A MACROECONOMIC AND SPATIAL ANALYSIS OF LONG-DISTANCE EXCHANGE: THE AMPHORA EVIDENCE FROM ROMAN BRITAIN

by César Carreras Monfort

Doctor of Philosophy

September 1994

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF ARTS

ARCHAEOLOGY

Doctor of Philosophy

A MACROECONOMIC AND SPATIAL ANALYSIS OF LONG-DISTANCE EXCHANGE: THE AMPHORA EVIDENCE FROM ROMAN BRITAIN

by César Carreras Monfort

This thesis examines the economic and social implications of amphorae distribution in Roman Britain. The study reconsiders economic models on long-distance exchange developed in Classical History, following exclusively an archaeological perspective. Such an attempt required the introduction of new methods and techniques for the analysis of archaeological data and their economic interpretation. Consequently, the thesis presents original methodology for the study of pottery distribution, the results of which draw a completely different picture of Roman economy, at least, in the British Isles.

The research contemplates the study of amphorae in the initial place of recovery, aiming to discover common patterns of disposal and consumption at local level. In addition, the amphorae distribution is examined at a larger scale since it covers the province of Roman Britain as a whole. This approach permits the linking of amphora distribution to populations, transport networks, purchasing power and exchange mechanisms according to the conditions in Roman times. The interpretation of distribution patterns at both levels is assisted with the support of Geographical Information Systems, in which a series of simulation models have been implemented.

Amphorae evidence in Roman Britain represents the effect of long-distance exchange carried out by traders following a number of defined rules. The debate over the characteristics of these rules, also known as exchange mechanisms, becomes the objective in the present research. Therefore, the final theoretical proposals on the nature of long-distance exchange in Roman times can be considered the main contribution of this thesis.

LIST OF CONTENTS

Volume 1

Volume 2

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

This thesis would have never been undertaken without the collaboration and help of many individuals and Institutions. I am personally indebted to all of them for their time and kindness. First of all, I would like to thank all the curators, keepers or assistants of the Museums visited for the facilities to access the material and related information. I am grateful to: E.Cartwright (Tullie House, Carlisle); J.Miles (Corinium Museum, Cirencester); J.Owen (City & County Museum, Lincoln); A.Jones (Grosvenor Museum, Chester); H.Swain, R.Symonds, R.Tomber and J.Groves (Museum of London); A.Bone (Chichester District Museum); C.Green and H.Simons (Verulamium Museum, St.Albans); K.Buxton (Lancaster University Archaeology Unit, Lancaster); M.Taylor, M.Lyne and N.Moore (English Heritage, Dover Castle, Dover); M.Darling and B.Davies (City of Lincoln Archaeological Unit); RJ.Pollard (Leicestershire Museums); J.Ridge (Ribchester Museum, Ribchester); G.Plowright and N.Askew (Corbridge Museum, Corbridge); R.Iles and K.Parker (Winchester Museums Service, Winchester).

I must also thank the assistance of lecturers and the staff from other Museums to complete the references and illustrations of the amphora stamps. I would like especially to mention C.Wallace (Essex County Council, Chelmsford), who was very kind to send his own particular records. Moreover, I am indebted to A.P.Fitzpatrick (Wessex Archaeology, Salisbury) for showing me his umpublished material from Scotland. I am also grateful to R.White (University of Liverpool) and A.Leigh (Warrington Museum) who sent me numerous illustrations, which I enclose in the present thesis. Other people and Institutions that collaborated in the stamps catalogue are: C.Longworth (Liverpool Museum); R.Birley (Vindolanda Trust); J.Ruffle and RJ.Brickstock (University of Durham); A.Savage (Canterbury Archaeological Trust); K.L.Crowe (Southend-on-Sea Museum); L.Pontin (Bristol Museums); J.Allan (Exeter Museum); RJ.Brewer (Segontium Roman Fort Museum); F.Hunter (Royal Museum of Scotland, Edinburgh); D.R.Evans (The Glamorgan-Gwent Archaeological Trust); R.Rand (Calleva Museum, Silchester); L.Keppie (Hunterian Museum, Glasgow); L.Allason-Jones (University of Newcastle-upon-Tyne); and, A.Croom (Tyne and Wear Museums Service).

Furthermore, I cannot overlook the name of P.Crummy (Colchester Archaeological Trust); S.Willis (University of Durham); C.Addison (Northamptonshire County Council); J.Lopez; K.Greene (University of Newcastle-upon-Tyne); D.Gurney (Norfolk Landscape Archeology); S.Martin-Kilcher (University of Bern); F.Laubenheimer (University of Besançon); J.Molina Vidal (University of Alicante); J.Martínez Maganto (University Autonoma of Madrid) and, PV.Webster

(University of Wales) for their comments and supply of unpublished data. However I must especially mention the assistance of PR.Sealey (Colchester Borough Council), D.Zienkiewicz (Roman Legionary Museum, Caerleon) and MH.Callender for their always enjoyable correspondence.

With reference to technical matters, I am grateful to the members of the Geodata Institute from Southampton University (J.Davenport, J.Feaver and J.Gatward) for the support in the use of SPANS; and JL.Cuevas (Fac.Geology, University of Barcelona), Servei Cartogràfic de la Generalitat (Barcelona) and R.González (ESRI-España, Madrid) in the use of ARC-INFO. Furthermore, I must thank the collaboration and advice of P.Durham and F.Massagrande (University of Southampton) and J.Folch (Servei d'Arqueologia, Barcelona) as well as R.Alvarez, P.Berni and A.Aguilera (University of Barcelona). In addition, I was assisted in the final text with the aid of M.Peiró, C.Cessford and J.Watson, who I also thank.

I am also indebted to Mª D.Molas (University of Barcelona), S.Shennan (University of Southampton), MG.Fulford (University of Reading), G.Wolff (University of Oxford) and CR.Whittaker (University of Cambridge) for their comments and suggestions on initial drafts. Moreover, I must thank PPA.Funari (university of Sâo Paulo), who allowed me to study amphora stamps, for their constant advice and assistance. Finally, I am grateful to my supervisor, SJ.Keay, and advisors, DF.Williams and J.Remesal Rodríguez (University of Barcelona) for their dedication and unvaluable time. I really enjoyed learning from them all over these years.

Apart from my family, Judith and Ana, and friends already mentioned; I must remember the support of Maria Mertzani, Margarita Díaz-Andreu, Bernd Brink, Nicola Grochowski, Rin Tatebe and Cristina Ruiz. Without their presence, I would have never finished this PhD.

0. INTRODUCTION

The present thesis is a new attempt to study trade in Roman times on the basis of the archaeological evidence of amphorae. Trade or, in general, exchange, is a complex human activity with many aspects, not only of an economic nature. It facilitates communication between individuals, groups and societies with different beliefs, customs and purposes; they may even live at a certain distance from each other. Nevertheless, exchange takes place continously despite all the obstacles, affecting everyone's life to some extent. If the volume, variety of articles and distance covered through exchange appears amazing nowadays, with the numerous technical advantages; the experience of past societies looks even more astonishing.

Rome is probably one of the best examples of a society with a highly developed exchange due to its extension as a unique political entity and the volume of commodities traded. Although comparisons are always fraught with danger, it can be said that Rome reached a level of exchange which was not matched until the late middle ages. This high development of exchange was one of the foundations of its economy, and it is basic for understanding the overall Roman economic experience.

Therefore there are numerous reasons why Roman trade deserves a thorough analysis, related to the study of this particular period and society, or of the essence of exchange. The latter motif is worthwhile in the way that it might supply answers to solve present problems by equivalents in past societies. However, the fruits of the analysis become more evident in the strict comprehension of the Roman world, and above all its economy.

Unfortunately, no financial records survive from Roman period with the only exception of some texts, writing tablets and inscriptions. Consequently, research in Roman trade requires the analysis of archaeological testimonies, which provide an alternative source for reconstructing exchange. The use of archaeological records implies the painstaking task of collecting, classifying, quantifying and relating them to a context. Furthermore, every object has its particular constraints for interpretations, which create additional difficulties. Nevertheless, archaeological artifacts are, without doubt, the most suitable sources for the analysis of the Roman exchange in the sense that they are direct evidence without any human interference, as in the case of a text.

Amongst the numerous archeological artifacts, amphorae are probably the best suited for the study of long-distance exchange, because they were the commonest container for the transport of agricultural produce. The range of commodities carried for these vessels and the essential economic role of agriculture explain clearly the reason of its choice. Therefore, amphorae serve as direct testimonies of trade in this research and their attached information constitutes the central axis for many related topics. Apart from amphorae, other archaeological evidence (i.e. samian, coins, inscriptions, architecture) act as complements in the study of trade at different levels.

Amphorae were basically employed in long-distance commerce, so this kind of exchange is the one covered in the present thesis. In addition they also supply a limited testimony of the local exchange in the last stages of their distribution. Both ranges of trade define their own particular features, which are partially perceptible through the amphora evidence.

If an archaeological object is the principal source of information, Roman Britain happens to be the area of research for its role as destination point. Due to the extension of the Roman Empire, only a limited territory can be examined thoroughly as a case study. Thus, Britain is taken as representative of what was long-distance trade in the Roman world as a whole. Notwithstanding the particular characteristics of this province, Roman Britain as an island and the northernmost province constitutes an excellent example in practical terms. Furthermore, this province distinguishes a military and civil zone, which reflect two types of organizations and potential economic systems. Hence, Britain is a suitable starting point for the study of trade in this period.

In theoretical terms, exchange has been a continous focus of discussion among scholars through the years. Naturally, there are some paradigms that deserve more attention since they seem to identify the Roman economy as a particular experience. Four of these paradigms are the initial questions hopefully to be answered by the present research. The first one refers to the role of the market in the Roman economy as a mechanism of exchange, the second deals with the degree of monetization, and the third relates to the city as a consumer centre. The final paradigm discusses whether the Roman Empire can be defined as an economy at scale. The nature of trade becomes an essential point in the consideration of all these paradigms.

The initial chapter of this thesis describes the theoretical positions of different schools with reference to the four paradigms. With this background, the present research reconsiders them according to the partial testimony of amphorae in Roman Britain. On one hand, the archaeological evidence only examines particular problems related to this province. On the other hand, the evidence challenges previous general conceptions that can be applied to the Empire as a whole. The real difficulty is the adequate use of amphorae for economic inferences, which implies defining a serie of methods for sampling and quantifying them. The second chapter deals with these problems as well as the application of some analytical techniques in their study. Amongst the techniques introduced, the practice of simulation analyses and geographical information sytems (GIS) constitute a new contribution for the development of methodological tools in archaeology. This thesis presents a series of new computer models which is believed will have a significant role in further investigations.

The third chapter introduces all the types of amphorae recovered in the research sample. Therefore it updates the knowledge of every singular type according to the specialized literature and personal finds from the present sample. Up to this third chapter, only a detailed account of the background has been established following a sequence that starts from theory to method and object of study. Afterwards, the thesis reveals the original parts of the research, which comprise the actual data and its interpretation.

Like the initial chapters, the next ones follow another sequence that begins at the point of recovery of the amphorae to their origin, in an attempt to complete the whole commercial cycle. Thus, the fourth chapter examines the contextual information of amphorae in the final destination. The employment of these vessels, after their initial function, serves to analyse the patterns of rubbish disposal in the community. Amphora distributions at this level supply additional information on the site growth over the time. Likewise, their epigraphy compared to other archaeological artifacts (i.e. coins, samian) reveals the economic development of each Romano-British community. Moreover, the comparison permits one to recognize the degree of monetization in Roman times.

In contrast, the fifth chapter deals with amphora distributions in the province as a whole. Apart from a thorough study about the economic structure of Roman Britain, it examines the consumption of a serie of commodities according to their containers. Moreover this section reconsiders the role of the market and the realtionship between city and countryside on the basis of the archaeological distributions. Although the economic perspective is essential for the amphora interpretation their distribution is also viewed from a historical and anthropological angle.

As trade always links an origin with a destination, it is also necessary to reconstruct the movement of amphorae to Britain. Chapter six covers this topic, which includes infrastructures, routes and aims. In addition, it concentrates on the leading roles of commerce, the traders, and their spheres of influence. Thus, exchange is examined there from a social perspective, in which the economic reasons are not the only ones, but they are fundamental. Moreover this section reconsiders the exchange mechanisms in economic terms based on original simulation models in GIS. In this way the chapter deals with the role of the market and the existence of an economy at scale in Roman times.

The thesis summarises the final results of the whole research in chapter seven, when it reconsiders all the paradigms introduced at the outset on the light of the amphora evidence in Roman Britain. Consequently, the initial theoretical framework is revised there according to the material testimony collected in this thesis. Since this structure no longer sustains the diverse economic manifestations observed, an alternative framework is proposed at the end of the chapter. Therefore, the new conclusions obtained from the study of amphorae trade appear to improve the knowledge of the Roman economy as a particular experience and the essence of exchange as cross-cultural activity.

The aim of this research was the study of Roman trade, as a preferential topic, but including new developments and proposals in theoretical and methodological terms. The research attempted in this way an original contribution in the field, which can be judged in the following pages.

1. AMPHORA AND ROMAN ECONOMIC STUDIES

1.1 Theory on Roman Economic Studies

1.1.1 Introduction

Since its beginnings amphora research has been considered [Dressel, 1899] an integral part of Roman economic studies. The great quantity of amphorae documented, their predominant presence in shipwrecks and the increasing number of kilns discovered led to the assumption that these archaeological artifacts could give new insights into the nature of the Roman economy. Despite this initial aim, amphora studies have often overstressed the importance of the object on its own (e.g. typologies, origins) instead of focusing on its economic interpretation [Keay, 1992].

This chapter returns to the initial point of amphora studies, linking their evidence to the economic framework in which they were used. Likewise Tchernia [1967] realized a few possible applications of amphora information to enhance the perception of exchange and agricultural production in Roman times. The movement of these foodstuff containers within the frontiers of the Roman Empire has always suggested an economic development only matched again in the Late Middle Ages. The reasons behind these movements of goods, the volume traded and the mechanisms of exchange constitute the hub and aim of the present research.

Studies of the Roman economy have a very long tradition not only in Archaeology and History but also in other specialities such as Law, Politics, Geography, Anthropology and Sociology. This long tradition implies that theoretical concepts and paradigms have changed over time and they may not now express the same idea that they did in the past [Kuhn, 1970]. Thus, this chapter attempts to describe the history of the economic research as well as to discuss the main issues and concepts as currently defined by different schools of thought.

Economics became a completely developed speciality in the Social Science during the nineteenth century, though the first theorists appear in the eighteenth century [Blaug, 1968; Barbé, 1991]. Before the XVIIIth century, economic thought was restricted to different government policies aimed at obtaining a favourable balance of trade, which was supposed to produce national prosperity. This political economy, also known as mercantilism, was applied from the XVIth to XVIIIth century, the French finance minister Colbert being one of the most outstanding proponents. However, the first theoretical concepts, which are still currently in use, were put forward in the eighteenth century.

1.1.2 Economic Theory in the XVIIIth and XIXth century: the Enlightenment and the Historical School.

With the development of the Industrial Revolution, a series of intellectuals decided to analyse in depth the essence of economic processes taking place at that time. This pursuit not only aimed to describe the structures of the new system, but also to understand previous sytems well as examine contradictions and possible improvements of the current economic situation [Blaugg, 1968; Napoleoni, 1973; Barbé, 1991]. The so-called Classical thinkers defined a theoretical framework, which according to them could explain any economic system of either present or the past. This school of thought is also known as liberal or the Enlightenment. Nevertheless the economic experience of some countries seemed rather different, thus an opposite perspective was developed by the so-called Historical School, which presented a variety of economic models for diverse periods and geographical areas. Both schools had a deep influence in Roman studies, and some of their conceptual proposals are still in use.

1.1.2.1 The Enlightenment

The most influential author of this school was Adam Smith [1723-1790], who published all his theories in his fundamental work, *The wealth of Nations* [1776]. He defined concepts such as market, value, offer, demand and function of money; which were more extensively discussed by later authors of the same school[1]. The market as an abstract institution is the key concept, the "hidden hand", in which all the economic elements interact (e.g. consumer, producer, good, money). The values of goods are determined by supply and demand in the market, where each individual obtains a profit that consists of interest plus a risk premium. The value at the market reflects how scarce a product is. For instance, the higher the quantity of supplies, the lower the value is and the opposite is also true. Nevertheless, this basic idea was modified by Ricardo [1817] who introduced the principle of natural price, which defines how cost of production affects the market price[2].

The Classical school proposed a materialistic approach to economy that attempted to be of universal application. Market was the key institution that interconnected different branches of economy such as production, distribution and consumption. Smith and Ricardo also distinguished concepts such as value of use and value of exchange, value before and after entering the market, or real and nominal price, prices influenced by money fluctuations. Nevertheless, these concepts

---

[1] Malthus [1798]; Say [1803]; Ricardo [1817]; Mill [1848].

[2] All these concepts can be followed in Schumpeter [1954], Whittaker [1960], Blaug [1968], Heilbroner [1982] and Barbé [1991].

were not generally accepted in Germany, where economy was considered a part of the society as a whole, this was a result of Hegel´s influence, and the principle of universal theory was reconsidered [Schumpeter, 1954; Whittaker, 1960; Kahn, 1990].

1.1.2.2 The Historical School

The Historical School appears in the middle of the XIXth century represented by a first generation of economists such as Roscher, Knies and Hildebrand[3]. They proposed a methodological change to an inductive approach to economics [Schumpeter, 1954; Whittaker, 1960, 206]. The aim was to study different geographical areas and periods in order to produce generalizations from these case studies [Schumpeter, 1954, 807; Iggers, 1968; Capel, 1981]. With reference to commerce Darwin´s ideas on evolution were applied by Hildebrand as stages in the mechanisms of exchange (i.e. barter, money and credit). A second generation of economists such as Schmaeller, Wagner and Bücher made even more clear distinctions between forms of economy from domestic to world economy [Kahn, 1990, 241]. All these proposals were later incorporated by the third generation of German economists, Sombart [1916-28] and Weber, who created their personal responses.

1.1.3 Influences of the Classical and Historical School on Roman Studies

Roman studies in the early nineteenth century, in both Archaeology and History, did not stress the importance of economy within society. Initially Greek studies were the first to introduce economy as a central focus of discussion in research on Graeco-Roman world, influencing their Roman counterparts. Boeck [1817] published a book on Athenian economy that employed for first time concepts from the Classical economic school. Likewise Mengotti [1797], Dureau de la Malle [1840], Ferrara [1848] and Mommsen [1854-56] assimilated economic ideas and terms without getting involved in any theoretical discussion.

Nevertheless, the development of the historical school brought about further discussion concerning the suitability of Classical economic concepts for Graeco-Roman societies [Jongman, 1991, 28]. On the one hand, the concept of household economy [Robertus, 1867] and its application to the Graeco-Roman world by Bücher [1893] defined the so-called Primitivist school. This school argued that the market institution did not play any significant role, since products were consumed in the same household, never reaching a proper market. There were neither signs of industry, commerce nor monetary system which occur in present times [Will, 1954; Pearson, 1957; Austin and Vidal-Naquet, 1972; Cartledge, 1983]. This perspective considered that well-

---

[3] Two early economists influenced this first generation were Fichte [1800] and List [1841].

documented modern style features such as coinage, pottery workshops or trade were simply exceptions to the rule. This group of researchers were following in fact the principles of the Historical School in which each chronological period had its own distinctive economic system. However, they reached the extreme view of denying any shared economic characteristics between Antiquity and the period in which they lived.

On the other hand, the concepts introduced by the Enlightenment were applied to the analysis of Greek economy [Meyer, Beloch, Busolt] defining the so-called Modernist school. Meyer [1924], who was the leading figure, maintained that there were no distinctions between modern and ancient economic manifestations, so concepts such as industry, money or market were perfectly applicable to ancient times. The contradictions between both schools were differences in scale or a question of degree rather than of kind [Godelier, 1966, 281; Finley, 1979; Jongman, 1991, 28]. Despite extreme positions there were obvious common links that were sometimes labelled exceptions to the rule. The great mistake was to force the Graeco-Roman economy into either a modern or primitive straitjacket [Austin and Vidal-Naquet, 1972, 5].

Weber [1891; 1897; 1922] realized that both extreme views were excessively dogmatic. He defended the existence of a market economy in very particular periods and geographical areas, but elsewhere different from present conceptions [Love, 1991]. Influenced by the Historical School and Fustel de Coulanges [1864], he attempted to differentiate the Graeco-Roman economy on the basis of the conception of ancient city as opposed to the medieval nucleus [Austin and Vidal-Naquet, 1972; Bruhns, 1989; Nippel, 1989; Love, 1991]. The ancient city was a centre of consumption rather than a productive nucleus as the medieval city was. He also gave a special importance to agriculture, the level of economic rationality (e.g. accounting), lack of trade policy and sociopolitical organizations (e.g. patronage, freedmen, leasing) [Love, 1991]. Although he introduced a new framework for studying ancient economies, his models were basically static, so that they could not explain the deep transformations which the Roman economy underwent in the Late Empire. He still used the word capitalism to define ancient economies, which received criticism from another important German scholar of that time, Marx.

1.1.4 Economic Theory in the XXth century: Neo-classicism and Marxism

At the end of the XIXth century, it seemed that the two early economic schools could not provide a suitable theoretical framework for all the new changes and experiences of the current economic situation. Discussions and critics led to new views about the economic reality, challenging some of the previous conceptions. Thus, two independent economic schools emerged at that time. One of them, the Neoclassic or Marginalist school, attempted to redefine some classical concepts such as value or market on the basis of the empirical evidences gathered. In addition, the Marxist school created new concepts and models following early principles introduced by the historical school. These new economic currents and the work of Weber were the most influential contributions for scholars of the Roman economy.

1.1.4.1 The Neo-classical School

The concept of utility was developed by Jevens [1871] in order to relate cost of production of a commodity to the supply of that good and its market value, following the early steps of Ricardo [1817]. The degree of utility of a particular commodity depended on the priorities of individuals (i.e. demand) and how they maximized their satisfactions under the restrictions of taste, money and prices[4] [Schumpeter, 1954; Whittaker, 1960; Blaug, 1968]. The market was considered a system of equilibrium where demand was balanced by supply [Walras, 1874-77; Marshall, 1948], which could be summarised by algebraic equations. The equations are based on the principle of maximization, which defines the optimum allocation of scarce resources in order to obtain maximum profit, pleasure or utility [Lipsey, 1963; Sugden, 1986; Jongman, 1991, 41]. These principles have remained almost unchanged until the present day, with the exception of new proposals by Keynes [1936] who defined a state of unbalanced equilibrium responsible for amongst other things, unemployment.

Another important contribution of this school is the interrelationship between money, price and trade; which is summarised by Fischer´s formula of exchange [Fischer, 1911]:

$$M * V = T * P$$

where M = quantity of money; V = velocity of money circulation; T = volume of trade; and, P = prices. The principles of monetary economy were later developed by Friedmann [1953; 1977; 1991], and they are still basic in the present economic policies.

1.1.4.2 The Marxist School

Marx [1953] and Engels [1884] created an alternative theoretical framework for economic and social studies, in which modes of production and control of the means of production were the key concepts to differentiate between economies. Slavery was defined as the main mode of production in the Graeco-Roman world, where the market had the function of fixing goods values (i.e. value of exchange). Nevertheless, the real aim of Marx´s analysis of ancient economies was

[4] All these concepts are commented on in more detail by Menger [1871], Walras [1874-77] and Pareto [1909].

to explain present capitalism as the result of a long economic evolution, so these past societies were hardly studies in detail [Harnecker, 1969]. The evolutionist ideas present in Marxism were relatively popular at that time, following the work of Morgan [1877] and Darwin [1888].

The main corpus of essays related to Classical modes of production are the Formen and Grundrisse, which were first published in Russia in 1939-41 [Prieto, 1986, 5; McGuire, 1992, 24]. Apart from the influence of his ideas in communist countries, Marx's doctrine was widespread in Western Europe through the work of people like Lukács, Korsch and Gramsci [McGuire, 1992, 33-36]. However they recovered some of Hegel´s dialectic principles and stressed the influence of ideological superstructure and social relationships on economic infrastructure. Finally, the last contribution was the Frankfurt school that introduced new conceptions such as the so-called critical theory, which denied amongst other things the idea of evolution or progress [McGuire, 1992, 36-38].

1.1.5 Early XXth century scholarship in Roman studies

Prior to the application of the economic concepts from these two contemporary schools of thought, Roman historians and archaeologists were influenced by Weber´s scholarship. Hasebroek [1928; 1931], one of his followers who specialized in Greek studies, denied the existence of modern concepts such as market policy or industry in Classical times, though he never reached the extreme views of the primitivist school [Will, 1954; Vidal-Naquet, 1972, 21]. Moreover both Weber and Hasebroek stressed the importance of the economic concept of the City in the Graeco-Roman world with regards to earlier and medieval societies. The principle was taken up again and developed by Finley [1973]. It is still one of the main foci of the current debate.

With reference to the influence of the Neo-classical school, their economic conceptions are present, conciously or not, in the work of Salvioli [1906], Loane [1907], Frank [1927; 1936-40], Warmington [1928] and Yeo [1952]. The principles of utility, rational industry and maximization appear clearly in the descriptions of economic life in Roman times. There was no discussion about the kind of exchange, because market system forces were supposed to integrate all manifestations at any level of the Roman economy. Another eminent scholar was Charlesworth [1926], who explained the movements of goods all over the Roman Empire as a result of scarcity and profit craving. The majority of these scholars integrated archaeological evidence with historical documents for first time providing a new dimension for the study of economic phenomena.

Rostovtzeff [1899; 1926] was the most outstanding representative of this generation, influenced by Neoclassic concepts as well as early German academics such as Mommsen and

Weber [Momigliano, 1966]. He identified the Roman economy as an early stage of capitalism, where the free market was developed by craftmen and traders (bourgeoisie) who constituted the driving force in the Republic and the Principate [Rostovzeff, 1926]. The involvement of the State in the economy in the Late Empire was according to him the main cause of the fall of Rome. In this context, trade within a market system, was one of the key factors in Roman economic success [Rostovzeff, 1926, 145], which differed from present standards only in scale not in kind. His abuse of Neo-classical terminology (e.g. proletarian, factory, mass production, middle class) has been fully criticized by other scholars [Rheinhold, 1946; Finley, 1973; D´Arms, 1981] who consider it oversimplistic. His principles include the paramount role of the State in long-distance exchange, through institutions known as *annona civilis* and *militaris* [Rostovzeff, 1926, 149].

With regards to Marxism, only Soviet scholars seriously applied these theories to Roman studies in the first half of the century [Petit, 1972]. They were interested in the role of slaves as the main source of labour, thus production was the focal point in their economic research. Childe [1944; 1946] was the best known Marxist archaeologist in Western Europe, though his work hardly affected Roman scholarship [Trigger, 1989, 244-262]. Marxist theory reached a special status in Roman research in the second half of the century with the development of two Western schools (i.e. the French and Italian schools).

Finally, Clark [1952] can be considered as a particular archaeologist of this generation who created his own school. Although he integrated materialistic principles of Neo-classical origin (i.e. maximization) [Zipf, 1949], his main contribution was an ecological-functional approach to ancient economies [Sheridan and Bailey, 1981; Trigger, 1989, 264-270]. Apart from developing techniques to reconstruct palaeoenvironments, his studies developed a deterministic view of ancient economies in terms of limited ecological resources [Trigger, 1989, 270], humans societies constrained by their environment.

1.1.6 Developments in History, Anthropology and Geography

In 1929, two French historians, Fevbre and Bloch, founded a new journal called the Annales d´Histoire Sociale et Economique, whose main aim was a "total" history involving interdisciplinary research [Bincliff, 1991; Knapp, 1992a]. Although this school included different trends and approaches, it provided an original time scale framework suitable for interrelating different levels of research [Braudel, 1949; Knapp, 1992b, 5; Smith, 1992]. Braudel [1949] suggested a first level of *long durée* processes constrained by geographic and environmental structures; a second level, *conjoncture*, affected by medium-term socioeconomic cycles and a third one, *histoire événementielle*, reflecting short-term political events. This scale framework allowed a more flexible integration of economic phenomena related to other social manifestations incorporating many early concepts together (e.g. politics, environment, mentalities) [Braudel, 1979a; 1979b]. Later Wallerstein [1974; 1980] developed his world system theory mixing Marxist and Braudelian ideas. He defined peripheral zones supplying labour and goods to a consumer core which exercised political and economical power over the peripheral zones.

Anthropology underwent a deep theoretical debate on economics after the work of Polanyi [1957c] and his colleagues. Polanyi was a Hungarian emigré who brought the concepts of the German Historical School to the USA [Kahn, 1990, 235]. Furthermore, he was influenced by his friendship with Lukács and ideas from Bücher and Weber, though he developed his own theoretical framework for studying ancient societies [Polanyi, 1957c; 1977]. He argued that economic rationality is a product of present Western societies whereas other societies have economy embedded in other social practices, with substantive meaning. According to him, economic practices are integrated within three different institutions: reciprocity, redistribution and market exchange [Polanyi, 1957c, 247]. Only the last one represents present economic patterns where the mechanisms of supply-demand-price exist as well as maximization, profit making, scarcity, money and banking have an overwhelming function [Polanyi, 1957c, 243-269; Neale, 1957].

His denial of modern economic theory for the explanation of practices in past societies was briskly criticized by some colleagues [Cook, 1966; Leclair and Schneider, 1966; Schneider, 1974], who created the so-called Formalist school as opposed to the Substantivist model of Polanyi. Both schools of economic anthropology maintain a similar dilemma as between Modern and Primitivist schools of ancient historians in the XIXth century [Kahn, 1990; Jongman, 1991, 36-47]. However this is not the only theoretical debate, a second interesting contribution in Anthropology includes the French school, lead by Godelier [1966] and Meillassoux [1981], which interrelates Marxist and Structuralist concepts in economy. The later influences were due to the scholarship of Levi-Strauss [1964].

Geography is another Social Science whose theoretical deliberations have influenced Roman economic studies. Economic geographers deal with the spatial dimension of economic activities, which is a domain generally disregarded by other fields [Dicken and Lloyd, 1990, 8]. Geographical theory is aimed at analyzing capitalistic societies and includes principles such as maximization, scarcity and market [Haggett, 1965; Chorley and Haggett, 1967]. At production level, agriculture revenues are studied on the basis of the most profitable location for each crop [von Thünen, 1842; Chisholm, 1962], while industrial location is analyzed with reference to accessibility to raw materials and markets [Weber, 1909; Isard, 1956] and linked to transport networks [Garrison, 1960; Kansky, 1963]. Finally, patterns of consumption are examined according to hierarchies of population and how this is distributed on space, in what is known as Central Place Theory [Christaller, 1937; Lösch, 1954].

1.1.7 New perspectives on the Roman economy in the second half of the XXth century

Without any doubt Finley´s [1965; 1973; 1985b] work on the ancient economy constitutes a benchmark in the research of the second half of the XXth century [Frederiksen, 1975; Bruhns, 1989; Nippel, 1989; Jongman, 1991]. Influenced by Weber´s concept of Classical consumer city, he returned to the principle of a particular type of economy for the Graeco-Roman world. He challenged the existence of a single market system similar to that of modern times, instead postulating a myriad of independent ones [Finley, 1985b, 22]. He shared with Polanyi the idea of economic embeddedness in social structures, being even invited to collaborate in the first papers of the substantivist school [Polanyi et al, 1957; Finley, 1973; Jongman, 1991, 36]. Finley and Jones [1974] represent the so-called New orthodoxy of ancient economic studies [Hopkins, 1983a] and the pioneers of the Cambridge School in Roman economy. They argued that the Roman economy was based on agriculture and obliged local communities to achieve the ideal of self-sufficiency. The importance of the administrative system was also stressed as well as the role of cities as centres of consumption. Moreover, expensive overland transportion and the low status of traders indicated, according to them, the low importance of trade [Jongman, 1991, 33]. In this sense, Jones´s statement is conclusive:

> ***"Trade and manufacture played a very minor part in the economy of the Roman Empire"*** *[AHM.Jones, 1974, 30]*

Nevertheless archaeological evidences of exchange in Roman pottery, above all amphora distributions, made Finley [1985b] later accept that trade had a specific role, though difficult to evaluate without careful quantitative analysis. This change in viewpoint was partly due to the two conferences on trade in the ancient economy held between historians and archaeologists [Garnsey et alii, 1983; Garnsey and Whittaker, 1983]. A second generation of scholars from Cambridge questioned the initial view of Finley on Roman trade [Whittaker, 1983; 1989; Garnsey, 1983; Duncan-Jones, 1990]. This academic group is influenced by the Annales and Neo-classical schools of economics, though they do not share any Modernist stance [Love, 1991], identifying the Graeco-Roman world as a distinctive economic system.

One of these scholars, Hopkins [1980], proposed a model based on Wallerstein´s world theory[5], in which the Roman Empire was divided into three geographical zones interconnected by

[5] Other application of this theory in Roman economy can be found in Woolf [1990].

taxes and trade. He presupposed a monetaized economy where taxes were directed to the City of Rome and peripheral provinces as Army pay, this money was later recovered by tax-payer provinces through trade.

With regards to Marxism, the Instituto Gramsci at Rome became a leading school in the application of Marxist concepts to Roman economy[6]. Carandini [1979; 1980] created an idealised model of a villa, whose production was oriented towards a market. The value of exchange was the key concept in this model, accepting the need for a kind of exchange despite transport constraints in Roman times [Carandini, 1979, 43]. Following the same approach, Manacorda [1981] and Panella [1981], attempted to explain amphora exchange. The integration of archaeological evidence to historical background served in this case to evaluate an economic model. Other Italian scholars such as Tozzi [1968] or De Martino [1979] reconstructed Roman economy denying both neoclassical and Marxist backgrounds despite their own ideas, in an attempt to use exclusively ancient evidence following Finley´s approach [Mazza, 1980].

In France Roman economic studies were developed by different schools. On the one hand, Vernant [1976; 1980] and Vidal-Naquet [1970; 1979] combined concepts from the Substantivist school of anthropology as a critique to the Marxist framework which was the main current school. On the other hand, Structuralism and Marxism influenced a new generation of ancient historians who revised concepts such as mode of production and social-economic formation. The group was organized around the Centre d´Etudes de Besançon and included researchers such as Clavel-Léveque [1977; 1980], Favory [1980] or Annequin [1982; 1983; 1985]. Members of this group together with Italian scholars from the Gramsci school and other historians such as Kolendo [1973; 1976; 1980] and Staerman [1979] constituted GIREA, an International Forum for Marxist studies in Antiquity[7]. Finally some French researchers followed the Annales conceptual framework including some Neoclassical trends, though they considered the Graeco-Roman world as a distinctive economic system. This group includes scholars such as Veyne [1976], Nicolet [1966; 1977; 1988] or Andreau [1987; 1989a].

Another influential school of Roman economic studies has been developed around the University of Leyden. A first generation of scholars introduced a series of Neo-classical concepts in their study of ancient economies such as Heilchelhein [1958-70] or Bolkestein [1958]. Nevertheless, a second generation influenced by Finley and the Substantivist school´s theories

---

[6] Some conferences and publications were chiefly concerned with slavery as the main classical mode of production. See Annalisi marxista e società antiche [1975], Rome; Opus I, I [1982]; and, Giardina and Schiavone [1981];.

[7] Some articles appeared in the number 84 of *Recherches Internationales à la lumière du marxisme* [1975] (Trans. Formas de explotación del trabajo y relaciones sociales en la antigüedad clásica [1979], Madrid).

recognized specific features for ancient societies. Notwithstanding the fact that they still use neoclassical concepts, they emphasize that they are being used whenever conditions in the Graeco-Roman world seem suitable [Pleket, 1983; 1984; Jongman, 1991]. The role of market trade and the Classical city as a consumer centre are the two focus of debate in their research [Jongman and Halstead, 1989; Jongman, 1991].

With the exception of the Instituto Gramsci, economic theory in Roman studies has been chiefly cultivated by ancient historians. However, archaeological sources provide new, sometimes contradictory, evidence that complements the literary information on the Roman economy. The last decades have seen the first attempts to create theoretical models based solely on archaeological material, an approach which had been already developed in Prehistoric studies [Binford, 1962; 1972; 1983].

Processual archaeology was a theoretical reaction against cultural-historical approaches [Clarke, 1968; Binford, 1972; Hodder, 1986; Trigger, 1989; Paddayya, 1990], which transmitted some of the economic theory as well as methodology elaborated in Anthropology and Geography. Substantivist concepts were applied to analyse trade, combining geographical methods such as fall-off curves [Renfrew, 1975; 1977a]. Other geographical principles (e.g. Central Place or locational theories) were employed to study distribution patterns of Roman pottery [Hodder and Orton, 1976; Clarke, 1977], thus accepting a market system framework. Studies on palaeoenvironment were also continued after Clark´s lead, developing the concept of site-catchment [Higgs and Vita-Finzi, 1972] as the resource area for a site. The empirical evidence of pollen and seeds has necessistated a revision of previous conceptions of environmental conditions and crops in Roman times [Greene, 1986, 73-88]. For instance, an ecological approach has shed some light into economical changes and trade in foodstuffs in frontier zones [Künnow, 1980; Brandt and Slofstra, 1983; Lange, 1990; Jones, 1991]. Anthropology provided some models for exchange [Sahlins, 1972], but also supplied new ethnographical comparisons for the study of technologies and trade (e.g. pottery) [Peacock, 1982].

With regards to the Post-processual school of archaeology, it has not yet contributed any alternative economic model, being scarcely known in Roman studies [Shanks and Tilley, 1987; Hodder, 1986; Trigger, 1989].

1.1.8 The contribution of amphora research

Archaeological material such as amphorae constitute an excellent testimony for testing some of the previous economic models. Apart from their assistance for backing theories, they can potentially supply hindsights for alternative hypotheses. However they have only been recently employed for this purpose and there is no general agreement as their suitable use.

Initially amphora research under the lead of Dressel [1899] focused upon recording all types of data that a vessel could supply, from epigraphic to morphological information. He created his typological classification with the aim of linking shape to origin, content and date-range [Beltrán, 1977]. In fact this early scholarship attempted to set up an adequate framework for further study, recording as much data as possible without any prior interpretation. Therefore the beginning of amphora research did not assimilate the archaeological object to its economic context, but simply maintaned a positivist approach.

The pursuit of adequate classifications of amphorae and the increase of information related to each type were the general goals of the second generation of amphorologists [Pelichet, 1946; Lamboglia, 1950; Almagro, 1955; Benoit, 1956; Callender, 1965; Beltrán, 1970]. The corpus of new data collected in those years showed the potential of amphora studies in Roman archaeology. A first Conference organized in 1970 by the French School in Rome[8] manifested the increasing interest in these vessels and the typological stance of the majority of researchers. New methodological developments in the mid 70´s related to the study of ceramic fabrics and contents [Tchernia and Zevi, 1972; Peacock, 1977; Peacock and Williams, 1986] proved that the same amphora shapes were produced in more than one geographical area and carried different contents. Therefore a more scientific approach towards classification and documentation of each type has been followed since then. The current discussions on methodological issues were brought to a second Conference in Rome[9], which marked a new direction in the research.

At that time, however, the databank was large enough for the first attempts to link amphora evidence to Roman economy. With this aim, some international conferences[10] were held to exchange ideas between historians and archaeologists in the light of the new evidence. Nevertheless there was, and still exists, some scepticism about the quality of amphora evidence and the real scale of its trade. Panella [1982; 1986] undertook a serious effort to improve the quality of the amphora data by quantifying it, also analyzing distributions and narrowing date ranges so as to enable a more reliable comparison between different assemblages. In fact her scholarship, together with that of other researchers (e.g. Keay, 1984), demonstrated that the Mediterranean enjoyed a thriving

---

[8] Recherches sur les amphores romaines [1972]. MEFRA 10, Rome (1970), Rome.

[9] Methodes clássiques et méthodes fornelles dans l´étude des amphores [1977]. MEFRA 32, Rome (1974). Rome.

[10] D´Arms and Kopff [1980]; Blázquez [1980]; Giardina and Schiavone [1981]; Garnsey, Hopkins and Whittaker [1983]; Blázquez and Remesal [1983]; Giardina [1986]; Recherches sur les amphores grécques [1986].

trade in the Late Empire. Another important study was carried out by Tchernia [1986], who integrated literary sources on the wine trade with the diverse amphora types recorded in the Republic and Principate. Likewise Remesal [1986] constructed a model of military supply based on the distribution of amphora stamps, despite the fact that no literary records existed. This new approach to amphora studies appears in the title of the last conference organized by the French School in 1986, Amphores romaines et histoire économique: dix ans de recherches. Nevertheless, the conference showed that classification and data collection were still the most common practices in the field [Keay, 1992], so that economic interpretations were stil lacking. Although any improvement in the quality of the information is welcome and must be an integral part of any amphora research, the large amount of data for its potential requires a deep economic analysis.

The last conferences[11] still reveal these two divergent approaches to amphora studies, one aiming for a historical analysis of the archaeological material whereas the second maintains a positivist outlook. As mentioned before, some researchers have already challenged traditional views on historical periods and the Roman economy [Finley, 1985b], hence their contribution goes far beyond the single object. With this approach, amphora studies can provide an alternative source of information for building new economic theories of the Roman period.

1.1.9 Conclusions

The Roman economy has always enjoyed an important role in the literature of Classical studies. The last section attempted to summarise the main theoretical schools and issues in the long history of the speciality. Besides, amphora research has provided new evidence for a wider discussion on the mechanism of long-distance exchange. The combination of theoretical models and archaeological evidence permit a thorough analysis of the nature of Roman exchange that is the objective of the present research. A general overview of previous works on either the Roman economy or amphora studies serves as a reference and starting point for this thesis.

1.2. Amphorae and Economic Theory

Amphorae represented the standard Roman container for long-distance exchange. This practice known as exchange involves many spheres of economic life that become interconnected through it such as producer, trader, consumer, good, value and money. The importance of exchange is intimately associated with any economic manifestation. For instance, an elementary division of the whole economic cycle can distinguish three levels known as production, distribution

[11] Les Amphores en Gaule. Production et Circulation [1992]. Metz (1990). Paris; Harris [1993].

and consumption; which only come together through exchange. That is why the definition of exchange is a key point and has been a bone of contention from Smith [1776] to Polanyi [1957]. Understanding the reason behind the movement of goods from one place to another, as in the case of amphorae, is the objective in the study of exchange and its mechanisms.

The present thesis is focused upon the analysis of, basically, two levels in the economic cycle, distribution and consumption, since amphorae in Britain are recorded far away from their original production centres. Nevertheless, the link with production appears always present in amphorae through contents, volume of imports and original workshops, so that despite the distance they reflect the primary stage in the economic chain. Some agricultural goods required a safe container like amphora for travelling long distances [Peacock and Williams, 1986, 31], thus from the beginning preferential relationships were established between landowners and potters [Revilla, 1993]. Although ancient agronomists recommended that each food producer manufactured their own container (Varro, De Re Rustica, i.22.1) [Carandini and Setris, 1979; Manacorda, 1978], archaeological evidence suggests that workshop supplied their products to more than one producer [Laubenheimer, 1985; Remesal, 1986; Manacorda, 1993]. In fact, the practice is attested by an Egyptian papyri (P.Oxy. 3595), which describes a kiln´s lease with the promise of supplying amphorae as a part of the payment [Cockle, 1981]. Whatever relationship was established between potters and food producers [Revilla, 1993], the vicissitudes in their production were mirrored by the volume of goods at the final destinations.

> *" Production and consumption are the poles of routine economic analysis. Between them, trade provides a vital link. "* *[K.Hopkins, 1983a, x]*

However the volume of amphorae recorded at a particular settlement and its location with reference to its origin reveal two other stages in the economic cycle: distribution and consumption. The movement of amphorae to specific locations in a precise number respond to a range of variables, which will be analysed here, but they mostly depended on the exchange mechanism through which they travelled [Polanyi, 1957; 1977; Renfrew, 1977]. Taste, purchasing power, transportation networks amongst other things may reflect the variation in quantities at each destination, but they do not explain why commodities were distributed over such distances in Roman times.

Long-distance exchange is possibly the most extreme case evidencing this movement of goods in the Roman economy, and therefore it should provide a more coherent explanation. The choice of Roman Britain as study area permits someone to see the limits of long-distance exchange in terms of scale at the northernmost point of the Roman Empire. Moreover the province combines two distinctive, civil and military, zones that allow us to examine public and private administrations separately. In practical terms, the tradition of amphora studies in Britain [Peacock and Williams, 1986] and the accessibility to the material (i.e. publication, Museums) represent the availability of such a quality of data unparalleled in any other country.

The pursuit of clear explanations to the import of amphorae in Roman Britain necessitates a more thorough analysis of the nature of exchange and to some extent of the foundations of Roman economy. Amphorae, with their own limitations, are mute witnesses of all those economic manifestations and their evidence may challenge the present conceptual framework for the Roman Empire.

1.2.1 The Market in Roman economy

The basic theoretical debate between modernists and primitivists or formalists and substantivists is the significance of the market as the only economic integrating institution in antiquity. Initially, Finley [1973] underlined that the Roman economy was self-sufficient in structure, thus agricultural production was aimed to cater chiefly for local needs. Nevertheless neither Finley [1973] nor Jones [1974] denied the existence of the market in Roman times, though they rejected its paramount role in the everyday life. On the one hand, Finley [1985b, 22] pointed out that there were not conglomerations of interdependent markets, which are required for a proper market system whose prices are the result of the laws of supply and demand. On the other hand, Jones referred solely to luxurious goods as the ones present in a market system structure.

> *"It was only products of a rather superior kind which commanded a wider market and were manufactured on a large scale" [AHM.Jones, 1974, 38]*

However amphora and pottery distributions showed that even low value goods were widespread in the Roman Empire [Carandini, 1983a; Rostovzeff, 1926; Manacorda, 1981; Panella, 1981], so that the market may have had a more prominent position than is usually admitted. Despite accepting the archaeological evidence to some extent, Finley [1985a] wondered whether this data was biased, overestimating the importance of exchange.

> ***"The Roman bricks and the amphoras as object tell us little in themselves and provide insufficient grounds for choosing among possible historical explanations, while the symbols and abbreviated words inscribed on them are similarly ambiguous or inconclusive without careful quantitative analysis both of the inscribed data and of the site-finds" [MI.Finley, 1985a, 20]***

Amphorae generally contained wine or olive-oil, which were the cash crops recommended by Cato (De Agri Cultura), Varro (De Re Rustica) or Columella (De Re Rustica) [Herz, 1988].

These three Roman agronomists gave advice of how to obtain the maximum profits in agriculture by selling excess production to the market [Duncan-Jones, 1974; Kolendo, 1980]. Therefore economic rationality [Weber, 1968; Love, 1991] is clear in these agricultural treatises that require a market institution with its price mechanism for obtaining the expected revenues. A collection of Egyptian papyri [Rathbone, 1991] supports the idea of a rational accounting system so as to maximize profits at production level in an estate. Following the same argument, Carandini [1979; 1980] created a villa model based on the ancient authors in which a rational production was oriented to a market (i.e. value of exchange). The villa of Settefinestre [Carandini and Settris, 1979] constituted the typical example with his supposed landlord´s trademark, SESTIVS, a proof of the wide distribution of the Roman market [Manacorda, 1978; Manacorda, 1981].

Although the model is suggestive, it basically applies to a small group of Italian estates where slavery was common [Carandini, 1979]. Other provinces such as North Africa [Kolendo, 1976; Kehoe, 1988] revealed different modes of production that may have demanded other types of exchange, although there is some variability such as the Tripolitanian factories with between 3 to 9 olive presses that also suggest a surplus oriented towards a market [Buck and Mattingly, 1985]. On the other hand, the accounting rationality of Roman landlords does not adjust to present standards as Mickwitz [1937] and Ste.Croix [1956] demonstrate.

The production of amphorae basically indicates that some commodities were expected to travel long-distances, but whether they moved within a market system or not can be questioned. Furthermore, these vessels were designed for ship transport, thus local distribution was never their primary destination[12]. Within long-distance exchange, amphora distributions give an insight into the kind of mechanism through which they travelled. Reducing costs is a way of maximizing profits in a market system [Jevens, 1871; Dicken and Lloyd, 1990]. This behaviour can be easily recognized in archaeological distributions [Hodder and Orton, 1976; Carreras, 1994a], which may determine the existence of a market system in antiquity. If this system existed, what was its degree of development and was it the only mechanism of exchange ?

Weber [1976] admitted the existence of market features in Roman times but he judged that there was never a high degree of technological innovation, rational structure of production and mass markets [Love, 1991]. Moreover limitations in transport, flow of information and social infrastructure hindered the existence of an integrated market [Finley, 1985b, 22; Harris, 1993a] where a price mechanism could be established through supply and demand.

[12] Jongman [1991, 125] suggests that the major part of Pompeian wine was consumed locally, despite a widespread distribution of Pompeian amphorae all over the Empire.

"Faut-il rappeler ici que la concurrence généralisée suppose une circulation de l'information, la disponibilité d'une infrastructure sociale et matérielle (marchands, moyens de transport) et une mentalité d'entrepreneur dont l'existence n'est jamais évidente dans l'Antiquité"
[A. Tchernia, 1985,329]

Notwithstanding these inconveniences, Roman exchange of staples reached the limits of the Empire in relatively high quantities as far as amphora assemblages are concerned. If a market system was not the explanation of such a thriving movement of goods, there must have been other exchange mechanisms responsible for it [Voljoen, 1974]. Thus, one must resort to Polanyi [1957c], who defined alternative mechanisms of exchange, listed below, based on empirical ethnographic evidences[13].

A. Reciprocity

Reciprocity denotes movements of goods between correlative points (i.e. individuals) or groups. There are a wide variety of forms contained in this definition from a gift [Malinowski, 1922; Mauss, 1954] to hierarchical obligations [Sahlins, 1972]. Social regulations establish the rules of these transactions and equivalent goods were expected in return. Kinship proximity and physical distance normally define the rules put into practice [Sahlins, 1972]. There are numerous literary evidences of reciprocity in Roman times. Apuleius (Met. ix.33; ii.11) describes a wealthy neighbour giving some food presents to a stranger and a rich woman sending some food gifts to a relative, in both cases jars of wine were included. Whittaker [1983] demonstrates that hospitality and gift exchanges were part of the obligations among rich landowners in the Late Empire. He quotes Pontius Paulus (Ep.5.21) sending oil and garum to his friend Ausonius, who replied by sending corn oil from Bourdeaux (Ausonius Ep.25). Even in the Army this practice is attested, as in the case of some soldiers asking their relatives for specific food (P.Mich.474; 483; 203) or receiving presents such as oysters from distant friends, as on a Vindolanda tablet [Bowman and Thomas, 1983,Tabl.39, 126].

In public life, Roman politicians were obliged to invest part of their fortunes in social expenditures (i.e.games, donations) to obtain support in their careers [Woolf, 1990a]. This social institution, known also as evergetism [Hands, 1968; Garnsey, 1988], was a peculiar type of reciprocity where gifts were expected to be paid off by votes [Hands, 1968]. Even bribes can be considered as part of the reciprocity system, as documented in Egypt for obtaining supervisors' favours (FIRA 1497) and other people's help (P.Fayum 117) [MacMullen, 1974]. Moreover,

13 Jongman [1991, 36-48] argues that Polanyi's theories are the result of non-rational evidence of past economies, which can be analyzed in modern economic science.

Roman society had a particular social relationship called patronage (*patronus-cliens*), which involved reciprocal exchange of goods and services between unequal parties [Saller, 1982, 1; De Salvo, 1992]. Amongst the goods collected by the *cliens* at the *patronus* house were normally food or money (i.e. *sportula*) (Martial vi.88; i.55; Juvenal Sat.ii.121).

Some of the goods exchanged by reciprocity may have been contained in amphorae. However this exchange was normally restricted to a short distance where social contacts were more common in every day life. Therefore long-distance exchange due to reciprocity may have been rather uncommon and basically concerned to luxurious goods. Thus amphora distributions could hardly be affected by reciprocity, except when contents were highly valued (e.g. Falernian wine, dates) [Renfrew, 1975]. In theory, reciprocity shows a steep decrease in quantity of a traded good in relation with the distance from the original source [Renfrew, 1975; Hodder and Orton, 1976, 108-122].

B. Redistribution

This type of exchange indicates appropriational movement of goods towards a centre and out of it again [Polanyi, 1957c]. It requires a central authority which can make the members of its society accountable for some duties. These liabilities towards central authorities are represented by labour services (i.e. transportation, storage and distribution) [Polanyi, 1977, 35] and taxes. The goods collected by the central government are normally used to pay administrative services (i.e. bureaucracy and army) as well as to balance socioeconomic differences within the group [Dalton, 1975, 93; Earle and Altroy, 1982, 266]. For instance, the Inca Empire [La Lone, 1982] and Hellenistic Egypt [Lewis, 1986] illustrated complex redistributive systems with public services and taxes for their social requirements.

The Roman world records some particular systems of redistribution, one of them known as *annona* [Lo Cascio, 1990]. *Annona* was an institution originally created to distribute free food to Roman citizens below the subsistence level[14] [Rostovzeff, 1926; van Berchem, 1937; 1939; Veyne, 1976; Casson, 1980; Jongman and Halstead, 1989; De Salvo, 1992]. It was mainly administered in the City of Rome and it could also include other staples apart from corn such as olive-oil and wine[15] (HA Sep.Sev. 18.3; HA Aurel. 35.2; 48.1) [Pavis d´Escurac, 1976; Remesal, 1986]. These commodities were obtained through taxes in kind from provinces such as Sicily, Spain, North Africa or Gaul; evidencing a movement of goods from a middle provinces to

[14] In Republican times only corn was distributed (i.e.*frumentationes*) [Rickman, 1980a; Garnsey, 1983].

[15] These two products were carried by amphorae whose relation with the State administration is recorded by *tituli picti* [Rodríguez Almeida, 1980c] and inscriptions [Panciera, 1980].

the centre. Furthermore, there was an *annona militaris* destined to supply staples to the Roman armies settled in the frontiers of the Empire. This institution is fully documented in the late third century A.D. (P.Beatty Panop.2.245-249; P.Oxy. xliii.3111; P.Oxy.xvii.2114) [van Berchem, 1939; Pavis d´Escurac, 1976], however Remesal [1986] suggests it was introducted as early as the Claudian period. He considers that olive-oil was one of the *annona* products distributed by the Roman State, that is why military sites present such high concentrations of olive-oil amphorae. Similar arguments were used by Middleton [1979; 1983] to explain high concentrations of wine amphorae in Gaul in Republican times.

Other scholars, though aware of these concentrations, simply refer to it as preferential or subsidized trade by the State [Garnsey and Saller, 1987, 109-117; Whittaker, 1989a, 53-77]. At least, a system of compulsory purchase of local products at a fixed price whereby Roman armies covered some of their needs is attested (P.Ryl. 189; BGU 1564; P.Oxy. 1414; P.Michael 21; P.Oxy. 1448) [Jones, 1974]. In the case of military supply, the locational movement of goods was normally between middle provinces and peripherical areas (i.e. the *Limes*).

Another kind of redistribution was the public property of mines and quarries, whose product could be allocated to anywhere in the Empire[16]. Emperors and military leaders were also keen on public donations as a result of war booty or excedents of private properties (i.e. Egypt was an Imperial possesion). For instance, L.Lucullus (Pliny NH xiv.96) distributed wine after his campaigns in Asia, J.Caesar (Suetonius Caes. 38.1; Cassio Dio 43.21.3) donated olive-oil at the end of the civil war as well as S.Severus (HA Sep.Sev. 18.3). All these commodities collected in Mediterranean provinces were destined to satisfy the citizens of the City of Rome. The redistributive systems of the Principate varied substantially in the Late Empire when *munera*, public services, were established at any social level [Sirks, 1991].

Archaeologically, redistribution may show any kind of distribution pattern depending on the way that the central authority wishes to allocate its resources. Nevertheless, locational movements were normally directed towards a centre (i.e. palace, temple, capital) where administative staff lived or to frontiers where armies were based. The latter type of pattern differs completely from any market system behaviour, thus it is relatively easy to identify [contra Renfrew, 1975; Earle and D´Altroy, 1982]. Amphora distributions provide exceptional evidence of special long-distance exchanges, which have been interpretated as a kind of redistribution system [Middleton, 1979; 1983; Remesal, 1986]. They are characterised by high concentrations of amphora in frontier areas whereas sites between the workshops and the frontiers have lower densities.

[16] Coinage for army payments [Crawford, 1986] and marble for public buildings [Ward-Perkins, 1980].

C. Market exchange

This describes vice-versa movements of goods aimed to obtain profits in both sides. The market is the institution which links supply and demand of goods through the price mechanism [Polanyi, 1957c; Neale, 1957]. The flow of goods reflects the fluctuation of prices, which also identifies the public demand for a specific product. Some scholars still argue that this is the only mechanism responsible for the movement of goods in Roman economy [Jongman, 1991] as it is today. Market exchange is based on the principle of maximization that expresses the idea of obtaining maximum profit by minimizing costs at all stages in the economic circle (i.e. production, distribution and consumption).

There are numerous examples of market behaviour in Roman times, but it is relatively difficult to evaluate its real role. For instance, Tiberius (Suetonius Tib. 34) appealed to the Senate to control market prices every year. Apuleius (Metamophosis) documents numerous transactions typical of a market system such as a gardener selling to local retailers (Apuleius Met.ix.32) [Millar, 1981]. Door-to-door sellers appear in Egyptian papyri (P.Oxy. 520; P.Oxy. 1727) as well as evidence of bankers [Andreau, 1987], private traders [D´Arms, 1981] and a complete account of a trading route including details of all the transactions (i.e. Periplus Maris Erythraei) [Casson, 1989]. Furthermore, Roman periodic markets and fairs, *nundinae*, were held every eight days in the same town, after changing the venue to other local communities during the week (Cas.Her. frg.14; Columella i.18; Pliny NH xviii.3.13) [De Martino, 1979, 163; Frayn, 1993]. These were territorial markets, which were complemented by periodic sales (i.e. *macella*), in local communities [Kleberg, 1957; De Ruyt, 1983; Frayn, 1993].

A calendar of *nundinae* between Capua and Rome has been found [MacMullen, 1970] as well as the permission to hold a periodic market on a North African private estate (CIL viii 270; 11451; 23246) [Kehoe, 1988, 216] or in a frontier city such as Dura-Europos [Heichelheim, 1970]. *Nundinae* lists and some tablets from Pompeii and Puetoli suggest a hierarchy of markets amongst settlements in their territory [Andreau, 1989a]. Archaeologically, market exchange should be identified by the decrease of one good´s proportion exponentially with the distance from source [Renfrew, 1975; Hodder and Orton, 1976]. In fact, it decreases with the increase of transport cost since minimizing these costs is one of the features of the principle of maximization. Some Roman wares seem to show a pattern of distribution which fits into a market system exchange (e.g. Oxford ware, Black Burnished 2) [Carreras, 1994a], though other examples reveal possible exceptions (i.e. Savernake and New Forest ware) [Hodder and Orton, 1976, 105-125].

These three forms of exchange are co-existent in a great number of societies, however it is difficult to assess their respective degree of development and whether they represent an evolutionary sequence [Curtin, 1984, 87]. Another distinction should be established between local and long-distance exchange, as well as whether the exchange took place inside or outside the Roman frontiers [Polanyi, 1975; 1977, 9; Hedeager, 1977; 1988a; Willems, 1983; 1986]. In Roman times, there was little flow of information for long-distance trade between production areas and final destinations. Therefore it is difficult to understand the role of market exchange for a long-distance trade such as the one represented by amphorae, since there was hardly any contact between supply and demand areas which affected the whole price mechanism basic for a market system[17]. In other words, traders did not know the potential demand and sale price for their merchandise until they reached their destination. Although taking risk was an integral part of trader´s life, as a required step towards obtaining financial and social profits [Polanyi, 1957c; 1977], there was always a limit.

Within a market system framework, there are different ways to overcome the lack of information between production and consumption areas. First of all, a specialized trade in luxurious goods or staples, chiefly corn, avoids risks since their demand and profits are relatively fixed [Pirenne, 1936, 93; Hodges, 1977; Braudel, 1979c]. Furthermore, combined cargoes [Pucci, 1983; Pavolini, 1993] allow other products to travel with low risk products, sometimes legislation fostered such level of trade [Braudel, 1979b; 1979c]. The involvement of the State in economy could reach the so-called administrative trade, in which exchange involved political treaties [Polanyi, 1957c] or modification of rules in the market price mechanism [Curtin, 1984]. Finally, there is a documented procedure of establishing minimum goods prices for each season so as to atract traders to a market [Skinner, 1964]. Local retailers had to invest a stated sum to bargain with incoming traders as a institution called *pancada* in the XVth century Philippine [Curtin, 1984, 134].

Another strategy for obtaining a minimum benefit in long-distance exchange required the control of supply in a few hands. This practice is known in modern economy as monopoly and oligopoly, when one or few traders or producers control the whole supply, which means that they are capable of fixing their own sale price [Galbraith, 1974]. There is evidence of grain speculation in early times that may indicate a kind of monopoly (Livy 38.35.5). This problem was solved with the introduction of the the Julian law against manipulation of grain supply (Dig. 48.4) [Garnsey, 1988, 215].

---

[17] Duncan-Jones [1990] demonstrates the hindrances in communications between Rome and Egypt with delays of almost one year for the news of the Emperor´s death. However, the public post service, *cursus publicus* [Sartorio, 1988, 23-25], was supposed to be faster than the private channels through which financial affairs were undertaken (Cicero, Ad.Att. i.10.4) [Achard, 1991, 135].

With regards to the amphora trade, the major part of the commodities carried were neither luxurious goods nor corn. Therefore they could not be considered low risk merchandise for long-distance exchange. The existence of monopolies and oligopolies might be inferred by the distribution of amphora stamps [Remesal, 1986; Funari, 1991] likewise the distribution of stamped lamps was interpreted as a trade controlled by a few firms [Harris, 1980; Duncan-Jones, 1990, 48-58]. Since the amphora trade is well-attested by archaeological finds, the real issue is whether a market system exchange can explain these transactions [Harris, 1993a]. Long-distance exchange in Roman times required a highly organized structure, involving many individuals and even institutions. Amphorae evidence in Roman Britain suggests a continuous flow of merchandise which cannot be due to occasional trading ventures.

> ***"Long-distance trade is rarely carried out by a single individual or a single firm. Too many specilized functions are involved. From producer to consumer goods pass through the hands of freight agents, transporters, wholesalers, and many more."   [P.D.Curtin, 1984, 53]***

Hopkins [1980] proposed a general model[18] for long-distance exchange in Roman times as a way to balance the flow of money from central provinces to the periphery. He distinguished Rome and Italy as the central core of the Empire, an inner ring of rich provinces such as Asia, Greece, North Africa, Gaul and Spain, and an outer ring of poor peripherical provinces. According to him, taxes were mainly raised in rich provinces so as to pay the administrative system in the core (e.g. Rome) and the periphery (e.g. Army pay). This drain of the rich provinces resources needed to be offset by profits obtained in trading with both core and periphery. Thus reallocation of taxes by the Roman State was a stimulus for trade.

The model identifies market exchange as the only one responsible for the movement of goods between provinces with highly urbanized societies and predominantly monetized economies. These three foundations can be further discussed on the basis of archaeological evidences collected in the present project.

The importance of trade is also a bone of contention in recognizing the degree of complexity of Roman economy. Trade was the hub of the debate between modernists and primitivists, and it still retains a prominent role in the present discourse [Hopkins, 1983a; Finley, 1985b; Jongman, 1991, 32]. Nevertheless Finley [1973; 1985b] redirected the discussion by pointing out that the status of traders was the key for evaluating the real role of trade in Roman economy. Since traders held a relatively low status in the society (Cicero De officis i.150-151;

[18] The model, although original, recalls Braudel´s [1949] and Wallestein´s [1974] structures of world economy.

Horace Sat.i.1.5), this activity may have also been of low importance [Hopkins, 1983a; Finley, 1985b].

> *"What race of men would you call more wretched than traders and shippers ? They sail about seeking markets ill-supplied, dealing with local agents and petty retailers, borrowing at unholy rates and risking their heads"*
> *[Philostratus Vita Apoll. 4.32]*

Finley [1985b] argued that trade in antiquity was left to either men of low status (i.e. freedmen) [Duff, 1928] or foreigners (i.e. Athenian *metics*), which meant that the higher classes did not consider it a worthy activity. D´Arms [1980a; 1980b] and Love [1991] defended the possible involvement of Roman nobility, despite the lex Claudia (218 BC) [Clemente, 1983], though slaves and freedmen undertook businesses on behalf of their owners [De Salvo, 1992, 248; Harris, 1993a; Schleich, 1983; Bürge, 1987]. This discussion among scholars goes far beyond the economic scope, dealing with the Roman systems of values and aristocratic mentalities [Pavis d´Escurac, 1977; Schleich, 1983; 1984; Narducci, 1985; Haley, 1988].

Against the majority of opinions, archaeological evidence demonstrate that trade had a significant role in the Roman economy [Giardina and Schiavone, 1981; Garnsey et al, 1983; Garnsey and Whittaker, 1983]. Rostovzeff [1926] first pointed to the distribution of samian ware as good evidence of such a role, which was rejected by some scholars arguing the low representativity of ceramics in trade [Finley, 1973]. However amphorae document trade in agricultural goods that were the basis of ancient economy, thus they represent the real value of trade in Roman economy. The quantification of amphorae constitutes the main obstacle for evaluating this role and it is always fraught with danger to establish any comparison with later periods since no statistics of Roman economy have survived [Jongman, 1991, 19].

Finally, the function of markets seems to have changed between Republican times and the Late Empire. In fact, this was one of the traditional explanations of the decline of the Roman Empire [Rostovzeff, 1926]. It was suggested that a more active economic involvement of the State in late periods [Jones, 1974] straightjacketed private enterprises limiting the importance of markets in economic life [Sirks, 1991]. This temporal evolution can also be assessed by changes in the volume of amphora trade. In general terms, a limitation of long-distance exchange is observed in later periods on the basis of smaller quantities of amphorae recorded as well as a reduction in the number of shipwrecks documented [Parker, 1992].

1.2.2 The degree of monetization in Roman times

The existence of a market economy is usually linked to the presence or absence of coinage and the function of money in everyday life [Melitz, 1970; Greene, 1986, 45-48; Depeyrot, 1991]. However market exchange does not necessarily require coinage to operate, although it helps, but any measure of value or even barter can be a good alternative [Orlowe, 1986]. Also some macroeconomic models for long-distance exchange entailed a developed monetized economy [Hopkins, 1980], which has always been under discussion [Pekáry, 1980; Howgego, 1992]. Rome developed a complex metrological system of coins and values in the Republic that despite numerous changes, was in use until the end of the Empire [Crawford, 1982; Picozzi, 1986]. Thus coins were at least available in the economic world.

However, the principal issue is whether these coins were used in all economic transactions such as tax-payments, loans, salaries, rents and exchange so they can be considered indicators of real economic life. Howgego [1992] summarises the limits of coins quantification for economic inference which are biased by supply of metal and its use for coinage and by the velocity of circulation. There are numerous literary mentions of their use for exchange, clearly outlined by Apuleius (Metamorphosis) [Millar, 1982], New Testament [Sutherland, 1967], Egyptian papyri (P.Corn. 9; P.Mich.Zen. 28; P.Lan. 12; P.Oxy. 1049; P.Lon. 1.131) and the Vindolanda writing-tablets [Bowman and Thomas, 1983].

For external exchange, Romans had to supply their own currency to foreign nations in order to provide the locals with means of payment (i.e. India and Arabia) (Pliny NH 6.101; Perip.Maris Erythr. 24.8.2-6) [Singh, 1988; Casson, 1989]. For internal exchange, the interpretation of coin assemblages from Pompeii [Breglia, 1950] throws some light into the real role of money. Pekáry [1980, 152] argues for a minor function of money due to the low number of assemblages recovered (circa 13,000 coins published up to 1950), which suggested that there were not many coins in circulation[19].

Notwithstanding the common use of coins for exchange, the practice of barter is well documented in Egypt [Bowman, 1986; Lewis, 1983] as well as payment of taxes and loans in kind (P.Lugd.Bat=P.Brux.5; P.Soterichos ; BGU iii.802) [Gara, 1988]. As a conclusion, money can be considered always present in the Roman economy, though combined with other measures of value and exchange. Howgego [1992] epitomizes the role of money in Roman times as follows:

[19] Sutherland [1967] believes that coins were hoarded elsewhere.

"That is to say that coin was used both in towns and in areas of settled agriculture, and in the less developed as well as the more sophisticated provinces. In that sense the Roman world in correctly described as monetized. It is more useful, however, to view monetization not as an absolute which is either present or absent, but something which may be present in varying degrees and in different ways" [CJ.Howgego, 1992, 30]

The function of money is quite relevant for understanding long-distance exchange, in this case amphora trade. Crawford [1970; 1984] argued that the main purpose of Roman coinage, chiefly silver (i.e. *denarii*) was army pay. Roman soldiers received three annual wages, *stipendia*, from which some sums for fodder, food and equipment were deducted (P.Yadin 722; RMR 68) [Speidel, 1992]. Crawford [1964; 1970] suggested that new coinage circulated from the military establishments in peripheral provinces (i.e. Britain, Germany) to the central areas of the Empire through exchange[20]. Nevertheless, the new supply of money was also used for administrative payments and public buildings in all the provinces [Lo Cascio, 1981], so only a proportion reached the armies[21]. The relation between trade and coinage is also revealed by Fulford [1978a], who indicated a possible link between mints supplying money to Britain and pottery trade in the Late Empire.

On the other hand, Hopkins [1980] defined his model on the basis of Crawford´s theory of a military supply of coinage that was the result of tax-farming in the rich provinces[22]. According to him this was a stimulus for long-distance exchange with peripheral provinces. He did not believe in taxes in kind or State purchases for the Army, as argued by Remesal [1986] since they could limit the sphere of market and monetary transactions [Hopkins, 1980, 103]. Furthermore, he applied Fisher´s formula to explain the relationship between volume of trade and money supply [Vilar, 1969]. The use of Fisher´s formula in the Roman economy is prone to error since there are no enough testimonies of fluctuation in prices and velocity of money circulation[23] [Going, 1992]. However if both variables are left constant, the formula allows us to relate money supply and quantity of goods, in different periods and places.

In spite of problems in quantifying coins [Casey, 1974; Reece, 1984], their number can be compared to other archaeological objects. Of course there are distinctions between the

[20] In the IIIrd and IVth century, silver circulated in the frontier areas whereas central provinces use basically bronze [Callu, 1969].

[21] Numerous papyri document *stipendia* of different scale soldiers (P.Panop. 2.36; P.Panop. 2.292; P.Panop. 2.57).

[22] Duncan-Jones [1990] criticises all Hopkins´ assumptions.

[23] These impediments are normally overcome by studying non-inflationary period, similar prices, and supposing a identical velocity, although some scholars have distinguished some changes in the speed [Creighton, pers.comm; Going, 1992].

circulation of bronze (AE) and silver (AG) as well as the circulation time-span of each particular issue, none the less a simple quantification of coins can provide useful general reference. For instance, a great number of coins in a period should reflect a thriving trade, at least in a monetary economy, which should be represented by high quantities of goods and even imports such as amphorae. Therefore a comparison between coins and amphora or samian proportions for each period and site may recognize the extent to which Roman economy can be identify as monetized [Gara, 1978; Howgego, 1992; Casey, 1992].

The last subject involving trade and money are the banking practices of the Roman world. A series of terms were applied to name different professions related to banking: *argentarii*, *coactores*, *stipulatores argentarii* and *nummularii*. However the concept of banking in Roman times differs from medieval or present practices [Bogaert, 1968; Andreau, 1987]. Roman banks provided services of deposit, credit, exchange of currency (OGIS 484) and payments [Andreau, 1987; Howgego, 1992, 28-29; Harris, 1993a], though neither cheques nor bills of exchange were known[24]. These constraints hampered transfers of money between distant places, thus limiting facilities for trade [Duncan-Jones, 1990]. Long-distance traders were supposed to carry the money themselves, the fruit of their sales, risking possible robbery. Only members of the upper classes (i.e. senators, knights) could transfer funds through a network of friends and acquaintances with whom one had social bonds or common interests[25] [Andreau, 1987].

During the Republic and the Early Empire, the *publicani* were another social group capable of transferring money to distant places, though they took advantage of their contacts with the State [Badian, 1972, 77]. The need of money transfers may have been one reason for the involvement of Roman elites in trade, carried out through slaves and freedmen [D´Arms, 1980a; Schleich, 1983; Bürge, 1987].

Bankers were always close to traders. They frequently worked in ports or market towns (i.e. Ostia) [Meiggs, 1960; Andreau, 1987], where they accepted the deposits of merchants even if they were in kind[26] [Andreau, 1987, 530; Bogaert, 1988]. Therefore some concentrations of amphorae found in stores, *horrea*, may have been bank deposits prior to the sale of merchandise. Nevertheless the most common service required by traders was credit. Loans were needed to purchase cargoes and charter ships, and banks could either provide them or act as intermediaries (P.Vindob. 197926). A complete agreement from Alexandria (P.Vienna SB=7169) to finance a

---

24 Some kind of cheques are documented only in Egypt (P.Wisc. 77; P.Col. Zen. 45) [Lewis, 1983; Bogaet, 1987].

25 For instance, Cicero (Verr. v.67) and Digest (xlv.1.122).

26 Two tablets from Pompeii (Tab. Pomp. 15-16; 8-69) refer to deposits in kind (i.e. corn, vegetables) [Bove, 1984].

trading venture to the "spice-bearing land" includes a lender, 5 borrowers, 5 sureties and a banker, who acted as a broker in this case. Maritime loans were basically advances with the obligation of repayment at the arrival, *traiecticia pecunia* or *nauticum fenus* [Rougé, 1966, 351; De Martino, 1979, 169-174; Millett, 1983; De Salvo, 1992]. These contracts were legislated to establish limits on interest as well as responsibilities and insurances, *pretium periculi*, in case of wreck (Dig. xlv.1.122; xx.2.1-4; CJ iv.32-33).

Amphorae constitute the principal archaeological testimony of all these economic activities in which money played an important part. In the following chapters, it will be attempted to establish a relationship between the physical representation of money (i.e. coins), and long-distance exchange through amphora evidence. The degree of monetization in the Roman economy is closely linked to the existence of a market system as the main mechanism of exchange. Therefore both sources of evidence, coins and amphorae, serve to demonstrate together the structure of Roman economy. In fact apart from the actors of exchange, traders, and mechanisms of exchange both amphora and coins represent the two remainng pieces in this enterprise: goods and means of exchange.

1.2.3 The city as a consumer centre

Weber [1922] and Finley [1973; 1985b] defined the city in the Graeco-Roman world as a centre of consumption, with a parasitical relationships upon the countryside. First of all, Weber argued that this characteristic of ancient cities was the main difference compared to medieval centres, where production was part of their economic vitality [Sjoberg, 1960; Duby, 1980; Bruhns, 1989]. Later, Finley [1973] pointed out that industrial production in medieval cities was the reason of the development of a bourgeoisie, which set up the basis for a rational market economy. Moreover, he claimed that there was a change in mentality since medieval traders reached a high status in society whereas traders were frowned upon in Roman times.

Nevertheless some scholars [Loane, 1907; Rostovzeff, 1926; Frank, 1927; Moeller, 1976] described a completely different picture of industrious Roman towns following scattered testimonies from Rome, Ostia and Pompei. Numerous inscriptions showed a myriad of professions within the town from shoemakers to perfumers [Loane, 1907]. Likewise the trades documented at Korykos [Hopkins, 1978] implied the importance of cloth manufacturers (18%) whereas food sales (15%) and luxury trade (13%) were the second most common activities. Besides, Jones [1974] recognized the prominent role of cloth production in the Late Empire, which was also revealed in the Diocletian Prices Edict (AD 301), in which there are numerous mentions of a wide variety of garments. Even Moeller [1976] recreated a lively picture of Pompei where fullers developed a thriving clothing industry, which is denied by Jongman [1991]. Finally, the evidence from Roman Egypt reveal that cities such as Arsinoe, Hermopolis, Paropolis and Oxyrhynchos had thriving textile production diverted chiefly for export [Bagnall, 1993, 314].

Although crafts and trade are well-attested in urban centres (i.e. Pompeii, Ostia, Rome, Alesia, Châlon-sur-Sâone, Alexandria, Clermont-Ferrand, Limoges, Poitiers) [Loane, 1907; Meiggs, 1960; Mangin, 1981; 1985; Bonneau, 1985; La Torre, 1988; Sauget and Pin, 1990; Desbordes and Loustand, 1990; Boissavit-Camus *et alii*, 1990], it is difficult to evaluate whether city production offset the value of its imports from the countryside [Pleket, 1983; Wallace-Hadrill, 1991]. Of course, some industries such as pottery were often located outside towns [Peacock, 1982], though there are testimonies to workshops on some cities´ outskirts [Morel, 1987; Meastripieri and Ceci, 1990].

As far as amphorae are concerned, they carried agricultural goods produced in the countryside, thus cities were simply consumers of all these commodities. Since amphora production indicates a likely distant movement of goods, even shipment, their testimony in suburban villas does not demonstrate a local consumption but the opposite (i.e. Pompeii) [contra Jongman, 1991, 125]. Comparisons of amphora quantification from different sites suggest higher concentrations in big urban centres, whereas low percentages are restricted to minor settlements in the countryside. The pattern does not differ much from the present day situation, since high rank centres, big cities, normally attract more services and goods [Christaller, 1937; Lösch, 1954]. Wrigley [1978] reflects on the contradictory function of towns as a parasite or stimulus for ancient economy, clearly evidenced by the concentration of goods.

> *"Goods in transit do not move randomly across the face of a land. The pattern of their movements is normally dentritic and at each node in the network there is a town"   [EA. Wrigley, 1978, 300]*

This non-random distribution has been explained by the existence of site hierarchies (i.e. central place theory) [Christaller, 1937; Lösch, 1954; Haggett, 1965], which redirect the flow of services, goods and information within a market system [De Light, 1990]. The model was applied to recognize the spacing between towns in Roman Britain as well as the relationship between towns and nearby villas [Hodder and Hassall, 1971; Hartley, 1973; Hodder and Millet, 1980; Grant, 1986]. With regards to amphorae, a scale in quantities should identify a rank hierarchy of sites, at least according to market rules[27].

[27] Such a scale was not available in other spatial analysis of pottery distributions [Hodder, 1974; Fulford and Hodder, 1975; Hodder and Orton, 1976] because the standard measures used were not suitable. Only Sydris [1975] distinguished hierarchies in obsidian trade by applying densities.

The concept of city as a consumer centre means that a city population can neither live off its own territory (i.e. carrying capacity) [Higgs, 1972; Garnsey and Morris, 1989] nor through the exchange of its local production [Harris, 1993a, 12; Tchernia, 1986, 21-27; Frier, 1983; Chariotis, 1988]. Therefore they require a supply of food from outside that they cannot afford. This necessary provision of food in Roman times may have been obtained through market forces but within this framework, shortages and speculation were the most likely outcomes [Garnsey and Whittaker, 1983; Garnsey, 1988; Halstead and O´Shea, 1989]. Due to frequent rises in corn prices, the City of Rome in the Republican period (Ti.Grachus, 133 BC) established State corn donations, known as *frumentationes*, which later evolved to a complex institution called *annona* [Veyne, 1976; Rickman, 1980a; Casson, 1980; Garnsey, 1983; Jongman and Halstead, 1989]. This institution distributed and regulated prices firstly of corn, though this was later complemented by wine and olive-oil (HA Ant. 8.11; Caesar De Bello Afri. 97) [van Berchem, 1939; Pavis d´Escurac, 1976; Tengström, 1974; Remesal, 1986].

Both products, wine and olive-oil, were transported by amphorae that testify the substantial function of the redistributive system, as in the case of Monte Testaccio (Rome) [Rodríguez Almeida, 1984], a mountain of amphora sherds.

As a conclusion it can be said that amphorae provide some insight into the economic character of ancient cities. Roman towns were considered to be, in economic terms, parasites of the rural areas. Amphora evidence supports this ascendancy, though it is biased since these vessels carried agricultural commodities originating from the countryside. A more detailed analysis of the mechanism of exchange reveals a kind of hierarchy between settlements. The hierarchy appears represented on the basis of amphora quantifications that outline the structure of the distribution system, sometimes related to a particular type of exchange.

1.2.4 Economy at Scale

The Roman Empire has been defined as the first economy at scale [Duncan-Jones, 1990], where different provinces became economically integrated by complementing their respective productions. This supposition implies a highly developed inter-provincial exchange and bulk production destined for export [Harris, 1993a]. Amphorae found in the Northern provinces of the Empire testify that products such as olive-oil or wine were also consumed, although they originated from the Mediterranean provinces. To what extent these imports satisfied the British demand as a whole or to what extent the producing provinces depended on distant consumers, can be seriously questioned. Nevertheless, the concept of economy at scale is the hub of world empire concept [Wallestein, 1974], which is the basis of some models [Hopkins, 1980] and interpretations of

Roman economy [Woolf, 1990a; Santley and Alexander, 1992]. Of course, there was some one-direction interdependance between provinces supplying grain (i.e. North Africa, Sicily and Egypt) or metals (i.e. Dacia, Spain), but only a few other products relied on external markets.

The limitations in transport structure [Cipolla, 1956; Jones, 1974; Hopkins, 1980] and flow of information [Davidson and Harper, 1972] restricted long-distance exchange, so that complementarity between provinces became rather problematical. Basically there are four factors which influence the nature of transport service: speed, frequency, reliability and cost [Braunch, 1979, 180]. Roman transport did not reach high standards in either speed, frequency or reliability [Casson, 1974; 1984] and above all, expensive overland transport costs hampered movements of goods [Jones, 1974; Greene, 1986; Carreras, 1991; 1994a; Harris, 1989; 1993a]. Despite the advantages of economic specialization and exports [Lipsey, 1983; Hindley, 1974], Roman long-distance exchange seems to have been condemned to a reduced role [Davidson and Harper, 1972; Finley, 1985a, 23] due to structural constraints [Harris, 1989; 1993a; Fentress, 1991; Sippel, 1987].

Likewise external exchange, outside the Empire, seems to have been limited to a few commodities, normally high value (e.g. spices) [Miller, 1968]. Products such as wine, garum or olive-oil contained in amphorae were integrated in foreign scales of values and they could even reach high prices [Williams, 1981; van der Leeuw, 1983; Dietler, 1990]. However, only a few examples of amphorae have been found outside the Empire[28] compared to quantities inside which reveals its scarce importance. Although Pliny (NH 6.101) complained about the drain of Roman cash in the trade with India, this may have been due to luxury goods (e.g. spices, drugs, gems, textiles, ivory and pearls) [Casson, 1989, 15] whereas amphora-borne commodities such as wine or olive-oil were exported in return trips probably for the resident foreign colony (Perip.Maris Erythr. 6.2.32).

Initial triggers in development of long-distance exchange are highly profitable contacts for both sides, which can be achieved with high value goods, trading with areas of scarcity or of high densities of population [Dicken and Lloyd, 1990]. Nevertheless there is a threshold of a maximum price for a good that cannot be surpassed otherwise it cannot be sold, in other words, a limited elasticity of demand [Lipsey, 1983, 85-193; Harris, 1993a]. In long-distance exchange, transport costs were serious handicaps for the movement of low value products since they caused an increase in the added value to the final sale price. A series of measures were implemented to overcome this

[28] Exchange with Scandinavian areas is studied by Hedeager [1977; 1988a] while Willems [1983; 1986] deals with contacts in the Low countries. Other examples are the researches of trade in the Free Germany by Künnow [1980; 1990] and India by Singh [1988].

impediment such as sharing cargoes [Nieto, 1988; Pucci, 1983; Harris, 1993a]. In the case of State involvement (i.e. redistributions), goods could move farther away since no profits were expected from their allocation [Akalu and Stjernquist, 1988]. That is why the study of Roman army supply has enjoyed a special interest. Middleton [1979; 1983] and Remesal [1986] suggest that the high concentration of amphorae in the frontiers of the Empire cannot be explained by single market forces but by a direct involvement of the Roman State. Whittaker [1989a] defines a subsidized exchange with public allowances in order to interpret the amphora distributions.

It is evident that the volume of finds in frontier areas questions the extension of market exchange as the only driving force of Roman economy [Harris, 1993a; 1993b]. The degree of development of communications and transport represented a serious setback for a long-distance exchange of such characteristics. Other alternative mechanisms such as redistribution may reflect these peculiar amphora distributions, as in the case of Britain, as well as traits of economy at scale. As Jongman [1991] shows fitting modern economic conceptions to the Roman manifestations is possible at the expense of the own Roman experience.

"Rome may have been successful in pushing a traditional economy to its limits, but proper economy growth requires more than that ... " [W.Jongman, 1991, 25]

1.2.5 Conclusions

The present chapter has outlined the main theoretical principles concerning the Roman economy related to long-distance exchange, whose archaeological evidence is the amphora distribution all over the Roman Empire. Paradigms such as the existence of a market system, monetization, city as a consumer centre and the scale of the Roman economy are central issues to understand the movement of amphorae. However, those paradigms have been discussed for a long time so that a previous introduction to the history of theoretical concepts in Roman economy, in either Archaeology and History, was required. The introduction was linked to developments in economic studies in other disciplines, since concepts and theories have often been borrowed from other fields. Likewise the history of amphora research was used here to complement the theoretical debates, since the nature of these archaeological evidence of trade challenge some older conceptions as well as introducing new models. Therefore the combination of theory and archaeological evidence may supply a new prespective for the Roman economy.

The aim of this thesis is not so ambitious since the focus of this research is only the structure of long-distance exchange. However, it is expected that theory and archaeological records combined together in this project, may help not only to understand the nature of each distribution but also the reasons behind the movement of goods.

2. METHODOLOGY: QUANTIFICATION, SAMPLING AND ANALYTICAL TECHNIQUES

Introduction

Amphorae are indicators of long-distace exchange in Roman times. At least, all scholars seem to agree with this statement. But, the main problem arises whenever the economic theories introduced in the previous chapter are applied to the archaeological evidence. It is relatively difficult to fit archaeological realities to theoretical models and vice versa, because of the limited material evidence and the complexity of human societies. In order to bridge this gap, a variety of methodological tools have been developed in Archaeology.

This chapter introduces a series of methods which were considered to be suitable for the purpose of this research. First of all quantification measures present amphora data in an adequate way for further study. Secondly, a sampling stategy which provides a general view of amphora in Britain from a limited number of assemblages. Finally, a group of analytical techniques which could bring out the essence of the data as well as some interpretative models for experimentation. This chapter presents some well-known methodologies of the speciality; but also includes a few original models, experiments, evidences and conclusions that may broaden the possibilitites for other researches.

2.1. Quantification Methods

The use of archaeological data for economic inferences requires some means of quantification. Unless the material is measured, it becomes extremely difficult to establish any kind of comparison between assemblages and therefore, no conclusion can be drawn without being totally subjective. The need for quantitative techniques has been recently recognized by archaeologists well-aware of the results of their applications in other fields of Social Sciences [Doran and Hodson, 1975; Orton, 1980; Shennan, 1988; Orton *et alii*, 1993, 166-181]. Moreover Graecoroman historians involved in economic studies have welcomed the progress towards quantification [Whittaker, 1989a; Duncan-Jones, 1990; Jongman, 1991], since it allows them to incorporate archaeological information in their own research as supportive or contradictory data [Finley, 1973]. If archaeologists and historians seem to agree to some extent with the employment of quantitative methods, problems arise whenever a standard practice has to be selected [Pollard, 1991].

Among all archaeological finds, pottery is probably the most useful but difficult to deal with due to its fragmentary nature in excavations. It is also by far the commonest artifact found in sites dating from the Neolithic onwards [Peacock, 1982,1]. That is why pottery has enjoyed an outstanding rôle in the discussion on quantitative methods in Archaeology. But before introducing each of these methods, it is worth reflecting upon the kinds of information that can be gleaned from quantification. Orton [1989,94-97] provided a brief insight into why is worth quantifying pottery, basically he distinguished between two types of information available: temporal and spatial.

a. Spatial

a.1 Intersite

- Relationships between production and consumption centres (e.g. fall-off curves; Orton and Hodder, 1976).
- Relationships between city and countryside (e.g surface survey; Keay and Millett, 1991,129-139)

a.2 Intrasite

- Defining activity areas [Millett, 1979a]
- Defining patterns of refuse disposal [Schiffer, 1976,67ss]
- Social divisions [Redman, 1979]

b. Temporal

- Chronological seriation [Carver 1985]
- Economic evolution [Panella, 1989]
- Formation processes [Butzer, 1982]
- Residuality [Evans and Millett, 1991]

Any pottery assemblage may supply one or more types of information according to its nature and context [Orton and Tyers, 1991]. However, this information can be only reliable depending on which measure has been used to quantify the pottery. Thus, the choice of a quantitative measure becomes relevant for any possible interpretation. There are at least two different approaches to the quantification, measuring amount of pottery per type disregarding formal characteristics (e.g. size, thickness...) or actual number of vessels [Orton, 1982,1; Orton *et alii*, 1993, 166-181].

Measures of quantity of pottery

1. **Sherd Count** (e.g. Solheim,1960; Evans,1973; Orton,1975)

This is a simple method which involves counting each sherd in an assemblage. However it is biased since counts may not represent a true sample of the population [Orton, 1975; 1989,96]. It will always exagerate proportions of large pottery types with regard to the others. Nevertheless, it is invariant under transforms in the retrieval percentage.

2. **Sherd weight** (e.g. Solheim,1960; Evans,1973; Hulthen,1974; Orton,1975)

The method requires weighing each sherd in an assemblage. It is also biased because weights exaggerate proportions of heavy and large pottery types, but it is invariant under any change in the breakage and retrieval percentage [Orton, 1989,96].

3. **Adjusted sherd weight** (e.g Hulthen,1974; Millett, 1979a)

This is a variation of the previous measure that balances the differences in vessel dimensions by taking into account sherd thickness. Despite this calculation, the measure is still biased as it disregards specific fabric weights and complete vessel size. Other criticisms arise because it is rather time consuming [Millett, 1979a, 78].

4. **Surface area** (e.g. Glover,1972; Hulthen,1974)

This is a development of the previous method which aims to get rid of any biasing effect of the measure weight. It adjusts its value by taking into account vessel dimensions and density. Despite being in theory a quite good measure, it is rather time consuming and therefore unsuitable for practical archaeology.

5. **Water displacement** (e.g. Hinton,1977; Blake and Daicy, 1983)

This method quantifies volume of pottery through water displacement and it can be also complemented by weight calibrations, as are standard practice in Chemistry and Physics. However, it is still biased since it does not take vessel size into account. Apart from this, the method is too time consuming for practical purposes.

1. **Estimated Vessels Represented [EVR]** (e.g. Orton,1975; Vince,1977)

There are two different methods also known as **maximum and minimum number of vessels**. The **minimum number** [Vince, 1977] involves calculating the minimum number of complete vessels present in an assemblage. It disregards any possible joins, therefore it underestimates sample numbers in general [Millett, 1979b, 77-78; Arcelin and Arcelin, 1981; Mourhouse, 1986,118]. Although there is still some confusion about the use of terms such as maximum and minimum [Pollard, 1991,75], the description above seems to be generally accepted. The maximum number is defined by Orton [1975,31] as *the number of distinct fragments remaining after all possible joining of sherds has been made*. This second method overestimates the sample numbers. As a summary, these two measures are biased and not invariant [Orton, 1989,96] which makes their use dicouraged.

2. **Average Vessel Weight (AVW)** (e.g. Rice,1987,292)

This measure requires a table of complete vessels weights in order to calibrate weights obtained from an assemblage. However the complete vessel weights are not always available, which sometimes makes this method difficult to implement.

3. **Estimated Vessel Equivalents [EVEs]** (e.g. Bloice,1971; Egloff, 1973; De Boer,1974; Orton,1975)

This method defines *each sherd as an appropriate fraction of a vessel* [Orton, 1975,31], so adding sherds a proportion of the vessel can be obtained. Since the original definition was overambitious in practice only proportion of rims and bases are normally calculated [Orton, 1980,164-167]. There are at least three formulae to estimate vessel equivalents, which creates great difficulties when comparisons are required[1]. The most common of them identifies **EVE** with rim equivalent (RE) which is calculated on the basis of sherd diameter as a percentage of the complete vessel [Tomber, 1988,69; Pollard, 1991,96].

a. **Estimated Vessel Equivalent** = (RE; Rim Equivalent)

Orton [1980,66] provides another formula which requires the base equivalent as well.

b. **Estimated Vessel Equivalent** = (Rim Equivalent + Base Equivalent) + 2´ (ibid)

[1] R.Pollard [1991,76] complains about using EVEs without specifying neither the calculation method or initial values.

Finally, a third and more complicated formula was defined by Fulford [1973, 23-24; Millett,1979a, 77] that has never been popular.

c. **Estimated Vessel Equivalent** = Rounding to the next integer (Rim length of sherds + Mean rim diameter)

EVE is supposed to be the most accurate method according to tests of diverse measures carried out with simulation analyses [Orton, 1982], however, it is not always suitable for all different pottery types. From now on, the term **Estimated Vessel Equivalent** identifies in this text **Rim Equivalent** (formula a), so there is no grounds for confusion.

2.1.1 Assessment of quantitative measures

The reliability of these measures has been assessed on the basis of four theoretical criteria: bias, invariance, variability and interpretability [Orton, 1975; 1987]. **Weights** and **EVEs** are supposed to provide the best results and it is recommended they be used together. The measure **EVR** can yield different estimates in identical assemblages whenever breakage and retrieval rate differ. Similar conclusions were drawn from a simulation analysis by Orton [1982], though the excellent perfomance of **sherd count** was surprising. Other tests were undertaken by Millett [1979b, 78-79], who compared between **sherd count, weights, minimum number of vessels** and **adjusted sherd weight** concluding that they provided comparable results.

Nevertheless, other comparative studies [Keay, 1984; Tomber, 1988] show that there is some variability between measures used on different sites. Following Orton´s advice, no reliable comparisons of different assemblages can be made by using alternative measures:

> ***" Results from different contexts or from different sites, using different measures, cannot be compared with one another. Comparisons may in general be made if the same measure has been used on both sites"   [C.Orton, 1975, 31]***

Since data can be used in different kinds of comparative studies and there is still no standard practice in quantification, the best solution consists of quantifying pottery with as many measures as possible if this is not too time consuming. Doing so, the information can be always used in the future, otherwise new research may require quantifying the same material again. The present study involved classifying and quantifying amphora assemblages by means of **sherd count, weight, number of handles** and **EVE (rim equivalent)**. The remaining standard measures can be inferred from these four methods used, except **adjusted sherd weight, surface area** and **water displacement** as they are too time consuming, despite its flaws.

However the nature of an archaeological artifact being studied may influence the choice of measure. In the case of amphorae, neither **handles** nor **EVE** seem to represent them accurately due to the fact that rims and handles are relatively small in proportion to the size of the amphora as a whole [Peacock and Williams, 1986,19]. Therefore some amphora types, normally the smaller ones, can be either under or overrepresented in the assemblage because of retrieval percentages. The following table, which summarises the data of amphora assemblages from Chichester, may illustrate this point.

As can be observed some amphora types do not include any rim which means that they cannot be measured by **EVEs**, creating a false image of the assemblage composition. If some types are underrepresented by **EVEs**, the same happens with **handles**, but in this case it can overestimate other types (i.e. Italian Dr.1, Eastern 2/4). Thus **sherd count** and **weight** become the most suitable initial measures. Notwithstanding the favourable performance of **sherd counts** in simulations [Orton, 1982, 14-15] and its relatively similar percentages to weights in the table above, this measure is biased and variant under changes in breakage rate [Orton, 1989, 96], so its unreliable. In the end, only **weight** seem to provide a good measure for amphora quantifications though it is not perfect. It is also biased because it overestimates large and heavy vessels, which could be calibrated if there was a table of weights for complete vessels.

Table 1

Amphorae	**Weight**	%	**Counts**	%	**EVE**	%	**Handle**	%
Dr20	279563	83.84	1308	75.04	808	66.99	17	54.83
S.Spain	13098	3.92	100	5.73	193	16.00	3	9.67
Rhodian	3566	1.06	26	1.49	18	1.49	0	0
Gauloise 4	11591	3.47	107	6.13	149	12.35	2	6.45
Kapitan II	100	0.02	1	0.05	0	0	1	3.22
Haltern 70	4240	1.27	30	1.72	10	0.82	2	6.45
Italian 2/4	12499	3.74	84	4.81	28	2.32	4	12.9
Italian 1	209	0.06	4	0.22	0	0	2	6.45
Italian	234	0.07	9	0.51	0	0	2	6.45
Eastern 2/4	790	0.23	5	0.28	0	0	1	3.22
African	4120	1.23	17	0.97	0	0	1	3.22
Unrecog.	3401	1.02	52	2.98	0	0	0	0
TOTAL	333411		1743		1206		31	

A quantitative method only becomes relevant when it allows comparisons between different assemblages or within one assemblage. Desbat [1990, 131] emphasises that the same measure should satisfy both kinds of comparison at once, which seems relatively difficult. Nevertheless, two related measures can fulfil both set of conditions separately. **Weights** make a good measure for comparisons between sites because it is invariant. However, comparisons between different amphora types within an assemblage require some sort of calibration of the initial weights. In fact, this calibration is also known as a measure, **average vessel weight (AVW)**[Rice, 1987,292], which stipulates the existence of a weight table for each vessel in this case complete amphorae.

An initial table has already been created [Peacock and Williams, 1986,52] summarizing data from different authors, but it was not complete. The inventory below, which includes the main types of amphora and their weights, volumes and ratios (volume/weight); represents an attempt to update and expand that earlier contribution.

Table 2

Amphora Type	Weight (Kg)	Volume (litres)	Ratio
Dressel 1B	25.00 (1)	24.00	0.96
Dressel 2/4	12.00 (1)	24.50	2.04
	16.50 (1)	18.00	1.09
	16.50 (1)	33.00	2.00
Dressel 2/4 (Catalan) [5 ex.]	15.00 (2)	27.75	1.85
Haltern 70	15.50 (1)	25.50	1.65
	20.50 (3)	34.75	1.70
Rhodian	-	13.60 (1)	-
	5.90 (4)	12.00	2.03
Beltrán I	-	16.50 (1)	-
	-	18.00 (1)	-
	18.50 (5)	14.00	0.75
	17.90 (4)	27.00	1.50
	21.00 (6)	36.70	1.74
	20.00 (6)	33.70	1.68
	19.00 (6)	32.70	1.72
	21.00 (6)	30.30	1.44
	19.00 (6)	33.30	1.75
Beltrán II A	-	15.00 (1)	-
	-	15.00 (1)	-
	-	12.50 (1)	-
[4 ex.]	22.50 (5)	33.00	1.46
Beltrán II B [16 ex.]	22.00 (5)	33.00	1.5
Carrot	-	3.15 (1)	-
Gauloise 4	12.00 (7)	37.00	3.08
	10.00 (7)	33.50	3.35
	9.70 (7)	33.50	3.45
	10.00 (7)	30.00	3.00
	11.00 (7)	35.00	3.18
Dressel 20	37.20 (8)	72.25	1.94
	35.80 (8)	80.50	2.24
	32.32 (8)	77.50	2.40
	28.40 (3)	69.80	2.46
Africana	19.50 (8)	68.00	3.49
	17.30 (8)	56.50	3.27
	17.20 (8)	61.80	3.59
	17.30 (8)	64.50	3.73
Tripolitanian	14.00 (9)	57.60	4.07
	14.00 (9)	54.50	3.89
	15.50 (9)	60.50	3.90
	17.50 (9)	56.50	3.23
	17.00 (9)	55.50	3.26
	17.00 (9)	57.00	3.53
	17.00 (9)	58.00	3.41
	14.00 (9)	50.00	3.60
	14.90 (9)	50.10	3.36
	15.50 (9)	54.50	3.52
	17.00 (9)	53.00	3.12
	15.00 (9)	59.00	3.93
	15.86 (9)	56.18	3.56

(1) Sealey, 1985
(2) Corsi-Scilliano and Liou, 1985
(3) Colls et alii, 1977
(4) Santamaria, 1984
(5) Manacorda, 1977a
(6) Laubenheimer, 1991
(7) Laubenheimer, 1985
(8) Zevi and Tchernia, 1969
(9) Panella, 1977

However, two problems arise with the use of **average estimated weight (AVW)** for amphorae. Firstly, there are variations in weights and volumes within the same type, so a mean vessel-weight is needed for the calculations. The second difficulty relates to the fragmentary nature of archaeological records, in this case amphorae, and the coincidence of production areas for different types. Since amphorae types are normally recognized by fabric, sometimes it becomes impossible to distinguish form from body sherds. If two types are produced in the same area (e.g. Dressel 20 and Haltern 70) it is difficult to assign individual sherds (i.e. weights) to one of them, except the ones with distinctive form or thickness. Therefore quantifying by **weights** and **AVW** are prone to error whenever this situation occurs. If these errors are accepted, **weight** and **AVW** become quite good measures for analysis of amphora assemblages. It is advised to complement amphora quantifications with **EVEs** and **handles**, as another reliable reference [Keay, 1984,607; Tomber, 1988,74].

Another quantification relates to volumes of content. Amphorae were simply ceramic containers for foodstuffs; in other words they did not have any special intrinsic value but their content. Therefore, quantification of possible contents may provide another source of information for economical analyses [Rigoir, 1981]. Although there are some exceptions to the rule [Liou, 1988], an amphora type normally carried only one kind of product. Therefore these calculations may allow us to compare imports of the same product which originated in different areas in order to assess consumption preferences, supply or economic structures [Liou and Scilliano, 1989]. That is the logic behind calibrations according to vessel volumes introduced by Sealey [1985,113-123]. However, he obtained a number of litres per amphora type, by multiplying the amphora volume by a **minimum number of vessels** present in the assemblage. Thus his initial quantitative measure was the **minimum number of vessels**.

The only criticism to this approach is that it depends on **minimum number of vessels**, which is biased and not invariant. If **AVW** was used instead of it, the calibration would be more reliable. All the advantages of **AVW** as one of the best measures for quantifying amphorae become again evident when volume of contents are calculated. The table below shows volume calculations from Chichester amphora assemblage on the basis of the three quantitative methods: **minimum number of vessels (MNV)** established by **EVEs** or **handles** and **AVW**. Only **AVW** provides a good proportion of all amphora types, avoiding risks of over or under representation (e.g. African, Rhodian, S.Spain, Gauloise 4).

Table 3

Amphora type	MNV (EVE)	%	MNV(handle)	%	AVW	%
Dressel 20	322.2	62.59	322.2	57.41	631.81	85.57
S.Spain[2]	66	12.82	66	11.76	19.12	2.58
Rhodian	12	2.33	0	0	7.23	0.97
Gauloise 4	60	11.65	30	5.34	37.20	5.03
Haltern 70	29.5	5.73	29.5	5.25	7.08	0.95
Italian 2/4	25	4.85	50	8.9	21.37	2.89
African	0	0	63.5	11.31	14.50	1.96

Finally, it should be mentioned that there are a series of formulae which combine some of the measures already introduced. They may quantify the state of conservation of a vessel on the basis of its brokenness (**sherd counts/EVEs**) and completeness (**EVEs/EVR**) [Orton, 1989; Orton et alii, 1993, 168]. Another algorithm indicates vessel properties as containers such as capacity, stability (i.e. centre of gravity), transportability (i.e. form, weight and graspability)[3] and efficiency[4]. The concept was not alien to the Romans who recognized the quality of containers on the basis of the resistence (Dig. 19.1.6.4; 19.2.19.2; 21.1.13) [Manacorda, 1993]. For the importance of the concept transportability towards amphora, it is worth quoting the definition by Rice:

> ***"The transportability of a ceramic artifact is a ratio of the value of the item to its weight and to the breakage ratio in transit" [PM.Rice, 1987,199]***

The idea associates measures advanced in this section such as ratio weight/volume with amphora contents (see next chapter) and residuality (see below). Transportability is a key concept which relates current quantifications of amphora with the real use and properties of such vessels in the past.

Conclusion

Summing up, this section introduced the main quantification measures for pottery and it assessed their performance with reference to amphorae. **Weight** and **average vessel weight** seem to be the most reliable, though not perfect measures. Although **EVEs** are considered to be the best

---

[2] Beltrán II A ratios are chosen, though this fabric also includes Beltrán I and Beltrán II B.

[3] Rice [1987, 225] includes an interesting account of how to measure all these properties following an ethnographical and functional approach.

[4] The concept of efficiency as a container is expressed in terms of the volume transported by unit of weight [Zevi and Tchernia, 1969,177; Widemann et alii, 1979; Peacock and Williams, 1986,51-52].

performer for pottery [Orton 1975; 1982], they are not really suitable for amphora quantification. Following these conclusions, the present research applies **weights**, **sherd counts**, **EVEs** and **handles** as basic methods from which the other standard measures can be obtained. However only **weights** and **average vessel weight** supply the quantities analysed in detail. At a second level, whenever the analysis required calculations of volumes, **AVW** was the basic measure from which these were obtained.

2.1.2 Standardization practices

Before comparing two different assemblages, the quantitative data should undergo a process of standardization in order to relate assemblages to populations. Although this step has not attracted any special attention in the archaeological literature, it has a key role in quantitative studies [Renfrew and Bahn, 1991].

> ***"Given the fundamental importance of [...] estimating changes in population size, it is remarkable that there has been so little discussion about the relationship between the artifacts found in this case pottery - and past populations"***
> ***[M.Millett, 1991,18]***

The most common practice consists of calculating percentages of artifacts in the total assemblage, normally a pottery type with reference to the rest [Hodder and Orton, 1976,24; Riley, 1976,128]. This was considered the adequate method for the study of trade and spatial distribution of obsidian [Renfrew, 1969; 1972] and pottery [Peacock, 1969; Hodder, 1974; Fulford and Hodder, 1974] in the past. However, conclusions obtained from these analyses should be revised since standardizations were in fact artificial. In other words, some artifacts may have similar properties (i.e. pottery) but this does not mean that they were parts of the same functional or economic systems. For instance, quantities of African red slip bowls may have not had any relation to quantities of other fine wares, coarse wares, mortaria or amphorae.

Therefore, calculating a percentage with reference to other pottery types may be biased and create confusion. Furthermore, the use of percentages constrains the application of some statistical analysis, which require unrelated data [Shennan, 1988]. Notwithstanding the fact that percentages can be useful for graphical purposes [Panella, 1973; Liou and Scilliano, 1989], it is recommended to restrict them solely to this use. The following theoretical example helps to illustrate this point. Two excavations from two different sites (A and B) yield different quantities (weight) of three types of amphora (x, y and z).

Table 4

Site A (100 m²)	%	Site B (100 m²)	%
x 40 kg	40.00	x 40 kg	80.00
y 30 kg	30.00	y 5 kg	10.00
z 30 kg	30.00	z 5 kg	10.00

Observing the percentages, one may infer that there was a major supply of pottery x to the site B. However the raw data shows clearly that both sites imported the same amount of pottery x per m², so variations in quantities of pottery y and z were biasing the results. Sidrys [1977] reached similar conclusions in his study of obsidian distribution in Mesoamerica. So he developed a second standardization method, which involved the calculation of densities. According to his principle, a quantity of a specific artifact should be divided into the volume of earth removed during the excavation. This method provided him with unexpected information that threw some light into the complexity of obsidian marketing (i.e. attraction of large centres), though the approach has been also criticized [Hodder, 1979,7].

Unfortunately this practice has not become popular because of the time consuming calculation of volumes, hence cubic measures are not normally available. Despite some suggestions of counting them by number of buckets per layer while the excavation is under way [Millett, 1991,238], it is still difficult to put into practice.

Nevertheless, the method also has some flaws regarding the characteristics of site formation processes (i.e. depositional and post-depositional)[5], chiefly evident in multiperiod sites. If an artifact is only quantified when it is found in its own chronological contexts and then divided by the volume of these contexts, it means that all residual material is discarded. This residual material may constitute the most important representation of an artifact in the site so such information cannot be disregarded, if the study is concerned with the overall supply to the site. On the contrary, if an artifact is quantified in whatever contexts it is found, and later divided by the overall volume of all these layers, there is always the risk that the volume of later layers may diminish the artifact proportion. It is clear from this example that the method may not be ideal, but it is still prefereable to the result obtained from percentages.

Some problems of standardization become really acute in urban archaeology where multiperiod sites are the most common feature [Ottaway, 1992]. Since cubic densities seem not to

[5] More detailed discussions can be found in Schiffer [1976; 1987], Butzer [1982] and Huggett and Cooper [1991].

be the most suitable answer to the problem, an alternative should be found that could handle the temporal and spatial dimension of the archaeological distribution.

Spatial and temporal dimensions

Amphorae provide information about activities such as exchange, consumption or production within an economic framework. Quantities of amphorae in a site will vary according to a site area which normally identifies its potential population [Hassan, 1981], and its occupation length [Rice, 1989]. These are the two dimensions, spatial and temporal, embedded in the quantity of archaeological material recovered that are likely to lead to confusion.

The application of cubic densities to standardize quantified data is due to the need to relate these values to the extent of the area in which they were found. If a site is considered to be a focus of human activities at a specific time, the remains of such activities should have left traces within its area[6]. Since only a part of the site can be excavated, the data recovered corresponds to a small portion of this human activity as a whole [Cogwill, 1970].

The spatial dimension can be simply overcome by dividing quantities of artifact into the area excavated, then obtaining an area density [De Boer, 1974]. The method is well-known in field walking because it involves the surface collection of material [Haselgrove et alii, 1985; Schofield, 1991; Kroll and Price, 1991], but it can be also applied to excavation data. A possible criticism is that different excavations on the same site may yield different densities, which in fact will provide new information about diverse functional areas in the site, its organization and even evolution.

Therefore this variation in densities is desired and welcome. Furthermore, an average of densities may supply a more representative figure of an artifact proportion in a site as a whole, taking into account the variations in all locations. Human activities in the past were undertaken in two-dimensional space, the result of which are also reflected in a point in the space. Standardizing archaeological data by a two-dimensional space retrieves information attached to it related either to depositional or post-depositional processes [Schiffer, 1976; Butzer, 1982]. In practical terms, the method is easy and simple, so that its application is not time consuming.

If this method can overcome the spatial dimension in quantitative data, a second standardization is needed to take into account the temporal dimension. The best way is to simply

---

[6] The discussion about the dynamic of a temporal dimension in the archaeological record with reference to Pompei can be followed in Binford [1981;1982] and Schiffer [1985].

calibrate densities according to the site's occupation length, though it becomes sometimes difficult to integrate the own artifact production span. Applications of standarization according to the spatial and temporal dimensions are better illustrated by examples. For instance, two sites (A and B) after 1 season of excavations covering different areas and different occupation lengths yielded some quantities of pottery. It is required to compare three pottery types (x, y and z) in order to assess patterns of exchange and consumption between them.

Site A	Site B
10 years of occupation	5 years of occupation
100 m^2 excavated	200 m^2 excavated
x 30 kg	x 30 kg
y 20 kg	y 80 kg
z 60 kg	z 40 kg

Once the quantities of pottery are standardized according to spatial variations between sites (i.e. area excavated), the following densities are obtained:

Site A	Site B
x 0.3 kg/m^2	x 0.15 kg/m^2
y 0.2 kg/m^2	y 0.4 kg/m^2
z 0.6 kg/m^2	z 0.2 kg/m^2

Except for the pottery y, it seemed that densities in site B were lower than in site A. However, this effect is overcome by calibrating densities by occupation length.

Site A	Site B
x 0.03 kg/m^2 per year	x 0.03 kg/m^2 per year
y 0.02 kg/m^2 per year	y 0.08 kg/m^2 per year
z 0.06 kg/m^2 per year	z 0.04 kg/m^2 per year

These last densities allow us to compare the supply of both sites in equal terms and consequently to draw some conclusions from reliable values. For instance, pottery x reached both sites at the same rate whereas y and z were better represented in only one site respectively. Therefore, standardization remove a great deal of "noise" related to the spatial and temporal dimension attached to archaeological data, allowing a better understanding of pottery distribution.

Conclusion

This section attempted to underline the importance of standardization practices in the use of quantitative data. A new method of standardization was proposed here since previous ones did not provide reliable outputs for comparison. The method involved calculating densities per area and calibrating the results by site occupation length. This technique is recommended because it removes spatial and temporal distortions to the data. Other practices, such as cubic densities bring about numerous problems whenever multiperiod sites are studied. However it is still quite an useful method for sealed deposits as it provides more complete temporal information than area densities. Therefore it is advisable to apply both at the same time since they can complement each other. Percentages are only useful as graphical representations, but they should not be used for anything else. Otherwise the conclusions drawn from them may be completely false.

2.1.3 Quantifying Stamps

Amphorae are unusual as containers, in that they sometimes carry epigraphic information. They can bear *stamps*, *graffiti* or *tituli picti* (i.e. painted inscriptions), although these are exceptional. The analysis of such an epigraphic information refers in more detail to the structure of exchange mechanisms and production [Remesal, 1977,1986; Rodríguez Almeida, 1989; Manacorda, 1989; 1990; Liou, 1991]. However, the limited number of amphorae with such information with reference to the overall number of these vessels makes rather difficult to use this data in a quantified manner. Therefore, there are some specific constraints to the epigraphy on amphorae which must be borne in mind. *Graffiti* and *tituli picti* are very rare, and the latter are related to the state of conservation of the material: this is affected by weathering and soil coinditions (i.e. ph). This situation means that they cannot be used as reliable quantitative measures.

On the other hand, amphora stamps are more common but only on some specific types, thus they have to be quantified with care. In the present thesis Dressel 20 stamps were analyzed in detail since they represent more than 1800 examples out of 2000 in Roman Britain. Nevertheless only a small proportion of these amphorae were stamped and it is extremely difficult to assess how this rate might have changed over time or according the originary workshop. Rodríguez Almeida [1977] pointed out that the number of stamped amphorae at Monte Testaccio increased over time, reaching 75% in third century contexts. Such an increase in stamps on later Dressel 20s seems also to be supported by some later examples of amphorae stamped two or three times[7] in the third century A.D. A pilot study was carried out to test if there was a change in proportions of stamped Dressel 20 according to well-dated contexts from Mt.Testaccio (Rome) and shipwrecks. Although the first century examples are scarce, and none are recorded from the second half of the second century A.D., the provisional results show an increase in the proportion of stamped to non-stamped amphora over time. The table following includes an average of kilograms of amphora per stamp for each period, as well as the number of contexts from which this data was collected.

Table 5

Period (A.D.)	Average	Samples
1st century	107.01	4 (1)
1st half 2nd century	71.11	8 (2)
2nd half 2nd century	-	-
3rd century	38.36	28 (3)

(1) Colchester Sheepen [Sealey, 1985]; Port-Vendres II [Colls et alii, 1977]; Culip IV [Nieto et alii]; Longthorpe [Dannell and Wild, 1987].

(2) Mt.Testaccio [Blázquez, Remesal and Rodríguez Almeida, forth.].

(3) Mt.Testaccio [Blázquez, Remesal and Rodríguez Almeida, forth.]

Similar variations in the number of stamped vessels may be expected from individual production centres that could have stamped more amphorae than others. This feature may explain the popularity of some stamps such as CANTONIQVIETI, FSCIMNIANO or CSEMPPOLY that may be simply overrepresented as a mean of advertising [Curtis, 1984-86]. Nevertheless quantifying stamps is still worthwhile if they are defined as relative values. Therefore, analyses of differences in supply between sites or between sites, and their province can yield a valuable insight into production and distribution mechanisms. That is the reason why this information has been analysed in the present research.

Moreover, it is doubtful whether the quantity of stamps reflect accurately the amount of amphora Dressel 20, reaching a specific site. Since early excavations, amphora stamps have been collected and recorded while amphora sherds have been only documented and kept in recent times [Callender, 1965: Peacock and Williams, 1986]. Therefore an absolute number of stamps represent all the excavations undertaken on a site while amphora sherds only identify later discoveries.

---

[7] Callender [1965] describes a Dressel 20 amphora at Worms bearing three stamps, two on handles and one on the body. Remesal [1986] interpretes one of them as the olive-oil producer name, IIIVNIMELISSIETMELISSE; the second one as the pottery kiln's name, FPATERNI; and the third one, as the potter's name, VENERF.

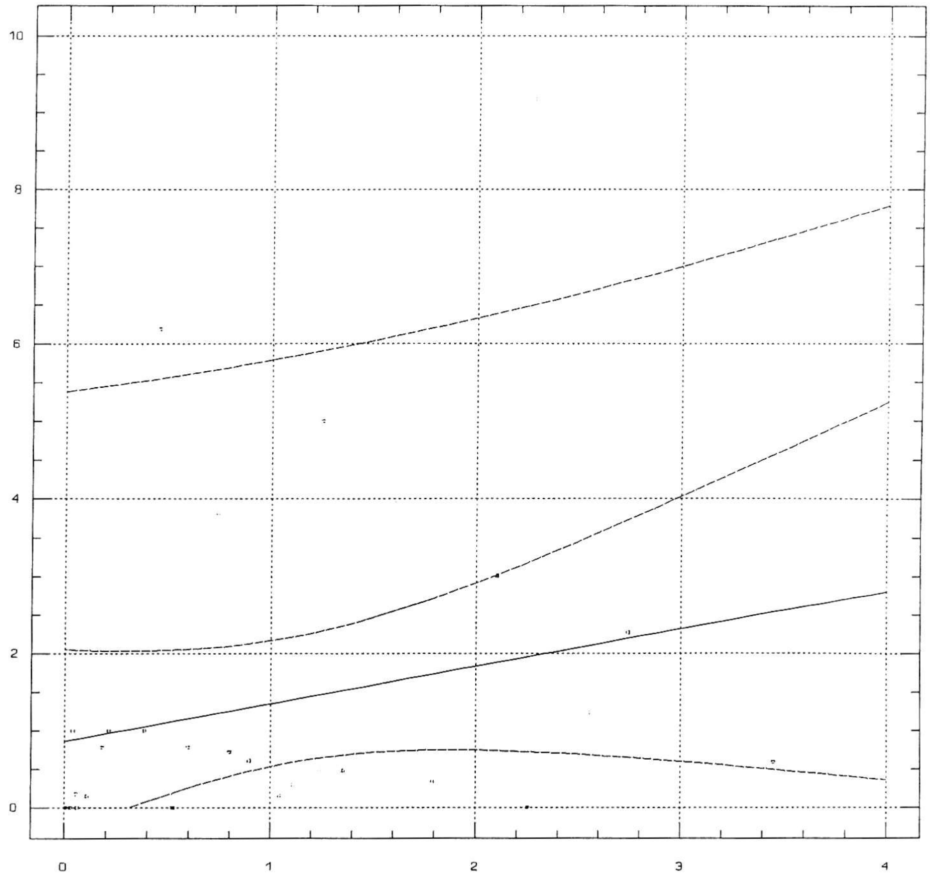

Figure 1 Regression analysis plot of Dressel 20 stamps densities on Dressel 20 weights densities.

Again a pilot study served to assess whether number of stamps could identify the supply of Dressel 20. The aim was to compare densities of Dressel 20 per square metre recorded in a sample and densities of all recorded stamps per hectare at the same site. A regression analysis demonstrated that there is not a high correlation between number of stamps and quantity of amphorae, so that they cannot be considered as representative. The results of the regression analysis show only a 0.234689 as correlation coefficient and 5.15% coefficient of determination. This means that there are other variables affecting the total number of stamps collected in a site (i.e. collectionists, number of excavations ...). Therefore, both types of data should be studied separately without taking for granted that stamps accurately identify amphora supply. There are many other variables affecting the final number of stamps recovered, so the data must be dealt with carefully.

Regression Analysis

Correlation Coefficient	0.234689
Standard Error	2.12562
R-Squared	5.51 %
Equation:	Y= 0.863915 + 4.836995 E-5 ± 2.12562

Conclusion

Amphora stamps are a relatively difficult type of data, since rates of stamped vessels varied over the time and according to production centre. As absolute values they may mislead, but as relative measures they can be used to compare sites and periods. In the present thesis, stamp quantifications are taken into account as references, which would be always contrasted with other data.

2.1.4 Residuality and sherd size

One of the great problems entailed in standardizing by cubic densities is residuality. This term defines an archaeological reality of finding objects in chronological contexts to which they do not belong. In other words, archaeological finds are considered to be residual when they are recovered from contexts whose assemblage as a whole is significantly later than their date of production or accepted life span. First of all, it is agreed that the archaeological principle is that a layer is dated by the latest artifact (i.e. terminus post quem). But as Cooper [1989] states there are numerous assumptions behind this idea, which are not always true according to the empirical evidence.

> ***"First not every impact will contain artefactual material. Secondly, not all artefactual material will be datable, or the dates will be in form of a wide date range. A third and more far reaching problem which is especially apparent on urban sites is that of derived (i.e. residual or intrusive) material"***
> ***[MOH.Cooper, 1989,82]***

Residuality has become a "bone of contention" in studies of artifact assemblages, chiefly in urban sites [Angle et alii, 1988; Evans and Millett, 1992, 225; Orton *et alii*, 1993]. It creates not only problems for dating sites and contexts but also for understanding the processes of deposition. These processes can be defined as artifact changes from a systemic to an archaeological context [Schiffer, 1972; 1976,28].

The real difficulty is in assessing and differentiating between material discarded by original occupants of a site at that time, and material re-excavated and re-deposited by later occupants [Carver, 1985,353]. Pottery seriation was supposed to be an analytical method to overcome residuality, or at least to recognize it[8] [Sinopoli, 1991; Orton *et alii*, 1993, 188-194]. Nevertheless some practical applications have demonstrated that residuality is more complex than first

[8] Carver [1985] and Laxton and Restorick [1989] provide a guide of how to use this method and its first achievements; whereas Cooper [1989] includes a critical viewpoint.

appreciated [Crummy and Terry, 1979; Bradley and Fulford, 1980; Tomber, 1988; Symonds, 1991; forth.; Evans and Millett, 1992].

Sherd size was considered to be a second source for detecting and recognizing residuality. Ethnographic studies showed that small size artifacts were normally found in primary refuse areas whereas larger ones were common in secondary refuse areas [Schiffer, 1978,244-245]. Furthermore experimental research [Kirby and Kirby, 1976] indicates that sherd decreases steadily in size due to trampling, which had been also used to explain the effect of time [Bradley and Fulford, 1980; Tomber, 1988; Orton *et alii*, 1993, 214]. The principle is that the later the context, in which a residual artifact is found, the smaller the artifact should be.

> *"...pottery with a long history of disturbance and redeposition will tend to get smaller through time. In a sequence with a uniform depth of disturbance and a constant wastage rate of pottery one would expect to find an increasing density of sherds, combined with a smaller mean size"*
> *[R.Bradley and MG.Fulford, 1980, 87]*

The statement presupposes constant disturbance and redeposition of material, which can undergo trampling from its initial date of disposal until its final recovery. In other words, pottery should have been on surface (i.e. top-soil 10 cm) so as to be subjected to any disturbance such as trampling, weathering, mass movements or stream activity [Butzer, 1982,117-120]. Some empirical studies reinforce the idea that there is no such unique correlation between sherd size and time, there are many other variables affecting a final size [Evans and Millett, 1992].

Nevertheless, there may be a correlation between the length of time during which an artifact is on surface and its final size. Urban sites of continuous occupation usually demonstrate large scale constructions that alter earlier structures and deposits. Some of these disturbances last for a short period in which material from earlier contexts comes to the surface, where it can undergo changes in size before forming part of a new contemporaneous archaeological context. For instance, some early material in a short formation layer of its own date may have come to light for a few years in a late development (i.e. XIXth century buildings). During these few years, the material is again on the surface running the risk of being reduced in size by trampling. Therefore the result of such an alteration for a short time may be simply that the average size of early material is greater than the size of similar material of later date which has been longer on surface since its deposition.

The data collection of quantified amphorae from various sites and contexts permits the reconsideration of the effects of time on sherd size. Residuality is relevant in amphora studies because typologies normally have a long time-span of production [Symonds, 1991]. Therefore, residuality may indicate the end in the supply of an amphora type to a site during its production span [Carreras and Keay, forth.].

First of all, it must be demonstrated that an amphora type always has a similar breakage ratio [Orton, 1986] or its sherds after breaking have a similar size. The Mte. Testaccio (Rome) seems to provide an excellent example since all the amphora were broken and dumped on the site once they reached the *Urbs* of Rome [Rodríguez Almeida, 1984]. With the exception of the top layer and the amphora walls, a general trend in sherd size can be distinguished [Blázquez and Remesal, forth.]. Moreover sherd sizes recorded from different Romano-British sites demonstrate a normal distribution curve for three amphora types, which should be interpreted as similar brokenness ratios (see Figure 2).

Dressel 20

Average sherd-size:	179.965 gr
St.Error:	73.139 gr
Lower quartile:	135.00 gr
Upper quartile:	223.00 gr

If a sherd size classification is established on the basis of the mean and quartiles of the Dressel sherd-size histogram, it can provide a framework to assess the degrees of residuality of different archaeological assemblages including this amphora type. For instance, Dressel 20 sherds in a context with a smaller mean size may identify a residual group of material or a residual context. On the contrary, a group with a greater mean size may be recognized as present in a contemporaneous layer or context. Of course, there can be human intervention affecting such a principle so it is necessary to proceed with caution.

Following this argument, some experiments were undertaken with amphora sherds from well-dated contexts and layers in order to test if there was a general pattern of sherd size for the Dressel 20 amphora type. Knowing beforehand whether the amphora sample came from later or contemporaneous layers, the aim was to assess if the mean size of each assemblage compared to the overall sherd size could identify residuality. The following examples (see table below) make clear that sherd size can recognize residuality, though not in detail. All short formation layers have greater mean sizes than the overall one, whereas the majority of later or long formation contexts have smaller mean sizes.

Table 6

Early Contexts	Average sherd-size	Late Contexts	Average sherd-size
CID 90	321 gr	IRO 80	299 gr
LEN 89	283 gr	HSS 79	259 gr
RAC 89	383 gr	RGB	179 gr

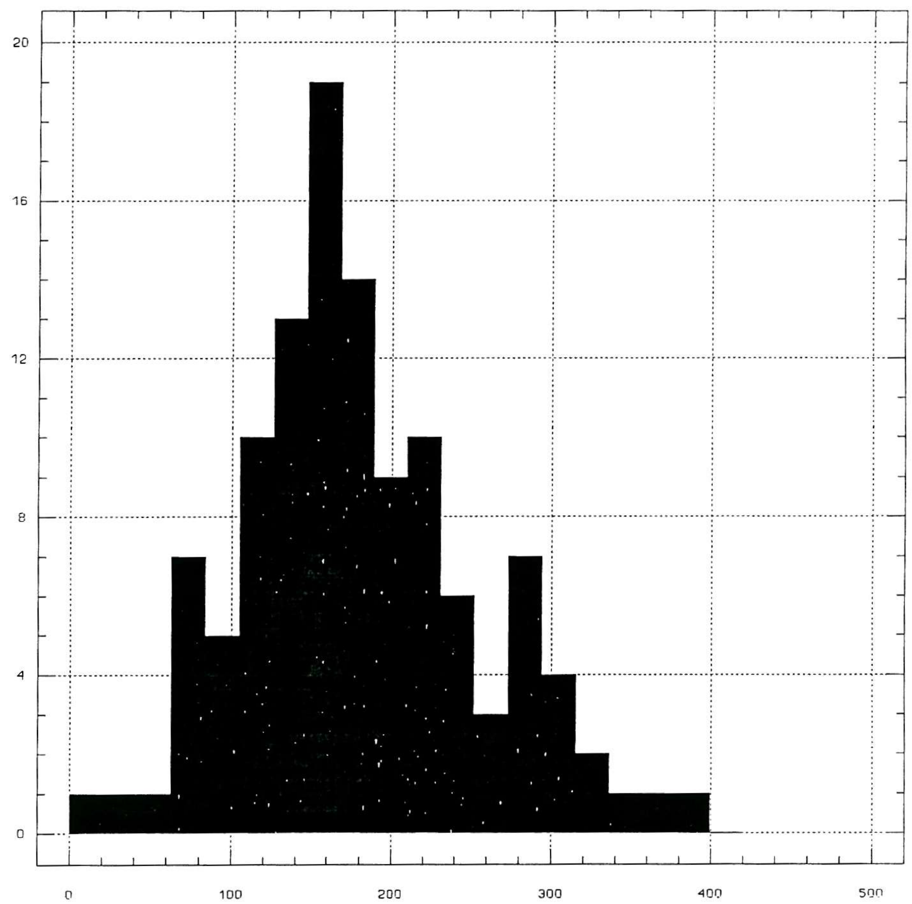

Figure 2 Histogram of Dressel 20 sherd sizes from different Romano-British sites

Similar pattern can be inferred from other types of amphorae, Southern Spanish and Gauloise. Thus the conclusion is that sherd size can supply us with an useful measure to assess residuality. However, it is too early to define normal trends and standard deviations since more testing and data collection is needed. The present exercise reveals some relationship between amphora-sherd sizes and their contexts giving, some scope for further tests and research into the subject. It is clear that no direct relationships between individual age group and sherd-size can be made as Bradley and Fulford [1980, 87] suggested. However sherd-size can reflect time of deposition on suface, thus the measure cannot be disregarded in the sense that Evans and Millett

[1992] proposed. Sherd-size can determine effects such as trampling on pottery, therefore it sheds light into processes of layer formation and disturbance.

2.2. Sampling strategies

The second methodological problem refers to the selection of an adequate sample for the research, which must be a good representative of the whole study area. Generally, a population is studied on the basis of analyses undertaken on a restricted number of its members, so that this limited group constitutes a sample from which the population features can be inferred. Only in a very few occasions are representatives identical to populations, but generally speaking a sample is a rather small part of the overall population. Therefore the real task becomes to select an appropriate specimen that may accurately represent the population as a whole. In this context, there are two different strategies available: probabilistic or non-probabilistic sample [Shennan, 1988].

The distinctive characteristic of a probabilistic sample is that every individual within the population has a known probability of being included in the sample [Blalock, 1981]. For instance, a transect in fieldwalking can be considered as a probabilistic sample whenever it is a random choice within the area of study, in which each transect has the same chances of being selected [Cherry *et alii*, 1978]. Statistical theory provides the framework for the choice of representatives, basically mathematical formula degrees of accurancy and errors in a sample, and how to interpret results with reference to the initial populations. Statistics is a field in Mathematics dealing with relationships between measurements and populations, which is the kind of information required in data collection.

The present project aims to analyse the amphora distribution in Roman Britain, which is a relatively wide research scope. Since the study of the whole country is unavailable in terms of cost and effort involved, a sampling strategy had to be specified from the start. Although there are no references to a minimum number of samples, regarding previous case studies (e.g. Classic Maya) [Kvamme, 1990], 48 Romano-British settlements was considered a good representation of Britain as a whole. In fact, this is a kind of non-probabilistic sampling also known as judgement or purposive sampling. The only problem with this approach is that the representativity of a sample cannot be evaluated. In judgement sampling, a researcher selects a representative according to a well-grounded knowledge of a population. In this case, the sample was selected by previous amphora scholarship[9]. However, the process involved a more specific selection according to five criteria:

---

[9] There are numerous amphora reports of Romano-British sites, which provide an initial prespective of amphora distributions. Some of them are referred in Peacock and Williams [1986] and others in the present thesis.

1. Sites with good number of recorded amphora stamps
2. Sites with wide variety of amphora types
3. Large sites without previous knowledge of their amphorae
4. Sites located in different geographical areas (coast vs inland, North-South, East-West, plain-mountain)
5. Sites representing different function (administrative, commercial...) and status (capital, coloniae, civitates)

At least one amphora assemblage of each 48 sites was studied, thus all provided a minimal representation so as to have an overall view of Roman Britain. Nevertheless, more than one assemblage was analysed in the case of large sites because of their extension and variability of amphora types. Therefore a sample of 14 major sites was defined to be studied thoroughly, at least by a minimal number of amphora assemblages. The sites selected for this purpose were:

1. Winchester	8. Carlisle
2. Chichester	9. Corbridge
3. Cirencester	10. York
4. Chester	11. Colchester
5. London	12. Leicester
6. St.Albans	13. Lincoln
7. Ribchester	14. Silchester

Despite the fact that this judgement sampling strategy cannot be evaluated according to probabilistic theory, it follows a logical argument founded on previous knowledge of amphora studies in Britain[10]. The aim was to obtain a representative group of amphora assemblages from which inferences could be made about the characteristics of their distributions. If the features of the sites selection did not permit us to apply probabilistic theory, the amphora assemblages from the sites chosen do. Considering site size as a limited area where potential amphora assemblages can be found, each excavation constitutes an individual sample of the whole population [Kintigh, 1989]. The larger the area excavated, the more representative the assemblages will be. At least, urban sites are excavated according to building programs and developments, which do not take into account any previous archaeological strategy. Thus, each excavation constitutes a single random sample of the site as a whole. Since sites sizes and areas excavated are available, a confidence interval can be obtained for the quantifications applying probabilistic theory [Shennan, 1988, 301-303].

[10] Research undertaken by Callender [1965] and Funari [forth.] with reference to amphora stamps; and Peacock and Williams [1986] in amphora and petrological studies.

In the past, a good amphora deposit was taken as representative of the overall amphora imports for a site and chronological period[11]. However, they were relatively small samples of the whole site; in other words the amphora assemblage from the remaining unexcavated area of the site might have provided a different picture. Therefore, the application of probabilistic theory permits one to assess sample limits from which some conclusions can be drawn. It simply shows the relationship between a sample (i.e. excavation data) and a potential population (i.e. the whole site). Considering amphora imports as one activity taking place within a delimited known area (i.e. settlement), their analysis can be only undertaken on the basis of the data available for the area excavated. However, the sum of all the excavation areas is still a small portion of a settlement, thus only relating both extensions some confidence intervals and conclusions can be drawn.

This point can be illustrated with some examples. For instance, Roman London seems to have occupied an area of at least 1336500 m² [Millett, 1990a, 153]. Unfortunately, the sample available from 15 excavations in this site corresponds to an approximate area of 3273 m². The average density of amphora (gr/m²) from these 15 sites is 364.12, showing a normal distribution around the mean that presupposes standard deviations on the basis of this value[12], but how representative is this mean ? One possible answer to this question implies a calculation of a confidence interval, adding the standard error of the mean which previously should have been standardised by using the finite correlation factor. The following formula can be applied to calculate a confidence interval [Shennan, 1988,305]:

$$\bar{x} \pm Z_\alpha \left(\frac{s}{\sqrt{n}} \right) \sqrt{\left(1 - \frac{n}{N} \right)}$$

where $\bar{x}$ is the mean, Z_α number of standard deviations, s standard deviation, n sample (e.g sum of area excavated) and N the population size (e.g. site size). In the case of London, these are the necessary values:

$$364.125 \pm 1.96 \left(\frac{447.794}{\sqrt{15}} \right) \sqrt{1 - \frac{15}{1336500}}$$

[11] Some of the best monograph studies of amphorae from one site or excavation are Hesnard [1980]; Fulford and Peacock [1984]; Sealey [1985]; Dore and Keay [1989].

[12] S.Shennan [pers.comm.] warns of calculating standard errors whenever the initial values evidence a non-normal distribution.

According to probabilistic theory, there is a 95% probability that the average amphora density in the site lies between 379.155 and 349.095 gr/m². This confidence interval provides at least a framework to interpret the amphora data gathered from different excavations in the same settlement. Since the example of Roman London may not be enough to illustrate this point, the following table summarises the confidence intervals of amphora densities at a 95% of probability for three other sites apart from London.

Table 7

Site	**Mean (den.)**	**Confidence Interval**
London	364.125	590.755 - 137.495
Leicester	87.128	125.198 - 49.058
Chester	202.83	388.49 - 17.17
York	337.154	603.724 - 70.584

A second advantage of this approach relates to the kind of standardization method used (i.e. densities), which has been already discussed in detail. Moreover, it is relevant to mention this method now because it allows a quantified databank to be updated and so, to improve sample quality [Orton *et alii*, 1993, 229]. As has already been indicated, the amphora data from this thesis come from a limited number of excavations within different sites. Since the number of excavations available will increase in the future, all amphora data can be added to the current database, improving the relationship between sample and population as well. Thus if, for example, a further 15 excavations were undertaken in Roman London in the 90's, covering an approximate area of 3000 m². The quantities of amphora recovered from them could be summed to the initial data collected before the 90's, providing new means and confidence intervals. The increase of the area excavated, once the new information is included, tends to narrow the confidence interval limits unless the new assemblages increase the standard deviation. In other words, a larger sample size defines more reliable values from which to infer archaeological patterns. The closer the sample size is to the actual population size, the greater the confidence of the samples' representativeness.

The idea behind this argument is that archaeological data should be sampled and quantified in such a way that the resulting information can be used, improved and revised by complementing it with new data. The conclusions drawn from these limited samples should be constantly challenged whenever more samples are available. In the present research, it was decided to show the sample limitations indicating excavation areas from which the data comes with reference to each site size. The following table summarises the sample size for each site:

Table 8

Settlement	Area excavated in m^2	Site extension in m^2
1. London	3273	1336500
2. Mucking	800	-
3. Beddington (Surrey)	658	-
4. Ardleigh (Essex)	650	-
5. Sandy (Berdf.)	10000	-
6. Hibaldstow (Humb.)	250	-
7. Malton (Yorks.)	900	32000
8. Rocester (Straff.)	5000	36000
9. Metchley (Burgh.)	14000	-
10. Brancaster	300	-
11. Godmanchester	176	110000
12. Longthorpe	1200	1200
13. Inchtuthill	17896	217400
14. York	2516	405000
15. Leicester	6169	420000
16. Stonea	10000	10000
17. Bewcastle	225	20000
18. Old Penrith	1255	-
19. Ivy Chimneys	6145	6145
20. Canterbury	1800	530000
21. St.Albans	2080	810000
22. Chester	4979	209000
23. Winchester	5435	558000
24. Chichester	3120	405000
25. Exeter	321	370000
26. Cirencester	4967	972000
27. Silchester	1760	400000
28. Chelmsford	75	60000
29. Purbeck	300	-
30. Staines	282	-
31. Corbridge	676	160000
32. Carlisle	1501	300000
33. Lancaster	250	40000
34. Ribchester	1378	40000
35. Colchester	14275	430000
36. South Shields	2000	21000
37. Chesterholm	540	20000
38. Kingsholm	300	-
39. Poundbury	900	-
40. Skeleton Green	1340	-
41. Segontium	8712	-
42. Pentre Farm	5625	-
43. Falrik	3250	-
44. Alchester	382	-
45. Gillingham	300	-
46. Kirkbride	320	-
47. Chesterfield	1000	-
48. Tiverton	389	-

2.3. Analytical techniques

The third stage of the research requires the study of the data, thus some analytical techniques become necessary so as to simplify and understand their structure and complex nature. This section outlines the techniques applied to this specific research and the main reasons for their use. Three different kind of techniques, applications or methodologies, depending on how they want to be defined, can be distinguished:

2.3.1 Statistical Analyses
2.3.2 Simulation Analyses
2.3.3 Geographical Information Systems (GIS)

These techniques have been combined together in some cases, though in general terms they are distinctive and unrelated to each other. They have been used as tools to analyse the characteristics of the real data in order to identify common links or patterns.

2.3.1 Statistical Analyses

The field of statistics involves explaining relationships between numbers and has two main functions. The first function is description by which data is summarised in a way that is understandable and usable, something required for the present research. The second function is induction, which means that a sample can be used to generalise about populations, another principle already described in the previous section. A series of multivariate analyses developed in statistics are being applied to archaeology in order to discover general trends in the data [Doran and Hodson, 1975; Orton, 1980: Shennan, 1988; Madsen, 1988]. Basically the present research employs cluster, principal components and correspondence analysis[13] in different kinds of applications with the aim to analyze amphorae.

a. **Cluster Analysis** is a process for classifying data in different groups that will simplify the variability observed [Escudero, 1975; Aldenferder, 1982; De Lagarde, 1985; Batalle and Visauta, 1986; Shennan, 1988, 212-232].

b. **Principal Component Analysis (PCA)** is a method of analyzing data in order to express their variation in a minimum number of linear combinations of the original partially correlated variables [Doran and Hodson, 1975; Jambu, 1978; Shennan, 1988, 244-280; Cuadras et alii, 1988].

---

[13] See Shennan [1988] for more detailed information about cluster and principal component analysis; and Bolviken et alii [1982] and Madsen [1988] for correspondence analysis in Archaeology.

c. **Correspondence Analysis (CA)** is again a method of analysing data in order to summarise their variability in a minimum number of linear combinations of the originally partially correlated variables. Its difference to PCA is that it was developed to analyse frequencies as data [Bolviken et alii, 1982; Sánchez-Carrión, 1984; Lebart et alii, 1984; Madsen, 1988; Shennan, 1988, 283-286; Ringrose, 1992].

