

ROME, PORTUS AND THE MEDITERRANEAN

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Edited by
SIMON KEAY

21
ARCHAEOLOGICAL MONOGRAPHS OF
THE BRITISH SCHOOL AT ROME

The British School at Rome, London
2012

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10 Carlton House Terrace, London, SW1Y 5AH

www.bsr.ac.uk

Registered Charity No. 314176

ISBN 978-0-904152-65-4

Cover illustration

Detail from the *Tabula Peutingeriana* showing Rome, Portus and the central Mediterranean. Image provided by Richard Talbert and Jeffrey A. Becker. (Reproduced courtesy of the Österreichische Nationalbibliothek.)

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Typeset by ACADEMIC + TECHNICAL TYPESETTING, BRISTOL, GREAT BRITAIN
Printed by BERFORTS INFORMATION PRESS, EYNHAM, OXFORD, GREAT BRITAIN

THE PORT SYSTEM OF IMPERIAL ROME

Simon Keay

INTRODUCTION

Portus, the maritime port of Imperial Rome, was located some 30 km to the southwest of Rome, and just under 3 km to the north of Ostia at the mouth of the Tiber. It was an artificial port that was begun under Claudius, was substantially enlarged under Trajan, and underwent continued further development in the late antique period. There is little doubt that the prime purpose of Portus was to help satiate the huge demand of the city of Rome for foodstuffs and material (Tchernia and Viviers 2000: 779–89). While Ostia was clearly an important nexus of traders, shippers and representatives of the state involved in supplying Rome with food, Portus was the maritime hub of Rome that actually enabled cargoes to be unloaded and stored before reaching the City.¹ The view underlying this paper is that the full implications of the establishment of Portus for our understanding of the mechanisms of how Rome was supplied have yet to be appreciated fully.

One of the major achievements of ancient Rome was that, despite its distance from the sea, it succeeded in overcoming considerable natural constraints² and developed a port infrastructure that enabled its population to be supplied from across the Mediterranean. It was a piecemeal process extending between the fourth century BC and the earlier second century AD, aspects of which have been the subject of several recent important studies.³ Notwithstanding these, this paper argues that previous scholarship perhaps has downplayed the significance of Portus, and that it needs to be understood in terms of tightly-knit relationships between Ostia, Centumcellae and Rome itself; the success of these hinged upon the free flow of goods within networks of communication articulated by roads, canals and the Tiber itself.

This is an approach that builds upon recent studies of a number of ancient ports. These have begun to look at harbours and port cities in a wider context than traditionally has been the case, where the focus of research has been upon individual buildings, wharves and jetties, for example. It is becoming increasingly clear that ports cannot be viewed in isolation, or simply in relation to the sea. They occupy liminal positions between land and sea that can be appreciated only by looking at their relationships to surrounding hinterlands and to other ports. The port of Alexandria, for example, cannot be understood without taking into account the function of the Mareotis and canal links to the Nile; similarly, Seleucia Pieria (Uggeri 2006) can be understood only by taking into account Antioch and its surrounding territory.

This paper builds upon these advances and emphasizes the relevance of the concept of ‘connectivity’, the ways in which micro-regions within the Mediterranean coalesce into a larger whole (Horden and Purcell 2000: 123–72).⁴ This concept has particular relevance to the relationship of Portus to other ports across the Mediterranean as a whole, an issue that is the focus of Chapter 1 and many of the contributions to this volume.⁵ This paper, however, explores its relevance at the local level, in terms of what might be called a ‘micro-connectivity’ between adjacent locales. It examines relationships between the different ports of Rome by reviewing the physical characteristics of second-century AD Ostia, Portus and the river port of Rome. It emphasizes the relevance of geographical context, the complementarity of functions, the ways in which links between ports were articulated and how cargoes moved between them. The paper concludes by briefly reviewing the relationship between Portus and other ports along the Tyrrhenian coast of Italy, particularly Centumcellae, which is argued to be a further element of the port system of Imperial Rome (Fig. 2.1).

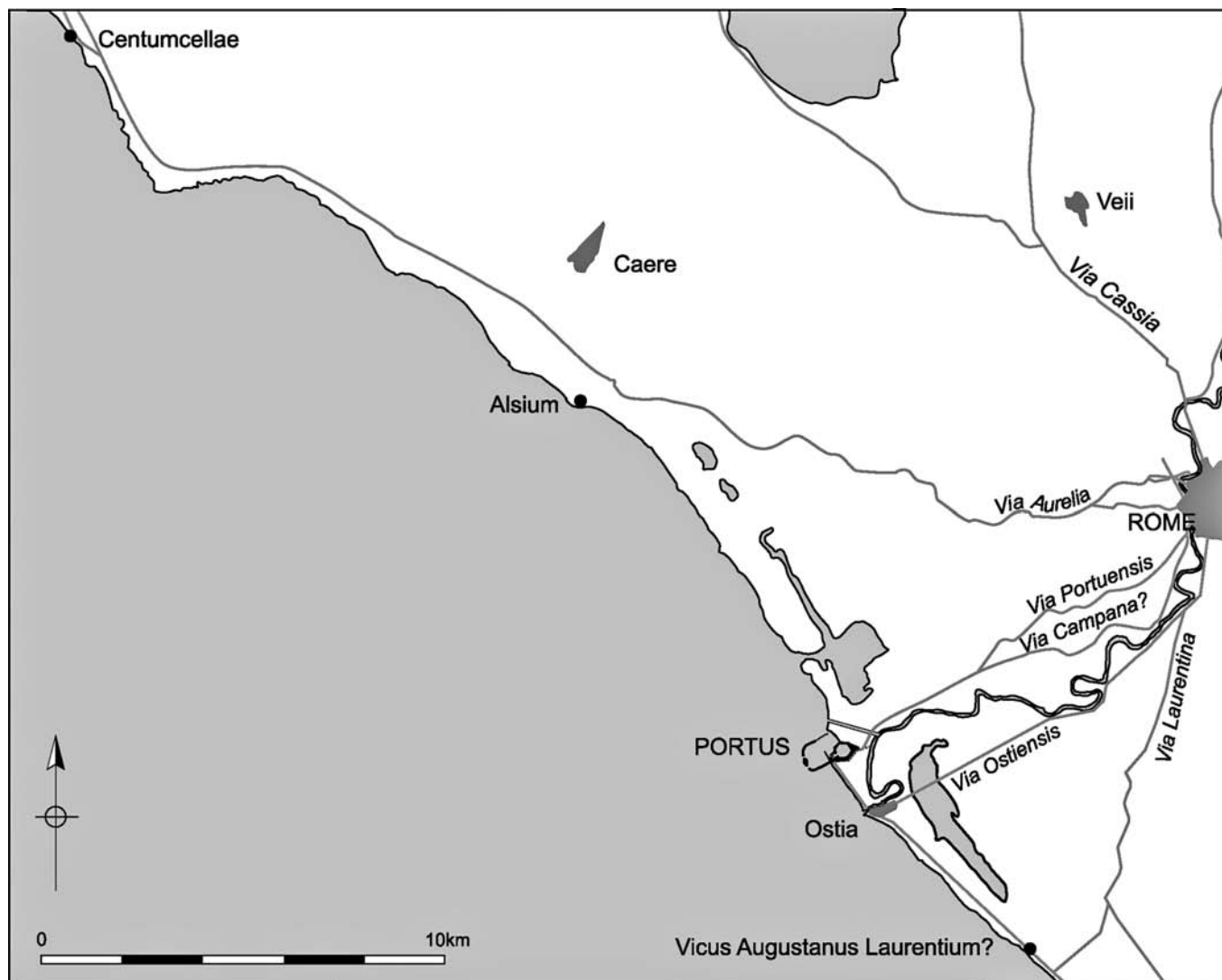


FIG. 2.1. General map showing Rome, Ostia, Portus and Centumcellae, as well as the principal roads. (*Portus Project.*)

THE RIVER PORT OF ROME

By the early second century AD port facilities had developed along both banks of the Tiber within the city of Rome (Fig. 2.2).⁶ The natural topography of the site of Rome did not lend itself to this easily, however, and it is true to say that the port developed as a consequence of the growing needs of the City, rather than being a catalyst in its growth. Thus the Portus Tiberinus, the earliest port of Rome, developed in the narrow space between the Tiber and the Capitoline and Aventine Hills from about the sixth century BC. Lack of space meant that additional facilities had to be established further south in the Emporium from the early second century BC. The Imperial period saw the development of additional port facilities at the northern edge of the Campus

Martius, and along the east bank of the Transtiberim. The principal area of the river port, therefore, encompassed the Portus Tiberinus and the Emporium, with quays running for a distance of *c.* 1.5 km, a figure that perhaps should be doubled if one takes into account the west bank of the river bordering the Transtiberim.⁷ It is unclear how this was administered, although it must have involved the *curatores alvei tiberis et cloacarum*,⁸ who had particular responsibility for maintaining the embankment of the Tiber within the City and beyond.⁹ Control was probably coordinated by the *curatores operum publicorum* and the *praefectus annonae* (Robinson 1995: 93), although the evidence for this is unclear.¹⁰ What follows is a review of the evidence for these different areas, which for the sake of convenience runs from north to south.

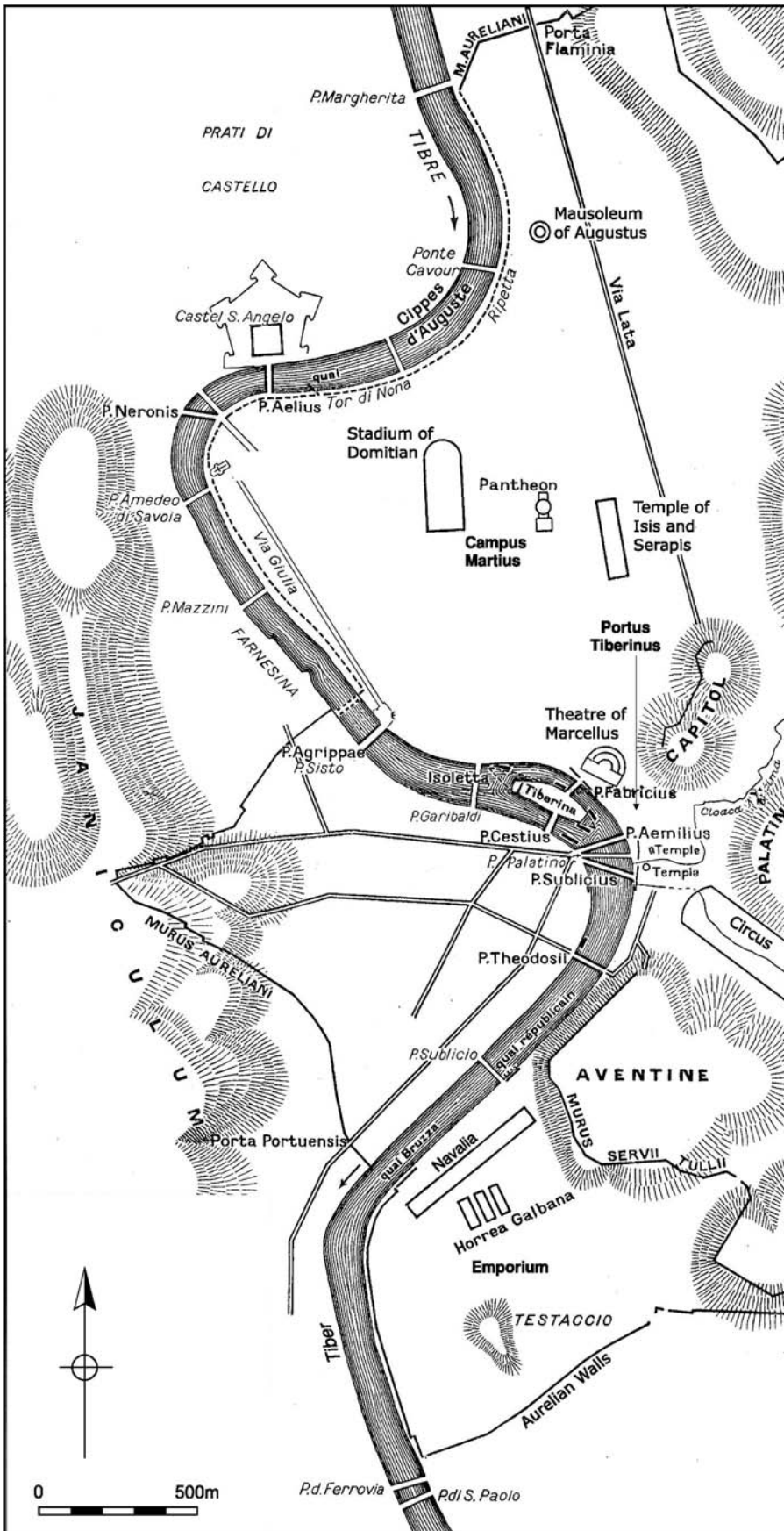


FIG. 2.2. General plan showing the river port of Rome. (After Le Gall 2005: fig. 42.)

THE CAMPUS MARTIUS

Excavations in the late nineteenth century uncovered stretches of quay along the Tiber bank to the north of the Pons Aemilius, the best known of which was a substantial structure that projected into the river at Tor di Nona (Quilici 1987; Maischberger 1997: 100–4), but included others at the Piazza Nicosia and the Ripetta. Unfortunately, the records of this work are such that nothing is known about any associated warehouses or finds. It seems very likely, however, that these installations primarily handled imports from the Tiber valley to the north of the City. It is all too easy to forget that, during the early Empire, Rome was a key market for a range of agricultural and other products produced in central Etruria and Umbria (Mocchegiani Carpano 1984: 59–61; Tchernia 2003: 47–51; Le Gall 2005: 316–24), as well as from across the Mediterranean, and that these were sent down-river to Rome by way of key river ports like Otriculum (Otricoli). One thus suspects that the wine and other amphora-borne products from central Italy¹¹ may have been unloaded here. Thus, even though there is no empirical evidence, it is likely that the Portus Vinarius was located somewhere in the general vicinity of the quays at Tor di Nona, Piazza Nicosia or the Ripetta (Coarelli 1999a).

