1956	level III	Mañá-Pascual A4	Punico-Mauretanian	2	small frags.	Girard 1984a: 60, no. 132, fig. 30; Lopez Pardo 1990a: 11-14; Luquet 1964a: 128, fig. Ib; Euzennat 1957b: 202-205, pls. II, III	Inv. 189B. See discussion for Inv. 56B above.
87	*Banasa*	46	Secteur 1955 C	level VI	Mañá-Pascual A4	Punico-Mauretanian	?	frags.	Girard 1984a: 60, no. 133, fig. 30; Lopez Pardo 1990a: 11-14	Inv. 156B. See discussion for Inv. 56B above.
88	*Banasa*	46	Secteur 1953, east of the Cardo Maximus	level III	Mañá-Pascual A4	Punico-Mauretanian	?	rim and body frags.	Girard 1984a: 60, no. 134, fig. 30; Lopez Pardo 1990a: 11-14	Inv. 230A. See discussion for Inv. 56B above. No number given for fragments.
89	*Banasa*	46	Secteur 1956	level V	Mañá-Pascual A4	Punico-Mauretanian	2	1 shoulder w/ part of rim, and beginning of handle; other is w/ shoulder, rim and handle, and also toe frag.	Girard 1984a: 60, no. 135, fig. 30; Lopez Pardo 1990a: 11-14; Euzennat 1957b: 202-205, pls. II, III	Inv. 274B. See discussion for Inv. 56B above.
90	*Banasa*	46	Secteur 1956	level II	Mañá-Pascual A4	Punico-Mauretanian	*	frags.	Girard 1984a: 60, no. 137, fig. 30; Lopez Pardo 1990a: 11-14; Euzennat 1957b: 204, pl. II/2	Inv. 165B, Inv. 301/303?. See discussion forInv. 56B above. No number given for fragments.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
91	*Banasa*	46	Secteur 1954	level II	Dressel 18	Punico-Mauretanian	2	amphora	Girard 1984a: 60-61, nos. 138-139, fig. 30, 1b; 90 (date)	Inv. n.p. Girard (1984a: 90): "these represent the earliest type of the amphora, like Taradell has seen at Melilla."
92	*Banasa*	46	Secteur 1954	level III	Dressel 18	Punico-Mauretanian	2	frag. of body and handle	Girard 1984a: 61, nos. 140-141; 90 (date)	Inv. 201A, 202A. Fragment associated with campanienne frags and painted ceramics.
93	*Banasa*	46	Secteur 1954A, east of Maison A	level II	Dressel 18	Punico-Mauretanian	4	amphora	Girard 1984a: 61, nos. 142-143; 90 (date)	Inv. n.p. Identical to no. 138. Girard writes: level II?
94	*Banasa*	46	Secteur 1955 B, kiln #1	under level B	Dressel 18	Punico-Mauretanian	2	amphora	Girard 1984a: 61, nos. 144-145; 90 (date); Luquet 1964a: 118-121	Inv. 28B, 29B. Found broken but all was there; identical to no. 138
95	*Banasa*	46	Secteur 1955 B, kiln #1	level III	Dressel 18	Punico-Mauretanian	1	amphora	Girard 1984a: 61, no. 146; 90 (date); Luquet 1964a: 118-121	Inv. n.p. Identical to no. 138. Girard writes: level III?
96	*Banasa*	46	Secteur 1955 B, 1 meter east of kiln #1	level III	Dressel 18	Punico-Mauretanian	1	half of an amphora w/ frags.	Girard 1984a: 61, nos. 147-148; 90 (date)	Inv. n.p. Half of the amphora in place, with fragments identical to no. 138.Girard writes: level III? Inv. n.p. "Numerous fragments found"; identical to no. 138.
97	*Banasa*	46	Secteur 1955 D, kiln #2	level II	Dressel 18	Punico-Mauretanian	2	amphora	Girard 1984a: 61, fig. 17 (on left) nos. 149-150; 90 (date); Luquet 1964a: 121	Inv. n.p. Found intact. Girard writes: level II?
98	*Banasa*	46	Secteur 1955 D, Maison E	level II	Dressel 18	Punico-Mauretanian	*	"frags."	Girard 1984a: 61, no. 151; 90 (date)	Inv. n.p. "Fragments found"; identical to no. 138
99	*Banasa*	46	Secteur 1955 A, kiln #3	level III	Dressel 18	Punico-Mauretanian	1	amphora	Girard 1984a: 61, no. 152; 90 (date); Luquet 1964a: 121	Inv. n.p. 1 well-preserved amphora, identical to no. 138. Girard writes: level III?
100	*Banasa*	46	Secteur 1955 B	level III	Dressel 18	Punico-Mauretanian	1	amphora	Girard 1984a: 61, no. 153; 90 (date)	Inv. n.p. Intact amphora; identical to no. 138
101	*Banasa*	46	Secteur 1955 A, under the foundation of the walls	level II	Dressel 18	Punico-Mauretanian	1	body frag.	Girard 1984a: 61, no. 154, 68, no. 209; 90 (date); Euzennat 1955-56: 228; Jodin 1966a	Inv. 159B. Presently in Rabat Museum. This type of amphora dated by Jodin between 146 – 25 BC. 2 parallel lines of libyique inscription, 9 & 11 signs.
102	*Banasa*	46	Secteur C, in S-W sector	level III	Dressel 18	Punico-Mauretanian	56	amphorae	Girard 1984a: 88-89, n. 139, 90 (date); Thouvenot & Luquet 1951b: 74-75, Pl. XVI,2	From unpublished notes of A. Luquet, 1942; discovered standing side-by-side, probably in a magazine or depot, during excavations in the S-W sector, north of the house of the Aureus of Juba II. (Mentioned in Thuvenot & Luquet 1951b: 74-75, Pl. XVI,2: "at 3 meters depth, a storeroom of these amphores, about 50, stood up next to each other.") Plate shows them in place, nearly all are complete.
103	*Banasa*	46	southern sector	"bottom layer"	Mañá A & B types	Punico-Mauretanian	2	nearly complete amphorae	Arharbi & Lenoir 1998: 8	Southern zone of site, probably near the potters quarter, test trenches dug in 1997. Two amphorae shown in plan near a brick wall.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
104	*Banasa*	46	unknown		Mañá-Pascual A4	Punico-Mauretanian	25	5 rim/neck frags.; 5 handles; 2 feet; 13 body frags.	Hassini 1992: 57-59; Hassini 2001: 32-35 (D no. 181-186), 103-105, 164-166 (Tables 9-11)	Hassini notes (p. 57) that these two types should be MP-A4 and A5. Numbers represent both new and old excavation totals combined. Mana types total 2.96% of amphorae from site (4 complete from frags.).
105	*Banasa*	46	unknown		Mañá C2b/Dressel 18	Punico-Mauretanian	686	41 rim/neck frags.; 13 handles; 4 toes; 626 body frags.; (= 12 complete amphorae?)	Hassini 1992: 60-64; Hassini 2001: 41-44 (D. no. 205-211), 164-166 (Tables 9-11)	Hassini notes that only C2b (Dr. 18) found at Banasa. Includes numbers from both recent and earlier excavations. Represents 7.40% of amphorae from the site. Epigraphy (p. 62-63): 1) Inv. B 949: VI or IΛ. 2) Inv. B 113: 4 characters, but same graffito was found on the body frag. of Dr. 1. Interpreted by Girard: SYN'K or SYN'N (*Shin* in punic or *nun* in neo-punic) (Girard 1984: 11-93). 3) Inv. B 115: "resembles the leg of a bird". 4) Inv. BAN 90.2420 "complete graffito on the shoulder after firing"; no indication given of what it is. 5) Inv. BAN 1506: HEH (difficult to distingusih the last letter as a Y or H). Mark high on body, after firing. 6) Inv. BAN 90.2374: no description given. Could not find in material at the museum in Rabat the 2 lines of libyque inscription published by Jodin and mentioned again by Girard 1984a: 63.
106	*Banasa*	46	unknown		Dressel 7-11	Punico-Mauretanian/ Roman	978	88 rim/neck frags.; 71 handles; 24 toes; 345 body frags. (= at least 10 complete amphorae)	Hassini 1992: 65-68; Hassini 2001: 45-47 (D. no. 271-301), 103-105, 164-166 (Tables 9-11); Limane & Rebuffat 2004: 7	52.59% of the amphorae found in Banasa; numbers include old and recent excavations. Epigraphy (p. 67): 1) Inv. BAN 90.2305-B 1508: PA[...] (Mayet 1978, no. 15). 2) Inv. B 606: MI. identical to a grafftio to one found on a body frag. of a Tripolitainian I (BA127) 3) Inv. B 198: incomplete graffito, inscribed after firing (no description given). 4) Inv. B210: IANV ro IAN. Graffito on high body, not far from neck. Added after firing. Limane & Rebuffat cite one with Inv. 1982-no.11.
107	*Banasa*	46	unknown		Beltran IIB	Punico-Mauretanian/ Roman	274	65 neck/rim frags.; 44 handles; 9 toes; 156 body frags. (= at least 12 complete amphorae)	Hassini 1992: 69-71; Hassini 2001: 48-49 (D. no. 352-360), 103-105, 164-166 (Tables 9-11)	This number includes both recent and the old excavation finds. Hassini notes that these amphorae are included by Mayet, see Mayet 1978: 363-364, nos. 4, 6, 9, 10, 12, 14. Represents 8.88% of amphorae from the site. These numbers also include those from recent excvations in baths of the frescoes.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
108	*Banasa*	46	unknown		Beltran IIB/Pompeii VII	Punico-Mauretanian/Roman	8	frag. or amphora (?)	Mayet 1978: 363, pl. IV.1, IV.4, IV.6, IV.9-10, IV.13-15; Thouvenot 1954: 127-129	In Archaeological Museum, Rabat; Banasa, no. 886: mark under base of handle: ALB; no. 24: mark situated halfway between handle and base: BINNEI (?); no. 899: mark at base of handle: DELPHICI; no. 911: mark "probably" at base of handle: HEDVLI; no. 910: mark at base of handle: HERCVLANI; no. 609: mark located halfway between base and handle: L-A-TA, ot L-A-AT; no. 930: mark halfway between base and handle: NTHR or ANTHR; no. 1508: mark is at base of handle: PA [...].
109	*Banasa*	46	unknown		Almagro 50 or 51C	Roman/Late Roman	1	frag. of handle/body	Mayet 1978: 381-383, pl. XIII, 2; Thouvenot 1954: 128.	In Archaeological Museum, Rabat; Banasa, no. 891. Mark located under handle: EXOFF/APQETO, where ET are joined. Should this be restored as EXOFF(icina)/AP( )Q( )ET O( ), with Q or O representing the initials of surnames of 2 people bearing the name Appius? Thouvenot (1954) restores: *Appianus, Quintilianus* and *Onesimus*.
110	*Banasa*	46	unknown		Almagro 50	Roman/Late Roman	5	5 rim/neck frags (= 5 complete amphorae)	Hassini 1992: 73-75; Hassini 2001: 50-51, 164-166 (Tables 9-11)	Epigraphy (2 marks) are published by Mayet 1978: 380-383; a third was found in recent excavations but it is not legible. Represents 1.48% of amphorae from site.
111	*Thamusida*	47	unknown		Dressel 18	Punico-Mauretanian	70	3 rim/neck frags.; 12 handles; 3 feet; 52 body frags.	Hassini 1994: 49-51, 79; Hassini 1995: 147	Hassini notes that this type is very abundant in Morocco (1994: 51).
112	*Thamusida*	47	unknown		Dressel 18	Punico-Mauretanian	7	amphorae	Hassini 1994: 49-51, 79; Hassini 1995: 147	Hassini notes that this type is very abundant in Morocco (1994: 51). Numbers represent 6.19% of complete amphorae found at Thamusida.
113	*Thamusida*	47			Dressel 18	Punico-Mauretanian	70	3 rim/neck frags; 12 handles; 3 toes; 52 body frags. (= 6 complete amphorae)	Hassini 2001: 41-44 (D. no. 212-218), 167 (Table 12)	Represents 7.22% of amphorae from site.
114	*Thamusida*	47			Dressel 7-11	Punico-Mauretanian/Roman	118	3 rim/neck frags.; 18 handles; 15 toes; 30 body frags. (= 28 complete amphorae)	Hassini 2001: 45-47 (D. no. 302-318), 106, 167 (Table 12)	Represents 33.73% of amphorae from site. Site starts to be occupied 2nd c. BC.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
115	*Thamusida*	47	Temple carré	surface	Beltran IIB/Pompeii VII	Punico-Mauretanian/ Roman	1	body frag. w/ handle	Mayet 1978: 363, pl. IV.5; Rebuffat 1977: 84	In Archaeological Museum, Rabat; Thamusida, no. 575. Mark at base of handle: DELPHICI, where HIC are joined. Rebuffat cites: DELPICI.
116	*Thamusida*	47	insulae du fleuve	"secteur sud-ouest"	Beltran IIB/Pompeii VII	Punico-Mauretanian/ Roman	1	body frag.	Mayet 1978: 364, pl. IV.11; Rebuffat 1977: 82	In Archaeological Museum, Rabat; Thamusida, no. 415. Mark "probably" situated on base of handle. [H]ERCVLANI.
117	*Thamusida*	47	grand temple	"sur la face sud" of the building, "pres du mur"	Beltran IIB	Punico-Mauretanian/ Roman	2	complete amphorae	Rebuffat 1977: 185; Rebuffat, *et al.* 1970: pl. XLVIII,4.	Thamusida nos. 379, 380. This identification is my own, based on plates. Toes/amphora bottom not visible because they are buried or missing. Note: this building is on river, next to the area/foundation of the fish-salting site. Building dated by coins: later half, 2nd c. AD (Rebuffat, *et al*. 1970, p.243).
118	*Thamusida*	47	East quarter, Decumanus & Insula de Nigidius Albanus	"en fait le revers du mur sud bornant la cour triangulaire"	Beltran IIB	Punico-Mauretanian/ Roman	7	broken, but nearly complete amphorae	Rebuffat 1977: 185-186; Rebuffat, *et al.* 1970: 260, pl. L	Thamusida no. 255 (for all). Give date here for "depot" as 274-280 AD, the abandonment of the city.
119	*Thamusida*	47	unknown		Dressel 7-11	Punico-Mauretanian/ Roman	118	55 rim/neck frags.; 18 handles; 15 feet; 30 body frags.	Hassini 1994: 53-58, 79; Hassini 1995: 147	Most abundant at site. Found at all sites in Morocco (Hassini 1994: 55). Inscriptions discussed, p. 57-58.
120	*Thamusida*	47	northwest of site		Beltran IIB	Punico-Mauretanian/ Roman	*	?	Cerri 2007b: 40-41, fig. 7	Functioned from the end of the 1st c. BC to first half 1st c. AD.
121	*Thamusida*	47	northwest of site		Dressel 7-11	Punico-Mauretanian/ Roman	*	?	Cerri 2007b: 40-41, fig. 7	Functioned from the end of the 1st c. BC to first half 1st c. AD.
122	*Thamusida*	47	unknown		Dressel 7-11	Punico-Mauretanian/ Roman	30	amphorae	Hassini 1994: 53-58, 79; Hassini 1995: 147	Most abundant at site (26.55% of complete amphorae at site). Found at all sites in Morocco (Hassini 1994: 55). Inscriptions discussed, p. 57-58. Check reference for page numbers and plates.
123	*Thamusida*	47	unknown		Beltran IIB	Punico-Mauretanian/ Roman	29	16 rim/neck frags.; 4 handles; 2 feet; 7 body frags.	Hassini 1994: 60-61, 79; Hassini 1995: 147; Hassini 2001: 48-49 (D. no. 361-364), 167 (Table 12)	Found at all sites in Morocco. With complete amphorae, represents 8.43% of amphorae from site.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
124	*Thamusida*	47	unknown		Beltran IIB	Punico-Mauretanian/ Roman	11	amphorae	Hassini 1994: 60-61, 79; Hassini 1995: 147; Hassini 2001: 48-49 (D. no. 361-364), 167 (Table 12)	Found at all sites in Morocco, represents 7.97% of complete amphorae found at Thamusida. With frags., represents 8.43% of amphorae from site.
125	*Thamusida*	47	unknown		Almagro 50	Roman/Late Roman	1	toe frag.	Hassini 1994: 62-63; Hassini 1995: 147	Found in abandonment layers at site, ca. 274-280 AD. Fragments not considered in estimating percentages at site.
126	*Thamusida*	47	unknown		Almagro 50	Roman/Late Roman	1	amphorae	Hassini 1994: 62-63; Hassini 1995: 147	Represents 0.887% of complete amphorae found at site (says .97% in Hassini 1995: 147). Found in abandonment layers at site, ca. 274-280 AD.
127	*Thamusida*	47			Almagro 50	Roman/Late Roman	1	toe (= 1 complete amphora)	Hassini 2001: 50-51, 167 (Table 12)	Date here because they were found at Thamusida, which was abandoned before the end of the 3rd c. AD (Rebuffat 1968-72: 60). Represents 1.20% of amphorae from the site.
128	Sidi Slimane	48	in base of monument		Mañá-Pascual A4	Punico-Mauretanian	*	frags.	Ruhlmann 1939: fig. 22; Luquet 1973-75a: 255-257, figs. 9-10, Luquet also cites Ruhlmann p. 62-63, figs. 16-17; Jodin 1957: 38, fig. 13b; Hassini 2001: 32-35	Found "a fragment" in a funerary monument over the Wadi Beth. Luquet (1964a: 122): there are "handle fragments and shoulder fragments of this type found here and at Mogador that are identical to those types found at Sidi Slimane." Hassini 2001 notes that this is Ramon T-12.1.1.1 sub-type. Ramon gives date as 350-50 BC (1995: 237-238), but other finds for this type throughout Morocco are other date. Jodin (p. 38) says that "numerous fragments" of this type were discovered in the tumulus, and cites Ruhlmann p. 63, fig. 18.
129	Sidi Kacem	49			Dressel 7-11	Punico-Mauretanian/ Roman	28	rim frags.	Limane & Rebuffat 2004: 7	From surveys of the region.
130	Rirha	50	south side of the promontory, above Oued Beth	level IV	Mañá-Pascual A4	Punico-Mauretanian	12 (?)	amphorae fragments	Girard 1985: 97-98, 105-106, no. 29; Luquet 1966a: 369; Euzennat 1957b: 206	Site may be identified as *Gilda* . Excavation documented by Luquet in 1955 but not published. Identified by Girard as "Guasch B = var. Cintas 281-294 = var. Mana A5 = Kouass II," but reference to Guasch paper (1969), where this type is shown, and is in fact MPA4. Date ranges given by Girard range from 3-2 c. BC (Gibraltar zone), 5-4 c. BC (Mogador), 4-1 c. BC (Banasa). Mlilou (1991: 107) says that Mana types were made here (?).