These three methods were inially applied to clarify morphological changes in some amphora types. In fact, as the typologies are well-known, the classification only serves to establish relationships between variations in form and chronology. Likewise the methods were used to categorize assemblages from different excavations of the same settlement as well as to group sites according to the composition of amphora assemblages [Blankholm, 1991]. Taking the quantity of each amphora type as a variable, excavations and sites can be grouped on the basis of common proportions of material. These preliminary groups may identify functional, economical or chronological patterns in Roman Britain.

Moreover, simple regression analyses have been employed here whenever it was necessary to establish relationships between variables defined by polynomial equations. These analyses allowed us to assess the strength of correlations and therefore, how well a variable may represent variations in others [Blalock, 1981; Shennan, 1988]. Finally a series of descriptive statistics and plots were used to present results and quantifications with the aim to make them easy to understand.

2.3.2 Simulation Analyses

The term simulation defines many different kind of operations in which real situations are represented in an alternative form. Simulation modelling is a research tool that allows one to experiment with a model identifying a real system instead of experimenting with the real world, which is not always possible. The main aims of their applications are: **comparison** of variables in a system; **prediction** of system evolution; and **investigation** of how the system works [Naylor et alii, 1966; Davies and O'Keefe, 1989].

On the one hand, a system can be defined as **stochastic**, when there are random elements affecting its behaviour. When a system does not have such elements is known as **deterministic**. On the other hand, if a system changes with time, it is said to be **dynamic**, whereas the opposite identifies a **static** one. These are the key features of a system that wants to be simulated. Simulation analyses were introduced in Archaeology through previous applications in Geography [Hägerstrand, 1952; 1957], though the aims and approaches were diverse [Doran, 1970; Hodder and Orton, 1976]. While simulation analyses were employed in different fields, including Geography, so as to study present systems or predict future events, their applications in Archaeology aimed to predict past situations [Hodder, 1978; Sabbloff, 1981; Bells, 1987; McGlade, 1987; Doran, 1990].

> ***"Prediction is making suppositions about future phenomena on the basis of the well-grounded knowledge of the present. Analogously, predicting the past is making suppositions about past phenomena on the basis of the well-grounded knowledge of the present"*** *[EBW.Zubrow, 1990,308]*

Some archaeological applications were designed to simulate artifact distributions by simple random walks [Hodder and Orton, 1976], population changes [Zubrow, 1975], migrations [Hodder, 1977], exchange patterns [Doran and Corcoran, 1985] agricultural production [Reynolds, 1986], herd evolution [Cribb, 1987] or even hoard formation [Lockyear, 1991]. A few of them can be related to Roman economic studies from an archaeological prespective [Carreras, 1994a], when simulating traders' decisions, or from an historical one [Jongman, 1991]. Any simulation requires a series of processes in order to adequate a theoretical concept to a practical utility which can produce an output [Aldenferder, 1981]. These processes can be divided into 4 main groups [see also Freeman, 1988]:

a. **Conceptual Background**, any theoretical principle which can be studied by simulation. It requires the formulation of a series of specific aims and targets for a research.

b. **Definition of constants and variables**, a simulation needs a structure based on constants and variables with a key role in the system that wants to be simulated. Defining these key constants and variables, as well as assigning initial values or limits, is paramount for the model.

c. **Computer implementation**, this is a technical stage that requires applying all the theoretical concepts including variables and constants in a computer program. Generally, it is necessary to create one's own program, but in some cases, the facilities of computer systems can be used instead (i.e. GIS).

d. **Analyses of results**, this stage includes hypothesis testing and simple analysis of some results for further research. A simulation can be considered successful whenever it provides a result which needs to be discussed in more detail, since it broadens previous knowledge.

One of the advantages of simulation analyses is the possibility of defining the limits of research scope. Simulation allows unlikely possibilities to be discarded, limiting the number of possible explanations to an archaeological question.

> *"The logic of simulation is that even when we have little documented knowledge, the range of possibilities is still limited, and the more it can be limited, the more successful simulation may become" [W.Jongman, 1991,19]*

In the present research, a simulation model was needed to reconstruct transport networks through which amphora exchange took place. In attempting to recreate such networks and including features of the main modes of transport, it was thought that variables such as time consumption or transport costs might explain the quantities of amphora present at sites thoroughout Roman Britain [Carreras, 1994a]. The principle of this simulation model was to define the best route between two geographical locations or points on the map to the specific transport conditions in Roman times. Some analogous network studies have been undertaken in Geography to analyse network layouts, industrial locations and travelling problems[14]. The present simulation owes part of its structure to the background of the research in Geography, sometimes even experimenting with past societies [Dicks, 1972], which provided a basic knowledge in the subject. In fact, it is based on the so-called problem of the travelling salesman [Vicent and Daly, 1990], who wants the best route between different points so as to minimize time expenditure and transport costs.

It was a **deterministic** and **static** model designed for research purposes in order to study the distribution patterns of archaeological artifacts. The model is based on market system principles, in which the cheapest route is used to minimize costs, by employing different means of transport. The simulation could also supply all the cheapest routes from any point on the map. In other words, the simulation model could show the most likely area of market control for a good whose production centre was known, also called the optimal trading area.

Optimal trading areas based on transport is a well-known topic of research in other archaeological studies [Drennan, 1984; Metcalf and Barlow, 1992]. In the present case, it was only necessary to run the model from a production centre. This would be the initial point in the routing, and once the optimal trading area was defined, it would be compared to the actual distribution of the archaeological object[15]. For instance, an analysis of market exchange in Oxford ware [Carreras, 1994a] involves running the simulation from Oxford (i.e. production centre) as initial point. The outcome are the minimal transport costs following the network to reach any other point

[14] Network analyses (i.e. graphs theory) were developed by Garrison [1960] and Kansky [1963] but numerous studies are also introduced by Haggett [1965], Price [1977] and Dicken and Lloyd [1990].

[15] The importance of transport networks in pottery distribution has been emphasised since the first applications of spatial analyses in Archaeology [Fulford and Hodder, 1974; Hodder and Orton, 1976] and after ethnographical observations [Van der Leeuw, 1984; De Boer, 1984; Rice, 1984].

in Britain, whose results can be converted in contour maps in the end. Besides, contour maps of Oxford ware distribution based on archaeological finds [Hodder and Orton, 1976] permit us to test whether the actual distribution identifies the ideal market exchange represented by the simulation.

2.3.3 Geographical Information Systems Applications

Some data analyses and simulation models were undertaken using Geographical Information Systems (GIS). GIS can be defined as systems for capturing, storing, revising, integrating, manipulating, analyzing and displaying data with spatial reference to the Earth. Normally, it is a computer system which consists of hardware and software, including graphics and database system. This is a simple definition for a complex computer system which may require scanners and digitizers as input devices, and remote sensing images as raw data[16]. GIS data is characterised by holding apart from any other information, its location (i.e. coordinates). This special feature makes these systems effective for studying spatial phenomena in either Geography or Archaeology.

The systems store data in two forms: vector and raster. Within a vector form, data is stored as a point, line or polygon, this is especially suitable because of its accuracy and low memory demand. This format is normally used for high quality cartographic maps and network analyses [Burroughs, 1986]. The former application, or network analysis, is represented by some investigation models for migrations and settlement patterns in the European colonization of the State of New York [Zubrow, 1990] or exchange in the Great Lakes [Allen, 1990]. The basic principles of both models have been applied here to the simulation analysis of transport networks in Roman Britain [Carreras, 1994a].

Within a raster format, data is stored as a cell, which represents a single point in a grid [Burroughs, 1986]. Raster form is very suitable for manipulating and analyzing data in a myriad of ways, being the most common format in archaeological applications [Kvamme, 1989; 1990a; 1990b; 1992; 1993; Allen et al, 1990; Gaffney and Staĉniĉ, 1992; Brandt et al, 1992; Munt, 1992; Guillet and Leroy, 1993; Nunez, 1993; Cucarzi, 1993; Boaz and Uleberg, 1993; Miller, 1993; Massagrande, 1993; Biro and Fejes, 1993; Blasco *et alii*, 1993]. Both formats were necessary in this research for separate studies, the details of which are described below.

[16] Burroughs [1986] explains in more detail the GIS features and their applications in Geography. For a more comprehensive summary of applications in Archaeology, there are some basic readings such as Wansleeben [1988], Kvamme [1989], Allen et alii [1990] and Gaffney and Stančič [1991].

2.3.3.1 Transport Network Simulation in GIS

The simulation model introduced in the previous section was implemented in GIS. First a transport network was digitized from maps of Roman roads [Ordnance Survey, 1978], attaching sites to the nearest road, linking Roman ports [Fryer, 1973; Cleere, 1978] and defining river navigability [Jones and Mattingly, 1990] in Britain. As a result, a digital map was created in AUTOCAD combining the different networks of four different means of transport (i.e. ship, boat, waggon and pack animal) (see chapter 6). The final map was transferred to GIS (i.e. SPANS and ARC/INFO) where it was scaled and a cost coefficient was assigned to each mode of transport according to the costs per km. A first implementation of the simulation was undertaken in SPANS, a GIS with limited facilities for network analysis (i.e. both ways direction in a line, no values attached to node-point level) [Carreras, 1994a]. Nevertheless, the present application overcomes such problems by using ARC/INFO instead of SPANS, which is a system ideal for network studies. The model as it was defined, included only one condition:

1. Every time that there was a change in the means of transport, a charge was applied to the final transport cost (i.e. 5 kg ton/km in wheat), in an attempt to simulate transhipment freight rates[17].

This is the only constrain in an otherwise simple model. The network analyses were the next stage, and can be defined as analytical techniques concerned with relationships between locations on a network for calculating optimal routes through transport networks or flow simulation. Within this framework, the simulation recreates the cheapest routing between two points in the map by using the shortest path facility [Burroughs, 1986]. However, a better output can be obtained by defining the cheapest route from one initial point (i.e. production centre) to the remaining locations in the map (i.e. potential consumption centres). Since the result is a table of values for each destination point on a map, a contour map can be obtained by grouping ranges of values. These contours can be defined by two different ways: trend-surface or interpolation (see following section).

Then, some optimal sales areas were created by the contours, which were the final output of the simulation model. These maps needed to be compared to the actual distribution pattern of the archaeological artifact under study. Distribution maps of different amphora types were the result of other GIS applications in raster form that were used here not only to validate the simulation model of a market system but also to pinpoint possible exceptions to this model.

---

[17] An important portion of freight rates are transhipment charges and handling costs [Brauch, 1979]. Transhipments in modern times are always kept to minimum since they can bring about increased transport costs.

Further discussion about archaeological-historical implications of this simulation and other possible alternatives will be fully commented upon later (see chapter 6). It is worth pointing out, however, that there are two similar models, one created for Roman Britain in order to analyse internal exchange; the second one of the whole Roman Empire to study external commercial constraints[18].

2.3.3.2 Distribution Maps of Archaeological objects

The distribution of single archaeological artifacts have been studied in different ways in order to recognize cultural, social or economic patterns [Hodder and Orton, 1976, 100-197; Clarke, 1977]. Regression analyses, or so-called "fall-off" curves, constitute the most common statistical technique employed. The premise is that the quantity of an archaeological object from its original production centre diminishes exponentially with distance [Renfrew, 1975; Hodder, 1974]. Despite misinterpretations of the concept of distance as an economic reference, instead of transport cost or time expenditure, the method introduced initially a relationship between original source and consumption centre [Alonso, 1964; Hodder, 1974a; Dicken and Lloyd, 1990, 63; Carreras, 1994a]. However, distance as a variable in this kind of analysis presupposes that land surface is completely flat and homogeneous, in other words an isotropic plain, and that the same means of transport are used in any direction [Dicken and Lloyd, 1990, 15].

A second method is a distribution map including all locations of specific archaeological finds as points on a map [Orton *et alii*, 1993]. However, none of these maps assign any information about quantities of an artifact recovered at each site, so the same type of representation, a point, serves for any quantity. Since these maps were bound to mislead, some graphical symbols had to be used to indicate differences in volume. Nevertheless, the application of symbols for different quantities [Ettlinger, 1977] did not improve the analysis of distributions, as they are too general and disregard any context. A similar conclusion was reached in amphora studies [Panella, 1981; Tchernia, 1986a; Fitzpatrick, 1987; Orton *et alii*, 1993, 197-206], after realizing that even quantities in diverse areas were biased by differences in survey or excavations, site and material preservation and publication [Hodder and Orton ,1976, 104-105; Panella, 1981].

A third alternative are contour maps that involved the application of trend-surface or interpolation analysis. Trend-surface analysis has been praised since its first application in archaeology for its potentials [Clarke, 1968; Bradley, 1970; Hodder and Orton 1976, 155], though sometimes it produced strange results [Haigh and Kelly, 1982]. Normally, these abnormalities in

---

[18] The simulation model for Roman Britain is as it was introduced in this section whereas one for the whole Empire does not include either pack animals network or transhipment freight rates because of their overheads.

the expected representation are due to "edge" and residual effects. The "edge" effects can be removed by defining boundaries or including new points outside the area under study [Hodder and Orton, 1976,163-164]. However, residual effects are related to the polynomial level of the equations used to represent the trend surface [Davies, 1973,349; Bassett and Chorley, 1971], and they cannot be eliminated except by increasing the equation level, which is not always possible. For instance, a four level polynomial equation introduces 66.7% of variation in the trend surface, while 33.3% corresponds to its associated residuals. On the contrary, a five level equation reaches 78.5% of the variation, whereas its residuals identify only 21.5% [Bassett and Chorley, 1971]. Accepting the flaws of this technique, some results can be obtained by carefully monitoring all side effects. In general GIS provides facilities for trend-surface analyses including goodness-of-fit tests.

Interpolation, originally developed for oil exploration [Richards, 1991; Biswell *et alii*, 1993; Weimer, 1993], is an alternative for creating contour maps [Haighs and Kelly, 1982]. The technique calculates averages between sample points according to a weighted distance step. Maps are usually consistent to the data input, and the more sample points recorded, the more reliable becomes the map representativiness. This method was used in this thesis at site and regional level in order to distinguish patterns of amphora distribution based on the sample quantities. On the one hand, at site level its application sheds light on possible functional areas [Bitswell *et alii*, 1993], occupation and the evolution of the settlement [Richards, 1991; Miller, 1993]. On the other hand, at regional level contours can illustrate patterns of exchange, site hierarchies and transport network features.

Finally, the concept of spatial autocorrelation should be mentioned. This refers to the fact that nearby quantities tend to be similar [Cliff and Ord, 1973; 1981; Hodder and Orton, 1976,174-183]. In theory, trend-surface and interpolation should be applied only if this autocorrelation exists, otherwise no spatial pattern should be expected. The concept is a central issue for analysis of point data patterns, as the study of the Classical Maya collapse demonstrates [Bove, 1981; Whitley and Clark, 1985]. Moran's I statistic is a way to test the existence of spatial autocorrelation, whereby Kvamme [1991] revised the Maya question again.

Conclusions

The analytical techniques introduced in this section permit us to study and relate the different amphora quantifications. After stressing the importance of using an appropiate quantification method and sampling strategies in order to assure the data quality, analytical techniques become relevant for making some sense of all this volume of information.

Statistical analyses basically simplify and summarise data. In this case, they were applied to classify amphora types according to morphology as well as grouping similar amphora assemblages and relationships between sites. However, statistics are not the only technique used for explaining economic phenomena. Simulation analyses provide a complementary way which allows experiments with economic systems by reproducing them in simplified form. In this thesis, an original simulation was defined to study in detail the rôle of transportation in the amphora distribution pattern.

The models were implemented in Geographic Information Systems (i.e. ARC/INFO, SPANS and IDRISI) that are computer systems specialized in handling spatial data. The analytical techniques used provided the necessary tools for reconstructing relationships and defining contexts where amphorae played a prominent rôle.

Conclusions

This chapter outlined different methods and techniques applied in this research and the reasons of their choice. It started by stressing the importance of measures of quantification for extracting diverse kinds of information from amphora assemblages. Among, all the measures introduced, weight and average vessel weight seem to be the most suitable for amphora quantifications, and they can also be complemented by content quantifications based on the latter measure. The second important point was standarization of these values in order to overcome the temporal and spatial dimensions. The practice suggested was calculating densities by area excavated and site occupation length. Furthermore the special case of stamps quantification was highlighted. With regards to residuality, the empirical evidence of amphora-sherds reveals a standard size for each amphora type, which could have varied according to the sherd presence on the surface.

The second section underlined the need of a representative sample of amphora assemblages in order to make any economic inference. At regional level, a judgement sample of 48 Romano-British sites was considered a good representative for Britain as a whole. On the other hand, at site level, the excavation area was defined as a probabilistic sample of the whole settlement. Therefore confidence intervals and standard deviations could be calculated from site and excavation areas. The sampling approach claimed two advantages: a better representation of amphora assemblages at any level and the possibility of updating a quantified databank whenever more data is available.

The third and final section introduced a series of analytical techniques for the study of amphora assemblages. An initial group included standard statistical methods for distinguishing patterns among the data. Moreover, some simulation analyses were explained in detail including their applications as economic models. In fact, an original model was developed for the study of amphora distributions which consists of simulating the Roman transport network. This simulation model has already been introduced before [Carreras, 1994a]; however, the present improvements in both technical and conceptual terms produce more accurate outputs.

3. AMPHORAE IN ROMAN BRITAIN: A BRIEFING

The word amphora defines a myriad of ceramic containers employed for transport and the conservation of liquids and foodstuff [Martínez-Maganto and Arnaiz, 1991]. The original word stems from ancient Greek (i.e. *amphoreus*, *amphiphoreus* which means "what is carried by two handles", in other words, container for transportation. The same term in Latin has two different meanings, it identifies a ceramic vessel as well as a ship capacity measure [Wallinga, 1964; Pomey and Tchernia, 1978; Paterson, 1982]. Both latin meanings share the same origins since amphorae were chiefly vessels used on seaborne transport and ships were designed to accommodate them as the Madrague de Giens wreck demonstrates [Tchernia, Pomey and Hesnard, 1978]. Amphorae could be stowed as one layer (e.g. La Cavalière) [Charlin et al, 1978], two layers (e.g. Titan) [Tailliez, 1967] or more (e.g. Albenga) [Pallarés, 1987], and other lightweight goods could be used to fill the gaps between them [Parker, 1992b, 90; Casson, 1994].

Amphorae were long-distance sea transport containers of relatively large dimensions. Despite changes in the standard size represented by the initial canaanite prototype (eighteenth century B.C̄.) [Gianfrotta and Pomey, 1981; Peacock and Williams, 1986, 20-21], Roman amphorae are archaeologically distinctive in their dimensions in comparison with to other ceramic containers such as flagons, jars or *dolia*[1]. The amphorae were not the only containers used in Roman times. Apart from the other ceramic alternatives already referred to, wooden barrels and skins were also used as substitutes though their rôle on the basis of archaeological finds is difficult to assess [Peacock 1978; Tchernia, 1980a; 1986a; Laubenheimer, 1991]. Moreover basketry, skin and wood are easily destroyed in warm climates, but hides and wood are as resistent as pottery in temperate regions [Arnold, 1985, 141].

Wooden containers are described in Roman literature by terms such as *cadus*, *ligneis vasis*, *orca*, *cupa* and *tonna* [Laubenheimer, 1991, 149]. Moreover they are represented on bas-reliefs [Ellmers, 1978; Reddé, 1979], on silver plates (e.g. Castro Urdiales)[Sartorio, 1988] and in archaeological excavations in Northern Europe [Breuer, 1918; Ulbert, 1959; Molin, 1990; Desbat, 1991; Rule and Monaghan, 1993; Scialliano, 1994]. The silver plate from Castro Urdiales also

---

[1] The initial classifications by Dressel [1899], Callender [1965] and Beltrán [1970] marked the distinctions in size between amphorae and other containers, however such differences in terminology with regards to jars and flagons are blurred by etruscan [Gras, 1985], massalian [Py, 1978] or Gauloise types [Laubenheimer, 1985; 1989]. Dolia are huge containers whose capacity can reach 3000-6000 litres [Pallarés, 1981; Hesnard et al, 1988], so very distinctive from amphorae. Six shipwrecks containing dolia have been recorded so far, demonstrating the importance of such alternative containers to amphorae (i.e. Gran Rimbaud D, Ladispoli, Garoupe, Petit Congloué, Diana Marina and Rouse island).

details how the content of an amphora was transferred into barrels for more comfortable overland transportation [Sartorio, 1988, 66, fig.72]. The scarce evidence from Roman Britain[2] suggests that some were of Continental (i.e. larch, silver fir) or Mediterranean (i.e. cedar) origin as well as coming from local sources (i.e. oak), so barrels may have played a prominent rôle in long-distance transportation. However, only two shipwrecks show evidence of barrels being used as a cargo container. Barrels were not the predominantly used as container, out of 1259 wrecks documented in the Mediterranean (i.e. Grado and Port-Vendres C) [Picozzi, 1988; Colls et al, 1988; Parker, 1992].

In contrast, there is no testimony of skins being used in the archaeological record except in some inscriptions of (i.e. *utricularii*), river sailors. The etymology of this word seems to come from *utri* (i.e. goatskin) [Künnow, 1980,6; Panella, 1986b, 25]. Goatskins are also documented in a tax law of Palmyra [Mathews, 1984]. Furthermore cow and goatskins, also known as *cullei* by the Romans, are represented in some Pompeian paintings [Sartorio, 1988, 65] depicting the wine held in them being transferred to amphorae [Reinach, 1922, 248]. Other bas-reliefs with *cullei* appear at Sulmona (Mus.Civiltà Romana 53, n.28), Rome (Mus.Nat.della Therma, inv.108438) and the Vatican (Mus,Civiltà Romana 53, n.27) [Sartorio, 1988, 65; Molin, 1990]. They seem to have been used for transportation only when other containers were unsuitable [Kneissl, 1981; De Salvo, 1992, 137].

Accepting the limitations of amphorae as the main testimony of long-distance exchange, nevertheless it may be noted that they are of extraordinary value in understanding interprovincial relationships in the Roman Empire. Such relations reflected in the production of these containers for carrying agricultural goods to distant provinces through complex networks of transport and commerce. However, amphorae only become relevant for economic inference if their origin, content and date range can be established [Parker, 1973, 363]. Early amphora research defined typological classifications with the aim of assigning a form to a place, context and date; although this simple method of identification was revised later [Tchernia and Zevi, 1972; Beltrán, 1977].

Dressel [1899] was the pioneer in creating the first typological classification of the main Roman amphorae which is still basically in use. Some later scholars such as Pélichet [1946], Almagro [1955], Panella [1972] and Keay [1984] increased the number of types as a result of their own researches. Nevertheless, the more information was gathered, the more evident it became that the same type of vessel was produced in different geographical areas. The most striking case

[2] Few remains were recovered at Newstead [Curle, 1911; Viérin and Levin, 1961], Colchester [Hawkes and Hull, 1949], Bar Hill [Robertson et al, 1985], Wickford (Essex), Khirby Thore, Caernarvon, Silchester [Boon, 1975], London [Jones and Rhodes, 1980] and Carlisle [Carlisle Arch. Unit. interim report] identifying different barrel sizes.

concerns the form known as Dressel 2-4 or Koan, which first originated in the Eastern Mediterranean [Empereur and Picon, 1989], though the same shape was produced in Italy (Campania, Latium and Etruria) [Hesnard, 1977; Peacock, 1977b; Panella, 1981], Hispania (Baetica, Tarraconense) [Beltrán, 1970; Tchernia and Zevi, 1972; Pascual, 1977; Miró, 1988], Galia [Tchernia and Villa, 1977; Schweitz, 1986; Becker, 1986] and even in Britain [Castle, 1978; Symonds, 1993; 1994; forth.]. Fortunately, scientific methods such as petrology [Peacock, 1977a] or physio-chemical analyses (e.g. neutron activation analysis) [Peacock, 1970; Widemann et al, 1978] have helped to identify different sources of the same form, allowing a new link to be established with the production areas.

If determining amphora origins raise some initial problems, recognizing their most likely content is not simple either. Painted inscriptions on amphorae [Dressel, 1899; Zevi, 1966; Beltrán, 1970] provide the first clue about possible content related to a specific form. However, some cases demonstrate that the same type could bear inscriptions relating to two or more different contents [Liou, 1988]. Even residues found in vessels can contradict initial suppositions [Sealey, 1985]. One of the most clear examples of this is a Dressel 2-4, which was commonly used to carry wine, found at Southwark bearing an inscription reading *liquamen* (fish sauce) with reference to its content [Hassall and Tomlin, 1984; Laubenheimer, 1989]. Nevertheless, it seems that shape of amphora and context do correspond as most painted inscriptions and occasional remains are found to agree.

Finally, amphora types were normally produced over long periods of time during which time few formal changes ocurred, which makes it difficult to give an accurate dating for them [Callender, 1965]. Notwithstanding these limitations, a few formal changes may help to identify chronological sequences as being a possible means of dating them [Guéroche and Tchernia, 1977; Fariñas del Cerro et al, 1977; Martin-Kilcher, 1983; 1987]. Another important means of amphora dating involves the epigraphic elements (i.e. painted inscriptions and stamps) that may even narrow a vessel date range down to one year [Rodríguez-Almeida, 1975-6; 1977-8; 1979; 1989; Manacorda, 1977d; 1990; Remesal, 1986; Hesnard and Gianfrotta, 1989]. However, these elements appear only occasionally on amphora which is a great inconvenience.

3.1 Amphora typologies: a general view

A **type** can be defined as a number of vessels with similar form and fabric, which allows identification of a source, a possible content and a date range [Peacock and Williams, 1986, 7]. Such ambitious targets cannot always be achieved because of the fragmentary nature of the material nor the limitations in the speciality. Nevertheless a variety of classifications of amphorae on morphological grounds have been available since Dressel [1899] defined the first one. Later typologies served to complement his initial classification, but they were always based on the form. With the development of petrological and physico-chemical analysis, a classification system to include fabrics was produced by Peacock and Williams [1986] and this was used in order to circumscribe amphora origins. This system was used to classify the amphora material from Roman Britain studied for the present project, first according to the fabric and secondly to the form if possible. The types distinguished in this survey are introduced in this chapter, with new details about the material found in the sample.

However, it can be argued that typologies may not have existed for the Romans as they are defined now. One of the testimonies of typologies used by the ancients is a papyrus (BGU 2536.11) that recognizes different vessel-shapes containing diverse wines [Rathbone, 1983; 1991, 305]. The same distinctions are mentioned in relation to duties at Nikopolis and Schedia (P.Fayum 104; P.Fayum 335) and containers carrying Chian, Lesbian and Rhodian wine (P.Lau. 12; P.Oxy. 3595; P.Cair.Zen. 59012). The reasons for there being such distinctions in amphorae shape probably relate to the identification of a content and quality (i.e. wine, olive-oil, garum) with a form which explains why there were imitations and geographical traditions. Amphora typologies as well as their epigraphy served as product identifications, and in some cases they may have acted as advertisements [Manacorda, 1981; Curtis, 1984-86]. Therefore the link between amphora kilns and commodity production is obvious, though it may have been organized in many different ways [Peacock and Williams, 1986, 41].

3.2 Amphora types recorded in Roman Britain

The following survey of amphora types found in Roman Britain does not pretend to be exhaustive, but aims to include the most common groups present on any Romano-British site. These types are the ones available in the research sample, so the absent ones may be considered as a minority or as unidentified in Britain. The typologies are defined according to the common terminology, though a concordance with other systems is also included [Peacock and Williams, 1986]. Moreover a list of shipwrecks for each amphora type, which is recorded according to Parker´s [1992a] reference number, is added to the description.

3.2.1 Dressel 1 (Ostia xx; Camulodunum 181; P&W 3-5)

This type is distinguishable by a curved-triangular shaped long rim, flat rounded handles and a cylindrical body, ending in a short spike. Three distinctive classes have defined according to height and rim form (i.e. A, B and C) [Lamboglia, 1955]. This vessel seems to have been a successor of the so-called Greco-Italian types, appearing around the middle of the second century B.C. and disappearing in the late first century B.C. [Tchernia 1983b; 1986][3]. Some painted inscriptions indicate that wine was the main content [Zevi, 1966; Beltrán, 1970]. This is also supported by the presence of grape pips in a example at the Madrague de Giens [Tchernia et al, 1978, 13], though other exceptional cases suggest diverse contents (i.e. Cavalière: olives; Archipel de Riou: oysters; Ile Marie D: hazel nuts) [Benoit, 1962, 164; Charlin et al, 1978, 23-24].

With regard to its origin, this amphora was mainly produced in Italy (e.g. Etruria, Campania and Latium). In fact the fabric studied in our sample corresponds to Campania because it contains the distinctive volcanic "black sand". Nevertheless, some imitations of this form are documented in Catalonia [Pascual, 1960; Keay and Jones, 1982; Comas, 1987; Miró, 1988], Southern Spain [Beltrán, 1970; Arteaga, 1985b] and Southern Gaul [Laubenheimer et al, 1983; Laubenheimer, 1989; Dangreaux *et alii*, 1992; Desbat, 1994]. The type had a widespread distribution in the Western Roman Empire during the period of conquest, although it is also documented in the Eastern Mediterranean [Riley, 1979; Will, 1979]. The distribution in the Western provinces [Panella, 1981; Manacorda, 1981; Fitzpatrick, 1987] shows high concentrations of Dressel 1 in the Southern Gaul, isthme gaulois [Tchernia, 1983b; 1986a, 79-94; Galliou, 1984].

Shipwrecks: La Madrague de Giens (P.616) [Tchernia et al, 1978]; Albenga (P.28) [Pallarés 1977; 1985]; Cavalière (P.282) [Charlin et al, 1978]; Grand Congloué A (P.472) [Long, 1987]; Plane A (P.819) [Ximenés, 1976]; Dramont A (P.371) [Gianfrotta, 1981].

3.2.2 Pascual 1 (P&W 6)

This type is considered to be a copy of the Italian Dressel 1 B, characterized by a long cylindrical neck, rounded-grooved handles, ovoid body and solid spike [Pascual, 1962; Miró, 1988]. Occasionally, it is stamped on the spike or neck [Pascual, 1977; 1991]. This type was mainly produced in the Catalan area in Northeastern Spain, where numerous workshops have been

[3] Each subtype has a different date range: A, from mid second to mid first BC [Lamboglia, 1955]; B, early to late first century B.C. [Peacock, 1971b; 1977b]; C, late second to early first century B.C. [Will, 1979]. A Dressel 1 A was found at Lake Farm in a Claudian context, though it may have been reused [Darling, pers.comm.].

discovered [Miró, 1988; Pascual, 1991; Revilla, 1993]. Two distinctive fabrics from the Catalan region have been recognized [Williams, 1981; Keay and Jones, 1982]: one brick-red with granitic inclusions and the other, creamy white lacking mica. Recently, the production of this vessel has also been documented in some kilns in Southern France (i.e. Aspiran, Montans, Corneilhan, Sainte-Cécile-les-Vignes, Béziers and Vaison-la-Romaine) [Laubenheimer, 1985; 1990; Meffre and Meffre, 1992] defined by the typically fine creamy-pink fabric [Schmitt, 1988; Desbat, 1994].

The amphora has a widespread distribution in the Western Roman provinces. It is well-documented in Italy, Hispania, Galia, North Africa (Carthage), Germany and Britain [Miró 1988, 123-144, map 6; Remesal and Revilla, 1991; Comas, 1991]. However, the area of Toulouse probably holds the major concentration of vessels in what it is considered to be a break point where the wine carried in the Pascual 1 was transferred to other containers [Tchernia, 1971; 1983b; 1986a; Galliou, 1984]. Despite this concentration, Pascual 1 amphorae did also reached the Atlantic coasts of Gaul as well as Britain [Galliou, 1982; Siraudeau, 1988; Berthault, 1990].

With regards to its date range, the type was first produced in the second half of the first century B.C. which was at its height in the Augustan period. At the end of this reign or at the beginning of the Tiberian period, the evidence from Ampurias and Lyon suggest [Aquilue et al, 1984; Desbat and Martin-Kilcher, 1989] that the form disappeared, and was gradually replaced by the Dressel 2/4. Some finds in later contexts (e.g. Pompeii, Rome) [Tchernia, 1971, 52-54; Ciotola et al, 1989] seem to be residual and therefore their chronology is not completely reliable. In Britain, amphora sherds of Catalan fabric have normally been identified as Pascual 1 when found in Iron Age contexts but as Dressel 2/4 when found in post-conquest contexts. Without diagnostic sherds, it is impossible to distinguish both types, so some multiperiod sites are prone to misclassification, although this cannot be avoided [Sealey, 1985]. Pascual 1 is documented in Britain in at least 8 sites: Poundbury, Hengisbury Head, Bagendon, Knighton, Colchester, Thaxted, Ower and Owslebury [Peacock, 1971; Williams, 1981; 1987].

Shipwrecks: Cap Béar C (P.171) [Corsi-Scilliano and Liou, 1985]; Los Ullastres (P.1192) [Foerster, 1976]; Cap del Vol (P.186) [Nieto and Foerster, 1980].

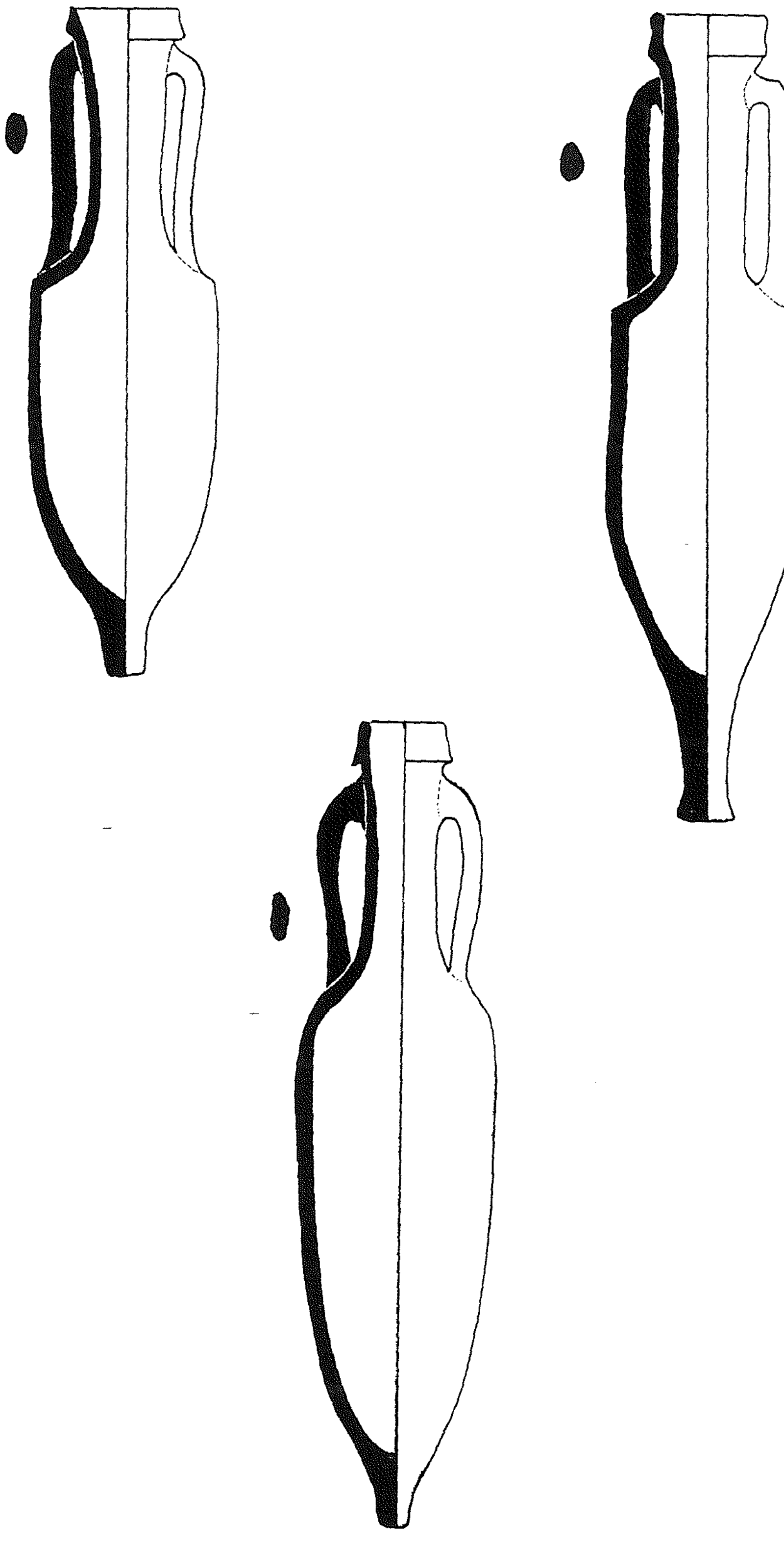

Figure 3 Different varieties of Dressel 1 (A, B and C).

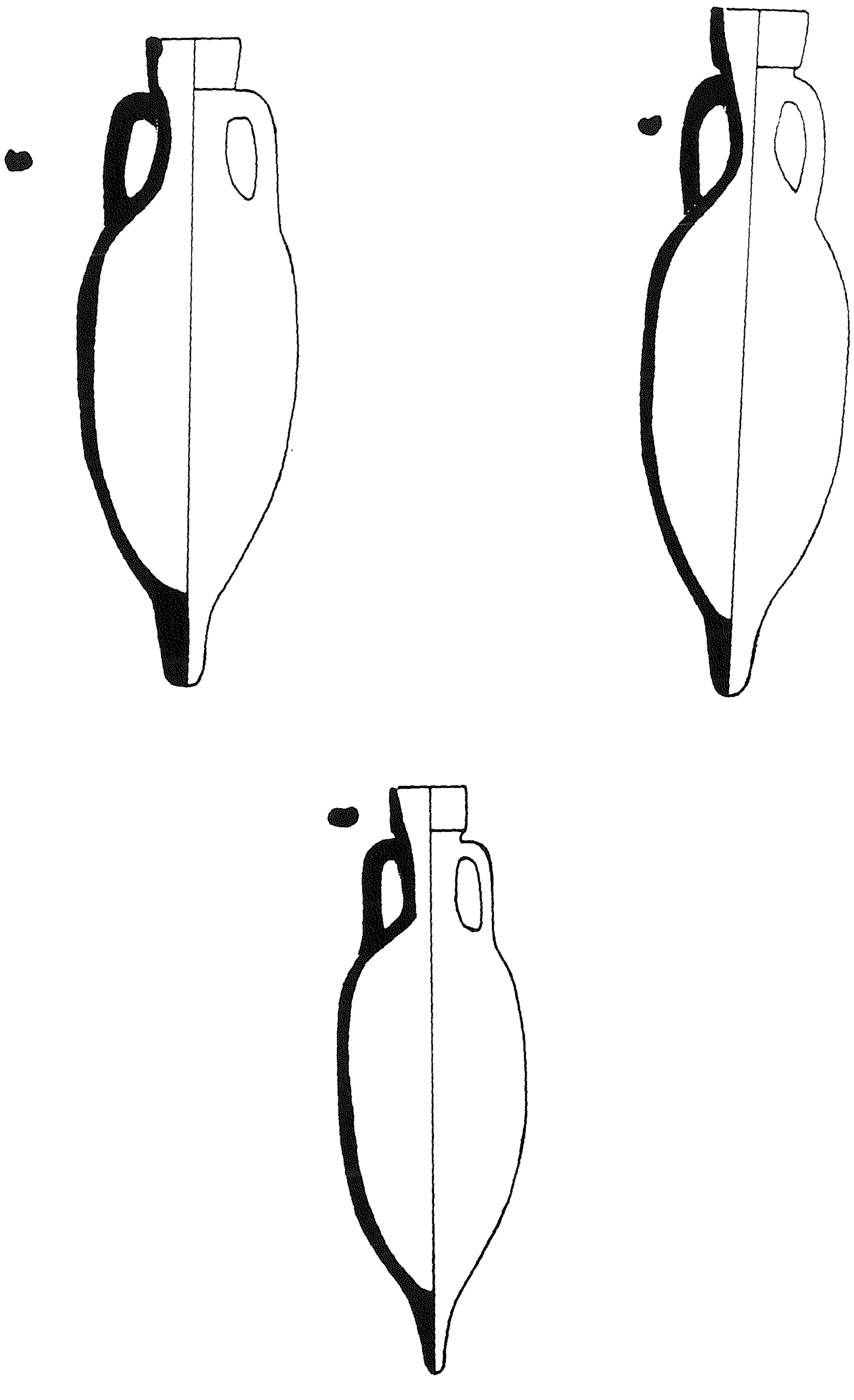

Figure 4 Pascual 1 amphora types.

3.2.3 Rhodian (Ostia lxv; Camulodunum 184; P&W 9)

The Rhodian amphora can be recognized by its simple rounded rim, peaked single rod handles and solid spike. An initial production is recorded from the Hellenistic period reaching its height before the Roman conquest [Magie, 1950; Grace, 1961]. The great volume of Rhodian amphora is demonstrated by the 80.000 stamps found to be present at Alexandria and by another large quantity found at Delos [Maiuri, 1925; Grace and Savvatuianou-Pétropoulakon, 1970]. Nevertheless the Rhodian unstamped imperial prototype seems not to have arrived in the Western provinces until the Augustan period (i.e. Ostia, Lyon, Augst) [Panella, 1973; Hesnard, 1980; Desbat and Picon, 1986; Baudoux, 1990, 80; Martin-Kilcher, 1994] where it remained in evidence until the second half of the second century A.D. [Becker et al, 1989; Dangreaux and Desbat, 1992].

Although the type is known as Rhodian, this Greek island was not the only production centre as petrological analyses have revealed [Peacock, 1977a], but there were many other workshops in the Aegean [Desbat and Picon, 1986; Empereur and Picon, 1989]. But certainly, the Rhodian Peraea was one of the important suppliers of this type [Empereur and Tuna, 1989]. At least two main fabrics were distinguished for this type: the first was reddish-pink with a light yellow slip including some limestone, whereas the second fabric is creamy-white, lacking pyroxene inclusions [Peacock, 1977a; Peacock and Williams, 1986, 103]. Both clays were recognized in the present sample, though the second group was the most common. It has been argued that the same form was produced in Italy [Panella, 1973, 558; Peacock, 1977b; Sealey, 1985, 15], though it does not share the same fabrics as Italian Dressel 2-4s. A unique example of the imitation in Britain comes from London (i.e. Billingsgate Building) [Green, 1980] but it is extremely rare even in the Western provinces.

Wine was believed to be the vessel content and this is also supported by a painted inscription at Pompeii (e.g. Pass(um) Rhod(ium)/ P Coeli Galli) [CIL iv, 9327]. However there are some which were filled with figs (e.g. Dramont D) [Joncheray, 1974, 31-33][4]. Rhodian wine was considered to be a sweet ordinary Greek beverage (Atheanaeus, Deip.1.32.5), which was not renowned among Romans for having the flavour of other Greek wines [Sealey, 1985, 56-57; Tchernia, 1986a, 240-245]. The presence of good quantities of this type of amphora in Western Roman sites (e.g. Longarina, Ostia, Lyon, Oberaden, Haltern, Rödgen, Fos, Salla)[5] carrying such

---

[4] Sealey [1985, 57] describes all the epigraphic and literary evidences of figs related to Rhodes and some archaeological find of figs from Colchester.

[5] See Loeschcke [1909] [1942]; Panella [1973]; Schönberger [1976]; Hesnard [1980]; Bezeczky [1984] [1987]; Desbat and Picon [1986]; Liou and Scilliano [1989]; Martin-Kilcher [1994].

an ordinary wine was therefore difficult to explain. Peacock [1977a] observed that its distribution in the Western provinces reflects a concentration, mainly in military sites, so he established a possible link between the unrest of Rhodes under Claudius reign, A.D. 44 (Tacitus, Ann.12.58.2; Suetonius, Clau.25.3; Nero.7.2; Cassius Dio, 60.24.4) and the presence of this amphora as a special tribute on the island.

The densities obtained in the present sample provided some comparative data between military and civil sites in Roman Britain. As can be observed from the table and interpolation map (chapter 5, figure 54), there are high densities in early military sites in the Western areas of the province, including Wales (e.g. Kingsholm, Exeter, Tiverton and Carlisle). The concentration suggests imports of Rhodian wine during the very specific period of the late 40´s and 50´s, when the army was campaigning in this area against Welsh tribes and Caracatus [Frere, 1987, 64-67]. Nevertheless, its presence is also attested in civil sites, though the quantities are lower. Therefore it is not so clear that this represented a directed distribution to the Roman troops and the pattern must be compared to other wine amphorae in order to assess whether it is so distinctive (see chapter 5).

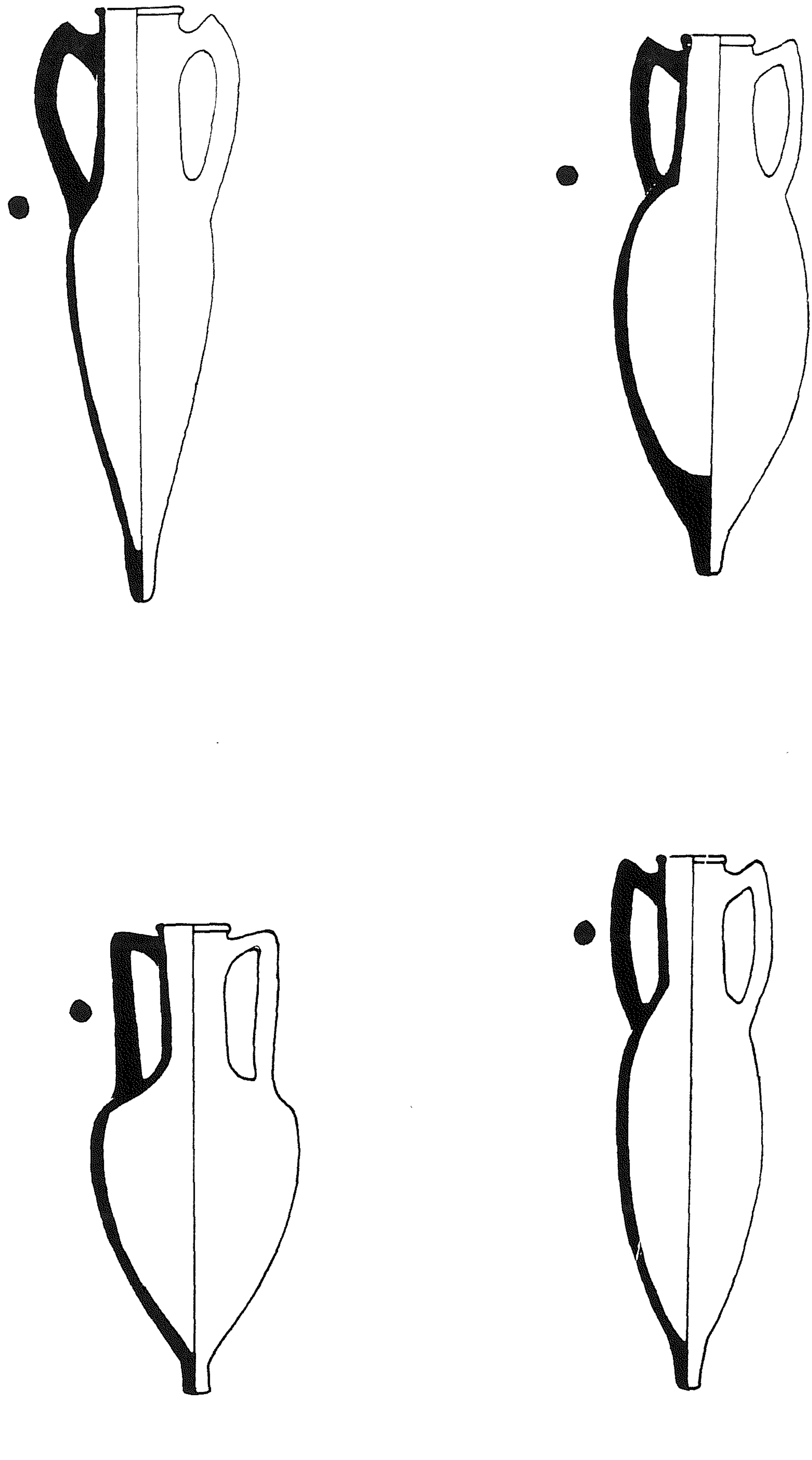

Figure 5 Rhodian amphorae.

Table 9

Sites	gr/m²	Sites	gr/m²	Sites	gr/m²
London	6.01	Stonea	-	Carlisle	9.17
Ribchester	-	Cirencester	1.23	Corbridge	0.16
Longthorpe	-	Winchester	0.24	Leicester	0.26
Vindolanda	-	Chichester	1.14	S.Shields	-
Kingsholm	102.58	Chester	0.8	St.Albans	2.17
Poundbury	-	York	0.01	Silchester	0.07
Skeleton	-	Old Penrith	-	Colchester	2.61
Inchtuthill	-	Bewcastle	-	Lancaster	-
Exeter	7.35	Purbeck	-	Staines	0.07
Ivy	-	Chelmsford	-	Canterbury	0.57

Shipwrecks: La Tradelière (P.1174) [Fiori and Joncheray, 1975]; La Cavalière (P.282) [Charlin et al, 1978]; Jeaune-Gaude (P.530) [Carrazé, 1972]; Chretienne H (P.307) [Santamaria, 1984]; Akandia (P.24) [Parker, 1992, 48]; Sancak Burun (P.1026) [Bass, 1974]; Serçe Limani D (P.1073) [Bass, 1981].

3.2.4 Dressel 2-4 (Koan; Ostia li; Camulodunum 182-3; Benghazi ER4; P&W 10)

The vessel is a cylindrical amphora with a simple rounded rim, long bifid handles and a solid spike. The original prototype was developed in the Eastern Mediterranean, on the isle of Kos, from the early III century B.C. [Tchernia, 1986b]. This type had a long life-span and was produced in different geographical areas. Because of this, some typological studies have been carried out to establish common links between production areas, chronology and form [Tchernia and Zevi, 1972; Hanson and Hesnard, 1977; Fariñas del Cerro et al, 1977; Hesnard, 1987]. Although initially this vessel was thought to be produced in uniquely one area, some distinctive fabrics indicating different origins were identified [Tchernia and Zevi, 1972] and later discoveries of production centres confirmed these [Empereur, 1986]. This vessel was widespread not only in the Western Mediterranean but also to the East and as far as India [Riley, 1979; Panella, 1983]. However the life-span and distribution varied accordingly of vessels have. These origins are recognized in the well-studied fabrics listed below:

a. Eastern Mediterranean (Pompei v-vi)

There are a wide variety of fabrics from the Eastern Mediterranean, which reflect the different production regions. Macroscopically, the Eastern Mediterranean type can be distinguished by a hard thin sandy texture of reddish-yellow colour, some including high quantities of golden mica [Peacock and Williams, 1986, 108]. Analyses of fluorescence X [Desbat and Picon, 1986] showed some distinctive groups of fabrics, whose sources have been confirmed by the discoveries of regional workshops (i.e. Cos, Myndos, Theaugela, Cnidos, Rhodes, Aigeai, Alexandria) [Empereur and Picon, 1986; Empereur and Picon, 1989, 227]. Although this type was developed in the Hellenistic period, it did not reach the Western provinces until the Augustan period (e.g. Lyon, Oberaden, Neuss, Rödgen, Laurentzberg) [Panella and Fano, 1977; Desbat and Picon, 1986; Optati, 1987; Baudoux, 1990, 69]. It was thought to have disappeared in the Western sites in the Flavian period [Panella 1986a, 618; 1992; Desbat and Picon, 1986; Liou and Scilliano, 1989; Martin-Kilcher, 1990; Baudoux, 1990, 69], though new evidence from Rome [Ciotola et al, 1989] suggests the early second century as marking the end of the production period.

Moreover, there are many other types sharing the same fabric. These are grouped as pseudo-koan [Peacock and Williams, 1986, 107] because of their higher peaked handles. These distinctive handles have been recorded in some Romano-British sites, but as no complete vessels are normally preserved, it becomes difficult to assign them to one standard type[6]. In the present sample, the Eastern Mediterranean group includes Dressel 2-4 and Pseudokoan, with Dressel 43 being absent, since so few diagnostic sherds were available to distinguish both types.

Shipwrecks: La Tradelière (P.1174) [Fiori and Joncheray, 1975]; La Cavalière (P.282) [Charlin et al, 1978]; Grand Ribaud D (P.477) [Hesnard, 1988].

b. Italian

The production of Dressel 2-4 was widespread in Italy (e.g. Emilia, Aquileia, Apulia-Calabria) [Tchernia, 1986a, 127-129] though the most common vessels can be distinguished by their fabrics which identify them as coming from Campania, Latium and Etruria [Peacock 1971a; Tchernia and Zevi, 1972][7]. The Campanian fabric is defined by the presence of "black sand",

---

[6] Panella [1976; 1986a] includes an exhaustive relation of oriental vessels with peaked handles known also as Knossos 19 [Hayes, 1983], Schöne xiii/Agora G 198, Dressel 43/Knossos 1-5, Mau xxxviii and Mau xxvii-xxviii. Optati [1987] classifies some varieties in his types II-IV (Koan-Pseudokoan) with a date range from 75 B.C. to second half of the first century A.D.

[7] A good description and discussion of different Italian fabrics appears in Peacock [1971a], Panella and Fano [1977]; Courtois and Velde [1978], D'Ambrosio et al [1989] and Ricq de Boüard et al [1989].

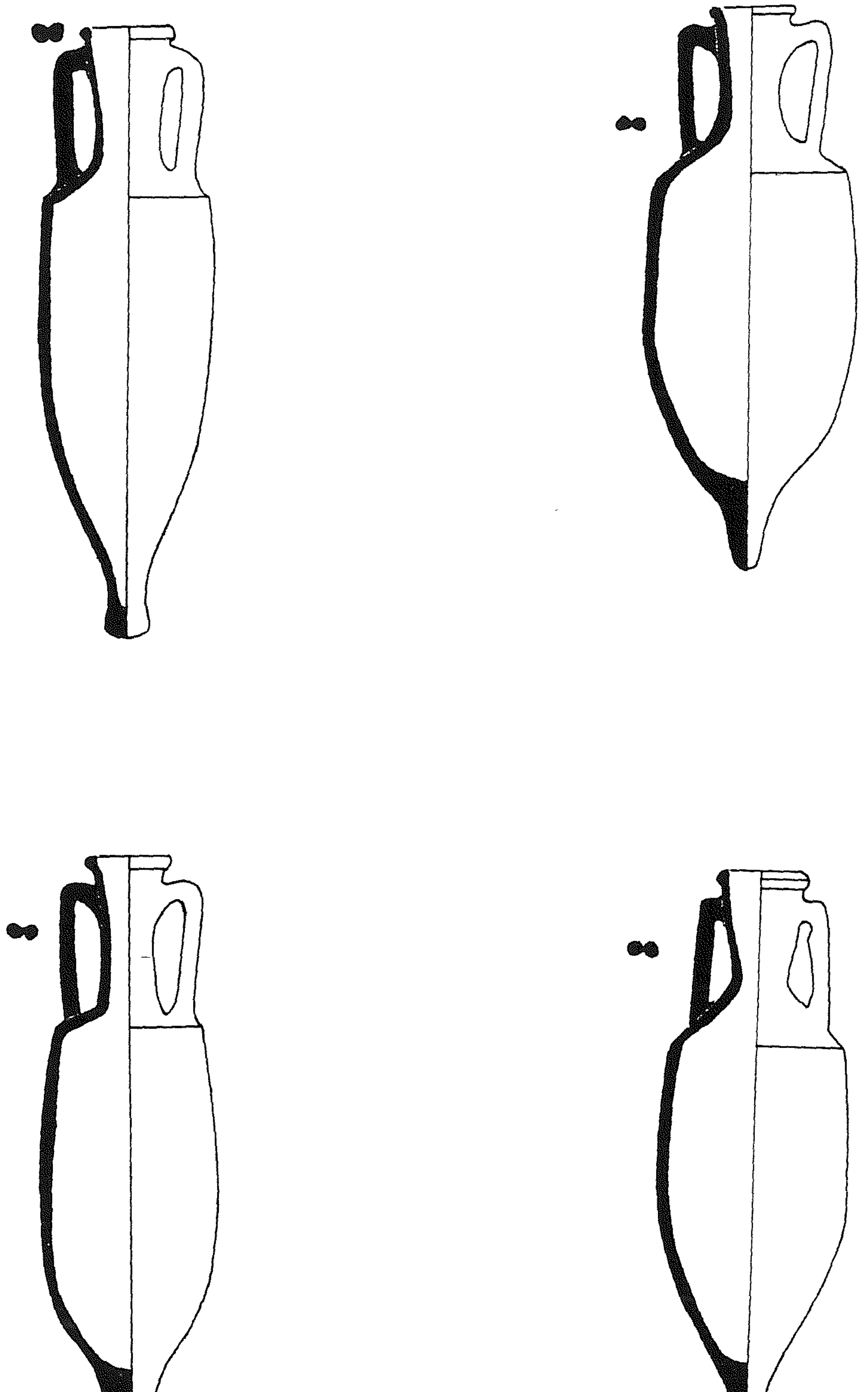

Figure 6 Dressel 2-4 amphorae.

which points to a volcanic origin close to the area of Pompeii and Herculaneum [Peacock, 1977b]. This is the only Italian fabric, also shared by the Dressel 1 type, that has been recognized in the present sample.

The form was produced by the Italian workshops in the middle of the first century B.C. substituting the heavy Dressel 1 amphorae [Zevi, 1966; Peacock, 1977a; Hesnard, 1977; Arthur, 1982b; Manacorda, 1989; 1990]. The importance of Italian wine in the Western provinces is attested by the proportions of wine vessels found at Ostia, Rome, Lyon and Fos-sul-Mer [Panella, 1973; Ciotola et al, 1989; Desbat and Martin-Kilcher, 1989; Liou and Scilliano, 1989]. The Campanian Dressel 2-4 is documented in the Western provinces and present in small quantities in the Eastern part [Panella, 1981; Bezeczky, 1987]. With regards to its date range, the type was thought to disappear in the middle of the first century A.D. However, later evidence suggests that a close variant was still being produced and exported in the second and even third century A.D., though in smaller number [Panella, 1989; Freed, 1989; Desbat and Savay-Guerraz, 1990; Arthur and Williams, 1992; Panella, 1992]. Some of the most renamed Italian wines (e.g. Surrentium, Falernum, Amineum) were frequently transported in these vessels according to painted inscriptions [Sealey and Davies, 1984; Sealey, 1985, 42-47; Tchernia, 1986a, 358]

Shipwrecks: La Garoupe (P.438) [Fiori, 1972; Pollino, 1983]; Grand Ribaud D (P.477) [Hesnard et al, 1988]; Dramont D (P.374) [Joncheray, 1972].

c. Baetican

Dressel 2-4 production in Southern Spain seems to start approximately in the Augustan period later than its Italian counterpart. At least, two kilns at El Rinconcillo and Guadarranque (South Spanish coast) evidence Dressel 2-4 production together with fish-sauce vessels [Beltrán, 1990; 1970]. The production is thought to have ended in the middle of the first century A.D., though the evidence for this is scarce [Sealey, 1985, 37]. This amphora fabric is obviously identical to the clays of fish-sauce containers, and morphologically the vessels differ from the normal Dressel 2-4 types in their flat rims and grooved handles instead of bifids [Beltrán, 1977]. This type is basically attested to only by concentrations found at Colchester [Sealey, 1985; Symonds, forth.].

d. Catalan

Two Catalan fabrics have been distinguished, which are identical to the Pascual 1 fabrics already introduced [Williams, 1981; Keay and Jones, 1982]. A first differentiation of the fabric of Catalan origin was done by Tchernia and Zevi [1972]. This was confirmed from the discovery of some kilns in later surveys [Pascual, 1977; Miró, 1988; Revilla, 1993]. The type development from the Pascual 1 amphora produced in the reign of Augustus and Claudius to the standard Dressel 2-4 was gradual, as some kiln dumps clearly demonstrate (e.g. Can Feu and Sant Boi) [Martínez et al, 1988; Lopez-Mullor, 1990; Carbonell et al, 1991]. The type disappeared in the late second century A.D. according to Ostia and Rome datings [Panella, 1973; 1989; Tchernia, 1986a; Ciotola et al, 1989; Revilla, 1993].

Dressel 2-4 amphorae were also produced in other areas in the Tarraconensis province with slight variations in fabrics used: Oliva, Sagunto and Denia [Aranegui and Enguix, 1977; Aranegui, 1987; Gisbert, 1987]. The ordinary wine contained in these vessels[8] seems to have enjoyed an extraordinary popularity judging from the cargoes of numerous shipwrecks in the Gulf of Lion [Corsi-Scilliano and Liou, 1985; Liou, 1987] and the widespread distribution of such amphorae (e.g. Germany, Holland, Switzerland, France, Italy, North Africa, Britain and Spain) [Miró, 1988, 145; Remesal and Revilla, 1991; Galliou, 1991].

Shipwrecks: Planier A (P.824), Petit-Congloué (P.806), Formigues (P.776) and Dramont B (P.372) [Corsi-Scilliano and Liou, 1985].

e. Gaulish

Thirteen workshops that produced Dressel 2-4 have been identified so far in Gaul [Laubenheimer, 1985; 1989; Berthault, 1988; Gébara and Beraud, 1992; Meffre and Meffre, 1992] dating variously from the Augustan [Bertucchi, 1982] to the Claudian-Nero period [Dangreaux *et alii*, 1992]. The fabrics are fine, creamy-pink in colour and identical to amphorae produced at other sites in the province [Tchernia and Villa, 1977; Schweitz, 1986; Becker, 1986; Morel, 1989; Martin-Kilcher, 1990; Desbat, 1994]. Despite the fact that wine was supposed to be the main content, a painted inscription from London indicates that fish-sauce as being another content[9]. Little is known about the type distribution, though at least it is attested in Gaul and Britain in small quantities.

f. North African

Examples of this North African imitation are recorded only at Ostia in the Western

[8] Laietanian wine is mentioned by some ancient authors as low quality beverages (Martial i.26.9-10; vii.53; Pliny NH.xiv.71) although there are some contradictory opinions (Silvius It.iii,369; xv,178; Martial xiii.118; Florus Verg.ii.8).

[9] Hassall and Tomlin [1984] described the inscription from Southwark as LIQUAM(em)/ANTIPOL(is)/EXC(ellens)/L(ucii) TETTI AFRI/CANI.

provinces [Panella, 1973, 478-482; Manacorda, 1977, 366]. They are first documented in early second century A.D. contexts, disappearing by the end of that century [Panella, 1989]. No evidence of this type has been discovered in Britain so far.

g. Switzerland

Recent analyses of Dressel 2-4 found in Switzerland indicate a probable production centre at Augst [Martin-Kilcher *et alii*, 1987; Martin-Kilcher, 1992]. However, there are no traces of this vessel in Britain and little is known about its distribution and date range from elsewhere.

h. Verulamium Region (Britain)

Dressel 2-4 were also produced in the Verulamium region according to petrological analyses [Castle, 1978; Symonds, 1993; 1994; forth.] and the sites of two possible workshops have been discovered (i.e. Brockley Hill and Hills Field) [Castle, 1978]. The examples recorded have a very distinctive granular creamy-grey fabric and almost all the handles recovered at Colchester contain some holes, which may indicate that the handles were strapped before firing, the pin holding the cloth being responsible for the holes [Symonds, forth.]. These vessels were first produced in the late first century [Castle, 1978; Sealey, 1985, 129], though recent evidence from Colchester suggests an earlier date as be applicable (circa A.D. 44-49/55) [Symonds, forth.]. The production end seems to correspond to the early second century A.D., when the same region started developing a Gauloise 4 form [Greep and Sealey, forth.]. Therefore wine may have been produced in these areas, which had all the requisite conditions [Sealey, 1985, 128-130; Symonds, 1993].

As can be observed, the Dressel 2-4 form had a different evolution in each geographical area, although all of types share some common features. One of these common characteristics is obviously the shape which may have been imitated to suggest a prestigious link with the wine from Kos, Chios and Lesbos (Cato.De Agr.112; Varro Sat.Men.104; Pliny NH.xiv.95-96) which was transported in the earliest vessels [Tchernia, 1986a; 1986b; Hesnard, 1986]. Therefore wine is supposed to represent the most frequent content of this particular form elsewhere [Condamin and Formenti, 1976; Tchernia, 1986a].

3.2.5 Carrot amphora (Camulodunum 189; Schöne-Mau xv; P&W 12)

This vessel is typified by a small rounded rim, small conical ribbed body and short loop-handles [Peacock and Williams, 1986, 109]. This type has been occasionally confused with the Kingsholm 117 amphorae, evidence of which is found in similar rilled body sherds and fabric [Sealey, 1985, 89-90]. The eroded quartz inclusions in its clay suggest it emanates from a desert environment [Shackley, 1975, 58-59; Tomber and Williams, 1986, 44]. This is supported by the fact that burnt dates were recovered in one of the vessels at Avenches [Reusch, 1970, 58-59]. A recent discovery at Carlisle suggests that this type was produced in Egypt. The discovery establishing this link, was a Greek painted inscription interpretated as Kouk(iov) or *cuci* (latin), which was the fruit of the doun palm (Hyphaene thebaica) found only along the Nile Valley [Tomlin, 1992]. Nevertheless, neither kilns nor waste heaps containing these amphorae have been documented so far in Egypt [Peacock, pers.com.]

The date range is not clear either. This type was first recorded in the Augustan camps of Wiesbaden and Vindonissa [Reusch, 1970]. Its presence is also attested to at Colchester in the Claudian-Nero period [Sealey, 1985], whereas it is dated A.D.c.75 at Fishbourne [Cunliffe, 1971]. Apart from other early Flavian dates at York and Chester, the latest reliable chronology comes from Inchtuthill (A.D. 83-87/92) [Pitts and St.Joseph, 1985]. However the type has been found in early second century contexts at Verulamium, Fishbourne, Colchester, Ostia and Augst [Cunliffe, 1971, 208; Wilson, 1984, 202; Panella, 1989, 175; Martin-Kilcher, 1994, 436; Symonds, forth.] which may indicate the continuity of its production.

With regard to its distribution, the vessel has been found in concentrations at early military sites in Britain, Germany and Pannonia [Reusch, 1970; Brukner, 1981, 55; Brulet *et alii*, 1992; Martin-Kilcher, 1994, 434-436]. According to our sample, the type shows a strong presence at military sites and is completely absent from middle-size civil sites. It seems that military personnel were the main consumers of this possible egyptian fruit; however some supplies may have reached the main provincial markets but not minor sites. The following table provides an accurate picture of carrot amphora imports in the province.

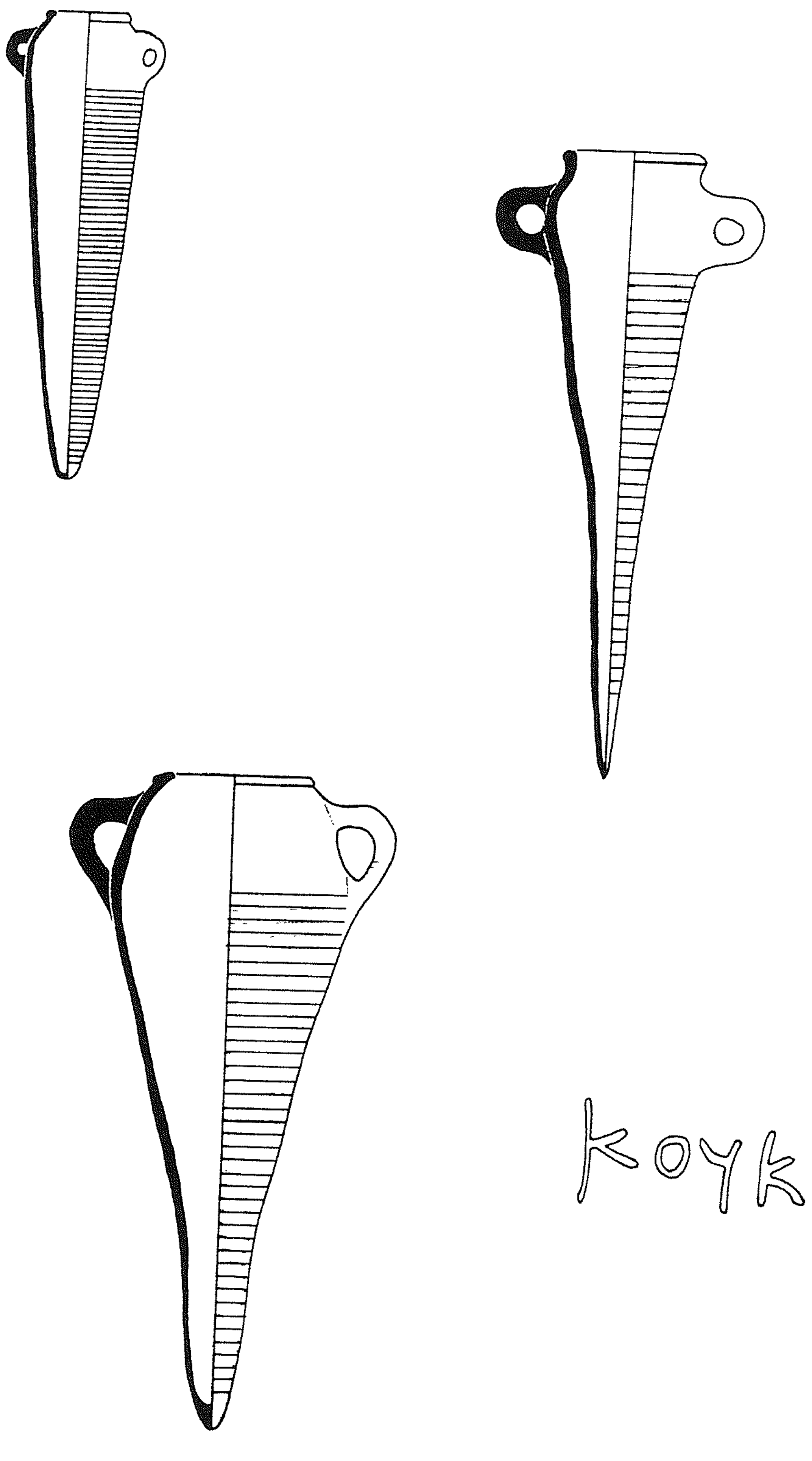

Figure 7 Carrot amphorae and a painted inscription recovered at Carlisle.

Table 10

Sites	gr/m²	Sites	gr/m²	Sites	gr/m²
London	0.65	Stonea	-	Carlisle	0.44
Ribchester	0.02	Cirencester	-	Corbridge	1.02
Longthorpe	-	Winchester	0.01	Leicester	0.97
Vindolanda	-	Chichester	-	S.Shields	0.01
Gloucester	-	Chester	0.09	St.Albans	0.27
Poundbury	-	York	0.46	Silchester	0.13
Skeleton	-	Old Penrith	-	Colchester	0.24
Inchtuthill	0.24	Bewcastle	-	Lancaster	-
Exeter	5.54	Purbeck	-	Staines	-
Ivy	-	Chelmsford	-	Canterbury	0.23

The table above shows that this amphora type was mainly distributed in sites in the Southern region (e.g. Exeter). A clear military pattern of distribution for this vessel is evident, though the interpolation map (chapter 5, figure 65) does not support any exclusiness. On the contrary, the major concentration is defined only by Exeter, which may also be an indication the possible port of entry. However, it must be stressed that the sample from Exeter is relatively rich in amphorae types, consequently a thorough testing is required in order to compare it to densities of future assemblages.

3.2.6 Richborough 527 (P&W 13)

This type is represented by a large thick rounded rim with short, chunky, semicircular, ridged handles. The body is shallow and ribbed finishing in a short solid spike [Cunliffe, 1968] and only seldom stamped. This standard type is frequently present in Roman Britain [Peacock, 1977a; Sealey, 1985, 91-93], France [Picard, 1970; Sanquer, 1979; Galliou, 1984; Borgard and Gateau, 1991; Borgard and Cavalier, 1994] and occasionally in Switzerland [Roth-Rubi, 1975, 233; Martin-Kilcher, 1994] and Spain [Arthur, 1989, 255]. Furthermore, some examples have been recovered from Italy, though some types are slightly different in rim shape, perhaps because they are later in date [Arthur, 1989, 251; Williams and Arthur, 1991; Borgard y Cavalier, 1994]. The fabrics of these samples seem similar greenish-grey in colour, rough and with volcanic glass inclusions which points to the likely origins of this production type [Peacock, 1977a; André, 1989; Williams and Arthur, *1991*, *391*; Bogard and Gateau, *1991*, *314*][10]. A volcanic area of production is initially indicated, and the Massif Central (Puy Dome) would be a likely option due to the high concentration of samples found in France (e.g. Angers, Arles, Frejus, Nimes, Rennes, Saint-Marcel, Vannes, Cavaillon, Marseille, Bordeaux) [Arthur, 1989; Bogard and Gateau, 1991; Laubenheimer *et alii*, 1992]. Nevertheless, recent finds in Italy (Puetoli area) make the Campanian zone (Phlegrean Fields) another probable source for this type [Williams and Arthur, 1991, 396]. A final possibility is that Lipari was one of the production centres, linked to posible workshops [Borgard and Cavalier, 1994].

Table 11

Sites	gr/m²	Sites	gr/m²	Sites	gr/m²
London	43.40	Stonea	-	Carlisle	-
Ribchester	-	Cirencester	-	Corbridge	-
Longthorpe	-	Winchester	1.00	Leicester	0.04
Vindolanda	-	Chichester	-	S.Shields	-
Gloucester	-	Chester	0.02	St.Albans	0.0125
Poundbury	-	York	-	Silchester	0.47
Skeleton	1.03	Old Penrith	-	Colchester	0.01
Inchtuthill	-	Bewcastle	-	Lancaster	-
Exeter	5.38	Purbeck	-	Staines	-
Ivy	-	Chelmsford	-	Canterbury	0.04

With regard to the likely content, no evidence has been obtained from recent analysis of organic residues from two samples, although olive-oil and fish-sauce have been discarded from the list of possibilities [Williams and Arthur, 1991, 196; Laubenheimer *et alii*, 1992], whereas paint adhesive (i.e. *allum*) has recently been suggested [Borgard and Cavalier, 1994]. The date range, initially established as pointing to the first century A.D on the basis of well-dated British and French contexts [Peacock and Williams, 1986] must now be drawn back to the late first century

10 Some variations appear in the absence of fossil foraminifera and more mica in the Italian samples, though this fact does not imply a different source necessary [Williams and Arthur, 1991, 394].

B.C. which probably represented the starting point (e.g. Cavaillon) [Borgard and Gateau, 1991]. This type is documented in third century contexts at London (i.e. New Fresh Wharf) [Green, 1986, 101] and Puetoli [De Franciscis, 1981], whereas a sample in Naples was dated as belonging to the fourth century A.D. [Arthur and Vecchio, 1985].

The distribution of this vessel in Britain includes sites such as Richborough, Cirencester, Colchester, London, Silchester and York [Peacock, 1977a; Sealey, 1985, 91-93; Arthur and Williams, 1991]. The present sample increases the number of recorded sites, which are chiefly concentrated in the Southwestern part of the province, by far the main importer being London. The table and the map (chapter 5, figure 70) illustrate the densities of this amphora type, whose distribution pattern seems to suggest that the main routes of supply were the rivers Rhine and Seine through the Thames estuary.

Shipwreck (possible): Punta di San Francisco (P.936) [Cavalier, forth.]; Palegruža B [Orlić and Jurisić, 1987]; Sveti Audriga [Orlić and Jurisić, 1987].

3.2.7 Haltern 70 (Camulodunum 185 A; P&W 15)

This vessel can be recognized by its cylindrical body and solid spike, complemented by a grooved handle[11]. The open collared rim, which underwent a clear change over time [Carreras, 1994b], is probably the most distinctive feature of the vessel. Despite having only 18 well-measured rims in the sample, between two and four groups can be defined on the basis of statistical analysis. Figure 10 shows the 6 measures established for the rim. On the one hand, the correspondence analysis showed clearly groups of grooved and non-grooved tops of rim respectively, but cluster analysis (Ward's Error SS) suggested that even four different divisions could be established.

Unfortunately, no dates are available for each rim form, the morphological variation of which could also be due to their originating from different production areas. Since the rims were not complete, the lower edge of the collar could not be taken as a measure, although such a measure has been used for distinguishing late variations (i.e. Haltern 70 similis) [Dangreaux and Desbat, 1987; Martin-Kilcher, 1990]. At least two fabrics were recognized for this form: sandy buff with inclusions of quartz and felspar [Peacock and Williams, 1986, 140] produced along the Guadalquivir Valley (Southern Spain) [Peacock, 1974; van der Werff, 1984; Sealey, 1985] and a

[11] The type Lomba do Canho 67 has been recently related as a predecessor to Haltern 70 due to possible similar fabric [Fabiao, 1989; Molina, 1993].

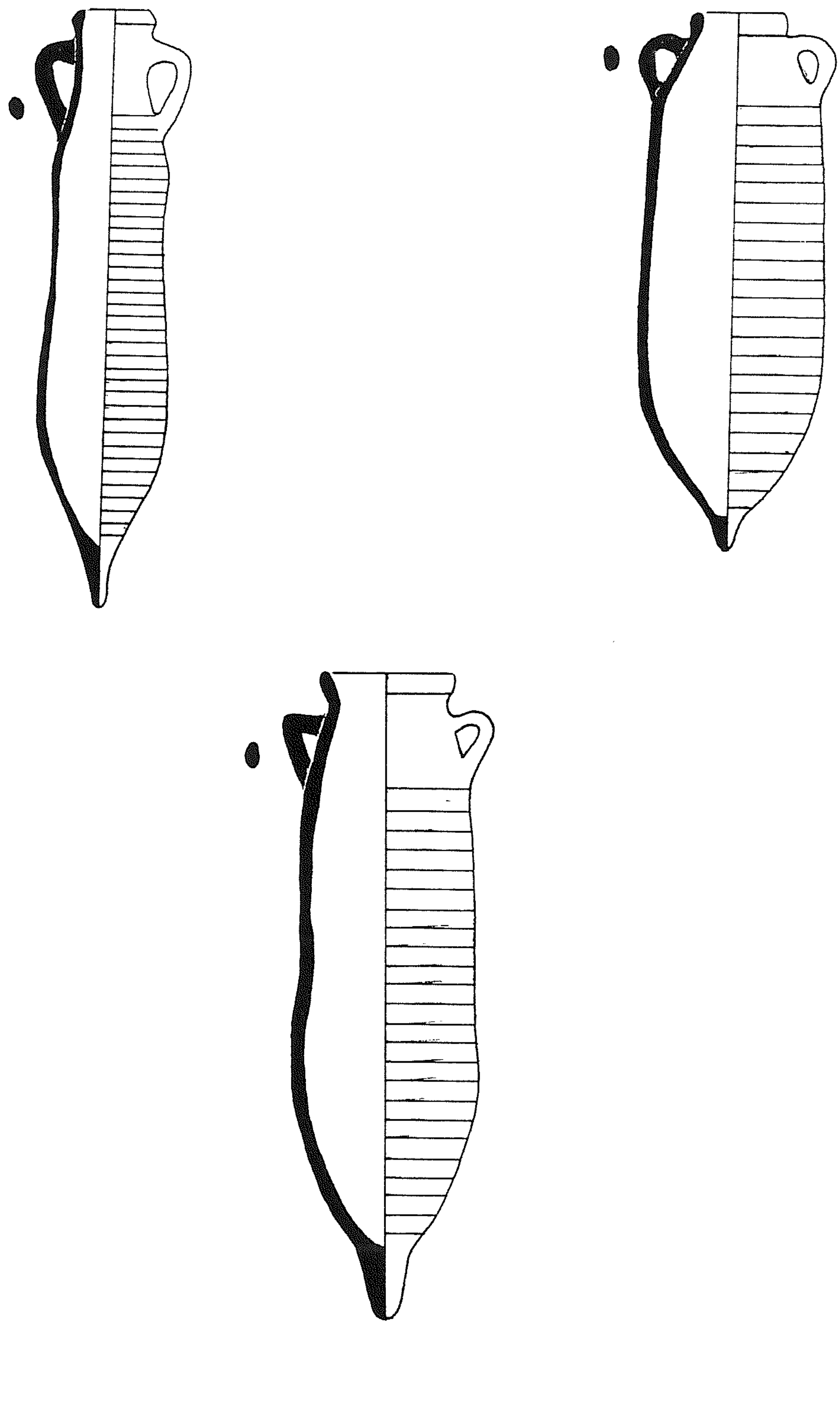

Figure 8 Richborough 527 amphorae.

fine creamy clay from Southern Gaul [Desbat, 1987; Dangreaux and Desbat, 1988]. Most of the sherds from the sample were Baetican in origin, since the only Gaulish example was found at Chester (Gross Str. 73). The Baetican amphorae is sometimes stamped on the handle, sharing some stamps with the Dressel 20, also produced in the same area [Colls et al, 1977; Amar and Liou, 1984]. This may indicate possible common kilns for the production of both amphora types, though the only Haltern 70 workshop located so far does not provide evidence for such a relationship [Remesal, pers.comm.; Carreras, 1994b]. The Gaulish type seems to have also been produced along the Rhône (e.g. Lyon and Vienne; sandy rough fabrics) [Desbat, 1987; Schmitt, 1988, 32; Desbat and Dangreaux, 1992] and Doubs (e.g. Maudeure) [Jeannin and Laubenheimer, 1989], its shape being slightly different but closer to the so-called London 555 type [Sealey, 1985; 1994; Sealey and Tyers, 1989].

With regard to its date range, the type is first documented in the mid first century B.C. (circa 60-50 BC, Madrague de Giens) [Tchernia et al, 1978], although it became common in the last decades of that century (e.g. Ostia, Dangstetten, Neuss, Oberaden, Haltern, Galicia) [Fingerlin, 1972; 1986; Ettlinger, 1977; Hesnard, 1980; Naveiro, 1991, 66]. Notwithstanding the fact that A.D. 50 was considered to mark the date of its disappearance by some authors [Colls et al, 1977; Sealey, 1985; Fitzpatrick, 1989], it is still attested in Flavian contexts (i.e. Nijmegen, Strasbourg, Rome, Lyon) [Van der Werff, 1984, 356; Tchernia, 1986a; Dangreaux and Desbat, 1987; Ciotola et al, 1989; Baudoux, 1990, 75; Martin-Kilcher, 1990; 1994]. However, the best dating is given by the Cala Culip IV wreck [Nieto et alii, 1989] which indicates their production still in the reign of Vespasian, between A.D.69-79. Recent excavations at Rome (i.e. Crypta Balbi, Curia Forum Iulium) also provide a late dating (A.D. 80-90), though they may have been residual in other contexts (i.e. Via Sacra-Via Nova) (A.D. 90-110) [Panella, 1992] as well as the ones from Augst (A.D. 140-230) [Martin-Kilcher, 1994, 389]. In Britain, Haltern 70 are documented at military sites in Neronian-Flavian foundations (i.e. Chester and York) and Flavian contexts [Carreras, 1994b; Symonds, forth.]. According to this evidence, it is unlikely that the example recovered in the Orkneys could only be explained by a Claudian invasion of the island [Fitzpatrick, 1989].

A second area of contention related to this type is its context. Some painted inscriptions indicate that olives preserved in boiled wine were the basic content[12]. The best evidence for this suggestion is a Haltern 70 filled with olive stones recovered from the Sud-Lavezzi II shipwreck [Liou, 1982, 444]. Other scholars have identified *defructum* and *sapa* with the French vins cuits [Parker and Price, 1981; van der Werff, 1984], which it is claimed were the main content.

---

[12] Loeshcke [1942,100-101] described 3 painted inscriptions from Vindonissa and Mayence, one reading oliva/nigra/ex defr(uto) and two, oliva/nigr(a) ex defr(uto) pennar(ia) excell(ens) likewise a oli(va)/dul(cis)/pl/mcil; whereas others from Port-Vendres II [Liou and Lequément, 1977, 88-89; Tchernia, 1980] and Soissons [Lequément and Massy, 1980] mention only *defrutum* (boiled wine) and *sapa*, an equivalent, at Amiens [Lequément and Liou, 1978, 183-184].

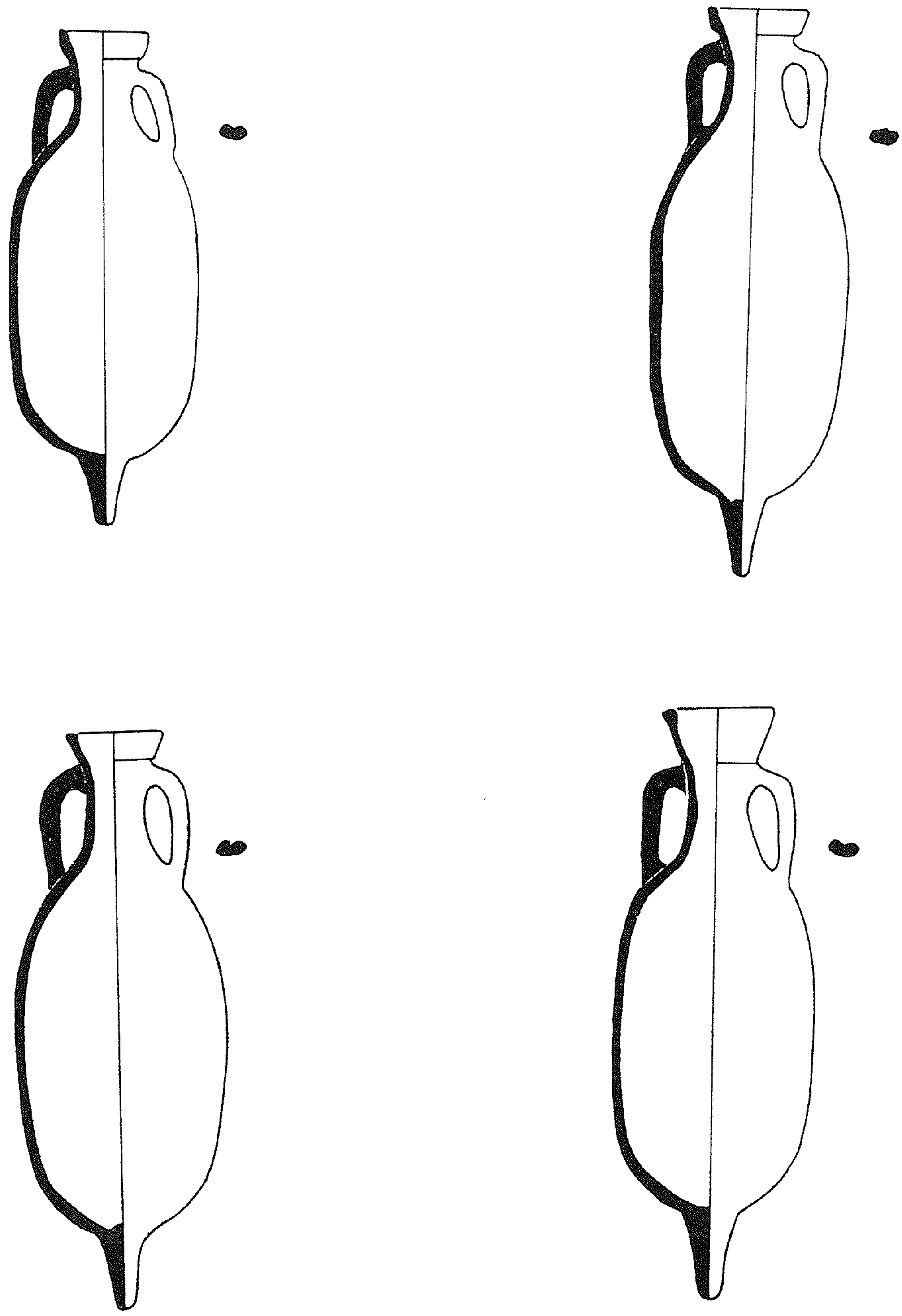

Figure 9 Haltern 70 amphorae.

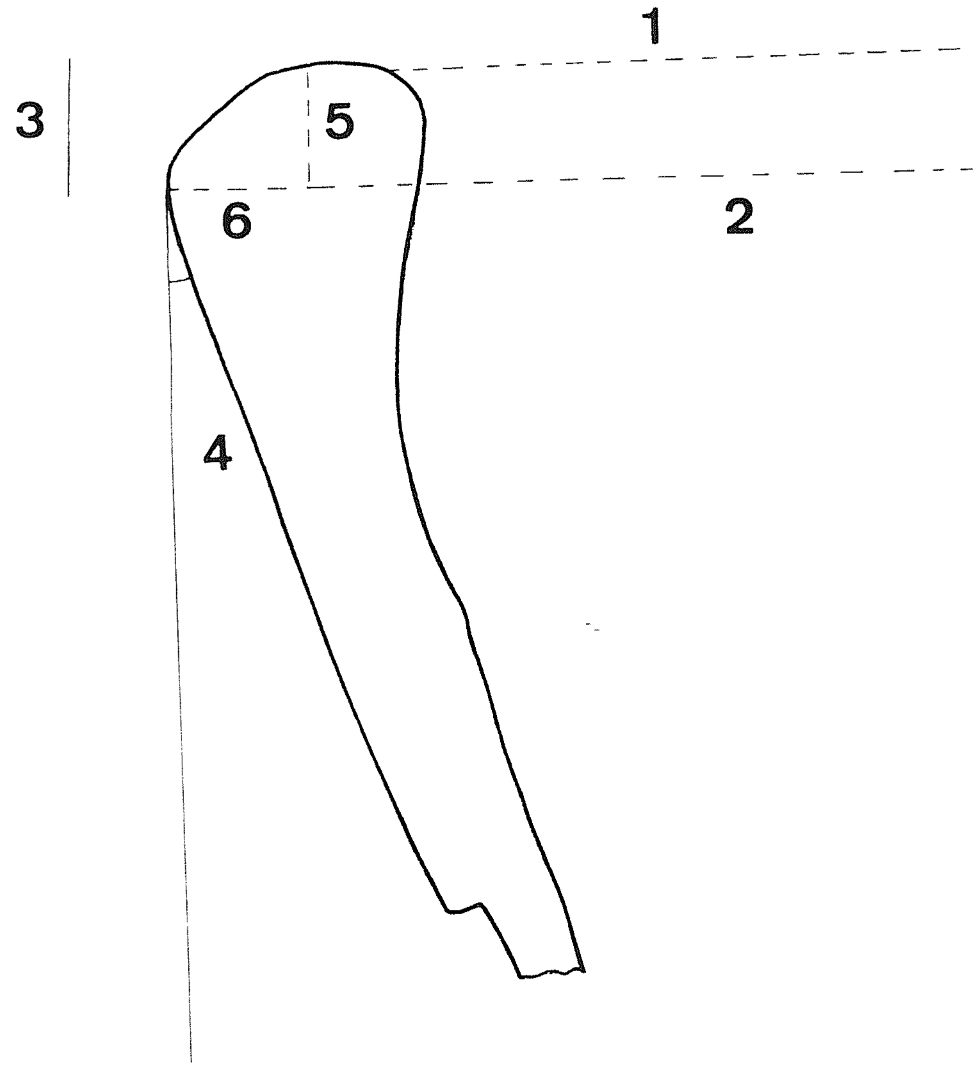

Figure 10 Structure of a Haltern 70 rim and the six measures taken for the statistics.

Finally, Sealey [1985, 62-63] points out that *defrutum* and *sapa* were non-alcoholic syrups used as preservatives, sweetening ingredients in cooking or as beverages (Cato De Agri.7.4; Varro RR 1.60; Columela De Res.Rus.12.49.3; 12.49.6-7; Pliny NH.15.4.16). A unique amphora find at Punta de la Nao (Cádiz) contained some grape pips. Moreover, Haltern 70 has a widespread distribution in the Western Mediterranean, including provinces such as Germany, Gaul, Italy, Spain and North Africa [Ettlinger, 1977, 16; Lequément and Liou, 1982, 42-43; Siraudeau, 1988; Baudoux, 1990, 266]. Haltern 70 amphora seems to have been the predecessor of other types that have been recognized only recently. One of these, Haltern 70 similis, has already been introduced as a Gaulish variation of later date (i.e. Lyon, circa A.D. 80; Augst, circa 10-80 A.D.) [Dangreaux and Desbat, 1988, 117; Martin-Kilcher, 1994]. A second type of vessel with an elongated body and longer rim than Haltern 70 is also known as Verulamium 1908 [Sealey, 1994; Sealey and Tyers, forth.] or a late Haltern 70 [Martin-Kilcher, 1994, 386; 455]. This form has been recorded at least in Verulamium, London and Leicestershire, with a hadrianic date in London [Sealey, pers.comm.] and a distinctive Baetican fabric[13].

Shipwrecks: Port-Vendres II (P.875) [Colls et al, 1977]; Sud-Lavezzi II (P.1118) [Liou, 1982]; Tour-Ste-Marie A (P.1171) [Tchernia, 1969, 496-499]; Lavezzi A (P.585) [Bebko, 1971, 21].

3.2.8 Fish-Sauce amphorae

This group includes a wide variety of interrelated forms since they have contained a series of products derived from fish, which were known as *garum*, *liquamen*, *halex* or *muria* (Pliny NH.31.43.93) [Martínez-Maganto, 1992]. Numerous painted inscriptions on these amphorae [Zevi, 1966; Martin-Kilcher and Schillinger-Häfele, 1990; Liou, 1993] and a few analyses of contents [Sealey, 1985, 84; Lepiksaar, 1985; Laubenheimer, 1990] confirm this link with fish products, though there are some exceptions including *defrutum* at Pompeii (CIL iv, 9324) [Sealey, 1985, 84] or Strasbourg [Van der Werff, 1987, 160], and olives are also attested in two Beltrán II B a la Bourse de Marseile [Boyer, 1986]. Testimonies of fish industries are well documented along the Atlantic coasts of Morocco, Spain and Portugal [Ponsich and Tarradell, 1965; Edmonson, 1987; Arruda et al, 1990; Alarçao and Mayet, 1990; Curtis, 1991; Martinez-Maganto, forth.]. The presence of hypocausts and tanks in establishments near the coast has been interpreted as providing evidence of the production fish-sauces so appreciated by the ancient Romans [Curtis, 1991]. As well as the Southern Atlantic coast, others areas have provided testimonies of possible fish-industries, for example, in the Mediterranean (e.g. Cartagena, Eastern Andalucia, Catalonia,

[13] Seen by the writer thanks to M.Darling (Leicestershire example) and personal comments by Sealey (Verulamium and London examples).

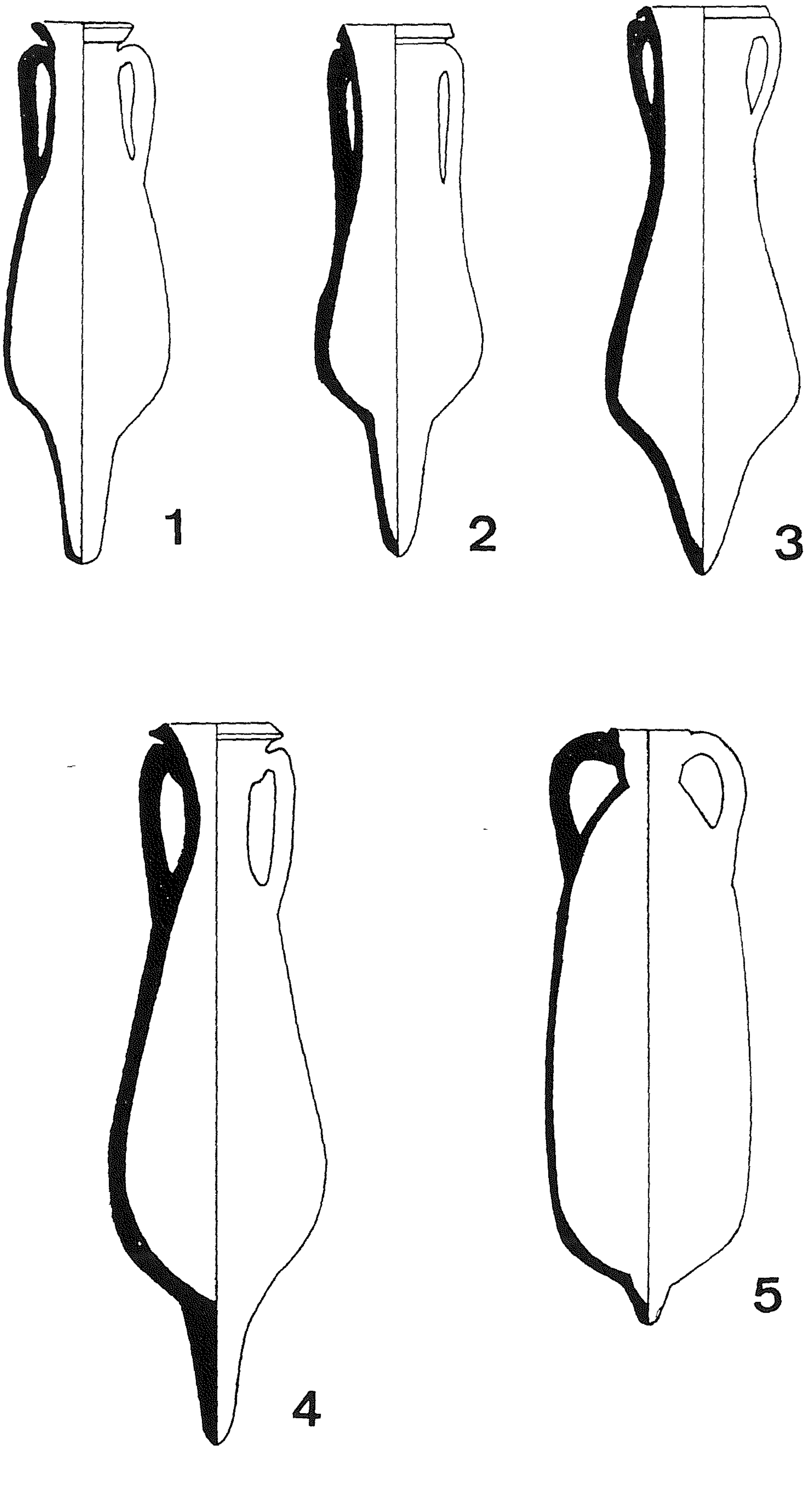

Figure 11 Fish sauce vessels: (1) Belt.I, (2-3) Belt.II A, (4) Belt.II B and (5) Alm. 50.

Southern France)[14], Western Brittany [Sanquer and Galliou, 1972; Galliou, 1986], Northwestern Spain [Naveiro, 1991; Martínez-Maganto, forth.] and even London [Bateman and Locker, 1982].

The amphora sample for this project included two well-known fabrics which identify two fish-sauce production areas: Southern Spain and Southern France. The first one was characterised by a normally white slip, rough fracture and red iron inclusions [Peacock, 1974][15]. With reference to the Gaulish fabric, this is very fine and creamy with the typical inclusions of a granitic environment [Peacock, 1978; Desbat, 1994]. Although only two fabrics were predominant in the sample, other fish-sauce amphorae are attested in Britain but in low numbers [Peacock and Williams, 1986, 128]. Nevertheless the two recognized fabrics represent in fact four different typologies, which are described below:

a. Beltrán I (Dressel 7-11; Camulodunum 186 A; Pompei vii; P&W 10-17)

This type comprises 5 different forms described in Dressel's classification [1899]. These reflect very slight variations in shape, which is why Beltrán [1970] classified them as one group. The amphora is characterized by a bell mouth and thick everted rim. It has a long neck, ovoid flattered handles and a long hollow or solid spike. Some amphora kilns producing this type were discovered in the Southwestern coast of Spain, provinces of Cádiz and Huelva (i.e. El Rinconcillo, Puerto Real, El Olivar and Cerro de los Mártires, Torrelata, Cantera Lavalle, El Gallinero, Villanueva)[16] and more recently in the Spanish Southeast (i.e. Huerta del Mar, Manganeto, Cerro del Mar) [Arteaga, 1985a; 1985b; Serrano et alii, 1991]. Although this type was also produced on the Mediterranean coast of Hispania, no evidence of it appears in the present sample [Miró, 1981-82; 1988]. However, the same form in Gaulish fabric is attested in Britain. Some of the Gaulish workshops have been studied in detail, covering an area comprising the middle Rhône valley and Mediterranean coast (i.e. Lyon, Fréjus, Velaux) [Tchernia and Villa, 1977; Laubenheimer, 1985; Schmitt, 1988; Brentchaloff, 1988; Brentchaloff and Picon, 1990; Gébara and Beraud, 1992; Dangreaux *et alii*, 1992; Desbat, 1994].

This type is widely recorded in the Western Roman provinces [Beltrán, 1970; Ettlinger,

[14] Cartagena appears mentioned by Martial (xiii.102) and Pliny (NH.xxxi.93) as well as attested in painted inscriptions on amphorae [Zevi, 1966]. Amphorae workshops are reported in Eastern Andalucia [Arteaga, 1985b], Catalonia [Miró, 1988] and Southern France [Laubenheimer, 1985].

[15] There are more samples with hardly any iron which may have been produced in the Eastern part (i.e. Mediterranean coast).

[16] See Jiménez-Cisneros [1958], Sotomayor [1969], Beltrán [1970], Ramos [1981], Lagostera [1993] and Martínez-Maganto and Carreras [forth.].

1977; Deniaux, 1980; Siraudeau, 1988; Desbat and Martin-Kilcher, 1989; Baudoux, 1990; Hochuli-Gysel et al, 1991] as well as in North Africa in small numbers [Riley, 1979]. In Britain, Beltrán I is attested at least in London, Colchester, St.Albans, Richborough, Chichester, Leicester, Cirencester, Chester and Wroxeter [Martínez-Maganto and Carreras, 1993]. With regards to its date range, Panella [1973] provided a provisional chronology from Ostia pointing to the end of the first century B.C. as marking the beginning of the production while the early second century A.D. could be considered as its end [Panella, 1992]. Other sites such as Oberaden, Mount Beuvray and La Longarina confirm the initial date which is also supported by the stratigraphy of Cerro del Mar's kiln (last quarter of the first century B.C.) [Arteaga, 1985b]. Moreover, this kiln shows that the type was still being produced in the middle of the second century A.D. Nevertheless evidence from other provinces (i.e. Vindonissa, Nijmegen) shows the late first or early second century A.D. as marking the most likely end of this production. The same date is suggested by the British evidence, with the latest *terminus post quem* possible date being the 70s A.D. (i.e. Ribchester and Chester)[17].

Shipwrecks: Sud-Lavezzi II (P.1118) [Liou and Domergue, 1991]; Dramont D (P.374) [Joncheray, 1973]; Gran Ribaud D (P.477) [Hesnard et al, 1988]; Chrétienne H (P.307) [Santamaria, 1984].

b. Beltrán II A (Dressel 38-9; Ostia lxiii; Camulodunum 186 C; P&W 18)

This type is distinguishable by a wide neck and hooked rim ending in a hollow spike. It has a pear-shaped body with flattened handles. The only fabric represented by this amphora is from Southern Spain. Some workshops producing this type have been discovered in both Western (e.g. Puerto Real, Cerro de los Mártires, El Olivar, Olivar de Valencianos, Villanueva and Punta Umbria) [Beltrán, 1970; Ramos, 1981; Lagostera, 1993] and Eastern Baetica (i.e. Cerro del Mar) [Arteaga, 1985b].

Its date range according to evidence from Ostia is from the early Flavian to the late second century A.D. [Panella, 1973; 1992]. However the chronologies obtained at the Western frontier (e.g. Augst, Mainz, Vindonissa and Nyon) [Martínez-Maganto and Carreras, 1993] suggest a late Augustan date whereas Alsace and Lorraine support an earlier start, during the Tiberian-Claudian period [Baudoux, 1990]. Cerro del Mar's stratigraphy confirms the Ostia date range, but the latest evidence points to the Antonine period [Arteaga, 1985b]. The amphora presence at Pompei (A.D.

[17] Sealey [1985, 84] suggests that it may not have been produced on any scale after Nero on the basis of his evidence from Sheepen (Colchester), view shared by Symonds [forth.] in his study of new excavations from Colchester.

79) [Manacorda, 1977b] supports the estimated first arrival in Britain recorded at Colchester [Sealey, 1985, 80-84], Inchtuthill (circa A.D.78) [Pitts and St.Joseph, 1985] and London [Green, 1980]. The type occurs throughout the Western Roman Empire from the Atlantic coast [Beltrán, 1970; Monaghan, 1987; Naveiro, 1991] to the central provinces [Ettlinger, 1977; Desbat and Martin-Kilcher, 1989; Bezeczky, 1989; Martin-Kilcher, 1990], Italy [Panella, 1973; Manacorda, 1977b] and even in North Africa and the Eastern Mediterranean [Riley, 1979]. In Britain, this type is recorded at least in London, Colchester, St.Albans, Richborough, Chichester, Leicester, Cirencester, Chester, Wroxeter, Ribchester, Lincoln, Caerleon, Corbridge, York and Newstead [Martínez-Maganto and Carreras, 1993]. Moreover the vessel seems to have been as commonplace as its predecessor, Beltrán I, according to raw quantifications from Northwestern Gaul [Baudoux, 1990, 266, fig.28] and British evidence.

Shipwrecks: Lavezzi I (P.585) [Liou, 1991]; Gandolfo (P.435) [Pascual, 1968]; Gorgona A (P.461) [Martelli et al, 1982]; Olib B (P.761) [Brusić, 1980, 162]; Tour-St.Marie A (P.1171) [Tchernia, 1969].

c. Beltrán II B (Dressel 39, Ostia lviii)

This vessel differs from the previous type in terms of its everted rim and long thick spike. Its production is attested in Southwestern (i.e. Puerto Real and Punta Umbria) [Beltrán, 1977] and Southeastern Spain (i.e. Manganeto and Cerro del Mar) [Arteaga, 1985a; 1985b]. According to the evidence from Ostia [Panella, 1973], it dates from the Tiberian-Claudian period to the mid II century A.D., and this is also confirmed by an occasional find made at the necropolis of Cádiz [Beltrán, 1970, 436]. However, the stratigraphy of Cerro del Mar presents a later date for the beginning of this production. In Alsace and Lorraine, there are some later datings pointing to the Hadrianic-Antonine and Commodus' reigns, but the material may be residual [Baudoux, 1990, 114].

A wide distribution is documented in the Western provinces [Beltrán, 1970; Panella, 1973] and North Africa [Riley, 1979]. Nevertheless, this type never became as commonplace as other fish-sauce containers. At least, this is the impression obtained from the lack of evidence in Northeastern Gaul [Baudoux, 1990, 114] as well as in Britain, where only one third of the sites with Beltrán II A contain Beltrán II B as well (i.e. London, Chichester, Colchester, Leicester, Chester) [Martínez-Maganto and Carreras, 1993].

Shipwrecks: Saint-Gervais III (P.1002) [Liou and Gassend, 1991]; Gandolfo (P.435) [Pascual, 1968]; Little Rusel A (P.602) [Monaghan, 1987]; Cueva del Jarro B (P.343-4) [Pascual, 1973, 113-118]; Tiboulen de Maïre (P.1148) [Pomey et al, 1989].

d. Almagro 50 (Ostia vii; Keay xvi; P&W 22)

This type is characterized by a thick rim from which its rounded handles start. It has a long cylindrical body finishing in a short spike [Almagro, 1955]. Although this type was produced in Southern Portugal[18] (Lusitana II, Keay XXII) and North Africa [Keay, 1984], the samples recovered from the Romano-British sites show a distinctive Southern Spanish fabric with some red iron inclusions, recognized as Keay XVI/Augst 30 [Keay, 1984, 149-151; Martin-Kilcher, 1994, 401]. Notwithstanding the fact that its origin was taken for granted [Manacorda, 1977b; Beltrán, 1977; Carandini and Panella, 1981], the examples studied nevertheless do confirm this supposition.

The chronology of this vessel was originally established as being from the beginning of the fourth to the end of the fifth century A.D. [Keay, 1984]. However the Cabrera III shipwreck has provided an earlier date (after A.D. 257) for the beginning of its production [Guerrero et alii, 1987]. Its distribution is concentrated at Western Mediterranean sites and only occasionally has it been found in Northern Europe. The best testimony of its importance are provided by some shipwrecks along the Languedoc and Provence coasts. The only two pieces of evidence found in this sample come from London and Chester, where the form is also very rare.

Shipwrecks: Randello (P.975) [Parker, 1989]; Cabrera C (P.125) [Guerrero et al, 1987]; Lazzareto (P.593) [D'Oriano, 1989]; Nora (P.748) [Parker, 1992, 290]; Sobra (P.1100) [Kisić, 1987].

Epigraphic data can be found in the form of two painted inscriptions from London on Spanish fish sauce amphorae. The first *titulvs* on a Beltrán I, which reads C(.) ACERRONI FVR... [Hassall and Tomlin, 1982], whereas the second is on a vessel described as Haltern 70 or Beltrán I and reads S(.)L(.)F(.)T [Hassall and Tomlin, 1982; Milne, 1985]. Finally a stamp found on a Beltrán IIA at Caerleon records the name ARIST(palm).

The account above included all the fish-sauce amphora typologies identified in the research sample. Nevertheless the fragmentary nature of the amphorae studied means that in most cases,

---

[18] Apart from a distinctive fabric recognized by petrological and chemical analyses [Peacock and Williams, 1986, 131; Alarçao and Mayet, 1990], some workshops have been discovered in Algarve region, Valle del Tejo (Q.do Rouxinal) and Valle del Sado (Q.de Alegria, H.do Pinheiro and Vale da Cepa) [Edmonson, 1987; Alarçao and Mayet, 1990; Arruda et al, 1990].

origins could only be established on the basis of fabrics. Therefore for analytical purposes, fish-sauce amphorae are identified from this point on as Southern Spanish or Gaulish.

3.2.9 Dressel 20 (Beltrán v; Ostia i; P&W 25)

This type represents a large globular amphora with oval handles, a thick body and a short neck. The neck finishes with a convex internal rim, while the bottom is spherical with a very short spike. This type was produced at, at least, 100 different centres along the Guadalquivir Valley (Southern Spain) [Clark-Maxwell, 1899; Bonsor, 1931; Ponsich, 1974a; 1979; 1991; Remesal, 1986; 1989]. Although this shape seems to have been imitated in Germany (i.e. Rheinzabern, Reichschoffen, Brumath, Daspich-Mte-Yutz, Walldürn)[19] [Baudoux, 1990; 1992a; Schallmayer, 1992; Baudoux and Schweitzer, 1993], it never appears to have been distributed outside this province [Baudoux, 1990]. In fact, all the samples found in Britain contain the characteristic sedimentary fabric of the Guadalquivir valley with inclusions of quartz, felspar, limestone and mica [Peacock and Williams, 1986, 140]. Some differentiation of fabrics within the Guadalquivir valley is currently being claimed [Pieskma, 1982; Martin-Kilcher, 1985; Picon, 1986; Grubessi et al, 1991], although research is still in progress.

This amphora type was introduced by the Augustan period [Hesnard, 1980], although it was being commonly exported from the time of Claudius onwards [Colls et al, 1977]. The amphora Oberaden 83, also known as Haltern 71 or Dressel 25 similarly produced in Southern Spain, is considered to be the predecessor of the Dressel 20. The change from one form to another seems to have been gradual during the Augustan period, though some Oberaden 83 amphorae appear in later contexts, circa A.D. 50 [Martin-Kilcher, 1983]. The Dressel 20 continued to be produced until the reign of Gallienus as far as the epigraphic evidence suggests [Etienne, 1949; Remesal, 1983; Rodríguez-Almeida, 1989], however it has been claimed that production continued up until the fourth century A.D. [Manacorda, 1977a]. A smaller amphora, also called Dressel 23, replaced the present type during the third century as the standard amphora container for the area [Beltrán, 1970; Martin-Kilcher, 1983; 1987a; Remesal, 1983; 1989; Bost et alii, 1992].

A likely content for this amphora type was olive-oil which represented the main agricultural product associated with it. Apart from the actual olive-culture of the Guadalquivir area and the presence of Roman oil presses [Ponsich, 1974a; 1979; 1991], some oil residues from Dressel 20 have been studied using gas chromatography [Condamin et al, 1976]. Moreover, there are records

---

[19] Rheizabern amphorae bear identical stamps to the Samian potters of the area (i.e. RestutusF, FidelisF, VitalisF, Antoninus, Pervircus).

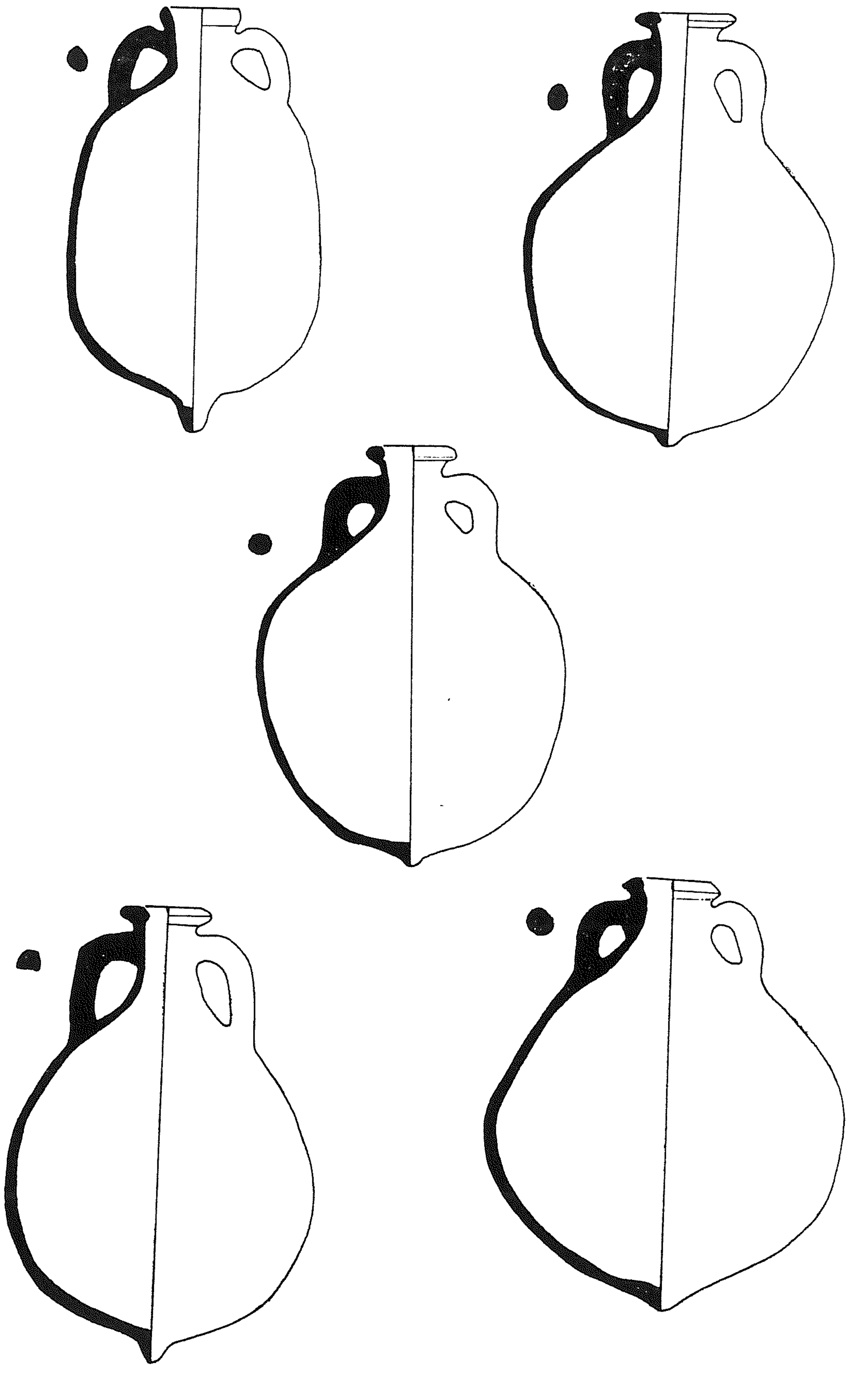

Figure 12 Dressel 20 amphorae.

of possible olive-oil traces in presumably this kind of vessel [Newstead, 1939]. Olive-oil production in the Guadalquivir valley is fully described by classical authors (Columella RR 5,85; Pliny NH, 17.93; 17.31; Caesar, B.Hisp. 27.1) and olives were noted as the main crop. To add to this, sources indicate that the Baetican olive oil was appreciated all over the Roman world because of its excellence (Pliny NH, 15.3.8; Pausanias 10.32.19; Strabo iii.2.6).

Since this type of amphora had a long-life span, the form underwent different changes over time [Beltrán, 1970; Rodríguez-Almeida, 1984; Abreu Funari, 1985; 1987]. Tchernia [1967] first draw attention to transformations undergone by Dressel 20 rims. This evolution was later analyzed in more detail by Martin-Kilcher [1983; 1987a], who created a classification system based on the stratigraphies from Augst and Kaiseraugst (Switzerland). Recently a similar classification was elaborated by Baudoux [1990] using well-dated evidence from Lorraine and Alsace. Dating a sample of 137 rims recovered from different British sites (i.e. Leicester, Winchester, Chichester and Chester) using both systems of classifications, it became clear that there were some discrepancies with the second century datation. Both classifications agree about the first (i.e. Claudian, Neronian and Flavian) and third century A.D. rims, however there is disagreement in some cases concerning rims assigned to either the first or second half of the second century A.D.

It was decided therefore, to use statistical analysis in order to classify the British sample and also establish as well some common typological features which could be used to identify the different stages of rim development over time (i.e. variables). As can be observed in figure 13, seven main measures were thought to cover all possible variations in the form of Dressel 20 rims.

First of all, two kinds of cluster analysis (Ward's Error and K means) were applied to classify the 137 rims of the sample. The resulting clustering did not correspond to any date range from the classifications, but combined rims from different periods. Similar results were obtained by undertaking principal components and correspondence analyses. The results supported the idea that no clear chronological pattern could be inferred from the statistics. It can be argued that the measures were not valid representatives of formal changes in the rim shape, but at least the experiment represented a good starting point.

However, dating Dressel 20 rims was still a problem to the earlier or later part of the second century A.D. Evidence from the Cala Culip IV shipwreck [Nieto et alii, 1989] shows how a cargo of Dressel 20 amphorae from the Vespasian period included a wide variety of either rim and handle types. One of the conclusions drawn from this was that some variations reflect geographical traditions [Price, 1984] rather than chronological changes. A similar approach based on a probable geographical origin is being currently followed to classify third century Dressel 20

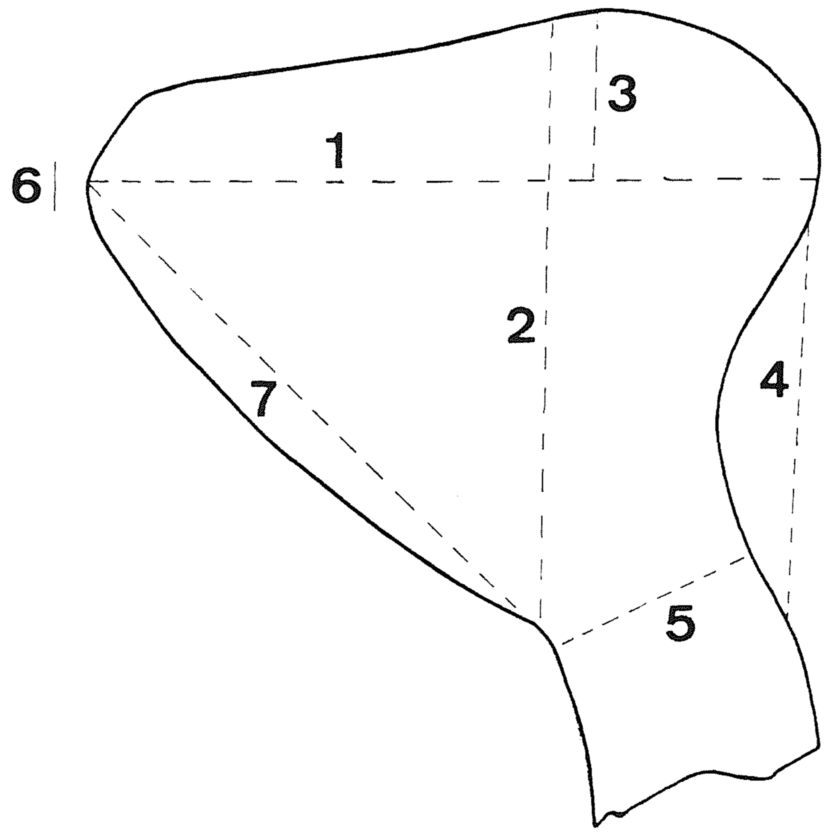

Figure 13 Structure of a Dressel 20 rim and seven measures taken for the statistics.

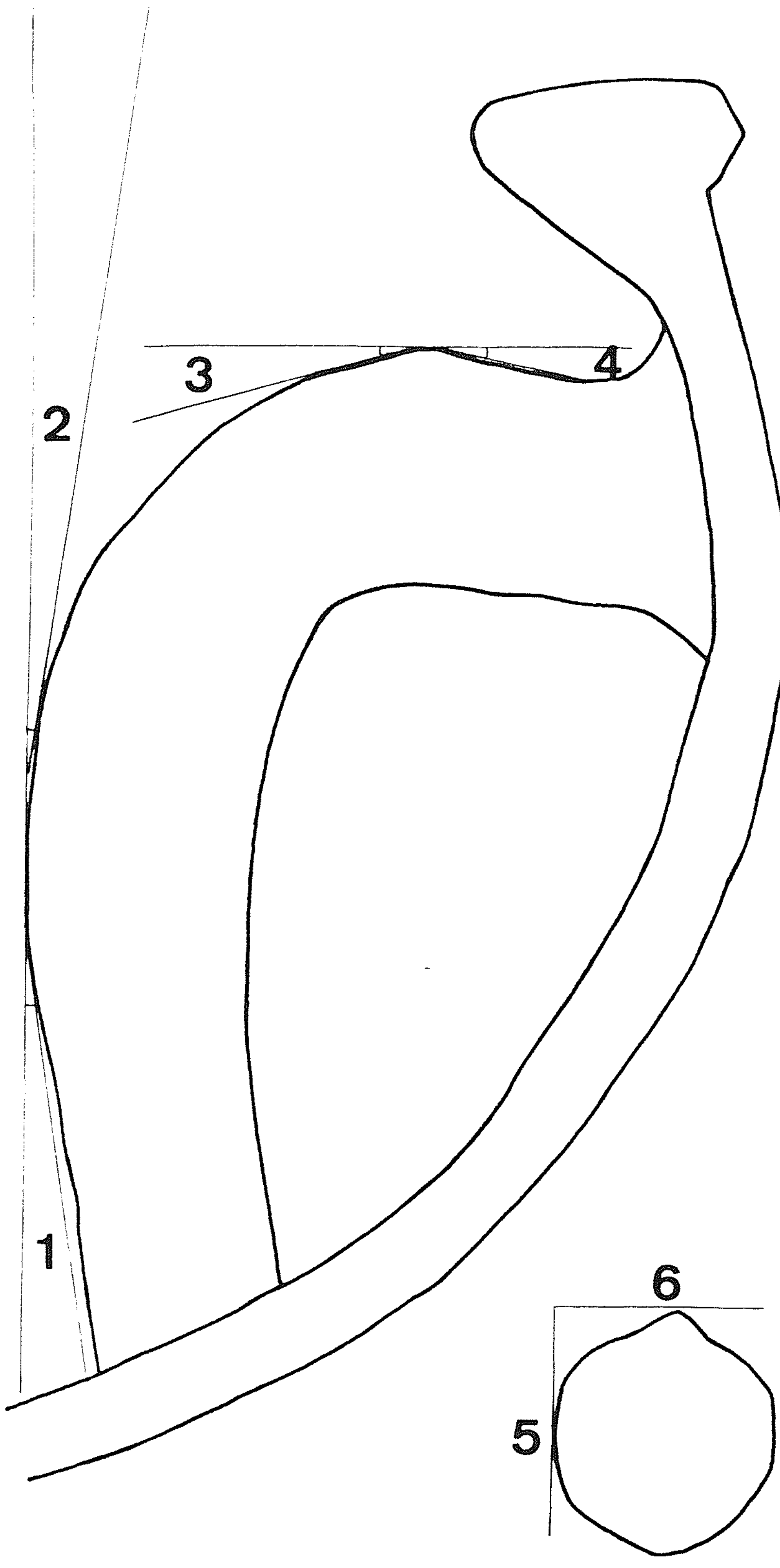

Figure 14 Structure of a Dressel 20 handle and the six measures taken for the statistics.

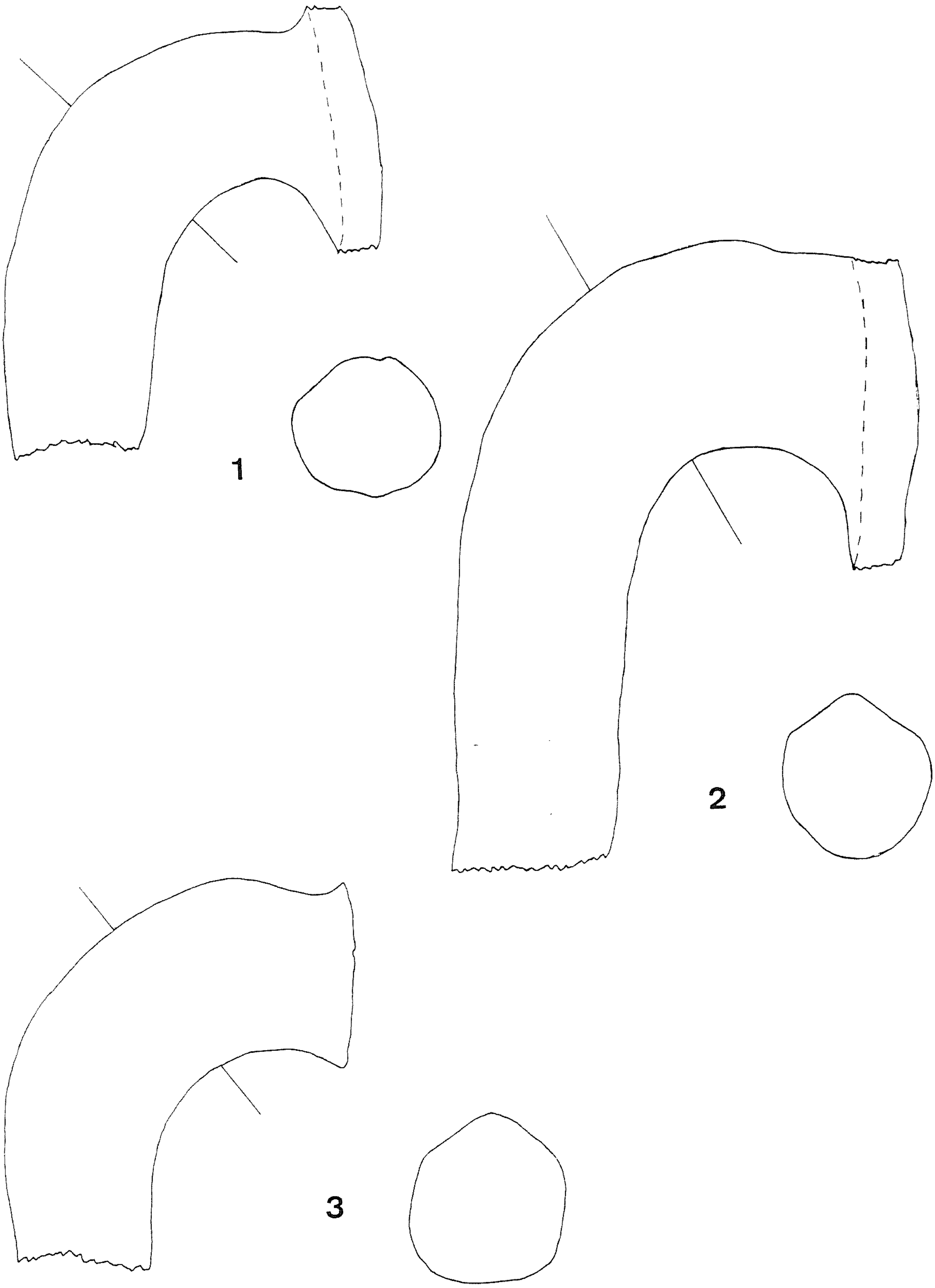

Figure 15 Groups: (1) Flavian CANTQVIETI, (2) IIc. CIALB and (3) IIIc. FSCIMNIANO.

rims [Morreta, forth.]. Therefore, current thinking is that variability in the shape of the rim does not necessarily imply any chronological pattern.

A second morphological study involved Dressel 20 handles that present quite clear variations within different periods [Guénoche and Tchernia, 1977; Rodríguez-Almeida, 1984]. Again, multivariate analyses were used to classify a sample of 48 stamped Dressel 20 handles, whose date ranges were previously established. Six measurements illustrated in figure 14, were considered to be representative of all the changes in handle shape.

Neither cluster nor principal analyses could explain these changes in handle-shape over time. Nevertheless, correspondence analysis showed an initial chronological pattern though it did not apply to all cases. The analysis grouped 6 Flavian handles with low values for the variable 1 (angle of vertical axis) and high values for variable 3 (angle of horizontal axis), including average scores for variable 4. The second cluster combined 3 early second century handles characterised by an average score for variable 1 and with similar values to the first group for the remaining variables. Finally, a third cluster included two third century handles characterised by high scores for the variables 1, 2 and 4. Figure 15 shows an example of each chronological group.

Accepting that some formal evolution of handle shape ocurred over time, the statistics nevertheless demonstrated that there were still many exceptions to the rule. As a result, a type produced in many workshops was likely to vary according to different potters' customs, which could even be passed on through more than one generation of potters [Shepard, 1968; Rice, 1984]. There was a degree of standardization in shape through different periods which may have been for functional reasons such as to facilitate movement or avoid breakages [Rice, 1987, 202]. The present typological classification based on statistical analysis highlights the fact that there is still a lot of variability in the groups. Although Martin-Kilcher [1983; 1987a] and Baudoux' [1990] classifications provide excellent guidelines, they must be applied carefully since not all the formal variations in rims and handles fit into their classification structure.

Dressel 20 amphorae sometimes bear stamps on the handles, and only occasionally on their body. This type was stamped more often than any other amphora type, except possibly the early Rhodian [Garland, 1983]. Clear evidence of their importance can be seen in the fact that around 1800 stamps out of 2000 found in Britain belong to the Dressel 20 type. Dressel [1899] and Callender [1948; 1965] were pioneers in the study of amphora stamps, especially of this type, whose origin and production centres were recognized as being in the Baetican province by surveys [Clark-Maxwell, 1899; Bonsor, 1931; De la Peña, 1967; Ponsich, 1974a; 1979; 1991; Remesal, 1983; 1986; 1989a; Chic, 1985].

The interpretation of stamps is still a much disputed area. Remesal [1977; 1986; 1989c] argues that three letters identified the olive-oil producer *tria nomina* (i.e. name), a complete name followed by F (i.e. *fecit*,did) indicated a potter while toponims identified either a kiln (i.e. *figlina*) or an estate (i.e. *fundus*). However, Liou [1991] contends that *tria nomina* may simply identify the workshop owner. This theory is also used to explain stamps on other amphorae [Manacorda, 1989; 1990; Manacorda and Panella, 1993].

Apart from the high proportion of stamps they bear, Dressel 20 amphorae sometimes also bear painted inscriptions (i.e. *tituli picti*). Both features seem to indicate fiscal control of the Baetican olive-oil production [Remesal, 1986; Rodríguez-Almeida, 1989]. Dressel [1899] first distinguished four elements on the Baetican amphora labelled with the Greek letters α, β, γ and δ. Rodríguez-Almeida [1972; 1980a; 1983; 1993] has followed Dressel in this but has included also occasional new elements: ϵ and ϱ. The meaning of the four basic elements according to Rodríguez-Almeida [1989, 26-30] is as follows:

α) A number interpreted as relating to the empty weight of the amphora [Dressel, 1899] ranging between 79 to 107 *librae* (circa 30 Kg) [Rodríguez-Almeida, 1984].

β) Tria nomina (i.e. *praenomen*, *nomen* and *cognomen*; forenames and surnames) of one or more people (i.e. a possible society) identifying traders (i.e. *diffusores*, *mercatores* and *negotiatores*) or transporters (i.e. *navicularii*)[20]. By the end of the second century A.D., they identified the Imperial family (i.e. *Dominorum Nostrorum*) and fisc (i.e. *Ratio Fisci Provinciae Baeticae*) underlining their new public rôle in olive-oil distribution.

γ) A second number interpreted as relating to the amphora content weight ranging between 178.5 to 219.5 *librae*, though 50% of the amphorae correspond to a standard 216 [Rodríguez-Almeida, 1989, 28].

δ) This element became more complex over time, being followed by one line of information in the first century A.D. while in later periods, it consisted of three or five lines. This inscription included details concerning to the area of control, the controlling office, the weight, the controller (i.e. *ponderator*, *mensor*), the estate where the olive-oil was produced and even, the consular date[21].

[20] This interpretation is supported by other epigraphical evidences on stone commented by Rodríguez-Almeida [1978], Panciera [1980], Tchernia [1980a] and González-Fernández [1983].

[21] The reasoning behind each interpretation and alternative explanations can be followed in Rodríguez-Almeida [1974-5; 1989], Liou et al [1977], Liou and Maricahl [1978], Colls and Lequément [1980], Liou [1980, 1991] and Helly et al [1986].

The complexity of the Dressel 20 epigraphic records is not the only notable matter concerning to this amphora type, since together with the Dressel 1, it is also the most widely distributed amphora in the Western Roman Empire, not only in extension but also in quantity [Tchernia, 1983a]. As well as the production area, Dressel 20 amphorae are particularly well-represented in the city of Rome where Mt.Testaccio, a dumping area of 50 metres high by 250 x 150 chiefly consisting of Dressel 20 sherds, stands out. Other high concentrations of Dressel 20 amphorae appear along the military frontiers in the West (i.e. Germania, Britannia, Raetia, Noricum, Pannonia)[22]. Despite possible fieldworking differences in the areas comprising the Western Roman Empire, there is a clear distribution pattern towards the centre, Rome, and the periphery, *limes*. Comparing the number of stamps from Britain (circa 1800) or Germany (circa 1200) [Remesal, 1986] to the number from other geographical areas closer to the source such as Catalonia (circa 25) [Berni, pers.comm.], Cartagena (scarce number) [Mas, 1979], Portugal (almost unexistent)[23] and Galicia (unexistent) [Diaz-Alvarez, 1981; Naveiro, 1991], a special economic pattern related to Baetican olive-oil can be recognized. Although the lack of stamps in Catalonia may be explained by the existence of local olive-oil productions, the same argument cannot be applied in the North of Portugal or Galicia[24].

With regard to Britain, Dressel 20 is the most common amphora type from the first to the third centuries A.D. [Williams and Peacock, 1983] normally comprising between 50-80% in weight of the total amphora assemblage, which could be 30-60% in EVEs. A steady increase in supply was suggested on the basis of a well-dated sample [Williams and Peacock, 1983] from the first century up to the mid second century A.D. when it reached its peak. This was followed by a drop in imports until the middle of the third century. This would seem to match the evolution of Baetican olive-oil exports according to the number of shipwrecks [Pascual, 1980]. The same picture appears clearly from the Dressel 20 dated stamps after the necessary calibrations.

The stamps also indicate the location of the exporting regions in the Guadalquivir Valley, whose quantities of exported amphorae in the case of Britain are similar to those obtained for the German provinces (see appendix 6) [Remesal, 1986, 48-49]. Variations can be attributed to

---

[22] Regional research has been undertaken in different countries such as France [Thevenot, 1950; 1964; Armand and Viallefond, 1958; Harmand, 1969; 1971; Labrousse, 1977; Colls et al, 1977; Dangreaux and Desbat, 1978; Lamour and Mayet, 1980; 1981; Thouvenot, 1980; Le Gall, 1983; Baudoux, 1990; Liou et al, 1991], Britain [Callender 1949; 1965; Williams and Peacock, 1983; Funari, 1991; 1994]; Morocco [Mayet, 1978]; Switzerland [Ettlinger, 1969; Pauvier, 1981; Schüpbach, 1983; Martin-Kilcher, 1983; 1987a]; Austria [Bezeczky, 1984; 1987]; Hungary [Gabler and Kellmen, 1984]; Holland [Van der Werff, 1984; 1987]; former Yugoslavia [Cambi, 1975-6; 1983]; Egypt [Will, 1983]; Italy [Rodríguez-Almeida, 1972; 1980a; 1989; Manacorda, 1977b] and Germany [Schallmayer, 1983; Remesal, 1986].

[23] See Maia [1974-7]; Alarçao [1976]; Tavares and Soares [1978]; Cardoso [1978]; Beltrán [1983]; Fabiao [1989].

[24] Although a possible olive-oil press was recovered at Fonte do Minho [Naveiro, 1991].

individual workshops and chronological periods, though these details are better explained in section 5.3.1.

Shipwrecks: Saint-Gervais III (P.1002) [Liou and Gassend, 1991]; Sud-Lavezzi II (P.1118) [Liou and Domergue, 1991]; Lavezzi A (P.585) [Liou, 1991]; Port-Vendres II (P.875) [Colls et al, 1977]; Culip D (P.347) [Nieto et al, 1989].

3.2.10 Dressel 23 (Keay xiii; P&W 26)

This type is identical in shape to its predecessor, Dressel 20, but smaller in size. The evolution of this form from Dressel 20 was demonstrated by Martin-Kilcher [1983; 1987a], although there are other variants in the same group, which have been classified by Keay [1984] as forms xiv, xv, xvii, xviii and xix. Furthermore, excavations at the El Tejarillo kiln in the Guadalquivir Valley have yielded other distinctive types belonging to the same family: Tejarillo I, II and III [Remesal, 1983]. Occasionally, this amphora is stamped on the handle with the same names as have previously been found on Dressel 20 amphorae (e.g. PNNF, CTYC, LFF) [Remesal, 1989; 1991; Martin-Kilcher, 1987a].

The indications are then, that Dressel 23 amphorae were produced along the Guadalquivir Valley sometimes in the same kilns as Dressel 20 (i.e. Tejarillo, Cerro de los Pessebres, La Graja) [Remesal, 1983; 1989]. For this reason, the fabric is identical to the other types produced in the same area [Carreras and Williams, 1993]. Painted inscriptions suggest that olive-oil was the main content, although occasionally they could have been filled with olives [Beltrán, 1970; Rodríguez-Almeida, 1984]. The form is well-represented in the Western Roman provinces (i.e. Spain, Portugal, Italy, France, Tunisia, Germany, Switzerland) [Keay, 1984; Martin-Kilcher, 1987a]. In Britain, the type is only documented at Winchester [Carreras and Williams, 1993] and York [Williams, pers.comm.], and even two stamps from Colchester may, in fact, belong to a Dressel 23 amphora (i.e. CIR, IIMINICIOR) [Funari, 1991].