It is probable that construction materials also were unloaded and stored here. For the Imperial period stockpiles of construction material would have made good sense in view of the many public buildings constructed and restored here during the second century AD. Marble finds are quite common in the area between the Ripetta and the principal monuments in the Campus Martius (Maischberger 1997: 178–9, Abb. 67–8), possibly having been redistributed from the *statio marmorum* in the Emporium district to the south, or imported directly from the *statio marmorum* at Portus. It is also probable that wood (Diosono 2008), bricks¹² and stone (Lancaster 2005: 12–18) from along the Tiber valley and the hills to the north of Rome would have been unloaded here for deployment across the Campus Martius and beyond, or transhipped for use at Ostia, Portus and other centres in the *suburbium*. If so, then it would make sense if the Portus Parrae, known from second-century AD brick stamps, were located somewhere in the vicinity also (Camilli 1999a).¹³ It has been suggested, for example, that bricks were unloaded and stored in stockpiles close to the Tiber in the Campus Martius.¹⁴

There is good evidence, therefore, for important port facilities along the bank of the Tiber to the north of the Pons Aemilius. They were well connected to the south and the north by the Tiber, to the west by the key artery of the Pons Aemilius, and to the southeast by the road network.

THE PORTUS TIBERINUS

This had been a nexus of commerce and redistribution at the heart of the City since as early as the sixth century BC (Coarelli 1992: 113–27). It was a low-lying area of c. 8,000 m² that encompassed the area between the river frontage to the west, the Theatre of Marcellus to the north, the Forum Holitorium to the east, and the Forum Boarium to the south (Fig. 2.3). Much of this space was taken up by public buildings of considerable antiquity, most notably the temple and precinct of Portunus, to the south, those of Janus, Juno Sospita and Spes, in the north, and the temples to Fortuna and Mater Matuta, to the northeast.

As regards the port facilities, however, the Trajanic period saw two major developments. The first was the raising of the level of the Tiber embankment, made necessary by the continual need to protect port areas from flooding. This needs to be understood in the context of a reorganization of the *cura alvei et riparum tiberis*, with the addition of the *cura cloacarum urbis* c. AD 101–3.¹⁵ The second was the establishment of a complex of *horrea* on a regular grid in the central area of the port. It is unclear what was unloaded and stored here, although the assumption is that it was grain (Colini 1980; 1986). Support for this suggestion comes from the discovery of an inscription to a *praefectus annonae* of Constantinian date between the church of Santa Maria in Cosmedin and the Tiber, emphasizing the link between the Portus Tiberinus and the offices of the *annona* (Coarelli 1999b).

The central location of the Portus Tiberinus ensured that it had good access to the Roman forum to the east by means of the Velabrum, the Campus Martius to the north, the Pons Aemilius and the Transtiberim to the west, and the Emporium to the south. It was a logical site for the Trajanic grain warehouses and, on its southern side, the offices of the *statio annonae*.¹⁶ Furthermore, the site afforded reasonably direct access northwards to the Porticus Minucia Frumentaria, site of the *frumentationes* (Virilouvet 1995: 131–60). These originally were constructed under Domitian, but were partly restructured in the Trajanic period (Manacorda 1999).

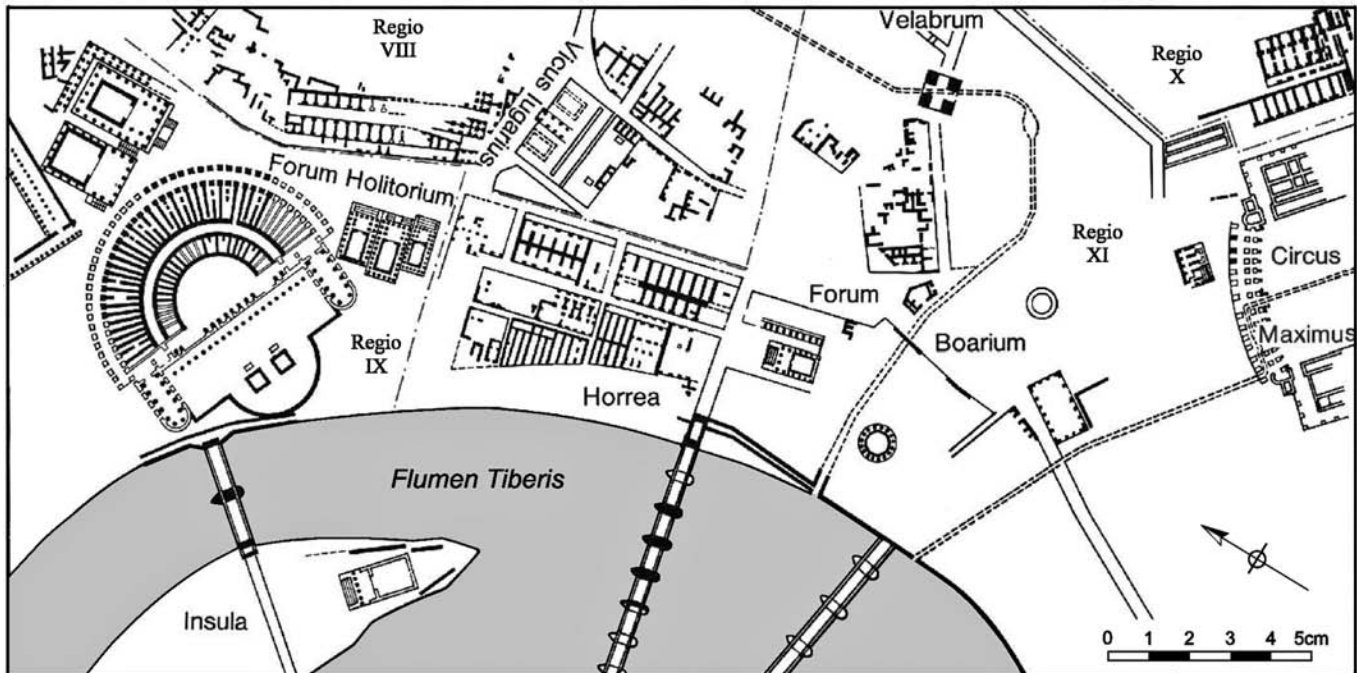


FIG. 2.3. Plan of the Portus Tiberinus. (After Coarelli 1998: 412.)

THE EMPORIUM DISTRICT

By the second century AD, the Emporium encompassed the river-bank southwards from the Forum Boarium to the point where it curved westwards. This incorporated a narrow stretch of land between the Aventine and the Tiber,¹⁷ the modern Lungotevere Testaccio, as well as the large expanse of flat land in what is now the Testaccio quarter (Mocchegiani Carpano 1995) (Fig. 2.4). This was the principal area for transshipment and storage in later Republican and Imperial Rome. While the outlines of its topography are known from a range of archaeological and epigraphic evidence and from the slabs of the *Forma Urbis* (the marble plan of Rome), precision is difficult.

Until recently, archaeological excavations had focused primarily upon the river-bank. These showed that quays and associated buildings of the first century AD were reinforced at some stage between AD 100 and 125 (Meneghini 1985: 40–6). A row of concrete vaulted storerooms on two or three storeys (Meneghini 1985: site 1) was built behind the earlier river frontage in such a way as to ensure that they would stand above the level of the Tiber in flood.¹⁸ While ceramics were found here, those published belonged to the late antique occupation phase (Meneghini 1986; 1987–8).

Much of the Emporium would have been taken up with large warehouses originally constructed during

the Republican period. The building traditionally identified as the Porticus Aemilia was one of the largest (Coarelli 1999a; Aguilera Martín 2002: 66–72); however, this recently has been re-identified on epigraphic and archaeological grounds as the *Navalia* (Cozza and Tucci 2006), even though this interpretation raises some practical issues.¹⁹ Even if these are resolved, it is clear that the function of the building changed at a later date, with the space between its façade and the river-bank being occupied by several large structures, possibly with a commercial function.²⁰ Other warehouse complexes in the vicinity include the *Horrea Galbana* (Coarelli 1996a),²¹ the *Horrea Seiana* (Palombi 1996b) and the *Horrea Lolliana* (Coarelli 1996b). These buildings are known largely from the marble plan of Rome (Rickman 1971: 108–21; Rodríguez Almeida 1981: 102–7; Aguilera Martín 2002: 51–104). It often is assumed that they were used for the storage of grain, a supposition bolstered by the discovery of inscriptions in this area that have led scholars to suggest that the *vicus frumentarius* (*CIL VI 975*) was situated in this area (Lega 1999; Virilouvet 1995: 98 n. 235).²² It would be prudent, however, not to overstate the case. For example, there are grounds for suggesting that olive oil was the principal commodity stored in the *Horrea Galbana* (Coarelli 1996a: 40), an arrangement that makes good sense in view of the proximity of Monte Testaccio.²³ This artificial hill

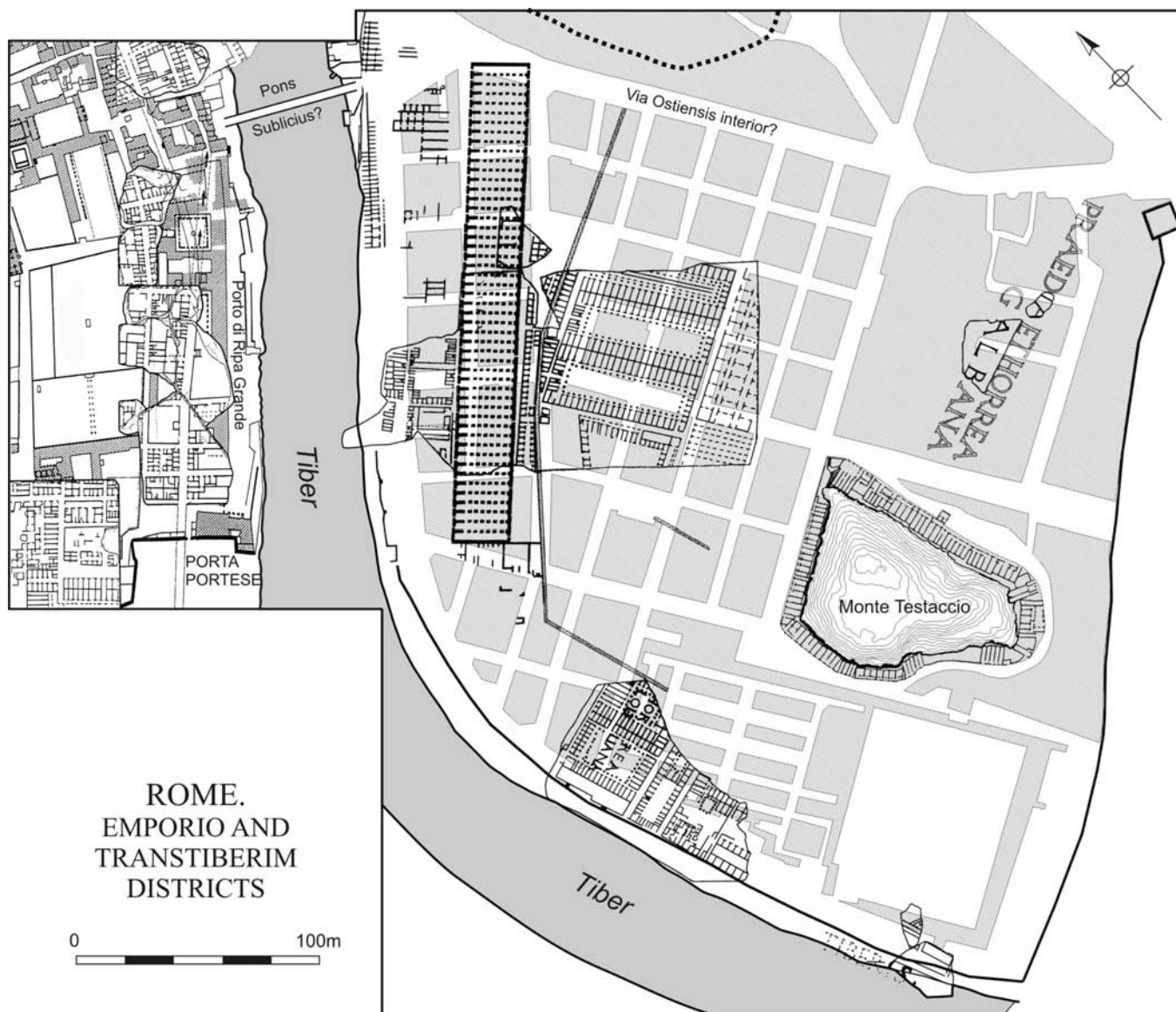


FIG. 2.4. Plan of the Emporium District and Transtiberim. (After Aguilera Martín 2002: fig. 7; Tucci 2004: fig. 6.)

developed as a result of the systematic deposition of empty olive-oil amphorae between the early first and mid-third centuries AD.²⁴ It has been estimated that Monte Testaccio still contains *c.* 24,750,000 amphorae, which represents *c.* 1,732,500,000 kilos of olive oil, or *c.* 7,000,000 kilos per year (Remesal Rodríguez 1998: 197). Most of the amphorae deposited there derived from the kilns along the banks of the rivers Guadalquivir and Genil in Baetica, but an appreciable number also came from Africa and Tripolitania, as well as elsewhere in the Mediterranean.

Excavations beneath the Nuovo Mercato Testaccio, lying between the Porticus Aemilia and Monte Testaccio, have uncovered one large warehouse with a triangular plan dating to the second century

AD (Sebastiani and Serlorenzi 2008; 2011) (Plate 2.1), as well as part of the probable remains of another, and seems to have been used for the storage of wine amphorae. The ceramics from the site provide a small but important sample of the range of material imported into this part of Rome from Portus via the Tiber during the late first and second centuries AD.

