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THE ROMAN ECONOMY

SIMON KEAY

The Role Played by the *Portus Augusti* in Flows of Commerce between Rome and its Mediterranean Ports

[Figs. 1–30 on pp. 175–192]

This paper addresses the issue of how Roman Mediterranean ports functioned as centres for importing, exporting and re-distributing merchandise, by re-appraising the archaeological, historical and epigraphic evidence from the most important of these, the *Portus Augusti* during the 2nd century AD. Portus served as the maritime port of imperial Rome until at least the later 5th century AD and, as such, was the hub of a system of ports that also included Ostia, Centumcellae and Rome itself. The article addresses four major questions: (1) What was the administrative relationship of the port to the authorities in charge of importing food to Rome? (2) How were ships and their cargoes managed upon arrival at the port? (3) How successfully could its installations cope with the throughput of large numbers of ships and the processing of their cargoes? (4) How extensive was the geographical range of imports passing through Portus on their way to Rome?

1. Introduction

The centrality of the Mediterranean Sea to the Roman Empire is one of the key characteristics that sets it apart from other ancient empires.¹ The establishment of control by Rome of all the lands bordering the Mediterranean by the mid 1st century AD promoted a closer integration of flows of people, money, goods and services than had been possible before, or has been achieved subsequently, particularly in the centre and west. Crucial to the success of this was the centrality of Rome within the Mediterranean as a whole and its high degree of accessibility to ships from the different provincial ports that bordered its many constituent seas. This was dependent upon such issues as the directness of maritime connections, ship technology and navigational knowledge. Equally important, however, were the roles of the ports themselves. Even though many of them have been the subject of important studies in recent years, there is still much to be learned, not least in terms of how they actually functioned as centres for the import, export and re-distribution of merchandise.

This paper, which forms part of a broader project on the role of Roman Mediterranean ports in general, attempts to address this last issue from the perspective of perhaps the most important of these, the *Portus Augusti* during the 2nd century AD.² It served as the maritime port of Imperial Rome down until at least the later 5th century AD, and has much to teach us about commercial relationships between Rome and Mediterranean ports in general.³ Portus was established in the mid 1st century AD and enlarged in the early 2nd century AD with a primary mission to funnel state organized supplies (*annona*) to Rome, both for free distributions and “open-market” supplies more generally. The port lies close to the mouth of the Tiber, and was dominated by three very large harbour basins and a dense infrastructure of canals, warehouses and public buildings. While recent research has started to disentangle the development of the port and the range of its connections, little attention has been directed towards understanding how it might have worked

¹ This centrality is clearly illustrated in terms of travel time and costs across the Roman Empire by recent calculations undertaken as part of the ORBIS project (Scheidel 2014, 12–24).

² It represents my first contribution to the ERC-Advanced Grant funded Project *Rome's Mediterranean Ports* (Project Number 339123, RoMP: <www.portuslimen.eu> [accessed on 23 November 2017]) which I direct in collaboration with Pascal Arnaud.

³ I wish to thank Pascal Arnaud for reading through and commenting upon an earlier version of this paper. The opinions expressed within it, however, are entirely my own.

in practice. Moreover the epigraphic and historical evidence, which is the crucial context within which this needs to be understood, is usually interpreted primarily in relation to Ostia. While the evident complementarity of the two port sites makes this approach understandable, it also obscures some of the very distinctive characteristics of Portus, thus impoverishing our understanding of the 'port-system' as a whole. Indeed the range and complexity of the evidence means that this paper is a synthesis that has to sacrifice depth in favour of breadth, in the hope that by doing so it will raise new questions about the role and functions of this unique complex.

2. The 'port system' of imperial Rome

Portus and Ostia were situated in an estuarine landscape close to the mouth of the Tiber some 35 km from Rome (Fig. 1). The latter had been founded in the 4th century BC and was located on the south bank of the river a short distance from the sea. It was connected to Rome by the *Via Ostiensis* and bordered to the east by a salt-water lagoon, the Stagno di Ostia. Portus, by contrast, was a totally artificial port that was first established by the emperor Claudius in AD 46. It lay 2 km to the north of Ostia, was connected to Rome by the *Via Campana/Portuensis* and was bounded to the north-east by another coastal lagoon, the Stagno Maccarese. The initial complex comprised a huge artificial basin for safe anchorage (the Claudian basin) as well as a smaller basin (the *Darsena*) and a warehouse complex. Two canals linked the port to both the Tiber and the sea, making possible the rapid transfer of cargoes to Rome and providing flood relief to the Tiber valley south of Rome. It was only with the Trajanic enlargement of Portus in the early 2nd century AD, with the notable addition of a large hexagonal inner basin, additional canals and an increased number of warehouses, that the City of Rome evolved the infrastructure that enabled it to meet the growing demands of its population more effectively. The fully developed Portus, together with Ostia and the river port of Rome, can be understood as nodes in a network of ports (or 'port-system') that were inter-connected by sea-routes, river, canals and roads (Fig. 2).

At its height in the middle 2nd century AD, it also incorporated Centumcellae (Civitavecchia) and one chain of ports extending northwards from the mouth of the Tiber, as well as another running southwards as far as Puteoli (Pozzuoli) on the Bay of Naples.⁴ This multi-nodal infrastructure dwarfed provision at other major coastal ports in the West Mediterranean, such as Carthage and Lepcis Magna. Indeed its only real parallel in terms of scale was the Alexandria-Mareotis complex in the East although its primary mission was export and re-distribution, while that of Portus was largely import.

Central to understanding the success of this 'port-system', however, are questions relating to how Portus actually functioned as a Mediterranean-wide shipping hub. (1) What was its relationship to the authorities in charge of importing food to Rome? (2) How were ships and their cargoes managed upon arrival at the port? (3) How successfully could its installations cope with the throughput of large numbers of ships and the processing of their cargoes? (4) What was the geographical range of commerce that might have passed through Portus on its way to Rome from ports across the Mediterranean? While there are no easy answers to any of these questions, posing them at least helps us to better understand the problems that confront us.

3. Challenges of the evidence

The only way that such questions can be answered is by addressing a range of different kinds of evidence, from the archaeological analysis of different buildings at the port, to the sedimentary profiles of deep cores in basins and canals, and epigraphic and historical references. One obstacle to do this is that very little archaeological research has been done at Portus unlike at neighbour-

⁴ Keay 2012a.

ing Ostia. While key elements of the port have been known from the work of antiquarians and archaeologists like Lanciani (1868), Lugli⁵ and others, it has only really been since the recent geo-physical survey of the port and its hinterland⁶ that we have a clearer understanding of the broader regional context of the port. It is also only very recently that systematic excavation,⁷ geo-archaeological research⁸ and synthetic work⁹ has started to tease out the complex developmental histories of individual port buildings and associated water spaces.

Another issue is that the survival of epigraphic material is unequal across Portus and Ostia. Most extant texts were found at the latter with far fewer coming from the former, while some of those that are understood to have derived from the former may have actually originated at the latter. Furthermore those that are known rarely have a good archaeological context. Last but not least there are some kinds of information, such as those relating to ship registers and records of the weighing of grain and olive oil, that do not survive at Portus, and have to be imagined from the evidence of ports much further afield, such as Carthage and Alexandria.

4. The principal buildings at Portus in the later 2nd century AD (Fig. 2)

A. The three basins

By the mid to later 2nd century AD, the port complex comprised three key elements. The Claudian harbour basin encompassed c. 200 ha and had a depth of up to 6 m. It was defined by two concrete moles that projected westwards out into the Tyrrhenian Sea with a centrally placed lighthouse (Pharos). Within it there was a larger western sector that was separated from a smaller eastern one by a north-south mole.

The basin provided ample anchorage for seagoing ships with cargoes being transferred onto lighters for unloading at (i) the eastern quay immediately in front of the Monte Giulio at the eastern edge of the eastern basin¹⁰ (Fig. 4) and (ii) the quay that defined the southern side of the northern sector of the basin. There is some evidence here that the parts of the latter were used for unloading heavy and bulky cargoes. Recent excavations immediately to the east of the *Palazzo Imperiale* have uncovered holes cut into the quayside that may have supported wooden cranes for unloading large pieces of timber in the *Navalia* some 30 m to the south.¹¹ A final (iii) unloading area, but for less bulky cargoes, lay at the southern end of the southern sector of the basin, in front of the *Portico di Claudio* and the adjacent *Grandi Magazzini di Traiano* and *Foro Olitorio*.¹²

The far smaller *Darsena* basin, which had an area of 1.2 ha and a depth of c. 7 m, probably provided anchorage for the smaller boats (*naves codicariae*) that would have moved down the *Canale Traverso* to access the *Fossa Traiana* to the south. It was bordered on three sides by quays that provided access to the adjacent warehouse complexes of the *Grandi Magazzini di Traiano* to the north and the *Foro Olitorio* to the south.¹³

The Trajanic harbour basin lay a short distance to the east of its Claudian counterpart and the *Darsena*, and acted as the core of the port from the early 2nd century AD onwards (Fig. 5). It was hexagonal in form, encompassed an area of 32 ha and was dug from the natural sand to a depth

⁵ Lugli – Filibeck 1935.

⁶ Keay et al. 2005.

⁷ Keay et al. 2011; www.portusproject.org [accessed on 23 November 2017]; Maiorano – Paroli 2014.

⁸ Viz. Bellotti et al. 2009; Salomon et al. 2014 amongst others.

⁹ Boetto 2010.

¹⁰ Keay et al. 2005, Area 1 and figs. 5.5–5.6.

¹¹ Keay et al. forthcoming.

¹² Keay et al. 2005, Area 3 and figs. 5.9–5.10.

¹³ Keay et al. 2005, Area 4 and figs 5.13–5.14.

of 7 m.¹⁴ Its sides were c. 358 m long, lined with concrete and, at least along sides IV and VI, were provided with travertine mooring rings every c. 15 m (Fig. 6).¹⁵ In theory this meant apart from the gap created by the entry to the basin on side V, each side of the basin was designed to permit the mooring of a maximum of c. 23 seagoing ships at any one time (Fig. 7). The quayside was c. 3 m wide¹⁶ and provided periodically with low columns that bore sequential mooring positions inscribed in Latin numerals (Fig. 8). These indicate that there was some kind of systematic procedure for docking incoming ships.

Since the quays themselves were quite narrow (c. 3 m wide) it seems likely that cargoes were unloaded here by porters (*saccarii*) and not by cranes. A substantial internal wall (the *Contramura Interna*) was built around at least two (III and V), but probably all six, sides of the hexagonal basin and was pierced by small doorways every c. 75 m.¹⁷ Since it incorporated some of the inscribed columns it was clearly established some time after the completion of the basin, and was probably used to help channel the movement of *saccarii* between moored ships, the internal road behind the wall and warehouses that flanked it. The establishment of the wall reflects a high degree of centralized control in regulating the unloading and storage of cargoes.

Finally, there is epigraphic and numismatic evidence¹⁸ to suggest that a monumental column with an inscribed base and crowning statue was placed at each angle of the hexagonal basin, presumably to help guide seagoing ships entering the basin. They would have entered the basin from the *Canale di Imbocco del Porto di Traiano* and could have anchored temporarily at the centre until such time as a mooring space along its edges became free. Presumably the large corner columns and intervening lower inscribed columns could then have been used to help guide the ships to their allocated berths. These, together with the temple (below) and statuary in general, would also have played a key role as symbolic points of reference within the broader topography of the port.

These three basins together encompassed c. 233.07 ha of water space, providing ample capacity for incoming and outgoing seagoing ships. Overall the complex was able to offer up to c. 13.89 km of quay space at which ships and boats could have moored.¹⁹ While this is a figure that dwarfs provision at Ostia and Rome it should be considered a maximum estimate.

B. Other port infrastructure

Portus could not function without the network of canals that connected it to Ostia, the Tiber and, by virtue of this, to Rome. By the later 2nd century AD it was linked to the Tiber and the Tyrrhenian Sea by the so-called the *Fossa Traiana* and a transshipment canal (the *Canale Romano*) built by Trajan c. AD 102–109,²⁰ with the latter running from mid-way along the *Fossa Traiana* past the south-east side of the hexagonal basin to the Tiber.²¹ In its approach to the latter, it ran parallel to a stretch of road that probably corresponds to the westernmost stretch of the *Via Campana/Portuense* and which connected Portus to Rome. A third canal, possibly out of use by this time, ran between the Tiber to the north-east of the port and the sea at a short distance to the north of the Claudian basin (Fig. 2).²²

¹⁴ Keay et al. 2005, Pullout 2.

¹⁵ Calza 1925, fig. 2.

¹⁶ Calza 1925, 55 and fig. 2.

¹⁷ Calza 1925, 56–57.

¹⁸ Keay – Woytek forthcoming.

¹⁹ How much of this was actually used, as such, however, is unclear.

²⁰ Thylander 1952, B312.

²¹ Keay et al. 2005, Areas 15, 16 and 17 and figs 5.39–5.44.

²² Keay et al. 2005, Zone 4 and figs 5.56–5.57.

Terrestrial communication between Portus and Ostia across the Isola Sacra was achieved by means of the *Via Flavia*, and a fourth canal. This was c. 90m wide at its northern end, ran due south from Portus and flowed into the sea just north of the small harbour at Ostia.²³ Canals also played an important role within the port complex, with the *Canale di Imbocco del Porto di Traiano* providing the route for ships moving through the Claudian basin to gain access to the hexagonal basin, and with the *Canale Traverso* branching southwards off this to join the *Fossa Traiana*.

C. Central administrative buildings

A key suite of buildings occupied an isthmus of land that separated the Claudian from the hexagonal basins. Their centrality within the port, coupled with their sheer scale and architectural originality when compared to others across the port, argues strongly in favour of them playing complementary administrative roles related to coordinating activities in both harbour basins (Figs. 2–3).

The first was the *Palazzo Imperiale*, a palatial complex covering up to 3 ha that was completed c. AD 117 and which dominated both the Claudian and the Trajanic basins.²⁴ It had a distinctive trapezoidal plan, stood to a height of three stories (c. 29 m) and was composed of complex suites of vaulted rooms and passages (Fig. 9). Its western side was graced with a monumental colonnaded façade that opened onto the eastern sector of the Claudian basin, while along its northern face was a suite of luxurious residential rooms with polychrome mosaic floors and painted walls and adjacent work areas that opened onto the southern side of the Claudian basin. To the south a more functional frontage faced onto the Trajanic basin, while to the east the building was accessed from a very broad quayside that extended eastward to join the eastern edge of the Claudian basin at Monte Giulio.

Immediately adjacent to this and running perpendicular to it along the rest of Side VI of the hexagonal basin was a massive brick-faced concrete building (Building 5) that has been identified as the imperial *Navalia* of Trajanic Portus, and which formed part of the same architectural scheme as the *Palazzo Imperiale* (Fig. 10).²⁵ The complex was c. 240 m long by 58 m wide, stood c. 27 m high and was set back c. 35 m from both the Claudian and the Trajanic quays. It comprised three building sections (Buildings 5.1, 5.2 and 5.3) each of which consisted of the following sequence of vaulted spaces: (1) passage, (2) narrow bay, (3) narrow bay, (4) narrow bay, (5) passage, (6) wide bay. Current evidence suggests that this building was used to construct and repair ships, quite possibly both military galleys and large commercial ships (Fig. 11).

The so-called *Grandi Magazzini di Settimio Severo* were a third complex. This directly abutted the south-western tip of the *Palazzo Imperiale* on a narrow spit of land that projected into the south part of the eastern sector of the Claudian basin. It was an L shaped battery of vaulted storerooms and offices on two or three stories that was built in the later 2nd century AD (Fig. 12).²⁶ Its north and eastern sides formed two sides of a large piazza that opened onto the pool of the harbour in front of the *Canale di Imbocco del Porto di Traiano* as it approached the Trajanic basin and directly opposite the northern mouth of the *Canale Traverso*. A small bath building (*Terme della Lanterna*) lay a short distance to the west of this complex (Fig. 13).

²³ Germoni et al. 2011, 238 and fig. 12.5.

²⁴ Keay et al. 2005, Area 8 and figs 22–23; Keay et al. 2011.

²⁵ Keay et al. 2005, Area 9 and figs 24–25; Keay et al. 2012.

²⁶ Keay et al. 2005, Area 7 and figs 5.20–5.21.

D. Warehouses

The *Horrea Portuensia* (AE 1983, 976), or warehouses of Portus, are the predominant building type at the port. It has been estimated that in the early 2nd century AD the port had a total storage capacity of just under 60,000 m².²⁷ Most of the warehouses are oblong in plan and lack courtyards, unlike those at Ostia and Rome, and have narrow entrances. It has been argued that this arrangement was dictated by the need to arrange the buildings around the sides of the hexagonal basin.²⁸ While it is generally assumed that grain was the principal commodity stored in them the evidence for this is in reality limited.

Two parallel rows of warehouses ran the full length of Side I and along Side II on either side of a large temple complex.²⁹ Side III, by contrast, was a key point of transshipment for cargoes that had been unloaded from ships in the hexagonal basin and were then moved here for transshipment onto river-boats (*naves codicariae*) moored in the Trajanic canal (*Canale Romano*) for moving cargoes upriver to Rome. The warehouses here (Fig. 14) were composed of groups of oblong buildings, at least one of which seems to have had a central corridor, while another had raised floors (*suspensurae*) suggesting that it was used to store grain at some stage.³⁰ The whole of Side IV, on the other hand, was taken up by at least two oblong warehouses arranged in a triangular form.