With regards to its date range, it appeared in the second half of the third century A.D., replacing the Dressel 20 vessel [Remesal, 1983; Rodríguez-Almeida, 1984; Manacorda, 1977b; Coriagnani and Pacetti, 1989]. The Cabrera III shipwreck documents a cargo consisting of Dressel 20 and Dressel 23 amphorae mixed with other types. This cargo is dated post A.D. 257 by a hoard [Bost et alii, 1992] and demonstrates a progressive, rather than dastric, substitution of one form by the other. The end of this production seems to have been reached by the late fifth or early sixth

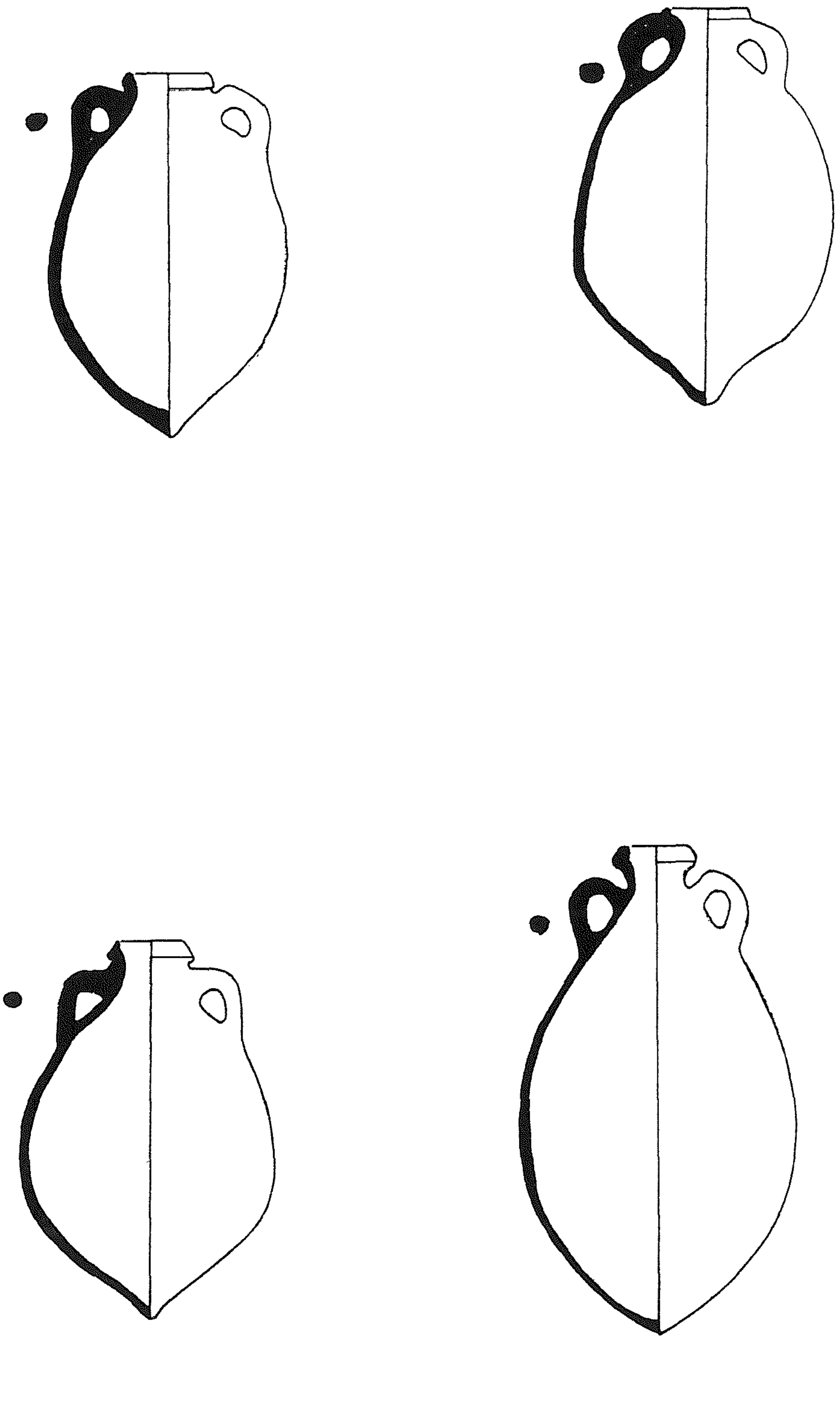

Figure 16 Dressel 23 amphorae.

century A.D. according to new evidence from the Temple Magna Mater in Rome [Corignani and Pacetti, 1989] and some Gaulish sites (e.g. Lyon, Marseille and Arles) [Becker et al, 1989; Bonifay et al, 1989].

Shipwrecks: Cabrera C (P.125) [Guerrero et al, 1987]; Chrétienne D (P.305) [Pomey et al, 1989]; Catalans (P.280) [Liou, 1973]; Sud-Lavezzi A (P.1117) [Liou, 1982].

3.2.11 Gauloise

The group of amphorae known as Gauloise includes a wide variety of vessels produced originally in Gaul. These are chiefly flat bottomed [Laubenheimer, 1985; 1989; Dufourarier and Marin, 1987; Berthault, 1991; 1992; Gébara and Beraud, 1992; Meffre and Meffre, 1992]. At least twelve different individual typologies have been recognized, although only four of them were documented in our sample (Gauloise 2, 4, 5 and 12). Wine seems to have been the main content but other foodstuff is also possible [Panella, 1973; Widemann et al, 1979]. Gauloise amphorae were imitated in other Western provinces, although they were not widely distributed. The Gauloise 4 form was also produced at Adarró, St.Maria de Freixes, Llafranc and Almadrava (Spain) [Gisbert, 1987; Remesal and Revilla, 1991; Aranegui and Gisbert, 1992]; however, there is no evidence of this variant in Britain. Similarly, this shape was manufactured in Germany but its distribution seems so far to have only been local [Baudoux, 1992a]. Moreover, the same form was produced in the Verulamium region and possibly London as fabrics and kiln remains demonstrate. It is widely documented in the Southeastern Romano-British sites [Symonds, 1993; 1994]. The following account includes details about the Gauloise types recorded in Britain.

a. Gauloise 2

This form is characterized by an open pulley-wheel rim, with short double-grooved handles and flat bottom [Laubenheimer, 1989, 123]. It was produced chiefly in Marseille in the first century A.D. and distributed along the axis Rhône-Rhin [Laubenheimer, 1989; Desbat and Martin-Kilcher, 1989; Baudoux, 1990; Remesal and Revilla, 1991]. The only fabric documented is Gaulish, characterised by a very fine texture, cream in colour and containing quartz, mica and limestone as normal inclusions [Widemann and Naconi, 1989]. Some body sherds in the sample are highly micaceous, showing similarities with the fabric features of amphorae from Marseille workshops (i.e. Butte-des Carmes) [Bertucchi, 1982]. However, they cannot be identified as belonging specifically to the Gauloise 2 form. In the present sample, only London and Chester provided testimonies of this latter type.

b. Gauloise 4 (Pélichet 47; Ostia lx; P&W 27)

The Gauloise 4 vessel is defined by a thick rounded rim and flat-grooved handles, and it is finished in a narrow footring [Laubenheimer, 1985]. The type became the most common wine-amphora produced in Gaul, being imitated in Spain, and Germany as well as Verulamium. As wine is presumed to have been the main content, this vessel shows how Gaulish producters became the main suppliers of the Western Roman Empire [Laubenheimer, 1985; Baudoux, 1990]. A painted inscription from the Saint Gervais III shipwreck reads MASS(icum) [Liou and Marichal, 1978] which refers to the origin of a well-known ancient Gaulish wine (Virgil Geor.ii; Columela RR iii.8.5) [Tchernia, 1986a]. Numerous workshops manufacturing this type have been discovered in Southwestern Gaul (e.g. Velaux, Nimes, Corneilhan) [Brentchaloff, 1980; Laubenheimer, 1985; 1989, 1990; Berthault, 1988] which is evidence of widespread distribution and a significant volume of wine production.

With regard to its date range, it first appeared in the middle of the first century A.D. disappearing gradually in the early fourth century according to the evidence from Ostia [Panella, 1973]. However, it was not until the end of the first century A.D. that this vessel showed a widespread distribution outside Gaul [Laubenheimer, 1985]. This type is not documented in Britain in pre-Boudiccan contexts (A.D. 60/61) [Peacock, 1977b; 1978]. However, new finds at Cirencester and Longthorpe [Dannell and Wild, 1987] suggest a Neronian date for the first imports. This is also backed by recent discoveries at Colchester [Symonds, forth.]. The production is confirmed as continuing until the third and early fourth century A.D. [Panella, 1973; Laubenheimer, 1985; 1989]. Due to the long lifespan of the Gauloise 4 amphora, there have been some attempts to establish a morphological sequence of this type over time [Alexandre-Baudoux, 1987; Dangréaux and Desbat, 1988]. Both researchers seem to agree that a shortening of necks and narrowing of bases ocurring from late second century onwards, represent the main distinctive features. This form is commonly found in some Western Roman provinces such as Italy, Hispania, Raetia and Germania in relatively high quantities [Panella, 1973; Peacock, 1978; Laubenheimer, 1985; Dangréaux and Desbat, 1989], although it only appears in small quantities in the Eastern Mediterranean [Riley, 1979].

Two distinctive fabrics were recognized in our sample: a typical Gaulish clay already described in the section concerning the Gauloise 2 type and the Verulamium one. This second fabric is characterised by a granular texture and creamy-grey colour [Castle, 1978]. Brockley Hill and Hills Field are the only two workshops found so far in Verulamium area. The Gauloise 4 is

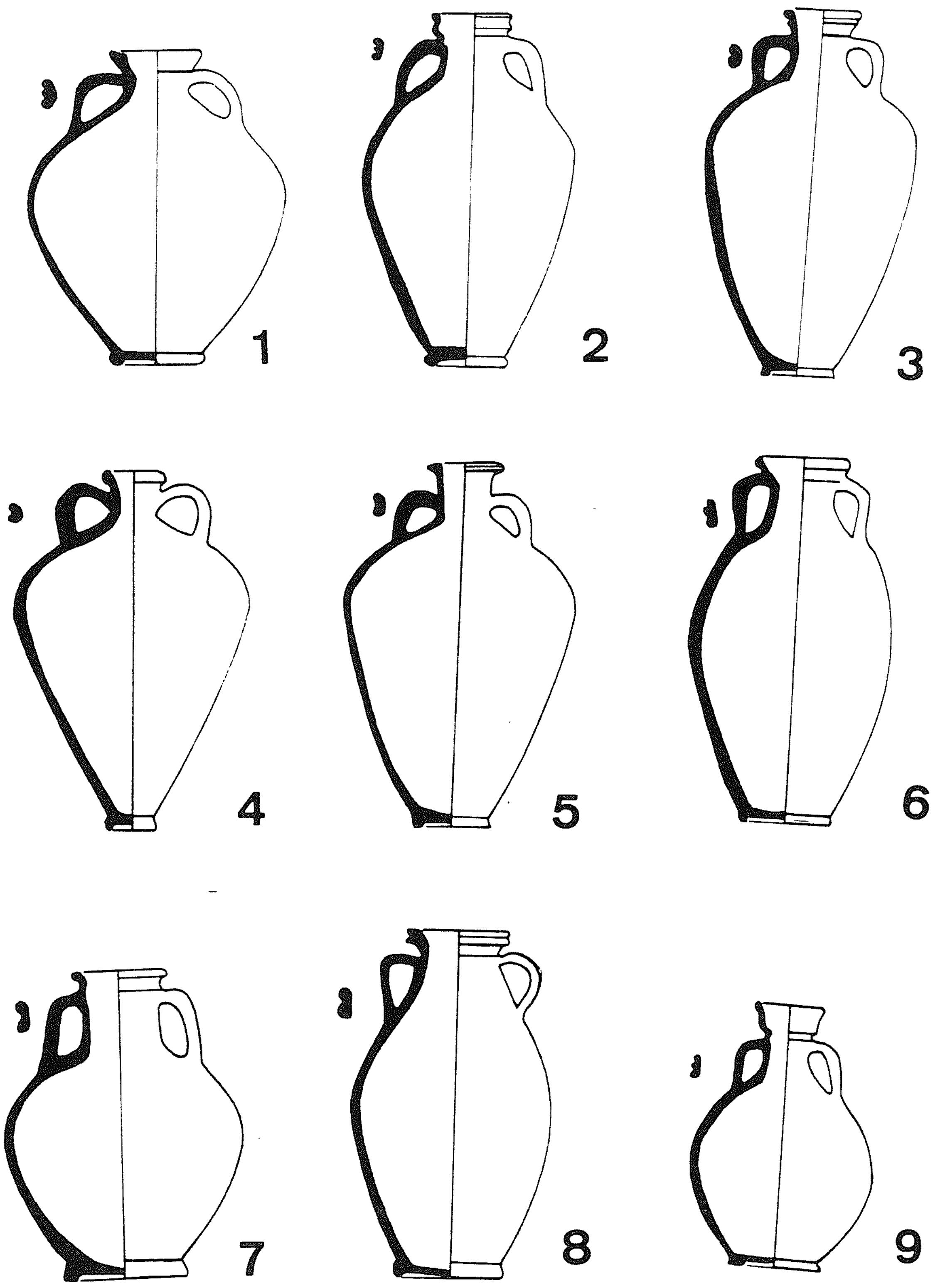

Figure 17 Gaulish amphora types: Gauloise (1, 2, 3, 4, 5, 6, 7, 8 and 9).

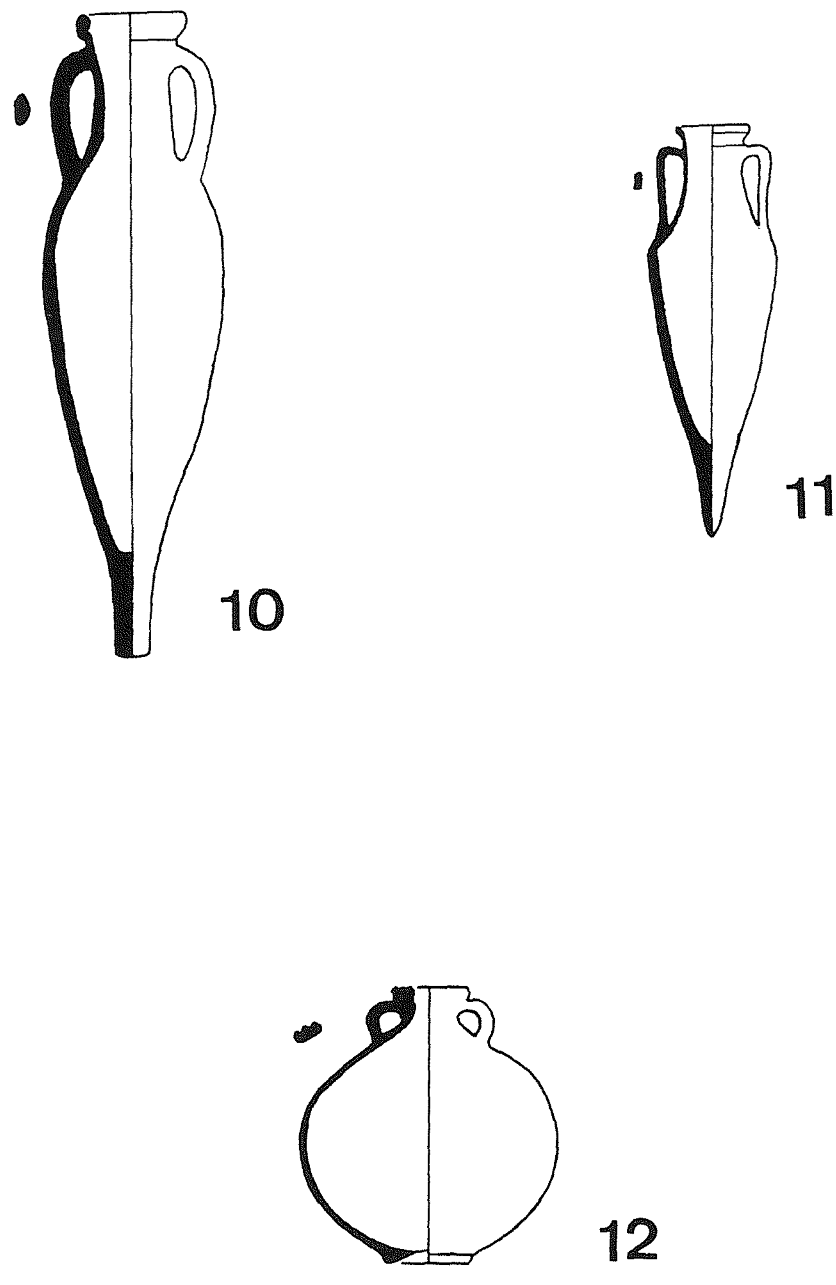

Figure 18 Gaulish amphorae: Gauloise (10, 11 and 12).

documented in Hills Field production whereas Brockley Hill seems to have specialized in Dressel 2/4 [Greep and Sealey, forth.]. This local production seems to have started in the late first century A.D., after the Dressel 2-4 had been discarded, and it probably finished in the second century [Symonds, 1993].

Shipwrecks: Saint-Gervais III (P.1002) [Liou and Gassend, 1991]; Roches d'Aurelle (P.994) [Pollino, 1987]; Cap Bénat C (P.174) [Pollino, 1984]; Ile-Rousse (P.510) [Pomey et al, 1989]; Les Laurons C (P.579) [Ximénès et al, 1985, 40-41]; Port-Vendres C (P.876) [Colls et al, 1985]; Tiboulen de Maïre (P.1148) [Pomey et al, 1989, 15]; Montecristo [Bound, 1992].

c. Gauloise 5 (Ostia l; Nijmegen 132b)

This form is distinguishable by its flat thick rim and grooved handle and it is finished by a small footring. It seems to have only been produced in Southern Gaul (e.g. Fréjus) [Fontes et al, 1981; Laubenheimer, 1985] from the second half of the first century to the beginning of the second century A.D. Although it was mainly distributed in Gaul, this type is also documented from Italy (Ostia), Vidy, Augst, Vindonissa, Nijmegen and Eschenz [van der Werff, 1984; Dangreaux and Desbat, 1989; Baudoux, 1990]. In Britain, it is documented at least from York, Leicester, London, Ribchester and Chester [Peacock and Williams, 1986].

d. Gauloise 12 [P&W 55]

The Gauloise 12 is typically a globular vessel with a flat base and multiple grooved at the top of the rim. It also has furrowed handles. This type seems to have been produced in Calvados (Normandy) according to chemical analyses [Dufournier and Marin, 1987]. The characteristic vessel is chiefly found in Normandy (i.e. Caen, Lisieux, Bayeaux, Falaise, Rouen) [Deniaux, 1980; 1982; 1989; Dufournier and Marin, 1987], although there have been some examples found in Britain as well (i.e. Carpow, Winchester, Hacheston, Thorney Bay, Molnehale, Exeter, Guernsey and Richborough) [Peacock and Williams, 1986, 210; Laubenheimer and Lequoy, 1992; Wood, 1994]. On the basic of the discovery of some distinctive local fabrics it has also been suggested that a variant was in local production at Colchester (Middleborough kiln) [Symonds, forth.]. A possible date range for this Gaulish type is from the second to the third century A.D. [Deniaux, 1982; Peacock and Williams, 1986, 210; Fitzpatrick, 1992].

3.2.12 North African (Africana I-II; Ostia III-IV; Keay types; P&W 33-7)

This group includes a wide variety of forms produced in North Africa and characterized by long cylindrical bodies, with short spikes. They are occasionally stamped [Zevi and Tchernia, 1969; Boube, 1973-75; Manacorda, 1983; Di Vita-Eurard, 1985]. Since the present sample generally was found to contain non-diagnostic sherds, it became impossible to classify them according to the established typologies [Panella, 1973; Keay, 1984]. All these amphorae share a similar hard fabric, red-brick in colour occasionally with a white slip, as well as frequent inclusions of quartz [Peacock and Williams, 1986, 154]. The workshops were concentrated in the Sahel region, Roman Byzacena (Central Tunisia) [Peacock et al, 1989; 1990]; the Carthague region, Roman Zeugitana (Coastal Tunisia) [Panella, 1979] and Tripolitana (Lybia) [Panella, 1973; Arthur, 1982]. The differences in fabric among amphorae from these regions are slight and pose problems in identification [Dore and Keay, 1989, 80], however limestone inclusions are common only found in Central Tunisian and Tripolitanian vessels [Peacock and Williams, 1986, 154-167].

Table 12

Sites	gr/m²	Sites	gr/m²	Sites	gr/m²
London	6.87	Stonea	-	Carlisle	2.72
Ribchester	-	Cirencester	-	Corbridge	-
Longthorpe	-	Winchester	1.02	Leicester	0.97
Vindolanda	-	Chichester	1.32	S.Shields	-
Gloucester	-	Chester	0.71	St.Albans	-
Poundbury	0.26	York	6.32	Silchester	0.02
Skeleton	-	Old Penrith	-	Colchester	0.03
Inchtuthill	-	Bewcastle	-	Lancaster	-
Exeter	15.62	Purbeck	-	Staines	-
Ivy	-	Chelmsford	-	Canterbury	0.22

As far as the content is concerned, olive-oil is believed to have been the main produce carried in the amphorae [Beltrán, 1978; Carandini and Panella, 1981; Keay, 1984] so this is evident from the close relationships between the olive-oil presses and kilns located by surveys [Buck and Mattingly, 1985; Mattingly, 1988a; 1988b; Peacock et al, 1989]. Nevertheless, other goods such as fish-sauce were thought to have also been contained [Beltrán, 1978; Keay, 1984;

Morales and Roselló, 1989; Peacock et al, 1990] and recent discoveries of remains of fish-bones, olive stones and pitch at Cabrera III wreck [Guerrero et al, 1987] confirm this point.

These vessels are well-documented in the Western-Mediterranean where they are relatively common, although there are also some testimonies from the Eastern Mediterranean, Central Europe and Britain [Panella, 1973; 1981]. Some insight into the commercial significance of North African amphorae in the Mediterranean can be inferred from quantified data obtained from Ostia, Berenice and Carthage [Fulford, 1987; 1989; Tomber, 1988].

Its date range would seem to vary according to the form. Africana I and II started respectively in the early and late second century A.D., and finished in the fourth century [Panella, 1973; 1992], although recent evidence indicates an earlier dating (circa A.D. 70) [Ciotola et al, 1989] for the production of Africana II and Tripolitana II. The start of late Roman types classified by Keay [1984] can be assigned to the second century A.D. This amphora presence in Roman Britain can be dated as early as the mid second century A.D. (i.e London, Caerleon, Exeter) [Tyers, 1984; Peacock, 1991; Zienckiewicz, 1993]. However, the majority of vessels may have arrived during the third and fourth century A.D. [Peacock and Williams, 1986], being associated with the African Red Slip imports in the province [Bird, 1977]. Everyday more North African amphorae are being documented in the province although their volume never matches that of the other olive-oil container, the Dressel 20 [Williams and Carreras, forth.].

Shipwrecks: Camarina A (P.163) [Parker, 1976]; Procchio (P.906) [Zecchini, 1982]; Plemmirio B (P.834) [Gibbina and Parker, 1986].

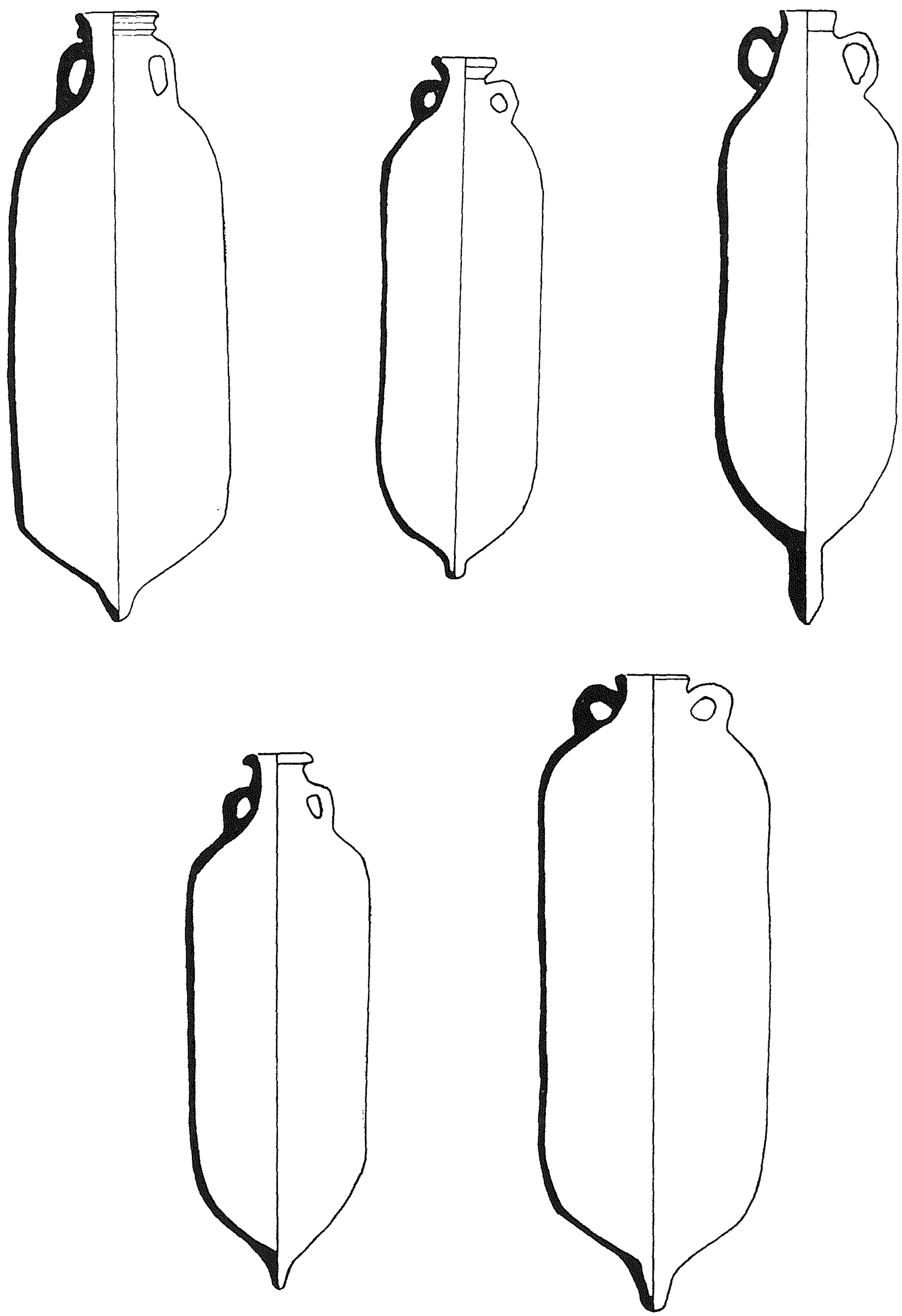

Figure 19 North African amphorae.

3.2.13 Late Roman amphorae (British Bi-Biv; LR1-3; Keay lxv, liii; P&W 43-6)

This group includes a motley collection of Late forms of ribbed amphorae produced in the Eastern Mediterranean according to the fabrics [Riley , 1979; Williams, 1994]. Because some diagnostic sherds can be attributed to more than one shape, all these amphorae are grouped here. Petrological and neutron activation analyses have managed to narrow the possible range of sources for each type, but there are still type variations and different probable origins for the same amphorae [Riley, 1979; Tomber and Williams, 1986; Empereur and Picon, 1989; Rendici, 1989].

Table 13

Sites	gr/m²	Sites	gr/m²	Sites	gr/m²
London	0.86	Stonea	-	Carlisle	-
Ribchester	-	Cirencester	-	Corbridge	-
Longthorpe	-	Winchester	0.08	Leicester	0.22
Vindolanda	-	Chichester	-	S.Shields	-
Gloucester	-	Chester	-	St.Albans	-
Poundbury	0.07	York	0.33	Silchester	-
Skeleton	-	Old Penrith	-	Colchester	0.19
Inchtuthill	-	Bewcastle	-	Lancaster	-
Exeter	-	Purbeck	-	Staines	-
Ivy	-	Chelmsford	-	Canterbury	0.04

All the amphorae belonging to these group are late productions, some beginning in the fourth century A.D. (LR2), reaching their height in the fifth and sixth centuries [Riley, 1979; Fulford and Peacock, 1984] and disappearing by the end of the seventh century A.D. [Bonifay, 1986; Bonifay et al, 1989]. They have a widespread distribution in the Eastern Mediterranean and are found in Athens [Robinson, 1959], Constantinople [Hayes, 1968], Rumania [Ràdulescu, 1984], Palestine [Zemer, 1978; Ariel, 1990], the Black Sea [Zeest, 1960; Barnea et al, 1971] and North Africa [Riley, 1979; Fulford and Peacock, 1984; Panella, 1986b]. In contrast, they are scarcely represented in the Western provinces although they are documented at least in Britain [Thomas, 1959; 1981; Giot and Querre, 1985; Tomber and Williams, 1986; Rathz *et alii*, 1992], Spain [Keay, 1984; TEDA, 1989], Switzerland [Martin-Kilcher, 1990], France (i.e. Marseille, Arles, Fos and Lyon) [Bonifay et al, 1989; Becker et al, 1989; Liou and Scilliano, 1989] and Italy (i.e. Luni,

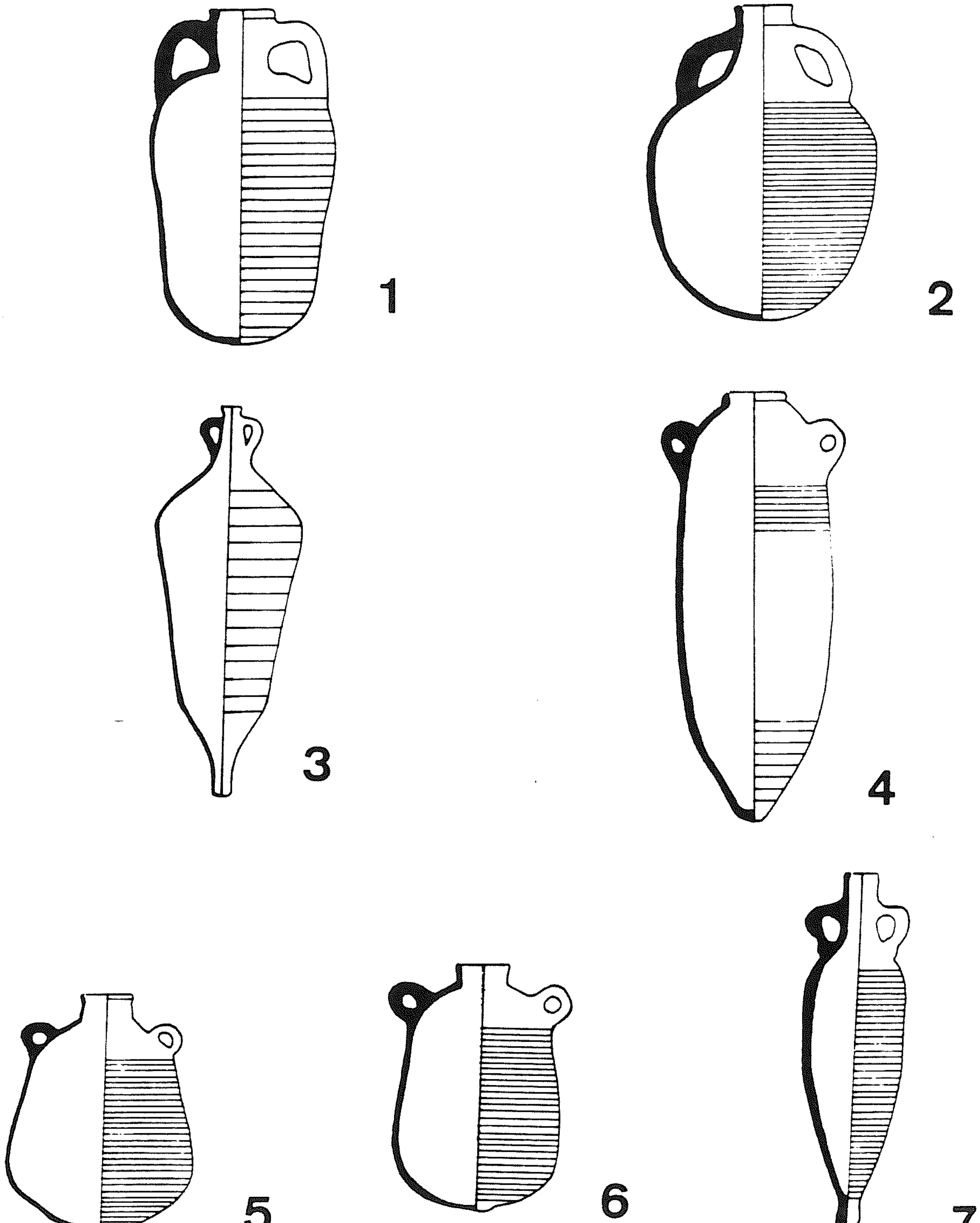

Figure 20 Late Roman amphorae: LR (1, 2, 3, 4, 5, 6 and 7).

Rome, Ostia and Naples) [Panella, 1973; Manacorda, 1977a; Frova, 1977; Arthur, 1985; Carignani and Pacetti, 1989]. The distribution of this group of amphorae in Britain shows quite an interesting pattern. They are chiefly concentrated in the big urban centres on the Southern and Eastern coasts, with some exceptions such as at Cadbury Congresbury (Somerset) [Rathz *et alii*, 1992]. The densities table and map (chapter 5, figure 60) show this distribution, which is closely related to the economic developments of the province in later periods.

Shipwrecks: Yassi Ada A (P.1239) [Bass and van Doorninck, 1982]; Delphinion (P.357) [Garnett and Boardman, 1961]; Iskandil Burum A (P.518) [Lloyd, 1985].

3.2.14 Hollow foot (Kapitan II; Ostia vi; Kuzmanov vii; P&W 47)

This amphora has broad flat handles steeply arched above the rim level, a small mouth and a long ribbed neck. It has a tapering body and hollow base. The fabric is orange-red with a pale grey core, particularly evident in the handles, which normally contain some quartz and sandstone inclusions [Peacock and Williams, 1986, 195]. This type may have been produced in the Aegean [Riley, 1979; Empereur and Picon, 1989]. This supposition is based on the high concentrations of finds in that area.

Table 14

Sites	**gr/m²**	**Sites**	**gr/m²**	**Sites**	**gr/m²**
London	0.17	Stonea	-	Carlisle	-
Ribchester	-	Cirencester	0.1	Corbridge	-
Longthorpe	-	Winchester	-	Leicester	0.07
Vindolanda	-	Chichester	0.03	S.Shields	-
Gloucester	-	Chester	1.9	St.Albans	-
Poundbury	-	York	0.14	Silchester	-
Skeleton	-	Old Penrith	-	Colchester	0.15
Inchtuthill	-	Bewcastle	-	Lancaster	-
Exeter	15.62	Purbeck	-	Staines	-
Ivy	-	Chelmsford	-	Canterbury	-

The amphorae are distributed in the Eastern Mediterranean from the Black Sea to Tripolitania, although they are also documented in the Western North Africa, Italy, Southern Gaul, Northern Spain [Riley, 1979; Naveiro, 1991]. In Northern Europe, this type is only documented from scattered finds in Pannonia [Brukner, 1981], Germany [Riley, 1979], Raetia [Martin-Kilcher, 1987; 1990] and Britannia [Peacock, 1977d]. With regard to their chronology, hollow foot amphorae are attested in the late second or early third century A.D. at Ostia [Panella, 1973; 1989], and lasted until the fourth century (i.e. Lyon, Rome) [Becker et al, 1989, 659; Carignani and Pacetti, 1989, 614].

Their distribution in Roman Britain seems to have been concentrated in coastal areas, and in the main urban centres of the province, showing a similarity with the Late Roman amphorae pattern. Exeter has a very high density of this type of amphora, which may indicate that it was a specialized port in Mediterranean trading due to its convenient location for the Atlantic sea-route on the western coast. The above table and map (chapter 5, figure 59) illustrate the pattern of distribution.

Shipwrecks: Cape Ognina A (P.755) [Kapitan and Price, 1974]; Ain el Gazaba (P.22) [Parker, 1992, 48]; Bagaud A (P.76) [Pomey et al, 1989]; Methone C (P.695) [Throckmorton, 1969].

3.2.15 London 555 (P&W 59)

This form was first documented in London by Wheeler [1930] and a second example was recovered at Pan Sand (Thames Estuary) filled with olive stones [Sealey and Tyers, 1989, 53-54; Sealey, 1994]. The amphora has a distinctive horizontal groove around the neck, which makes this type completely original. It also has long grooved handles and an elongated body. For this reason, this type has been compared to the Haltern 70 similis identified from the Rhône Valley despite slight morphological differences in the rim [Dangreaux and Desbat, 1988, 123; Sealey and Tyers, 1989, 60] and Augst 21 from the same area [Martin-Kilcher, 1994,391-2]. At this stage, it is therefore important to be wary of possible misidentifications in this group. The shape as defined is basically documented in Britain so far (i.e. Colchester, Cirencester, Verulamium, London, Chester and Pan Sand) [Sealey and Tyers, 1989][25] and Augst [Martin-KIlcher, 1994, 391-2], although links can be established with some Haltern 70 similis amphorae (e.g. Soissons, Nyon).

With reference to its content, the olive stones from Pan Sand and a painted inscription from

[25] Fabiao [1989, 69] includes an illustration of a rim similar to London 555, defined as Class 67, with a first century B.C. dating, which may have been Haltern 70 predecessor [Molina, 1993].

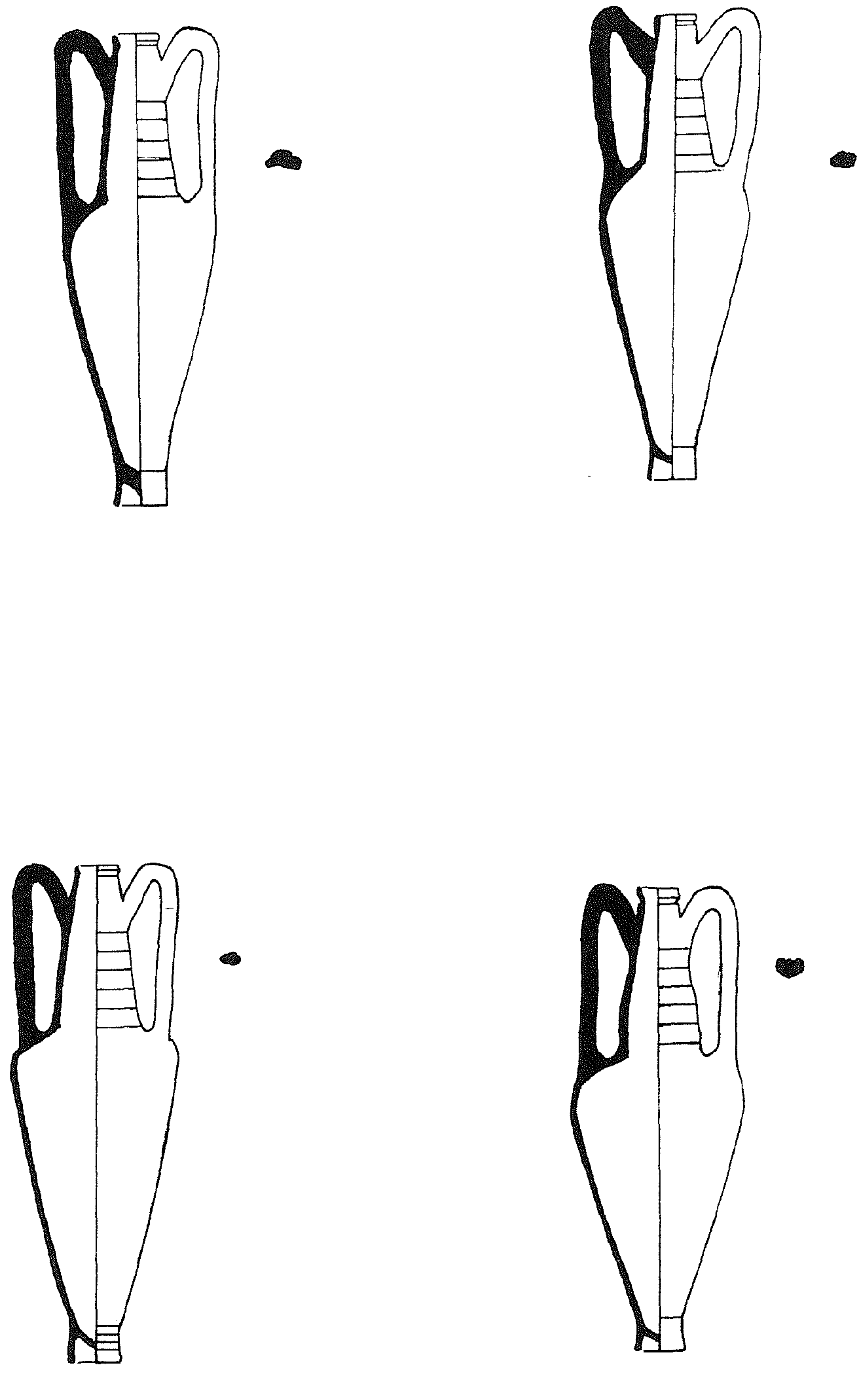

Figure 21 Hollow foot amphorae.

London Cornhill reading ol(iva)/al(ba)/ccl/cla/vianv [Sealey and Tyers, 1989, 63] suggests that olives were the main content. These could have been preserved in *defrutum* or *sapa*. Its date range would seem to be approximately from A.D. 50 to A.D. 125/150 or A.D. 230 [Martin-Kilcher, 1994, 389], thus overlapping at the beginning with the standard Haltern 70 type. There is some discussion about the vessel origin, since Haltern 70 similis has been recognized as a Rhône Valley production [Schmitt, 1988; Desbat, 1987]. London 555 thin-sections from London [Tomber, pers.comm.] and visual identification at Colchester, Chester and London; have confirmed a Gaulish origin for the London 555[26].

3.2.16 Cigar-shaped amphora (Kingsholm 117; P&W 66)

As the name indicates this form has a cigar-shaped body, two ring handles and a rounded base. It is a rimless rilled amphora easily confused with carrot and Late Roman types [Sealey, 1985, 89-90]. The fabric is similar to that of the carrot type, suggesting a desert environment in the Mediterranean basin as a likely origin [Peacock and Williams, 1986, 217]. Apart from possible misidentifications of this amphora [Joncheray, 1976; Bonifay, 1986, 281; Liou and Scilliano, 1989, 164], little is know about it since most of the evidence is limited to Britain. The first record of it was published by Hurst [1985, 75] as a result of an excavation at the military fortress of Kingsholm occupied from A.D. 49 to circa A.D. 58. A similar dating was obtained from the Dramont D wreck (A.D. 40s) which also contained two examples [Joncheray, 1973, 22-23] as well as Colchester (A.D. 43-60/61) [Sealey, 1985, 89; Symonds, forth.] and Augst (A.D. 30-70) [Martin-Kilcher, 1994, 436]. The type has been recorded at Rome (p.e. Curia Forum Iulium) in a later context [Panella, 992] The present sample only recorded this amphora type in three Romano-British sites: Kingsholm (26.66 gr/m^2), Leicester (0.0026 gr/m^2) and Colchester (0.14 gr/m^2).

Shipwreck: Dramont D (P.374) [Joncheray, 1973]; La Tradelière (P.1174) [Pomey et al, 1989, 48-49].

[26] Symonds [forth.] studied the material from Colchester and the writer saw examples from Chester and London. Dr.Williams [pers.comm.] has only distinguished Gaulish fabrics so far.

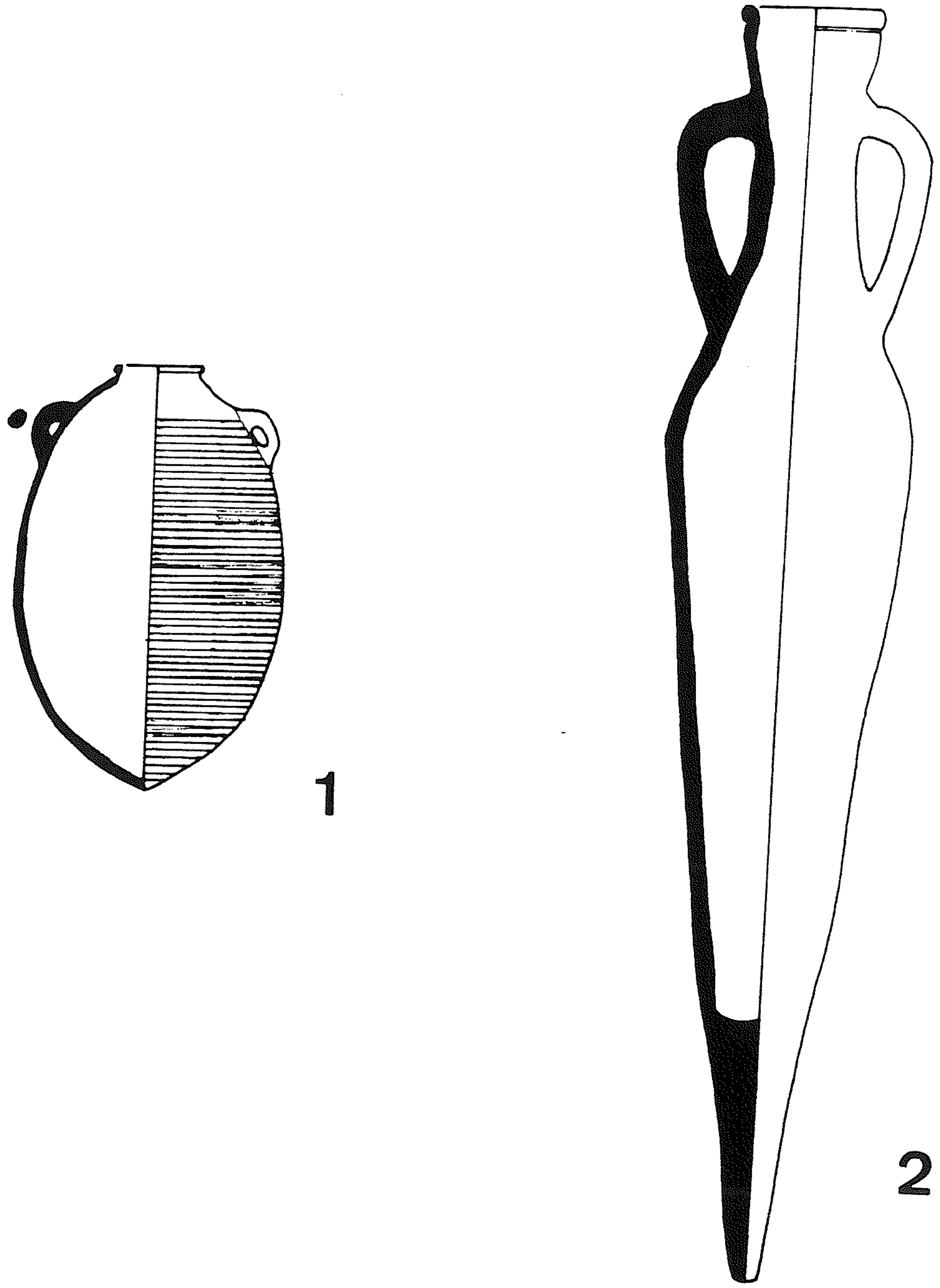

Figure 22 Cigar-shaped amphora (1) and London 555 (2).

Miscellaneous

The amphora sample from Roman Britain included some other types, the importance of which in terms of the quantity involved was very limited. The majority of them were only documented in one site, so they could not provide much information about distribution patterns. An account of all these minor amphora types, including basic references, is given below.

3.2.17 Dressel 21-22 (Ostia liv; P&W 7)

This was a first century A.D. amphora (A.D. 64-68) [Panella, 1992] that contained fruit according to painted inscriptions [Zevi, 1966]. It was probably produced in Campania or Lazio on the basis of its fabric [Peacock and Williams, 1986, 97]. This type is only recorded in Britain at Colchester [Symonds, forth.]

Ref. Zevi [1966]; Beltrán [1970]; Panella [1970; 1992]; Peacock and Williams [1986]; Ciotoa et al [1989] and Becker et al [1989].

3.2.18 Lamboglia 2 (P&W 8)

This was a bag-shaped amphora with a triangular-opened rim produced at Istria and Apulia from the mid first century B.C. to the end of the first century A.D. It was also found in some shipwrecks such as La Tradelière (P.1174) [Fiori and Joncheray, 1975]; La Madrague de Giens (P.616) [Tchernia et al, 1978] and the Albenga (P.28) [Lamboglia, 1952; Pallarés, 1985]. In Britain, it is only documented at Skeleton [Peacock, 1981].

Ref. Lamboglia [1955]; Baldacci [1969; 1972b]; Buchi [1971]; Tchernia [1986a]; Peacock and Williams [1986]; Desy [1989]; Cipriano and Carre [1989]; Cambi [1989] and Mattioli [1992].

3.2.19 Beltrán IV B (Lusitania I; Ostia lxi; Dressel 14; P&W 21)

The Beltrán IV B was a fish-sauce amphora produced in Lusitania from the mid first century A.D. to the late second [Parker, 1977; Mayet, 1990, 29-36; Panella, 1992], and appear to have been distributed chiefly in the western Mediterranean according to the shipwrecks [Lopes and Mayet, 1990; Parker, 1992], although it also appears in Northwestern Spain [Naveiro, 1991].

Unexpectedly, this form and its fabric are hardly documented in Britain [Alarçao, 1990], despite its proximity. It is only attested at Colchester [Symonds, forth.] and at Leicester Museum [Peacock and Williams , 1986, 128]. Beltrán IV B were found to have been part of the cargoes of some shipwrecks such as Conillera (P.334) [Parker, 1977]; the Cap Bénat A (P.172) [Calmer, 1973]; the Gandolfo (P.435) [Pascual, 1968].

Ref. Parker [1977]; Peacock and Williams [1986]; Edmonson [1987]; Alarçao and Mayet [1990]; Arruda et al [1990] and Panella [1992].

3.2.20 P&W 50

This is a small amphora with a slender spindle-shaped body and dating between A.D. 250-350 [Peacock, 1977d]. It is documented at Chalk (Kent), Chelmsford [Going, 1987], London [Green, 1980], Colchester [Symonds, forth.], Lincoln [Williams and Carreras, forth.] and Caerleon [Lee, 1862].

Ref. Peacock [1977d]; Peacock and Williams [1986].

3.2.21 Egloff 172 (P&W 53)

Egloff 172 was a long cylindrical wine amphora produced in Egypt [Riley, 1979] from late fourth to mid sixth century A.D. The only example recognized in Britain so far ocurred at Colchester [Symonds, forth.].

Ref. Egloff [1977]; Riley [1979]; Peacock and Williams [1986].

3.2.22 P&W 60

The P&W 60 is a globular hybrid between the Dressel 20 and Gauloise 4 amphorae. Its fabric suggests an East Anglian or Gaulish origin, produced in the second century A.D. [Peacock and Williams, 1986, 214-215]. The only examples documented in Britain are at Norwich and Colchester [Symonds, forth.].

Ref. Peacock and Williams [1986]; Symonds [forth.].

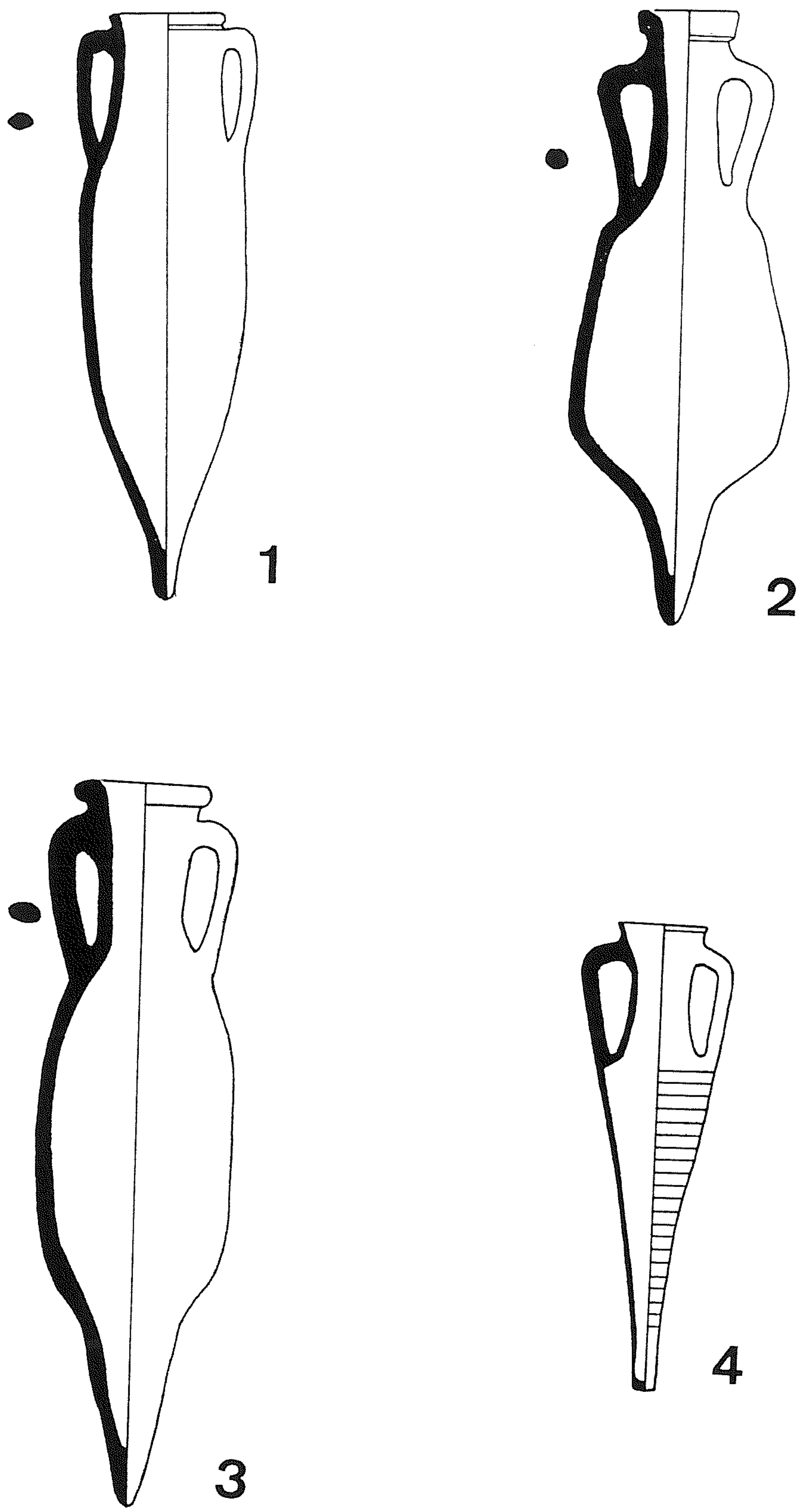

Figure 23 Dressel 21-22 (1), Lamboglia 2 (2), Beltrán IV B (3) and P&W 50 (4).

3.2.23 P&W 64

This was a small, funnel-mouthed amphora produced in Belgium from the early first century A.D. to the mid second century in its small version, while the bigger form disappeared as late as the third century A.D. [Willems et al, 1964; Laubenheimer and Lequoy, 1992; Brulet *et alii*, 1992]]. One example is recorded at Colchester, with fabric similar to that of the carrot amphora [Symonds, forth.].

Ref. Willems et al [1964]; Peacock and Williams [1986]; Laubenheimer and Lequoy [1992]; Brulet *et alii* [1992]; Symonds [forth.].

3.2.24 P&W 65

The P&W 65 was a narrow-mouthed and ribbed amphora that probably contained dates and whose fabric resembles that of the carrot amphora. Its date range corresponds to the second century A.D. Two possible examples were found at Verulamium [Wilson, 1984, fig.81, n.1918-9] and Colchester [Symonds, forth.].

Ref. Callender [1965]; Peacock and Williams [1986]; Symonds [forth.].

3.2.25 Dressel 43

This type had peaked-handles and was a cylindrical amphora similar to the Rhodian type. It was produced in Crete [Hayes, 1983; Liou, 1987; Dangreaux and Desbat, 1988: Empereur *et alii*, 1991; Markoulaki *et alii*, 1989] from the late first to the third century A.D. Interestingly, the dating at Meta Sudens (Rome) is A.D. 130-150 [Panella, 1992], whereas at Rue des Farges (Lyon) [Desbat and Dangreaux, 1992] it is as late as A.D. 180-200. The only example attested in Britain comes from Colchester [Symonds, forth.].

Ref. Dressel [1899]; Baldacci [1972b]; Riley [1979]; Liou and Marichal [1982]; Hayes [1983]; Panella [1986a; 1989; 1992] and Desbat and Dangreaux [1992].

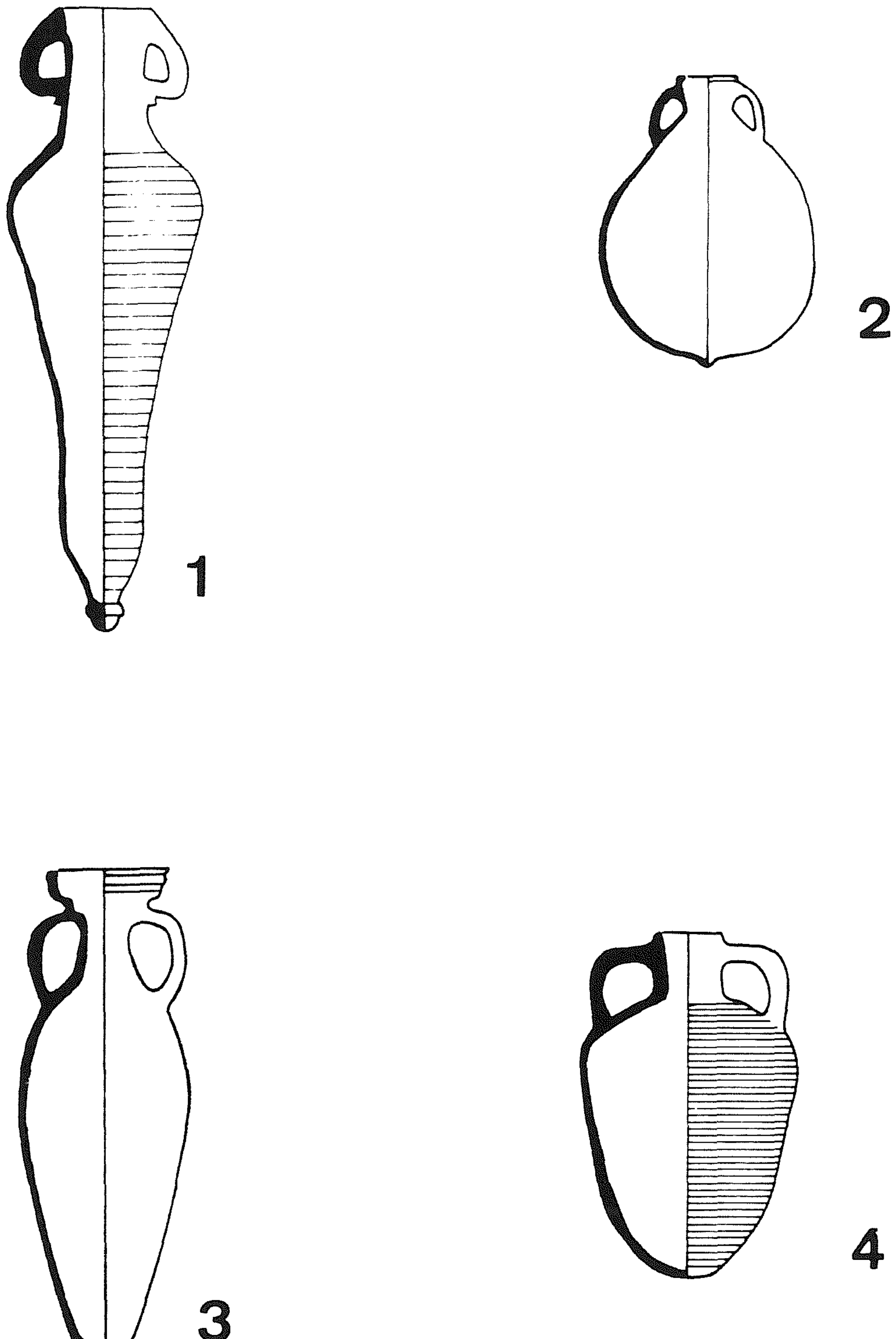

Figure 24 Egloff 172 (1), P&W 60 (2), P&W 64 (3) and P&W 65 (4).

3.2.26 Middlesborough amphora

The Middlesborough amphora is an imitation of the Gauloise 1 with differences in the form produced at the Middlesborough kiln [Symonds, 1984] during the Flavian-Trajanic period. This type has so far only been documented at Colchester.

Ref. Symonds [1984; forth.].

3.2.27 Fishbourne 148.3

This amphora with its bead-rim is unknown in its complete form [Cunliffe, 1971, fig.100]. It is present in early levels at Fishbourne, York, Lincoln, Dorchester, Colchester, Leicester and Wroxeter [Carreras and Williams, forth.; Williams and Carreras, forth.]

Ref. Cunliffe [1971]; Carreras and Williams [forth.] and Williams and Carreras [forth.].

3.2.28 Stonea type

The Stonea type is a small ribbed amphora of possibly Eastern Mediterranean origin, the first evidence of which appeared at Stonea [Carreras and Keay, forth.].

Ref. Carreras and Keay [forth.]

3.2.29 Oberaden 74

This type has a "pulley-wheel" rim, a cylindrical body and is a flat-bottomed amphora produced in Catalonia among other places, during the Augustan-Tiberian period [Miró, 1988]. A similar form was also produced in Gaulish workshops [Berthault, 1992]. This type in Catalan fabric is only documented in Britain at London (e.g. Billingsgate Buildings) [Green, 1980].

Ref. Loeschcke [1942]; Green [1980]; Miró [1988]; Berthault [1992] and Revilla [1993]

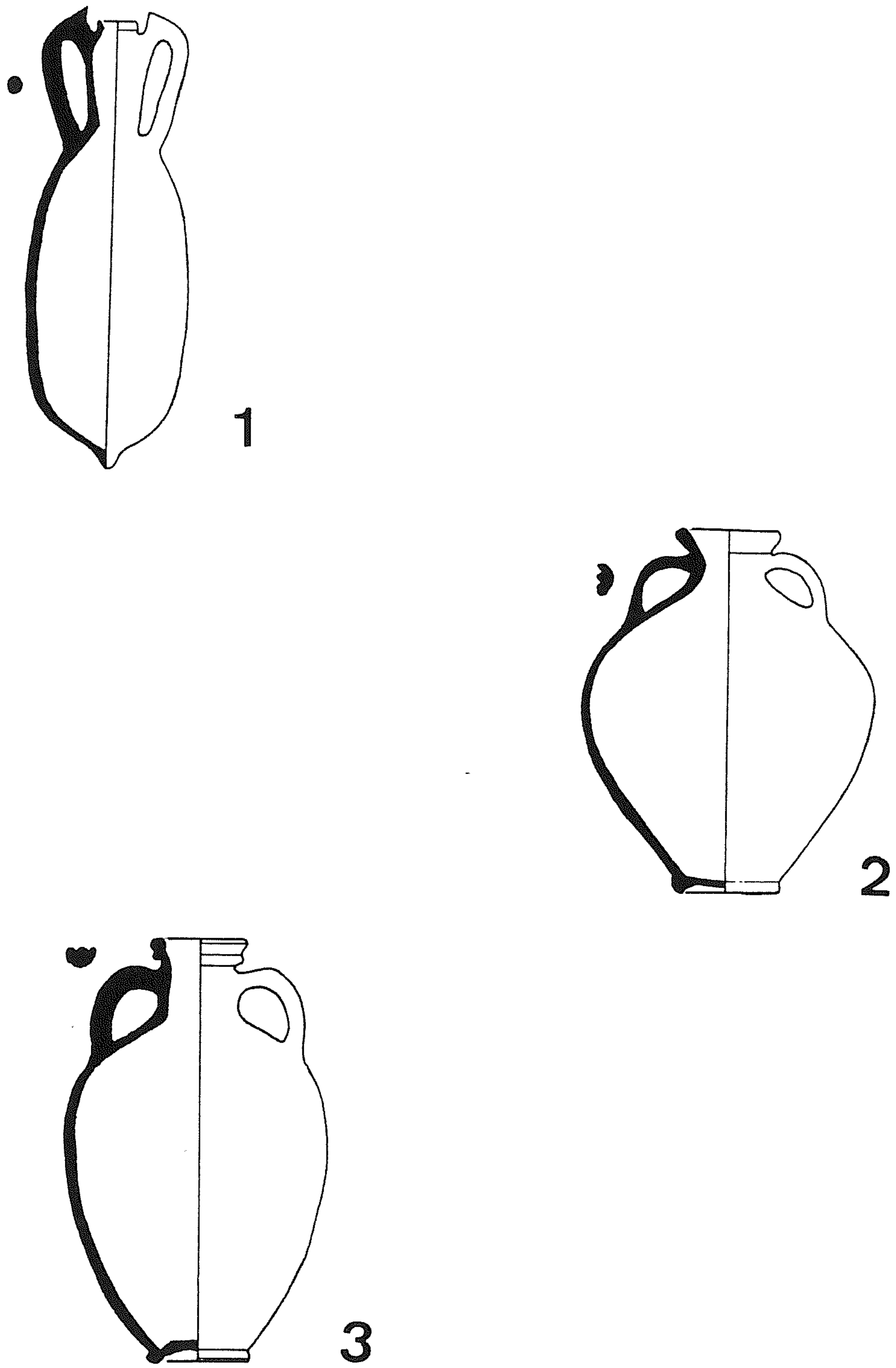

Figure 25 Dressel 43 (1), Middleborough type (2) and Oberaden 74 (3).

4. AMPHORA DISTRIBUTION AT SITE LEVEL

4.1 Introduction

The present chapter intends to discuss and analyse the information concerning amphora distribution at site level. As well as the economic information available regarding patterns of consumption and distribution (see chapter 1), amphora depositions provide useful information abouts everyday life in the local community. First of all, it is necessary to understand the original function of amphorae and feasible patterns of amphora reuse, as these factors may determine the kind of distributions that occur. Moreover, once amphorae had served their primary or secondary function, they were discarded. This step is significant since the amphorae pass from a cultural to an archaeological context [Schiffer, 1972; 1976]. Amphorae, amongst other archaeological material of similar volume, can provide a clear picture of how the Romans organized their rubbish disposal. High concentrations of the population (e.g. in cities) needed a coordinated way of collecting and getting rid of garbage, the physical evidence of which can be expected to have left some traces in the archaeological record. Changes in dumping areas within or outside a city reveal the evolution of an urban centre in economic terms.

As well as giving an indication of a communal pattern of rubbish disposal, amphora assemblages may reveal differences between districts of a town. On the one hand, differences in the composition of assemblages may identify particular functional areas such as warehouses or shops. On the other, they can also identify the status and ethnicity of the consumers inhabiting a particular sector of the town. The composition of the assemblages, together with their location can provide answers to these questions. Three case studies from Roman Britain (i.e Chester, Leicester and London) serve to document in detail how amphorae can indicate spatial and temporal variability within a site.

Furthermore, epigraphic material such as amphora stamps can supply other kinds of information about each individual settlement. Once quantified, their chronological data allows a contrast of their evidence with that of other economic indicators such as samian ware and coins. Combining all these testimonies, a single town can be studied in terms of its degree of monetization, as a consumer centre or as a final destination in a exchange network. Amphora stamps, in this case, on Dressel 20, are presented here as alternative indicators of changes in the local economic life.

Amphora assemblages and stamps are, independently, sources for the study of individual towns as unique economic contexts. Since the data is recorded at site level, they are able to provide social and economic practices within a community. Only a comparison of each particular context can allow general interpretations on amphora distributions at site level to be made with the existing provincial pattern.

4.2 Amphora distribution and consumption of content

4.2.1 The initial function of amphorae

Amphorae are normally recovered in places distant from their original production centres. Thus, the position of recovery is considered to be the final destination or represent a transit point [Rhodes, 1991]. Nevertheless, only on a few occasions is the second alternative even considered, yet amphorae found at a site are usually interpreted as local imports and all the shipwrecks can be considered as representing transit points, since their cargo of amphorae never reached their final destinations [Parker, 1992a]. Moreover, sites where amphora contents were transferred to other containers can also be included in this definition, because these centres did not consume all the goods carried by amphorae. Archaeologically, these settlements can be distinguished by high densities of amphorae whose content were not intended for local consumption [Galliou, 1982; 1984; Tchernia, 1983; 1986a].

Trade routes in Gaul have documented these transit points linked to the different types of networks and the political frontiers. For instance, Châlon-sur-Saône documents an enormous quantity of Dressel 1 amphorae, between 200 and 500 thousand vessels [Tchernia, 1986, 78], which may be indicative of a site where wine, carried by amphorae was transferred to barrels or skins for a better distribution among tribal societies without a proper road layout (see chapter 3) [Galliou, 1984; Tchernia, 1986a]. Furthermore, the inland route between Narbonne and Bourdeaux, the "isthme gaulois", had Toulouse as its transit point (see chapter 6.3.4). The extraordinary number of amphora recorded in the Toulouse area[1] suggested a transhipment of wine to other containers, also supported by the existence of a nearby frontier and *portoria* (Cicero, Pro.Front. xix-xx) [Tchernia, 1986a, 87-89; Roman, 1988; Laubenheimer, 1990, 48-52]. These special cases seem quite clear. However, numerous transit points of lesser importance may have existed without leaving any obvious archaeological trace. Roman Gaul also provides other possible examples of transit points such as Lyon, Vienne, Fréjus and Narbonne, where high densities of

---

[1] Labrousse [1968] documents a great amount of Dressel 1 found in shaft tombs (puits funeraires).

amphorae may not indicate local content consumption but a point of change for containers[2]. Similarly, the contents of amphorae recovered in urban centres may have been consumed in their hinterland and not in the towns themselves [De Light, 1990]. Retailers may have resorted to small containers to sell a portion of the amphora content which otherwise could not be sold as a whole (see chapter 6.2).

In conclusion, amphora distributions indicate the end of the primary function of amphora as containers but they do not necessarily reflect patterns of local consumption [Laubenheimer *et alii*, 1992]. In Roman Britain there are two special cases with high concentrations of amphorae which suggest the locations of possible transit points: Richborough and Corbridge. Both military sites have a high number of Dressel 20 stamps which represent high densities per m^2. This is incomparable with any other similar site in the province [Carreras, 1991; 1994a]. It seems very unlikely that this variation was due to local taste or preference. On the contrary, the fact that both sites are attested as military depots might explain these high densities [Frere, 1987; Millett, 1990a]. In other words, some products contained in amphorae and directed to the Army were kept in both establishments, and later transferred to other carriers before reaching their final consumers.

4.2.2 Amphora reuse

Once amphorae were emptied and their contents had been consumed, they could be used for a secondary function. Although this secondary function did not normally involve movement outside the consumption site, it affected the final distribution within it. At least four different ways of re-using amphorae are documented:

a. As storage vessels
b. As building material
c. For burial
d. For drainage

a. Reuse as storage vessels

Amphora were employed in the storage of perishable goods and liquids [van der Werff, 1987, 167; 1988], whenever the fat or smell of the original content did not rule out their re-use. Olive-oil and fish-sauce amphorae needed to have been cleaned thoroughly in order to be utilized

---

[2] Doliae were other vessels destined to transportation by ship whose content was transferred to amphorae or other containers once they reached a port before starting a journey inland [Hesnard et alii, 1988].

again, though their narrow mouth may have created serious difficulties in this aspect. The labor involved in this cleaning task would not have normally been worthwhile, as the Mte. Testaccio dump of olive-oil amphorae appears to demonstrate [Rodríguez-Almeida, 1984]. Thus, olive-oil and fish-sauce amphorae were not usually reemployed as complete containers again. Nonetheless they could easily be washed when split horizontally into two parts. Finds of bottom halves of Dressel 20 are well-documented in Roman sites such as Augst [Martin-Kilcher, 1987a, 177-180], Cirencester or Corbridge. These halves of amphorae are deduced to have been water storage vessels for use in households, after undergoing a thorough cleaning [Martin-Kilcher, 1987a, 177]. Besides this, they may have been used as public urinals known by Romans as *dolia curta* (Lucretius 4.1026-9; Propertius 4.5.73; Martial 6.93; Macrobius 3.16.15) [Robinson, 1992, 121].

However, other liquids such as wine left traces that could easily be removed, hence complete amphorae previously used as wine containers were suitable as storage vessels of foodstuff. As well as water any liquid could be held in amphorae; even dry goods such as wheat flour are recorded (i.e. Heuneburg, Alphen aan den Rijn) [Rottländer, 1986; Schallmayer, 1992; van der Werff, 1994]. Due to their shape, amphora could be used to contain anything, even slags refused by a local smith (i.e. Mt.Beuvray) [Laubenheimer, 1990, 55; Orton *et alii*, 1993, 76]. Moreover, they were also adapted to control hearths [Martin-Maganto and Arnaiz, 1991].

b. Reuse as building material

These voluminous ceramic containers provided an excellent building material once they were fragmented. First of all, a careful breakage could yield substitute bricks that could be employed in house walls. Numerous examples of this practice are reported in the amphora production areas, where even pottery kilns were constructed from amphora sherds (i.e. Tejarillo, Arva, Peñaflor) [Bonsor, 1931; Remesal, 1977; forth.; Keay, forth.]. The curved bodies of amphorae could also be used to build drains or sewers as Mt.Beuvray shows [Dechelette, 1904: Laubenheimer, 1990, 56]. Occasionally they were employed in monumental vaults as in the case of Galla Placidia´s Mausoleum, the Basilica of Sant Vitale (Ravenna) and the Circus of Maxentius (Rome) [Martínez Maganto and Arnaiz, 1991].

Similarly, they could be applied and frequently were in the building foundations of new developments as filling. The normal practice in Roman architecture was to excavate to a depth of at least two metres of foundation walls (Vitruvius Arch.iii.4) [MacDonald, 1969, 155]. Later the deposit could be filled with any earth or rubble available, including broken amphorae. Furthermore, these sherds were applied to level grounds not only in natural reliefs but also in human constructions (e.g. ditches). The best example is provided by Ostia, since its building level was raised above the flood level under Domitian, documenting inmense foundation fillings of earth and rubble [Meiggs, 1973, 64]. Relief areas were eradicated by levelling terraces sometimes with the use of amphorae as at Byrsa [Lancel, 1972, 101] or Baetulo [Padrós, 1985].

Filling ditches was an intermediate stage in the development of military fortresses into towns [Webster, 1988]. Military earthworks were no longer required once the troops had been moved to a new location. Ramparts and ditches were the first structures to be removed in order to integrate the different areas of the new urban centre. For instance, quantities of samian ware were recovered from inside a ramp of the military fort of Zugmantel (Germany) [Anonymus, 1911], while a ditch from the early fort at Cirencester yielded samian ware and amphorae [Wacher and McWhirr, 1982]. Another amphora filling is documented in Roman Britain, in the case of Exeter [Holbrook and Bidwell, 1991] and in Spain (i.e. Astorga) [Garcia-Marcos and Vidal, forth.]. Similar patterns of levelling early military structures appear in Carlisle, where two timber forts preceded the final stone fortress (circa A.D. 165) (i.e. Tullie House and BBC Radio Cumbria sites) [Carlisle Arch. Unit interim report].

Finally, amphorae broken into small pieces were also employed as material for floors, including in *opus signinum* or they are shaped as *tesserae* in mosaics [Laubenheimer, 1990, 55].

c. Reuse for burial

The presence of amphorae in burials is rather common in both Iron Age and Roman societies. Nevertheless their inclusion stems from different motives, sometimes made explicit from the context [Hodder, 1982]. Amphorae could form part of the burial goods offered by family or friends to reflect the status that the deceased held in the society. This normally ocurred when amphorae were rare commodities, as in the case of Iron Age Britain, Gaul or Germany, so their scarcity indicated both value and power [Hedeager, 1978]. One example of this the rich burial of Clémency (Luxembourg), which is believed to have been a princely tomb in which the Dressel 1 reflected the status of the deceased in life [Metzler et alii, 1989]. In Iron Age Britain amphorae are normally associated with rich burials such as the Lexden *tumulus* [Laver, 1927; Foster, 1986], Thaxted [Peacock, 1971] or Welwyn [Peacock, 1971]. Nonetheless, in later periods amphorae seemed to have been available to other members of society as recorded by humbler burials. The necropolis of King Harry Lane [Stead and Rigby, 1989] illustrates how amphorae in fact became a rather common part of burial furniture in the period A.D. 1-60. The practice continued in some provinces after the Conquest, continuing in even later periods (i.e. Vatteville-la-Rue) [Laubenheimer and Lequoy, 1992].

In contrast, amphorae received in large quantities could be used as simple fillings for tombs, even in Iron Age societies. The clearest examples of this are the shaft tombs near Toulouse, which were filled with a minimum of 10 amphorae, chiefly of the Dressel 1 type [Labrousse, 1968]. The great number of amphorae available in this community made their use as a symbol of power redundant.

Amphorae in the Roman world could also be employed in burials [Calza, 1940; Cagnere, 1960; Del Amo, 1979], although this practice was restricted to the lower classes in society. These vessels and *tegulae* were substitutes for coffins and sarcophagi and were used for containing the corpse in inhumation rituals as well. Since amphora burials did not show any wealth in terms of grave goods, the practice seems to be related to the poorer classes who could not afford more elaborate burials. Examples of amphorae used as coffins are documented in Isola Sacra (Ostia) [Calza, 1940; Martínez Maganto and Arnaiz. 1991], Narbonensis [Cagnere, 1960], Loire valley [Provost, 1993] and Tarraco [Del Amo, 1979; TEDA, 1987].

d. Reuse for drainage

A common reuse of amphorae, which is attested in different Roman sites, is as material for drainage [Laubenheimer, 1991; Laubenheimer *et alii*, 1992]. Ceramic material permits an excellent means of isolating from humidity, already noted by Vitruvius (Arch. v.9). He also recommended setting up drainage systems to avoid leakage from city sewers (Arch. vii.4). This included the use of a wall of sand. Moreover drainage systems were usually constructed to protect granaries, *horrea* (i.e. Saint-Romain-en-Gal, Vienne) [Becker et alii, 1986], and households from humidity. For this reason, these structures were more common in coastal or river towns [Laubenheimer, 1991b][3].

Drains consist of aligments of complete amphorae filled with sand, which could consist of one or more levels, combined with layers of pressed clay (i.e. Lyon, Vienne, Carthage) [Delattre, 1894; 1907; Becker et alii, 1986; Helly et alii, 1986]. The alignments could be either horizontal (i.e. Castro Pretorio, Rome; House of the Porch, Ostia) [Dressel, 1879; van der Werff, 1986]. or vertical (i.e. Bellecour, Lyon; Montfó, Herault) [Bacon and Bacon, 1982-83; Becker et alii, 1986] depending on the structure to be isolated. The employment of amphorae for drainage is widely documented in Gaul, Italy and North Africa [Laubenheimer, 1991b]. All the examples are located on important transport networks lines, at transit points, or in large centres of consumption. In all these cases, high concentrations of amphorae permited their use in planned urban developments

[3] Laubenheimer [1990] illustrates with a picture from Luxor (Egypt) the still usual practice of building walls of amphorae close to the river Nile in order to preserve people from humidity.

such as at Vienne (i.e. Saint-Romain-en-Gal) [Becker et alii, 1986]. Roman Gaul provides the most clear examples the use of amphorae for local drainage at transit points such as Fréjus [Goudineau, 1981; 1982; Laubenheimer, 1991b], Narbonne [Narbonne et la mer, 1990], Toulouse [Müller, 1918], Arles [Jacob et alii, 1987-88], Ambrussum [Laubenheimer, 1989], Angers [Siraudeau, 1988], Baurdeaux [Laubenheimer and Watin, 1991], Besançon [Laubenheimer and Humert, 1992], Vienne [Saint-Romain-en-Gal, 1984; Helly et alii, 1986; Desbat and Savay-Guerraz, 1990] or Lyon [Allmer and Dissard, 1887-88; Bruhl, 1964; Reynard et alii, 1973; Becker et alii, 1986; Dangreaux and Desbat, 1987-88; Bertrand, 1992]. In Italy, Ostia documents a couple of examples (i.e. Longarina, House of the Porch) [Hesnard, 1980; van der Werff, 1986], whereas Castro Petrorio provided a good example from Rome [Dressel, 1879].

As well as from these well-planned drainage systems, amphorae dumped in humid areas of a town could fulfil similar functions, though their employment as isolation material may not have been intentioned. The disposal of amphorae in the port of Cosa (Trench U1, east of wall U) suggests their deliberate use in drainage systems, but even some amphora dumps recorded at its waterfront may have satisfied the same requirements [McCann, 1987]. The discarding of amphorae at waterfronts seems to have been a regular practice that permitted waste material to be recycled in an area requiring some kind insulation from the sea or river humidity. For instance, an abundance of pottery and amphorae are documented in the harbour of Sabratha [Kenrick, 1986], Marsala [Wilson, 1990] and Valentia [Fernández-Izquierdo, 1984].

Unless the context clearly indicates that an amphora alignment represents part of a drainage system, such an arrangement can always be taken for part of the content of a storage area or warehouse. Two examples are recorded in Baetulo [Guitart, 1976, 244] of alignments of 236 and 50 amphorae respectively. Another possible warehouse is reported at Arles near the docks [Grenier, 1934] whereas Italica [Italica, 1982] attests another concentration of amphorae interpreted as a cellar. In all these cases, drainage was not included as an alternative explanation for the assemblages. Of course, there are clear examples of warehouses but with amphorae, as the walls discovered in the excavations of Horrea Galbae (Rome) show [Roma. Archeologia nel Centro, 1985].

4.3 Patterns of rubbish disposal

All the amphorae which were not in use for a secondary function, must have been discarded in a place that would not be an inconvenience to the life of the local community. Schiffer [1972; 1976] distinguishes two patterns of disposal according to their physical location:

"If trash is discarded at its location of use, it forms primary refuse, and if away from its location of use, secondary refuse" [M.B.Schiffer, 1976, p.30]

Although primary refuse was still present in settlements with low densities of population or of a relatively small size, it is negligable on large sites or in urban centres with high densities of population [Schiffer, 1972, 162]. Some spatial patterning is normally expected in minor settlements and in identifying activity areas (e.g. Uley Shrines, Cadbury Congresbury) [Rahtz *et alii*, 1992; Woodward and Leach, 1993, 245-249], but it is uncommon in large ones. Empirical evidence in comtemporary Mexico reveals that may have existed a provisional discard in out-of-the-way places, before a final disposal was made [Arnold, 1985; 1990]. Highly populated centres required a systematic organization for the disposal of garbage, which did not alter the normal life within the community. Otherwise, a disorganized pattern or dumping within the site was likely to affect life in the community (e.g. normal movements, smell, conflicts between neighbours) and even bring about risk of epidemic outbreaks.

Large settlements normally coordinated ways of discarding rubbish that permitted the designation of a single or multiple refuse areas outside the town [McKellar, 1973; Schiffer, 1976; Camilli and Ebert, 1992]. Amphorae, as voluminous objects to be discarded, would have been thrown away at these secondary refuse deposits, hence a primary refuse pattern seems very unlikely. Therefore, rubbish deposits represent the most outstanding indicators of a site´s economic pulse as far as amphorae are concerned. Moreover they could be combined with a myriad of other archaeological artifacts defining different economic functions in the town that later came together in a common refuse deposit.

"The logistics of refuse removal, storage, transport and discard subsystems determine in a complex fashion the kinds of artifact associations that occur in a secondary refuse area" [M.B.Schiffer, 1976, p.68]

4.3.1 Three case studies of amphora distributions at Romano-British sites

The only general reference to rubbish disposal in Romano-British towns appears in Cleary [1987, 179], who summarised some scattered evidence of refuse deposits in extra-mural areas. Their diverse locations and chronologies did not permit him to establish common rules or behaviour concerning trash disposal in these communities. For instance, Cirencester provides documented evidence of trash being use to fill the disused quarries in the west whereas Colchester and Lincoln record rubbish deposits near their defences. The same evidence is observed at

Chichester and Winchester, though the refuse near the defences served to furnish pits. Even Winchester showed evidence for the dumping of rubbish in an external building after its abandonment. Other debris deposits can be related to manufacturing locations on the outskirts of towns yielding metal slag and ceramic (i.e. Water Newton, Worcester, Caistor-by-Norwich, Lincoln, Towcester, Gloucester, Silchester, Bath) [Cleary, 1987, 182].

The analysis of different amphora assemblages from the same site permits a new approach to determining the internal organization and evolution of a specific town. The study of each separate amphora type, with refererence to a date range, helps to illustrate changes in the city boundaries and patterns of garbage refuse. An excavation assemblage in fact can indicate amphora density (gr/m^2). Combining the densities of a few excavations by means of map interpolation, a series of contour maps can be created. These contour maps summarise a general pattern in the amphora distribution of a town as a whole on the basis of a limited sample. This principle was applied to the study of amphora distributions in three Romano-British sites: Chester, Leicester and London.

Five distribution maps were created for each site, the first of them represents the overall amphora density whereas the other four indicate distributions of varied amphora types (i.e. Haltern 70, Gauloise 4, Dressel 20 and North African). Furthermore, the composition of each amphora assemblage at each site was examined by means of statistical multivariate analysis in order to discern whether they could represent general patterns and activity areas.

4.3.1.1 Deva (Chester): a legionary fortress

Chester was a military foundation dated by early structures in A.D.74/75 that accommodated the legio II Adiutrix [Jones, 1975; Holder, 1982]. Although some evidence suggests that it was an early timber fort of Neronian date, there is no conclusive proof of such an early occupation [Mason ,1980; Todd, 1989]. The site seems to have been garrisoned by military forces almost constantly. The legio II Adiutrix was first removed during the Agricolan campaigns (circa A.D.83) and later (A.D.87-92) the legio XX Valeria settled at the site. This second legio remained there either in its entirety or in limited numbers (i.e. *vexillatio*) until the fourth century A.D. [Frere, 1987] conferring a special character on this settlement.

The amphora assemblages from 26 excavations (see table appendix 3) serve as a reference for refuse disposal at this site. High concentrations of amphora are attested outside the SE corner of the early military camp. The area is close to the river, though neither harbour installations nor warehouses are known to have existed [Milne and Hobley, 1981]. Two excavations (DH83 and

CS76) report high densities representing in fact the densities of the Dressel 20s in this zone. The high density of CS76 is due to the filling of a well with these vessels. This demonstrates the practice of dumping garbage in disused structures. This habit is attested in two other Romano-British sites, Brecon and Caerhun, where wells were filled with rubbish in a process of reconstruction of these sites. The high concentrations mentioned appear in figure 26 which defines the distribution of amphora densities at Chester.

With reference to individual amphora types, Dressel 20 densities reflect the general pattern of amphora distribution since this type was the commonest form (see appendix 2, fig. 1). Chronologically, Dressel 20 represents the typical amphora discarded from the time of the Principate to the mid third century A.D. Nevertheless, three other amphora types, Haltern 70, Gauloise 4 and North African, furnish a more clear time framework for observing the city evolution. For instance, the concentration of Haltern 70[4] densities (see appendix 2, fig. 3) was located in the same SE corner of the early fort (DH83), though the camp was clear of any refuse like that found at Nijmegen and Kaiseraugst [van der Werff, 1984, 375; Martin-Kilcher, 1987a, 188-191]. Other Haltern 70 deposits are reported at the boundaries of the fortress which confirms the military practice of removing any garbage from the living areas.

The second type, Gauloise 4 (see appendix 2, fig. 2), has a long chronological sequence of ocucrrence from the 60s to the third century A.D. At Chester, its highest concentration fits with that of the Dressel 20 in the South at the river side, back- filling the same well (CS76). However, a second deposit is documented at an extramural site in the Eastern part (CRS63) which may identify a later rubbish dump once the civil site had grown [Mason, 1980]. The last good representation of this type is found at a site NW of the town (PP89). North African types (see appendix 2, fig. 4) show patterns of disposal in later periods since these forms seem to have been more common from the thid century A.D. onwards [Peacock and Williams, 1986]. The major concentrations in Chester are recorded in the South, close to the river bank (CS76) filling the already mentioned well. The refuse dump second in importance appears in the NW part of the town in a zone where rebuilding work was possibly going on.

The statistical analyses of amphora assemblages by means of Principal Components and Correspondence summarise the variability in their composition. In fact, both methods stress the high densities of two deposits (DH83 and CS76) as well as the homogeneity of assemblages in general. The greatest variation is in the presence and absence of North African amphorae, which indicates chronological changes in amphora supply. Only the site CMS91 appears differentiated in the Correspondence Analysis because of the presence of an unusual amphora type, a Gauloise

---

[4] This type may have arrived into the city from the late 60s to late 70s A.D.

Figure 26 Interpolation of total amphora densities at Chester.

Dressel 2/4. Since the assemblages are homogeneous, this evidence supports the identification of the communal refuse pattern of gathering trash from different living and activity areas in one dumping place. The chronological variability in amphora types defines changes in the location of these secondary refuse areas once the early debris deposits were no longer usable. No activity areas can be inferred from the amphora assemblages as their composition and location seem to identify secondary refuse areas rather than primary ones. Apart from this initial conclusion, the study of amphora deposits permits us to propose an overview of the pattern of refuse disposal for Chester.

a. The early military fort (A.D.60-70) indicates the maintained practice of dumping refuse close by outside the camp.

b. With the development of the civil site, refuse was restricted to the area close to the river, in abandoned structures and at extramural locations.

c. The Northwest area underwent a re-building programme in a later period which involved the reuse of amphorae as construction material.

4.3.1.2 Ratae Corieltavorum (Leicester): a native *oppidum*

Leicester was a territorial settlement of the Corieltavorum tribe founded in Augustan times [Clay and Mellor, 1985]. This indigenous *oppidum* was occupied by Roman military forces after the Conquest (circa A.D.47) [Clay and Mellor, 1985; Frere, 1987, 57; Millett, 1990a, 61], though it is still unclear when they abandoned the town [Todd, 1990]. Wacher [1974] suggested a military presence for this until the late Flavian date, A.D. 80, though there is a lack of evidence[5]. Nevertheless the majority of amphora stamps on Dressel 20 are of Claudian (22.9%) or Flavian date (37.8%), which presupposes a military supply since they decreased drastically afterwards despite the town's growth in population. The town became an administrative centre as a *civitas* capital of a relatively big size (42 ha.) [Millet, 1990a, 152] which experienced a continuous occupation until the end of Roman rule.

With reference to amphora densities (see appendix 3), high concentrations are recorded in the Forum area (A.316.1962; A.302.1971) in the *insulae* XXII and XVIII. The place may have held the initial military fort, and in fact, both assemblages record early amphora types, though this public zone underwent numerous rebuilding over time. Therefore, the amphora concentrations appear in the SW areas of the Forum as the probable dumps and fillings of early occupations. The deposits, which are second in importance are close to the riverbank (A.12.1977; A.77.1975) and

[5] R.Pollard [pers.comm.] considers that nothing proves a continuous military presence until the end of the fist century A.D.

this area may have been kept as a storage zone, NW densities were also high. Some industrial activites such as quarrying and pottery making were documented in this extra-mural area [Cleary, 1987, 103]. The following illustration (figure 27) shows the general distribution of amphorae.

Again the densities of Dressel 20 as the major amphora type clearly indicate the general trend already outlined (see appendix 2, fig. 5). The high concentrations are recorded in the SW of the Forum area and close to the river (A.316.1962; A.305.1963; A.12.1977) in relatively central locations. This picture can be completed with the detail concerning distribution of Haltern 70s, which indicate early patterns of rubbish disposal. The higher densities of this form are concentrated in the SW of the Forum (A.302.1971; A.316.1962; A.138.1968) where an early occupation or activity seems to have existed. Haltern 70s are also well-documented close to the river in a zone with traces of an Iron Age settlement (A.1.1968) [Clay and Mellor, 1985] (see appendix 2, fig. 7). Furthermore, the sector surrounding the public area (i.e. Forum, *macellum*, baths) reports higher densities of early amphora discards, which may mark the early boundaries of Leicester. If this is the case, the concentrations of Haltern 70 were simply indicating debris deposits on the outskirts of the town apart from the riverside.

Even Gauloise 4 densities reinforce the idea of redevelopments in the South of the Forum (A.302.1971; A.353.1973) (see appendix 2, fig. 6) which also is suggested by the distribution of North African amphorae. This latest type is well represented in the South of the Forum as well (A.302.1971; A.316.1962; A.163.1969), which dates the amphora supply in these points to as late as the second half of the second century A.D. (see appendix 2, fig. 8).

The statistical analyses singled out the two assemblages with higher densities and a number of forms represented in the Forum (A.302.1971; A.316.1962). Both assemblages contained items representing a wide representation of chronological periods, which supported the likelihood of redevelopments in this area. Therefore amphorae in these deposits seem to indicate the locations of initial refuse zones whose material was later re-used for building foundations over long periods of time (i.e. renovations, redevelopments). Furthermore, the assemblage from A.316.1962 constitute the only example with high densities of two minoritanian types, the Richborough 527 and Carrot amphorae. Nevertheless the homogeneity of all the assemblages did not provide evidence of any links to activity areas as far as amphorae are concerned. The distribution of amphorae at Leicester gives some insight into the likely site location.

a. Early debris deposits surround the public area and the riverbank. These may represent the early limits of urbanization.

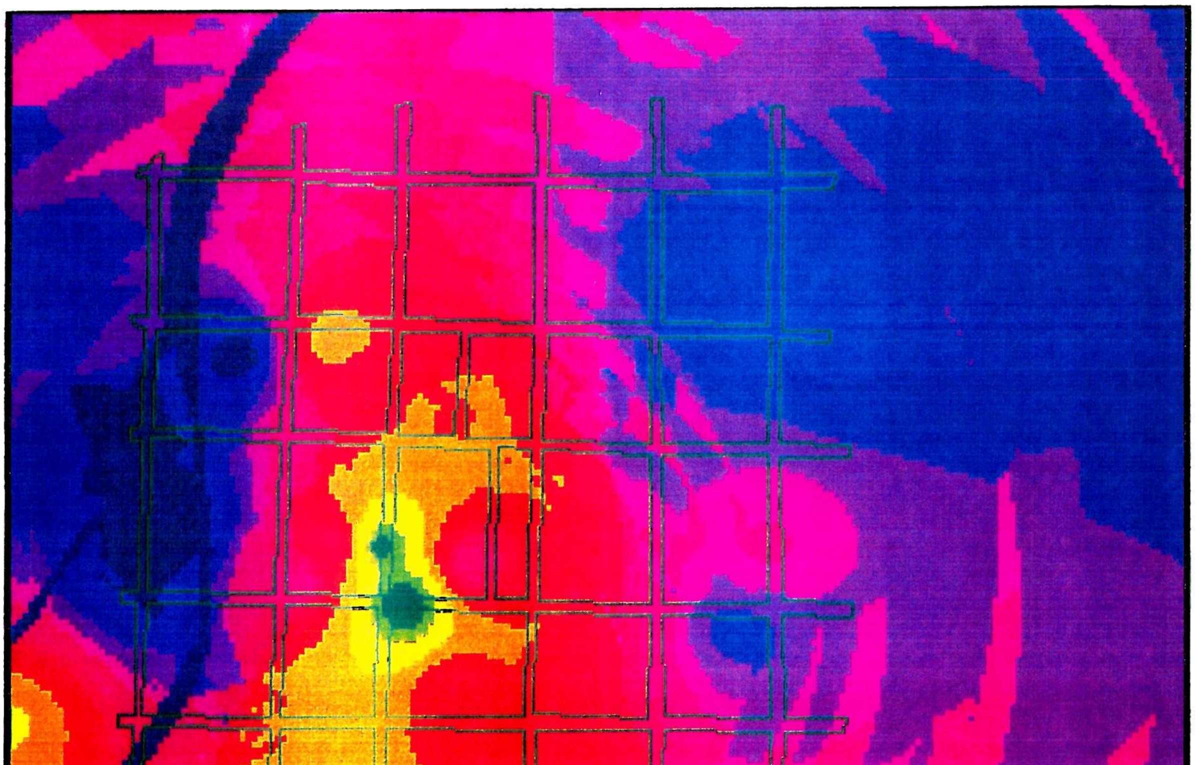

Figure 27 Interpolation map of total amphora densities at Leicester.

b. Higher densities of amphorae in the town centre may be products of redevelopments and appear to have been reused as building materials.

4.3.1.3 Londinium (London): the capital

The origin of London is still a disputed matter due to the lack of testimonies either literary or archaeological [Merrifield, 1969; Marsden, 1980; Williams, 1990]. One possible theory regarding an early Iron Age settlement [Kent, 1978] has been discarded because there is no evidence of a native habitat [Merriman, 1987; Marsden, 1987, 17; William, 1990, 599], whereas the discussion about a Roman foundation focuses on whether its character was military or civil. The first occupation is dated after the conquest (A.D.43) in the Walbrook area [Perring, 1985; Perring and Roskams, 1991] where buildings made of wattle and daub[6] appear to demonstrate an indigenous presence at the early site. Tacitus (Ann. xiv.33) described London as an important trading post in A.D. 60-61, though there is no mention of its origin.

> ***"...London; which, though not distinguished by the title of colony was none the less a busy centre, chiefly through its crowd of merchants and stores"***
> ***[Tacitus Ann.xiv,33]***

Merrifield [1969] suggested that London may have had a military foundation after the battle of Medway because of its location at a crossing point of the river Thames and the navigability of this tidal river up to it. Early harbour features from the middle of the first century A.D. are well-documented though they do not imply military administration [Hobley, 1980; Milne, 1985]. However, the Roman military equipment found in London [Webster, 1958] was possibly used to support a military establishment.

Although the dating and function of these military structures seem rather confusing [Hobley, 1980; Williams, 1990], an enclousure discovered at Fenchurch St. [Marsden, 1980; Ottaway, 1992] and a ditch at St.Bride´s [Grimes, 1968, 183-184] have been interpreted as possible early forts. As well as Walbrook occupation, London documents a planned development in the Forum zone [Marsden, 1987, 19] with only civilian traces. This early settlement suffered a complete destruction during Boudicca´s revolt, A.D.60-61, but it expanded rapidly in the Flavian period.

The establishment of the *procurator C.Iulius Alpinus Classicanus* (RIB 12) at London after its reconstruction [Merrifield, 1983] encouraged the arrival of new settlers. The town then became

---

[6] Some houses show a circular plan typical of of the British Iron Age architecture [Harding, 1974, 53-73; Perrin and Roskams, 1991, 119].

the official administrative centre when the governor decided to reside there in the late first century A.D. as the presence of the palace seems to indicate [Marsden, 1975; 1980, 79]. Military staff from different legions (i.e. VI Victrix, XX Valeria Victrix and II Augusta) accompanied the governor as members of his *officium*. As a result, Cripplegate fort was built in the first half of the second century A.D. at the NW corner of the town to accommodate these military staff [Hassall, 1973]. The city flourished until the Hadrianic period when a fire affected the majority of its half-timbered buildings [Frere, 1987, 233]. Despite being reconstructed quickly, the city did not grow again and maintained its boundaries without major changes until the end of Roman rule.

Amphora densities supply an estimulating contrast of the city evolution (see appendix 3)[7]. The major dumping areas recorded were at the waterfront (TR74) close to the harbour installations, though two deposits of secondary importance are documented in the SW of Cripplegate fort, between this structure and Walbrook (IRO80; CID90). This quarter of the town was occupied in the late first or early second century, and thus it may have been an early refuse zone. Both concentrations are clearly verified by the interpolation map (figure 28).

The same pattern of distribution is inferred for Dressel 20s, which were the commonest type of amphora present (see appendix 2, fig. 9). The waterfront and Cripplegate corner represent the zones with a higher proportion of olive-oil amphorae. However, other amphora forms provide indications of completely different patterns. On the one hand, the concentrations of Haltern 70 (figure 29) are in the Forum area. Since this was an early amphora type, the accumulations in the Forum zone (FEN83; LEN89; TR74) suggest the activities of an early settlement [Marsden, 1987] with a garbage dump not far from the occupation area. Yet there is an even larger concentration at an extramural site (BAR79) in the NW. This rubbish dump seems rather far from any of the plausible occupation areas of this period (i.e. Aldgate, Walbrook and Forum). So it may represent a secondary settlement of military character. The existence of temporary military bases on the outskirts of the city is supported by some slight archaeological evidence which also refutes the idea of a military nucleus in the town centre [Williams, 1990, 600]. Besides this, the amphora assemblage (BAR 79) is quite homogenous providing a late first century dating. Moreover, it is notable that most of the pottery from this period has been recovered from rubbish pits where it had been tidily buried [Waddington, 1930, 68-69].

With regard to Gauloise 4 amphorae, the bigger concentrations appear at the waterfront (TR74; SLO82; DEH86) (see appendix 2, fig. 10). This zone suffered a complete transformation from the Flavian period onwards [Milne, 1985; Dyson, 1986], and was chiefly restricted to harbour activities. Waterfront deposits seem to fulfil the double function of producing material for

[7] A previous general archaeological assessment was presented by Biddle and Hudson [1973].

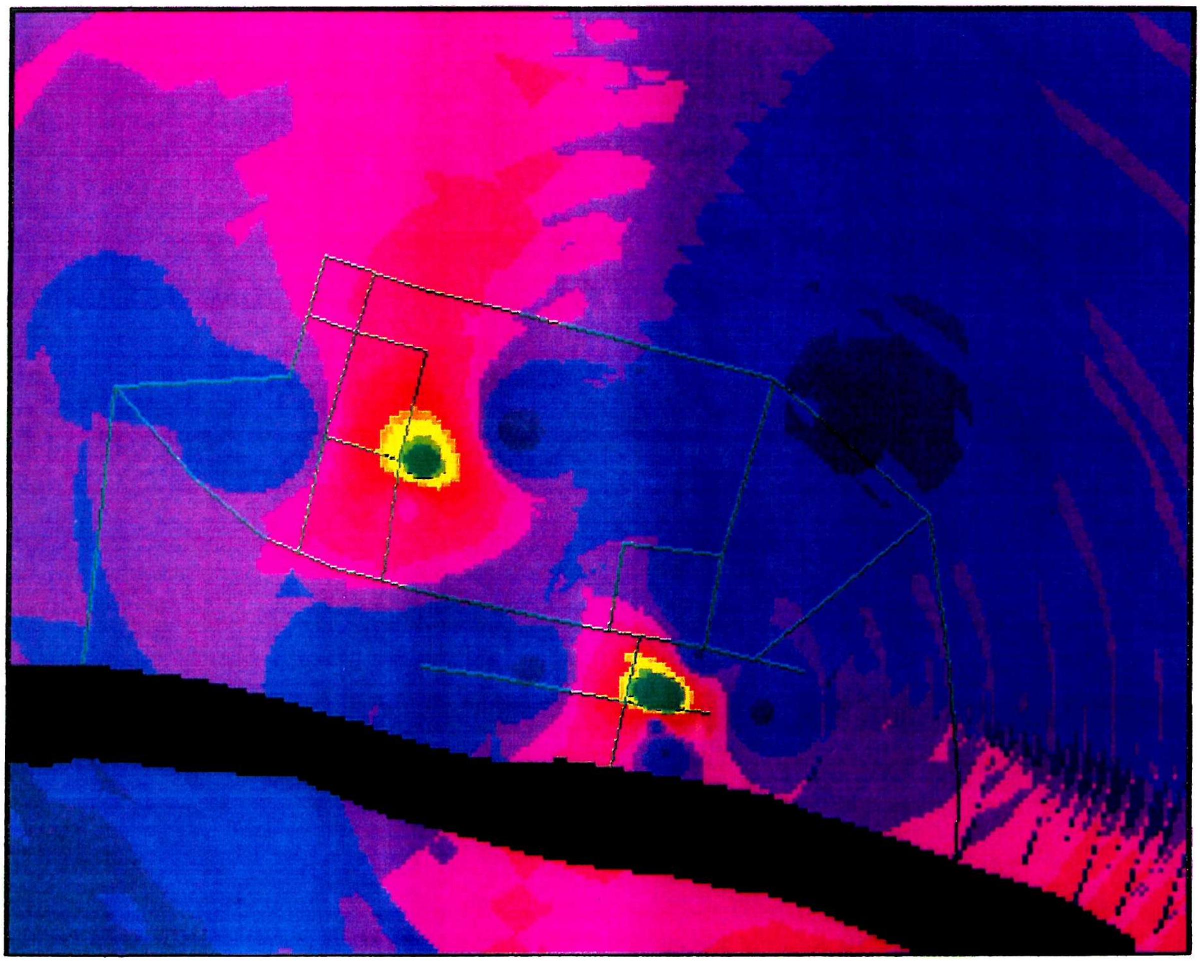

Figure 28 Interpolation map of total amphora densities at London.

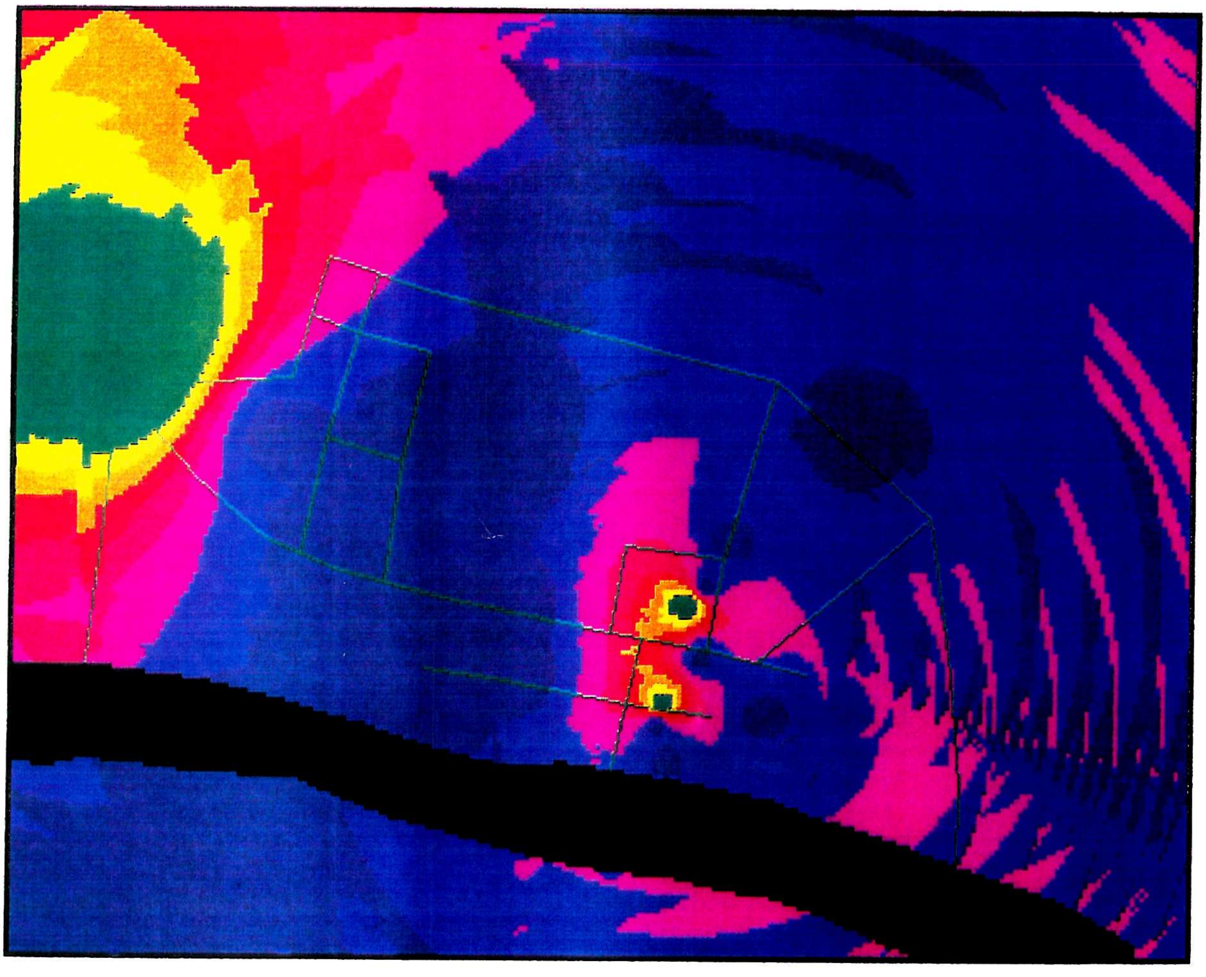

Figure 29 Interpolation map of Haltern 70 amphora densities at London.

building structures and material for drainage systems against humidity. A dumping pit with almost complete vessels is recorded at Bishopgate [Tyers, 1984] in the same waterfront area. This zone, as the Bishopgate pit also records [Tyers, 1984][8], was fovoured for the dumping of North African amphorae (ER; DGH86; NFW74). This indicates that later developments took place (see appendix 2, fig. 11). Debris comprising dumped amphorae from the second London fire, A.D.120-125, are also attested from other riverside excavations as in the case of Regis House [Dummy, 1945], which was possibly a warehouse. Both the warehouse and its crates of samian were destroyed.

The statistical results from Principal Components and Correspondence analyses distinguish the high densities of amphorae in two deposits, IRO80 (Cripplegate zone) and TR74 (waterfront). The former assemblage stands out because of its high representation of a particular amphora type: Richborough 527. This type constitute 42.49% of the total weight of the assemblage. Thus Richborough 527 is an exceptional case. A second good representation of Richborough 527 is documented at the waterfront (NFW74) though a lower percentage (7.86%) was recorded.

Apart from this special case, the general composition of all the assemblages is quite homogeneous. They were found to combine the different types imported in the same period. In fact, only two late deposits (ER; DGH86) show distinctive proportions and types (i.e. North African, Late Roman). Therefore, the amphora distribution suggests their role as a secondary refuse in communal areas. The following summary gives the main conclusions obtained from the deposits of Roman London.

a. Dumping zones are normally concentrated at the waterfront or near the early boundaries of the city (i.e. Cripplegate fortress).

b. The high concentration of early amphorae suggests two possible areas of occupation in early times, the NW sector and the Forum area.

c. The composition of the assemblages provides indication of secondary community refuse areas.

---

[8] Tyers [1984, 379] points out that the pit debris could correspond to a primary refuse of a huge dwelling or workshop, though there is no sign to deny a possible secondary refuse.

4.3.1.4 Conclusions from the three case studies

The analysis of the amphora assemblages from these three Romano-British settlements allows us to identify the common traits of trash disposal. In general, amphora deposits on the outskirts of towns have been documented where these dumps did not disturb everyday life. Since towns' boundaries were modified over a period of time, each amphora type (e.g. Haltern 70, Gauloise 4, North African) suggests possible changes in the occurrence of urban plans. Amphora deposits with a possible secondary function are also reported in intramural sites. Amphorae were used as filling for material abandoned structures (e.g. Chester´s well) or as building foundations in development programmes (e.g. Leicester´s Forum, NW Chester). However, the major concentrations of amphorae within these sites were restricted to riverbanks, where occupation was limited to warehouses and harbour installations. Populations kept at a relatively safe distance from riversides due to the dampness that living there could entail (e.g. Leicester, London, Chester).

With regard to the composition of the assemblages, all of them include a good representation of the types imported into the town during any period. Therefore the location of no functional areas can be inferred from the deposits, as they can respond to secondary refuse in which garbage from different zones came together. This evidence from Roman Britain supports the hypothesis that a communal pattern of rubbish disposal hinted at in literary and archaeological sources, did exist.

4.4 Parallels of refuse disposal

Other complex societies with a high urban development had to face similar problems related to garbage dumping. Parallels drawn between these societies can give some insight into the way that Roman communities organized their refuse disposal. Egypt constitutes an excellent example for comparison. Hoffman [1974], who studied patterns of rubbish disposal in the Early Empire, distinguished three patterns that reflected socio-economic diversity, these related to elite, non-elite and industrial areas. On the one hand, the elite zone, chiefly located in the city centre, showed signs of having been thoroughly cleaned in an attempt to remove all the possible garbage. A few terms recovered from this area seem to have been lost and not left on purpose (i.e. coins, precious objects). The non-elite zones contain evidence that inorganic trash (e.g. heavy potsherds) was removed from living quarters and mean filling to level off nearby depressions [Hoffman, 1974, 42], whereas industrial areas were concentrated on the outskirts of the town where their rubbish was dumped.

Empirical evidence from the Memphis´survey points to the existence of rubbish mounds on the outskirts of the city almost 5 Km away [Jeffreys, 1985, 8]. In addition, the village of Amarna [Kemp, 1984, 8] records rubbish deposits on its outskirts providing filling for pits and quarries to flatten the ground. It also seems that the path leading to the village was kept clear of any rubbish.

An organized pattern of disposal outside the city is likely to have been the case at Teotihuacán [Cowgill *et alii*, 1984], though the evidence is scarce. A more complete picture was obtained from the study of remains of the communities in the Maya highlands, who appeared to dump their communal thrash outside the living areas [Hayden and Cannon, 1983]. Besides these, a thorough survey conducted at the Pueblo site of Grasshopper [Ciolek-Torello, 1984], revealed a highly organized refuse disposal system using abandoned structures or sites away from habitation areas. An opposite picture is obtained from the Broken K Pueblo, where some rooms showed signs of trash dumping [Schiffer, 1989]. In other cases, middens are located close to the occupation areas in abandoned houses and behind walls [Boone, 1987]. Early medieval towns record rubbish deposited in middens, or pits in the 12th and 13th centuries, or at municipal dumps in the 14th and 15th centuries and, at municipal dumps or in pits in the 16th and 17th centuries [Platt, 1975; Keene, 1982; Carver, 1987]. Similar patterns can be inferred from the study of contemporary societies, though the mechanisms and scales of dumping are rather different [Rathje, 1974; Rathje and McCarthy, 1977].

4.4.1 The importance of the location of rubbish deposits

As Hoffman [1974] has pointed out the disposal of primary refuse distinguished between social groups within a community. High status quarters invested more time and effort in removing refuse, whereas the attitude towards rubbish disposal was more relaxed in quarters of lower status. Whenever manufactures were recorded, chiefly on the outskirts of the town, they generated a specilized trash which reflected the type of manufacturing activity.

Secondary refuse is normally located on the outskirts of towns, relatively close, although in some cases it might be found at a distance [Jeffreys, 1985]. These secondary dumping areas could be used to level off previous structures or to effect changes in relief (i.e. filling in pits) [Hodder *et alii*, 1978; Miró, 1991]. Nevertheless, communities appeared to avoid dumping trash on nearby access roads to a site. Despite the fact that the dumping sites may not provide detailed topographical information [Schofield, 1987, 5], their combined knowledge about their location should supply a general overview of a settlement as a whole.

All these features lead us to the conclusion that deposits of rubbish marked the limits of urbanized areas, thus they may provide information about the town expansion. Derelict parts of a town can document debris deposits, the construction material of which may establish the date of abandonment. In this context, amphora deposits may provide an alternative view of how a Roman settlement progressed over time, since each amphora type provides a chronological pattern.

4.5 Roman towns and waste disposal

Classical literature does not include any account of how the Romans organized the disposal of their refuse and of whether local authorities had any involvement in this activity [Carcopino, 1942, 81; Duby, 1990, 305]. A few municipal laws recovered provide a patchy picture of local administration with reference to this matter [Robinson, 1992].

The lex Municipii Tarentini (before 45 B.C.) banned the demolition of any house without due permission from the local senate, except if the house was being restored (iv.32) [Hardy, 1911; Dudley, 1967]. In addition, the lex Iulia Municipalis (44 B.C.) codified that each house owner should keep his portion of street in a good state of repair (vii/x), whereas the *aediles* and *duumvirs* were responsible for cleaning and maintaining the streets located inside and outside Rome (viii/ix/xi/xii) [Chester Johnson *et alii*, 1961]. The lex Iulia Municipalis also includes two laws forbidding the driving of waggons along the streets of Rome during daylight (xiv/xvi), although there were two exceptions.

> *"...[except] for the transportation and the importation of material for building temples of the inmortal goods, or for public works, or for removing from the city rubbish from those buildings..." [Lex Iulia Municipalis. xiv]*

The law indicates that building material was transported and discarded outside the city of Rome. A second exception refers to organic refuse as mentioned below.

> *"It is not the intent of this law to prevent ox wagons or donkey wagons that have been driven into the city by it from going out or from carrying out dung." [Lex Iulia Municipalis, xvi]*

The Lex Iulia Municipalis became the legal source for the Italian and provincial charters. Some examples have been documented in Southern Spain [Chester Johnson et alii, 1961]. For instance, the charter of Salpensa (A.D. 82/84) does not include any mention of refuse disposal, whereas the one from Malaga (A.D. 82/84) as well as the lex Irnitana (lxii) [González, 1986, 190] regulated the demolition of houses (lxii). Roman Egypt documents leases specifying that houses should be turned back to their owners free of dung, hence organic waste was a common problem inside towns and sometimes responsible for a house´s collapse (P.Berl.Bork. i.3; xi,12; ix.31) [Bagnall, 1993,50].

Archaeologically, Roman towns show complex systems of water supply and sewer works [Adams, 1984], which were necessary for the removal of organic refuse[9]. Although private houses may have utilized cess-pits, most people followed the practice of emptying commodes and chamber pots into drains or wagons. Nevertheless inorganic and voluminous waste such as amphorae required a specific system for its disposal since dumping in public areas or streets was condemned by local law. The two references to the lex Iulia suggest that waste disposal outside the city was practiced, although they do not make clear whether the collection and dumping was a public or private duty.

A few fragments of literature present a blurred picture of refuse disposal in the limited case of the City of Rome [Dudley, 1967; Ramage, 1983]. The Urbs was particularly unhealthy in late Summer and Autumn (Horace, Ep.1.7.5-9; Odas, 2.14.15-6; Sat. 2.6.18-19) when the low level of the river Tiber hampered the removal of organic trash carried by the flow of the sewage system [Scobie, 1986]. Refuse was thrown into the river, which may have increased the risk of flooding.

---

[9] Remains of sewer structures are recorded in a motley of Romano-British settlements such as Wroxeter, Lincoln, Colchester, Silchester, St.Albans, Kenchester or Bath [Frere, 1987, 236].

This seems to be the reason why Augustus (Suet. Aug.30.1) had to order the river bed up to be cleared of refuse. He or his successor, Tiberius, established a special office in charge of cleaning the Tiber [i.e. *curatores alvei et riparum Tiberis*] (Suetonius Aug.37; Cassius Dio 57.14.8). The curatores were responsible for dredging the river, preventing any uncontrolled dumping and later, they were also made responsible for the sewers. Rodríguez-Almeida [1984, 116] relates this duties with regard to Mte. Testaccio, an area used for dumping amphorae near the river port and *horrea*. Mte. Testaccio appears to have been located in a non-urbanized zone at that time, close to warehouses and outside the Servii Tulii wall [Le Gall, 1953; Rodríguez-Almeida, 1984]. Thus it represented a location where the refuse could not affect everyday activities.

After the fire of Nero's time, the same emperor cleared up the city of Rome at his own expense in order to construct new quarters (Tacitus, Ann.xv.43.1).

> ***"The marshes by Ostia were designated for the dumping of rubble and instructions were given that the ships employed to bring corn up the river should make the return trip loaded with rubble." [Tacitus, Ann.xv.43.1]***

Although this was an exceptional case, it indicates the distance that the city trash had to be taken to be dumped when the excessive quantity of it required a special location. The last mentioned record tells how Aurelian (A.D. 271)(HA. Aurel. 27.3) had to dredge the river bed again, probably because of the accumulation of debris.

Finally, Tacitus (Ann. xi.32) mentions that Messalina escaped from Rome hidden into a wagon containing garden waste. Wagons carrying night-soil out of the City are also recorded in other sources (HA Val.Max. 1.7.10). These wagons mentioned too by the Lex Iulia Municipalis may have followed regular routes under the supervision of *aediles*, who let cleaning service works out to private contractors such as the *foricarii*, according to Robinson [1992, 123]. They were probably responsible for sub-contracting cart drivers and receiving citizens payments. At least one piece of evidence, a graffito from Herculaneum, records an instance of payment for the removal of manure [Scobie, 1986].

4.5.1 Archaeological evidence in support of the hypotheses

Trash disposal in a Roman town would appear to have been coordinated to some extent, if this is the case, it may be assumed to have left an archaeological traces. Amphorae were voluminous containers normally discarded on wasteland together with other debris. Therefore amphora assemblages cannot usually identify functional parts of a town, because they were dumped in secondary refuse areas [Schiffer, 1972; 1976: Sinopoli, 1991].

Some shops specializing in one or more products are well documented (i.e. Rome, Ostia) [Loane, 1907; Meiggs, 1973]. They may have contained a few specific amphora types. For instance, Rome attests at least two wine shops at the Velabrum (CIL vi.9993) and the Fountain of Four Scauri (CIL vi.9671), but their wine amphorae were not necessarily thrown away in the vicinity. The house of an oil merchant is also recorded at Hierakion (Egypt) (P.Brem. 23), thus documenting another instance of a specilized trader [Lewis, 1983, 136-144]. This vessel refuse in communal areas made it difficult to identify their locations of specialized shops. Similarly, groups of traders who specialized in the same merchandise in a specific quarter of a city (e.g. Rome) [Morel, 1987, 143-144] may not have left any traces of their trading activity in terms of amphorae. The only exception appears at Pompeii [Curtis, 1979] where a *garum* shop can be clearly identified on the basis of the complete amphorae recovered. The exceptional end of Pompeii explains why the vessels present are able to document functional space precisely. However, apart from this, Pompeii does not show any clear division of specialized shops and craftsmen but instead reflect quite a mixed commercial structure [Raper, 1977; 1979; La Torre, 1988].

Similar reasons can be put forward for rejecting amphora concentrations as indicators of market areas (i.e. *macellum*) [De Ruyt, 1983]. The containers employed to carry goods to these urban markets were probably discarded at distant sites under the supervision of *aediles*, who were responsible for the *macella* organization [Dudley, 1967; De Ruyt, 1983].

Amphora distributions within a site basically define patterns of reuse (e.g. drainages, buiding foundations, burial) or locations for waste disposal. The latter were probably limited to unoccupied areas (e.g. outskirts, river beds) where amphorae were combined with the refuse from other urban activities. Rubbish mounds on the outskirts of towns in Roman Egypt are well documented since they constitute the richest source of papyri (e.g. Oxyrhyncus) [Lewis, 1983, 5]. Moreover, unwanted babies left among the refuse and saved by the Egyptians normally carried the name *kopreus*, which means off the dunghill, indirectly giving evidence of the practice of dumping all the trash together [Lewis, 1983, 34]. Early archaeological accounts of Egyptian towns (i.e. Oxyrhynchos, Herakleopolis) reveal the presence of large garbage heaps scattered around [Bagnall, 1993, 52]. They were even reported as occurring inside the town, each of them belonging to a specific period. In some cases, the changes in the location occurring of trash dumps can be linked to the city economic evolution [Bagnall, 1993, 52]. At present, archaeological evidence from Mons Claudianus [Peacock, pers.comm.] reports middens of combined debris on the outskirts and in abandoned structures.

Also Petra (Jordan) provides an excellent example of a rubbish dump at the Katute site [Browning, 1974]. It is formed by a huge deposit of first century material dumped probably over the South City wall into an area unoccupied except for one unique dweller[10]. Dura-Europos (Syria) documents another refuse area being created over an early cemetery in disuse. It was, therefore, outside the urbanized zone [Hopkins, 1979]. The same settlement indicates the use of refuse material as filling for an inner wall embankment [Hopkins, 1979, 244]. However, the best evidence comes from Ghirza (Lybia) where at least seven middens in the town neighbourhood have been recognized [Brogan and Smith, 1984, 92]. These debris deposits reach huge dimensions (circa 100 x 40 x 6 metres) and seem to have been disposed on recognized ground. The middens composition included organic remains (i.e. seeds, fruits, pips, husks) as well as inorganic material (i.e. cloth, leather, terracota, lamps, oyster shells, pottery). Among the pottery types discarded appeared a good number of amphorae [Brogan and Smith, 1984, 93].

Sites in Western provinces show similar patterns, though indications of these do not always survive. For instance, Pompeii documents debris dumps on the outskirts of the city, some of which may have been existed at the time of the fire of A.D. 62 [Richardson, 1988, 18]. A military site such as Vindonissa (Switzerland) also provides an external pattern of refuse disposal over a short occupation [Ettlinger, 1952]. Similarly, the periphery of Toulouse concentrates refuse areas on the right side of the river Garonne [Labrousse, 1968, 314], though puits funeraires accumulated part of the town´s trash, chiefly in the form of amphorae [Labrousse, 1968, 217-226]. Narbonne is another good example of a case where dumping took place in the suburbs of a town [Labrousse, 1981, 304]. This is also the case with Tarraco [Cortés and Gabriel, 1985] and Astorga [Garcia-Marcos and Vidal, forth.]. The port of Narbonne (i.e. La Nautique) provides evidence of a large ditch filled with a great quantity of pottery including amphorae and unused samian ware [Ficher et alii, 1978]. The extramural evidence of some Romano-British municipies supports the likelihood of a communal dump on the town's outskirts [Esmond-Cleary, 1981; Carver, 1987, 9].

A collective disposal practice also becomes evident from the extensive intramural excavations of Roman towns and fortresses, where hardly any occurrences of random refuse are recorded. For instance, within a town, amphora assemblages normally indicate either reuse (e.g. as drainage, or building material, or storage areas), abandonment of structures or unoccupied areas. The excavation of Nijmegen (Holland) constitutes a clear example of lack of any refuse within the fortress [van der Werff, 1984, 375].

A more detailed picture comes from the study of Dressel 20 sherd densities for each period at Augst and Kaiseraugst (Switzerland) [Martin-Kilcher, 1987, 188-192]. The military fortress provides only high densities in late periods whereas the civil settlement documents these densities in early periods in quarters which seem to have been developed at that stage. However, intramural

[10] The house was left in the first century A.D. may be due to the dump location [Browning, 1974, 194].

refuse dumps can indicate a town's growth over time as the amphora deposits at Baetulo, Ostia or Byrsa [Padrós, 1985; Lancel, 1979; Meiggs, 1973, 274] show by indicating the usual procedure of flattening ground to prepare it for building (Vitruvius, iii.4). Abandoned structures such as pits, ditches, houses or dried wells can accumulate great quantities of refuse as a result of the same rebuilding work. For instance, Nijmegen also provides evidence of a square pit in which were a good number of Dressel 2-4 amphorae. This was first interpreted as a cellar [Bloemers, 1990].

The effect of a town contracting in size can also be documented on the basis of debris dumps. The clearest evidence provided by refuse deposits in public areas where they do not seem to be related to a rebuilding policy. The Circus of Carthage includes an amphora assemblage in a dump of late material [Humphrey, 1981; Fulford and Peacock, 1984]. This is also the case with the Forum of Tarraco, dated to the late fifth century A.D. [TEDA, 1989]. Both refuse deposits outlined the changes undergone by these two cities in the late centuries of the Roman Empire. Dumping inside cities seems to have been a common practice in the Late Empire, and a clear sign of an extensive economic and social crisis evident elsewhere in Britain as well, or perhaps this practice may indicate changes in the perception of how local life should be [Barral, 1978].

> ***"...the standards and organization of the disposal of refuse had changed; instead of being taken out of town it was dumped on vacant ground or unused streets near the remaining dwelling" [P.Ottaway, 1992, p.111]***

As has been already mentioned, there are some intramural waste deposits in supposedly unoccupied or industrial areas. The latter are normally identified by their primary refuse (i.e bone crafts, metallurgy) (e.g. Alesia, Volubilis, Clermont-Ferrand) [Mangin, 1981; Jodin, 1987; Sanget and Pin, 1990], but they could include other materials. In river and coastal towns, the waterfronts were not inhabited by high densities of the population. On the contrary, these zones were preserved for warehouses, port installations and communal refuse deposits. Vitruvius (v.13) describes how an ideal harbour should be built and the materials that should be employed to set strong foundations and walls. Humidity seems to have been one of the reasons for their rejection as habitation areas, as well as the unhealthy conditions encountered in riverside zones (Vitruvius i.4).

Therefore, amphora deposits in waterfront zones played a double role. On the one hand, these locations were the most suitable for amphorae refuse after their life as containers was over because those areas were unoccupied. On the other hand, amphora mounds could provide protection from floods and also humidity since ceramic is a perfect insulating material [Laubenheimer, 1991]. The evidence from Sabratha [Kenrick, 1986, 243], Valentia [Fernández Izquierdo, 1984, 99], Marsala [Wilson, 1990, 169], Mt.Testaccio [Le Gall, 1953; Rodríguez Almeida, 1984], Cosa [McCann, 1987, 139] and Fos [Liou and Scilliano, 1989] suggest that one or both of these explanations could apply to the location of the waterfront amphora dumps.

Conclusions

Amphora distributions at site level can provide an excellent source of information providing that the nature of their disposal can be ascertained. Apart from a possible reuse of these vessels, which may explain the reasons why they were found at a particular location. An examination of the Roman patterns of waste disposal can reveal the logic of the distribution of dumping sites. The literary and archaeological evidence indicates communal practices of rubbish disposal which determine secondary refuse areas in deserted parts of a town. These deserted parts are normally on the outskirts or in the countryside, though town boundaries could be subject to modifications during different periods. With regard to intramural rubbish deposits, such areas may correspond to the early limits of a settlement, or represent unoccupied areas (e.g. waterfronts) or abandoned habitations. The three case studies have provided an excellent example of how amphora assemblages within a town can be interpreted. The pattern that has emerged relates to the dumping of rubbish on the outskirts of towns, rubbish tips which were moved to different locations with the growth of the community. Moreover, they attested to the use of amphora in secondary functions such as building material for intramural constructions, for example.

4.6 The evolution of towns: the Dressel 20 stamps as economic indicators

A completely different picture of local life can be inferred from the dating of amphora stamps. Changes in amphora imports do not only reflect regional economic variability but also particular developments at a microspatial level. At local level, the amphora stamps combined with other archaelogical objects and literary sources can indicate the evolution of a community in economic terms. Accepting that some of the answers sought become apparent only at a higher level, yet local analysis can supply useful data for establishing common patterns between towns as well as contrasts or parallels between two or more individual communities. With this in mind, the aim of this section is to relate the information obtained from the Dressel 20 stamps to the other parts of a town´s economic life: its market, degree of monetization and mechanism of exchange.

Although the difficulties of using Dressel 20 stamps for quantifications have already been indicated elsewhere (see chapter 2), the present section refers to the proportions of stamps standarized by number of years per period (stamps period/ overall number of stamps x 100 x correction of years per period) using this as an economic unit of measure. For practical reasons, five chronological periods have been defined:

1. Claudius-Nero	[Clau-Nero]	A.D.42-68
2. Vespasian-Trajan	[Flav-Traj]	A.D.68-117
3. Hadrian-Antonine	[Hadr-Anto]	A.D.117-160
4. M.Aurelius-Commodus	[Aure-Comm]	A.D.160-192
5. Sep.Severus-Galienus	[Sev-Galie]	A.D.192-259

The results obtained from the Dressel 20 amphora stamps have been combined with the ones obtained from coins [Reece, 1991] and samian ware stamps [Marsh, 1981]. In this way, three independent archaeological artifacts could mirror a town´s economic life providing three different perspectives [Riedel, 1979; Going, 1991]. However, each archaeological object presents its own limitations and problems that must be borne in mind whenever comparisons are made. With reference to samian ware stamps, it should be noted that while they constitute a portion of the table ware in use, they do not necessarily identify the local economic life but rather changes in production centres [Stanfield and Simpson, 1958; Vernhet, 1975]. Marsh [1981] concluded after a thorough survey of the samian ware supply to Britain and the Continent, that consumer demand did not much affect the volume of pottery imported.

> *"The consumer, whether civilian or military, seems to have had little control over supplies, except perhaps in the Augustan period, and all alike were exposed to shortages in the early second century and again at the end of the century."*
> *[G.Marsh, 1981, p.212]*

Coins are complex economic indicators [Casey, 1974; 1980; Reece, 1984a] since they could still be found in use one century after their date of issue (i.e. Cabrera III shipwreck, Carthage) [Fulford and Peacock, 1984; Bost et alii, 1992]. The number of coins recovered from excavations constitutes a very small sample of the overall number in circulation at each site. Thus their representativeness can always be put in doubt [Casey, 1974]. Moreover, the two metals used for coins (AE and AR) appear to have been used in different contexts and monetary circuits, hence it may not be appropriate to add coins made from both metals in this case.

Other problems relate to their nominal and intrinsic value as well as the fluctuations in the issue and supply of coins in each reign since they could also prejudice the economic inference [Casey, 1974; Reece, 1984a, 199; 1987], although the periods chosen do in fact show relative stability in this respect[11]. Despite these difficulties, the number of individual coins have been totalled here for each period regardless of the metal or the coins' value. It is believed that this

[11] This theoretical stability is contradicted by the silver metrology [Bolin, 1958; Walker, 1976; 1977; 1978], a monetary reform by Nero [Kunisz, 1978; MacDowall, 1979; Lo Cascio, 1981] and a second reform by Caracalla leading to the third century crisis [Callu, 1979; Corbier, 1986; Lo Cascio, 1986].

simple quantification can provide a general picture of money circulation at each site.

Sixteen case studies have been included for individual analysis, each representing a Romano-British site. From this, we will also be able to observe if comparisons can be made between the three archaeological artifacts (see appendix 3.B and fig.1-9). In the present analysis, Dressel 20 stamps constitute the central economic indicator whereas the two other objects, coins and samian ware, are referred to as complements. As already stated, economic inferences based on amphorae presuppose the consumption of their content on the spot, since any transfer of contents to other vessels would completely alter the picture.

4.6.1 Coins, samian and Dressel 20 stamps: the evidence from Verulamium, Chester, Richborough and London

Verulamium represents a good example of how the proportions of coins, samian ware and Dressel 20 stamps seem to correspond in each period (appendix 3, fig.1). The main differences appear during the early stage, the Julio-Claudian era, when the Dressel 20 supply was rather low. This is also the case in the period of Severus-Gallienus when samian imports decreased sharply. The second case is explained by the fact that the East Gaulish potters never matched the volume of production of the Central and Southern centres [Marsh, 1981, 210]. In general, the evidence from Verulamium suggests steady development in the town´s economic life from the early Iron Age [Frere, 1983] reaching its height in the Antonine period and undergoing a decline in activity afterwards. This outline roughly fits into the chronological framework defined by the urban structures [Frere, 1972; 1973; 1983; 1984; Wacher, 1974; Todd, 1989b].

Similar correspondences are attained at Chester, though there are slight variations in samian ware and Dressel 20 supply (appendix 3, fig.1). The Flavian-Trajanic period records a high proportion of Dressel 20 stamps when the whole legio XX Valeria was established in the town. These proportions decreased sharply in the following periods, which shows an identical relation with the evolutionary picture attested to by the supply of money. Nevertheless, samian ware imports reached high percentages from the reigns of Hadrian to Commodus, in contrast to the pattern observed in the third century in Verulamium.

The third case reproduces the pattern of a military depot of Richborough, which had a prominent role in the early stages of the Claudian conquest [Frere, 1987, 48-49]. Later the site became the headquarters of the *Classis Britannica* and this lasted until the second half of the second century A.D. when it was moved to Dover [Cleere, 1977; Philp, 1981]. That it was a military

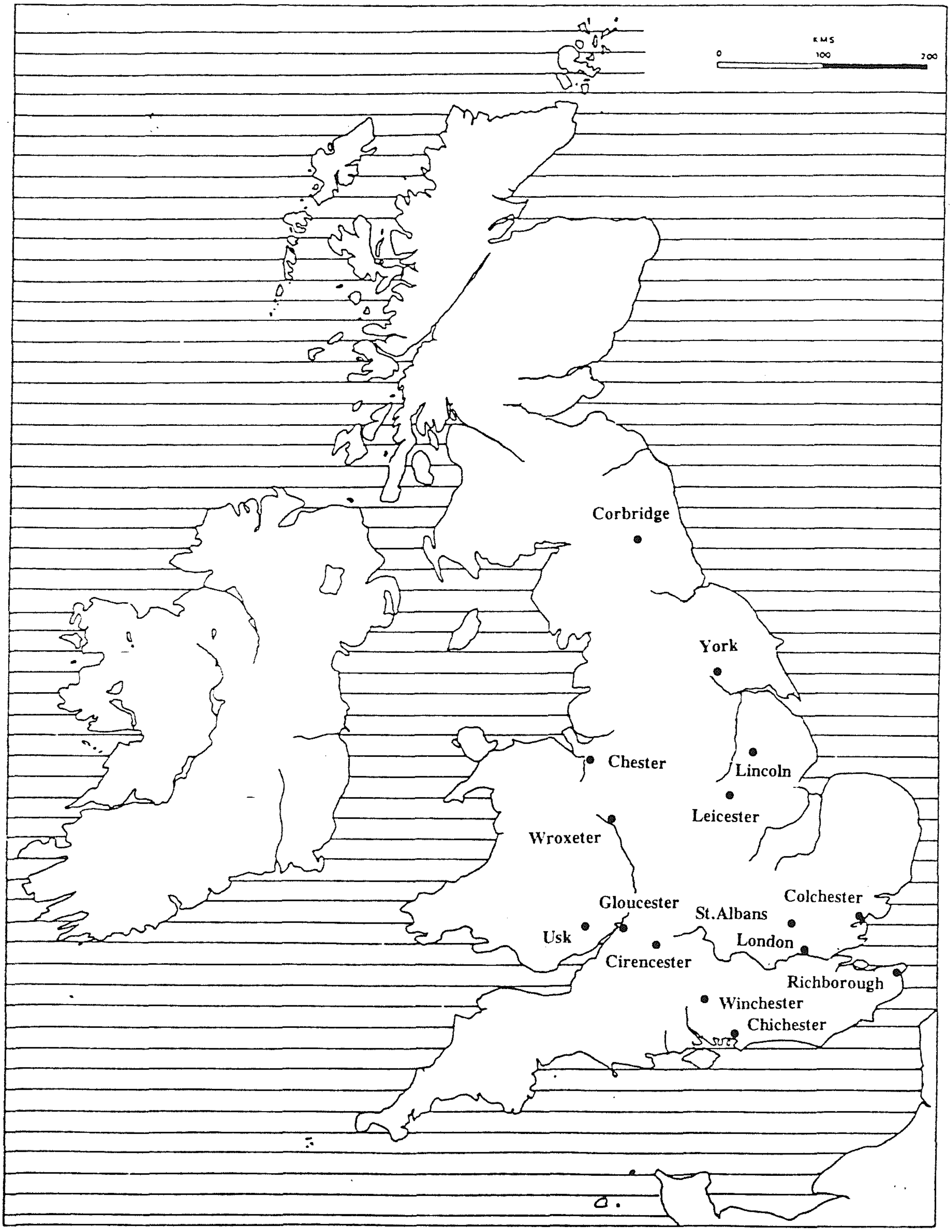

Figure 30 Map of Romano-British sites mentioned in the current section.

depot, is also evident by the high densities of Dressel 20 stamps found there [Carreras, 1994a], but even so not all the contents of documented amphoraeshould have been consumed by the local garrison. These special features bring out the variations in local supply (appendix 3, fig.2). On the one hand, most of the coins can de dated to Julio-Claudian period when the site was occupied by military forces destined to conquest the Isles. These coins were probably still in circulation in later periods, thus they do not seem to represent good indicators of the local economic life or simply reflect payments to troops. On the other hand, samian ware and Dressel 20 stamp proportions seem to be similar and indicate that the site reached its height in the Flavian-Trajanic period when it was the *Classis* headquarters.

The consequent slump in Dressel 20 and samian ware supply in the Hadrianic period coincides with a peak in samian ware imports at Dover, the new headquarters of the *Classis* [Marsh, 1981, 218]. The military nature of this site and the lack of correspondence between coin and pottery proportion suggests that some supplies (e.g. Dressel 20) arrived at the garrison without the involvement of coins as means of payment. In other words, a marketless supply of some goods was in place which did not involve the exchange of money. Therefore there was no reason why the proportion of Dressel 20 stamps should correspond to that of money supply during each period.

The last example is London, another site in which the three archaeological indicators seem to fit the same pattern (appendix 3, fig.2). Despite the expansion of the city in the middle of the second century A.D., the Flavian-Trajanic period documents the highest percentages of Dressel 20 imports. This pattern has already been observed by Marsh [1981, 186] for samian ware which constitutes an example of the contradiction between the level of architectural expansion [Marsden, 1980; Perring, 1985; Todd, 1989b] and that of probable economic development. Moreover, the proportions of Dressel 20 stamps comprise new evidence for the debate about the origins of Roman London [Williams, 1990]. As already mentioned, Dressel 20 amphorae are closely linked to military supply in frontier provinces [Remesal, 1986]. However London has not so far yielded evidence of any fortress earlier than the early second century A.D. (i.e. Cripplegate) [Hassall, 1973] despite the volume of first century Dressel 20 stamps [Funari, 1991]. If the local inhabitants were importing Baetican olive-oil, why did they reduce their consumption later when this product was still available in the rest of Britain?

Among the diverse hypotheses concerning the origins of London, it has been argued that a civilian settlement could not have been feasible without an initial economic trigger [Williams, 1990]. Economic triggers promote the development of geographical areas on the basis of exchange contacts which may require a transport infrastructure, and urban and industrial growth [Traffle et alii, 1963; Dicken and Lloyd, 1991]. The existence of a military supply base comparable to that established at Richborough may provide the motive for the settlement of traders in London [Williams, 1990, 600]. The early site could have consisted of warehouses under military surveillance, the presence of which seems to have been recorded at the periphery of the town, whereas the nucleus of the town would have included native and continental immigrants supplying the army (see chapter 4.3.3). Todd [1990, 80] suggests that the extensive riverside building programme in the Julio-Claudian period could not have been accomplished without official support, paving the way for the establishment of a *conventus civium Romanorum*, a community of Roman citizens.

From the period of the conquest until early Flavian times, the military forces were campaigning inland (i.e. Wales, Central Britain) [Holder, 1982; Frere, 1987]. Therefore, London represented a suitable transhipment point where continental ships could offload their cargoes [Milne, 1985; McGrail, 1987, 167] to be distributed to the armies across inland routes. The town was located in an already pacified zone with neither an early settlement nor a strong military presence, so there was a lack of social restrictions, a situation that could benefit newcomers providing major economic and social opportunities [Williams, 1990].

In this context, Dressel 20 amphorae arrived in London to be consumed by distant armies. Since these vessels were rather heavy for land transportation, their olive-oil may have been transferred to other containers. Thus, according to this hypothesis, most of the olive-oil of earlier date identified from London may not have been consumed by local inhabitants but by Roman troops. This supply structure seems to have been in use since the Claudian reign, though it was developed in the Flavian-Trajanean period (appendix 3, fig.2).