It is likely that the *statio marmorum* of Rome was also located in this same area. These were the principal marble yards of the City and had begun to be used from the end of the reign of Nero onwards.²⁵ This is supported by the discovery of quantities of marble in a late nineteenth-century excavation of a stretch of river embankment (Meneghini 1985: site 2) close to the southwestern tip of the Porticus Aemilia

(Maischberger 1997: 61–93, 175–7), together with the discovery nearby of the funerary stelae of officials and traders involved in the marble trade.

The Emporium was well located for the unloading and redistribution of commodities that were brought up-river from Portus. Thus marble for use in public monuments in the Campus Martius, alongside other goods, could have been ferried up-river to the Ripetta, Tor di Nona and Piazza Nicosia quays. One imagines that this would have been preferred over the land-route northwards along what is now the Lungotevere, given the congested space in the Portus Tiberinus.²⁶ If so, it is possible that marble, wine and other commodities destined for the centre and the eastern part of the City might have been transported southwards to join the Via Ostiensis before moving northwards into the City.

THE TRANSTIBERIM DISTRICT

This part of the City was articulated by the Via Campana/Portuensis that ran parallel to the river-bank as far as what is now the Porta Portese, and then skirted the south side of the Porto di Ripa Grande before heading towards the Pons Sublicius (Fig. 2.4).²⁷ There is little evidence here for any river port as such, although one is suspected to have been situated on the site of the Porto di Ripa Grande, which is recorded as having been first established in 1704 (Mocchegiani Carpano 1984: 64). The problem here is that most of what we know of the topography of the west bank comes from what is recorded on surviving slabs from the *Forma Urbis* and a few poorly understood excavations.²⁸

It seems that much of the Transtiberim on either side of the Via Campana/Portuensis was taken up by closely-packed warehouses with central courtyards, as well as possible apartment blocks and other buildings (Rodríguez Almeida 1981: tavv. XIX, XX; Tucci 2004: figs 2, 4–6). Some of these may have been connected to the Cella Civicana (Chioffi 1993a; also Castagnoli 1980: 37), which stored wine and were commemorated on an inscription of AD 111, and the Cella Saeniana (Castagnoli 1980: 37; Chioffi 1993b). Little survives of the river frontage *per se*, apart from the discovery of some kind of embankment structures in the southernmost area (Mocchegiani Carpano 1985: 57–60, 61–4, sites 6 and 7), and what is documented on slab 27 of the *Forma Urbis*, an area lying between the Pons Sublicius and the Pons Aemilius. However slab 28 shows what appear to be two large

colonnaded courtyards bordering the Tiber to the southwest of the Porta Portese, the more northerly of which may have been an unloading point. There is also evidence that the west bank to the north of the Pons Aemilius was occupied by extensive imperial wine warehouses, the Cellae Vinariae Nova et Arruntiana Caesaris Nostri, in the Lungotevere Farnesina near the Villa Farnesina (Castagnoli 1980: 37, fig. 1 n. 7; Rodríguez Almeida 1993), which are commemorated in an inscription dated to AD 102.

Although commodities stored in these warehouses could have been transported into the centre of the City by means of the Via Campana, the Pons Sublicius and the Pons Aemilius, there would have been considerable congestion at the bottleneck of the Portus Tiberinus. This suggests that commodities unloaded along the west bank may have been destined for consumption primarily in the Transtiberim — a part of the City that may have been supplied also by wheeled traffic heading westwards from the Portus Tiberinus.

SUMMARY

There is little doubt that the river port of Rome would have extended along both banks of the Tiber from north to south. The four key areas that came to prominence in the early Empire — the Campus Martius, the Portus Tiberinus, the Emporium and the Transtiberim districts — owed their prominence to their roles as nodal points, offering access to key routes of communication within the City, notably the Pons Aemilius and the Via Aurelia, the Velabrum, the Via Ostiensis and the Via Portuensis.

OSTIA AND PORTUS

Both these ports were situated in a marginal estuarine landscape close to the mouth of the Tiber, some 35 km from Rome (Fig. 2.5). Ostia was located on the south bank of the river a short distance from the sea, was connected to Rome by the Via Ostiensis, and bordered to the east by a salt-water lagoon, the Stagno di Ostia. Portus lay 2 km to the north of Ostia, arguably within its territory, and was situated close to a key bend in the Tiber, to which it was connected by a canal. It was linked to Rome by the Via Campana/Portuensis and was bounded to the northeast by another coastal lagoon, the Stagno Maccarese. Both ports, therefore, played complementary roles in supplying Rome.

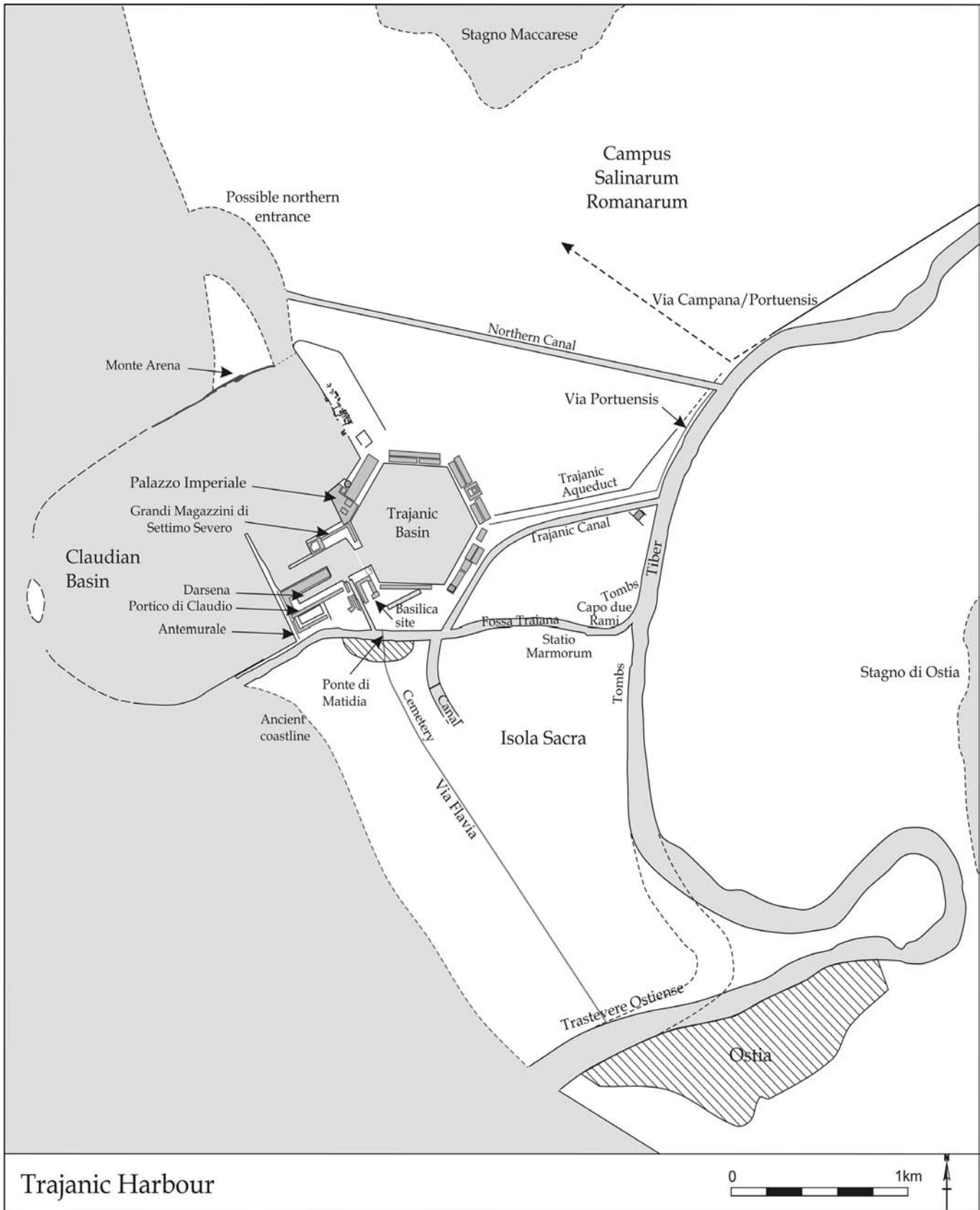


FIG. 2.5. Plan of Ostia and Portus. (Portus Project.)

The *castrum* of Ostia was established in the fourth century BC.²⁹ Its role was probably strategic, acting as the main fleet base for Rome until the reign of Augustus, when the fleet headquarters were established at the Portus Iulius and subsequently Misenum (Meiggs 1973: 304). Its value as a commercial port was compromised by challenges to shipping offered by the mouth of the Tiber, and the fact that only ships of limited size could sail up the Tiber to Rome (Strabo 5.3.50; Dio Cassius 60.2; Meiggs 1973: 279, 289–90). It presumably was because of these failings that the *colonia* of Puteoli (Pozzuoli), on the bay of Naples, which was established in 194 BC, acted as the maritime port of Rome until the first century AD. It lay three days' sailing to the south of Ostia and had the advantage of a capacious natural harbour that enabled it to handle large numbers of ships from across the Mediterranean, particularly from the eastern provinces. Cargoes were then transhipped onto smaller coastal craft that sailed up the coast to Ostia, which henceforth acted as little more than a conduit through which grain was supplied up-river to Rome.³⁰

By the time of the Empire, the volume of foodstuffs and other material needed by Rome had become too great. At the same time the proximity of Ostia to Rome meant that it remained the obvious conduit through which to import supplies. Consequently, the first and second centuries AD saw it gradually transformed to fulfil this role. It began in the administrative sense with the establishment of officials³¹ responsible to the *praefectus annonae* at Rome under Claudius,³² and gathered pace under Trajan with the establishment of the *procurator annonae Ostiensis* (Bruun 2002: 163–6) in the context of the broader concern that he showed towards the supply of grain in general (Rickman 1980: 85–6, 89–93) and the various *corpora* involved in the transportation of this and other goods to Rome (Sirks 1991: 81–107, 257–65, 268–86, 313–22). These changes were echoed in the infrastructure of the river port, with increased construction of *horrea* in the course of the Julio-Claudian period.

The most important development, however, came with the establishment of a new maritime port at Portus in AD 46.³³ This complex, which is seen by some as being built primarily to serve the needs of the *annona*, comprised a huge artificial basin for safe anchorage as well as a smaller basin (the *Darsena*)³⁴ and warehouses. Two canals linked the complex to both the Tiber and the sea, enabling a much more rapid transfer of cargoes to Rome, and at the same time providing flood relief to the Tiber valley south

of Rome. This complex was enlarged substantially under Trajan with the addition of a second, smaller basin of hexagonal form and more warehouses. This would have permitted the access of larger ships than before,³⁵ greatly increased anchorage and warehouse space, enabled an even more efficient transshipment of cargoes. It was a development that ensured that much of the maritime traffic that hitherto had gone to Puteoli now went to the newly-enlarged port; it is unclear how much of this, if any, used facilities at Ostia (Meiggs 1973: 278–80).

OSTIA

Comments by Strabo and others³⁶ have led some scholars to downplay the significance of Ostia as a maritime port.³⁷ This view has been bolstered by the fact that the port installations have never been excavated, not least because much was destroyed when the Tiber changed course in the sixteenth century. Nevertheless the existence at Ostia of a *statio Anto[nini] Aug(usti) n(ostr)i XXXX Galliarum et Hispaniarum*³⁸ suggests that it was functioning as a commercial harbour in the late second century AD. There is also good archaeological evidence that the capacity of the port was still considerable, even though dwarfed by that of Portus.

By the middle of the second century AD, the early nucleus of the original *castrum* on the south side of the Tiber had developed into a densely occupied port-scape that followed the alignments of the Via Ostiensis and the Via Laurentina. The layout of the port clearly demonstrates the centrality of trade, storage and commerce to the life of the city,³⁹ arguably at the expense of the monumentality that one might expect at a port of this kind (Fig. 2.6).⁴⁰

The existence of the port was advertised to incoming ships by a lighthouse, which Meiggs suggested might be identified with the later Torre Boacciana (Meiggs 1973: 279).⁴¹ The harbour basin lay at the western limit of the port, between the Palazzo Imperiale and the Porta Marina, and comprised a small *c.* 2 ha basin and associated temple–naval complex (Heinzelmann and Martin 2002). The extent of the quays is unclear, since they have never been excavated. However, it is probable that they ran along both the south bank of the river between the Porta Marina⁴² and the Porta Romana, while there is also a good chance that they would have followed the meander of the ancient course of the river beyond the walls eastwards, to a point north of where the Castello di Giulio II now stands (Plate 2.2).⁴³ Furthermore, the discovery of a