The warehouses that were situated around the *Darsena* in the south-western part of the port were laid out in a different manner and there is evidence that they were primarily used for the storage of grain. The best known of these are the *Grandi Magazzini di Traiano*³¹ which have been the subject of a major research project for the past few years.³² This massive complex (c. 5 ha) consisted of c. 300 storerooms and occupied the whole of the north, west and south sides of the *Darsena*. On the north and south sides it comprised two parallel rows of storerooms on two stories running from west to east and separated by a wide corridor; each of the rows was broken down into groups of five storerooms (Fig. 15). To the west there was an extensive open area, to the west of which was a north-south row of storerooms that backed onto another range of storerooms opening westwards into the Portico di Claudio (Fig. 16). The survival of a painted Latin numeral on one of the piers flanking the entrance of one of these storerooms indicates that all of these storerooms were numbered. Recent excavations have revealed the existence of *suspensurae* below their floors, suggesting that they probably held grain from at least the Trajanic period onwards. To the south of this complex was another structure, the so-called *Foro Olitorio* (23,715 m²),³³ which took the form of a massive courtyard type warehouse of the kind that is frequently found at Ostia and at Rome. It seems very likely that this complex also stored predominantly grain.

Elsewhere there are buildings that also probably served as warehouses. These include large structures situated on the quayside at the foot of the eastern edge of the Claudian basin at the Monte Giulio,³⁴ and along the north side of the Trajanic canal (*Canale Romano*) between the hexagonal basin and the Tiber.³⁵

²⁷ Keay et al. 2005, Table 9.1.

²⁸ Rickman 1971, 130–132.

²⁹ Keay et al. 2005, Pullout 2.

³⁰ Keay et al. 2005, Area 11 and figs 5.29–30; Calza 1925, fig. 2 and 58–60.

³¹ Keay et al. 2005, Area 4 and figs. 5.13–14.

³² Boetto et al. 2010.

³³ Keay et al. 2005, Area 3 and figs. 5.09–5.10.

³⁴ Keay et al. 2005, Area 1 and figs 5.5–5.6.

³⁵ Keay et al. 2005, Areas 16 and 17 and figs 5.41–5.44.

E. Temple

A temple (6 m x 20 m) lay on the eastern side (Side II) of the hexagonal basin. It was situated on a high podium within a *temenos* (40 m x 55 m) and flanked by two pairs of oblong warehouses to the west and the east (Fig. 17).³⁶ While little is known about its architectural decoration or the divinity or divinities to whom it might have been dedicated, it seems to have had a close association with the emperor Trajan, not least because of the discovery of an acrolithic statue of the emperor at this spot in 1794.³⁷ It also occupied a very significant position within the topography of the hexagonal basin. Since it was directly on axis to its entrance it was the principal visual focus for ships entering its waters. It would also have reminded visitors of Trajan's achievement in enabling an enhanced supply of foodstuffs to the capital. In the context of an inner harbour basin with possible provision for the repair or construction of military galleys, it may also have echoed his martial qualities. Such symbolic allusions to Imperial power would have complemented those of the corner columns and the statues of Bacchus and other deities illustrated on the Torlonia relief (Fig. 23).³⁸

F. Commercial and residential quarter?

The main area of residential occupation probably lay in what is one of the least understood areas of the port. It was defined by the *Canale Traverso* to the west, the south side of the pool at the centre of the port to the north, sides IV and VII to the east and the *Fossa Traiana* to the south.³⁹ Known buildings include some kind of commercial building (the so-called *Scalo all'imboccatura del Porto*) on the south side of the pool and a possible temple near the *Episcopio Portuense*. Furthermore, recent excavations below the site of the later early Christian basilica suggest that this area was heavily built-up during the early and mid-imperial periods.⁴⁰

Our evidence for the range of the population at the port comes from the cemeteries, most notably on the Isola Sacra to the south⁴¹ and on the flat land between the hexagonal basin and the Tiber to the east.⁴² Analysis of the funerary inscriptions from the former make it clear that the population was composed largely of freedmen with close connections to leading families at Ostia and Rome, with some coming from overseas.⁴³ Inevitably, however, this tells us little about the size of the population. However, all the indications are that it would have been relatively low in comparison with Ostia. Given that the primary function of Portus was as a hub for the processing of the ships, boats and cargoes destined for Rome, this is understandable. Moreover, it is also likely that numbers would have risen and fallen in tandem with the high and low sailing seasons.

G. The northern side of the Isola Sacra

Excavations undertaken during the 1970s and subsequently have shown that much of the northern bank of the Isola Sacra on the south side of the *Fossa Traiana* was occupied by a range of major buildings that were reached from Portus by a bridge (Fig. 18).⁴⁴ In the area to the west of the Portus to Ostia canal lay the so-called *Isaeum* and the *Terme di Matidia*, while to its east lay

³⁶ Keay et al. 2005, Area 12 and figs 5.33–5.34.

³⁷ Lanciani 1868, 165–166.

³⁸ Visconti 1885, 306–311.

³⁹ Keay et al. 2005, Area 6 and fig. 5.17–18; Area 10 and figs 5.29–5.30.

⁴⁰ Maiorano – Paroli 2014, 15–39.

⁴¹ Baldassare et al. 1996.

⁴² Keay et al. 2005, 290.

⁴³ See the analysis in Helttula 1995, which should be read in conjunction with Helttula 2007. By contrast, the skeleton burials in a cemetery of the 3rd century AD situated away from the hexagonal basin to the east of the *Navvalia* belonged to much lower status individuals whose bones bear clear physical evidence of having been involved in hard manual labour at the port.

⁴⁴ Veloccia Rinaldi – Testini 1975.

the marble yards, the *statio marmorum* (Fig. 19).⁴⁵ Activities of members of the *corpus traiectus marmorariorum*⁴⁶ that is mentioned on an inscription from Ostia must surely relate to a stretch of water close to the *statio marmorum*, perhaps facilitating passage across the Portus to Ostia canal. The *Via Flavia* ran southwards to Ostia along the western side of the canal and was bordered by the tombs of the Isola Sacra cemetery.⁴⁷

H. The river port

This complex of buildings extended for c. 500 m either side of the mouth of the Trajanic canal (*Canale Romano*) at the point where it entered the Tiber.⁴⁸ The buildings here included what appear to have been courtyard warehouses and possibly large residences (Fig. 20).

5. The administrative context of Portus

Portus cannot be understood in isolation from Ostia or Rome. Since the chosen position of the Claudian port was close to the westernmost meander of the Tiber, one imagines that it was situated in the northern part of the territory of the *colonia* of Ostia. At the same time, however, the two great phases in its development, its establishment by Claudius and subsequent enlargement under Trajan, were both imperial initiatives and, as such, would have been financed almost entirely by the emperor. Indeed the very name of the port on the commemorative sestertius issued by Nero in AD 64 was *Portus Augusti Ostiensis*,⁴⁹ giving the official view that it was the imperial harbour of Ostia, rather than simply being the harbour of Ostia. Similarly the Trajanic enlargement of the harbour is commemorated on specially issued sestertii as the *Portum Traiani* in AD 112–114.⁵⁰

This strongly suggests that the land on which Portus was built had been appropriated from the *colonia* by the emperor. Indeed there is good evidence to suggest that the port was run as an Imperial estate.⁵¹ Thus, while municipal officials from Ostia probably played some kind of role in the running of the port until the earlier 4th century AD,⁵² it was primarily administered by a range of key imperial officials based primarily at Rome with agents acting on their behalf at Ostia.⁵³ However, it is important not to over-emphasize the degree of imperial intervention in the administration of Portus, which Arnaud⁵⁴ has recently characterized as being “much more like an administration at Portus (rather) than an administration of the harbour properly speaking”. He has also argued that this is a quite exceptional arrangement in the administration of Roman harbours and that those of other western ports may have been under the authority of the *aediles* who would have delegated this responsibility to compulsory *curatores*.⁵⁵

Surviving epigraphic records provide us with glimpses of the predominance of imperial officials in the management of Portus’ infrastructure, even though the scope of their roles is extremely hazy. The authority of the *curatores riparum et alvei Tiberis*, who were primarily responsible for the maintenance of the river-bed and banks of the Tiber at Rome, also seems to have played a role in the lower stretch of the Tiber in the vicinity of Ostia and Portus. There is epigraphic

⁴⁵ Pensabene 2007, 389–469.

⁴⁶ CIL 14, 425.

⁴⁷ Baldassare et al. 1996.

⁴⁸ Keay et al. 2005, Areas 19 and 20 and figs 5.49–5.50 and 5.54–5.55.

⁴⁹ Keay et al. 2005, 315.

⁵⁰ Woytek 2010, 422–423, no. 470.

⁵¹ Maiuro 2012, 263–264.

⁵² Bruun 2002, 167; Meiggs 1973, 62.

⁵³ Meiggs 1973, 298–310; Houston 1980; Bruun 2002.

⁵⁴ Arnaud 2015, 65.

⁵⁵ He sees Centumcellae and the Portus Iulius as the two exceptions (Arnaud 2015, 65); Arnaud 2016.

evidence for a *statio* of the *curatores* at Ostia,⁵⁶ while the discovery of a late 4th century AD inscription⁵⁷ to the east of Portus tells us that they also had thirteen bridges under their care in this area. If the *curatores* were responsible for the bridges as well as the Tiber bed and banks in the immediate vicinity of Portus and Ostia in the 4th century it is likely that this was also true of the 2nd and 3rd centuries AD. Moreover there is also a strong argument to be made that they would have also looked after the canals as well since these and the Tiber all formed part of an integrated transport system. The moles, lighthouse and dredging of the harbour basin, by contrast, seem to have been the periodic responsibility of a special official. During the reign of Constantine, Lucius Crepereius Madalianus was given an extraordinary commission with responsibility over the *molium fari at(que) purgaturae*,⁵⁸ after which he was appointed *praefectus annonae* (Fig. 21).⁵⁹ One assumes that there would have been some kind of precedent for this during earlier centuries.

The principal official body involved in the administration of Portus was presided over by the *praefectus annonae*, an official who was responsible for the organization of the supply and transport of fiscal foodstuffs to Rome.⁶⁰ He was based at Rome, most probably at the *portus Tiberinus*, although he had a *statio* close to the *Porta Romana* at Ostia by AD 62⁶¹ but not, as far as we know, at Portus. From the reign of Trajan onwards he was served by several key officials including the *procurator annonae Ostiae et in portu* who has been attested on Ostian inscriptions of the 1st and 2nd centuries AD, and the *proc(urator) ann(onae) A(ug)*, who is attested on an honorific inscription from Portus.⁶² The earliest holder of this post, in AD 112, was an African, M. Vettius Latro, and many of the about fifteen known holders of the post down to AD 247 were also of North African origin.⁶³ The precise scope of these officials' responsibilities is unclear. There were more junior officials who also worked for the *praefectus annonae*,⁶⁴ and the fact that quite a few inscriptions mentioning them have been found at Portus,⁶⁵ suggests that payments to the office or agents of the *praefectus annonae* and the monitoring of incoming cargoes could have taken place at Portus as well as at Ostia.

Another important official who would have played a key role in the administration of Portus was the *proc(urator) portus utriusq(ue)*⁶⁶ or *proc(urator) p(ortus) u(triusque)*.⁶⁷ Up until the earlier 3rd century AD he was an imperial freedman who has been attested on inscriptions from Ostia and Portus and supposedly involved with the grain supply;⁶⁸ subsequently he was of Equestrian rank (*ducenarius*). Bruun has convincingly suggested that the two ports referred to in the title correspond to the Claudian and Trajanic basins⁶⁹ at Portus alone, rather than Ostia and Portus. Furthermore, Arnaud has argued that the latter official is the same as the *procuratores Augusti* whose

⁵⁶ CIL 14 Suppl. 5384; Meiggs 1973, 303; Bruun 2002, 162.

⁵⁷ Cébeillac-Gervasoni et al. 2006, 137–138.

⁵⁸ In other words, he had responsibility for the quays, lighthouse and dredging – presumably referring to the Claudian basin.

⁵⁹ CIL 14, 4449; Thylander 1952, B336.

⁶⁰ Pavis D'Escurac 1976, 43–152; 203–266.

⁶¹ Cébeillac-Gervasoni et al. 2010, 157.

⁶² Thylander 1952, B340.

⁶³ Cébeillac-Gervasoni et al. 2010, 233.

⁶⁴ These include a chief cashier who paid contracted suppliers (*praepositus mensae nummulariae fisci frumentarii Ostiensis*) and his subordinates (*dispensatores*), secretaries who exercised controls and registrations (*tabularii* and *tabularii adiutores*), particularly those that were relevant to the *corpora* of *navicularii* (Pavolini 2005, 76–82).

⁶⁵ These include: a *Caes(aris) n(ostris) disp(ensator)* (Thylander 1952, B343); a *dispensator* (Thylander 1952, B222); a *tabellarius* (Thylander 1952, A256; A279); a *ta(bularius)* (Thylander 1952, B67); a *tabulario portus Aug* (Thylander 1952, B68); a *tabularius adiutor* (Thylander 1952, B305).

⁶⁶ Thylander 1952, B338.

⁶⁷ Thylander 1952, B324,6.

⁶⁸ Pavis d'Escurac 1976, 417–423; Houston 1980, 157–162.

⁶⁹ Bruun 2002, 166–167.

names have been documented on lead pipes from Portus and Ostia, who were under the authority of the *a rationibus*, rather than the *praefectus annonae*, and responsible for the administration of imperial infrastructure at Portus and Ostia. He suggests that the *proc(urator) portus utriusq(ue)* or *proc(urator) p(ortus) u(triusque)* is more likely to have been responsible for imperial property or estates at the ports, rather than acting as harbour-master as such.⁷⁰

While there is as yet no solid evidence for a building at either Ostia or Portus where these officials might have been based, the most likely candidates at Portus are the *Palazzo Imperiale* and the adjacent *Grandi Magazzini di Settimio Severo*.⁷¹ Their central location would have made it possible for their staff to keep track of the movement of ships and their cargoes as they passed through the port. While it might be objected that the former complex in particular was perhaps too grand for relatively junior officials, it would have been less of an issue if it also served as a periodic residence for the emperor passing through the port at the beginning or at the end of an official voyage.⁷²

The initial construction of the *Horrea Portuensia* was presumably undertaken on imperial initiative and at imperial cost, with the needs of the *praefectus annonae* in mind. One imagines that the buildings would have been subsequently leased out to contractors (*conductores*) under the supervision of an imperial procurator, who could then sublet storage space within the buildings.⁷³ It is very doubtful, however, that the *praefectus annonae* would have been in any way involved with their maintenance, and more likely that his agents sought to ensure that there was sufficient storage space for incoming foodstuffs bound for Rome. This would seem to be how to read the sense of two related inscriptions, one from Mactar in Africa Proconsularis and another from Hispalis in Baetica.⁷⁴ The former (AE 1983, 976) dates to AD 166 and refers to Sextus Iulius Possessor, an official who was probably based in Rome and who is recorded as having served as an *adiutor* to the *praefectus annonae* at the warehouses of Ostia and Portus.⁷⁵ The latter inscription also refers to him as an *adiutor* to the same *praefectus annonae* but states that he controlled olive oil from Africa and Hispania, directed the transport of grain, and paid shippers for their costs.⁷⁶ On the other hand, an inscription⁷⁷ set up at Ostia by members of the *collegium* of the *fabri tignuarii*, or builders, in honour of the *proc(urator) annonae Aug(usti) Ostis* does seem to hint at some kind of relationship between members of this association, who presumably constructed warehouses, and the *praefectus annonae*.

One of the key tasks of the *praefectus annonae* and his subordinates was to establish contracts with the private shipowners (*navicularii*) who played a fundamental role in transporting supplies for the *annona*, and in facilitating maritime commerce more generally.⁷⁸ They belonged to *corpora naviculariorum* from the reigns of Trajan and Hadrian onwards, following the enlargement of Portus, and their members set up a number of inscriptions in honour of the *praefectus annonae*.⁷⁹ In addition to these there were another c. sixty *collegia* and *corpora* known from Portus and Ostia.⁸⁰ Their members provided the agents of the *praefectus annonae* with a range of key services as

⁷⁰ Arnaud 2015, 65.

⁷¹ The situation during the pre-Trajanic period is unclear.

⁷² Keay et al. 2012.

⁷³ This is one of the ways in which imperial warehouses at Rome were managed: see France 2008, 483–492.

⁷⁴ I would like to thank Pascal Arnaud for making this point to me.

⁷⁵ *ad horrea Ostiensia et Portuensia*.

⁷⁶ *adiutori Ulp̄i Saturnini praef(ecti) annon(ae) ad oleum Afrum et Hispanum recensendum item solamina transferenda item vecturas naviculariis exsolvendas* (CIL 2.1, 23); see Pavis D'Escurac 1986, 384–385 and Remesal Rodríguez 1991 for different aspects of this text.

⁷⁷ CIL 14, 160.

⁷⁸ Rougé 1966, 229–268; Meiggs 1973, 285–292; Di Salvo 1992, 183–390; Pavolini 2005, 76–79.

⁷⁹ Rougé 1966, 245–255; Sirks 1991, 81–107; Di Salvo 1992, 225–298; Lo Cascio 2002.

⁸⁰ Their activities included (1) grain, shipping and related services, (2) commerce, and (3) transport and trades (Hermansen 1982, 56ff.).

well as information about the amounts and condition of grain, oil and wine arriving at the port, the location of available storage, the quantities that needed to be transported upriver to Rome, and the number of available seagoing ships and riverboats.⁸¹ Since the function of these associations was primarily social and religious,⁸² the precise nature of their relationship with the *praefectus annonae* is difficult to gauge.