The highest financial office in the province was held by the *procuratores Britannicae*, whose responsibilites involved collecting taxes, supplying and paying the provincial army [Pflaum, 1960]. Before Boudicca´s revolt, A.D.60-61, the *procurator Decianus Catus* administered the province from a place other than Colchester [Frere, 1987, 187], which may have been London. After quelling the rebellion, *C.Iulius Alpinus Classicianus* was appointed as his successor, holding the office at London as documented by an inscription (RIB 12)[12]. The *Procuratores* seemed to play an important, active role in the distribution of Baetican olive-oil to the Army (see chapter 5) [Remesal, 1990]. Their presence at London supports the thesis that a possible supply-depot existed, in early periods.

However, the imports of Dressel 20s decreased sharply from the Hadrian period onwards

[12] The city also attestes a wooden writing tablet stamped by the *procuratores* of the province (Proc.Aug.Brit.Prov.) [Frere, 1987, 187].

as well as the proportions of coins and samian ware. Therefore, the initial function of the city seems to have disappeared, consequently affecting its economic life. If London was a military depot in the early periods, the decrease in the number of Dressel 20 stamps suggests that this function was transferred to another centre (i.e. Corbridge) in the middle of the second century A.D.

The comparison of three archaeological artifacts has allowed an analysis of the economic life of four Romano-British sites. The general picture obtained according to each of them is quite consistent though some discrepancies exist. Further tests were undertaken in order to examine whether these coincidences were simply random or not.

4.6.2 The question of a monetized economy: coins and Dressel 20 stamps

The previous case studies reveal an extraordinary similarity between the results obtained from coins and Dressel 20 stamps. There was a unique exception, regarding the military depot at Richborough. The presence of coins is considered a sign of a monetized economy normally linked to market exchange [Howgego, 1992], whereas Dressel 20 distributions seem to indicate at least two mechanisms of exchange: market and redistribution [Remesal, 1986; Rodríguez-Almeida; 1989; Carreras, 1994a]. Redistribution in this case is related to the army supply, thus variations between proportions of coins and Dressel 20 stamps should be more in evidence at military sites. Ten case studies served to contrast the supply patterns of these two archaeological artifacts.

First of all, Corbridge represents a second example of a military depot located at Hadrian´s wall, with granaries and warehouses[13] [Hanson et alii, 1979; Dore, 1988]. Like Richborough, Corbridge identifies a different kind of supply linking coins and stamps (appendix 2, fig.3). The coins in circulation were rather old compared to the imports of Dressel 20, coins dated earlier than the Agricola foundation (A.D.79) reaching the site. The Flavian-Trajanic period produced the major supply in terms of coins, though the settlement was relatively small [Dore, 1988]. It became an important supply depot with the construction of Hadrian´s wall and kept this predominant role until the third century A.D., as Dressel 20 stamps reveal. The variation between coin and stamp supply can be explained in different ways. On the one hand, the early dating of the coin supply is similar to that of the rest of the Romano-British sites [Reece, 1972; 1973; 1991]. Thus this coins do not reflect the local economic life. On the other hand, Dressel 20s may have arrived through a redistributive mechanism so they may simply reflect the site life as supply depot.

Wroxeter is another important military settlement with differences in the proportions of coins and stamps (see appendix 3, fig.3). Most of the coinage coincides in date with the

[13] An inscription (RIB 1143) records an officer in charge of the granaries.

establishment of a legionary fortress in this area (i.e. legio XIV Gemina, XX Valeria) [Webster, 1987] that was abandoned in the 90s [Wacher, 1974; Holder, 1982]. However a remarkable scheme of rebuilding is recorded from the period c.90 to 120 A.D., when the city was enlarged to more than twice the size of the earlier site [Todd, 1990, 84]. Nevertheless, the Dressel 20 imports became more frequent from the Hadrian period onwards, which contradicts the idea of a link between this supply and the Roman army. Therefore although the Dressel 20 stamps´ sequence may represent the city's evolution, it does not fit with the coin supply. The lack of evidence for early olive-oil imports can be compared to the high proportions attested to in London in the same period. If this latter site was a supply depot and a break point in the distribution of olive-oil, part of the amphora contents should have been consumed in distant places like Wroxeter. Combining the two sets of data, Dressel 20 stamp proportions become quite logical with regard to the evolution of both urban centres. The presence of a *beneficiarius* at Wroxeter before A.D. 61 (RIB 123), which was an administrative post in the governor´s *officium*, may have been related to the army supply linking London, as the administrative headquarters, with the former settlement.

The last two sites, which indicate some differences between coins and stamps, are Winchester [Biddle, 1975] and Exeter [Bidwell, 1979; Holbrook and Bidwell, 1991]. The variation in Winchester (see appendix 3, fig.4) is limited strictly to the second century A.D. whereas the differences found at Exeter correspond to an early supply of coins in the city coinciding with the military presence up to c.71-74 (see appendix 3, fig. 4).

Nevertheless, in general terms proportions of coins and Dressel 20 stamps correspond in the majority of cases of Romano-British sites studied. For instance, Lincoln (see appendix 3, fig.5) shows common traces in both supplies. This early military fortress abandoned in the mid 70s [Wacher, 1974; Jones, 1980; 1985] imported substantial quantities of Dressel 20 amphorae in the Julio-Claudian period, to which time most of the coins belong. The early economic dynamism of this town seems to have decreased with the transfer of the military detachment (i.e.legio II Aduitrix) to Chester [Holder, 1982] and the establishment of veterans in the new colony [Frere, 1987, 229-255]. However a second peak is recorded from the period of Severus to Galien that may represent an economic revival not only at a local level but also affecting to other nearby cities (i.e.York)[14].

Cirencester reveals stability in the supply of both items (see appendix 3, fig.5), only cahnging in the second half of the second century A.D. [Wacher and McWhirr, 1982; McWhirr,

[14] The majority of Dressel 20 stamps recovered at York (37.89%) can be dated in this period. At that time, the settlement had an active role first as army headquarters of the Severian campaigns and legionary fortress, becoming later capital of the new province of Britannia Superioris and obtaining the title of colonia [Frere, 1987, 171; Millett, 1990a, 131].

1986]. Despite the early presence of an auxiliary force, its departure, recorded as being before the early seventies [Todd, 1990, 86] does not seem to have changed a great deal its economic life. Two other civilian centres, Chichester [Down, 1978] (see appendix 3, fig.6) and Leicester [Clay and Mellor, 1985] (see appendix 3, fig.6), show a different evolution in their respective supplies that demonstrates the existence of different economic conditions being experienced in the same province. For instance, Chichester reports a pattern of Dressel 20 imports close to the one obtained for that of the province as a whole (see appendix 6, fig.1.1) whereas Leicester shows an early peak and then a slump, which may reflect its early military occupation and abandonment [Todd, 1990, 85].

Finally must be considered the function of the army as an economic trigger and the consequences of its disappearance from a site's life [Luttwark, 1976; Keppie, 1984; Webster, 1989]. Even the degree of commercial specialization may have been due to the Army's presence.

> *"The greater degree of specialization in merchandise which the Roman period witnessed was almost certainly tied to military requirements, although it would be foolhardly to deny some spin-off in the civilian sphere also"*
> *[P.Middleton, 1979, p.87]*

This point is substantiated in the case of Gloucester, and the presence of the legio II Augusta (circa A.D.65-75). Moreover, after the army's departure, the town received the tittle of colonia which presupposes the settling of army veterans there (A.D.96-98) [Wacher, 1974; Frere, 1987]. This span of time with the direct or indirect influence of the army over the settlement corresponds to the periods of major economic activity supported by coin and stamp chronologies (see appendix 3, fig.7). A similar picture appears at Colchester (see appendix 3, fig.7). A peak in imports is recorded in Julio-Claudian times, when the legio XX was settled on the outskirts of the indigenous *oppidum* [Crummy, 1984]. Its presence is attested to until A.D.49, the year in which the title of colonia was conferred to the town after a *deductio*, a settlement of retired veterans was established. Both actions should have represented a boost to the local economy as far as the two economic indicators, coins and Dressel 20, reveal which its later evolution never fulfilled. The early economic activities of the town are documented by the extra-mural site at Sheepen [Nibblett, 1985; Todd, 1990] which records metallurgy, pottery making and leather workcrafts.

The comparisons of coins and Dressel 20 stamps have produced a series of interesting results in the present section. First of all, it may be said most of the case studies agree in the proportion of both archaeological artifacts which reflects their suitability as economic indicators. Likewise, the comparisons demonstrate that Roman economy was highly monetized since coins indicate conditions regarding diverse imports (e.g. samian ware and Dressel 20) probably obtained through market exchange mechanisms. Nevertheless, there are exceptions to the rule as in the case of the two military depots of Richborough and Corbridge, whose specific functions denotes a different relationship between coins and Dressel 20 amphorae. Since part of the amphorae contents were not consumed locally but possibly transferred to other containers (e.g. *urceus*), they may not reflect the towns' economic life in these cases. Furthermore, Dressel 20s in military establishments may have arrived through other exchange mechanisms (i.e. State redistributions) [Remesal, 1986; Carreras, 1994a] which did not require the exchange of money in the transactions [Casey, 1974; 1980; Gabba, 1978], at least at the final destinations.

The existence of supply depots and redistributive systems provides an explanation for the varying proportions of Dressel 20 stamps by combining the evidence from more than one site. The special characteristics of Wroxeter and London percentages are excellent examples, which make more sense when integrated[15]. The only two negative matches between coins and stamps with no clear explanation occur at Exeter and Winchester. The results in these two cases recommend a more cautious use of these archaeological objects but nevertheless do not invalidate their potential as economic indicators.

A careful examination of the economic conditions experienced at each Romano-British site through coins and stamps suggests that there was no unique provincial pattern but a myriad of local models. This variability seems to be influenced by the historical events linked to each particular place. Factos such as the establishment of administrative staff or presence/absence of military forces play a part. However, some changes could also be due to the economic performance of each individual settlement in comparison to the rest of the province.

4.6.3 Two ceramic imports: samian ware and Dressel 20

The comparisons of percentages of samian ware and Dressel 20 stamps showed numerous similarities in the first examples (e.g. Verulamium, Chester, Richborough and London). The distribution varied for every case study in the third century when samian ware imports slumped [Fulford, 1977; King, 1981], probably due to the movement of the pottery production centres. This synchronism can always reflect local economic conditions that affect both pottery types in the same way. However, it conflicts with the existence of a redistributive system for Dressel 20 (i.e. Richborough, Corbridge, London), since samian ware should have been exchanged through a market system. In spite of the fact that this coincidence may appear strange, it can shed light on commercial currents, routes and transportation linked to Roman Britain. The distribution maps of Gaulish samian ware [Marsh, 1981; Bémont and Jacobs, 1986] suggest the use of an Atlantic route

[15] Despite the logic of the argument there are no material proofs to support it.

to reach Roman Britain[16]. Similarly, an Atlantic route seems to be the most likely explanation for the volume of Dressel 20 recovered in Germania [Remesal,1986, 78-79] and Britannia (see chapter 6) [Funari, 1991; Carreras, 1994a].

If both ceramic products travelled along the same commercial route, the volume of traffic from Baetica may have favoured the movement of Gaulish goods, notwithstanding the possibility of an independent means of transport for each product as the Pudding-Pan Rock and Vichy shipwrecks reveal[17]. In fact, numerous shipwrecks confirm the presence of fine ware as a possible secondary cargo in vessels loaded with amphorae (e.g. Sant Antioco A, Cortegada, Porto Azurro A) [Parker, 1992a, n.1030, n.340, n.880]. According to the cargo composition of the wrecks recorded by Parker [1992a], 70% of the Gaulish samian ware travelled as secondary freight, while almost all of the African Red Slip cargoes accompanied amphorae.

With regard to compounded cargoes of Dressel 20 and Gaulish samian ware, at least two Mediterranean shipwrecks include both goods (i.e.Port Vendres II, Cala Culip IV) [Colls et alii, 1977; Nieto et alii, 1989]. The fine wares in these two cases were probably collected during a call in Southern Gaul [Nieto, 1988]. Similar practices could have been expected on the Atlantic route, where ships from Southern Spain could call at North-Gaulish ports such as *Portus Brivates*, *Portus Saliocanus* or *Vindana Portus* mentioned by Ptolomeus [Galliou, 1992, 30]. Southern and Central Gaulish products should have reached the Atlantic coast by passing along the waterways (i.e. Loire, Garonne) up to the terminal centres of *Coudevincum* (Nantes) and *Burdigala* (Bourdeaux) [Galliou, 1982b].

Nevertheless, the only possible evidence for this economic circuit emerges from the proportion of Dressel 20 and Gaulish samian ware at the final destinations: the Romano-British sites. The first four examples, especially London, revealed an extraordinary coincidence but there are also some exceptions. For instance, Usk (see appendix 3, fig.8) presents a similar pattern in the Claudius- Nero period though then Dressel 20s are not documented until the second half of the second century A.D. Both peaks of Dressel 20 imports may be related to the presence of legionary forces at the site [Frere, 1987, 168] only attested to from A.D.58-65 and in the late second century A.D. A second anomaly is reported at York (appendix 3, fig.8), where samian ware percentages are quite high in the second half of the second century A.D., whereas those of Dressel 20 are relatively low and the opposite occurs in the third century A.D. In spite of the structural problems

[16] The route would start from any Gaulish port in the Gulf of Biscay [Reddé, 1979; McGrail, 1983; Naveiro, 1991; Naveiro and Pérez Losada, 1992].

[17] Pudding-Pan Rock [Parker, 1992a, n.908] is a wreck in British waters that reports exclusively Terra Sigillata from Lezoux and the Vichy´s river boat [Parker, 1992a, n.1214] was also laden of Terra Sigillata from Central Gaul.

affecting the samian ware industry itself which may explain the variation in the third century, no clear reasons can be found to explain the former difference.

Bearing in mind the limitations of quantifying such a diversity of archaeological objects, the combination of each individual result sheds some light on the economic life of the Romano-British sites studied. Economic evolutionary patterns often cannot be interpreted at site level but require further analysis within the context of the province as a whole.

4.6.4 Conclusions

The chronologies of the Dressel 20 stamps recovered at each Romano-British site have allowed us to establish an economic profile at site level. Comparing these results with the ones obtained from other archaeological objects, a series of matches were recorded that reflect the suitability of these artifacts as economic indicators. Notwithstanding variations in coins supply due to the rapidity of coin circulation [Fisher, 1911], the proportion of these coins normally matched the ones reported for samian ware and Dressel 20. The evidence, though insufficient, suggests the dominant role of a monetary system in economic life. Using coins for everyday exchange [Howgego, 1992] supposes a highly monetized society in which the coinage enjoyed an important role in the exchange probably linked to fluctuations of a market system, while barter was only reserved for a limited number of transactions [Lewis, 1983; Bowman, 1986; Greene, 1986, 50].

Nevertheless, three special cases (i.e. Richborough, Corbridge, Wroxeter) demonstrated that there were also differences between Dressel 20 stamps and coins proportions. These settlements are considered to have been part of a redistributive network of military supply [Holder, 1982] in which the olive-oil contained in the Dressel 20 amphorae was involved [Remesal, 1986; Funari, 1991; Carreras, 1991; 1994a]. A public redistributive network does not imply the physical use of money at each link point in the chain [Lo Cascio, 1981]. Thus, a greater degree of activity in this network, illustrated by the increased number of Dressel 20 stamps at a site, did not therefore require a great supply of cash. This is another difference between a redistributive and a market exchange system [Polanyi, 1957c; Neale, 1957]. Testimonies of Roman Egypt recorded how the military administration farmed taxes in kind, requisition transport sometimes without payment and stored goods (Select Papyri 211; 221; P.Lond. 1171; ILS 214; SB 4226; OGIS 609; P.Flor 278; P.Amph. 107; P.Greuf.i.48; P.Gen. 35; O.Stracs.445.6] [Lewis, 1983; Davies, 1988]. However there is no mention at any stage of payment in cash on the spot.

A military redistributive system results rather appropriately points to the proportions of Dressel 20 stamps in early periods at two sites: Wroxeter and London. The lack of early evidence at Wroxeter, occupied at that time by a legion, contrasts with the high percentages of amphorae finds in London. This second site may have been a transhipment point at which the olive-oil was transferred from amphorae to other containers, being finally consumed in military fortresses such as Wroxeter. This hypothesis also goes some way to explain the low level of samian ware supply in London [Marsh, 1981].

With reference to the relationship between Dressel 20 and the samian ware supply, with the only exception of the third century, both distributions patterns are rather similar. Although these two goods were produced at different centres, the coincidence in proportions found at the Romano-British sites casts doubt on the possible independence of their supply. The coincidence may be the result of a local economic evolution, which is documented by evidence of the consumption of both goods. However, an alternative explanation could point to a common import route, the Atlantic itinerary, and the compound structure of ship cargoes comprising both Dressel 20s and samian ware. This is, however, an interpretation that lacks solid archaeological documentation as yet.

Furthermore, the analysis of some Romano-British sites carried out separately demonstrate that each individual settlement underwent its own economic evolution. Only a few common traits were found to apply to more than one town, and these may have related to greater geographical areas such as regions, provinces or the whole Empire. Therefore, the economic long waves[18] proposed by Going [1991] to explain increases and decreases in ceramic supply cannot be generalised to the province as a whole. There are a myriad of manifestations at local level that do not fit into the economic cyclical phases identified for the province.

Finally, this section outlines the suitability of coins, samian ware and Dressel 20 stamps as economic indicators at site level preferably considered in combination with each other. Economic developments, which can also be followed through the process of urbanization, architectural changes and in other archaeological finds, complement the picture of Roman towns.

[18] The theory put forward by Kondratiev [1925] attempted to explain the cyclical crisis of the capitalist system characterised by upturns followed by downturns almost every 25 years [Marshall, 1987; Dicken and Lloyd, 1990].

5. AMPHORA DISTRIBUTION AT PROVINCIAL LEVEL

5.1 Introduction

Amphora distributions at site level provide limited information about the local economy and its organization. However, amphorae constitute valuable economic indicators when studied on a larger scale, or at macro-spatial level [Clarke, 1977, 13-15]. This latter term refers to spatial analyses that include details of more than one site (e.g. region, province). These analyses can yield information about economic and geographical structures [Haggett, 1965; Dicken and Lloyd, 1990]. Economic and geographical models for Roman Britain have already been introduced with the aim of showing the relationship between sites and archaeological distributions [Hodder and Orton, 1976]. The present chapter will reconsider some of the models and economic questions in the light of amphorae distributions at provincial level.

The amphorae recovered in Roman Britain permit a link to be established between this most Northern province and the main routes used in long-distance exchange. Moreover, the study of amphorae distribution within the province should shed some light on the province's internal economic organization and show how it was connected to the outside world. In principle, a common pattern for all amphora types could be expected which would identify the basic economic framework of Roman Britain. Nevertheless, variability could also be present in terms of the different commodities transported, the datings and patterns of content consumption. All these perspectives are integrated in the discussion of the present chapter. On the one hand, common features of all amphora distributions may represent key elements in the internal economic structure. On the other hand, diversity in patterns may point to economic or non-economic irregularities that constitute another source of information in themselves.

Macrospatial analyses in Archaeology have often been applied to theoretical models, chiefly developed in Geographical and Biological studies [Hodder and Orton, 1976; Clarke, 1977], to discover regularities in ancient societies. However, models may bias the results, by providing their own rigid framework for archaeological observations [Clarke, 1968, 26-29]. The application of such models to Roman Britain in the past [Hodder and Hassall, 1971; Dicks, 1972; Fulford and Hodder, 1974; Hodder, 1974a] has produced a picture that may not correspond to the Roman reality. Thus, the empirical observations of the current thesis represent an alternative viewpoint to such models.

The distribution of amphora densities may provide only a partial picture of the economic framework, but at least it establishes complementary evidence. With this aim, a study of the amphora sample is proposed as a means of providing a mirror on the economic life of Roman Britain as a whole.

5.2 The economic structure of the province

Long-distance exchange constituted a significant part of the economic life of Roman Britain. Notwithstanding the fact that it is difficult to determine the importance of the archaeological testimonies in assessing the local economy [Fulford, 1984], they are nevertheless relatively rich. The passage of goods from distant provinces through a commercial network ending at a Romano-British settlement, involved a complex system organized at different levels. The exchange network consisted of at least two parts: an external chain conveying goods up to the province and an internal one, distributing goods according to demand, profit and costs within it. Only the internal circulation can be studied on the basis of the amphora quantification in the province and this study is the purpose of the present chapter.

5.2.1 Internal transport infrastructure

Since Britain is an island, any merchandise coming from any other Roman province at that time should have arrived by ship. Therefore, the initial point of arrival would have been any local harbour with the minimum facilities for offloading cargoes such as amphorae as well as for storing and distributing them [Meneghini, 1984; Meiggs, 1960]. Little is known about harbour installations in Roman Britain [Fryer, 1973; Cleere, 1978; Milne and Hobley, 1981; McGrail, 1990], despite recent discoveries of wharves at London [Milne, 1985; Dyson, 1986]. However, it is commonly accepted that forty five possible ports existed (see figure 31) [Cleere, 1978, 36][1], although only a few inconclusive archaeological remains are documented [Fryer, 1973; Milne and Hobley, 1981]. Some of the potential harbours would have been located on tidal rivers (e.g. Caerhun, Caernarvon, Neath) or navigable waterways (e.g. Brough-on-Humber, York, Lincoln, London) [Cleere, 1978; Jones and Mattingly, 1990, map 6:19]. The requirements of a harbour for dealing with long-distance traffic were deep waters for merchant ships such as *naves onerariae* [Ericson, 1984][2],

[1] Wallsend-South Shields, Scarborough, Filey, York, Brough-on-Humber, Winteringham, Lincoln, Brancaster, Caistor-by-Yarmouth, Burgh Castle, Colchester-Fingringhoe, Bradwell, London, Rochester, Reculver, Richborough, Dover, Lympne, Hastings, Pevensey, Chichester-Fishbourne, Portchester, Bitterne, Hamworthy, Radipole, Exeter-Topsham, Sea Mills, Gloucester, Caerwent, Caerleon, Cardiff, Neath, Carmarthen, Pennal, Caernarvon, Caerhun, Chester, Wilderspool, Ribchester, Lancaster, Ravenglass, Moresby, Maryport, Beckfoot and Bowness.

[2] *Naves onerariae* laden with amphorae are documented not only by the major part of shipwrecks [Parker, 1992] but also by numerous mosaics [Blázquez et alii, 1991] and other representations [Ericson, 1984].

anchoring areas protected from storms, and offloading and storing facilities (e.g. lighters, crates, warehouses, staff) [Milne, 1985; Oleson, 1989]. Furthermore, these large ports should have accomodated potential buyers for the incoming cargoes, crews, areas for ship repairs, provisions, money changers (i.e. *coactores*, *argentarii*) [Palmer, 1980; Houston, 1980] and even temples [Karmar, 1985]. Besides this, interprovincial exchange generally incurred taxes (i.e. *portoria*)[3] [De Laet, 1949] which may have obliged ships to be directed to specific ports with an administrative infrastructure (i.e. *statios*) [Houston, 1980; Palmer, 1980; De Salvo, 1992, 50].

These conditions could only be satisfied by a few Roman ports, of which Alexandria, Caesarea, Carthage and Ostia stood out in the Mediterranean[4]. The position of other ports as hubs of communications on principal river or roads could also explain their preference for accepting long-distance traffic, as was the case of Narbonne, Massalia and Arelate [Rickman, 1985; De Salvo, 1992, 41]. In Roman Britain, only a few settlements with suitable facilities could accommodate sea-going ships. The London waterfront has recently been excavated extensively disclosing structures of a jetty, warehouses and a bridge [Milne, 1985; Dyson, 1986]. Milne [1985, 98; 1990] suggested that sea-going ships may have gone upstream, anchoring in mid-river because of the shallow waters instead of docking. Once there, lighters may have been used to offload and carry cargoes to the port installations.

The port of London is the best known establishment of this kind in the province and probably the most important [Milne, 1985]. Other possible primary harbours with slight archaeological evidence to suggest this function are Exeter-Topsham, Chester, Bowness, Wallsend-South Shields, Gloucester, York, Lincoln, Colchester-Fingringhoe and Chichester-Fishbourne [Fryers, 1973; Milne and Hobley, 1981]. Apart from these sites, three important centres (i.e. Richborough, Lympne and Dover) were connected with the Roman Navy, the *Classis Britannica* [Cleere, 1977; 1978]. Richborough was the fleet headquarters from the first century until the second half of the second century A.D. [Cunliffe, 1968; Cleere, 1978], whereas Dover subsequently became the new headquarters [Philp, 1977]. Nevertheless the military character of these three harbours may have limited their reception of traffic which was basically directed towards supplying the army.

> ***"... the fleet would appear to have carried out primarily a support role, supplying and servicing the army units in the military zone of the north and west..."***
> ***[H.Cleere, 1978, 19]***

[3] Goods such as wine or oil were taxed by counting the handles (i.e. *ansarium*) [Palmer, 1980].

[4] Ancient sources described these harbour installations in great detail, which complements the limited documentation obtained by their excavations. For instance, there are references to Carthage (Appian, Punic Wars 96), Alexandria (Strabo, xvii.1.6-9), Caesarea (Flavius Josephus, BJ i.408-413) and Ostia (Cassius Dio lx.1-5; Pliny Letters vi.31.15-17; Properce i.14-1-4).

None of these ports provide any clear evidence of the presence of administrative offices responsible for duties (i.e. *portoria*), though inscriptions made by military and administrative personnel are recorded [Birley, 1979]. *Beneficiarii* and *stratores* were the members of the governor´s staff (i.e. *officium*) in charge of collecting duties and ensuring communications. However, their inscriptions in Roman Britain are chiefly documented inland (i.e. Catterick, Housesteads, Irchester, Great Bridge, Vindolanda) with the exceptions of the coastal settlement at Dorchester and Dover [Holder, 1982].

Once the goods imported in amphorae reached the province, they had to be distributed according to demand. The internal circulation of products was normally constrained by aspects of the transport network [Carreras, 1994a]. These constraints were related to the type of infrastructure existing and the means of transport, as well as the time and cost involved [Duncan-Jones, 1974; Carreras, 1994a]. Therefore, transportation was one of the key issues in the internal economic structure of the province. As far as amphorae were concerned, they were unsuitable for transportation by land due to their weight. Consequently, contents may have occasionally been transferred to other lighter containers [Tchernia, 1986a, 85-87]. Such an operation should have left archaeological traces such as the presence of high amphora densities in the ports of arrival. Hence, primary harbours in Britain are expected to provide evidence of their role by the presence of higher concentrations of amphorae among other things.

Waterways were the most likely routes of internal communication because of the speed at transportation they allowed and the proportionally lower costs [Carreras, 1994a]. As well as the navigation of the river Thames evident in the activities of the port of London and the recovery of two vessels, County Hall and Blackfriars I [Marsden, 1965; 1967], other rivers were also suitable for navigation upstream. The axes of water transport in Roman Britain were defined by the rivers Severn, Humber-Ouse, Humber-Trent and to a lesser extent by the rivers Tyne, Clyde and Forth at the Northern frontiers [Jones and Mattingly, 1990, map 6:19]. In fact, some of the possible primary harbours such as Gloucester, Chester, York or Lincoln were located in the accesses of watercourses [Fryers, 1973]. The predominance of the river system as a medium for transportation was stressed, though overstated, by Selkirk [1983] with his proposal of the Piercebridge formula for the military zone, but this has recently been revised [Anderson, 1992].

Land transportation was probably the main method for the inland circulation of goods as testimonies of the complex road layout of the province suggest [Peel, 1971; Margary, 1973]. The hierarchy of roads in the layout was analysed according to the number of connections by Dicks [1972]. The results indicated that London was the real hub of communications in the province, and the main arteries of the system were the Northern route (i.e. London-Lincoln-York) and Watling

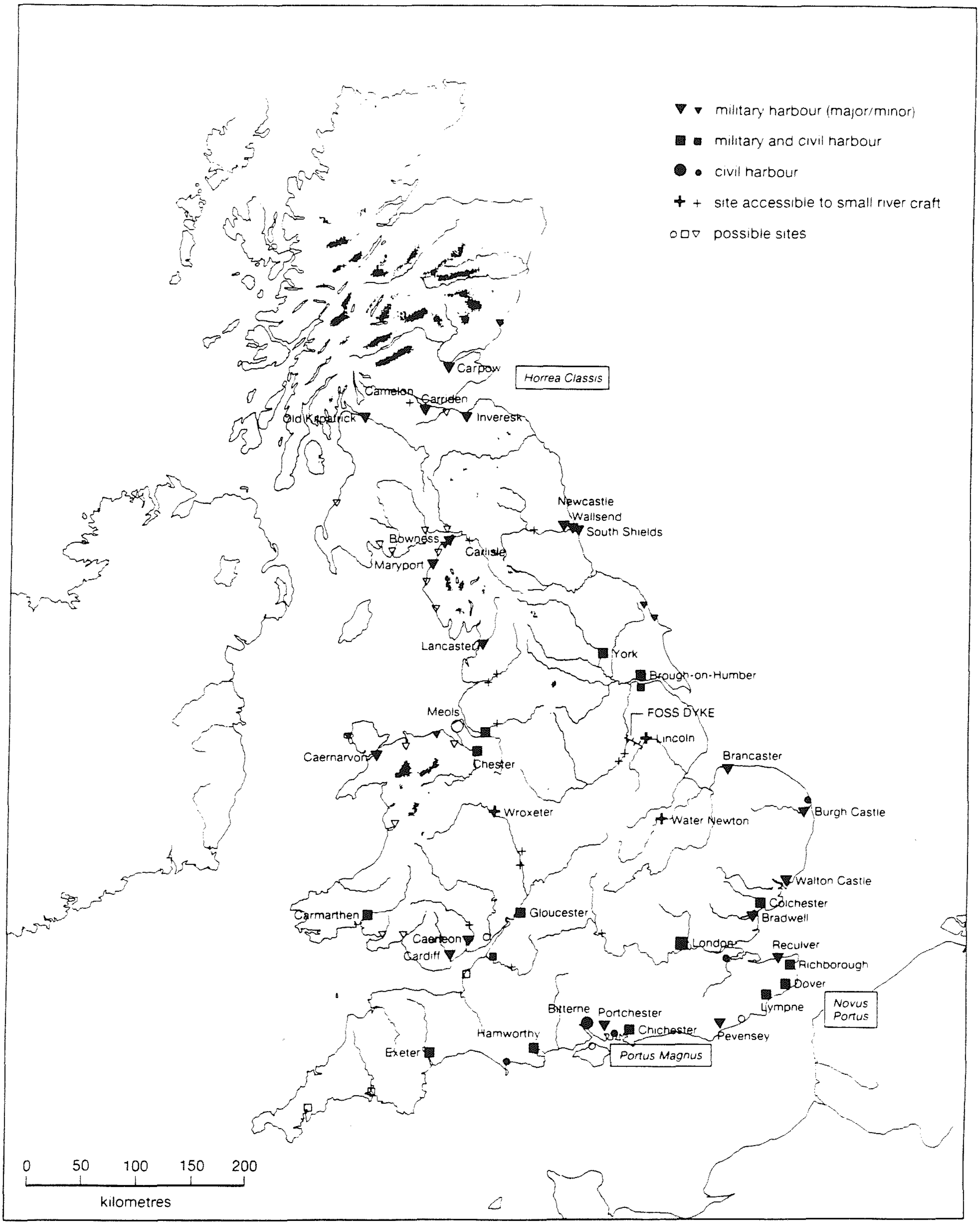

Figure 31 Distribution of harbours (after Jones and Mattingly, 1990, map 6:19).

Street (i.e. London-St.Albans-Wroxeter-Chester).

Although the transport infrastructure permitted the movement of goods across the province, the amount of time involved may have restrained this flow [Sartorio, 1988]. Each means of transport had a speed limitation attached, which affected the way in which was used to some extent. Classical references and ethnographic records [Anderson, 1992; Carreras, 1994a] present an appropiate framework within which to compare the performance of different means of transport in antiquity. This appears summarized in the table below.

Table 15

TRANSPORT	Conditions	Miles / hour	Km / hour
Pack animals	Plain	2.08	3.34
Pack animals	Relief	1.65	2.65
Waggons	Plain	1.00	1.60
Waggons	Relief	0.25	0.40
River barges	Dowstream	1.56	2.51
River barges	Upstream	0.39	0.62
Coastal-shipping	Normal	2.30	3.70

The final but no less influential condition related to transportation is that of cost. The cost coefficient for each mode of transport limited the movement of goods since the need to maximize profits in transactions may have necessitated the cutting of tranportation costs [Carreras, 1994a][5]. This factor completely alters the likely patterns of distribution in interior zones, because land transportation incurred overhead charges [Sartorio, 1988]. The coefficients obtained from Diocletian´s Price Edict show ratios of usage with regard different modes of transport and how the above fact could affect the final selection of transportation means (seagoing ship 1: river barge -downstream- 3.4: river barge -upstream- 6.8: pack animals 43.4: waggons 50.72) (see chapter 6.5.3).

So far, the principal structural variables affecting the distribution of imports in the civilian zone have been introduced. Nevertheless, areas under military surveillance lacked an economic

[5] Numerous studies on trasport costs in Roman items have been undertaken in the past. They were based on the transport fees recorded in the Diocletian´s Price Edict [Jones, 1974; Duncan-Jones, 1974; Künnow, 1980; Deman, 1987; Anderson, 1992].

logic [Bradley, 1971, 350], since distributions were influenced rather by the internal organization of the Roman army [Whittaker, 1989; Anderson, 1992]. Some commodities carried in amphorae had the military camps as their main destinations [Davies, 1971], thus their final distribution was in part dictated by military administration. Moreover, military supplies could have reached the province as result of specific mechanisms of exchange [van Berchem, 1937; Remesal, 1986; Whittaker, 1989]. Consequently, amphora distributions in Roman Britain present distinct patterns reflecting both differences in the types of exchange and the administration of the distribution.

The Mediterranean imports intended for the Army may have initally reached the fleet headquarters, Richborough[6] and later Dover, from which points they were delivered to military outposts [Middleton, 1979, 95]. Also the constraints imposed by transport costs had no meaning in the military domain since the *Classis Britannica* appear to have been responsible for the distribution of commodities. Detachments of the British fleet are documented at the Northern frontiers as an inscription at Benwell (RIB 1340), dated in A.D. 125, manifests. However, the imports could also have been directly offloaded at other ports with a military character such as Exeter, Chester, Bowness, York, Chichester, Gloucester or London [Anderson, 1992; Jones and Mattingly, 1990, map 6:19]. For instance, a reference to the military pilot (i.e. *gubernator*) of a river boat has been found at York (RIB 653), Marcus Minucius Andens, who was probably transporting goods up and down the rivers Ouse and Humber. There are other testimonies of the use of these ports such as those provided by an altar at Bowness-on-Solway (RIB 2059), and dedications to Neptune and Oceanus in Newcastle by soldiers of the VI Legio (RIB 1319; 1320) or an inscription from a shipper (i.e. *moritex*) at York [Birley, 1979; Anderson, 1992].

Once the merchandise was landed at any of these ports, the army was the main body responsible for facilitating its passage to final or temporary destinations (i.e. military depots) (Vegetius Ep.Res.Mil. iii.8) [Gentry, 1976] via waterways and for roads. Selkirk [1983] suggested that military supplies were carried out mainly by river with the aid of dams and canals for part of the journey involving upstream navigation. This hypothesis known as the Piercebridge formula is supported by the location on rivers of both Hadrian and Antonine walls, though it has been refuted by Anderson [1992] on the basis of numerous military documents relating to the preference for land transportation[7].

Actually, the preference for either means of transportation would hardly have affected the

---

[6] Richborough was also the starting point of the Antonine Itinerary and a synonimus of Britain for some ancient writers (Lucan vi.67; Juvenal iv.141; Ausonius Par.9.20) [Collingwood, 1937].

[7] Numerous writing tablets from Vindolanda (Inv.85/103; Inv.85/121; Inv.86/447; Inv.85/51; Inv.88/946) refer to waggons and land transport of military supplies [Bowman and Thomas, 1987; Bowman, Thomas and Adams, 1990].

final distribution of commodities. Only concentrations of troops and the presence of strategic points at the location of military depots [Gentry, 1976; Gudea, 1979] could have affected the supply of provisions. Agricola (Tac. Agri.22.2) made it compulsory to keep a year´s supply in reserve at each fort, though additional supplies could have been left in military depots situated at accessible points in the rearguard [Johnson, 1989; Salway, 1965; Breeze, 1984; Breeze and Dobson, 1987; Breeze, 1982][8]. Similar arrangements can be detected in the structure of other Roman frontiers such as at Pannonia [Mocsy, 1974], Noricum [Alföldy, 1974] or Germania [Schönberger, 1969]. This seems to point to a recognizable common policy [Luttwak, 1976, 117; Millar, 1982]. The whole system appears represented iconographically, on Trajan´s column where the conveyance of supplies during the Dacian campaigns is depicted [Richmond, 1935].

Installations recorded at Benwell, Corbridge, Housesteads, South Shields or Birdoswald have been interpreted as granaries or supply depots [Gentry, 1976] with greater capacity than those needed solely for local consumption[9]. Moreover, accessible forts located at main crossroads (i.e. Corbridge, Carlisle) may have contained the best concentrated facilities for accommodating central depots. These special establishments were likely to accumulate a great number of amphorae due to their representing points for the possible transfer of contents to other containers, hence higher densities of amphorae are expected at such places. A further point is that the presence of the military frontier hampered the movement of goods northwards, outside the Empire, so that the presence or absence of amphorae reflected more the political situation than the influence of economic constraints [Dobson, 1986].

The whole military network through which commodities travelled to distant outposts of the frontier was used for other activities such as to provide safeguard for minerals from some Romano-British mines (see figure 84) [Holder, 1982, 95]. For instance, the *Classis Britannica* held direct control of the iron mining in the Weald [Cleere, 1977], whereas silver mines were under the direct surveillance of military detachments (i.e. Charterhouse-on-Mendip, Shropshire, Halkyn Mountain, Brough-on-Noe, Alston Moor) [Holder, 1982, 95].

Aspects of the economic framework of the province discussed so far should reflect a distinctive emerging pattern of amphorae distribution summarised in the following diagram (figure 34). Nevertheless, a unique pattern is not expected since different mechanisms of exchange and sociocultural behavioural practices may mirror exceptional cases. The economic structure identified

---

[8] The strategic importance given to military supply is stressed by different Emperors such as Hadrian (HA Hadr.11.1) or Severus Alexandre (HA Ale.Sev.15.5; 44.2), and also recomended by Vegetius (Ep.Res.Mil. iii.3; iii.26; iv.7).

[9] Other examples are attested at Inchtuthill and Carpow, which were temporary military depots in the campaigns of Agricola and Septimius Severus respectively [Pitts and St.Josephs, 1985; Wright, 1985]. Likewise Corbridge fulfilled this temporary function during the Severian campaigns as it is documented (RIB 1143).

can be thoroughly contrasted with the empirical evidence of the amphora sample analysed in the current thesis, which appears in detail in the following section.

5.2.2 The population: a magnet for trade

Although transportation constrained the range and volume of goods in circulation, it was not the only variable altering the pattern of distribution. Products such as those contained in amphorae were directed to people who were irregularly settled in the province [Millett, 1990, 181-185]. High densities of population such those recorded in the South of Britain[10] or the presence of large urban centres [Parkin, 1992] would have had the effect of diverting trade towards specific locations. Amphora densities to some extent, neutralize the population effect, since they indicate level of consumption per area, and this can point to level of consumption per person. Nevertheless, high densities of population have some influence on quantities of goods arriving. In other words, even assuming equal demand and available transportation facilities, areas of higher populations should attract more commodities per inhabitant.

This phenomena is also known as population potential [Dickens and Lloyd, 1990, 182]. It can be expressed in economic terms as market potential [Harris, 1954]. A measurement calculated using the algorithm below, estimates spatial patterns of demand in absolute terms.

$$MP_i = \sum_{j=1}^{n} \frac{M_j}{d_{ij}}$$

MP_i : market potential at i

M_j : size of market at j measured in terms of retail sales.

d_{ij}: distance between i and j based on estimated transportation costs.

In the case of Roman Britain, high densities of population ocurring in the Southeast may have acted as magnets for exchange, since potential traders expected to sell all their merchandise there at once. The attraction increased in the case of long-distance exchange as traders tried to avoid long stays in distant places. The *Periplus Maris Erythraei* [Casson, 1989] records numerous stops on the route to India where exchange took place relatively quickly in large ports (e.g. Adulis, Barygaza, Muziris). The preference for highly populated areas, despite the competition involved or even the higher transportation costs, stemmed from the principle of the smaller number of risks involved in selling, and this practice is attested to generally in all societies [Curtin, 1984].

[10] Comparative data obtained from intensive field surveys [Millet, 1990a, 184].

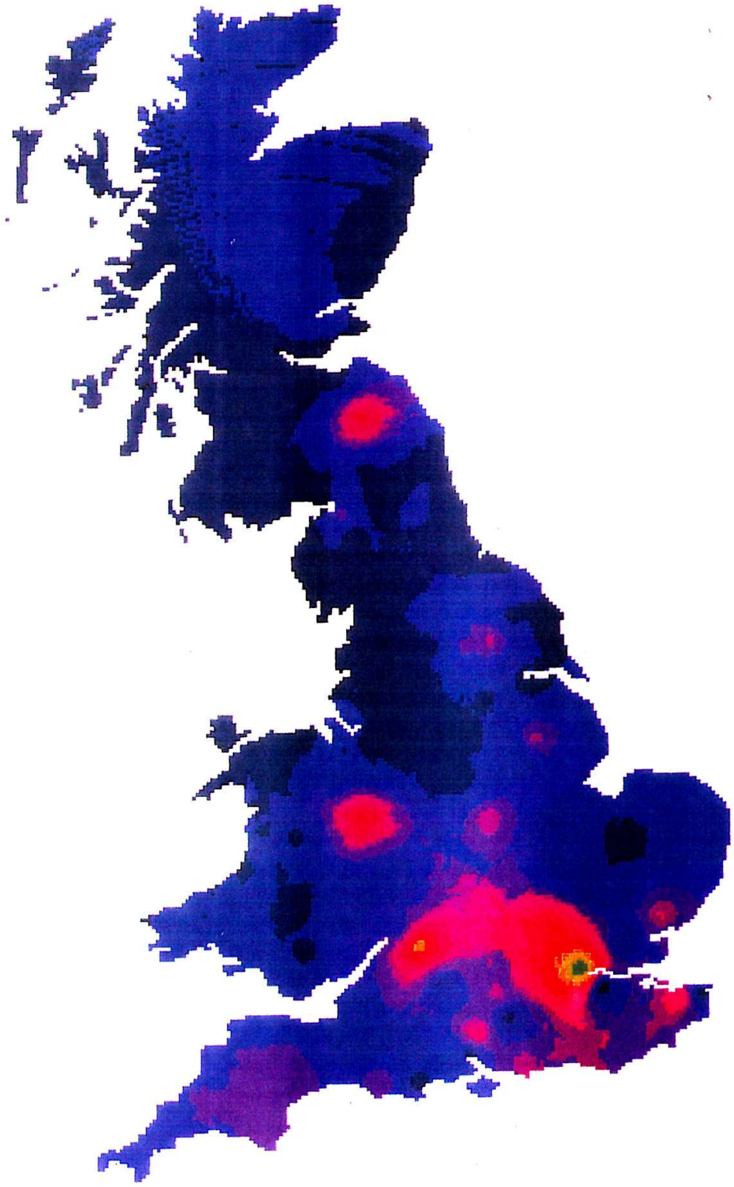

Figure 32 Distribution of population in Roman Britain.

Roman Britain concentrated a great part of its population in the Southeastern sector, in both the countryside and in cities such as London, Colchester, St.Albans, Canterbury, Silchester or Winchester [Millett, 1990, 152-153]. A possible distribution model of population in the province is provided by the interpolation map below, based on the sizes of 105 Romano-British settlements, and given an identical area of residence per person [Packer, 1967; Dyson, 1982; De Roche, 1983]. The map supports a major density of population in the SE sector. However, it also identifies two high concentrations in the SW around Exeter and Cirencester. Other minor densities are reported in military zones around Wroxeter, Lincoln, Leicester, York and Newstead. These urban concentrations which exerted some influence on long-distance exchange formed a kind of hierarchy. A hierarchical structure can be defined by relationships between size or population and rank[11] [Haggett, 1965, 132; Cliff and Ord, 1973; Carrera et alii, 1988]. Rank is seen to indicate the importance of a site, in terms of services, so that rank 1 concentrates the majority of them as is the case of a capital city. One of the services involved the provision of an economic market where produts of greater or lesser quality and variety were exchanged according to the site´s rank [Engels, 1990]. Long-distance commodities are normally classified as of average or high quality due to their scarcity, thus they were allocated to higher rank centres.

Hierarchical spatial relationships with regard to the locations of settlements have been studied in detail by Christaller [1933] and Lösch [1954] in what is known as central place theory [Haggett, 1965]. The hierarchy of settlements may not only be related to economic factors, but also to geographical, social, religious and political ones [Berdan, 1989; Plattner, 1989b; 1989c]. The model was applied to ascertain whether there was a regular settlement pattern in Roman Britain [Hodder and Hassall, 1971; Hodder and Orton, 1976, 56-81] and the results were indicative of that. Smaller walled towns were normally found at an average distance of 34.6 Km from one another, whereas major centres were at 51.5 Km. This regular structure is interpreted as being the result of economic interactions that were only partially modified over time between cities and territories [Reece, 1986; Millett, 1986].

> *"... important settlements grew up midway between, and dependent on two (the Transport principle) rather than three major centres (the Marketing principle)"*
> *[I.Hodder and M.Hassall, 1971, 405]*

Furthermore, each Romano-British town controlled the supply of its correspondent hinterland. In other words, these towns acted as the primary markets of areas including rural settlements [Milne, 1982; Hingley, 1989] and minor urban centres [Hodder and Hassall, 1971]. This kind of relationship was modelled by von Thünen [1842] and Chisholm [1962] with reference

[11] The relationship is expressed by a formula developed by Anerbach [1913], $P_n = P_1(n)^{-1}$, where P is population and n ranking.

to agricultural production and land use, but they also included inverse relations from a central point to the periphery. The dependence of rural sites on towns is clearly documented in the classical literature (Pliny Ep. 2.17.26; Virgilius More. 79-81). It is also evident in the location of Roman villas, which reveals the double linkage between the countryside and urban centres [Hodder and Millett, 1980]. The radius for interaction between rural sites and towns varied according to the products; the length of time they reamined edible and the demand for them (e.g. fresh meat, vegetables) [De Neeve, 1984; Frayn, 1993, 71-82]. As far as amphora distribution is concerned, the relationship between the city and countryside may indicate the selling price including the transfer of goods to smaller containers. Such practices should have left higher densities of amphorae in distribution markets and lower proportions or even no traces at the points for final consumption.

Population dispersal is one of the variables strongly affecting any pattern of distribution. Highly populated areas became attractive as potential trade regions, since the sales involved provided other opportunities [Harris, 1954; Dickens and Lloyd, 1990, 182]. In long-distance exchange. these settlements or regions were considered to be safe options for traders because they normally provided enough demand to ensure the sale of their merchandise [Curtin, 1984; Harris, 1980].

Rural densities of population in Southeastern Britain seem rather high compared to the rest of the province according to the number of *villae* documented [Jones and Mattingly, 1990, map 7:6]. The presence of *villae* reveal areas specially suited for agriculture, which not only represented concentrations of rich landowners but also of labourers for their estates and dependent nuclei. The density of rural sites obtained from diverse surveys of Roman Britain supports the likelihood of a concentration of the population in this SE sector (e.g. NW Essex, Chalton) [Millett, 1990a, 184]. Therefore, the Southeastern region was likely to have received a greater proportion of the overseas trade in Roman times, which would have been reflected in amphora densities. In general, the majority of amphora types show higher concentrations in this zone, although a few also point to the SW sector as holding some concentrations (i.e. Dr.23, Italian Dr.2-4, Eastern Dr.2-4, G-4, Catalan Dr.2-4, Rhodian, North African, Kapitan II, South Spanish, Carrot, Haltern 70, London 555, Chalk, Rich.527). The effect of population cannot be overestimated since the mechanism of exchange in relation with transport cost may have favoured the same type of distribution pattern [Carreras, 1994a].

Diverse estimations of population of Roman Britain [Millet, 1990, 181-185] stress that the major part of the island's inhabitants lived in rural areas [Miler, 1982; Clack and Haselgrove, 1982; Hingley, 1989]. The latest calculations by Millett [1990, 185] propose that only 6.5% of the population lived in urban centres, whereas the countryside contained at least 90% (circa 3.300.000)[12]. Nevertheless as far as amphorae are concerned, their concentrations are basically found in urban areas, thus rural residents never enjoyed easy access to them. These people may have been compelled to travel to the nearest centre where amphorae commodities could be transferred to smaller containers, or possibly peddlers distributed them through retailing sales outletts [Peacock, 1982, 156]. In fact differences in amphora densities between the towns and the countryside support the concept of the central place principle of a hierarchical relation between settlements [Hodder and Orton, 1976].

As amphora distribution indicates a densely populated area, which was obviouly a magnet for trade with a multiplying effect that attracted either salesmen or consumers. The basic assumption is that the higher the population there was, the more potential buyers for any merchandise there were [Dickens and Lloyd, 1990, 182]. Moreover highly populated centres become nuclei for trade in a region, obliging rural residents to come to them for occasional shopping [De Ruyt, 1983]. On the other hand, large cities normally accommodate a variety of ethnic groups, hence ethnic produce could easily be sold there. In the case of Roman Britain, the consumption of olives, dates and fish-sauces tended to occur in urban centres where some continental communities may have appreciated these delicacies more. Finally, populated areas also included more people with higher purchasing power towards whom the trade in luxury items was chiefly oriented. Therefore, expensive amphora-borne commodities were likely to be found in large urban centres of the province [Jones, 1974, 38].

5.2.3 Purchasing power: its social function and the symbolism of goods

Some amphora-borne commodities carried social and symbolic meaning at their final destinations, so that their consumption was more related to status than taste [Hodder, 1982]. In general, merchandise of high cost and scarce availability was likely to have prestigous value within a society [Hopkins, 1957; Neale, 1957; Fulford and Huddleston, 1991, 6]. This factor also affected some beverages and cooking ingredients [Farb and Armelagos, 1980; Goody, 1982], which denoted purchasers as members holding certain positions in society [Dietler, 1990, 362; Bats, 1993]. Higher cuisine is normally characterized by its complexity, involves ingredients from outside, it has stronger taste and involves cooking innovations [Eckstein, 1980; Dancer, 1984, 174; Cruz, 1991, 244; Contreras, 1993]. The consumption of exotic species[13] was the most evident reason for a thriving trade with the East in Roman times [Miller, 1968; Casson, 1989] and constituted a sign

[12] Population estimates are constant focus of discussion [Hassan, 1981], the current one is not an exception but it looks reasonable.

[13] The word itself comes from the latin *species*, meaning a commodity of special distinction and value [Goody, 1982, 105].

of wealth in cuisine [André, 1961; Giacosa, 1986].

Prestigous goods had to be exhibited in public in order to fulfil their social role [Tannahill, 1973; Dietler, 1990; Cruz, 1991], making differences more acute. A rich table in Rome normally introduced more fats, meats[14] and white bread, whereas poor people were restricted to olive-oil, garlic, onion and brown bread [Robert, 1986; Whittaker, 1989b, 335]. An average meal in a Roman *taberna* would include cheap meat (e.g. lamb and pork), chickpeas, kidney beans, lupines or cabbage in addition to wine or *alica* (i.e. fermented grain) for only two asses [Robert, 1986, 52]. Exotic merchandise was displayed chiefly at banquets, donation, charity events and burials; where people were able to show off their status [Lévi-Strauss, 1964; Goody, 1982; Cruz, 1991; Dietler, 1990; Fulford and Huddleston, 1991; Wells, 1992]. Wealthy families in Rome were famous for their banquets characterized by the quantity and variety of food[15] [André, 1961; Carcopino, 1938; Mattioli, 1986], a practice that was swiftly copied by the newly rich (e.g. freedmen) such as Trymalchio (Petronius Sat.34-35; 52-60) [Andreau, 1989b].

With regard to Roman Britain, any amphora-borne commodity from the Mediterranean region to some extent constituted a highly valued commodity due to the overhead transportation costs involved [Braudel, 1979, 143; Toussaint-Sanat, 1987]. Goods that were not produced locally were more appreciated in the British province if there was an opportunity to consume them. There are at least three commodities which were likely to have enjoyed a special status.

a. Wine

Wine consumption in Rome always indicated a minimal status, whereas beer was linked with the lower classes [Darby et alii, 1977, 532]. Moreover the wines´ origins and ages established distinctions between their consumers [Tchernia, 1986a; Dietler, 1990] revealing indirectly its function. Diocletian´s Price Edict reveals, in terms of cost, the social distinctions of a *sextarii* of different beverages, these were 30 denarii for a Piceneum wine, 24 for an Attican, 16 for a second quality, 8 for a table one and 4 for beer (see chapter 5.4).

b. Fish sauces

Among fish sauces, *garum* was considered to be the highest quality produce, obtained from garon (Isidorus Ori.xx.3.19) and more often from mackerel [Jardin, 1961; Etienne, 1970; Martinez-

[14] Major consumption of meat normally define wealth in any society [Harris, 1985, 23].

[15] In some cases this demostration of wealth was strongly critisized (Martial Ep.x.36; x.45; ix.93; Juvenal Sat.v.24-156; Pliny Ep.ii.6).

Maganto, 1992]. The second quality salazon was known as *muria* (Martial Ep.xiii.103) and procured chiefly from tuna [Jardin, 1961]. Finally the *allex* was the cheap fish sauce produced from residues of the 3 previous varieties mentioned (Manilio v.673) [Curtis, 1991; Martinez-Maganto, 1992]. Although all three fish sauces shared similar amphorae for their transportation [Edmonson, 1987], they may have had particular distributions according to the purchasing power of the local populations (see chapter 5.5).

c. Dates

Palm fruits were economical purchases in the provinces of origin and even thoroughout the Mediterranean basin. However, this exotic fruit may have fetched high prices in Northern provinces on account of its scarcity and transportation cost. Dates, therefore, probably constituted another sign of status in the context of high cuisine (see chapter 5.6.1), in which they could normally be found (Apicius, De Res Cul.) [André, 1961; Robert, 1986].

The distribution of amphorae carrying such merchandise in Roman Britain must have been affected by the concentration of wealth in particular centres or areas. Considering that only a minority of the population could afford them, the position of these fortunate social groups in the province may explain the amphora distribution. The possession of any pottery, as in the case of amphora, contained an intrinsic symbolic [Hodder, 1986, 122-124; Orton et alii, 1993, 227] meaning that has been summarised by Strange [1989] as follows:

> ***"It [a pot] may mean that I, as the ancient owner of this vessel, belong to <u>this</u> group, and I believe <u>this</u> thing, that I have <u>this</u> level of wealth, and <u>this</u> much status. I am also of a specific sex and perform <u>these</u> labors defined by my sex, and this vessel correlates with <u>this</u> sex and <u>these</u> labors."***
> ***[J.F.Strange, 1989, 26]***

In the Iron Age, local tribal elites from the Southern and Southeastern Britain controlled trade links with the Continent (see figure 33). Thus, they were largely responsible for the consumption of amphora commodities, obtaining status from them as numerous burials document (e.g. Lexden, Welwyn B, Welwyn Garden City, Hertford Heath, Snailwell, King Harry Lane) [Peacock, 1984; Cunliffe, 1988; Stead and Rigby, 1989]. A limited geographical distribution of these vessels is evident (e.g. Dressel 1, Pascual 1 and Lamboglia 2), corresponding to the area which had direct commercial contacts, also known as the border region. In this area, an intermediate form of economy between the Roman and indigenous system existed [Hedeager, 1988a; 1988b; Haselgrove, 1990; Bloemers, 1990].

After the Conquest, new power centres emerged in Britain and some administrative and military authority was given to the local rulers [Millett, 1990a, 46-53]. Although local elites preferred to maintain their own residences, new authorities settled in urban centres that become prosperous economic nuclei overnight [Frere, 1987; Todd, 1989; Millett, 1990a]. In the Principate the power centres in Britain were distributed as follows.

a. Provincial administration

London was a newly created city that had held from early times (circa AD 60s) the administrative powers of Britain. The provincial governor and *procuratores* with their associated personnel (i.e. *officium*) were established there [Mann, 1985; Frere, 1987, 181-205] thereby attracting traders and craftsmen for public contracts. The evidence of public buildings, and private architecture and archaeological material recovered in London reflect its wealth and status over the province [Marsden, 1980; Millett, 1990a] as well as its dominance of the luxury goods market.

b. Local administration

Local administration was a public service and positions in it were reserved for members of the wealthy families in each community. The native aristocracy and prosperous immigrants constituted the groups holding these posts in urban centres. The Southern towns stood out on account of their richness evident in their public buildings (i.e. euergetism) [Todd, 1989], private architecture (e.g. large houses, baths, mosaics) [Frere, 1987; Millett, 1990, 104-116] and numerous inscriptions [Cunliffe and Davenport, 1985; Mann, 1985; MacMullen, 1992]. These places also concentrated possible potential consumers of luxury goods.

c. Army officers

Members of the most influential senatorial and equestrian Roman families spent short periods of their lives and careers in Britain (i.e. *cursus honorum*). They were destined for temporary military posts in either legionary or auxiliary detachments. Also, they belonged to a minority who were used to and could afford luxury merchandise. It is believed that some concentrations of wine and fish-sauce amphorae (e.g. Tarraco, Nijmegen) were consumed mainly by military officers [van der Werff, 1987; 1990; Keay, 1990]. Similarly Vindolanda writing-tablets testify the purchase of fish-sauce, Massic wine and spices [Bowman and Thomas, 1983, tabl.4-5] in small quantities, which may have been destined for a group of consumers of high rank.

The concentration of wealth in different areas of Britain sheds some light on individual amphora distributions. In the Iron Age, wine and fish-sauce amphorae occur at high status burial sites and eminent oppida (e.g. Hengisbury Head, Camulodunum). Nevertheless the relationship is even more evident in the Principate with a myriad of wealth centres recording amphora types such as Eastern Dressel 2-4, Italian Dressel 2-4, Southern Spanish fish-sauce, Carrot, Haltern 70, Chalk or Richborough 527. In the Late Empire, new administration centres are recorded in Britain after the creation of new provinces[16] bringing about new distributions of power in the capitals (i.e. London, Cirencester, York, Lincoln). The changes may explain the characteristic distribution of Late Roman vessels (see chapter 5.7) chiefly in the three capitals of Eastern Britain.

Finally, the value of these status symbols in the process of acculturation must be stressed [Bloermers, 1982; van der Leeuw, 1983]. Iron Age aristocrats were ready to accept Roman symbols of wealth over their own preferences [Dannell, 1979; Edmonson, 1987, 200; Okun, 1989a; 1989b] in order to preserve their positions in a new framework [Millett, 1990a; 1990b]. An external etiquette permitted them to be distinguished from their own communities as well as to become the main intermediaries between the newcomers and the local population [Bloemers, 1990; Haselgrove, 1990; Millett, 1990b]. The consumption of prestigious wines, fish-sauces and dates was probably part of the integration process for the local elite into Roman culture [van der Leeuw, 1983, 24; King, 1984; Bloemers, 1988; Bats, 1988; 1993].

5.2.4 Food and ethnicity

Tastes determined in the end how a merchandise was distributed [Haggett, 1965; Dicken and Lloyd, 1990]. The extent of variability in taste becomes even more evident with regard to food, which was the main amphora-borne commodity. Eating practices among different societies and cultural groups have deservedly received the attention of every school of Anthropology, since around the matter of food are concentrated the basic social responses and attitudes of a group or an individual [Farb and Armelagos, 1980; Goody, 1982; Cruz, 1991][17]. Behaviour concerning food constitutes a sign of identity even at an unconscious level.

> ***"... eating becomes associated, if only an unconscious level, with deep-rooted sentiments and assumptions about oneself and the world one lives in ..."***
> ***[P.Farb and G,Armelagos, 1980, 97]***

[16] First division by Septimius Severus (circa AD 197) (Herodian iii.8.2) and second by Diocletian (documented in the Verona list, AD 312-314) [Frere, 1987, 198-199].

[17] Cooking and food have been analyzed from a functional [Malinowski, 1922; Richard, 1932; Radcliffe-Brown, 1952], structural [Lévi-Strauss, 1964], cultural [Douglas, 1984; Chang, 1977] and materialistic [Harris, 1985] viewpoint, and it is still a subject of research in Anthropology.

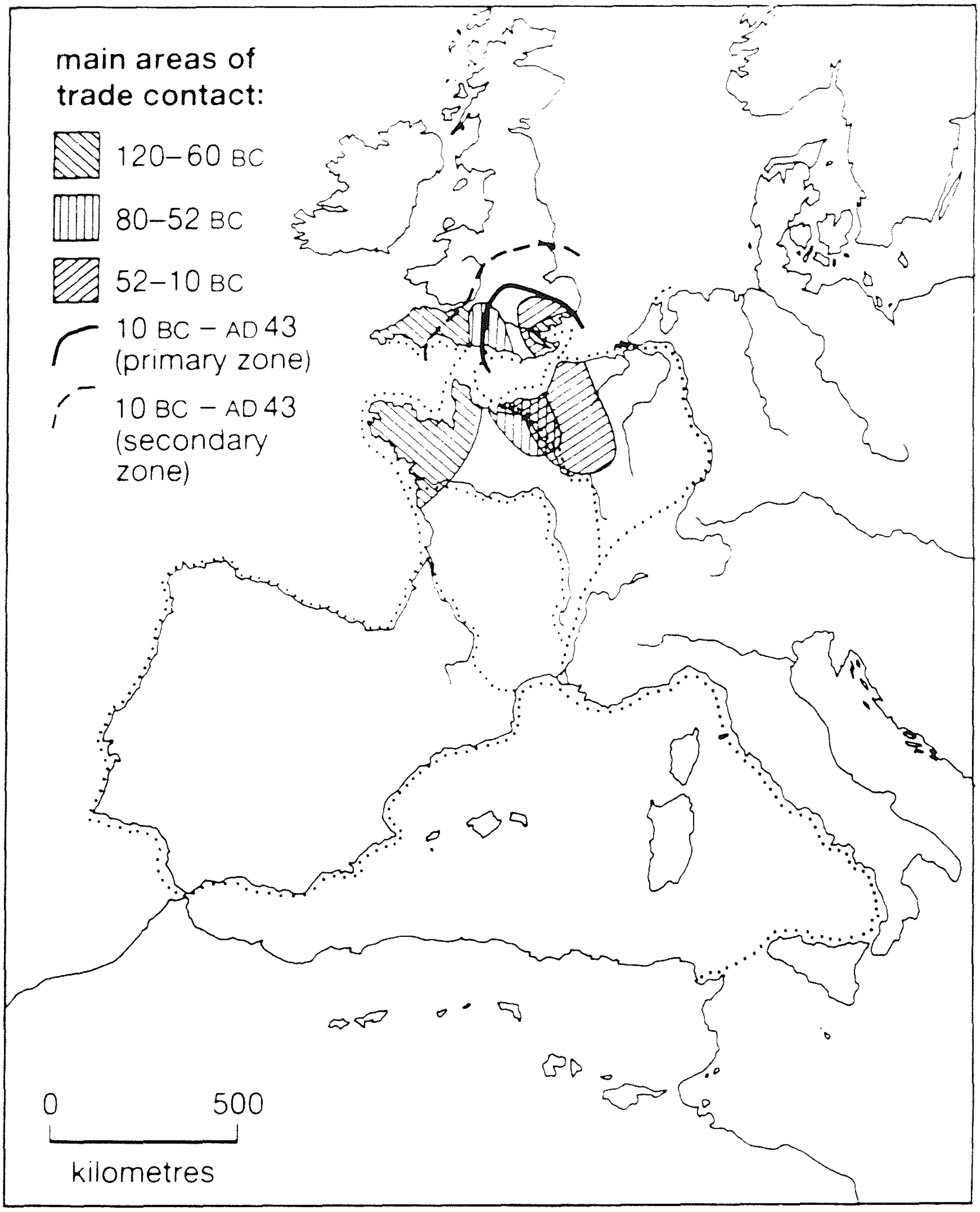

Figure 33 Trade contacts with Britain up to AD 43 (after Jones and Mattingly, 1991).

Food represents a source of energy and is essential for health (at a physiological level). It is the origin of sensations (at a psychological level) and can represent a means of communication (at a sociocultural level) [Cruz, 1991]. Psychologically, a food type can be linked to past experiences related to one´s original social group. For instance, smells and tastes may remind one of childhood and a specific geographical location [Farb and Armelagos, 1980; Goody, 1982; Rozin, 1983; Cruz, 1991, 57-88; Contreras, 1993]. The individual association to a specific community becomes even more evident at a sociocultural level, at which food may convey information about personal status, original group or religious affiliation [Eckstein, 1980]. Therefore amphora distributions connected to particular goods may serve to distinguish the composition of Romano-British society and the integration level of each single group.

"What is food to one may be fierce poison to others"
[Lucretius, De Re Natura iv.615]

Food and its related taboos define limits between cultural groups. Stereotypes are created about food both, inside and outside, such groups (e.g. frogs, snails, horsemeat, insects) [Chang, 1977; Farb and Armelagos, 1980, 3; Goody, 1982, 146; Harris, 1985; Cruz, 1991]. Strong emotional ties are established between people sharing meals or simply eating together [Richards, 1932] and the selection of ingredients makes union or division easier [Bahn, 1981; Pyszczyk, 1989]. When food is connected to religious rituals cultural manifestations become more evident and boundaries between groups are difficult to overcome[18] [Harris, 1985; Cruz, 1991, 281]. Among the particular forms of cultural manifestation (e.g. clothing, language, architecture, religion), the cuisine associated with a particular group is one of the most conservative, sometimes being transmitted over down generations[19] [Chang, 1977; Farb and Armelagos, 1980; King, 1984; 1991; Fischler, 1990; Cruz, 1991]. Before the transport revolution in the XIX century, eating habits were determined by the geographical constraints affecting food production [Goody, 1982], hence dietary regions were clearly marked on basis of goods such as wine/beer, butter/lard/olive-oil or pork/lamb/beef [Braudel, 1979a; Hodges, 1982; King, 1991].

The Graeco-Roman world documents a myriad of dietary practices among the numerous societies visited by ancient ethnographers, geographers and historians (e.g. Herodotus, Strabo, Pliny, Pausanias). They noted the diverse eating habits, sometimes with the aim of trying to

[18] European inmigrants in America kept some dietetic barriers (e.g. white bread, ham, wine, spirits) even though these commodities were there a luxe [Braudel, 1979a, 143-144].

[19] Ethnic communities in USA can be perfectly distinguished by their culinary habits, whereas young generations have almost forgotten their ancestors language and typical dressing [Farb and Armelagos, 1980, 190].

identify distinctive traits of either so-called civilised behaviour or barbarism[20] [Balsdon, 1979; Dange, 1981; Thompson, 1993]. In Northern Europe, Romans described the diets of the Gaulish tribes as based on milk, meat (basically pork), lard, cheese, mead and beer (Diodorus Siculus v.26; Strabo iv.4.3; Dion Halicar. xiii.11; Varro ii.10.4; Pliny NH xi.241; Martial xii.32.18). However, after contact with Greek and Roman communities, these tribes incorporated wine in their diets, although they rejected olive-oil because of its taste and smell (Dion Halicarn. xiii.11) [Balsdon, 1979; Bats, 1988]. Likewise olive-oil was completely absent in the German eating habits; which otherwise included milk, cheese, berries, venison, beer and lately pure wine (Athaeneum 1533; Caesar BG vi.22; Tacitus Germ. xxii-xxiii) [Balsdon, 1979; Bats, 1988; 1993; Okun, 1989a; 1989b].

Nevertheless once some of these societies came under Roman rule, the movement of people (i.e. traders, administrative staff, soldiers, immigrants) brought diverse dietary practices into coexistence in the same environment. The interaction between two or more societies, also known as acculturation [Brand and Slofstra, 1983], has a key form of expression in eating habits. Roman policies allow conquered communities to retain their particular cultural manifestations (e.g. clothes, languages, arts, gods, food), so that racist attitudes were uncommon, with the only exception in the case of Ethiopians [Alföldi, 1950; 1952; Saddington, 1961; 1975; Sherwin-White, 1967; Swonden, 1970; Dange, 1981; Thompson, 1993]. Therefore, the Conquest meant for the Romans an enrichment in the number of culinary ingredients that were normally in use among the higher classes (Apicius De Res Cul.) [André, 1961; Robert, 1986, 127]. Notwithstanding their common rights, each Roman citizen kept strong ties with his *civitas* (i.e. tribal group) and the importance of the bond is evident from inscriptions, in religious cults, dress practices, language and even in diet [Balsdon, 1979; MacMullen, 1990].

An outstanding example of a cosmopolitan city is Alexandria which included at least four important cultural communities: Egyptian, Jewish, Greek and Italic [Darbi et alii, 1977; Lewis, 1983]. Pork meat was barred by the Egyptian and Jewish religions while it constituted the staple meat in the Greek and Roman colonies [Darby et alii, 1977; Lewis, 1983, 131]. Moreover, Jews consumed *garum* in ritual practices (Pliny NH xxxi.95) [Jordano and Kahn, 1966; Etienne and Mayet, 1991] and citrons, also known as the fruits of Palestinian trees, which they spread throughout the Mediterranean [Farb and Armelagos, 1980, 132-133; Cruz, 1991]. With reference to the Egyptians, the local beer (i.e. *zuthos*) (Pliny NH ii.164; Strabo xvii.1.14.799; xvii.2.2.821) was the most popular beverage, dates were staple in their diet, while radish oil (Pliny NH xv.7.30)

[20] The Scythians drank mare´s milk (Martial i.3), the Sarmats consumed horse´s blood (Pliny NH.18.24), the Numids ate salt for opening the appetite (Salustius Jug.89.7), whereas beyond Berenice (Egypt) the land was inhabited by Ichthyophagoi (fish eaters), Agriophagoi (wild animal eaters) and Moschophagoi (shoot eaters) (Peryp.Maris.Eryt. 2) [Casson, 1989].

was essential in their cuisine [Darby et alii, 1977]. In contrast, Greeks and Romans were distinguished by their preference for olive-oil and wine [Darby et alii, 1977; Lewis, 1983].

Amphora borne commodities may have often been oriented towards and distributed to particular cultural or ethnic groups living in the same province that may have been ready to pay high prices for food pertaining to their original diet. The conquest of Roman Britain meant the arrival of a new population in the Isles, which brought, among other things, new culinary customs.

a. Eating habits in Roman Britain

Iron Age communities in the British Isles show specific ingredients and a cuisine based on local produce before contact with the Romans. Although there were numerous traits in common with other societies on the Continent, archaeological evidence suggests substantial variations as well [White, 1970; Renfrew, 1973; 1985; Reynolds, 1979; King, 1984; Barker, 1985]. First of all, sheep and goats may have normally provided the main source of meat [King, 1984], while goats were also highly valued for their milk [Renfrew, 1985, 13-14]. Cattle was another animal appreciated for its meat, and pork was the third type of meat consumed [King, 1984].

Butter and cheese obtained from milk were the main fats. Butter could be buried in wooden vessels or leather in order to make bog butter, which was a characteristic recipe from the Isles [Brothwell and Brothwell, 1969; Renfrew, 1985]. Furthermore animal fat (e.g. lard) or oil of flax[21] could be incorporate into their soups, porridges and roasts to add flavour or facilitate cooking [Brothwell and Brothwell, 1969; Balsdon, 1979, 223; Renfrew, 1985, 16].

The principal drink was beer, obtained by brewing barley malt, though there are also testimonies of mead production (i.e. Methilhill) [Renfrew, 1985, 22]. The local diet would have contained high quantities of wild game and plants, but it lacked some foodstuffs from other latitudes: yeast, lemons, oranges, grape juices, olive-oil and onions [Liversidge, 1957; Hall and Kenward, 1990]. The existence of one or more dietary regions in the British Isles, can be also corroborated by quotes from Roman authors. Strabo refers to Poseidonius (I c. BC) regarding the eating habits of the people from Thule and the frozen zone.

> *"... the people live on millet and other herbs, and on fruits and roots; and where there are grain and honey, the people get their beverage also, from them"*
> *[Strabo 4.5.4-5]*

[21] Flax remains are documented in Spain, Holland, England, Switzerland and Denmark (e.g. Østerbølle) probably destined to oil production as caneline is a plant of a high oil yield [Brothwell and Brothwell, 1969, 154].

Later, Caesar (BG v.12) indicates the existence of taboos on the consumption of wild animals such as goose, hare and fowls. He also describes the pastoral diet of the tribes living inland.

> *"... those inhabiting the interior do not grow corn, but live instead on milk"*
> *[Caesar, BG v.14]*

Another vivid picture comes from Cassio Dio in his account of the Brigantian and Scottish tribes.

> *"Northern Britons lived off their flocks, wild game and fruit, eating no fish not wearing shoes and clothes" [Cassio Dio, ix.263]*

These ethnographic documents suggest differences between Roman and British eating habits, which is why the classical authors recorded them as signs of diversity. Despite the minor differences, the presence or absence of three individual elements really singled out both cuisines: bread, olive-oil and wine. These elements, together with the types of their houses, are in the words of Boudicca (AD 61), according to Cassio Dio, the essential traits that made Britons different from Romans.

> *"They require shade and covering, they require kneaded bread and wine and oil, and if any of these things fails them, they perish; for us, on the other hand, any grass or root serves as bread, the juice of any plant as oil, any water as wine, any tree as a house" [Cassio Dio lxii.5-6]*

The arrival of the Romans brought with it the settlement of Continental immigrants usually in the large urban centres of Southern Britain. The new population came from diverse provinces (e.g. Hispania, Italy, Greece, Syria, Germany, Gaul); however, in the main they came from the nearest regions [Birley, 1979], so their eating habits were quite similar to those of the Britons. In contrast, the Roman army were significally different as far as dietary habits were concerned, since the army's composition was basically Mediterranean. The Roman legions in Britain (circa 15.000-18.000 men) [Millet, 1990] were composed initially of Italians, though Roman citizens from Narbonensis and Hispania outnumbered them from the Flavian period onwards [Dobson and Mann, 1973; Holder, 1982; Mann, 1983]. From the Hadrianic period onwards, the presence of British recruits is documented and they became the majority by the mid third century [Dobson and Mann, 1973; Mann, 1983]. At least half of the legionaries who come from outside seem to have settled in the province eventually (e.g. Colchester, Lincoln, Gloucester, York) [Mann, 1983].

The rest of the occupying army were the auxiliary troops (circa 35.000-20.000 men), composed of ethnic units from recently conquered regions (e.g. Batavians, Helvetians, Tungrians, Celtiberians, Vascones, Astures, Frisians, Germans) [Holder, 1980; 1982]. The majority of them came from regions in Northern Europe so their culinary habits did not differ much from the local ones [Balsdon, 1979; King, 1984; Renfrew, 1985]. As far as amphora assemblages are concerned, there are no apparent distinctions between auxiliary or legionary camps[22]. This homogeneity suggests an identical military supply of some commodities (e.g. olive-oil) regardless of a unit´s possible preferences. Nevertheless, other produce seems to have been obtained locally by each unit according to their tastes, the availability and price, as Vindolanda´s writing tablets manifest [Bowman and Thomas, 1983, tab.4-5]. A local purchase[23] may explain differences in bone assemblages present in the military sites close to German regions [King, 1984].

The immigrants from Southern Europe introduced a very distinctive cuisine and some entirely new foods to Britain. The so-called Mediterranean diet [King, 1991] consisted of bread, wine, olives, soup and olive-oil for a Republican Roman farmer (Cato De Agri. lxvi-lxviii; xciv). A kind of porridge (i.e. *puls*) (Pliny NH xviii.83) sometimes mixed with herbs and garlic (i.e. *moretum*) was another typical dish complemented with milk, cheese, fruits (e.g. apples, plums, chestnuts) (Virgil Buc.ii.1-13; 28-30; 45-73) [Robert, 1986, 135; Dossi and Schnell, 1990, 18]. There are other testimonies of typical Roman meals which included ingredients such as lettuce, snails, eggs, olives, garlic, pumpkin, tuna, pork, mutton, onion and wine (Pliny Ep.i.15; Martial x.48; iii.77; Juvenal xi.64-76)[24].

Nevertheless in the days of the early Republic, a Roman high cuisine existed among wealthy families that was different from that of the average citizen. This high cuisine incorporated new and unusual ingredients from distant places which were difficult to obtain (e.g. spices, dates, wild game, fish, sea food) [Robert, 1986; Cruz, 1991, 361-366]. Wealthy banquets are recorded such as Trimalchio´s dinner (Petronius Sat.31-35; 52-53; 58; 60). Mention is also made of the typical meals of upper classes in the capital (Juvenal v.24-156; Pliny Ep.ii.6; Martial Ep.xii; Macrobio Sat.ii.9) and a book of recipes transmitted by Apicius (De Res Culinaria) [Carcopino, 1938; André, 1961; Robert, 1986; Dossi and Schnell, 1990].

---

[22] The multivariate analyses did not reveal differences in composition but in densities due to each site hierarchy in the supply.

[23] In Egypt the Roman army consumed the standard local meat, pork (P.Mil ii.70; SB xvi.12663; PSI ix.1073; P.Lips 97; P.Ryl. iv.692; 693; 695; 696), which was not eaten by the natives. Furthermore other unusual meats were adquired occasionally such as beef (SB xiv.12156) or veal (BGU i.34; P.Stras vii.736; P.Oxy. liv.3765; P.Mert ii.86; SB vi.9563) [Bagnall, 1993, 28].

[24] Vegetarism was an intellectual doctrine in the Graeco-Roman world practiced mainly by philosophers (e.g. Pythagoras, Neopythiangorian school, Plutarch), who believed meat consumption was unnatural and a vegetal diet favoured a longer life [Balsdon, 1979; Wagennan, 1988; Cruz, 1991, 330; Parkin, 1992]. For instance, Pythagoras reached between 80-90 years according to Diogenes Laertius 8.44 and 117 according to Galen (De res Pag. 3.14.56).

Although with time, there was an increasing complexity in Roman cuisine, Apicius however revealed that olive-oil, wine and fish-sauce, which appear in more than 40% of his recipes remained the key elements. In fact olive-oil was necessary for cooking food, either for roasting, boiling or frying meats, fishes or pulses [André, 1961; Robert, 1986; L´Alimentazione, 1987; Bettini, 1987; Dossi and Schnell, 1990]. On the other hand, mutton and goat[25] were the most popular meats in the Mediterranean due in part to the suitability of the environment for grazing [White, 1970; Luff, 1982; King, 1984; Dedet, 1987; Harris, 1989].

Therefore a Mediterranean diet was characterised by the consumption of mutton and goat, wine and olive-oil [André, 1961; Flaudrin, 1983; Amoureti, 1986; Bats, 1988; 1993], the latter liquids even having a religious meaning[26] [Cruz, 1991, 280-281]. These three ingredients have left archaeological traces of their importance in the form of either bones or amphora sherds of their original container. Since the army was by tradition a main consumer of Mediterranean foodstuffs, this may be an indication that their preference for a Mediterranean based diet outside that region was the result of nutritional or medical needs.

In fact, none of the main medical treatises of that time (e.g. Hippocrates, Celsus, Galenus) [Brothwell and Saddington, 1967; Gourevitch, 1984; Mazzini, 1987; Jackson, 1988; Mudry and Pigeaud, 1991; D´Amato, 1993] suggest any advantages in consuming olive-oil[27], wine or mutton, although olive-oil and vinegar were used in staunching blood flow and cleaning wounds (Celsus 5.26.21-24) [Davies, 1970]. Olive-oil is a monosaturated fat that helps maintain low levels of cholesterol limiting risks of heart attacks and therefore beneficial to health [Whittaker, 1989b; López-Alegret, 1990]; however, it is unlikely that ancient doctors knew about this property. Low levels of cholesterol in a sewage at Bearsden [Knights et alii, 1983; Breeze, 1984] which have been interpreted as the result of a military vegetarian diet, may in fact simply indicate a high level of olive-oil consumption among the troops.

b. The role of food in the acculturation process

The early decades after the Roman conquest reveal the existence of at least two distinctive cultures with their own distinctive diets. On the one hand, the Roman army and Mediterranean immigrants consumed bread (i.e. emmer, spelt, bread wheat, yeast) [Reynolds, 1979], olive-oil,

[25] Pork enjoyed a special preference as the feast meat (Ovidius Fast.vi.169; Varro RR ii.4.10) [Dossi and Schnell, 1990, 24].

[26] The Graeco-Roman mythology as well as the Bible, Levitic and Coran include numerous mentions to wine and olive-oil in ritual contexts (e.g. purity, peace, fertility) [Farb and Armelagos, 1980; Cruz, 1991].

[27] Some medical papyri recommended boiling animal ingredients in oil (Eb.lxvi.469; lxvi.467) but any could be used instead.

fish sauce, wine and basically beef or pork [King, 1984]. Early distributions of amphorae indicate the ethnic character of these foods which were mainly recorded from military camps or urban centres with a strong immigrant presence (i.e. Colchester, London, Gloucester) [Martínez-Maganto and Carreras, forth.]. In constrast, the local population based its diet on porridges (i.e. emmer, einkorn, spelt, barley) [Reynolds, 1979], lard, butter, flax oil, beer and chiefly ovicaprid meat [King, 1984; Renfrew, 1985; Reynolds, 1979]. The contrast between both cultural groups in dietary terms can also be observed at other Roman frontiers or in conquered provinces such as Pannonia [Gabler and Kellner, 1984; Bökönyi, 1988], Raetia [Martin-Kilcher, 1990], Germania [Petrikovits, 1980; van der Werff, 1987; Okun, 1989a; 1989b; Baudoux, 1990; Lange, 1990; Lauwerier, 1990] or Lusitania [Fabiao, 1989], hence this represented a general pattern.

The dietary division however, becomes less clear in later periods when both communities started to include the other´s foodstuffs in their own diets. Bone assemblages from different communities in Britain from the III and IV centuries AD seem more uniform, despite some minor differences between the civilian and military sectors [King, 1984; 1991]. Amphora distributions imply similar processes of acculturation within the native community which started consuming substantial proportions of wine and fish sauce. Likewise, immigrants adjusted their own diets to the customs and environmental conditions found in their new home, as the case of beer demonstrates.

The complex acculturation processes that took place during the Roman expansion [Bartel, 1980; van der Leeuw, 1983; Slofstra, 1983; Willems, 1983] also influenced food consumption [Dannell, 1979; Barran, 1983; King, 1984; Bats, 1988; Okun, 1989a; Haselgrove, 1990]. Some ingredients were easily accepted into local or immigrant diets, whereas a few tended to be rejected (e.g. olive-oil). The romanization of new provinces encouraged by the State stimulated local elites to emulate their conquerors' cultural customs, even in their own eating habits [Hedeager, 1988a; Millett, 1990a; 1991; Haselgrove, 1990; Bloemers, 1990; Keay, 1990].

> ***"Not only that: he [Agricola] was having the sons of the chieftains educated in the liberal arts, and Agricola preferred the keen-witted Britons to the Gauls... Little by little they went astray, taking to the colonnades, bath houses and elaborate banquets that make moral failing attractive."***
> ***[Tacitus, Agricola xxi.2]***

Nevertheless this adoption of new eating habits was in fact limited to the native upper classes and urban populations, and some geographical areas and rural settlements were hardly affected in this respect [Jobey, 1982; Higham, 1982; Clare, 1982; Haselgrove, 1982; Clark, 1982; Hingley, 1989; King, 1991; Jones, 1991]. The capacity for change among rural populations was limited compared to their urban counterparts, who were exposed to a myriad of new influences [MacMullen, 1990, 63]. Although rural sites testify to the arrival of Mediterranean amphorae (e.g. Dressel 20, Gauloise 4), the densities are so low that their presence can be interpreted as representing only periodic consumption perhaps largely as the result of curiosity about them [van der Leeuw, 1983]. In fact, a positive effect of the acculturation process was the tolerance that developed towards new foods, even though these foods were not integrated into the community's diet [van der Leeuw, 1983, 24; Barran, 1983].

> *"Hence, so long as they were unlearning these [ancestral] customs gradually and by the way... [they] were becoming different without knowing it"*
> *[Cassius Dio lxi.18]*

In contrast, some foods such as olive-oil retained a strong ethnic character possibly as a result of the State intervention in its distribution. Olive-oil amphorae were clearly associated with the army and such marked distinctions between groups. Only urban markets record a strong presence of these amphorae which may have been due to the settlement of immigrants in such areas (e.g. Colchester, London, Cirencester)[28]. In the Late Empire, the lack of olive-oil imports as represented by North-African vessels provides some evidence of its scarce consumption in the province and the non-intervention of the State in the supply to the Army, which was composed of Britons, at that time. The opposite was the case for beer. Beer was widely drunk among immigrants and legionaries as the predominance of beakers as drinking vessels testifies. Beer became the most popular drink in Roman Britain and was quickly adopted by the newcomers, probably because of its low price and the possibility that they could brew it themselves.

In conclusion, it can be said that cultural eating habits were determining factors in the consumption of particular foods. The irregular distribution of some amphora types supports this point, and is a reminder that cultural attitudes do not always respond to any economic logic [Harris, 1985].

> *"People change their skies, not their feelings, when they rush overseas"*
> *[Horace Epist.i.11.27]*

[28] Fats constitute an element of ethnic association in many societies [Farb and Armelagos, 1980; Goody, 1982; Cruz, 1991] and historical periods [Braudel, 1979, 180; Hodges, 1982; Toussaint-Sanat, 1987; Mazzini, 1989] may be due to their constant presence as lubricating in the passage of food through the mouth (i.e. common smell, taste) [Flaudrin, 1983].

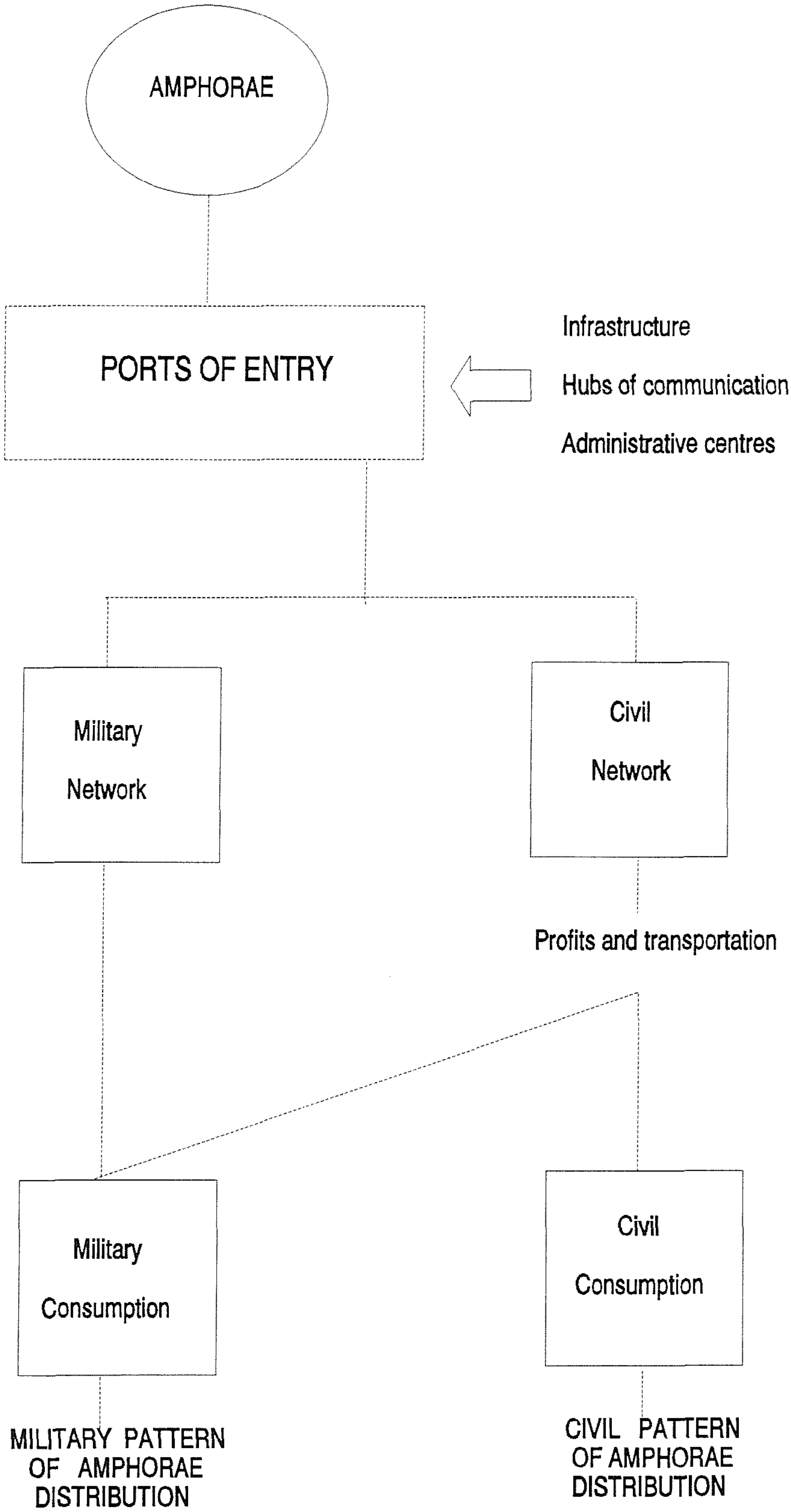

Figure 34 Diagram of the amphora distribution in the province.

5.2.5 Amphorae in Roman Britain: an overall view

The overall distribution of amphorae in Britain is summarised by an interpolation map with the total densities recorded in 48 Romano-British sites illustrated by figure 36. The first interpolation map (figure 36) reveals high concentrations in the SE area, mainly around London and Mucking, as well as on the SW coast centred at the site of Exeter. Other high densities are reported in military establishments such as Kingsholm, York and Carlisle; whereas minor volumes are attested at Chester and Corbridge. As can be observed, all these sites are very accessible by water, so that the transportation costs involved in reaching them were relatively low. Furthermore, a few of them (i.e. London, Exeter, Kingsholm, Chester and York) had harbour installations suitable for accommodating heavy merchant ships [Fryers, 1973; Cleere, 1978]. In contrast, central Britain shows very low densities which suggests either comparatively restricted accessibility for imports or a change in the container type used. If the latter supposition is correct, the higher quantities found at main ports could indicate the transfer of amphorae contents to other vessels. The most important roads in the province (i.e. London-Chester and London-York) [Dicks, 1972] do not document evidence of a greater proportion of amphorae being carried along them, whereas the main rivers provide evidence of significant ratios. The major importing sites were regularly distributed around the province, giving the impression that they each held some economic control over larger geographical zones [Hodder and Orton, 1976, 84-87]. This fact may imply the existence of central markets, with the function of distributing provincial imports to second order centres [Christaller, 1933; Lösch, 1954]. The theory of a hierarchical structure among urban centres is also supported by the results of the cluster analysis[29]. The first group comprising London, York, Carlisle and Exeter, documented high densities in the majority of types as well as a wide variety of them. Each settlement appears in a strategic region in the province, for example London (SE), Exeter (SW), York (NE) and Carlisle (NW).

The cluster analysis also defined other groups including possible second order markets (e.g. Chester, Chichester, Leicester) and final consumption centres (e.g. Brancaster, Godmanchester, Stonea). However, the overall distribution map is, to some extent, affected by the pattern of distribution of the commonest amphora type, Dressel 20. Due to the special characteristics of this container [Rodríguez Almeida, 1984; 1989; Remesal, 1986], its pattern of distribution (figure 38) does not match that of any other type in the province, but it is almost identical to the overall pattern that emerges. Therefore the general conclusions that can be drawn from this need to be verified by the individual studies of each amphora's distribution.

[29] The analysis (Ward's error) was undertaken to classify 40 Romano-British sites according to the standarized densities of 27 amphora types present in the sample.

Figure 35 Distribution of the 48 Romano-British sites providing amphorae assemblages.

Some groups shown in the cluster analysis include only military sites that seem to have had similar supplies of amphorae. For instance, the second group consisting of Chester, Corbridge, Staines, Vindolanda, Kingsholm and Mucking and characterised by substantial densities of Dressel 20, Italian Dressel 2-4 and Gauloise 4. The second group of settlements can be considered as second order centres within the hierarchical structure of the province, although like the seventh group (e.g. South Shields, Malton, Bewcastle, Leicester) they have a military character. Moreover, both military and civilian of lower order document similar proportions of amphorae as is the case with the third and fifth groups. Despite these common links in the amphora supplies to both zones in the case of minor sites [Williams and Peacock, 1983], the higher rank settlements in contrast show a clear distinction in the imports they received.

The results obtained by Principal Components and Correspondence Analyses using the same set of data support the existence of a site hierarchy and different patterns of distribution. On the one hand, Principal Components revealed groupings at eight sites with relatively high densities of amphorae and good representation of the diverse types (i.e. London, Exeter, Kingsholm, Chester, York, Carlisle, Colchester and Mucking). This alternative cluster again identifies major urban centres accessible by seagoing ships and river barges, which controlled specific geographical areas. A second division indicates that the Southeastern sector (i.e. London, Winchester, Colchester and St.Albans) imported a great variety of types, so that amphorae of minor importance are only represented there. In this case, high densities of population may have attracted the occasional less common type of exchange represented by Eastern Dressel 2-4, Almagro 50, Gaulish Dressel 2-4, Gaulish Dressel 7-11, Richborough 527, Verulamium Dressel 2-4, Late Roman and Gaulish Haltern 70 sherds.

In contrast, Correspondence Analyses highlighted unparalleled amphora assemblages such as the ones present at Purbeck or Ardleigh with high proportions of Catalan Dressel 2-4. Another remarkable assemblage that showed was the one documented at Kingsholm with high densities of Rhodian, Haltern 70 and Cigar-shaped amphorae, which indicates supply during a specific period (circa A.D. 49-57) [Hurst, 1985]. The spatial structure defined by the overall distribution of amphorae in Britain reveals an underlying logic to the pattern, connected to economic factors. However, an analysis of the overall distribution does not provide enough information, so an individual study of products and amphora types was necessary for this purpose.

Figure 36 Interpolation map on 48 Romano-Britiah sites of total amphora densites.

5.3 Olive-oil in Roman Britain

Olive-oil is a product alien to the British Isles, as the climate is unsuitable for growing olive-trees. Thus any olive-oil consumed in this territory during Roman times was imported from Southern countries, chiefly the Mediterranean. The first reference to its consumption in Britain is linked to some sherds of Oberaden 83 amphora found at Prae Wood and Gatesbury Track [Williams and Peacock, 1983] in Augustan contexts. As can be observed, the type, a predecessor of the Baetican Dressel 20, very occasionally reached the Iron Age communities settled in the Isles in part because of the lack of commercial contacts [Cunliffe, 1988; Millett, 1990, 9-39] or taste for such commodities. Only a couple of sherds of a type produced over fifty years were found and this seems a rather low representation for a local demand. Furthermore, this type is completely absent in the current amphora sample, demonstrating its relative unimportance compared to other early amphora imports [Peacock, 1971; Williams, 1981].

In addition early Italian imports were also present in the first century A.D. as finds of Lamboglia 2 amphorae reveal. Actually, only Skeleton Green records the presence of this amphora type with a relatively low density (1.34 cgr/m^2) [Peacock, 1981]. A unique find does not yield much information for an interpolation map, representing a possible distribution pattern (figure 37). However, the find does not contradict the currents of trade operational before the Conquest and represented by wine imports (e.g. Dressel 1), which basically affected the Iron Age communities of the South and South East. These document the tribal groups with more complex socio-economic systems [Harding, 1974; Cunliffe, 1978; Haselgrove, 1987].

Olive-oil reached the local communities in very low quantities before the Roman Conquest, forming part of occasional contacts between native aristocracts and Continental traders, either Gaulish or Romans, sometimes as simple diplomatic gifts. Reciprocity is considered to be the most suitable exchange mechanism to explain this early distribution of amphorae. The picture suffered a complete change with the arrival of Claudius and the Roman legions in A.D. 43.

5.3.1 The Roman conquest and the boom ofolive-oil imports: the role of Dressel 20

With the arrival of the Roman troops, the supply of olive-oil increased sharply and this surge is archaeologically documented by the massive presence of Dressel 20 amphorae [Williams and Peacock, 1983; Funari, 1991; Carreras, 1994a]. The type was the most common amphora in the province, usually accounting for more than 60% in weight of any assemblage recovered at any

Figure 37 Interpolation map of Lamboglia 2 amphora densities (cg/m²).

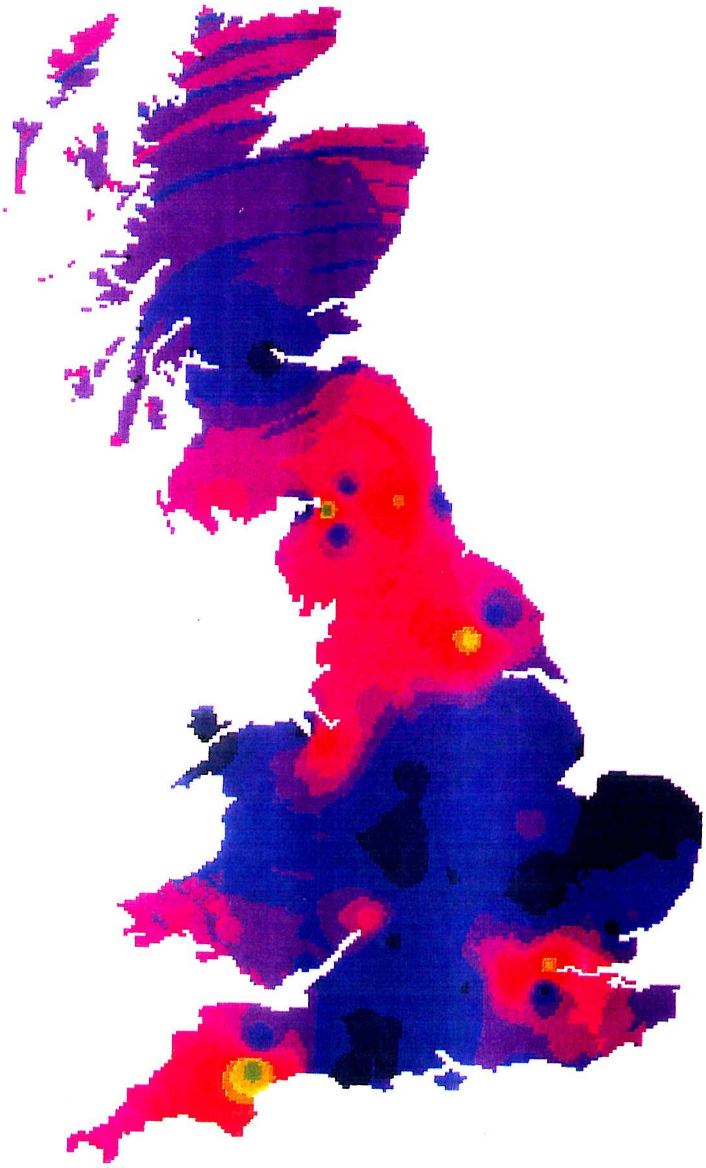

Figure 38 Interpolation map of Dressel 20 amphora densities (cg/m²).

Figure 39 Interpolation map of densities of Dressel 20 stamps.

Romano-British site[30]. Notwithstanding its general distribution all over Britain[31], the increase in imports was undoubtedly due to the mainly military consumption of olive-oil. High densities of Dressel 20 stamps, as well as the major concentrations of amphora densities in general (figure 38), are chiefly recorded in the military zone (figure 39). But this becomes even more evident when time sequence maps of stamps densities are considered. The stamp chronologies reveal high densities in the area occupied by the Roman legions during each period. In the early days of the Conquest, in the reigns of Claudius and Nero (A.D. 43-68), the majority of the Dressel 20 were distributed in the already pacified SE sector (figure 40), chiefly at Richborough [Cunliffe, 1968] and Colchester [Sealey, 1985]. Both settlements played a prominent role during the early stages of the Conquest as fleet headquarters and a temporary legionary fortress (circa A.D. 43-49) respectively.

The second chronological period comprises the Flavian and Trajan reigns (A.D. 68-117) when the governorships of *Q.Petillius Cerialis, S.Iulius Frontinus and C.Iulius Agricola* [Frere, 1987, 83-88] pushed the provincial frontier northwards as far as the Lowlands in Scotland after the pacification of Central Wales [Hanson and Breeze, 1991]. The army movements involved can be seen from the map indicating stamp densities (figure 41), which reveals high concentrations in Northern Wales, the Northwestern coast and the Tyne-Solway isthme, all areas of military occupation at that time. Moreover, the highest density recorded occurs at Richborough which was complemented by high densities at other civilian centres in the SE sector (i.e. London, Colchester).

The reigns of Hadrian and Antoninus Pius (A.D. 117-160) witnessed the construction of two walled frontiers in the Tyne-Solway and Forth-Clyde isthmes. Again the map of stamps densities (figure 42) reveals the active presence of the army in the Northern part of the province, with a significant presence at the Antonine wall. Other high densities are reported along Hadrian´s wall, on the Northwestern coast, and around the legionary fortress of Chester, and at Richborough. These concentrations of stamps in the military zones contrast with a low representation of the same in civilian areas. This would appear to underline a preferential supply.

The withdrawal from the Antonine wall [Hanson and Maxwell, 1983; Breeze, 1989], archaeologically studied on the basis of samian ware [Hartley, 1972], coins [Hanson and Breeze, 1991] or inscriptions [Keppie, 1982], can also be observed in the distribution of Dressel 20 stamps (figure 42). The period from Marcus Aurelius to Commodus (A.D. 160-192) reveals no olive-oil

[30] Unfortunatelly the olive-oil imports of Roman times cannot be compared to the ones of other historical periods, since there is no written documentation. In the Middle Ages, olive-oil was almost a luxurious good northwards of the river Loire and other substitutes such as poppy oil was used instead of it [Toussaint-Sanat, 1987, 18]. Proportionally, olive-oil constituted 25% of the total trade between Spain and Britain in the last century [Nadal, 1978].

[31] Williams and Peacock [1983] indicated that no distinctive patterns could be distinguished between civilian and military areas.

Figure 40 Interpolation of Dressel 20´s stamp densities in Julio-Claudian period (A.D. 43-68).

Figure 41 Interpolation map stamp densities in the Flavian-Trajanean period (A.D. 68-117).

Figure 42 Interpolation map of stamp densities in Hadrian-Antonine period (A.D. 117-160).

Figure 43 Stamps densities in the Aurelius-Commodus period (A.D. 160-192).

Figure 44 Stamps densities in the Severus-Postumus period (A.D. 192-259).

imports further North of Hadrian´s Wall except at Newstead [Curle, 1911]. The higher densities are reported along this later wall as well as at Richborough and Caerleon [Zienkiewicz, forth.], which suggests a new military occupation may be due to indigenous uprisings [Frere, 1987, 146-147]. Finally, the period between Septimius Severus and Postumus (A.D. 192-259) shows (figure 44) high concentrations of stamps in the Scottish Lowlands (i.e. Crammond, Carpow) which may be seen as indicating the Severian campaign activity. The second concentration in importance is documented at Hadrian´s wall which again constituted the frontier from the time of Caracalla onwards. Moreover, other military establishments such as Ribchester, Ilkley, Chester and Richborough reveal high densities of Dressel 20 stamps.

All these partial maps combine to produce the overall distribution of stamp densities (figure 39), showing three distinct zones. First of all, the military area limited by the rivers Severn and Humber, exhibits a regular concentration of stamps over the whole territory. Secondly, the Southeastern region reveals another regular concentration affected to some extent by Richborough. This may also have been as a result of the high densities of population. Between both zones there is a territory with very low densities. The same threefold division can be distinguished in the map of Dressel 20 amphora densities (figure 38), although this map also records a high density in the SW region, around Exeter.

This second map also provides a more detailed picture of possible hierarchical relationships between settlements [Hodder and Orton, 1976]. The major concentrations are recorded in well-attested or possible sites with military functions (i.e. London, Mucking, Exeter, Chester, York, Carlisle and Corbridge). The highest density is documented at Exeter, which may be due to the location of this harbour at the end of some Western trade routes[32]. Apart from the key settlements in the military zone recording high densities of Dressel 20 amphora, the area presents a clear regularity. It does not seem that transportation costs, but rather the number of troops at each fort and fortress are modelling the distribution. The four exceptions to the rule are the legionary fortresses of Chester and York, which held special logistic and administrative functions, as well as the military depots of Carlisle and Corbridge [Holder, 1982; Anderson, 1992]. Both sites record the presence of warehouses that were possibly reserved for the storage of olive-oil amphorae, since their excavation yielded high densities of exclusively Dressel 20 and North African vessels[33].

---

[32] The routes via Atlantic, Aude-Garonne-Atlantic and Rhone-Loire-Atlantic had their most accessible port at Exeter. However, the amphora sample from this site comes from a rich excavation in the Forum [Holbrook and Bidwell, 1991], which may provide a blurred picture. Despite the large area excavated, more amphora samples from Exeter are needed in order to corroborate these first conclusions.

[33] For instance, Castle Str. excavation at Carlisle revealed a building outside the military fort interpretated as a probable warehouse. The amphorae documented there were either Baetican Dressel 20 or North African olive-oil containers, reaching extraordinary high densities (109330 cg/m²) [Carlisle Arch. Unit, interim report]. Similar features are attested in the military of depot of Red House, Corbridge [Hanson et alii, 1979], with exclusively Dressel 20 amphorae (248292 cg/m²).

Although the proportions of Dressel 20 in accessible ports could suggest the minimization of transport costs [Carreras, 1994a], and therefore a market exchange pattern, the evidence in the military zone contradicts this argument. The overwhelming presence of this amphora type in the German limes permitted Remesal [1986] to develop his hypothesis proposing a direct State intervention in this amphora's distribution. He assimilated evidence from a later institution into his theory. This institution known as *annona militaris* [van Berchem, 1937; Pavis d´Escurac, 1978][34] was responsible for the military supply to the Early Empire of produce such as olive-oil. According to his hypothesis, olive-oil obtained by the State through taxes paid in kind, confiscation (i.e. *indictiones*) or purchase at fixed prices [Pavis d´Escurac, 1978; Remesal, 1986] could be allocated to any region of the Empire [De Salvo, 1992].

The practice was in economic terms dubbed as a directed or subsidized market policy [Remesal, 1986, 111; Whittaker, 1989a, 65], which was an ambiguous and confusing definition that disguised the real nature of the institution. In fact, the *annona militaris* was a complex redistributive system that operated long range and combined public and private transportation networks. Since this later institution is still not attested to in the Principate, the term military redistribution system is used here instead with reference to the early periods. At provincial level, the military administration under the surveillance of *procuratores* (Strabo 3.4.20; Pliny Epist. x.27) was responsible for conveying commodities to the troops [Remesal, 1990]. Ten *procuratores* are known to have existed in Roman Britain [Birley, 1981, 419], the earliest being Decianus Catus who held office at the time of Boudicca´s revolt (circa A.D. 60)[35].

The headquarters of the *procuratores* were established in London after the quelling of the native rebellion (see chapter 4). This demostrated by the burial of C.Iulius Alpinus Classicianus, sucessor of Decianus Catus. The continuous presence of *procuratores* in this site is also documented by the writing tablet stamped *Proc. Brit. dederunt* (i.e. issued by the procurators of Britain) [Frere,

[34] Van Berchem [1937] attributed to Septimius Severus the creation of this institution on the basis of a new office documented for M.Rossius Vitulus (AE.1911, 7; 1914, 248) as *praepositus annonae* (A.D. 193) and *procurator annona* (A.D. 196-197) [van Berchem, 1977; Remesal, 1986, 104]. The inclusion of olive-oil in the army supplies is based on its mention on a papyri in the reign of Diocletian (P.Beatty Panop. 2. 245-9) [Skeat, 1964; Duncan-Jones, 1978]. There are also private letters of legionaries demanding olive-oil as additional food (P.Mich. 483; BGU 814) [Davies, 1971].

[35] One of them, M.Maenius Agrippa, commanded the British fleet at Richborough before becoming *procurator*, which may indicate the connexion between both offices (RIB 823-6) [Frere, 1987, 187].

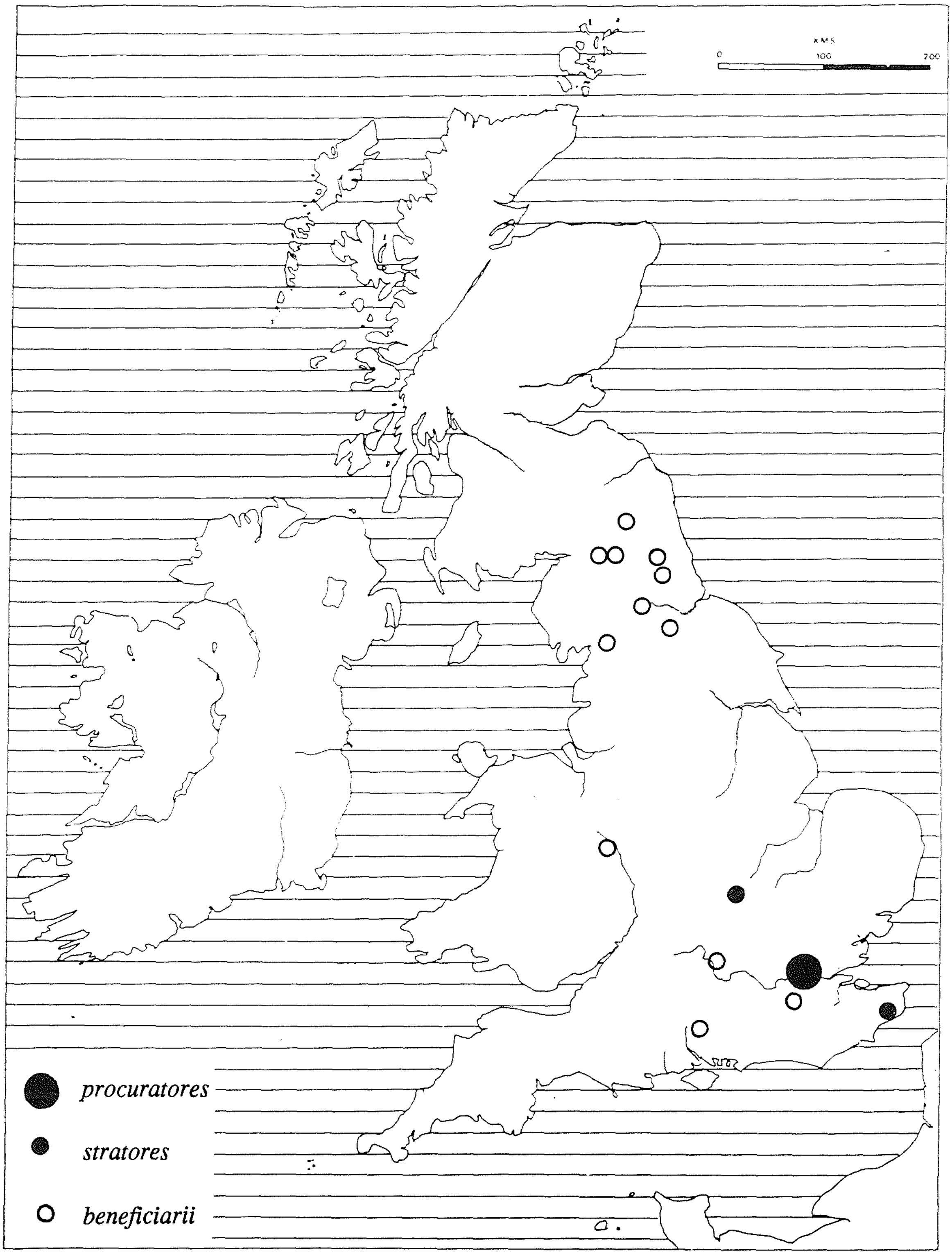

Figure 45 Distribution of inscriptions dedicated by administrative staff.

1987, 187]. Although inscriptions by local *procuratores* are documented from many places inside and outside the province (see appendix 9), London was likely to have remained the central headquarters until the division of the province in the time of Late Empire. As already stated (see chapter 4.6), the location of this office may explain the high densities of Dressel 20 stamps during the early phases of the Roman settlement of London. Therefore, *procuratores*' staff may have carried out their duties from London or any other location while the army supply came from other provinces, paying for traders and transporters themselves. However, once the olive-oil reached the province, it was controlled by the local authorities and had to be assigned to a military camp. It is unlikely that interprovincial traders were responsible for this final distribution, but rather local transporters or even military personnel. In fact this assumption seems quite reasonable, since the military staff were reportedly present in the main hubs of communication in the province. Therefore amphorae were probably transported by ship to the key military centres in the North (i.e. York, Carlisle, Chester, Corbridge)[36] with a possible previous call at Richborough. Another alternative involves the use of land transport via the public network, *cursus publicus*, which was under the control of administrative staff such as *beneficiarii*[37] and *stratores consularis*[38] (figure 45).

The final stage in the military network system involved the local allocation of supplies which was under the responsibility of senior officers and auxiliary personnel (Veg Ep.Res.Mil. ii.25) (i.e. *praefectus castrorum*, *primus pilum*, *signifer*, *optio*) [Fink, 1971; Dobson, 1972; 1974; 1978; Speidel, 1977; 1984; Breeze, 1984; Devijver, 1989]. This complex system included maxima deductions from the soldiers pay (i.e. *stipendia*) (RMR 68; RMR 69) for food (*in victum*) [Speidel, 1992; Wierschowski, 1984; Jahn, 1984]. This was probably destined to pay for olive-oil expenditures among other things. It is remarkable that none of Vindolanda´s tablets containing lists of foodstuff purchased from private traders includes olive-oil despite the fact that Dressel 20 are the best represented amphora type present [Bidwell, 1985]. Their absence would be perfectly explicable under a public redistributive system that did not require buying from local merchants in Britain.

The density maps of Dressel 20 sherds (figure 38) and stamps (figure 39) provide the archaeological evidence of this distinctive redistributive system. Furthermore, the original

---

[36] The transport to Carlisle and Corbridge required the combination of other modes of transportation (i.e. river boats, waggons, pack animals) [Anderson, 1992; Carreras, 1991; 1994a].

[37] There are numerous inscriptions of *beneficiarii* in either civilian centres such as Dorchester-on-Thames or Winchester or military establishments such as Wroxeter, Lancaster, Catterick, Binchester, Greta Bridge, Lanchester, Chesterholm, Housesteads, Risingham and perhaps Brougham (see appendix 9).

[38] *Stratores* are only recorded at Irchester (RIB 233) and Dover (Britannia vii, 426-427) (see appendix 9).

provincial distribution of stamps on the basis of a sample recorded from the 10 main importing sites[39] did not suggest any clear pattern. The results suggested the existence of four key centres (i.e. Richborough, Colchester, London, Corbridge) and the presence of products from Delicias, Tejarillo, Arva and Huertas de Belén kilns at very specific sites (i.e. Cirencester, York and Colchester). Although the evidence is slight, it seems that some production areas were prefering to supply specific destinations over long periods of time.

Similar conclusions were drawn by Remesal [1986] for Germany and Funari [1991] for Britain, although the connections between workshops and destinations were in fact affected by the supremacy of some workshops during specific periods (e.g. Malpica, Catria) and movements of troops and frontiers[40]. Funari [1991] distinguished three areas of supply with diverse amphora stamps which were at Colchester-London, Hadrian´s wall and in the Welsh settlements. In fact, they should rather have represented the three chronological phases of the conquest of the British Isles.

Nevertheless, the contrast obtained from the present statistics does not reflect any temporal change, but the preferences or presence of specific olive-oil firms in some locations. The meaning of such a pattern may indicate physical control of markets (i.e. oligopolies, monopolies) and direct transportation (i.e. Atlantic route), although the evidence is still in short supply. In contrast, the results produced by the same statistics for the stamps found at 10 German sites[41] showed no geographical pattern.

Generally speaking, the production regions in Baetica underwent an identical chronological evolution in both Germania and Britannia. First of all, the region of La Catria was the main supplier to Germania from the first century A.D. to the late second century [Remesal, 1986, 39]. Like Germania, this region controlled the British markets until the Severian period, when the region of Delicias took over the control of the province. Although the region of Arva was the main supplier in the third century in Germania, the percentage of supply held by Delicias was very important. Finally, products from Malpica showed a substantial presence in both provinces during the second century A.D.

[39] Chester, York, Colchester, London, Cirencester, Silchester, Wroxeter, St.Albans, Corbridge and Richborough.

[40] For instance, Malpica reached its peak in production in the mid second century A.D. in both Britain (see appendix 5) and Germany [Remesal, 1986], hence its high proportions at Saalburg, Zugmantel or Corbridge are due to the late foundations of these settlements (late first century A.D.).

[41] Koln, Mainz, Saalburg, Zugmantel, Nida, Nijmegen, Bonn, Rottweil, Stuttgart and Trier.

These parallels appear to indicate the particular evolution pf each distinct production area in Baetica and possible contact with the public administration system. For instance, La Catria appear to produce large quantities of olive-oil in earlier periods, and also seem to enjoy a special relationship with the administrators in charge of the military supply to Germania and Britannia. Similar pattern, which may be due to the land concentration, can be inferred from the rise to prominence of other regions such as Malpica, Arva and Delicias in later periods.

At a higher level, one may question whether Baetican workshops were specialized in supplying a single province. The combination of both sets of data, involving German and British stamps, enabled a statistical assessment to be made to establish whether a particular pattern may have existed or not. The results obtained by Correspondence Analysis highlighted a group comprising all the most important German sites (i.e. Koln, Mainz, Zugmantel, Nida), except for the inclusion of one unique British settlement (i.e. Corbridge). Nevertheless, the evidence was still rather vague so a more detailed study was required. A sample of 6 sites from three Roman provinces (i.e. Gaul, Britain, Germany) were selected, from which a number of 10 Dressel 20 stamps for each chronological period were quantified (see appendix 5). The stamps considered in the Julio-Claudian period were CSEMPOLY, SATVRNINI, LVALVIT, PORLFS, QANTRV, SISEN, PHILO, LAT, CFAV and PORCPR and their number was recorded according to each Roman site represented in the sample from Gaul (i.e. Lyon, Vienne, Finns d´Annency, Arles, Nuits St.Georges and Strasbourg) [Callender, 1965; Baudoux, 1990], Germany (i.e. Nijmegen, Koln, Mainz, Saalburg, Zugmantel and Nida) [Remesal, forth.] and Britain (i.e. Richborough, Corbridge, Chester, Cirencester, London and Colchester) [Funari, 1991; the author].

The results obtained from the multivariate analyses (Principal Components and Correspondence) were so significant that they deserve a thorough discussion and it is to the discussion of these results which we now turn.

a. The Julio-Claudian period (A.D. 43-68)

Only Principal Components provided relevant results, since the first component chiefly represented the stamps CSEMPOLY and SATVRNINI. This combination is well-attested at Colchester and London, two key sites of the period in Britain. Both stamps are almost absent in Germany[42], whereas they are in significant numbers at the two fluvial ports of the river Rhone: Vienne and Lyon. The concentrations recorded at Vienne and Lyon suggest that the olive-oil destined for the German legions was transferred there to other containers and this coincided with

[42] Only one stamp of SATVRNINI at Nida, Nijmegen and Mainz, while a unique example of CSEMPOLY is reported at Mainz.

a change to land transport in a zone of military administration. Similiarly Ettlinger [1987, 13] indicates the use of comparable combination of transport means and administrative offices in the distribution of Arretine in the Rhineland. Difficulties in accessing to the German frontier by land during the Julio Claudian period (Strabo 4.1.14) are evident in the construction of new roads that took place [Schönberger, 1969; van Berchem, 1982; Rougé, 1985; Schlippschuh, 1987; Whittaker, 1989a] and the project undertaken to build a canal (A.D. 50).

> ***"... Lucius Autistius Vetus, planned to build a Sâone-Moselle canal. Goods arriving from the Mediterranean up to the Rhône and Sâone would thus pass via the Moselle into the Rhine, and so to the North Sea. Such a waterway, joining the Western Mediterranean to the northern seaboard, would eliminate the difficulties of land transport."   [Tacitus, Ann. xviii.53.2-4]***

In this context, the presence of *diffusores olearii ex Baetica* at Lyon (CIL vi.29722) and Arles (CIL xii.714) could be easily understood since they may well have been responsible for the transhipment of olive-oil to other vessels (see chapter 6.2.1) [Panciera, 1980; Le Roux, 1988; Loyzance, 1988; De Salvo, 1992]. With regard to the distribution of SATVRNINI and CSEMPOLY stamps in Roman Britain, their strong presence suggests the use of a possible alternative transportation route to the British Isles that could have involved the Atlantic sea-route via Gibraltar [Harmand, 1974; Reddé, 1979; Remesal, 1986], since the stamps hardly ever seem to have reached any site further North on the Continent than Lyon and Vienne.

The preference shown by the two producers, Saturnini and C. Semproni Polycliti, for a particular province may suggest an established contact with the *annona* administration, which could reflect personal relationships. Perhaps the link between a *procurator* or *adiutor* and the olive-oil producers could have resulted in continued purchase of their produce to supply the same province. The same *mercatores* and *navicularii* were responsible for the movement of the olive-oil because they knew the routes and had their own contacts in the destination province (see chapter 6).

Since this initial hypothesis is rather fragile, it requires a more thorough investigation of the possible personal and political relationships in the province of Baetica. This has also been observed by Remesal [1977; 1989]; however, it goes far beyond the aim of the present thesis.

b. The Flavian-Trajanic period (A.D. 68-117)

The Dressel 20 stamps from this second period demonstrate that there was a notable supply to the British and German limes. The first component (Principal Component) accounting for the stamps QCC, APC and BELLICANAPAG is only represented at German sites (i.e. Nijmegen, Koln, Saalburg, Zugmantel and Nida) [Drinkwater, 1983, 57-69], whereas the two components of Correspondence Analysis only relate German and Gaulish settlements[43]. The most common stamps at Romano-British sites are CANTONIQVIETI, MAR, MIM and IIENNIVL, which are less represented in the Continental settlements. Again the preferential links of some olive-oil producers with particular provinces may indicate special relationships between landowners and administrators in Baetica.

The variation in Dressel 20 stamps from both areas suggests a possible geographical specialization in the supply produced by some Baetican workshops. In other words, an olive-oil producer may have been responsible for supplying the army in one province with a regular quantity of olive-oil. Such a link between origin and destination required periodic transportation of goods probably through the same people (i.e. *navicularius*, *mercatores*, *negotiatores*).

c. The Hadrianic-Antonine period (A.D. 117-160)

In contrast to the other periods, there are no clear differences in supplies produced in the early second century A.D. In fact, only the military depot of Corbridge reveals a pattern identical to that of the German sites (i.e. Mainz, Saalburg, Zugmantel and Nida). All these settlements document a good number of stamps VIRGINENSIA, MMCS, QIA, SAXOFERRO, DOMS, QIM and SNR which comprised the predominant stamps of this period. The overwhelming predominance of those stamps suggests that control of Baetican olive-oil production lay in a few hands or at least that the military supply was controlled by a few.

d. The Marcus Aurelius-Commodus period (A.D. 160-192)

The second half of the century reflects again a different pattern of supply to the two frontiers. Although the most common types (i.e. LIT, LQS, QMR, GMMF, LCM) were equally distributed at German sites such as Saalburg, Zugmantel and Nida than in the depot of Corbridge, minority stamps were documented in specific regions. For instance, the stamps TAAPA, LSELSENC and LAF are chiefly recorded in Britain (i.e. Richborough, Cirencester, London, Colchester) as well as in Nuits St.Georges and Vienne. However, there are no testimonies of any of them ocurring at any German site [Remesal, forth.]. Again, the specilized supply of some workshops to individual provinces or regions seem the most likely explanation for this in a period dominated by continual wars (e.g. Marcomanni, Quadi) [Drinkwater, 1983, 76].

---

[43] The first component clustered QCC, APC, BELLICANAPAG and IIENNIVL (i.e. Saalburg, Zugmantel and Strasbourg) while the second one did QCC, APC, BELLICANPAG, HISPSAEN and MIM (i.e. Saalburg, Zugmantel, Strasbourg, Nida, Koln, Nijmegen and Lyon).

e. Septimius Severus-Postumus (A.D. 192-259)

The last period considered revealed no trace of a distinct pattern linking provinces. On the contrary, stamps from Delicias (i.e. FSCIMNIANO, LIVNIMELISSI, II IVNIMELISSI ET MELISSE) and the Arva regions (i.e. PARVA, PNN) in Baetica seem to have exercised an almost complete monopoly over all the military supply, which of course is indicative of a change probably linked with the production area.

5.3.1.1 Dressel 20 in Britain: an overview

The significance of Dressel 20 amphora finds in Roman Britain has long been recognized [Callender, 1948; 1965; Williams and Peacock, 1983; Funari, 1991]. The presence of this olive-oil container identifies a remarkable change in patterns of food consumption in the region after the Roman Conquest. Furthermore, the distribution of amphora finds with a notable concentration ocurring in military areas suggests a non-market mechanism of distribution involving the military administration.

The redistributive system under military rule permitted the allocation of Baetican olive-oil wherever it was considered necessary, regardless of cost. Although the ramifications of the whole structure are still unknown, it is clear that some military officers such as *procuratores*, *stratores* and *beneficiarii* seem to have been in charge [Remesal, 1990]. Therefore, the distribution of Romano-British inscriptions belonging to these administrative personnel provide an useful means of approaching the questions of the internal organization of the supply.

With regard to the external system in operation, the Dressel 20 stamps indicate a possible link between production centres and final destinations within the province. Similarly a distinctive provincial pattern becomes evident from the different assemblages of stamps present at German, Gaulish and British sites. This represents a diversity also reflecting changes over time due not only to the transport infrastructure but also to historical events.

5.3.2 The end of a system: the Dressel 23

The Dressel 20 amphora disappeared gradually during the early second half of the third century A.D. [Rodríguez Almeida, 1989], being replaced by another Baetican vessel, the Dressel 23 [Remesal, 1991]. This was not a sudden change over as the Cabrera III shipwreck dated in A.D. 257 [Bost et alii, 1992] demonstrates by its compound cargo of both types. Nevertheless, the role of the new vessel never matched that of its predecessor and testimonies of its presence at the Western frontiers are less important [Martin-Kilcher, 1987a; Baudoux, 1990; Remesal, 1991][44]. Thus it seems that the redistributive system responsible for the movement of the major part of Dressel 20s was not employed by its successor.

The contrast in Roman Britain is clear, only two examples of Dressel 23 at Winchester [Carreras and Williams, 1993] and York [Williams, pers.comm.] have been documented so far, although two possible Dressel 23 stamps at Colchester (i.e. CIR, IIMINICIOR) [Funari, 1991] may provide further evidence. The interpolation map (figure 46) reflects the unique record that the current sample provides and underlines the difference between this type and its predecessor.

5.3.3 The second olive-oil supplier: North African amphorae

North African amphorae were produced over more than three centuries. The first examples in Roman Britain were dated to the Antonine period (i.e. Bishopgate, Caerleon and Exeter) [Peacock, 1977a; Tyers, 1984; Williams, forth.], though the peak in imports probably ocurred during the third century A.D. (i.e. New Fresh Wharf and St.Magnus, London; Castle Str., Carlisle) [Williams and Carreras, forth.]. Therefore, African amphorae competed with the Baetican Dressel 20 for at least one century, though from the late third century onwards they dominated the local market completely with the only competition being from the Dressel 23s. The stratigraphic sequence of Castle Str. (Carlisle) reflects this change in olive-oil suppliers in the third century A.D. which is also confirmed by Late Roman excavations in London (e.g. ER and DGH-86 excavations).

Notwithstanding the fact that North African amphorae are quite common at numerous Romano-British sites, they never matched the Dressel 20s in terms of quantity [Williams and Carreras, forth.]. This statement is based on comparative studies of the possible quantities of olive-oil imported using both types of container, taking into account ratios, weight/capacity. The table below records standarized measures in litres for both amphorae according to data from the present sample (litres * $10^5/m^2$).

As can be observed, Baetican olive-oil represented by the Dressel 20 amphorae accounted for more than 93.8% (e.g. Exeter) of the total imports, whereas the North African produce totalled less than 6.2%. Furthermore, the later imports of olive-oil were chiefly documented in urban centres of relatively large size. In contrast to the Dressel 20 distribution, the North African vessels do not reflect any military pattern, but rather they seem to be distributed through an alternative

[44] Only the church of St.Gedeon at Koln reports a large quantity of Dressel 23s [Remesal, 1991].

commercial network. The interpolation map (figure 47) reveals high densities of them in accessible urban centres such as Exeter, London, York and Carlisle. In the case of each of these four cities the transportation costs involved by combining sea and river transport were relatively low [Carreras, 1994a], hence they could be considered excellent potential markets. For this reason, a possible market exchange mechanism may explain the distribution pattern of North African amphorae. Moreover, the map implies that the four main importers in the province (i.e. Exeter, London, York, Carlisle) may have acted as the central markets for specific geographical zones. In the Severan dynasty, the province was divided into two parts, Upper and Lower Britain with York and London respectively as their capitals [Frere, 1987, 163]. The concentration of North African amphorae at both sites may result from the reorganization of this period which affected not only to the administrative but also the economic structure. Finally, the fact that Exeter recorded the highest density may be due to the limited sample collected. The use of a specific route (i.e. via the Atlantic), is possible although unlikely.

Olive-oil imports suffered a steep decline from the time of the Principate to that of the Late Empire and this is reflected in the quantities of Dressel 20, Dressel 23 and North African amphorae found (see following table) [Carreras and Williams, 1993; Williams and Carreras, forth.]. This sudden shift is difficult to explain on the basis of changes in patterns of consumption or historical events. Nevertheless the change appears to be related to the disapperance of the exchange mechanism that conveyed the olive-oil from the Mediterranean. The redistributive system partially responsible for the quantities and special distribution of the Dressel 20 amphorae simply disappeared, and afterwards there was no similar pattern in operation. The consequences of a change of this kind can be evaluated through the limited role of North African olive-oil in the Late Empire.

5.3.4 Olive-oil and Britain: a initial conclusion

Olive-oil was a completely unknown product in Britain until the first contacts between Iron Age communities and the Roman world were established. The early presence of the olive-oil amphorae before the Conquest may be regarded as a merely symbolic one. In fact, there was a lack of taste for this produce among the native population. However, the picture changed radically with the arrival of the Roman troops and olive-oil became the most habitually imported commodity in amphorae as the overwhelming presence of Dressel 20 makes evident. The new situation was not only the result of immigration and processes of acculturation [Okun, 1989a; 1989b], but also of the creation of an original mechanism of exchange, a redistributive system. The redistributive system permitted the Roman army to be supplied with produce which was difficult to obtain in quantities from the local markets of the province. The complexity of such a system is fully apparent in the distinctive distribution of amphora stamps within the province and along the routes between Gaul, Germany and Britain; which suggests a clear link between production areas and final destinations.

In the middle of the third century A.D., the system seemed to collapse and Dressel 20 were replaced by Dressel 23 and North African vessels. The latter type became predominant in the province, though neither its distribution nor quantity matched that of its predecessor. In fact, its pattern of distribution indicates that a market exchange mechanism may have been responsible for the presence of African amphorae. Thus, a new type of exchange permitted the entry of olive-oil into Britain in the Late Empire under the direct influence of demand and supply. The vicissitudes of olive-oil imports in Roman Britain can be roughly seen in the table below, which includes amphora densities (gr * $10^2/m^2$).

5.3.5 Olive-oil and the Roman army

The major presence of Dressel 20 amphorae at the military frontiers (i.e. Germany, Britain) has been interpreted as indicating the possible existence of a public redistributive system [Remesal, 1986] or a subsidized trade in olive-oil [Whittaker, 1989a]. The considerable military consumption of this oil in Roman Britain has already been stressed in the discussion of the distribution of stamps and amphora densities (see also chapter 4). There is no doubt that the military administration made a particular effort to ensure that legionaries were supplied with a commodity that had to be brought a long distance. It is argued that the State, collecting taxes in kind, kept back a proportion of the olive-oil produce and that this was employed to satisfy the needs of the Roman *plebs* and of the legions [Remesal, 1986]. Thus, a political reason has been put forward to explain the reasons for this type of redistribution. The advantages of collecting taxes in kind instead of money are debatable, chiefly taking into account the gains that the State obtained from withdrawing old coins and striking new ones [Walker, 1976]. Furthermore, shared interests between Baetican people (i.e. landowners, traders) and public contractors may have been another good reason, which would have reaped economic benefits for both parties. However, the reasons for such vast expenditure and effort do not seem clear. Moreover, from a dietetic viewpoint it must be borne in mind that the destination provinces did not need the olive-oil since there were other available fats that could be substituted such as lard, butter or flax oil in the province[45]. If an economic explanation does not provide a satisfactory answer, physchological and sociocultural considerations may provide an alternative view.

[45] In fact bacon, cheese and hard tack were a fundamental part of the iron rations for the army in campaign (HA Hadr.10.2; HA Sev.Alex. 51.5; 61.2; Herodian 2.11.2; 4.12.2; HA Avius Casius 5.3). On the other hand, olive oil is also present in the literary sources as staple for the troops (Appian Iber.54; Frontinus Strat. 3.16.3; Josephus Ant.Jud. 14.408; Josephus Bell.Jud. 1.299; P.Oxy. 2046).

Table 16: Comparison of weights of Baetican and African amphorae

SITES	Dr.20	%	African	%
1. London	65827	96.5	2387	3.5
2. Ribchester	32652	100.0	-	0.0
3. Longthorpe	21888	100.0	-	0.0
4. Vindolanda	46833	100.0	-	0.0
5. Kingsholm	32565	100.0	-	0.0
6. Poundbury	2613	96.6	91	3.4
7. Skeleton Green	1488	100.0	-	0.0
8. Inchtuthill	17664	100.0	-	0.0
9. Exeter	82821	93.8	5397	6.2
10. Ivy	765	100.0	-	0.0
11. Stonea	1207	100.0	-	0.0
12. Cirencester	4365	100.0	-	0.0
13. Winchester	5858	94.2	357	5.8
14. Chichester	21504	97.8	462	2.2
15. Chester	53928	99.5	248	0.5
16. York	65781	96.7	2212	3.3
17. Old Penrith	11263	100.0	-	0.0
18. Bewcastle	15333	100.0	-	0.0
19. Purbeck	192	100.0	-	0.0
20. Chelmsford	25070	100.0	-	0.0
21. Carlisle	84722	98.8	952	1.2
22. Corbridge	59354	100.0	-	0.0
23. Leicester	14316	97.6	339	2.4
24. South Shields	13226	100.0	-	0.0
25. St.Albans	19185	100.0	-	0.0
26. Silchester	5138	99.8	7	0.2
27. Colchester	17697	99.9	10	0.1
28. Lancaster	32462	100.0	-	0.0
29. Staines	54084	100.0	-	0.0
30. Canterbury	21108	99.6	77	0.4
31. Brancaster	3555	100.0	-	0.0
32. Metchley	1226	100.0	-	0.0
33. Rochester	3928	100.0	-	0.0
34. Malton	13113	100.0	-	0.0
35. Hibalstow	9458	100.0	-	0.0
36. Sandy	1089	100.0	-	0.0
37. Ardleigh	1094	100.0	-	0.0
38. Beddington	3439	100.0	-	0.0
39. Mucking	37680	100.0	-	0.0
40. Godmanchester	3734	100.0	-	0.0
41. Tiverton	7389	100.0	-	0.0
42. Chesterfield	10243	100.0	-	0.0
43. Gillingham	4800	100.0	-	0.0
44. Alcester	3304	100.0	-	0.0
45. Falkirk	3338	100.0	-	0.0
46. Pentre Farm	1219	100.0	-	0.0
47. Segontium	796	100.0	-	0.0
48. Kirkbridge	2284	100.0	-	0.0

Figure 46 Interpolation map of Dressel 23 amphora densities.

Figure 47 Interpolation map of North African amphora densities.

There was less risk involved if soldiers kept to the staple foods of their native diets. Soldiers who tried new foodstuffs could experience digestion problems, such as those documented by Appian (Iber. 54) who recorded soldiers suffered ill effects from eating hare without salt (i.e. cunicular inanition) [Harris, 1989, 43]. Moreover, psychologically, by retaining their original diets soldiers kept emotional ties with their original home (i.e. smells, tastes) [Cruz, 1991, 84-85], sometimes complemented by the direct rejection of local foods (i.e. neophobia) [Farb and Armelagos, 1980, 191; Goody, 1982; Cruz, 1991]. Olive-oil was also important because it could be used in a number of ways for cooking (i.e. roasting, boiling, frying) and was deeply rooted in cultural communities [Lévi-Strauss, 1964; Goody, 1982; Okun, 1989b, 122-127; Cruz, 1991]. Thus, although olive-oil was never important for the Egyptians, they associated it with Greek, Syrian and Phoenicians cultures [Darby et alii, 1977, 785]. From a sociocultural perspective, a distinctive diet for the whole army could reinforce the sense of solidarity among soldiers based in a possibly hostile environment. It could also create a sense of collective mentality, even and bridge differences with the auxiliary troops [Carrié, 1989, 124; Le Bohec, 1989a, 273]. It should also be noted that olive-oil provides a means of establishing links between the population from the core provinces of the Empire and the legionaries defending the frontiers, since both groups shared the same food, whereas peripherical populations had different eating habits.

The Roman State may have supplied olive-oil in an attempt to make the army represent a model of the Roman way of life (i.e. in terms of clothes, language, architecture, entertainment) [Davies, 1971; Carrié, 1989; Le Bohec, 1989a], in terms of its diet[46]. Long-distance transportation of olive-oil in amphorae was at least less burdensome than that of corn or animals. As long-distance trade in animals was not recorded in Roman times, meat consumption may have been affected by the local environmental constraints applying to stock raising [Knörzer, 1970; Luff, 1982; Bowman and Thomas, 1983, tab.5; King, 1984; Lauwerier, 1988]. The following diagram (figure 48) summarises the organization of the military redistributive system as reconstructed from archaeological and epigraphic evidence.

[46] Actually the practice seems to have been also documented in the French army [Corvisier, 1976] and the XIX century British army where soldiers had to subsist on beef-broth and boiled beef supplied by the metropolis to the troops garrisoned in any foreign station [Fortescoe, 1923, 13-25].