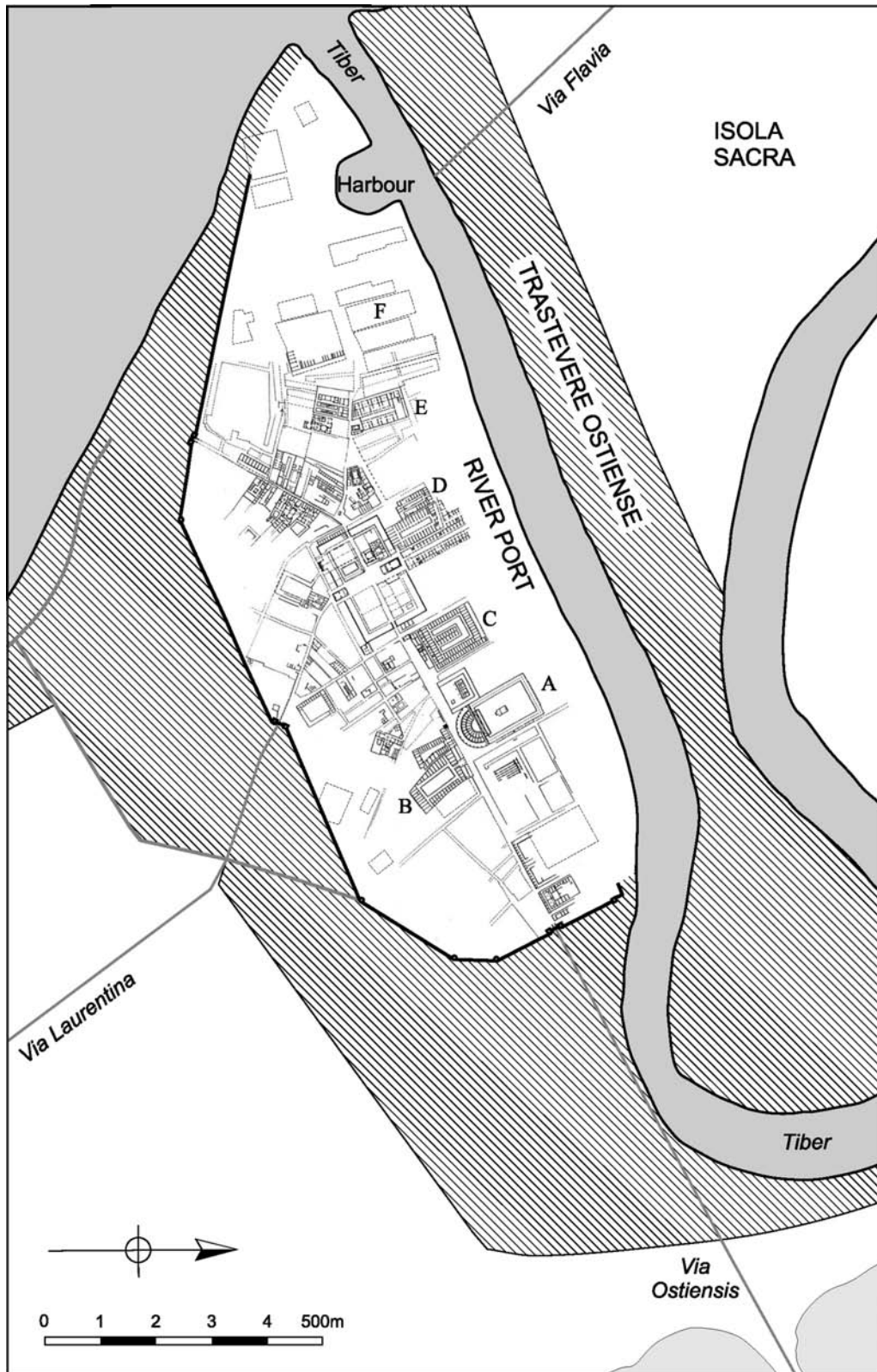


FIG. 2.6. Plan of Ostia showing the warehouses and other public buildings of Trajanic and Hadrianic date. (After Heinzelmann 2002: *Abb. 1, Tafel 4.2*; Mar 2002: *fig. 7*.) Key: A. Piazzale delle Corporazioni; B. Horrea di Hortensius; C. Grandi Horrea; D. Piccolo Mercato; E. Horrea dei Mensores; F. Warehouses identified in geophysical survey (Portus Project). The shading represents areas of suburban settlement revealed in the course of recent geophysical survey.

warehouse on the north side of the Tiber (Zevi 1972)⁴⁴ and the existence of a quay in the curve of the ancient river bed (*fiume morto*) (Santa Maria Scrinari 1984) indicate that the north bank was taken up with port installations as well. The minimum total quay space on the southern side of the Tiber between the Porta Marina and the Porta Romana was *c.* 1.2 km. This was slightly less than the *c.* 1.5 km of quay space running between the Portus Tiberinus and the Emporium district on the east bank of the Tiber at Rome, but a long way short of the 2.1 km within the Trajanic basin at Portus.⁴⁵ If one counts both sides of the Tiber, then the figure would have been correspondingly greater, although the narrowness of the river would have caused overcrowding, suggesting that the river port would have been hard to use at full capacity.

The volume of cargo that would have been unloaded on these quays can be gauged by the proliferation of warehouses at Ostia (Rickman 1971: fig. 1; Mar 2002: 148–53, fig. 13; Heinzelmann 2002: 112–16, Taf. IV.2).⁴⁶ While some of the Ostia warehouses may have originated in the Republican period,⁴⁷ they were essentially the result of developments that began under the Julio-Claudians and substantially increased in number under Trajan and, particularly, Hadrian,⁴⁸ and continued to be constructed until the Severan period (Fig. 2.6). This caused an increase in warehouse space from 17,667 m² in the first century AD, to 31,882 m² in the early second and 46,118 m² in the later second (Keay and Millett 2005b: table 9.1). This has been understood to have been a consequence of the enlargement of Portus under Trajan and its subsequent development by his successors (Rickman 2002: 355–6; Mar 2002: 144–8).⁴⁹ The larger warehouses, such as the Piccolo Mercato, Horrea Epagathiana et Epaphroditiana, Horrea di Hortensius, the Grandi Horrea and the Horrea dell'Artemide proliferated in the area between the river and the Decumanus Maximus, and on the basis of their size and prominence have been attributed to public ownership.⁵⁰ They were all well placed to receive grain and other commodities being unloaded along the quays, since their entrances faced directly on to the river port. Furthermore, their proximity to the Decumanus and branch roads ensured that commodities being stored in them could have been redistributed to the smaller corridor warehouses and other buildings in the southern and western parts of the port.

The size and number of warehouses often are assumed to be excessive for Ostia's needs, and, therefore, to be *prima facie* evidence for the nature of the

port's involvement in the supply of grain to the Capital. However, this may not necessarily be the case. Ostia encompassed a built-up area of *c.* 190 ha, with a population between *c.* 26,000 and 41,000 (Keay in press a), figures that stand in contrast to its limited harbour facilities and the apparent absence at Portus of a significant population. This suggests that the population of Ostia grew as a consequence of the establishment and development of Portus, particularly under Trajan. Indeed, it is possible that the redevelopment of the urban centre of Ostia under Hadrian and subsequently (DeLaine 2002; Mar 2002: 144–58; Pensabene 2007: 24–34) might, at least in part, be explained by this.

While much is known about the architecture of Ostian warehouses, it is frustrating that there is so little evidence for the goods that they would have held. The assumption tends to be that grain was the principal commodity,⁵¹ even though there is very little evidence apart from the presence of raised floors from the mid- to later second century AD onwards, and the fact that grain was the most important traded foodstuff. One should recognize that there are grounds for suggesting that some warehouses, such as the Horrea Epagathiana et Epaphroditiana, might have held other unspecified commodities,⁵² or combinations of goods. Excavated ceramics from across the site are a good index of the range of commodities from different parts of the Mediterranean that one might expect to have been stored in these warehouses. Unfortunately, however, many of the published ceramics deposits have derived from the fills of buildings other than warehouses situated away from the river-port installations.⁵³ Instead they provide us with 'snapshots' of the range and relative proportions of imported and locally-produced wine, olive oil, fish sauce and other foodstuffs, and of the table- and kitchen-wares that inhabitants of the port used and discarded in different parts of the port at different times. In aggregate terms, however, they can be taken also as an index of the balance of importation to local production at Ostia as a whole.⁵⁴

Amongst the other key buildings related to the commercial life of the port, the Piazzale delle Corporazioni and the Caserma dei Vigili were arguably amongst the most important.⁵⁵ The former lay immediately to the north of the theatre and acted as a meeting-place for the representatives of the merchants and shippers active at Ostia and Portus, and possibly also as a forum for meeting officials working on behalf of the *praefectus annonae* (Meiggs 1973: 283–7).⁵⁶ By the later second century AD, the mosaic floors of the *stationes* that surround the piazza make it clear that the merchants

and shippers represented here traded in grain, wine, olive oil, wild beasts and other commodities from cities across the Mediterranean, but particularly north Africa. The Caserma dei Vigili lay further west and was frequented by individuals who would have played a key role in ensuring the security of food stored in the warehouses from fire and other threats.⁵⁷

Apart from these buildings, and those associated with the public life of the port, there is no evidence as yet for the kind of buildings that one might expect for the *procurator annonae Ostiensis* and other officials involved in the supply of foodstuffs to Rome, coordinating the movement of shipping and the registration of cargoes. The one possible exception is the large building situated at the western edge of the port, known as the Palazzo Imperiale (Spurza 1999; 2002).⁵⁸

One imagines that the town council must have run the port area in close collaboration with the *praefectus annonae* and the *curatores alvei Tiberis et cloacarum* based at Rome. It is noteworthy, however, that the relatively small scale of the port facilities at Ostia is out of all proportion to the abundant epigraphic evidence for the *collegia* and other groups that serviced them.⁵⁹ This is precisely the opposite to the situation at Portus, which had far more extensive harbours and associated infrastructure, but limited evidence for *collegia*. This imbalance might be explained by the fact that many of the people belonging to them were based primarily at Ostia and remained there during the quieter winter months, when work at Portus was probably limited to monitoring warehouses and transshipment onto river-boats, but who would have commuted to the harbours of Portus during the busier summer months.

While there is no doubt that Ostia played a key role in the supply of grain and other foodstuffs to Rome, this would seem to have been confined largely to the establishment of contracts between shippers, traders and merchants, and between these and agents of the *praefectus annonae*. This would mean that the river port was responsible primarily for the business associated with trade, rather than the physical handling of bulk cargoes, which would have been dealt with by Portus. The small size of its harbour and the shallowness of the Tiber would have constrained severely the number of sea-going ships that it could accommodate during the peak summer months. This would suggest that it was supplied primarily by Portus, either by means of the Fossa Traiana and Tiber southwards, or by the Via Flavia between the two, or possibly by means of the Isola Sacra canal.⁶⁰

PORTUS

The establishment of an artificial deep-water harbour at Portus along a stretch of coast that was prone to offshore drift from the mouth of the Tiber is an index of how acute the need for anchorage space had become by the middle of the first century AD. Claudius's engineers were not constrained by earlier developments, and the only earlier activity of note in the region was the extraction of salt in the Campus Salinarum Romanarum, which lay to the east of the later port (Lanciani 1888; Morelli *et al.* 2011). They thus designed a complex that was able to accommodate sea-going ships in unprecedented numbers. However, it was the Trajanic enlargement of the port that ensured that Portus became the lynch-pin of what one might term a 'port-system' serving Imperial Rome.⁶¹

By the mid- to later second century AD the port complex comprised three key elements (Figs 2.5 and 2.7). The first was the Claudian basin, which comprised an area of *c.* 200 ha enclosed by two large artificial moles, which projected into the sea to the west and had a centrally-placed lighthouse (pharos).⁶² The second was the small 1.07 ha rectangular basin, or Darsena, to the south; while the third was the 32 ha Trajanic hexagonal basin that lay a short distance inland to the east.⁶³ Together these three basins encompassed *c.* 233.07 ha, an area that would have absorbed all of the ships with goods bound for Rome, together with a proportion of those that subsequently were transported southwards to Ostia.

The originality of the complex is to be explained firstly by the ample space for anchorage and for unloading, with up to *c.* 13.89 km of quay,⁶⁴ a figure that dwarfs provision at Ostia and Rome. It was also characterized by a network of interconnecting canals that linked the port to Ostia, the Tiber, and ultimately Rome. It is unclear how the port was administered, although it would seem to have involved the municipal authorities at Ostia, the *praefectus annonae* based at Rome and the *curatores alvei Tiberis et cloacarum*, working in conjunction with the *procurator annonae Ostiensis*, or later the *procurator utriusque portus*.

The success of Portus as a maritime port would have been measured in the ability of the port authority to clear incoming and outgoing ships efficiently, register cargoes, assign berths, and coordinate the unloading of ships and subsequent assignment of their cargoes to warehouses for storage⁶⁵ or transshipment (Casson 1965: 34–6). Unfortunately we have virtually no direct information about what must have been an

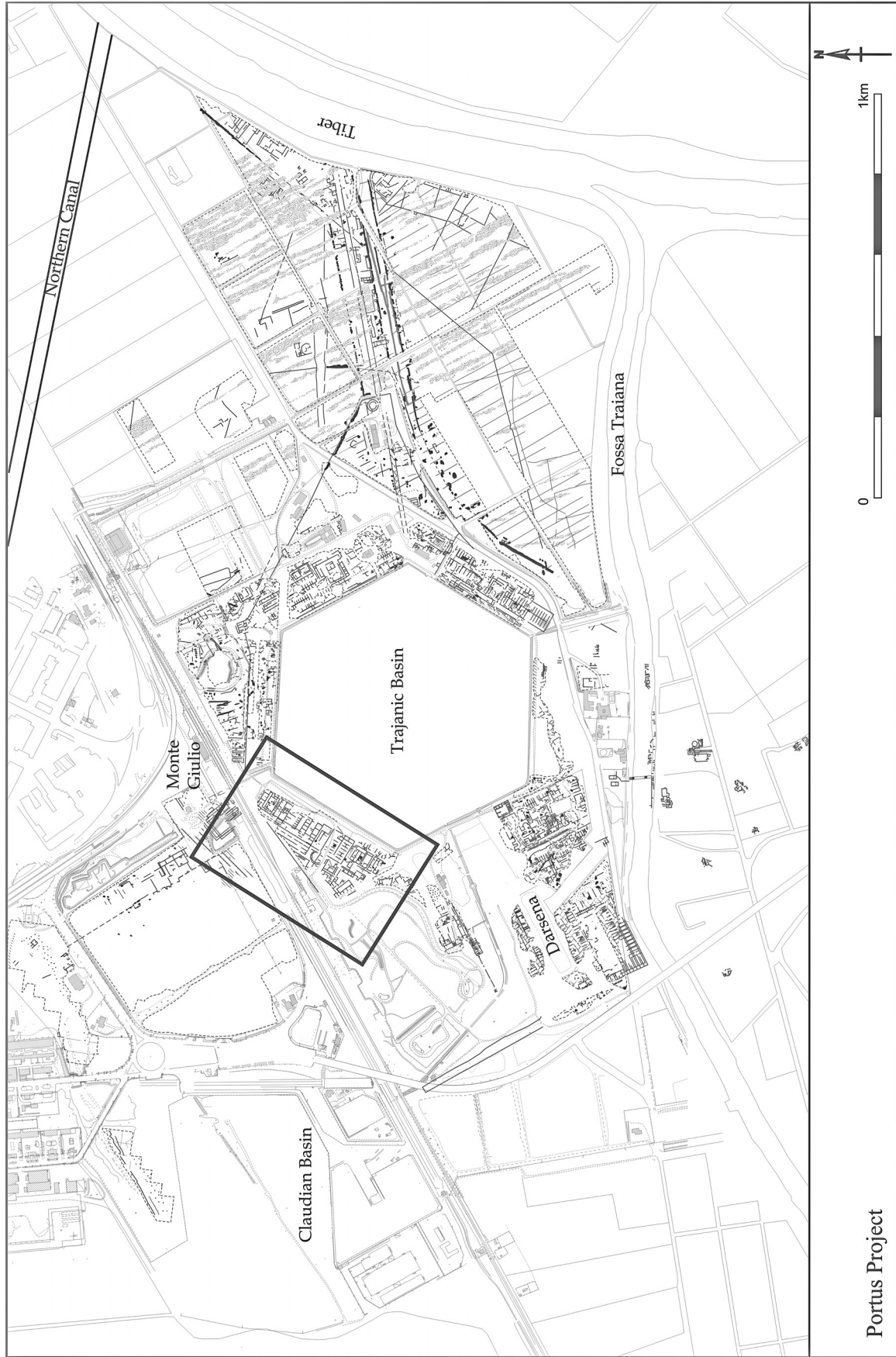


FIG. 2.7. Plan of Portus, with the focus of recent fieldwork (2007–12) indicated by the box. (Portus Project.)