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
131	Rirha	50	south side of the promontory, above Oued Beth	level I	Dressel 18	Punico-Mauretanian	10 (?)	amphorae fragments	Girard 1985: 105, no. 28; Luquet 1966a: 369	Site may be identified as Gilda. "Very numerous fragments", identified by Girard as "Mana C2?" Luquet's 1955 excavation not published. Mlilou (1991: 107) says that Mana types were made here (?).
132	*Volubilis*	51			Dressel 10	Punico-Mauretanian	*		Jodin 1987: 267	No exact numbers given for these. Certainly must be included in Monkachi material.
133	*Volubilis*	51	pre-Claudian kiln		Dressel 18	Punico-Mauretanian	1	amphora	Jodin 1987: 253; Khatib-Bougibar 1966: 544	Mis-fired example of a Dr. 18 found in punic kiln beyond the walls of the city, down by the Oued Khroumane. Kiln mentioned by Khatib-Bougibar.
134	*Volubilis*	51			Mañá C2a/Dressel 18	Punico-Mauretanian	109	rim/neck frags. & handles	Monkachi 1988: 10-11, figs. 1-2, 109-118, pls. CXXVII.7-CXXXVI.63, 225, fig. 14	Cintas 312-313/Dr. 18 (for this and C2b type). 56 described by Monkachi, says 59 other frags. have been also identified of this type (total 115). But on p. 225, fig 14, shows a total of 109 found.
135	*Volubilis*	51	center of acropolis plateau, insula 24	in Maison au *Desultor*	Mañá-Pascual A4	Punico-Mauretanian	1	handle	Jodin 1987: 254, n. 85	Found in Maison au *Desultor; Inv. no. AD (1965)*
136	*Volubilis*	51	center of acropolis plateau, insula 25	in house walls	Mañá-Pascual A4	Punico-Mauretanian	1	rim/neck frag.	Jodin 1987: 254, n. 86	Found inside some apparently archaic walls, approx. 1 m. underneath some material from the 3rd c. AD.
137	*Volubilis*	51	center of acropolis plateau		Mañá-Pascual A4	Punico-Mauretanian	*	frags.	Jodin 1987: 254, 356	"Other fragments of the same type (Mañá-Pascual A4) found amongst the vestiges in this sector." No exact number given. Some from Maison au Desultor.
138	*Volubilis*	51	unknown		Mañá-Pascual A4	Punico-Mauretanian	*		Hassini 2001: 32-35; Monkachi 1988: 206	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon Torres 1995: 237-238 (date), but other finds throughout Morocco suggest 4th-2nd c. BC for this type, generally.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
139	*Volubilis*	51			Dressel 18	Punico-Mauretanian	*		Jodin 1987: 255-256, pl. XVIII,1-4, fig. 25,1-9; Hassini 2001: 42, 172 (Table 17)	No number given. Just mentioned that they are found in the same stratigraphy as Greco-italic and Dr. 1 amphorae. On p. 267, Jodin says that in insula 24 (*Desultor* AA), these type of amphorae were found with greco-italic types. 5 rims shown in fig. 25, and this is also where insulae 4 & 5 are mentioned as find spots. In plate XVIII, 3 rim/neck frags are shown of C2b type, and 1 shoulder frag. w/ handle. Jodin (1987: 267) also mentions that these were found in insula 24 (Maison au *Desultor* AA), and possibly also insulae 46 & 47, if "punic" can be applied to this type. Boube (1987-88: 191) proposes that at this site, this type packed olives, as demonstrated by the Dramont A wreck (1st c. AD), which had a Dr. 18 full of olives. Mana C types identified as 17.88% of the finds from the site (255 frags)..
140	*Volubilis*	51			Beltran IIA/Pompeii VII	Punico-Mauretanian/ Roman	37	20 rim/neck frags.; 15 handles; 2 feet	Monkachi 1988: 10-11, figs. 1-2, 59-63, pls. LXXII-LXXV, 216, 225, fig. 14; Hassini 2001: 172 (Table 17)	Represents 2.6 % of amphorae recovered at site. 15 catalogued by Monkachi.
141	*Volubilis*	51			Beltran IIB	Punico-Mauretanian/ Roman	287	167 rim/neck frags., incl 1 complete amphorae; 79 handles; 35 body frags.; 6 feet. .	Monkachi 1988: 10-11, figs. 1-2, 51-58, pls. LIII-LXX, 216, 225, fig. 14; Hassini 2001: 48-49, 172 (Table 17)	Represents 20.15 % of amphorae recovered at site. P. 57: One (no inv. no. given) has a stamp at the base of the handle: BCM (pl. LXVIII.25). See also Mayet 1978: 363, pl. V.3. p. 57-58: Inv. Vol. 12609 stamp on body frag: C II D (pl. LXVIII.26/LXIXa). p. 28: Inv. Vol. 1679: stamp on body: GALLI (pl. LXVIII.27/LXIXb). p. 58: Inv. Vol. 82-652: on body frag.: HERCUL(ANI).(pl. LXVIII.28). (Mayet 1978: 364, pl. IV.10). Inv. Vol. 13858: mark on the body: ...]NTERI of ...]IVTERI (pl. LXVIII.29/LXXa). p. 58: Inv. Vol. 82-49: on body frag.: VB/VNI (pl. LXVIII.30/LXXb). 24 descibed in catalogue by Monkachi.
142	*Volubilis*	51			Dressel 7-11	Punico-Mauretanian/ Roman	349	270 rim/neck frags.; 36 handles; 30 body frags.; 13 feet frags.	Monkachi 1988: 10-11, figs. 1-2, 36-46, pls. XXVIII-XLV, 216, 225, fig. 14; Hassini 2001: 45-47, 172 (Table 17)	Represents 24.51% of amphorae recovered at site, p. 39: incised graffito on no. Vol. 14800 (pl. XXX.11), after firing: IA; p. 44-45: graffito incised on no. Vol. 14388 near handle after firing: X (pl. XLI.40). 49 described in catalogue by Monkachi.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
143	*Volubilis*	51	unknown		Beltran IIB/Pompeii VII	Punico-Mauretanian/ Roman	4	frags.(?)	Mayet 1978: 363-364, pl. IV.2, IV.3, IV.7-IV.8; Thouvenot 1941: 97	In Archaeological Museum, Volubilis; 1) mark at base of handle: ATVR or TAVR; 2) mark halfway between base of amphora and handle: circular, 'BCM' with leaves on top and bottom. Can possibly be associated with BCMATERNI/SAGVNTO, 3) mark at base of handle: [DELP]HICI. 4)mark at base of handle: EFFEC.
144	*Volubilis*	51			Dressel 14	Roman	3	rim/neck frags.	Monkachi 1988: 10-11, figs. 1-2, 64-66, pls. LXXVII-LXXVIII, 217, 225, fig. 14; Hassini 2001: 172 (Table 17)	Represents 0.21 % of amphorae recovered at site. 3 described in the catalogue by Monkachi.
145	*Volubilis*	51			Almagro (all)	Roman/Late Roman	89	amphorae/inc. frags (?)	Monkachi 1988: 10-11, figs. 1-2, 218, 225, fig. 14	Represents 6.25 % of amphorae recovered at site. Datation of the Almagro finds at Volubilis is not precise, see p. 221-222.
146	*Volubilis*	51			Almagro 50	Roman/Late Roman	18	5 rim/neck frags.; 13 handles	Monkachi 1988: 10-11, figs. 1-2, 86-87, 92, pl. CVI, 225, fig. 14; Hassini 2001: 50-51, 172 (Table 17)	1 body frag., and 2 handle frag. of this type found, plus 5 other fragments of handles located; Hassini: All Almagro finds make up 6.25% of amphoare from site (89 total frags.).
147	*Volubilis*	51			Almagro 51 c	Roman/Late Roman	52	16 rim/neck frags.; 36 handles	Monkachi 1988: 10-11, figs. 1-2, 89-90, 94-96, pls. CVII.6-CIX, 225, fig. 14	1 body frag. Inv. Vol. 10307, with graffito incised on handle after firing: VIVI. (p. 94). 1 handle frag. Inv. Vol. 82-537, with graffito incised on the external face of the handle: MVF (p. 96). See marks published by Mayet (1978: 382, pl. XIII. 11) described by Monkachi in catalgoue; 2 other body frags. and 16 frags. of handles also present.
148	*Volubilis*	51			Almagro 51a-b	Roman/Late Roman	*		Hassini 2001: 52-53, 172 (Table 17); Monkachi 1988: 96	Type thought to be introduced to Morocco at the end of the 3rd c. AD or beginning of the 4th c. AD, because it is absent from sites like Cotta, Thamusida, and Kouass (p. 53). Hassini: All Alamgro finds make up 6.25% of amphorae from site (total 89 frags.).
149	*Volubilis*	51			Almagro 51b	Roman/Late Roman	19	5 rim/neck frags.; 14 handles	Monkachi 1988: 10-11, figs. 1-2, 88, 93, pl. CVII.4-5, 225, fig. 14	3 catalogued: 2 frags. of handles, 1 body frag. Almagro 51a-b called Keat XIX A, B by Bernal Casasola 1996: 1198.
150	*Volubilis*	51			Almagro 51c	Roman/Late Roman			Hassini 2001: 52-53, 172 (Table 17); Monkachi 1988: 97-98	All Alamgro finds make up 6.25% of amphoare from site (total 89 frags.).
151	Volubilis valley	52	sites in Volubilis plain		Mañá-Pascual A4	Punico-Mauretanian	*	no number given	Akerraz & Lenoir 1990: 224-225, fig. 5	Survey of sites to the north, south, and west of Volubilis area. 71 pre-roman sites identified. Kouass III type identified at these sites, but no number or number of sites given.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
152	Mhaya	53	near a large enclosure wall		Beltran IIB	Punico-Mauretanian/ Roman	10(?)	amphorae fragments	Limane 1997: 9	Site located on two banks of the Oued Jouaou, 4 km north of Mhaya, between Fes and Meknes. River cuts through site, and ceramics found all over the site. Walls (which are cut through by the river) appear to be of an olive press, walls forming a complete enclosure. "Vast number of fragments strewn about on both sides of the bank". Site named Maghilla/Marhilla in medieval texts.
153	*Exploratio Ad Mercurios* /Khedis	54	general site	Pre-Roman	Dressel 18	Punico-Mauretanian	1	amphora (but in frags?)	Akerraz 2002: 198	Amphorae frags found in layers below the Roman camp; Roman camp given date of 1st c. AD - 3rd c. AD
154	*Exploratio Ad Mercurios* /Khedis	54	general site	Pre-Roman	Mañá-Pascual A4	Punico-Mauretanian	1	fragment	Akerraz 2002: 198	Amphora frags found in layers below the Roman camp; called "Kouass III" in report. Roman camp given date of 1st c. AD - 3rd c. AD.
155	*Exploratio Ad Mercurios* /Khedis	54	vestibule at East Gate	Roman	Dressel 7-11	Punico-Mauretanian/ Roman	1	fragment	Akerraz 2002: 198	Found around 1st c. AD layers; Roman camp given date of 1st c. AD - 3rd c. AD.
156	*Exploratio Ad Mercurios* /Khedis	54	vestibule at East Gate	Roman	Beltran IIB	Punico-Mauretanian/ Roman	1	fragment	Akerraz 2002: 198	Roman camp given date of 1st c. AD - 3rd c. AD
157	Rabat	55	unknown		Beltran IIB/Pompeii VII	Punico-Mauretanian/ Roman	1	frag. or amphora (?)	Mayet 1978: 364, pl. IV.12	In Archaeological Museum, Rabat; no find place noted. Mark located halfway between the base and the base of the handle: IDN (or IDAN, where the AN are joined?).
158	Rabat	55	unknown		Almagro 50	Roman/Late Roman	1	frag. of handle/body	Mayet 1978: 381-382, pl. XIII, 1	In Archaeological Museum, Rabat; no find place noted. Mark located just under handle: LEVGEN. Callender 1965: 152, no, 847.
159	*Sala*	56	north area of northwest sector	under islamic layers	Almagro 51B	Roman/Late Roman	2(?)	amphorae	El Khayari, et al.1998: 5	Area excavated in 1997 by INSAP students; located between the north-west section and the Merinid enclosure, about 100 meters north west of the capitol. Not described as fragments, just "amphorae" (plural used compared to singular in next entry). Also one Mauretanian Cesarienne amphora found.
160	*Sala*	56	northeast of forum, outside Merenid enclosure	under paving of *decumanus* no. 3	Dressel 18	Punico-Mauretanian	1	upper part of amphora	Boube 1973-75: 170, fig. 1,5, pl. II; Boube 1987-88: 191, pl. VIII.4	Inv. S-10 853; on the esterior of the handle is a stamp: FIGVL. Beltran 1970: 143, no. 163, found a mark FICV, signalling the south of Spain, but does not mention amphora form.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
161	*Sala*	56	south of the forum	under paving of cardo no. 4	Dressel 18	Punico-Mauretanian	1	body frag.	Boube 1973-75: 170-172, fig. 1,6, pl. II; Boube 1987-88: 191, pl. VIII.5	Inv. S-11 138; incomplete stamp on body: fi] GVL
162	*Sala*	56	south of Building D	in a pre-roman layer	Dressel 18	Punico-Mauretanian	1	large body frag.	Boube 1973-75: 172, pl. II; Boube 1987-88: 191	Inv. S-11 929; incomplete stamp on handle (in reverse):] BISV. Does not know of any similar stamps, but a TIBISI on Dr. 2-4 from southern France and eastern Spain. This layer is also "rich in numerous fragments of Dr. 18"
163	*Sala*	56			Dressel 18	Punico-Mauretanian	*		Boube 1987-88: 189-191, pls. VIII-IX	No numbers given; "very abundant at Sala". Called also Cintas 312/Mana C2. Pls. VIII-IX show 3 upper halves, and 14 rim/neck frags. Noted (p. 193, n.73) to have been found with Beltran I types north of Temple A, in a rich layer of amphorae and ceramics from the 1st c. BC. p. 194: abundance of mis-fires of this type, show that they were made at Sala, as well as Beltran I type.
164	*Sala*	56	burial		Dressel 18	Punico-Mauretanian	*	bodies	Boube 1987-88: 194, n. 79; Boube 1966: 30, n. 1	Bodies of these types used for infant inhumations. Boube: 1999: 68: this type do not appear at all in the necropolis, but are found in abundance in the layers around the monumental quarter of the city in the 1st c. BC
165	*Sala*	56	unknown		Mañá-Pascual A4	Punico-Mauretanian	1	rim frag. (= 1 complete amphora)	Hassini 2001: 32-35, 107-109, 168 (Table 13)	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon Torres 1995: 237-238 (date), but other finds throughout Morocco suggest 4th-2nd c. BC for this type, generally. Only Mana type found at site. 0.65% of amphorae from RECENT excavations at site.
166	*Sala*	56			Dressel 18	Punico-Mauretanian	67	43 rim/neck frags.; 13 handles; 9 toes; 2 body frags (= 18 complete amphorae)	Hassini 2001: 41-44 (D. no. 219-221), 107-109, 168 (Table 13)	Kouass certain place of production (mis-fire, Inv. Kos. 2215) in kiln 3 (Mlilou 1991: 67-68), but Boube (1987-88: 191) notes a mis-fire in Volubilis and in level D at Sala as evidence of other production locations. Probably also made in the Tanger region or at Banasa (Ponsich 1970: 187). Represent 11.76% of amphorae from RECENT excavations.
167	*Sala*	56			Dressel 7-11	Punico-Mauretanian/ Roman	104	42 rim/neck frags.; 43 handles; 5 toes; 14 body frags (= 22 complete amphorae)	Hassini 2001: 45-47 (D. no. 319), 107-109, 168 (Table 13)	Found at all sites in Morocco except Cotta. Boube (1987-88: 192, n. 66) points to a mis-fire at Sala as being evidence of production here, but Hassini says production at other sites like Lixus and Volubilis is possible. Represents 14.37% of amphorae from RECENT excavations.