Table 17: Comparisons of number of litres imported for each olive-oil amphora type

SITES	Dr.20	African	Lamb. 2	Dr.23
1. London	27428	682	-	-
2. Ribchester	13605	-	-	-
3. Longthorpe	9120	-	-	-
4. Vindolanda	19514	-	-	-
5. Kingsholm	13569	-	-	-
6. Poundbury	1089	26	-	-
7. Skeleton Green	620	-	134	-
8. Inchtuthill	7360	-	-	-
9. Exeter	34509	1562	-	-
10. Ivy	319	-	-	-
11. Stonea	503	-	-	-
12. Cirencester	1819	-	-	-
13. Winchester	2441	102	-	31
14. Chichester	8960	132	-	-
15. Chester	22470	71	-	-
16. York	27409	632	-	-
17. Old Penrith	4693	-	-	-
18. Bewcastle	6389	-	-	-
19. Purbeck	80	-	-	-
20. Chelmsford	10446	-	-	-
21. Carlisle	35301	272	-	-
22. Corbridge	24731	-	-	-
23. Leicester	5965	97	-	-
24. South Shields	5511	-	-	-
25. St.Albans	7994	-	-	-
26. Silchester	2141	2	-	-
27. Colchester	7374	3	-	-
28. Lancaster	13526	-	-	-
29. Staines	22535	-	-	-
30. Canterbury	8795	22	-	-
31. Brancaster	1483	-	-	-
32. Metchley	511	-	-	-
33. Rochester	1637	-	-	-
34. Malton	5464	-	-	-
35. Hibalstow	3941	-	-	-
36. Sandy	454	-	-	-
37. Ardleigh	456	-	-	-
38. Beddington	1433	-	-	-
39. Mucking	15700	-	-	-
40. Godmanchester	1556	-	-	-
41. Tiverton	3083	-	-	-
42. Chesterfield	4268	-	-	-
43. Gillingham	2000	-	-	-
44. Alcester	1377	-	-	-
45. Falkirk	1391	-	-	-
46. Pentre Farm	508	-	-	-
47. Segontium	332	-	-	-
48. Kirkbridge	952	-	-	-

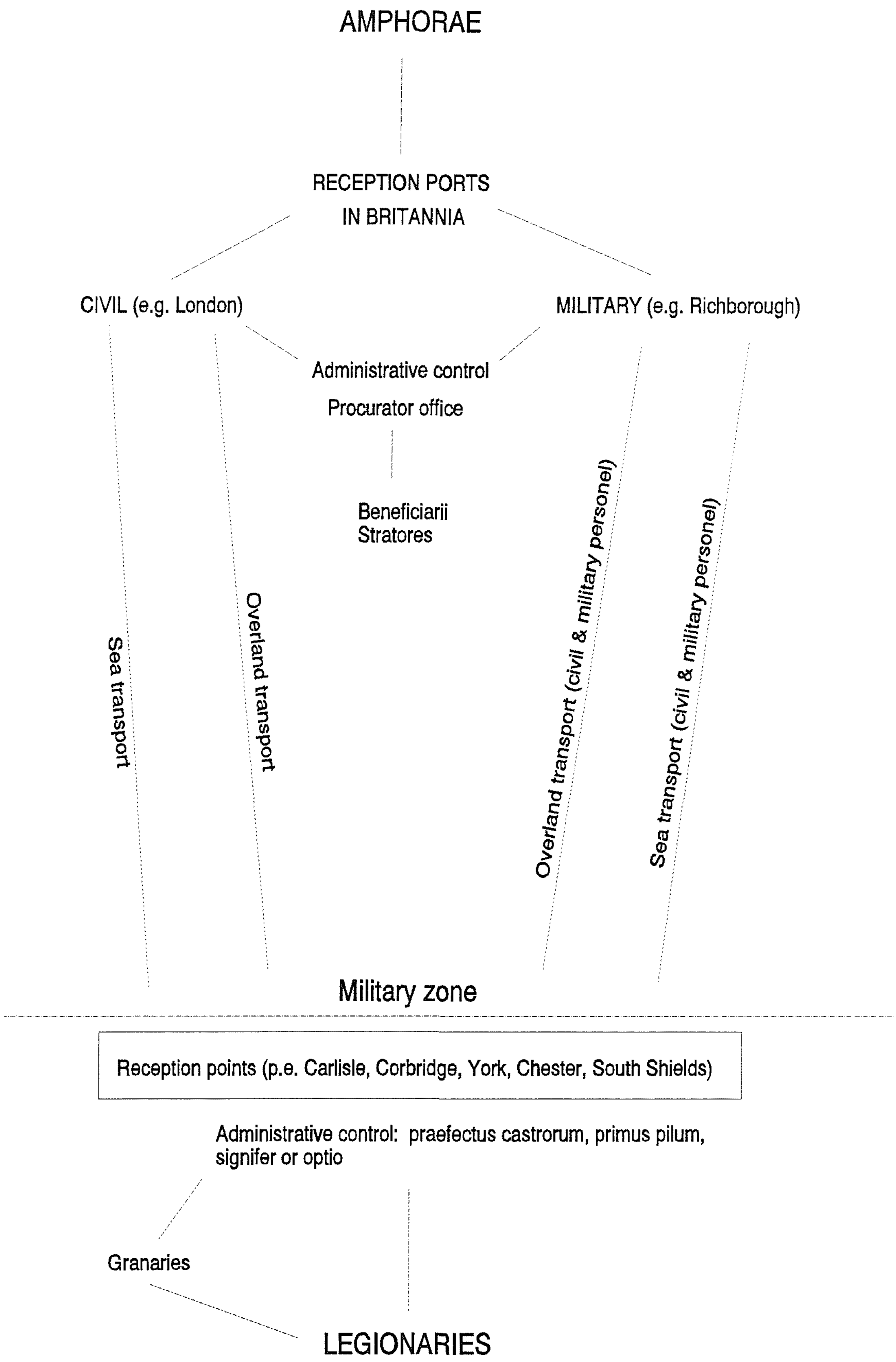

Figure 48 Diagram on the structure of the military network.

5.4 Wine in Roman Britain

Wine was another product, which was not originally produced in Britain, although vineyards could adapt to its climate [Sealey, 1985] as the existence of English wines in later periods demonstrates. Nothwithstanding the possibility of a local production, wine was an exotic commodity in the Isles obtained from Continental growers as early as the Iron Age. Beer and mead (Strabo 4.55.201), however, were the typical local beverages, occupying the place of wine among the Northern peoples whose traditions limited the spread of the latter drink [Balsdon, 1979, 222]. Alcoholic beverages fulfil a social role in the majority of cultural groups, promoting solidarity among members and bridging differences with strangers [Dietler, 1990]. Groups normally define a series of rules and taboos around alcohol, so that each member knows how to behave when it is consumed [Pittman and Snyder, 1962; Marshall, 1979].

> *" It means also that drinking behaviour is almost universally governed by cultural rules and expectations, and there are often very emotionally laden. "*
> *[M.Dietler, 1990, 360]*

Wine amphorae are first recorded in Iron Age contexts in Britain (i.e. Dressel 1A and C) [Peacock, 1971; Fitzpatrick, 1985] in relatively low quantities. They can often be found in burials [Whimster, 1981], revealing their value as prestige items. This empahsizes their values as scarce items and the competition involved in obtaining them [Haselgrove, 1987; Cunliffe, 1988]. Nevertheless the arrival of Roman citizens after the Conquest altered this pattern, since the volume of imports increased steeply. The settlers had access to a myriad of wines from diverse regions and their preferences were affected by economic, social and cultural factors. Wine again became an unusual commodity in the Late Empire, when contacts between different provinces were reduced to a minimum.

The quantification of amphorae in the present thesis permits the evolution of imported wine-bearing amphorae in Britain to be studied. As three chronological periods seem to be clearly defined, the analysis of amphora types will be made according to this initial division.

5.4.1 Wine in the Iron Age communities

The earliest evidence of wine consumption in Britain is documented by the presence of Dressel 1A of Italian origin, which can be dated to the first two centuries B.C. The majority of finds are recorded in the South, Hengistbury Head being the site with the highest proportion [Peacock, 1971; Fitzpatrick, 1985; Williams, 1987]. The successor of this type, the Dressel 1C, basically appears in Southeastern Britain [Fitzpatrick, 1985], indicating a possible change in supply

Figure 49 Interpolation map of Dressel 1 amphora densities.

routes, exchange networks or centres of consumption. The distribution pattern of both amphora types have been related to their datings and the development of the local tribal societies [Haselgrove, 1987; Cunliffe, 1988; Millett, 1990]. Despite the value of these finds as indicators of long-distance contacts, the low quantities recorded suggest that they have little importance in economic terms. Local beverages remained the more consumed drinks whereas wine fulfilled a social function at local parties express frequently status (i.e. guest, host) [Dietler, 1990, 369].

> *" A couple of amphorae for a lifetime's quite imbiding does not imply that beer was abandoned as the main alcoholic beverage... " [GB.Dannell, 1979, 187]*

The low volume of imports can be inferred from the 69.6 Kg of amphora sherds recovered at Hengistbury Head [Williams, 1987] in an area of 3 ha. over a time span of approximately two centuries [Cunliffe, 1987]. Despite this evidence, wine was the most accepted commodity in Iron Age societies in comparison with to other imports such as olive-oil, fish sauce or dates. The easy acceptance of a new alcoholic drink seems to have been a common attitude in societies with well-integrated drinking practices [Dietler, 1990, 374][47], as the case of the British communities demonstrates.

Italian wine carried in the Dressel 1 variants was documented in two settlements in the current sample: Silchester and Skeleton Green. Although the evidence is scarce, it supports a preferential distribution in Central and Eastern South Britain (figure 49). The area was occupied by tribes such as the Atrebates, Belgae, Catuvellauni or Trinovantes which had a developed social fabric and strong political and economic links with the Continent [Haselgrove, 1987; Cunliffe, 1988]. Italian amphorae were the most common wine containers in the last centuries B.C.. However, in the Augustan period another type, produced in the Tarraconensis known as Pascual 1 arrived [Williams, 1981]. This new type is also present in Southern Britain in the same areas as its predecessors.

In the sample, Pascual 1 is only recorded at two sites, Purbeck and Silchester, though it may have been confused with the Catalan Dressel 2-4 which shares the same fabric. The type Dressel 2-4 also appeared in the late first century B.C. but it became really important on the local markets after the Conquest [Sealey, 1985]. Nevertheless, some imports could have reached the Iron Age communities [Sealey, 1985; Williams, 1989; Stead and Rigby, 1989], though their quantity is difficult to assess.

---

[47] Only two Celtic tribes in Roman times, the Suebi and Nervii, forbade the consumption of wine (Caesar, BG iv.2; ii.15), though they can be considered as exceptions.

As far as amphorae are concerned, the consumption of wine in Iron Age Britain can be considered rare and it never replaced the local alcoholic beverages. Amphorae may have arrived as diplomatic or kinship gifts according to the quantity involved, and more occasionally through trade[48] [Bloemers, 1990; Trow, 1990]. Their presence represents a sign of the adoption of Roman practices by local elites in order to achieve status in their own communities as well as to appear equal to Romans [Bartel, 1980; van der Leeuw, 1983; Okun, 1989a]. Italian wines exercised a complete monopoly over the British market until the late first century B.C. when other wines (e.g. Catalan) reached the British Isles. As happened in the case of olive-oil, the Claudian conquest completely modified this picture.

5.4.2 Wines in the Principate

The Claudian invasion brought with it the arrival of a large Roman army estimated at c.40.000 men [Frere, 1987, 48]. The direct impact of the Army became evident in the need for supplies obtained through taxation or from the market [Breeze, 1984]. Roman troops, administrative personnel and Mediterranean traders brought to the conquered province new drinking habits in which wine had the foremost role. In fact, wine amphorae become so abundant from this period onwards that there may be a close link between the quantity of amphorae and the number of newcomers. The Roman army constituted an important consumer of wine and its derivatives such as *posca* and vinegar [Davies, 1971; Tchernia, 1986a, 11-19][49]. But they were not the only consumers, since it was accessible to the civilian populations as well. Apart from an increase in the volume of wine imported, the Conquest represented a widening of the varieties available. Wines from diverse origins are well-documented at Romano-British sites and they signify the difference in tastes, purchasing power and accessiblity to local people. The cult of Bacchus, a Roman divinity related to wine, was equally present in the military and civilian areas [Hutchinson, 1986]. Although the army initially spread the cult, it quickly established itself in the main urban centres of the Southeastern region (i.e. London, Colchester, Canterbury, St.Albans, Silchester).

However, levels of consumption of particular wines varied in terms of their respective qualities, since quality normally served to indicate status [Tchernia, 1986a, 28-37]. Production areas and age were the two conditions to distinguish a quality wine (e.g. Falernian, Salerno, Massico, Chios) (Martial viii.45; vii.92; Juvenal v.36-37; Pliny NH xiv.124) which could reach

[48] For instance, Hengistbury Head has been intrepretated as a Port-of-trade [Polanyi, 1957a; Cunliffe, 1987].

[49] There are numerous mentions to these alcoholic drinks as part of the army supplies (HA Hadr. 10.2; HA Sev.Alex. 51.5; 61.2; Herodian 2.11.2; 4.12.2; HA Avid.Cas. 5.3; HA Pesc.Niger 10.3-4; Appian Iber. 54; Vegetius Ep.Res.Mil. 4.7; CJ xii.37; CTh vii.4; P.Oxy. ix.1194; ix.2114; P.Cairo Goospead xi.7-8; P.Rein. 56; P.Lond. 249; P.Beatty Panop. 2 246-249; 285-289) and the Vindolanda writing tablet 4 [Bowman and Thomas, 1983].

prices only affordable by an elite[50]. Oxyrhynchus (P.Oxy. liv.3765) records price lists which included local wines and vinegars of diverse kinds, while other papyri refer to different qualities (P.Iand. vi.99). Distinctions in quality make the study of wine amphora rather difficult, since their values could fluctuate quite a lot as deduced from an inscription from Pompeii.

> ***" Hedone declares: Drinks cost one as. If you pay double, you will drink better. If you pay quadruple, you will be drinking Falernian wine"   [CIL iv.1679]***

A survey of painted inscriptions on wine amphorae recovered in Britain testifies to the presence of high quality draughts such as Falernian (FAL/LOLL, Colchester) [Sealey and Davies, 1984], Campanian (LYMP[a], Richborough) [Bushe-Fox, 1949, 253-254], Greek (GLUK[us oinos], Mumrills) [Wright, 1964] or Aminean wine (AMINE, Caerleon) [Wright, 1966]. Unfortunatelly, both high quality and table wines were decanted into the same types of vessels and were produced in nearby areas, so that neither amphora form nor fabric can normally be used to identify the original content. These were distinctions that otherwise, the Romans were completely aware of as Martial points out.

> ***"... This vintage is not pressed in Peligrian wine-presse; nor is that grape origins born on Tuscan hills; may, a choice jar of ancient Opimius is drained; this Massic store-room sends forth its smoked jars. Get from the taverna dregs of the Laletania if take more than ten drinks, Sextilianus." [Martial Epig. i.26]***

In Roman Britain, two amphora groups can be easily detected. One of them includes the most common vessels in the province representing both quality and table wines, while a second group comprises occasional types of table wines.

5.4.2.1 Common wine amphorae in the province

The most common wine amphorae recorded in the Principate come from at least five different origins: the Eastern Mediterranean, Italy, Catalonia, Gaul and even Britain itself. Although the production span varied for each type, using the current sample their relative quantities can be compared in terms of their content densities (litres * $10^5/m^2$) (see following table).

As can be observed, the Gauloise 4 is predominant at the majority of Romano-British sites, reaching percentages of 80-90% of the total. The type arrived in Roman Britain in the 60s A.D.

---

[50] The same distinctions in wine consumption have been documented in other historical periods [Dion, 1959] as well as the present days (e.g. Trockenberenauslese wine) [Farb and Arnelagos, 1980, 6].

[Peacock, 1978; Sealey, 1985], so earlier sites and assemblages reflect the supremacy of other wines. For instance, Italian wines were in the majority at Longthorpe, Skeleton Green, Metchley and Silchester; Rhodian at Kingsholm, Tiverton and Cirencester; and Catalan at Poundbury. However, effective domination of the British markets was achieved by the Gaulish wines as soon as they reached the province in quantities. An individual analysis of each amphora distribution gives some insight into the characteristics of the market as well as the changes that occurred over time.

a. Eastern Dressel 2-4

Eastern Mediterranean wines are considered to have been relatively high quality wines due to the distance they travelled to reach the province. This would have increased their price enormously [Carreras, 1994a]. Wines from Chios, Lesbos, Cos, Thasos and Leucade enjoyed a great prestige among Romans[51], who even sought to produce similar types themselves (Cato De Agr. 112) [Tchernia, 1986a, 100-102]. The low proportion of this amphora type in the province suggests that it carried quality wines affordable by only a few[52].

The interpolation map (figure 50) reveals a distribution concentrated in the main urban centres of the populated Southeast (i.e. London, St.Albans). This area constituted the most attractive market for expensive commodities since it represented a gathering point for many potential customers and the wealthy groups of people involved in administration and trade [Marsden, 1980; Merrifield, 1983]. However some amphorae also reached key military centres such as Chester or Carlisle, where high ranking officers may have been the most likely consumers of quality wines. The amphora distribution reveals that they were basically imported during the first century A.D., as they are not recorded in any later military foundation. In this early period, Chester and Carlisle may have represented the two principal military depots and markets in the Northern part of the province.

In general terms, the pattern of distribution corresponds to that of a market exchange since major concentrations are recorded in places of low transportation costs and easy accessibility [Carreras, 1994a]. Within the province, the Eastern amphorae never reached secondary settlements or rural sites, consequently no hierarchical systems in the market can be inferred.

[51] From the early second century B.C. there are continuous mentions to the luxurious Greek wines (Varro Sat.Men. 105; Pliny NH xiv.97; Horace Epod. ix.34; Sat. i.10.24; Properce i.14.2).

[52] However great quantities are reported in other Northern settlements such as Lyon [Desbat and Picon, 1986] that may contradict this point.

Table 18: Comparisons of volume in imports of wine amphorae

SITES	Eastern 2-4	Italian 2-4	Gauloise-4	Rhodian	Catalan 2-4	Verula. 2-4
1. London	2100	1728	16687	1220	18	-
2. Ribchester	346	74	806	-	-	-
3. Longthorpe	-	1600	197	-	-	-
4. Vindolanda	204	-	1496	-	-	-
5. Kingsholm	-	1520	4971	20823	-	-
6. Poundbury	-	26	157	-	183	-
7. Skeleton Green	-	832	-	-	-	-
8. Inchtuthill	-	480	739	-	-	-
9. Exeter	154	2000	24858	1492	1779	-
10. Ivy	-	-	15	-	-	-
11. Stonea	4	2	166	-	-	-
12. Cirencester	238	38	46	249	-	-
13. Winchester	232	22	2223	48	-	-
14. Chichester	50	1086	1142	231	-	-
15. Chester	798	338	4469	162	92	-
16. York	-	1824	19613	2	-	-
17. Old Penrith	-	6	104	-	-	-
18. Bewcastle	-	106	-	-	-	-
19. Purbeck	-	258	492	-	238	-
20. Chelmsford	-	-	5460	-	-	-
21. Carlisle	328	1338	2269	1861	-	-
22. Corbridge	-	-	850	32	-	-
23. Leicester	334	54	3163	52	44	-
24. South Shields	-	814	129	-	-	-
25. St.Albans	824	14	1684	440	-	678
26. Silchester	-	1264	231	-	92	-
27. Colchester	-	20	2531	529	419	-
28. Lancaster	20	322	736	-	-	-
29. Staines	-	-	1613	14	-	360
30. Canterbury	-	630	2528	115	-	-
31. Brancaster	-	-	535	-	-	-
32. Metchley	-	8	-	6	-	-
33. Rochester	-	-	21	-	-	-
34. Malton	-	-	1188	-	-	-
35. Hibalstow	-	-	163	-	-	-
36. Sandy	-	-	30	-	-	-
37. Ardleigh	-	-	329	-	229	-
38. Beddington	-	250	616	-	-	-
39. Mucking	-	2534	25585	-	-	-
40. Godmanchester	-	78	455	-	-	-
41. Tiverton	-	-	-	129	-	-
42. Chesterfield	-	876	-	-	-	-
43. Gillingham	-	-	-	-	-	-
44. Alcester	-	-	-	-	-	-
45. Falkirk	-	-	-	-	-	-
46. Pentre Farm	-	4	33	2	-	-
47. Segontium	-	2	61	-	-	-
48. Kirkbridge	-	-	-	-	-	-

Figure 50 Interpolation map of Eastern Dressel 2-4 amphora densities.

b. Italian Dressel 2-4

Italian imports continued to arrive in the Principate carried in new containers of the Dressel 2-4 type. This represented an amphora that carried the most praised wines of Campania such as Falernum, Salernum, Massicum, Surrentium or Vesuvium as well as table wines from the same zone or from other Italian regions [Tchernia, 1986a]. Therefore, the distribution of this type involved both high and low quality beverages that had in fact independent markets.

In terms of quantity, Italian amphorae have proved to be the second most common wine container in Roman Britain due to some extent to a long production span [Panella, 1989; Arthur and Williams, 1992]. The interpolation map (figure 51) could be considered a prototype of a market exchange distribution, with a clear hierarchy of markets. First of all, the higher densities are reported in the large urban markets which had easy access for water transport and consequently involved low costs (i.e. London, Exeter, Kingsholm, York and Carlisle). Each of these central markets controlled a geographical area with the support of secondary centres situated equidistant from the main centres (i.e. Silchester, Chichester, Canterbury, Chesterfield).

The military zones report very low densities of Italian vessels with the only exceptions being those of Longthorpe, Carlisle, York and South Shields. This is in contrast to the civilian zones which received the major part of the supply. However, Massicum wine is also mentioned in the food supplies acquired by the military garrison of Vindolanda (tablet 4) [Bowman and Thomas, 1983]. Despite the direct influence of the army in the early imports, Italian wines seem to have been consumed basically in the populated Southeast and in other large urban centres. Again the quality of the Italian wines may explain their distribution since the limited purchasing power of the legionaries did not allow expenditure on lavish goods.

c. Gauloise 4

Gauloise 4 was the most popular wine amphora in the Principate, exercising a remarkable control over the majority of provincial markets. The proximity of Gaul as well as the light weight of the vessel [Peacock, 1978; Laubenheimer, 1985] are two possible explanations for such an effective control. Nevertheless, the low quality of the wine may also be an alternative explanation, Gaulish wines seem to have provided the most common table wines and apart from a few comments on the high quality of some wines from Marseille and Beziers (Pliny NH 14.18; 14.68), the majority appear to have had an inferior reputation (Martial 3.82.22-23; 10.36.1-2; 13.123;

14.118)[53]. Therefore, its overwhelming presence in Roman Britain may have satisfied a bulk demand less expensive wines.

The pattern inferred from the interpolation map (figure 52) suggests a market exchange distribution. Higher densities are recorded in three urban centres (i.e. London, York and Exeter) with low transportation costs and covering three geographical areas. Secondary centres are also identified at Winchester, Colchester, Leicester, Kingsholm, Chester and Carlisle; which occupied intermediate regions. However the difference in amphora volume between primary, secondary and other centres is even more marked than in other types, as if there were a deficit in wine. In other words, Gauloise 4 could not reach rural settlements in quanties since it was sold and consumed in the first markets it arrived at. Another alternative explanation may lie in differences in the drinking habits of inhahitants of small towns and rural settlements. Finally, a lack of Gauloise 4 is documented in military sites. Although the army was always considered to be the principal market for the wine amphorae in frontier areas [Middleton, 1979; 1983; Whittaker, 1989a; van der Werff, 1989], the current evidence denies such a close link. Beer may have been an alternative alcoholic drink of less cost for the legionaries who received a small salary (i.e. *stipendia*), or soldiers could brew their own beer (i.e. *cervesa*) by malting grain [Helbaek, 1964].

d. Catalan Dressel 2-4

Similarly, the Catalan Dressel 2-4 also carried another kind of table wine, scarcely represented in Roman Britain. Finds of this type of amphora are generally distributed in the Southern region implying that it was only imported in the early periods up until Flavian times (i.e. Chester). Although the interpolation map (figure 53) does not provide much information, it suggests a probable market exchange distribution at large sites such as Exeter or Colchester. There are no indications of military supply, though the centres mentioned were temporary fortresses during the early periods. Catalan wine seemed to satisfy, together with some Italian types, the demand for cheap wine, a role fulfilled until latter by Gaulish produce.

e. Rhodian

Rhodian wines were another low quality beverage according to ancient sources (Pliny NH xiv.79; xiv.73-76; Athaneus Deip.1.32.5), though they were of a special character as sea water was added before the fermentation [Tchernia, 1986a, 105]. Despite this, they cannot be considered to

[53] Liou and Marichal [1978] suggested that some Gauloise 4 and 5 may have contained Massicum wine from Campania on the basis of some painted inscriptions (e.g. Saint Gervais wreck). This high quality wine could have been transferred from amphora or dolia to the Gaulish vessels for the final part of the journey.

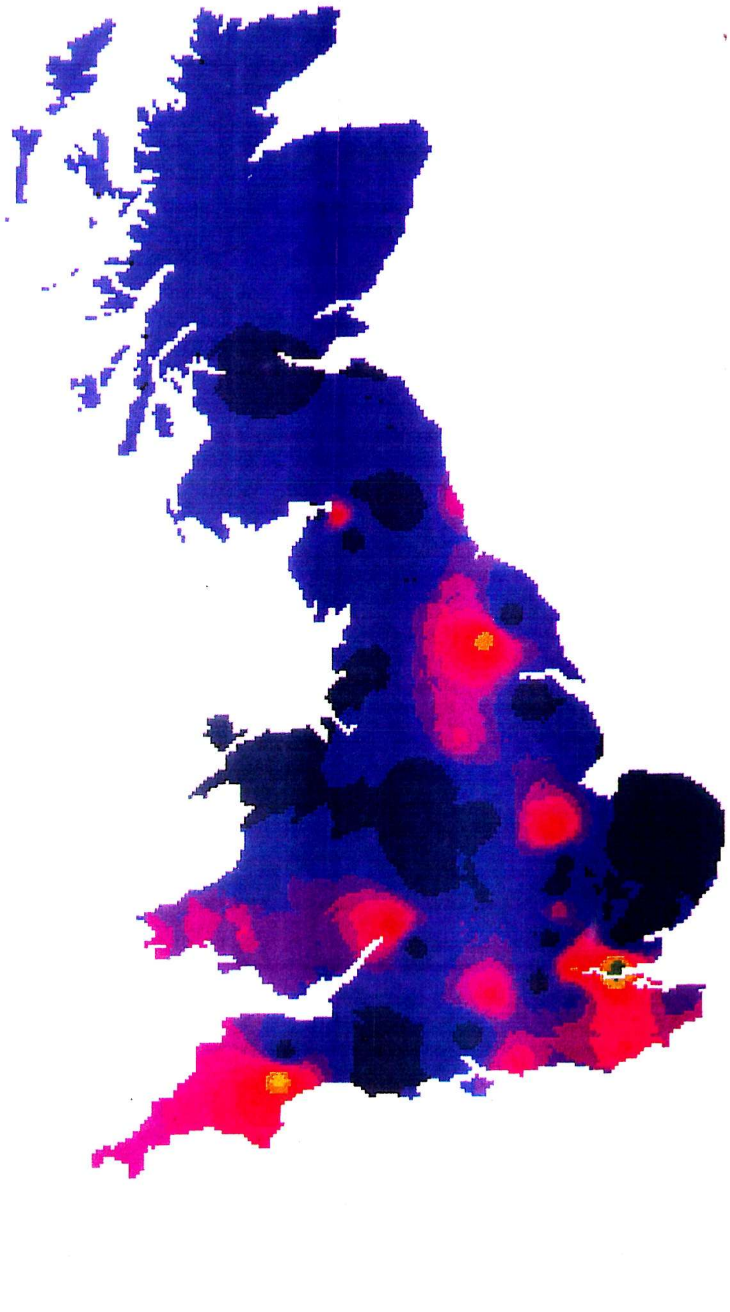

Figure 51 Interpolation map of Italian Dressel 2-4 amphora densities.

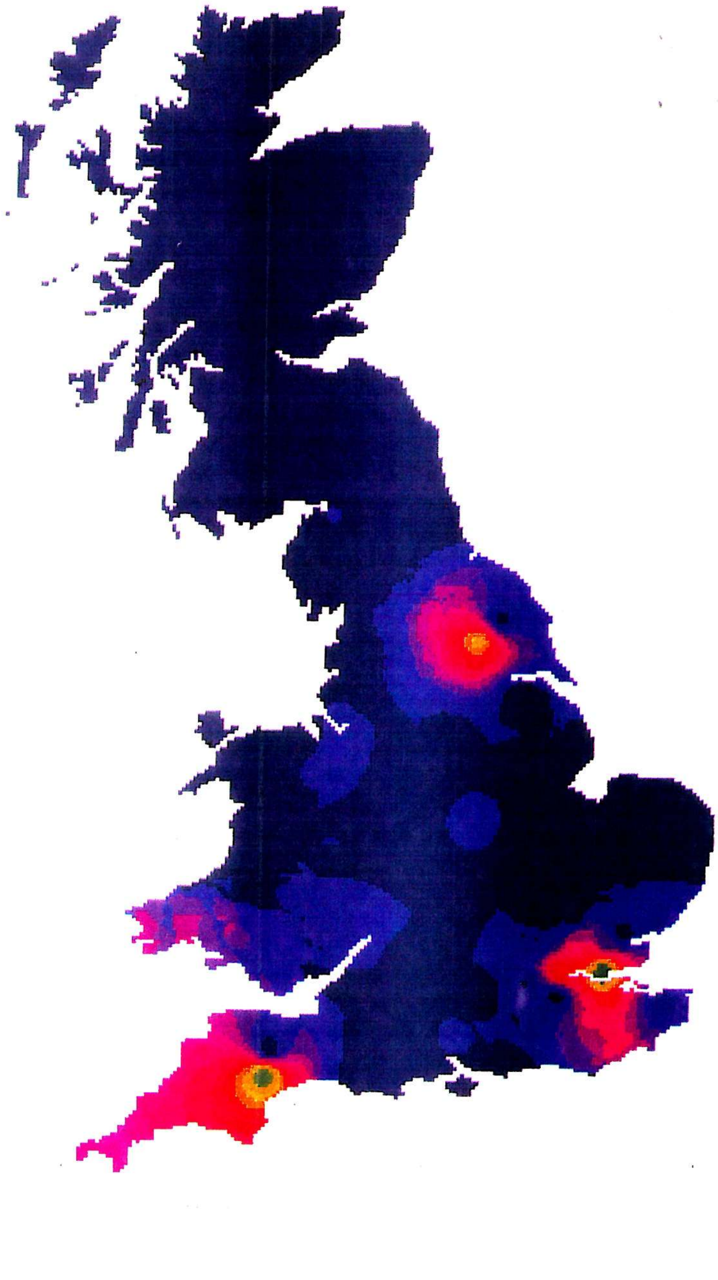

Figure 52 Interpolation map of Gauloise 4 amphora densities.

be prestige wines so their presence in distant provinces such as Britain is rather curious. Peacock [1977a] attempted to explain this contradiction by positing the theory of a possible Rhodian tribute to the State and therefore a military distribution. However, the great quantity recorded at Kingsholm skews the picture obtained by the interpolation map (figure 54), since the type is documented in good proportions in other urban centres, even some civilian ones. Putting aside the evidence from Kingsholm, the Rhodian pattern could be assimilated into other market exchange distributions (i.e. Italian Dr.2-4, Gauloise 4, Catalan Dr.2-4) with high densities in main markets accessible by water transport (i.e. London, Exeter, Carlisle). Moreover, other smaller towns received lower quantities, typical of secondary markets (i.e. St.Albans, Colchester, Chichester).

f. Gauloise 4 from the Verulamium region

The significant quantities of Gauloise 4 produced in the Verulamium region suggest a possible deficit in wine mitigated, to some extent, by the presence of local beverages [Sealey, 1985, 128-130]. Although the presence of the Gauloise 4 type is proportionally low, it is attested to in the large urban centres of the Southeastern area (i.e. London, Colchester, St.Albans) [Symonds, pers.comm]. Thus, the local production was oriented to satisfy the demands of highly populated market areas. The interpolation map reflects the restricted distribution in the SE region (figure 55) using evidence from two centres (i.e. St.Albans, Staines).

5.4.2.2 Minor wine amphorae in the province

A series of secondary wine vessels are recorded in the current sample, although their proportions suggest a minor role in the supply of the Romano-British market. They supposedly contained table wines of lower prestige value, so they could not compete with other similar produce (i.e. Gauloise 4, Catalan Dr.2-4, Rhodian, Italian Dr.2-4).

a. Dressel 2-4 from the Verulamium region

Dressel 2-4 was probably the first container used by the local producers and later replaced by the Gauloise 4, hence quantities found are reduced by its limited production span [Castle, 1978]. Its distribution is identical to that of the other local type (figure 56), encompassing the main urban centres in the Southeast (i.e. London, St.Albans and Colchester). As before, the wine was oriented towards the closest centres whose demand was not satisfied by other suppliers.

Figure 53 Interpolation map of Catalan Dressel 2-4 densities.

Figure 54 Interpolation of Rhodian amphora densities.

Figure 55 Interpolation of densities of Verulamium Gauloise 4 amphora.

b. Gaulish Dressel 2-4

The occasional presence of this vessel shows the earliest consumption of Gaulish wines to have been before the introduction of the Gauloise 4 amphora. Only two unusual testimonies appear in Roman Britain (i.e. Chester, London). However, the quantities involved are rather modest (figure 57). The pattern represented by the interpolation map also indicates a possible market exchange mechanism.

c. Gauloise 12

Another Gaulish vessels produced in Normandy is documented from a few places in the Southern region (i.e. Winchester, Exeter, Richborough, Thorney Bay, Hacheston and Holmehale) as well as at the Northern frontier (i.e. South Shields, Carpow) [Fitzpatrick, 1992]. Nevertheless thecurrent sample only recorded this type at South Shields, which suggests its limited importation into the province (figure 58).

5.4.3 Wines in the Late Empire

The Late Empire presents a completely different picture of wine imports in the province compared to the previous period. As far as amphorae are concerned, the difference is so drastic that a changeover to perishable containers (i.e. barrels) may explain the lack of later evidence. Roman Britain does not document the presence of any amphorae from the closest wine producing provinces (i.e. Gaul, Hispania, Italy), while the basic evidence comes from distant places such as the Eastern Mediterranean (e.g. Late Roman, Kapitan II). It is certain that historical events such as the creation of the Gallic Empire or the usurpation of Carausius (see chapter 5.7) may have limited the contacts of Britain with other Mediterranean provinces in the third and fourth centuries A.D., but they do not explain the complete absence of any record of wine imports as opposed to other evidence of trade (i.e. glass, ceramic, metals) [Fulford, 1977a]. Similar to the pattern observed in olive-oil commerce, a steep drop in wine imports is inferred from the amphora assemblages. Only high quality Eastern Mediterranean wines are attested in this period, whereas the table wine market seems to have disappeared completely according to the amphora evidence. Moreover densities of late types are very low, which leads to the conclusion that wine was not in great demand any longer. As well as the significance of the growth in perishable containers, an alternative explanation could lie in a revival of local beverages such as mead and beer which in fact were always present (see chapter 5.4.5).

Figure 57 Interpolation map of Gaulish Dressel 2-4 densities.

Figure 58 Interpolation map of Gauloise 12 densities.

a. Kapitan II

This type was mainly attested in the Southern urban centres of the province (i.e. London, Exeter, Cirencester, Chester, York, Leicester, Brancaster). However, higher densities are only reported on the Western coast (i.e. Exeter, Chester), in two accessible urban centres. A typical market distribution (figure 59) concentrated in the Western zone, which may be linked to other late amphorae distributions such as those of the North African ones[54].

b. Late Roman amphorae

These Eastern Mediterranean amphorae which extend to quite a late date in terms of their production may be linked with another group of quality wines. Like the previous amphora type, their densities are very low, which does not conflict their assumed value. However, the distribution pattern suggests a movement of the economic axis in Britain towards the Eastern coast extending from York to London. Late Roman amphorae are concentrated in large urban centres with low trasportation costs in the East. Two capitals in the Late Empire, York and London, report the highest densities which may reflect their role as the central markets of Roman Britain during this period (figure 60). At a secondary level, there were other centres such as Winchester, Leicester or Colchester. The dominance of Eastern, high quality wines during the time of the Late Empire may have been promoted by the thriving economy of this part of the Empire, the foundation of Constantinople as the new metropolis and the holy land pilgrimages [Wilkinson, 1977; Hunt, 1982; Cameron, 1993]. These three features fostered contact between these two extreme points of the Empire, that may have not held such importance before.

5.4.4 Wine and Britain: an initial conclusion

The distribution patterns of the majority of wine amphorae suggest that the optimization of transport costs, accessibility of markets in terms of time and high densities of population in potential market areas were the principal reasons behind their movement. In contrast with the Dressel 20 distribution, wine amphorae distributions reproduce a pattern typical of a market exchange mechanism. Only the case of the Rhodian type may be doubtful in this respect, but in general terms its pattern is similar to that of other wine vessels. Therefore, it may be concluded that a different exchange mechanism in the distribution of wine existed without the direct intervention of a central authority. Demand and supply within a market framework seems to have been responsible for wine supplies to the province, with profit being the main aim. The following diagram (figure 61) summarises the structure of a civil network through which wine may have been

[54] The quality of Exeter´s sample still questions any kind of interpretation.

Figure 59 Interpolation map of Kapitan II densities.

Figure 60 Interpolation map of Late Roman densities.

exchanged. Furthermore, the concentrations of the better represented types (i.e. Italian Dressel 2-4, Gauloise 4) outline the economic framework of Roman Britain. This framework consisted of primary and secondary markets defined by hierarchies of amphorae densities covering the major part of the province. The central markets were urban centres located strategically at accessible points and each controlling a region (i.e. London, Exeter, Kingsholm, York, Carlisle). Secondary markets (i.e. Silchester, Winchester, Colchester, Canterbury, Chichester, Chesterfield) appear to link these principal centres with less populated or less accessible zones. The distribution also makes clear that wine consumption was generally speaking an urban pastime, and was scarce in the countryside. It is rather difficult to establish this behaviour and the wider range of diverse cultural drinking habits (i.e. inmigrants, natives) (see chapter 5.2.4), although there seems to be likelihood of a link.

> *"In Antiquity as today, wine was the staple drink of the Mediterranean peoples, beer of northerners. "* *[JPVD.Balsdon, 1979, 222]*

Competition between wine suppliers involved at least two distinctions between high and low quality produce; and common and occasional imports. The latter division is an obvious one to consider according to the empirical data, while the former can be inferred from the literature as well as the quantities of amphorae recorded.

> *" Dans l´exportation de masse d´un produit comme le vin, la marchandise de qualité (les grans crus et même les appellations contrôlées) tend à être minoritaire"* *[JH.van der Werff, 1989, 365]*[55]

Some Greek and Italian wines seem to have satisfied the demand for high quality beverages in either military or civilian centres, though the SE urban centres were the major areas of consumption. Similarly, Italian and Laodicean wines were exported to distant places in the Indian Ocean (Periplus Maris Ery. 6:2.32), where colonies of Roman residents may have paid high prices for them [Casson, 1989, 20]. Recent discoveries increase the number of sites in India known to have Mediterranean amphorae [Deo, 1991], including those linked not only with Greek and Italian wines (i.e. Pseudokoan, Koan and Italian 2-4) but also with fish-sauce (i.e. Baetican Beltrán I) as well as olive-oil (i.e. Baetican Dressel 20, Istrian Dressel 6) [Will, 1991].

Table wines are represented by Italian, Catalan, Gaulish and even local produce. Italian and to a lesser extent, Catalan wines dominated the British markets in the Iron Age and early post-Conquest phase, being replaced by the Gaulish produce from the 60s A.D. until the third century.

[55] Trans. In the mass export of a product such as wine, the merchandise of quality (great wines and controlled brands) tend to be a minority.

Despite the good proportion of amphorae attested to, a possible deficit in wine may have existed, made up for by the local production of Verulamium region, which supplied the principal cities.

Finally, the present evidence shows that the Roman army was not the main consumer of imported wine. Despite the quantitative increase in volume of wine after the Conquest due partly to the supply of legionaries, all the amphora patterns suggest a significant civilian distribution. The distance covered by these beverages, their qualities and scarcity in the province may have increased their prices enormously[56], to the extent that average soldiers could not have afforded to purchase them. Local alcoholic drinks of lower cost should have competed not only on the military markets but in the province as a whole, and more specifically in the countryside.

5.4.5 Drinking habits

The acceptance of new alcoholic drinks appears to have been universal [Fortescoe, 1923; Dietler, 1990, 374], hence its case is rather different to that of olive-oil. Drinks fulfil an integrating role in social relations, even with foreigners, through the part that they play in hospitality [Marshall, 1979; Farb and Armelagos, 1980, 180; Dietler, 1990, 352], and new beverages normally confer prestige to the host. Although the kind of drink may be less important culturally speaking, its consumption involves a number of rules and cultural codes relating to sex, age and status[57]. The Roman conquest of Britain supposed contact between cultures with different principal beverages (i.e. wine, beer) and probably a multitude of rules regarding drinking etiquette.

In archaeological terms, both wine and beer seem to have employed a distinctive ceramic vessel for their consumption. On the one hand most beakers[58] of average to large size were commonly used for beer while fine wares were employed for wine [Greene, 1978; 1979a; 1979b; Renfrew, 1985; Swan, 1988]. There were other ceramic shapes closely related to wine consumption, but not common in Britain (e.g. *scyphus*, *patera*, *cantharus*, *cymbium*, *rhytium*, *calix*, *diatreta*) [Dosi and Schnell, 1990, 113-120]. According to the distribution of fine wares in Britain, wine tended to be consumed in military camps and urban centres until the Flavian period [Greene, 1979a], though hardly any differences can be distinguished after that. In fact, the numerous testimonies of beakers in the military zone suggest that beer was quickly adopted by the legionaries

[56] During the Civil Wars, shortages in supplies or remote areas meant exorbitant prices (Caesar BC i.52.2).

[57] In Rome wine was barred to women and children, while wine consumption in banquets followed a social practice known as *comissatio* [Carcopino, 1938; Robert, 1986, 135].

[58] Iron Age beakers and most of the Roman types were preferently used for beer [Symmonds, 1986], however some designs as the ones from Mosel valley were specially suited for wine according to their inscriptions (i.e. DA MIHI VINVM, give me wine) [Bös, 1958; Okun, 1989b; Orton et alii, 1993, 218].

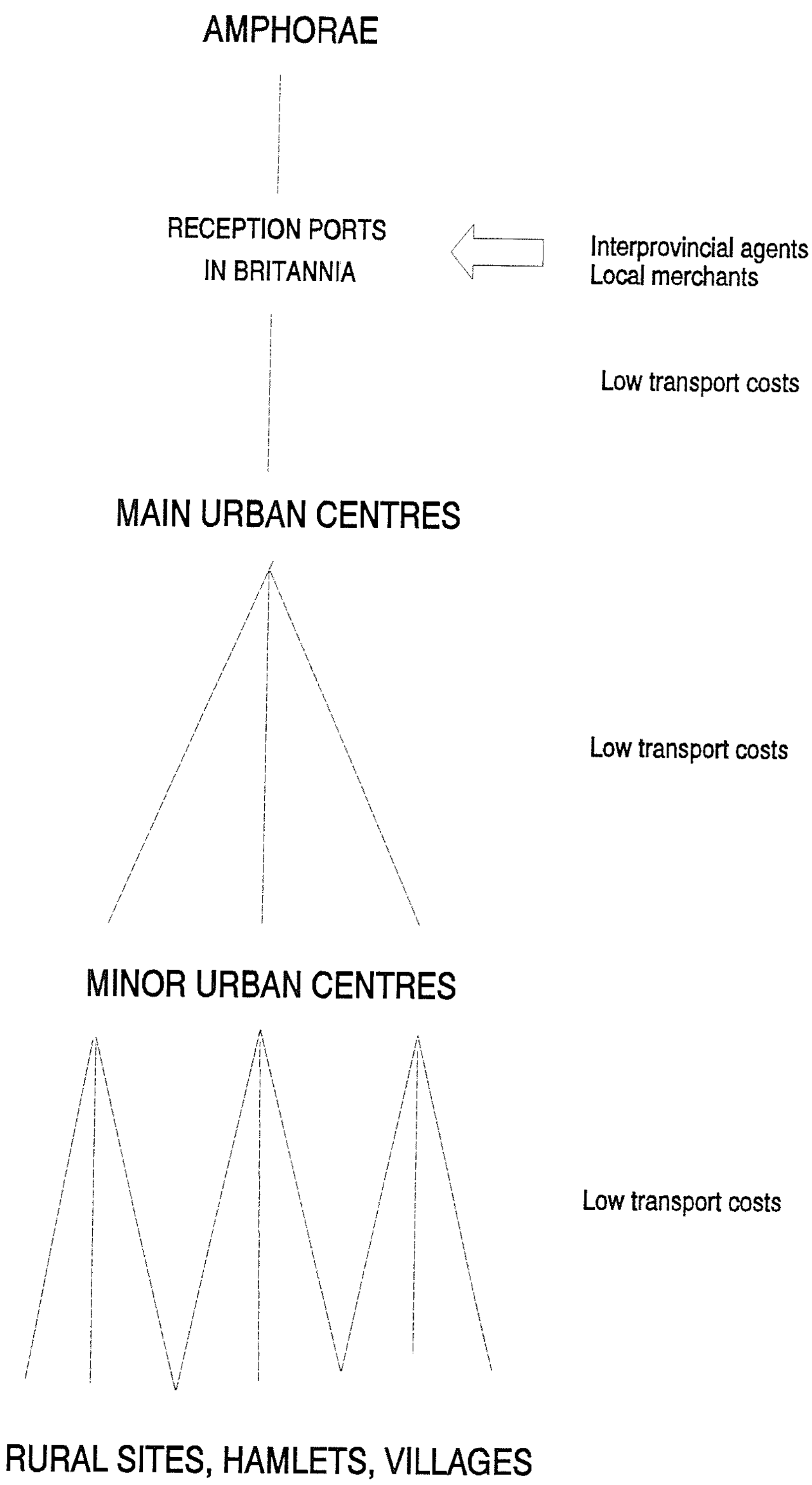

Figure 61 Diagram on the structure of the civil network.

[Knörzer, 1970; Davies, 1971; Swan, 1988]. Moreover, the consumption of beer is documented on one writing tablet from Vindolanda (tabl.4, 4 mentions) [Bowman and Thomas, 1983], a beer supplier in the German limes (AE 1928, 183) and this is also supported by the presence of some barrels (e.g. Carlisle, Newstead, Bar Hill).

Wine has always been associated with the army, since it was the principal beverage in the Mediterranean basin. There are numerous references to its presence in the soldier´s diet during both peace-time and campaigns (see chapter 5.2.4). The most popular drink was a mixture of water and grape juice (i.e. *posca*) [Tchernia, 1986], though it could be substituted by other alcoholic beverages in other latitudes. The low densities of wine amphorae at the Northern frontier supports the idea of a shift in alcohol consumption towards beer, facilitated by the low price of this local drink. However, wine was also consumed in Roman Britain, mostly in urban centres in the South. Therefore it looks as if purchasing power, accessability and status were more important in the consumption of wine than any association it might hold with an ethnic group[59].

5.5 Fish-sauce in Britain

The third commonest amphorae-borne commodity was fish-sauce. Fish-sauces were the product of a series of processes (i.e. drying, salting, macerating) carried out upon a variety of fishes [Ponsich and Tarradell, 1965; Curtis, 1991; Martínez Maganto, 1992][60]. All these recipes passed down by Greeks and Phoenicians were spread by Carthaginians and Romans, who distinguish between produces such as *salsamenta*, *garum*, *liquamen*, *muria* or *hallex* (Pliny NH xxxi.43.93; Geoponica xx.46; Isiododro Orig. xx.3) [Curtis, 1991; Martínez Maganto, 1992]. Fish-sauces were quickly introduced into the Roman cuisine as numerous recipes with this ingredient included reveal (Apicius, De re coquinaria).

Nevertheless, access to these sauces seems to have been restricted to a limited part of the population since in general they were considered expensive (Martial xiii, 102; Pliny NH xxxi.43.93). Although this point has been refuted by Curtis [1991] and Edmonson [1987], who document the presence of fish sauces in Pompeii in both poor and rich houses, this product was nevertheless less popular than wine or oil according to the number of amphorae. However, an amphora of *garum*, in general, lasted longer than one of wine or olive-oil, since its consumption

[59] Likewise modern Ghana testimonies a social hierarchy acknowledged by their alcoholic preferences. A high class consuming imported whisky and cognac, a middle urban class drinking bottled beer and the average citizen consuming the local traditional beer [Goody, 1982].

[60] It was similar to the Vietnamise nouc-mam, Turkish rajibe or Philippine bagoong which consists of fish bowels dried and salted [Robert, 1986, 128; Martínez Maganto, 1992].

involved smaller quantities, thus comparisons are difficult. However different qualities could also be distinguished according to the place of origin and fish species used (e.g. *Garum sociorum, muria* from Antipolis) (Martial Ep.xiii.102; 103) [Etienne, 1970; Curtis, 1991][61].

The presence of fish-sauce vessels in Britain is first attested to in Iron Age communities together with other amphora-borne commodities [Peacock, 1971; Martínez Maganto and Carreras, forthcoming]. Their distribution at this first stage was limited to the Southern and Southeastern tribes[62], areas that document other amphora imports such as wine and olive-oil. The quantities of fish-sauce amphorae in this period were as low as the ones obtained for olive-oil, suggesting the native populations limited interest in such imports. Again the arrival of a new foodstuff seems to be initially linked with diplomatic gifts or specialized trade involving local aristocrats [Haselgrove, 1987; Cunliffe, 1988]. The prestige linked to these foreign goods becomes evident in cases where fish-sauce amphorae have been found in burials [Peacock, 1971; Stead and Rigby, 1989] as a symbol of power [Hodder, 1982].

The Roman Conquest meant a boom in fish-sauce imports in Britain, mostly destined for the new immigrants and troops. The link between the Roman army and fish-sauce imports has also been recognized at other sites near the German limes such as Nijmegen, De Horden, Augst, Rögden or even Lyon [Schöenberg and Simon, 1976; van der Werff, 1984; 1987; Martin-Kilcher, 1990; Desbat and Martin-Kilcher, 1989]. The proportion of fish-sauce amphorae at Kingsholm [Hurst, 1985], Inchtuthill [Pitts and St.Josephs, 1985], Newstead [Curle, 1911] or Carlisle manifests this close link that existed in Roman Britain. Watered down *Garum* was a normal part of military meals according to Elagabalus (HA 29.5), who introduced the practice at Roman banquets[63].

As far as amphorae are concerned, the majority of salazones came from Southern Spain. Three types signify their predominance in the Principate: Beltrán I, IIA and IIB. A second place of origin recorded in the present sample is Southern Gaul which shows some Beltrán I production, whereas other possible sources (i.e. Lusitania, North Africa) may simply have been symbolic. In fact, the information provided by the amphorae suggests a monopoly of fish-sauces by Spanish suppliers at least during the first three centuries, although this decreased later according to the

[61] Allec or allex was produced from the residues of *muria* and *garum*, hence it had a lower cquality and cost. This produce is considered the *garum* for poor and slaves [Pucci, 1989, 384; Martínez-Maganto, 1992].

[62] Spanish Beltrán I amphorae are reported at Wavendon Heath (Buck.), Snailwell, Camulodunum, Lexden Park, Fitzwalter Road, Mount Bures, Verulamium, Hengisbury Head and Skeleton Green [Martínez-Maganto and Carreras, forth.].

[63] Keeping the distance with sauces, fish was also consumed by Roman troops probably obtained on the spot. There are numerous evidences of pike, perch, sturgeon and cod eaten at military sites of Germany and Britain (i.e. Chester, Corbridge, Brecon, Caerleon) [Davies, 1989, 194-195].

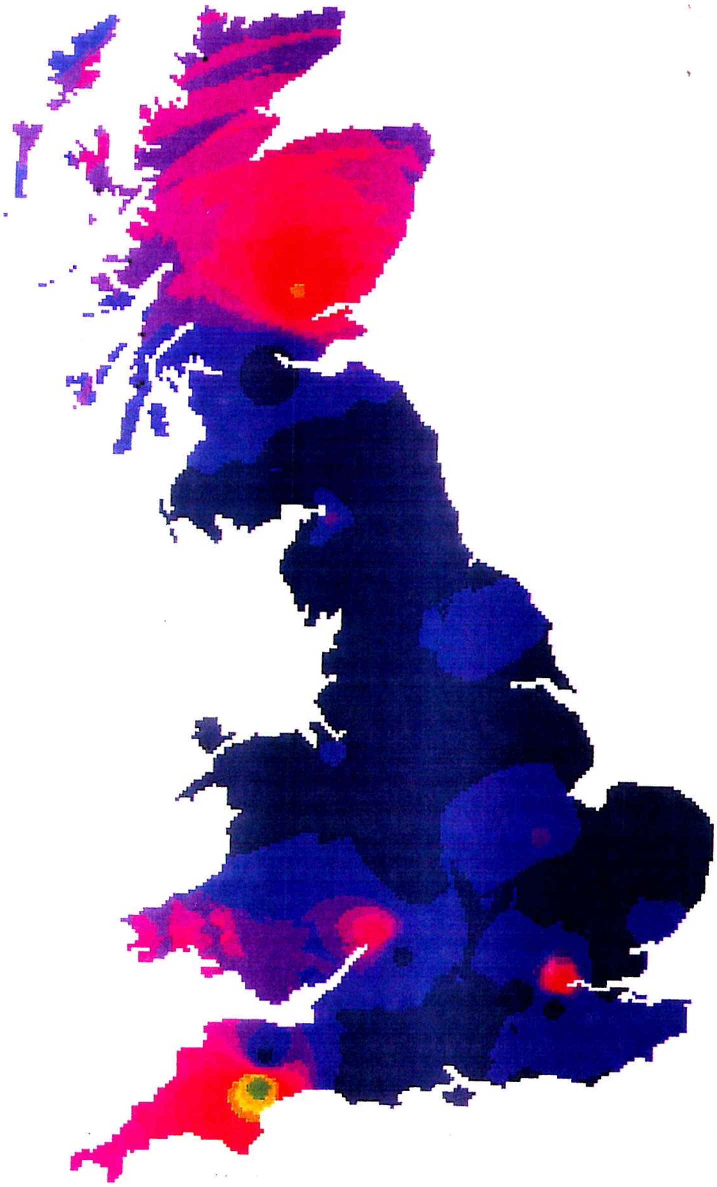

Figure 62 Interpolation map of Southern Spanish fish-sauce amphora densities.

evidence provided by the Almagro 50 type.

5.5.1 A Southern Spanish monopoly: Beltrán I, IIA and IIB

Due to their common fabric, the three distinctive Southern Spanish vessels are studied here together, though their production span varied [Beltrán, 1970; Martínez Maganto and Carreras, forth.][64]. The interpolation map obtained by the sum of densities shows a clear market pattern of distribution (figure 62) with high concentrations in the Southern markets (i.e. London, Exeter, Kingsholm). This pattern does not correspond to any connected to a State monopoly or preferential trade system as suggested elsewhere [Whittaker, 1989, 59]. Minor concentrations are reported at York, Chester, Carlisle and Leicester, while the high densities of Longthorpe and Inchtuthill seem to be the product of a short occupation, and may have been overestimated in standardization of densities (see chapter 2.1.2).

Apart from the later examples, the distribution is basically urban and concentrated in the Southern civilian regions. Notwithstanding the importance of the Roman army as a potential consumer (HA Elio. 29.5; HA Aurel. 9.6), which is also documented on a writing tablet at Vindolanda[65], the present sample calls into question its dominant role in the province [Edmonson, 1987, 104]. Bearing in mind that fish-sauce can be considered as a luxury item at least in Britain, its distribution in highly populated civilian centres appears quite natural. Traders were attracted by these populous markets in which groups with enough purchasing power could afford their goods. Although, amphorae reached military sites, they were never so common as in the South. Only officers and those of high rank (i.e. *sesquiplicarius*, *duplicarius*) [Speidel, 1992] would have been able to afford them, thus the demand was rather limited. Moreover, the high densities reported in this zone appear in urban centres accessible by water transport. Their market exchange distribution contrasts completely with the one observed for olive-oil amphorae produced in the same province. According to the sample, the Spanish sauces exercised an almost entire monopoly over imports. Comparing overall percentages of amphora weights from the main suppliers, the following picture is obtained:

Hispania	98.77 %
Galia	0.03 %
Lusitania	1.25 %

[64] A more detailed distribution of each variant is included in a list of maps and sites [Martínez- Maganto and Carreras, 1993; Martínez-Maganto and Carreras, forth.].

[65] The tablet records a list of foodstuff adquired by the service corps: ".../ 33 of fish-sauce 1 1/2 sextarii through Privatvs" [Bowman and Thomas, 1983, tab.4, 89].

At first glance, the proximity of Gallia and Lusitania may have made their produce more competitive than that of Hispania, within a market exchange [Martínez Maganto and Carreras, 1993], except if each place of origin was responsible for a different quality. Thus the monopoly seems to conceal a rather more complex type of distribution system that needs to be studied together with those of the other amphora suppliers.

5.5.2 Other fish-sauce suppliers

The comparative figures above show the limited presence of other fish-sauce amphorae in the province, which may reflect the real marketing situation of such a commodity. Nevertheless, some scholars suggest that the use of perishable containers [Martin-Kilcher, 1990, 37] and the presence of infrastructures may explain the lack of evidence for fish-sauce production and distribution in Northern provinces, including Britain [Sauquer and Galliou, 1972; Curtis, 1991, 80]. However this does not clarify the umbalance in amphora quantities between the three supply in provinces which used this vessel as the main container. The few examples present in the sample are as follows.

a. Gaulish Beltrán I

Only one find in London represents this amphora type, whose density is quite modest (7 cg/m²). The fact that the type is recorded in the largest provincial market supports the idea of a curtailed volume of imports. Amphorae with scarce representation were directed to large urban centres, where their sale would have been relatively easy.

b. Lusitanian Beltrán IV

The case of Lusitanian imports is even more extreme since only a single site (i.e. Colchester) documents their presence in very low proportions (1 cg/m²). The Lusitanian products seem to have accessed Mediterranean markets [Edmonson, 1987; Alarçao and Mayet, 1990]; in the Principate, however, they are hardly present at all in Northern Europe.

Although chiefly the two types above were the main competitors of Spanish fish-sauce amphorae, other vessels may have occasionally carried this produce. For instance, some North African amphorae (i.e. Africana II) were likely candidates according to some chemical analysis of internal walls (i.e. Pampelonne and Cabrera I wrecks, Pointe de la Luque) [Léquement, 1976; Guerrrero et alii, 1987, 20; Laubenheimer, 1990, 140]. Therefore some African vessels taken to have been olive-oil containers here may actually have carried salazones [Keay, 1983; 1984]. An exceptional case is a Gaulish Dressel 2-4 recovered at Southwark [Hassall and Tomlin, 1984; Laubenheimer, 1990, 104] with a painted inscription reading LIQVAM(em) ANTIPOL(is) EXC(ellens) (Excellent *liquamen* from Antipolis). Moreover a supposed Haltern 70 recovered in London included a *tituli picti* reading MVR(ia) [Hassall and Tomlin, 1982]. Both examples indicate that other vessels, normally intended for other goods, could have occasionally carried fish-sauces into Roman Britain.

Apart from amphora evidence, fish-sauce trade in Britain is linked to the presence of pools and salting installations in Brittany [Sauquer and Galliou, 1972; Curtis, 1991] and some inscriptions recovered from the mouth of the Rhine (i.e. Colijnsplaat, Domburg) [Bogaers, 1971; Stuart and Bogaers, 1971; Hassall, 1978]. With regard to salazones produced in Brittany, no ceramic vessels have been found in connection with the installations, hence wooden barrels may have been the likely containers. Due to its proximity, Britain is believed to have been a potential market as well as other regions in Northern Gaul and Hispania [Sauquer and Galliou, 1972; Galliou, 1986; Martínez Maganto and Carreras, forth.]. The second piece of evidence appears in the estuary of the river Scheldt where at least two shrines to the goddess Nehalennia existed [Bogaers, 1971; Stuart and Bogaers, 1971]. Some of the dedications were made by *negotiatores allecarii* (AE 1973, 365; 375), fish-sauce traders shipping from Germania Inferior probably to Gaulish and British markets [Hassall, 1978]. The salazones traded by those merchants are believed to have been produced locally, though no installations are recorded [Curtis, 1991][66].

The picture of fish-sauce trade in Roman Britain becomes even more complex when considering the evidence for local production along the river Thames. The excavation of Peninsular House at London revealed a structure interpreted as a drying fish tank [Battermann and Locker, 1982; Milne, 1985]. Moreover, a broken amphora filled with thousands of spines was discovered close to the drains. The ictiarchaeological analysis of such remains demonstrated that the major part are likely to have come from a local catch (i.e. herring, sprat, bass, flatfish, sandeel) [Locker, 1983][67]. Although the structure was dated to the first century A.D., the authors concluded that the fish-farm was built in the fourth century A.D. [Battermann and Locker, 1982]. The discovery of Peninsular House suggests that a local production could satisfy some demand in the province and more installations could have been established along the main rivers and coasts.

[66] One of the *negotiatores*, C.Gatullinius Seggo, was a citizen of Treveris (i.e. Trier), place which was argued as a possible production centre of fish-sauces [Curtis, 1991, 79].

[67] Only bones of a non-British sparis fish have been documented at York [Hall and Kenward, 1990, 401].

5.5.3 Conclusions concerning fish-sauce imports in the Principate

On the basis of the amphora sample, fish-sauce trade was controlled by Spanish suppliers throughout the whole Principate. Occasionally, other competitors (i.e. Lusitanian, Gaulish, African) reached the Isles, though they only achieved a small share of the market. However this overwhelming monopoly can appear misleading. Produce from other zones (i.e. Brittany, Rhine valley, Britain) may have been carried in other perishable vessels. Thus, the role of these other potential sources is difficult to assess, since only amphora quantification permits a partial study of fish-sauce imports.

Amphora quantification in Roman Britain shows the predominance of supply from distant provinces (i.e. Hispania), whereas the closer production centres did not always manage to sell all their goods. Since fish-sauce products seem to have been distributed through a market exchange mechanism, a monopoly does not make much sense and even less, when comparative transport costs are considered [Carreras, 1994a]. A series of alternative interpretations can be made from such an unclear pattern.

a. Production costs were relatively low in Southern Spain, so that differences in transportation costs for other suppliers were insignificant.

b. The quality attached to the produce of Spanish origin (Pliny NH 31.94) may created a preference for this luxury item in a limited market[68].

c. Transportation costs were reduced by sharing cargo space with other commodities distributed through a non-market exchange system (e.g. olive-oil, metals) [Martínez Maganto and Carreras, forth.].

The third hypothesis proposes a special relationship between the distribution of olive-oil carried in Dressel 20 and fish-sauce vessels. In terms of internal distribution, there is no link between the Spanish types of amphorae, as the combination of maps demonstrates (figure 63)[69]. The figure reveals a contrast in densities represented by the darker zones (i.e. military and Southeastern areas), whereas the brighter contours define areas of coincidence in amphorae distributions, only documented at Inchtuthill. Nevertheless, the journey from a Spanish to a British

[68] Similar to the present status of Frech champagne, Russian or Iranian caviar [Goody, 1984]. However the *garum* from Pompeii, Clazomene and Leptis also enjoyed great fame (Pliny NH xxxi.94), and no special evidences are attested in Britain.

[69] The figure is obtained by combining the Dressel 20 (D) and Southern Spanish (S) interpolation maps with the formula D-S/D+S.

port may well have involved ships whose cargoes integrated both types of amphorae. Thus reductions in tranportation costs should have ocurred during interprovincial passage rather than in the internal circulation. A further discussion of transport routes and mechanisms of exchange can be found in chapters 6 and 7.

5.5.4 Fish-sauce in Late Roman Britain

In addition to the pattern observed in wine and olive-oil imports in the Late Empire, quantities of fish-sauce amphorae decreased sharply in this period. Therefore, difficulties in interprovincial exchange, already documented for wine and olive-oil, affected fish-sauce too. The only amphora of late type recorded so far is the Spanish Almagro 50, which suggests continuity in the place of origin of fish-sauces. However the quantities recorded are so low that they are reminiscent of preconquest levels, with the only two examples at Chester (1 cg/m²) and London (3 cg/m²)[70]. Also the interpolation map (figure 64) shows concentrations in both urban centres accessible by water transport and a lack of evidence in the rest of the province.

As well as from Southern Spain, fish-sauce may also have been obtained from local fish-farms as stated before. The late chronology of Peninsular House´s structure has been interpreted as pointing to the development of a local industry due to difficulties in the supply of fish-sauce from other sources [Battermann and Locker, 1982]. It is clear that the Late Empire is likely to have brought a deep change in commercial contacts with Roman Britain, which would also have affected salazones trade. A reduction in the volume of fish-sauce available supplies characterises the late period. This probably brought about the creation of local industries by necessity.

5.5.5 Conclusions

Imports of fish-sauce in Britain underwent fluctuations over time, a first stage in the Iron Age being characterised by a scarce presence, a dramatic increase in the Principate period and a drastic reduction in the time of the Late Empire. Nevertheless, the three periods showed the existence of a predominant supplier in Southern Spain, whose goods monopolized the main provincial market. Although the Principate documents the presence of a wide variety of suppliers in terms of amphorae, the dominance of the former sauce supplier was paramount. The pattern suggests a complex economic network combining means of transport and diverse mechanisms of exchange, which permitted the movement of goods in quantities to distant places at relatively low costs.

---

[70] In the Principate Chester recorded 461 cg/m² of Southern Spanish amphorae, whereas London reached 3522 cg/m².

Figure 63 Map overlay of Dressel 20 and Southern Spanish amphorae interpolations.

Figure 64 Interpolation map of Almagro 50 amphora densities.

5.6 Other Foodstuffs in Roman Britain

Not all the amphorae carried either wine, olive-oil or fish-sauce; there were other foodstuffs contained in these vessels though they are less represented. Two groups of amphorae recorded in the current sample are associated with two Mediterranean fruits: dates and olives. Furthermore, other amphora types such as Richborough 527 and Chalk do not provide any reliable clues about their possible content [Peacock and Williams, 1986]. The present section deals with these vessels which are becoming increasingly better documented in the province.

5.6.1 Dates: an exotic fruit

The only evidence of date-stones in Roman Britain was discovered at Colchester [Crummy, 1984]. However, two amphora types (i.e. Carrot and Cigar-shaped amphora) produced in desert environments are likely candidates for containing this fruit [Peacock and Williams, 1986; Reusch, 1970]. Dates are cultivated between the 15th and 30th parallels, from North Africa to India, where date palms (Phoenix dactylifera) can grow well at temperatures of 30 degrees centigrades for several months in alkaline and sandy soils [Curtin, 1984, 23]. They were the staples along with milk of the nomadic tribes dwelling in North Africa and the Near East. They became an exotic food in Greek and Roman cuisine, so they acquired high status in non-producing provinces (Plutarch 8.4.732; Strabo 17.1.51; Pliny NH xiii.9.47-48) [Darby et alii, 1977, 724][71]. Although a bunch of dates was seen as a pauper's gift in the context of a social visit (Martial Ep.xiii.27), nevertheless, the fruit was included at the banquets of the upper classes at Rome (Petronius Sat.40) [André, 1981][72].

Its presence in Northern provinces such as Britain was probably due to the demand for it by a minority with significant purchasing power and exotic tastes, like the legionaries garrisoned in Egypt who asked their relatives to send dates (P.Mich 470). The number of amphora finds is relatively small and basically concentrated in military as well as large urban centres. Immigrants, both civilian and military, were the most likely consumers of this fruit that was completely unknown in Britain before the arrival of the Romans. A more detailed insight into the patterns of date consumption can be inferred from the two amphora distributions.

---

[71] Syrian and Thebes dates enjoyed the best reputation in the Graeco-Roman world (Theophrastrus 4.3.1; Pliny NH xiii.23.111-112)[Lewis, 1983, 127; Bagnall, 1993, 31].

[72] The Diocletian's Price Edict (vi. 81-83) includes a list of prices from Nicola (i.e. 8 of first quality for 4 denarii; 16 of second quality for 4 denarii) and comon ones at 4 denarii for 25..

Figure 65 Interpolation map of Carrot amphora densities.

a. Carrot amphora

This early vessel is documented in numerous settlements with low densities that ranges from 554 cg/m² at Exeter to 1 cg/m² at Winchester. In spite of an assumed military distribution [Reusch, 1970; Bukner, 1981], the type in Britain also appears in significant quantities in civilian centres. There is evidence of it in London, Ribchester, Inchtuthill, Exeter, Chichester, Chester, York, Carlisle, Corbridge, Leicester, South Shields, St.Albans, Silchester, Winchester, Colchester, Canterbury and Segontium. Although military personnel, chiefly officers, were a likely group of consumers of its contents, the amphora nevertheless reached the main provincial markets of the period. Dates carried in these amphora would have fetched high prices since the amphora's capacity was limited (3.15 litres) [Sealey, 1985] and its ratio volume/weight was less than 1.

The interpolation map of densities (figure 65) produces a strange pattern of distribution, which cannot only be the result of market mechanisms. There are concentrations in very specific places (i.e. Leicester, Exeter, York, Corbridge, London) and absences at other potential military markets (i.e. Chester, Kingsholm) and centres of the highly populated SE region (i.e. Colchester, St.Albans, Silchester, Canterbury). Some concentrations are located at accessible points with low transportation costs (i.e. London, Exeter, York), but other high densities appear in less suitable places (i.e. Leicester).

The consumption of dates is a clear example that not only economic or social but also cultural factors affected food distribution. A valuable and exotic fruit such as dates was occasionally consumed by Italians, and basically limited to higher classes [Darby et alii, 1977]. Similarly, these patterns in consumption would have been adopted in Britain after the arrival of the newcomers, since an elite group could yearn for this food [Ernan, 1966] and be able to pay exhorbitant prices to get it.

b. Cigar-shaped amphora

This second type of vessel, believed to have carried dates, is only documented at Kingsholm with a relatively high density (2666 cg/m²) which may question how representative the sample may be seen on being. Its presence in that site contrasts with the distribution of the carrot type which is completely absent in the region.

5.6.2 Olives: an addition to the Roman table

Olives were another typical Roman food, which became an essential part of meals from

Figure 66 Interpolation map of Baetican Haltern 70 densities.

Figure 67 Interpolation map of Gaulish Haltern 70 densities.

Figure 68 Interpolation map of London 555 densities.

the time of the Late Republic onwards [Robert, 1986, 131]. Although olive-oil was common in Roman Britain, olives were relatively rare in the province [Sealey and Tyers, 1989]. A few olive-stones have been recovered from Romano-British sites such as Colchester [Kenward et alii, 1986], Caerleon [Zienkiewicz, 1986, 224], London [Willcox, 1977], York [Kenward *et alii*, 1986; Hall and Kenward, 1990] and Pan Sand [Sealey and Tyers, 1989]. Olives normally travelled preserved in oils or grape products (Columella Res Rus. xii.49.8; Pliny NH xv.4.16) [Tyers and Sealey, 1989, 58-59]. A unique inscription relating to green olives was recovered at Cornhill (London) on a possible London 555 [Sealey and Tyers, 1989, 63], reading OL(iva)/ AL(ba)/ CCL/ C()L()A() Averni [Funari, 1992]. Finally, a writing tablet from Vindolanda (Inv. 839) mentions the word *olivae* in a personal letter [Birley, 1989].

As in the case of olive-oil, these fruits had to be imported from other Mediterranean provinces, such as Baetica or Gaul. Olives were considered a modest food in the place of production[73], however they could fetch higher prices in places such as Britain. The trade in olives is documented by three amphora types: Baetican Haltern 70, Gaulish Haltern 70 and London 555[74]. Amongst the three variants, the Baetican Haltern 70 stands out as the most common one, the other two being simply indicators of presence at least in the current sample.

a. Baetican Haltern 70

This early type dominated the British markets until the late first century A.D. (circa A.D. 60-70) [Carreras, 1994b]. Its distribution in the province (figure 66) corresponds to a market exchange pattern with high densities in the large urban centres (i.e. Kingsholm, London, Exeter, Leicester, Chichester, Colchester, Canterbury). Due to its chronology, it is only attested to in a few Northern military sites such as York or Chester; however, for the same reason the distribution cannot be considered as mostly relating to the civilian sector.

The Haltern 70 pattern also reflects the economic structure of the province in the early stages of the Conquest, when places such as London, York or Chester were in a state of development [Todd, 1989b; Millett, 1990a, 65-101]. Therefore, some concentrations (e.g. Chichester, Colchester, Canterbury) may indicate the economic peaks of these sites, which could have been linked to the temporary presence of the army.

[73] The Diocletian's Edict (vi.89-91) records a maximum price of 4 denarii for either 20 olives from Tarso, 40 olives in a special sauce or a italian sextarii of black olives.

[74] Dressel 23 may have also contained olives occasionally [Zevi, 1966] as well as Dressel 20 [Boyer, 1986], Beltrán IIB (i.e. Villepey wreck) [Boyer and Février, 1971] and some North African type [Williams and Carreras, forth.].

Olives were part of the Mediterranean diet, hence imports of them to the frontier provinces would have been well received by immigrants, both military and civilians. For instance, the legionaries of Neuss (Germany) [Knörzer, 1970] included olives in their meals. Similarly, some letters of soldiers garrisoned in Egypt to their relatives contain requests for this food (P.Mich. 474; P.Mich. 203) [Davies, 1989, 200]. Besides this, the Haltern 70 pattern reveals a normal distribution in a market exchange characterized by concentrations in low transport cost areas.

b. Gaulish Haltern 70

Only one example of this variant is recorded in the sample. Chester provided a very low density (2 cg/m^2) of the Gaulish vessel, which indicates an unusual ocurrence in the provincial market (figure 67). The Gaulish amphora seems to have been introduced at a later date (circa A.D. 80) [Dangreaux and Desbat, 1988, 117], while the Baetican variant was disappearing [Sealey and Tyers, 1989; Carreras, 1994b]. Therefore, its limited presence in Roman Britain may reflect a lack of demand for it or profits in the olive trade in later periods.

c. London 555

The last olive-borne amphora is another late type of Gaulish origin which despite being recorded at numerous sites (i.e. Verulamium, London, Colchester, Cirencester, Pand Sand) [Sealey and Tyers, 1989, 65-67] is almost absent in the present sample. This situation is indicative of the limited trade in olives in the late first and early second century A.D. then under the control of Gaulish suppliers. Only Colchester documents London 555 in the present sample (figure 68), though its density is rather high (320 cg/m^2). Compared to the other Gaulish prototype, this vessel achieved predominance in the Romano-British market in later periods.

5.6.3 Two unrecognized contents: Chalk and Richborough 527

These two amphora types provide evidence of a rather similar distribution concentrated in the Southeastern region. Large size centres such as London may have acted as magnets for merchants involved in transporting both types of vessels. However there are clear distinctions since the Chalk type is scarcely known in Britain (i.e. Chalk, Caerleon) [Peacock, 1977d] and only appears at Chelmsford in the current sample with a modest density (73 cg/m^2) (figure 69).

In contrast, the Richborough 527 is well represented at numerous Romano-British sites (i.e. London, Skeleton Green, Exeter, Winchester, Chester, Leicester, St.Albans, Silchester, Colchester, Canterbury) in substantial proportions (see chapter 3). As can be observed, it is chiefly documented

Figure 69 Interpolation map of Chalk amphora densities.

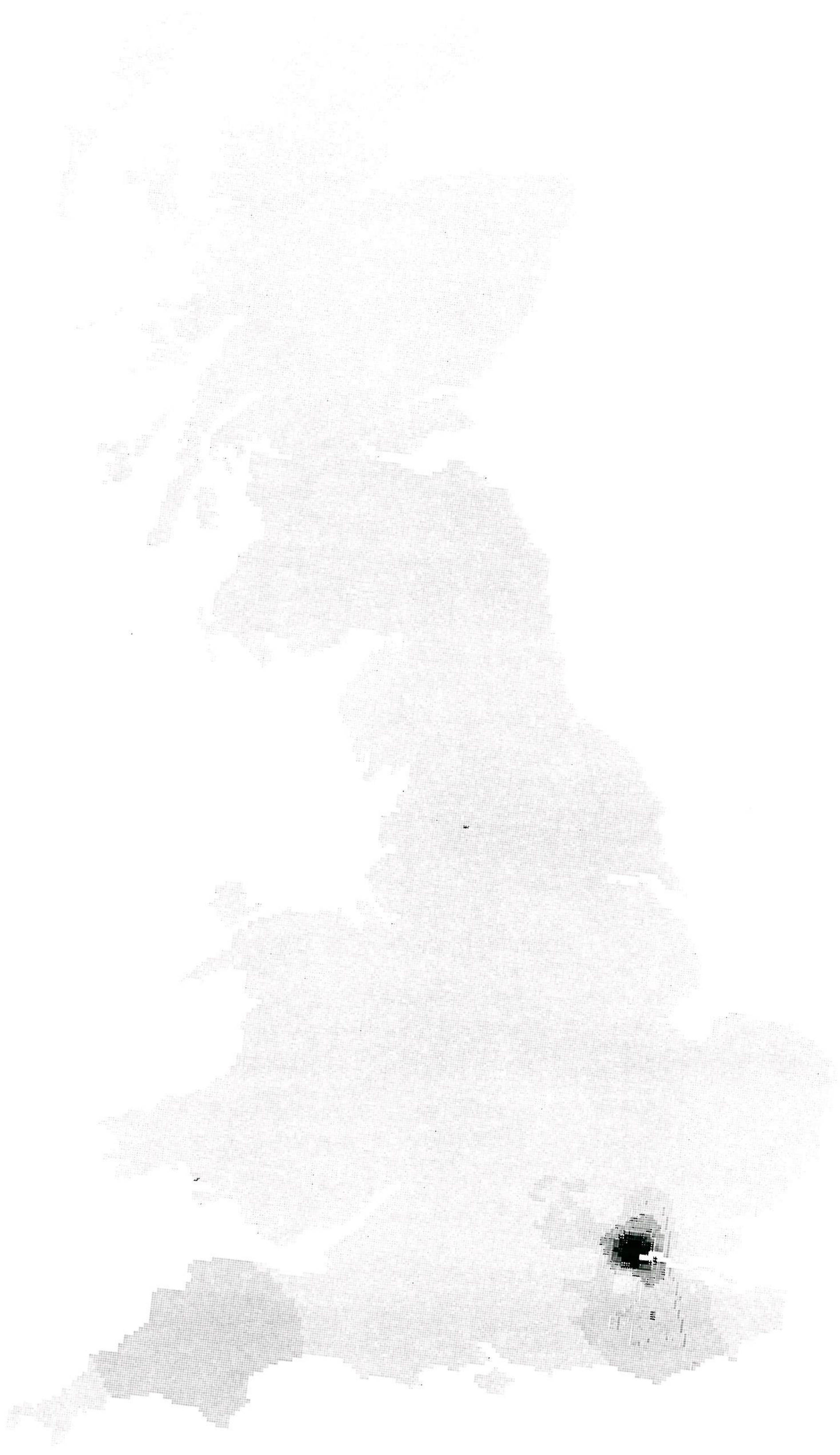

Figure 70 Interpolation map of Richborough 527 amphora densities.

in large civilian centres and the pattern exhibits a clear market distribution (figure 70). Unfortunately, the contents of this type have not been yet confirmed[75] though the high density reported at London (4340 cg/m²) suggests a significant role for this commodity in the local market.

5.7 Historical changes: the Late Empire

Long-distance exchange was never a continuous process in Roman Britain, and it underwent numerous changes over time due to social and political events. These fluctuations were reflected, amongst other things, in the amphora imports which dropped during late periods because of obstacles in the movement of commodities from the Mediterranean to Britain.

The creation of an independent Imperium Galliarum including Britain, Northern Gaul and perhaps Hispaniae (AD 260-275) by Postumus was a blow for interprovincial exchange. As well as establishing a new political frontier and currency [Callu, 1969; Reece, 1987], the period also records continuous conflicts and German invasions in Gaul which made internal transport in this province rather hazardous. Land and river communication in Gaul were ever fraught with the danger of attack by brigands (i.e. *bagaude*), which even forced the Emperor to take direct action. Furthermore, Saxon raiders made the movement of traffic in the Channel quite dangerous from the reign of Marcus Aurelius to that of Probus as the coin hoards of East Anglia indicate [Reece, 1987]. The end of the Gaulish Empire under Aurelian (AD 274) and the initiative of Probus (AD 276-282) permitted a more coordinated approach to solving the Saxon problem with the establishment of a line of fortresses on both sides of the Channel supported by the Classis Britannica [Johnson, 1976; 1980; Welsby, 1982; James, 1984].

The rebellion of Carausius and later Allectus (AD 286-296) represented a breakaway of the province from the rest of the Empire, which without doubt affected its trading contacts. After the victory of Constantius (AD 296), Britain remained a Roman province until the end of its administration in the late fourth or early fifth century, though it was subject to constant plundering from Saxons, Picts and Scotti [Johnson, 1980, 57-91]. The unrest necessitated the development of a policy of defence in the form of the *Notitia Dignitatum* (AD 296-367), which at least kept open the main supply routes [Johnson, 1980; James, 1984; Casey, 1989]. Notwithstanding the travel risks involved, trade continued between Britain and at least the nearest provinces of Gaul and Germany[76]. Pottery and coins prove that trading contact between both sides of the Channel never disappeared completely [Fulford, 1977a; Reece, 1984a; 1987]; however, a substantial decline in

[75] *Allum* is the last proposal by Bogard and Cavalier [1994].

[76] Britain seems to have supplied with corn to these two provinces (Ammianus Marc. xviii.2.3; Libanius, Orat.xviii.82; Julian, Letters to the AM 279-280; Zosimus iii.5).

volume is observed [Millett, 1990a, 159].

With reference to amphorae, the quantifications of late types of amphorae exhibit a downturn in the number of imports of every commodity (i.e. olive-oil, wine, fish-sauce) [Funari, 1991], but no interruptions in trade [Todd, 1985, 191]. It seems that long-distance exchange diminished in importance and became specialized in the trade of highly valued goods (e.g. Eastern wines) [Tomber and Williams, 1986]. However, the most striking change appears in the volume of olive-oil imported and its pattern of distribution, which suggest its disappearance as part of the produce that passed through the military redistributive system [Carreras and Williams, forth.].

From the third century AD onwards, Britons were the principal conscripts in the army garrisoned in Roman Britain [Holder, 1982; Dobson and Mann, 1973], hence olive-oil represented an alien ingredient for the average legionary. In contrast, Late Roman Britain provides evidence that a policy of creating self-sufficient provincial economies was put into effect. This was achieved by the autonomous collection of goods intended for the military supply system as well as by laws that encouraged Britons to grow foreign plants such as the vine (HA Probus 188) [Johnson, 1980]. The result of this was a drastic cut in Mediterranean imports and changes in the mechanisms of exchange that limited the scale and volume of the movement of goods.

Internally, there was also a shift in the pattern of amphora distribution probably due to new provincial divisions being created in Britain and their new administrative capitals. Septimius Severus (AD. 197) first divided the Island into Upper and Lower Britain, London and York being their capitals respectively. A second division was made by Diocletian (c.AD 286-305) who created four provinces: Britannia Prima (Cirencester), Flavia Caesarensis (Lincoln), Britannia Secunda (York) and Maxima Caesarienses (London) [Johnson, 1980, 13; Millett, 1990a, 133]. In terms of amphorae, a concentration of late types ocurred in the Eastern part with higher densities in the three capitals (i.e. London, York, Lincoln) [Williams and Carreras, forth.]. Some of the highly valued goods carried in these vessels were probably destined for consumption by the administrative staff. On the other hand, customs barriers in the newly created provinces may have affected the internal movement of such commodities [Jones 1973, 825; Millett, 1990, 130]. However, no patterns have become apparent so far from the present amphora densities.

It can be, then, concluded that the main features of long-distance exchange in the Principate were altered during the Late Empire as a result of conjunctural changes [Braudel, 1949]. A new picture emerges from this period that seems to indicate modifications in the nature of the exchange mechanisms, and therefore in the structure of trade. The temporal study of pottery distributions suggests that the economic state was never static and underwent changes over long time spans

[Hodder, 1974a, 74-75].

5.8 General Conclusions

The present chapter has attempted to outline the economic structure of the Roman province of Britannia and the changes it suffered over a period of the time. The provincial organization was affected by distribution through the main ports, the transport network layouts, geographical concentrations of populations, differences in purchasing power, the ethnic constitution of the area, hierarchical relationships existing in settlements and administrative bodies (i.e. civilian and military). All these represented economic constraints that influenced the regular distribution of goods in the province, but none of them created a unique pattern on its own.

Studies of different amphora distributions related to specific commodities suggest a more complex picture of events modelled by diverse exchange mechanisms, social hierarchies and cultural patterns of behaviour. In other words, simplistic explanations for amphora distributions can no longer be sustained because these distributions were affected by many variables.

The pattern documented by the Dressel 20 amphorae revealed a distinctive exchange mechanism compared to other types. This was identified as a redistributive system under military administration. In contrast, the distribution of the majority of types involved a market exchange mechanism through which commodities (i.e. wine, olive-oil, fish-sauce, olives) reached their final destinations. It has also been noted that there are other exceptional patterns linked to the value of some goods (e.g. high quality wines, dates) which vary from the expected distributions pattern. In other cases, eating practices (e.g. wine vs beer, olive-oil vs other fats, dates) followed by different cultural groups seem to have altered regular patterns. Movement of people as a consequence of the Roman invasion (i.e. Continental immigrants, internal migrations, army, administrative staff) brought about an exceptional situation where cultural interaction was inevitable. The varying responses to this new situation (i.e. assimilation, rejection, selection) are also reflected in the degree to which different eating habits were susceptible or not to change. This can be inferred through amphora distributions.

The aim of this chapter was simply to describe this diversity by analyzing the supply of some commodities according to their containers. Although some possible explanations have been put forward, the interpretation of this kind of evidence is reserved to the following chapters.

6. TRADERS AND EXCHANGE MECHANISMS: THE POWER OF COMMERCE

Introduction

Amphora distributions in Roman Britain were analyzed from different angles in the previous chapter, but the role of traders and exchange mechanisms has not been considered in depth. The current chapter approaches these key elements in the economic cycle, as they are closely related to the level of distribution (see chapter 1.2). In opposition to the negative stance Jones [1974] and Finley [1985a] towards the use of pottery for drawing conclusions regarding the economic aspect of the Roman life, the amphora testimonies considered in this thesis may be seen as allowing a complete review of concepts relating to Roman commerce. *Comercium*, the latin word, referred to business activity or interchange or the buying and selling of goods for profit accepting the risks attached to the activity [Will, 1987].

The salient features of demand in Roman Britain and their influence in the amphora distribution patterns have been fully discussed in the previous chapter. Nevertheless, the means of physical movement of goods from their place of origin to a final consumption centre is unclear without reference to traders and exchange mechanisms. Traders were responsible for the movement of goods, and their role was even more significant in the allocation of valued commodities, including most amphora and their contents. Although there are many testimonies of Roman traders involved in long-distance exchange [De Salvo, 1992], little is known about the reasons that compelled them to take part and their trading strategies. Therefore this chapter attempts to reconstruct the influence of traders on the distribution of amphorae based on the British evidence, with the aim of answering a simple question: what did traders earn from moving goods ?

However the question must be put within its particular historical context, since the Roman economy exhibited distinctive features [Jongman, 1991, 36-48]. The commodities distributed by traders all over the Roman Empire were channelled through economic frameworks known as exchange mechanisms (see chapter 1) [Polanyi et alii, 1957; Cook, 1966; Schneider, 1974; Jongman, 1991]. Exchange mechanisms are social and economic institutions through which transactions take place according to rules that traders must observe. Therefore the complementary combination of exchange mechanisms and traders' aims would most likely have affected both how and where goods were allocated.

Long-distance exchange, operating as in the case of amphorae, produces a full picture of the way in which traders and exchange mechanisms affected final distributions. Apart from satisfying the internal demand, commodities were allocated according to the commercial strategies of traders as well as this determining the mechanism through which they travelled.

6.1 Traders and profits: the reason for commerce

A good´s distribution responds to some extent to its value in different locations and the possibility of acquiring it by their inhabitants. Any commodity has a value of use, relative importance for a society (e.g. water, diamond) [Smith, 1776] and a value of exchange, rate obtained by combining its demand and supply. Both concepts were thoroughly discussed by the Classical School [Smith, 1776; Malthus, 1798; Say, 1803; Mill, 1848], but modified by Ricardo [1817]. He suggested the existence of a natural price that identified a minimum cost of production including raw materials and labour.

Nevertheless, these principles were superseded by the concept of utility developed by the Neoclassic School [Jevens, 1871; Menger, 1871; Walras, 1874-77; Pareto, 1909]. The degree of utility identifies how individuals maximise their satisfactions under the constraints of taste, money and price. Disregarding taste at this point, the relationship between purchasing power (i.e. money) and price (i.e. value) constitutes the key issue for interpreting a distribution. According to its utility, a commodity can be classified as necessary or not at a particular cost.

> *"Goods are of lower order or of a higher order, according to the manner of their usefulness for the consumer´s point of view"* *[K.Polanyi, 1957c, 248]*

If the purchase power is uniform, only the good´s final price determines its acquisition [Duncan-Jones, 1978]. Apart from the production cost, only the transport rate modifies the supposed natural price of any commodity. Therefore transportation cost becomes a direct responsible of any distribution [Haggett, 1965; Renfrew, 1975; Dicken and Lloyd, 1990; Carreras, 1994a]. The influence is even more critical for long-distance exchange where only light high-valued goods report attractive revenues.

> *"As a general proposition, the longer the distance, the more trade had to be confined to products of comparatively high value and low bulk, though bulkier goods could be carried further as the technology of transportation improved over time"* *[PD.Curtin, 1984, 15]*

Amphora trade was, in general, restricted to bulkier and low value goods with only a few exceptions of wines and fish-sauces. Therefore their widespread distribution evidences a remarkable economic achievement with limited transportation facilities. In long-distance exchange, a greater care was necessary for selecting modes of transport and routes, since they could bring overhead costs. The majority of amphora distribution maps in Roman Britain shown in the previous chapter manifest the preference for cheaper transports and routes (e.g. North African, Italian, Gauloise, Eastern, Fish-sauces). Moreover long-distance exchange in a market system represents more people involved in the movement of goods, who have to obtain a profit [Curtin, 1984, 53], which is always reflected in the good´s final price. In other words, low and mid valued commodities can reach high prices in distant places (e.g. dates) due to the participation of numerous middlemen.

Added values increased through transport and middlemen should have attained a point from which a commodity was no longer affordable by a society depending its utility[1]. The amphora distribution maps revealed in general a marked difference in densities between coastal and inland regions, Southern and Northern zones as well as urban and rural sites (e.g. Eastern, Italian, Gauloise, Late Roman). If the purchase power had been regularly distributed in Roman Britain, these boundaries would have corresponded to the limit between normal and luxurious goods. Actually there are some hints that the purchase power was irregularly spread in the province (see chapter 5.2.3). First of all, rural Romano-British settlements with the only exception of *villas* (see figure 71) display poor material culture (e.g. pottery, coins, metalwork, architecture) that suggest a limited income [Miles, 1982; Clack and Haselgrove, 1982; Hingley, 1989]. However *villas* display the most luxurious material (e.g. metalworks) and structures (e.g. large buildings, baths, mosaics) that identify upper class owners. Also wealthy families seem to have been chiefly settled in urban areas of the Southern regions [Frere, 1987; Millett, 1990] or in the immediate countryside (i.e. rich *villas*) [Hodder and Millett, 1980]. Finally, the military zone in Northern Britain can be considered a region of limited purchase power, since an average legionary did not enjoy a generous *stipendium* (i.e. salary).

Legionary payments were relatively low but complemented by imperial donations, and became accumulated at the end of one´s service [Gabba, 1978; Carrié, 1989]. However, soldiers generally complained about their misery (CIL v.38) resorting to their relatives for money and food (P.Mich. 478; 476; 481; 467; 468; 470; 483; 203; 206; BGU 814). Despite the army being an important market in the province, its purchasing power was limited so that high priced goods may have been hardly consumed [Duncan-Jones, 1978]. The point is relevant in order to understand why wine amphorae are scarcely represented in military settlements.

[1] In the Middle Ages, olive-oil was so expensive beyond the river Loire that was traded even reused in the main capitals such as London, Bruges or Paris [Toussaint-Sanat, 1987, 17].

Although legionaries of Mediterranean origin were potential consumers for any imported wine and this beverage was present in their diets (see chapter 5.2.4), the British evidence suggests a low volume of consumption according to the amphora densities. Roman soldiers were described as heavy drinkers (HA DuoMax iv.3; Libanius Or.Patr.5; J.Chrys. Cat.B. 7.29) in their leisure time, so that part of their wages may have been spent in *tabernae.* Since wines in Northern Britain may have reached high prices due to the transportation cost attached, they may have been less popular than beer (i.e. *cervesa*), the local beverage. The consumption of beer should have been widespread all over the provinces of Gaul, Germany and Britain, where the best and strongest varieties were made by grain-malting processes [Jackson, 1988, 36].

Since wine growing in Britain has not been proved, the only local beverage documented was beer. Considering that an additional transportation and trading cost had to be added to the previous wine rates, they could never have competed in price with beer. Preferential beer consumption among the military was the most likely outcome to this situation that is reflected partially by the low densities of amphorae. Likewise olive-oil was a quite expensive article in non-producing provinces compared to local fats, as Roman Egypt demonstrates where radish-oil was only a third the price of olive-oil (P.Mich. xi.613) [Bagnall, 1993, 30].

Another obstacle to long-distance exchange in antiquity was the lack of information flow between production area and final destination [Callner, 1988, 266]. In economic terms, it meant that there was no integrated market [Finley, 1985b] that could articulate a price mechanism according to demand and supply. Only luxurious goods (e.g. metals, spices) could keep stable prices [Miller, 1968], whereas the value of other commodities was kept artificially down, without representing a real demand. These circumstances increased the trade risks enormously, which affected the range of products commercialized as well as the area of distribution.

> ***"One of the elements necessary to a market is adequate information about the goods and services demanded and available for sale and their prices. The slow and limited means of communication in the ancient world made specific locations necessary." [WI.Davidson and JE.Harper, 1972, 129]***

All these constraints related to the cost of any commodity in different geographies, conditioned the amphora distribution in Roman Britain. The divergences in densities between regions in the province are a partial result of how a good´s price affected local consumption.

The movement of goods usually reveals a common interest in reallocating products that are abundant in one place but scarce in another [Polanyi, 1957c; Neale, 1957]. These movements take place easily at a local level, since there is a steady flow of up-to-date information and knowledge

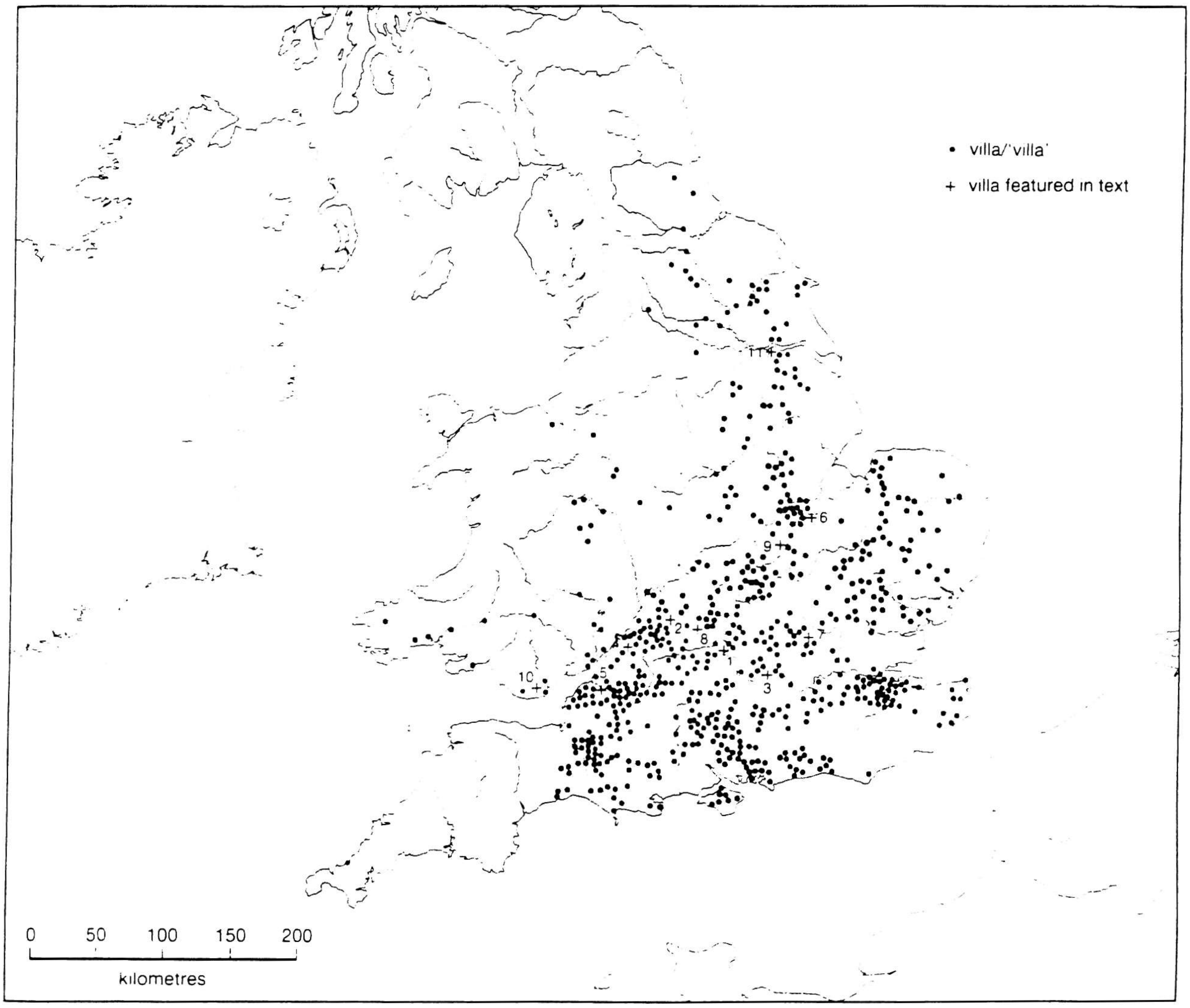

Figure 71 Distribution of Roman villas in Britain (after Jones and Mattingly, 1990, map 7:6).

about the environment, so that a specialized function is not required. At a local level, any individual can exchange goods with people close to them [Sahlins, 1972]. Nonetheless the movement of goods that are relatively large in volume, the coverage of a minimal distance and the contact between different communities requires the full dedication and attention of a specialized trader [Curtin, 1984, 2; Frederiksen, 1975; Morel, 1983].

This specialist expects to obtain a reward for his work, which may take the form of a social elevation (i.e. rise in status in society) or be of a material nature (i.e. profits) [Polanyi, 1957c; 1977]. Although it is always difficult to establish the limits between social and economic behaviours, in fact social recognition is the basic aim of any economic improvement; the material gains were a priority in commerce. Social recompense[2] seems to have been exceptional in Roman times according to the literary sources [Giardina, 1989; D´Arms, 1980; 1981], hence a material gain was the general rule (Juvenal Sat. 14, 201-204), though social rewards could be obtained as a consequence of material achievement. A purely profit seeking approach was condemned by the upper classes (Cicero De Off. 1.151) who despised people specializing in this activity (Cicero Verr. 2.5.65.117) [D´Arms, 1981; Wallace-Hadrill, 1991; Love, 1991]. Notwithstanding social prejudices, traders were usually people of low birth hoping to make a fortune from their work which would allow them to ascend in the social ladder. Petty traders now are nurtured by the same social classes with the same aims of self enrichment [Gómez-Crespo, 1993, 49]. Trimalchio (Petronius S̄at.) is a good example of how freedmen or the family of *Caecilii* from Astigi (Ecija) [Remesal, 1989], or even a poor farmer (Plautus, Merc.1) achieved prominent positions in Roman society thanks to trade [Duff, 1928].

Therefore trade was an activity which provided new opportunitiess for people aiming to improve their social standing by taking part in a risky venture that might generate good profits. In a hierarchical society such as the Roman one, trade was one of the activities that permitted an individual to overcome many social barriers. Thus it tended to be carried out by members of low classes with minimal rights and prospects (i.e. freedmen, foreigners, farmers and urban plebs).

The material gain was the trader's reward, which conferred on him a new role in society (S.Ambrosius De Off. 3.6.42-44) [Giardina, 1989]. In fact, good profits were never frowned upon by popular classes, even if they involved underhand activities. Traders sometimes acquired their earnings by deceiving consumers, so they enjoyed a bad reputation among Romans, who identified some of them as thieves (Cicero De Rep. 3.4; Salvianus De guber Dei 4.6.9; S.Ambrosius De fide 3.10.65) [Giardina, 1989]. Interestingly, the patron of traders and boundaries was the god

[2] The substantivist school overstressed the social dimension of some economic affairs, though their testimonies normally lack [Polanyi et alii, 1957; Polanyi, 1977].

Mercurius, also known as protector of thieves[3] [Combert-Farnoux, 1980; Curtin, 1984, 6]. However, the real hallmark of traders was their pursuit of profits in any commercial transaction. Success in trade helped them to reach high positions in Roman society without their possible origin being taken into account, except in the case of freedmen [Duff, 1928]. This materialistic stance results in a quite easily understood model in economic terms since it was based on maximizing revenues by minimizing expenditures [Lipsey, 1963]. In other words, a simulation model of trade activity would show the optimal strategy for drawing the highest possible revenues (see chapter 6.5.3). Roman traders, in general, made their decisions on the basis of this rule, though this may not have always been possible or acknowledged.

If profit was the main reason for traders' involvement in the movement of goods, the next step is to determine the minimal percentage of benefits that would attract a merchant. The percentage of profit from the sale price of any item of goods depended, of course, on its value of exchange. Thus the profit margin obtained from a highly valued good (e.g. jewellery, species) was more attractive than the ones from staples. As most amphora-borne commodities were staples, only a minimal profit could be expected from their long-distance exchange, hence traders employed adequate strategies to retain and increase this reduced profit margin. Comparative data from the Middle Ages and Modern times suggest that benefits in trade on staples ranged between 2-3% [Pounds, 1974, 407-410] to 10% [Braudel, 1979a, 378][4]. The percentage of profit is intimately related to the distance, as commodities did not reach some regions or at least not in sufficient quantities due to the lack of interest of traders despite a possible good demand (see chapter 6.2). Thus a consideration of the diverse categories of Roman traders and the territory that they covered is also required, because all these levels of trade corresponded to different range and the volumes of goods, and the expected profits.

6.2 Roman traders: spheres of activity

Numerous latin terms were used to refer to traders, though often their meanings are rather vague [Baldacci, 1967; Casson, 1980; Panciera, 1980]. The differences between them seem to be associated with the distance and volume of trade, for which each merchant was specialized, but sometimes there was an overlap [Jones, 1974; Love, 1991]. The number of people involved in commercial activities and their role in society are best described by Cicero´s comments about trade in Republican Rome.

---

[3] Saint Nicholas was the patron of thieves and traders alike [Curtin, 1984, 6].

[4] High valued goods such as tobacco could yield percentages of 500-200% [Braudel, 1979a, 378].

" Business on a small scale is despicable; but if it is extensive and imports commodities in large quantities from all over the world and distributes them honestly, it is not so very discreditable; may, if the merchant, satiated, a rather satisfied man, with the future he has made, retires from the harbour and steps into an estate, as one he returned to harbour from the sea, he deserves, I think, the highest respect." *[Cicero De Off. 1.151]*

The operation of long-distance exchange involved many individuals, each of whom had a particular function and geographical zone [Skinner, 1964; Katzin, 1964; Curtin, 1984, 53]. They together formed a kind of hierarchical network through which all the comodities travelled, though their final presence in a particular place in Roman Britain depended on whether they still served a profitable role at any stage in the chain. Concentrations and absences of amphorae at specific points may simply indicate the limits of commercial activity between two level of traders.

A point noted in the interpolation maps of amphora distributions (e.g. Italian Dressel 2-4. Southern Spanish and Gauloise 4) (see chapter 5) was the existence of hierarchies in densities related at that time to the settlements' rank-order. Nervertheless, these could also be linked to a diverse category of traders, dealing in different markets who correspond to this rank-order.

The stable markets were located in large and medium sized urban centres where there were permanent shops (i.e. *tabernae*) and suitable buildings for selling (i.e. *macella*) [De Ruyt, 1983; Frayn, 1993, 1-10]. A second level included itinerant weekly markets known as *nundinae*, which were held in towns, villages and local estates [Frayn, 1993, 4-5][5]. Thirdly, there were seasonal gatherings (i.e. *mercatus*) normally held in rural areas with limited access to urban centres [Frayn, 1993, 133-143]. Every category of trader was specialized in the supply of one of these markets in the province, although the commercial chain also included people responsible for transferring commodities between provinces. Therefore the hierarchical structure of traders covers two spheres of activity: interprovincial and intraprovincial.

6.2.1 Interprovincial traders

People responsible for the movement of goods between provinces were the real specialists of long-distance exchange. Literary sources distinguished at least four diverse functions in long-distance exchange that are defined by the latin terms of *negotiator*, *mercator*, *navicularius* and

[5] The marble tablets recovered so far with town lists for *nundinae* (i.e. *parapegmata*) imply that the venues were located at intervals of 30-50 Kms [Frayn, 1993, 41], which is the average distance between walled towns in Roman Britain (see chapter 5.1) [Hodder and Hassall, 1974]. This distance is the average covered daily by an ox-waggon, which matches the distance between *mansiones* (25.6-72 Km) [Jones, 1974; Tengstrom, 1974; Chevalier, 1976; 1988] and the one covered by the legionaries (Vegetius Ep.Res Mil. i.9) [Chevalier, 1976; Carreras, 1994a, 16].

diffusor [Rougé, 1966, 274-283; Rodríguez-Almeida, 1980b; Panciera, 1980; Kneissel, 1983; De Salvo, 1992]. Their sphere of activity was limited to the space comprising the extent of a production area and the first ports of arrival in the destination provinces, whereas the final distribution activity was reserved to the local traders.

> *" The first is like a migratory bird who comes back regularly, usually during summer. Like birds many of them fly over the seas, traders avid for profit, and come in the summer season to visit foreign cities. " [Plato Laws xii.952]*

Without the intervention of these interprovincial traders, no overseas commodities (e.g. amphorae) would have ever reached Britannia. Hence the first decision was whether merchandise could yield good revenues in distant places and what would constitute a suitable quantity of it to transport. Interprovincial traders had particular duties, as discussed below, but boundaries between them were never wholly clear.

a. *Negotiator* (Wholesaler)

The term refers to wholesalers, large scale traders involved in commerce but normally on the financial side [Rougé, 1966, 274-283; Jones, 1974; Kneissl, 1983]. They chartered ships and also lent money but they did not usually travel with their merchandise, delegating this task to other traders. Their sphere of activity was normally linked to that of *publicani*, who were public contractors in Republican times (i.e. farming taxes, building developments) [Badian, 1972; Cimna, 1981] and continued their relationship with the public administration until the Late Empire. *Negotiatores* had the money to invest in trade ventures either by backing other merchants or dealing themselves [De Salvo, 1992], hence they often had a considerable personal fortune. The distinction between *negotiatores* and *mercatores* creates some difficulties, and has often been reduced only to a difference in the scale of their operations. A *negotiator* could charter an entire ship, while a *mercator* was restricted to a part of the whole cargo [Rougé, 1966, 290; D´Arms, 1981, 24; Peacock, 1982, 158]. Nevertheless, financial power and lack of movement were associated with *negotiatores* and were distinctive features of this group of traders. *Negotiatores* could be also involved in many other activities such as landowning, money lending, transporting goods or shipowning which often obliged them to remain in a single place, usually close to a production or destination area [Panciera, 1980]. Producers acting as *negotiatores* for their own commodities have been identified in numerous cases [D´Arms, 1974; Rathbone, 1991], combining exportation and importation practices was common[6], basically for products employed as ballast in the return trip.

[6] *Aulus Umbricius Scaurus* was a known fish-sauce producer and possibly *negotiator* at Pompeii involved in retailing as well as large scale export and import [Curtis, 1979; 1991, 92-95].

Due to the limitation in their movements, *negotiatores* normally operated from the main commercial centres of the Roman Empire (e.g. Rome, Ostia, Puetoli, Arles, Lyon, Carthage, Alexandria, Hispalis, Gadir) [De Salvo, 1992], where they could arrange trade operations and make contact with other merchants and shippers. The distribution of their inscriptions [Hatzfeld, 1919; D´Arms, 1974; 1981; Middleton, 1979; De Salvo, 1992] documents this as well as suggesting their financial involvement in trade. The port of Ostia and its forum (i.e. Piazzale delle Corporazione) demonstrate how *negotiatores* organized in guilds could arrange their commercial transactions through their offices in town [Calza, 1915; Becatti, 1961; Pohl, 1978; Houston, 1980]. The second distinguishing characteristic of *negotiatores* was their personal fortune that could have been obtained over years of trade or through the exploitation of agricultural estates. Wealthy families of the equestrian class increased their fortunes through trade in the Late Republic [Badian, 1972; D´Arms, 1981] and probably the senatorial members did likewise. However the lex Claudia (218 B.C.) barred senators from owning ships of more than 300 amphorae capacity, limiting their direct involvement in trade (Livy 21.63.4) [Raschke, 1978; D´Arms, 1981; Wallace-Hadrill, 1991].

Nevertheless this class had the necessary resources for investing in trade so that the law seems to have been by-passed in a direct or indirect manner [D´Arms, 1980; 1981; Wallace-Hadrill, 1991]. Senatorial families were directly involved in trade with the Eastern Mediterranean [D´Arms, 1974; 1981; Raschke, 1978; Pleket, 1978] or indirectly through their freedmen, who were stooges in their affairs [Duff, 1928; D´Arms, 1981; Gilliver, 1990; Harris, 1993]. The need for an initial outlay of capital for trade was the fundamental reason for the existence of *negotiatores*[7], who took part themselves in the commercial transactions from their central offices. Their direct influence in the variety and volume commodities traded to distant province responded to common interests with producers (i.e. special prices, own production) [Frayn, 1993, 162] as well as resulting profitable commerce in particular goods. It is important to bear in mind that these special ties with the production area may have favoured deals concerning specific foodstuffs despite the small margin of profit or demand.

b. *Mercator* (Middle scale traders)

The term refers to middle scale traders, who often travelled with their own merchandise and required loans to obtain goods and charter ships [Rougé, 1966; Panciera, 1980; D´Arms, 1981]. Their trading scale and personal fortunes were much lower than those of the *negotiatores* and they risked their own lives on the journeys. *Mercatores* were normally specialized only in trade

[7] Roman bankers never took part personally in trade, but keep deposits and lend money to traders (see chapter 1). Their distance with reference to trade is the main distinction between them and *negotiatores* [Andreau, 1987].

and no other activities were combined with it. They needed economic support from *negotiatores* or bankers, who lent them capital normally at high interest (Philostratus Vit.Apoll. 4.32) with the obligation of a repayment (i.e. *traiecticia pecunia, nauticum fenus*) [Rougé, 1966, 351; De Martino, 1979, 169-174]. They were direct responsible for the cargo, contacting suppliers in the production areas and local traders in the destination province. Therefore they were often forced to travel with the merchandise as well as arranging transportation. Since they were not normally involved in the sphere of production, they selected the merchandise to be traded on the basis of economic reasons alone. In other words, they chose commodities that were in high demand and with good margins of profit.

The group of *mercatores* were supported by members of popular origin (Cicero Verr. 2.5.65.117) who expected to increase their fortunes by risking their lives in trade [Giardina, 1989][8]. An enterprising spirit and cupidity were the necessary characteristics of a *mercator* wishing to become successful (Diodorus v.26; Tacitus Ann. ii.62; Caesar BG iii.1; Ovidius Trist. i.2.75; Seneca ad Paul 2) [Glodarin, 1976]. However, the risks involved in travelling with the merchandise as well as the effort required to create supply and distribution networks restricted the work to people of low status [Curtin, 1984, 6]. The risk to a trader´s life was normally compared to other changeable and dangerous professions such as those of athletes or soldiers (J.Chryst. PG 47.309; Horace Sat. i.15).

Although, in general, the owners were responsible for introducing freedmen in trade, this activity could be also chosen willingly by themselves. Therefore freedmen, as members of a low class, were well represented in trade since this work could report them opportunities of improving their social standing [Duff, 1928; D´Arms, 1981]. Freedmen could be backed by their former owners with whom they set up business societies [D´Arms, 1974; 1981]. If they were successful, they could become *serviri Augustales*, members of a religious magistrature for the Empereor's cult in the provinces, which involved gross expenditures and was the highest aspiration for a freedmen [Duff, 1928; Whittaker, 1989]. Since mobility was the principal requirement of *mercatores* as well as the willingness to accept the drudgery of the work, they tended to specialize in one region or route [Curtin, 1984, 32].

c. *Navicularius* (Shipowner)

Navicularii were essentially shipowners who arranged transportation or trading ventures with public institutions, *negotiatores* and *mercatores* [Rougé, 1966, 244; 1981; Casson, 1974, 314-

[8] As the inscription (CIL vi.9659) recalls: "*Whoever hopes he may grow rich by trade will be fooled in his hopes*".

321; De Salvo, 1992]. In contrast, *nauclerus* and *magister navis* were responsible on behalf of the *navicularii* for cargoes and passengers on the ship and were normally on board (Lucianus Navig. 7.9; Act Apost. 27.11; Plutarch Pomp. 73.3.6; Aristides Sermo Sacro B.305) [Rougé, 1966; 1981; Casson, 1974, 314-321]. *Navicularii* could also trade on their own account, either by chartering a part of the cargo or the ship as a whole [Rickman, 1980a]. Contrary to *nauclerus* and *magister*, a *navicularius* usually remained on shore like *negotiatores* in order to deal with his financial commitments.

Navicularii were organized in guilds (i.e. *corpora, collegia*) supported by the State that required stable associations for arranging public transport [De Robertis, 1981; Christol, 1982; Sirks, 1991; De Salvo, 1992]. They also had geographical specialization, preferring to exploit few routes as *collegia* from Ostia document. The Piazzale delle Corporazione includes mosaics of geographical associations of *navicularii* suggesting that each guild controlled one province supply [Becatti, 1961; Houston, 1980; De Salvo, 1992].

The confusion between *negotiatores*, *mercatores* and *navicularii* is not only a question of terminology but a mixture of occupations in the same hands. A former *mercator* could with good fortune become a *navicularius* or *negotiator*, and vice versa due to a downturn in business. That is why the interpretation of the inscription β on Dressel 20s comprises three functions [Rodríguez-Almeida, 1984; 1989], representing the people in charge of long-distance exchange.

d. *Diffusor* (Commercial agent)

Diffusores were, according to the interpretations [Panciera, 1980; Loyanze, 1988; De Salvo, 1992] people who transferred liquids from large to smaller containers. They were probably responsible for organizing the emptying of amphorae in the province of destination and the filling of other containers (e.g. ceramic, skins, barrels) with the aim of facilitating the final distribution [Panciera, 1980]. A second hypothesis identify *diffusores* as distributor or dealers [Remesal, 1992], who were the middlemen between the production centres and local merchants in the destination province. The proposal has been criticized according to the word ethymology and some epigraphic evidences [Liou, 1993]. There are only a few recorded inscriptions of *diffusores* at transfer points such as Rome, Lyon and Arles, which seem to be related to the public supply of Baetican olive-oil [Loyanze, 1988; Liou and Gassend, 1991]. The transfer of fluid goods from one to another container suggests that the *diffusores* were located in key hubs of communication which should therefore have yielded concentrations of amphorae. Either Arles, Lyon or Rome do report these high densities.

Diffusores constituted the final link in the chain of the long-distance exchange of public transport [Le Roux, 1988; De Salvo, 1992], establishing contacts between interprovincial and local traders or official transporters for the final allocation of commodities. Therefore they remained in the principal points of access to the province and were agents of interprovincial traders.

6.2.2 Intraprovincial traders

Once commodities reached the destination province, they were transferred to other hands for the final distribution. Due to the difficulties in the flow of up-to-date information, only local traders were aware of the real demand in a region, thus foreign traders rarely gained access to the consumer [Baldacci, 1967]. The link between these two spheres of activity was established through agents of the interprovincial traders settled in the principal ports of access to the province [De Salvo, 1992]. A *diffusor* was one of these agents, but also *mercatores* and *navicularii* settled, seasonally[9] or permanently in the province, could act as representatives.

The importance of agents in interprovincial exchange has not yet been fully appreciated, but they must have been key elements in the exchange of information between both spheres of activity as medieval analogies reveal [Goris, 1925; Pirenne, 1936; Lacour-Gayet, 1950; Pounds, 1974; Braudel, 1979c]. With respect to internal distribution, local traders constituted a hierarchical structure according to their range of operation. The demand influenced the way they were organized. Thus final distributions of goods depended on the accesibility of traders to consumers and the related costs. At least four distinctive types of local traders can be distinguished in Roman times.

e. Local *mercator*

Local *mercatores* were middle and petty traders moving commodities from distant regions to the province [Doehaerd, 1978; Gilliver, 1990]. They usually operated between the principal urban centres and in the case of amphorae, they conveyed these commodities from the ports of arrival to central markets in the province. Their job involved contact with foreign agents as well as with the local retailers, middlemen and peddlers, who distributed goods at lower scale. Testimonies of these traders are well-documented in Italy [Giardina, 1989; Frayn, 1993] and Egypt [Lewis, 1983; Bowman, 1986; Rathbone, 1991; Bagnall, 1993] and some seem to have specialized only in imports (CIL vi.4680; 1035).

---

[9] Sea-traffic was barred in the winter months (November-March/April) (Vegetius Ep.Res.Mili. 4.58.63; C.Th. 13.9.3; Dig. 34.4.15) [Rougé, 1952; 1966; 1981; Casson, 1971], thus traders may have remained in the destination provinces.

Provincial *mercatores* required a complete knowledge of the geography of an area and transportation routes, including adequate contacts with transport companies. In fact sometimes they owned their own means of transport [Lewis, 1983; Rathbone, 1991; Bagnall, 1993, 36-39]. As their task consisted of moving goods between the main urban centres, they defined a central market structure in the province [Hodder and Orton, 1976; Hodder and Hassall, 1974], which accurately shows some of the amphora distributions recorded in Roman Britain (see chapter 5).

They basically supplied centres with *nundinae* or *macella*, though the retail sales were left to other traders. Differences in the distribution of amphorae (e.g. North vs South, coast vs inland) may reflect their decision to avoid overhead transport costs, time expenditure [Carreras, 1994a] or limited demand on some occasions. Their trading strategies together with those of middlemen and peddlars had some influence on final distributions despite the existence of constant potential demand in some places. Local *mercatores* above all had an important role in the allocation of luxury goods, which were restricted to specialized urban markets [Frayn, 1993, 61].

f. Middlemen and peddlers

Commodities reaching the principal markets in the province entailed other groups of traders conveying them to minor towns and settlements in the countryside. This category included middlemen and peddlers who sold goods at minor sites, *mercatus* (i.e. fairs), *nundinae* or to shopkeepers in local *tabernae* [MacMullen, 1970; Frayn, 1993, 38-39]. Itinerant traders covered all the areas where demand was scarce and where access was difficult. Consequently they selected profitable goods with limited risk. The routine movement of these traders is evident in the distribution of ceramic types [Hodder, 1974a; 1974b; Peacock, 1982; Millett, 1990]. Itinerant traders were basically specialized in organizing the land transport for short distances[10] as numerous latin synonyms manifest (i.e. *circitor, ambulator, institor, circumforaneus*) [Loane, 1907, 149]. They could even have direct contact with the final consumer because sometimes their job was similar to the door-to-door salesman (e.g. a bookseller in a small village of El Fayum; P.Petans 30.ii; Ovidius Ars.Amat. 1.421-422) [Bowman, 1986].

Middlemen, known as *ekdocheis* in Egypt (P.Oslo iii.144), sometimes had to file declarations concerning the prices of their merchandises (P.Oxy liv.3772) for public control [Bagnall, 1993, 88]. After being handled by the intervention of middlemen and peddlers, goods only generally moved within the destination community till they were finally consumed. The degree of movement involved and the preference for using land transport imposed limitations on the range

---

[10] Medieval merchants were known as "dusty foot" in different languages such as Italian (pedes pulverosi) or French (piedpouche) [Pirenne, 1936].

and volume of good carried. In the case of amphorae, the transfer of their contents to other vessels may have been an adequate solution to this problem.

g. *Tabernarius* and *venditor*

The two latin terms, *tabernarius* and *venditor*, refer to shopkeepers who sold goods in places specially designed for that purpose (i.e. *tabernae, macella*) [De Ruyt, 1983; Frayn, 1993, 7]. They were therefore specialized in retailing produce in their communities, where their shops and produce were well-known [Lewis, 1983, 136; Etienne and Mayet, 1991]. The shops could be found grouped in the same quarters of the large cities as the case of Rome (e.g. Subura, Velabrum) (Martial 7.31; 10.94; 10.52.10; 13.32; Juvenal 11.136-141; Horace Sern. 2.3.239) [Loane, 1907; Frayn, 1993]. Archaeologically, pottery shops have been documented in a few Roman towns with large ceramic stocks [Peacock, 1982, 156; Rhodes, 1991].

Shopkeepers were the link between the consumers and the local *mercatores*, middlemen and peddlars; however, their sales decisions hardly affected the distribution, they simply were indicators of the requirements of local consumers. It is unlikely that their added margin of profit on free sale price of goods affected consumption, since the overhead costs had already been taking into account in previous stages.

h. Door-to-door salesman

The lowest level in the scale of trade was the door-to-door salesman who normally operated in the large urban centres where there was minimal potential demand for a specialist. A list of market taxes from Oxyrhynchus (P.Oxy 520.43; 1727 ii/iii) mentions the existence of those "who sell throughout the city" identified as door-to-door salesmen [Bowman, 1986]. As in the case of shopkeepers, they had hardly any influence on the distribution of commodities since these reached their destinations thanks to the work of other traders.

All these types of traders pursued a similar aim of obtaining revenues by minimizing expenditures. The principal difficulty in long-distance exchange in antiquity was the distance to be covered and the lack of reliable information, which made it rather complicated. In this framework, the key roles of long-distance commerce were held by the traders transferring goods from the production zone to the destination province; in other words, the functions performed by *mercatores*, *navicularii* and their agents. They were the linchpin between the two spheres of activity, running most of the risks in the transaction.

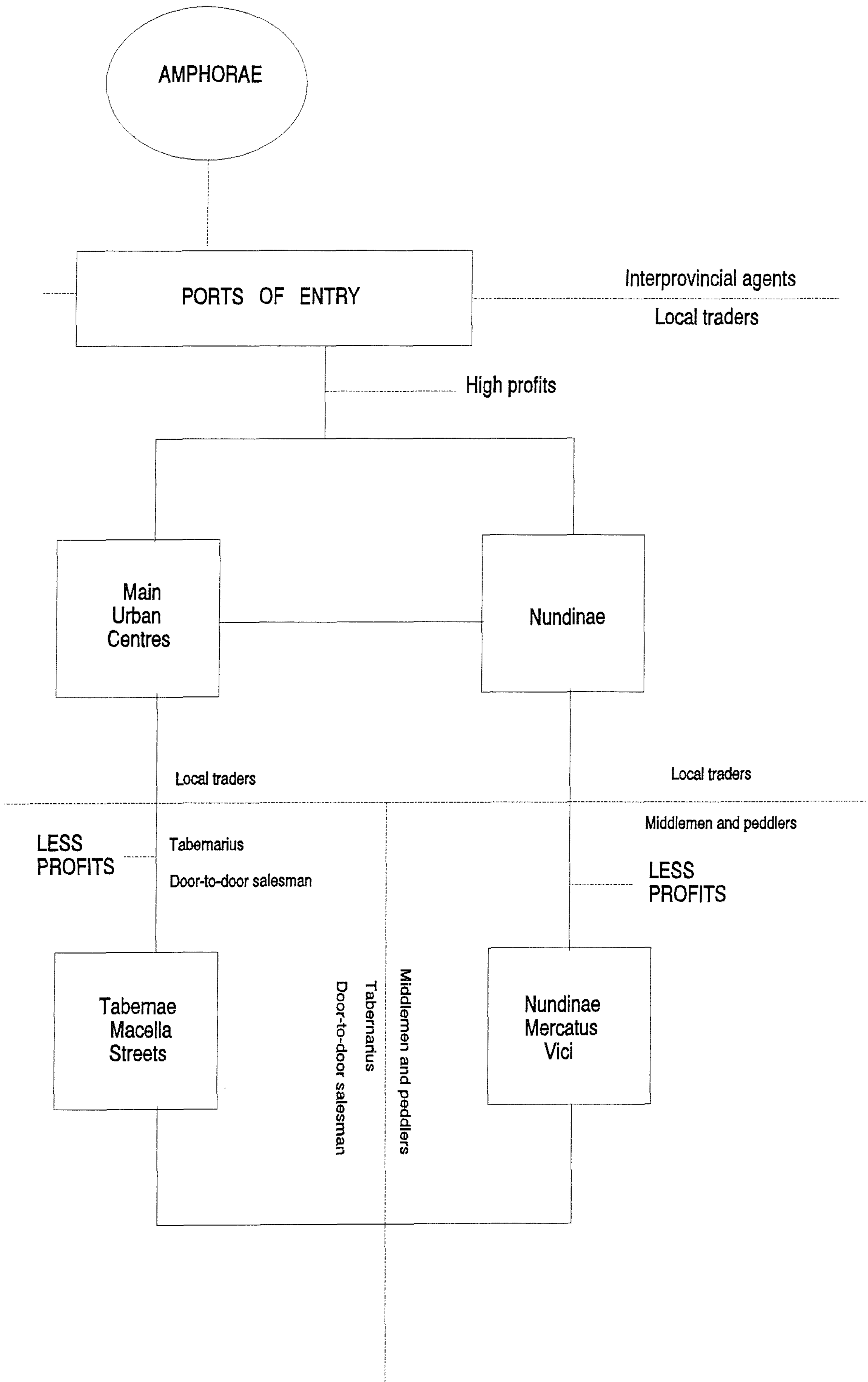

Figure 72 Diagram on the hierarchy of interprovincial traders.

6.3 External routes of access to Britain

The choice of a particular transcontinental route of access to Britain affected the distribution of goods in the province since each route ended in a particular destination. Moreover, the internal road network in Britain seems to have been developed in relation to the external routes (see chapter 5), so that the main ports became the key hubs of communications. In economic terms, a route´s choice influences chiefly the internal transportation costs as the initial port varies, benefitting the distribution in adjacent regions. Transportation costs are an added value to any commodity with regards to the final price [Dicken and Lloyd, 1990; Carreras, 1994a], thus reducing these costs favoured sales of goods.

The distribution of some amphora types (e.g. North African, Kapitan II) (see chapter 5) suggested a preferential use of some transcontinental routes ending at key ports (e.g. Gloucester, Exeter, Chester, London, Richborough). The choice of each external route was due to numerous factors that can be classified into three main groups:

a. Infrastructure
b. Cost and time consumption
c. Risk

6.3.1 Infrastructure

A good route requires a minimal infrastructure in terms of transport, personnel and warehouses [Rougé, 1966; Milne and Hobley, 1981; Milne, 1985; Reddé, 1986]. Sufficient number of transportation means imply that goods could be always in movement, hence no important delays were expected. Delays usually influence the sale price of any good since traders accessing late to a market may have to accept lower sale prices or less potential buyers due to competition, which often means losses. Furthermore, a prosperous itinerary attracts buyers at each urban centre, making merchandise easier to sell on route [De Salvo, 1992, 396-412]. In an adequate route, there must be centres with warehouses for short or long stops [Meiggs, 1960], establishments for the repair of ships, boats and waggons and handling staff at places where cargoes were transferred to other means of transport (i.e. *saccarii*, *baiuli*, *phalancarii*) [Casson, 1971; Rougé, 1981; van Berchem, 1982; Höckman, 1988].

Navigation requires special installations for unloading cargoes and mooring ships the whole winter (i.e. *portus*) or short periods (i.e. *statio*) (Isidorus Et.xiv.8) [Rougé, 1966; Casson, 1971; Höckman, 1988]. Maritime journeys also needed the guidance of lighthouses [Martinez-Maganto, 1990], knowledge of stars and use of maps [Rougé, 1966; Casson, 1971] for a safe arrival to the destination. The most celebrated routes disposed of a large corpus of information supplied by all the merchants, navigators, military and geographers who had travelled along them [Miller, 1968; Achard, 1981]. An adequate infrastructure and knowledge of a route improved its chances to be selected regardless its location. Epigraphic and literary sources give testimony to the degree of popularity of a particular route [De Salvo, 1992] and how traders used to travel continuously along the same itinerary.

The presence of a military administration exploiting an individual route favoured its prosperity, since the army created a minimal infrastructure (i.e. roads, ports, staff) as well as a stable flow of goods[11] [Middleton, 1979; 1983; De Salvo, 1992]. Although parts of the military network could be under direct military control, it also shared civil infrastructures with private hands [De Salvo, 1992; Anderson, 1992; Whittaker, 1989a]. Moreover, the presence of the Roman army became a guarantee of security for traders travelling across remote lands.

6.3.2 Cost and time consumption

The movement of commodities has always attached a cost that normally explains the variability in the distance travelled and the volume reaching each destination [Dicken and Lloyd, 1990]. Although the paramount importance of transport costs is related to a single mechanism of exchange, market system (see chapter 1), they act on other mechanisms as well. Time consumption also alters the final value of a good depending on the number of competitors accessing to the same destination and the demand. Therefore, selecting the fastest route between two points improves the possibilities of obtaining a good final price. Normally a fast route was reckoned on the distance to cover and the speed of the transport means used [Carreras, 1994a] and required less changes of transport so that there were less breaking points [Remesal, 1986, 78]. Seagoing ships and downriver boats were the fastest modes of transport and the routes employed by them resulted in the greatest time efficience (see chapter 5.2.1).

Transport cost is an important portion of the final sales price of any good and relates to its weight, volume and handling. Although the portion varies according to the intrinsic value of a good, the transportation cost for staples and pottery seems to have been not more than 25% of the final price, following the testimony of XIIIth century records [Hodder, 1974]. Bearing in mind this evidence, it is supposed that traders were careful in choosing an appropriate route which could provide them a good margin of profits. Diocletian´s Price Edict reports transport costs for each

[11] A habitual flow supposed regular employment for transporters and suppliers that guaranteed the minimal means of transport and personnel for a route.

mode that suggests a preference for sea and river transport [Duncan-Jones, 1974; Carreras, 1994a].

Combining transport ratios with the distance covered by each mode, the cost of each transcontinental route can be assessed [Peacock, 1978; Fulford, 1984; King, 1981; Carreras, 1994a]. The conclusion offers no doubts, Romans had to avoid land transport and take advantage of maritime routes; in fact, the Atlantic itinerary to Britain was always the most convenient. None the less, the transport cost varied according to the departure point, so that cost indexes for each route were diverse from either Narbonne [Peacock, 1978] or Arva (prov. Seville) [Carreras, 1994a]. Furthermore, there are two extra charges in the final transportation cost due to handling cargoes from one to on other means of transport [Milne, 1990] and duties [de Laet, 1949; Abad, 1986; Höckman, 1988]. Avoiding transhipments of cargoes made it possible to save the money and time involved in offloading and loading goods. This strategy was even more beneficial in long-distance exchange when the destination was known, whereas cargo transfers were common in short distances as tramp ships demonstrate (e.g. Cala Culip IV) [Nieto et alii, 1989]. Duties of interprovincial exchange (i.e. *portorium*) were farmed in few places (i.e. *statios*) on the main itineraries. Goods were charged between 2-5% of their market value [de Laet, 1949; Rougé, 1966; Hopkins, 1980], though the rates could vary according to the routes and provinces[12]. Traders and transporters were perfectly aware of all these details and selected a route which could represent less overhead costs in terms of time and price.

6.3.3 Risk

The loss of a cargo meant a terrible blow for any trader, who had some mechanisms of assuring his relief by sharing risks with lenders (i.e. *nauticum fenus*) [Rougé, 1966, 354-360]. In other words, a shipwreck was also a disaster for a lender, who lost the repayment of his loan. The hazards of sea were always in the mind of Roman navigators (Acts of Apost. 27; Synesius Letters.4; Strabo viii.6.20; Suetonius Agus.98.2) [Meijer and van Nijk, 1992] who preferential used the safest routes not only for the cargo´s sake but also their own lives [Casson, 1984]. Nevertheless, often the higher the risk was the more substantial revenues a trader could expect from a trip that is why perilous routes became frequented [Giardina, 1989; Casson, 1989]. Rough seas, visibility and weather conditions were deterrents for the navigation of some routes [Reddé, 1979; McGrail, 1983] whose their relatively low transport cost otherwise made them rather attractive. This contradiction points out that the existence of a risk could not discard the exploitation of any route[13]. Finally, piracy [Gianfrotta, 1981] and brigandage [Shaw, 1989;

[12] For instance, the province of Hispania charged the *quiquagesima* (2%), while Galia demanded the *quadragessima* (2.5%) [de Laet, 1949; Abad, 1976].

[13] A 20% of shipwrecks for the total naval traffic has been proposed [Höckman, 1988, 139].

Drinkwater, 1983] were another potential risks involved in travelling particular routes and periods, which traders may have avoided if possible.

All these constraints affected the selection of a specific route. In the case of Roman Britain, at least six routes of access are known according to literary and archaeological sources. Amphora imports from the Mediterranean regions reached the province across one or more of these routes, arriving at different destinations. The following figures illustrate the location of the main infrastructures on the six routes. The figure 73 documents only coastal centres, whereas figure 74 displays the inland sites on the routes from Southern Gaul to the Atlantic [Bonnard, 1913; Peacock, 1978; Rougé, 1985]. Inscriptions of traders are reported in numerous sites on these routes as figure 75 reveals (see appendix 10), reflecting the situation of the key commercial centres. Finally figure 76 (see appendix 10) includes inscriptions of boatmen in the main Gaulish waterways.

List of sites illustrated (figures 73 and 74)

1. Lixus
2. Tingis (Tánger)
3. Baelo
4. Gades (Cádiz)
5. Hispalis (Sevilla)
6. Onoba (Huelva)
7. Balsa
8. Ossonoba
9. Lacobriga
10. Mirobriga Celtica
11. Caetobriga
12. Olisipo (Lisboa)
13. Scallabis
14. Eburobrittium
15. Conimbriga
16. Portus Cale (Oporto)
17. Bracara Augusta (Braga)
18. Tudae
19. Iria Flavia (Padrón)
20. Brigantium (La Coruña)
21. Gigia (Gijón)
22. P.Vereasuecae (S.Vicente)
23. P.Blendium (Suances)
24. P.Vict.Iuliobrigensium (Santander)
25. Flaviobriga (Castro Urdiales)
26. Tritium Tuboricum
27. Ossaron (Oyarzu)
28. Aquae Tarbellicae
29. Boii
30. Burdigala (Burdeos)
31. Mediolanum (Saintes)
32. Condevincum (Nantes)
33. Darioritum
34. Gesocribate (Brest)
35. Fanum Martis (Alet)
36. Guernsey
37. Crociatorum
38. Aregennae
39. Rotomagus
40. Gesoriacum (Boulogne)
41. Ondenburg
42. Domburg
43. Gannenta (Colijnsplaat)
44. Forum Hadriani
45. Ulpius Noviomagus
46. Carteia
47. Malaca (Málaga)
48. Sexi
49. Abdera
50. Urci
51. Baria
52. Carthago Nova (Cartagena)
53. Lucentum (Alicante)
54. Alonae
55. Dianium
56. Valentia (Valencia)
57. Saguntum
58. Dertosa
59. Tarraco (Tarragona)
60. Barcino (Barcelona)
61. Baetulo
62. Iluro
63. Emporium (Ampurias)
64. Ruscino
65. Narbo Martius (Narbona)
66. Nemausus (Nimes)
67. Arelate (Arles)
68. Massilia (Marsella)
69. Olbia
70. Forum Iulii (Fréjus)
71. Antipolis
72. Nicaea (Niza)
73. Agathe (Adge)
74. Carcaso (Carcasonne)
75. Tolosa (Toulouse)
76. Aginum
77. Cassio
78. Arausio (Orange)
79. Valentia (Valence)
80. Vienna (Vienne)
81. Lugdunum (Lyon)
82. Geneva (Ginebra)
83. Colonia Equestris
84. Cabilonnum (Châlon)
85. Augustodunum
86. Decetia

87. Cenabum
88. Caesarodunum
89. Iuliomagus
90. Eburodunum
91. Aventicum
92. Vindonissa
93. Augusta Rauricorum (Augst)
94. Argentovaria
95. Argentorate (Strasbourg)
96. Noviomagus
97. Mogontiacum (Mainz)
98. Confluentes
99. Bonna (Bonn)
100. Colonia Agripensis (Köln)
101. Novaesium (Neuss)
102. Asciburgium
103. Castra Vetera
104. Augusta Treverorum (Trier)
105. Divodurum
106. Tullum
107. Virodunum
108. Aduatuca
109. Vesontio (Besançon)
110. Alesia
111. Autessiodurum
112. Augustobona
113. Metiosedum
114. Lutetia (Paris)

List of sites illustrated in figure 75 (Traders)

More than 10 inscriptions

42. Domburg
43. Gannenta (Colijnsplaat)
81. Lugdunum (Lyon)

More than 5 inscriptions

97. Mogontiacum (Mainz)
100. Colonia Agrippinensis (Köln)
104. Augusta Treverorum (Trier)

One inscription

30. Burdigala (Bordeaux)
45. Ulpius Noviomagus (Nijmegen)
65. Narbo Martius (Narbonne)
66. Nemausus (Nîmes)
67. Arelate (Arles)

List of sites illustrated in figure 76 (Boatmen)

32. Condevincum (Nantes)
42. Domburg
43. Gannenta (Colijnsplaat)
65. Narbo Martius (Narbonne)
66. Nemausus (Nîmes)
67. Arelate (Arles)
70. Forum Iulii (Fréjus)

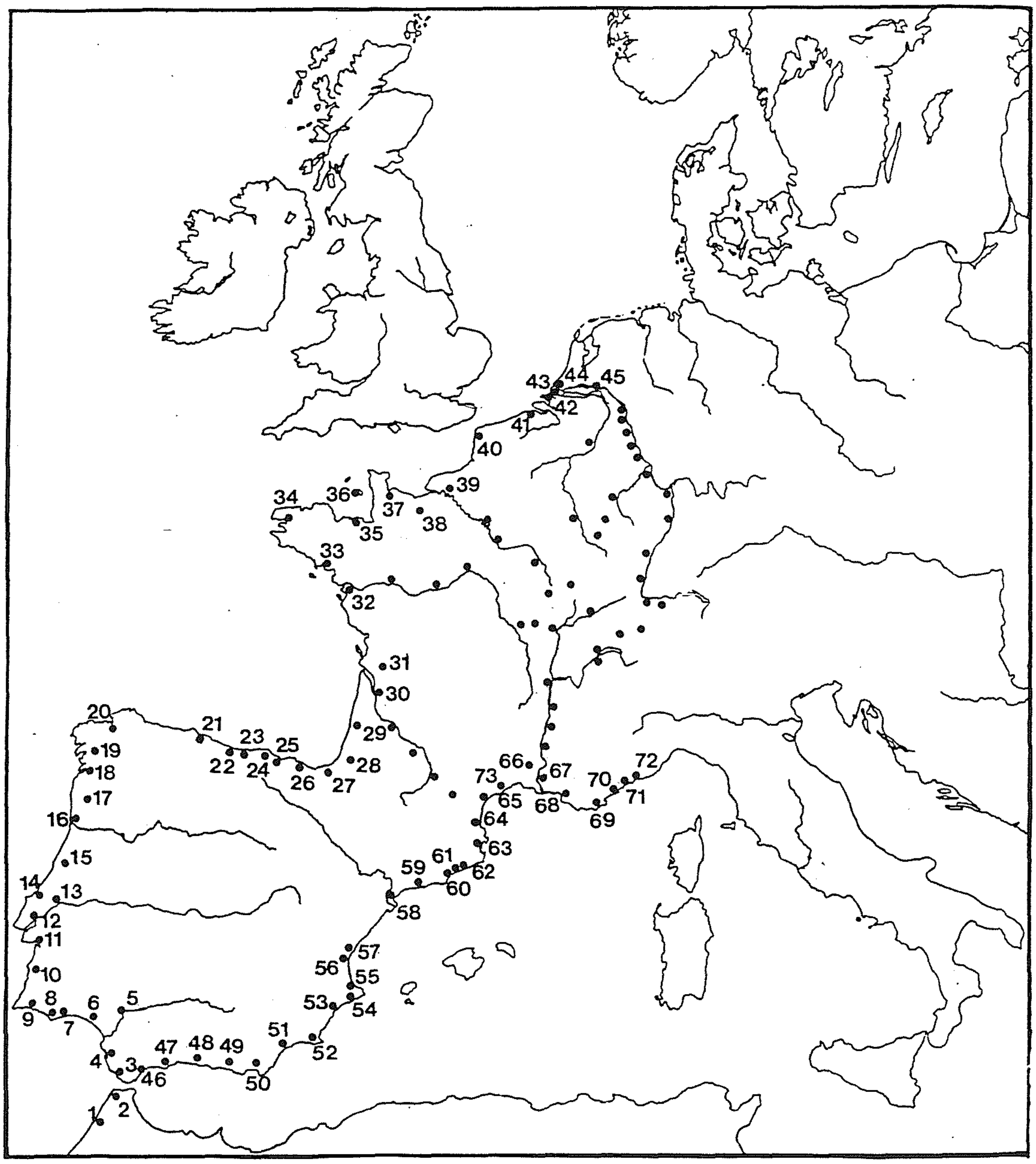

Figure 73 Coastal centres on the main transcontinental routes.