extremely complex, bureaucratic and, at times, lengthy process.⁶⁶ However, since rapid information flow would have been central to this, the three large buildings at the centre of the port were best placed as the focus of some of these, and, thus, the focus of the port authority.⁶⁷

The first was the Palazzo Imperiale, a unique complex covering 3 ha that was completed *c.* AD 117 and that dominated both basins (Plate 2.3).⁶⁸ There is no epigraphic evidence as to who might have been based in this building and overseen these operations: one possibility is the *procurator annonae Ostiensis*, an official first attested in the Trajanic period and who usually is assumed to have been based at Ostia (Bruun 2002: 163–4). Another would be the *procurator utriusque portus*, who is first firmly attested in AD 247 and who, according to a recent interpretation, was charged with overseeing the two large harbour basins at Portus (Bruun 2002: 166–7). Specific activities centred here might have included the coordination of the movement of sea-going ships between the Claudian and Trajanic basins, sequences of mooring and unloading cargoes, associated charges, the assignment to warehouses and the rental of space therein. Immediately to the east of the Palazzo Imperiale and lying perpendicular to it was a second, very large, building of Trajanic date measuring *c.* 240 m from west to east, and 60 m wide. The function of this is unclear, although it obviously was related to that of the Palazzo Imperiale (Keay in press b).

The third building was the so-called Grandi Magazzini di Settimio Severo, a late second-century AD complex that was immediately adjacent to the Palazzo Imperiale, and physically joined to it at a later date. Although this usually is interpreted as a large warehouse (Rickman 1971: 128–30), its central position within the port as a whole and its unusual architectural form suggest that it may have had some kind of public role, in which storage played a secondary part. One possibility is that the offices on the first floor could have housed the secretariat that registered the cargoes on incoming and outgoing ships. It was well placed for this since it would be passed by every sea-going ship that moved from the outer Claudian to the inner Trajanic basin along the Canale di Imbocco al Porto di Traiano, as well as by boats heading past the Darsena southwards along the Canale Trasverso towards the Fossa Traiana.

An idea of the information required during the process of registration can be gained from the painted notations (*tituli picti*) recorded primarily upon Baetican

Dressel 20 oil amphorae that were eventually deposited at Monte Testaccio in Rome, following their initial unloading at Portus. They record the tare of the amphorae,⁶⁹ the name of the merchant or shipper involved in their transport,⁷⁰ the weight of the oil they carried⁷¹ and their official registration.⁷² Since much of the oil that they carried was destined for the *annona*, they were a fiscal cargo, perhaps explaining the need for controls of this kind. However, it is also possible that the unusual anaerobic conditions at Monte Testaccio have ensured the preservation of *tituli picti* that otherwise might not survive. If so, then it is possible that many other non-fiscal cargoes might have borne similar kinds of information that has not survived.⁷³

The Claudian basin had a depth of up to 7 m, and probably acted at least in part as a holding-space for sea-going ships waiting to pass through the Canale di Imbocco al Porto di Traiano and berth in the hexagonal basin. It also could have facilitated cargoes being transhipped onto smaller boats and unloaded elsewhere in the port. The far smaller Darsena,⁷⁴ with a depth of 3.5 m, seems to have provided anchorage for the smaller boats (*naves caudicariae*) that would have moved down the Canale Trasverso to access the Fossa Traiana to the south. It was delimited on its northern side by the Magazzini Traianei complex and by the so-called Foro Olitorio to the south, a massive warehouse-type structure that was first established during the pre-Trajanic phase of the port.

The Trajanic basin, with a depth of 5 m, was the core of the harbour system at Portus. Its hexagonal shape would have enabled a more efficient sequence of arrival, unloading and departure for a larger number of ships than was possible at Ostia. Sea-going ships entering the basin could have anchored temporarily at the centre until such time as a berth along its edges became free. The regular sequence of numbered columns and mooring rings that have been found around the sides of the basin suggest that there was a strict procedure in docking the ships.⁷⁵

It is well known that the hexagonal basin was surrounded on five of its six sides by large oblong buildings traditionally identified as warehouses,⁷⁶ and together represent an increase in warehouse space from 32,790 to 59,488 m² (Keay and Millett 2005b: table 9.1).⁷⁷ Recent work, however, suggests a rather more complex picture, with significant functional differences in the buildings along its six sides (Keay and Millett 2005a: 281–8). The northern side (I) was bordered by an oblong warehouse, behind which

there was a sprawling burial area of lower status, possibly servile, burials.⁷⁸ The western side (II), opposite the entrance (V), was dominated by a temple complex between double pairs of oblong warehouses, behind which there seems to have been building of a largely ephemeral nature. The southern side (IV) was distinguished by two warehouses defining a triangular space; furthermore, the area between this, the Fossa Traiana to the south and the Canale Trasverso to the east seems to have been filled with a range of residential buildings, small temples and official structures. The northwestern side (VI) of the hexagonal basin was dominated by the frontage of the Palazzo Imperiale and the large adjacent oblong building, traditionally identified as a warehouse.

The oblong plans of these warehouses are distinctive and, unlike those at Ostia and Rome, they lack courtyards. It has been argued that this is explained best by the need to arrange the buildings around the sides of the hexagonal basin (Rickman 1971: 130–2). It is worth noting in this regard that there is evidence for the provision of a substantial internal wall running around at least two sides (III and V) of the hexagonal basin, pierced by small openings that effectively would have funnelled the movement of cargoes into warehouses through prearranged points, suggesting that there was a degree of centralized control in regulating the movement of cargoes in and out of warehouses. This is particularly clear on the southeastern side (III) of the hexagonal basin. The strip of warehouses here is defined to the east by a 40 m wide canal of Trajanic date that branches off from the Fossa Traiana and meets the Tiber just over 1 km to the east.⁷⁹ This enabled cargoes that had been unloaded directly from sea-going ships to be stored before being transhipped onto smaller river-barges bound for Rome. While this arrangement inevitably speeded up the process of transshipment, it is unclear whether all cargoes that were unloaded in the Trajanic basin passed through here, and, if so, how they were moved here from their original point of storage.

There is as yet, however, little evidence as to what was stored in any of the warehouses at Portus since none have been excavated, and the identifications generally proposed by Testaguzza (1970) are without foundation. Even if a warehouse is excavated, it is likely to have been backfilled with rubble and contain later burials. Furthermore, it is probable that the commodities stored therein could have changed from one year to the next. While grain often is assumed to have been the principal commodity,⁸⁰ the only likely

candidates for this are the warehouse complexes on side III of the hexagonal basin and along the northern side of the Magazzini Traianei, since both were fitted with raised floors some time in the later second century AD (Rickman 1971: 130–1).⁸¹

At present, therefore, ceramics provide our only clue. However, published material is rare, and what there is tends to date to the later second and early third centuries AD onwards. Nevertheless, there are grounds for arguing that the storage of amphora-borne goods was organized into different zones within the port. Thus the predominance of north African olive oil and fish sauce for much of the Imperial period from excavations on the site of the Basilica Portuense (Di Giuseppe 2011), the Antemurale (Di Santo 2011) and the Palazzo Imperiale (Zampini 2011)⁸² could be taken to indicate that north African imports were stored in warehouses to the west and south of the port. Southern Spanish Dressel 20 olive-oil amphorae, by contrast, which form the majority of the amphorae deposited at Monte Testaccio in Rome, seem to have been more common in large buildings on the north side of the Trajanic canal that ran along the southeast side of the hexagon towards the Tiber (Mele 2005: 226, fig. 6.76): but even here they tend to be rarer than north African imports.⁸³ Eastern imports are present at Portus for the whole of the Imperial period, but always in smaller quantities than those from the western Mediterranean (Keay and Paroli 2011). This is not the case with marble. From the late first century AD onwards this was deposited in the *statio marmorum*⁸⁴ on the southern bank of the Fossa Traiana, before being moved up-river to the *statio marmorum* at Rome. Analysis of the surviving material from the site points to the presence of a wide variety of material from the east Mediterranean and, to a lesser extent, north Africa.⁸⁵

These warehouses and storage areas were used primarily to hold goods destined for Rome, providing the City with a strategic reserve that was drawn upon throughout the year, but particularly during the winter months. It is also likely that some space was taken up with goods — particularly construction materials, but also other goods such as millstones from the Orvieto region (Antonelli and Lazzarini 2010; McCallum 2010) — that passed through Portus to different Mediterranean destinations, from Rome and the middle and upper Tiber valley. This stands as a complete contrast with Ostia, which arguably imported primarily to feed its own population, rather than to supply Rome. It is also possible that a significant

proportion of these goods actually came to Ostia from Portus by means of a large 90 m wide canal running southwards from the Fossa Traiana to the Trastevere Ostiense.⁸⁶ Again, unlike Ostia, available evidence suggests that, despite the large overall area of Portus, the area of residential space was limited, arguing against a large population. One very rough recent estimate puts the maximum potential population at between 11,000 and 17,000 (Keay in press a), a figure that surely would have fallen much lower between autumn and spring, when the volume of shipping was lower and the need for staff for unloading and registration must have been reduced correspondingly. Since there is so little potential residential space, one imagines that some people must have been based at Ostia, travelling to Portus on a daily basis by road or canal.

It is difficult to gauge the scale of traffic that used Portus at any one time. Only nine Roman wrecks are known from the site (mostly from the northern sector of the Claudian basin), a tiny sample that does not give us any idea about the full range of ships and boats that would have used the port.⁸⁷ Moreover, there is an almost complete lack of information about the anchorage capacities of the different basins, and the ways in which the known different kinds of ship and boat used different areas within each port.⁸⁸

CONNECTIVITY BETWEEN PORTUS, OSTIA AND ROME

The key to Portus's success as a maritime hub was the high degree of connectivity that existed between the different 'micro-regions' within and between it, Ostia and Rome. This was achieved by means of a network of roads and canals articulated around the Tiber itself.

THE TIBER AND THE CANALS

Most goods were moved up and down the Tiber in *naves caudicariae*⁸⁹ that were towed by men or oxen using a path along the western side,⁹⁰ although some small merchant ships are also known to have arrived at Rome (Meiggs 1973: 291). River ports on the western side of the river would have served as convenient stopping points, such as those closer to Rome in the vicinity of the Temple of Fors Fortuna (Coarelli 1994a), Santa Passera (Mocchegiani Carpano 1986), Pietra Papa (Le Gall 2005: 219–22), as well as at Quartaccio (Ponte Galeria) further south (Vittori and Vori 2000).⁹¹ There will have been a need also for

ferries and bridges to allow people and cargoes to move from one side of the river to the other. At Rome, the Pons Aemilius connected the Transtiberim and the Portus Tiberinus, while the Traiectus Rusticeli mentioned on second-century AD inscriptions refers to the transfer of people across the Tiber by ferry between the Emporium and the Transtiberim (Aguilera Martín 2002: 46–9).⁹² To the south of the City, the river ports were the obvious sites for bridges or ferries.⁹³

Development of this riverine system had never been a straightforward issue owing to the periodic flooding of the Tiber at Rome and down-river (Lugli 1953: 61–6). Thus under Tiberius the whole length of the river from Ostia to the Ponte Milvio at Rome became the responsibility of a body of officials, the *curatores alvei Tiberis et riparum*, who had a *statio* at both Ostia (*CIL* XIV 5384) and Rome (*CIL* VI 12240). Evidence of their work has been attested epigraphically⁹⁴ and archaeologically⁹⁵ at different points along the river in Rome, but also down-river in the direction of Ostia, notably on the east bank of the Tiber to the west of San Paolo fuori le mura near the Ponte Marconi (Castagnoli 1980: 37, figs 8.1 and 8.2) and at the river port of Santa Passera a short distance further west on the west bank (Castagnoli 1980: 37 no. 6, fig. 10). The *curatores* were responsible also for maintaining bridges. An inscription dating to the late fourth century AD (Cébeillac-Gervasoni, Caldelli and Zevi 2006: 129–31) records that there were thirteen under their care, which must have included the bridge that, it is suggested (Germoni *et al.* in press), crossed the Tiber from the Trastevere Ostiense on the south side of the Isola Sacra to the northern bank of Ostia itself.