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
168	*Sala*	56			Beltran IIB	Punico-Mauretanian/ Roman	10	7 rim/neck frags.; 2 handles; 1 body frag (= 3 complete amphorae)	Hassini 2001: 48-49, 107-109, 168 (Table 13)	Very rare at Sala; represents 1.96% of amphorae from RECENT excavations at the site.
169	*Sala*	56	cremation burial		Dressel 7-11	Punico-Mauretanian/ Roman	1	frag. of col	Boube 1999: 66-67	Found in grave 52.
170	*Sala*	56	burial		Dressel 7-11	Punico-Mauretanian/ Roman	15	amphorae	Boube 1999: 67, 534	Found in burials 67, 91, 106, 142, 149, 162, 326, 342. Associated finds maybe dates amphorae no. 162 to the period of Augustus-Tiberius. These types of amphorae are particularly abundant at Sala in the first half of the 1stc. AD. On page 534, mentions that 16 were found in necropolis. Double-check these finds with those mentioned above.
171	*Sala*	56	north east of forum, outside the Merenid enclosure		Dressel 12/Beltran III	Punico-Mauretanian/ Roman	1	amphora	Boube 1985-86: 401	Found in layer from mid-1st c. BC, with coins, etc.
172	*Sala*	56	burial		Beltran IIB	Punico-Mauretanian/ Roman	8	amphorae	Boube 1999: 68-69, 534	Used "for protection" in burials nos. 26, 27, 188, 192, 212, 254. No. 26, with associated lamp, dates to the end of the 1st c. AD or the first part of the 2nd c. AD. Same date for no. 27 (found with cremation burial). No. 188, period Cladius-Vespasian (b/c of unguentarium). No. 192 (icremation burial), probably period of Flavians-Trajan. No. 193, dated between 75-80 AD. No. 212 is last qtr. of 1st c. AD. p. 534, says that 8 were found in necropolis, but that there are probably many more. Double-check these finds with those mentioned above.
173	*Sala*	56	Building E (Hellenistic)	lower than the western gate of the forum	Beltran IIB	Punico-Mauretanian/ Roman	1	body frag.	Boube 1973-75: 172, fig. 1,8, pl. III; Boube 1999: 69, n. 2	Inv. S-10 933; stamp near the lower attachment of the handle on the handle: HEIEN (mark unpublished)
174	*Sala*	56	burial		Dressel 7-11	Punico-Mauretanian/ Roman	11 (?)	amphorae	Boube 1973-75: 228; Boube 1966: 30, n. 1	found in 11 burials, not clear if more than I amphora found in each

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
175	*Sala*	56	Arab silo under the "salle communiquant" near the forum	debris/fill	Almagro 51b	Roman/Late Roman	1	upper part of amphora	Boube 1973-75: 210-212, fig. 6.69, pl. IX	Inv. S-2 378; under the handle attachment, rectangular stamp: DALT-IANI. This amphora type is known to be at Sala in the 3rd and 4th c. AD, see Beltran Lloris 1970: 545.
176	*Sala*	56	vestibule of forum baths	underneath brick paving, in destruction layer	Almagro 51b	Roman/Late Roman	1	rim frag.	Boube 1973-75: 212, fig. 6.70, pl. IX	Inv. S-11 196; stamp reversed, incomplete: VICTOR. Possibly this stamp is identified by Callender 1965: no. 1786e (VICTORINI), from Rome.
177	*Sala*	56	burial		Almagro 51b	Roman/Late Roman	4 (?)	amphorae	Boube 1973-75: 228; Boube 1966: 30, n. 1	found in 4 burials, not clear if more than I amphora found in each
178	*Sala*	56	burial		Almagro 51b	Roman/Late Roman	3	amphorae	Boube 1999: 70	Inhumation burials of infants nos. 21, 347, and adult burial no. 71. This form very similar to those used in burials at Ampurias. Double-check these finds with those mentioned above.
179	*Sala*	56	burial		Almagro 51c	Roman/Late Roman	1	amphora	Boube 1999: 70	Found in infant burial no. 348. Very similar to burial types from Ampurias.
180	*Sala*	56			Almagro 50	Roman/Late Roman	3	3 rim/neck frags. (= 2 complete amphorae)	Hassini 2001: 50-51, 168 (Table 13); Villaverde Vega 2001: 182	Represents 1.30% of amphorae from RECENT excavations.
181	*Sala*	56			Almagro 51a-b	Roman/Late Roman	26	5 rim/neck frags.; 8 handles; 13 toes (= 13 complete amphorae)	Hassini 2001: 52-53, 107-109, 168 (Table 13)	All Almagro 51 types represent 8.49% of amphorae from RECENT excavations. Fragment numbers are of all Almagro 51 types.
182	*Sala*	56			Almagro 51c	Roman/Late Roman	26	5 rim/neck frags.; 8 handles; 13 toes (= 13 complete amphorae)	Hassini 2001: 52-53 (D no. 374), 107-109, 168 (Table 13); Villaverde Vega 2001: 182	All Almagro 51 types represent 8.49% of amphorae from RECENT excavations. Fragment numbers are of all Almagro 51 types.
183	Essaouira	57	unknown	layer III (abandonment layer)	Mañá-Pascual A4-A5	Punico-Mauretanian	2	frags.	Hassini 1995: 6, 17-20; Jodin 1967: 19; Hassini 2001: 34; Jodin 1957: 38, fig. 13a	Not clear how many of this type were found. Believes also produced at Kouass and Banasa (Hassini 1995: 18). Found in "level of abandonment" at Essaouira (Hassini 1995: 20). Mentioned by Jodin (1957: 38) as 1 rim/neck frag. being found in abandonment layers, but not sure if this is exactly the Mana type it belongs to.
184	Essaouira	57	unknown		Dressel 18	Punico-Mauretanian	7	6 body frags., 1 amphora	Hassini 1995: 25-29, 146, Table 1	Says 7 frags. in text; Noted as 1.61% in Table 1 (p. 146), of complete amphorae found at site (says 1.4% in text, p. 25).

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
185	Essaouira	57	south-east coast of island	layer III (abandonment layer)	Mañá-Pascual A4	Punico-Mauretanian	1	rim frag.	Hassini 2001: 32-35 (D no. 187), 110-113, 169 (Table 14); Jodin 1967: 19; Jodin 1957: 36, fig. 13	Aka sub-type Ramon T-12.1.1.1 is very abundant. Ramon Torres 1995: 237-238 (date), but found in abandonment layer dated between the post-6th c. - 1st c. BC. All Mana amphorae from site form 34.92% of total amphorae from site (22 complete from fragments).
186	Essaouira	57	south-east coast of island		Dressel 18	Punico-Mauretanian	6	6 body frags. (= 1 complete)	Hassini 2001: 41-44, 110-113, 169 (Table 14)	Represents 1.61% of amphorae from site.
187	Essaouira	57	south-east coast of island	"Roman" ?	Dressel 7-11	Punico-Mauretanian/ Roman	68	24 rim/neck frags.; 9 handles; 10 feet; 25 body frags. (= 11 complete amphorae)	Hassini 2001: 45-47 (D. no. 320-334), 110-113, 169 (Table 14)	At all sites in Morocco except Cotta. Boube (1987-88: 192, n. 66) points to a mis-fire at Sala as being evidence of production here, but Hassini says production at other sites like Lixus and Volubilis is possible. Represents 17.46% of amphorae from site.
188	Essaouira	57	south-east coast of island	"Roman"	Beltran IIB	Punico-Mauretanian/ Roman	10	4 rim/neck frags.; 2 handles; 4 body frags. (= 3 complete amphorae)	Hassini 2001: 48-49 (D no. 365-366), 110-113, 169 (Table 14); Jodin 1967: 21-24	Beltran, Jodin say production started 256 BC, but everyone gives 42 AD (Mayet 1978: 362). Represents 4.76% of amphorae from site.
189	Essaouira	57	unknown		Dressel 7-11	Punico-Mauretanian/ Roman	68	24 rim/neck frags.; 9 handles; 10 feet; 25 body frags.	Hassini 1995: 29-35, 146, Table 1	Inscriptions discussed, p. 32-35
190	Essaouira	57	unknown		Dressel 7-11	Punico-Mauretanian/ Roman	11	amphorae	Hassini 1995: 29-35, 146, Table 1	Noted as 17.74% in Table 1 (p. 146), of complete amphorae found at site. Inscriptions discussed, p. 32-35
191	Essaouira	57	unknown		Beltran IIB	Punico-Mauretanian/ Roman	10	4 rim/neck frags.; 2 handles; 4 body frags.	Hassini 1995: 35-40, 146, Table 1	Inscriptions discussed, p. 38-40
192	Essaouira	57	unknown		Beltran IIB	Punico-Mauretanian/ Roman	3	amphorae	Hassini 1995: 35-40, 146, Table 1	Noted as 4.83% in Table 1 (p. 146), of complete amphorae found at site. Inscriptions discussed, p. 38-40
193	Essaouira	57	unknown		Almagro 51c	Roman/Late Roman	3	1 rim/neck frag.; 2 handles	Hassini 1995: 44-46, 146, Table 1	Found elsewhere at Volubilis, Sala, and in large numbers at Zilil (p. 46).
194	Essaouira	57	unknown		Almagro 51c	Roman/Late Roman	2	amphorae	Hassini 1995: 44-46, 146, Table 1	Noted as 3.22% in Table 1 (p. 146), of complete amphorae found at site. Found elsewhere at Volubilis, Sala, and in large numbers at Zilil (p. 46).

Cat. #	PROVENANCE	Site #	LOCATION	LEVEL	AMPHORA TYPE	PERIOD	NO.	PART	REFERENCE	COMMENTS
195	Essaouira	57	south-east coast of island		Almagro 51c	Roman/Late Roman	3	1 rim/neck frag; 2 handles (= 2 complete amphorae)	Hassini 2001: 52-53 (D no. 375), 110-113, 169 (Table 14)	Type thought to be introduced to Morocco at the end of the 3rd or beginning of the 4th c. AD, because it is absent from sites like Cotta, Thamusida, and Kouass (p. 53). Represents 3.17% of amphorae from site.

Appendix 4.
Written sources

Metadata

This appendix is comprised of two sections: a catalogue of textual references and a table of *tituli picti.* Appendix 4.1 is a list of textual references contemporary to the Punico-Mauretanian, Roman and Late Roman periods that relate aspects of marine resource exploitation in the province of *Mauretania Tingitana,* including nearby western Mediterranean or eastern Atlantic regions. These are listed by author in chronological order.

Appendix 4.2 is a table comprised of contemporary *tituli picti* found on salazón amphorae that describe the contents as salted-fish products from *Mauretania Tingitana*. In these, the product and its origin are named in the first line, followed by other details in various orders. These details usually include quality, use and age of the product, sometimes followed by the *mercatores* name.

Two locations are interpreted from the *picti*: "TING" (*Ting[itana]* = from *Tingi*) and "LIX" "LIXS" (*Lix[itana]* = from *Lixus*). Two types of salted products are mentioned in the *tituli* (discussed below), and some carry additional descriptions, such as "ARG" (*argutum/arguta* = spicy), "VET" (*vetus* = old/aged), "PENVAR" (*penuar[um]* = for the larder), "EXCEL" (*excel[lens]* = excellent), "SVMMA" (*summa[rum]* = highest quality) and "AIIIA" (*annorum trium* = aged three years) or "AIIIIA" (*annorum quadrum* = aged four years).[1]

The first product is referred to as "COD", which is generally accepted to mean *cordyla,* a young tunny under a year old (probably bluefin tuna, *Thunnus thynnus*). This identification is suggested by descriptions in Martial and Pliny.[2] The "COD" referred to in the *tituli* could describe a *salsamentum* product made of young tunny.[3]

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[1] Liou 1987: 66-67; Liou 1993: 137, 140-143; Martínez Maganto 2007: 394-395, fig. 4; Martínez Maganto 2000: 1212

[2] Martial, *Epigrams* 11.52.7; Pliny, *NH* 9.18.47; see also 32.53.146-147

[3] Liou 1987: 66-69; Étienne & Mayet 2002: 39; Bernal, *et al.* 2007: 356; Concoran 1957: 58-59; García Vargas & Bernal Casasola 2009: 145-146; contra Manacorda (1977: 127-128) who suggests that "COD" actually refers to a fish sauce made from the tails of fish, *codae*.

The second product referred to in the *tituli* is “LAC”, which is less clear to interpret.[4] This could refer to *laccatum,* which is listed as a lizard fish or possibly a spindle fish (*elacata*) by Columella.[5] Some scholars have identified this fish as Spanish/chub mackerel (*Scomber japonicus*) or Atlantic mackerel (*Scomber scombrus*) or even shad (Italian *laccia*).[6] Other scholars have identified *laccatum* as a milk concoction, a type of herb, or aromatic liquor made with a type of herb*, lacca.* “LAC” might refer to a type of fish-based product flavoured with an herb and is included here based on this last identification.[7]

The *tituli* are listed in the table in geographical order of place of origin, and therein by chronology.

[4] The problem of identification is discussed in Curtis 1991: 8-9, n. 12; Étienne & Mayet 2002: 52-53.
[5] Columella, *DRR* 8.17.12
[6] Cerri 2007b : 38-39, n. 27; Cerri 2007a: 198-200
[7] Cerri 2007a: 198-200; Manacorda 1977: 127; Liou 1987: 68; Martin-Kilcher (1994) includes “LACC” and “LAC” epigraphy in her grouping of salazón amphorae.

Appendix 4.1.
Texts

Text 1. Horace, *Epistolae* (late 1st century BC)

a) 2.2.181: "*vestes Gaetulo murice tinctas*"

(robes dyed in Gaetulian purple)

Text 2. Strabo, *Geography* (late 1st century BC/early1st century AD)

a) 2.3.4: "…τοὺς δὲ πένητας μικρά, ἃ καλεῖν ἵππους, ἀπὸ τῶν ἐν ταῖς πρῴραις ἐπισήμων· τουτ́οις δὲ πλεῖν μέχρι τοῦ Λίξου ποταμοῦ περὶ τὴν Μαυρουσίαν ἁλιευομένους·"

(…[story of Eudoxus of Cyzicus]:…the poor men of *Gades* fit out small ships which they call "horses" from the devices on the prows of their ships, and that they sail with these small ships on fishing voyages around the coast of *Maurusia* as far as the river *Lixus*….)

b) 3.2.7: "ἐν δὲ Καρτηίᾳ κήρυκας δεκακοτύλους καὶ πορφύρας φασίν· ἐν δὲ τοῖς ἐξωτέροις τόποις καὶ μείζους ὀγδοήκοντα μνῶν τὴν σμύραιναν καὶ τὸν γόγγρον, ταλαντιαῖον δὲ τὸν πολύποδα, διπήχεις δὲ τὰς τευθίδας καὶ τὰ παραπλήσια. πολὺς δὲ καὶ ὁ θύννος σύνελαύνεται δεῦρο ἀπὸ τῆς ἄλλης τῆς ἔξωθεν παραλίας πίων καὶ παχύς."

(At *Carteia*, there are shells of trumpet fish and purple-fish which hold ten *cotylae* [5 pints] and in the regions farther out to sea the lamprey and the conger eel weigh even more than 80 *minae* [8 pounds], the sea-polyps (*polupodia*) a talent [60 pounds] and the cuttle fish are 2 cubits long…..large numbers of plump, fat tunny congregate hither (at *Carteia*) from the other coast, that outside the Pillars….the nearer the tunny-fish approach the Pillars, in coming from the exterior sea, the leaner they become since their food fails them)

c) 17.3.4: "Μαυπουσίας… ἐν ποταμῷ δέ τινι γεννᾶσθαι βδέλλας ἑπταπήχεις, κατατετρημένα ἐχούσας τὰ βραγχία, δί ὧν ἀναπνέουσι·"

(… *Maurusia* [Libya, Morocco]…in certain rivers are found leeches seven cubits long, with gills pierced through with holes, through which they breathe.)