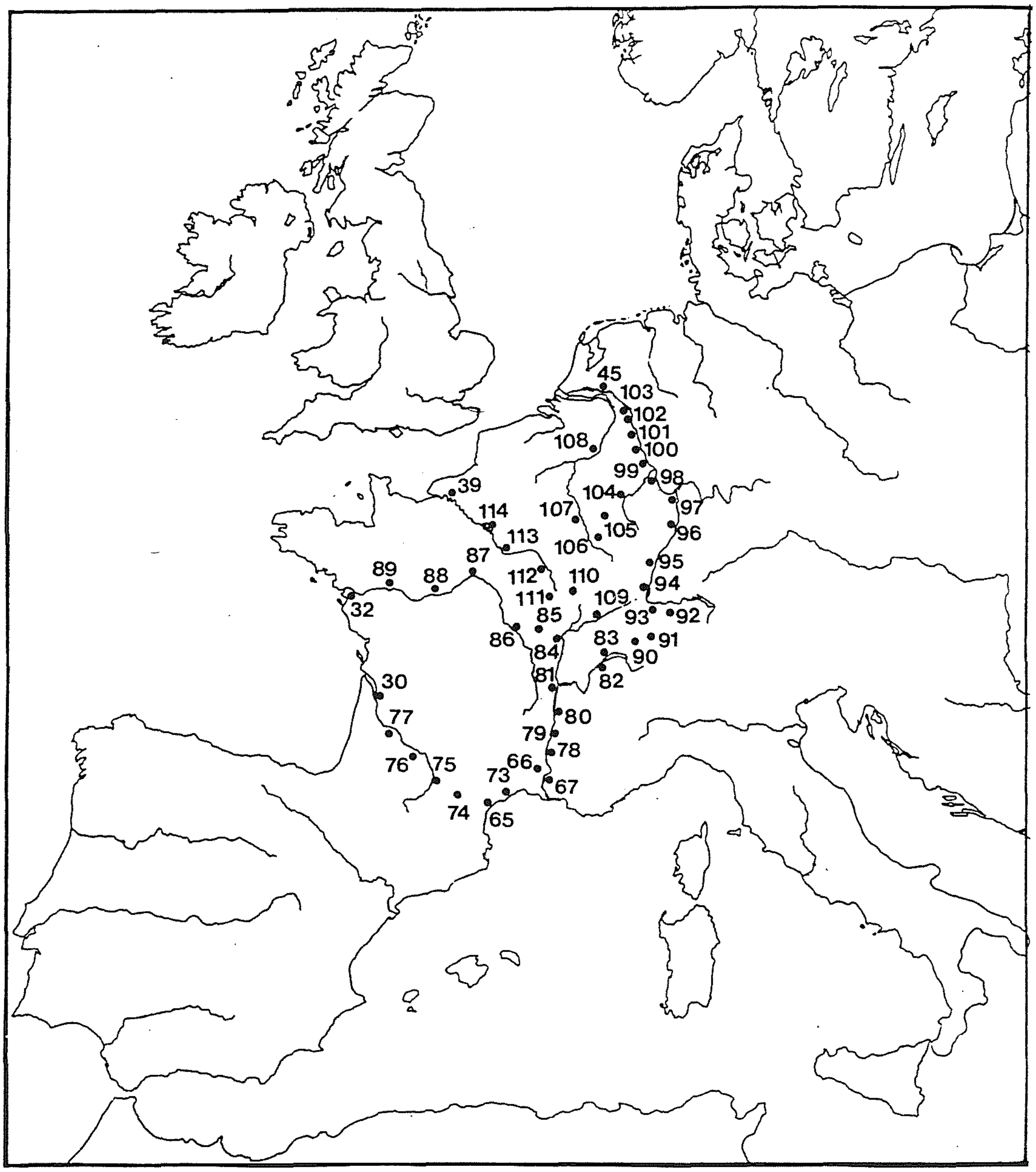

Figure 74 Inland centres on the main transcontinental routes.

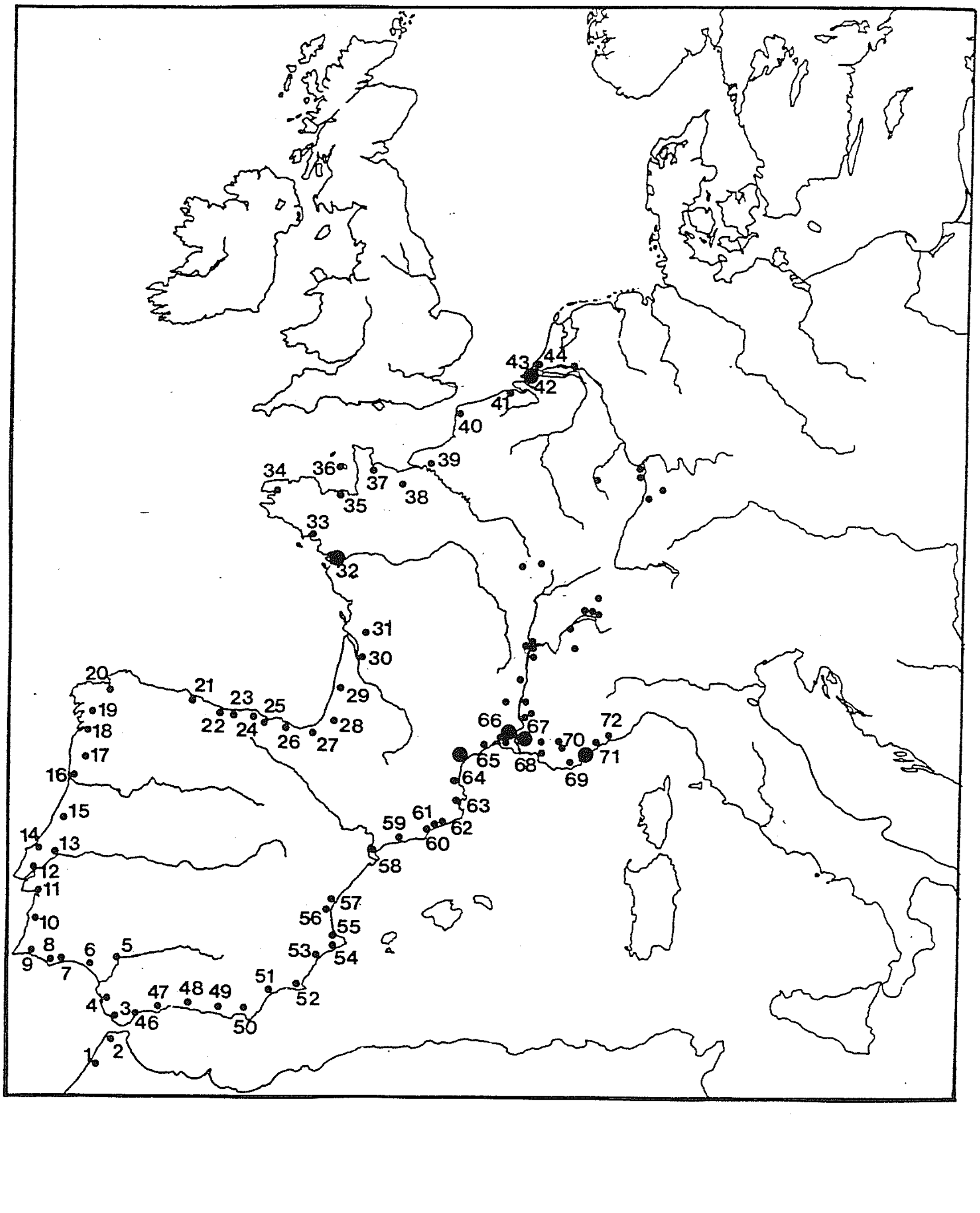

Figure 75 Inscriptions of traders on the main transcontinental routes.

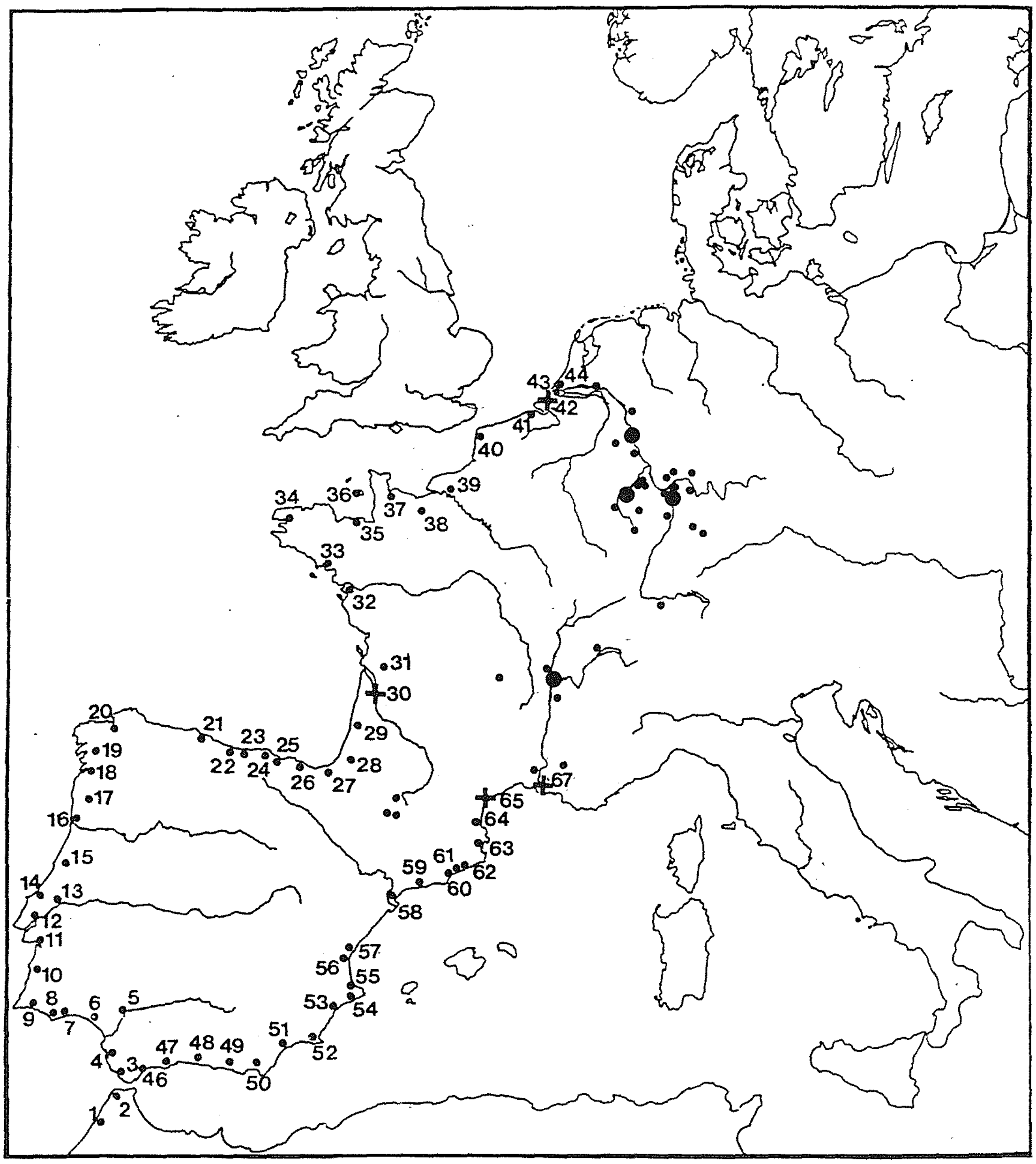

Figure 76 Inscriptions of boatmen on the main transcontinental routes.

A general picture emerges from all these archaeological maps, nonetheless a more detailed account on the exploitation of routes requires a thorough analysis of each particular itinerary as appears below.

a. Atlantic route

A few literary sources report the use and explotation of the Atlantic route by Tartessians (Strabo iii.5.10-11) or Phoenicians (Pseudo.Arist. Mic.Ausc. 136) who obtained tin from the British Isles. The navigation of the Atlantic Ocean from the Northern Spain up to Britain was documented by ancient travellers such as Pytheas, Timaeus or Posidonius (IV-I c. BC) and their account was included in the texts of Avienus and Strabo[14]. After this previous experience, the Romans mastered navigation in Atlantic waters for military and commercial reasons [Harmand, 1974].

> *"... the Romans learned all about the voyage... [Publius Crassus] he forthwith laid abundant information before all who wished to traffic over this sea, albeit a wider sea than which separates Britain from the Continent. So much, then, Iberia and the islands that lie off its coast."* *[Strabo iii.5.11]*

Notwithstanding the literary evidence, the Atlantic route has always been considered less frequented than the other transcontinental passages due to the dangers of the Gulf of Biscay [Peacock, 1978; Reddé, 1979; Rougé, 1981; McGrail, 1983]. Visibility, maritime currents and winds made the Atlantic voyage rather demanding for Roman sailors, and necessitated a full knowledge of the coastal geography and stars [Naveiro, 1991; 115-136; Martinez-Maganto and Carreras, 1993]. As figure 77 reveals, the Atlantic route started near the Strait of Gibraltar [Ponsich, 1974b] following the whole Atlantic coast of Baetica and Lusitania [Gonzalez, 1954] until it reached cape Ortegal in NW Spain. At this point there were two alternative itineraries to Britain: one direct and another indirect. The former went straight to Cornwall or the English Channel, often calling at ports of Brittany[15], whereas the later one followed the Cantabric coast [Perex, 1986; Iglesias and Muñoz, 1992; Pérez and Illaguerri, 1992] and continued along the Western coast of Gaul up to the English Channel [Pineau, 1970; Reddé, 1979; McGrail, 1983; 1987; Galliou, 1991; 1992].

The main ports and possible *statios* (i.e. customs) of this route were Gades (Cádiz), Brigantium (La Coruña), Burdigala (Bourdeaux) and Gesoricum (Boulogne) [de Laet, 1949;

---

[14] Pliny (NH ii.167) and Horace (Od. i.31-13) are other ancient sources of this route.

[15] Appianus (Iber.1) indicates that it took only one day and a half to cross the Gulf of Biscai.

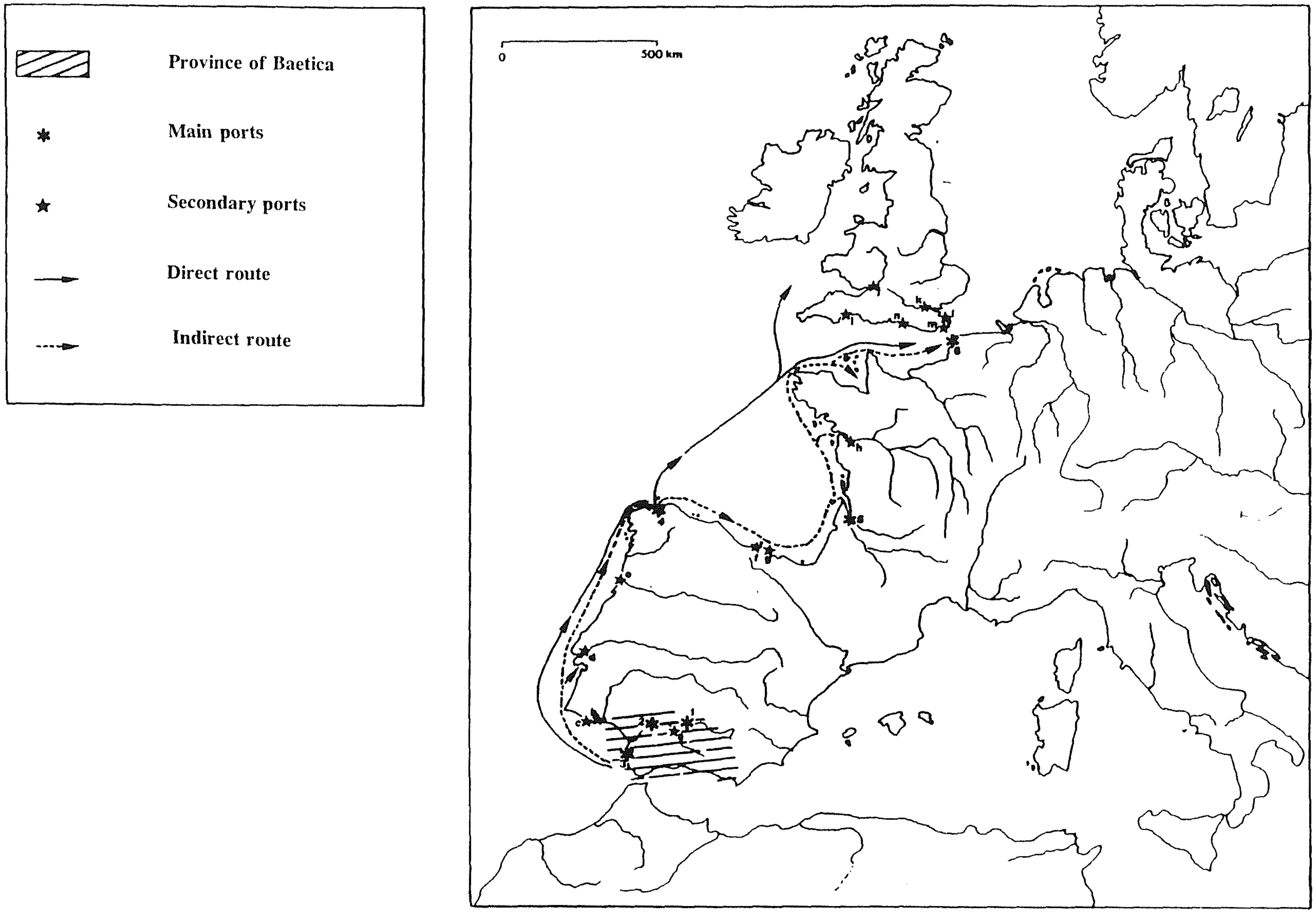

Figure 77 Direct and indirect itineraries of the Atlantic route.

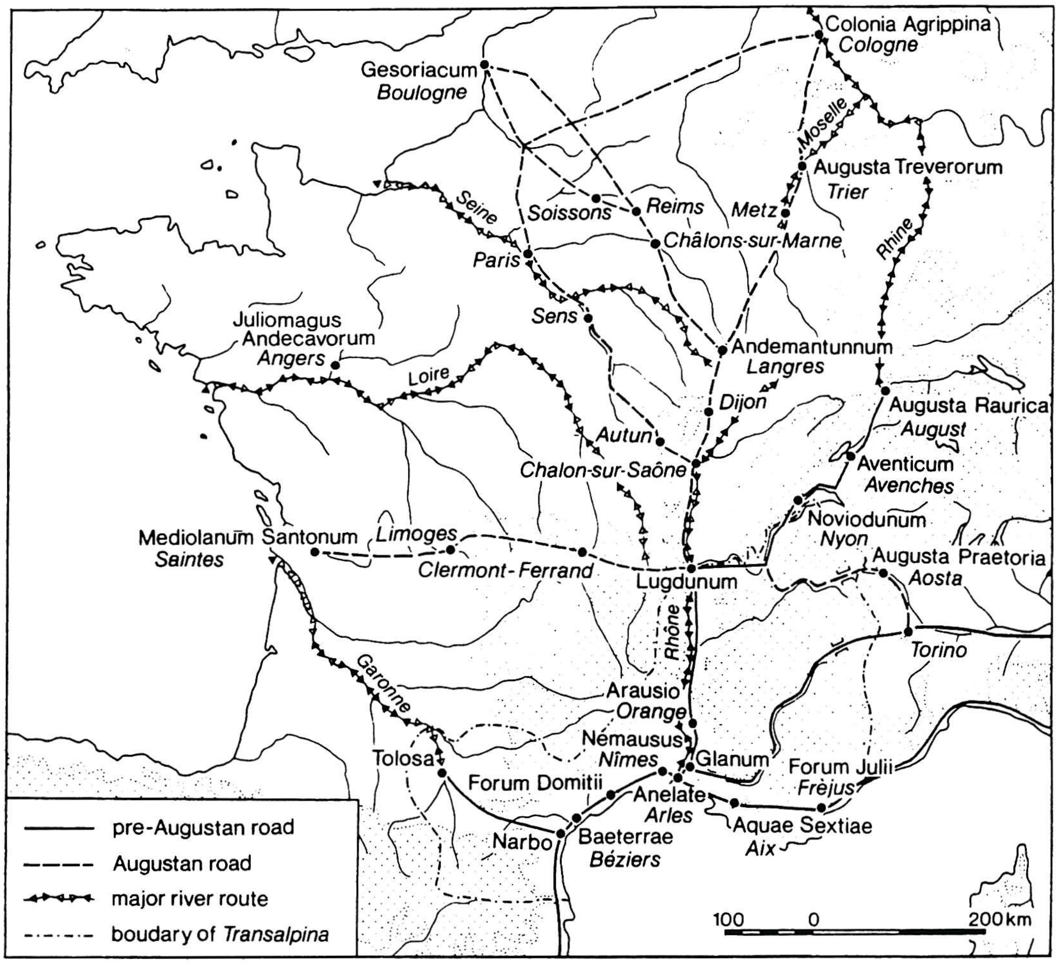

Figure 78 Transcontinental routes crossing Gaul (after Cunliffe, 1988).

Naveiro, 1991; Martinez-Maganto and Carreras, 1993], but there were many other ports for occasional calls (see figure 73) [Naveiro, 1991]. The infrastructure was also complemented with the construction of a lighthouse at Brigantium, which seems to have been destined to guidance for transoceanic navigation [Martinez-Maganto, 1990].

The archaeological evidences of this route are numerous and include the presence of Southern Spanish, African, Italian and Eastern Mediterranean material in the Atlantic and Cantabric coasts (i.e. amphorae, coins, pottery) [Siraudeau, 1978; Deniaux, 1980; Naveiro, 1991; Blaszkiewicz, 1992; Carreras, 1994b][16]. Some of these finds may have been part of shipwrecks [Martinez-Maganto and Carreras, 1993] that complemented the list of wrecks known along the portuguese coast [Diaz-Alvarez, 1984], three recorded in NW Spain (i.e. Fuenterrabia, Corteaga, Cabo del Mar) [Parker, 1992a, n.430, 340 and 121] and two from Guernsey with Southern Spanish cargoes (i.e. Little Russell A and B) [Monaghan, 1987; 1991; Parker, 1992a, n.602 and 603][17]. Although the archaeological testimonies do not match the ones documented in the Mediterranean region, a minimal maritime traffic should be accepted despite risks [Remesal, 1986; Whittaker, 1989a; Naveiro and Pérez-Losada, 1992][18].

On the contrary, the economic aspect of the Atlantic route was its real advantage since transport costs were relatively low compared to other itineraries. A cost index calculated from Narbonne, which is useful for comparing routes despite the lack of units, accounts only 4.440 [Peacock, 1978], whereas the cost from Arva reached 61.61 Kg of olive-oil, which corresponds to 9.25% of the sales price of transporting one ton of this produce in amphorae [Carreras, 1994a]. The privilege of such a cost index was already underlined by different authors [Fulford, 1989; Edmondson, 1990; Curtis, 1991], noting the volume of Southern goods recovered in Britain [Martinez-Maganto and Carreras, forth.]. The final destination of this route may have been Exeter, Gloucester or Chester, though other SE ports may have attracted the Atlantic ships.

b. Aude-Garonne route

The Aude-Garonne route (see figure 78), also known as the "isthme gaulois" [Braudel, 1949, 159] departed from Narbonne following the Aude upstream and reaching Toulouse by land

---

[16] New evidences in NW Spain are found at La Guardia, St.Tegra, Vigo, Isla de Corteaga, Arancedo, Coaña, Campa Torres, Santander and cape Higuer [Naveiro, 1991; Martinez-Maganto and Carreras, forth.].

[17] Another shipwreck probably loaden with barrels rather than amphorae at Guernesey provides an interesting assemblage of pottery defining a possible Atlantic route with material from Algeria, Spain, Western France, Dorset and Eastern England [Rule and Monaghan, 1993, 82].

[18] There are numerous testimonies of pilgrimages in the Late Empire to Jerusalem [Wilkinson, 1977; Doehaerd, 1978] and Santiago [Tate, 1993].

transport. At Toulouse, the passage continued along the river Garonne down to Bourdeaux, from which merchandises were shipped skirting the Gaulish coast to reach Britain [Bonnard, 1913; De Izarra, 1993; Roman, 1983; 1989; McGrail, 1983; Cunliffe, 1988; Sillières, 1990; Galliou, 1991; 1992]. The itinerary ended in the western coast of Britain, thus Exeter was the nearest port. The huge quantities of amphorae (i.e. Dressel 1, Pascual 1) [Labrousse, 1968; Fitzpatrick, 1985; Tchernia, 1986] recovered in the Toulouse area, where a custom was set up in the late Republic (Cicero Pro.Front. ix.19), substantiates the exploitation of this route [Roman, 1983; Cunliffe, 1988].

A transfer of wine from amphorae to wooden barrels seems the most likely explanation to the high densities of the Toulouse region, which was therefore a breaking point. A vivid traffic can be also inferred from the amount of amphorae reported in the two main ports of this route: Narbonne [Liou and Scialliano, 1989] and Bourdeaux [Berthault, 1990]. The Atlantic journey is also documented by distributions of Dressel 1 amphorae [Galliou, 1982; Blaskiewicz, 1992] and its navigation was relatively easy [McGrail, 1983; 1986].

Although there is abundant evidence of this route in Republican and Augustan times, the testimonies are scarce in later periods [Roman, 1983, 183]. Moreover, the absence of epigraphic mentions to boatmen suggests a downturn in volume of trade [Bonnard, 1913; Middleton, 1979]. Nevertheless, samian produced in Southern Gaul had access to the Atlantic markets through this route as individual distributions seem to suggest (i.e. Montans, La Graufesenque) [Bémont and Jacob, 1986]. Also, Bourdeaux still maintained strong ties with Roman Britain as reveals the inscription found there (AE 1922, 116; A.D. 237). In economic terms the Aude-Garonne route was the second cheapest passage from the Mediterranean to Britain. The transport cost index from Narbonne proposed by Peacock [1978] reached a value of 5.779, while the price from Arva [Carreras, 1994a] was 206.36 Kg of olive-oil (30.98% of the sales price).

c. Rhône-Loire route

The route (see figure 78) (Strabo 4.189) began at the sea-river port at Arles in the mouth of the river Rhône. The boatmen carried the merchandises up to Vienne, Lyon[19] or Chalon-sur-Sâone from which they were transferred to the river Loire by land transport [Bonnard, 1913; De Izarra, 1993; Rougé, 1985; Cunliffe, 1988][20]. The later transhipment point (i.e. Châlon) seems to have enjoyed a prominent role at least in early periods on the basis of the great quantities of

[19] Lyon was a *statio* (i.e. customs) for farming the *quadragesima gallicorum* [De Salvo, 1992, 400-412].

[20] There was an alternative itinerary by road starting at Lyon and crossing Clermont-Ferrand and Limoges to end at the Atlantic port of Mediolanum (Saintes).

amphorae recovered in the region [Bonnamour, 1975]. Bibracte [Laubenheimer, 1991a] and later Autun were two other key centres in the passage from the river Rhône to the Loire.

The itinerary continued downstream Loire up to Nantes where goods were embarked for the final stage by ship along the Atlantic coast [Galliou, 1983; 1986; McGrail, 1983]. The route was specially suited for the distribution of samian manufactured in Central Gaul (e.g. Lezoux) and even La Graufesenque [Bénont and Jacob, 1986; Fulford, 1977; Middleton, 1979; 1980]. With reference to cost coefficient, it reached 8.354 from Narbonne [Peacock, 1978], whereas 205.68 Kg (30.88%) was the transport cost from Arva [Carreras, 1994a].

The Rhône-Loire passage was always frequented as the distribution of pottery à l´éponge [Fulford, 1977] reveals for later periods and even the presence of river boatmen is attested on the river Loire (CIL xiii.3105; 3144) [Middleton, 1979; De Salvo, 1992].

d. Rhône-Seine route

The Rhône-Seine route (see figure 78) followed initially the same itinerary as the previous route as far as Châlon-sur-Saône. However the transfer of cargoes to the river Seine had three alternative corridors [Bonnard, 1913; Rougé, 1985; Cunliffe, 1988; De Izarra, 1993]. The first one involved land transport from Châlon to Alesia, the second required a trip to Dijon and then to the river Seine and the third, demanded a passage to Langres by road[21] and then a transfer to the river Seine [Mangin, 1985]. The journey continued by going down river, crossing Lutetia, before arriving at Rotomagus that was the port from which ships sailed to Britain. The nearest port to Rotomagus was Chichester, but the crossing to Eastern harbours was also easy (i.e. Richborough, London, Colchester). There was another itinerary from Langres by road, which crossed Châlon-sur-Marne, Reims and Soissons ending at the Channel port of Gesoriacum (Boulogne) [Rougé, 1985; Cunliffe, 1988].

Archaeological evidence appears in the form of inscriptions of river boatmen (CIL xiii.3026; 11244) [Middleton ,1979; De Salvo, 1992] as well as high concentrations of amphorae at Châlon-sur-Saône [Bonnamour, 1975] and Alesia [Le Gall, 1983]. Moreover, other pottery types such as Central Gaulish samian may have been distributed along this route [Fulford, 1977a; 1984; Raepsaet, 1987b; Raepsaet and Raepsaet-Charlier, 1988]. With regards to the cost, Peacock [1978] suggested an index of 9.321 from Narbonne, while transport from Arva [Carreras, 1994a] amounted 236.36 Kg (30.50%).

[21] A sculpture depicting a waggon carrying a wooden barrel is reported at Langres [Molin, 1984; 1990].

e. Rhône-Rhine route (via Saône-Doubs)

The route via Saône-Doubs (see figure 78) (Strabo 4.1.14) continued from Châlon-sur-Saône by road to Besançon and ending at Epomanduodurum (Mandeuve) [Drinkwater, 1983, 126; Mangin, 1985; Schlippschuch, 1987; De Izarra, 1993; Cloppet, 1989; Bonnard, 1913]. Merchandises prolonged their journey down the river Rhine up to ports such as Domburg or Gannenta from which they were shipped directly to the Eastern harbours of Britain. Numerous inscriptions of Roman traders are attested at Domburg and Gannenta [Hondris-Crone, 1955; van Gansbeke, 1957; Bogaers, 1971; Stuart-Bogaers, 1971; Hassall, 1978; Môcsy, 1984] proving the existence of a thriving trade between the Dutch coast and Britain. Nevertheless, nothing suggests that Mediterranean goods travelled along the Rhine to end in British lands since the cost index was rather high reaching 11.038 from Narbonne [Peacock, 1978] or 240.58 Kg (36.12%) from Arva [Carreras, 1994a].

Although inscriptions of river boatmen are well documented [Middleton, 1979; De Salvo, 1992] together with a military fleet (i.e. Classis Germanica) [Starr, 1941; Saddington, 1990], their testimony only reveal a heavy traffic on the river. Likewise the common presence of the same amphora types in both Germany and Britain [Desbat and Martin-Kilcher, 1989; Baudoux, 1990] does not explicitly indicate the use of the same route of supply. Roman legions garrisoned in both provinces had similar demands and tastes, which often resulted in similar imports and suppliers but not necessarily identical itineraries. Trade contacts between both provinces cannot be denied as a myriad of German imports in Britain demonstrate (i.e. samian, glass, coarse wares, mortaria); however, the use of the river Rhine for transporting local produce does not signify an identical pattern for distant commodities.

f. Rhône-Rhine route (via Saône-Mosel)

A second variant of the Rhône-Rhine route (see figure 78) prolonged the itinerary from Châlon to Metz by road and then downstream the river Mosel crossing Trier and joining the river Rhine [Bonnard, 1913; Cunliffe, 1988; De Izarra, 1993; Cloppet, 1989][22]. The difficulties in the passage from the Saône to Mosel resulted in a plan building of a canal (AD 55), which was never undertaken (Tacitus Ann.xiii.53.2-4). The last part of the journey coincided with the previous variant, so that all the infrastructure and evidences are shared. Trier was the central market on the route and its products were distributed along the Rhine and in Britain as well [Wightman, 1970; Symonds, 1986]. Common to the previous itinerary, this second variant involved overhead

[22] Mosel wine enjoyed a good fame (Ausonius Mes.194-195; 152-168), though wooden barrels seem the most likely containers as two bass-reliefs from Metz and Trier show [Moulin, 1990].

transport costs that may have discouraged long-distance traders. The index from Narbonne was 12.082 [Peacock, 1978], while the one calculated from Arva reached 244.28 Kg (36.67%) [Carreras, 1994].

6.3.4 Remarks on transcontinental routes

The evidence gathered from statistical analyses on Dressel 20 stamps (see chapter 5) manifested a different supply of the German and British provinces in particular periods. Despite importing the same Baetican olive-oil, each province had its own suppliers and probably its own route of access. The testimony of Julio-Claudian period revealed that Lyon and Vienne may have been military depots for the German legions, whereas Britain received its Dressel 20s from an alternative route (i.e. via the Atlantic)[23]. The effect of military campaigns, road building policies, army movements, invasions and secession would have altered the traffic of each route, as becomes evident on the Aude-Garonne route [van Berchem, 1982; Roman, 1983].

The presence of amphorae always indicate a preferential maritime transport, since the vessels were specially designed for this. Thus any use of river and, above all, land transport represented a hindrance in the movement of goods, so these routes were avoided or the container was changed as amphora densities in break-points prove (i.e. Châlon-sur-Saône, Toulouse). On this basis, the Atlantic constitutes the most natural route from amphora trade with Britain. On the contrary, inland transport required a more suitable vessel, which seems to have been achieved with the flat bottomed Gauloise types (Gauloise 1-9, 12) [Laubenheimer, 1985]. Exploitation of particular routes had a strong effect in the amphora distribution in the province since each journey could end in a different port from which goods were distributed. Medieval England yields comparative data on the ports monopoly of particular routes [Braudel, 1979a, 334].

> ***"... by the late 16th and 17th centuries many provincial ports specialized very strongly in trade with the ports on the part of the continental coastline which was closest to them: Hull with Elbing and Hamburg; the East Anglian ports with Holland; Exeter with Normandy and Brittany; Plymouth with the west coast of France and Iberia" [J.Allan, 1983, 37]***

Therefore the amphora distributions with an observed pattern related to an either Eastern or Western axis of Roman Britain (see chapter 5) may identify a preferential exploitation of a particular route from one or more ports. Likewise, two zones of coin circulation in relation to the Continent representing two metals (AR and AE) are distinguished according to vertical axis that

---

[23] Middleton [1979] already defended to directions of supply towards Britain (via Atlantic) and Germany-Danube provinces (via Rhône).

were linked to diverse areas of supply [Fulford, 1989b]. Testimonies of such a preferential trade or supply are rather vague, so at the present time only hypotheses can be put forward.

6.4 Long-distance exchange: strategies for minimizing risks

Traders involved in long-distance exchange attempted to reduce their risks by sharing expenses [Rougé, 1966], insuring cargoes [Rougé, 1966; Casson, 1970] and devising ways of obtaining minimal profits. The distance between source and destination meant a lack of knowledge about the demand for goods, prices and tastes; which merchants could only overcome by creating a series of support mechanisms. They normally became specialists in some commodities and a single route, being obliged to move their homes to the trading region.

> ***"Commercial specialists would remove themselves physically from their home community and go to live as aliens in another town, usually not a fringe town, but a town important in the life of the host community. They could serve as cross-cultural brokers, helping and encouraging trade between the host society and people of their own origin who move along the trade routes."***
> ***[PD.Curtin, 1984, 2]***

Nevertheless a trader setting up a new business contact with a distant community required some support and this was provided by previous experience, other individuals or institutions. Together these constituted what can be called trading strategies.

6.4.1 The strategies of *mercatores* and *navicularii*

Trading strategies give some insight into patterns of distribution, since they are socioeconomic mechanisms that reflect the role of the human factor in exchange. They may lack strict economic logic, but they reveal how people organized themselves in face of a hazardous activity in an unfamiliar environment such as that involved in distant commerce [Curtin, 1984].

a. Trade associations (*collegia, corpora*)

Sharing common interests was good reason to create colonies of traders and professional associations such as *corpora* or *collegia*. Professional associations could support individual traders by offering legal advice, economic backing or social influence [Japella-Contardi, 1980; De

Robertis, 1981][24], however their creation was not due to private initiative but organized bodies. Public contracts were easier to arrange with associations, thus Emperors encouraged their formation [Garnsey, 1980; Rickman, 1980a; Sirks, 1991; De Salvo, 1992]. *Collegia* were the result of the development of previous organizations like *conventus civium romanorum*, which formed a focus for Romans from the same place of origin living in a host community. Most of their members were traders united together to facilitate contacts with the host community or to create a familiar environment among themselves [Curtin, 1984][25].

These associations in large urban centres (e.g. Ostia, Rome, Alexandria, Puzzoles) had a strong ethnic character since only traders from the same province or *civitates* joined together [Lacour-Gayet, 1950; Curtin, 1984][26]. In this way, they could even live separately from their hosts in a particular district of the town, preserving their cultural identity to serve as brokers between both societies [Curtin, 1984, 38-39]. Ostia probably has the best example of professional trading associations from all over the Mediterranean represented in the Piazzale delle Corporazione (i.e. Narbonensis, Sardinia, Egypt, Africa and Hispania) [Houston, 1980; Becatti, 1961; De Salvo, 1992]. This case was not an exception since trading cultural enclaves were documented in Alexandria at least (Dio of Prusa Or. 32.40)[27] [Bowman, 1986], Pozzuoli (Nabateans, Tyrians) [Lacour-Gayet, 1950; Paltiel, 1991], Tarsus [Ruggini, 1980], Lyon (Syrians, Greeks) [Ruggini, 1980], Coptos (Palmyrians) [Bingen, 1984], Malaca [Pavis d'Escurac, 1988], Aquileia [Bezeczky, 1987] and Arikamedu [Casson, 1989]. *Collegia peregrinorum* were also common in the frontier provinces. These included foreign traders of diverse origins such as the ones reported in Germania at Voorburg, Marbach, Marbach-Meaning and Oehringen [Pavis d'Escurac, 1988].

The distribution of these cultural colonies influenced the way in which commodities reached provinces since the first contact was through these trade settlements. Therefore, internal distribution started in a particular centre where foreign and local traders came into contact. Some of the amphora concentrations in particular cities (e.g. North Africa, Rhodian, Richborough 527) (see chapter 5) may indicate the existence of these foreign diasporas the members of which acted as brokers in the host province.

---

[24] Although associations were always considered politically dangerous.

[25] Numerous diasporas of Roman traders were documented in the Eastern Mediterranean in the Late Republic (e.g. Asia, Delos) [D´Arms, 1981].

[26] The phenomena is common to other historical periods such as Middle Ages with meridional colonies in Northern Europe [Goris, 1925] or african and asiatic in Prague [Pounds, 1974]., it is also recognized in the XX century (e.g. Pakistani in Britain) [Werbner, 1987; Eader, 1987].

[27] Alexandria reports the presence of Lybians, Cilicians, Ethiopians, Arabs, Bachrians, Scythians, Indians, Jews, Greeks and Italians involved in trade [Lewis, 1983; Bowman, 1986; Bagnall, 1993].

b. Geographical trading expertise

The settlement of traders in foreign communities is an indication of the commercial exploitation of a province and of certain routes. Knowledge of regional geography, local traders and provincial demand also helped to ensure the success of long-distance exchange [Hicks, 1969]. Therefore traders chose to specialize in a particular destination from which they should have required a full account that permitted them to supply it with the quantities and range of goods requested.

> *"The merchants successively gained a detailed knowledge of all the information necessary for journeys of this kind, like the geography and topography of the country, the social customs and especially the exchange habits and also a knowledge of the language of the Barbarians and perhaps different forms of lingua franca."* *[J.Callner, 1988, 266]*

Having access to this information about the host community gave a trader an advantage over other potential competitors. Trade colonies, presence of inscriptions [Hassall, 1978; De Salvo, 1992] and references in literature [Giardina, 1989] indicate the existence of trading specializations in some particular regions. Moreover, oral proficiency in local dialects allowed traders to bargain and communicate with their potential customers and other local traders, and to find out their requirements and purchase power [Raschke, 1978; MacMullen, 1990]. Personal contact between people enganging in commercial transactions served as a form of guarantee (e.g. quality, price), so these contacts were kept up over periods of years as part of the geographical specialization [Mintz, 1982; Plattner, 1989]. Traders with this geographical expertise in fact attempted to exert a control in the supply of a limited population. This is also known as oligopoly or monopoly [Bradley, 1971, 348]. The aim of any trader and particularly a merchant specializing in long-distance commerce, was to secure a stable market.

Monopolistic practices (Arist. Pol.I.4.1259) and their main advantages (Arist. Pol.I.4.1259; VII.5.1327) and disadvantages (Dig. xlvii.11.6) were recognized in antiquity [Tozzi, 1968; Wallenstein, 1980]. Trade diasporas attempted to control routes and the supply of particular goods, even sharing the same markets with other traders. Sometimes they divided regions into areas where on trading group exerted an influence and each trading firm had control of parallel routes [Curtin, 1984, 32].

c. Specialization in particular goods

An alternative strategy involved the trading specialization in only a few goods normally obtained from the same region. This kind of specialization was an advantage because it required a fair knowledge of all the suppliers, competitors and potential consumers [Curtin, 1984].

Roman long-distance traders were generally specialized in one or two related types of produce (e.g. *cretarii, vinari, oleari, vestiari, boviari*) [Loane, 1907; Hassall, 1978; Panciera, 1980; Rickman, 1980a; 1980b; Curtis, 1991]. By combining geographical expertise with specialization in particular goods, traders could make themselves indispensable as brokers for local merchants. In fact, they sought monopolistic control of their imports in the province.

d. Trading agents in the province

Every commercial society may have had at least one agent in the destination province or region, either working in association with other countrymen or on their own. His function consisted of arranging prices and establishing distribution contacts in the province as well as ordering, sometimes by mail, the volume of merchandise to be imported [Achard, 1991]. Foreign agents settled in the province got to know local traders, changes in the regional markets and prices. Thus their job was fundamental for a successful trading venture. Moreover, they could arrange return cargoes (e.g. ballast, goods) so that sailors did not waste time in the local harbours [Rougé, 1981; McGrail, 1984; Tomber, 1987].

Delays in business correspondence (Seneca Ep. 37; Cicero Ad Atti.) [Duncan-Jones, 1990; Achard, 1991] meant that agents were compelled to take vital decisions, hence their job gave them heavy responsibilities[28]. Commission agents and other operators active in the large urban centres of the distant markets were entrusted by *mercatores* and *navicularii* with such powers that this job required them to be careful selected [Heichelheim, 1970, 229; Casson, 1989]. They were normally selected from among people known to each other from the same region, relatives or dependents (i.e. freedmen) [D´Arms, 1981; Curtin, 1984; Gardner, 1993, 19-33]. This fact, therefore, explains the common existence of foreign trading colonies.

> *"...trade at a distance required a kinsman or at least a trusted fellow-countryman to act as agent, with time, a variety of other agents came to be available"*
> *[PD.Curtin, 1984, 3]*

Family firms were probably the predominant trading structure in Roman times, as was the case in the Middle Ages [Braudel, 1973, 445; Pounds, 1974]. Italian families in the Late Republic exploited particular trade routes and markets in the Eastern Mediterranean (i.e. Aufidii, Laelii,

[28] *Diffusores* can be considered a kind of agent related to transport and distribution [Panciera, 1980].

Oppii) [D´Arms, 1974; 1981] by using their own agents in the ports of destination (i.e. Delos, Athens, Antioch). A similar structure can be indentified in the Principate from the *tituli picti* present on Dressel 20s and other inscriptions, where family firms represented the commonest type of association (i.e. Decii, Cornelii, Octavii, Aponii, Atilii, Caecilii, Casii, Claudii) [Rodríguez-Almeida, 1980b; 1984; De Salvo, 1992, 248-260]. Freedmen could be also part of these family firms acting not only as agents, but also sometimes as full members [Gardner, 1993, 19-33]. A good example is the case of *P.Annius Proclamus*, a leading Italian trader whose freedmen were involved in Eastern Mediterranean trade from Pozzuoli to Egypt [Meredith, 1953; Raschke, 1978; D´Arms, 1981, 166].

Operators acting as possible trading agents on the transcontinental routes towards Britain appear at Lyon[29] [Ruggini, 1980; Pleket, 1983; De Salvo, 1992], Arles [De Salvo, 1992], Narbonne [De Salvo, 1992] or Bourdeaux[30] [Charlesworth, 1926; Doehaerd, 1978]. Some of them may have been freedmen as suggested by the numerous testimonies of *serviri augustales* in some inscriptions from Northern Europe [Whittaker, 1989, 59, fig.24]. They were probably linked to equestrian and senatorial families [D´Arms, 1981].

e. Public transport

The arranging of public contracts concerning, for example, transportation was a way of securing a regular income and fixed profits in long-distance exchange. *Negotiatores*, *mercatores* and *navicularii* could occasionally work for the State in the mobilisation of goods (e.g. marble, metals, corn, olive-oil) [Ward-Perkins, 1980; Clayton-Fant, 1993; Domergue, 1990; Rickman, 1980; Sirks, 1991; Remesal, 1986] from distant provinces. Once the commodities reached the destination province, an administrative service (e.g. the army) may have then been responsible for the final distribution (see chapters 4 and 5) [Pavis d´Escurac, 1976; Remesal, 1986].

The traders made contracts, and already knew the routes and destinations for the transportation. In return, they received a payment called *vectura* [Rodríguez-Almeida, 1980; Padilla, 1989; Remesal, 1991; Sirks, 1991]. Public contracts for transportation appeared for the first time in the Republican period (Livy xxiii.44.16; xxiii.48.15) [Badian, 1972], although they were continued in the Principate with the creation of *collegia* [Japella-Contardi, 1980; Houston, 1980; Sirks, 1991; De Salvo, 1992]. Apart from the one direction contract, the State could also guarantee a return cargo (e.g. metals), which constituted a second incentive. Nevertheless public

---

[29] For instance Italians (CIL xiii.2022; 1942), a Greek (CIL xiii.2005) and Syrians (CIL xiii.2448; 1945).

[30] For instance Spaniards (CIL xiii.612; 621), Germans (CIL xiii.634; 618), Greeks (CIL xiii.619; 620; 625) and Syrians (CIL xiii.632).

contracts (*locatio-conductio*) normally of five years duration [Sirks, 1991, 33], did not always attract enough traders so Emperors improved conditions by granting allowances. Claudius (Sueto. Clau. 18.4) compromised the State to take over the payment of damages in trade, Trajan (Dig. 50.6.6.3) promising exemptions to merchants involved in the *annona* and Hadrian (Dig. 50.6.6.5-8) introduced new allowances [Garnsey, 1988; Sirks, 1991].

From a trader´s viewpoint, State contracts provided a security in risky long-distance exchange, however the public service did not tend to produce revenues that were as good as those of a private venture [Sirks, 1991].

6.4.2 Strategies and amphora distributions

All these practices for minimizing risks result in a particular distribution pattern of commodities. In other words, the organization of traders in the province influenced the initial point of arrival of goods and subsequently their internal distribution in the province. Foreign imports were centralised at reception points where commercial agents and local traders could arrange their sale and distribution. Moreover public transport was oriented to specific centres (see chapter 5.2.1) from which goods could be conveyed to administrative and military destinations.

Archaeological and literary sources providing evidence of trader activity in the province offer a very patchy image of Roman Britain. First of all, the origin of London as a settlement is related to the establishment of foreign traders and agents (see chapter 4) [Milne, 1985; Williams, 1990]. The city was described on the eve of Boudicca´s uprising as a centre flocking with traders (Tacitus Ann. xiv.33), and at least two statuettes probably dedicated by merchants have been recovered there [Milne, 1985, fig.47 and 83]. There is also a *sarcophagus* from London which is inscribed with the term *navicularii*[31] [Birley, 1979, 125] and a Greek name (RIB 9) suggesting a possible trader. It can always be argued that a foreign name and origin does not necessarily indentify a trader, though it seemed a common practice among traders to indicate their *origo* (e.g. *civitates*) [Pavis d'Escurac, 1988, 58]. The concentration of traders in London, added to its transport infrastructure (i.e. river port, hub of Roman roads) and the density of the population suggests that the provincial capital was the main destination of many overseas imports. Thus, commodities may well have been initially distributed from there, which in fact supports the evidence of many of the amphora distributions (e.g. Italian Dr.2-4, Richborough 527, Late Roman and Eastern Dr.2-4).

Nevertheless, only Silchester documents the existence of an important foreign colony

[31] The inscription in fact is transcribed as [navi]cular[ii].

organized in a *collegium peregrinum consistentium Calleva* (RIB 219), of which some members were probably traders [Birley, 1979, 125]. Other inscriptions relating to immigrants, recovered in the civil zone have also been interpreted as referring to possible traders. For instance a Treveran Peregrinus resident at Bath (RIB 218) or a Sequanian called Philus at Cirencester (RIB 179). The evidence of operation of traders in the civil areas is outweighted by that ocurring in military zones. This reflects the orientation of long-distance exchange in the province.

The city of York became an important trading centre in the third century A.D. (see chapter 5) as testified by the three inscriptions found relating to traders. *M. Verecundius Diogenes* operated as a shipper (i.e. *moritex*) from the cives Biturix Cubus (Central Gaul), who became *servir augustalis* in this town (RIB 678) [Hassall, 1978]. Also M.Aurelius Lunaris was *servir augustalis* at York and Lincoln, trading between this community and Burdigala (Bourdeaux) (AE 1922, 116) [Hassall, 1978; Birley, 1979]. Finally the *negotiator L.Viducius Placidus* from the civitas Veliocassium (Rouen) [Birley, 1979; Sommer, 1984], who specialized in trade at the mouth of the river Rhine as an inscription from Colijnsplaat attests [Hassall, 1978; Birley, 1979]. Again, the concentration of traders at York can be related to the distribution of late amphorae, indicating that the centre functioned as the initial point of arrival in the province.

An inscription recovered at Bowness-on-Solway (RIB 238) points to the existence of a trader operating in the Irish sea. Also Corbridge documents the presence of Barathes from Palmyra who was *vexilarius*, dealer in military ensigns (RIB 1065; 1171) [Hassall, 1978; Birley, 1979]. A few writing tablets from Vindolanda record traders like Privatus supplying foodstuff to the garrison [Bowman and Thomas, 1983, tabl.4-5] or hides like Octavius [Bowman, Thomas and Adams, 1990, Inv.88/946]. Furthermore, some foreign names documented in the military zone may have been those of trading agents in the province: M.Nonius Romanus (Treveran, Caerwent; RIB 109), Fl.Helius (Greek, Lincoln; RIB 251), FL.Antigonus Papias (Greek, Carlisle; RIB 985), Salmanes (Greek, Auchendary; RIB 2182), Flavia Baetica (Spanish, Birrens; RIB 2115), Lurio (German, Chesters; RIB 1483), Mudulus (German, Carrawburgh; RIB 1526), Titullinia Pussitta (Raetian, Netherby; RIB 1984) and Aurelia Aia (Dalmatian, Carvoran; RIB 1828) [Birley, 1979; Sommer, 1984].

The testimonies of traders in Roman Britain reveal that interprovincial commerce was probably centralized in London and Silchester for the civil zone since they document the existence of foreign diasporas. Therefore, the highly populated Southeastern sector also contained a cluster of resident traders. This supports the evidence of concentrations of amphorae recovered in this region (see chapter 5). The initial starting point for the distribution of imports seems to have been the large Southeastern centres, from which the interprovincial trade network was developed.

Although the distribution pattern may vary according to the exchange mechanism, in general terms the region close to the arrival point should have shown higher concentrations [Carreras, 1994a].

With regard to the military zone, traders were established in many centres not always of large size. Their residence there may be linked to the need for a continuous contact with a particular site through public transportation. In other words, merchants were supplying the same garrisons every year without needing to deal with local traders. The pattern inferred on the basis of the inscriptions fits with the distribution of Dressel 20 stamps in the province (see chapter 5.3). Products from Delicias, Tejarillo, Arva and Huertas de Belén were targeted to particular centres, which may indicate tied up supply being organized by the same companies from a specific region over long periods of time. A complete knowledge of a route as well as the advantage of constant personal contact were good reasons why the public administration, should maintain a business connection with the same transporters or trading partners.

Nevertheless, the evidence of trade ocurring with Roman Britain is better documented in other provinces. As has been already stated, the traders recorded abroad were specialized in a single province (e.g. Britannia) and sometimes in a single product (i.e. *allecarius, cretarius, salarius, vinarius, vestiarius*) [Hassall, 1978]. The best testimony of this comes from the mouths of the river Rhine, where 122 altars dedicated to the goddess Nehalenmia were recovered at Colijnsplaat and Domburg [Bogaers, 1971; Stuart-Bogaers, 1971; Hassall, 1978]. Most of them have been related to transport or trade with Roman Britain, and in fact some include the formula *negotiator Britannicianus* [Hassall, 1978, I.4,5,6 and 7]. Other inscriptions regarding traders specialized in Britannia_commerce appear at Bourdeaux (CIL xiii.639), Koln (CIL xiii.8164a), Bonn (BRKG 27, 99.167), Kassel (CIL xiii.7300), Marsal (CIL xiii.4564) and Xanten (CIL xiii.8568) [Hassall, 1978; Birley, 1979].

The origins of these traders as well as the location of the inscriptions reveal the preferred trading routes to Britain and the nature of possible goods reaching the province (see figure 79). With respect to amphora-borne commodities, two inscriptions from Colijnsplaat and Domburg mention *negotiatores allecari* (i.e. fish-sauces) of possible local origin (see chapter 5.5) that may have required ceramic containers, unrecognized so far. Another inscription from the same place identifies a *negotiator vinarius* [Stuart and Bogaers, 1971, no.44], who may also required amphorae for the transportation. This mention together with the gaulish origin of some merchants could be related to the exchange of Gaulish wine and the presence of Gauloise amphorae in Britain.

The scattered evidence of traders linked to Britain does not provide any clear picture.

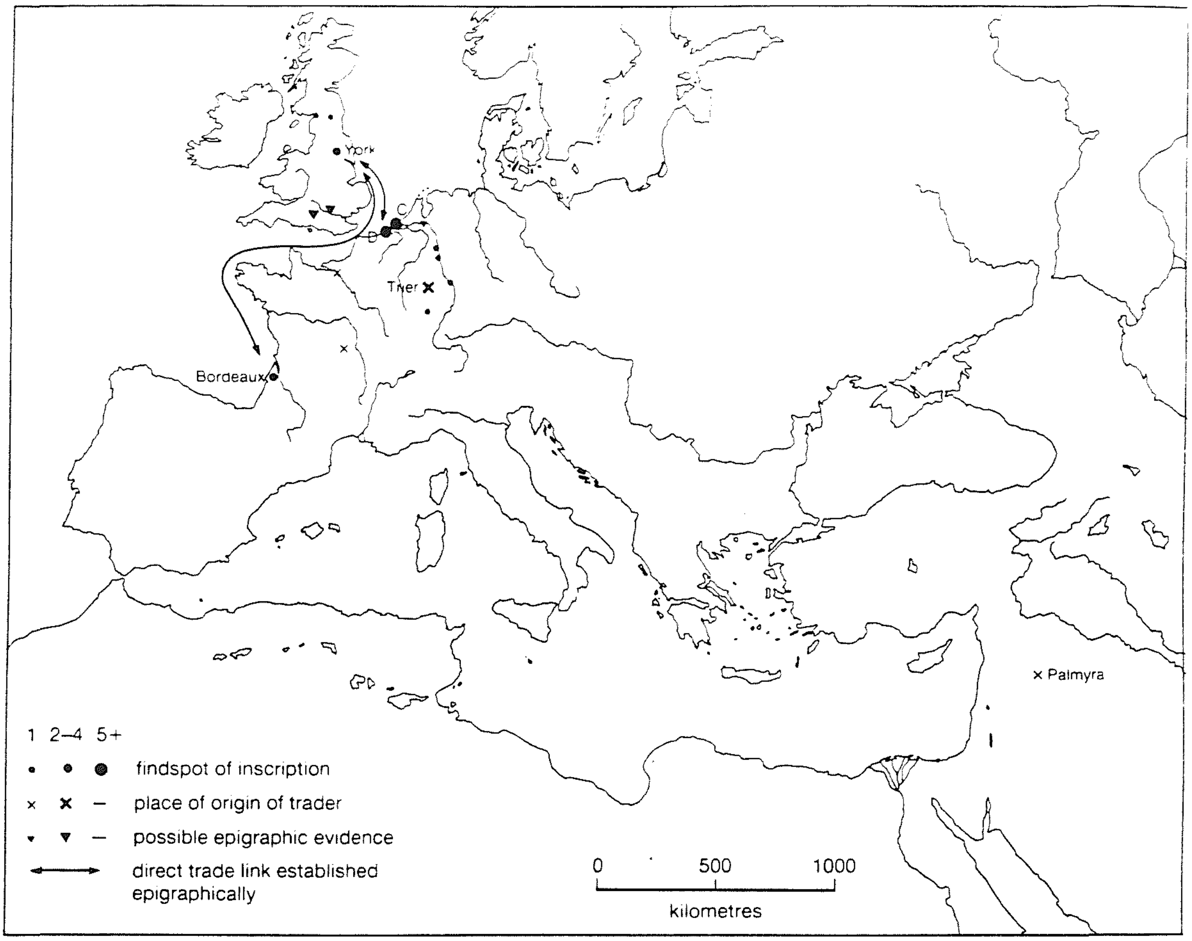

Figure 79 Distribution of British traders (after Jones and Mattingly, 1990, map 6:20).

Nevertheless at least an initial hypothesis can be put forward of how traders were probably organized and how it influenced amphorae distributions.

First of all, London and Silchester had concentrations of many foreigners who could have been the provincial agents of interprovincial traders. From their basis in this SE sector, they could contact local merchants who were responsible for the final distribution. Therefore, transport costs must refer to this SE sector as the starting point for internal movement. Thus the decrease in quantities of amphorae should relate to this. In other words, high densities reported in this sector can be partially due to the concentration of commercial links between inter and intra provincial traders, represented by the physical presence of their agents there. Other urban centres such as Exeter, Gloucester or Colchester may have been important for foreign trade diasporas specializing in long-distance exchange using particular routes in the provinces. However, no epigraphic trace survives.

These overseas traders were basically specialized in Roman Britain and sometimes in an exclusive product. Specialization in some commodities and regions within Britain could result in oligopolies, which must have affected patterns as the distribution of Dressel 20 stamps seems to suggest. In other words, unique agents collaborating with a group of local traders could dominate an area thereby regulating the volume of supply and prices as well as the detailed allocation of goods.

The numerous presence of foreigners in the military zone can be the result of a combination of free trading agent activity and transporting within the public network. Direct deals with the army personnel could explain their presence at the frontier zone complementing the redistribution network under military surveillance (i.e. *beneficiarii, stratores*), which has been previously outlined (see chapter 5.3 and appendix 9). The system of military supply may have varied over the four centuries of Roman rule according to the interaction of public and private organizations.

Conclusions

The organization of traders in the province and their spheres of activity provide some indications of how amphorae moved from the production area to their final destinations. Although evidence for Roman Britain is scarce, a possible trading structure has been developed here based on comparisons of sources. First of all, interprovincial traders travelling with the merchandise or simply funding trading ventures, who could have decided which commodities and quantities were to be distributed. At the end of this line, trading agents in the destination provinces settled in particular centres from which they arranged distributions with the local merchants. Finally, these local traders could have been organized in a hierarchical manner acting at different levels or for different markets from *macella* to *tabernae*. The decisions made at each stage of the operation influenced the availability of commodities.

Moreover trading strategies provide another complementary source of information to improve our understanding of amphora distributions, since long-distance exchange required certain mechanisms to secure minimal revenues. Long-distance exchange needed to produce profits because they were the main aim of the people involved in it. Seeking profits was the reason for moving amphorae from one province to another in the Roman Empire, but patterns of distribution were never identical. The explanation for this diversity cannot, therefore, be found in the reasons for people´s acts but in the mechanisms through which goods were exchanged.

6.5 Exchange mechanisms: the framework

Profit-seeking was identified as the main reason for traders involvement in exchange. However this fact alone does not explain the movement of goods. The allocation of goods does not always correspond to market rules, hence alternative mechanisms may explain these patterns (see chapter 1) [Hopkins, 1957; Polanyi, 1957c; Harris, 1993]. Exchange mechanisms are only the framework in which traders operate according to a series of rules and goals. Every mechanism determines, to some extent, the distribution of the goods being exchanged [Renfrew, 1977b]. Accepting that a myriad of mechanisms can act on the same society at the same time, the difficulty becomes to separate the effect of each one.

> *"In fact, the best social scientists on either side recognize that both market and other forms of exchange have a role to play. The problem is to measure the influence of each in specific situations"* *[PD.Curtin, 1984, 14]*

Long-distance commerce reflected in the distributions of amphorae in Roman Britain took place within the framework of, at least, two exchange mechanisms. On the one hand, wine and fish-sauce amphorae identify a possible market exchange mechanism (see chapter 5). On the other hand, Dressel 20 amphorae seem to mirror a redistribution system connected with the Roman army (see chapter 4 and 5). However, the features and effects of both mechanisms require a more thorough analysis of how they operated and influenced the economic life in Roman times.

6.5.1 Market exchange over long-distances

The physical separation of the area of production and the area of consumption in long-distance exchange was the principal obstacle because it limited the flow of information between demand and supply. A market system requires a price fixing mechanism integrating production and consumption areas (see chapter 1). Nevertheless, transport constraints and lack of information in antiquity hindered this contact. Although market behaviour can be detected in the distribution of pottery in the province, which was determined by reductions in transport cost [Hodder, 1974a; Fulford and Hodder, 1974; Hodder and Orton, 1976; Gillam and Greene, 1981; Carreras, 1994a], interprovincial exchange is rather different. The inherent dangers of long-distance transportation did not prevent traders from distributing amphorae using a market framework, as the current evidence manifests, but they were compelled to employ particular strategies.

a. A preference for commerce in light highly valued goods (e.g. spices) as represented by some amphora-borne commodities such as quality wines, fish-sauces and exotic fruits [Casson, 1989; Stanley-Alexander, 1992].

b. The fixing of artificial prices, maintained season after season, with the collaboration of interprovincial and local traders or trading agents in the province.

c. The minimizing of the risks of losses by association, geographical expertise, specialization, agents and public transport (see previous section). Moreover the choice of a safe route of access to Britain was necessary.

A market distribution is characterised by the principle of maximization, and a rational approach to trade [Martínez-Vega, 1990]. These factors should lie behind some of the amphora patterns already discussed. The maximization of gains is the main purpose of any trader, allocating goods wherever can he obtains a better margin of profit. In long-distance exchange one basic way of increasing the margin of profit is by minimizing transport costs. In this way, sale prices could be more elastic [Dicken and Lloyd, 1990].

Medieval records indicate that transport costs in long-distance commerce comprised on average only 10% of the final sales price [Bechtel, 1952], though the difference could range between 11.70-20.34% for some commodities [Braudel, 1979c, 373] or be as high as 25% [Hodder, 1974a, 346]. Comparing these percentages with the cost indexes for each access route to Britain reveals how difficult Roman trade with this province was within a simple market framework [Carreras, 1994a]. The same principle of transport cost minimization should have applied in the internal distribution of amphorae, which were allocated using the cheapest routes. In other words, higher densities of amphorae ought to be found in places with lower costs of access [Carreras, 1994a].

6.5.2 Redistribution in long-distance commerce

This exchange mechanism appears as a need for constant supply to distant public personnel (i.e. the army, administration) and poorer social groups (i.e. plebs in Rome) [Garnsey, 1988; Garnsey and Morris, 1989; Jongman and Halstead, 1989]. Redistribution consists of an appropiative movement of goods from the producers to the public authority as well as a locational transfer from the production to the consumption area [Polanyi, 1957c; 1977]. The mechanism was necessary because a market system could not guarantee any regular supply of great volumes of goods at low prices [Badian, 1972; Pavis d´Escurac, 1976; Snugden, 1986]. Redistribution, as mentioned, involves not only the articles changing hands but also their movement from an origin to a destination and this aspect was an integral part of the system (e.g. *locatio-conductio* contracts) [Earle, 1977; Peacock and Williams, 1986; Whittaker, 1989a]. Roman society created at least one institution to deal with the redistribution of commodities to the city of Rome (i.e. *annona*) [Rickman, 1980a; Casson, 1980; Garnsey, 1983; Jongman and Halstead, 1989] and to the armies stationed at the frontiers [van Berchem, 1937; 1976; Remesal, 1986].

The supply of the Roman *plebs* is not relevant to the amphora distribution in Britain but, in contrast, the presence of the Roman army was quite influential. An army could hardly depend on obtaining its food from markets on the spot, hence public involvement was required [Polanyi, 1977; Middleton, 1983; Remesal, 1986; Tainter, 1988, 129; Whittaker, 1989a].

> ***"The ability to bring large numbers of men on the scene of combat, to construct the required infrastructure, to provide a steady supply of food and equipment in remote and sometimes desolate places" [EN.Luttwack, 1976, 117]***

Roman public administration was not capable of undertaking this service alone and employed private personnel to collect and distribute the commodities. The institution called *annona militaris* was according to van Berchem [1937; 1976] created by Septimius Severus (c. A.D. 193), whereas Remesal [1986] argues for its existence as early as the Claudius reign on the basis of the Dressel 20 amphora testimonies and the inscription of a freedman (CIL vi.8538) employed in military supply (i.e. *copiis militaribus*)[32]. The archaeological evidence of Dressel 20 stamps and amphora sherds in Roman Britain (see chapter 4 and 5) suggests that this may have existed since the Augustus period. Nevertheless, the redistributive system inferred from the archaeological evidence does not need to correspond to a differenteated institution such as the *annona militaris* of the later period, but as a part of other mechanisms known for the city of Rome [Remesal, 1986, 110]. Nevertheless, a loose concept of military redistributive systems is used here instead to avoid possible misidentifications. Although the institution known as *annona militaris* may have shared essentially common traces with the redistributive military system of the Principate, the former organization operated in a different way without an overwhelming public presence (i.e. *munera*, public transport) [van Berchem, 1937; Sirks, 1991].

[32] Olive-oil in the military supply is attested in the Diocletian´s reign (P.Beatty Panop. ii.245-249).

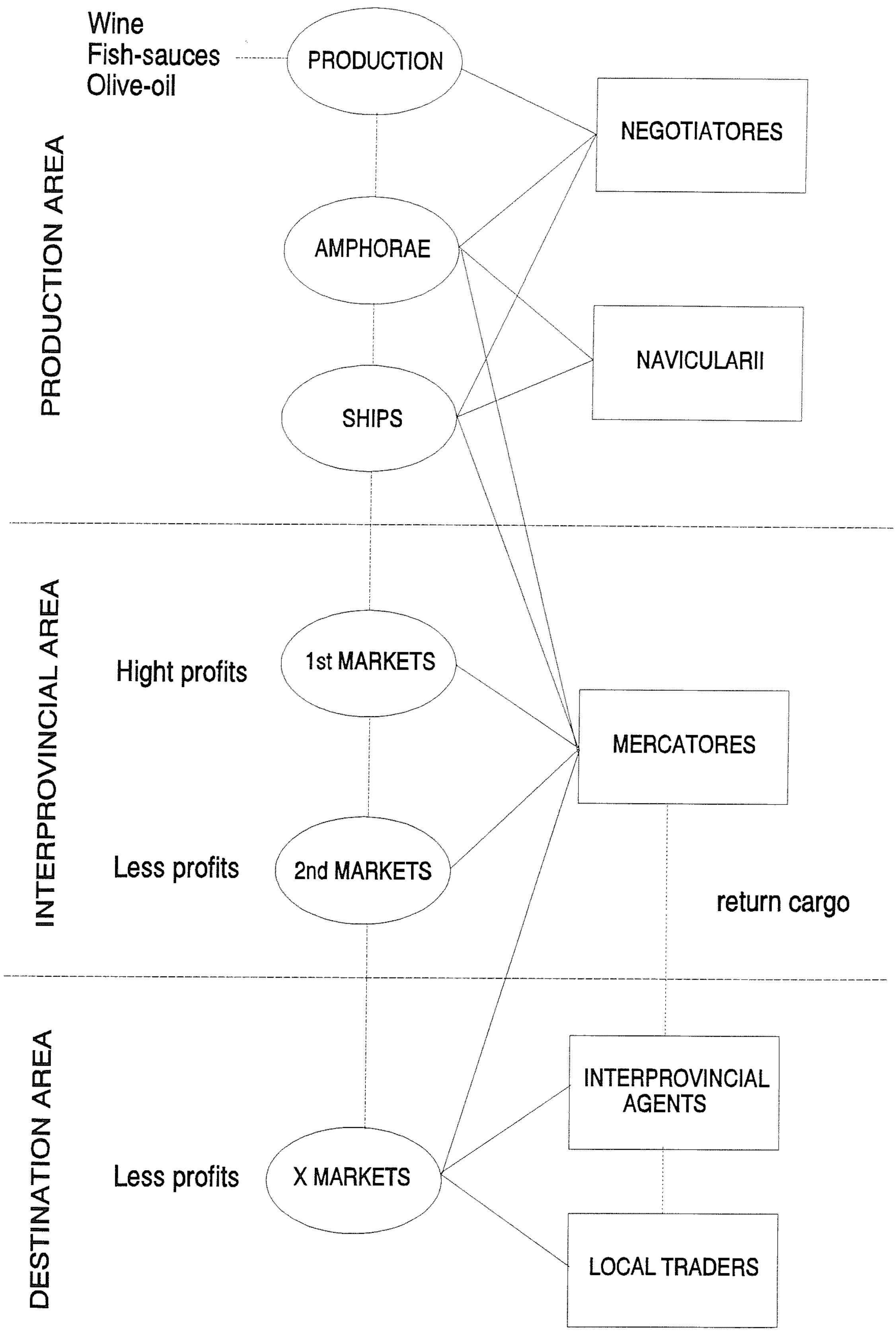

Figure 80 Diagram of the theoretical framework of a market system.

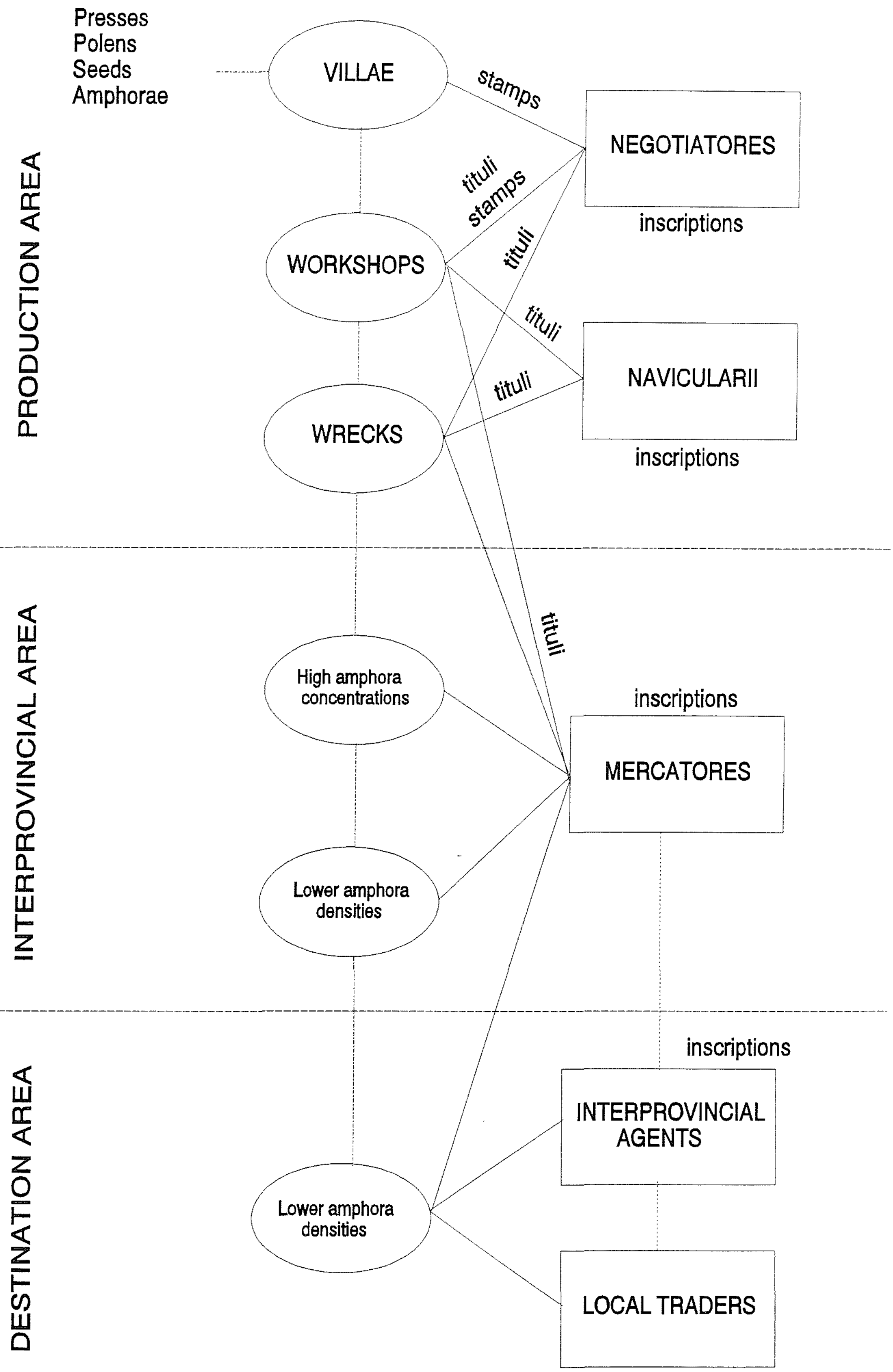

Figure 81 Archaeological evidence of a market system.

Little is known about its internal organization due to the lack of evidence [van Berchem, 1937; 1976; Pavis d´Escurac, 1976; Remesal, 1986; Sirks, 1991], but it seems to have been centralized by the Praefectus Annonae who was responsible for supply to the City of Rome from A.D. 8-14 [Remesal, 1986; Sirks, 1991]. His office and representatives in the suplying provinces (i.e. *procuratores, auditores*) acquired the commodities by means of taxes, appropriations (i.e. *indictiones*) or purchases. The existence of a central office was needed to combine resources from the two independent treasuries controlled by the Senate (i.e. *aerarium Saturni*) and the Emperor (i.e. *fiscus*) [Corbier, 1976; Remesal, 1986, 88]. Since these acquisitions were regular, they supposed a stability for the local producers despite the possibly tight public payments.

Once these commodities were collected and controlled (see chapter 3 on Dressel 20) [Rodríguez-Almeida, 1989], the public administrators in the province had to make contact with local traders and shippers for their transport to the frontiers. Goods were not only destined for the Roman legionaries but also for the State administration in the frontier provinces [De Salvo, 1992, 98]. In these provinces, the administrative personnel were far away from the front line where the troops were garrisoned. Therefore a twofold pattern can be inferred in the final distribution, one towards the military camps and one to the provincial capitals (e.g. London). As was observed in the distribution of Dressel 20 stamps (see chapter 5.3), the regular employment of the same suppliers and transporters was likely to be preferred. Public contracts with traders organized in *collegia* [De Robertis, 1981; Japella-Contardi, 1980] were normally signed for at least 5 years (Dig. 50.4.5), but they could often be renewed [Sirks, 1991]. Emperors were especially interested in keeping the services of these private transporters and sometimes resorted to granting public allowances in order to attract them [Sirks, 1991; Whittaker, 1989; Remesal, 1986].

As the function of traders and shippers employed by the State was the transportation of public commodities to particular destinations, some geographical expertise was required. Roman administration endorsed these ventures with payments known as *vecturae*. The whole process is documented by an inscription from Seville (CIL ii.1180)[33] (A.D. 166) in which a civil servant paid traders for the transport of African and Spanish olive-oil [Pflaum, 1961; Picard, 1968; Nesselhauf, 1968; Pavis d´Escurac, 1976; Dardaine and Pavis d´Escurac, 1986; Remesal, 1986; 1991].

The commodities were also controlled at the reception point in the destination province by *procuratores* or *diffusores* [Panciera, 1980; Remesal, 1991]. Probably the provincial administration and military personnel were responsible for the final distribution within the province. In the case

[33] Trans. Sextus Iulius Possessor assistant of Ulpius Saturninus, *praefectus annona*, for the African and Spanish oil at checking, transport control and paying *vecturae* to shippers.

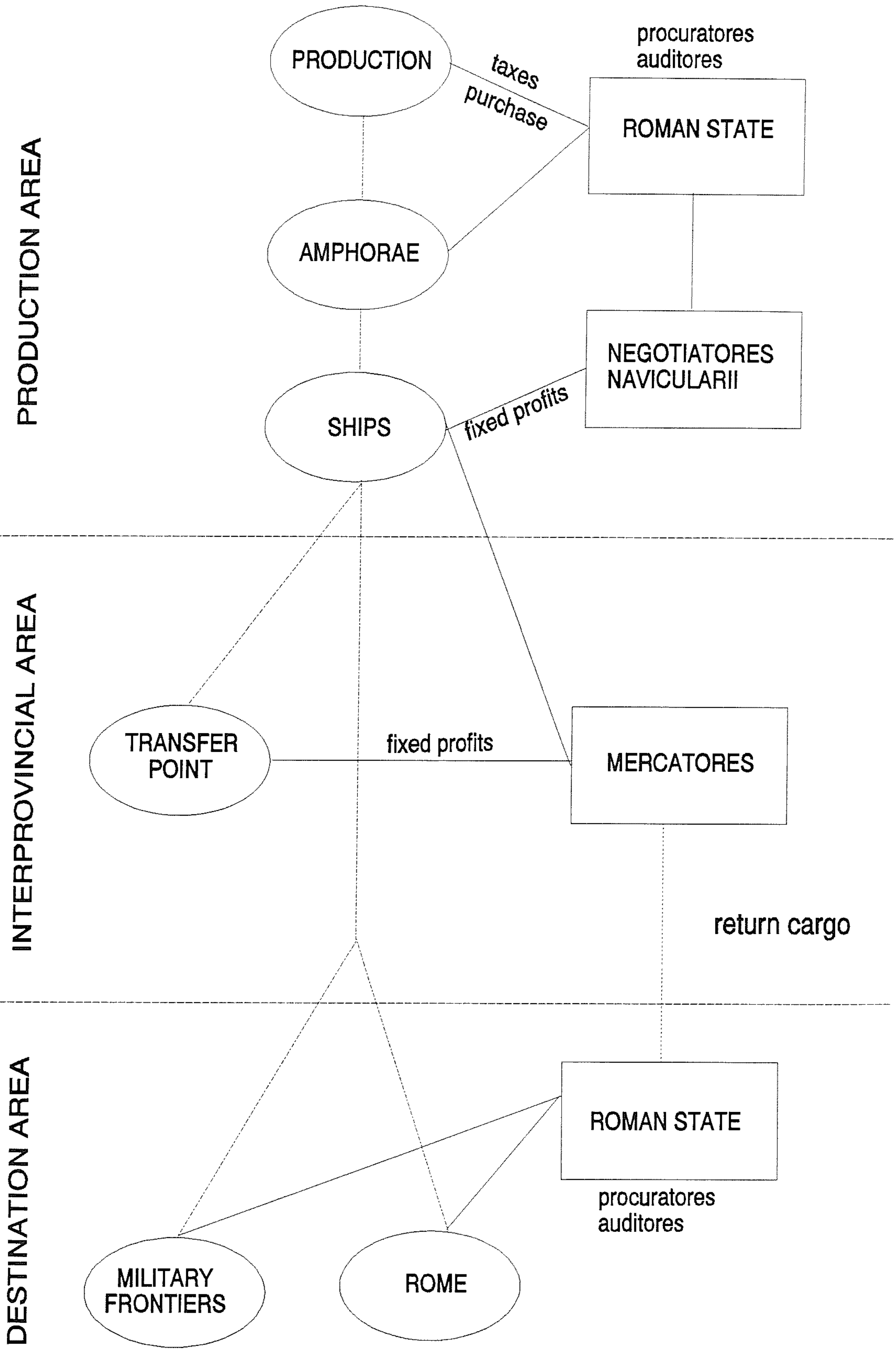

Figure 82 Diagram of the theoretical framework of a redistributive system.

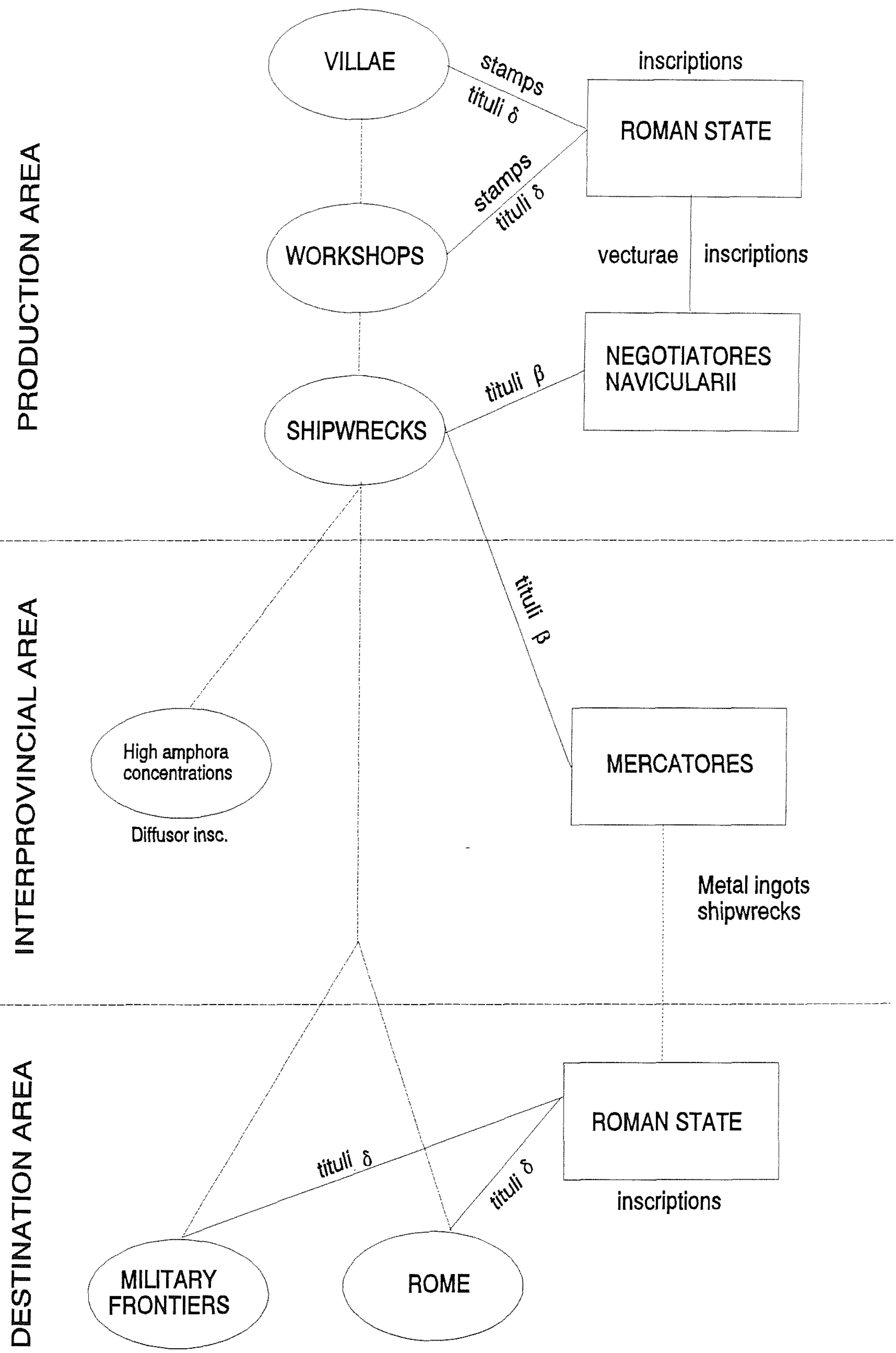

Figure 83 Archeological evidence of a redistributive system.

of Roman Britain, a tentative structure of the public network has been already proposed (see chapter 5.3). Furthermore, the public involvement of private traders could be completed with the transport of other fiscal merchandise such as metals in the return trip [Cimna, 1981; Domergue, 1990]. Roman Britain was rich in metals (e.g. gold, silver, copper, tin, lead) [Tylecote, 1967; 1976], which were sent to other provinces. The figure 84 shows the distribution of lead pigs and their probably shipping ports some of which coincided with the reception points of Dressel 20s.

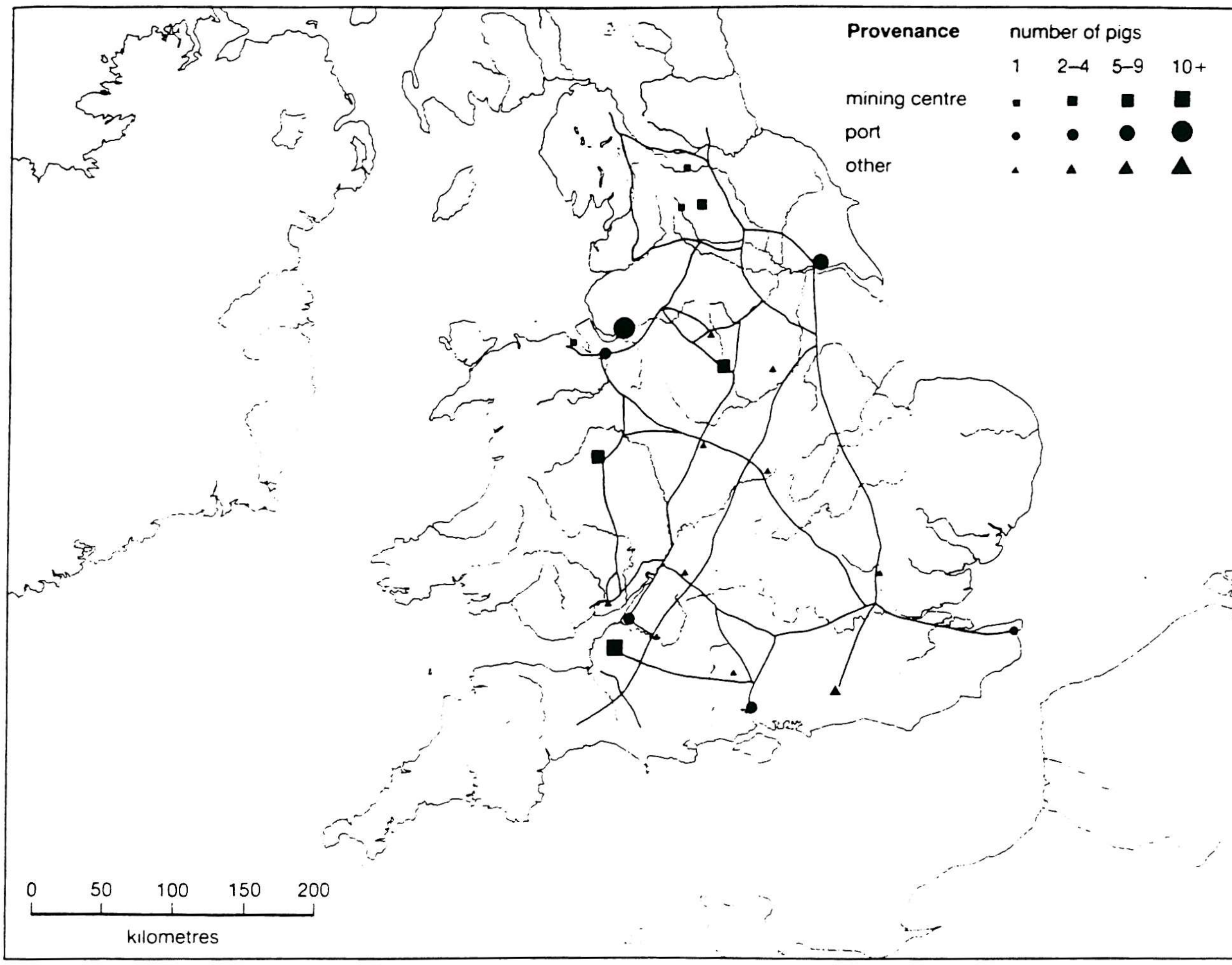

Figure 84 Distribution of lead pigs in Britain (after Jones and Mattingly, 1990, map 6:10).

Public transport represented safe revenues for traders apart from legal advantages, and it did not deter them from taking part in private enterprises. Nevertheless, a combination of public and private interests was liable to abuse since traders cheated for avoiding duties (Dig. 50.6.6.8) or not taking the shortest route (CJ 11.2.5.409) [Sirks, 1991]. Another possible abuse involved the transportation of private merchandise (e.g. other amphora-borne commodities, pottery) with fiscal cargoes, the ship being already chartered by the State [Garnsey and Saller, 1987]. In this way, any private merchandise was free of transport costs [Middleton, 1979; 1983; Pucci, 1983; Morel, 1983; Ettlinger, 1987]. This practice constituted a variant of a market exchange.

Archaeologically speaking a redistributive system can be distinguished as a preferential distribution towards specific locations (i.e. the army, administrative centres, the capital). The distribution of Dressel 20 amphorae in the Western Empire with high concentrations at the frontier zones and at the city of Rome is an outstanding example of this. In the case of Roman Britain, variations in cities' supplies and differences in distributions between military and civil areas (see chapter 4 and 5) represented the archaeological manifestation of a redistributive system.

6.5.3 Simulation models of long-distance commercial exchange

The features of these two exchange mechanisms, market and redistribution, seem quite clear in theoretical terms. However, the potential resulting distributions of commodities through each mechanism are not so apparent [Renfrew, 1977]. For this reason, a few simulation models have been developed in order to reproduce the ideal conditions for both mechanisms (see chapter 2.3.2-3) [Carreras, 1994a]. The results of the simulations should indicate archaeological distributions. Thus amphora patterns in Roman Britain may serve as tests for the models.

With regard to the models, transport cost constitutes the key element since minimizing its effect on final sale prices is one of the basic characteristics of a market mechanism. Therefore, this mechanism is represented by the selection of the optimum routes that take into account the profit seeking motive of traders. In contrast, the redistributive model does not consider these costs so much but emphasizes the particular allocation of goods to specific places.

6.5.3.1 A Simulation Transport Network in Roman Times

The simulation model aims to reflect market exchange in Roman times by minimizing transport costs. As this is the goal, it is necessary to define the constants and variables that can point to ancient transport constraints in the model (see chapter 2.3.2) [Aldenferder, 1981]. As transport cost is the only variable taken into account in the present model, the cost of each mode of transport in Roman times, performing as a constant, should be worked out from the evidence of ancient sources.

Diocletian's Price Edict was a document issued in A.D. 301 to control prices in the Eastern

Roman Empire [Lauffer, 1971; Giacchero, 1974; Crawford and Reynolds, 1975]. Although all the copies were found in Eastern parts of the Empire, a fragment was recently recovered at Aquileia [Giacchero, 1974], which suggests that it could have been applied to the Western Empire as well. The document is a valuable source for equivalences between different modes of transport and other products, the relationships of which were probably kept unchanged in Roman times. Despite possible fluctuations in the price of agricultural products [Frank 1933-49; Duncan-Jones, 1974; 1990], there is no reason to believe that their equivalence with transport fees may have varied much, since no technical improvements were introduced[34].

Jones [1974] was a pioneer in the study of transport equivalences in Diocletian's Edict, and continued by Duncan-Jones [1974], who was the first to include a detailed account of transport ratios and ethnographical parallels [Dyos and Aldcroft, 1969]. However, the Edict's references to transport were not complete until the discovery of Aphrodisias' copy [Erim and Reynolds, 1971; 1973; Erim, Reynolds and Crawford, 1974]. River transport costs appear for the first time in this new copy consequently the ratios put forward by Duncan-Jones did not contain this evidence, although was available later[35]. He proposed a ratio between the different means of transport, in the order of 1 ship: 4.9 water transport: 28-56 land transport[36].

These calculations matched quite well with the transport ratios obtained for England before the Industrial Revolution (1:4.7:22.6) [Dyos and Adcroft, 1969]. The small variation in the land transport ratio was explained by improvements in harnessing techniques [Burford, 1960]. Moreover, Duncan-Jones [1974] calculated his ship ratios by taking only one of the ship fees included in the Edict (i.e. Rome-Alexandria), although there were many more for different routes. Taking an average cost according to the distance of each route may have been a better value for transport by ship. Actually, all the sea-transport fees in the Edict show an outstanding correlation regarding distance.

Künnow [1981] improved previous ratios by adapting them for the special conditions of the German provinces in Roman times, where transport costs should have increased due to the lack of roads and strong river currents. His new ratio reached an equivalence of 1 ship: 5.9 water transport: 62.5 land transport. Deman [1987] provides an alternative ratio introducing some changes with reference to river transport fees based on new evidences from Aphrodisias. He

---

[34] Technological innovations and science in Antiquity related to transport and agriculture are widely discussed by Singer [1956]; Farrington [1962]; Forbes [1963]; Finley [1965] and White [1970].

[35] Rouche [1989] analyses in detail this new copy, including a complete transcription.

[36] The calculation varies according to the use of *modii italici* or *kastrenses* [Carreras, 1994a].

obtains a ratio of 1 ship: 5.8 water transport: 39 land transport.

As there were many variations in the ratios proposed by these different authors, new calculations were required for the present model since those values have a key role in the simulation. A more detailed step by step account of all the calculations appears in previous papers [Carreras, 1994a]. They are summarised here.

a. **Sea Transport**

Diocletian's Edict details numerous maritime routes including their costs. Calculating an average cost for the routes, a value of 0.097 kg ton/km in wheat or 0.0214 kg ton/km in second class olive-oil is obtained. The calculation of such a mean involves demonstrating that there is a strong correlation between distances and fees, so that the values from the Edict have a common cost per distance unit. Hopkins [1983b] discovered that there was a strong correlation between fees and distances covered by each route in Edict. However, he dismissed such evidence arguing that the Romans could not be so accurate in the calculations. A simple regression analysis showed that the coefficient of determination reaches a 90%, so an average specifying a common cost per distance unit would be an useful representative [Carreras, 1994a].

b. **River transport**

Diocletian's Edict includes two costs for water transport depending upon whether the navigation was upstream or downstream [Rouché, 1989]. The values obtained from these fees are 0.33 kg ton/km (downstream) and 0.66 kg ton/km (upstream) for wheat. Although differences between upstream and downstream transport costs were normally around 25% according to ethnographical sources [Clark and Maxwell, 1967], the Edict shows an unexpected variation of 100%.

c. **Waggon**

The calculation of a waggon fee on the basis of the Edict's evidence gives a 4.92 kg ton/km by using *modii kastrenses* as a measure [Duncan-Jones, 1974]. Evidence of a second price for land transport costs comes from an Edict of Pisidia, although it has been disregarded because it was in fact from a State confiscation. State payments may not have corresponded to the actual market fees [Mitchell, 1976; 1982].

d. **Pack animals**

The transport fee for a donkey is equivalent to 4.21 kg ton/km in wheat according to Diocletian's Edict.

All these coefficients can be used to obtain alternative transport ratios to the ones introduced already. As may be observed there are only small variations with Duncan-Jones' [1974] and Deman's [1987] ratios, however the general trend does not change. The table below summarises the new ratio:

Table 19

Modes of Transport	Ratio
Sea shipping	1
River boats (downstream)	3.4
River boats (upstream)	6.8
Pack animals	43.4
Waggons	50.72

In conclusion the simulation model attempts to reconstruct transport cost conditions in Roman times within a market system framework [Polanyi, 1957c; Dicken and Lloyd, 1990]. This framework presupposes that a trader wants to minimize cost in order to maximize profit. Thus he chooses the cheapest route between two points. The same principle in Roman times involved outlining a transport network map including all the different modes of transport linked together. Once this network is designed, it is necessary to provide some cost coefficients for each transport mode, so that the cost per km would differ according to the means of transport chosen. As soon as all these steps have been undertaken, the model can be implemented by a computer, in this case a Geographical Information System [Burroughs, 1986]. The computer environment allows contour maps of minimal cost to be created. The final contour map must be compared to the distribution pattern of the archaeological artifact under study, the production centre of which reresents the initial point of the simulation. If the distribution matches the final contour map, it means that the object in question was exchanged through a market system. In other words, the simulation permits identification of the governing economic structures, the only traces of which lie in the archaeological remains.

Map comparisons also become hypothesis testing stages, since a contour map of artifact distribution may also represent a market system pattern. Each time that there is a match with the final contour map, the simulation of market conditions succeeds as a model. Therefore, concepts such as the maximizing of profits by minimizing costs included in the model appear to identify conclusively one type of exchange present in the Graecorroman world. Two successful experiments carried out with this simulation indicated that Black Burnished 2 and Oxfordshire ware were two pottery types exchanged within a market system in Roman times [Carreras, 1994a].

6.5.3.2 Network models

An initial application of this model was introduced in SPANS [Carreras, 1994a], however the current analysis is developed in ARC/INFO. Thus any further discussion relates to this later environment (see appendix 7 for a technical description). The command INTERACTION of ARC/INFO calculates the cheapest itinerary from an original point to the rest of the locations on the map. Therefore the application provides an associated transport cost index for each centre in relation to a starting place.

Once these values are obtained, contour maps can be created with the help of TIN so as to reconstruct potential trade areas [Fotheringham and O´Kelly, 1989; O´Kelly and Miller, 1989; Goodchild, 1991]. The resulting contour maps should identify the effects of each exchange mechanism simulated with no other influences. Finally amphora distribution maps (see chapter 5) can be compared to these theoretical contours with the aim of isolating the mechanism responsible for their distribution.

The essence of the model is that areas of low transport costs are more likely to document a high volume of commodities (e.g. amphorae) since their final price would be convenient for both consumers (i.e. low costs, bargains) and salesmen (i.e. a high margin of profits, price elasticity). In contrast, regions with high transport cost indexes could neither attract traders (i.e. low profits) nor commodities (i.e. heavy low-valued goods). Network models were set up for Roman Britain as well as for the whole Roman Empire though each of them includes some specific variations.

a. Market exchange in Roman Britain

The simulation model described above with no changes was developed to represent a market exchange system in Roman Britain [Carreras, 1994a]. Actually the model reconstructs only the intraprovincial sphere of activity, where local traders, middlemen-peddlers, shopkeepers and door-to-door salesmen operated. Contour maps obtained with this simulation identified distributions of local ceramics (e.g. Black Burnished 2, Oxford ware), hence these types were supposed likely to have been commercialized through a market system [Carreras, 1994a]. As suggested (see chapter 5), most amphora distributions looked like those resulting from a market exchange so the model should recognize them. Since amphorae were imports, the simulation needed to be run from the point of access to the province. These initial points were crucial because they represented the end of transcontinental routes and the place of residence of trading agents (see previous section) from which the provincial distribution of imports began. Only three initial locations, which were possible ends of access routes, were selected for their potential contrasting results. They identify

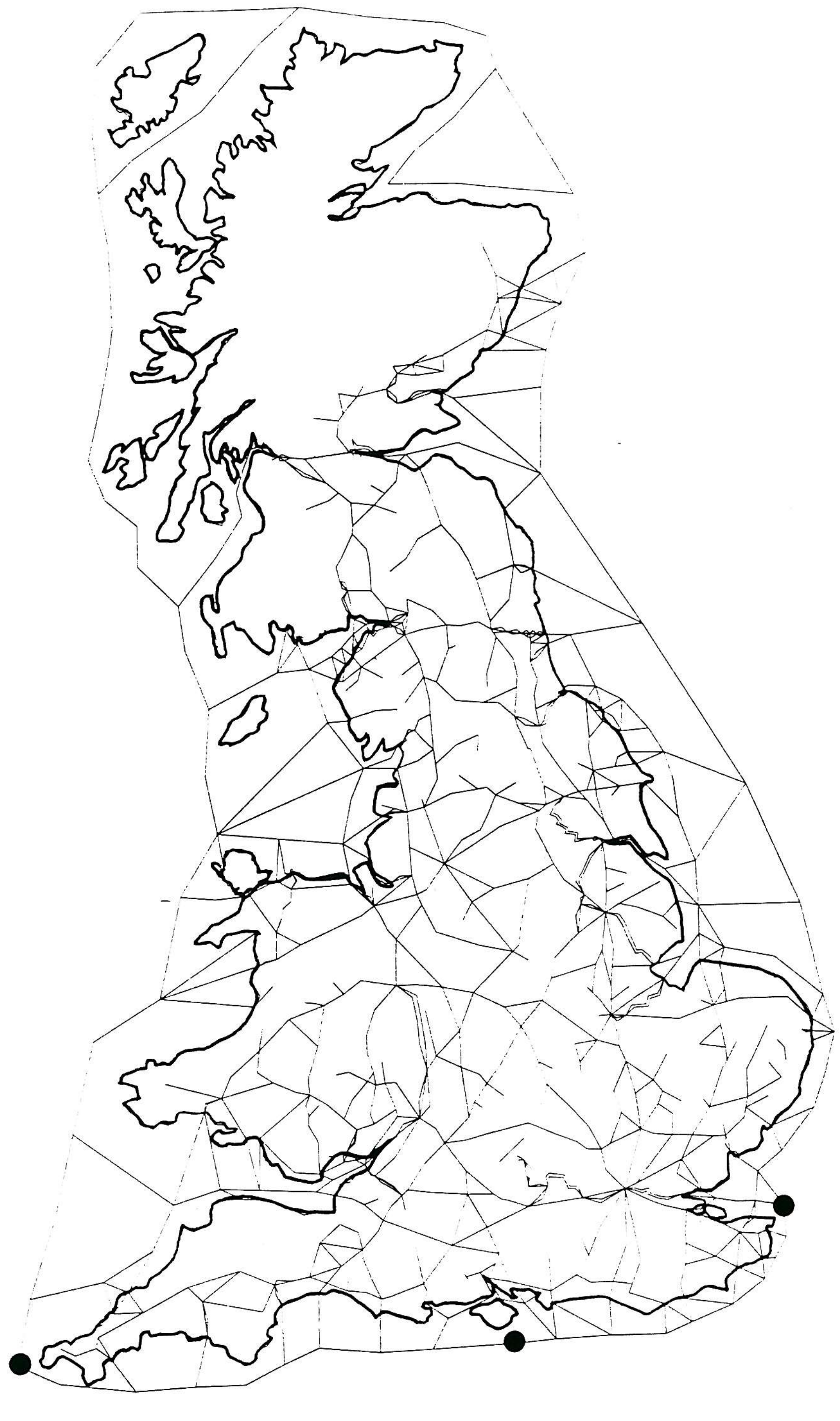

Figure 85 Transport network for a market sytem with the initial points.

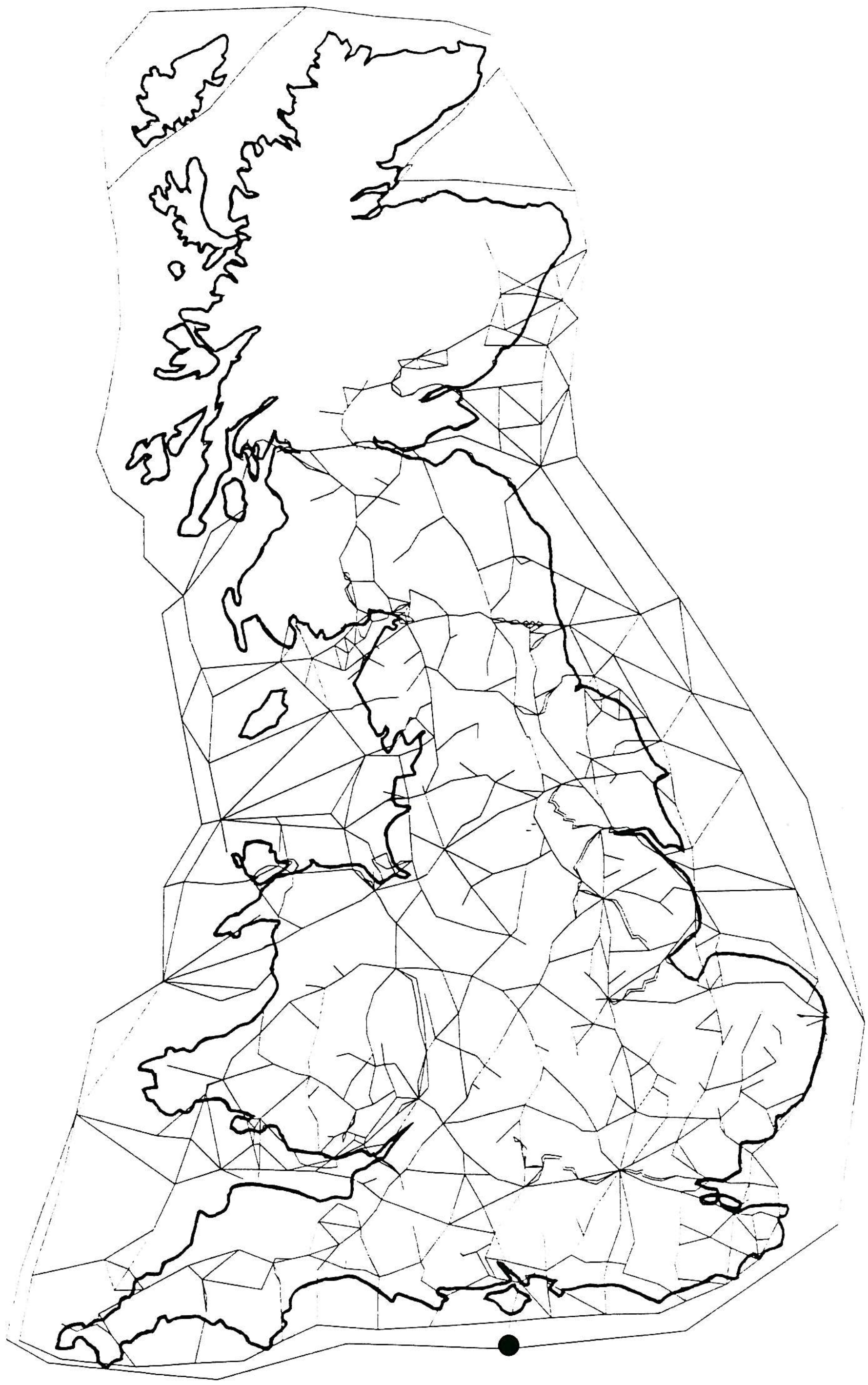

Figure 86 Transport network for a redistributive system with its initial point.

respectively a point of arrival in the Western, Central and Eastern sectors of Southern Britain (see figure 85).

b. The redistributive system in Britain

An alternative model represents the redistributive system in Roman Britain oriented towards the legions garrisoned at the Northern frontier (i.e. Hadrian's and Antonine's walls). The preferential links with this particular zone have been added to the market exchange model in the form of priority routes connecting seagoing itineraries operating in the English Channel with key military depots on both sides of the walls [Selkirk, 1983; Anderson, 1992]. The priority given to these routes was made possible by supplying a cheaper cost index, at half the cost of ship transportion[37].

Although the model combines redistributive (i.e. preferential locations) and market features (i.e. the remaining network), it is better suited to past conditions since it is unlikely that a purely redistributive system would have appeared in the real world[38]. This simulation model claims to identify the distribution of the amphora Dressel 20 in the province, the only exceptional pattern recorded (see chapter 5.3). Therefore the model is run from a starting point in the middle of the English Channel, since the access point to the province is redundant in any preferential allocation (see figure 86).

c. Market system in the Empire as a whole

Focusing on long-distance exchange requires that the reasons for the movement of commodities cannot be comprehended only for regional levels but also for an interprovincial ones. In other words, the two models introduced may reflect internal patterns. However, they do not satisfactorily explain the priorities of particular suppliers as well as the comparative values of amphorae. Similar amphora-borne commodities (i.e. wine, fish-sauce, olive-oil) were produced in different regions and recorded in distinct quantities in Britain (see chapter 5). Within a market system these volumes and monopolies can only be explained by transportation costs on a larger scale, which is the Roman Empire as a whole [Hoover, 1948; Isard, 1956; Dicken and Lloyd, 1990, 112-150].

Nevertheless an identical market exchange mechanism must be used for all the competitors

---

[37] Comparative data is provided by the Spanish flota in which merchants had to pay 40 % in taxes of the final saleprice for their commodities, while of course public goods were not charged [Lorenzo-Sanz, 1979, 462].

[38] A pure redistribution only documents a commodity wherever a central authority wishes to allocate it.

in order to apply the transport cost principle for interpreting their distributions. A simulation model of a market system for the whole Empire shows whether all the suppliers moved their merchandise by means of the same exchange mechanism. If market exchange was the only exchange mechanism operating, the transport principle should recognize the predominance of particular suppliers in the province. The supplier with less transport costs was likely to dominate a market rising over other competitors with similar products. In practical terms the scale of the map involved so many calculations that only three modes of transport (i.e. seagoing ships, river boats, waggons) were chosen to be implemented in the model. This simulation is in fact identical to the one for market exchange in Roman Britain, but using a reduced number of means of transport. Furthermore the points of departure in the model correspond here to the original production centres, hence involving the trading circuit as a whole. Eight points of origin were selected representing locations in the provinces of Lusitania, Baetica, Tarraconensis, Africa Proconsularis, Aquitania, Narbonensis, Italy and Greece (see figure 87).

6.5.4 Analyses of the results from the simulations

Contour maps obtained from the computer applications in ARC/INFO are commented on below in relation to the three simulation models described.

a. The market system in Britain

The three contour maps created from the Western, Central and Eastern sectors of Southern Britain seem to identify many amphora distributions (see chapter 5). Although there are many variations in the distributions probably as a result of internal consumption patterns, a market system represents the commonest exchange mechanism for amphorae (figure 88). The distributions of Italian Dressel 2-4 and Gaulish Gauloise 4 are, without any doubt, better represented by the map as having initialized in the Southeastern sector (figure 88). In contrast, distributions of Haltern 70s and Southern Spanish fish-sauce amphorae can be easily recognized by the map, starting in the Southwestern sector (see appendix 7, fig. 1). This may indicate the two possible access routes to Britain as well as the place of residence of trading agents from these areas.

On the one hand, Italian and Gaulish wines were probably reaching Britain along the transcontinental routes crossing Gaul (i.e. Rhône-Seine, Rhône-Rhine via Doubs and Rhône-Rhine via the Mosel) (see early sections), and ending in eastern ports. On the other hand, Spanish produce (i.e. fish-sauces, olives) arrived in Britain by way of the Atlantic routes, probably via Gibraltar rather than via Aude-Garonne or Rhône-Loire, and concluded their journey in a Western port (i.e. Exeter, Gloucester). However, both types of distribution correspond to an identical

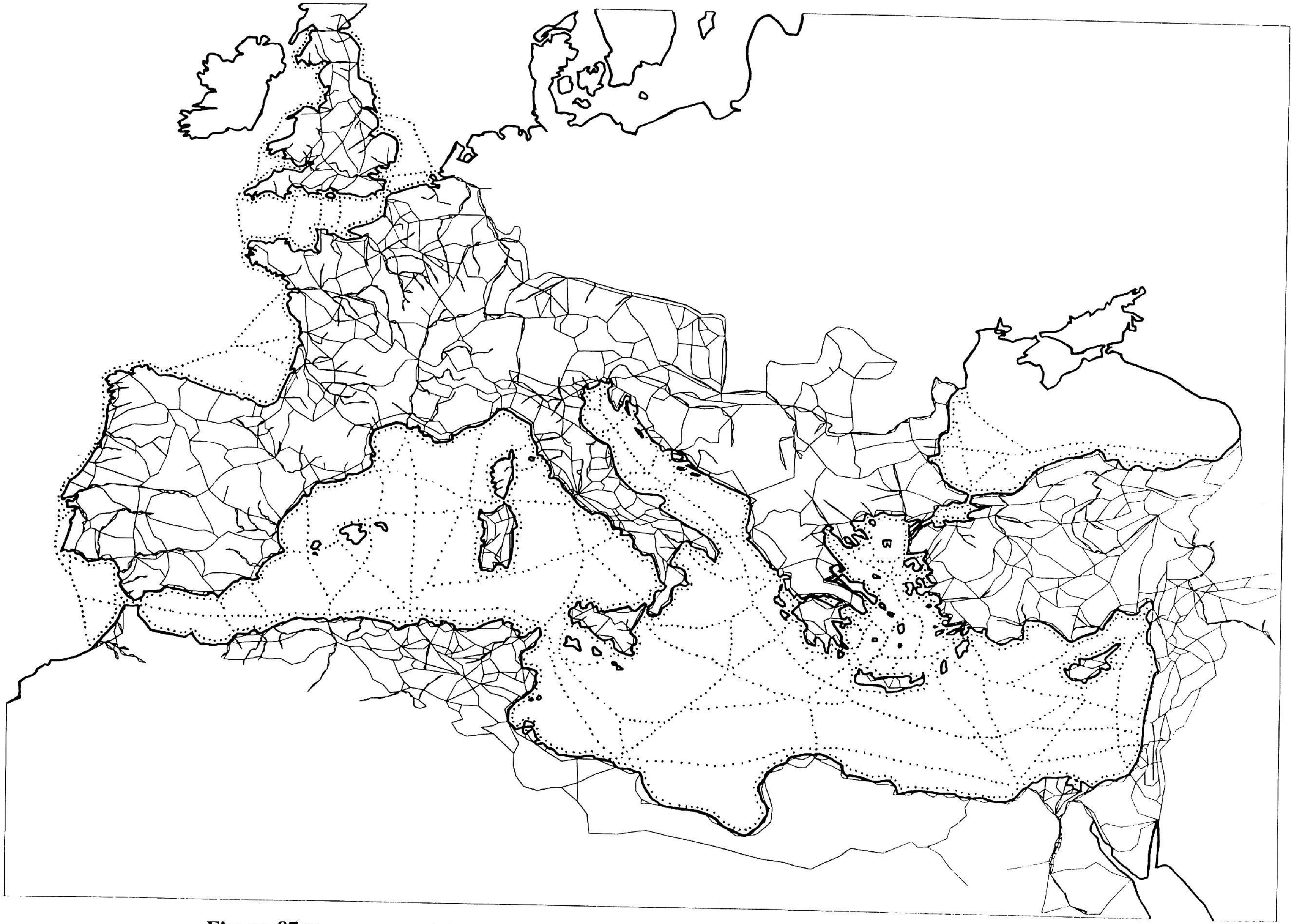

Figure 87 Transport network for a whole Empire market sytem with their initial points.

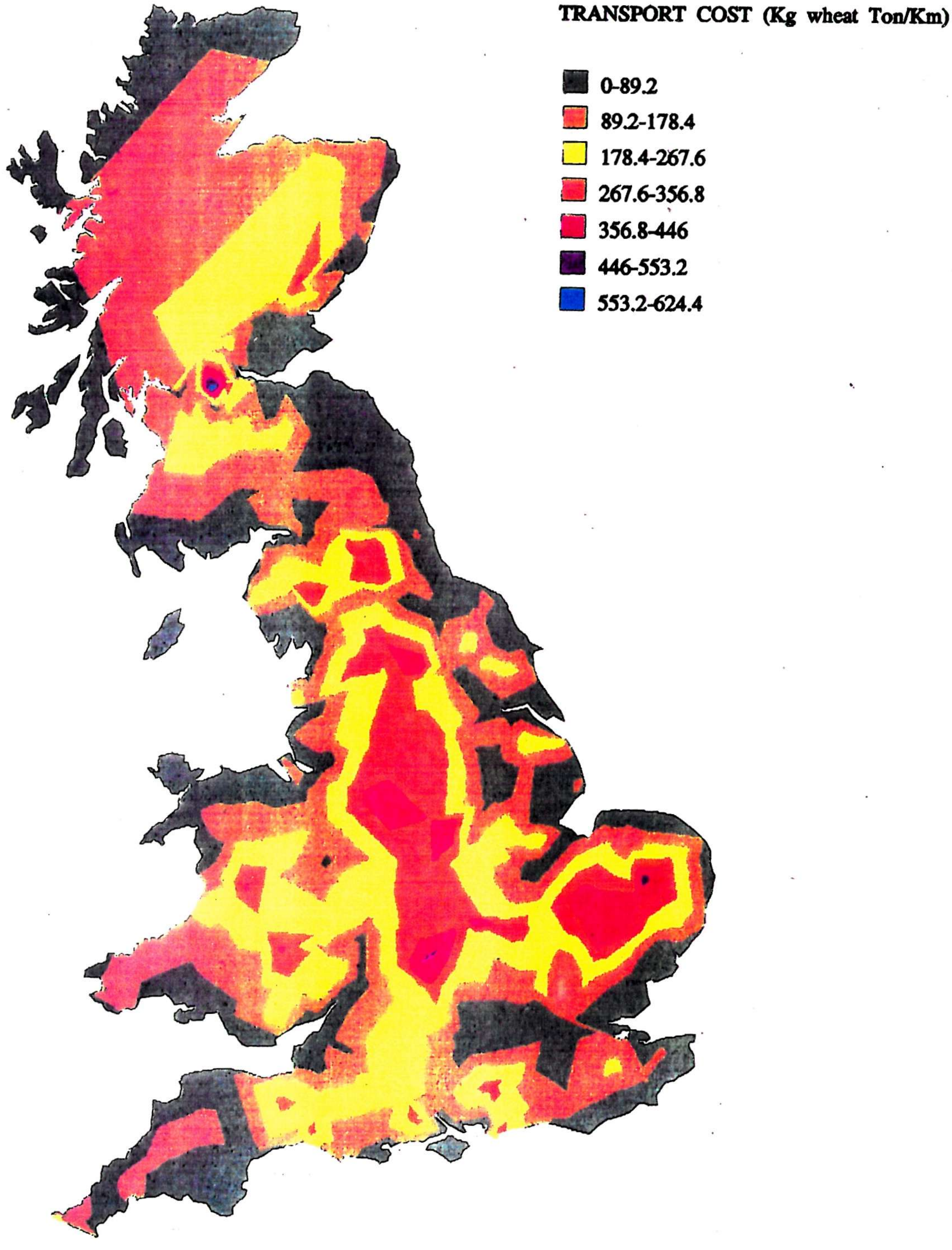

Figure 88 Contour map (ARC/INFO) resulting from the simulation of a market system.

market exchange mechanism, although setting out from a different place of origin [Dicken and Lloyd, 1990].

A market system was also responsible for other ceramic distributions [Hodder, 1974; Fulford and Hodder, 1974; Gillam and Greene, 1981] as simulation models developed in SPANS have made evident [Carreras, 1994a]. Therefore the minimizing of transport costs was a common practice in Roman trade that revealed the presence of market behaviour even in long-distance exchange. Empirical data constitutes an undeniable demonstration of the existence of an operational market in Roman times. Its importance and the scale of its operation can always be questioned, but its existence seems undeniable [Carney, 1975, 141].

Nevertheless, some amphora distributions, which were expected to indicate market mechanisms (e.g. Rhodian, Carrot, African, Eastern Mediterranean Dr. 2-4, Kapitan II, Late Roman), do not match any former simulation maps. Although consumption patterns (e.g. ethnicity, luxury goods) may to some extent have been responsible for these distributions, they also have been due to the operation of alternative exchanges.

The simulation of a market exchange system in Roman Britain does recognize some amphora distribution patterns; however, it does not represent all of them. Since the redistributive system introduced below does not identify them either, mechanisms or variations other than the present ones may account for these amphora distributions.

b. The redistributive system in Britain

The contour map built by the application of the redistributive model in ARC/INFO represents in detail the distribution of Dressel 20s in the province (figure 89). The distribution maps of Dressel 20 stamps and amphora densities are quite similar to the simulation one, with some minor differences resulting from the variation in the level of consumption (see chapter 5). Therefore Baetican olive-oil was part of a publicly organized supply for the army, here called a military redistributive system, which concentrated great volumes at the frontiers of the Empire. The concentration of Dressel 20 in London corresponds to the presence of the administrative personnel there.

The olive-oil present in the civil areas probably travelled by means of the same network of public transport and was later distributed through a market network, once it reached the province. In other words, it would have benefitted from private involvement in public transport to reach an initial port in Britain from which olive-oil was distributed using a market mechanism. As the model took into account market exchange features, the civil pattern is also simulated and apparently well-recognized.

Apart from the Dressel 20 distribution, no other amphora patterns in Roman Britain seem to have been the result of a redistributive mechanism. The case of Rhodian amphorae is difficult to simulate since they may have been part of this system for a short time [Peacock, 1977a]. Moreover their distribution is so concentrated in Kingsholm that no apparent traits are displayed (see chapter 3 and 5). With regard to North African amphorae, there are no signs of them being part of any public supply but they are more likely linked with a market system.

The preferential orientation of this public system towards particular destinations could have influenced the internal distributions of local goods in the province. Sea-going ships calling at Southern ports before reaching the Northern destinations could have loaded other commodities (e.g. pottery) destined for the military markets. Although it has been demonstrated that Black Burnished 2 distribution reflects a market pattern [Carreras, 1994a], their success may have been underwritten by the existence of a public transport network [Gillam and Greene, 1981].

The simulation model of a redistributive system identified precisely the distribution of Dressel 20 amphorae, which therefore represented a commodity supplied by the State to the Roman army [Remesal, 1986; Funari, 1991; Carreras, 1994a].

c. The market system in the whole of the Empire

Eight contour maps are the result of the simulation of a market mechanism for the whole of the Roman Empire. They document the advantages and disadvantages of each production centre in relation to its immediate competitors in terms of transport costs. Depending on transport costs, a centre could exert direct control over contiguous areas, hence trading regions could be distinguished. Regional patterns were suggested for the distribution of Roman terracotta lamps [Harris, 1980; Duncan-Jones, 1990, 48-58] which constituted another item of interprovincial exchange.

The amphora evidence of similar produce in Roman Britain and the testimony of the simulation maps may point to market control of particular suppliers. In the case of wine, Gaulish beverages dominated the Romano-British market (see Gauliose 4, chapter 5) which is quite logical according to the simulation (figure 90). Transport cost from Aquitania (appendix 7, fig. 2) together with those from Narbonense (figure 90) are the lowest in the group[39]. In contrast, Baetican wines (appendix 7, fig. 7) could have reached the Isles at relatively low costs but they are hardly represented in the province. This may be due to their poor quality. Tarraconensis wine was popular in Britain until the Gaulish production started. At that point, they could not compete because of their higher transport costs (appendix 7, fig. 3). Therefore the downturn in the trade of Catalan wine was chiefly due to the higher overhead transport costs involved within a market exchange [Remesal and Revilla, 1991; Revilla and Carreras, forth.]. Moreover, the cost indexes for Greek (appendix 7, fig. 4) and Italian (appendix 7, fig. 5) products suggests they could not compete with other production regions in tables wines. Hence, these two zones specialized in high quality beverages which could reach distant provinces in low volumes but fetch high prices. The presence of the products of these two areas in Roman Britain manifests their policy of offering high quality wines for export. Otherwise these two regions would never have been able to extend to distant provinces such as Britain through a market exchange mechanism.

Although the testimony of wine exchange seems to be clearly indicated by the simulations, the case of the two other commodities (i.e. olive-oil, fish-sauces) cannot be explained with reference to market exchange rules. On the one hand, the comparison between the cost indexes of the two olive-oil producing regions, North African (appendix 7, fig. 6) and Baetica (appendix 7, fig. 7), does not justify the overwhelming presence of the latter amphorae in the province. The differences were so slight that North African vessels would have been better represented in Britain, if a market exchange had been in place for both olive-oil producing provinces. Actually the simulation model demonstrates the non-existence of a market exchange for the distribution of Baetican oil. In other words, the redistributive system alters the relative presence of both suppliers as well as the concentration of amphorae. The simulation map from Baetica (appendix 7, fig. 7) also shows that the frontier provinces incurred the highest transport costs[40], so that public intervention was required for supply to the Roman army. In this case the map substantiates the reasons behind the introduction of redistributive systems for long-distance exchange. Transport costs in Roman times constituted an obstacle to the long-distance movement of goods and when this regular flow was needed, the involvement of the public administration was necessary.

On the other hand, the comparison of three fish-sauce producing zones; Aquitania (appendix 7, fig. 2), Lusitania (appendix 7, fig. 8) and Baetica (appendix 7, fig. 7), does not explain the dominant position of Baetican imports in the province. Transport cost indexes were lower for Aquitania and Lusitania, which should have resulted in their dominance of British

[39] Basically the Aquitanian wines from Bourdeaux [Laubenheimer, 1985; Berthault, 1992] should have wielded a complete control of British markets.

[40] The transport costs surpassed the 25% of the good sales price [Carreras, 1994a].

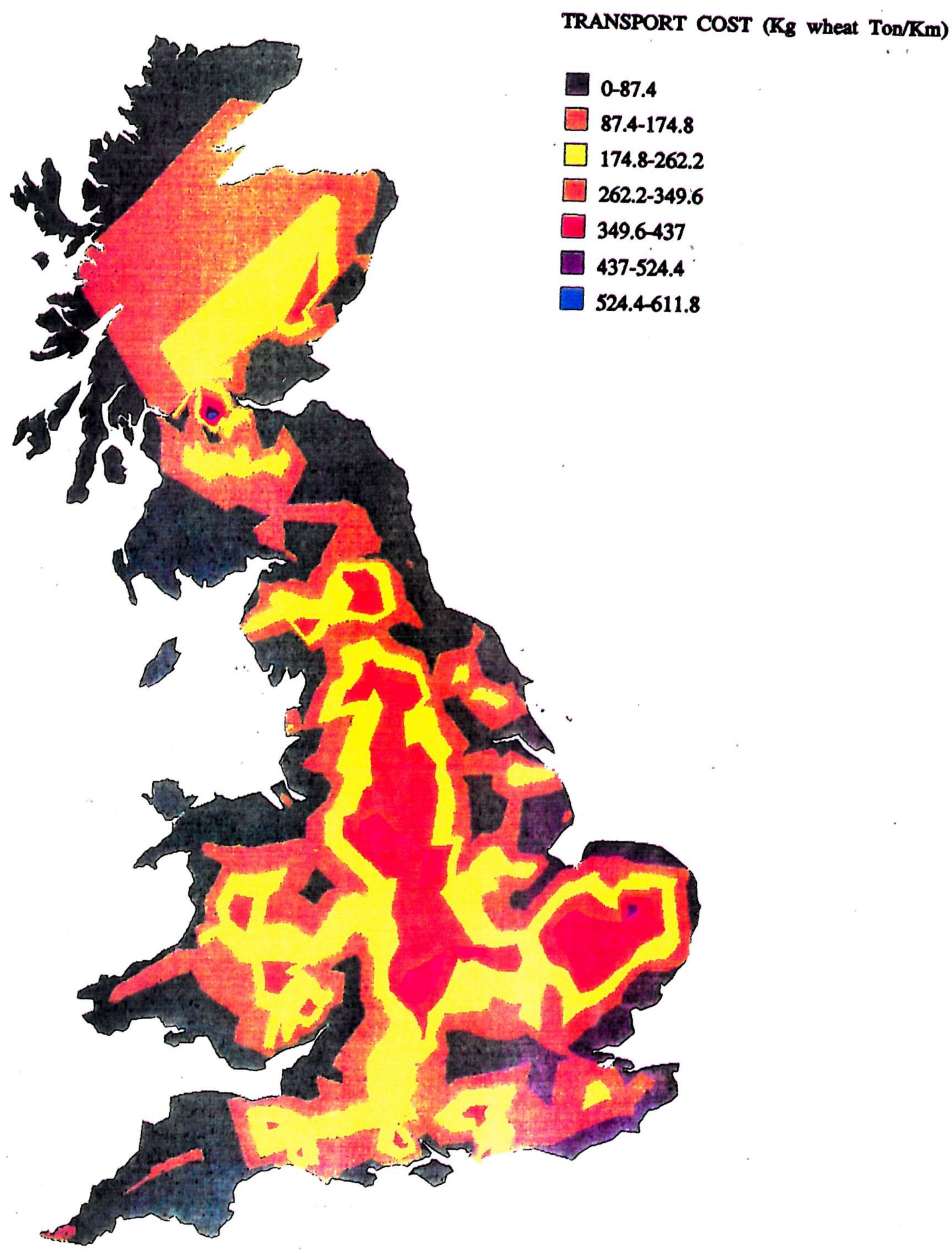

Figure 89 Contour map (ARC/INFO) resulting from the simulation of a redistributive system.

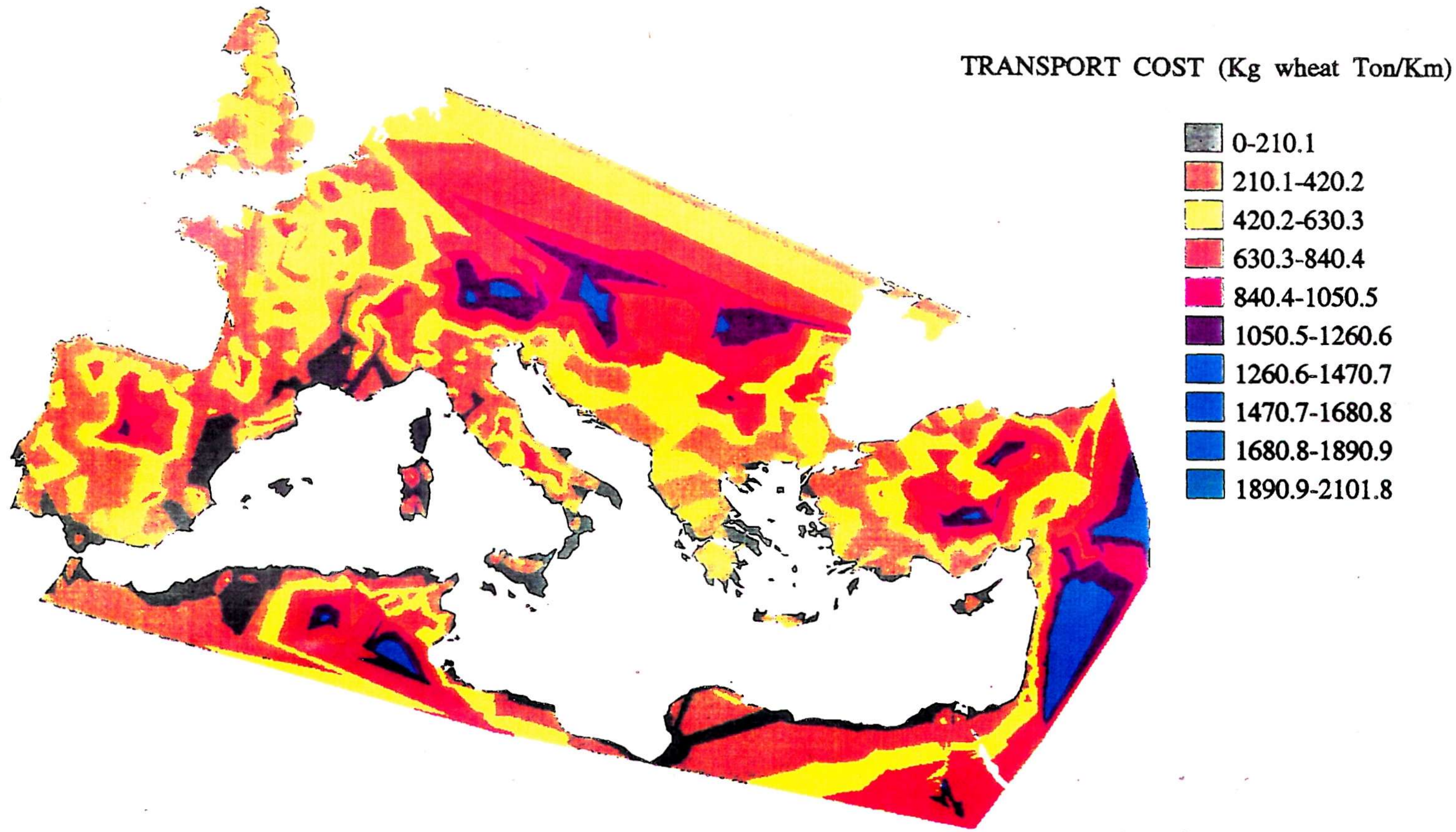

Figure 90 Contour map (ARC/INFO). identifying the optimal transport costs from Narbonense.

markets. Since this was not the case, there are two possible explanations, already put forward (see chapter 5):

- Baetican fish-sauces enjoyed a unique popularity because of their high quality and affordable price.

- Baetican fish-sauces were not distributed through a market exchange network but shared transport in a redistributive system.

The first hypothesis is put into doubt by the comparative high percentages of African and Lusitanian amphorae in the city of Rome[41] and their steady control of the majority of Mediterranean markets from the middle of the second century A.D. onwards [Panella, 1986; 1992; Edmonson, 1987; Alarçao and Mayet, 1990; Curtis, 1991]. In contrast, the second possible explanation suggests a new exchange mechanism or at least a variation of the market one.

Baetican fish-sauces may have shared identical means of transportation with the Dressel 20 olive-oil amphorae to Britain, where they were distributed through alternative networks [Martinez-Maganto and Carreras, forth.]. A combination of distribution maps of Baetican olive-oil and fish-sauce amphorae (see chapter 5) revealed a complete contrast between them. Dressel 20s were allocated in particular places through a provincial redistributive system, whereas Southern Spanish fish-sauce amphorae were distributed according to a provincial market exchange. So far, no clear sign of any distinctive exchange mechanism can be found for these vessels; however, the predominance of Baetican fish-sauces in the province lacks any market logic, since regional differences in the cost of manufacturing due to major volume of production or lower labour expenses, lack of any evidence.

The principal distinction in the Baetican amphorae supply is the fact that it often shared space with sea-going shipments in the official form of transport, which meant an important reduction in the cost of transportation. In other words, traders may have paid very little for conveying goods from the supply provinces to the port of arrival in Britain. This conferred special non-market advantages on their products. Therefore Baetican fish-sauces may have cost almost the same at the initial arriving point in Britain as at their place of origin since no transport costs (10-25% of the sales price) [Braudel, 1979c; Hodder, 1974a] were added, whereas Lusitanian and Aquitanian goods had to include a supplement for transport.

Although sharing cargoes was not always a common practice on sea-going ships coming

---

41 Rome was one of the most demanding markets in terms of quality and price [André, 1961; Robert, 1986].

to the province as Little Russel A and B suggest [Monaghan, 1987; 1991], the existence of many shipwrecks supports this special practice. On the basis of cargo compositions recorded by Parker [1992a], Baetican amphorae carrying fish-sauces and olives (i.e. possibly Haltern 70) have been found with either metal ingots of official character or Dressel 20 amphorae [Carreras, 1994b]. The following table summarises the composition of cargoes with diverse fish-sauce and olive bearing amphorae: the overall number of shipwrecks, shipments sharing with either metals or Dressel 20s, the minimum number of official cargoes and their proportion in relation to the total number [Parker, 1992a].

Table 20

AMPHORAE	TOTAL	Ingots	Dressel 20	Offic.cargoes	Proportion %
Beltrán I	54	7	6	10	18.51
Beltrán II A	10	1	3	3	30.00
Beltrán II B	18	1	10	10	55.55
Haltern 70	17	3	6	6	35.29

In view of this evidence, the long distance exchange of Baetican fish-sauces may have benefitted from sharing a common place of origin with the official cargoes (e.g. olive-oil, metals). Thus it would have altered the nature of their distribution and the exchange mechanism [Martinez-Maganto and Carreras, forth.]. These commodities from Southern Spain reached Britain and probably other distant provinces by taking advantage of the public transport system, therefore resulting in a peculiar exchange mechanism.

A more complete picture of how public and private cargoes shared the same holds and their relation to different *mercatores*, *negotiatores* and *navicularii* can be inferred from the composition of shipwrecks such as that of Port-Vendres II [Colls et alii, 1977], Sud Lavezzi 2 [Liou and Domergue, 1991], Lavezzi 1 [Liou, 1991], Saint Gervais 3 [Liou and Gassend, 1991] and Cabrera 3 [Bost et alii, 1992]. If the effect of a redistributive system on goods from the same production region is clear, a similar influence could be exerted on goods manufactured along the routes of access to the frontiers (i.e. pottery) [Middleton, 1983]. As was mentioned in the case of samian ware (see chapter 4), public networks may have affected the long-distance exchanges of many other commodities such as fine wares [Pucci, 1983; Ettlinger, 1987] which would not travel well alone.

The simulation models introduced in this section provided a suitable environment for analyzing in detail exchange mechanisms and their influence on amphora distributions. They made clear that at least two mechanisms, market and redistribution, operated in Roman times which yielded distinctive distributions. Nonetheless, the models did not describe all the amphora patterns recorded in Britain, but suggested other possible explanations. On the one hand, consumption habits may have determined this diversity in their distribution. On the other hand, other exchange mechanisms or variations of existing ones might have been responsible for the final allocations and volume of amphorae.

6.6 Conclusions

This chapter discussed the reasons behind the movements of amphorae or any other objects involved in long-distance exchange. The nature of these movements is determined by the people who took part in the exchange and the mechanisms being used. People mostly implicated in exchanges are known as traders, and their main aim is to seek profits. However they were two spheres of activity, involving interprovincial and intraprovincial exchange. In this a hierarchy of traders acted at particular levels of operation and covered smaller and greater areas. The effect of the hierarchical level on the distribution of amphorae has already been dicussed in relation to the degree to which each level was settled in the province.

Moreover, the inherent difficulties of long-distance exchange on account of lack of information and securities necessitated the development of trading strategies aimed at limiting risks. These strategies define to some extent preferred trading areas that probably modelled some amphora distributions. The social organization of traders takes into account the human element in commercial exchange which sometimes does not correspond to a rational economic logic.

In contrast to this approach, trade is also analyzed in practical economic terms as a series of logical exchange mechanisms offering alternative frameworks.In the present chapter three applications of ARC/INFO were introduced to analyse amphora distributions in Roman Britain at provincial and supraprovincial level. The results revealed that some amphorae were distributed by means of obvious mechanisms of exchange, while others seem to have resulted from alternative systems. The current chapter not only introduced new methodological tools such as GIS simulation models for spatial analysis but also disputed the theoretical structure of Roman exchange. The combination of empirical data and deductive simulations serves as means of revising the basis of Roman economy.

7. ROMAN EXCHANGE RECONSIDERED

7.1 Introduction

The present chapter covers the last stage in the research, which consists of reviewing to the theoretical framework defined at the outset. The thesis reassesses the questions put forward in the first chapter presuming that the analysis of amphora evidence from Roman Britain considered show. The testimonies of amphorae cannot resolve all the economic dilemmas posed at the start, since their nature and the size of the sample limit the quality of the information that can be obtained. Nevertheless the previous chapters have demonstrated the many implications of amphorae finds how their archaeological contexts can be related to economic arguments.

Although long-distance commerce and the associated mechanisms of exchange formed the core of this research, many other economic topics were discussed on the basis of amphora testimonies. At this final stage, it is time to reconsider whether amphora distributions in Roman Britain, as a case study, offer new perspectives on these economic topics, and thus enhance previous knowledge.

7.2 Amphorae and the Roman economy: a review

Four central points of discussion were proposed in chapter 1 to be examined thoroughly with the support of amphora evidence. Detailed considerations of all these subjects appear in prior sections but they were not dealt with as individual issues. Therefore at this point it is appropiate to combine together the results of a range of analyses and compare them to the theoretical framework within which they are discussed. The current review covers the main topics related to exchange in Roman times: the existence of an economy of scale, its degree of monetization and the city as a consumer centre.

7.2.1 Economy at Scale: how and why ?

The question of whether an integrated economy existed in Roman times is complex, based on the evidence of many artifacts found at a certain distance from their original production areas. The movements of goods from one extreme of the Roman Empire to the other provides an impressive demonstration of how this ancient economy may have worked [Jongman, 1991]. It also serves according to some scholars, as a testimony of the first economy at scale [Rostovzeff, 1926; Duncan-Jones, 1990]. In this context, scale means that there is an integrated market covering a large area (i.e. Roman Empire, peripheral nations) [Finley, 1985b, 178]. Furthermore there is an important volume of trade between distant regions and, ultimately, a complementarity between production and regions of consumption (i.e. core-periphery) [Wallerstein, 1974; Duncan-Jones, 1990].

In fact movement over long-distances of light highly valued goods is well documented in earlier societies [Renfrew, 1975; Earle and Ericsson, 1977; Ericsson and Earle, 1982], but the great difference with respect to the Roman economy was that the movement of bulky low-valued commodities[1] was involved (e.g. olive-oil, wheat, table wines). Furthermore, this commerce left numerous testimonies which hinted at the possibility of a significant volume of trade.

Amphora distributions in Roman Britain prove the existence of a long-distance exchange of bulky low-valued foodstuff between diverse provinces. However, they do not suggest the presence of an integrated market linking demand and supply by means of a price-fixing mechanism, since the lack of information flow hampered it [Finley, 1985b, 178; Achard, 1991]. The reasons behind the movement of these goods over great distances can be found in a combination of market and non-market mechanisms, which are not based on any integrated system.

The amphorae quantifications can be considered an initial but not a definitive step towards an evaluation of the volume of commerce. As the Romans did not bequeath us any bookeeping records of their trading ventures or statistics that could be related to amphora evidence or other chronological periods, quantifications have only a relative value [Jongman, 1991, 19; Finley, 1985b, 25]. The current research contributes a significant sample of quantified material from a peripheral province, and it is believed that this will assist in the identification of overall imports. However amphora quantifications from other provinces[2] are lacking, consequently at the present no possible comparisons can be made that give insight into the real volume of trade. Dressel 20 stamps and high amphora concentrations (e.g. Toulouse, Lyon, Châlon-sur-Sâone, Rome) at least imply a significant volume insofar as no other information is available.

In contrast to the ideas of the new orthodoxy [Davidson and Harper, 1972; Jones, 1974;

[1] Similar movements are only recorded in the Late Middle Ages, though comparisons seem to be rather difficult [Pounds, 1974; Braudel, 1949].

[2] The use of standarized densities or at least weights plus contextual information are minimal requisites for establishing comparisons (see chapter 2).