The procurators discussed above may have liaised closely with individuals who belonged to the *corpus* of the *curatores navium marinarum*, an association known from inscriptions found at both Portus⁸³ and Ostia⁸⁴ and which was composed of individuals of high social standing. While Meiggs argued that these people might have helped secure docking facilities, there have been more recent suggestions that they were in some way responsible for the oversight or maintenance of seagoing ships at the port.⁸⁵ Arnaud, by contrast, has argued that in those cases where a member of the association is associated with a place name, such as the *curator navium Karthaginensium*, it is possible that this person may have in some way represented the ships of his home-port – in this case Carthage – and that he may have had authority over ships and crew from there while they were anchored at Portus.⁸⁶ Another very influential group of actors involved in the shipping at Ostia and Portus were of course the shipwrights. While their *schola* and a range of epigraphic texts have been identified at Ostia,⁸⁷ the main focus of their activity would seem to have taken place in the imperial *Navalia* (Building 5) at Portus.⁸⁸

While food bound for Rome was the primary rationale for the existence of Portus it was not the only one. Another was the import of other commodities and material needed at the City. One of the better-understood examples of this is the marble. This was imported from across the empire and stored at the *statio marmorum* on the north side of the Isola Sacra prior to being shipped upriver to Rome from the late 1st century AD onwards. This supply system was controlled on behalf of the *ratio marmorum* by a junior equestrian official based at Rome, the *procurator marmorum*.⁸⁹

Since Portus was the primary strategic food reserve of the Capital, security will have been an important consideration for the authorities. While there are no contemporary sources that directly attest to this, it is worth noting that there is an edict in the Theodosian Code (14.15.4) dated to AD 398 that exhibits the concerns of the emperor over the theft of supplies from storehouses at Rome and Portus.⁹⁰ One can assume that similar concerns in the 2nd and 3rd centuries AD explain at least in part the presence at Portus of detachments of *vigiles*⁹¹ under the authority of the *praefectus vigilum* at Rome. Since the texts that attest these were found in the Commercial and Residential Quarter of the port discussed above,⁹² it has been suggested that there may have been a barrack block here.⁹³ More recent analysis, however, argues that they were more likely to have been based at the *Caserma dei Vigili* at Ostia with only a small detachment and guard-post

⁸¹ Rickman 1998, 323.

⁸² Tran 2006, 1–41; 295–334; 519–526.

⁸³ Thylander 1952, B339; CIL 14, 409.

⁸⁴ CIL 14, 363, 364, 4626 and possibly 4549,42.

⁸⁵ Meiggs 1973, 288; Di Salvo 1992, 275–278; Terpstra 2013, 118.

⁸⁶ Arnaud 2016.

⁸⁷ Pavolini 2005, 137–139; Hermansen 1982, 61–88; 111–120; Pensabene 2007, 343–364; Zevi 2008.

⁸⁸ There is also good epigraphic evidence here for the *fabri navalium [Portuens(ium)]*: Thylander 1952, B337 = CIL 14, 169; Thylander 1952, B346 = CIL 14, 256; Konen 2001.

⁸⁹ Maischberger 1997, 51–52; Pensabene 2013, 125–136.

⁹⁰ It has been argued that the security of stored goods in warehouses at Rome, specifically the *horrea Galbana*, was the responsibility of *horrearii*: Rickman 1971, 312–315; see also France 2008, 487, note 21. Since there is no epigraphic evidence for *horrearii* at Portus and Ostia, it is assumed that this task was in the hands of *saccarii*: Martelli 2013, 17, 21; see however Virlouvét 2015, 8.

⁹¹ Inscriptions referring to cohorts II, III and IV have been found at Portus (Thylander 1952, B288, 289 [290]; A 31).

⁹² Near the *Episcopio Portuense*.

⁹³ Lanciani 1868, 144.

(*excubitorium*) actually being present at Portus.⁹⁴ Further security was provided by detachments of *milites* and their galleys from the *Classis Misenensis* based at Misenum.⁹⁵ It may be that their activities were in some way dictated by the needs of officials based at the *Palazzo Imperiale*, since galleys may have been repaired and/or housed in the adjacent imperial *Navalia* (Building 5). But a naval presence would have also been needed to escort the incoming African or Egyptian grain fleets, take governors out to their provinces to assume their commissions, and on rarer occasions transport emperors such as Hadrian and others on imperial journeys.

6. The use of the port

A key consideration in evaluating the role of Portus as a hub for the importing of foodstuffs bound for Rome, and indeed their possible export and re-distribution, is to understand how each of the different basins and canals were used, their relationship to known port buildings, and their inter-connectivity within Portus and the 'port-system' as a whole. The paucity of good geo-archaeological, archaeological, literary and epigraphic evidence makes this a considerable challenge.

A. Movement of ships into the port

Analysing the movement of ships through the harbour basins and canals needs to take account of their topography and depth, the currents and prevailing winds within them, and the draft of ships that plied their waters. There is now broad agreement that most seagoing ships would have approached the Claudian basin from the west, entering on either side of the Pharos; other, smaller ships and boats could have used the northern entrance close to the Monte Giulio. One imagines that seagoing ships would have initially anchored in the Claudian basin until space was freed up in the Trajanic basin. Some support for this idea comes from a recent study of water dynamics within both basins. It is based upon the advanced computer modelling of seasonal wind directions and the record of ancient harbour sediments gleaned from geo-archaeological cores,⁹⁶ and it underlines the importance of the western entrance, particularly at the height of the navigational season in the summer months. The research⁹⁷ suggests that when the wind was blowing from the south-east, ships could move (1) into the Claudian basin along the south side of the Pharos towards the centre of the basin in a clockwise spiral, before then (2) turning an anti-clockwise spiral to move northwards up the mole that separated the western from the eastern side of the Claudian basin, before then (3) turning in to the more sheltered waters in the eastern side of the Claudian basin, and thus (4) onwards into the *Canale di Imbocco del Porto di Traiano* and ultimately into the hexagonal basin (Fig. 22).⁹⁸

Within the latter there was a contrast between the currents at the centre and those running around the outside.⁹⁹ This is the context in which one imagines that incoming seagoing ships would have moved. Upon arrival they would either have anchored at the centre of the basin before moving to the assigned berth, or would have remained at the centre of the basin and their cargo unloaded onto lighters and then carried to the quays.¹⁰⁰ Evidence for the latter can be seen

⁹⁴ Sablayrolles 1996, 308–310.

⁹⁵ Thylander 1952, A178, B37, B70, B73 and B105). See also Keay 2012a, note 67.

⁹⁶ Delille – Goiran 2014.

⁹⁷ Delille – Goiran 2014, fig. 6C and 6D.

⁹⁸ However, the narrowness of the entry into the *Canale di Imbocco del Porto di Traiano* suggests that ships must have been towed through it and into the hexagonal basin rather than moving under sail.

⁹⁹ Delille – Goiran 2014.

¹⁰⁰ The celebrated commemorative Trajanic sestertius (Woytek 2010, plate 94: 470b1–3; 470c; 470f; 470v1–v4) shows a range of different kinds of ship in the basin, including what appear to be merchant ships and possibly a galley (Keay – Woytek forthcoming).

on the bottom right hand corner of the Torlonia relief. Here a *saccarius* is represented unloading from a small boat whose bow is facing the quay and is fastened by a mooring ring; the craft is adjacent to a seagoing ship (Figs. 23 and 24).

This latter arrangement helps explain the scenario described in the 3rd century AD *Refutation of all Heresies*. The Christian Carpophorus, who was a member of the imperial household, was in hot pursuit of his slave Callistus who had embarked upon a ship preparing to leave Portus. Upon arriving at the port he tried to catch up with him by taking a rowing boat to the ship that was anchored in the centre of the harbour (presumably the Trajanic basin) so that he could pursue Callistus.¹⁰¹ It is these kinds of boat and other small craft¹⁰² which plied the waters of the harbour basins that were managed by members of the five *corpora* of the *lenunculariorum* and the *corpus scapharior(um)*¹⁰³ who have been attested on inscriptions from the port.

The movement of ships through the port would have to have been carefully coordinated by port authorities, particularly since they had to oversee outgoing and ingoing ships and manage the movement of smaller ships and boats as well. As argued above, the central position and high elevation of the *Palazzo Imperiale* would have made this the best place from which to supervise this activity, while visual alignments between the Pharos and lanterns within the Claudian basin, and the temple, monumental angle columns and inscribed columns would have acted as fixed reference points for the ships once inside the hexagonal basin. Precisely who coordinated these movements is unclear.

Since there is very little evidence as to what was stored in the warehouses throughout the port, it is difficult to identify preferential areas for certain kinds of cargo. That said there are some indications that these probably existed. The *Grandi Magazzini di Traiano* and the *Foro Olitorio*, which focused upon the *Darsena* in the south-western part of the port, seem to have been the primary destination of grain ships. The presence of *suspensurae* in the oblong warehouse along Side III of the hexagonal basin points to further grain storage in this part of the port¹⁰⁴ at some stage. One imagines that foodstuffs borne in amphorae and other kinds of container would have been stored in many of the other warehouses around the hexagonal basin, together with other commodities. The bulkier cargoes, however, seem to have been stored in more peripheral areas. Timber may have been unloaded on the southern side of the northern sector of the Claudian basin for use in the *Navalia*. The difficulty of moving marble and the position of the *statio marmorum* on the northern side of the Isola Sacra meant that ships bearing this would have avoided the main basins and approached their destination directly from the open sea along the *Fossa Traiana*.

There was some variation in the size of the ships that could have used the different water spaces at Portus. Recent research¹⁰⁵ suggests that (i) the Claudian and hexagonal basins could have accommodated ships ranging from 50 to 1200 t; (ii) the *Canale di Imbocco del Porto di Traiano* could have taken ships of c. 350–390 t; (iii) the *Darsena* would probably have taken ships of c. 130–150 t and smaller boats such as the *naves codicariae* at 80 t; even though there would have been sufficient draft for much bigger ships, the narrowness of the basin means that they would have had little room to manoeuvre; (iv) the *Canale Traverso* could have accommodated most sizes but is more likely to have taken the smaller boats and *naves codicariae* on the grounds of manoeuvrability.

¹⁰¹ Roberts – Donaldson n.d.: Chapter VII.

¹⁰² *Lenunculi* and *scaphae*: Meiggs 1973, 296–298; Le Gall 2005, 267–273.

¹⁰³ Thylander 1952, B339; see also Sirks 1991, 268–282.

¹⁰⁴ Calza 1925, 58–60, figs 2 and 4.

¹⁰⁵ Boetto 2010, Tableau 1 and fig. 11.

B. Obtaining permission to enter the port

Ships sailing into Portus are likely to have been subject to a number of controls designed to enable the port authorities to keep track of the cargoes bound for Rome. Rickman has interpreted the reference to a *procurator Phari* on an ostrakon from Alexandria as an official from whom ships needed to get a permit to leave and enter the port.¹⁰⁶ This suggests that permission was needed to enter that port and, if so, it may have also been the case at Portus and elsewhere, although there is as yet no evidence.

C. Registration of ships, harbour charges and checking of cargoes

There followed a series of procedures that were central to the functioning of the port and which represent the final stage in a complex series of arrangements and agreements between provincial producers, merchants, shipowners and the office of the *praefectus annonae*. While many of the members of the *collegia* and *corpora* of the shipowners (*navicularii*) who would have been involved in this are known from Ostia,¹⁰⁷ gaps in the epigraphic record mean that we do not as yet have any epigraphic evidence from the site itself.

(i) Registration of ships

One imagines that this was another fundamental step in the arrival of imports at Portus. But since we have no evidence from the port it is unclear who would have undertaken this. Nor do we know where it might have taken place although the centrality of the *Magazzini di Settimio Severo* to the port and their proximity to the *Palazzo Imperiale* is an argument that it could have occurred there.¹⁰⁸ It seems reasonable to suppose that the way in which incoming ships and their cargo were listed was similar to the details recorded on an Alexandrian papyrus, P.Bingen 77. This dates to the second century AD and records details of a number of ships that had arrived at the port from different parts of the eastern Mediterranean and from Ostia.¹⁰⁹ These take the form of the following short sequence of notations: (a) the port of origin of the ship, (b) the name of the owner of the ship, (c) the name of the ship, and (d) the commodities carried and for whom. So, for example, the entry for a ship from Ostia (presumably Portus) runs:

From Ostia, 1 [/. [The ship] of Lucius Pompeius Metrodorus, ["(name of the ship)"]; 22.500 artabae. To sail in.

Contingent upon the registration of ships would have been the payment of harbour charges – including mooring costs.¹¹⁰

(ii) Processing of cargoes

There then followed a complex series of procedures that ended with the deposition of the cargoes in the various warehouses around the port. Although evidence is very fragmentary and indirect, a number of studies give us some idea of what was involved.¹¹¹ The first stage involved checking that the quantities of different kinds of cargo recorded on the ship's papers (*relatoria*) at the port of origin were the same as those actually present on the moored ship. These were akin to modern simple bills of lading and were used to ensure that nothing had gone astray for whatever reason.

¹⁰⁶ 1998, 320 and note 10; *id.*, 1988, note 7; Puk 2010 provides the most up to date discussion of this official.

¹⁰⁷ Generally, see Meiggs 1973, 311–336; Di Salvo 1992, 391–395; Terpstra 2013, 95–126 amongst others.

¹⁰⁸ One clause in the text of the Customs Law of Asia (75 BC–AD 62) could be interpreted to mean that in Asia, the registration of ships might have taken place at customs posts (2, 42–45, 17: Cottier et al. 2008, 45).

¹⁰⁹ <<http://www.papyri.info/hgv/78045>> [accessed on 23 November 2017].

¹¹⁰ Arnaud 2011, 66ff.

¹¹¹ Sirks 1991; Rickman 1998; Arnaud 2011; Levrero 2014: 99–101.

While none of these documents actually survive, they are mentioned in the late 4th century AD Theodosian Code in relation to African grain ships arriving at Portus from Carthage.¹¹² Although this is a late source and the practice at that time may have been different to that of the early and mid-imperial period, it remains our only source of information. Since these were state cargoes it was in the interests of the authorities to ensure that their integrity was safeguarded. Thus it would have been incumbent upon the captain of each ship to submit proof of the integrity of his cargo to the office of the *praefectus annonae*.¹¹³ Following the unloading of cargoes from the ships, officials from the office of the *praefectus annonae* issued the captain of each ship with documents (*securitates*) that were proof that the cargo was intact and which were ultimately passed to the shippers concerned.¹¹⁴ A similar processing sequence has been gleaned from ostraca found at the circular harbour at Carthage in Africa Zeugitana.¹¹⁵ They date to AD 373 and consist of ink-written notations on African amphora sherds that record (a) the inspection of olive oil for export by *mensores olearii*, and (b) their consignment to a weighing or storage facility on the circular harbour. It has been argued that at this second stage the *ensor olearius* would have issued a receipt akin to the *securitates* issued to *navicularii* at Portus by the local office of the *praefectus annonae*.

During a subsequent (?) stage, samples of the different commodities being carried as cargoes would have been examined prior to unloading, in order to ensure that they met the importing merchants' quality expectations.¹¹⁶ Surviving evidence suggests that these samples (*deigmata*) were carried in small amphorae. A small amphora (Schöne-Mau XXVI) discovered at Pompeii, which one assumes must have originally come through the port at Puteoli, bore four painted inscriptions.¹¹⁷ A recent interpretation of the longest of these¹¹⁸ identifies the contents of the amphora as a sample of grain belonging to a total cargo of 15,200 modii, in a ship (*cumba*) owned by Publius Popilius Saturus and under the command of the magister Marcus Lartidius Vitalis; since the latter was from the port of Clupea in north-eastern Africa Proconsularis, it is assumed that the grain also derived from that province. A second *titulus pictus* records that the unnamed transporters (*vect[ores] estis*) were given 200 modii each as payment. A third inscription records some kind of consignment taking place on the 14th October of an unspecified year, an act that may perhaps relate to the checking procedures discussed above. One imagines that a similar process would have taken place at Portus, with small varieties of amphorae holding samples of grain, olive oil and other foodstuffs.

All of the documents produced in the course of these controls must have been collected together at Portus, and again the *Grandi Magazzini di Settimio Severo* would seem to have been a logical place for this, before the documents presumably were transported to the *statio* of the *praefectus annonae* at Ostia, and then ultimately to Rome. At the same time the returning captain would have taken a copy of the *securitates* back to his port of origin to provide proof to the shippers that the cargo had been delivered as commissioned.

(iii) Unloading of cargo, storage at warehouses and payment of charges

Most of the ships that moored in the Trajanic basin would have transported cargoes that were required by the state. Estimates for the time that it would have taken to unload grain ships have ranged from 2–4 days for ships of 130–150 t to 5–6 days for a ship of 350 t, although a more recent calculation has suggested that 5 days would have been needed for a ship of 150 t.¹¹⁹ Once this was

¹¹² Sirks 1991, 156–157; Rickman 1998, 322.

¹¹³ Cod. Theod. 14.15.2; Sirks 1991, 156.

¹¹⁴ Cod. Theod. 14.15.2; Sirks 1991, 123.

¹¹⁵ Peña 1998.

¹¹⁶ Rickman 1998, 319–320.

¹¹⁷ CIL 4, 9591.

¹¹⁸ Varone 2015.

¹¹⁹ Brandt 2005, 35–36.

complete, the authorities had to ensure that all the incoming cargoes ended up in their assigned warehouses, and that nothing went missing during the unloading process.