Text 3. Ovid, *Fasti* (early 1st century AD)

a) 2.319: "*dat tenius tunicas Gaetulo murice tinctas*"

(she gave him gauzy tunics in Gaetulian purple dipped)

Text 4. Pomponius Mela, *De Chorographia* (mid-1st century AD)

a) 3. 103-106**:** *"Nigritarum Gaetulorumque passim vagantium ne litora quidem infecunda sunt, purpura et murice efficacissimis ad tinguendum, et ubique quod tinxere clarissimum."*

(Not even the coasts of the Nigritae and the Gaetuli, who are quite nomadic, are infertile; these coasts are very fertile for purple and murex – the most effective dying materials – anything they have dyed is instantly recognizable.)

Text 5. Columella, *De Re Rustica* (1st century AD)

a) 8.16.9: "*ut Atlantico faber, qui generosissimis piscibus adnumeratur in nostro Gadium municipio - eumque prisca consuetudine zaeum appellamus*"

(the dory in the Atlantic which in our municipality of *Gades* is numbered amongst the noblest of fishes and which by an ancient custom we call zeus)

Text 6. Pliny, *Natural History* (1st century AD)

a) 5.1.12-13: "*omnes scopuli Gaetuli muicibus, purpuris*"

(all the rocks of Gaetulia explored for the *murex* and the purple)

b) 6.36.201: "*paucas modo constat esse ex adverso Autololum a Iuba repertas, in quibus Gaetulicam purpuram tinguere instituerat*"

(off the coast of the Autololes, Juba II had established a dyeing industry that used Gaetulian purple)

c) 9.3.8: "*in Gaditano oceano arbor in tantum vastis dispansa ramis ut ex ea causa fretum numquam intrasse credatur*"

(the largest animal in the Gulf of Cádiz is the tree-polypus, which spreads out such vast branches that it is believed never to have entered the Straits of Gibraltar because of this)

d) 9.5.12: "*in Gaditano oceano non ante brumam conspici eas tradunt, condi autem aestatis temporibus in quodam sinu placido et capaci, mire gaudentes ibi parere; hoc scire orcas….*"

(whales in the Gulf of Cádiz are not seen before mid-winter, but during the summer periods hide in a certain calm and spacious inlet, and take marvellous delight in breeding there – these are attacked by orcas)

e) 9.32.68: *"Est et haec natura ut alli alibi pisces principatum optineant...zaeus, idem faber appellatus, Gadibus…"*

(It is also a fact of nature that different fishes hold the first rank in different places – the John Dory [also called the carpenter fish] in Cádiz)

f) 9.48.92: "*Carteiae in cetariis assuetus exire e mari in lacus eorum apertos atque ibi salsamenta populari*"

(in the fish tanks at *Carteia*, a polyp [octopus] was in the habit of getting into their uncovered tanks from the open sea and there forging for salted fish)

g) 9.48.93: "*...et lolligines eiusdem magnitudinis expulses in litus illud idem auctor est*."

(cuttlefish driven ashore near the *Carteia* coast)

h) 9.56.115: "*namque et Ibua tradit Arabicis concham esse similem pectini insecto, hirsutam echinorum modo, ipsum unionem in carne grandini similem; …meliores circa Actium, sed et hi parvi, et in Mauretaniae maritimis."*

(for Juba also records that the Arabs have a shell resembling a toothed comb, that bristles like a hedgehog, and has an actual pearl, resembling a hailstone, in the fleshy part …Better ones are found round Actium, but these too are small, and in sea-board Mauretania)

i) 9.60.127: "*...Meninge Africae et Gaetulo litore oceani…"*

(the best African purple is Menix and on the Gaetulian coast)

j) 31.43.94: "*scombros quidem et Mauretania Baeticaeque Carteia ex oceano intrantes capiunt ad nihil aliud utiles*."

(the scomber is caught also in *Mauretania* and at *Carteia* at *Baetica*; the scomber enters the Mediterranean from the Atlantic, but it is used only for making *garum*)

k) 32.6.15: "*Trebius Niger xiphian, id est gladium, rostro mucronato esse, ab hoc naves perfossas mergi; in oceano ad locum Mauretaniae, qui Cottae vocetur, non procul Lixo flumine idem lolligines evolare ex aqua tradit tanta multitudine, ut navigia demergant. Lolligo quotiens cernatur extra aquam volitans, tempestates mutari.*"

(Trebius Niger tells us that the swordfish…has a pointed beak, by which ships are pierced and sunk; in the open sea, off the place in *Mauretania* called *Cottae*, not far from the river Lixus, the same authority tells us that the *lolligines* [cuttle fish] flies out of the water in such numbers as to sink a vessel. Whenever the *lolligines*, he says, is seen flying out of the water a change in weather occurs)

Text 7. Silius Italicus, *Punica* (late 1st century AD)

a) 16.565: "*albentes invertere lanas murice Gætulo docta*"

(Experts in transforming white wool with the Gaetulian purple)

Text 8. Oppian, *Halieutica* (2nd century AD)

a) 3.620-624: "Θύννων δ` αὖ γένεὴ μὲν ἀπ' εὐρυπόροιο τέτυκται`Ωκεανοῦ· στείχουσι δ` ἐς ἤμετέρης αλὸς ἔργα εἰαρινοῦ μετὰ λύσσαν ὅτι οἰστρήσωσι γάμοιο. Τοὺς δ` ἤτοι πρῶτον μὲν `Ιβηρίδος ἔνδοθεν ἄλμης ἀνέρες ἀγρώσσουσι βίῃ κομόωντες ῎Ιβηρες·"

(the breed of tunnies comes from the spacious Ocean [Atlantic], and they travel into the regions of our sea when they lust after he frenzy of mating in spring. First the Iberians who plume themselves upon their might capture them with the Iberian brine [Sea of Alboran])

b) 5.56-61: "πολλάκι καὶ νήεσσιν ἄγει δέος ἀντιόωντα ἑσπέριον κατὰ πόντον Ἰβηρικόν, ἔνθα μάλιστα γείτονος Ὠκεανοῖο λελοιπότ' ἀθέσφατον ὕδωρ εἰλεῖται, νήεσσιν ἐεικοσόροισιν ὁμοῖα. πολλάκι δὲ πλαγχθέντα καὶ ἠόνος ἐγγὺς ἱκάνει ἀγχιβαθοῦς, ὅτε κέν τις ἐπί σφισιν ὁπλίζοιτο."

(Often too they [whales] bring terror to ships when they meet them in the Iberian sea [Sea of Alboran] in the West, where chiefly, leaving the infinite water of the neighbouring Ocean [Atlantic], they roll upon their way, like unto ships of 20 oars. Often also they stray and come neigh the beach where the water is deep inshore; and there one may attack them.)

Text 9. Athenaeus, *Deipnosophistae* (2nd/3rd centuries AD):

a) 7.302b-c: "οἱ δὲ θύννοι…περὶ κυνὸς ἐπιτολήν·…θύννοι τε διοιστρήσοντι / Γαδείρων δρόμον."

(…when the Dog-Star rises [early summer]…..tunnies will dart on their frenzied courses through the straits of *Gadeira* [Gibraltar])

Appendix 4.2.
Tituli picti

	Site #	ORIGIN	FIND LOCATION	PERIOD	PRODUCT	*TITULUS PICTUS*	*TP* READ AS:	AMPHORA TYPE	REFERENCE
1	22	*Tingi*/Tangier	Chester	Context unknown	Cordula	[--]DTINGVE PENVAR [---]OL	*(Cor)d(ula) Ting(tae) ve(tus)* *penuar(ium)* *[---]OL*	Indeterminate	*RIB* II,6, no. 2492.11; Wright & Hassall 1971: 294, no. 26
2	22	*Tingi*/Tangier	Toulon	Context unknown	Cordula	?	*"Cordyla, Tingis"*	Unknown	unpublished; Liou & Rodríguez Almeida 2000: 13, n. 24; Cerri 2007a, Fig. 7, no. 30
3	22	*Tingi*/Tangier	Vindonissa	Context unknown	Cordula	CORD TING VET	*Cord(ula) Ting(itana) vet(us)*	Indeterminate	Marichal 1975 : 536, n. 13; Cerri 2006: Cat. 16; Cerri 2007a: Fig. 7, no. 26; Liou 1987: 66-67
4	22	*Tingi*/Tangier	Vindonissa	Context unknown	Cordula	COD TING VE	*Co(r)d(ula) Ting(itana) vet(us)*	Indeterminate	Marichal 1975 : 539, n. 32; Cerri 2006: Cat. 17; Cerri 2007a: Fig. 7, no. 27; Liou 1987: 66-67
5	22	*Tingi*/Tangier	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD TI VE XXX M ET L CLAVDIORVM	*Co(r)d(ula) Ti(ngitana) ve(tus)* *XXX* *M(arci ?) et L(uci ?)* *Claudiorum*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5629; Cerri 2006: Cat. 1; Cerri 2007a: Fig. 7, no. 22; Manacorda 1977: 126 for amphorae type
6	22	*Tingi*/Tangier	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD TING VET SVMMAR P XX LXXX C. TERENTI PAVLLI	*Co(r)d(ula) Ting(itana) vet(us)* *summar(um)* *p(ondus ?) XX* *LXXX* *C(ai) Terenti Paulii*	Pompeii VII-XI (Beltrán IIA)	*CIL* IV, 5637; Cerri 2006: Cat.7; Cerri 2007a: Fig. 7, no. 20; Liou & Rodríguez Almeida 2000: 13, n. 19; Manacorda 1977: 126 for amphorae type
7	22	*Tingi*/Tangier	Pompeii	Punico-Mauretanian/ Roman	Laccatum	LAC BES TING VE EXSCELL AAA CXXXXV A. ATINI HERCVLANI	*Lac(catum) BES Ting(itanum)* *ve(tus)* *exscell(ens)* *(annorum trium)* *CXXXXV* *A(uli?) Atini Herculani*	Beltrán IIA (Pompeii VII)	*CIL* IV, 9373; Cerri 2006: Cat. 11; Cerri 2007a: Fig. 7, no. 31; Manacorda 1977: 126 for amphorae type
8	22	*Tingi*/Tangier	Pompeii	Punico-Mauretanian/ Roman	Cordula (?)	CODT TING VE SVMMAR XXX G[---] M ET L CLAVDIORVM	*Co(n)d(i)t(um) T(i)ng(itanum)* *ve(tus)* *summar(um)* *XXX* *G[---]* *M(arci) et L(uci) Claudiorum*	Beltrán IIA (Pompeii VII)	*CIL* IV, 10286b; Cerri 2006: Cat. 13; Cerri 2007a: Fig. 7, no. 23; Liou & Rodríguez Almeida 2000: 13, n. 19; Manacorda 1977: 126 for amphorae type
9	22	*Tingi*/Tangier	Herculaneum	Punico-Mauretanian/ Roman	Cordula	COD TING VE	*Co(r)d(ula) Ting(itana) ve(tus)*	Beltrán IIA (Pompeii VII)	*CIL* IV, 10730; Cerri 2006: Cat. 14; Cerri 2007a: Fig. 7, no. 24; Liou & Rodríguez Almeida 2000: 13, n. 20; Manacorda 1977: 126 for amphorae type
10	22	*Tingi*/Tangier	Carlisle	Punico-Mauretanian/ Roman	Cordula	CO[-]T[-]NG V[-] PENVAR EXSCEL[-] [--]MARV	*Co(rdula) T(i)ng(itana) v(etus)* *penuar(ium)* *exscel(lens)* *[sum]marum*	Beltrán IIA	Tomlin & Hassal 2002: 361, n. 17, fig. 6, no. 7; Cerri 2006: Cat. 22; Cerri 2007a: Fig. 7, no. 25

	Site #	ORIGIN	FIND LOCATION	PERIOD	PRODUCT	*TITULUS PICTUS*	*TP* READ AS:	AMPHORA TYPE	REFERENCE
11	22	*Tingi*/ Tangier	Heidelberg	Punico-Mauretanian/ Roman	Cordula	CODTINGVET EXCELLE [-]XAAA[-] AAA LXXX CLEVCIT[---]THERM[- TRIN[--]	*Co(r)d(ula) Ting(itani) vet(us)* *excelle(ns)* *[-]XAAA[-]* *(annorum trium ?)* *LXXX* *C.Levciti[Ma]Therm ?* *TRIN[---]*	Beltrán IIA	CEIPAC no. 12021; Hahn 1988: no. 50; Cerri 2007a: Fig. 7, no. 21
12	22	*Tingi*/ Tangier	Mainz	Punico-Mauretanian/ Roman	Laccatum	LACTINGVE Q(---) [---]	*Lac(ca)t(um) Ting(itana) ve(tus)* *Q(---) [---]*	Beltrán IIA	Ehmig 2003: 256, n. 47; Cerri 2007a: Fig. 7, no. 32
13	22	*Tingi*/ Tangier	Strasbourg	Punico-Mauretanian/ Roman	Cordula	CORDTINGVE PER[---] EXCLE AII VE[---]XXLI	*Cor(dula Ti)ng(itana) ve(tus)* *pe(nua)r(ium)?* *exc(e)l(l)e(ns)* *(annorum duom?)* *VE[---]XXLI*	Beltrán IIA	Baudoux 1996: 73, fig. 30.3, 75, no. ST 32; Cerri 2007a: Fig. 7, no. 28
14	22	*Tingi*/ Tangier	Strasbourg-Koenigshoffen	Punico-Mauretanian/ Roman	Cordula	CODTING SUMMAR ACCCCA XXX E[---] GEF	*Co(r)d(ula) Ting(itana)* *summar(um)* *annorum CCCC(?)* *XXX* *E[---]* *GEF*	Unknown	Baudoux 1996: 73, fig. 30.2, 75, no. SK 127; Cerri 2007a: Fig. 7, no. 29
15	22	*Tingi*/ Tangier	Pompeii	Punico-Mauretanian/ Roman	Cordula	COR---NGVE EXCELL SVMMVR XXXX LXXXV LLIVICIS HERMETIS	*Cor(dula Ti)ng(itana) ve(tus)* *excell(ens)* *summ(a)rum* *XXXX* *LXXXV* *L.Livicus (?)* *Hermetis vel Hatimetis*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5639; Cerri 2007a: Fig. 7, no. 34; Manacorda 1977: 126 for amphorae type
16	22	*Tingi*/ Tangier	Carlisle	Roman	Cordula	CO[D]TINGVE PENVAR EXSCEL[L] S[V]MAV[R]	*Co(r)[d](ula) Ting(itana) ve(tus)* *penuar(um)* *exscel[l](ens)* *s[u]mau[r](um)*	Unknown	D. Williams (Univ. of Southampton) pers. com. (R. Tomlin, trans.)
17	36	*Lixus*	Pecio Gondolfo wreck	Punico-Mauretanian/ Roman	?	..] ARG LIX VET EXCEL SUMM AIIIA [-] [---]M[---]	*…] Arg(uta) Lix(itana) vet(us)* *excel(lens)* *summ(arum)* *(annorum trium)* *[-]* *[tria nomina?]*	Beltrán IIA	Martínez Maganto 2007: 394-395, fig. 4; Cerri 2007a: Fig. 7, no. 2
18	36	*Lixus*	Ladenburg	Punico-Mauretanian/ Roman	Cordula	CODLIX VET AIIIIA LXXX QFABIPHILARGYRI MAVRI	*Co(r)d(ula) Lix(itani)* *vet(us)* *(annorum quadrum ?)* *LXXX* *Q. Fabi Philargyri* *Mavri*	Beltrán IIA	CEIPAC no. 12020; Hahn 1988: 267 ff; Cerri 2007a: Fig. 7, no. 3