The *curatores* also took responsibility for the canals created by Claudius and Trajan, not least because of the role that they played in providing flood relief to the Tiber valley to the south of Rome. It has been suggested that they also may have overseen the movement of *naves caudicariae* and other river-craft between Portus and the Tiber, and Portus and the sea.⁹⁶ Indeed, the canals were the key part of the whole port-system scheme,⁹⁷ making it possible to move ships and boats between the harbour basins, and for cargoes to be transferred seamlessly from ships to warehouses, canals, boats, the Tiber and, ultimately, Rome. The Fossa Traiana lay at the heart of this system. It ensured rapid access from the sea, past the southern side of Portus and the northern side of the Isola Sacra, and onwards into the Tiber at Capo Due Rami. It was spanned by the Pons Matidiae, a little to the

east of which lay a nexus for two further canals. The most northerly of these, some 40 m across and 6 m deep, branched off from the Fossa Traiana and headed for the Tiber in a northeasterly direction. It ran alongside the southeastern side of the hexagonal basin and acted as a conduit for cargoes transshipped onto the *naves caudicariae* destined for Rome, and a substantial river port developed at the point where it intersected with the Tiber at the Capo Due Rami (Keay and Millett 2005a: 288–90). The other canal headed southwards from the Fossa Traiana. At its northernmost point it measured *c.* 90 m across, and was bridged by a substantial east–west bridge that provided access to the *statio marmorum* from the Via Flavia (Fig. 2.8).⁹⁸ Further south, the canal narrowed to *c.* 20 m and then would have intercepted the Tiber at a point opposite the small harbour at Ostia.

Lastly there was a northern canal that ran from the Tiber to the north of the river port at Capo Due Rami in a northwestern direction. It was probably of Claudian date and may have been excavated both to provide flood relief and to facilitate the movement of material during the creation of the new port (Keay and Millett 2005a: 272). If it could be shown that it continued into the second century AD, there would be grounds for arguing that it could have acted as a key conduit for the movement of salt from the Campus Salinarum Romanarum to the Tiber and thence to Rome, as well as to the Claudian basin at Portus, from whence it could have been exported.⁹⁹

THE ROADS

Although the river and canals would have carried most of the traffic between Ostia, Portus and Rome, their role was supplemented by a network of roads that was fully developed in the course of the second century AD. The close relationship between Portus and Ostia had given rise to the need for the establishment of a road, the Via Flavia, by the late first century AD. This ran southwards from the Pons Matidiae on the south side of Portus to another bridge (Germoni *et al.* 2011) over the Tiber opposite Ostia. Communications between Ostia, Laurentum (Castelporziano) and Antium (Anzio) to the south were formalized with the establishment of the Via Severiana in the later second century AD (Fogagnolo and Valenti 2005: 7–24). There was no road northwards from Portus to Alsium (Palo) or Centumcellae, which were approached either by sea or by means of the Via Aurelia from Rome.

The extent of the road-based connection between Portus and Rome prior to Trajan is uncertain, although the Via Campana had provided communication between the Campus Salinarum Romanarum and the City since the Republican period (Scheid 2004), while excavated stretches of the road well to the north-east have yielded evidence of Claudian reconstruction (Serlorenzi and Di Giuseppe 2011). However, it is clear that it was only in the Trajanic period at the latest that an extension of the Via Campana¹⁰⁰ was built from Portus northeastwards to intercept with the pre-existing stretch (Keay and Millett 2005a: 288–90; Serlorenzi and Di Giuseppe 2011). Although there is still considerable polemic about the precise route taken by the Via Portuensis, and its relationship to a continuing Via Campana, this new extension ensured that henceforth there was a direct road-based connection from Portus to the commercial buildings in the Transtiberim at Rome. It is also important to note that there was a key point of intersection between the road and the Tiber at Santa Passera.

The Via Ostiensis, by contrast, which ran from Ostia to the southeastern part of the City, had been established as early as the fourth century BC and remained an important route of communication throughout the Imperial period. The key point of intersection between the road and the Tiber lay near the site of the later church of San Paolo fuori le mura.

LIMITATIONS

All these considerations need to be tempered by a realization that this port-system was far from perfect. The Claudian basin, for example, was still vulnerable to the northwards drift of sediment from the mouth of the Tiber, and would have needed to be dredged continually. Further, despite the establishment of the canal system under Claudius and Trajan, the lower Tiber valley between Rome and the mouth of the Tiber was still subject to frequent floods. Indeed, in his panegyric to the Emperor Trajan of AD 105, Pliny (*Letters* 8.17.1–2) deplures the floods that occurred despite the emperor's construction of a canal, possibly a reference to that which he built at Portus.

There was also the danger of serious bottlenecks throughout the system (Fig. 2.9). The worst of these would have been at the junction of the Canale Trasverso and the Fossa Traiana (Fig. 2.9, A), the intersection of the Trajanic Canal, the Fossa Traiana and the Portus to Ostia canal (Fig. 2.9, B), the junction of the Fossa Traiana and the Tiber at Capo Due Rami



FIG. 2.8. Results of a geophysical survey of the Isola Sacra, showing the position of the canal that may have connected Portus and Ostia. (Portus Project.)

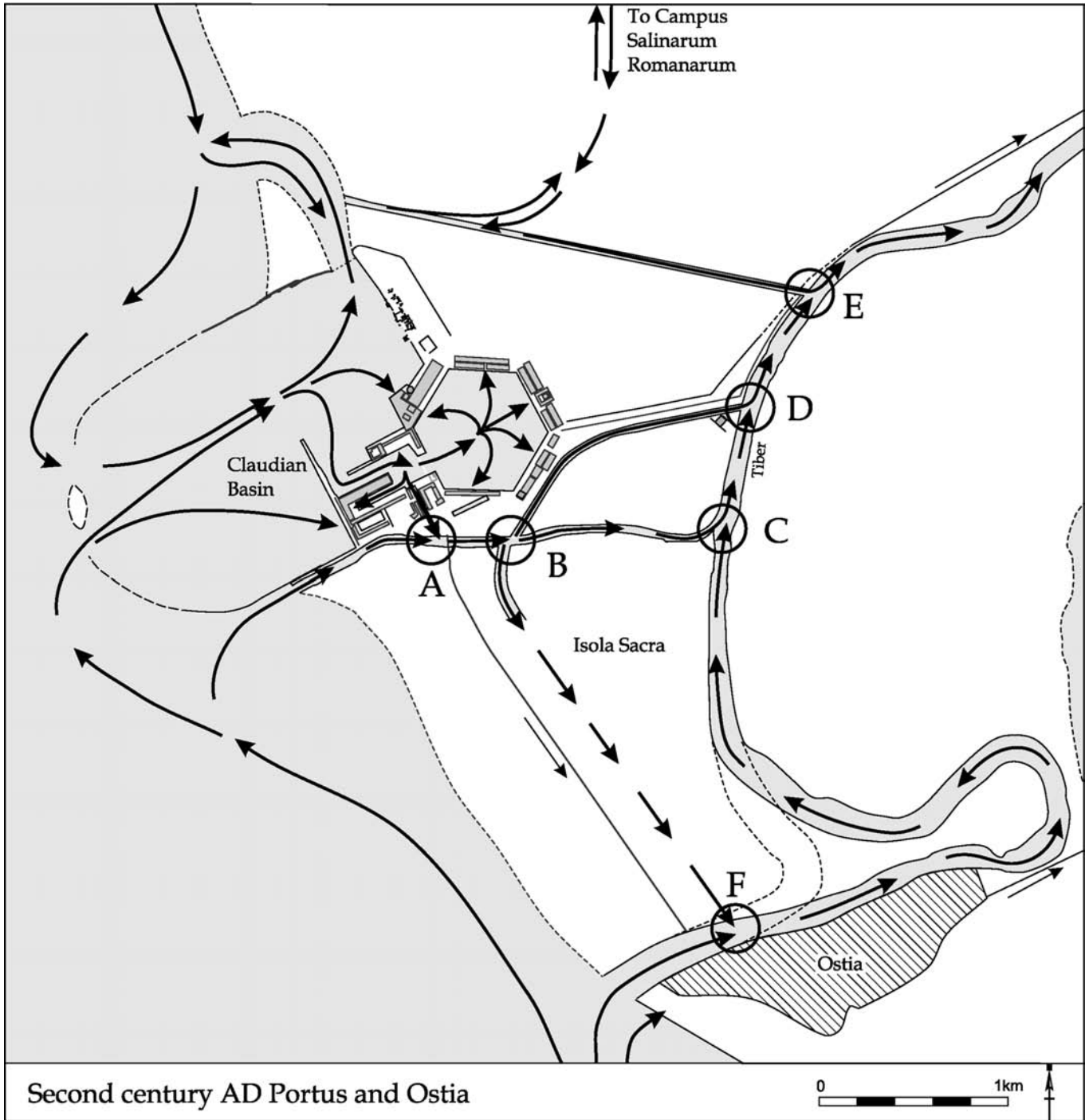


FIG. 2.9. Interpretative plan of movement within Portus and between Portus, Ostia and the Tiber. For ease of reference this is based upon movement inwards towards Rome; it needs to be remembered that traffic also flowed the other way. The circles denoted by capital letters represent bottlenecks in the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

(Fig. 2.9, C), the intersection of the Trajanic canal and the Tiber (Fig. 2.9, D) and the junction of the Claudian canal and the Tiber (Fig. 2.9, E). The port and river authorities must have developed an effective way of coordinating information about the movement of

ships and boats if these were to be avoided, although the details elude us. Another difficulty was presented by the fact that, since the Rome-bound traffic would have headed up the west side of the Tiber from Portus, the river-craft would have had to transfer to

the east side at some stage if they were to unload in the Emporium (Brandt 2005: 41); similarly, Portus-bound vessels heading southwards from Rome eventually would have had to transfer to the west. The challenge of coordinating this up- and down-river traffic must have been considerable.

OVERALL SIGNIFICANCE

The Tiber, the canals and the roads were an integrated system of transport and communication that connected Ostia and Portus with Rome, creating what was in effect a single variegated port landscape. This included the harbours and warehouses of Portus, the Campus Salinarum Romanarum, the settlement and adjacent cemetery on the northern side of the Isola Sacra, the gridded landscape of the Isola Sacra itself, the Trastevere Ostiense, the port city of Ostia, agricultural areas to the east of Ostia, the river ports and associated communities up the Tiber, and of course the river port of Rome. The Tiber and its associated canals would have taken the majority of the heavy cargoes that had moved through Portus and, to a lesser extent, Ostia, leaving the roads free for the movement of officials, travellers and other individuals. Furthermore, the interception of both roads with key river ports points to a high degree of integration between riverine and terrestrial communication and transport. Overall, therefore, this communication network provided all three ports with a degree of connectivity that was sufficient for them to function together in a coordinated and integrated manner. Boats bearing cargoes and people from the Mediterranean were able to flow to the capital and back to the sea again, while those from central Italy were able to move down the Tiber to Rome, and then outwards into the Mediterranean.

Recent work has suggested that the volume of traffic within the system was considerable.¹⁰¹ One recent study has attempted to calculate the scale of shipping on the basis of estimates for imports of olive oil, wine and fish sauce as well as grain, suggesting that *c.* 1,807 sea-going ships may have anchored in the Trajanic harbour at Portus each year, or between 12–13 and 21–2 per day within the sailing season (Brandt 2005: 34). These figures represent a substantial increase over those calculated as having moved between Puteoli, Ostia and Rome in the period prior to the establishment and development of Portus under Claudius and Trajan, and, thus, illustrates the impact of the latter.¹⁰² It is riskier to calculate the number of *naves caudicariae* that would have been needed every

day for loading at Portus, being towed up the canals and the Tiber to Rome and back again, although a figure of between 152 and 264 has been suggested (Brandt 2005: 40–1). It needs to be pointed out, however, that all these estimates are notional calculations and do not take into account the inevitable delays that would have occurred during the registration and unloading of ships,¹⁰³ or by congestion in the movement of goods by canal and river to Rome.

REGIONAL IMPLICATIONS

The three-way relationship of Rome, Portus and Ostia had major implications for the roles of the Tyrrhenian ports to the south of the Tiber mouth. Since it is recognized that Puteoli continued to play some kind of role in supplying Rome down to the later second and early third centuries AD (Keay 2010), there is a strong case for arguing that Antium, Tarracina (Terracina) and Cumae¹⁰⁴ acted as stopping points for ships sailing northwards to Portus after the Trajanic enlargement.¹⁰⁵ No doubt this also would have enhanced market opportunities for the ports and their hinterlands.

There were also consequences for the ports lying to the north of the Tiber that can be understood really only with reference to Centumcellae (Civitavecchia). This was another artificial port, situated on the coast to the north of Portus, close to a key bend in the Via Aurelia. It was established by Trajan between AD 106 and 110 (Bastianelli 1954: 15–17),¹⁰⁶ comprised an outer and an inner basin, both of which were much smaller than those at Portus, and was served by a major urban settlement.¹⁰⁷ While important archaeological research has been undertaken here more recently (Maffei and Nastasi 1990: 209–14; Toti 1992: 13–50; Quilici 1993; Caruso 2003) (Figs 2.10 and 2.11), much still remains to be learnt about the layout of the port, and about the range of goods that moved through it. The rationale for its creation is unclear and has generated considerable discussion. The discovery of some 40 tombstones of *classarii* has led some to suggest that it was a base for the Roman fleet (Bastianelli 1954: 25–7), while others have argued that it may have been a refuge for Portus-bound ships during bad weather, or for ships with cargoes bound for Rome from Gaul and Hispania (Meiggs 1973: 59).