While there is no direct evidence as to how this process was managed at Portus, there are a few clues. In the first instance, the architecture of the port installations was designed to control the movement of *saccarii* between the ships where cargoes were unloaded and the warehouses that had been allocated to them. The spaced narrow entrances in the post-Trajanic encircling wall running around the basin and the narrow entrances to the warehouses themselves were key in this respect, as would have been the numbering of warehouses and storerooms. Secondly, the actual process of unloading from a moored ship is illustrated on the famous painting of the Isis Giminiana ship from the Via Laurentina cemetery outside Ostia.¹²⁰ It shows *saccarii* carrying sacks of grain onto the ship and emptying them into a measure under the watchful eyes of officials (Fig. 25). The latter would have been members of the *collegium* of the *mensores frumentarii* and the mosaic floor of the *horrea* of the *mensores* at Ostia¹²¹ records them in the process of measuring out grain (Fig. 26). The ideal place for undertaking this particular control at Portus would have been the *Portico di Claudio* onto which opened the westernmost and sea-facing storage rooms of the *Grandi Magazzini di Traiano* and the *Foro Olitorio*, both of which stored grain on a large scale. It has been suggested recently that the *saccarii* at Portus might have moved the sacks of grain from the measuring point to the warehouses of destination by means of what amounted to a human chain, passing sacks from one to the other up to the entrance of the warehouse.¹²² Recent work at the *Grandi Magazzini di Traiano* suggests that the storage rooms themselves could only be entered by two men, side-by-side, one with a sack on his shoulders, and the other empty handed.¹²³ However, it is unclear whether it was the *saccarii* who would have entered and emptied the contents of their sacks into the assigned storerooms, or whether this was undertaken by warehouse workers (*horrearii*) akin to those who have been documented at warehouses at Rome.¹²⁴

Rickman has argued that the image on a relief from Portus¹²⁵ represents a key stage in a similar process for other goods (Fig. 27).¹²⁶ Here *saccarii* can be seen unloading amphorae from a ship that was moored close to some kind of building. They are being handed a token by one of three officials, while a second one registers the act, and a third writes it down or checks it off. Rickman goes on to suggest that this act of presenting the token was a way of ensuring that the number of amphorae that was counted out from the ship was the same as that which was counted in to the warehouse. This counting in must have taken place close to the narrow doorways of the oblong warehouses that clustered around the hexagonal basin.

Further information comes from the epigraphy of Dressel 20 amphorae carrying olive oil from southern Spain (Hispania Baetica). This was a commodity that we now know was supplied to Rome by means of the *annona*¹²⁷ by the 2nd century AD and which had to pass through Portus on its way to Rome from Hispalis (Seville) in Baetica. In addition to stamped handles that record the names of the estates that produced the oil carried in the containers, they bear painted inscriptions (*tituli picti*), many of which have been found in massive quantities at the Monte Testaccio in the *emporium* district at Rome. They record the tare of the amphorae,¹²⁸ the name of the merchant or

¹²⁰ Viriouv 1995, fig. 20.

¹²¹ Becatti 1961, 33–36 and plates CLXXXXVII–CLXXXXVIII.

¹²² Viriouv 2015, 8.

¹²³ Martelli 2013, 102.

¹²⁴ Specifically the *horrea Galbana* in the *emporium*; Tran 2008 and France 2008 are the most recent treatments that refer to *horrearii* and their roles in the running of warehouses.

¹²⁵ Lugli – Filibeck 1935, fig. 82.

¹²⁶ Rickman 1998, 321–322.

¹²⁷ Chic García et al. 2001.

¹²⁸ The so-called *alpha titulus* (Remesal Rodríguez 1998, 191).

shipper involved in their transport,¹²⁹ the weight of the oil they carried¹³⁰ and their official registration.¹³¹ All of this information was required by the state in order to monitor the safe arrival of this key commodity.

All of the above comments are based on the assumption that these were cargoes destined wholly or in part for re-distribution at Rome by means of the *annona*. There are good grounds, however, to suspect that some of the cargoes that passed through Portus were destined for the non-state purchase and use. Although these kinds of goods passing through Italian ports were not apparently subject to customs dues (*portoria*),¹³² this tax would have been levied upon them leaving their ports of origin. The *statio Antonin(iana) XXXX Galliarum et Hispaniarum* at Ostia¹³³ would have presumably archived receipts for the 2.5% tax paid on cargoes leaving ports in Gaul and Spain. It is also very likely that exports from Rome and the Tiber valley and goods bound for Mediterranean markets were redistributed through Portus.¹³⁴

It is in the context of non-state cargoes that Arnaud discusses the tokens mentioned above. On the basis of the Greek evidence, he relates them to the *portoria* and suggests that customs clearance would have required the entire unloading of the cargoes of individual ships – or at least the part of it that was to be sold. This would have allowed customs officials to affix lead seals or wooden tablets to cleared items of cargo, mark ingots or write painted inscriptions on amphorae. He then goes on to argue that if the goods were to be re-embarked, the same process of registering had to begin again.¹³⁵

(iv) *Buying and selling*

One gets some sense of the vitality of the commercial activity at the port from the sheer volume and range of imported foodstuffs that have been documented on excavations and surveys.¹³⁶ It is unlikely, however, that much of this will have derived from buying and selling on any significant scale,¹³⁷ not least given the likely low population at the port. Virtually none of the known warehouses, for example, were built with the central courtyards where auctions could have taken place as at Ostia.¹³⁸ The one exception is the *Foro Olitorio* complex which, given its proximity to the *Grandi Magazzini di Traiano* and the *Darsena*, would have made it well suited to the auctioning or sale of grain. Nor is there any evidence for fixed commercial outlets, spaces for moveable markets, areas for the storage and sale of bulk commodities.

(v) *Other activities*

The only other activity that appears to have taken place on any scale was shipbuilding or ship repair. The recently identified *Navalia* (Building 5) adjacent to the *Palazzo Imperiale* on the narrow isthmus of land at the centre of the port had the capacity to shelter a minimum of nine large ships, and possibly more. While it is still unclear whether these were military or commer-

¹²⁹ The so-called *beta titulus* (Remesal Rodríguez 1998, 192).

¹³⁰ The so-called *gamma titulus* (Remesal Rodríguez 1998, 192).

¹³¹ The so-called *delta titulus* (Remesal Rodríguez 1998, 192).

¹³² Harris 2011, 215.

¹³³ CIL 14 Suppl. 4708; more generally see De Laet 1949, 119–454; France 2001.

¹³⁴ Keay 2012a, 55 and note 111.

¹³⁵ Arnaud 2011, 66.

¹³⁶ Discussed below, p. 169.

¹³⁷ Indeed there is some evidence from *Portus Project* excavations on the site of the *Palazzo Imperiale* and the *Navalia* (Building 5) that here at least ceramic and faunal deposits of 3rd to 6th centuries AD date are best interpreted as either deriving from the re-deposition of material that had been in storage (in warehouses?) prior to loss, or from residential activities.

¹³⁸ Delaine 2005, 39–45.

cial ships, or both, it is clear that it provided a vital service to the port. The *album* of the *corpus fabrum navalium* [*Portuens(ium)*], or shipwrights, whose members may have coordinated repair and construction of ships at the shipyard is an index of this. It was very large, with at least 353 listed members.¹³⁹ Many of them were Roman citizens and freedmen, some of whom had connections to the imperial house, while most were not involved in any other professional body.¹⁴⁰ Inscriptions mentioning other *collegia* whose members were working in related fields record caulkers (*stuppatores*), ballast providers (*saburrarii*) and salvagers of sunken ships and goods (*urinatores*).

D. Transport of cargoes upriver to Rome

The topography of Portus is such that there were only two ways by which riverboats, *naves codicariae* and others, could leave the complex and head up river to Rome. The first was by means of the *Canale Traverso*, which could have taken traffic from both the pool at the centre of the harbour and the *Darsena* and provided access to the *Fossa Traiana*, and thence to the Tiber. This must have been one of the main ways in which grain that had been stored in the *Grandi Magazzini di Traiano* could have been transported out of the port; grain stored in the *Foro Olitorio* was presumably loaded directly onto boats moored in the *Fossa Traiana* itself. The second route out of the port would have been by means of boats moored in the *Canale Romano* where it ran parallel to Side III of the hexagonal basin. This means that the warehouses at this point were a key focus of transshipment, and that in order for goods from all the other sides of the hexagon to be transhipped at this point, they would have to be first moved by *saccarii* from their primary place of storage.¹⁴¹ This would clearly have been a complex logistical task that would have needed careful coordination and involved a series of checks and controls similar to those already discussed above.

Since many of the warehouses at Portus are likely to have been under imperial ownership, goods that were stored within them and earmarked for state use would have been exempt from charges. However, there must have been a mechanism in place to ensure that no goods were mislaid in transit between the warehouses where they had been stored and the riverboats that transported them up to Rome. Rickman suggests that there was a system in place similar to that practiced in Egypt, whereby regional warehouse managers (*sitologoi*) (a) issued receipts for the grain that they received from local producers, and was then handed over to *naukleroi* and *kubernetai* for transport up the Nile to Alexandria, and then (b) deposited the receipt and periodic summaries with regional authorities.¹⁴²

The loading of cargoes on to the *naves codicariae* anchored in the *Darsena* and in the *Canale Romano* was undertaken by boatmen working under contract from the *praefectus annonae*. They are known to us from inscriptions found at Portus, most notably the *codicarii*;¹⁴³ others are found on texts from Ostia.¹⁴⁴

There must also have been a procedure for registering people and cargoes on and off the riverboats, and indeed ferries along or across canals at Portus and down to Ostia. Interesting in this regard are a range of bronze and lead tokens that for the most part do not have any firm

¹³⁹ Thylander 1952, B337 and 344.

¹⁴⁰ Konen 2001.

¹⁴¹ Recent experimental research on the storage conditions for the grain supposedly stored in the storerooms of the *Grandi Magazzini di Traiano* suggests that grain may have only been stored in them for a short space of time, which would point to a fairly rapid process of transshipment, or that they may have held products other than grain (Pagliaro et al. 2015).

¹⁴² Rickman 1998.

¹⁴³ Thylander 1952, B338,10.

¹⁴⁴ Meiggs 1973, 293–296; Le Gall 2005, 275–283.

provenance or context, but which would seem to have been used somewhere in the area of the lower Tiber between Rome, Portus and Ostia. The larger tokens take the form of bronze coins that are traditionally identified as being of Julio-Claudian date but which could be dated to anywhere between the beginning of the first century AD and c. AD 150, and illustrate what appear to be river boats with a rear oar but no mast or sail and bear, on their reverses, various letters such as D, G, V or T (Fig. 28).¹⁴⁵ The smaller bronze tokens are rather cruder, rectangular/sub-rectangular in form and only bear an image on one side. Most commonly this takes the form of a galley carrying two men, but also a horse or a deity, and these pieces carry the inscriptions MPV, MAD, TA or AT C/AL (in two lines), AT/NI, AN/IT or AN/TI (also in two lines; for a selection, see Fig. 29).¹⁴⁶

Coordination of the movement of the riverboats up and down the Tiber between Rome, Portus and Ostia would have been a complex logistical challenge. A recent estimate has suggested that somewhere between 152 and 264 riverboats undertook this journey daily.¹⁴⁷ So, to ensure that this traffic moved smoothly would have required close liaison between the boatmen, who would have had to maintain an agreed daily timetable of trips, and the various port and river authorities. Congestion and delays along the harbour canals, the Portus to Ostia canals and the river between Rome, Portus and Ostia must have been frequent. The worst of these would have been at the junction of the *Canale Traverso* and the *Fossa Traiana* (Fig. 30, area A), the intersection of the Trajanic Canal, the *Fossa Traiana* and the Portus to Ostia canal (Fig. 30, area B), the junction of the *Fossa Traiana* and the Tiber at the Capo Due Rami (Fig. 30, area C), the intersection of the Trajanic canal and the Tiber (Fig. 30, area D) and the junction of the Claudian canal and the Tiber (Fig. 30, area E). A further challenge to resolve was that since the Rome-bound traffic would have headed up the west side of the Tiber, river craft would have at some stage needed to move from the west side of the river upon which Portus was located to the east side in order to unload in the *emporium* at Rome.¹⁴⁸

One way to avoid this kind of congestion along the canals and the river would have been a signalling system. One suspects that the various river ports or stopping places along the Tiber that are usually mentioned in connection with the towpath used for pulling *naves codicariae* upriver to Rome¹⁴⁹ also served as signalling stations. The *Fors Fortuna* and the *Vicus Alexandri*, for example, were ideally located for this at key bends in the river between Portus and Rome, and were also served by both the *Via Portuensis* and the *Via Ostiensis*. But since they were rare over the full 35 km distance they could have been supplemented by small signalling towers. The best parallel for this kind of arrangement is perhaps the system of *skopeloi* used primarily to connect the port of Myos Hormos with Coptos over the watershed of the Red Sea Mountains.¹⁵⁰ This inland route was marked out by means of large (3 m²) and small (c. 1.5 m²) signalling towers that were used to send simple messages across the desert between the port and Coptos, possibly by means of shields or flags.¹⁵¹ One assumes that signalling was accomplished using shields reflecting sunlight or the smoke from fires. To date, however, there is no evidence for towers such as these along the Tiber.

¹⁴⁵ Personal communication from B. Woytek who is preparing a detailed study of these for publication. The pieces measure between 16 and 18 mm and weigh c. 2–4 g.

¹⁴⁶ See Stannard 2015. He has catalogued 81 examples of these “tesserae di Ostia”. These tokens measure c. 12–15 mm and weigh c. 0.7–1.39 g.

¹⁴⁷ Brandt 2005, 40–41.

¹⁴⁸ Brandt 2005, 41.

¹⁴⁹ Aguilera 2012.

¹⁵⁰ Peacock – Blue 2006, 7–11; Sidebotham 2012, 140–144.

¹⁵¹ Sidebotham 2012, 140.

7. Discussion

In addressing the first of the questions raised in section 2 of this paper, it is clear that Portus was of fundamental importance to the interests of both Rome and Ostia. It was distinctive in not being centrally administered as a self-contained port complex by a single authority. Rather, it was the responsibility of several imperial officials with broader portfolios based at Rome and with offices at Ostia, most notably the *praefectus annonae*, as well as being run on a day-to-day basis by organized bodies largely based at Ostia. Despite this lack of a single authority it was an arrangement that appeared to work.

In terms of the second question, the evidence points to a closely-controlled management of ships and cargoes upon their arrival at the port.¹⁵² The monitoring of incoming cargoes of grain and other foodstuffs from their place of unloading to their embarkation on to riverboats will have generated voluminous records for the office of the *praefectus annonae* that will have been transferred to the *statio* at Ostia before ending up in his archives in the *portus Tiberinus* at Rome. What is known of the movement of other bulk cargoes, such as decorative stone, indicates a similar imperative to keep track of movement through the port and suggests that the office of the *ratio marmorum* at Rome maintained similarly extensive records.¹⁵³ There will also have been lists of the merchant ships belonging to members of the *corpora naviculariorum* that would have been accessible to officials of the *praefectus annonae* so that shipping contracts could be drawn up, as well as extensive records of the galleys under repair at the imperial *Navalia*.¹⁵⁴ It should not come as a surprise that harbour activities should have generated these kinds of archive since they were symptomatic of how public administration functioned at both Rome¹⁵⁵ and in the provinces.¹⁵⁶

Central to Rome's success in maintaining these archives will have been the degree to which the various bodies concerned with the administration of the port were able to circulate and exchange the information necessary to track the daily movement of ships and boats both ways through the canals and basins. Records generated at Portus would have to have been relayed to the various officials and authorities at Ostia, presumably by means of the *Via Flavia* and possibly also by the *Canale Romano*, but also to Rome and back again, presumably by means of the *Via Ostiensis*: alternatively, information could have been relayed to Rome directly by means of the *Campana/Portuensis*. One also has to think of flows of official information from shippers, merchants and provincial authorities moving in and out of Portus and Ostia by ship. While we are in the dark as to how this traffic may have been organized, one imagines that it may have been at least in part in the hands of *frumentarii*, who were responsible for the relaying of information around the empire in general.¹⁵⁷

The sequence of procedures through which incoming ships and cargoes at Portus passed was thus necessarily complex – even more so when one remembers that there would have been simultaneous controls of a similar kind for departing ships. While it is hard to judge how well the installations at Portus were able to cope with these flows of traffic, our third question, some points

¹⁵² Rickman 1998; Sirks 1998.

¹⁵³ Fant 1993, 153–162; Pensabene 2012, 74–78.

¹⁵⁴ If the military ship lists from 4th century BC Piraeus are a guide: for example IG 2², 1604, 72 dated to 378/377 BC; IG 2², 1611, 3–9 of 357/356 BC; IG 2², 1613, 302; IG 2², 1627, 398–405 of 330–329; IG 2², 1628, 552–559 of 326–325 BC; IG 2², 1629, 1030–1036 of 325/324 BC. See also Blackman 1968 and Gabrielsen 1994 and 2008.

¹⁵⁵ Nicolet 1998, 202–203; Viriouvét 1995, 165–368; Panciera – Viriouvét 1998.

¹⁵⁶ Carrié 1998; Peña 1998.

¹⁵⁷ One inscription from Portus refers to a *centurio fru(mentarius)* (Thylander 1952, B4), and another to a *statio fru(mentariorum)* (Thylander 1952, B324). There is also an inscription (CIL 14, 2045) from Castelporziano, to the south of Ostia that mentions an imperial freedman who had served as *procurator pugillationis et ad naves vagas* – a position that could have been responsible for the delivery of official letters or information (Meiggs 1973, 302; Pavolini 2005, 82; Bruun 2002, 162).

can be made about the volume of traffic. An excellent recent study¹⁵⁸ provides a starting point for this. It has calculated that between 370,000 and 640,000 t grain, olive oil, wine, fish sauce and other organic and inorganic products would have been needed to feed Rome's population of c. 1 million people, and that this would have required between 1,011 and 1,807 ships to transport it all. On the assumption that all the traffic would have passed through Portus, the study then moves on to calculate the capacity of the port. Noting that there were c. 135 mooring rings around the Trajanic basin and, following earlier arguments that two ships could have been attached to each one, the study estimates that the basin could have held at least 235 ships.¹⁵⁹ It also suggests, probably rightly, that much of the Claudian basin would not have been used primarily for mooring, and that 265 ships and boats would have been moored along the *Canale di Imbocco del Porto di Traiano*, the *Darsena*, along the western frontage of the *Grandi Magazzini di Traiano* and the *Foro Olitorio*, and along the *Fossa Traiana*. Overall, therefore, this study estimates the capacity of Portus at any one time as c. 500 seagoing ships and river-boats.