	Site #	ORIGIN	FIND LOCATION	PERIOD	PRODUCT	*TITULUS PICTUS*	*TP* READ AS:	AMPHORA TYPE	REFERENCE
19	36	*Lixus*	Mainz	Punico-Mauretanian/ Roman	Cordula	CODLIXVET EXCELL SUM AAAA LXX PROCULI ET URBICI DOMESTICUS [---]IV LXXV	*Co(r)d(ula) Lix(itana) vet(us)* *excell(ens)* *summ(arum)* *(annorum quadrum ?)* *LXX* *Procvli et Urbici* *Domesticus* *[---]IV LXXV*	Beltrán IIA	Ehmig 2003: 257, n. 50; Cerri 2007a: Fig. 7, no. 4
20	36	*Lixus*	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD LIXDEM EXSCELL IIII LXXXIV PROCULIETURBICI	*co(r)d(ula) Lix(itani) dem?* *exscell(ens)* *IIII* *LXXXIV* *Procili et Urbici*	Beltrán IIA (Pompeii VII)	*CIL* IV, 9368; Liou & Rodríguez Almeida 2000: 13, n. 15; Cerri 2007a: Fig. 7, no. 8; Manacorda 1977: 126 for amphorae type
21	36	*Lixus*	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD LIX VE EXCEL M. VALERI ABINNERICI	*Co(r)d(ula) Lix(itana) ve(tus)* *excel(lens)* *M(arci) Valeri Abinnerici*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5630; Cerri 2006: Cat. 2; Cerri 2007a: Fig. 7, no. 15; Liou & Rodríguez Almeida 2000: 13, n. 15; Manacorda 1977: 126 for amphorae type
22	36	*Lixus*	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD LIX VET A[---]	*Co(r)d(ula) Lix(itana) ve(tus)* *a(nnorum) [---]*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5631; Cerri 2006: Cat. 3; Cerri 2007a: Fig. 7, no. 11; Liou & Rodríguez Almeida 2000: 13, n. 15; Manacorda 1977: 126 for amphorae type
23	36	*Lixus*	Pompeii	Punico-Mauretanian/ Roman	Cordula	C[---] LIX VE EXCELL SVMMA XXXX [---] [---]	*C[ordula] Lix(itana) ve(tus)* *excell(ens)* *summa(rum ?)* *XXXX* *[---]* *[---]*	Dressel 12 (Pompeii XIV)	*CIL* IV, 5632; Cerri 2006: Cat.4; Cerri 2007a: Fig. 7, no. 12; Liou & Rodríguez Almeida 2000: 13, n. 15
24	36	*Lixus*	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD LIX V SVMMA EXCEL X[---] XXXX M. COSCONI SATVRNIN	*Co(r)d(ula) Lix(itana) v(etus)* *summa(rum)* *excel(lens)* *X[---]* *XXXX* *M(arci) Cosconi Saturnin(i)*	Dressel 12 (Pompeii XIV)	*CIL* IV, 5633; Cerri 2006: Cat. 5
25	36	*Lixus*	Pompeii	Punico-Mauretanian/ Roman	Cordula	COD LIXS EXCELL SVMMAR AIIIIA XXV C. PAPINI PLANTAES	*Co(r)d(ula) Lix<s>(itana)* *excell(ens)* *summar(um)* *(annorum trium)* *XXV* *C(ai) Papini Plantaes*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5636; Cerri 2006: Cat. 6; Cerri 2007a: Fig. 7, no. 13; Liou & Rodríguez Almeida 2000: 13, n. 15; Manacorda 1977: 126 for amphorae type

	Site #	ORIGIN	FIND LOCATION	PERIOD	PRODUCT	*TITULUS PICTUS*	*TP* READ AS:	AMPHORA TYPE	REFERENCE
26	36	*Lixus*	Pompeii	Punico-Mauretanian/Roman	Laccatum	LAC BES LIX A VET SVMMAR AAA CXL C. TERENTI PAVL[--]	*Lac(catum?) BES Lix(itanum)* *a(rgutum) vet(us)* *summar(rum?)* *(annorum trium)* *CXL* *C(ai) Terenti Paul(li)*	Beltrán IIA (Pompeii VII)	*CIL* IV, 5648; Cerri 2006: Cat. 8; Cerri 2007a: Fig. 7, no. 19; Manacorda 1977: 126 for amphorae type
27	36	*Lixus*	Pompeii	Punico-Mauretanian/Roman	Cordula	[---]D LIX VE [---]AR [---]II [---]VM LXXXX PROCVLI ET URBICI	*[Cor]d(ula) Lix(itana) ve(tus)* *[sum]ar(um?)* *[annorum duorum?]* *[---]um?* *LXXXX* *Procvli et Urbici*	Beltrán IIA (Pompeii VII)	*CIL* IV, 9369; Cerri 2006: Cat. 9; Cerri 2007a: Fig. 7, no. 9); Manacorda 1977: 126 for amphorae type
28	36	*Lixus*	Pompeii	Punico-Mauretanian/Roman	Cordula	CORD L ARG VE PENVAR SVMMAR AXIIIA CC ASPASIA POLIDDORI	*Cord(ula) L(ixitana) arg(uta) ve(tus)* *penuar(um)* *summar(um)* *(annorum) XIII* *CC* *Aspasia Poli<d>dori*	Beltrán IIA (Pompeii VII)	*CIL* IV, 9370; Cerri 2006: Cat. 10; Liou 1987: 66-67; Manacorda 1977: 126 for amphorae type
29	36	*Lixus*	Pompeii	Punico-Mauretanian/Roman	Cordula (?)	CONDT ARG LI PENVAR CI AAA TRII	*Cond(i)t(um ?) arg(utum)* *Li(xitanum)* *penuar(um)* *CI* *(annorum trium?)*	Beltrán IIA (Pompeii VII)	*CIL* IV, 10286a; Cerri 2006: Cat. 12; Cerri 2007a: Fig. 7, no. 18; Liou & Rodríguez Almeida 2000: 13, n. 19; Manacorda 1977: 126 for amphorae type
30	36	*Lixus*	Pecio Gondolfo wreck	Punico-Mauretanian/Roman	Cordula	COD PORT LIX VET EXCEL SVMMVR AIIIA	*Co(r)d(ula) port(uensis)* *Lix(itana) vet(us)* *excel(lens)* *summ(arum?)* *(annorum trium)*	Beltrán IIB	Liou & Rodríguez Almeida 2000: 11, n. 1; Cerri 2006: Cat. 15; Cerri 2007a: Fig. 7, no. 1; Liou 1987: 69
31	36	*Lixus*	Augst	Punico-Mauretanian/Roman	Cordula	CORD LIX VET [---] SVM[-] EXCEL LXX M[---]	*Cord(ula) Lix(itana) vet(us)* *[penuarum]* *sum(marum)* *summa(rum)* *LXX* *M[---]*	Beltrán IIB	Martin-Kilcher 1994: P27 (4179), p. 404; Cerri 2006: Cat. 18; Cerri 2007a: Fig. 7, no. 10
32	36	*Lixus*	Mainz	Punico-Mauretanian/Roman	Cordula	COD LIX VE EXCELL [---]M LXX PROCVLI ET VRB[-	*Co(r)d(ula) Lix(itana) ve(tus)* *excell(ens)* *[---]m(arum)?* *LXX* *Proculi et Urbici*	Indeterminate	Martin-Kilcher 1994: 564-565, n. 991, fig. 272.1; Cerri 2006: Cat. 21; Cerri 2007a: Fig. 7, no. 5
33	36	*Lixus*	Aquileia	Punico-Mauretanian/Roman	Cordula	CORDL[...	*Cord(ula) L(ixitana)?*	Indeterminate	Liou & Rodríguez Almeida 2000: 13, n. 16; Cerri 2006: Cat. 23; Cerri 2007a: Fig. 7, no. 14; Liou 1987: 68, n. 25)

Appendix 5.
Pictorial representations

This catalogue contains selected pictorial representations from *Mauretania Tingitana* that depict fish and all the images that depict fishing known from the Punico-Mauretanian to Late Roman periods. They are arranged in general chronological order.

Cat. 1. Ornamental disc/medallion
Inv. none
Provenance: *Tamuda*
Material: terracotta
Date: Punico-Mauretanian (3^{rd}-2^{st} c. BC)
Description: Ornamental terracotta disc from the Punico-Mauretanian settlement of *Tamuda*. The disc depicts a man riding a sea monster-like creature (horse with fish tail) facing left, brandishing a multi-barbed harpoon, raised up behind his head. Surrounding the scene are six smaller fish-like creatures, which have been identified as possibly also including sharks and maybe also a whale. The edge of the disc is bordered by raised dots. A series of discs were found at *Tamuda*, but this is the only one with a marine scene.
Location: unknown
Reference: Tarradell 1960: 112-114, fig. 31; Fumadó Ortega 2006; Bernal Casasola 2009b: 271-272, fig. 5

Cat. 2. Coin
Inv. LR.79.M1
Provenance: *Lixus*
Material: bronze
Date: Punico-Mauretanian (2^{nd}-1^{st} c. BC)
Description: Max Ø: 3 cm
Weight: 15.4 g
Coin very worn. *Obverse:* Two heads of wheat, parallel; 'LIXS' at bottom. Entire face encircled with raised dots. *Reverse:* Two fish in profile, generic in style, thin and facing the same direction, much like the wheat heads on the obverse (and in the same orientation). Entire coin face encircled with raised dots; off-struck.
Location: Musée Archéologique, Larache
Reference: Ripoll López 1988 (for type); Alexandropoulos 1992: 252-253 (for type and date); Boube 1992: 261; Aranegui Gascó, *et al*. 2000: 22 (for date); Tarradell-Font 2001

Cat. 3. Amphora graffito
Inv. none
Provenance: *Lixus*
Material: ceramic
Date: Punico-Mauretanian (50-20 BC)
Description: Rough fish graffito, facing upwards, carved on the neck of a broken Mañá C2b amphora. No contents are known in this particular example.
Location: Musée Archéologique, Larache
Reference: Aranegui Gascó, *et al.* 2006: 358, fig. 16; Aranegui, *et al.* 2007: fig. 3

Cat. 4. Lamp
Inv. 99.3.7.704
Provenance: *Thamusida* (East necropolis)
Material: ceramic
Date: Roman (1st-3rd c. AD)
Description: Length: 11.3 cm
Width: 8 cm
Type: Ponsich II, BI
Pouter-pigeon style lamp with central scene depicting a man, facing left and sitting on a rock under a tree, He is holding a fishing rod in his right hand with a fish dangling off the end of the line. He is possibly holding a basket in his right hand.
Location: Musée Archéologique, Rabat
Reference: Rebuffat 1977: 184, Pl. 42, no. 1437

Cat. 5. Mosaic
Inv. none
Provenance: *Volubilis*, "Maison de Desultor"
Material: stone tesserae
Date: Roman (1st-2nd c. AD)
Dimensions: 1.72 x 1.34 m (scene only)
Description: From "Maison de Desultor" (also called "Maison aux mosaïques"). From a house situated between the *forum* and the triumphal arch of Caracalla. The mosaic depicts a fishing scene: in the upper register, heavily damaged in the upper right, three fishermen are moving from left to right (Image 2). Left-most fisherman holds a possible cast net, and the other two might be using cast nets (Image 1). In the middle left register is a fisherman who appears to be sitting in the water with a rod and line hooked to a fish (Image 1). To the left of this fisherman are two large and two small fish. Above him are the letters PISCAI. In the bottom right register is a fish (eel or dolphin[?], see Image 2). The scene consists of orange, yellow, grey and black tesserae on a white background.
Location: exposed at *Volubilis*, no longer *in situ*
Reference: Chatelain 1935b: 69; Chatelain 1918: 17; Chatelain 1933: 14; Limane, *et al.* 1997: 38; Luquet 1972: 73

Image 1

Image 2

Cat. 6. Mosaic

Inv. none

Provenance: *Volubilis*, “La Maison de l’Éphèbe”

Material: stone tesserae

Date: Roman (3rd century AD)

Dimensions: 3.10 x 3.20 m (scene only)

Description: From the “La Maison de l’Éphèbe”, on eastern part of the upper plateau of the city, just north-west of the triumphal arch of Caracalla. Floor of the north room of three-room bath complex on the east side of the peristyle court. Scene consists of central octagonal medallion (ca. 1.35 mº) with pointed edges surrounded by four circular medallions (1.05 mº) connected by four lozenges (0.45 cm L) (Image 1). Central octagonal medallion is heavily damaged. On the west side of the medallion, there is a yellow trident held by an arm that is disembodied; trident poised above a brown and white fish. The remainder of the medallion is missing (Image 2). At the north side of the medallion is a black and red branch (coral?) with an orange and white fish and white octopus (Image 3). The floor consists of red, black, brown, yellow, green, pink, blue, pink and white stone tesserae. Medallions have dark brown backgrounds. The floor is surrounded by yellow, black and white braid and egg-and-dart pattern border.

Location: exposed *in situ* at *Volubilis*

Reference: Thouvenot 1949: 52; Luquet 1972: 80, Pl. XXXII; San Nicholás Pedraz 2000: 1073-1087 (for date)

Image 1

“La Maison de l’Éphèbe” at Volubilis:
trident detail (left); coral and fish (above).

Appendix 6.
Ethnography

This catalogue is primarily comprised of artisanal fishing equipment, practices, related vessels and catches documented in northern Morocco and southwest Spain by the author between 1999 and 2009. Included is similar published material, documented in the same region in the 20th and 21st centuries. The catalogue is organised into four regions: the Mediterranean (1), Straits of Gibraltar (2), and Atlantic (3) coasts of northern Morocco, as well as southwest Iberia (4). The numbers on the map below correspond to the catalogue site numbers.

Appendix 6.1.
Mediterranean coast

Cat. 1.1. **Oued Moulouya.** Top and middle: trap nets ('hoop-nets') that are usually set just inside the mouth of the river, brought up onto the banks when not in use. Bottom: fishing boats beached inside the river mouth (March, 2007). Photos: ALT

Cat. 1.2. **Ras el Ma.** Artisanal fishing boats and offshore trawlers in the modern port. Note the cement blocks used as weights for the nets in the foreground (March, 2007). Photo: ALT

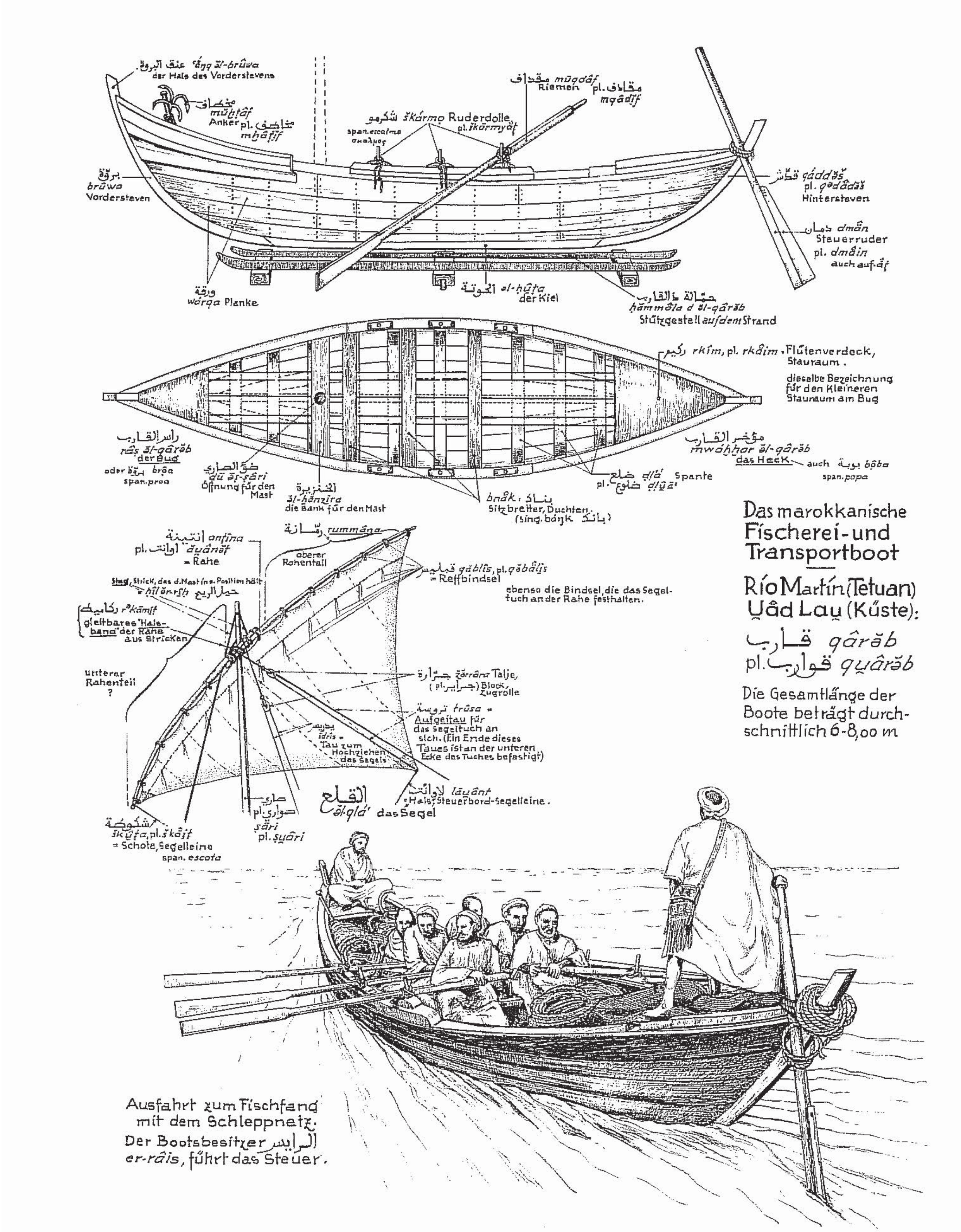
Cat. 1.3. **Al Hoceima.** Left: hand-lining just offshore in the Mediterranean, in front of Al Hoceima Bay. Right: morning catch from long-lining techniques. Bonito (*sarda sarda*) in the foreground and dogfish shark (*Centroscymnus coelolepis*) in the background (March, 2007). Photo: ALT