Finley, 1985b], amphora distributions in Britain indicate a substantial volume of distant exchange [Fulford, 1986; 1992]. The level of importance of commerce cannot, however, suggest a complementarity in general between production and consumption regions [Wallenstein, 1974; 1980]. Only the regular supply resulting from a redistributive system guaranteed this interdependence. Thus, the province of Baetica relied on Rome and the Western frontiers to consume the olive-oil contained in the Dressel 20s. In other words, structural constraints (e.g. transport, communication) hindered the development of a market economy at scale in Roman times, but other mechanisms facilitated the regular movement of commodities to distant locations.

Other historical periods (XV-XVIII century A.D.) reveal identical problems in terms of the scale of their economy, which were only overcome by the combination of new exchange mechanisms and technical innovations (e.g. navigation) [Chaunu, 1959; Chaudhuri, 1978; Wallerstein, 1974; 1980; Curtin, 1984]. Complementarity in the Roman Empire never developed beyond the initial stage, being limited to public supply (e.g. grain from Egypt, Africa and Sicily or olive-oil from Baetica and Africa) under strong coercion. The Roman market system was only responsible for a small part of long-distance exchange in limited numbers of amphorae compared to a public system.

Highly valued commodities were the commonest goods distributed through market networks because of their profitable revenues in long-distance transactions (e.g. wines, fish-sauces, dates). Moreover, the market system took advantage of public infrastructures and mechanisms, creating new variants or systems for long-distance exchange. The overwhelming role of transport cost in the movement of goods has been already stressed. It hampered, of course, the movement of products [Jones, 1974; Pekary, 1980; 1981] but it did not deter this as some exchange mechanisms were quite flexible. The effect of transport cost on amphora distributions is clear (see chapters 5 and 6), limiting the distance and the volume of trade. Again, public systems (e.g. Dressel 20 distributions) could overcome these constraints with their preferential allocation and lack of profits. Without the effect of transport costs, the earth would have been a homogeneous surface [Dicken and Lloyd, 1990].

The conclusions drawn from the current research support the partial existence of an economy at scale in the Roman Empire with important volumes of goods being conveyed chiefly by public systems. Nevertheless only a limited range of commodities were moved by means of these mechanisms, whereas the majority were traded through independent markets at a lower level. This intermediate position between the views of Hopkins [1980] and Finley [1985b, 127-130], simply implies that the Roman economy was a complex entity that cannot be reduced to a singular system. Many exchange mechanisms appear in the Roman economy which influenced the volume and scale of commerce. Consequently, in different ways disregarding even one of them may distort the full picture.

7.2.2 A monetized economy: coins and exchange

The frequent presence of money in exchange necessitates a discussion of its role in distant commerce. Money is involved at any stage in long-distance trade, from loans for chartering ships to insurances, transport fees and sales prices [Rougé, 1966; Howgego, 1992]. For this reason, Hopkins [1980] developed his model of commerce between core and peripheral provinces as reliant on a highly monetized economy with a regular circulation of coins.

The direct use of coins in any economical transaction was never widespread, since barter still remained common at a local level [Appadurai, 1986b; Howgego, 1992]. Besides, redistributive systems (i.e. *annona*) did not require the physical presence of coins, but employed a system of compensation between *fiscus* and salaries. Therefore long-distance exchange did not always involve the use of money, so coin circulation at site level may not identify fluctuations in imports.

Comparisons of Dressel 20 stamps, coins and samian ware recovered from a few Romano-British settlements (see chapter 4) demonstrates that the Roman economy was not fully monetized. Many military settlements did not use money in order to obtain their supply of foodstuffs, since a redistributive mechanism was responsible for their arrival. In archaeological terms, many military sites (e.g. Richborough, Corbridge, Wroxeter, Exeter) exhibited different proportions of coins and Dressel 20 supply, which hinted at the non-intervention of money in the importation of olive-oil.

On the contrary, most of the civil sites displayed a stricking coincidence between coins, Dressel 20 and samian supply that suggested the opposite case, a highly monetized economy. The empirical evidence indicates that there were at least two patterns of coin circulation, denoting civil and military, within the province. The former identifies fluctuations in the local life, including the volume of imports [Going, 1992], whereas the latter is difficult to interpret due to the public redistribution of goods without monetary intervention.

However, urban life in the civil centres manifests the degree of monetization suggested [Hopkins, 1980; Howgego, 1992] and their important role in exchange. Traders engaged in commerce to seek profit, normally in the form of money. Although they may not have carried large sums of money with them because of the danger of robbery, they probably invested their trading profits in return cargoes and properties (e.g. ships, warehouses, estates) in either the destination or original province. Besides, banking constraints limited the flow of money between provinces in

Roman times [Andreau, 1987], as cheques or bills of exchange did not exist. Therefore transfers of money were reduced to loans among the upper classes and simple cash, which represents a view opposite to that of the one defended by Hopkins [1978]. Obstacles to the flow of money reduced the scale of trade and distance involved [Pekary, 1980; 1981].

Therefore the model of core and peripheral provinces linked by taxation and commerce [Hopkins, 1978; 1980] does not fit with the present evidence in that the interprovincial coin circulation did not represent all economical transactions and that tax allocation was not such an important factor in trade, whereas redistributive mechanisms were. The degree of economic integration through money circulation and market mechanisms endorsed by Hopkins [1978; 1980; 1983a], hardly explains the volume of long-distance exchange documented by amphorae. Many amphora-borne commodities reached Roman Britain through public networks, which demanded little coinage (i.e. *vecturae*, official purchases), hence they did not bring about any significant flow of money between provinces.

7.2.3 The city as a consumer centre: a pole of attraction

This is a general pattern in the magnifying effect of urban centres in terms of consumption is and also documented in the volume of imported amphorae (see chapter 5). This phenomenon not only identifies the Roman world but any highly urbanized society [Braudel, 1979c; Dicken and Lloyd, 1990]. High densities of imports in urban centres normally express the effect of population and territorial organization in central markets [Haggett, 1965; Hodder and Orton, 1976; Martinez-Veiga, 1990; Dicken and Lloyd, 1990; Frayn, 1993]. The city becomes a service centre [Engels, 1990, 43-48; Whittaker, 1993], in this way returning the income originally taken in taxes from the countryside. Apart from the existence of a territorial market, the city was supplied with religious, cultural, educational and judicial services [Engels, 1990, 43]. Numerous distributions of amphorae in Roman Britain describe the hierarchical structure of markets as well as the significance of high densities of population.

Moreover, distributions of amphorae showed a marked contrast between rural and urban centres, a feature normally typical of a network of markets [Frayn, 1993, 76-77]. Although the pattern is to some extent comparable to other modern societies, this feature may indicate the parasitic nature of the relations between city and countryside. It seems that the trading function of cities, with regard to amphora-borne commodities, influences rural populations and this is evident in the hierarchy of densities. Nevertheless long-distance imports would have had preferential buyers in the cities due to their value and characteristics (see chapter 5.2), thus they can hardly be indicators of relationships between city and countryside.

Difficulties in interpretation that can be increased by the effect of diverse exchange mechanisms acting on the distribution of amphorae. Redistributive systems with their preference for allocations reveal high densities in hubs of communications or strategic sites, which sometimes do not correspond to the location of large urban centres. Studies of archaeological distributions like amphorae in the countryside should be more thoroughly conducted in order to obtain a minimal sampling data for basing economical interpretations.

7.3 Exchange mechanisms revisited

The central focus of discussion in this research concerned was the active role of exchange mechanisms in the movement of goods in the Roman world. If their importance is paramount in local transactions, they become vital in long-distance commerce. Roman Britain located at extreme of the Empire, revealed by the testimony of their amphorae how these mechanisms operated. It is necessary to mention that the present research deals with internal exchange, in other words, commerce taking place within the Roman frontiers, since external exchange introduces special gradations [Renfrew, 1975; Callner, 1988; Renfrew and Bahn, 1991, 308].

Although some scholars insist on identifying the market system and its variations as the unique exchange mechanism [Jongman and Halstead, 1989; Jongman, 1991], the variants are so distinctive from the supposed original system that they can be considered individual mechanisms on their own. A similar approach was developed by the substantivist school which ended in an initial classification of exchange mechanisms [Polanyi et alii, 1957; Polanyi, 1977], though the social dimension was probably overstressed [Cook, 1966]. Nevertheless the substantivist division is still quite a useful theoretical framework for the analysis of trade.

The scale, degree and type of long-distance exchange developed in Roman times was the result of a series of mechanisms that were already in place. The outcomes of the three defined exchange mechanisms (i.e. reciprocity, redistribution and market) have been fully examined in the previous chapter and compared to the documented amphora distributions. Despite the use of simulations for recreating these mechanisms, not all amphora distributions were identified by one of the three systems. Consequently, the theoretical framework must be revised and modified as necessary to incorporate the exceptions. Although theory, as Jongman [1991] states, cannot mirror reality exactly, at least it should represent the full diversity.

With the aim of incorporating the diversity reflected in amphora distributions, an alternative classification of exchange mechanisms is defined here. The classification reconsiders the features of the systems introduced by the substantivist school, adding two new variants or types. This alternative framework suits the observations recorded for Roman long-distance exchange in the last decades [Middleton, 1979; 1983; Marsh, 1981; Pucci, 1983; Garnsey and Saller, 1987] and only attempts to recreate as models the empirical archaeological evidence. New empirical data always serves the purpose of testing models and changing them when they might lead to confusion instead of simplifying reality.

A detailed account of what are considered to be the main features of each individual mechanism are included below. First of all, the three systems defined by Polanyi [1957c] are again revised in the context of Roman long-distance commerce (i.e. reciprocity, redistribution, market). They are followed by a consideration of two variants recognized in Roman economy that can be called market interventionism and parasitic market.

7.3.1 Reciprocity: gifts and social obligations

Reciprocity is a social institution that regulates the transfer of goods in two directions between individuals and groups. Both sides in the transaction are symmetrically placed or they are considered more or less as equals [Polanyi, 1957c; 1977]. Reciprocity is normally assimilated to gift exchange [Mauss, 1954; Sahlins, 1972] when individuals reinforce social relationships by means of gift giving.

This exchange not only implies an economic transaction but a social obligation towards the giver. Once a present is accepted, the recipient establishes a social bond with the giver owing him a compensation [Sahlins, 1972; Gregory, 1982; Geary, 1986]. Although this exchange chiefly reinforces social links, it also involves an economic meaning, since each side intends to obtain some profit [Sahlins, 1972; Appadurai, 1986b; Parry and Bloch, 1989; Gómez-Drezpo, 1993]. The mechanism can be described as balanced, or positive and negative according to the intrinsic value of goods exchanged and the status of participants. Normally social (e.g. kinship) and spatial distance fix the norms according to which the exchange takes place [Sahlins, 1972].

Long-distance reciprocity indicates either large social networks or very strong bonds, since separation hindered contact. Moreover, long-distance gifts are normally light, highly valued goods that could easily be transported [Mauss, 1954].

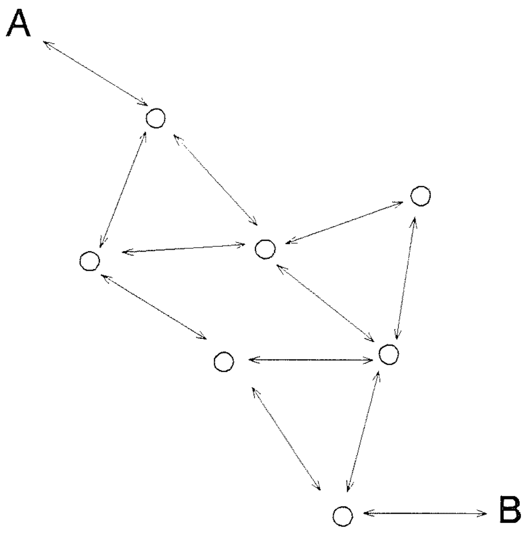

Figure 91 Diagram identifying reciprocity.

The figure 91 summarises how this exchange operates in social networks, which do not demand the common acknowledgement of all their members. Archaeologically, reciprocity is difficult to recognize due to the scarcity of a volume of exchange, but generally it refers to valuable goods. Their distribution through social networks defines a decreasing pattern as the outcome of spatial and social distance[3]. Kinship ties might alter this uniform distribution with directional allocations in spite of the distance.

Literary testimonies in the Roman world document all these practices embedded in politics, patronage, neighbour and kinship relationships [Carcopino, 1942; MacMullen, 1974; Saller, 1982]. With respect to amphorae, they were bulky commodities inconvenient for transporting over long-distances. Nevertheless, the value of some of their contents explains why they reached far away lands as simple presents (Ausonius Ep. 25; Paul Ep. 5.21; P.Mich 467, 476, 478, 481) [Davies, 1971; Whittaker, 1983]. The high-esteem in which some amphora-borne commodities were held was demonstrated even in societies far beyond the Roman frontiers that record the presence of these containers (i.e. India, Germania, Pannonia) [Hedeager, 1977; Bezeczky, 1987; Künow, 1987; Begley and Daniel de Pura, 1991].

Amphorae in Iron Age Britain were probably distributed through this exchange mechanism as tokens of political or social bonds with members of continental tribes [Haselgrove, 1987]. Nevertheless there were other mechanisms in place operating at the same time. Thus, reciprocity

[3] In this context, obsidian trade in Mesoamerica and Greece can be fully understood [Renfrew and Dixon, 1976; Pire-Ferreira, 1976; Sydris, 1977; Renfrew et alii, 1965; 1968].

was not the only factor responsible for the ocurrence of all the amphorae in the Iron Age.

The distribution of amphorae containing luxurious goods (e.g. high quality wines, fish sauces, exotic fruits) through reciprocity in Britain during the Principate and Late Empire may have still been common. However, there is no direct archaeological evidence of such a practice. Reciprocity could be at any stage in the exchange from the origin to the final destination. Consequently, commodities reaching the province through other systems may have been part of gift exchange networks by the time they arrived.

The limited volume of goods distributed through reciprocity in long-distance exchange reduces the significance of its role in the movement of Roman amphorae. Although the mechanism was present, it benefitted from the operations of other systems that acted as main moving forces.

7.3.2 Redistribution: *annona* and a military supply system

Redistribution can be defined as the appropriation of goods by a central authority that later reallocates them according to social needs and administrative requirements [Polanyi, 1957c; 1977]. The central authority coerces community members, who are obliged to give money or goods as taxes, resulting in confiscations or public purchase at fixed rates. Redistributive mechanisms can be either beneficial or abusive for society as a whole in the way that the central power deals with their citizens.

The intervention of a central authority (e.g. State) indicates possible deficiencies of other exchange mechanisms [Sugden, 1986] or the material appropriation for increasing public power [Service, 1975]. The Roman world is an outstanding example of how redistributive systems operated. Redistributive practices include the use of public charities and donations known as euergetism, which was in general employed by wealthy families pursuing political careers [Hands, 1925; Saller, 1982]. Moreover two public institutions, *annona* and a military supply system[4], were created by the Romans to overcome the deficiencies in the food supply of the city of Rome and the army respectively [van Berchem, 1937; Pavis d'Escurac, 1976; Remesal, 1986; Sirks, 1991]. Famines and social upheavals in the city of Rome forced the State to establish a dole for the plebs, firstly grain (i.e. *frumentationes*) and later other commodities (i.e. *annona*) [Pavis d'Escurac, 1976; Rickman, 1980a; 1980b; Garnsey, 1980; 1988; Garnsey and Morris, 1989]. On the other hand, the military supply system served to cater for an army garrisoned at distant frontiers which could not live off its own territories and required a regular incoming supply of food [van der Berchem,

[4] Annona systems are also recorded in Medieval Italy to supply grain for city needs [Ball, 1977].

1937; 1976; Remesal, 1986].

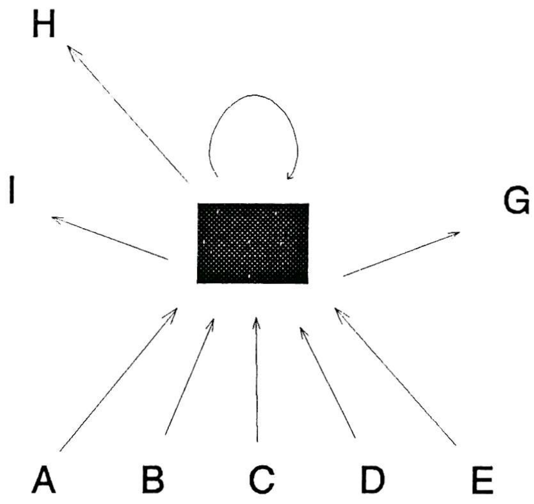

Figure 92 Diagram identifying redistribution.

The figure 92 represents a redistributive system (e.g. Rome) with a variety of community members (A-E) supplying goods to a central authority that uses them to feed populations in need (G) (e.g. in the city of Rome), defensive and coercitive forces (H) (e.g. army), administrative personnel (I) (e.g. provincial and capital staff) and itself. Due to the great size of the Roman Empire, this system was essential for the mobilisation of goods that otherwise might never have reached the more distant locations in such volumes. The widespread distribution of marble in Roman times was basically the result of a public redistributive system, which transported this heavy material from one side of the Mediterranean to the other [Ward-Perkins, 1980; Baccini-Leotardi, 1989; Clayton-Faunt, 1993]. The marble was basically used in public buildings or programmes funded by the Imperial family. Thus it had a social and political function.

A few amphora-borne commodities (i.e. olive-oil, wine) seem to have been involved in these institutional systems that utilised both public and private personnel in this operation (see chapters 5 and 6) [Pavis d'Escurac, 1976; Remesal, 1991; Sirks, 1991]. The redistributive mechanism is especially suitable for long-distance exchange since no profits are expected from the transactions except those obtained by the producers and transporters. Therefore merchandise can be carried to more remote places because the effect of transport cost are less onerous.

The regular supply of distant armies was always a problem before the transport revolution. This was not all the necessary foodstuff could be acquired locally in a hostile environment

[Whittaker, 1989]. A redistributive system was one of the answers to this difficulty [Fortescoe, 1923; Corvisier, 1976][5], and this was put into practice by the Romans [Whittaker, 1989a, 64-65].

The volume of Dressel 20 amphora concentrations in either Rome [Rodríguez-Almeida, 1984] or the frontier areas [Remesal, 1986] indicates the action of a redistributive system. The requirement of a steady supply of Baetican olive-oil necessitated the direct intervention of the State through this mechanism[6]. The system takes the form of a military supply, though other authors ascribed it to a late institution (i.e. *annona militaris*) [Remesal, 1986]. The redistributive system conferred a stability on the production areas, transporters and recipients, and established a preferential allocation of goods. In archaeological terms, these preferential allocations give rise to high concentrations of artifacts in places that no other economic mechanism could have ever resulted in.

The redistributive system played a key role in Roman economy since it partially merged the exchanges between a number of regions under a single political authority [Wallerstein, 1974; Woolf, 1990a]. It was an important driving force of commerce, though not the only one, other mechanisms being involved as well.

Redistributive systems reduced the circulation of money between provinces because a number of the commodities mobilised took the form of taxes in kind. The effect of this on long-distance exchange may have favoured the integration between regions [Wallenstein, 1974, 392], though the model core-periphery cannot be based on market exchange and monetization [Hopkins, 1980].

7.3.3 Market exchange: its influence in Roman economy

Market exchange refers to the reciprocal movement of goods taking place between sides under the constraints of a price making system [Polanyi, 1957c]. Price fluctuation is believed to have moved supply and demand to a position of equilibrium that integrated consumption and production [Neale, 1957]. Participants in a market exchange attempt to obtain the maximum benefits from a transaction with minimal risks [Jevens, 1871; Walras, 1874-77; Pareto, 1909]. The market system was thought to be the unique universal mechanism of exchange [Jongman, 1991],

[5] Delays in payments (i.e. asientos) and even advances (i.e. socorros) obliged to create an institution known as proveedor de viveres for the supply of bread, clothes, arms and medicines for the Spanish army in the reign of Felipe II [Corvesier, 1976, 78-79].

[6] Fluctuations in olive-oil supply can be inferred from statistics of XVIII-XX centuries [Nadal, 1978].

but empirical evidence refutes this.

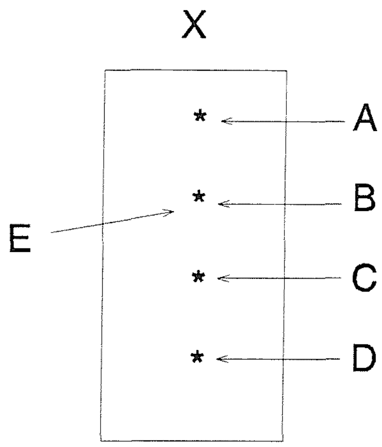

Figure 93 Diagram identifying market exchange.

The figure 93 represents a typical market transaction where producers (A-D), directly or through traders, bring goods to a market (X), in order to sell them to consumers (E). Market structures although present at local level in Roman times (see chapter 1, 4 and 5) [Frayn, 1993; Carreras, 1994a] contained features characteristic for long-distance exchange. Problems of communication and transport in antiquity have been already stressed. These limited the integration of markets and knowledge of fluctuations in prices [Polanyi, 1957b; Finley, 1985; Harris, 1993a]. Both features are fundamental to any proper market system. Thus the Roman market mechanism for long-distance exchange was curtailed and limited to highly valued commodities, the prices of which remained relatively stable [Hodges, 1982]. Furthermore, the volume and regularity of Roman long-distance market exchange may have been another feature that differed from the modern practice [Hopkins, 1978; Finley, 1985]. Although archaeological evidence reveals the extensive influence of a possible market exchange [Fulford, 1989b; 1992], it is rather difficult to gauge the volume of commerce.

Long-distance market exchange implied the existence of a strong social framework in antiquity, as also evident in later periods too (see chapter 6) [Pounds, 1974; Curtin, 1984]. Strategies to minimize the risk of unstable demand aimed to create areas of control, and this required the effective support of strong social bonds. Monopolies and oligopolies were the result of these strategies and these limited the scope of a really free market.

As Garnsey [1983, 128] suggests, even the State influenced the balance in the Roman market operating either as part of the system [Jongman and Halstead, 1989] or through other mechanisms. The coercive power of a central authority can result in amendments to the market system rules, whenever the market alone fails[7]. The degree of State interference can modify the mechanism as a whole, creating directly or indirectly, alternative systems [Lipsey, 1963]. National protectionism, monopolistic political trade and colonialism were common State methods of mediation in the long-distance market, which affected relationships between competitors and the nature of price fixing mechanisms. Polanyi [1957b; 1977] defined this kind of market exchange as an administrative or treaty trade, viewing the central authorities as simple players in the transaction.

Nevertheless, the coercive power the State has over its own community and other societies makes it more than a simple participant. Trading nations historically owed too much to their monopolistic practices and intimidation tactics. For instance, Venice normally used preferential treaties and naval forces to keep control of the Mediterranean in the XVIth century [Aymard, 1966; Ball, 1977] as the Dutch government did through the VOC and WIC companies [Boxer, 1965; Curtin, 1984]. Portuguese and Spanish monopolistic practices in their commerce with America [Lang, 1975; Curtin, 1984] or the same practice used by England with India [Chaudhuri, 1978; Curtin, 1984] reveal the difficulties of long-distance commerce and how they were eventually overcome by altering free market rules. European coercion in transcontinental commerce was the protection cost paid to keep monopolies [Curtin, 1984, 136-151; Lane, 1966]

The Roman State also intervened in long-distance market exchange not only with other societies but also within its own Empire. It favoured particular citizens, regions and provinces which could not have held such positions in a proper free market. Despite common citizenship, some production areas and traders were placed in better positions by the action of the central authority. Market exchange cannot therefore be considered the mechanism regulating this commerce. Other alternatives need to be defined.

With regard to amphorae and the distribution of other archaeological artifacts there is sufficient documentation of normal market exchange patterns in Roman Britain [Hodder and Orton, 1976; Carreras, 1994a]. Depending on the volume and distance involved, some amphorae indicate the commerce in luxurious items that never necessitated any public mediation [Fulford, 1989b; 1992]. Transport costs modelled their distributions in the past as they do nowadays [Haggett, 1965; Dicken and Lloyd, 1990] in an attempt to increase their marginal profit. However, other patterns suggest the influence of public decisions in what can be interpreted as exceptions to the normal

---

[7] Modern economies are concerned chiefly with how and when governments must intervine in markets [Sugden, 1986].

market behaviour. Under the constraints of transport and information, the market exchange system was not an efficient mechanism in long-distance commerce. On a lower scale, marketing operated satisfactorily in the GraecoRoman world, but distance imposed its own conditions.

7.3.4 Market interventionism: changing the rules

Free market exchange is even today a theoretical concept that does not exist in the real world. A pure market system should have its own feedback mechanism for regulating imbalances. In fact, the market system often fails in everyday life, hence central authorities have to intervene [Sugden, 1986]. The degree of State intervention can create alternative exchange mechanisms, the outcomes of which can hardly be compared to a normal exchange system. Furthermore, this exchange mechanism can be put in the same level of a market system, but its structure is completely different [Martínez-Veiga, 1990; Gómez-Crespo, 1993]. This kind of structure can be called market interventionism and is characterised by the introduction of economic legislation that substantially alters a market behaviour. Polanyi [1957b; 1977] realised the effect of State involvement in commerce when he defined his concept of an administrative or treaty trade, but the principle goes far beyond the State's direct participation in exchange.

A central authority can enforce by coercion a series of laws which may benefit single production areas, group of traders or destination zones. The legislation, therefore, can modify supply and/or demand and, above all, the price fixing mechanism of the existing market. In a world economy, national custom duties were the most common practice for favouring local productions over foreign competitors by assuring a minimal market. They prevented the disappearance of local crafts and industries by artificial means. Other laws can benefit a single production region barring the distribution of other goods, and even production in other locations. Besides this, some legislation facilitates the long-distance distribution of commodities by obliging carriers to include them as a portion of their cargoes[8]. Central interference always benefitted a part of the population while another part suffered the consequences.

Intervention in market exchange could result from taking risks with long-distance commerce requiring a minimal securities. Early Empires (e.g. Babylon, Egypt) [Curtin, 1984] frequently resorted to market intervention to ensure that a regular supply of necessary goods reached distant lands. Likewise, modern Empires (e.g. Venice, Genoa, Portugal, Spain, Holland, England) [Wallerstein, 1974; 1981; Curtin, 1984] guaranteed their long-distance transfers and commerce by establishing laws defending monopolies, which were implemented by force. The structure of this

[8] In the second half of the XVIII century A.D. one third of the Spanish fleet to Indies was reserved for carrying local wines despite the potential revenues of other higher-valued goods [Braudel, 1979c; Garcia-Fuentes, 1980].

interventionism mechanism deriving from a market exchange can be observed in the following diagram (figure 94).

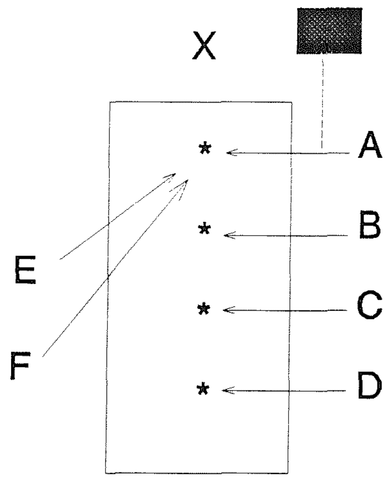

Figure 94 Diagram identifying market interventionism.

The direct intervention of the State in the distribution of commodities from A favours its consumption by E and F over other competitors (B-D) within a market (X). Following this principle, monopolistic areas and trade companies were the answer to transoceanic exchange in the last centuries [Chaunu, 1959; Boxer, 1965; Lang, 1975; Braudel, 1979c], when a world system seems to have been in place [Wallestein, 1974; 1981]. However, the Roman economy constituted a world Empire with a unique State for all its citizens [Woolf, 1990a]. Direct intervention of the State in economic affairs was evident in the supply of grain. Not only did the State act as a distribution agent but it also controlled prices and acted as a free agent in the market [Rickman, 1980a; 1980b; Garnsey, 1983; 1988; Jongman and Halstead, 1989]. State interference reduced price indexes, limited speculation and famines, but distorted the structure of the corn market. On the one hand, *aediles* were responsible for the regulation of prices (i.e. *annona macelli*), first for grain and later, for other foodstuffs [Frayn, 1993, 124]. On the other, the Emperor himself could fix prices on special occasions such as when food shortages ocurred. Suetonius (Tib. 34.1) records how Tiberius asked the Senate to regulate prices in the market as well as to limit the activities of foodshops and restaurants [Seager, 1972, 141; Frayn, 1993, 61].

The Diocletian's Price Edict of A.D. 301 is another good example of economic regulations affecting the behaviour of a market. This limited the maximum price of a substantial number of goods [Lauffer, 1971; Giacchero, 1974; Rouché, 1989]. Differences in price according to the origin of the product indicate potential imbalances in demand, and modify the proportional presence of each competitor saleable goods in the market. However, Diocletian's reforms never achieved their goals and were doomed to failure because of further speculation (Lactantius, On the Deaths of the Pers. vii).

At least two Edicts from Domitian (Suetonius Dom. vii.2; xiv.5; Stace Silves iv.3.11-12; Phylos. Vita Apoll. vi.42; Vit. Soph. 580) attempted to protect wine growing in Italy by curbing provincial production. It is difficult to assess how these might have affected the distribution of amphora-borne commodities. The increasing volume of Gaulish amphorae at that time seems to have been a cause not a consequence of the introduction of these laws [Tchernia, 1986a]. However, the testimony of later imports of Italian Dressel 2-4 in the Western provinces [Panella, 1989; 1992; Desbat and Savay-Guerraz, 1990; Arthur and Williams, 1992] may perhaps have been influenced by changes in the legislation.

On the other hand, redistributive systems based on the public purchase of commodities might have indirectly favoured some production zones, since they had an important regular buyer of a portion of their output, the State, which could reduce risks and costs in the distribution of the remaining goods. In other words *annonae* and the military supply system secured the sale of a large part of the production, permitting a more flexible sale price for the remaining merchandise, so that they became more competitive within a market exchange system. The long-distance trade in Baetican and North-African olive-oil received special privileges only because of the fact that most of the production was consumed by the State, facilitating a reduction in the cost of its production. State intervention through the redistributive system generated higly organized production units that were always more cost-efficient than those of their competitors [Bain, 1968; Peacock, 1982; Dicken and Lloyd, 1990].

Direct or indirect interferences by the Roman State in the diverse economic cycles produced unexpected results in the market mechanism. Although some mediation is always expected in any market system, the influence of the Roman State was determinant in the supply of some staples, creating an alternative exchange mechanism of its own. Market interventionism was simply required when a minimum volume of imports needed to be secured in a place, and redistributive systems were not considered suitable. Subsidized trade[9] or protectionism [Tchernia, 1986a; Whittaker, 1989a] were other manifestations of the same system that simply changed the rules of the game.

[9] Discrimination in trade for political reasons (e.g. former colonies) can constitute a kind of subsidized exchange [Lipsey, 1963; Hindley, 1974].

7.3.5 Parasitic exchange: abuses of public networks

Another market mechanism variant consists of the use of public networks for the movement of goods without full payment of transport fees. This single mechanism can be defined as parasitic exchange since commodities assume privileged positions in long-distance commerce by the abuse of State services. In this case, transport costs are not an obstacle to long-distance exchange because goods produced at a distance do not include any added value due to transportation. The effect of using public networks is equivalent to the position of imports where local production in the areas of destination, altering the whole price fixing mechanism again.

The structure of this mechanism is described in figure 95 where public and private goods (A) are transported together until they reach their destination regions. Once goods arrive at this point, State commodities were allocated through redistributive networks (B) whereas private merchandise gained access to local markets (X) sometimes competing in better conditions than local produce (D-E).

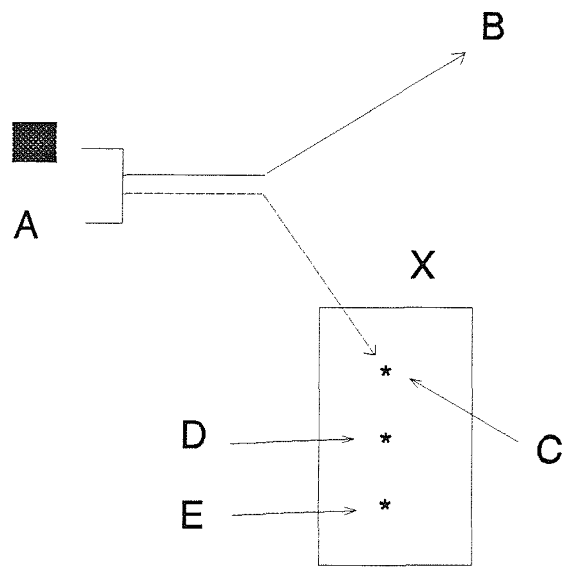

Figure 95 Diagram identifying parasitic exchange.

The trade companies of modern Empires (i.e. Dutch, English, Spanish, Portuguese) combined the transportation of fiscal and private merchandise under monopolistic laws [Curtin, 1984]. Although some of these commodities did not face any local competition, taking advantage of the public networks was the only means of reaching distant markets and remaining at affordable prices.

The Roman economy owes part of its dynamism in long-distance commerce to the existence of this mechanism. Middleton [1979; 1983] was the first to note the role of public networks in facilitating the movement of goods towards frontier areas.

> *"... a close link between the necessary movement of bulk goods in support of the standing garrisons of Gaul and entrepreneurial activity. This latter, long distance trade, was dependent, indeed parasitic, upon official supply lines, and was almost certainly directed to the needs of the military market which was the goal of these supply lines. " [P.Middleton, 1979, 81]*

Parasitic trade was sometimes permitted by the State in order to entice shippers and merchants to transport public cargoes within its redistributive system. Similar to allowances (Dig. 50.6.6.3; 50.6.6.8; Sueto. Clau. 18.4), combining private interests with public transport facilitated the movement of numerous commodities to faraway provinces. Archaeologically, many shipwrecks document the combination of fiscal and private cargoes [Parker, 1992a]. These are interpreted as evidence of parasitic trade [Garnsey and Saller, 1987]. It was not always the State that bestowed privileges on transporters, but they were taken for granted. Thus the State had to establish some conditions for the investment of a portion of their fortunes in public shipping (Dig. 50.6.6.8) or punish abuses of the system such as not taking the shortest route (CJ 11.2.5, 409) [Sirks, 1991].

More often shippers and merchants combined their public obligations with private interests without permission to use the redistributive system in this way [Depeyrot, 1991]. Public controls were the answer to these abuses as documented by painted inscriptions on Dressel 20 or Egyptian papyri. In Egypt, boats transporting public goods along the river Nile were checked to avoid tampering with cargoes on route and normally they carried sealed samples for inspection by officials (P.Oxy 2125; 708), who demanded billets and receipts in any transfer (P.Oxy 2670). The attainment of free transport was one of the commonest crimes recorded in Roman Egypt (Select Papyri 211, 221; P.Lond 1171; ILS 214; SB 4226; OGIS 609) [Lewis, 1983].

The combination of private and public transport whether permitted or not, completely altered long-distance commerce. Parasitic trade can be considered as a simple variant of a market exchange mechanism but it yielded completely different outcomes. Again, market exchange façade hides an alternative mechanism unrecognized by the authorities, since it only benefitted a few [Martínez-Veiga, 1990; Gómez-Crespo, 1993]. The involvement of public transport may explain the distribution of low-valued goods such as fine wares or lamps [Harris, 1980; Pucci, 1983; Middleton, 1983] in distant markets. In this context, the proportion of samian ware in Britain can be linked to the public supply of Dressel 20 amphorae (see chapter 4). This mechanism favoured the loading of low-valued goods at calling ports on route to the frontier provinces. Therefore samian ware loaded in the fiscal ships destined for Britain should have arrived in that province with a limited added value incurred through the cost of transport fees, so that it could compete in ideal conditions with local products [Marsh, 1981].

Amphora-borne commodities could also benefit from the exploitation of public networks, and in fact, this is a possible interpretation of some patterns of distribution (see chapter 6). Olives, fish-sauce and wine amphorae shared holds with official cargoes destined for Rome and frontier areas [Parker, 1992a]. High concentrations of Haltern 70s and amphorae bearing Spanish fish-sauce in Britain probably indicate how sharing transport with Dressel 20 vessels may have favoured their access to distant markets.

Parasitic trade changed relationships between the main competitors in a market. Reduced transport costs lifted spatial barriers in the movement of goods. This was essential in long-distance market exchange. The result of this mechanism is documented by a multitude of archaeological distribution patterns that can hardly be explained by any other type of exchange. The Roman economy resorted to parasitic trade for long-distance commerce of low-valued goods, which otherwise, would have never undertaken such long journeys.

7.3.6 Exchange mechanisms: a conclusion

The previous section introduced an alternative theoretical framework for discussing the different types of exchange that were in operation in antiquity. Some of these exchange systems are especially relevant for understanding the long-distance movements of goods, which could not be fully explained in terms of either substantivist or formalist models. Two alternative mechanisms or variants of the market system have been defined here and named as market interventionism and parasitic trade. The former can be associated with changes affecting a market system through the interference of a central authority which altered the equilibrium of forces between competitors. The latter recognized how conveying goods through public networks with almost no payment could also umbalance the relationships between rivals accessing the same market.

7.4 Conclusions

The present chapter has attempted to discuss theoretical issues with reference to the Roman economy on the basis of amphorae evidence examined in this research. As empirical data provided a means of testing and revising former conceptual frameworks, the argument focused on how long-distance exchange could be viewed through these vessels. It seems clear from the current experience that amphorae are exemplary potential contributors to the analysis of distant exchange. First of all, they are indicators of the scale of the commerce which covered broad areas, in some cases of large volumes of low-valued commodities. However, with the exception of redistributive systems, there are no signs of complementarity between production and consumption areas, which is another characteristic of an economy at scale. Therefore Roman structure cannot be considered to have been a fully integrated economy at scale.

The degree of monetization in Roman exchange is also discussed in the context of the mismatches in proportions of ceramics and coins found in many settlements. These suggest that some ceramics were obtained through redistributive mechanisms and barter, without direct intervention of money. Thus, models that imply the existence of a highly monetized economy must be used with caution since current evidence suggests a completely different picture. As regards to the city as a consumer centre, amphora evidence cannot shed much light on this point because imbalances in terms of their densities in city and countryside may be due to hierarchies of markets, consumption patterns and strategic reasons. Consequently, they are not good indicators of relationships between urban and rural communities.

In contrast, amphora evidence appears to be fundamental in reconstructing the kinds of exchange mechanisms responsible for the long-distance movement of merchandise. The empirical evidence from Roman Britain necessissated a thorough revision of the theoretical types of exchange defined. Alternative mechanisms were suggested as frameworks for classifying particular amphora distributions that could not be fitted into any previous models of exchange. In this context, amphorae records constitute a significant contribution to the theoretical interpretation of Roman economy.

8. FINAL CONCLUSIONS

The thesis reaches its final stage and it is time to consider whether the targets put forward at the outset have been achieved. In general, it can be said that the present research answers to some degree some questions but opens new ones to debate. Trade has been examined from different angles with the aim of understanding better this complex activity in Roman times. In this sense, it is believed that the research has improved the general knowledge of it.

Although Roman Britain as a research area was a limited scope, it supplied a wide range of information due to the particular features of this province. Nevertheless, a complete analysis of long-distance exchange requires investigations of other regions and provinces in a way that their information can be a complement and be compared with the present data. At least, the data collected in this thesis remains an useful background for further research. It was quantified by diverse methods with the intention that it could be employed, updated and challenged in the future. As long as the information remains valuable, it confers continuity on a research that still requires more contributions.

Despite the fact that the data established a limit to the possible inferences, it supplied new economic frameworks for the interpretation of settlements and the province as a whole to be compared with other sources. It looks like more general and particular questions can be addressed in this way, pushing back the boundaries of archaeological interpretation further. The quantitative methods, standardization practices and sampling strategies are responsible for this improvement in the data quality, of which the present one is only an example.

With regard to the material, the investigation only enhanced particular aspects of some amphora typologies such as formal changes, date ranges and distributions. The reduced quantities of amphorae in Roman Britain compared to other provinces imply that this information may be easily obtained in other regions. Nevertheless, this province has contributed so far enormously in the typological research.

In contrast, the present thesis provides original methods for studying amphora distributions. The employment of statistical analyses, contour maps and simulation models simplify the interpretation of their distribution, broadening the possible applications of this data. It is hoped that the thesis has managed to demonstrate the suitability of these methods and their potential in the future. Of course, they need to be improved and made adequate to archaeological requirements, but this development is also a scope for research. The particular applications of these methodological tools in the present investigation illustrate how economic inferences can be obtained from archaeological data.

The spatial and economic analysis of amphora distributions began at the place of recovery. At this point, amphorae were examined according to their function and possible reuse inferred through their archaeological context. Above all, the final deposition was linked to the patterns of rubbish refuse, which is intimately associated to a settlement growth. Three case studies illustrated how this information could enhance the knowledge on the evolution of individual cities. However, amphorae are not the only economic indicator, hence similar analyses can be made with other archaeological artifacts.

This point becomes evident in the study of local settlements on the basis of three different archaeological objects (i.e. amphora stamps, samian, coins). Coincidences in proportions of samian, amphorae and coins suggested a highly monetized economy and possible transport links between the two ceramic artifacts. Nevertheless, some discrepancies in proportions of coins and amphorae, mainly in military sites, revealed an alternative economic organization. Although both economic systems, civil and military, lived together they exhibited completely contrasting frameworks.

These two frameworks were fully documented in the study of amphora distributions at provincial level, where every type was individually analyzed. Amongst the distributions, the one of Dressel 20s stands out for their military pattern that contrasts with the remaining amphora types. In general terms, the provincial distributions evidenced the existence of two economic systems and networks (i.e. civil and military). The civil framework, identifying a probable market system, was studied according to its transport infrastructure, population distribution and purchasing power. Therefore, the Roman province was defined in an alternative way, which matched most amphora distributions.

Since there were minor variations between the theoretical and observed distributions, some of them were thought to identify distinctive eating habits. Thus, the patterns were interpreted according to the amphorae contents as result of cultural behaviours (i.e. native vs Roman). Moreover, other discrepancies appeared to be due to changes over time that affected the internal organization and routes of access, which were discussed from a historical perspective.

With regard to the military framework identifying a probable redistributive system, it was studied according to the political and military organization of the province. In addition, amphora stamps allowed us to compare Dressel 20 imports in different provincial centres as well as the supply between provinces such as Gaul, Germany and Britain. The statistical results obtained imply a highly organized structure with a possible regional and provincial specialization of suppliers. This complex structure of long-distance exchange can hardly be understood without an examination of the whole economic cycle.

Therefore, the movement of amphorae was reconstructed from their original provinces up to the ports of Roman Britain. In fact, the principal request was why amphorae reached so distant places, something which required the interpretation of the reasons behind traders' involvement in exchange. Although material gain was considered the basic reason for traders' involvement in exchange, there were particular shadows in every sphere of activity.

The Romans recognized a hierarchy of traders with distinct areas of influence and competences that started in a basic division of local and interprovincial merchants. Notwithstanding the particular strategies at local level, the real challenge of long-distance exchange was the separation between origin and destination that interprovincial traders needed to overcome.

It was thought that the distance between origin and destination represented by a series of particular transcontinental routes was easily understood from an economic perspective. The transport infrastructure, cost and time consumption and the potential risks outlined the principal characteristics of each continental route under Roman conditions. In the end, these economic constraints served to analyse the possible strategies of Roman traders and how they affected amphora distributions. Amongst these strategies, some do not correspond to economic aspects, but social and anthropological responses.

In addition to the role of traders, long-distance commerce was linked to the exchange mechanisms through which it took place. The two economic systems recognized in the amphora distributions, market and redistribution, were modelled in GIS. The aim of such simulation analyses, which are original contributions of this research, was the interpretation of amphorae distributions as the result of one of these economic systems. In fact, the final contour maps created by the simulations identify most amphora distributions in the province. Thus, the two exchange mechanisms acted as economic frameworks in the allocation of some commodities. Nevertheless, there are some exceptions that question the suitability of these two mechanisms for all the cases. This evidence compels us to reconsider if the actual theoretical framework for exchange mechanisms does not accommodate the present amphora testimonies.

One of the possible contributions of this research is the revision of the theoretical framework of long-distance exchange with the inclusion of two new types or variants. Still open to debate are their particular characteristics and material manifestations, but they represent a more valid answer to the existing empirical data. In a sense, the discussion of new theoretical models means that the present research has improved the initial knowledge about trade in Roman times, so that the previous structure no longer identified all the new observations. But the debate is far from over, and it is expected that further research in archaeology and history will provide a more accurate picture of Roman exchange.

BIBLIOGRAPHY

Abad-Casal L. (1976) *El Guadalquivir, via fluvial romana*. Sevilla.

Abrams PH. and EA.Wringley (eds)(1978) *Towns in Societies*. Cambridge.

Achard G. (1991) *La comunication à Rome*. Paris.

Adam JP. (1984) *La construction Romaine*. Paris.

Adam RM. (1974) Anthropological perspectives on ancient trade. *Current Anthropology* 15, pp.239ff

Akalu A. and P.Stjernquist (1988) To what extent are ethnographic analogies useful for the reconstruction of Prehistoric exchange. In B.Hardth et alii (eds), pp.5-14.

Alarçao A. (1976) Les Amphores. *Fouilles de Conimbriga vi, Ceramiques diverses et verres*, Paris.

Alarçao A. (1986) *Roman Portugal*. Warwinster.

Alarçao A. (1990) Introduçâo ao estudo laboratorial das ânforas lusitanas. In A.Alarçao and F.Mayet (eds), pp.253-258.

Alarçao A. and F.Mayet (eds) (1990) *Les amphores Lusitaniennes*. Paris.

Alderferder MS. (1981) Computer simulation in Archaeology: an introductory essay. In JA.Sabloff (ed), pp.11-49.

Alexandre-Baudoux J. (1987) Nouvelles données sur les importations en Gaule du Nord-Est: les amphores Gauloises de la villa de Saint-Ulrich (Moselle). *Rev. Arch. de l'Est et de Centre-est* 38, pp.85-91.

Alföldi A. (1950) Die ethische Grenzscheide am römischen Limes. *ESHG* 8, pp.37-50.

Alföldi A. (1952) The moral barrier on Rhine and Danube. In E.Birley (ed) *Roman Frontier Studies*. Durham (1949), pp.1-16.

Alföldy G. (1974) *Noricum*. London.

Allan J. (1983) Some post-medieval documentary evidence for the trade in ceramics. In P.Davey and R.Hodges (eds), pp.37-45.

Allen JR. (1982) Market place exchange as indirect distribution: an iranian example. In JE.Ericson and TK.Earle (eds), pp.83-102.

Allen KM., SW.Green and EBW.Zubrow (eds)(1990) *Interpreting space: GIS and Archaeology*, London.

Allen KM. (1990) Modelling Early historic trade in the Eastern Great Lakes using Geographical Information Systems. In KM.Allen et alii (1990), pp.319-329.

Allmar A. and P.Dissard (1887-8) *Trion. Antiquités découvertes en 1885, 1886 et antérioreurement on quartier de Lyon dit de Trion*. Lyon.

Almagro M. (1955) *La Necrópolis de Ampurias*. Vol.II, Barcelona.

Alonso W. (1964) Location Theory. In J.Friedman and W.Alonso (1964), pp.78-106.

Amar G. and B.Liou (1984) Les estampilles sur amphores du Golfe de Fos. *Archaeonautica* 4, pp.145-212.

D´Amato C. (1993) La medicina. Col. *Vita e Costumi dei Romanai Antichi* n.15. Rome.

D'Ambrosio B., T.Mannoni and S.Sfrecola (1989) La provenienza delle anfore romane di alcuni contesti italiani. Possibilità e limiti del metodo mineralogico. *MEFRA* 114, pp.269-284.

Amouretti MC. (1986) *Le Pain et l'huile dans la Gréce antique*. Paris.

Amouretti MC. (1990) Vin, vinaigre, piquette dans l'antiquité. In *Vin et Histoire*, pp.75-88.

Amphores Romaines et Histoire économique: dix ans de recherche, Rome. MEFRA 114 [1989].

Analisi Marxista e Società Antiche (1978). Rome.

Anderson JD. (1992) *Roman military supply in North-east England*. BAR Brit.Ser. 224, Oxford.

Anderson BL. and AJH.Latham (eds)(1986) *The Market in History*. London.

André J. (1980) La notion de pestilentia à Rome. *Latomus* 39, pp.3-16.

André J. (1981) *L'alimentation et la cuisine à Rome*. Paris.

André P. (1989) Les amphores cannelées du Ier siècle dans le France de l'Ouest. *MEFRA* 114, pp.588-589.

Andreau J. (1974) *Les affeires de Monsieur Jucundus*. Rome.

Andreau J. (1976) Pompéi: enchères, foires et marchés. *Bull.Soc.Arch.Fran.* pp.104-127.

Andreau J. (1978) Financiers de l'aristocracie à la fin de la République. In E.Frézouls (ed), pp.47-62.

Andreau J. (1987) *La vie financière dans le Monde Romain: les mètiers des monieurs d'argent*. Paris.

Andreau J. (1989a) La cité antique et la vie économique. *Opus* vi-viii, pp.175-186.

Andreau J. (1989b) El liberto. In A.Giardina (ed), pp.201-226.

Angle M., S.Bruschini, C.Caneva, O.Colazingari, R.Dotarelli, MF.Fulgenzi, A.Gianni, C.Giardino, G.Gabbi and A.Guidi (1988) Il computer nello strato: integrazione di tecniche informatiche alla ricerca archaeologica. *Archeologia e Informatica, Quaderni dei Dialoghi di Archeologia* 4, pp.83-124.

Annequin J. (1982) M.F. et l'esclavage antique. *La Pensée* 227, pp.36-47.

Annequin J. (1983) Capital marchand et esclavage dans le procés de transformation dans les societés antiques. *MEFRA* 67.

Annequin J. (1985) Formes de contradiction et rationalité d'un systeme économique. Remarques sur l'esclavage dans l'Antiquité. *La Pensée* 244, pp.45-63.

Anonymous (1911) Kastell Zugmantel. *Saalburg Jahrbuch* ii, pp.23-55.

Anthony IE. (1968) Excavations at Verulan Hills Field, St.Albans 1963-4. *Hertfordshire Arch.* 1, pp.9-50.

Appadurai A. (ed) (1986a) *The social life of things. Commodities in cultural perspective*. Cambridge.

Appadurai A. (1986b) Introduction: commodities and the politics of the value. In A.Appadurai (ed), pp.3-63.

Aquilue J., R.Mar, JM.Nolla, J.Ruiz de Arbulo and E.Sanmarti (1984) *El Forum Romà d'Empuries. Excavacions de l'any 1982*, Barcelona.

Aranegui-Gascó C. (1987) La producción de ánforas Dressel 2-4 de Sagunto. In *El vi a l'antiguitat*, Badalona, pp.100-104.

Aranegui-Gascó C. and R.Enguix (1977) *Taller de ánforas romanas de Oliva*. Valencia.

Aranegui-Gascó C., M.López-Piñol and M.Orfila-Pons (1991) Anforas tardorromanas en el Grau Vell (Saguntum, Valencia). *Saguntum* 24, pp.117-127.

Aranegui-Gascó C. and JA.Gisbert (1992) Les amphores à fond plat de la Péninsule ibérique. In *Les Amphores en Gaule*, pp.101-111.

Arcelin P. and Ch.Arcelin-Pradelles (1981) Un problème de méthode: choix des dennées quantitatives en céramologie. *Dossier d'Archaéologie Méridionale* 4, pp.189-192.

Ariel DT. (1990) *Excavations at the City of David, 1978-85, Jerusalem.* QEDEM Monog. 30.

Armand-Calliat L. and G.Viallefoud (1958) Amphores et monnaies romaines trouvées en 1956 à Autun. *Rev. Arch. de l'Est et du Centre-Est* 9, pp.275-278.

D'Arms JH. (1974) Puteoli in the Second century of the Roman Empire: a social and economic study. *JRS* lxiv, pp.104-124.

D'Arms JH.(1980) Rifflessioni antiche e moderne sulle attività commerciali a Roma nei secoli II e I a.C. In JH.D'Arms and EC.Kopff (eds), pp.77-90.

D'Arms JH. (1981) *Commerce and Social standing in ancient Rome.* Cambridge.

D'Arms JH. and EC.Kopff (eds)(1980) The Seaborne Commerce of Ancient Rome: Studies in Archaeology and History, *MAAR* 36, Rome.

Arnold B.(1992) *Balleterie gallo-romaine sur le lac de Neuchâtel.* Arch.Neuchâtelaise n° 12 and 13, vol.i and ii. Saint Blaise.

Arnold DE. (1985) *Ceramic theory and cultural process.* Cambridge.

Arnold III PJ. (1990) The Organization of refuse disposal and ceramic production within contemporary Mexican households. *American Anthropologist* 92, pp.915-932.

Arnott ML. (ed) (1975) *Gastronomy. The anthropology of food and food habits.* La Hague.

Arqueologia de las Ciudades Modernas superpuestas a las Antiguas. Madrid (1985). Zaragoza, 1983.

Arroyo-Bishop D. and MT.Lantada Zarzosa (1993) Formalising recording structures for GIS site and intra-site data analysis and interpretation. In *GIS Conference.*

Arruda AM., J.Frade and J.Travassos (1990) *Amphores lusitaniennes: typologie, production, commerce.* Paris.

Arteaga O. (1985a) Los hornos de Manganeto. Almagate Bajo (Málaga). *Not. Español de Arqueología* 23, pp.175-194.

Arteaga O. (1985b) Excavaciones arqueológicas en el Cerro del Mar (Campaña del 1982). *Not. Español de Arqueología* 23, pp.195-233.

Arthur P. (1982a) Amphorae production in the Tripolitanian Gabel. *Lybian Studies* 13, pp.61-72.

Arthur P. (1982b) Roman amphorae and the Ager Falernus under the Empire. *PBSR* 50, pp.22-33.

Arthur P. (1989) On the origins of the Richborough Form 527. *MEFRA* 114, pp.249-256.

Arthur P. and G.Marsh (eds)(1978) *Early fine wares in Roman Britain.* BAR Brit.Ser. 57, Oxford.

Arthur P. and M.Vechio (1985) Scavi nel complesso dei Gerolomini. In *Napoli Antica.* Naples, p.421.

Arthur P. and DF.Williams (1992) Campanian wine, Roman Britain and the third century A.D. *JRA* 5, pp.250-260.

Auerbach F. (1913) Das Gesetz der Bevölkermgskonzentration. *Petermann's Mitteilungen* 59, pp.74-76.

Austin M. and P.Vidal-Naquet (1972) *Economies et societés en Grèce Ancienne.* Paris.

Aymard M. (1966) *Venise, Raguse et le commerce du blé pendant la seconde moitié du XVIe siècle.* Paris.

Baccini Leotardi P. (1989) *Nuove testimonianza sul commercio dei marmi in età imperiale.* Rome.

Bacon JP. and A.(1982-3) L´oppidum de Monfau à Magalas, Hérault (1963-1979). *Archéologie en Languedoc* 5, pp.61-114.

Badian E. (1972) *Publicans and Sinners: Private Enterprise in the service of Roman Republic*. Oxford.

Bagnall RS. (1993) *Egypt in Late Antiquity*. Princeton.

Bagwell PS. (1974) *The transport revolution from 1770*. London.

Bahn RE. (1981) The raw and the cooked: the material culture of a modern supermarket. In RA.Gould and MB.Schiffer (eds) *Modern Material Culture*. New York, pp.183-196.

Bailey GN. (1987) Breaking the time barrier. *Arch.Review from Cambridge* 6, pp.5-20.

Bain JS. (1968) *Industrial Organization*. New York.

Baker G. and J.Lloyd (eds)(1991) *Roman Landscapes*, London.

Baldacci P. (1967) Negotiatores e mercatores frumentarii nel periodo imperiale. *RIL* 101, pp.273-291.

Baldacci P. (1969) Alcuni aspetti dei commerci dei territori Cisalpini. *Atti Centro Studi e Documentazione sull'Italia Romana* 1, pp.7-50.

Baldacci P. (1972a) Le principali correnti del commercio di anfore romane nella Cisalpina. Importazioni ed esportazioni alimentari nella pianura padana centrale dal III sec. a.C. al I sec. d.C. In A.Forni (ed) *I Problemi della Ceramica Romana di Ravenna della Valle Padana e dell'Alto Adriatico*. Bologna, pp.103-131.

Baldacci P. (1972b) Importazione Cisalpine e produzione apula. *MEFRA* 10, pp.7-28.

Balil A. (1983) Un bodegón en mosaico hallado en Marbella (Málaga). *Baetica* 6, pp.159-170.

Balsdon JPVD. (1979) *Roman and aliens*. London.

Ball JN. (1977) *Merchants and merchandise*. London.

Ballarini G. (1989) Leguminose e strutture nutrizionali mediterranae. In O.Longo and P.Scarpi (eds), pp.285-294.

Barbé L. (1991) *Curs d'Introducció a l'Economia*. Barcelona.

Barker G. (1985) *Prehistoric farming in Europe*. Cambridge.

Barnea I., O.Iliescu and C.Nicolescu (1971) *La Cultura Byzantine en Rommanie*. Bucharest.

Barnish SJB. (1987) Pigs, Plebeians and Potentes: Rome's Economic Hinterland, c.350-600 AD. *PSBR* 55, pp.157-185.

Barnish SJB. (1989) The transformation of the Classical cities and the Pirenne debate. *JRA* 2, pp.385-400.

Barral-Altet X. (1982) Transformaciones de la topografia urbana a la Hispània cristiana durant l'antiguitat tardana. In *II Reunió d'Arqueologia Paleocristiana Hispana, Montserrat* (1978). Barcelona, pp.105-132.

Barran J. (1983) *Les hommes et leurs aliments. Esquisse d'une histoire écologique et ethnologique de l'alimentation humaine*. Paris.

Barret J., A.Fitzpatrick and L.Macinnes (eds)(1989) *Barbarians and Romans in North-West Europe*. BAR Int.Ser. 471, Oxford.

Bartel B. (1980) Colonialism and cultural responses: problems realted to Roman provincial analysis. *World Archaeology* 12.1, pp.11-26.

Bass GF. (1972) News report. *IJNA* 3, pp.335-338.

Bass GF. (1981) *Serçe Limani 1979*. II Kazi Sonuçlari Toplantisi (Ankara) 15-17, pl.vi-viii.

Bass GF. and F.Van Doormick (1982) *Yassi Ada. Vol.II. A seventh-century Byzantine shipwreck.*

Bassett K. and RJ.Chorley (1971) An experiment in terrain filtering. *Area* 3, pp.78-91.

Batalle P. and B.Visauta (1986) *Métodos estadísticos aplicados*. Barcelona.

Batterman N. and A.Locker (1982) The sauce of the Thames. *London Archaeologist* 8, pp.204-207.

Bates W. (1983) A spatial analysis of Roman Silchester. *Scottish Arch. Review* 2(2), pp.134-143.

Bats M. (1989) *Vaiselle et alimentation à Olbia de Provence, mòdeles culturels et catégories céramiques*. Revue d´Arch. Narbonnaise, suppl. 18, pp.249-264.

Bats M. (1993) Les Gaulois à table: hiératisme et hiérarchies. *Mélanges P.Lévêque* t.7, pp.15-20.

Baudoux J. (1988) Le commerce des amphores dans le Nord-Est de la Gaule: premier bilan. *Ktema* 13, pp.95-108.

Baudoux J. (1990) *Les amphores d'Alsace et de Lorraine: contribution a l'histoire de l'economie provinciales sous l'Empire Romain*. PhD Thesis. University of Strasbourg.

Baudoux J. (1992a) Production d´amphores dans l´Est de la Gaule. In *Les Amphores en Gaule*, pp.59-69.

Baudoux J. (1992b) La circulation des amphores dans le Nord-Est de la France. In *Les Amphores en Gaule*, pp.163-169.

Baudoux J. and J.Schweitzer (1993) La céramique d'Illzach (Haut-Rhin). Fouilles de 1968 à 1978. *Revue Archéologique de l'Est et du Centre-Est* 44, pp.143-160.

Bebko W. (1971) Les épaves antiques du Sud de la Corse. *Corsica* 1-3. Bastia.

Becathi G. (1961) *Scavi di Ostia. Mosaici e pavimenti marmorei* 4. Rome.

Bechtel H. (1952) *Wirtschaftsgeschichte Deutschlands vom 16 bis 18 Jahrhundret II.*

Becker C. (1986) Note sur un lot d'amphores regionales du Ier siècle ap.JC à Lyon. *Figlina* 7, pp.250-260.

Becker C. (1989) Production régionale d'amphores de type Dressel 2-4 et de type Dressel 1. *MEFRA* 114, pp.578-579.

Becker C., C.Constantin, A.Desbat, L.Jacquin and JP.Lascoux (1986) Le dépôt d'amphores Augustéen de la rue de la Favorite à Lyon. *Figlina* 7, pp.65-89.

Becker C., C.Constantin and F.Villedieu (1989) Types d'amphores en usage à Lugdunum du Ier au Vi siècle. *MEFRA* 114, pp.656-659.

Begley V. and R.Daniel de Pura (eds)(1991) *Rome and India. The Ancient Sea Trade*. Princeton.

Begley V. (1993) New Investigations at the Port of Arikamedu. *JRA* 6, pp.93-108.

Beltrán-Lloris M. (1970) *Las ánforas romanas en España*. Zaragoza.

Beltrán-Lloris M. (1977) Problemas de la morfología y del concepto histórico-geográfico que recubre la noción tipo. *MEFRA* 32, pp.97-132.

Beltrán-Lloris M. (1978) *Cerámica Romana: tipología y clasificación*. Zaragoza.

Beltrán-Lloris M. (1983) El aceite en Hispania a través de las ánforas: la concurrencia del aceite itálico y africano. In JM.Blázquez and J.Remesal (eds), pp.515-550.

Beltrán-Lloris M. (1990) *Guía de la cerámica romana*. Zaragoza.

Bellhouse RL. and GGS.Richardson (1975) The Roman site at Kirkbride, Cumberland. *Trans. Cumberland* 75, pp.58-90.

Bells JA. (1987) Simulation modelling in Archaeology: reflections and trends. *European Journal of Operational Research* 30, pp.243-245.

Bénant C. and JP.Jacob (eds)(1986) *La Terre Sigillée Gallo-Romaine*. DAF 6. Paris.

Bencivenga C. (1987) Sulla diffusione delle anfore tardo-imperiali in Campania: il complesso di Gricignano (Caserta). In *El vi a l'Antiguitat*, pp.395-400.

Benoit F. (1961) *L'épave du Grand Congloué à Marseilles.* Gallia Supp. 14.

Benoit F. (1962) Nouvelles épaves de Provence. *Gallia* 20, pp.147-176.

Bérard F. (1984) La carrière de Plotius Grypus et le ravitaillement de l´armée en campagne. *MEFR* 96, pp.259-324.

Berchem D. van (1937) L´annone militaire dans l´Empire romain au IIIè siècle. *Mem.Soc.Nat.Ant. de la France* 10, pp.117-202.

Berchem D. van (1939) *Les distributions de blé et d´argent à la plèbe romaine sous l´Empire*. Geneve.

Berchem D. van (1977) L´annone militaire est-elle un mythe?. In *Armée et fiscalité dans le monde antique*. Paris, pp.331-339.

Berchem D. van (1982) *Les routes et l´histoire*. Laussanne.

Berchem D. van (ed.) (1991) *Nourrir la Plèbe*. Bassel, 1989, Kassel.

Berdan FF. (1989) Trade and markets in precapitalist states. In S.Plattner (ed), pp.78-107.

Bergier JF. (ed)(1989) *Montagnes, fleuves, forêts dans l´histoire*. St.Katharinen.

Berke S. (1990) *Römische Bronzegefässe und terra sigillata in der Germania Libera*. Münster.

Berthault F. (1988) Amphore a fond plat et vignoble a Bordeaux au Ier segle. *Aquitania* 6, pp.157-166.

Berthault F. (1990) Le vin et la vigne dans le Bordeleis aux Ier siècle av.JC et Ier siècle ap.JC. *Caesadorunum* xxiv, 25-30.

Berthault F. (1991) Observations sur le matériel amphorique de l'officine du Champ Cloux à Saintes. *SFECAG, Actes du Congres de Cognac*, pp.53-58.

Berthault F. (1992) Production d´amphores dans la région bordelaise. In *Les Amphores en Gaule*, pp.93-100.

Bertier J. (1988) L´animal dans la diététique hippocratique. In *L´animal dans l´alimentation humaine*, pp.83-90.

Bertrand E. (1992) Les amphores d'un vide sanitaire de Lyon du 1er s. à Lyon (Saint-Just). *SFECAG, Actes du Congres de Tournai*, pp.265-277.

Bertucchi G. (1982) Fouilles d'urgence et ateliers do potiers sur la Butte des Carmes à Marseille. Les amphores. *Rev.Arch. de Narbonnaise* 15, pp.135-160.

Bertucchi G. (1992) *Les amphores et le vin de Marseille*. Rev.Arch.Narbonnaise Suppl. 25.

Bettini M. (1989) Del fritto e d´altro. In O.Longo and P.Scarpi (eds), pp.39-44.

Bezeczky T. (1984) Roman amphorae from Zalalövo. In *Mitteilungen der Archäeologischen Instituts der Ungarischen Akademie der Wisserschaften* 12/13 (1982/83), pp.153-166.

Bezeczky T. (1987) *Roman amphorae from the Amber route in Western Pannonia*. BAR Int.Ser. 386, Oxford.

Bezeczky T. (1989) Roman amphorae along the amber route. *MEFRA* 114, pp.645-647.

Bezeczky T. (1991) Stamps and inscriptions: the case of Pannonia amphorae. *Specimia Nova Universitatis*

Quinqueclesiasis, pp.177-190.

Biddle M. (1975) Excavations at Winchester 1971, tenth and final interim report. Part 1. *Ant.Journal* 55, pp.96-126.

Biddle M. (forth.) *Excavations at Winchester from 1970 to 1980.*

Biddle M. and DM.Hudson (1973) *The Future of London Past.* RESCUE, Worcester.

Bidwell PT. (1979) *Exeter Archaeological Reports, vol.1: The Legionary Bath-House and Basilica and Forum.* Exeter.

Bidwell PT. (1985) *The Roman fort of Vindolanda at Chesterholm, Northumberland.* English Herit. Arch. Rep. 1, London.

Binford LR. (1962) Archaeology as anthropology. *American Antiquity* 28, pp.217-225.

Binford LR. (1972) *An Archaeological Perspective.* New York.

Binford LR. (1981) Behavioural Archaeology and the Pompei premise, *Journal of Anthropological Research* 37, pp.195-208.

Binford LR. (1982) The archaeology of place, *Journal of Anthropological Archaeology* 1, pp.5-31.

Binford LR. (1983) *In Pursuit of the Past.* London.

Bingen J. (1984) Una dédicace de marchands palmyreniens à Coptos. *CE* 59, pp.355-358.

Bird J. (1977) African red slip ware in Roman Britain. In J.Dore and K.Greene (eds), pp.269-278.

Bird J. (ed)(1978) *Collectiana Londinensis: studies presented to Ralph Merrifield.* London.

Birley AR. (1979) *The people of Roman Britain.* London.

Birley AR. (1981) *The Fasti of Roman Britain.* Oxford.

Birley AR. (1989) Vindolanda: new writing tablets 1986-1989. In VA.Maxfield and MJ.Dobson (eds), pp.65-72.

Birley E. (1961) *Roman Britain and the Roman army.* Kendal.

Biro KT. and IS.Fejes (1993) GIS approaches to multiperiod unilevel sites: a case-study from South East Huangary. In *GIS Conference.*

Biswell S., J.Evans, V.Gaffney and P.Leach (1993) GIS and intra-site analysis: a case study of the Roman small town at Shepton Mallet, Somerset. In *GIS Conference.*

Blackman BJ. (ed)(1973) *Marine Archaeology*, Proc. 23rd Symposium Colston Res. Roc., London.

Blagg TFC. and AC.King (eds)(1984) *Military and Civilian in Roman Britain.* BAR Brit.Ser. 136, Oxford.

Blagg TFC. and M.Millett (eds)(1990) *The Early Roman Empire.* Oxford.

Blake H. and P.Davey (1983) *Guidelines for processing and publication of medieval pottery from excavations*, Directorate of Ancient Monuments and Historic Buildings, Occ.Paper 5.

Blalock HM. (1981) *Social Statistics*, Singapore (2nd ed.).

Blankholm HP. (1991) *Intrasite Spatial Analysis in Archaeology.* Aarhus.

Blánquez-Pérez J. (1982) *L'archéologie sous-marine en Espagne.* Histoire et Archéologie, Dossiers 65.

Blasco C., J.Baena, V.Remero and J.Espiago (1993) A GIS application for studying Bell-Beaker sites of Madrid, Spain: a site catchment analysis. In *GIS Conference.*

Blaszkiewicz P. (1992) La place de la Normandie dans l´Empire Romain de la fin de l´indépendance jusqu´au Vè siècle de notre ère. In M.Wood and F.Queiroga (eds), pp.35-62.

Blaug M. (1968) *Economics theory in retrospect.* Cambridge.

Blázquez-Martínez JM. (1978) *Historia económica de la Hispania romana.* Madrid.

Blázquez-Martínez JM. (1981) *Mosaicos romanos de Córdoba, Jaén y Málaga.* Corpus de Mosaicos de España iii. Madrid.

Blázquez-Martínez JM. (ed)(1980) *Producción y Comercio del Aceite en la Antigüedad.* I Congreso, Madrid.

Blázquez Martínez JM. and J.Remesal Rodríguez (eds)(1983) *Producción y Comercio del Aceite en la Antigüedad.* II Congreso, Madrid.

Blázquez JM., MP.Garcia Gelabert and G.López Monteagudo (1991) El transporte marino de ánforas en los mosaicos romanos. *Gerión Anejos* III, pp.323-328.

Blázquez Martínez JM., J.Remesal Rodríguez and E.Rodríguez Almeida (1994) *Excavaciones en el Monte Testaccio (Roma). Campaña de 1989.* Madrid.

Bloemers JHF. (1983) Acculturation in the Rhine/Mouse Basin in the Roman period: a preliminary survey. In R.Brandt and J.Slofstra (eds), pp.159-209.

Bloemers JHF. (1988) Native populations and Romans. IN RFJ.Jones et alii (eds), pp.51-54.

Bloemers JHF. (1990) Lower Germany: plura consilio quam vi Proto urban developments and integration of native society. In T.Blagg and M.Millett (eds), pp.72-86.

Bloice BJ. (1971) Note. *London Archaeologist* 1, pp.250-251.

Bolkestein H. (1958) *Economic Life in Greece´s Golden Age.* Leyden.

Bølviken E., E.Helskog, K.Helskog, IM.Holm-Olsen, L.Solheim and R.Bertelsen (1982) Correspondence Analysis: an alternative to Principal Components. *World Archaeology* 14, pp.41-60.

Boeck A. (1817) *Die Staatsbraushaltung der Athener.*

Bogaers JE. (1971) Nehalennia en de epigrafische gegevens. *Deae Nehalenniae Gids bij de tentoonstelling Nehalennia de Zeeuwse godin, Zeeland in de Romeinse tijd, Romeinse monumenten nit de Oosterschelde*, pp.33-43.

Bogaert R. (1968) *Banques et banquiers dans les cités grecques.* Paris.

Bogaert R. (1988) Les opérations en nature des banques en Egypte gréco-romaine. *Anc.Soc.* 19, pp.213-224.

Bogard Ph. and M.Cavalier (1994) Recent research on Richborough 527 amphorae. In *Roman Amphorae. Problems of Identification and Methodology*, London.

Boissavit-Camus B., M.Fabioux and N.Le Masne de Chermont (1990) *Poitiers.* Aquitania VI Suppl., pp.129-133.

Bökönyi S. (1988) Animal breeding on the Danube. In CR.Whittaker (ed) *Pastoral economies in Classical Antiquity.* Cambridge, pp.171-176.

Bolin S. (1958) *State and Currency in the Roman Empire to 300 A.D.* London.

Bonifay M. (1986) Observations sur les amphores tardives à Marseille d'après les fouilles de la Bourse (1980-84). *Rev. Arch. de Narbonnaise* 19, pp.269-305.

Bonifay M., G.Conges and M.Leguilloux (1989) Amphores tardives (Ve-VIIe siècle) à Arles et à Marseille. *MEFRA* 114, pp.660-663.

Bonnamour L. (1975) Le port gaulois et gallo-romain de Chalon. *Mem.Soc.d´Hist.et d´Arch. de Chalon* 45, pp.63-65.

Bonnard L. (1913) *La navigation intériure de la Gaule à l'époque Gallo-romaine*. Paris.

Bonneau D. (1985) Apercu sur l'origine de la richesse des villes antiques en Egypte d'apres la documentation papyrologique. In Ph.Leveau (ed), pp.233-246.

Bonsor G. (1931) *The archaeological expedition along the Guadalquivir 1889-1901*. New York.

Boon GC. (1975) Segontium 50 years on: I, a Roman stave of larchwood and other unpublished finds, mainly of organic materials, together ith a note on late barracks. *Arch.Cambrensis* 124, pp.52-67.

Boone JL. (1987) Defining and measuring midden catchment. *American Antiquity* 52, pp.336-345.

Bordeau L. (1984) *Histoire de l'alimentation*. Paris.

Bös M.. (1958) Aufschriften auf rhinischen Trinkgefässen der Römerzeit. *Kölner Jahrbuch für Vor-und Frühgeschichte* 3, pp.20-25.

Boxer CR. (1965) *The Dutch Seaborne Empire 1600-1800*. London.

Boube J. (1973-5) Marques d'amphores découvertes à Sala, Volubilis et Banasa. *Bull. d'Arch. Marocaine* 9, pp.163-225.

Bound M. (1992) A Roman wreck (Pélichet 47) off the island of Montecristo, Italy - preliminary report. *IJNA* 21.4, pp.329-336.

Bouscaras A. (1974) Les marques sur amphores de Port-la-Nautique. *Cahiers d'Arch. Subaquatique* 3, pp.163-225.

Bove FJ. (1981) Trend-surface analysis and the Lowland Classic Maya Collapse. *American Antiquity* 46, pp.93-112.

Bove L. (1984) *Documenti di operazioni finanziarie dall'archivio dei Sulpici*. Naples.

Bowman AK. (1986) *Egypt after the Pharaohs*. London.

Bowman AK. and JH.Thomas (1983) *Vindolanda: The Latin writing-tablets*. Britannia Mono.Ser. 4.

Bowman AK. and JH.Thomas (1987) New texts from Vindolanda. *Britannia* xviii, pp.125-142.

Bowman AK., JD.Thomas and JN.Adams (1990) Two letters from Vindolanda. *Britannia* xxi, pp. 33-52.

Boyer R. (1986) Conserve d'olives dans deux amphores trouvées dans les fouilles de la Bourse à Marseille. *Gallia* 44, pp.229-233.

Boyer R. and PA.Février (1971) Épave romaine à Villepey près de Fréjus (Var). *Atti de III Congresso Int. di Arch. Sottomarina. Barcelona (1961)*, Bordighera, pp.159-166.

Bradley R. (1970) The excavation of a Beker settlement at Belle Tout, East Sussex, England. *Proc. of Preh. Soc.* 36, pp.312-379.

Bradley R. (1971) Trade competition and artifact distribution. *World Archaeology* 2, pp.347-352.

Bradley R. and MG.Fulford (1980) Sherd size in the analysis of occupation debris. *Bullet. Univ.London Institute of Archaeology* 17, pp.85-94.

Brandt R. (1983) A brief encounter along the Northern Frontier. In R.Brandt and J.Slofstra (eds), pp.129-145.

Brandt R. and J.Slofstra (eds)(1983) *Roman and Native in the low countries: spheres of interaction*. BAR Int.Ser. 184, Oxford.

Brandt R. , BT.Groenewanett and KL.Kvamme (1992) An experiment in archaeological site location: modelling in the Netherlands using GIS. *World Archaeology* 24 (2), pp.268-282.

Branch AE. (1979) *The Elements of export practice*, London.

Braudel F. (1949) *La Méditerranée et le Monde méditerranéen à l´époque de Philippe II*. Paris.

Braudel F. (1973) *Capitalism and material life 1400-1800*. London.

Braudel F. (1979a) *Civilisation et Capitalisme s.xvè-xviiiè siècle: Le temps du monde*. vol. I. Paris.

Braudel F. (1979b) *Civilisation et Capitalisme s.xvè-xviiiè siècle: Les jeux de l´exchange*. vol. II. Paris.

Braudel F. (1979c) *Civilisation et Capitalisme s.xvè-xviiiè siècle: Les structures du quotidien. Le possible et l´impossible*. vol. III. Paris.

Breeze DJ. (1974a) The organization of the career structure of the inmunnes and the principales of the Roman Army. *Bonner Jahrbücher* 174, pp.245-292.

Breeze DJ. (1974b) The career structure below the centurionate during the Principate. *ANRW* II.1, pp.435-451.

Breeze DJ. (1982) *The Northern frontiers of Roman Britain*. London.

Breeze DJ. (1984) Demand and Supply on the Northern frontier. In R.Miket and C.Burgess (eds), pp.264-286.

Breeze DJ. (1989) The Northern Frontiers. In M.Todd (ed), pp.37-60.

Breeze DJ. and B.Dobson (1987) *Hadrian´s Wall*. London.

Breglia L. (1950) Circolazione monetale et aspetti di vita economica a Pompei. In A.Maiuri (eds), pp.41-59.

Brentchaloff D. (1980) L´atelier du Pauvadou, une officine de potiers flaviens à Fréjus. *RAN* 13, pp.73-106.

Brentchaloff D. (1988) L'amphore a saumure de type Frejus-Leuzbourg. *Actes du Congres d'Orange*, pp.179-185.

Brentchaloff D. and M.Picon (1990) Amphores de Frejus-Leuzbourg: origine contrôlée. *Actes du Congre de Mandeure-Mathay*, pp.225-230.

Breuer J. (1918) Tonneaux de l'époque romaine découverts en Hollande. *Rev. d'études Anciennes* xx, pp.249-252.

Brogan O. and DJ.Smith (1984) *Ghirza. A Lybian settlement in the Roman period*. Tripoli.

Brothell D. and B. (1969) *Food in antiquity*. London.

Brothell D. and AT.Sandison (1967) *Diseases in Antiquity*. London.

Browning I. (1974) *Petra*. London.

Brukner O. (1981) *Rimska keramika u Jugoslavenkam delu provincije donje Panonije*. Belgrade.

Bruhl A. (1964) Circonscription de Lyon, Lyon, La Solitude. *Gallia* 22, pp.413.

Bruhms H. (1989) La cité antique de Max Weber. *Opus* vi-viii, pp.43-52.

Brulet R., F.Laubenheimer and F.Vilvarder (1992) Les amphores de Braives, un vicus de Gaule Belgique. In *Les Amphores en Gaule*, pp.171-177.

Brun JP. (1986) *L´oleiculture antique en Provence. Les huileries du départament du Var*. RAN suppl. 15, Paris.

Brun JP., P.Lecacheur and M.Pasqualini (1992) Les amphores du port antique de Toulon (Telo Martius). In *Les Amphores en Gaule*, pp.123-131.

Brusić Z. (1980) Neki problemi providbe kvarnericen. In *Pomorstvo Losinja i Cresa. Otocki Ljetopis Cress-Losinj 3 (Mali Losinj)*, pp.157-171.

Bücher K. (1893) *Die Entstehung der Volkswirtschaft*. Berlin.

Buchi E. (1971) Banchi di anfore romane a Verona. Note sui commerci Cisalpini. In *Il Territori Veronesi in Età Romana*. Verona, pp.531-637.

Buck DJ. and DJ.Mattingly (eds)(1985) *Town and Country in Roman Tripolitania*. BAR Int.Ser. 274, Oxford.

Buckland PC. (1976) *The environmental evidence from Church Street sewer*. London.

Burford A. (1960-1) Heavy transport in Classical Antiquity, *EcHR* 13, pp.1-18.

Bürge A. (1987) Fiktion und Wirklichkeit: Soziale und rechtliche Strukturen des römischen Bankwesens. *ZSS*, 144, pp.465-558.

Burham BC. and HB.Johnson (eds)(1979) *Invasion and Response: the case of Roman Britain*, BAR Brit.Ser. 73, Oxford.

Burham BC. and J.Kingsbury (eds)(1979) *Space, Hierarchy and Society: Interdisciplinary studies in Social Area Analysis*. BAR Int.Ser. 59, Oxford.

Burnham BC. and J.Wacher (1990) *The small towns of Roman Britain*. London.

Burroughs PA. (1986) *Principles of Geographical Inforamtion Systems for Land resources Assesment*, Oxford.

Butzer KW. (1982) *Archaeology as human ecology*, Cambridge.

Cagnat R. (1882) *Les Impôts indirects chez les Romains*. Paris.

Calderini A. (1933) *Le associazioni professionali in Roma antica*. Milano.

Callender MH. (1948a) Las ánforas del Sur de España y sus sellos. *Cuader.de Historia Prim.* 2, pp.139-142.

Callender MH. (1948b) Corbridge Amphora stamps. *AA*(4) 27, pp.264-286.

Callender MH. (1965) *Roman Amphorae*, Oxford.

Callner J. (1988) Three fundamental prespectives for the study of trade and exchange in Northern Europe in the second half of the first millenium A.D. In B.Hardth et alii (eds), pp.261-270.

Callu JP. (1969) *La Politique monetaire des Empereurs Romains de 238 à 311*. Paris.

Callu JP., JP.Morel, R.Rebuffat and G.Hallier (1965) *Thamusida*, vol.i. Paris.

Calmes R. (1973) L'épave I du Cap Benat. *Cah. Arch. Subaquatique* 2, pp.137-145.

Calza G. (1915) Il piazzale delle corporazioni e la funzione commerciale di Ostia. *BCAR* 43, pp.178-206.

Calza G. (1940) *La necropoli del Porto di Roma nell'Isola Sacra*. Rome.

Cambi N. (1975-6) Spanish amphorae found near Split. *Archeološki Veskuit* 26, p.120.

Cambi N. (1983) Le anfore Dressel 20 nella Yugoslavia. In JM.Blázquez and J.Remesal (eds), pp.363-389.

Cambi N. (1989) Anfore romane in Dalmazia. *MEFRA* 114, pp.311-337.

Cameron A. (1993) *The Mediterranean World in Late Antiquity AD 395-600*. London.

Camilli EL. and JI.Ebert (1992) Artifact reuse and recycling in continuos surface distributions and implications for interpreting land use pattern. In J.Rossignol and L.Wandsnider (eds), pp.113-136.

Capel H. (1981) *Filosofía y Ciencia en la Geografía Contemporánea*. Barcelona.

Carandini A. (ed)(1977) *L'Instrumentum Domesticum di Ercolano e Pompei nella Prima Etá Imperiale*, Rome.

Carandini A. (1979) *L'anatomia della scimia. La formazione economica della società prima del capitale*. Torino.

Carandini A. (1980a) Roma imperialistica: un caso di sviluppo precapitalistico. In JH.D´Arms and EC.Kopff (eds), pp.11-20.

Carandini A. (1980b) Il vigneto e le ville del fondi di Settefinestre nel Ager Cosano: un caso di produzioni agricola per il mercato transmarino. In JH.D´Arms and EC.Kopff (eds), pp.1-10.

Carandini A. (1983) Pottery and the African economy. P.Garnsey et alii (eds), pp.145-162.

Carandini A. (1986) Il mondo della tarda antichità visto attraverso le merci. In A.Giardina (ed), pp.3-20.

Carandini A. and S.Setris (1979) *Schiavi e padroni nell´Etruria romana: la villa di Settefinestre dallo scavo alla mostra*. Bari.

Carandini A. and C.Panella (1981) The trading connections of Rome and Central Italy in the late second and third century: the evidence of the Terma del Nuotatore excavations, Ostia. In A.King and M.Herring (eds) *The Roman West in the Third century*. BAR Int.Ser.109. Oxford, pp.487-503.

Carbonell-Solé E., J.Folch-Soler and J.Martínez-Tomás (1991) Noticia de les excavacions al jaciment ibèric i romà de Can Feu (Sant Quirze del Vallés). Campanyes 1987-88. *Limes* 1, pp.150-153.

Carcopino J. (1942) *La vida cotidiana en Roma*. Buenos Aires.

Cardoso G. (1978) Anforas romanas uo Museo do Mar (Cascais). *Conimbriga* xvii, pp.63-78.

Carnana ID. (1994) Carlisle: Excavation of a Section of the annexe ditch of the first Flavian fort, 1990. *Britannia* 23, pp. 133-140.

Carney TF. (1975) *The shape of the past: Models and Antiquity*. Lawrence.

Carrazé F. (1972) Le Gisement A de la Jeaunne-Gaude. *Cah.d'Arch.Subaquatique* 1, pp.75-87.

Carre MB. (1985) Les amphores de la Cisalpine et de l'Adriatique au début de l'Empire. *MEFRA* 97, pp.207-245.

Carre MB. and MT.Cipriano (1985) Le anfore. Saggi do Scavo a Sevegliano. *Aquileia Nostra*, pp. 6-24.

Carre MB. (1993) L'épave à dolia de Ladispoli (Etrurie méridionale). Etude des vestiges de la coque. *Archeonautica* 11, pp.167-172.

Carrera C. et alii (1988) *Trabajos prácticos de Geografía Humana*. Barcelona.

Carreras-Monfort C. (1991) *The Transport Network in Roman Britain: two simulation models in SPANS and PASCAL*. MSc Dissertation, University of Southampton.

Carreras-Monfort C. (1994a) *Una reconstrucción del comercio en cerámicas: la red de transportes en Britannia. Aplicaciones de modelos de simulación en PASCAL y SPANS*. Barcelona.

Carreras-Monfort C. (1994b) Haltern 70: a review. In *Roman Amphorae. Problems of identification and methodology*. London.

Carreras-Monfort C. and DF.Williams (1993) Spanish olive-oil trade in Late Roman Britain: Dressel 23 amphorae from Winchester. *J.Roman Pottery Studies* vi.

Carreras-Monfort C. and SJ.Keay (forth.) Amphorae. In T.Potter (ed) *Excavations at Stonea*.

Carreras-Monfort C. and DF.Williams (forth.) Roman Amphorae from Leicester. *J.Roman Pottery Studies* vi.

Carrié JM. (1975) Les distributions alimentaries dans les cités de l'Empire romain tardif. *MEFRA* 87.2, pp.995-1101.

Carrié JM. (1989) El soldado. In A.Giardina (ed), pp.121-160.

Cartledge P. (1983) Trade and Politics. In P.Garnsey et alii (eds), pp.1-15.

Carver MOH. (1985) Theory and Practice in Urban Pottery Seriation. *Journal of Anthropological Science* 12, pp.353-366.

Carver MOH. (1987) The nature of the urban deposits. In J.Schofield and R.Leech (eds), pp.9-26.

Casey J. (1974) The interpretation of Romano-British site finds. In J.Casey and R.Reece (eds), pp.37-51.

Casey J. (ed)(1979) *The end of Roman Britain*. BAR Brit.Ser. 71, Oxford.

Casey J. (1980) *Roman coinage in Britain*. Aylesbury.

Casey J. (1992) The monetization of a third world economy: money supply in Britain in the first century A.D. In M.Wood and F.Queiroga (eds), pp.101-106.

Casey J. and R.Reece (eds)(1974) *Coins and the Archaeologist*. BAR Brit.Ser. 4, Oxford.

Casey J. and JL.Davies (1993) *Excavations at Segontium (Caernarfon) Roman fort, 1975-1979*. CBA Res.Rep. 90. London.

Casson L. (1971) *Ships and ancient seamanship in the ancient world*. Princeton.

Casson L. (1974) *Travel in the Ancient World*. London.

Casson L. (1980) The Role of the State in Rome´s grain trade. In JH.D´Arms and EC.Kopff (eds), pp.21-34.

Casson L. (1984) *Ancient trade and Society*. Princeton.

Casson L. (1989) *The Periplus Maris Erythraei*. Princeton.

Casson L. (1994) *Ships and seafaring in ancient times*. Cambridge.

Castle SA. (1978) Amphorae from Brockley Hill. *Britannia* 9, pp.383-392.

Cavalier M. (forth.) Richborough 527 at Punta San Francisco.

Caves RE. and RW.Jones (1977) *World trade and payments*. Boston.

Cerati A. (1975) *Caràctere annonaire et assiette de l'import foncier au Bas Empire*. Paris.

Champion TC. (ed)(1989) *Centre and Periphery*. London.

Chang KC. (1977) *Food in Chinese Culture. Anthropological and Historical perspectives*. New Haven.

Chaniotis A. (1988) Vinum Cretium excellens: zum Weinhandel Kretas. *MBAH* 7.1, pp.62-89.

Charles-Picard G. and J.Rougé (1969) *Textes et documents relatifs à la vie économique et sociale dans l´Empire Romain*. Paris.

Charlesworth MP. (1926) *Trade routes and commerce of the Roman Empire*. Chicago.

Charlin G., JM.Gassend and R.Lequément (1978) L'épave antique de la Baie de Cavalière (Le Lavandon, Var). *Archeonautica* 2, pp.9-93.

Chase PG. (1985) Whole vessels and sherds: an experimental investigation of their quantitative relationship. *Journal of Field Archaeology* 12, pp.213-218.

Chastagnol A. (ed)(1977) *Armées et fiscalité dans le monde antique*. Paris.

Chaudhuri KN. (1978) *The trading world of Asia and the English East India Company*. Cambridge.

Chaunu P. (1959) *Séville et l´Atlantique (1504-1650)*. Paris.

Cherry J., C.Gamble and S.Shennan (eds)(1978) *Sampling in contemporany British Archaeology*. BAR Brit.Ser.

50, Oxford.

Chevalier R. (1976) *Roman Roads*. London.

Chevalier R. (ed)(1983) *Présence de l´architecture et de l´urbanisme Romains*. Paris.

Chevalier R. (1988) *Voyages et déplacements dans l'Empire Romain*. Paris.

Chic-García G. (1978) Consideraciones sobre la navegabilidad del Guadalquivir en época romana. *Gades* I, pp.7-20.

Chic-García G. (1980) Acerca de un ánfora con pepitas de uva encontrada en la Punta de la Nao (Cádiz). *Bol. del Museo de Cádiz* 1, pp.37-42.

Chic-García G. (1981) El Estado y el transporte de las ánforas olearias béticas durante el alto imperio romano. *Gades* 7, pp.27-36.

Chic-García G. (1985) *La Epigrafía Anfórica de la Bética*. Seville.

Chic-García G. (1986) El comercio del aceite de la Astigi romana. *Habis* 17, pp.243ss.

Childe G. (1944) *Progress and Archaeology*. London.

Childe G. (1946) *Scotland before the Scots*. London.

Chisholm M. (1962) *Rural Settlement and Land Use*. London.

Chorley RJ. and P.Haggett (eds)(1967) *Models in Geography*. London.

Christaller W. (1933) *Die zentralen Orte in Süddenntschland: Eine ökonomischgeographische Untersuchung über die Gesetzmässigkeit der Verbreitung und Eutwicklung der Siedlungen mit städtischen Funktionen*. Jena.

Christaller W. (1937) *Die ländliche Siedlungsweise im Deutschen Reich und ihre Beziehungen zur Gemeindeorganisation*. Berlin.

Christol M. (1982) Les naviculaires d´Arles et les structures du grand commerce maritime sous l´Empire romain. *PH* 22, pp.5-14.

Cimna MR. (1981) *Richerche sulle società di publicani*. Milan.

Cioleck-Torella R. (1984) An alternative model of room function from Grasshopper Pueblo, Arizona. In HJ.Hietala (ed), pp.127-153.

Cipolla CM. (1956) *Money, price and civilization in the Mediterranen world*. Princeton.

Cipriano MT. and MB.Carre (1989) Production et typologie des amphores sur la côte adriatique de l'Italie. *MEFRA* 114, pp.67-104.

Clack PAG. (1982) The Norther Frontier: Farmers in the military zone. In D.Miles (eds), pp.377-402.

Clack PAG. and S.Haselgrove (eds)(1982) *Rural settlement in the Roman North*. Durham.

Clark G. (1952) *Prehistoric Europe the Economic Basis*. London.

Clark-Maxwell WG.(1899) The Roman towns in the Valley of Baetis between Cordoba and Sevilla. *Arch.Journal* 56, pp.245-305.

Clark C. and M.Maxwell (1967) *The Economics of Subsistence Agriculture*, London.

Clarke DL. (1968) *Analytical Archaeology*, London.

Clarke DL. (ed)(1977) *Spatial Archaeology*, Cambridge.

Clavel-Lévêque M. (1977) Imperialisme developpement et transicion: pluralité des voies et universalisme imperial romain. *La Pensée* 196, pp.10-27.

Clavel-Lévêque M. (1980) Analisi marxista e società antiche. *Labeo* 26, pp.390-401.

Clay P. and JE.Mellor (1985) *Excavations in Bath Lane, Leicester*. Leicester.

Cleary SE. (1981) *Towns and urbanization in Roman Britain: the evidence from outside the defences*. PhD thesis, University of Oxford.

Cleary SE. (1987) *Extra-mural areas of Romano-British towns*. BAR Brit.Ser. 169, Oxford.

Cleere H. (1977) The Classis Britannica. In DE.Johnson (ed), pp.16-19.

Cleere H. (1978) Roman Harbours in Britain South of Hadrian's Wall. In J.du Plat and H.Cleere (1978), pp.36-40.

Clemente G. (1983) Il plebiscito Claudio e le classi dirigenti romana nell´età dell´imperialismo. *Ktema* 8, pp.253-259.

Cliff AD. and JK.Ord (1973) *Spatial Autocorrelation*, London.

Cliff AD. and JK.Ord (1981) *Spatial Processes: Models and Applications*, London.

Cloppet C. (1989) Les voies romaines du Rhône au Rhin et dans l'Est de la Gaule: les sources écrites. *Ktema* 14, pp.95-104.

Combet-Farnoux B. (1980) *Mercure romain. Le culte public de mercure et la fonction mercantile à Rome de la République archaique à l´époque augustéenne*. Rome.

Cockle H. (1981) Pottery manufacture in Roman Egypt: a new papyrus. *JRS* 71, pp.87-97.

Coll R. and R.Járrega (1993) Anforas itálicas de época tardorromana en Hispania. Los hallazgos de Palmar Hotel (Premià de Mar, Barcelona). *AEA* 167-168, pp. 310-323.

Collingwood RG. (1937) Roman Britain. In T.Frank (ed).

Collingwood RG. and RP.Wright (1965) *The Roman inscriptions in Britain*. Oxford.

Colls D., R.Ettiene, R.Lequément, B.Liou and F.Mayet (1977) L'épave Port-Vendres II et le commerce de Bétique à l'époque de Claude. *Archaeonautica* 1.

Colls D. and R.Lequément (1980) L'épave Port Vendres II: nouveaux documents épigraphiques. In JM.Blquez (ed), pp.177-186.

Colls D., C.Descamps, M.Faure and C.Guérin (1985) The bronze black rhinoceros from Port-Vendres III. *Antiquity* 59, pp.106-112.

Colls D., R.Ettienne and F.Mayet (1988) Des tonneaux dans l'épave Port-Vendres III ?. *Cahiers d'Histoire* 33, pp.309-319.

Comas-Sola M. (1985) *Baetulo. Les àmfores*. Badalona.

Comas-Sola M. (1987) Un tipus d'àmfora Dressel 1 de producció laietana. *Jornades d'Arqu. Romana. Granollers.*

Comas-Sola M. (1991) Les amphores de M.PORCIVS et leur diffusion de la Léetanie vers la Gaule. *SFECAG, Actes du Congrès de Cognac*, pp.329-345.

Condamin J. and F.Formenti (1976) Recherches de trace d'huile d'olive et de vin dans les amfores antiques. *Figlina* 1, pp.143-158.

Congès G. and M.Leguilloux (1991) Un dépotoir de l'Antiquité tardive dans le quartier de l'Esplanade à Arles. *Revue Archéologique de Narbonnaise* 24, pp.201-234.

Contreras J. (1993) *La antropología de la alimentación*. Madrid.

Cook S. (1966) The obsolete "anti-market" mentality: a critique of the substantivist approach to economic anthropology. *American Anthropology* lxviii, pp.323-345.

Cooper MA. (1989) The definition and representation of space in Urban Archaeology, *Scottish Archaeological review* 6, pp.75-88.

Corbier E. (1986) Svalutazioni, inflecioni e circulazione monetaria del III secolo. In A.Giardina (ed), pp.489-ss.

Corbier M. (1974) *L´aerarium Saturni et l´aerarium militare*. Rome.

Corbier M. (1976) L´aerarium militaire. In *Armées et fiscalité dans le monde romaine*. Paris, pp.197-234.

Corder P. (1941) A Roman pottery kiln of the Hadrian-Antonine period at Verulamium. *Ant.Journal* 41, pp.221-298.

Corsi-Scilliano M. and B.Liou (1985) Les épaves de Tarraconaise à chargement d'amphores Dressel 2-4. *Archaeonautica* 5.

Cortés B. and R.Gabriel (1985) *Tarraco. Recull dades arqueològiques*. Tarragona.

Corvisier A. (1976) *Armées et sociétés en Europe de 1494 à 1789*. Paris.

Courtine RJ. (1969) *L´assassin est à votre table*. Paris.

Courtois L. and B.Velde (1978) Une amphore à grenat jaune du Latium à amathonte. *BCH* 102, pp.977-981.

Cowgill MGL. (1970) Some sampling and reliability problems in Archaeology. In *Archéologie et Calculateurs (Marseille, 1969)*, Paris, pp.161-171.

Cowgill MGL., JH.Atschul and RS.Sload (1984) Spatial Analysis in Teotihuacan: a Mesoamerican metropolis. In HJ.Hietala (ed), pp.154-195.

Crawford MH. (1970) Money and exchange in the Roman world. *JRS* lx, pp.40-48.

Crawford MH. (1974) War and Finance. *JRS* lxiv, pp.29-32.

Crawford MH. (1982) *La moneta in Grecia e a Roma*. Rome.

Crawford MH. (1984) *Coinage and money under the Roman Republic*. London.

Crawford MH. (ed)(1986) *L´imperio Romano et le structure economiche e sociale delle province*. Como.

Crawford MH. and J.Reynolds (1973) The Publication of the Prices Edict: a new inscription from Aezani, *JRS* lxv, pp.160-163.

Cribbs RLD. (1987) The logic of the herd: a computer simulation of archaeological herd structure, *Journal of Anthropological Archaeology* 6, pp.376-415.

Crummy P. (ed)(1984) *Excavations at Lion Walk, Balkerne Lane and Middleborough, Colchester, Essex*. Colchester Archaeological Report 3.

Crummy P. and R.Terry (1979) Seriation problems in the Urban Archaeology. In M.Millett (1979), pp.49-60.

Cruz-Cruz J. (1991) *Alimentación y cultura. Antropología de la conducta alimentaria*. Pamplona.

Cuadras CM., B.Echevarría, J.Mateo y P.Sánchez (1988) *Fundamentos de estadística. Aplicación a las Ciencias Humanas*. Barcelona.

Cucarzi M. (1993) GIS and archaeological prospection: the case of Oppido Mamertina. In *GIS Conference*.

Cunliffe BW. (1968) *Fifth Report on the Excavations of the Roman Fort at Richborough, Kent*.

Res.Rep.Soc.Ant.Lon. 23.

Cunliffe BW. (1971) *Excavations at Fishbourne 1961-69. Vol.II: The Finds.* Res.Rep.Soc.Ant.Lon. 27.

Cunliffe BW. (1978) *Iron Age communities in Britain.* London.

Cunliffe BW. (1988) *Greks, Romans and Barbarians.* London.

Cunliffe BW. and P.Davenport (1985) *The Temple of Sulis Minerva at Bath.* Oxford.

Cuntz O. (1929) *Itineraria Romana Volumen Prius Itineraria Antonini Augusti et Burdigalense.* Leipzig.

Curle I. (1911) *A Roman Frontier Post and its People, Newstead.* Glasgow.

Curtin PD. (1984) *Cross-cultural trade in world history.* Cambridge.

Curtis RI. (1979) The Garum shop of Pompei (i.12.8). *Cronache Pompeiana* 5, pp.5-23.

Curtis RI. (1984-6) Product identification and advertising on Roman commercial amphorae. *Ancient Society* 15-17, pp.209-228.

Curtis RI. (1989) Spanish Trade in Salted Fish products in the 1st and 2nd centuries AD. *IJNA* 17.3, pp.205-210.

Curtis RI. (1991) *Garum and Salsamenta.* Leiden.

Dalton G. (1975) Karl Polanyi´s analysis of long-distance trade and his wider paradigm. In JA.Sabloff and CC.Lamberg-Karlovsky (eds), pp.63-132.

Dancer JB. (1984) *Il triangolo culinario. La cucina come cultura.* Bologna.

Dange JA. (1981) *Le barbare. recherches sur le conception romaine de la barbarie et de la civilisation.* Latomus 176. Brussels.

Dangréaux B. and A.Desbat (1988) Les amphores sur l'axe Rhône-Rhin a l'époque d'Auguste. *Gallia* 45, pp.339-365.

Dangréaux B., A.Desbat, M.Picon and A.Schnitt (1992) La production d´amphores à Lyon. In *Les Amphores en Gaule*, pp.37-50.

Dannell GB. (1979) Eating and drinking in pre-Conquest Britain: the evidence of amphora and samian trading and the effect of the invasion of Claudius. In BC.Burham and HB.Johnson (eds), pp.177-186.

Dannell GB. and JP.Wild (1987) *Longthorpe II*, Britannia Mono. 8, London.

Darby WJ., P.Ghalioungui and L.Grivetti (1977) *Food: the gift of Osiris*, New York.

Dardaine S. and H.Pavis d´Escurac (1986) Le Baetis et son mánagement: l´apport de l´épigraphie (CIL II.1183 et 1180). *Ktema* 8, pp.307-315.

Daris S. (1988) Documenti minori dell´esercito romano in Egitto. *ANRW* II.10.1, pp.724-742.

Darwin C. (1888) *The Origin of Species.* London.

Davey P. and R.Hodges (eds)(1983) *Ceramics & Trade.* Sheffield.

Davidson WI. and JE.Harper (1972) *European Economic History I: The Ancient World.* London.

Davidson D. and M.Schackley (eds)(1976) *Geoarchaeology*, London.

Davies JC. (1973) *Statistical methods in research and production*, Edinburgh.

Davies R. and R.O'Keefe (1989) *Simulation Modelling with PASCAL*, London.

Davies RW. (1970) The Roman military medical service. *Saalburg Jahrbuch* 27, pp.84-104.

Davies RW. (1971) The Roman military diet. *Britannia* ii, pp.122-142.

Davies RW. (1989) *Service in the Roman Army*. Edinburgh.

De Boer WR. (1974) Ceramic longevity and archaeological interpretation: An example from the Upper Ucayali, Peru. *American Antiquity* 39, pp.335-343.

De Boer WR. (1984) The last pottery show: System and sense in ceramic studies. In SE.Van der Leeuvw and AC.Pritchard (eds), pp.527-568.

Dechelette J. (1904) Les fouilles du Mont-Beuvray de 1897 à 1901. *Mém. Soc. Eduenne* 33, p.83.

Dedet B. (1987) *Habitat et vie quotidienne en Languedoc au milieu de l´âge du fer*. Rev.Arch.Narb. Suppl. 17. Paris.

De Franciscis A. (1981) Il Tempio di Augusto. *Puetoli* IV-V, pp.129-132.

De Izarra F. (1993) *La navigation intérieure de la Gaule à l'époque romaine*. Paris.

De Laet SJ. (1949) *Portorium*. Bruges.

De Lagarde J. (1983) *Initiation a l´analyse de donées*. Paris.

Del Amo A. (1979) *Estudio crítico de la necrópolis Paleocristiana (Tarragona)*. Tarragona.

De la Peña JF. (1967) Alfares y marcas de ánfora del Valle Medio del Guadalquivir. *AEA* xl, pp.129-137.

Delathe RP. (1894) La mur à amphores de la Colline Saint Louis à Carthage. *BAC*, pp.89-119.

Delathe RP. (1907) Un secund mur à amphores découvert à Carthage. *Bull.Soc.Arch.Sousse*, pp.89-119.

De Light L. and PW.De Neeve (1988) Ancient periodic markets: festivals and fairs. *Athenaeum* 66, pp.391-416.

Deman A. (1987) Réflexions sur la navigation fluviale dans l'antiquité romaine. In T.Hackens and P.Marchetti (eds.), pp.79-106.

De Martino F. (1979) *Storia economica di Roma antica*. Firenze.

De Neeve PW. (1984) *Peasants in peril*. Amsterdamm.

Deniaux E. (1980) *Recherches sur les amphores antiques de Basse-Normandie*. Caen.

Deniaux E. (1989) La Normandie productice d'amphores ?. *MEFRA* 115, pp.586-587.

Deo SB. (1991) Roman trade: recent archaeological discoveries in Western India. In V.Begley and R.Daniel de Pura (eds), pp.39-45.

Depeyrot G. (1991) *Crises et inflation entre antiquité et moyen âge*. Paris.

De Robertis FM. (1981) *Il fenomeno associativo nel mondo romano*. Naples.

De Roche C.D. (1983) Population estimates from settlement areas and number of residences. *Journal of Field Archaeology* 10, pp.187-192.

De Ruyt C. (1983) *Macellum. Marché alimentaire des romaines*. Louvain-la-Neuve.

De Salvo L. (1992) *Economia privata e pubblici servizi nell´Impero Romano. I Corpora Naviculariorum*. Messina.

Desbat A. (1984) *Les fouilles de la rue des Farges*. Lyon.

Desbat A. (1987) Note sur la production d'amphores à Lyon au début de l'Empire. *SFECAG, Actes du Congres* *de Caen*, pp.159-166.

Desbat A. (1990) Les bons comptes fout les bons amis ou la quantification des ceramiques, *SFECAG, Maudeure-Mathay*, pp.131-134.

Desbat A. (1991) Un bouchon de bois du Ier s.après J-C recueilli dans la Saône à Lyon et la question du tonneau à l'époque romaine. *Gallia* 48, pp.319-336.

Desbat A. (1994) Imitations of Roman amphorae in Gaul. In *Roman amphorae. Problems of identification and methodology*, London.

Desbat A. and M.Picon (1986) Les importations d'amphores de Méditerranée Orientale à Lyon (fin du Ier siècle avant J-C et Ier siècle après). *BCH Supp.* xiii, pp.637-648.

Desbat A. and S.Martin-Kilcher (1989) Les amphores sur l'axe Rhône-Rhin à l'époque d'Auguste. *MEFRA* 114, pp.339-365.

Desbat A. and H.Savay-Guerraz (1990) Note sur la découverte d'amphores Dressel 2-4 italiques, tardives, à St.Romain-en-Gal. *Gallia* 47, pp.203-213.

Desbat A. and B.Dángreaux (1992) La distribution des amphores dans la région lyonnaise. Etude de deux sites de consommation. In *Les Amphores en Gaule*, pp.151-156.

Desbordes JM. and JP.Lomstrad (1990) *Limoges*. Aquitania VI Suppl., pp.66-76.

Desy P. (1989) *Les timbre amphoriques de l'Apulia républicaine. Documents per une histoire économique et sociale.* BAR Int.Ser. 554, Oxford.

Detsicas A. (ed)(1973) *Current Research in Romano-British coarse pottery*. CBA Res.Rep. 10. London.

Devijver H. (1989) *The Equestrian officers of the Roman Imperial Army*. Mavors VI, Amsterdam.

Diaz-Alvarez P. (1981) *Anforas romanas en los caminos del mar*. Vigo.

Diaz-Alvarez P. (1984) *Anforas romanas en el eje Atlántico galaico-lusitano*. Vigo.

Dicken and PE.Lloyd P. (1990) *Location in Space*, London.

Dicks TRB. (1972) Network Analysis and Historical Geography, *Area* 4, pp.4-9.

Dietler M. (1990) Driven by drink: the role of drinking in the political economy and the case of Early Iron Age France. *Journal Anthrop. Archaeology* 9.4, pp.352-406.

Dilke OAW. (1985) *Greek and Roman maps*. London.

Dion R. (1954) Itinéraries maritimes occidentaux dans l´Antiquité. *Bull. de l'Assoc. Geogr. Fran.* 243-4, pp.128-135.

Dion R. (1959) *Histoire de la vigne et du vin en France: des origines au XIXè siècle*. Paris.

Di Vita-Eurard G. (1985) Note sur quelques timbres d'amphores de Tripolitana. *Bull.Arch.Con. des travaux historiques et scientifiques* 19, pp.147-155.

Dobson B. (1972) Legionary centurion or equestrian officer a comparison of pay and prospects. *Anc.Soc.* 3, pp.193-207.

Dobson B. and JC.Mann (1973) The Roman Army in Britain and Britons in the Roman Army. *Britannia* 4, pp.191-205.

Dobson B. (1974) The significance of the centurion and Primipilaris in the Roman Army and administration. *ANRW* II.1, pp.392-434.

Dobson B. (1978) *Die Primipilaren*. Bonn.

Dobson B. (1986) The function of Hadrian´s Wall. *AA*(5) 14, pp.1-30.

Dodgshon RA. (1987) *The European Past Social Evolution and Spatial order*. London.

Doehaerd R. (1978) *The Early Middle Ages in the West: economy and society*. Amsterdam.

Domergue C. (1990) Les mines de la Péninsule Ibérique dans l´antiquité romaine. *MEFRA* 127, Paris.

Donna J., J.Peuquet and DF.Marble (eds)(1990) *Introductory readings of Geographical Information Systems*. London.

Doran JE. (1970) Systems theory, computer simulation and Archaeology, *World Archaeology* 1 (3), pp.289-298.

Doran JE. (1990) Computerased simulation and formal modelling in archaeology: a review. In A.Voorips (ed), pp.93-114.

Doran JE. and F.Hodson (1975) *Mathematics and Computers in Archaeology*, Edinburgh.

Doran JE. and G.Corcoran (1985) A computational model of production, exchange and trade. In A.Voorips and SH.Loving (eds), pp.349-359.

Dore JN. (1988) *Excavations at Roman Corbridge: the site*. London.

Dore JN. and KF.Greene (eds)(1977) *Roman Pottery Studies in Britain and Beyond*. BAR Int.Ser. 30, Oxford.

Dore JN. and N.Keay (1989) *Excavations at Sabratha 1948-51*, vol.ii Part 1. Soc. for Lybian Studies 1. London.

D'Oriano R. (1989) Matrici tipo Uzita-Ostia della Sardegna. In A.Mastino (ed) *L'Africa Romana. Atti del VI Convegno di Studio. Sassari* 16-18, 2, pp.503-512.

Douglass M. (1973) *Pureza y peligro. Un análisis de los conceptos de contaminación y tabú*. Madrid.

Douglass M. (1984) *Food in the Social order-studies of food and festivities in three American communities*. New York.

Down A. (1978) *Chichester Excavations*, vol.iii. Chichester.

Drennan RD. (1984) Long-distance transport costs in Pre-Hispanic Mesoamerica. *American Anthropologist* 86, pp.105-112.

Dressel H. (1879) Di un grande deposito di anfore rinvenuto nel nuovo quartiere del Castro Pretorio. *BCAR* 36-112, pp.143-196.

Dressel H. (1899) *Corpus Inscriptorum Latinorum*, xv. Pars 1. Berlin.

Drinkwater J. and H.Elton (eds) (1992) *Fifth-century Gaul: a crisis of identity ?*. Cambridge.

Duby G. (ed)(1980) *Histoire de la France urbaine*. Paris.

Dudley DR. (1967) *Urbs Roma*. Aberdeen.

Duff AM. (1928) *Freedmen in the Early Roman Empire*. Oxford.

Dufournier D. and JY.Marin (1987) Une production d'amphores du IIe siècle dans le Calvados. *SFECAG, Actes du Congres de Caen*, pp.23-27.

Dunbabin KM. (1993) Wine and water at the Roman convinium. *JRA* 6, pp.116-142.

Duncan-Jones RP. (1974) *Economy of the Roman Empire*, Cambridge.

Duncan-Jones RP. (1978a) Two possible indices of the purchasing power of money in Greek and Roman antiquity. In *Les dévaluations a Rome*, vol.i (Rome), pp.159-168.

Duncan-Jones RP. (1978b) Pay and numbers in Diocletian´s Army. *Chiron* 8, pp.541-560.

Duncan-Jones RP. (1990) *Structure and Scale in the Roman Economy*, Cambridge.

Dunning GC. (1945) Two fires of Roman London. *Ant.Journal* 25, pp.48-71.

Durand A. (ed)(1987) *Musée des Docks Romains. Museum guide & catalogue*. Marseille.

Dureau de la Malle A. (1840) *Economie politique des romains*.

Duval N. (1982a) L´urbanisme de Sufetula=Sbeitla en Tunisie. *ANRW* II.10.2, pp.596-632.

Duval N. (1982b) Topographie et urbanisme d´Anmaedara (actuellement Haïdra, Tunisia). *ANRW* II.10.2, pp.633-671.

Dyos HJ. and DH.Aldcroft (1969) *British Transport: an economic survey from the seventeenth century to the twentieth*, London.

Dyson S. (1982) New methods and models in the study of Roman town-country systems. *Ancient World* 2, pp.91-95.

Dyson T. (ed)(1986) *The Roman Quay at St.Magnus House, London*. Special Papers 8 of the London & Middlessex Arch. Soc.

Eades J. (ed)(1987) *Migrants, workers, and the social order*. London.

Earle TK. (1977) A reappraisal of redistribution: complex Hawaian chiefdoms. In TK.Earle andJE.Ericson (eds), pp.213-229.

Earle TK. and JE.Ericson (eds)(1977) *Exchange Systems in Prehistory*, New York.

Earle TK. and TN.D´Altroy (1982) Storage facilities and state finance in the Upper Mautaro Valley, Peru. In E.Ericson and TK.Earle (eds), pp.265-291.

Eckholdt M. (1984) Navigation on small rivers in Central Europe in Roman and Medieval times. *IJNA* 17, pp.3-10.

Eckstein EF. (1980) *Food, people and nutrition*. Westport.

Edmunson JC. (1987) *Two industries in Roman Lusitania: Mining and Garum production*. BAR Int.Ser 362, Oxford.

Egloff BJ. (1973) A method for counting ceramic, rim sherds. *American Antiquity* 38, pp.351-353.

Egloff M. (1977) Kellia: La poterie Copte. Quatre siècles d'artisanat et d'échanges en basse-Egypte. *Recherches Suisses d'Archéologie Copte* 3.

El vi a l'antiguitat. Economia, producció i comerç al Mediterrani Occidental, Badalona [1987].

Ellis P. (1989) Roman Chesterfield: Excavations by T.Courting 1974-1978. *The Derbyshire Arch.Journal* 99, pp.51-130.

Ellmers D. (1974) Nautical archaeology in Germany. *IJNA* 3.

Ellmers D. (1978) Shipping on the Rhine during the Roman period: the pictorical evidence. In J.du Plat and H.Cleere (eds), pp.1-14.

Empereur JY. (1982) Les anses d'amphores timbrées et les amphores: aspects quantitatifs. *BCH* 106, pp.219-233.

Empereur JY. (1986) Un atelier de Dr 2-4 en Egypte au IIIe siècle de notre ère. *BCH* Supp. xiii, pp.595-608.

Empereur JY. and Y.Garland (eds)(1986) Recherches sur les amphores grécques. *BCH* Supp. xiii

Empereur JY. and M.Picon (1986) A la recherche des forns d'amphores. *BCH* Supp. xiii, pp.103-126.

Empereur JY. and M.Picon (1989) Les régions de production d'amphores impériales en Méditerranée Orientale. *MEFRA* 114, pp.233-248.

Empereur JY. and N.Tuna (1989) Hieroteles, potier Rhodien de la Peree. *BCH* 113, pp.277-299.

Empereur JY., C.Kritzas and A.Marangon (1991) Recherches sur les amphores Crétoises: Les centres de fabrication en Crète centrale. *BCH* cxv, pp.481-523.

Engels D. (1990) *Roman Corinth.* Chicago.

Engels F. (1884) *The Origins of the Family, Private Property and the State.* London.

Ericsson CH. (1984) *Navis oneraria.* Abo.

Ericson JE. and TK.Earle (eds)(1982) *Contexts for Prehistoric Exchange.* New York.

Erim K. and J.Reynolds (1970) The Copy of Diocletian's Edict on Maximum Prices in Aphrodisias in Caria. *JRS* lx, pp.120-141.

Erim K., J.Reynolds and MH.Crawford (1971) Diocletian's currency reform: a new inscription, *JRS* lxi, pp.171-177.

Erim K. and J.Reynolds (1973) The Aphrodisias Copy of Diocletian's Edict on Maximum Prices, *JRS* lxiii, pp.99-110.

Ernan A. (1966) *The Ancient Egyptians. A sourcebook of their writings.* New York.

Espéraudieu E. (1910) *Recueil Général des bas-reliefs de la Gaule Romaine.* Paris.

Etienne R. (1949) Les amphores du Testaccio au IIIe siècle. *MEFR* 41, pp.151-181.

Etienne R. (1970) A propos du garum sociorum. *Latomus* xxix, pp.297-313.

Etienne R. (1990) Que transportaient dons les amphores lusitaniennes ?. In A.Alarçao and F.Mayet (eds), pp.15-22.

Etienne R. and F.Mayet (1991) Le garum à la monde de Scaurus. *Gerión, Anejos* III, pp.187-194.

Ettlinger E. (1952) *Römische Keramik aus dern Schuttügel von Vindonissa (Veröffentlichungen der gesellschaft pro Vindonissa).* Basel.

Ettlinger E. (1969) Stempel auf Römischen Keramik von der Engehalbinsel Bern. In K.Roth-Rubi (ed) *Die Keramik von Engemeistergut.* Bern, pp.115-177.

Ettlinger E. (1977) Aspects of Amphorae: Typology - seen from the North. *MEFRA* 32, pp.9-16.

Ettlinger E. (1987) How was the Arretine sold?. *Rei Cretariae Romanae Fautorum,* Acta xxv/xxvii, pp.5-20.

Evans JD. (1973) Sherd weights and sherd counts. In DE.Strong (ed), pp.131-149.

Evans JD. and M.Millett (1992) Residuality revisited, *Oxford Journal of Archaeology* vol.11, n.2, pp.225-240.

Fabiao C. (1989) *Sobre âs anforas do acampamento romano de Lomba de Canho (Arganil).* UNIARG. Lisbon.

Fabré G. (1981) *Libertus: recherches sur les rapports patron-affranchi à la fin de la république romaine.* Rome.

Fanfani A. (1942) *Storie delle dottrine economiche. Il Volontarismo.* Milan.

Farb P. and G.Arnelagos (1980) *Consuming passions. The anthropology of eating.* Boston.

Fariñas del Cerro L., W.Fernandez de la Vega and A.Hesnard (1977) Contribution à l'établessiment d'una typologie des amphores dites Dressel 2-4. *MEFRA* 32, pp.179-206.

Farrington B. (1962) *Science in Antiquity*, London.

Favory F. (1981) Validité des concepts marxistes pour une théorie des sociétés de l´Antiquité. *Klio* 63, pp.313-330.

Fentress E. (1990) The economy of an inland city: Sétif. In *L´Afrique dans l´Occident romain (Ier siècle av.J.C. IV siècle ap.J.C.)*. Rome, pp.117-128.

Fernández-Izquierdo A. (1984) *Las ánforas romanas de Valentia y su entorno marítimo*. Valencia.

Ferrara F. (1848) Economia politica degli antichi. *Giornale di Statistica* 6.18, pp.323-377.

Février PA. (1982) Urbanisation et urbanisme de l´Afrique romaine. *ANRW* II.10.2, pp.321-396.

Fiches IL., M.Guy and L.Ponciu (1978) Un lot de vases sigillés des premières annèes de règne de Néron dans l´un des Ports de Narbonne. *Archaeonautica* 2, pp.185-219.

Fichte G. (1800) *Der geschlossene Handelsstaat*. Berlin.

Fieldhouse P. (1986) *Food, nutrition, custons, and culture*. London.

Filtzinger P. (1972) *Die römische Keramik aus dem Militärbereich von Novaesium*. Novaesium v. Limes 11.

Fingerlin G. (1986) *Dangstetten I*. Forsch.v.Ber.2. Frühgesch. im Baden-Württemberg 22.

Fink RO. (1971) *Roman military records on papyrus*. Ohio.

Finley MI. (1965) Technological Innovation and Economic Progress in the Ancient World. *Economic History Review* 18, pp.29-45.

Finley MI. (1973) *The Ancient Economy*, London. (1985b) 2nd rev.ed.

Finley MI. (ed)(1979) *The Bücher-Meyer controversy*. New York.

Finley MI. (1985a) *Ancient History. Evidence and Models*. London.

Fiori P. (1972) Etude de l'épave A de la Garoupe, dite "Des Dolia". *Cahiers d'Archéologie Subaquatique* 1, pp.35-44.

Fiori P. and JP.Joncheray (1975) L'épave de la Tradelière. Premiers résultats des fouilles entreprises en 1973. *Cahiers d'Archéologie Subaquatique* 4, pp.59-70.

Fischler C. (1990) *L'hommivore. Le gout, la cuisine et le corps*. Paris.

Fisher I. (1911) *The purchasing power of money*. New York.

Fitzpatrick AP. (1987) The Structure of a distribution map: Problems of sample bias and quantitative studies. *Rei Cretariae Romanae Fautores* Acta xxv/xxvi, pp.79-112.

Fitzpatrick AP. (1989) The Submission of the Orkney Islands to Claudius: new evidence. *Scottish Arch.Review* lxix, pp.53-72.

Fitzpatrick AP. (1992) La place des amphores dans l´approvisionnement militaire de l´Écosse romaine. In *Les Amphores en Gaule: Production et Circulation*. Metz, pp.179-183.

Fitzpatrick AP. (1994) Roman amphorae in pre-Roman Britain and in Scotland. In *Roman Amphorae. Problems of identification and methodology*, London.

Flannery KV. (ed)(1976) *The Early Mesoamerican Village*. New York.

Flannery KV. (ed)(1986) *Guila Naquitz: Archaic foraging and early agriculture in Oaxaca, Mexico*. New York.

Flaudrin JL. (1983) Le goût et la nécessité: réflexions sur l´usage das graises dans les cuisines d´Europa occidentale (XIV-XVIII s.) *Annales ESC* 2, pp.369-401.

Foester-Laures F. (1974) Spain. Sa Tuna & Los Ullastres (Gerona). *IJNA* 3, pp.332-333.

Fontes P., F.Laubenheimer, J.Leblanc, F.Bonnefoy, K.Gruel and F.Widermann (1981) Nouvelles données analyticals et typologiques sur les ateliers de production d'amphores en Gaule du Sud. *Rev. d'Archéometrie* 3, pp.95-110.

Foraboshi D. and A.Gara (1982) L´economia dei crediti in natura (Egitto). *Athenaeum* 60, pp.69-83.

Forbes RJ. (1963) *Studies in Ancient Technology*, Leiden.

Formenti F., A.Hesnard and A.Tchernia (1978) Note sur le contenu d'une amphore Lamboglia 2 de l'épave de la Mandrague de Giens. *Archaeonautica* 2, pp.95-100.

Foss C. (1976) *Byzantine and Turkish Sardis*. Cambirdge.

Foss C. (1979) *Ephesus after antiquity. A Late antiquity Byzantine and Turkish city*. Cambridge.

Foster J. (1986) *The Lexden Tumulus: a re-appraisal of an Iron Age burial from Colchester Essex*. Oxford.

Fortescoe JW. (1923) *A history of the British Army*, vol. xi. London.

Fotheringham S. and M.O´Kelly (1989) *Spatial interaction models: Formulations and Applications*. New York.

Frank T. (1927) *An Economic History of Rome*. London.

Frank T. (1933-40) *An Economic Survey of Ancient Rome*, Baltimore.

Frayn JM. (1990) Quality control in Roman agriculture. *Liverpool Classical Monthly* 15, pp.24-26.

Frayn JM. (1993) *Markets and fairs in Roman Italy*. Oxford.

Frederiksen MW. (1975) Theory, evidence and the ancient economy. *JRS* lxv, pp.164-171.

Freed J. (1989) Late stamped Dressel 2-4 amphoras from a deposit dated post 200 A.D. at Villa site on the Via Gabina. *MEFRA* 114, pp.616-617.

Freed J. and H.Hurst (1991) Pottery from dredging of the Circular Harbour. *CEDAC Carthage Bull.*12, pp.24-28.

Frere SS. (1972) *Verulamium Excavations*, vol.i. Oxford.

Frere SS. (1983) *Verulamium Excavations*, vol.ii. Oxford.

Frere SS. (1984) British Urban Defences in Earthwork. *Britannia* xv, pp.63-74.

Frere SS. (1987) *Britannia*. London.

Frézouls E. (ed)(1978) *Le dernier siècle de la République romaine et l´époque augustéen*. Paris.

Frézouls E. (1991) L'evergetisme alimentaire dans l'Asia Mineure romaine. In D. van Berchem (ed), pp.1-16.

Friedman M. (1953) *Essays in positive economics*. Chicago.

Friedman M. (1977) *A theoretical framework for monetary analysis*. New York.

Friedman M. (1991) *Monetarist economies*. Oxford.

Friedmann J. and W.Alonso (eds)(1964) *Regional developments and planning: a reader*, Massachusetts.

Frier BW. (1983) Roman law and the wine trade: the problem of vinegar sold as wine. *ZSS* 100.

Fryer J. (1973) The harbour installation of Roman Britain. In BJ.Blackman (1973), pp.261-275.

Fulford MG. (1973) Excavations of three Romano-British pottery kilns in Amberwood Inclosure, near Fritham, New Forest. *Proc. Hampshire Field Club Arch. Soc.* 28, pp.5-28.

Fulford MG. (1977a) Pottery and Britain´s foreign trade in Late Roman period. In DPS.Peacock (ed), pp.35-84.

Fulford MG. (1977b) The location of Romano-British pottery kilns: institutional trade and market. In J.Dore and K.Greene (eds), pp.301-306.

Fulford MG. (1978a) Coin circulation and mint activity in the later Roman Empire. *Arch.Journal* 135, pp.67-114.

Fulford MG. (1978b) The interpretation of Britain's late Roman trade: the scope of medieval historical and archaeological analogy. In J.du Plat and H.Cleere (eds), pp.36-40.

Fulford MG. (1984) Demonstrating Britannnia´s economic dependence in the first and second centuries. In TFC.Blagg and AC.King (eds), pp.129-142.

Fulford MG. (1987) Benerice-Carthage-Ostia: the amphora of three cities. *Res Cretariae Romanae Fautores* Acta xxv/xxvi, pp.155-160.

Fulford MG. (1989a) To East and West: the Mediterranean trade of Cyrenaica and Tripolitania in Antiquity. *Lybian Studies* 20, pp.169-192.

Fulford MG. (1989b) The economy of Roman Britain. In M.Todd (ed), pp.175-201.

Fulford MG. (1992) Territorial expansion and the Roman Empire. *World Archaeology* 23, pp.294-303.

Fulford MG. and I.Hodder (1974) A regression analysis of some late Romano-British fine pottery: a case study. *Oxoniensia* 39, pp.26-33.

Fulford MG. and DPS.Peacock (1984) *The Avenue du Président Habib Bourguiba, Salammbó: The pottery and the other ceramic objects from the site. Excavations at Carthage: the British Mission*, vol.1.2, Sheffield.

Fulford MG. and K.Huddleston (1991) *The current state of Romano-British Pottery Studies.* English Heritage Occ.Papers 1.

Funari PPA. (1985) *As transformaçôes morphologicas das anforas olearias beticas de typo Dr.20.* Sao Paulo.

Funari PPA. (1987) Estudo tipológico das ânforas béticas (Dressel 20) de ca. 149 dC. *Dedalo* 25, pp.209-233.

Funari PPA. (1989) Dressel 20 amphora inscriptions found at Vindolanda: the reading of the unpublished evidence. In VA.Maxfield and MJ.Dobson (eds), pp.435-438.

Funari PPA. (1991) *Olive-oil consumption in Roman Britain.* Unpubl. PhD Thesis from São Paulo University.

Funari PPA. (1992) Some Roman inscriptions from Britain: amphora evidences.

Funari PPA. (1994) Stamped Dressel 20 amphorae in Britain. In *Roman Amphorae. Problems of identification and methodology*, London.

Fustel de Coulanges ND. (1864) *La cité antique.* Paris.

Gabba E. (1975) Mercati e fiere nell'Italia romana. *Studia Class. et Orient.* 24, pp.141-163.

Gabba E. (1978) Aspetti economici e monetari del soldo militare dal II sec. a.C. al II sec. d.C. In *Les dévaluations a Rome*, vol. i (Rome), pp.217-225.

Gabba E. (1980) Riflesioni antiche e moderne sulla activitá commerciali a Roma nei secoli III e I a.C. In JH.D´Arms and EC.Kopff (eds), pp.157-172.

Gabler D. and M.Kellmen (1984) Olio betico in Pannonia. *AEA* 57, pp.153-161.

Gaffney V. and Z.Staĉniĉ (1991) *GIS approaches to regional analysis: A case study of the island of Hvar*, Ljubljana.

Gagnere S. (1960) Les sépultures à inhumation du IIIe au XIIIe siècle de notre ère dans le basse vallée du Rhône: essai de chronologie typologique. *Cah. Rhodaniens* vii.

Galbraith JK. (1974) *Economics and the public purpose*. Boston.

Gallant TW. (1991) *Risk and survival in Ancient Greece*. Oxford.

Gaillou P. (1982a) *Corpus des amphores découvertes dans l'Ouest de la France. Vol.I, Les amphores tardo-républicaines*. Arch.en Bretagne Supp.4

Gaillou P. (1982b) Sigillée de Gaule du Sud en Armorique: Diffusion et problèmes. *Rei Cretariae*, Actas 21-22, pp.117-130.

Gaillou P. (1983) *L´Armorique romaine*. Branspon ts.

Gaillou P. (1984) Days of wine and roses?. Early Armorica and the Atlantic wine trade. In S.MacReady and FH.Thompson (eds), pp.24-36.

Gaillou P. (1986) Celtic permanece or Roman change ? Roman Brittany revisited. *Oxford Journal of Archaeology* 5, pp.67-76.

Gaillou P. (1991) Les amphores Pascual 1 et Dressel 2-4 de Tarraconaise découvertes dans le Nord-Ouest de la Gaule et les importations de vins espagnols au haut-empire. *Laietania* 6, pp.99-105.

Gaillou P. (1992a) L´Armorique Romaine: Mutations et Resistances. In M.Wood and T.Queiroga (eds), pp.29-34.

Gaillou P. (1992b) Commerces et sociétés en Armorique romaine. *Revue des Etudes Anciennes* 94, pp.23-40.

Gansbeke P. van (1957) La voie commerciale de la Bretagne on Rhin à l´époque romaine. *RBPh* 35, pp.746-762.

Gara A. (1978) Aspetti di economia monetaria dell´Egitto romano. *ANRW* II, 10.1, pp.912-951.

Garcia-Bellido A. (1969) El mosaico de tema culinario de Marbella. In *Hommages à Marcel Renard* 3, Brussels, pp.241-246.

Garcia-Fuentes L. (1980) *El comercio español con América, 1650-1700*. Seville.

Garcia-Marcos V. and JM.Vidal-Encinas (forth.) Recent archaeological research at Asturica Augusta (León, Spain). *Oxford Arch. Journal*

Garcia-Moreno LA. (1972) Colonias de comerciantes orientales en la península ibérica, s.v-vii. *Habis* 3, pp.127-154.

Gardin J., O.Guillaume, PQ.Herman, A.Hesnard, MS.Lagrauge, M.Renand and E.Zadora-Rio (eds) *Artificial Intelligence and Expert Systems. Cases Studies in the knowledge domain of Archaeolgy*, Chichester.

Gardner JF. (1993) *Being a Roman citizen*. London.

Garland Y. (1983) Greek amphorae and trade. In P.Garnsey et al (eds), pp.27-35.

Garnett R. and J.Boardman (1961) Underwater reconaissance off the island of Chios, 1954. *BSA* 56, pp.102-113.

Garnsey P. (1983) Grain for Rome. In P.Garnsey et alii (eds), pp.118-130.

Garnsey P. (1988) *Famine and Food supply in the Graeco-Roman world*. Cambridge.

Garnsey P. (1991) Mass diet and nutrition in the city of Rome. In D. van Berchem (ed), pp.67-99.

Garnsey P. and CR.Whittaker (eds)(1983) *Trade and Famine in Classical Antiquity*, Cambridge.

Garnsey P., K.Hopkins and CR.Whittaker (eds)(1983) *Trade in the Ancient Economy*, London.

Garnsey P. and R.Saller (1987) *The Roman Empire. Economy, Society and Culture*. London.

Garnsey P. and I.Morris (1989) Risk and the Polis: the evolution of institutionalized responses to food supply problems in the ancient Greek state. In P.Halstead and J.O´Shea (eds), pp.98-105.

Garrison WL. (1960) Connectivity of the Inter-State Highway System, *Papers and Proc. Regional Science Assoc.* 6, pp.121-137.

Gates F. (1982) Farming on the frontier: Romano-British fields in Northumberland. In P.Clack and S.Haselgrove (eds), pp.21-42.

Geary P. (1986) Sacred commodities: the circulation of Medieval relics. In A.Appadurari (ed), pp.169-191.

Gébara C. and I.Beraud (1992) Production d´amphores à Frejus. In *Les Amphores en Gaule*, pp.15-24.

Gentry AP. (1976) *Roman military stone-built granaries in Britain*. BAR Brit.Ser. 32, Oxford.

Giacchero M. (1974) *Edictum Diocletiani et Collegarum de Pretiis Rerum Venalium*, Rome.

Giacosa IG. (1986) *A cena de Lucullo*. Torino.

Gianfrotta P. (1981a) Relitto di nave romana a Santa Severa presso Pyrgi. *Rendiconti Acc. Nazz. Lincei (Scienze Morali)* ser.xxvi 3-4, pp.167-171.

Gianfrotta P. (1981b) Commerci e pirateria: primo testimonianze archeologiche sottomarine. *MEFRA* 93, pp.227-242.

Gianfrotta P. and P.Pomey (1981) *L'archéologie sous-marine*. Paris.

Giardina A. (ed)(1986) *Le Merci gli insediamenti*. Bari.

Giardina A. (ed)(1989) *L´uomo romano*. Rome.

Giardina A. (1989) El hombre romano. In A.Giardina (ed), pp.9-28.

Giardina A. and A.Sciavone (eds)(1981) *Merci, mercati e scambi nel Mediterraneo*, Bari.

Gibbins DJL. and AJ.Parker (1986) The Roman wreck of c.AD 200 at Plemmirio, near Siracusa (Sicily): interim report. *IJNA* 15.4 , pp.267-304.

Gillam JP. and K.Greene (1981) Roman pottery and the economy. In AC.Anderson and AS.Anderson (eds), pp.1-23.

Gilliver CM. (1990) A mercator bovarius from Veii in a new inscription from the Mola di Moth Gelato. *PSBR* lviii, pp.193-196.

Giot R. and G.Querre (1985) Le tesson d'amphore B2 de l'Ille Lavret (Bréhat, Côtes-du-Nord) et le problème des importations. *Rev.Arch d'Ouest* 2, pp.95-100.

GIS Conference. The impact of Geographic Information Systems in Archaeology: an European perspective. Ravello (1993).

Gisbert JA. (1987) La producció del vi al territori de Dianium durant l'Alt Imperi: el taller d'àmfores de la vil.la romana de l'Almadrava. In *I Col.loqui d'Arqueologia Romana. El vi a l'Antiquitat*, Badalona 1985, pp.104-118.

Glodarin I. (1976) *Dacian trade with the Hellenistic and Roman world*. BAR Int.Ser.8, Oxford.

Glover IC. (1972) *Excavation in Timor*. PhD Thesis, Australian National University.

Goddard P. and F.Gateau (1991) Des amphores cannelees a Cavaillon (Vancluse) a la fin du Ier siècle avant notre ere. Nouveaux elements pour l'étude des Richborough 527. *SFECAG, Actes du Congres de Cognac*, pp.311-327.

Godelier M. (1971) *Rationalité et irrationalité en économie*. Paris.

Going CJ. (ed)(1987) *The Mansio and other sites in the South-Eastern Sector of Caesaromagus: the Roman Pottery*. CBA Res.Rep. 62.

Going CJ. (1991) Economic "long waves" in the Roman period? A reconnaisance of the Romano-British ceramic evidence. *Oxford Arch. Journal* 11.1, pp.93-117.

Gómez-Crespo P. (1993) *Comprar y vender*. Madrid.

González I. (1986) The lex Irnitana: a new copy of the Flavian Municipal Law. *JRS* lxxvi, pp.147-243.

González JM. (1954) *El litoral asturiano en la época romana*. Oviedo.

González-Fernández J. (1983) Nueva inscripción de un diffusor olearius en la Bética. In JM.Blázquez and J.Remesal (eds), pp.183-ss.

González-Serrano MP. (1958) Anforas romanas de origen español halladas en Autun. *AEA* 31, p.198.

Goodchild MF. (1991) Geographic Information Systems. *Journal of Retailing* 67 (1), pp.3-15.

Goody J. (1982) *Cooking, cuisine and class. A study of comparative sociology*. Cambridge.

Goris JA. (1925) *Les colonies marchandes méridionales*. Louvain.

Gose E. (1976) *Gefässtypen der Römischen Keramik im Rheinland*. Bonn.

Goudineau C. (1981) Une fouille de sauvetage aux Aiguières. *Les Dossiers, Arch. et Histoire* 57, pp.52-54.

Goudineau C. (1982) Une fouille récente à la périphérie de Forum Iulii: le chantier des Aiguières. *CRAI*, pp.279-292.

Gould RA. (ed)(1978) *Explorations in Ethnoarchaeology*, Alburquerque.

Gourevitch D. (1984) *Le triangle hippocratique dans le monde gréco-romain*. Paris.

Gowers E. (1993) *The loaded table*. Oxford.

Grace VR. (1961) *Amphorā and the Ancient wine*. Princeton.

Grace VR. and M.Savvatianou-Petropoulakon(1970) Les timbre amphoriques grecs. In P.Burneau et al (eds) *L'ilot de la Maison des Comédiens*. Paris, pp.277-382.

Grant E. (ed)(1986) *Central Places, Archaeology and History*. Sheffield.

Grant M. (1968) *Roman history from coins*. Cambridge.

Gras M. (1985) *Trafics tyrrhéniens archaïques*. Rome.

Green CM. (1980) The imported amphorae. In DM.Jones and M.Rhodes (eds) *Excavations at Billingsgate Buildings Triangle, Lower Thames Street, 1974*. London & Middlessex Archaeological Society, Spec.Paper 4, pp.40-45.

Green SW. and SM.Perlman (1985) *The archaeology of frontiers and boundaries*. New York.

Greene K. (1978) Imported fine wares in Britain to AD 250: a guide to identification. In P.Arthur and G.Marsh (eds), pp.31-60.

Greene K. (1979a) *The Pre-Flavian fine wares*. Cardiff.

Greene K. (1979b) Invasion and response: pottery and the Roman Army. In BC.Burnham and HB.Johnson (eds), pp.99-106.

Greene K. (1986) *The Archaeology of the Roman Economy*, London.

Greep S. and RP.Sealey (forth.) Gauloise 4 production at Verulamium region.

Gregory CA. (1982) *Gifts and commodities*. New York.

Grenier A. (1934) *Manuel d´Archéologie Gallo-Romaine II*. Paris.

Grew F. and B.Hobley (eds)(1985) *Roman Urban Topography in Britain and the Western Empire*. CBA Res.Rep. 59. London.

Grimes WF. (1968) *The excavation of Roman and Medieval London*. London.

Grubessi O., A.Villani and L.Lazarini (1991) Progetto Testaccio. Studio archeometrico delle anfore Dressel 20. In *Richerche Archeometriche e Studi Archeologi sulla ceramica antica*, (in press).

Gudea N. (1979) The Defensive system of Roman Dacia. *Britannia* x, pp.63-88.

Guénoche A. and A.Tchernia (1977) Essai de construction d'un modèle descriptif des amphores Dr.20. *MEFRA* 32, pp.241-259.

Guerrero-Ayuso VM., D.Colls and F.Mayet (1987) Arqueología submarina: el navío romano Cabrera III. *Revista de Arqueología* 74, pp.14-24.

Guillot D. and G.Leroy (1993) The use of GIS for archaeological resource management in France. In *GIS Conference*.

Guitart J. (1976) *Baetulo. Topografía Arqueológica, Urbanismo e Historia*. Badalona.

Guy CM. (1983) The assessment of access to local shopping opportunities: a comparison of accessibility measures. In *Environment and Planning B: Planning and Design* vol.10, pp.219-238.

Hackens T. and P.Marchetti (eds)(1987) *Histoire economique de l'Antiquité*, Louvain.