While this might seem to be a reasonable figure, four observations can be made. First, it can be argued that the capacity of the Trajanic basin was considerably less than 235 ships. Since the mooring rings were spaced every 23 m and the maximum width of one of the larger known Roman merchant ships, the 350–390 t *Madrague des Giens*, was 9 m¹⁶⁰ this would have left c. 14 m free space between each moored ship, assuming that they were berthed bow-on. While it is attractive to follow Brandt and accept that each mooring ring could have accommodated two ships, in reality this would only have left c. 5 m between each ship, a figure that would have made it very difficult to manoeuvre the ships in and out of their berths. It is perhaps more realistic to expect that the 14 m space between each ship would have been used by the many lighters and lesser craft of under c. 50–80 t that probably brought some cargoes directly to the quays from ships riding at anchor at the centre of the basin. If so then it can be argued that no less than c. 23 seagoing ships would have been moored bow first along each available side of the basin. The larger grain freighters, possibly reaching up to 1,200 t with a length of c. 53 m and with of c. 14 m, probably docked along the western façade of the *Grandi Magazzini di Traiano* and the *Foro Olitorio*.

A second observation is that it is now by no means certain that all six sides of the Trajanic basin were divided up by mooring rings in the same way. The evidence that we now have suggests that while Sides I, II, III and IV probably had mooring rings every c. 23 m, the number along Side V is likely to have been rather less since it hosted the entrance into the basin, thereby reducing the number from c. 23 to c. 14. Furthermore, the presence of the openings of the *Navalia* (Building 5) along Side VI would have meant that the number here could have been reduced to c. 6.¹⁶¹ Overall, therefore, these observations suggest that the maximum number of large seagoing ships that could be moored around the hexagonal basin at any one time would have been closer to c. 116 rather than the 235 proposed by Brandt. To this figure, however, one should add an unquantifiable number of lighters and smaller boats that would have moved between the quays and ships riding at anchor towards the centre of the basin, and helped move the latter in and out of their berths. This estimate means that when the Trajanic basin was full to capacity, the port authorities would have had to absorb a minimum of c. 45,240 t of incoming foodstuffs in terms of processing, checking, storing and transshipment; furthermore, to this figure needs to be added a similar amount of outgoing material, giving us an overall figure of c. 90,480 t moving through the port at any one time at the height of the sailing season.¹⁶²

¹⁵⁸ Brandt 2005, 28–34.

¹⁵⁹ Brandt 2005, 36–37.

¹⁶⁰ Boetto 2010, tableau 1.

¹⁶¹ And only occupying the quay space immediately in front of the *Palazzo Imperiale*.

¹⁶² While it is sometimes assumed that the cargo of outgoing ships was comprised largely of ballast, it seems very unlikely that merchants would not have taken advantage of the possibilities offered by ships returning to their home

While Brandt rightly attempts to quantify the length of time that it may have taken to unload ships, one can also try and factor in the inevitable delays brought about by administrative procedures. A papyrus dating to the 2nd or 3rd century AD may provide us with an idea just of how long it might have taken to process one of the incoming ships of the Alexandrian grain fleet. One imagines that it would have docked on the northern or western side of the *Grandi Magazzini di Traiano*, although of course it is also possible that it could have been on Side III of the Trajanic basin. Irenaeus, writing to his brother Apollinarius, explains that he had arrived on the 6th of the month Epeiph and that his cargo had been unloaded on the 18th – indicating an initial 12 day delay. He goes on to say that he went up to Rome on the 25th of the month, and that at the time of writing, the 9th of Mesore (the following month), neither he nor anyone else in the grain fleet had received his certificate of discharge, presumably so that they could return to Alexandria.¹⁶³ This reading of the papyrus suggests that it may have taken well over one month to process a single grain ship from arrival to departure.

An additional observation about Brandt's quantification of the volume of traffic moving through Portus is that since it was published, two new canals have been discovered that could have offered additional mooring space for small ships and boats, notably along both sides of the Trajanic transshipment canal, the *Canale Romano*¹⁶⁴ that connected the *Fossa Traiana* and the Tiber, and also along both sides of the Portus to Ostia canal.¹⁶⁵ Lastly, it can also be pointed out that his study does not factor in the additional potential capacity for shipping offered by Ostia, a key issue given the increase in warehouse space there during the Trajanic and Hadrianic periods. While the challenges presented by the mouth of the Tiber to shipping are well known, it is hard to believe that at least some of the c. 2.1 km of quay space along the south side of the Tiber¹⁶⁶ was not used by ships entering the port from the sea.¹⁶⁷ Similarly, while the idea that Centumcellae, which was well connected to Rome by Via Aurelia and provided with ample warehouse space, was simply part of a broader strategy to relieve the “bottleneck” in the Tiber¹⁶⁸ is plausible, it is odd that it should have been built before completion of the Trajanic enlargement of Portus.¹⁶⁹ A more nuanced explanation might be that it was built first to take traffic during the enlargement of Portus, and was then subsequently used to provide anchorage for specific kinds of cargo from the western Mediterranean,¹⁷⁰ and also to provide additional anchorage capacity when there was congestion throughout the system as a whole.

In sum, therefore, recent evidence from Portus cautions us against over-estimating the capacity of the Trajanic basin in supplying Rome, and instead points towards the importance of complementary shipping capacity at Ostia and Centumcellae. This conclusion underlines the point made towards the beginning of the paper that the role of Portus cannot be understood in isolation and that it needs to be considered in the context of the other ports that made up the ‘port-system’ of imperial Rome. This does not in any way diminish the exceptionality of the Trajanic basin at Portus but is instead a recognition that it had a multi-functional role, acting as

ports and buy space for a wide range of goods. The role of Portus as a hub for export and re-distribution is mentioned on pp. 160–164.

¹⁶³ Hunt – Edgar 1932, document 113: “A Letter from Rome” (BGU 1, 27).

¹⁶⁴ c. 2.82 km: Keay 2012b, note 64.

¹⁶⁵ Germoni et al. 2011: c. 2.4 km; indeed the two small early imperial ships recently discovered on the south side of the Isola Sacra (Boetto et al. 2013) almost certainly sank within the waters of this latter canal.

¹⁶⁶ Keay 2012b, 43.

¹⁶⁷ With a similar figure for the northern sides.

¹⁶⁸ Brandt 2005, 43.

¹⁶⁹ Centumcellae was completed between AD 106–110 while the enlargement of Portus was not inaugurated before 112–114, and perhaps not completed until as late as c. AD 117.

¹⁷⁰ See below, p. 169.

a statement of imperial power, as well as a focus of ship repair and the processing of incoming and outgoing ships.

Our fourth and final question, concerning the range of commerce that might have passed through Portus on its way to Rome from ports across the Mediterranean, is equally difficult to answer. The literary and epigraphic sources make it clear that grain imported from North Africa and Egypt in ships of the Alexandrian and the African grain fleets¹⁷¹ on behalf of the *annona* was the key commodity, even though sometimes it is perhaps over-emphasized at the expense of others. Our archaeological evidence, however, is largely restricted to a ceramic and marble deposits from excavations that are skewed in terms of date and size towards the late imperial period, with less material dating to the later 1st or early to mid 2nd century AD.¹⁷² These tell us that amphorae from North Africa were particularly common in contexts of the 3rd to 5th centuries AD in different parts of the port, containing olive oil, fish sauce and wine.¹⁷³ Also present in significant quantities were olive oil amphora imports from southern Spain and wine amphorae from across the east Mediterranean, together with very large quantities of different kinds of fine and coarse pottery that were imported as secondary cargoes on incoming ships.¹⁷⁴ Since the balance of the geographical origins tends to favour the central Mediterranean, particularly Africa and Tripolitania, it is possible that neighbouring ports may have taken up some of the slack for commodities from regions further to the west and the east. Thus Centumcellae could have been the primary point of imports from Gaul and Tarraconensis, while Puteoli may have retained its traditional role as the primary focus for eastern imports to Rome – at least until the 3rd and 4th centuries AD. Marble bound for the City of Rome, predominately from the east Mediterranean, was of course another key bulk commodity¹⁷⁵ to arrive at Portus.

It is well known that there was a sharp increase in the number of warehouses built at Ostia contemporary to, or shortly following the Trajanic expansion of Portus.¹⁷⁶ Since there were limitations in the capacity of Ostia as a maritime port it seems probable that the commodities that were stored in them must have been initially imported to Portus, and then transported to Ostia, presumably by means of the Portus to Ostia canal. While part of this increased warehouse capacity must have been destined to hold commodities for the population at Ostia, some of it could well have been intended as storage “offsite” from Portus destined to hold goods for eventual transport upriver to Rome.

In addition to the role of Portus as a focus of import, it probably acted as a hub for the re-distribution of goods to the broader Mediterranean. Analysis of epigraphic evidence on some of the marble blocks from the *statio marmorum* suggests that marble blocks imported to Portus from the east Mediterranean were being exported to other Mediterranean ports, such as Lepcis Magna in Tripolitania. Also construction materials, wine amphorae and other goods, such as querns, from the Tiber valley were almost certainly exported through Portus to the wider Mediterranean.¹⁷⁷

¹⁷¹ The evidence for this is discussed in Keay 2010.

¹⁷² This is a consequence of the fact that deposits of 1st and 2nd century AD date are deeply beneath later imperial structures.

¹⁷³ Zampini 2011; Di Santo 2011; Di Giuseppe 2011.

¹⁷⁴ Keay 2012a.

¹⁷⁵ Pensabene 2012.

¹⁷⁶ See for example Mar 2002, 148–153.

¹⁷⁷ Keay 2012a.

Bibliography

- Aguilera 2012 A. Aguilera, La sirga en el Tíber en época romana, in: Keay 2012b, 105–123.
- Arnaud 2007 P. Arnaud, Diocletian's Prices Edict: the Prices of Seaborne Transport and the Average Duration of Maritime Travel, *Journal of Roman Archaeology* 20 (2007), 321–336.
- Arnaud 2011 P. Arnaud, Ancient sailing-routes and trade patterns: the impact of human factors, in: D. Robinson – A. Wilson (eds.), *Maritime Archaeology and Ancient Trade in the Mediterranean*, Oxford 2011 (Oxford Centre for Maritime Archaeology Monograph 6), 61–80.
- Arnaud 2015 P. Arnaud, The interplay between practitioners and decision makers for the selection, organization, utilisation and maintenance of ports in the Roman Empire, in: J. Preiser-Kapeller – F. Daim (eds.), *Harbours and Maritime Networks as Complex Adaptive Systems. International Workshop at the Römisch-Germanisches Zentralmuseum in Mainz*, 17.–18. 10. 2013, Mainz 2015, 61–81.
- Arnaud 2016 P. Arnaud, Cities and maritime trade under the Roman empire, in: Ch. Schäfer (ed.), *Connecting the Ancient World. Mediterranean Shipping, Maritime Networks and their Impact*, Rahden/Westf. 2016, 115–172.
- Baldassare et al. 1996 I. Baldassare – I. Bragantini – C. Morselli – F. Taglietti, *Necropoli di Porto: Isola Sacra*, Rome 1996.
- Becatti 1961 G. Becatti, *Scavi di Ostia*, vol. 4: *Mosaici e pavimenti marmorei*, 2 vols., Rome 1961.
- Bellotti et al. 2009 P. Bellotti – M. Mattei – P. Tortora – P. Valeri, Geoarchaeological investigations in the area of the imperial harbours of Rome, *Méditerranée* 112 (2009), 51–58.
- Blackman 1968 D. Blackman, The 'shipsheds', in: J. S. Morrison – R. T. Williams (eds.), *The Greek Oared Ships 900–322 BC*, Cambridge 1968, 181–182.
- Boetto 2010 G. Boetto, Le port vu de la mer : l'apport de l'archéologie navale à l'étude des ports antiques, in: *XVII International Congress of Classical Archaeology, Roma 22–26 Sept. 2008. Meetings between Cultures in the ancient Mediterranean* (Bolletino di Archeologia On Line I 2010 Volume Speciale) <http://www.bollettinodiarcheologiaonline.beniculturali.it/bao_es_b_7.php> [accessed on 23 November 2017].
- Boetto et al. 2010 G. Boetto – E. Bukowiecki – N. Monteix – C. E. Rousse, Portus. Les entrepôts de Trajan, Chronique – Autres activités archéologiques françaises en Italie, *Mélanges de l'École française de Rome* 122 (2010), 303–310.
- Boetto et al. 2013 G. Boetto – A. Ghelli – P. Germoni, Due relitti d'epoca romana rinvenuti a Isola Sacra, Fiumicino (RM): primi dati sullo scavo sulla struttura delle imbarcazioni, *Archeologia Marittima Mediterranea* 9 (2012) [2013], 15–38.
- Brandt 2005 J. R. Brandt, "The Warehouse of the World". A Comment on Rome's Supply Chain during the Empire, *Orizzonti. Rassegna di archeologia* 6 (2005), 25–47.
- Bruun 2002 C. Bruun, L'amministrazione imperiale di Ostia e Portus, in: C. Bruun – A. Gallina Zevi (eds.), *Ostia e Portus nelle loro relazioni con Roma*, Rome 2002 (Acta Instituti Romani Finlandiae 27), 161–192.
- Calza 1925 G. Calza, VII. Ostia. Ricognizioni topografiche nel Porto di Traiano, *Notizie degli Scavi dell'antichità* (1925), 56–81.
- Carrié 1998 J. M. Carrié, Archives municipales et distributions alimentaires, in: *La mémoire perdue. Recherches sur l'administration romaine*, Rome 1998 (Collection de l'École française de Rome 243), 271–302.
- Cébeillac-Gervasoni et al. 2010 M. Cébeillac-Gervasoni – M. L. Caldelli – F. Zevi, *Epigrafia Latina. Ostia: Cento iscrizioni in contesto*, Rome 2010.
- Chic García et al. 2001 G. Chic García – E. García Vargas – A. Romo Salas – M. A. Tabales Rodríguez, Una nueva inscripción annonaria de Sevilla: M. Iulius Hermesianus, diffusor olei ad annonam Urbis, *Habis* 32 (2001), 357–374.

- CILA J. González, *Corpus de inscripciones Latinas de Andalucía*, vol. 2: *Sevilla*, Tomo 1: *La Vega (Hispalis)*, Seville 1991.
- Cod. Theod. C. Pharr, *The Theodosian Code and the Sirmondian Constitutions*, Princeton 1952.
- Cottier et al. 2008 M. Cottier – M. H. Crawford – C. V. Crowther – J.-L. Ferrary – B. Levick – O. Salomies – M. Wörrle, *The Customs Law of Asia*, Oxford 2008.
- Delaine 2005 J. Delaine, The Commercial Landscapes of Ostia, in: A. MacMahon – J. Price (eds.), *Roman Working Lives and Urban Living*, Oxford 2005, 29–47.
- Delille – Goiran 2014 H. Delille – J. P. Goiran, Hydrodynamic Modelling of the Roman Harbour of Portus: the Impact of the North-Eastern Channel on Current Sediment Dynamics, *Geoarchaeology* 29 (2014), 357–370.
- Di Giuseppe 2011 H. Di Giuseppe, I contesti ceramici della basilica portuense. Dati preliminari, in: Keay – Paroli 2011, 191–210.
- Di Salvo 1992 L. Di Salvo, *Economia privata e pubblici servizi nell'impero romano. I corpora naviculariorum*, Messina 1992 (Kleio. Studi Storici a Cura di Salvatore Calderone 5).
- Di Santo 2011 L. Di Santo, Portus tardoantica. Nuovi dati dai contesti ceramici e vitrei dell'antemurale, in: Keay – Paroli 2011, 147–189.
- Fant 1993 J. C. Fant, Ideology, gift, and trade: a distribution model for the Roman imperial marbles, in: W. V. Harris (ed.), *The Inscribed Economy: production and distribution in the Roman Empire in the light of instrumentum domesticum*, Ann Arbor 1993 (Journal of Roman Archaeology Supplement 6), 145–170.
- France 2001 J. France, *Quadragesima Galliarum. L'organisation douanière des provinces alpestres, gauloises et germaniques de l'empire Romain*, Rome 2001.
- France 2008 J. France, Les personnels et la gestion des entrepôts impériaux dans le monde romain, *Revue des Études Anciennes* 110 (2008), 483–507.
- Gabrielsen 1994 V. Gabrielsen, *Financing the Athenian Fleet*, Baltimore 1994.
- Gabrielsen 2008 V. Gabrielsen, Die Kosten der athenischen Flotte in klassischer Zeit, in: F. Burrell – H. Müller (eds.), *Kriegskosten und Kriegsfinanzierung in der Antike*, Mannheim 2008, 46–73.
- Germoni et al. 2011 P. Germoni – M. Millett – K. Strutt – S. Keay, The Isola Sacra: reconstructing the Roman landscape, in: Keay – Paroli 2011, 231–260.
- Goiran et al. 2010 J. P. Goiran – H. Tronchère – F. Salomon – P. Carbonel – H. Djerbi – C. Ognard, Palaeoenvironmental reconstruction of the ancient harbors of Rome: Claudius and Trajan's marine harbors on the Tiber delta, *Quaternary International* 216, issues 1–2 (2010), 3–13.
- Harris 2011 W. V. Harris, Roman Governments and Commerce 300 BC – AD 300, in: W. V. Harris (ed.), *Rome's Imperial Economy*, Oxford 2011, 198–219.
- Helittula 1995 A. Helittula, Observations on the Inscriptions of Isola Sacra and the People of Portus, *Acta Antiqua Hungarica* 36 (1995), 235–244.
- Helittula 2007 A. Helittula, *Le iscrizioni sepolcrali Latine nell'Isola Sacra*, Rome 2007 (Acta Instituti Romani Finlandiae 30).
- Hermansen 1982 G. Hermansen, *Ostia. Aspects of Roman City Life*, Alberta 1982.
- Houston 1980 G. Houston, The Administration of Italian Seaports during the First Three Centuries of the Roman Empire, in: J. H. D'Arms – E. C. Kopff (eds.), *The Seaborne Commerce of Ancient Rome. Studies in Archaeology and History*, Rome 1980 (Memoirs of the American Academy at Rome 36), 157–171.
- Hunt – Edgar 1932 A. S. Hunt – C. C. Edgar, *Select Papyri*, vol. 1: *Private Affairs*, London – New York 1932.
- Keay 2010 S. Keay, Portus and the Alexandrian grain trade revisited, in: *XVII International Congress of Classical Archaeology, Roma 22–26 Sept. 2008. Meetings between Cultures in the ancient Mediterranean* (Bollettino di Archeologia On Line I 2010 Volume Speciale) <http://www.bollettinodiarcheologiaonline.beniculturali.it/bao_es_b_7.php> [accessed on 23 November 2017].