Cat. 1.4. **Badis.** Small *platera*-type vessels used by artisanal fishermen are beached on the tombolo/spit when not in use (March, 2007). Photo: ALT

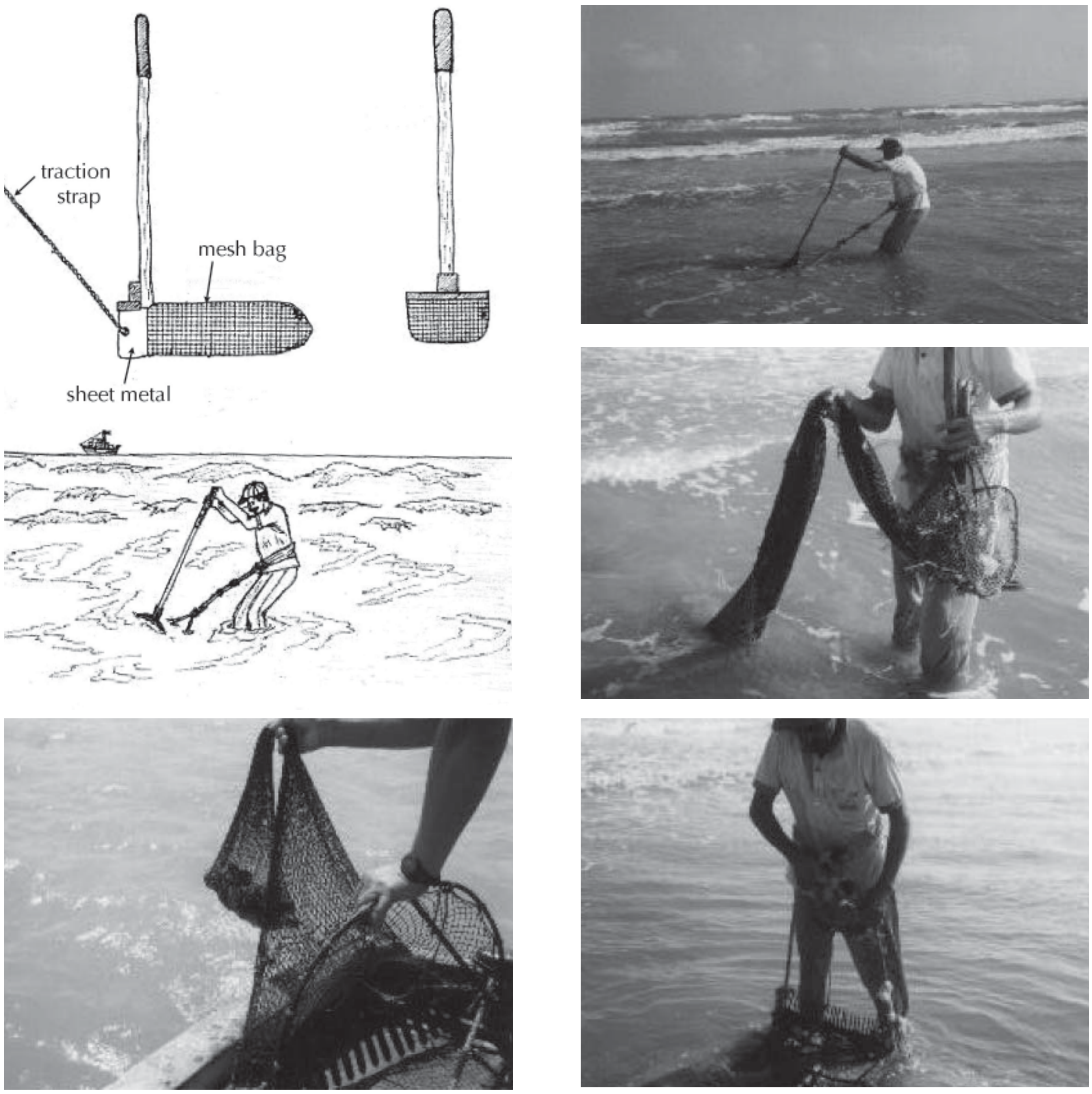
Cat. 1.5. **Cala Iris.** Left: a *lamparo*-type boat, for fishing at night and mainly used for shrimp and squid. Right: a fisherman mends purse seine nets with a navette. Note the lead weights along the net's edge (March, 2007). Photos: ALT

Cat. 1.6. **Amtar (1).** Beach seine-net fishing, practised by about 15 fishermen (*bahris*). Top: the boat has just brought the end of the net to the second group of fishermen waiting on shore. Middle: the owner of the net/head fisherman (*raïs*; the man in the striped *jeleba*) instructs the *bahris* about when and where to move on the beach. Bottom: the net's cork floats (left) and stone weights (right) (March, 2007). Photos: ALT

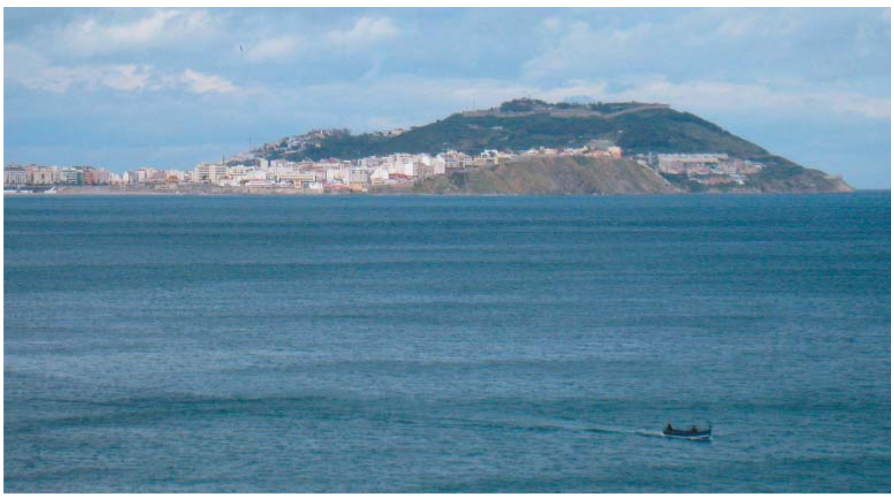
Cat. 1.6. **Amtar (2).** Top: bringing the boat ashore after the haul of the seine net is finished. Bottom: the small volume of catch, which took an hour to fish, brought in some sardines, needlefish and starfish (March, 2007). Photos: ALT



Cat. 1.7. **Oueds Laou/Martil.** Rowed and sailed fishing and transportation boats (*qârəb*) used along the coast from Oued Laou to Oued Martil in the 1950s (from Rackow 1958: Pl. XLIX).



Cat. 1.8. **Tetouan Bay.** Artisanal shellfish collecting techniques, using a metal rake with a bag, for oyster and scallops. These techniques can also be used from a boat (bottom left) (from Shafee 1999: fig. 19, Pls 6-7).



Cat. 1.9. **F'nideq.** A *platera* fishing boat used for hook-and-line fishing in Ensenada de Ceuta, here in front of Monte Hacho (April, 2009). Photo: ALT

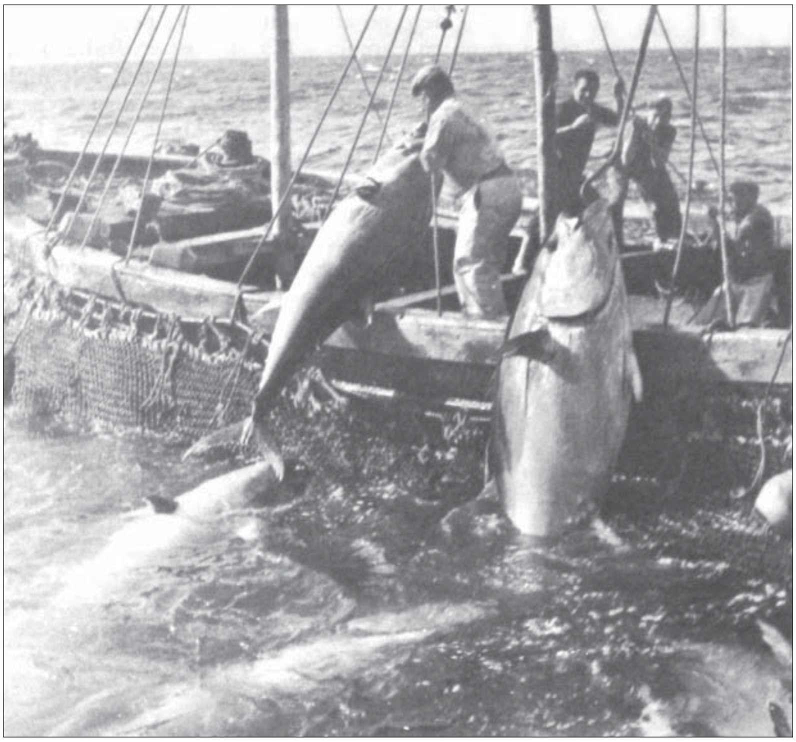
Appendix 6.2.
Straits of Gibraltar coast

Cat. 2.1. **Tangier Bay.** Top: trawlers and long-liners in the port. The two boats in the left background, with blue masts, are those used for pulling up the lift net in the '*chambre de la mort*' of the *al-madraba* net set off Ras Achakar in the Atlantic (see **3.1 Ras Achakar**). Bottom: trawlers and small long-liners side-by-side in the port (July, 1999). Photos: ALT

Appendix 6.3.
Atlantic coast

Cat. 3.1. **Ras Achakar (1).** Top: the *al-madraba* tunny net (pound net) set in mid-March at Ras Achakar. The net is set less than a kilometre offshore, with the edges of the chambers marked by orange floats. The *'chambre de la mort'* is indicated by the arrow. As the tunny are just beginning their spawning migration northwards along the coat into the Mediterranean ('*fase de derecho'*), the *chambre de la mort* is the northern-most of the series of chambers. Note the rod fishing taking place in the surf zone (March, 2007). Bottom: The *al-madraba* in mid-April, now with several boats anchored around the edges of the *chambre de la mort*. These were towed out to the net in anticipation of the fish beginning their migration (April, 2007) Photos: ALT

Cat. 3.1. **Ras Achakar (2).** Fishing for tunny using the *al-madraba* net (pound net) set off Ras Achakar in 1965. Top: fishermen gather in several boats that surround the *chambre de la mort*, the final chamber of the net. The fishermen then start pulling up the lift net from the bottom of the *chambre*. Bottom: the lift net is attached to lines leading to the masts of the boats that surround the *chambre* (from Ponsich 1988: 95, fig. 36).



Cat. 3.1. **Ras Achakar (3).** Bringing the tunny that have been brought to the surface on board the waiting boats using gaff hooks (from Ponsich 1988: 91, fig. 35, 99, fig. 38).

Cat. 3.2. **Larache.** Top: a small *flouka* under construction in a shipyard in Larache. Bottom: a near-finished *flouka* primed against rot. The arrow points to the fish well, much like those in Roman a *navis vivaria* (July, 2002). Photos: ALT

Cat. 3.3. **Oued Loukkos (1).** Crossing the Oued Loukkos was done by pulling on a line set across the river whilst standing on a float made of reeds. These photos date to the early 1960s (from Ponsich 1966a: Pl. VI).

Cat. 3.3. **Oued Loukkos (2).** Angling from the banks of the Loukkos (left), and tunny boats for the *al-madraba* offshore of Larache (right), anchored off-season in the river. The plateau of *Lixus* is at the far right (April, 2009). Photo: ALT

Cat. 3.3. **Oued Loukkos (3).** The floats of a gill net, set 2 km upriver in the Oued Loukkos (April, 2009). Photo: ALT

Cat. 3.4. **Merja Zerga.** Small fishing boats enter and exit the lagoon of Meja Zerga at Moulay Bouselham by the narrow break in the Atlantic dune ridge (looking west) (April, 2007). Photo: ALT

Cat. 3.5. **Oued Sebou.** Fishermen setting several gill/trammel nets for shad across the Oued Sebou. The net is set across the river by boat, and its position checked by boat periodically before it is drawn up. These nets are set in front of the site of *Thamusida* (March, 2005). Photos: ALT

Cat. 3.6. **Oued Bouregreg.** Hook-and-line fishing from a boat several kilometres upriver on the Oued Bouregreg. The site of *Sala* is in the background behind the rail bridge (October, 2007). Photos: ALT

Cat. 3.7. **Fédhala.** The landing of tunny caught in the *al-madraba* nets set off Fédhala in the early 1920s. The tunny fishing boats at this time, seen in the background, still used sails (from Gruvel 1923: Pl. XIV, fig. 28).

Cat. 3.8. **Moulay Abdallah (1).** Left: collecting shellfish at low tide in the *corrales* (constructed tide pools) just south of El Jadida. Right: angling in the *corrales*, inside which fish get trapped during low tide (October, 2007). Photos: ALT

Cat. 3.8. **Moulay Abdallah (2).** Top: fishermen return to shore after mackerel and eel fishing. The arrow points to the long-lining bait/hook box that is set inside these small *plateras*. Bottom: removing the box (October, 2007). Photos: ALT

Cat. 3.8. **Moulay Abdallah (3).** Top: a fisherman makes chum-bait by taking a catch of mackerel (caught by hook-and-line) and smashing the fish in a hole in the stone, mixing the meat with sand. (Fishermen who practise this in the Pacific Ocean say that this releases the oils and makes them "smell" very good. The sand which sticks to the fish adsorbs the oils and helps to prolong the effect. [Information collected by L. Huff, Dutch Harbor, Alaska].) Bottom: the mackerel is used as hook-and-line bait for the main artisanal catch of the region, moray eels (*Muraena helena*) (October, 2007). Photos: ALT

Cat. 3.9. **Essaouira (1).** Top: preparing long-lines for offshore fishing in the port of Essaouira. The wooden box around which they set the hooks sits in the centre of the small fishing boats (compare to those from Moulay Abdallah). (October, 2007). Photo: ALT. Bottom: baiting the long-line hooks with sardines (October, 2007). Photo: L. Huff

Cat. 3.9. **Essaouira (2).** Artisanal fishing boats in the port at Essaouira. The arrow points to a pad that is set on the starboard side of the boat, which fishermen lean against when long-lining, hand-lining or recovering nets (March, 2003). Photo: ALT

Cat. 3.9. **Essaouira (3).** Left: returning with an early morning catch of sardines that were caught by seine nets. The fish are thrown into the bottom of boat in a mixture of salt water and strained out once the boats reach port. Right: pouring salt over the sardines – these were destined for the market in the town of Had Draâ, ca. 30 km inland. The transport inland is reminiscent of the *tahammort* system practiced in the Rif (October, 2007). Photos: ALT

Cat. 3.9. **Essaouira (4).** Repairing a net with a plastic navette (detail) in the port of Essaouira (October, 2007). Photos: ALT

Cat. 3.9. **Essaouira (5).** Weighted *murex* shellfish baskets/weels in the port of Essaouira. These are set from a boat (October, 2007). Photo: ALT

Cat. 3.9. **Essaouira (6).** Fishermen cleaning their low-tide, early-morning collection of mussels and other shellfish in front of the seawall at Essaouira (October, 2007). Photo: L. Huff

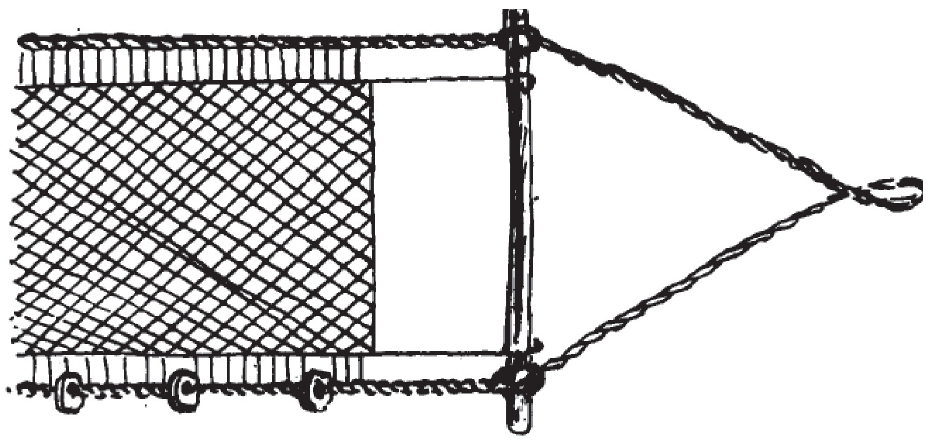
Cat. 3.9. **Essaouira (7).** Simple stones and bricks used as fishing net weights (October, 2007). Photo: ALT

Cat. 3.10. **Cap Sim.** Left: fishing in the littoral zone with a long-line near Cap Sim (just south of Essaouira) in the early 1920s (from Gruvel 1923: Pl. IV, fig. 7). Right: fishing in the rocky littoral zone with a *crochet* and harpoon near Cap Sim (from Gruvel 1923: Pl. III, fig. 6).