Hägerstrand T. (1952) The propagation of innovation waves. *Lund Studies in Geography, Ser.B. Human Geography* 4, pp.3-19.

Hägerstrand T. (1957) Migration and area: survey of a sample of Swedish migration fields and hypothetical considerations in their genesis. *Lund Studies in Geography, Ser.B. Human Geography* 13, pp.27-158.

Haggett P. (1965) *Location Analysis in Human Geography*, London.

Hague DB. (1973) Lighthouses. In BJ.Blackman (ed), pp.293-316.

Haigh JGB. and MA.Kelly (1987) Contourning Techniques for Archaeological Distributions, *Journal of Archaeological Science* 14, pp.231-242.

Haley EW. (1988) Roman elite involvement in commerce: the case of the Spanish TT.Manilii. *AEA* 61, pp.141-156.

Haley EW. (1990) The fish sauce trader L.Iunius Puteolanus. *ZPE* 80, pp.72-80.

Hall AR. and HK.Kenward (eds)(1982) *Environmental aracheology in the urban context*. CBA 43. London.

Hall AR. and MK.Kenward (1990) Environmental evidence from the Colonia. *The Arch. of York* 14.6. York.

Hall RW. (1989) Configuration of an overnight package air network. *Transportation Research* A 23, pp.139-149.

Halstead P. and J.O´Shea (eds)(1989) *Bad year economics: Cultural responses to risk and uncertainty*. Cambridge.

Halstead P. and J.O´Shea (1989) Introduction: cultural responses to risk and uncertainty. In P.Halstead and J.O´Shea (eds), pp.1-7.

Hamon E. and A.Hesnard (1977) Problèmes de documentation et de description relatifs a un corpus d'amphores romaines. *MEFRA* 32, pp.17-33.

Hands AR. (1968) *Charities and Social aid in Greece and Rome*. London.

Haning WH. (1987) Industrial growth. In J.Wacher (ed), pp.586-610.

Hansen V. (1987) *Römischer import in Norden. Det Kongelige Nordiske Oldskriftselskab*. Copenhagen.

Hanson WS. (1978) The organization of the Roman military timber supply. *Britannia* 9, pp.293-305.

Hanson WS. (1987) *Agricola and the conquest of the North*. London.

Hanson WS., CM.Daniels, JN.Dore and JP.Gillam (1979) The Agricolan supply-base at Red House, Corbridge. *AA* (5) 7, pp.1-97.

Hanson WS. and L.Keppie (eds)(1980) *Roman Frontier Studies 1979*. BAR Int.Ser. 71, Oxford.

Hanson WS. and GS.Maxwell (1983) *Rome´s North West frontier, the Antonine Wall*. Edinburgh.

Hanson WS. and DJ.Breeze (1991) The future of Roman Sctoland. In WS.Hanson and EA.Slater (eds), pp.57-80.

Hanson WS. and EA.Slater (eds)(1991) *Scottish Archaeology: New perceptions*. Aberdeen.

Harding DW. (1974) *The Iron Age in Lowland Britain*. London.

Hardth B., L.Larsson, D.Olausson and R.Petré (eds)(1988) *Trade and Exchange in Prehistory*. Lund.

Hardy EG. (1911) *Six Roman Laws*. London.

Harmand L. (1969) Amphores de Normandie portant des marques espagnoles sous le Haut-Empire. 94 *Congres de les Soc. Savantes*. Paris, pp.43-50.

Harmand L. (1971) Les marques d'amphores espagnoles dans le Gaule du Sud-Ouest. 96 *Congres de les Soc. Savantes*. Toulouse, pp.223-233.

Harmand L. (1974) Soldats et marchands romains aus prises avec l´univers atlantique. *Caesadorunum* ix bis, pp.247-256.

Harnecker M. (1969) *Los conceptos elementales del materialismo histórico*. México.

Harris CD. (1954) The market as a factor in the localization of industry in the U.S. *Annals of the Assoc. of Ame. Geog.* 44, pp.315-348.

Harris M. (1985) *Good to eat*. New York.

Harris WV. (1980) Roman terracota lamps: the organization of an industry. *JRS* lxx, pp.126-145.

Harris WV. (1989) Trade and the river Po: a problem in the economic history of the Roman Empire. In JF.Bergier (ed), pp.123-134.

Harris WV. (1993a) Between archaic and modern: some current problems in the history of the Roman economy. In WV.Harris (ed), pp.11-30.

Harris WV. (1993b) Production, distribution, and instrumentum domesticum. In WV.Harris (ed), pp.186-189.

Harris WV. (ed)(1993) *The Inscribed Economy. Production and distribution in the Roman Empire in the light of instrumentum domesticum*. Journal of Roman Archaeology, Suppl. 6.

Hartley BP. (1972) The Roman Occupation of Scotland: the evidence of samian ware. *Britannia* 3, pp.1-55.

Hartley F. (1973) The marketing and distribution of mortaria. In A.Detsicas (ed), pp.39-51.

Hasebroek J. (1928) *Staat und Handel im alten Griechenland*. Tubingen.

Hasebroek J. (1931) *Griechische Wirtschafts-und Gesell-schaftsgeschichte bis zu den Perserkriegen*. Tubingen.

Haselgrove C. (1982) Indigenous settlement patterns in the Tyne-Tees Lowlands. In P.Clack and S.Haselgrove (eds), pp.57-105.

Haselgrove C. (1987) *Iron Age Coinage in South East England: the archaeological context*. BAR Int.Ser. 174, Oxford.

Haselgrove C. (1990) The Romanization of Belgic Gaul: some archaeological prespectives. In TFC.Blagg and M.Millett (eds), pp.45-71.

Haselgrove C., M.Millett and I.Smith (eds)(1985) *Archaeology from the ploughsoil*, Sheffield.

Hassall MWC. (1973) Roman soldiers in Roman London. In DS.Strong (ed), pp.231-237.

Hassall MWC. (1978) Britain and the Rhine provinces: epigraphic evidence from Roman trade. In J.du Plat and H.Cleere (eds), pp.41-48.

Hassall MWC. and RSO.Tomlin (1982) Roman Britain in 1981. II Inscriptions. *Britannia* 13, pp.396-422.

Hassall MWC. and RSO.Tomlin (1984) Roman Britain in 1983. II Inscriptions. *Britannia* 15, pp.333-356.

Hassan FA. (1981) *Demographic Archaeology*. London.

Hatzfeld J. (1919) *Les trafiquants italiens dans l´Orient hellénique*. Paris.

Hawkes CFC. (1984) Ictis disentangled, and the British tin trade. *Oxford Journal Arch.* 3.2, pp.211-234.

Hayden B. and A.Cannon (1983) Where the garbage goes: refuse disposal in the Maya highlands. *Journal of Anthropological Archaeology* 2, pp.117-163.

Hayes JW. (1968) A seventh century pottery group. *Dumbarton Oaks Papers* 22, pp.203-216.

Hayes JW. (1983) The Villa Dionysos excavations, Knossos: the Pottery. *BSA* 78, pp.98-169.

Hedeager L. (1977) A quantitative analysis of Roman imports in Europe north of the limes (0-400 AD). In K.Kristiansen and C.Palaudau-Müller (eds), pp.191-316.

Hedeager L. (1988a) Money economy and prestige economy in the Roman Iron Age. In B.Hardth et alii (eds), pp.147-154.

Hedeager L. (1988b) The evolution of Germanic society 1-400 AD. In RFJ.Jones et alii (eds), pp.129-144.

Heichelheim FM. (1958-70) *An ancient economic history*. Leiden.

Heilbroner RL. (1982) *Vida y doctrina de los grandes economistas*. Madrid.

Helback H. (1964) The Isca grain. A Roman plant introduction in Britain. *New Phytologist* 63, pp.158-164.

Helly B., A.Le Bot-Helly and B.Liou (1986) Un dépôt d'amphores Dressel 20 à inscriptions peintes découvert à Sainte-Colombe (Rhône). *Archaeonautica* 6, pp.121-146.

Hendy M. (1985) *Studies in the Byzantine monetary economy c.AD 300-1450*. Cambridge.

Hernández MJ., M.Angulo and M.Orifla (1992) Nuevos datos sobre el poblamiento antiguo de la isla de Cabrera (Baleares). Una posible factoría de salazones. *Saguntum* 25, pp.213-222.

Heron de Villefosse A. (1914) Deux armateurs narbonnais, Sextus Fadius Secundus Musa et P.Olitus Appolonius. *Mém.Soc.Ant.de France* pp.153-180.

Heron C. and HM.Pollard (1988) The analysis of natural resinous materials from Roman amphorae. In EA.Slater and JO.Tate (eds) *Science and Archaeology. Glasgow, 1987.* BAR Brit.Ser. 196. Oxford, pp.429-448.

Herskovits MJ. and M.Harwitz (eds)(1964) *Economic transition in Africa.* London.

Herz P. (1988a) Studien zur römischen Wirtschaftsgesetzgebung. Die Lebensmittelversorgung. *Historia Einzelschr* 55, Stutgart.

Herz P. (1988b) Der praefectus annonae und die Wirtschaft der westlichen Provinzen. *Ktema* 13, pp.69-86.

Herz P. (1991) Organisation und Finanzierung der spätantiken annona. In D. van Berchem (ed), pp.161-186.

Herz N. and M.Waelkens (eds)(1988) *Classical marble: geochemistry, technology, trade.* Dorchecht.

Hesnard A. (1977) Note sur un atelier d'amphores Dr.1 et Dr.2-4 près de Terracina. *MEFRA* 32, pp.157-168.

Hesnard A. (1980) Un dêpot Augustéen d'amphores à La Longarina, Ostie. In JH.D'Arms and EC.Kopff (eds), pp.141-156.

Hesnard A. (1986) Imitations et raisonnement archéologique: a propos de amphores de Rhodes et de Cos. *BCH* Supp. xiii, pp.69-86.

Hesnard A. (1987) Case study no.4. Establishing the origin of Roman amphorae. In J.Gardin et al (eds), pp.126-149.

Hesnard A. and C.Lemoine (1981) Les amphores de Cécube et du Falerne. Prospections, typologie, analyses. *MEFRA* 93, pp.243-295.

Hesnard A., MB.Carre, M.Rival and B.Dangréaux (1988) L'épave romaine Grand Ribaud D (Hyères, Var). *Archaeonautica* 8.

Hesnard A. and P.Gianfrotta (1989) Les bouchons d'amphore en pouzzolana. *MEFRA* 114, pp.393-441.

Heukemes A. (1958) Datación de algunas marcas de ánfora españolas. *AEA* 31, p.197.

Hey D. (1980) *Packmen, carriers and packhorse roads.* Leicester.

Hicks J. (1969) *A theory of economic history.* Oxford.

Hietala HJ. (ed)(1984) *Intrasite Spatial Analysis in Archaeology.* Cambridge.

Higgs ES. (ed)(1972) *Papers in Economic Prehistory.* Cambridge.

Higgs ES. and C.Vita-Finzi (1972) Prehistoric Economies: a territorial approach. In ES.Higgs (ed), pp.27-36.

Higham NJ. (1982) The Roman impact upon rural settlement in Cumbria. In P.Clack and S.Haselgrove (eds), pp.105-122.

Hill D. and M.Jesson (eds)(1974) *The Iron Age and its hill forts.* Southampton.

Hindley B. (1974) *Theory of international trade.* London.

Hingley R. (1988) The influence of Rome on indigenous social groups in the Upper Thames valley. In RFJ. Jones et alii (eds), pp.73-98.

Hingley R. (1989) *Rural settlement in Roman Britain.* London.

Hinton PA. (1977) Rudely made earthen vessels of the twelfth to fifteenth centuries A.D. In DPS.Peacock (1977), pp.221-238.

Hobley A. (1989) The numismatic evidence for the post-Agricolan abandonement of the Roman frontier in Northern Scotland. *Britannia* 20, pp.69-74.

Hobley B. (1980) Military considerations in the Lower Thames valley during the A.D.43 campaign and their relevance to the origins of Londinium. In WS.Hanson and L.Keppie (eds), pp.311-316.

Hochuli-Gysel A., A.Siegfried-Weiss, E.Rnoff and V.Schalterbrand-Obrecht (1991) *Chur in römischen Zeit*. Bassel.

Höckmann O. (1988) *La navigazione nel mondo antico*. Rome.

Höckmann O. (1993) Late Roman Rhine vessels from Mainz, Germany. *IJNA* 22.2, pp.125-136.

Hodder IR. (1974a) Regression Analysis of some trade and marketing patterns. *World Archeology* 6.2, pp.172-189.

Hodder IR. (1974b) Some marketing models for Romano-British coarse pottery. *Britannia* v, pp.340-359.

Hodder IR. (1977) Some new directions in spatial analysis of archaeological data at regional scale. In DL.Clarke (1977), pp.223-351.

Hodder IR. (ed)(1978) *Simulation Studies in Archaeology*, Cambridge.

Hodder IR. (1979) Pre-Roman and Romano-British tribal economies. In BC.Burham and HB.Johnson (eds), pp.189-196.

Hodder IR. (1982) *Symbols in action*. Cambridge.

Hodder IR. (ed)(1986) *Reading the Past: Current Approaches to interpretation in Archaeology*. Cambridge.

Hodder IR. (ed)(1991) *Archaeological Theory in Europe*. London.

Hodder IR. and M.Hassall (1974) The non-random spacing of Romano-British walled towns. *MAN* 6, pp.391-407.

Hodder IR. and C.Orton (1976) *Spatial Analysis in Archaeology*, Cambridge.

Hodder IR., P.Halstead and G.Jones (1978) Behavioural Archaeology and refuse patterns: a case study. *Norwegian Arch. Rev.* 1, pp.118-131.

Hodder IR. and M.Millett (1980) Romano-British Villas and towns: a systematic analysis. *World Archaeology* 12, pp.69-76.

Hodges R. (1982) *Dark age economics: the origins of towns and trade AD 600-1000*. London.

Hoffman MA. (1974) The social context of trash disposal in an Early Dynastic Egyptian town. *American Antiquity* 39, pp.35-50.

Holbrook N. and PT.Bidwell(1991) *Roman Finds from Exeter*. Exeter Arch. Rep. 4

Holder PA. (1980) *Studies in the Auxilia of the Roman Army from Augustus to Trajan*. BAR Int.Ser 70, Oxford.

Holder PA. (1982) *The Roman Army in Britain*. London.

Hondins-Crone A. (1955) *The temple of Nehalennia at Domburg*. Amsterdam.

Hoover EM. (1948) *The location of economic activity*. New York.

Hopkins C. (1979) *The Discovery of Dura-Europos*. New Haven.

Hopkins K. (1978) Economic growth and towns in classical antiquity. In P.Abrams and EA.Wringley (eds), pp.35-79.

Hopkins K. (1980) Taxes and trade in the Roman Empire (200 BC- AD 400). *JRS* lxx, pp.101-125.

Hopkins K. (1983a) Introduction. In P.Garnsey et alii (eds), pp.ix-xxv.

Hopkins K. (1983b) Models, Ships and Staples. In P.Garnsey and CR.Whittaker (eds), pp.84-109.

Hopkins TK. (1957) Sociology and Substantivism. In K.Polanyi et alii (eds), pp.270-306.

Hornell J. (1946) *Water transport.* Cambridge.

Horsley JE. (1978) *Tools of maritime trade.* New Abbot.

Houston GW. (1980) The administration of Italian seaports during the first three centuries of the Roman Empire. In JH.D´Arms and EC.Kopff (eds), pp.157-172.

Howard H. and EC.Morris (eds)(1981) *Production and Distribution: a ceramic viewpoint.* BAR Int.Ser. 120, Oxford.

Howgego C. (1992) The supply and use of money in the Roman world 200 BC to AD 300. *JRS* lxxxii, pp.1-31.

Huggett JW. and MA.Cooper (1991) The computer representation of space in Urban Archeology. In K.Lockyear and S.Rathz (eds), pp.39-42.

Hulthen B. (1974) On choice of element for determination of quantity of pottery. *Norwegian Archaeological Review* 7 (1), pp.1-5.

Humbley JA. (ed)(1981) *Excavations at Carthage conducted by the University of Michigan.* Michigan.

Hunt ED. (1982) *Holy Land pilgrinage in the Later Roman Empire AD 312-460.* Oxford.

Hurst HR. (1985) *Kingsholm.* Gloucester Arch. Rep. 1. Gloucester.

Hutchinson VJ. (1986) *Bacchus in Roman Britain: the evidence for his cult.* BAR Brit.Ser. 151, Oxford.

Iggers GG. (1968) *The German conception of history. The national tradition of historical thought from Herder to the present.* Middletown.

Iglesias-Gil JM. and JA.Muñoz-Castro (1992) *Las comunicaciones en la Cantabria romana.* Santander.

Isard W. (1956) *Location and space-economy: a general theory relating to industrial location, market areas, land use, trade and urban structures.* New York.

Italica (Santiponce, Sevilla). Excavaciones Arqueológicas en España (1982). Madrid.

Jackson R. (1988) *Doctors and diseases in the Roman Empire.* London.

Jacob JP., A.D´Anna, S.Denante, A:Guilcher and M.Pagni (1987-88) Provence-Alpes-Côte d´Azur. *Gallia Infor.* 2, pp.185-343.

Jacquin L., C.Becker, B.Dangréaux and M.Genin (1993) Un dépôt d'amphores lyonnaises sur le site de l'îlot 24. *Revue d'Archéologique de l'Est* 44, pp.105-141.

Jahn J. (1984) Zur Eutwicklung römischen Soldzahlungen von Augustus bis auf Diokletian. *Studien zu den Fundmünzen der Antike* 2, pp.53-74.

Jambu A. (1978) Classification automatique pour l´analyse des donées. vol I. *Méthodes et Algorithmes.* Paris.

James E. (1977) *Merovingian Archaeology of SW Gaul.* BAR Int.Ser 33, Oxford.

James ST. (1984) Britain and the Late Roman Army. In TFC.Blagg and AC.King (eds), pp.161-186.

Japella-Contardi L. (1980) *Propaganda Imperiale e protezionismo commerciale nelle iscrizioni dei collegia professionali di Roma e di Ostia da Augusto ad Aureliano.* Torino.

Jardin C. (1961) Garum et sauces de poison de l´antiquité. *Rev.Studi Liguri* 17, pp.70-96.

Jashemski WF. (1979) *The Gardens of Pompeii.* New York.

Jeannin Y. and F.Laubenheimer (1989) Les amphores de Maudeure (Epomanduodurum) dans le Doubs. *Rev.*

d'Arch. de l'Est 40, pp.75-91.

Jeffreys DJ. (1985) *The Survey of Memphis*, vol.i. London.

Jevens WS. (1871) *The theory of political economy*. New York.

Jimenez-Cisneros M. (1958) Beobachtungen in einem römischen Tüpferbezirk bei Puerto-Real, Prov.Cádiz. *Germanien* 36, pp.469-475.

Jobey G. (1982) Between Tyne and Forth: some problems. In P.Clack and S.Haselgrove (eds), pp.7-20.

Jodin A. (1987) *Volubilis Regia Iubae*. Paris.

Johnson DE. (ed)(1977) *The Saxon shore*. CBA Res. Rep. 18. London.

Johnson Chester AC., P.Coleman-Norton and F.Bourne (eds)(1961) *Ancient Roman Statutes*. Austin.

Johnson I. (1984) Cell frequency recording and analysisof artifact distributions. In HJ.Hietala (ed), pp.75-96.

Johnson S. (1976) *The Roman forts of the Saxon shore*. London.

Johnson S. (1980) *Later Roman Britain*. London.

Johnson S. (1989) *Hadrian´s Wall*. London.

Joncheray JP. (1972) Contribution a l'étude de l'épave Dramont D, dite "des Pelvis". *Cah.d'Arch.Subaquatique* 1, pp.11-34.

Joncheray JP. (1973) Contribution a l'étude de l'épave Dramont D (campagnes 1970-1971). *Cah.d'Arch.Subaquatique* 2, pp.9-48.

Joncheray JP. (1976) *Nouvelle classification des amphores découvertes lors de fouilles sous-marines*. Fréjus.

Joncheray JP. (1989) L'épave de Cap Gros. Matériel du Ier s.av JC poupe de cale en bois. *Cah.d'Arch.Subaquatique* 8, pp.57-84.

Jones AHM. (1974) *The Roman Economy*, Oxford.

Jones GDB. (1984) Becoming different without knowing it. The role and development of vici. In TFC.Blagg and AC.King (eds), pp.75-92.

Jones M. (1991) Food production and consumption. Plants. In RFJ.Jones (ed), pp.21-28.

Jones MJ. (1975) *Roman fort defences to A.D. 117*. BAR Int.Ser. 21, Oxford.

Jones MJ. (1980) The defences of the Upper Roman enclousure. *The Archaeology of Lincoln* 7.1, Lincoln.

Jones MJ. (1985) New streets for old: the topography of Roman Lincoln. In F.Green and B.Hobley (eds), pp.86-93.

Jones RFJ. (ed)(1991) *Britain in the Roman Period: Recent trends*. Sheffield.

Jones RFJ., JHF.Bloemers, SL.Dyson and M.Biddle (eds)(1988) *First Millenium Papers*. BAR Int.Ser. 401, Oxford.

Jones B. and D.Mattingly (1990) *An Atlas of Roman Britain*, Oxford.

Jongman W. (1991) *The Economy and Society of Pompeii*, Amsterdam.

Jongman W. and P.Halstead (1989) Public intervention in the food supply in the pre-industrial Europe. In P.Halstead and J.O´Shea (eds), pp.114-122.

Jonguet P. (1968) *La Vie Municipale dans l´Egypte Romaine*. Paris.

Jordano C. and I.Kahn (1966) *Jews in Pompeii, Herculaneum and the cities of Campania felix*. Pompeii.

Junker H. and E.Winter (1965) *Das Geburtshaus des Tempels der Isis in Philä*. Wien.

Kahn JS. (1990) Towards a history of the critique of economism: the nineteenth century German origins of the ethnographer's dilemma. *MAN* 25.2, pp.230-250.

Kapitan G. and MJ.Price (1974) A Roman 3rd century shipwreck at Cape Ognina (Siracusa, Sicily). *IJNA* 23, pp.150-153.

Karman Y. (1985) Geographical components in the study of ancient Mediterranean ports. In A.Raban (eds), pp.1-6.

Katzin M. (1964) The role of the small entrepreneurs. In MJ.Herskovits and M.Harwitz (eds), pp.179-198.

Keay SJ. (1983) The import of olive-oil into Catalunya during the third century A.D. In JM.Blázquez and J.Remesal (eds), pp.551-568.

Keay SJ. (1984) *Late Roman Amphorae in the Western Mediterranean. A typology and economic study: the Catalan evidence*. BAR Int.Ser. 136, Oxford.

Keay SJ. (1987) La importación del vino y aceite en la Tarraconense Oriental en la Antigüedad. In *El vi a l'Antiguitat*, pp.383-395.

Keay SJ. (1990) Processes in the development of the coastal communities of Hispania Citerior in the Republican period. In TFC.Blagg and M.Millett (eds), pp.87-96.

Keay SJ. (1992) The Siena Amphora Conference: Part 1: Amphorae and the Roman Economy. *JRA* 5, pp.353-360.

Keay SJ. (forth.) *Excavations at Peñaflor*.

Keay SJ. and L.Jones (1982) Differentiation in early Imperial amphora production in Hispania Tarraconense. In I.Freestone, C.Johns and T.Potter (eds) *Current Research in Ceramics: Thin Section Studies*, Brit.Museum Occ.Paper, pp.45-61.

Keay SJ. and M.Millett (1991) Surface survey and site recognition in Spain: the Ager Tarraconensis Survey and its background. In J.Schofield (ed), pp.129-139.

Keene DJ. (1982) Rubbish in medieval towns. In AR.Hall and HK.Kenward (eds), pp.26-30.

Kehoe DP. (1988) *The Economic of Agriculture on the Roman Imperial States in North Africa*. Göttingen.

Kemp BJ. (1984) *Amarna Reports I*. London.

Kenrick PM. (1986) *Excavations at Sabratha 1948-51*. JRS Monograph 2. London.

Kent J. (1987) The monetary system. In J.Wacher (ed), pp.568-585.

Kent JPC. (1978) The London Area in the Late Iron Age: an interpretation of the earliest coins. In J.Bird (ed), pp.53-58.

Kenward HK., AR.Hall and AKG.Jones (1986) Environmental evidence from a Roman well and Anglian pits in the Legionary fortress. *The Archaeology of York* 14.5. York.

Keppie L. (1982) The Antonine Wall 1960-1980. *Britannia* xii, pp.91-112.

Keppie L. (1984) *The making of the Roman Army*. London.

Keppie L. and JF.Murry (1981) A Roman hypocaust at Falkirk. *PSA Scot.*, pp.248-262.

Keynes JM. (1936) *General theory of employment, interest and money*. Cambridge.

Kindler A. (ed)(1967) *International Numismatic Convention*. Jerusalem.

King AC. (1981) The decline of samian ware manufacture in the north west provinces: problems of chronology and interpretation. In A.King and M.Herring (eds), pp.55-78.

King AC. (1984) Animal bones and the dietary identity of military and civilian groups in Roman Britain, germany and Gaul. In TFC.Blagg and AG.King (eds), pp.187-218.

King AC. (1991) Food production and consumption - meat. In RFJ.Jones (ed), pp.15-20.

King AC. and M.Herring (eds)(1981) *The Roman West in the third century*. BAR Int.Ser. 109, Oxford.

Kintigh KW. (1989) Sample size, significance, and measures of diversity. In RD.Leonard and GT.Jones (eds), pp.25-36.

Kirby A. and M.Kirby (1976) Geomorphic processes and the surface survey of archaeological sites in semi-arid areas. In D.Davidson and M.Schackley (1976), pp.229-253.

Kisić A. (1987) Nalaz potounlog trgovačkog broda s početka iv. Stoljeća u uvali Sobra na Mljeta. *Anali Historiskog Institau Dubrovniku* 24-25, pp.7-31.

Kleberg T. (1957) *Hôtels, restaurants et cabarets dans l´antiquité romaine*. Uppsala.

Knapp AB. (1992) Archaeology and Annales: time, space and change. In AB.Knapp (eds), pp.1-22.

Knapp AB. (ed)(1992) *Archaeology, annales and ethnohistory*. Cambridge.

Kneissel P. (1981) Die utricularii: Ihr Rolle im gallo-römischen transportwesen und Weinhandel. *BJ*, pp.169-204.

Kneissel P.(1983) Mercator-negotiator. Roömische Geschaftsleute und die Terminologie ihrer Beruf. *MBAH* ii/1, pp.73-90.

Knights BA., CA.Dickson, JH.Dickson and DJ.Breeze (1983) Evidence concerning the Roman military diet at Bearsden, Scotland, in the 2nd century AD. *Journal of Arch. Science* 10, pp.139-152.

Koehler CG. (1986) Handling of Greek container amphoras. *BCH* Supp. xiii, pp.49-67.

Kolendo J. (1973) *Le traité d´agronomia des Saserna*. Wroclaw.

Kolendo J. (1976) *Le colonat en Afrique sous le haut-empire*. Besançon.

Kolendo J. (1980) *L´agricoltura dell´Italia antica*. Rome.

Knörzer KH. (1970) *Römerzeitliche Pflauzenfunde aus Neuss*. Novaesium iv (Limesforshungen 10), Berlin.

Kondratiev N. (1928) The Major Economic Cycles. *Voprosky Konjunctury* 1, pp.28-79 (Review Eco. Stat. 18, pp.105-115).

Kransky KJ. (1963) Structure of transportation networks, University of Chicago, *Dep.of Geography Research, Paper* 84.

Kristiansen K. and C.Palaudau-Müller (eds)(1977) *New directions in Scandinavian Archaeology*. Lyngby.

Kristiansen K., M.Trolle-Larsen and M.Rowlands (eds)(1987) *Center, periphery and dependency in Ancient Regional Systems*. Cambridge.

Kroll EM. and TD.Price (1991) *The interpretation of archaeological spatial patterns*, Wisconsin.

Kuhn TS. (1980) *The structure of scientific Revolution*. Chicago.

Kuna M. and D.Adelsbergerova (1993) A GIS analysis of microrregional settlement patterns: Vinorsky potck project, Bohemia. In *GIS Conference*.

Kunisz A. (1978) Quelques remarques sur le réforme monétaire de Nero. In *Les dévaluations à Rome. Epoque républicaine et impériale*, vol.i (Rome, 1975), pp.89-97. Rome.

Künnow J. (1980) *Negotiator et Vectura: Händler und Transport im Freieen Germanien*, Marburg.

Künnow J. (1987) Das Limesvorland der südlichen Germania Inferior. *Bonner Jahrbücher* 187, pp.68-77.

Künnow J. (1990) Relations between Roman occupation and the Limesvorland in the province of Germania Inferior. In T.Blagg and M.Millett (eds), pp.87-96.

Kvamme KL. (1989) Geographic Information Systems in Regional Archaeological Research and Data Management. In MB.Schiffer (1989), pp.139-203.

Kvamme KL. (1990a) Spatial Autocorrelation and the Classic Maya Collapse Revisited: Refined techniques and new conclusions. *Journal of Archaeological Science* 17, pp.197-207.

Kvamme KL. (1990b) The fundamental principles and practice of predictive archaeological modelling. In A.Voorips (eds), pp.257-295.

Kvamme KL. (1992) Geographic Information Systems and Archaeology. In G.Lock and J.Moffett (eds), pp.77-84.

Kvamme KL. (1993) A view from across the water: the North American experience in archaeological GIS. In *GIS Conference*.

Labrousse M. (1968) *Toulouse Antique*. Paris.

Labrousse M. (1977) Marques d'amphores à huile espagnoles trouvées à Toulouse, Cahors et Rodez. *Mém. de la Soc. Arch. du Midi de la France* 41, pp.7-38.

Lacour-Gayet J. (ed)(1950) *Histoire du commerce*. Paris.

Lagóstera-Barrios L. (1993) El alfar romano del Cerro de Ceuta (Puerto Real, Cádiz). *Habis* 24, pp.95-104.

L´Alimentazione en el Mondo Antico. Inst. Poligrafico i Zecca dello Stato. Roma (1987).

La Lone DE. (1982) The Inca as a non-market economy: supply on command versus supply and demand. In JE.Ericson and TK.Earle (eds), pp.292-316.

Lamberg-Karlovsky CC. (1975) Third millenium modes of exchange and modes of production. IN JA.Sabloff and CC.Lamberg-Karlovsky (eds), pp.341-368.

Lamboglia N. (1952) La nave romana di Albenga. *Rivista di Studi Liguri* 18, pp.3-4.

Lamboglia N. (1955) Sulla cronologia delle anfore romane di età repubblicana (III-I A.C.). *Rivista di Studi Liguri* 21, pp.241-270.

Lamour C. and F.Mayet (1980) Glanes amphoriques: I.Région de Béziers et Narbonne. *Etudes sur Pézenes et l'Hérault* 11, pp.5-16.

Lamour C. and F.Mayet (1981) Glanes amphoriques: II.Régions de Montpellier, Sète, Ensérune, Le Cayle (Mailhac). *Etudes sur Pézenes et l'Hérault* 12, pp.3-18.

Lancel S. (1972) *Byrsa I*. Rome.

Landels JG. (1978) *Engineering in the Ancient world*. Berkeley.

Lane F. (1966) *Venice and history*. Baltimore.

Lane RH. (1935) Waggons and their ancestors. *Antiquity* 9, pp.140-150.

Lang J. (1975) *Conquest and commerce*. New York.

Lange AG. (1990) *De Horden near Wijk Bij Duurstede*. ROB, Ammersfoot.

L´Animal dans l´alimentation humaine: les critèresde choix. Actes du Colloque Int. de Liège (1986). Anthropozoologica. Liège, 1988.

La Torre GF. (1988) Gli impianti commerciali ed artigianali nel tessato urbano di Pompei. In *Pompei. L´informatica al servizio di una città antica. Rome*, pp.75-102.

Laubenheimer F. (1977) Amphores gaulois de la region de Nimes. *Caesarodunum* 12, pp.197-226.

Laubenheimer F. (1985) *La production des amphores en Gaule Narbonannaise*. CNRS 66, Paris.

Laubenheimer F. (1986a) La production d'amphores de deux ateliers de potiers du bassin de la Loire moyenne. *Rev.Arch. du Centre de la France* 25.2, pp.175-187.

Laubenheimer F. (1986b) Les amphores produites à Guengnon (Sâone-et-Loire) et les débuts du vignoble bourguignon. *Dialogues d'histoire ancienne* 12, pp.431-453.

Laubenheimer F. (1989) Les amphores gauloises sous l'Empire. Recherches nouvelles sur leur production et leur chronologie. *MEFRA* 114, pp.105-138.

Laubenheimer F. (1990) *Le temps des amphores en Gaule*, Paris.

Laubenheimer F. (1991a) *Les amphores de Bibracte*. DAF 29. Paris.

Laubenheimer F. (1991b) Les vides sanitaries et les amphores de la Porte d'Orée à Frejus. *Gallia* 48, pp.229-266.

Laubenheimer F. (1994) Local amphora production, from Burgundy to Seine. In *Roman amphorae. Problems of identification and methodology*, London.

Laubenheimer F. and F.Widemann (1977) L'atelier d'amphores de Corneilhan (Hérault). Typologies et analyses. *Rev. d'Archéometrie* 1, pp.58-82.

Laubenheimer F. et alii (1981) Analyse par activation neutronique d'amphores Gallo-Romaines mise en evidence d'exporation aux frontières de l'Empire. *Rev.d'Archéometrie* 3, pp.155-175.

Laubenheimer F. and S.Humbert (1992) Emballages perdus objets trovés: les amphores. In JO.Guilhot and C.Goy (eds) *Les fouilles du parking de la mairie à Besançon*. Besançon, pp.188-212.

Laubenheimer F. and MC.Lequoy (1992) Les amphores Gauloise 12 de Normandie. Le matériel de la nécropole de Vatteville-le-Rue. In *Les Amphores en Gaule*, pp.75-92.

Laubenheimer F., C.Gébara and I.Beraud (1992) Circulation des amphores et vide sanitaire, l´exemple de Fréjus. In *Les Amphores en Gaule*, pp.119-122.

Laubenheimer F., M.Schwaller and L.Vidal (1992) Nimes, les amphores de la rue de Conde. In *Les Amphores en Gaule*, pp.133-150.

Lauffer S. (1971) *Diokletian's Preisedikt*, Berlin.

Lauwerier RCGM. (1988) *Animals in Roman times in the Dutch Eastern river area*. ROB, Amsterdam.

Laver PG. (1927) The excavation of a tumulus at Lexden, Colchester. *Archeologia* 76, pp.241-254.

Laxton RP. and J.Restorick (1989) Seriation by similarity and consistency. In S.Rathz and J.Richards (eds), pp.215-225.

Lebart A., F.Morineau and J.Warwick (1984) *Multivariate descriptive statistical analysis. Correspondence Analysis and Related technique for large matrices*. New York.

Le Bohec Y. (1989a) *L´armée romaine*. Paris.

Le Bohec Y. (1989b) *Les unites auxiliares de l´armée romaine*. Paris.

Le Clair EE. and HK.Schneider (eds)(1968) *Economic anthropology. Readings in theory and analysis*. New York.

Lee JE. (1862) *Isca Silurum. Catalogue of the Museum of Antiquities of Caerleon*. Cardiff.

Leeuw SE. van der (1983) Acculturation as information processing. In R.Brandt and J.Slofstra (eds), pp.11-42.

Leeuw SE. van der (1984) Dust to dust: a transformational view of the ceramic cycle. In SE.van de Leeuw and AC.Pritchard (eds), pp.707-774.

Leeuw SE. van der and AC.Pritchard (eds)(1984) *The Many Dimensions of Pottery*. Amsterdam.

Le Gall J. (1953) *Le Tibre. Fleuve de Rome dans l'Antiquité*. Paris.

Le Gall J. (1983) La diffusion de l'huile espagnol dans le Gaule du Nord. In JM.Blázquez and J.Remesal (eds), pp.213-ss.

Leighton AC. (1972) *Transport and communication in Early medieval Europe*. New Abbot.

Lennox Manton E. (1988) *Roman North Africa*. London.

Leonard RD. and GT.Jones (eds)(1989) *Quantifying diversity in Archaeology*. Cambridge.

Lepiksaar J. (1986) Tierrestre in einer römische amphora aus Salzburg (Mozartplatz 4). *Bayerische Vorgeschichts-Blätter* 51, pp.163-185.

Lequément R. and B.Liou (1978) Un nouveau document sur le vin de la Bétique. *Archaeonautica* 2, pp.183-184.

Lequément R. and JL.Massy (1980) Importation à Soissons (Aisne) d'olives au defructum en provenance de la Bétique. *Cah.d'Arch. de la Picardie* 1, pp.233-266.

Le Roux P. (1988) L'huile de Betique et le prince sur un itineraire annonaire. In *Hommage Robert Etienne*. Paris, pp.247-272.

Le Roy Ladurie E. (1971) *Times of feast, times of famine*. London.

Les Amphores en Gaule. Production et Circulation. Cah.Rev.d'Histoire Ancienne v.116. Paris (1992).

Les dévaluations à Rome, époque républicaine et impériale. vol I [Rome, 1975], Rome (1978). vol II [Gdansk, 1978], Rome (1980).

Leveau Ph. (ed)(1985) *L'origine des richesses dépensées dans la ville antique*. Aix-en-Provence.

Leveau Ph., P.Sillières and JP.Vallot (1993) *Campagnes de la Méditerranée Romaine*. Paris.

Lévi-Strauss C. (1964) *Les Mythologiques: I.Le cru et le cuit*. Paris.

Lewis N. (1983) *Life in Egypt under Roman rule*. Oxford.

Lewis N. (1986) *Greeks in Ptolemaic Egypt*. Oxford.

Lézine A. (1968) *Carthage Antique*. Paris.

Liebeschuctz JHWG. (1972) *Antioch. City and Imperial administration in the Later Roman Empire*. Oxford.

Light L. de (1990) Demand, supply, distribution: the Roman peasantry between town and countryside. *MBAH* 9.2 pp.24-56; 10.1 (1991) pp.33-77.

Lintott A. (1993) *Imperium Romanorum*. London.

Liou B. (1973) Informations archéologiques. recherches archéologiques sous-marines. *Gallia* 31, pp.571-608.

Liou B. (1980) Les amphores à huile de l'épave Saint-Gervais 3 à Fos-sur-Mer: premières observations sur les inscriptions peintes. In JM.Blázquez (ed), pp.161-176.

Liou B. (1982) Informations archéologiques. Direction des recherches sous-marines. *Gallia* 40, pp.437-454.

Liou B. (1987a) Inscriptions peintes sur les amphores: Fos (suite), Marseille, Toulon, Port-le-Nautique, Arles, Saint-Blaise, Saint-Martin-de-Grau, Mâcon, Calvi. *Archaeonautica* 7, pp.55-141.

Liou B. (1987b) L'exportation de vin de Tarraconaise d'apres les épaves. In I Col.loquir d'Arqueologia Romana. *El vi a l'Antiguitat, Badalona* 1985, pp.271-284.

Liou B. (1988) Le contenu des amphores, typologie et epigraphie: Quelques cas aberrants ou embarrassants, *SFECAG, Actes du Congres de Orange*, pp.171-176.

Liou B. (1991) Le Comerce de la Bétique au Ier siècle de notre ere. Notes sur l'épave Lavezzi 1 (Bonifacio, Corse du Sud). *Archaeonautica* 10, pp.125-186.

Liou B. (1993) Inscriptions peintes sur amphores de Narbonne (Port-la-Nautique). *Archaeonautica* 11, pp.131-148.

Liou B. et alii (1977) L'épave de Port-Vendres II. Les inscriptions peintes. *Archeonautica* I, pp.161-ss.

Liou B. and R.Marichal (1978) Les inscriptions peintes sur amphores de l'Anse Saint gervais à Fos-sur-Mer. *Archaeonautica* 2, pp.109-181.

Liou B. and M.Scilliano (1989) Le trafic du port de Fos dans l'Antiquité: Essai d'evaluation a partir des amphores, *SFECAG, Actes du Congres de Lezoux*, pp.153-167.

Liou B. and C.Domergue (1991) Le commerce de la Bétique au Ier siècle de notr ère. L'épave Sud-Lavezzi 2 (Bonifacio, Corse du Sud). *Archaeonautica* 10, pp.11-124.

Liou B. and JM.Gassend (1991) L'épave Saint-Gervais 3 à Fos-sur-Mer (Milieu du II siècle ap.JC). *Archaeonautica* 10, pp.157-269.

List F. (1841) *Das nationale System der politischen Oekonomia der internationale Handel, die Handels politik und der deutsche Bollorein*. Berlin.

Littleton AC. and BS.Yamey (eds)(1956) *Studies in the history of accounting*. London.

Liverside J. (1957) Kitchen in Roman Britain. *ANL* 96.4, pp.83-85.

Lloyd M. (1985) The shipwreck at Iskandil Burnu. *INA Newsletter* 12.3, pp.4-5.

Loane HJ. (1907) *Industry and Commerce in the City of Rome (50 BC- 200 AD)*. Baltimore.

Lo Cascio E. (1980) La riforma monetaria di Nerone: evidencia degli tessori. *MEFRA* 92.

Lo Cascio E. (1981) State and coinage in the late Republic and Early Empire. *JRS* lxxi, pp.76-86.

Lo Cascio E. (1986) Teoria e politica monetaria a Roma tra III e IV dC. In A.Giardina (ed), pp.535-ss.

Lo Cascio E. (1990) L´organizzazione annonaria. In *Civiltà dei Romani. La città, il territorio, l´impero*. Torino, pp.229-248.

Lock G. and J.Moffett (eds) *Computer Appications and Quantitative Methods in Archaeology*. BAR Int.Ser. 577, Oxford.

Locker A. (1983) The fish bones from Area A, PEN 79 Peninsular House. Unp. *Archive Report HBMC.*

Lockyear K. and S.Rathz (eds)(1991) *Computer Applications and Quantitative Methods in Archaeology*. BAR Int.Ser. 565, Oxford.

Lockyear K. (1991) Simulating Coin Hoard Formation. In K.Lockyear and S.Rathz (1991), pp.195-206.

Loeschcke S. (1909) Kerasmische Funde in Haltern. In *Mittelmagender Altertunkomission für Westfalen* v, pp.103-122.

Loeschcke S. (1942) Die römische und belgische Keramik aus Oberaden. In Ch.Albrecht (ed) *Das Römerlager in Oberaden* II, Dortmund.

London Association of Classical Teachers (1969) *Original Records 4. Some Inscriptions from Roman Britain.* London.

Long L. (1987) Les épaves du Grand Congloué. Etude du journal de fouilles de Fernard Benoit. *Archeonautica* 7, pp.9-36.

Longo O. and P.Scarpi (eds)(1989) *Homo Edens.* Verona.

Lopes C. and F.Mayet (1990) Commerce régional et lointain des amphores lusitaniennes. In A.Alarçao and F.Mayet (eds), pp.295-302.

López-Alegret P. (1990) *El libro de la nutrición.* Madrid.

López-Mullor A. (1990) Une nouvelle fouille dans le centre producteur d'amphores de Sant Boi de Llobregat (Barcelona). *SFECAG, Actes du Congres de Mandeure-Mathay*, pp.187-197.

López-Pérez JA. (1988) L´animal dans l´alimentation humaine selon Galien. In *L´Animal dans l´alimentation*, pp.91-94.

Lorenzo-Sanz E. (1979) *Comercio de España con América en la época de Felipe II.* Valladolid.

Lösch A. (1954) *The Economic of location.* New Haven [1939]

Love JR. (1991) *Antiquity and Capitalism.* London.

Loyzance MF. (1988) A propós de Marcus Cassius Sempronianus Olisiponensis, diffusor olearius. In *Hommage Robert Etienne.* Paris, pp.273-284.

Luff RM. (1982) *A zooarchaeological study of the Roman North-western provinces.* BAR Int.Ser. 137, Oxford.

Luttwak EN. (1976) *The grand strategy of the Roman Empire from the first century AD to the third.* Baltimore.

MacDonald DW. (1969) *The architecture of the Roman Empire.* New Haven.

MacDowall DW. (1979) *The Western Coinage of Nero.* New York.

MacKinlay AP. (1948) Ancient experience with intoxicating drinks: non-classical peoples. *Quaterly Journal of Studies on Alcohol*, pp.388-414.

MacMullen R. (1970) Market days in the Roman Empire. *Phoenix* 24, pp.333-341.

MacMullen R. (1974) *Roman Social Relations, 50 BC to AD 284.* New Haven.

MacMullen R. (1982) The epigraphic habit in the Roman Empire. *AJPhil* 103, pp.233-246.

MacMullen R. (1990) *Changes in the Roman Empire.* Princeton.

MacReady S. and FH.Thompson (eds)(1984) *Cross-Channel Trade between Gaul and Britain in the pre-Roman Iron Age.* London.

Maestripieri D. and M.Ceci (1990) Oli Oppi: una famiglia di fabbricanti urbani di lucerne. *JRA* 3, pp.119-133.

Magie D. (1950) *Roman Rule in Asia Minor to the end of the third century after Christ.* Princeton.

Maia M. (1974-7) Marcas de ânforas da forma Dr.20 de Troia, Setubal. *O.Arq.Port.* iii, vol.vii-ix

Maiuri A. (1925) *Nuova silloge epigrafica di Rodi e Cos*, Firenze.

Maiuri A. (ed)(1950) *Pompeiana: Raccolta di studi per il secondo centenario degli scavi di Pompei.* Naples.

Malinowski B. (1922) *Argonauts of the Western Pacific.* New York.

Malthus TR. (1798) *An essay of the principle of population.* [New York, 1960].

Manacorda D. (1977a) Anfore. *Ostia* IV, pp.117-254.

Manacorda D. (1977b) Anfore spagnole a Pompei. In A.Carandini (1977), pp.121-130.

Manacorda D. (1977c) Testimonianze sulla produzione nel III secolo. *Dialoghi di Archeologia* ix-x, pp.542-601.

Manacorda D. (1977d) Il Kalendarium Vegetianum e le anfore della Betica. *MEFRA* 32, pp.393-441.

Manacorda D. (1978) The Ager Cosanus and the production of the amphora of Sestius: new evidence and reassessment. *JRS* 68, pp.122-131.

Manacorda D. (1981) Produzione agricola, produzione ceramica e propietario nell'Ager Cosanus nel I a.C. In A.Giardina and A.Sciavone (eds) II. Bari, pp.3-54.

Manacorda D. (1983) Prosopografia e anfore tripolitane, nuove observazioni. In JM.Blázquez and J.Remesal (eds), pp.483-500.

Manacorda D. (1989) Le anfore dell'Italia Republicana: aspetto economico e sociale, *MEFRA* 114, pp.443-467.

Manacorda D. (1990) Le Foranci di Visellio a Brindisi. Primi resultati dello scavo. *Vetera Christianorum* 29, pp.375-415.

Mandelbann DG. (1965) Alcohol and culture. *Current Anthropology* 6, pp.281-293.

Mangin M. (1985) Artisanat et commerce dans les agglomerations secondaire du Centre-Est de la Gaule sous l´Empire. In Ph.Leveau (ed), pp.233-246.

Mann JC. (1983) *Legionary recruitment and veteran settlement during the Principate*. London.

Mann JC. (1985) Epigraphic consciousness. *JRS* 75, pp.204-266.

Manndelmann DG. (1965) Alcohol and culture. *Current Anthropology* 6, pp.281-293.

Mantilla-Collantes A. (1987-8) Marcas y ánforas romanas encontradas en Saguntum. *Saguntum* 21, pp.379-416.

Maraval P. (1985) *Lieux saints et pèlerinages d'Orient*. Paris.

Mardese RT. (ed)(1983) *Aspects of Graeco-Roman Urbanism*. BAR Int.Ser.188, Oxford.

Margary ID. (1973) *Roman roads in Britain*. London.

Markoulaki S., JY.Empereur and A.Marangon (1989) Recherches sur les centres de fabrication d'amphores de Crète occidentale. *BCH* cxiii, pp.551-580.

Marsden P. (1965) The County Hall ship. *Trans LMAS* 21, pp.109-117.

Marsden P. (1967) *A Roman ship from Blackfriars*. London.

Marsden P. (1975) The Excavation of a Roman Palace site in London, 1961-1972. *Trans. London and Middlessex Arch. Soc.* 26, pp.1-102.

Marsden P. (1980) *Roman London*. London.

Marsden P. (1981) Early Shipping and waterfronts of London. In G.Milne and B.Hobley (eds), pp.10-16.

Marsden P. (1985) London in the 3rd and 4th centuries. In F.Grew and B.Hobley (eds), pp.99-108.

Marsden P. (1987) *The Roman Forum site in London*. London.

Marsden P. (1993) A hydrostatic study of a reconstruction of Mainz Roman ships. *IJNA* 22.2, pp.137-142.

Marsden P. and B.West (1994) Population change in Roman London. *Britannia* 23, pp.133-140.

Marsden T. (ed)(1988) *Multivariate archaeology*. Aarhus.

Marsh G. (1981) London's Samian supply and its relationships to the development of the Gallic samian industry. In AC.Anderson and AS.Anderson (eds), pp.173-238.

Marshall A. (1848) *Principles of Economics*. New York.

Marshall M. (ed)(1979) *Beliefs, behaviours and alcoholic beverages*. Michigan.

Marshall M. (1987) *Long waves of Regional Development*. London.

Martin R. (1971) *Recherches sur les agronomes latins et leur conceptions économiques et sociales*. Paris.

Martin-Kilcher S. (1983) Les amphores romaines à huile de Bétique (Dressel 20 et 23) d'Augst (Colonia Augusta Rauricorum) et Kaiseaugst (Castrum Rauracense). Un rapport préliminaire. In JM.Blázquez and J.Remesal (eds), pp.337-342.

Martin-Kilcher S. (1985) Keramikanalysen au römischen Ölamphoren aus Augst, Kaiseraugst, Avenches et Lausanne. *Jb.Scheiz.Ges.f.Ur-u.Frühgesch.* 68, pp.173-204.

Martin-Kilcher S. (1987a) *Die Römischen Amphoren aus Augst und Kaiseraugst*, vol.i, Bern; [1994], vol.ii, Bern.

Martin-Kilcher S. (1987b) Céramique du Bas-Empire découverte à Sion "Sous-le-Scex". *Archéologie Suisse* 9. pp.157-ss

Martin-Kilcher S. (1990) Le vin et la vigne dans la Suisse Romain. *Caesarodunum* xxiv, pp.25-30.

Martin-Kilcher S. (1991) Fischsaucen und Fischkonserven aux den Römischen Gallien. *Archéologie Suisse* 13. pp.37-44.

Martin-Kilcher S. (1992a) La fabrication d'amphores vinaires Dressel 2-4 à Augusta Rauricorum (Augst, Suisse) et le début de la viniculture au Nord des Alpes. In *Les Amphores en Gaule*, pp.51-58.

Martin-Kilcher S. (1992b) Les amphores de Gaule romaine: leur présence à Augusta Rauricorum. In *Les Amphores en Gaule*, pp.157-161.

Martin-Kilcher S. (1994) Fish-sauce amphorae from the Iberian Peninsula: The markets in the provinces between Gaul and Pannonia. In *Roman Amphorae. Problems of Identification and Methodology*, London.

Martin-Kilcher S., M.Magetti and G.Galetti (1987) Fabrikation von Weinamphoren der Form Dressel 2-4 in Augusta Rauricorum (Augst). *Jahb.Schweiz.Ger.für Ur-und Frühgeschichte* 70, pp.113-ss.

Martin-Kilcher S. and V.Schillinger-Häfele (1990) Eine Südspanische Amphore für Fischsauce aus Mainz Weiseman unt Pinselaufschaft. *Mainzer Zeitschrift* vol.84-85, pp.273-278.

Martelli M. et alii (1982) Archeologia subacquea in Toscana. *Archeologia Subacquea* (Boll. d'Arte Supp. 4), pp.37-86.

Martínez J., J.Folch and T.Casas (1988) La intervenció arqueològica al jaciment ibèric i romà de Can Feu-1987. Notes preliminars. *Arraona* 3, pp.25-34.

Martínez-Maganto J. (1990) Faros y luces de señalización en la navegación antigua. *Cuad.Preh.Arq.Univ.Aut.Madrid* 17, pp.67-89.

Martínez-Maganto J. (1992) Los salazones romanos: aportes historiográficos de interés en Arqueología. *Archeofauna* 1, pp.73-81.

Martinez-Maganto J. (forth.) La industria de salazones Bética en época romana.

Martínez-Maganto J. and E.Arnaiz (1991) El ánfora envase comercial por excelencia en el mundo romano. *Rev. Arqueología* 124, pp.26-35.

Martínez-Maganto J. and C.Carreras (1993) El comercio de salazones hispanos en Britannia: Nuevos testimonios de la navegación a través de la ruta Atlántica. *XXII Congreso Nacional Arqueología*. Vigo.

Martínez-Maganto J. and C.Carreras (1994) El comercio de ánforas salarias béticas en Britannia. *AEA* 66.

Martínez Santa-Olalla J. (1948) Sobre el valor cronológico de las ánforas romanas. *Cuad. Historia Primitiva* 2, pp.135-139.

Martínez-Vega V. (1993) *Antropología económica*. Barcelona.

Marx K. (1953) *Grundisse de Kritik der politischen Oekonomia*. Berlin.

Mas J. (1979) *El Puerto de Cartagena*. Cartagena.

Mason DJP. (1980) *Excavations at Chester*. Grosvenor Museum Arch. Exc. and Surveys Rep. 4. Chester.

Massagrande F. (1993) Using GIS with non-systematic survey data: the Mediterranean evidence. In *GIS Conference*.

Mathews JF. (1984) The tax law of Palmyra: evidence for economic history in a City of the Roman East. *JRS* lxxiv, pp.157-180.

Mattingly DJ. (1988a) Oil for export ? A comparison of Lybian, Spanish and Tunisian olive oil production in Roman Empire. *JRA* 1, pp.33-56.

Mattingly DJ. (1988b) The olive boom. Oil supplies, wealth and power in Roman Tripolitania. *Lybian Studies* 19, pp.21-42.

Mattioli SP. (1992) *Anfore romana a Padova: ritrovamenti dalla città*. Padova.

Maxfield VA. (1991) Tiverton Roman fort (Bolhan). Excavations 1981-1986. *Devon Arch.Soc.* 49, pp.25-98.

Maxfield VA. and MJ.Dobson (eds)(1989) *Roman Frontier Studies*. Exeter.

Mau A. (1909) *Corpus Inscriptorum Latinorum IV*. Suppl.2. Berlin.

Maugin M. (1981) *Un quartier de commerçants et d'artisans d'Alesia*. Paris.

Mauss M. (1954) *The Gift*. London.

Mayet F. (1978) Marques d'amphores de Maurétanie Tingitane. *MEFRA* 90, pp.357-393.

Mayet F. (1986) Les figlinae dans les marques d'amphores Dressel 20 de la Bétique. *Rev.d'études anciennes* lxxxviii, pp.285-305.

Mayet F. (1990) Typologie et chronologie des amphores lusitaniennes. In A.Alarçao and F.Mayert (eds), pp.29-36.

Mazza M. (1980) De Martino e la Storia economica di Roma antica. *Index* 9, pp.129-143.

Mazzini I. (1989) Alimentazione e salute secondo i medici del mondo antico: teoria e realità. In O.Longo and P.Scarpi (eds), pp.257-264.

McCann AM. (1987) *The Roman Port and Fishery of Cosa*. Princeton.

McGlade J. (1987) Chronos and the oracle: some thoughts on time, timescales and simulation. *Arch.Review from Cambridge* 6, pp.21-31.

McGrail S. (ed)(1977) *Sources and techniques in Boat Archaeology*. BAR Brit.Ser. 29, Oxford.

McGrail S. (1983) Cross-Channel seamanship and navigation in the late 1st millenium BC. *Oxford Journal of Archaeology* 2, pp.299-337.

McGrail S. (1984) The shipment of traded goods and of ballast in antiquity. *Oxford J. Arch.* 8.3, pp.353-358.

McGrail S. (1987) *Ancient Boats in NW Europe: the archaeology of the water transport to AD 1500.* London.

McGrail S. (ed)(1990) *Maritime Celts, Frisians and Saxons.* CBA Res. Rep. 71, London.

McGrail S. (1990) *Boats and boatmanship in the Southern North Sea and Channel.* In S.McGrail (ed), pp.32-48.

McGuire RH. (1992) *A Marxist Archaeology.* San Diego.

McKellar J. (1973) *Correlations and the explanation of distributions.* Tucson.

McWhirr AD. (1986) *Houses in Roman Cirencester.* Cirencester.

McWhirr AD. (1987) Transport by land or water. In J.Wacher (ed), pp.658-670.

Meffre JC. and P. (1992) L´atelier augustéen d´amphores et de céramiques de Sainte-Cécile-les-Vignes (Vaucluse). In *Les Amphores en Gaule*, pp.25-36.

Meiggs R. (1960) *Roman Ostia.* Oxford.

Meiggs R. (1982) *Trees and timber in the Ancient Mediterranean World.* Oxford.

Meijer F. and O.van Nijf (1992) *Trade, transport and society in the ancient world.* London.

Melillo G. (1983) *Il negozio bilaterale romano.* Naples.

Melitz J. (1970) The Polanyi´s school of anthropology on money. *American Anthropology* lxxii, pp.1020-1040.

Mellinaoux C. (1981) *Maidens, meal and money: capitalism and the domestic economy.* Cambridge.

Meneghini R. (1984) Attività e installazioni portuali lungo il Tevere. La riva dell´Emporium. In *Misurare la Terra*, Modena, pp.162-171.

Menger K. (1871) *Grunsätze der Volkswirthschaftslehre.*

Mengotti F. (1797) *Del Commercio dei Romani.* Verona.

Meredith D. (1953) Annius Procalmus: two inscriptions from Berenice Road. *JRS* 43, pp.38-40.

Merrifield R. (1969) *The Roman City of London.* London.

Merrifield R. (1983) *London: City of Romans.* London.

Merriman N. (1987) A Prehistory for Central London? *London Archaeologist* 5 (12), pp.318-326.

Metcalf D. and KR.Barlow (1992) A model for exploring the optimal trade-off between field processing and transport. *American Anthropologist* 94, pp.340-356.

Méthodes Classiques et méthodes fornelles dans l'étude des amphores, Rome. MEFRA 32 [1977].

Metzler J., R.Waringo and R.Bis (1989) La riche tombe d´un prince gaulois. *Archéologia* 249, pp.18-25.

Meyer E. (1924) *Kleine Schriften.* Halle.

Meyer H. (ed)(1948) *History of transportation in the United States before 1860.* Washington.

Meyer-Freuler C. (1989) *Das Praetorium und die Basilika von Vindonissa. Veröffentlichungen der Gesellschaft pro-Vindonissa.* Band IX. Berlin.

Mickwitz G. (1937) Economic rationalism in Graeco-Roman agriculture. *English Historical Review* 52 (208).

Middleton P. (1979) Army supply in Roman Gaul: an hypothesis for Roman Britain. In BC.Burnham and HB.Jonhson (eds), pp.81-97.

Middleton P. (1980) La Graufesenque: a question of marketing. *Athenaeum* 58, pp.186-191.

Middleton P. (1983) The Roman Army and long-distance trade. In P.Garnsey abd CR.Whittaker (eds), pp.75-83.

Miket R. and C.Burgess (eds)(1984) *Between and beyond the walls*. Edinburgh.

Miles D. (ed)(1982) *The Romano-British countryside: studies in rural settlement and economy*. BAR Brit.Ser. 103, Oxford.

Mill JS. (1848) *Principles of political economy*. [New York, 1909].

Millar F. (1981) The world of the Golden Ass. *JRS* lxxi, pp.63-75.

Millar F. (1982) Emperors, frontiers and foreign relations, 31 BC to AD 378. *Britannia* xii, pp.1-23.

Millar F. (1991) Les congiaires à Rome et la monnaie. In D. van Berchem (ed), pp.143-157.

Miller J. (1968) *The spice trade of the Roman Empire*. Oxford.

Miller P. (1993) Terrain modelling and deposit evaluation in an urban setting: the York Archaeological assessment. In *GIS Conference*.

Millett M. (ed)(1979a) *Pottery and the Archaeologist*. Inst. of Archaeology Occ.Papers 4

Millett M. (1979b) How much pottery ?. In M.Millett (1979), pp.77-80.

Millett M. (1986) Central places in a decentralized Roman Britain. In E.Grant (ed), pp.45-47.

Millett M. (1990a) *The Romanization of Britain*. Cambridge.

Millett M. (1990b) Romanization: historical issues and archaeological interpretation. In TFC.Blagg and M.Millett (eds), pp.35-44.

Millett M. (1991) Pottery: population or supply patterns ?. In G.Baker and J.Lloyd (1991), pp.18-26.

Millett P. (1983) Maritime loans and the structure of credit in fourth-century Athens. In P.Garnsey et alii (eds), pp.36-52.

Mills BJ. (1989) Integrating functional analyses of vessels and sherds through models of ceramic assemblage formation. *World Archaeology* 21, pp.133-147.

Milne G. (1985) *The Port of Roman London*. London.

Milne G. (1990) Maritime traffic between the Rhine and Roman Britain: a preliminary note. In S.McGrail (ed), pp.82-84.

Milne G. and B.Hobley (eds)(1981) *Waterfront Archaeology in Britain and Northern Europe*. CBA Res. Rep. 41. London.

Mintz SW. (1982) Sistemas de mercado interno como mecanismos de articulación social. *Nueva Antropología* vi.19, pp.11-28.

Miró J. (1981-2) Les marques C.Mussidi Nepotis i Philodamus i la producció d'àmfores Dressel 28 i Dressel 7-11 a Catalunya. *Pyrenae* 17-18, pp.335-342.

Miró J. (1988) *La producción de ánforas romanas en Catalunya*. BAR Int.Ser.473, Oxford.

Miró J. (1991) Un conjunto de ánforas tardo-republicanas de un silo del poblado ibérico de Burriac (Cabrera de Mar). *Saguntum* 24, pp.53-67.

Mitchell S. (1976) Requisitioned transport in the Roman Empire: a new inscription from Pisidia, *JRS* lxvi, pp.106-131.

Mitchell S. (1982) The requisitioning Edict of Sex.Sotidius Strabo Libuscidianus. *ZPE* 45, pp.99-110.

Mócsy A. (1974) *Pannonia and Upper Moesia*. London.

Mócsy A. (1984) Benverkungen zu den negotiatores von Coijnsplat. *MBAH* 3.2, pp.43-57.

Moeller WO. (1976) *The wool trade of ancient Pompeii*. Leiden.

Molin M. (1984) Quelques considérations sur le chariot des vendages de Langres. *Gallia* 42, pp.97-114.

Molin M. (1990) Le transport du raisin et du vin par la route à l'époque romaine en la Gaule et dans les provincies vaisines. *Caesarodunum* xxiv, pp.205-218.

Molina-Vidal J. (1993) Las ánforas "Lomba do Canho 67". Aportaciones al estudio de un nuevo tipo: difusión y valoración económica. *XXII Congreso Nacional de Arqueología*. Vigo.

Momigliano A. (1966) *Studies in Historiography*. New York.

Mommsen T. (1854-56) *Römische Geschichte*. Leipzig.

Mommsen T. (1871-88) *Römisches Staatsredit*. 3 vol. Leipzig.

Monaghan J. (1987) Découvertes maritimes provenant du Baillage de Guernsey. *SFECAG, Actes de Congres du Caen*, pp.39-43.

Monaghan J. (1991) Pottery from the marine sites around Guernesey. *J.Roman Pottery Studies* 3, pp.63-69.

Moore WF. and MS.Ross (1989) The Romano-British settlement, Common Mead Lane, Gillingham Dorset. *Dorset Nat.Hist.Arch.Soc*, vol.111, pp.57-70.

Moorhouse SA. (1986) Non-dating uses of Medieval Pottery. *Medieval Ceramics* 10, pp.85-123.

Morales A. and E.Roselló (1989) Informe sobre la fauna ictológica recuperada en una àmfora tardorromana del tipus Keay xxvi (Spatheion). In *Un abocador del segle V d.C. en el Forum provincial de Tarraco (Memorias de Excavació, 2)*, Tarragona, pp.324-328.

Morcken R. (1968) Norse nautical units and distance measurements. *Mar Mirror* 54, pp.393-401.

Morel JP. (1983) La Céramique comme indice du commerce antique (Réalités et interprétations). In P.Garnsey and CR.Whittaker (eds), pp.66-74.

Morel JP. (1985) La manufacture, moyen d´enrichissement dans l´Italie Romaine ?. In Ph.Leveau (ed), pp.87-112.

Morel JP. (1987) La topographie de l´artisanat et du commerce dans la Rome antique. *MEFRA* 98, pp.127-155.

Morel JP. (1989) Un atelier d'amphores Dressel 2-4 à Cales. *MEFRA* 114, pp.558-559.

Morgan LH. (1877) *Ancient society on researches into the lives of human progress from savagery, through barbarism to civilization.*

Morris EL. (1981) Ceramic exchange in Western Britain: a preliminary view. In H.Howard and EL.Morris (eds), pp.67-82.

Morris I. (1992) *Death-ritual and social structure in Classical Antiquity*. Cambridge.

Mudry P. and J.Pigeaud (ed)(1991) *Les écoles medicales à Rome*. Geneve.

Müller A. (1981) Vieille-Toulouse: le fond d´habitat IV à La Tuilerie. In *Structures d´habitat à l´Age du Fer en Europe tempérée*. Paris, pp.129-138.

Munt ED. (1992) Up-grading site-catchment analysis with the use of GIS. *World Archaeology* 24 (2), pp.283-309.

Nadal-Farreras J. (1978) *Comercio exterior y subdesarrollo, España y Gran Bretaña de 1772 a 1914. Política* *económica y relaciones comerciales*. Madrid.

Napoleoni C. (1973) *Smith, Ricardo, Marx. Considerazioni sulla storia del pensiero economico*. Torino.

Narbonne et le mer. Catalogue de l'exposition. Narbona (1990).

Narducci E. (1985) Valori aristocratici e mentalità acquisitiva nel pensiero di Cicerone. *Index* 13, pp.93-125.

Naveiro-López JL. (1991) *El comercio antiguo en el NW. Peninsular*. Museo de Arqueo. de la Coruña no.5, La Coruña.

Naveiro-López JL. and F.Pérez-Losada (1992) Un Finisterre Atlántico en época romana: la costa galaica (NW de Península Ibérica). In M.Wood and F.Queiroga (eds), pp.63-90.

Naveiro-López JL. and JM.Canmaño (1992) El depósito subacuático del Río Ulla. El material romano. In *Finisterre. Santiago*, pp.257-296.

Naylor TH., JL.Balintfy, DS.Burdick and Kong Chu (1966) *Computer Simulation Techniques*, London.

Neale WC. (1957) The market in theory and history. In K.Polanyi et alii (eds), pp.357-372.

Newstead R. (1939) Records of archaeological kinds. Fatty matter in Roman amphorae. *Chester and North-Wales A.S.* 35, pp.104-105.

Nicolet C. (1966) *L'order équestre à l'époque républicaine (312-43 a.v. J-C)*. Paris.

Nicolet C. (1971) Les variations des prix et la "théorie quantitative de la monnaie" à Rome, de Cicéron à Pline l'Ancien. *Annales ESC* 26, pp.1203-1222.

Nicolet C. (1977) Les classes dirigeantes romaines sous la république: order sénatorial et ordre équestre. *Annales ESC* 31, pp.726-755.

Nicolet C. (1988) *Rendre à César*. Paris.

Nicolet C. (1991) Frumentum mancipale: en Sicile et ailleurs. In D. van Berchem (ed), pp.119-140.

Nicols J. (1980) Tabulae Patronatus: A study of the agreement between patron and client community 50 BC - AD 250. *ANRW* ii.13, pp.535-561.

Nieto J. (1988) Cargamento principal y cargamento secundario. *Cahiers d'Histoire* xxxii, pp.379-396.

Nieto J. and F.Foerster (1980) El pecio romano del Cap de Vol (Campañas del 1978 y 1979). *Cypsela* iii, pp.163-177.

Nieto J., A.Jover, P.Izquierdo, A.Puig, A.Alaminos, A.Martin and M.Pujol (1989) *Excavacions Arqueològiques subaquàtiques a Cala Culip*, vol.I, Girona.

Nippel W. (1989) Finley and Weber. Some coments and theses. *Opus* vi-viii, pp.43-52.

Nolla-Brufau JM. (1974-5) Las ánforas romanas de Ampurias. *Ampurias* 36-37, pp.147-197.

Nollé J. (1982) *Nundinas instituere et habere*. Hildeshein.

Nunez M. (1993) Towards the implementation of Geographical Information System techniques on the Aland Islands and mainland Finland. In *GIS Conference*.

Oelmann F. (1914) *Die Keramik des Kastells Niederbieber*. Frankfurt-Main.

O'Kelly M. (1986) The location of interacting hub facilities. *Transportation Science* 20, pp.92-106.

O'Kelly M. and HJ.Miller (1989) A synthesis of some market area delimitation model. *Growth and Change* 20 (3), pp.14-33.

Okun ML. (1989a) An example of the process of acculturation in the Early Roman frontier. *Oxford Jour. of Archaeology* 8.1, pp.41-54.

Okun ML. (1989b) *The early Roman frontier in the Upper Rhine area.* BAR Int.Ser. 547, Oxford.

Okun ML. (1989c) Pluralism in Germania Superior. In VA.Maxfield and MJ.Dobson (eds), pp.435-438.

O'Leary TJ. (1989) *Pentre Farm, Flint.* BAR Brit.Ser. 207, Oxford.

Oleson JP. (1989) *The harbours of Caesarea Maritima.* BAR Int.Ser. 491, Oxford.

Olin JS. and MJ.Blackman (eds)(1986) *Proceedings of 24th International Archaeometry Symposium.* Washington.

Optati A. (1987) Un dépôt d'amphores découvert à Aegyssus. *Dacia* xxxi, pp.145-155.

Ordenance Survey (1978) *Map of Roman Britain* (4th ed.), Southampton.

Orlić M. and M.Jurišic (1987) Adriatic Eastern Coast. Underwater Survey. *Arheloški Pregled* 28, pp.199-201.

Orlowe BS. (1986) Barter and cash sale on the Lake Titicaca: a test of competing approaches. *Current Anthropology* 27.2, pp.87-106.

Orton C. (1975) Quantitative Pottery Studies: some progress, problems and prospects. *Science Archaeology* 16, pp.30-35.

Orton C. (1980) *Mathematics in Archaeology*, London.

Orton C. (1982) Computer Simulation experiments to assess the perfomance of measures of quantity of pottery. *World Archaeology* 14, pp.1-20.

Orton C. (1986) Two useful parameters for pottery research. *Computer Applications in Archaeology*, pp.114-120.

Orton C. (1989) An Introduction to the quantification of assemblages of pottery. *Journal of Roman Pottery Studies* 2, pp.94-97.

Orton C., P.Tyers and A.Vince (1993) *Pottery in Archaeology.* Cambridge.

Ottaway P. (1992) *Archaeology in the British towns*, London.

Packer I.E. (1967) Housing and population in the Imperial Ostia and Rome. *JRS* 57, pp. 80-95.

Paddayya K. (1990) *The New Archaeology and afterwards.* New Delhi.

Padilla-Monge A. (1989) *La provincia romana de la Bética.* Ecija.

Padrós P. (1985) *Baetulo. Arqueología Urbana 1975-1985.* Monografia Badalonina 4, Badalona.

Pallarés F. (1977) Dalla nave romana di Albenga a quelle di Porto Venere e di Diano, I Mesi. *Riv. di attualità economiche e culturali dell'Instituto Bancario San Paolo di Torino* 5.1, pp.31-36.

Pallarés F. (1981) La nave romana del Golfo di Diano Marina. Relazione preliminare della campagna 1981. *Forma Maris Antiqui* xi-xii, 1975-81, Bordighera, pp.79-107.

Pallarés F. (1985) Relazione sulla campagna archeologica sottomarina 1985 sul relitto della nave romana di Albenga. *Rivista di Studi Liguri* 51, pp.632-639.

Palmer REA. (1980) Customs on market goods imported into the city of Rome. In JH.D´Arms and EC.Kopff (eds), pp.217-234.

Paltiel E. (1991) *Vassals and rebels in the Roman Empire.* Brussels.

Panciera S. (1980) Olearii. In JH.D´Arms and EC.Kopff (eds), pp.235-250.

Panella C. (1972) Annotazioni in margine alle stratigrafie delle terme Ostiensi nel Nuotatore. *MEFRA* 10, pp.69-106.

Panella C. (1973) Appunti su un gruppo di anfore della prima, media e tarda etá Imperiale, *Ostia* III, pp.460-633.

Panella C. (1976) Per uno studio delle anfore di Pompei. *Studi Miscellani* 22, pp.151-162.

Panella C. (1977a) Anfore Tripolitana a Pompei. In A.Carandini (ed), pp.135-149.

Panella C. (1977b) Le anfore con anse bifide conservata a Pompei: contributo ad una loro classificacione. *MEFRA* 32, pp.133-177.

Panella C. (1980) Retroterra, porti e mercati: l'essempio dell'Ager Falernus. IN JH.D'Arms and EC.Kopff (eds), pp.251-260.

Panella C. (1981) La distribuzione e i Mercati. In A.Giardina and A.Schiavone (1981), pp.55-80.

Panella C. (1983) Le anfore di Cartagine, nuovi elementi per la riconstruzione dei flussi commerciali del Mediterraneo in età imperiale romana. *Opus* II.1, pp. 53-73.

Panella C. (1986a) Oriente et Occidente: considerazioni su alcune anfore "egee" di etá Imperiali a Ostia. *BCH* Supp. xiii, pp.609-636.

Panella C. (1986b) Le anfore tardoantiche: centri di produzioni e mercati preferenziali. In A.Giardina (ed), pp.251-284.

Panella C. (1986c) Le merci: produzioni, itinerari e destini. In A.Giardina (ed), pp.431-454.

Panella C. (1989) Le anfore italiche del II secolo D.C., *MEFRA* 114, pp.139-178.

Panella C. (1992) Mercato di Roma e anfore galliche nella prima età imperiale. In *Les Amphores en Gaule*, pp.185-206.

Panella C. (1993) Merci e scambi nel Mediterraneo tardoantico. *Storia di Roma* III.2, pp.613-697.

Panella C. and M.Fano (1977) Le anfore con anse bifide conservate a Pompei: contributo ad una loro classificazione. *MEFRA* 10, pp.133-177.

Pareto V. (1909) *Manuale di economia politica*. Rome.

Parker AJ. (1973) The evidence provided by underwater archaeology for Roman trade in the western Mediterranean. In DJ.Blackman (ed) *Marine Archaeology*. London, pp.361-382.

Parker AJ. (1976) Il relitto romano delle colonne a Camarina. *Sicilia Archeologica* 30, pp.25-29.

Parker AJ. (1977) Lusitanian amphorae. *MEFRA* 32, pp.35-46.

Parker AJ. (1987) Trade within the Empire and beyond the frontiers. In J.Wacher (eds), pp.635-657.

Parker AJ. (1989) Amphores Almagro 50 de l'épave de Randello, Sicile. *MEFRA* 114, pp.650-653.

Parker AJ. (1992a) *Ancient Shipwrecks of the Mediterranean and the Roman provinces*. BAR Int.Ser. 580, Oxford.

Parker AJ. (1992b) Cargoes, containers and stowage: the ancient Mediterranean. *IJNA* 21.2, pp.89-100.

Parker AJ. and J.Price (1981) Spanish exports of the Claudian period: the significance of the Port-Vendres II wreck reconsidered. *IJNA* 3, pp.27-34.

Parkin TG. (1992) *Demography and Roman society*. Baltimore.

Parry J. and M.Bloch (eds)(1989) *Money and morality of exchange*. Cambridge.

Pascual-Guasch R. (1960) Centros de producción y difusión geográfica de un tipo de ánfora. *VII CNA*, pp.334-345.

Pascual-Guasch R. (1968) El Pecio Gandolfo (Almería). *Pyrenae* 4, pp.141-155.

Pascual-Guasch R. (1973) Underwater archaeology in Andalucia (Almeria and Granada). *IJNA* 2, pp.107-119.

Pascual-Guasch R. (1977) Las ánforas de la Layetania, *MEFRA* 32, pp.47-96.

Pascual-Guasch R. (1980) La evolución de las exportaciones béticas durante el Imperio. In JM.Blázquez (ed), pp.233-242.

Pascual-Guasch R. (1991) *Index d'estampilles sobre àmfores catalanes*. Cuaderns de Arqueologia 5, Barcelona.

Paterson J. (1982) Salvation from the sea:amphora and trade in the Roman West. *JRS* 72, pp.146-157.

Pauvier J. (1981) *La Céramique Gallo-romaine de Gèneve*. Geneve.

Pavis d'Escurac H.(1976) *La préfecture de l'Annona, service administratif impérial d'Auguste à Constantin*. Rome.

Pavis d'Escurac H. (1977) Aristocratie sénatoriale et profits commerciaux. *Ktema* 2, pp.339-355.

Pavis d'Escurac H. (1988) Origo et résidence dans le monde du commerce soul le Haut-Empire. *Ktema* 13, pp.57-68.

Pavolini C. (1986) *La vita quotidiana ad Ostia*. Bari.

Peacock DPS. (1969) A contribution to the study of Glastonbury ware from Southwestern Britain. *Ant. Journal* 49, pp.41-61.

Peacock DPS. (1970) The scientific analysis of ancient ceramics: a review. *World Archaeology* 1, pp.375-389.

Peacock DPS. (1971) Roman amphorae in pre-Roman Britain. In M.Jesson and D.Hill (eds) *The Iron Age and its Hill-Forts*. Southampton, pp.169-188.

Peacock DPS. (1974) Amphorae and the Baetican fish industry. *Ant.Journal* 54, pp.232-243.

Peacock DPS. (1977a) Roman amphorae: typology, fabric and origin. *MEFRA* 32, pp.261-278.

Peacock DPS. (1977b) Late Roman amphorae from Chalk, near Gravesend, Kent. In J.Dore and KT.Greene (eds), pp.295-300.

Peacock DPS. (ed)(1977c) *Ceramic and the Early Commerce*, London.

Peacock DPS. (1977d) Recent discoveries of Roman amphorae kilns in Italy. *Ant.Jounal* 57, pp.262-269.

Peacock DPS. (1978) The Rhine and the problem of the Gaulish wine in Roman Britain. In J.duPlat and H.Cleere (eds), pp.49-51.

Peacock DPS. (1981) The amphorae. In C.Partridge (ed) *Skeleton Green*. London, pp.199-203.

Peacock DPS. (1982) *Pottery in the Roman World*, London.

Peacock DPS. (1984) Amphorae in Iron Age Britain: a reassessment. In S.MacReady and FH.Thompson (eds), pp.37-42.

Peacock DPS. (1991) The amphorae. In N.Holbrook and PT.Bidwell (eds) *Roman Finds from Exeter*. Exeter, pp.215-219.

Peacock DPS. and DF.Wiliams (1986) *Amphorae and the Roman Economy*, London.

Peacock DPS., F.Bejaoui and N.Ben Lazreg (1989) Roman amphora production in the Sahel Region of Tunisia, *MEFRA* 114, pp.179-222.

Peacock DPS., F.Bejaoui and N.Ben Lazreg (1990) Roman pottery production in Central Tunisia. *JRA* 3, pp.59-

Pearson HW. (1957) The secular debate on Economic Primitivism. In K.Polanyi et alii (eds), pp.12-26.

Pédech P. (1974) L'analyse géographique chez Posidonius. *Caesarodunum* ix bis, pp.31-44.

Peel JHB. (1971) *Along the Roman roads in Britain*. London.

Pékary T. (1980) Les limites de l´économie monétaire à l´époque romaine. In *Les dévaluations* II, pp.103-120.

Pékary T. (1981) Zur Bechentung des Handels in der Antike. In GA.Ritter and R.Vierhaus (eds) *Aspekte der historichen Forschung in Frankreich und Deutschland*. Gottingen, pp.30-39.

Pélichet E. (1946) A propos des amphores romaines trouvées a Nyon. *Zeitschrift für Schweizerische Archäeologie und Kunstgeschichte* 8, pp.189-209.

Pelletier A. (1982) *L'urbanisme romain sous l'Empire*. Paris.

Pérez-Agorreta MJ. (1986) *Los Vascones*. Burlada.

Pérez C. and E.Illarregui (1992) *Algunas ideas sobre la romanización del mar Cantábrico*. Santiago de Chile.

Perrin JR. and DF.Williams (1990) Roman Pottery from the Colonia 2: General Accident and Rougier Street. *York Arch. Trust*. York.

Perring D. (1985) London in the 1st and early 2nd centuries. In F.Grew and B.Hobley (eds), pp.94-98.

Perring D. and S.Roskman (1981) *The development of Roman London west of the Walbrook*. CBA Res. Rep. 70. London.

Pesavento Mattioli S. (1990) Anfore per la bonifica. *Archeo* 60, pp.15.

Petino A. (1989) *Biografia della Economia Antica*. Napoli.

Petit P. (1955) *Libanius et la vie municipale a Antiochia au IVe siècle après J.-C.* Paris.

Petit P. (1972) L´esclavage antique dans l´historiographie soviètique. *Actes du Colloquie d'Histoire Sociale*. Besançon, pp.9-27.

Petit P., F.Vittinghof, EM.Schtajerman, B.Sharevskaia, R.Guenther, G.Schurnt, SL.Utchenko, E.Sereni and C.Parain (eds)(1986) *El Modo de Producción Esclavista*. Madrid.

Petrikovits H. von (1980) *Die Rheinlande in rómischen Zeit*. Dusseldorf.

Pflaum HG. (1960) *Les procurateurs équestres sous le haut-empire romain*. Paris.

Pflaum HG. (1961) *Les carrières procuratoriennes équestres sous le Haut-Empire Romain*. Paris.

Philp B. (1977) The British evidence. Dover. In DE.Johnson (ed), pp.20-21.

Philp B. (1981) *The excavation of the Roman fort at Dover 1979-77*. Dover.

Picard GC. (1959) Informations archéologiques. Circonscription de Paris (sud). *Gallia* 17, pp.209-309.

Picard GC. (1970) Informations archéologiques: circunscription du Centre. *Gallia* 28, pp.253-267.

Picon M. (1986) Analyse de céramiques de l´épave de Culip IV et corrections d´alteration. In J.Nieto (1986) El pecio Culip IV. *Archaeonautica* 6, pp.116-119.

Picozzi S. (1988) La nave romana di Grado. *Subacqueo* 16, 181, pp.45-50.

Pieskma EJ. (1982) *A petrological study of Dr.20 amphora*. MSc Thesis. University of Southampton.

Pineau M. (1970) *La côte atlantique de la Bidassoa à Quiberon dans l'Antiquité*. Paris.

Pinto Coelho AV. and JL.Cardoso (1990) Estudos sobre pastas de ânforas de fornos do Vale do Tejo e do Vale do Sado: Análises macro e microscópicas. In A.Alarçao and F.Mayet (eds), pp.267-271.

Pirenne M. (1936) *Histoire du Moyen Age*. Brussels.

Pires-Ferreira JW. (1976) Obsidian exchange in Formative Mesoamerica. In KV.Flannery (eds), pp.292-306.

Pittmann DJ. and CR.Snyder (eds)(1962) *Society, culture and drinking patterns*. New York.

Pitts LF. and JK.St.Joseph (1985) *Inchtuthill*. Britannia Mono.6

Plat J. du (1965) *Marine Archaeology*. London.

Plat J. du (1975) *The English medieval town*. London.

Plat J. du and H.Cleere (eds)(1978) *Roman Shipping and Trade: Britain and the Rhine provinces*. CBA Res.Rep. 24. London.

Plattner S. (ed)(1989a) *Economic Anthropology*. Stanford.

Plattner S. (1989b) Markets and marketplaces. In S.Plattner (ed), pp.171-208.

Plattner S. (1989c) Economic behaviour in markets. In S.Plattner (ed), pp.209-221.

Pleket HW. (1983) Urban elites and bussiness in the Greek part of the Roman Empire. In P.Garnsey et alii (eds), pp.131-144.

Pleket HW. (1984) Urban elites and the economy in the Greek cities of the Roman Empire. In *Münstersche Berträge zur Antiken Handelsgeschicte* iii, pp.3-37.

Pohl I. (1978) Piazzale delle corporazioni ad Ostia. Tentativo di ricostruzione del portico Claudio e la sua decorazione. *MEFRA* 90, pp.331-347.

Polanyi K., CM.Arensberg and HW.Pearson (eds)(1957) *Trade and Market in the Early Empires*. New York.

Polanyi K. (1957a) Marketless trading in Hammurabi's time. In K.Polanyi et alii (eds), pp.12-56.

Polanyi K. (1957b) Aristotle discovers the economy. In K.Polanyi et alii (eds), pp.64-96.

Polanyi K. (1957c) The economy as instituted process. In K.Polanyi et alii (eds), pp.243-269.

Polanyi K. (1975) Traders and trade. In JA.Sabloff and CC.Lamberg-Karlovsky (eds), pp.133-154.

Polanyi K. (1977) *The likelihood of man*. New York.

Pollard R. (1991) Quantification: Towards a standard practice. *Journal of Roman Pottery Studies* 3, pp.75-79.

Pollino A. (1984) *Object métalliques sur les épaves antiques (Musée d'Histoire et d'Archéologie)*. Antibes.

Pollino A. (1987) Antibes et la mer. *Archéologie du Midi Méditerranéen*, pp.30-88.

Pomey P. and A.Tchernia (1978) Le tonnage maximum des navires de commerce romaines. *Archaeonautica* 2, pp.233-252.

Pomey P., L.Long, M.L'Hour, F.Richez and H.Bernard (1989) Recherches sous-marines. *Gallia information* 1987-88 1, pp.1-78.

Ponsich M. (1974a) *Implantation rurale dans le Bas Guadalquivir*. Vol.I, Madrid. (1979), Vol.II, Paris. (1991), Vol.IV, Paris.

Ponsich M. (1974b) La navigation antique dans le Détroit de Gibraltar. *Caesadorunum* ix bis, pp.257-274.

Ponsich M. (1988) *Aceite de oliva y salazones de pescado*. Madrid.

Ponsich M. and M.Tarradell (1965) *Garum et industries antiques de salaisons dans la Mediterranee Occidental*. Paris.

Pounds NJG. (1974) *An economic history of Medieval Europe*. London.

Price WL. (1977) *Graphs and Networks: An Introduction*. Princeton.

Prieto AM. (1986) Prólogo. In P.Petit et alii (eds), pp.5-22.

Provost M. (1993) *Le val de Loire dans l'Antiquité*. CNRS Gallia Suppl. 52, Paris.

Pucci G. (1983) Pottery and trade in the Roman period. In P.Garnsey et alii (eds), pp.105-117.

Purpura G. (1986) Rinvenimenti sottomarini nella Sicilia Occidentale. *Archeologia Subacquea* 3 (Boll. d'Arte 38-39, Supp.), pp.139-160.

Py M. (1978) Quatre siècles d'amphore massaliote. Essai de classificaciones des bords. *Figlina* 3, pp.1-23.

Pyszczyk HW. (1989) Consumption and ethnicity: an example from the fur trade in Western Canada. *J. of Anthropological Archaeology* 8, pp.213-249.

Raban A. (ed)(1985) *Harbour archaeology*. BAR Int.Ser. 257, Oxford.

Radcliffe-Brown AR. (1952) *Structure and function in primitive society: essays and addresses*. London.

Rădulescu A. (1976) Amfore romane si romano-bizantine din Scythia Minor. *Pontica* 9, pp.99-114.

Raepsaet G. (1987a) Archeologie et iconographie des attelages dans le monde gréco-romaine: la problématique économique. In T.Hackens and P.Marchetti (eds), pp.9-48.

Raepsaet G. (1987b) Aspects de l´organisation du commerce de la céramique sigillée dans le Nord de la Gaule au IIè siècle de notre ère, I: les donées matérielles. *MBAH* 6.2, pp.1-29.

Raepsaet-Charlier MT. and G. (1988) Aspects de l´organisation du commerce de la céramique sigillée, II: négotiants et transporteurs. *MBAH* 7.2, pp.45-69.

Ramage ES. (1983) Urban problems in ancient Rome. In RT.Mardese (ed), pp.61-92.

Ramos A. (1981) El alfar romano de El Olivar (Chipiona, Cádiz). Aportación al estudio de las ánforas béticas de salazones. *Gades* 7, pp.5-35.

Raper RA. (1977) The analysis of the urban structure of Pompeii: a sociological examination of land use (semi-micro). In DL.Clarke (ed), pp.189-221.

Raper RA. (1979) Pompeii: planing and social implications. In BC.Burham and J.Kingsbury (eds), pp.137-148.

Raschke MG. (1978) New studies in Roman commerce with the East. *ANRW* II.9.2, pp.605-1363.

Rathbone D. (1983) Italian wines in Roman Egypt. *Opus* II, pp.81-98.

Rathbone D. (1991) *Economic Rationalism and Rural Society in the third century A.D. Egypt*. Cambridge.

Rathje WL. (1974) The garbage project: a new way of looking at the problems of archaeology. *Archaeology* 27.4, pp.236-241.

Rathje WL. and M.McCarthy (1977) Recycling and variability in contemporary garbage. In S.South (ed), pp.261-286.

Rathz P., A.Woodward, I.Burrow, A.Everton, L.Watts, P.Leach, S.Hirst, P.Fowler and K.Gardner (1992) *Cadbury Congresbury 1968-1973. A late post-Roman hilltop settlement in Somerset*. BAR Brit.Ser. 223, Oxford.

Rathz S. (ed)(1988) *Computer Applications and Quantitative Methods in Archaeology*. BAR, Int.Ser. 446, Oxford.

Rathz S. and J.Richards (eds)(1989) *Computer Applications and Quantitative Methods in Archaeology*. BAR Int.Ser. 548, Oxford.

Recherches sur les amphores grecques, Athens. BCH Supp.xiii [1986].

Recherches sur les amphores romaines, Rome. MEFRA 10 [1972].

Reddé M. (1979) La navigation au large des côtes atlantiques de Gaule à l'époque romaine. *MEFRA* 91, pp.481-489.

Reddé M. (1986) *Mare Nostrum. Les infrastructures, le dispositif et l'histoire de la marine militaire sous l'Empire romaine*. Rome.

Redfield JM. (1986) The development of the market in Archaic greece. In BC.Anderson and AJH.Latham (eds), pp.29-58.

Redman CL. (1979) Description and inference with late medieval pottery from Qsar er-Seguir, Morocco. *Medieval Ceramics* 3, pp.63-79.

Reece R. (1972) A short survey of the Roman coins found on fourteen sites of Britain. *Britannia* 3, pp.269-276.

Reece R. (1973) Roman coinage in the Western province. *Britannia* 4, pp.227-252.

Reece R. (1981) The third century: crisis or change. In AC.King and M.Herring (eds), pp.27-38.

Reece R. (1984a) The use of Roman coinage. *Oxford Jour.Arch.* 3, pp.197-210.

Reece R. (1984b) Mints, markets and the military. In TFC.Blagg and Ac.King (eds), pp.143-160.

Reece R. (1986) Cirencester: the central place of the first century A.D. In E.Grant (ed), pp.41-44.

Reece R. (1987) *Coinage in Roman Britain*. London.

Reece R. (1991) *Roman Coins from 140 sites in Britain*. Costwolds Studies iv. Cirencester.

Reinhold M. (1946) Historian of the classical world: a critique of Rostovzeff. *Science and Society* 10 (4), pp.361-391.

Remesal-Rodríguez J. (1977) La Economía oleícola Bética: nuevas formas de análisis. *AEA* 50-1, pp.87-142.

Remesal-Rodríguez J. (1986) *La Anonna Militaris y la exportación de aceite bético de Germania*, Madrid.

Remesal-Rodríguez J. (1987) Notes on the study about the production and commerce of Baetican oil during the Roman Empire. In *Olive Oil in the Antiquity, Haifa*, pp.159-169.

Remesal-Rodríguez J. (1989a) Tres nuevos centros de producción de ánforas Dressel 20 y 23. Los sellos de Lucius Fabius Cilo. *Ariadna* 6, pp.121-153.

Remesal-Rodríguez J. (1989b) Die Stempel auf amphoren des types Dressel 20 aus Worms. *Archäeologisches Korrespondenzblatt* 19, haf.14, pp.351-360.

Remesal-Rodríguez J. (1989c) Cuestiones en torno a la epigrafía anfórica de la Bética. *MEFRA* 114, pp.489-503.

Remesal-Rodríguez J. (1990) Die Procuratores Augusti und die versorgung des römischen heeres. In *Akten des 14 Internazionalen Limeskongresses 1986 in Carnutum, Wien*, pp.55-65.

Remesal-Rodríguez J. (1991) El aceite bético durante el Bajo Imperio. In A.González Blanco et al (ed) *Arte, Sociedad, Economía y Religión durante el Bajo Imperio y la Antigüedad Tardia*. Ant.Cristianismo (Murcia) viii, pp.355-361.

Remesal-Rodríguez J. (1992) Sextus Iulius Possesor en la Bética. Alimenta, Homenaje a M.Ponsich. *Anejos de*

Gerión III.

Remesal-Rodríguez J. (forth.) *Die Annona militaris und die Baetische Öliersorgung in Germania*

Remesal-Rodríguez J. and E.Schallmayer (1988) Römischem amphoren aus Baden-Württemberg. *Fundberichte aus Baden-Württember* 13, pp.395-431.

Remesal-Rodríguez J. and V.Revilla-Calvo (1991) Weinamphoren aus Hispania Citerior und Gallia Narbonensis in Deutschland und Holland. *Fundberichte aus Baden-Würtemberg* 16, pp.389-439.

Remola JA. (1993) Un tipo de ánfora tardo-romana poco conocida (ULR 8.198). *AEA* 167-168, pp.300-309.

Rendini R. (1989) Anfore di produzione locale e chi importazione a Gortina nel periodo tardo-romano e protobizantino. *MEFRA* 114, pp.648-649.

Renfrew C. (1969) Trade and Culture process in European Prehistory. *Current Anthropology* 10, pp.151-169.

Renfrew C. (1972) *The Emergence of Civilization*. London.

Renfrew C. (1975) Trade as an action of distance. In JA.Sabbloff and CC.Lamberg-Karlovsky (eds), pp.3-60.

Renfrew C. (1977a) Alternative methods for exchange and spatial distribution. In TK.Earle and JE.Ericson (eds), pp.71-90.

Renfrew C. (1977b) Introduction: Production and Exchange in Early State Societies, the evidence of pottery. In DPS.Peacock (ed), pp.1-20.

Renfrew C., JR.Cann and JE.Dixon (1965) Obsidian in the Aegean. *BSAA* 60, pp.225-247.

Renfrew C., JE.Dixon and JR.Cann (1968) Further Analysis of Near Eastern Obsidian. *Proc.Preh.Soc.* 34, pp.319-331.

Renfrew C. and JE.Dixon (1976) Obsidian in Western Asia: a review. In G.Sieveking et alii (eds), pp.137-150.

Renfrew C. and P.Bahn (1991) *Archaeology: Theories, Methods and Practice*. London.

Renfrew J. (1973) *Palaeoethnobotany*. London.

Renfrew J. (1985) *Food and cooking in Prehistoric Britain. History and Recipes*. Birmingham.

Reusch W. (1970) Kleine, spitzkonische Amphoren. *Saalburg Jahrbuch* 27, pp.54-62.

Revilla-Calvo J. (1993) *El alfar romano de l´Aumedina (Tivissa, Tarragona). Producción cerámica y economia rural en el Bajo Ebro*, Barcelona.

Reynand JF., J.Lasfargues and A.Desbat (1973) Une fouille de sauvetage à Lyon. *Archeologia* 60, pp.73-74.

Reynolds PJ. (1979) *Iron Age Farm. The Butser experiment*. London.

Reynolds RG. (1986) An adaptive computer model for the evolution of the plant collecting and Early Agriculture in Eastern Valley of Oaxaca, Mexico. In K.Flannery (ed), pp.439-500.

Rhodes M. (1991) Roman Pottery Lost on route from the kiln site to the user. A gazeteer. *Journal of Roman Pottery Studies* 4 pp.44-59.

Ricardo D. (1817) *Principles of political economy*. [New York, 1909].

Rice PM. (1984) Change and Convervatism in Pottery-producing systems. In SE.van der Leeuw and AC.Pritchard (eds), pp.231-288.

Rice PM. (1987) *Pottery Analysis. A source book*. Chicago.

Rice PM. (1989) Ceramic diversity, production, and use. In RD.Leonard and GT.Jones (eds), pp.109-117.

Rich JW. (ed)(1992) *The City in the Late Antiquity*. London.

Rich JW. and A.Wallace-Hadrill (eds)(1991) *City and country in the ancient world*. London.

Richards AI. (1932) *Hunger and work in a savage tribe*. London.

Richards JD. (1991) Terrain modelling, deposit survival and Urban archaeology. In K.Lockyear and S.Rathz (eds), pp.175-182.

Richardson L. (1988) *Pompeii: An architectural history*. Baltimore.

Richmond IA. (1935) Trajan´s Army on Trajan´s column. *PBSR* 13, pp.1-40.

Richmond IA. and OGS.Crawford (1949) The British section of the Ravenna Cosmography. *Archaeologia* 93, pp.1-50.

Rickman G. (1980a) *The corn supply of ancient Rome*. Oxford.

Rickman G. (1980b) The grain trade under the Roman Empire. In JH.D´Arms and EC.Kopff (eds), pp.261-276.

Rickman G. (1985) Towards a study of Roman ports. In A.Raban (eds), pp.105-114.

Rickman G. (1991) Problems of transport and development of ports. In D. van Berchem (ed), pp.103-115.

Ricq de Boüard M., E.Meille and M.Vichy (1989) Les argile utilisées pour la fabrication des amphores en Italie: Etruria, Latium, Campania. *MEFRA* 114, pp.257-268.

Riedel M. (1979) Das römische Baden-Baden. *Fundberichte aus Baden-Württemberg* 4, pp.260-315.

Rigby V. (1982) The coarse pottery. In JS.Wacher and AD.McWhirr (eds) *Early Roman Occupation at Cirencester*. Cirencester, pp.153-200.

Rigoir Y. (1975) *Le dessin technique en céramique*. Paris.

Rigoir Y. (1981) Méthode géometrique simple de calcul du volume des contenants céramiques. *Doc.d´Arch. Méridionale* 4.

Ringel J. (1975) *Césarée de Palestine*. Paris.

Ringrose DR. (1970) *Transportation and economic stagnation in Spain 1750-1850*. Duke UP.

Riley JA. (1975) *The pottery from the first session of excavations in the Caeasarea Hippodrome*. Bull. of the American Schools of Oriental Research 218.

Riley JA. (1976) The Carthage system for the quantification of pottery. In *Excavations at Carthage 1975, University of Michigan*, pp.125-156.

Riley JA. (1979) The Coarse Pottery from Benghazi. In JA.Lloyd (ed) *Sidi Khrebisch Excavations, Benghazi (Berenice)*. Vol.II, Tripoli, pp.91-497.

Rivet ALF. (1958) *Town and country in Roman Britain*. London.

Rivet ALF. (ed)(1969) *The Roman villa in Britain*. London.

Rivet ALF. (1970) The British section of the Antonine Itinerary. *Britannia* 1, pp.34-82.

Robert JN. (1986) *Les plaisirs à Rome*. Paris.

Robertson A., M.Scott and L.Keppie (1975) *Bar Hill: A Roman Fort and its Finds*. BAR Brit.Ser. 16, Oxford.

Robertus K. (1867) *Economic Life in Classical Antiquity*. London.

Robinson HS. (1959) *Pottery of the Roman period. The Athenian Agora*. Vol. V. Princeton.

Robinson OF. (1992) *Ancient Rome. City planing and administration.* London.

Rodríguez-Almeida E. (1972) Novedades de la epigrafía anforaria del Monte Testaccio. *MEFRA* 10, pp.106-240.

Rodríguez-Almeida E. (1974-5) Bolli anforari di Monte Testaccio I. *BCAR* 84, pp.199-248.

Rodríguez-Almeida E. (1977-78) Bolli anforari di Monte Testaccio II. *BCAR* 86, pp.107-137.

Rodríguez-Almeida E. (1979) Monte Testaccio: I mercatores dell'olio della Betica. *MEFRA* 91, pp.873-975.

Rodríguez-Almeida E. (1980a) El Monte Testaccio, hoy: Nuevos testimonios epigráficos. In JM.Blázquez (ed), pp.57-102.

Rodríguez-Almeida E. (1980b) Alcuni aspetti della topografia e dell'archeologia attorno al Monte Testaccio. In JM.Blázquez (ed), pp.103-130.

Rodríguez-Almeida E. (1980c) Vicissitudini nella gestione del commercio dell'olio betico da Vespasiano a Severo Alessandro. In JH.D'Arms and EC.Koff (eds), pp.277-290.

Rodríguez-Almeida E. (1983) El emporio fluvial y el Testaccio: onomástica extraanfórica y otros problemas. In JM.Blázquez and J.Remesal (eds), pp.133-161.

Rodríguez-Almeida E. (1984) *Il Monte Testaccio.* Rome.

Rodríguez-Almeida E. (1989) *Los Tituli Picti de las Anforas Olearias de la Bética.* Madrid.

Rodwell W. and T.Rowley (eds)(1975) *The Small Towns of Roman Britain.* Oxford.

Rolt LTC. (1969) *Navigable Waterways.* London.

Roma. Arqueologia nel Centro (1985). Supr.Arch di Roma 6.

Roman Y. (1983) *De Narbonne à Bordeaux. Un axe économique au Ier siècle avan J.-C.* Lyon.

Roman Y. (1988) L´isthme gaulois: déterminisme e géographique ou déterminisme des historiens. *Cahiers d´Histoire* t.xxxii, pp.475-490.

Roman Y. (1989) Une voie romaine: l'isthme gaulois. *Ktema* 14, pp.105-114.

Rossignol J. and Wandsnider (ed)(1992) *Space, Time, and Archaeological Landscapes.* New York.

Rostovzeff MI. (1899) Sur le Capitalisme antique. *Pallas* t.xxxiii [1987].

Rostovtzeff MI. (1926) *Social and economic history of the Roman Empire.* Oxford.

Roth-Rubi K. (1975) Die gehranchs-keramik von der Funstelle Solothurn Kreditanslalt. *Jb.Solothurnische Geschichte* 48, pp.1-111.

Rottländer RCA. (1986) Chemical investigation of potsherds of the Hennebury, Upper Danube. In JS.Olin and MJ.Blackman (eds), pp.403-405.

Rouché C. (1989) *Aphrodisias in the Late Antiquity.* Monograph JRS v, London.

Rougé J. (1952) La navigation hivernale dans l´Empire Romain. *Rev.Etudes Anciennes* 54, pp.316-325.

Rougé J. (1965) Les rélations de Lyon et de la mer. A propos de CIL xiii. 1492. 89 *Congres des Soc. Savants*, pp.137-152.

Rougé J. (1966) *Recherches sur l´organisation du commerce maritime en Méditerranée sous l´Empire Romain.* Paris.

Rougé J. (1980) Prêt et sociétés maritimes dans le monde romain. In JH.D´Arms and EC.Koff (eds), pp.291-304.

Rougé J. (1985) Les routes du commerce Gaule à l´époque romaine. In *Sept siècles de civilization galloromain vus d´Autun*, pp.67-83.

Rougé J. (1988) Transports maritimes et transport fluviaux dans les provinces occidentales de l'Empire. *Ktema* 13, pp.87-94.

Rouquette D. (1992) Estampilles sur amphora à huile de Bétique de la région Vienne-Lyon. *Rev.Arch.Sites* 48, pp.3-17.

Roymans N. (1990) *Tribal societies in Northern Gaul*. Amsterdam.

Rozin E. (1983) *Ethnic cuisine: The flavour-principle cookbook*. New York.

Ruddock AA. (1951) *Italian merchants and shipping in Southampton 1270-1600*. Southampton.

Ruggini LC. (1961) *Economia e società nell'Italia "annonaria"*. Milan.

Ruggini LC. (1980) Nuclei inmigrati e forze indigene in tre grandi centri commerciali dell´Impero. In JH.D´Arms and EC.Kopff (eds), pp.55-76.

Rule M. and J.Monaghan (1993) *A Gallo-Romain trading vessel from Guernesey*. Guernesey Museum Monograph 5.

Sabbloff JA. (ed)(1981) *Simulation in Archaeology*. Alburquerque.

Sabbloff JA. and CC.Lamberg-Karlovsky (eds)(1975) *Ancient Civilization and Trade*. Alburquerque.

Saddington DB. (1961) Roman attitudes to the external gentes of the North. *Ant.Class.* 4, pp.90-102.

Saddington DB. (1975) Race relations in the Early Roman Empire. *ANRW* ii.3, pp.112-137.

Saddington DB. (1990) The origin and nature of the German and British fleets. *Britannia* xxi, pp.223-232.

Saez P. (1987) *Agricultura romana en la Bética*. Sevilla.

Sahlins M. (1972) *Stone Age Economics*. London.

Saint-Romain-en-Gal (1984). Paris.

Saller RP. (1982) *Personal patronage under the early Empire*. Cambridge.

Salvait F. (1972) Circonscription de Provence. *Gallia* 30, pp.511-541.

Salvioli G. (1906) *Le capitalisme dans le monde antique. Études sur l´histoire de l´économie romaine*. Paris.

Salway P. (1965) *The frontier people of Roman Britain*. Cambridge.

Sánchez-Carrión J. (ed)(1984) *Introducción a las técnicas de análisis multivariable aplicadas a las Ciencias Sociales*. Madrid.

Sanget JM. and MC.Pin (1990) *Clermont-Ferrand*. Aquitania Suppl.VI, pp.66-76.

Sanmarti-Greco E. (1991) Las ánforas romanas del campamento numantino de Peña Redona (Garray, Soria). *Empurias* 47, pp.130-161.

Sanquer R. (1979) Rennes (Condante, Redones). *Gallia* 37, pp.371-374.

Sanquer R. and P.Galliou (1972) Garum, sel et salaisons en Armorique Gallo-Romaine. *Gallia* 30, pp.199-223.

Sanquer R., R.Piot and P.Galliou (1977) Problémes de navigation en Manche Occidentale à l'époque romaine. *Caesarodunum* 12, pp.491-508.

Santamaria C. (1984) L'épave H de la Chrétienne à Saint-Raphael (Var). *Archaeonautica* 4, pp.9-52.

Santley RS. and RT.Alexander (1992) The political economy of core-periphery systems. IN EM.Shortman and PA.Urban (eds), pp.23-50.

Sartorio GP. (1988) *Mezzi di transporto e traffico*. Col.Vita e Costumbri dei Romani Antichi 6. Roma.

Say B. (1803) *Traité d´économie politique*. Paris.

Scilliano M. and P.Sibella (1991) *Amphores. Comment les identifier?*. Aix-en-Provence.

Schackley ML. (1975) *Archaeological Sediments. A Survey of Analyrical Methods*. London.

Schallmayer E. (1983) Römische Okkupationslinien in Obergermanienun Räetien. Zur chronologischen, Typologie der Amphoren. In JM.Blázquez and J.Remesal (eds), pp.349-361.

Schallmayer E. (1992) Production d´amphores en Germanie superieure ?. In *Les Amphores en Gaule*, pp.71-74.

Schiffer MB. (1972) Archaeological Context and System Context. *American Antiquity* 37 (2), pp.156-165.

Schiffer MB. (1973) Methodological issues in ethnoarchaeology. In RA.Gould (ed), pp.229-247.

Schiffer MB. (1976) *Behavioural Archaeology*. New York.

Schiffer MB. (1985) Is there a Pompeii premise in Archaeology ?. *Journal of Anthropological Archaeology* 41, pp.18-41.

Schiffer MB. (1987) *Formation Processes of the Archaeological Record*. Alburquerque.

Schiffer MB. (1989) Formation processes of Borken K Pueblo: some hypotheses. In RD.Leonard and GT.Jones (eds), pp.37-58.

Schiffer MB. (ed)(1989) *Arcaheological Method and Theory*. Vol. I, Tucson.

Schleich T. (1983) Überlegungen zum Problem senatorischer Handelsaktivitäten, T.I., Senatorische Wirtschaftsmentalitäten in moderner und antiker Deutung. *MBAH* II.2, pp.65-90.

Schleich T. (1984) Zwischen "otium" und "negotium": Gelegenheitsunternehmungenund domestizierte Wirtschaft. *MBAH* III.1, pp.37-76.

Schlippschuch O. (1987) *Die Händler in römischen Kaiserreich im Gallien, Germanien und der Donanprovinzen Räetien, Noricum und Pannonia*. Amsterdam.

Schmitt A. (1988) Les productions d'amphores dans le moyenne vallée du Rhône: mise au point sur quelque types. *SFECAG, Actes du Congres d'Orange*, pp.25-33.

Schmitt MP. (1975) Les liasons de l´Arar vers l´Océan. *Caesarodunum* x, pp.124-127.

Schneider HK. (1974) *Economic man. The anthropology of economics*. New York.

Schoene R. (1871) *Corpus Inscriptorum Latinorum IV*. Berlin.

Schofield J. (1987) Recent approaches in urban archaeology. In J.Schofield and R.Leech (eds), pp.1-8.

Schofield J. (ed)(1991) *Interpreting Artefact Scatters*. Oxbow Monograph 4, Oxford.

Schofield J. and R.Leech (eds)(1987) *Urban archaeology in Britain*. CBA 61. London.

Schönberger H. (1969) The Roman frontier in Germany: an archaeological survey. *JRS* 59, pp.144-197.

Schönberger H. and HG.Simon (1976) *Römerlager Rödgen*. Limes 15, Berlin.

Schumpeter JA. (1954) *History of economic analysis*. New York.

Schüpbach S. (1983) Avenches: Contribution à la connaissance de la chronologie des estampilles sur les amphores à huile de Bétique. In JM.Blázquez and J.Remesal (eds), pp.349-361.

Schweitz D. (1986) L'atelier de pitiers de Moulon. *Rev.Archéologique du Centre de la France* 25, pp.47-83.

Scobie A. (1986) Slums, sanitation and mortality in the Roman world. *Klio* 68, pp.399-435.

Seager R. (1972) *Tiberius*. Berkeley.

Sealey PR. (1985) *Amphoras from the 1970. Excavations at Colchester Sheepen*. BAR Brit.Ser. 142, Oxford.

Sealey PR. and GW.Davies (1984) Falernian wine at Roman Colchester, *Britannia* 15, pp.250-254.

Sealey PR. and PA.Tyers (1989) Olives from Spain: a unique amphora find in British waters. *Ant.Journal* lxix, pp.53-72.

Sealey PR. (1994) London 555 and Ver 1908 amphoras. In *Roman Amphorae. Problems of Identification and Methodology*, London.

Selkirk R. (1983) *The Piercebridge Formula: a dramatic new view of Roman history*. Cambridge.

Service ER. (1979) *Origins of the State and Civilization*. New York.

Shanks M. and C.Tilley (1987) *Re-constructing archaeology: theory and practice*. Cambridge.

Shaw BD. (1980) Rural markets in North Africa. *Ant.Afric.* 17, pp.17-83.

Shaw BD. (1989) El bandido. In A.Giardina (ed), pp.351-394.

Shennan S. (1988) *Quantifying Archaeology*. Edinburgh.

Shephard AO. (1956) *Ceramics for the Archaeologist*. Washington.

Sheridan A. and GN.Bailey (eds)(1981) *Economic Archaeology: towards an integration of ecological and social approaches*. BAR Int.Ser. 96, Oxford.

Sherk RK. (1988) *The Roman Empire: Augustus to Hadrian*. Cambridge.

Sherwin-White AN. (1970) *Racial prejudice in Imperial Rome*. Cambridge.

Sherwin-White AN. (1973) *The Roman citizenship*. Oxford.

Shortman EM. and PA.Urban (eds)(1992) *Resources, power and interregional interaction*. New York.

Sieveking G., IH.Longworth and KP.Wilson (eds) (1976) *Problems in economic and social archaeology*. London.

Sijpestein PJ. and KA.Worp (1976) Documents on transportation by ship. *ZPE* 20, pp.157-165.

Sillières P. (1990) *Voies de communication et réseau urbain en Aquitanie romaine*. Aquitania Suppl.VI, pp.431-438.

Singh AK. (1988) *Indo-Roman trade. An archaeological perspective*. New Delhi.

Simonett C. and E.Ettlinger (1952) *Römische Keramik aus den Schuttbügel von Vindonissa*. Basel.

Singer C. (1956) *A History of Technology*. New York.

Sinopoli CM. (1991) *Approaches to archaeological ceramics*. New York.

Sippel DV. (1987) Some observations on the means and the cost of transport of bulk commodities in the late republic and early empire. *AncW* 16, pp.35-45.

Siraudeau J. (1988) *Amphores Romaines des Sites Angevinnes. Corpus des amphores découvertes dans l'Ouest de la France*, vol.2.

Sirks B. (1991) *Food for Rome*. Amsterdam.

Sjoberg G. (1960) *The pre-industrial city. Past and present*. Glencoe.

Slofstra J. (1983) An anthropological approach to the study of Romanization processes. In R.Brandt and J.Slofstra (eds), pp.71-105.

Skeat TC. (1964) *Papiri from Panopolis*. Dublin.

Skinner EC. (1964) West African Economic Systems. In MJ.Herskovits and M.Harwitz (eds), pp.77-98.

Smith A. (1776) *The wealth of nations*. [New York, 1937].

Smith ME. (1992) Braudel´s temporal rhytms and chronology theory in archaeology. In AB.Knapp (ed), pp.23-34.

Snell DC. (1984) *Ledgers and prices: early Mesopotamian merchants*. Yale.

Snowden FM. (1970) *Blacks in the antiquity: ethiopians in the Greco-Roman experience*. Cambridge.

Solheim WG. (1960) The use of sherd weights and counts in handling of archaeological data. *Current Anthropology* 1, pp.325-329.

Sombart W. (1916-28) *Der moderne Kapitalismus*, 3 vol. München.

Sommer CS. (1984) *The military vici in Roman Britain*. BAR Brit.Ser. 129, Oxford.

Sörbon P. (ed)(1980) *Transport technology and social change*. Stockholm.

Sotomayor M. (1969) Hornos romanos de ánforas en Algeciras. *X CNA*, pp.389-399.

South S. (ed)(1977) *Research strategies in historical archaeology*. London.

Speidel MP. (1973) The pay of the auxilia. *JRS* 63, pp.141-147.

Speidel MP. (1977) The Roman Army in Arabia. *ANRW* ii.8, pp.687-730.

Speidel MP. (1984) *Roman Army Studies*. Amsterdam.

Speidel MP. (1990) Work to be done on the Organization of the Roman Army. *Inst.of Arch. UCL* 36, pp.99-106.

Speidel MA. (1992) Roman Army pay scales. *JRS* lxxxii, pp.87-106.

Spruytte J. (1983) *Early harnessing systems experimental studies: contribution to the study of the history of the horse*. London.

Staerman EM. (1979) La lucha de clases a finales de la República romana. In *Formas de explotación del trabajo y relaciones sociales en la antigüedad clásica*, pp.179-222.

Stančič Z. (1993) Spatial archaeology - the case of GIS. In *GIS Conference*.

Stanfield A. and G.Simpson (1958) *Central Gaulish Potters*. London.

Stanley RS. and RT.Alexander (1992) The political economy of core-periphery systems. In EM.Shortman and PA.Urban (eds), pp.23-50.

Starr CG. (1941) *The Roman Imperial Navy 31 BC-AD 324*. New York.

Staubaugh J. (1988) *The ancient Roman city*. Baltimore.

Stead IM. and V.Rigby (1989) *Verulamium: the King Harry Lane Site*. English Herit. Arch. Rep. 12

Ste.Croix GEM. (1956) Greek and Roman accounting. In AC.Littletown and BS.Yamey (eds), pp.14-74.

Stein E. (1932) *Die Kaiserlichen Beaunten und Truppenkörpen im röm Deutschland.* Wien.

Strange JF. (1989) Beyond socio-economics: some reactions to. In JA.Blakeley and WJ.Bennett (eds) *Analysis and publication of ceramics.* BAR Int.Ser. 551, pp.23-30.

Strong DE. (ed)(1973) *Archaeology theory and practice.* London.

Stuart P. and JE.Bogaers (1971) Catalogus von de monumenten. *Deae Nehalenniae Gids bij de tentoonstelling Nehalennia de Zeeuwse godin, Zeeland im de Romeinse tijd, Romeinse monumenten nit de Oosterschelde*, 33-43.

Sugden R. (1986) Labour, property and the morality of markets. In Bl.Anderson and AJH.Latham (eds), pp.9-28.

Sutherland CHV. (1967) The pattern of monetary development in Phoenicia and Palestine during the Early Empire. In A.Kindley (ed), pp.88-105.

Sutherland CHV. (1976) The Emperor and the coinage. In *Julio Claudian Studies*, pp.8182.

Swan VG. (1988) *Pottery in Roman Britain.* Aylesbury.

Swan VG. (1992) Legio VI and its Men: African legionaries in Britain. *Journal of Roman Pottery Studies* 5.

Sydris R. (1977) Mass-distance measures for Maya obsidian trade. In TK.Earle and JE.Ericson (eds), pp.91-108.

Symonds RP. (1984) Sumary of the products of the Roman kiln F1019 at Middleborough. In P.Crummy (ed), pp.360-364.

Symonds RP. (1991) Datation et résidualité où sout les limites de la certitude ?. *SFECAG, Actes du Congres de Cognac*, pp.137-151.

Symonds RP. (1992) *Rhenish wares. Fine dark coloured pottery from Gaul and Germany.* Oxford.

Symonds RP. (1993) Amphores Romano-Britaniques. *SFECAG, Actes du Congrès de Versailles*, pp.281-291.

Symonds RP. (forth.) Amphorae. In RP.Symonds and C.Wade (eds).

Symonds RP. and C.Wade (forth.) The Roman Pottery from Excavations at Colchester 1971-1985. *Colchester Archaeological Report 10*

Taafe EJ., RL.Morrill and PR.Gould (1963) Transport expansion in underdeveloped countries. *Geographical Review* 53, pp.503-529.

Tainter JA. (1988) *The collapse of complex societies.* Cambridge.

Tannahill R. (1973) *Food in history.* New York.

Tarr L. (1969) *The history of carriage.* London.

Tate B. (1993) Las peregrinaciones marítimas medievales desde las Islas Británicas a Compostela. In *Santiago, Camino de Europa.* Santiago, pp.161-179.

Tavares C. and J.Soares (1978) Anforas romanas de area urbana de Setúbal. *Set.Arch.* 4, pp.171-202.

Tchernia A. (1964) Amphores et marques d'amphores de Bétique à Pompei et à Stabies. *MEFRA* 6, pp.419-449.

Tchernia A. (1967) Les amphores romaines et l'histoire économique. *J.des Savants*, pp.216-234.

Tchernia A. (1969) Informations archéologiques. Direction des recherches sous-marines. *Gallia* 27, pp.465-499.

Tchernia A. (1971) Les amphores vinaires de la Tarraconaise et leur exportation au début de l'empire. *AEA* 44, pp.38-85.

Tchernia A. (1980a) Quelques remarques sur le commerce du vin et des amphores. IN JH.D'Arms and EC.Kopff (eds), pp.305-312.

Tchernia A. (1980b) D.Caecilius Hospitalis et M.Iulius Hermesianus. In JM.Blázquez (ed), pp.155-160.

Tchernia A. (1983) Italian wine in Gaul at the end of the Republic. In P.Garnsey et al (ed), pp.87-104.

Tchernia A. (1985) Modèles économiques et commerce du vin à la fin de la République et au début de l´Empire. In *El Vi a l´Antiguitat*. Badalona, pp.327-336.

Tchernia A. (1986a) *Le vin de l'Italie romaine*, Rome.

Tchernia A. (1986b) Amphores et textes: deux examples. *BCH* Supp. xiii, pp.49-67.

Tchernia A. (1990) La vinification des Romans. In *Vin et Histoire*, pp.65-74.

Tchernia A. (1994) Dressel 2-4 amphorae. In *Roman Amphorae. Problems of identification and methodology*, London.

Tchernia A. and F.Zevi (1972) Amphores vinaires de Campanie et de Tarraconaise à Ostie. *MEFRA* 10, pp.35-67.

Tchernia A. and JP.Villa (1977) Note sur le matériel recueilli dans le fouille d'un atelier d'amphores à Velaux (Bouches-du-Rhône). *MEFRA* 32, pp.231-239.

Tchernia A., P.Pomey and A.Hesnard (1978) *L'épave romaine de la Madrague de Giens (Var)*. Gallia Supp.34.

TEDA (1987) *Els enterraments del Parc de la Ciutat i la problemàtica funerària de Tarraco*. Tarragona.

TEDA (1989) *Un abocador del segle V d.C. en el Forum provincial de Tarraco (Memories d´excavació 2)*, Tarragona.

Tengström E. (1974) *Bread for the people. Studies of the corn supply of Rome during the Late Empire*. Stockholm.

Thevenot E. (1950) L'importation des produits espagnols chez les Eduens et les Lingons à la fin du IIe siècle de notre ère, d'aprés les marques d'amphores. *Rev. Arch. de l'Est et du Centre-Est*, pp.65-75.

Thevenot E. (1964) Les amphores de provenance espagnole importées dans le départament du Cher. *Rev. Arch. du Centre* 3, pp.203-216.

Thierrin-Michael G. (1990) Roman wine amphorae: production sites in Italy and imports in Switzerland. *Archaeometry*, pp.523-532.

Thomas AC. (1959) Imported Pottery in Dark Age Western Britain. *Medieval Arch.* 3, pp.89-111.

Thomas AC. (1976) Imported Late Roman Mediterranean Pottery in Ireland and Western Britain: chronologies and implications. *Pro. Royal Irish Academy* 76, pp.245-255.

Thomas AC. (1981) *A Provisional List of Imported Pottery in Post-Roman Western Britain and Ireland*. Redruth.

Thompson LA. (1993) *Romans and Blacks*. Oklahoma.

Thouvenot R. (1980) Anses d'amphores de la collection des antiquaries de l'Ouest. *Bull. de Soc. des Antiquaries de l'Ouest* 15, pp.595-601.

Throckmorton P. (1969) Simple underwater surveying. In P.Throckmorton et al (eds) *Surveying in Archaeology Underwater*. London, pp.1-20.

Throckmorton P. (ed)(1987) *History froim the sea*. London.

Thünen JH. von (1842) *Der Isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomic*. Hamburg.

Todd M. (ed)(1978) *Studies in the Romano-British villa*. Leicester.

Todd M. (1985) Oppida and the Roman Army. A review of recent evidence. *Oxford Journal of Archaeology* 4 (2), pp.187-199.

Todd M. (1989) The Early cities. In M.Todd (ed), pp.75-89.

Todd M. (ed)(1989) *Research in Roman Britain*. Britannia Monograph 11.

Tomber RS. (1987) Evidence for long-distance commerce: imported bricks and tiles at Carthage. *Rei Cret. Rom. Fautorum*, Acta xxv/xxvii, pp.161-174.

Tomber RS. (1988) *Pottery in Long-Distance Economic Inference: an investigation of methodology with reference to Roman Carthage*. PhD Thesis. University of Southampton.

Tomber RS. (1992) Early Roman Pottery from Mons Claudianus. *Cahiers de Céramique Egyptienne* 3, pp.137-142.

Tomber RS. (1993) Quantitative approaches to the investigation of long-distance exchange. *JRA* 6, pp.142-166.

Tomber RS. and DF.Williams (1986) Late Roman amphorae in Britain. *J.Roman Pottery Studies* 1, pp.42-54.

Tomlin RSO. (1992) The Roman Carrot amphorae and its Egyptian provenance. *Journal of Egyptian Archaeology* lxxviii, pp.307-312.

Torr C. (1964) *Ancient ships*. Chicago.

Toussaint-Sanat M. (1987) *Histoire naturelle et morale de la nourriture*. Paris.

Tozzi G. (1968) *Economistas griegos y romanos*. México.

Trigger BG. (1989) *A History of Archaeological thought*. Cambridge.

Trow SD. (1990) By the northern shores of Ocean. Some observations on acculturation process at the edge of the Roman world. In TFC.Blagg and M.Millett (eds), pp.103-118.

Tuffreau-Libre M. (1992) *La Céramique en Gaule Romaine*. Paris.

Tyers PA. (1984) An assemblage of Roman ceramics from London. *London Archaeologist* 4, pp.367-374.

Tyers PA. and C.Orton (1990) Statistical Analysis of Ceramic assemblages - a year's progress. In K.Lockyear and S.Rathz (eds), pp.117-120.

Tylecote RF. (1962) *Metalurgy in Archaeology*. London.

Tylecote RF. (1976) *A history of metalurgy*. Cambridge.

Ulbert G. (1959) Römische Holzfässer aus Regensburg. *Bayerische Vergeschichtsblätter* 24, pp.6-29.

Urgen-Sternberg von J. (1991) Die politische und soziale Bedentung der spätrepublikanischen leges frumentariae. In D. van Berchem (ed), pp.19-41.

Vassy A. (1914) Rapport sur le découverte de trois gisements d´amphores romaines à Sainte-Colombe-les-Vienne. *Comptes rendus de l´Assoc.Fran.per l´Avan. des Sciencies*, pp.1-6.

Veen M. van der (1988) Romans, natives and cereal consumption - Food for thought. In RFJ.Jones et alii (eds), pp.99-107.

Vernant JP. (1976) Remarks on the class struggle in ancient Greece. *Critique of Anthropology* 7.

Vernant JP. (1980) *Myth and society in ancient Greece*. Brighton.

Vernhet A. (1975) *Notes sur la terre sigillée de La Graufesenque*. Milano.

Veyne P. (1976) *Le pan et le cirque*. Paris.

Vidal-Naquet P. (1970) Esclavage et gynécocratie dans la tradition, le mythe et l´utopie. In *Recherches sur les structures sociales dans l´antiquité classique*, pp.63-80.

Vidal-Naquet P. (1979) ¿Constituían los esclavos griegos una clase social? In *Clases y Luchas de Clases en la Grecia Antigua*. Madrid, pp.19-32.

Viérin J. and Ch.Léva (1961) Un puits à tonneau romain avec sigles et graffitti à Harelbeke. *Latomus* xx, pp.42-46.

Vigneron J. (1969) *Le cheval dans l´antiquité gréco-romaine*. Nancy.

Vikan G. (1982) *Byzantine Pilgrimage art*. Washington.

Vilar P. (1969) *Oro y moneda en la Historia 1450-1920*. Barcelona.

Villes et agglomérations urbaines antiques du Sud-Ouest de la Gaule. X Colloque, Bourdeaux (1990). Aquitania Suppl. VI.

Vince AG. (1977) Some aspects of pottery quantification. *Medieval Ceramic* 1, pp.63-74.

Vincent P. and R.Daly (1990) GIS and large travelling salesmen problems. *Mapping Awareness* 4 (1), pp.19-21.

Virlouvet C. (1991) La plèbe frumentaire à l'époque d'Auguste: une tentative de définition. In D. van Berchem (ed), pp.43-62.

Voljoen S. (1974) *Economic System in the World History*. London.

Voorips A. (ed)(1990) Mathematics and information science in Archaeology: a flexible framework. In *Studies in Modern Archeology*, vol.3. Bonn.

Voorips A. and SH.Loving (eds)(1985) To pattern the past. *PACT* 11, Strasbourg, pp.349-359.

Wacher JS. (ed)(1966) *The Civitas Capitals of Roman Britain*. Leicester.

Wacher JS. (1974) *The towns of Roman Britain*. London.

Wacher JS. (ed)(1987) *The Roman World*. London.

Wacher JS. (1989) Cities fron the Second to Fourth centuries. In M.Todd (ed), pp.91-114.

Wacher JS. and AD.McWhirr (1982) *Early Roman occupation of Cirencester*. Cirencester.

Waddington Q. (1930) Notes on Excavations made in the City of London in 1930. *J.Brit.Arch.Assoc. New Ser.* 36, pp.391-394.

Waegenan M. (1988) Plutarque, sur l´usage des viandes. In *L´Animal dans l´alimentation*, pp.95-98.

Wagstaff JM. (ed)(1985) *Landscape Culture. Geographical Archaeological Perspectives*. Oxford.

Walcher DN., N.Kretchner and HL.Barnett (eds)(1976) *Food, man and society*. New York.

Walcher DN. and N.Kretchner (eds)(1976) *Food, nutrition and evolution. Food as an environmental factor in the genesis of human variability*. New York.

Walke N. (1965) *Das Römische Donankastell Straubing-Sorviodurum*. Limesforschungen Band 3. Berlin.

Walker D. (1976) *The Metrology of the Roman silver coinage*. BAR Int.Ser. 5, vol.i; 22, vol.ii; 40, vol.iii, Oxford.

Wallace-Hadrill A. (1991) Elites and trade in the Roman town. In J.Rich and A.Wallace-Hadrill (eds), pp.241-272.

Wallace-Hadrill A. (ed)(1989) *Patronage in Ancient Society*. London.

Wallestein I. (1974) *The Modern World-System*. vol I, New York.

Wallestein I. (1980) *The Modern World-System*. vol II, New York.

Wallinga H. (1964) Nautika (1): the Unit of capacity for ancient ships. *Mnemosyne* 17, pp.1-40.

Walras L. (1874-77) *Eléments d'économie politique*. Paris.

Walthew CV. (1975) The town house and villa house in Roman Britain. *Britannia* 6, pp.189-205.

Waltzing JP. (1895-1900) *Etude historique sur les corporations professionelles chez les romains*. Louvain.

Wansleeben M. (1988) Applications of Geographical Information Systems in Archaeological Research. In S.Rathz (ed), pp.435-451.

Wansleeben M. (1993) GIS: the Archaeological essence. In *GIS Conference*.

Ward-Perkins J. (1980) The marble trade and its organization: evidence from Nicomedia. In JH.D'Arms and EC.Kopff (eds), pp.325-338.

Warmington EH. (1928) *The Commerce between the Roman Empire and India*. Cambridge.

Weber A. (1909) *Über den Standart der Industrien*. Tubingen.

Weber M. (1891) *Die römische Agrargeschichte in ihrer Bedentung für das Staats und Privatrecht*. Berlin.

Weber M. (1897) *Agrarverhältuisse im Altertum*. Berlin.

Weber M. (1922) *Wirtschaft und Gesellschaft*. Berlin.

Weber M. (1968) *Economy and Society*. New York.

Weber M. (1976) *The Agrarian Sociology of Ancient Civilizations*. London.

Webster G. (1958) The Roman military advance under Ostrius Scapula. *Arch.Journal* 115, pp.49-98.

Webster G. (1979) *The Roman Imperial Army*. London.

Webster G. (1987) Wroxeter. *Current Archaeology* 107, pp.364-368.

Webster G. (ed)(1988) *Fortress into City*. London.

Weimer R. (1993) A new method for the analysis of site distribution and intra-site structures. In *GIS Conference*.

Wells PS. (1992) Tradition, identity, and change beyond the Roman frontier. In EM.Shortman and PA.Urban (eds), pp.175-192.

Welsby DA. (1982) *The Roman military defence of the British provinces in its later phases*. BAR Brit.Ser. 101, Oxford.

Werbner P. (1987) 13 Enclave economies and family firms: Pakistani traders in a British city. In J.Eades (ed), pp.214-223.

Werff JH. van der (1984) Roman Amphoras at Nijmegen - A preliminary report. *BROB* 34, pp.347-387.

Werff JH. van der (1986) The amphora wall in the House of the Porch, Ostia. *B.A.Besch.* 61, pp.96-137.

Werff JH. van der (1987) Roman Amphoras at "Der Horden" (Wijk bij Duurstede). *BROB* 37, pp.153-172.

Werff JH. van der (1988) Secundaire merken op Romeinse amforen. *BROB* 38, pp.222-233.

Werff JH. van der (1989) L.Evmachi - à propos d'une marque d'amphore trouvée à Nimegue. *BROB* 39, pp.357-376.

Werff JH. van der (1990) Bemerkungen zu einer Pinselinschrift aus Xanten. *BROB* 40, pp.323-331.

Werff JH. van der (1994) The third and second lives of amphoras at Alphen aan den Rijn. In *Roman Amphorae*.

Problems of Identification and methodology, London.

Wheeler REM. (1930) *London in Roman Times*. London.

Whimster R. (1981) *Burial practices in Iron Age Britain*. BAR Brit.Ser. 90, Oxford.

White KD. (1970) *Roman Farming*. London.

Whitley DS. and MAV.Clark (1985) Spatial Autocorrelation tests and the Classic Maya Collapse: Methods and Inferences. *Journal of Archaeological Science* 12, pp.377-395.

Whittaker CR. (1983) Late Roman trade and traders. In P.Garnsey et alii (eds), pp.163-180.

Whittaker CR. (1985) Trade and the aristocracy in the Roman Empire. *Opus* 4, pp.49-75.

Whittaker CR. (1989a) *Les Frontières de l'Empire Romaine*. Besançon.

Whittaker CR. (1989b) El pobre. In A.Giardina (eds), pp.319-350.

Whittaker CR. (1993a) *Land, city and trade in the Roman Empire*. London.

Whittaker CR. (1993b) Do theories of the ancient city matter?. In TJ.Cornell and MK.Lomas (eds) (1993) *Urban Society in Roman Italy*. London, pp.1-20.

Whittaker E. (1960) *Schools and steams of economic thought*. Lonndon.

Wideman F., F.Laubenheimer, M.Attas, F.Fontes, K.Gruel, J.Leblanc and J.Lleres (1978) Analytical and typological study of Gallo-Roman workshops producing amphora in the area de Narbonne. *Archaeophysika* 10, pp.317-341.

Widemann F., F.Laubenheimer and J.Leblanc (1979) Amphora workshops in Western Narbonensis. The non-resolution space problem. In *XIXth Symposium on Archaeometry and Arcaheological Prospection*. London, pp.57-71.

Widemann F. and A.Naciri (1989) Analisi della anfore galliche d'Ostia. Variazione delle origine del vino gallico consumato a Roma nelle diverse epoche. *MEFRA* 114, pp.285-296.

Widgren M. (1983) *Settlement and farming systems in the early Iron Age*. Stockholm.

Wierschowski L. (1984) *Heer und Wirtschaft. Das römische Heer der Prinzipatszeit als Wirtschaftsfaktor*. Bonn.

Wightman EM. (1970) *Roman Trier and the Treveri*. London.

Wilkinson J. (1977) *Jerusalem pilgrims before the Crusades*. Warminster.

Will EL. (1954) Trois quarts de siècle de recherches sur l´économie grecque antique. *Annales ESC* 9, pp.7-22.

Will EL. (1979) The Sestius amphoras: a reappraisal. *J.Field Archaeology* 6, pp.339-350.

Will EL. (1983) Exportation of olive oil from Baetica to the Eastern Mediterranean. In JM.Blázquez and J.Remesal (eds), pp.392-440.

Will EL. (1987) Shipping amphoras as economic indicators. *Rei Cret. Romanae Fautores*, Acta xxv/xxvii, pp.71-78.

Will EL. (1991) The Mediterranean shipping amphoras from Arikamedu. In V.Begley and R.Daniel de Pura (eds), pp.151-156.

Willcox GH. (1977) Exotic plants from Roman waterlogged sites in London. *Journal of Arch. Science* 4, pp.269-282.

Willems WJH. (1983) Romans and Batavians: Regional developments at the Imperial Frontier. In R.Brandt and J.Slofstra (eds), pp.105-128.

Willems WJH. (1986) *Romans and Batavians. A regional study in the Dutch Eastern river area.* Amersfoort.

Willems WJH., J.Docquier and E.Lawerijs (1964) Notes au subject d'un type d'amphore belge. *Chronique Archéologique du Pays de Liège* 55, pp.38-41.

Williams DF. (1981) The Roman Amphorae Trade with Late Iron Age Britain. In H.Howard and EC.Morris (eds), pp.123-132.

Williams DF. (1987) The amphorae. In PJ.Woodward (ed) *Romano-British Industries in Purbeck*, Dorset. Monograph 6, pp.79-81.

Williams DF. (1989) The impact of Roman amphorae trade in Pre-Roman Britain. In TC.Champion (ed), pp.142-150.

Williams DF. (1994) Late Roman amphorae. In *Roman Amphorae. Problems of Identification and methodology*, London.

Williams DF. and DPS.Peacock (1983) The importaion of olive-oil into Roman Britain. In JM.Blázquez and J.Remesal (eds), pp.263-280.

Williams DF. and P.Arthur (1991) Roman amphora form Richborough 527; a continuing petrological study. In A.Middleton and I.Freestone (eds) *Recent Developments in Ceramic Petrology*. London, pp.389-398.

Williams DF. and C.Carreras (forth.) Roman amphorae from excavations in Lincoln. In A.Vince and M.Darling (eds) *Excavations at Lincoln.*

Williams DF. and C.Carreras (forth.) North African amphorae in Roman Britain: a reappraisal.

Williams DF. and DPS.Peacock (forth.) Roman amphorae in Iron Age Wessex. *Assoc.Française d'Etude de l'Age du Fer.*

Williams T. (1990) Early Roman London. *Antiquity* 64. 244, pp.599-607.

Wilson AG. (1975) Some new forms of spatial interaction model: a review. *Transportation Research* 9, pp.167-179.

Wilson MG. (1972) Catalogue of the pottery. In SS.Frere (ed) *Verulamium Excavations*, vol.I. Oxford, pp.265-370.

Wilson MG. (1983) The pottery used for dating. In SS.Frere (ed) *Verulamium Excavations*, vol.II. Oxford, pp.294-341.

Wilson MG. (1984) The other pottery. In SS.Frere (ed) *Verulamium Excavations*, vol.III. Oxford. pp.201-266.

Wilson RJA. (1990) *Sicily under the Roman Empire.* London.

Winters LA. (1981) *An econometric model of the export sector.* Cambridge.

Wood M. (1994) Gallic amphorae from selected sites in the Southern England and Breto-Norman Gulf: problems in determining the origin of certain flat-based types. In *Roman Amphorae. Problems of Identification and Methodology*, London.

Wood M. and F.Queiroga (eds)(1992) *Current Research on the Romanization of the Western Provinces.* BAR Int.Ser. 575, Oxford.

Woodward A. and P.Leach (1993) *The Uley Shrines.* English Heritage, London.

Woolf G. (1990a) World-Systems analysis and the Roman Empire. *JRA* iii, pp.44-58.

Woolf G. (1990b) Food, poverty and patronage: the significance of the epigraphy of the Roman alimentary schemes in early imperial Italy. *PSBR* 57, pp.197-229.

Woolf G. (1992) Imperialism, empire and the integration of the Roman economy. *World Archaeology* 23, pp.283-

293.

Wright RP. (1966) Roman Britain in 1965: II. Inscriptions. *JRS* 56, pp.217-225.

Wright RP. (1974) Carpow and Caracalla. *Britannia* v, pp.289-302.

Wringley EA. (1978) Parasite or stimulus: the towns in a Pre-industrial economy. In JA.Abrams and EA.Wringley (eds), pp.215-244.

Ximènès S. (1976) Note sur l'épave romaine Sud-Est de Plane. *Cah.d'Arch.Subaquatique* 5, pp.151-152.

Ximènès S., M.Moerman and G.Raepsaet (1985) Archéologie sous-marine en Provence: le port romain de l'Anse des Laurouns (Bouches-du-Rhône). *Annales d'Histoire, d'Art and d'Archéologie* 7, pp.35-46.

Yadin Y. (1966) *Masada*. London.

Yeo CA. (1946) Land and sea transportations in Imperial Italy. *TAPHA* 77, pp.221-244.

Yeo CA. (1952) The economics of Roman and American slavery. *Finanz.-Archiv.* 13.

Young CJ. (1977) *Oxfordshire Roman Pottery*. BAR Brit.Ser. 43. Oxford.

Yudkin J. (1978) *Diet of man, needs and wants*. London.

Zechinni M. (1982) *Relitti romani dell'Isola d'Elba*. Roma.

Zeest IB. (1960) Keramicheskaya Tara Bospora. Materiali i issled. po. arkh. *SSSR* 83.

Zemer A. (1978) *Storage jars in Ancient Sea Trade*. Haifa.

Zevi F. (1966) Appunti sulle anfore romana. *Archeologia Classica* 18, pp.207-247.

Zevi F. and A.Tchernia (1969) Amphores de Byzacene au Bas-Empire. *Antiq.Africaines* 3, pp.173-214.

Zienkiewicz JD. (1986) *The legionary fortress baths at Caerleon II. The finds*. Cardiff.

Zipf GK. (1949) *Human behaviour and the principle of least effort*. Cambridge.

Zubrow EBW. (1975) *Prehistoric Carrying Capacity: a model*. California UP.

Zubrow EBW. (1990) Modelling and Prediction with Geographical Information Systems: a demographic example from Prehistoric and Historic New York. In KM.Allen et al (eds), pp.307-318.