- Keay 2012a S. Keay, The Port System of Imperial Rome, in: Keay 2012b, 33–67.
- Keay 2012b S. Keay (ed.) *Rome, Portus and the Mediterranean*, London 2012 (Archaeological Monographs of the British School at Rome 21).
- Keay – Paroli 2011 S. Keay – L. Paroli (eds.), *Portus and its Hinterland: Recent Archaeological Research*, London 2011 (Archaeological Monographs of the British School at Rome 18).
- Keay – Woytek forthcoming S. Keay – B. Woytek, *Between archaeology and numismatics: the PORTVM TRAIANI sestertii*, forthcoming.
- Keay et al. 2005 S. Keay – M. Millett – L. Paroli – K. Strutt, *Portus. An Archaeological Survey of the Port of Imperial Rome*, London 2005 (Archaeological Monographs of the British School at Rome 15).
- Keay et al. 2011 S. Keay – G. Earl – F. Felici, Excavations and survey at the Palazzo Imperiale 2007–2009, in: Keay – Paroli 2011, 67–91.
- Keay et al. 2012 S. Keay – G. Earl – F. Felici – P. Copeland – R. Cascino – S. Kay – C. Triantafyllou, Interim Report on an Enigmatic New Trajanic Building, *Journal of Roman Archaeology* 25 (2012), 487–512.
- Keay et al. forthcoming S. Keay – G. Earl – F. Felici – P. Copeland, *Uncovering the Harbour Buildings. Excavations at Portus 2007–2012*, vol. 1: *The Surveys, Excavations and Architectural Reconstructions of the “Imperial Palace”, Sheds and Adjacent Buildings*, Cambridge, forthcoming.
- Konen 2001 H. Konen, Die Schiffsbauer und Werften in den antiken Häfen von Ostia und Portus, *Münstersche Beiträge zur antiken Handelsgeschichte* 20, issue 1 (2001), 1–36.
- Lanciani 1868 R. Lanciani, *Ricerche topografiche sulla città di Porto*, Rome 1868.
- de Laet 1949 S. de Laet, *Portorium. Étude sur l’organisation douanière chez les Romains surtout à l’époque du Haut Empire*, Bruges 1949.
- Le Gall 2005 J. Le Gall, *Il Tevere fiume di Roma nell’antichità*, Rome 2005.
- Leonardi 2013 A. Leonardi, *La cura riparum et alvei Tiberis. Storiografia, prosopografia e fonti epigrafiche*, Oxford 2013 (British Archaeological Reports, International Series 2464).
- Livrero 2014 R. Livrero, *Mercanti, prezzi e legislazione. Il commercio internazionale dei Romani. Arte e mestieri nel mondo Romano antico*, Rome 2014.
- Lo Cascio 2002 E. Lo Cascio, Ancora sugli “Ostia’s Services to Rome”, *Mélanges de l’École française de Rome. Antiquité* 114 (2002), 87–110.
- Lugli – Filibeck 1935 G. Lugli – G. Filibeck, *Il porto di Roma imperiale e l’Agro Portuense*, Bergamo 1935.
- Maischberger 1997 M. Maischberger, *Marmor in Rom. Anlieferung, Lager- und Werkplätze in der Kaiserzeit*, Wiesbaden 1997 (Palilia 1).
- Maiuro 2012 M. Maiuro, *Res Caesaris. Ricerche sulla proprietà imperiale nel principato*, Bari 2012.
- Mar 2002 R. Mar, Ostia, una ciudad modelada por el comercio, *Mélanges de l’École française de Rome. Antiquité* 114 (2002), 111–180.
- Martelli 2013 E. Martelli, *Sulle spalle dei saccarii. Le rappresentazioni di facchini e il trasporto di derrate nel porto di Ostia in epoca imperiale*, Oxford 2013 (British Archaeological Reports, International Series 2467).
- Maiorano – Paroli 2014 M. Maiorano – L. Paroli, *La Basilica Portuense. Scavi 1991–2007*, 2 vols., Florence 2014 (Biblioteca di Archeologia Medievale 22).
- Meiggs 1973 R. Meiggs, *Roman Ostia*, Oxford 1973.
- Nicolet 1998 C. Nicolet, Introduction, in: *La mémoire perdue. Recherches sur l’administration romaine*, Rome 1998 (Collection de l’École française de Rome 243), 201–204.
- Pagliaro et al. 2015 F. Pagliaro – E. Bukowiecki – F. Gugliermetti – F. Bisegna, The architecture of warehouses: A multidisciplinary study on thermal performances of Portus’ Roman store buildings, *Journal of Cultural Heritage* 16 (2015), 560–566.

- Panciera – Viriouviet 1998 S. Panciera – C. Viriouviet, Les archives de l'administration du blé public a Rome à travers le témoignage des inscriptions, in: *La mémoire perdue. Recherches sur l'administration romaine*, Rome 1998 (Collection de l'École française de Rome 243), 247–302.
- Pavis d'Escurac 1976 H. Pavis d'Escurac, *Le prefecture de l'annone, service administrative impérial d'Auguste à Constantin*, Rome 1976 (Bibliothèques françaises d'Athènes et de Rome 226).
- Pavolini 2005 C. Pavolini, *La vita quotidiana a Ostia*, Rome 2005.
- Peacock – Blue 2006 D. Peacock – L. Blue, *Myos Hormos – Quseir al-Qadim. Roman and Islamic Ports on the Red Sea. Survey and Excavations 1999–2003*, Oxford 2006.
- Peña 1998 J. Peña, The mobilization of state olive oil in Roman Africa: the evidence of late 4th-century ostraca from Carthage, in: J. J. Peña – J. J. Rossiter – A. I. Wilson – C. Wells – M. Carroll – J. Freed – D. Goden (eds.), *Carthage Papers. The Early Colony's Economy, Water Supply, a Public Bath, and the Mobilization of State Olive Oil*, Portsmouth, RI 1998 (Journal of Roman Archaeology, Supplementary Series 28), 117–238.
- Pensabene 2007 P. Pensabene, *Ostiensium marmorum decus et decor. Studi architettionici, decorativi e archeometrici*, Rome 2007 (Studi Miscellanei 33).
- Pensabene 2012 P. Pensabene, Il ruolo di Porto nella distribuzione dei marmi nel Mediterraneo, in: Keay 2012b, 69–86.
- Pensabene 2013 P. Pensabene, *I marmi nella Roma antica*, Rome 2013.
- Puk 2010 A. Puk, The procuratorship of the Alexandrian Pharos, *Zeitschrift für Papyrologie und Epigraphik* 175 (2010), 227–230.
- Remesal Rodríguez 1991 J. Remesal Rodríguez, Sextus Iulius Possessor en la Betica, in: *Homenaje al Dr. M. Ponsich*, Madrid 1991 (Anejos a Gerión 3), 281–295.
- Remesal Rodríguez 1998 J. Remesal Rodríguez, Baetican Olive Oil and the Roman Economy, in: S. Keay (ed.), *The Archaeology of Early Roman Baetica*, Portsmouth, RI 1998 (Journal of Roman Archaeology, Supplement 29), 183–199.
- Rickman 1971 G. Rickman, *Roman Granaries and Store Buildings*, Cambridge 1971.
- Rickman 1991 G. Rickman, Problems of transport and development of ports, in: A. Giovannini (ed.), *Nourrir la plèbe. Actes du colloque tenu a Genève les 28 et 29. IX. 1989 en Hommage à Denis Van Berchem*, Basle – Kassel 1991 (Schweizerische Beiträge zur Altertumswissenschaft 22), 103–118.
- Rickman 1998 G. Rickman, Problems of Transport and Storage of Goods for Distribution: “Les traces oubliées”, in: *La mémoire perdue. Recherches sur l'administration romaine*, Rome 1998 (Collection de l'École française de Rome 243), 317–324.
- Roberts – Donaldson n. d. A. Roberts – J. Donaldson, *Hippolytus of Rome. Early Christian Writings. The Refutation of All Heresies* <<http://www.earlychristianwritings.com/text/hippolytus6.html>> [accessed on 23 November 2017].
- Rohde 2012 D. Rohde, *Zwischen Individuum und Stadtgemeinde. Die Integration von Collegia in Hafenstädten*, Mainz 2012 (Studien zur Alten Geschichte 15).
- Rougé 1996 J. Rougé, *Recherches sur l'organisation du commerce maritime en Méditerranée sous l'Empire Romain*, Paris 1996.
- Sablayrolles 1996 R. Sablayrolles, *Libertinus miles. Les cohorts des vigils*, Rome 1996 (Collection de l'École française de Rome 224).
- Salomon et al. 2014 F. Salomon – J. P. Goiran – J. P. Bravard – P. Arnaud – H. Djerbi – S. Kay – S. Keay, A harbour-canal at Portus: a geo-archaeological approach to the Canale Romano: Tiber delta, Italy, *Water History* 6 (2014), 31–49.
- Scheidel 2013 W. Scheidel, Explaining the maritime freight charges in Diocletian's Prices Edict, *Journal of Roman Archaeology* 26 (2013), 464–468.
- Scheidel 2014 W. Scheidel, The shape of the Roman world: modelling imperial connectivity, *Journal of Roman Archaeology* 27 (2014), 7–32.

- Sidebotham 2012 S. Sidebotham, *Berenike and the Ancient Maritime Spice Route*, London – Berkeley 2012.
- Sirks 1991 B. Sirks, *Food for Rome. The Legal Structure of the Transportation and Processing of Supplies for the Imperial Distributions in Rome and Constantinople*, Amsterdam 1991.
- Sirks 1998 B. Sirks, Archives used with or by *corpora*, working for the *annona* of Rome and Constantinople, in: *La mémoire perdue. Recherches sur l'administration romaine*, Rome 1998 (Collection de l'École française de Rome 243), 325–343.
- Stannard 2015 C. Stannard, Shipping Tesserae from Ostia and Minturnae?, *Numismatic Chronicle* 175 (2015), 147–154.
- Terpstra 2013 T. Terpstra, *Trading Communities in the Roman World. A Micro-economic and Institutional Perspective*, Leiden 2013 (Columbia Studies in the Classical Tradition 37).
- Thylander 1952 H. Thylander, *Inscriptions du port d'Ostie*, 2 vols., Lund 1952.
- Tran 2006 N. Tran, *Les membres des associations romaines. Le rang social des collegiati en Italie et en Gaule sous le Haut-Empire*, Rome 2006 (Collection de l'École française de Rome 367).
- Tran 2008 N. Tran, Les colleges d'horrearii et de mensores, à Rome et à Ostie, sous le Haut-Empire, *Mélanges de l'École française de Rome* 120 (2008), 295–306.
- Varone 2015 A. Varone, L'anforetta del grano, in: C. P. Presicce – O. Rossini (eds.), *Nutrire l'Impero. Storie di alimentazione da Roma e Pompei*, Rome 2015, 20–21.
- Veloccia Rinaldi – Testini 1975 M. Veloccia Rinaldi – P. Testini (eds.), *Ricerche archeologiche nell'Isola Sacra*, Rome 1975.
- Virlouvet 1995 C. Virlouvet, *Tessera Frumentaria. Les procédures de la distribution du blé public à Rome*, Rome 1995 (Bibliothèque des Écoles françaises d'Athènes et de Rome 266).
- Virlouvet 2015 C. Virlouvet, Les métiers du port : les saccarii, dockers du monde romain antique, *Journal of Roman Archaeology* 28 (2015), 673–683.
- Visconti 1885 C. Visconti, *I monumenti del Museo Torlonia riprodotti con la fototipia*, Rome 1885.
- Woytek 2010 B. Woytek, *Die Reichsprägung des Kaisers Traianus (98–117)*, 2 vols., Vienna 2010 (Moneta Imperii Romani 14 = Österreichische Akademie der Wissenschaften, phil.-hist. Klasse, Denkschriften 387).
- Zampini 2011 S. Zampini, La ceramica dello scavo del Palazzo Imperiale di *Portus* di 2008, in: Keay – Paroli 2011, 93–99.
- Zevi 2008 F. Zevi, I collegia di Ostia e le loro sedi associative tra Antonini e Severi, in: C. Berrendonner – M. Cebeillac-Gervasoni – L. Lamoine (eds.), *Le quotidien municipal dans l'occident romain*, Paris 2008 (Collection Histoires croisées), 477–505.

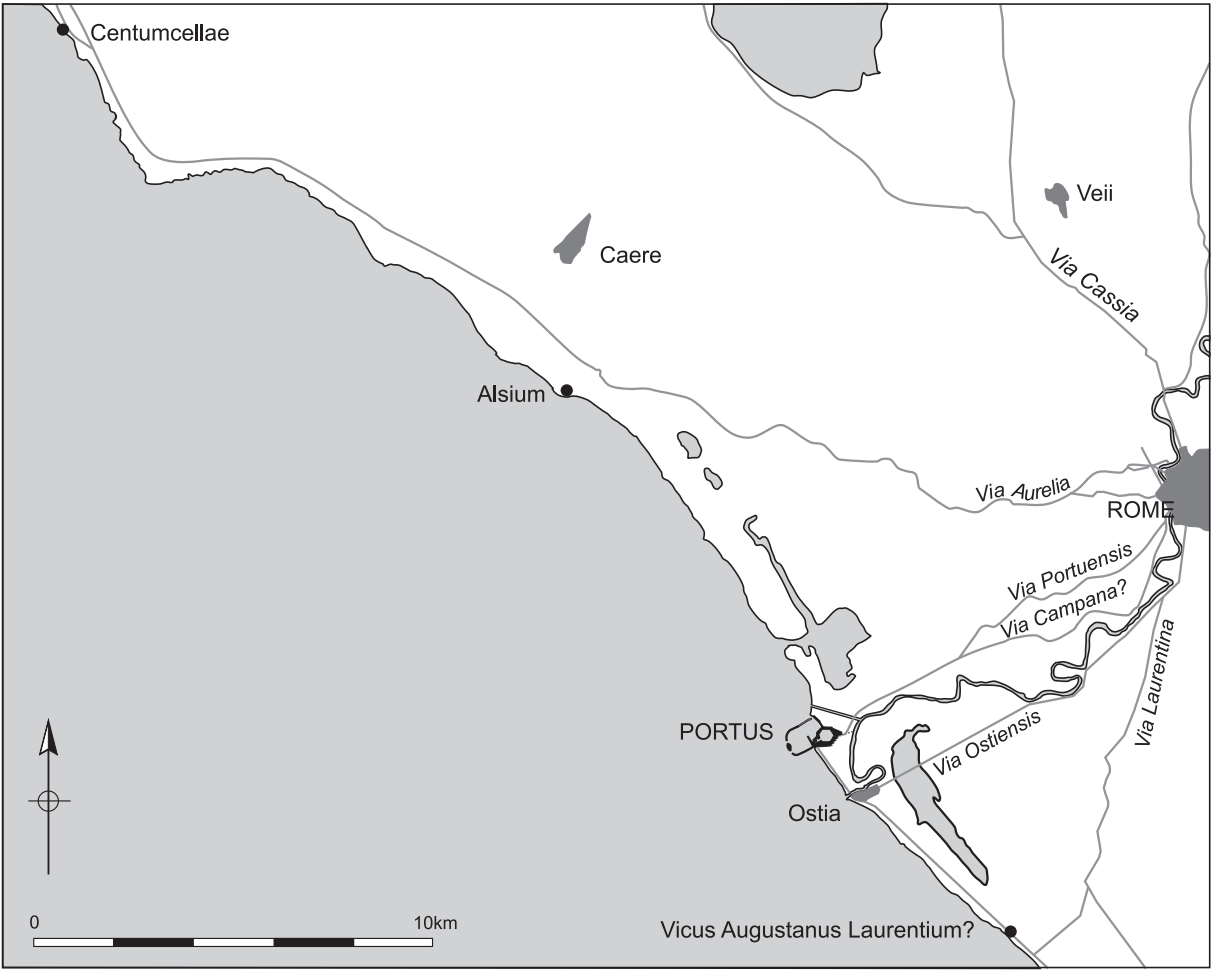


Fig. 1: Location map showing the position of Rome, Portus, Ostia and Centumcellae in respect to the Tiber mouth (Portus Project)