Cat. 3.11. **Oued Sous (1).** A wooden navette (*lqlem* in Berber) used along the Sous coast near Agadir in the early 1920s (from Laoust 1923: 254, fig. 16).

Cat. 3.11. **Oued Sous (2).** A harpoon (*amur* in Berber) used in the Sous coast near Agadir in the early 1920s (from Laoust 1923: 257, fig. 19).

Cat. 3.11. **Oued Sous (3).** A crochet (*ayonju* in Berber) used in the Sous coast near Agadir in the early 1920s (from Laoust 1923: 257, fig. 20).



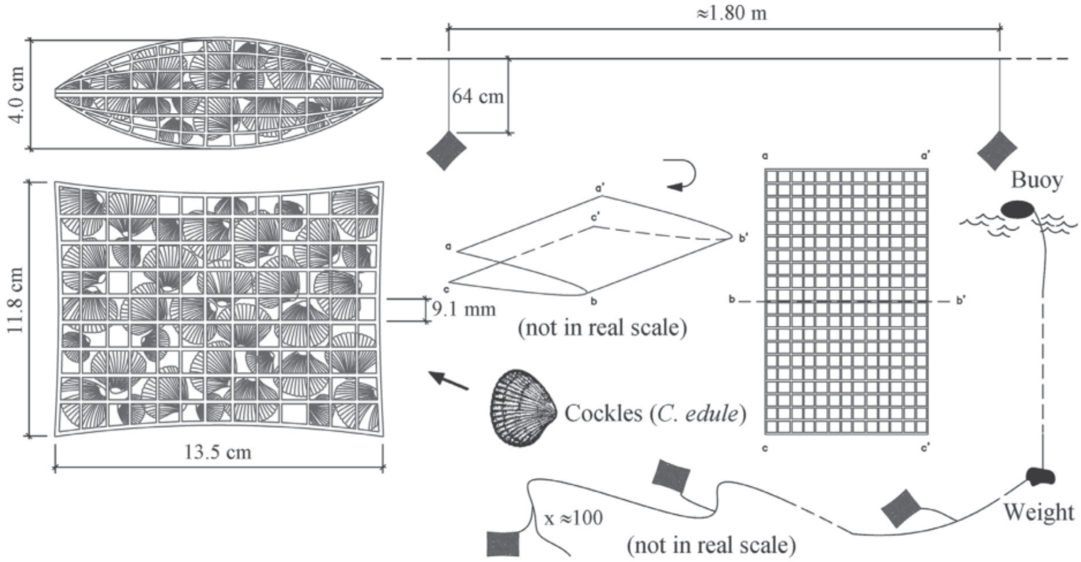
Cat. 3.11. **Oued Sous (4).** Diagram of a net type (set gill net) made of palm fibre that was fixed across the mouth of the Oued Sous in the early 1920s (from Laoust 1923: 256, fig. 18).

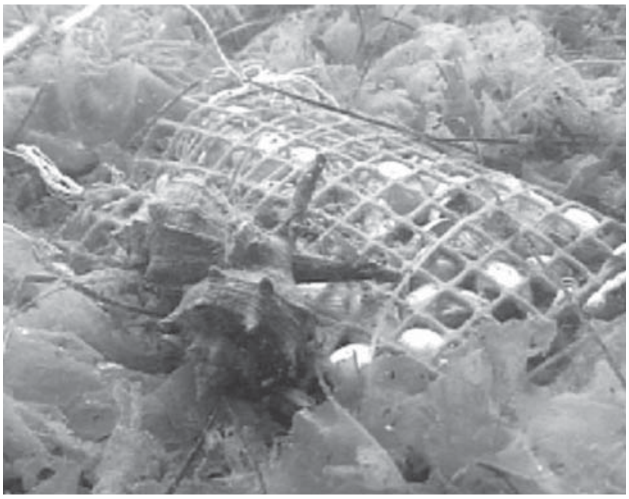
Appendix 6.4.
Southwest Iberian coast

Cat. 4.1. **El Puerto de Santa María, Spain.** The hypobranchial gland of a spiny-dye murex shellfish (*Murex [bolinus] brandaris*). This example has been steamed in its shell to be eaten (November, 2007). Photo: ALT

Cat. 4.2. **Corrales de Rota, Spain (1).** Small lead weights that line the edge of a cast net of the types used near and in the *corrales* near Cádiz (November, 2007). Photo: ALT

Cat. 4.2. **Corrales de Rota, Spain (2).** Using a cast net from the sandy shoreline outside the *corrales* near Cádiz (November, 2007). Photos: ALT





Cat. 4.3. **Ria Formosa, Portugal.** In the coastal lagoon at Ria Formosa, fishermen set wallet lines from boats (diagram, top). Formerly made of flax, these are now made of plastic and baited with cockles in order to attract *murex* species; here spiny-dye murex (*Murex [bolinus] brandaris*) are caught (from Vasconcelos, *et al.* 2008: 290-291, figs 2, 3b).

Appendix 7. Historical maps

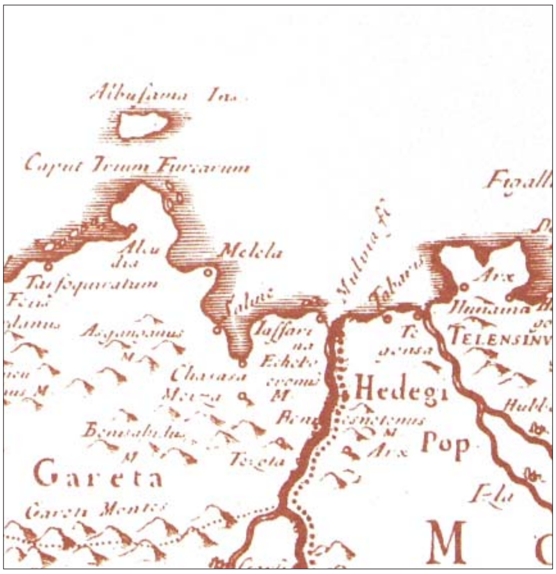
This catalogue contains parts of selected maps from collections held in the Tangier American Legation Museum (Morocco) and and Museo Municipal de Melilla (Spain). Permission for the images to be reproduced here was granted by the mueums. The maps are arranged in this catalogue by date and the specific area shown is noted at the end of the reference in bold italics.

Map 1. *Araccensis in Africa Munitionis Catholica regi traditae*. Anonymous (Lisbon 1610): ***Larache/Lixus.***

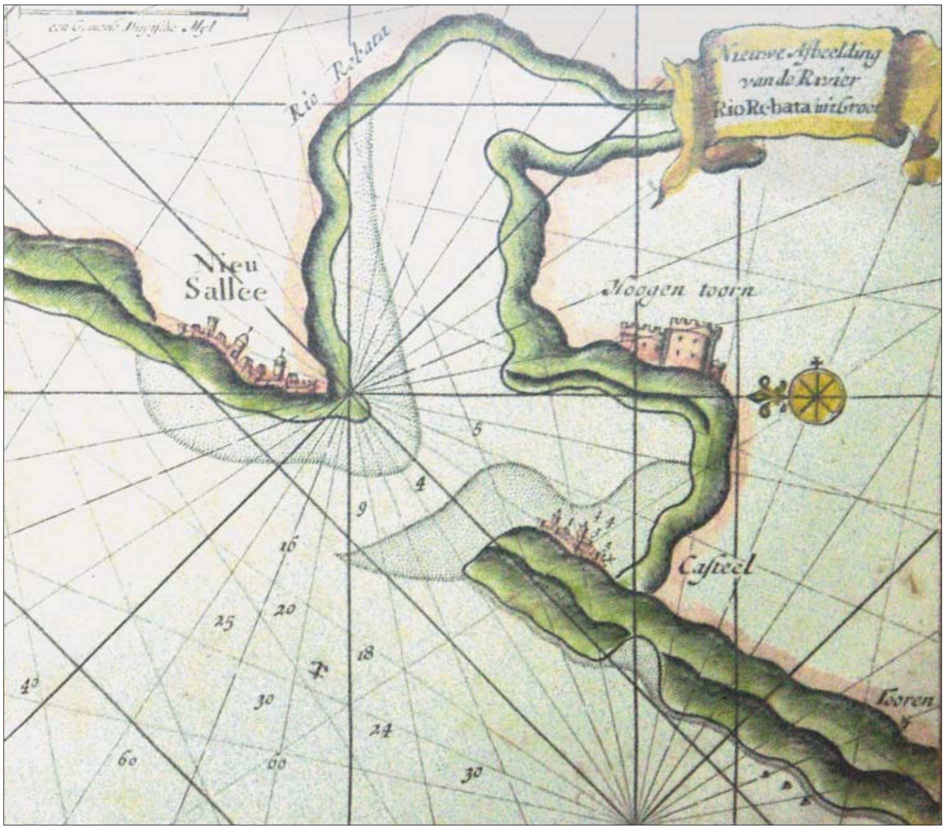
Map 2. *Plano de Larache.* J.B. Antonelli. Cortesía del Archivo de Simancas (Toledo 1611): ***Larache/Lixus.***

Map 3. *Fezzae et Marrochi Regna*. Willem Jan Blaeu (Amsterdam ca. 1635): ***Rusaddir/Melilla and Nador (left); Merja Zerga (right).***

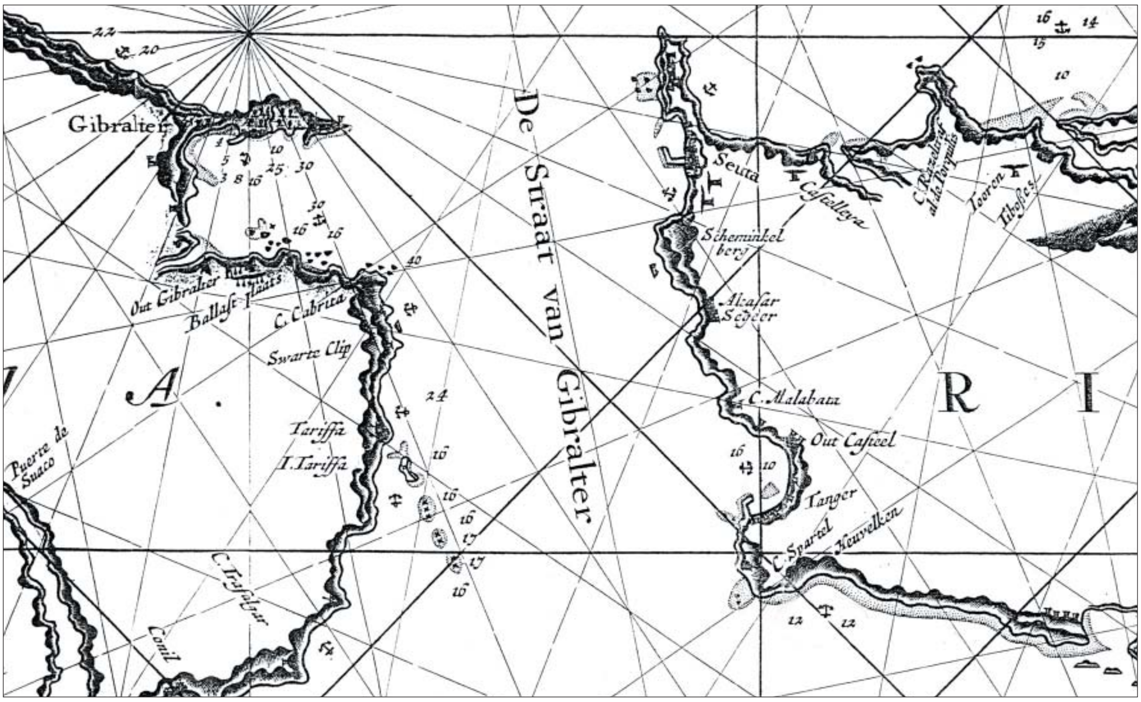
Map 4. *Estats et Royaumes de Fez et Maroc Darha et Segelmesse, tires de Sanuto de Marmol &c.* N. Sanson, Pierre Mariette (Paris 1655): ***Larache/Lixus and Merja Zerga (left); Rusaddir/Melilla and Nador (right).***



Map 5. *Paskaart Van de Kust Maroca beginnende can Larache tot ann C. Cantin*. Iohannis van Keulen (Amsterdam ca. 1680): ***Oued Bouregreg.***



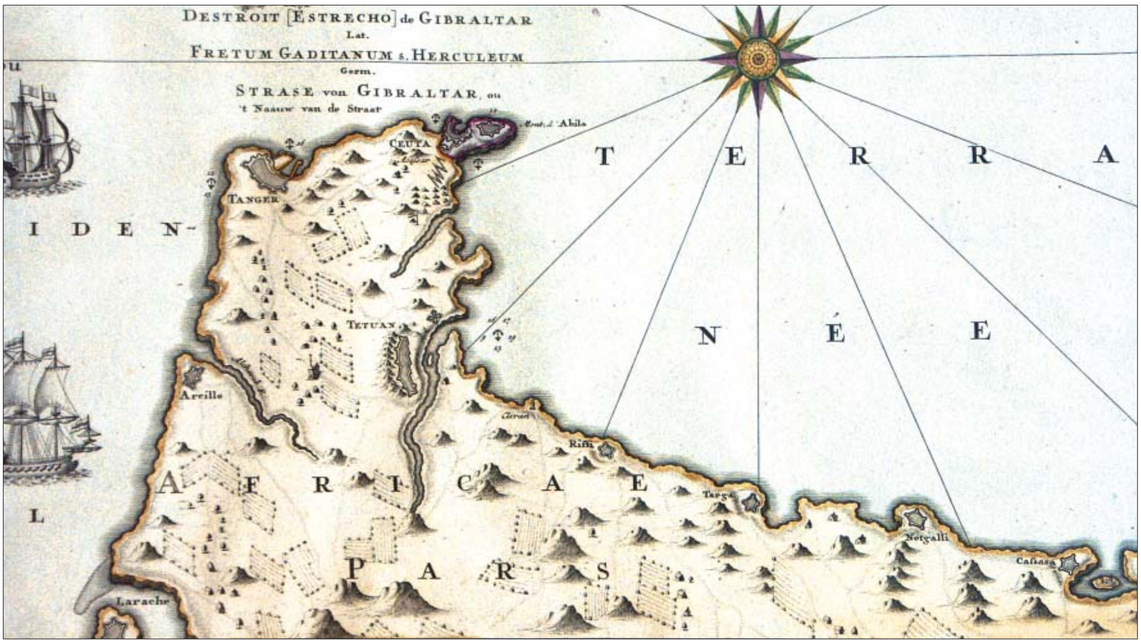
Map 6. *Nieuwe Paskaart Vande Kust vane Hispania. De Groote Nieuwe Vermeerderde Zee Atlas ofte Waterwerelt.* Johannes Van Keulen (Amsterdam 1694): ***Oueds Martil and Smir.***



Map 7. *Nieuwe Pafkaart ant Naauw van de Straat, opgedragen aan den Hoog Edel; geboren Heer F. van Aerssen van Sommelsdyk.* Hendrik Lynslager (Amsterdam 1726): ***Oueds Martil and Loukkos.***