While this paper has no new information to add, two observations can be made. Firstly, Centumcellae was completed by AD 110. This was up to four years before the inauguration of the hexagonal basin at Portus, and at least seven years before the completion

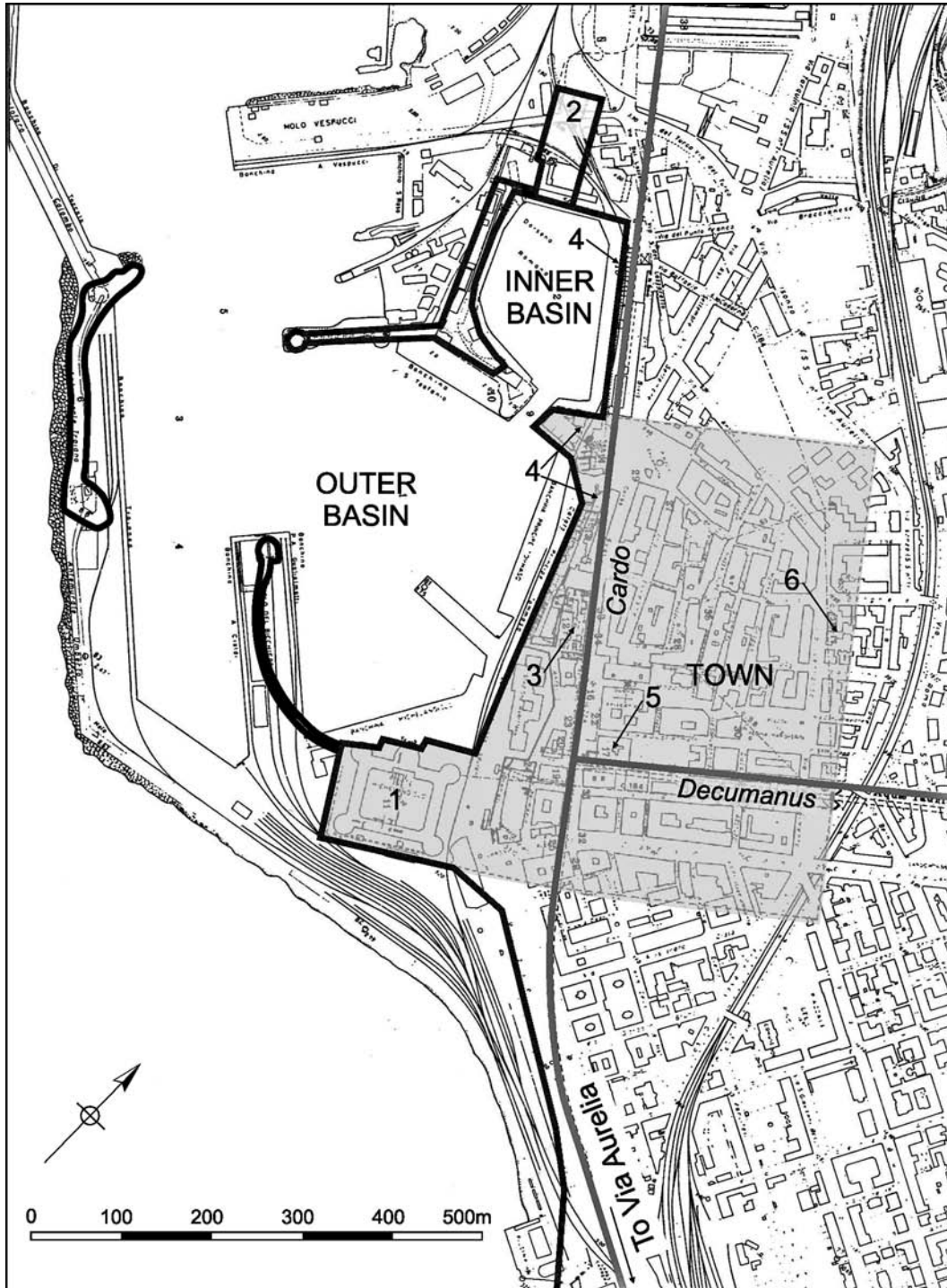


FIG. 2.10. Plan of Centumcellae. (After Maffei and Nastasi 1990: fig. 254 with additions.) Key: 1. Trajanic building; 2. basilical building; 3. complex with baths; 4. warehouses; 5. aqueduct; 6. tombstone of a *classarius*.

of the Darsena and Palazzo Imperiale. Since there is a strong likelihood that the Claudian basin at Portus could have continued to function during the construction of the hexagonal basin, it is likely that the port could have continued to import and export on a large scale. At the same time, however, Centumcellae

temporarily could have absorbed the shipping that was eventually to be absorbed by the Trajanic basin between *c.* AD 112/114 and 117, after which much of it could have switched to Portus.

The only direct land-based access from Centumcellae to Rome was southeastwards along the Via



FIG. 2.11. View of the harbour at Centumcellae. (Photo: Simon Keay.)

Aurelia. This suggests that after its initial role in ‘supporting’ Portus, the port may have acted henceforth as a terminus for ships sailing southwards along the Tyrrhenian coast from Gallia Narbonensis by way of the ports of Pisae (Pisa), Luna (Luni), the Vada Volaterrana, Populonia, Cosa (Ansedonia), Pyrgi and Alsium (Palo),¹⁰⁸ as well as for ships coming eastwards across the Mediterranean from northeastern Hispania Tarraconensis and Sardinia (Fig. 2.12).¹⁰⁹ In this scenario, goods unloaded at Centumcellae could have been transferred along the Via Aurelia into Rome and the Transtiberim.¹¹⁰ One also imagines that cargoes unloaded at Centumcellae could have been sent by sea southwards to Portus for redistribution to other parts of the Mediterranean. Inevitably, however, this is a hypothesis that can be tested adequately only once more ceramics are uncovered from excavations.

All of this suggests that there was a northern and southern network of ports serving the Capital. Portus served as the principal hub for all the ports of the Tyrrhenian coast, but in particular for the chain of ports that extended southwards towards Puteoli, and that drew upon supplies primarily from the southwestern and south-central Mediterranean. Centumcellae, by

contrast, was a secondary centre, which channelled some goods from the northeast Mediterranean to Rome by road, and others to Portus for redistribution elsewhere.

THE PORT SYSTEM OF IMPERIAL ROME

The supply of the city of Rome with foodstuffs and material was a logistical challenge without precedent before the modern era, and it was only with the Trajanic enlargement of Portus that Rome had developed the maritime infrastructure adequate to meet it. The fully developed port, complemented by Ostia and the river port of Rome, constituted a hub in a port system that drew upon key nodes at Centumcellae and key ports along the Tyrrhenian coast. As the hub, Portus played a redistributive role to the river ports of Ostia and Rome, thereby ensuring that their roles became complementary. The term ‘system’ is used here to describe the interconnections between all four ports. Ostia acted as a primarily administrative centre that supported the harbour-led role of Portus, while the facilities at Rome received the increased volume of merchandise from overseas and the Tiber valley, and

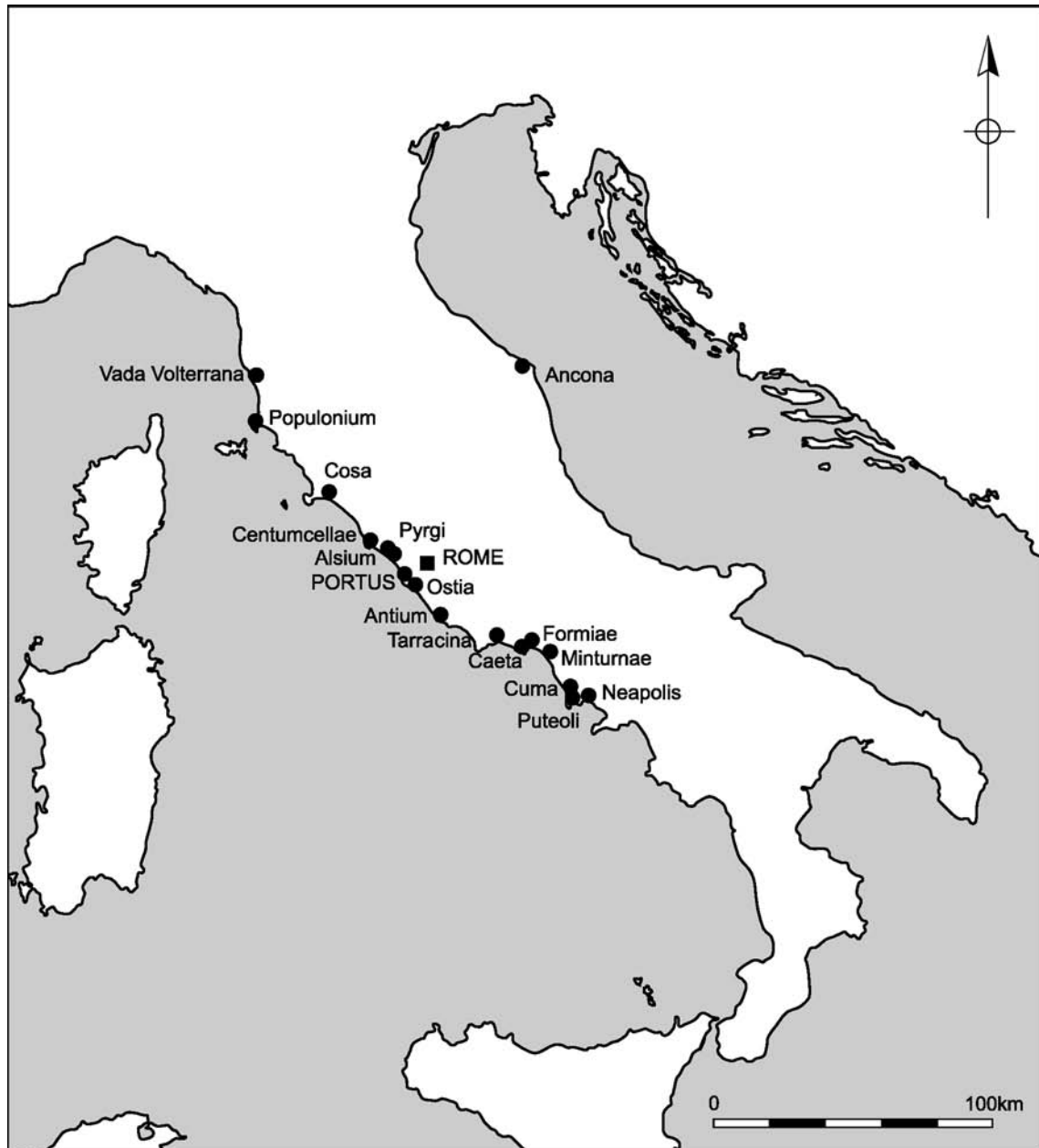


FIG. 2.12. The principal Tyrrhenian ports in connection with Portus, Ostia and Centumcellae. (*Portus Project.*)

redistributed them within the City and beyond. The balance of the ceramic and marble evidence from Portus, together with the epigraphic record from Ostia, suggests that both ports were central to networks that supplied imports primarily from the southern, and to some extent the eastern, Mediterranean, with a particular emphasis upon the north African provinces. Portus would have played a significant role also in the export of commodities from the Tiber valley and Rome, and in the redistribution of imported cargoes.¹¹¹ Until the reign of Trajan, this system developed gradually, as a series of ad hoc measures. However,

his enlargement of Portus, his establishment of Centumcellae, the upgrading of infrastructure at Ostia and the construction of port facilities in Rome can have been the result only of integrated strategic planning. What little is known about the management of the infrastructure of the city of Rome suggests that it would have required the *curatores alvei Tiberis et riparum et cloacarum urbis*,¹¹² imperial procurators¹¹³ and the *praefectus annonae* to have acted in concert, and for the commitment of a significant proportion of imperial resources derived from the recently completed conquest of Dacia (AD 101–6).

Portus, Ostia and Rome together were able to offer up to 10 km of quay space to shippers and merchants. This dwarfed the provision at other broadly contemporary Roman harbours in the west Mediterranean, such as Carthage and Lepcis Magna (Hurst 2010a). Indeed, its only real parallel in terms of scale was the Alexandria–Mareotis complex (Khalil 2010), although it needs to be remembered that its primary mission was export, while that of Portus was largely import. Portus was also unique in terms of the scale of the engineering work involved and represented a triumph over the natural constraints that existed between Rome and the mouth of the Tiber.

The success of the port system of Imperial Rome is in large part to be ascribed to the network of canals that connected Portus to Ostia and the Tiber, particularly from the reign of Trajan onwards. These enabled the rapid movement of goods and people from the Mediterranean sea to the centre of Rome and back again, and ensured that Portus could act as the hub for ships originating at ports along the Tyrrhenian coast south of the Tiber to Puteoli, as from the south-western, south-central and eastern Mediterranean. It was complemented by Centumcellae, which could have acted as a secondary hub for ships from ports northwards up the Tyrrhenian coast to the north of the Tiber, Gallia Narbonensis and northeastern Hispania Tarraconensis. Indeed there is epigraphic evidence that points to the involvement of imperial officials in port administration, both here¹¹⁴ and at Antium,¹¹⁵ as well as at Portus and Ostia.

FUTURE DIRECTIONS

Our knowledge of all four ports clearly is far from complete and much needs to be learnt about their development and about how their different basins and buildings were used. Portus has the greatest potential here, since large tracts of its portscape are available for archaeological excavation and survey. Careful analysis of the use of basins and canals by different kinds of ship and boat, and their topographic relationships to warehouses and other kinds of building, could help us better understand how the port actually functioned. Even though a considerable stretch of the riverside port at Ostia may still survive intact beneath the Museum and adjacent areas, this has never been excavated in the past. Structures associated with the river port of Rome are deeply buried and can be accessed only by fortuitous rescue excavations. Port installations at Centumcellae provide a similar challenge, since the

site still functions as the modern port of Civitavecchia. There are similar lacunae in our understanding of the immediate suburbs and surrounding hinterlands of the ports, where one might hope to find evidence for the industrial and agricultural activities that contributed to their economies, although recent work at Portus (Morelli *et al.* 2011) and in the Isola Sacra (Germoni *et al.* 2011) is starting to fill in the gaps in our knowledge.

As regards the Tiber and associated canals, there are major gaps in our knowledge at the most basic level. We still do not know the course of the Tiber in antiquity, particularly in the stretches closer to Rome, and even less about the nature and scale of the embankment work undertaken by the *curatores*. Nor do we know much about the physical nature of the canals and their relationship to the Tiber and surrounding country, although geophysical survey near Portus has started to provide some indications as to their extent and depth. The river ports also played a crucial role in the port system, but we still know very little about their scale, character and development. While some of those closer to Rome, such as Pietra Papa, are still accessible for excavation, the river port at Capo Due Rami holds out the best potential for future research.