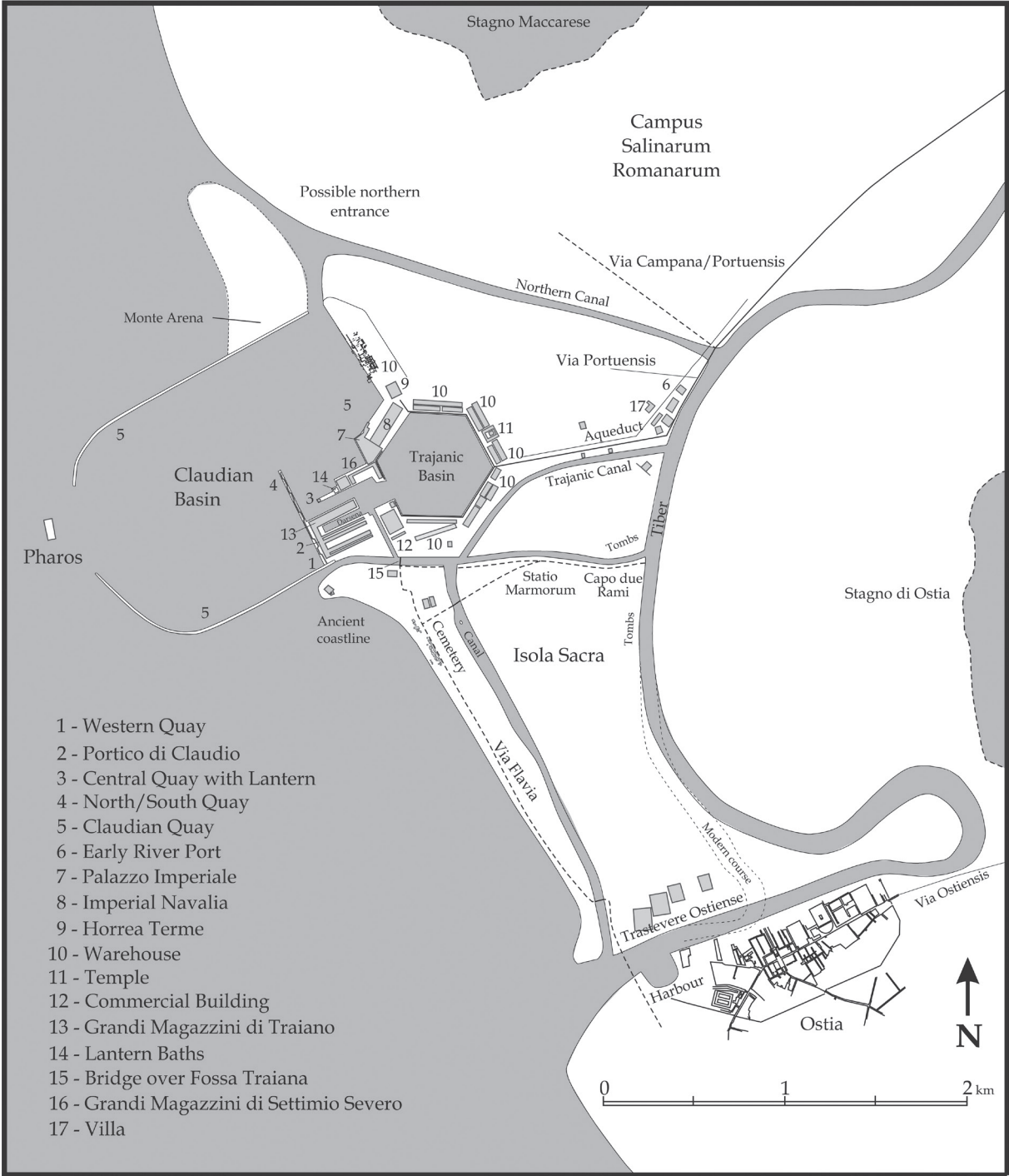


Fig. 2: Overall plan of Ostia and Portus in the late 2nd century AD with location of principal buildings (M. Carmen Escobar – Portus Project)



Fig. 3: Plan of the central area of Portus based upon the results of 1998–2005 geophysical survey (Keay et al. 2005, pull out)



Fig. 4: Aerial photo of the area of the Claudian basin, with the *Aeroporto Internazionale di Fiumicino* in the background (S. Keay – Portus Project)



Fig. 5: Aerial photo of the Trajanic basin (G. Verhoeven – Portus Project)



Fig. 6: Photo of the mooring rings in the Trajanic basin (Lugli – Filibeck 1935, fig. 39)

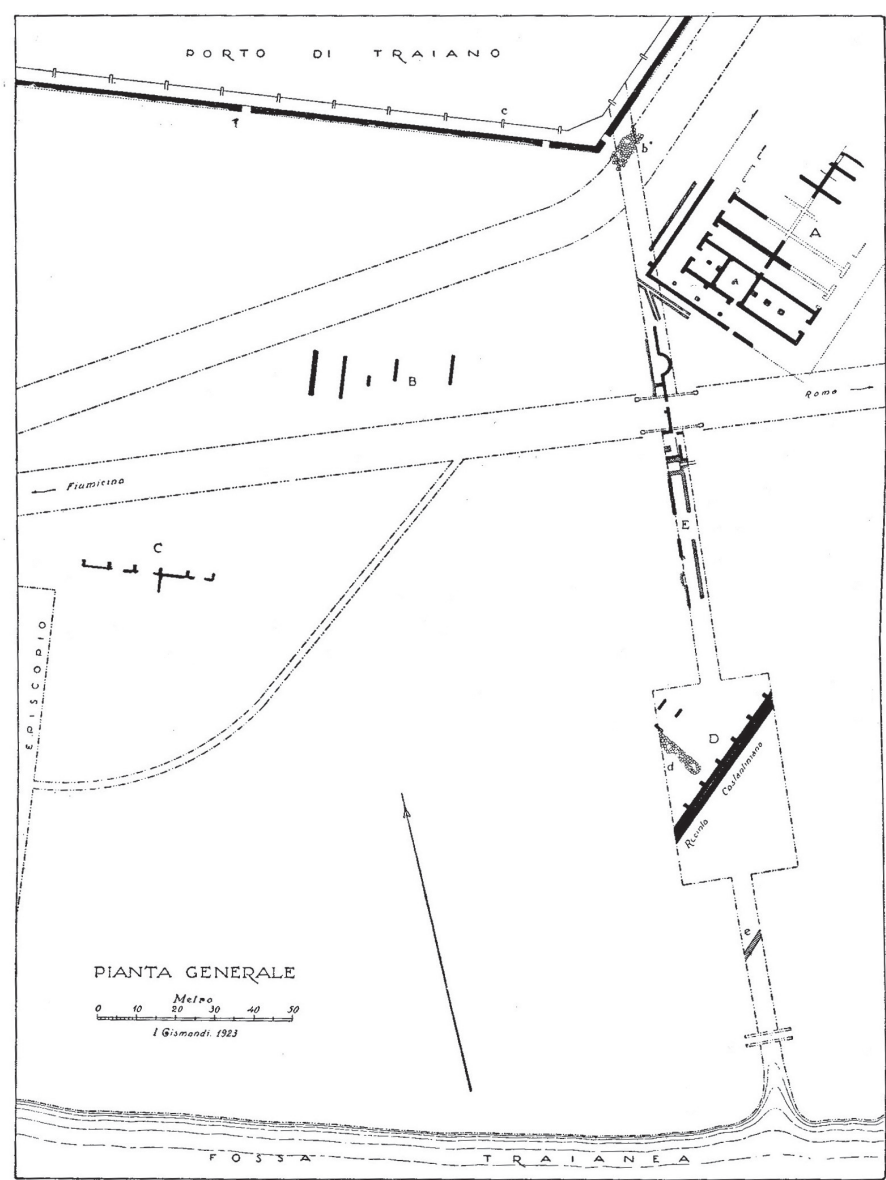


Fig. 7: Plan showing the position of the mooring rings and the periodic entrances (Calza 1925, fig. 2)



Fig. 8: One of the columns with inscribed Latin numerals in the gardens of the Villa Torlonia (S. Keay)



Fig. 9: Aerial photo showing the position of the *Navalia* (left), *Palazzo Imperiale* (centre and foreground), and *Grandi Magazzini di Settimio Severo* (background right) between the Claudian and Trajanic basins (S. Keay – Portus Project)

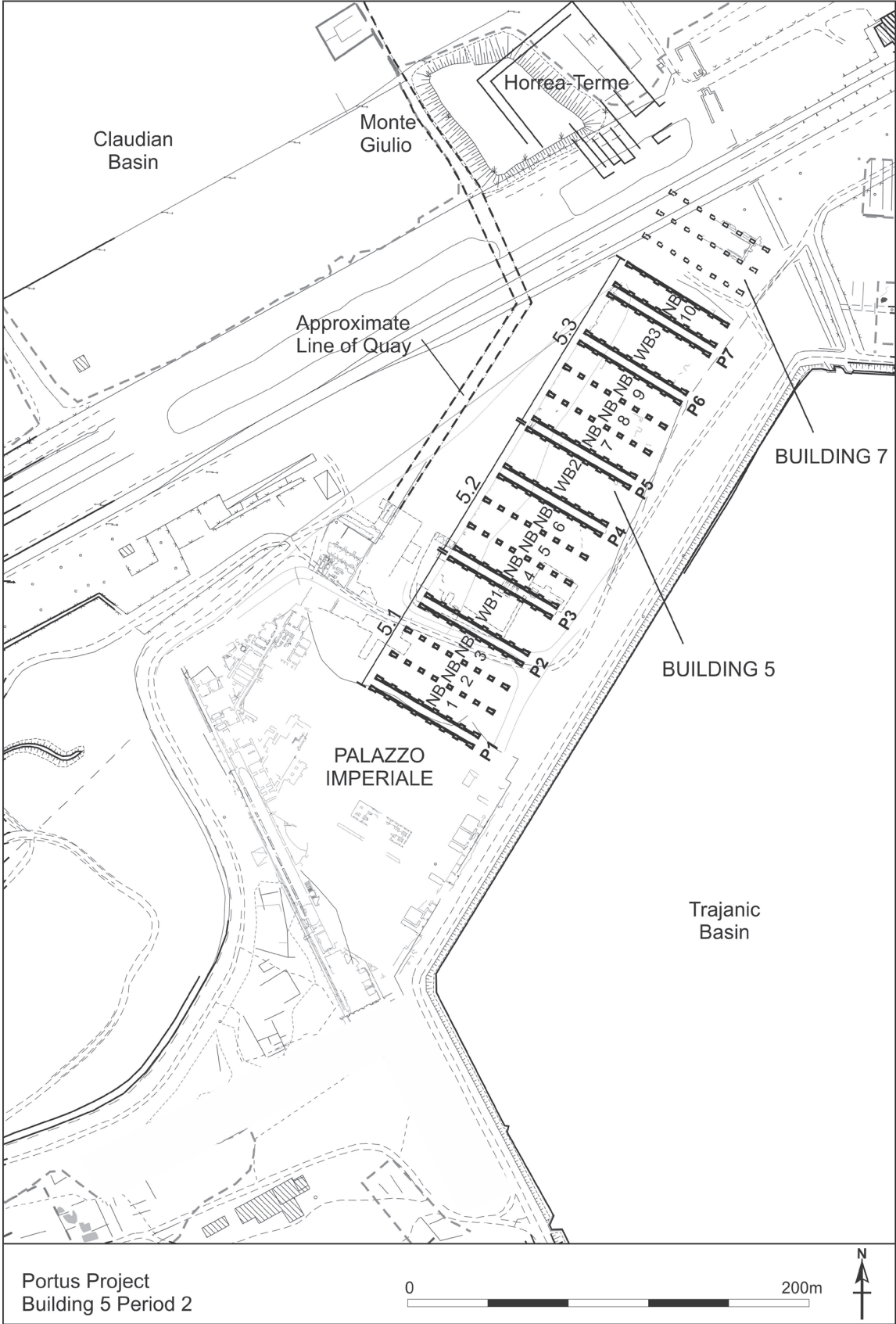


Fig. 10: Plan showing the site of the *Palazzo Imperiale* and the layout of the *Navalia* in the Trajanic period; the site of the later 2nd c AD *Grandi Magazzini di Settimio Severo* lies in the bottom left hand corner (Portus Project)



Fig. 11: Reconstruction of the *Palazzo Imperiale* and the *Navalia* looking south-westwards in the early to mid 2nd century AD (Portus Project and Artas Media)



Fig. 12: Aerial photo of the *Grandi Magazzini di Settimio Severo* (S. Keay – Portus Project)



Fig. 13: Aerial photo looking westwards from the Trajanic basin over the rectangular basin of the *Darsena* (left of picture) and the surrounding *Grandi Magazzini di Traiano* (left of picture), the *Canale di Imbocco al Porto di Traiano* (centre of picture) and the *Grandi Magazzini di Settimio Severo* (right of picture); the *Terme della Lanterna* lie a short distance away from the modern red building at the centre of the image (S. Keay – Portus Project)

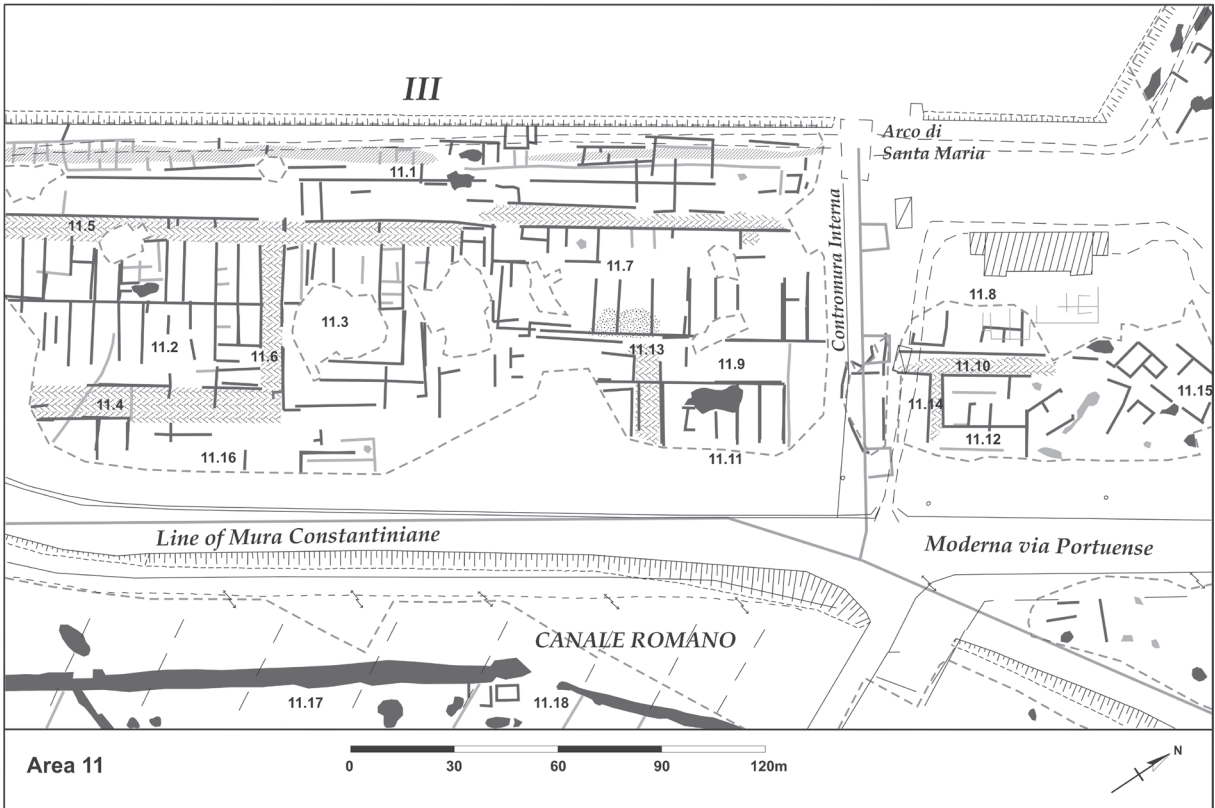


Fig. 14: Interpretation of the 1998–2005 geophysical survey of the warehouses on Side III of the Trajanic basin (Keay et al. 2005, fig. 5.32)

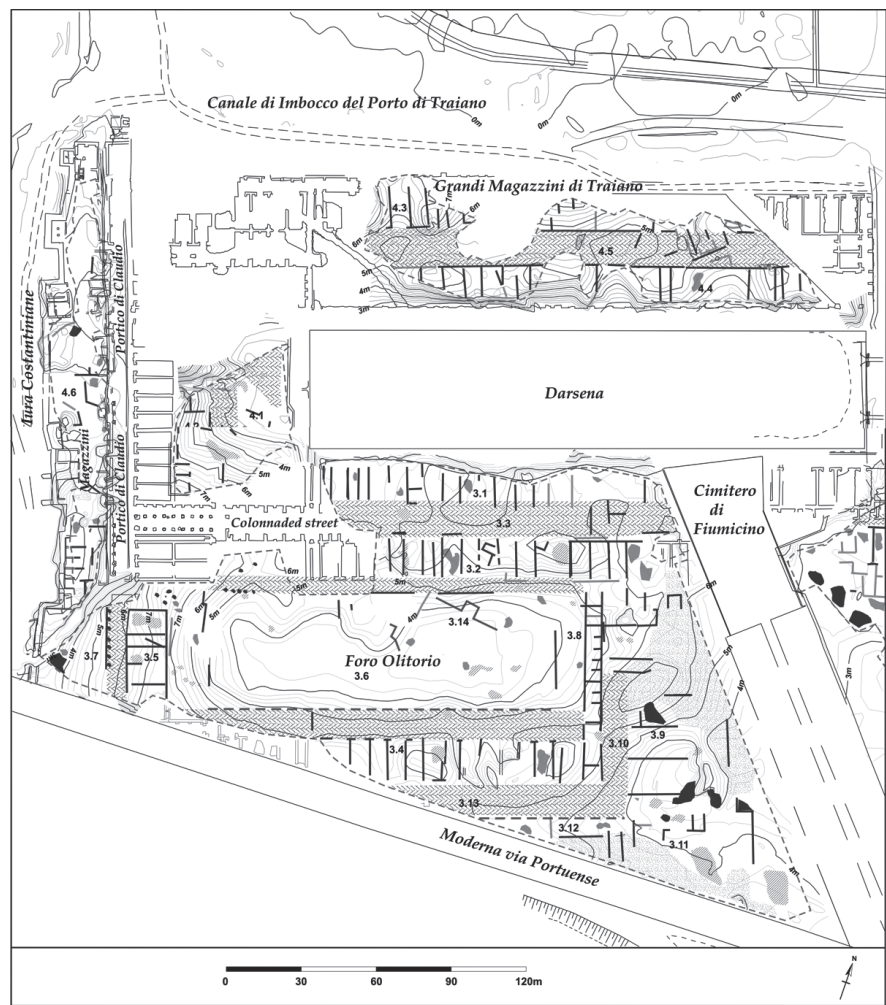


Fig. 15: Interpretation of the 1998–2005 geophysical survey of the *Grandi Magazzini di Traiano* and the *Foro Olitorio* (after Keay et al. 2005, figs. 5.10 and 5.14)