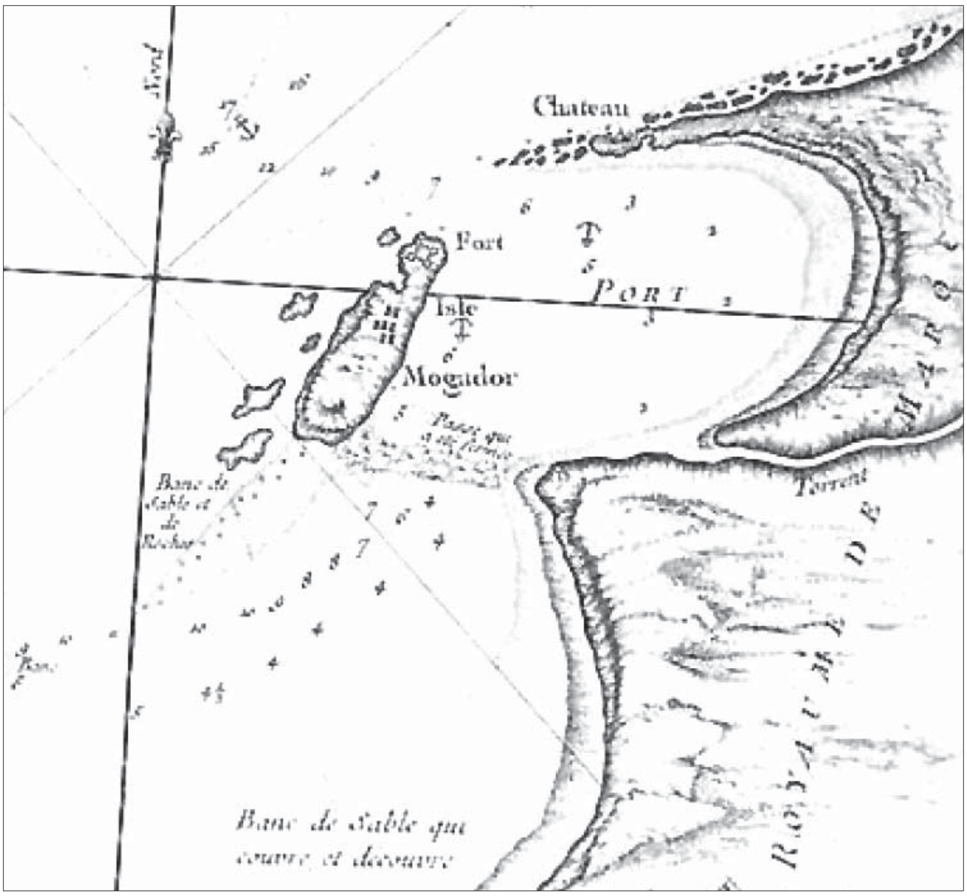
Map 8. *Statuum Marocca Norum. Regnorum nempe Fessani, Maroccani, Tafiletani et Segelomessani.* Johann Baptist Homann (Nuremberg 1728); ***Oued Oum-er-Rbia (left); Rusaddir/Melilla and Nador (right).***

Map 9. *Carte nouvelle de l'Isle de Cadix & du Detroit de Gibraltar.* Jean de Petit. Homann Heirs (Nuremberg 1730): ***Larache/Lixus.***

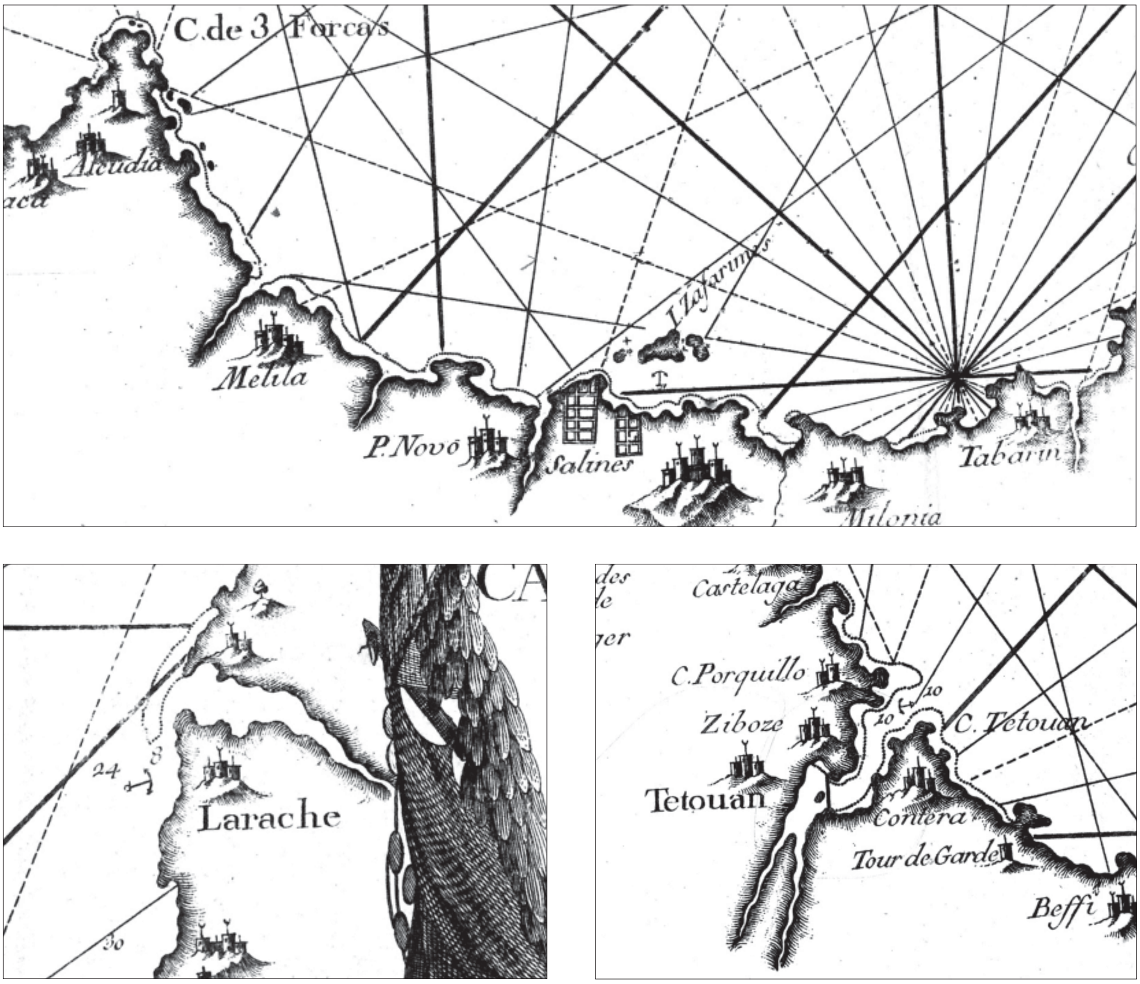


Map 10. *Carte Topographique des pays et côtes maritimes qui forment le Détroit de Gibraltar.* Homann Erben. Hertiers de Homan (Nuremberg 1756): ***Oued Martil and Septem Fratres/Ceuta.***

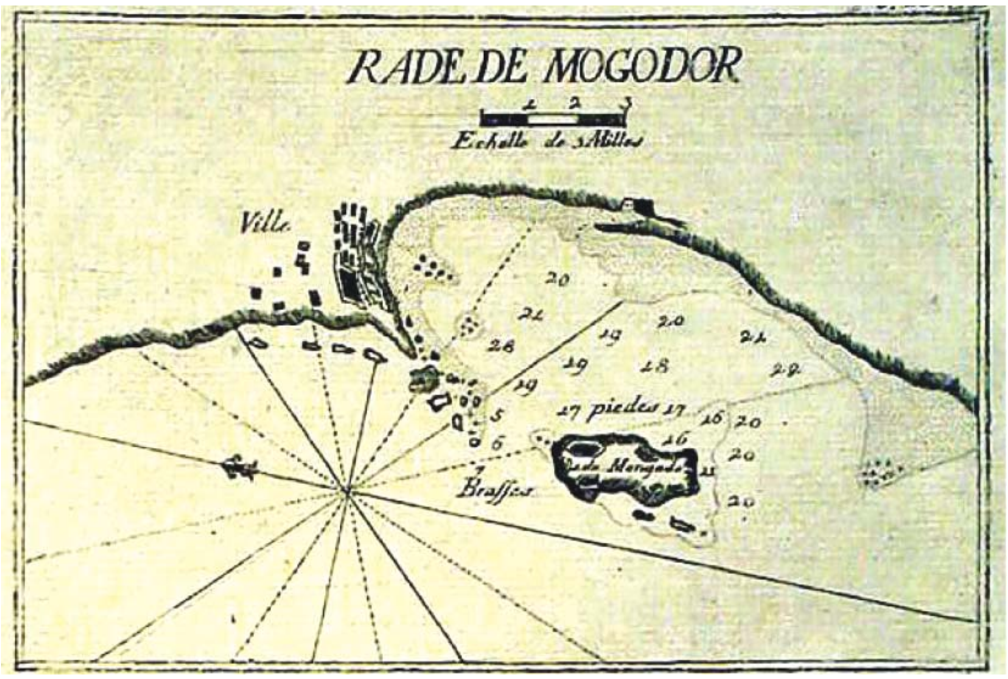
Map 11. *Plan de la grande Isle de Mogador. Ses Mouillages et son Port.* J. Bellin (Paris 1761): ***Essaouira.***



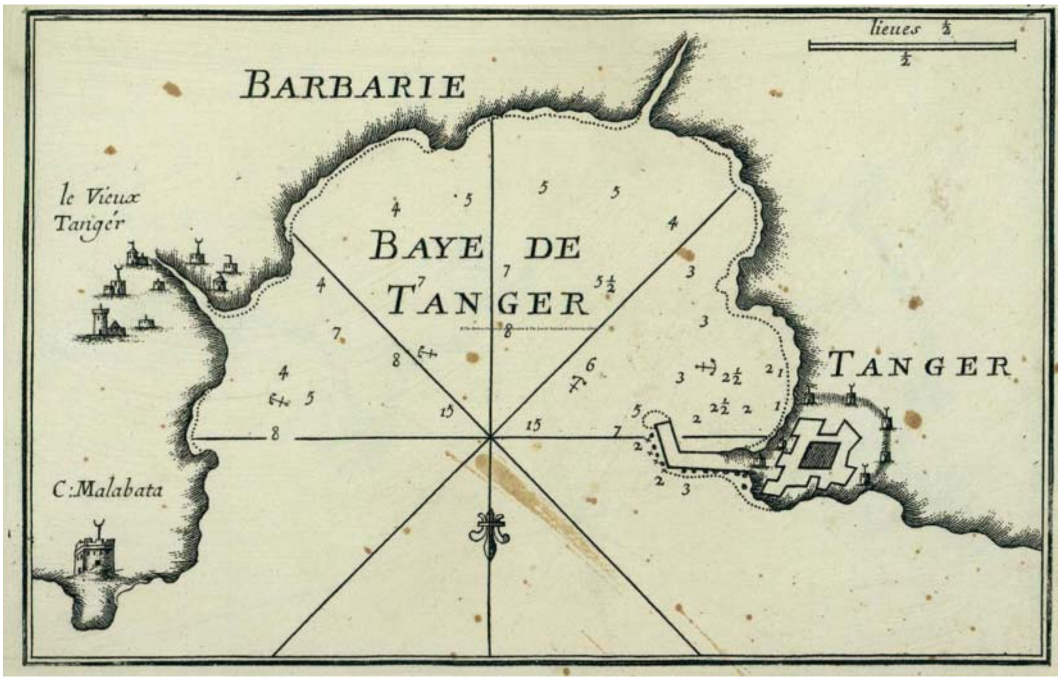
Map 12. *Des Principaux Plans Des Ports et Rades de la Mer Mediterranee.* J. Roux (Marseille 1764): ***Nador (top); Oued Loukkos (bottom left); Oued Martil (bottom right).***



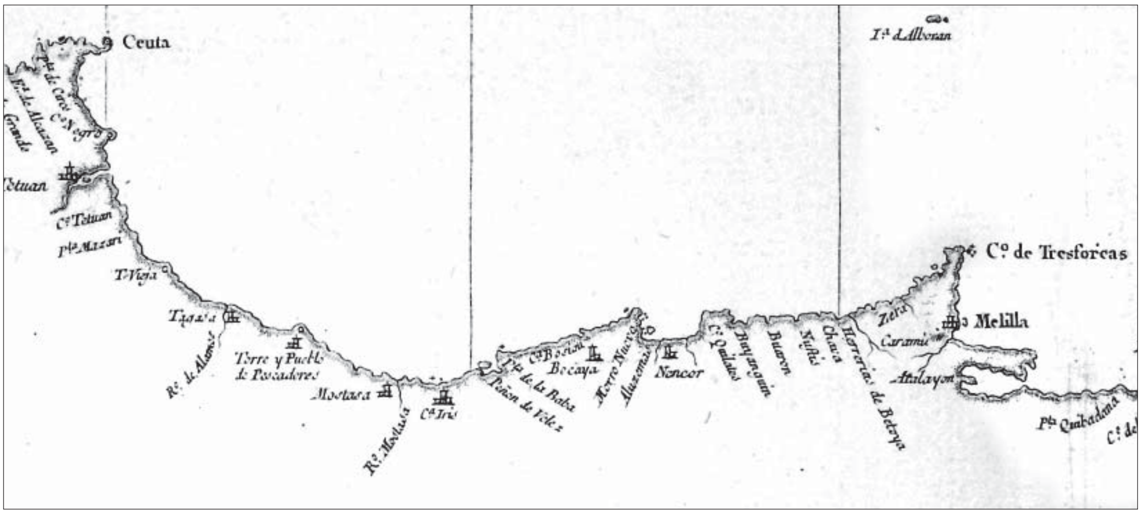
Map. 13. "Rade de Mogador," *Des Principaux Plans Des Ports et Rades de la Mer Mediterranee. Estraits de ma Carte en Douze Feuilles*. J. Roux (Marseille 1764): Pl. 250A: ***Essaouira.***



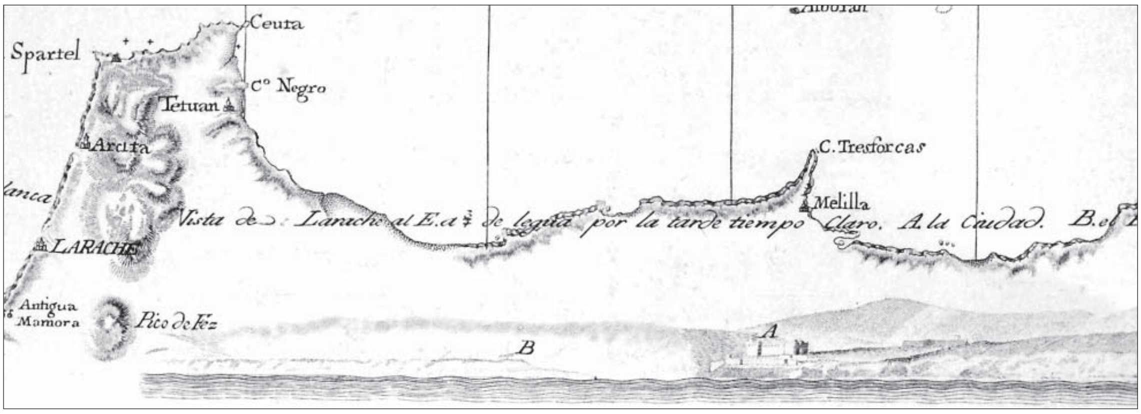
Map 14. "Baye de Tanger," *Des Principaux Plans Des Ports et Rades de la Mer Mediterranee. Estraits de ma Carte en Douze Feuilles*. J. Roux (Marseille 1764): Pl. 47: ***Tingi/Tangier.***



Map 15. *Carta esférica de la Costa de España en el Mediterraneo, y de su correspondient de Africa*. Vicente Tofiño de Sn. Miguel (Madrid 1786): ***Nador and Oued Martil.***

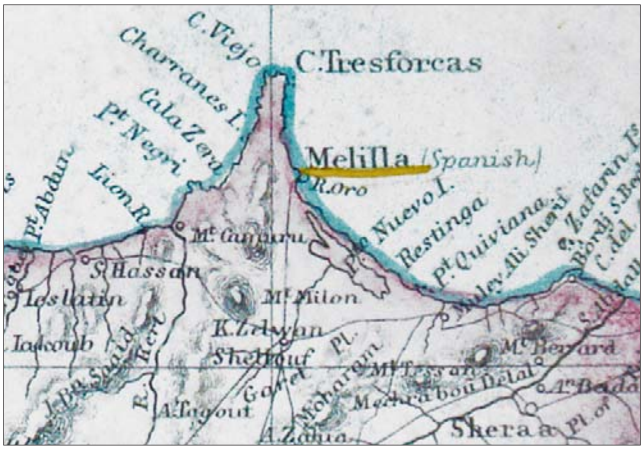


Map 16. *Carta Esferica de la costa de Africa desde Cabo Espartel a Cabo Bojador e yslas Adyacentes*. Joseph Varela y Ulloa (Madrid 1787): ***Nador and approach to Larache (in profile).***



Map 17. *Plano del Peñon de Velez de la Gomera con inclusion de la Ysleta parte del Campo Fronteriro.* Copy of the Archive of the Governor (Melilla 1814): ***Peñon de Velez de la Gomera.***

Map 18. *Marocco*. James Wyld (London 1859): ***Nador.***



Map 19. *Map of Morocco*. John Dower (London 1860): ***Oued Loukkos and Merja Zerga.***

Map 20. *Mapa del Imperio de Marruecos*. Lalloz (Madrid 1867): ***Nador.***