Fig. 16: Photo along the *Portico di Claudio*, with the colonnade opening onto the basin to the left and back of the *Grandi Magazzini di Traiano* to the right (S. Keay – Portus Project)

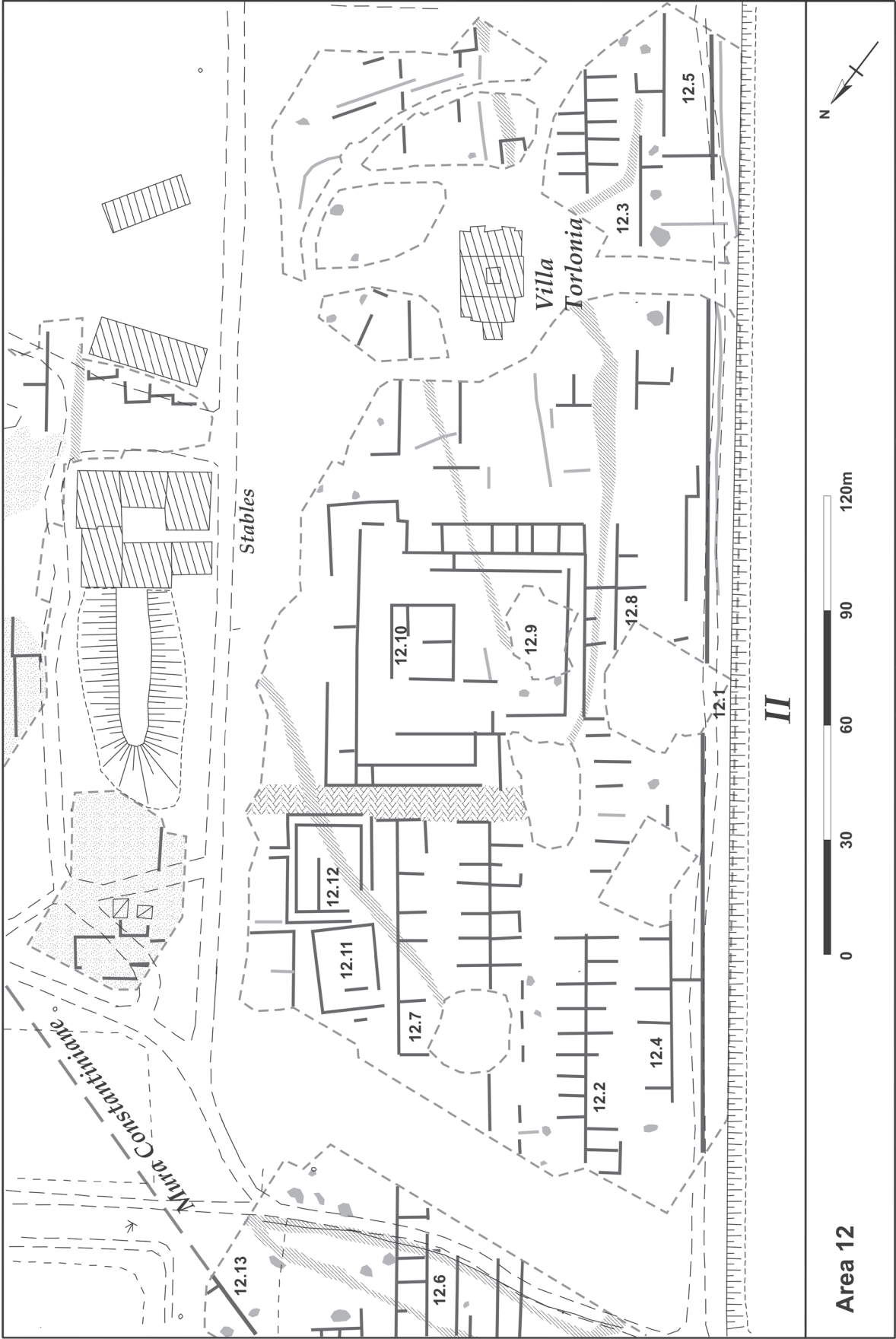


Fig. 17: Interpretation of the 1998–2005 geophysical survey of the temple and adjacent warehouses on Side II of the Trajanic basin (Keay et al. 2005, fig. 5.34)



Fig. 18: Aerial photo looking northwards across the *statio marmorum* and the northern sector of the Isola Sacra, and into the residential and commercial area of Portus to the north of the *Fossa Traiana* (S. Keay – Portus Project)

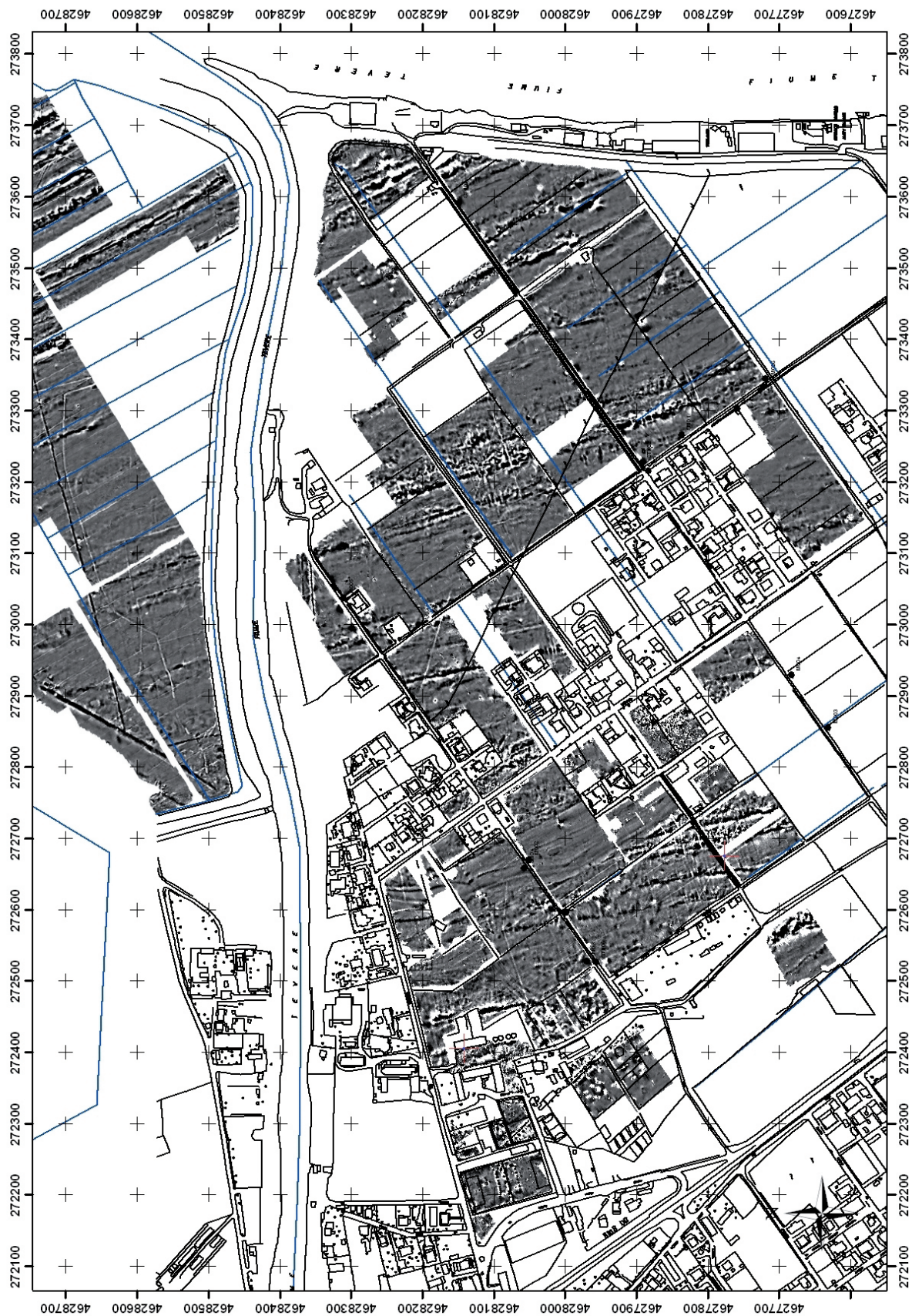


Fig. 19: Geophysical survey results of the Isola Sacra showing the Portus to Ostia canal (Germoni et al. 2011, fig. 12.4)



Fig. 20: Aerial photo showing the *Canale Romano*, aqueduct, road and river port (Keay et al. 2005)



Fig. 21: Inscription from Portus mentioning Lucius Crepereius Madalianus and his extraordinary commission with responsibility *molium phari at(que) purgaturae* (Thylander 1952, B 336 and pl. CXXXII.2)

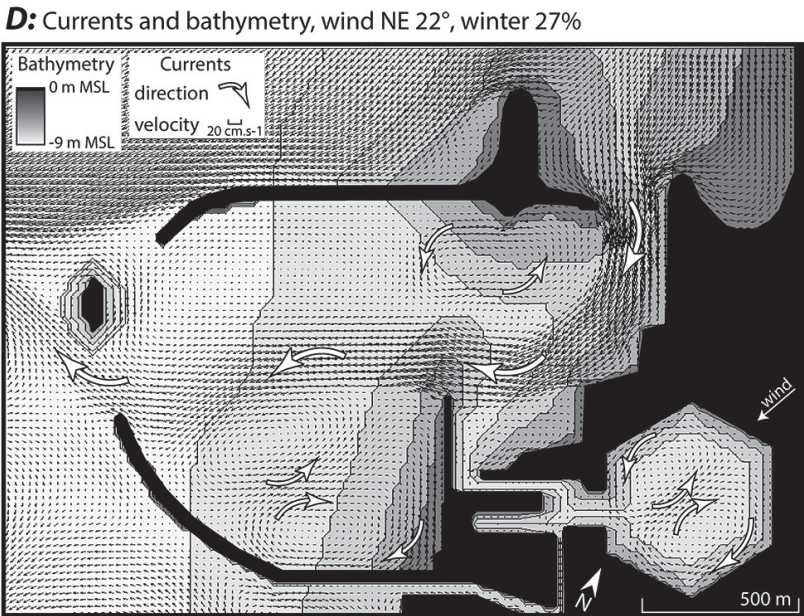


Fig. 22: Representation of the water dynamics within the Claudian and Trajanic basin (Delille et al. 2014, fig. 6)



Fig. 23: The Torlonia relief which was found at Portus and represents a composite allegory of scenes related to various activities at the port (S. Keay)



Fig. 24: Detail from the bottom right hand corner of the Torlonia relief showing ships tying up at the mooring rings, presumably in the Trajanic basin (S. Keay)



Fig. 25: Painting of the Isis Giminiana from the Via Laurentina cemetery (Virilouvet 1995, fig. 20)



Fig. 26: Mosaic floor from the *horrea* of the *mensores frumentarii* at Ostia (S. Keay)



Fig. 27: Relief from Portus showing *saccarii* carrying amphorae off a ship (Lugli – Filibeck 1935, fig. 82)



Fig. 28: Tessera with a ship (obv.) and the letter V (rev.), possibly struck in Rome; American Numismatic Society accession no. 1964.111.6 (Photo ANS). Reproduced at 200%.

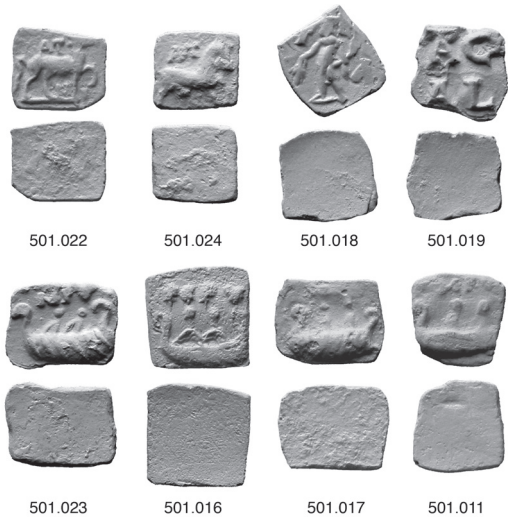


Fig. 29: Tokens possibly from the region of Ostia or Portus (Photo C. Stannard)

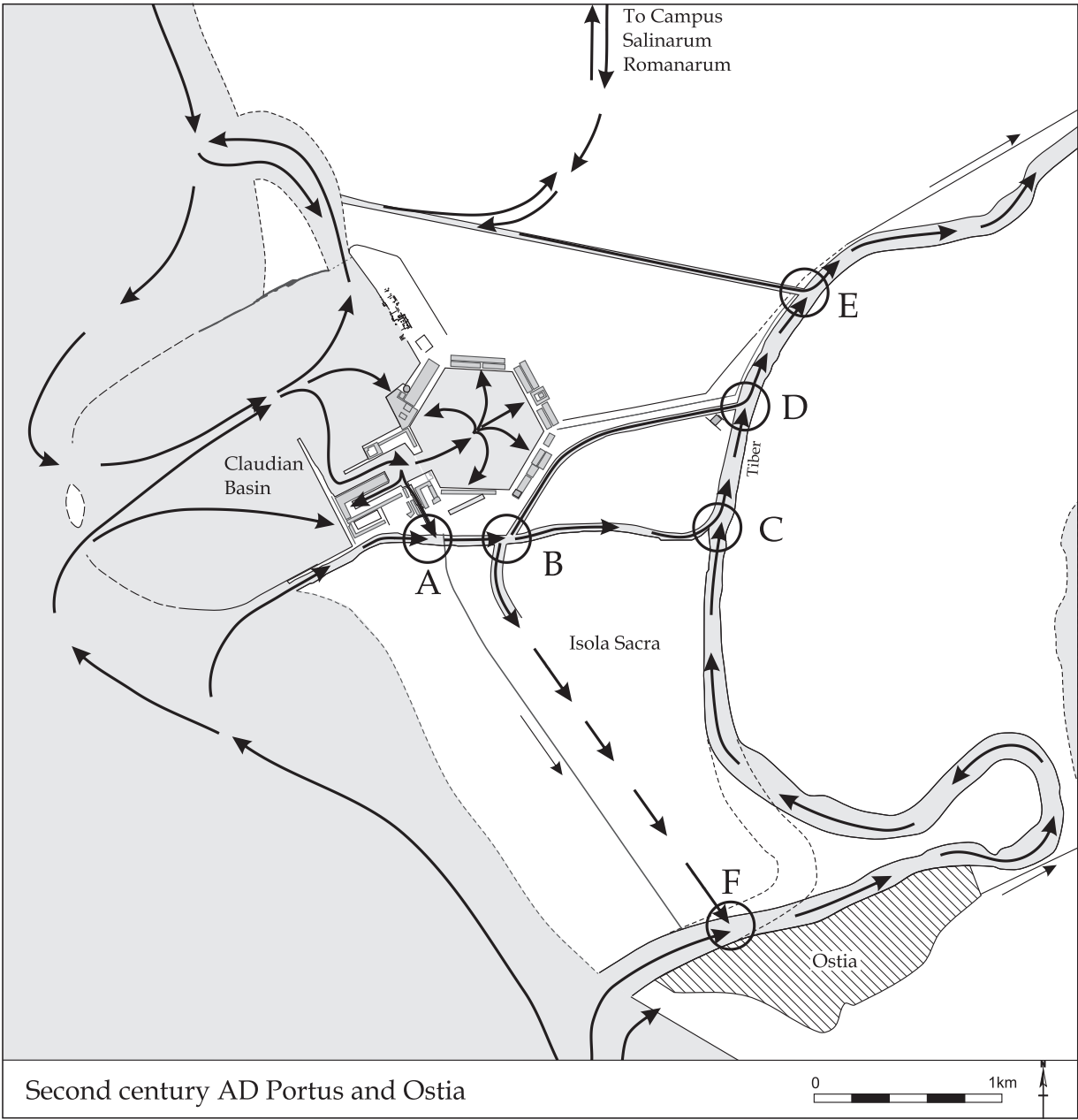


Fig. 30: Interpretative plan of movement within Portus and between Portus, Ostia and the Tiber. For ease of reference this is based upon movement inwards towards Rome; it needs to be remembered that traffic also flowed the other way. The circles denoted by capital letters represent bottlenecks in the movement of boats around the system: A (intersection of the *Fossa Traiana* and *Canale Traverso*), B (intersection of the *Fossa Traiana*, *Trajanic Canale Romano*, and *Portus to Ostia canal*), C (intersection of the *Fossa Traiana* and the Tiber at *Capo Due Rami*), D (intersection of *Trajanic Canale Romano* and the Tiber), E (intersection of the *Claudian canal* and Tiber) and F (the junction of the mouth of the Portus to Ostia Canal and the Tiber) (Keay 2012, fig. 2.9).