Past attempts at calculating annual figures for the numbers of ships that passed through the system are useful¹¹⁶ but probably provide us with a minimum figure. This is because they are based on a consideration of Portus alone, excluding Ostia and Centumcellae from consideration. Also they focus on the carrying needs of grain alone, and exclude the shipping needed for all the other kinds of merchandise imported to the City, particularly the larger amphora and marble cargoes.¹¹⁷ An alternative approach would be based upon the annual capacity of the harbours and canals at each of the ports within the system for accommodating different categories of known ships.¹¹⁸

The study of ceramics has done much to transform our understanding of the range of goods imported and exported through these ports in recent years. However, the spread of the evidence from each of them is still very uneven, with most published material deriving from Ostia, less from Portus, and virtually none from the river port at Rome or from Centumcellae. Also there are very few coetaneous deposits, which makes the task of intercomparison between all sites for any one period very difficult. The situation for marble is even more challenging. Furthermore, as is well known, ceramics tell us about one aspect of traded goods, and virtually none of the animal bones or

environmental evidence that might inform us about the movement of other traded goods has been published from any of the ports. More indirect sources of evidence, such as the warehouses, provide a particularly difficult interpretative challenge. Few have been excavated to modern standards, so there are few examples where we actually know what might have been stored in them; but even then this tends to refer to the time when the building was abandoned or destroyed.¹¹⁹ Inevitably, therefore, content is inferred indirectly through analysis of plans or epigraphic evidence. In the end, therefore, it is salutary to think that, when trying to understand the scope and origins of goods arriving at the ports, one still relies heavily on a combination of historical, epigraphic and archaeological data.

NOTES

1. Le Gall (2005: 289–304) has provided a survey of the epigraphic and literary evidence for the contacts between Portus and Ostia, on the one hand, and the rest of the Mediterranean, on the other.
2. Issues discussed by Tchernia (2003).
3. Including: Mocchegiani Carpano 1984; Mocchegiani Carpano 1985; Aldrete and Mattingly 1999; Mattingly and Aldrete 2000; Tchernia and Viviers 2000; Zevi 2001; Aguilera Martin 2002; Nicolet 2002; Pavolini 2002; Tchernia 2003; Brandt 2005; Le Gall 2005; Keay and Paroli 2011.
4. I should like to thank Christer Bruun, Pascal Arnaud and Filippo Coarelli for reading and commenting upon earlier drafts of this paper. Any errors within it remain my own.
5. See also: Rickman 2005.
6. Maischberger (1999a) provided a useful brief overview of the river.
7. For the late antique port of Rome, see: De Caprariis 1999.
8. See: Meiggs 1973: 303–4; Robinson 1995: 86–94; Daguet-Gagey 2001: 89–92; Le Gall 2005: 155–208.
9. Le Gall (2005: 213–35) has discussed the evidence primarily within the City.
10. Work on the *curatores operum publicanorum*, including that of Kolb (1993) and Bruun (1997; 2006), suggests that these officials played a largely ceremonial role.
11. They are found throughout Rome in contexts of the second and third centuries AD: see a good recent synthesis by Rizzo (2003).
12. Setälä (1977) analysed evidence for the landholders involved in production. See also: Filippi and Stanco 2005.
13. The location of the *Por(tus) Cor(nelii)* and *Por(tus) Lic(inii)* is less certain (Camilli 1999b; 1999c), but also presumably must have been somewhere along the Tiber.
14. Coarelli (1997: 358–61) reread fragment 37 of the *Forma Urbis marmorea*, taking NAVALEMFER to read *navale Marci Ferocis* and associating this with a building in which there are alignments, which he interpreted as bricks stacked ready for use. See also: Manacorda 2005.
15. The officials and other matters relating to this have been discussed by Le Gall (2005: 155–208). This *curatela* was established to maintain the Tiber bed to ensure unobstructed navigation along the Tiber and to reinforce the banks of the river to protect the City from periodic floods; it was established by Augustus or Tiberius (Mocchegiani Carpano 1984: 40–1). Bruun (2006) has looked at this *curatela* in the context of all three Roman *curae*.
16. A site traditionally identified with Santa Maria in Cosmedin, but which more recently has been located further south, near the Temple of Flora, adjacent to the Temple of Ceres on the lowermost slopes of the Aventine (Coarelli 1999b).
17. The possible site of salt warehouses or *salinae* (Castagnoli 1980: 36, fig. 1 n. 5).
18. This date is derived from an analysis of brick stamps.
19. See, for example: Hurst 2010b: 33.

20. These buildings are visible on the *Forma Urbis* plaque 24 (Rodríguez Almeida 1981: tav. XI). Aguilera Martín (2002: 71) suggested that there is evidence for the separation of the large rooms that constituted the Navalía with the construction of brick dividing walls.
21. Discussed by Rickman (1980: 97–104), Virlovvet (1995: 100–13) and Coarelli (1996a), amongst others. The buildings illustrated in plaques 24a–c of the marble plan of Rome have been interpreted as the *ergastula* of those who worked in the Horrea Galbana (Rodríguez Almeida 1981: 102–3).
22. The Horrea Aniciana also may have been located in this general area (Palombi 1996a).
23. Furthermore, Taglietti (1994: 190–2) argued that a proportion of the Baetican olive-oil amphorae imported to Rome would have been transshipped onto *naves caudicariae* at Portus without being stored at the port, before being stored in warehouses in the Emporium district that were managed by associated *mercatores*.
24. See, most recently: Aguilera Martín 2002: 125–218; Blázquez Martínez and Remesal Rodríguez 2003.
25. Coarelli (1996c) suggested that marble might have been stored in the Horrea Caesaris, which is possibly to be identified as a renamed Horrea Galbana, located immediately to the southeast of the Navalía.
26. Nevertheless, Panciera (1980: 238–40) suggested that the latter route could have been followed. He argued that the Portus Olearius Vici Victoriae mentioned on a mid-first-century AD tombstone perhaps might be identified with a point on the northern side of the Palatine. It would suggest that the oil passed northwards from the Emporium to the Portus Tiberinus, and from there via the Velabrum to the northern side of the Palatine. See also: Chioffi 1999.
27. Maischberger (1999b) provided a useful overview.
28. The most recent work by Catalli and his colleagues (2009) provides important information of a hitherto unknown *horreum* of Severan date between the Via Portuense, Via delle Mura Portuensi and Via Carcani.
29. Although Roman historians attributed its foundation to Ancus Marcius in the seventh century BC (Meiggs 1973: 16–27).
30. A task coordinated by the *quaestor Ostiensis*, an official who was stationed at Ostia and has been attested down to the reign of Claudius (Meiggs 1973: 298–310; Bruun 2002: 161–3).
31. Namely a *procurator Portus Ostiensis* (Bruun 2002: 163–4).
32. Discussed by Rickman (1980: 73–9).
33. It was inaugurated by Nero in AD 64 (Keay and Millett 2005c: 12).
34. But see n. 61 for new evidence that suggests that this may be of Trajanic date.
35. A development that would have required the excavation of a deep access channel through the Claudian basin and up to the entrance of the Trajanic basin.
36. Discussed on p. 41.
37. See, for example: Tchernia and Viviers 2000: 770.
38. *CIL* XIV 4708; see also: France 2001: 135–7.
39. Indeed Mar (2002) argued that it was a city whose form had been determined by commercial considerations.
40. Something that Heinzelmann (2002: 117–20) argued in terms of an urban ‘deficit’.
41. Meiggs suggested that the core of the building might have been Roman, while visual inspection makes it clear that much, if not all, of the lower part of this building is composed of Roman masonry.
42. Both Strabo (5.3.5) and Dionysius of Halicarnassus (*Antiquitates Romanae* 3.44.3) state that ships also moored and unloaded along the seafront, although there is no evidence for any port installations here; see also the discussion by Aguilera in this volume (Chapter 5).
43. The *molo repubblicano* close to the northeasternmost limit of the meander of the ancient course of the Tiber (*fiume morto*) probably marks the northernmost extent of this: see Arnoldus-Huyzenveld and Paroli 1995.
44. Recent geophysical survey undertaken in the course of the Portus Project (2011) has revealed a line of at least three large warehouses running along the northern bank of the Tiber to the east of the modern Ponte della Scafa.
45. See p. 44.
46. The account of Rickman (1971: 15–86) still remains the best analytical account of these.
47. It has been suggested that the Grandi Horrea at Ostia were first constructed c. 100 BC and that the origins of the Horrea di Hortensius are to be found in the later first century BC (Coarelli 1994b: 40–2). The identification of the Forum Vinarium and its close association with the Republican sanctuary on the Via della Foce (Coarelli 1996d) suggest that there may have been Republican warehouses in this area also.
48. Commencing in the years AD 112–15 (Mar 2002: 153).
49. However, these figures do not take into account the warehouses revealed in the course of the recent geophysical survey of Ostia (Heinzelmann 2002: Taf. IV.2), the chronology of which will remain uncertain until excavation is undertaken.
50. An argument developed by Rickman (1971: 23–8) but without any firm epigraphic evidence.
51. See, for example: Meiggs 1973: 278–83, fig. 24.
52. Rickman (1971: 37–8) stressed the unusual arrangement of the entrances in this building.
53. The best documented deposits come from the Terme del Nuotatore (for example — Palma and Panella 1968; Panella 1970; Panella 1973; Manacorda 1977; Carandini and Panella 1981; Panella 1986; Panella 1991); see also Rizzo in this volume (Chapter 4), discussing a site that lies some way to the south of the Decumanus Maximus, but which for many years has acted as the ceramic ‘signature’ of the port as a whole. This is being complemented by material from sondages at different points across the port (De Sena 2002; Martin *et al.* 2002; Martin and De Sena 2003; Martin 2005a; Martin 2005b; Martin 2006; Martin 2008), and outside (Hesnard 1980), although these have yet to be published fully.

54. Marble also has this potential although quantified evidence is rarer. See, however, the recent study by Pensabene, who has provided a masterful overview of the range of marble decoration at Ostia, as well as exploring its origins (Pensabene 2007: esp. pp. 631–89).
55. The discovery of a lead *fistula* stamped with the name of a *praefectus annonae* of Neronian date has been interpreted as evidence for the presence of a *statio annonae* close to the Porta Romana, at the western edge of the port (Cébeillac-Gervasoni, Caldelli and Zevi 2006: 151–2).
56. See, more recently: Cébeillac-Gervasoni, Caldelli and Zevi 2006: 225–31.
57. See the discussion of Meiggs (1973: 305–8) and Sablayrolles (1996).
58. Spurza suggested that this was a public building of some kind. Its origins are to be sought in the Trajanic/Hadrianic periods, while the key structural phases are of Antonine and Severan date.
59. See, for example: Meiggs 1973: 311–36.
60. See p. 49.
61. The date of the Trajanic enlargement of Portus is unclear. Meiggs (1973: 162) suggested a date of AD 112 on the basis of the commemorative coins depicting the hexagonal basin. However, a date of between AD 112 and 114 has been confirmed by recent reanalysis of these coins (Woytek 2010), which suggests that they were issued during Trajan's sixth consulship, and not the fifth. On the other hand, brick stamps from the rebuilding of the Darsena (n. 74 below) and from the Portus Project excavations of the Palazzo Imperiale date to AD 117/18. Assuming that construction work began after the conclusion of the Dacian wars in AD 106, this suggests that while the newly-enlarged port would have been functioning in some sense by AD 114, it would have been fully operational only after c. AD 117. See, however, n. 79.
62. The harbour was entered from the west, although it is possible that there was some kind of secondary entrance to the north (Goiran *et al.* 2011).
63. This figure is approximate, and is based upon the interpretation of a geophysical survey of the entire port complex (Keay *et al.* 2005: pull out), together with recent work that shows that the Claudian basin now encompassed c. 200 ha (Morelli, Marinucci and Arnoldus-Huyzenveld 2011), if not more.
64. This overall figure can be broken down as follows: Claudian basin — 2.86 km; Canale di Imbocco — 0.82 km; Magazzini Traianei — 0.47 km; Trajanic basin — 2.1 km; Canale Trasverso — 0.70 km; Fossa Traiana — 3.71 km; Trajanic Canal — 2.82 km; river port — 0.41 km. Precisely how much of this 'available' space was actually used and whether by ships or boats is, of course, unclear. Recent work by Boetto (2010), however, is a first attempt at answering this kind of question by matching the draft of ships and boats with the depth of basins at Portus. Wilson, Schörle and Rice in this volume (Chapter 20) base their assessment of the capacity of Portus on these figures.
65. Rickman (1998) provided a stimulating review of the evidence for the coordination and storage of goods at harbours. Sirks (1991: 256–9) also discussed the evidence from the perspective of the *corpus saccariorum*.
66. Casson (1971: 297–9), however, alluded to the inevitable delays that were experienced by ships awaiting clearance to leave Portus.
67. It is worth remembering that while it is perhaps natural to ascribe economic or commercial functions to these buildings, their position in the harbour would have made them ideal for the naval presence at Portus that upheld the authority of officials based there. The discovery at Portus of a number of tombstones of *militēs* of the second and third centuries AD from the fleet at Misenum (*CIL* XIV 233, 237, 239, 242, 534, 545, 546, 548, 555), including one belonging to a centurion of the *hexeres Ops* (*CIL* XIV 232), suggests that it hosted a base of a detachment of the Misenum fleet. The hexagonal basin, and specifically the Palazzo Imperiale, would have been a logical focus for this. For the naval question generally and the possible roles of the detachment, see: Starr 1941: 17–18; Meiggs 1973: 27, 216, 304; Reddé 1986: 203–6.
68. For recent excavations at this site, see: Keay, Earl and Felici 2011.
69. The so-called *alpha titulus* (Remesal Rodríguez 1998: 191).
70. The so-called *beta titulus* (Remesal Rodríguez 1998: 192).
71. The so-called *gamma titulus* (Remesal Rodríguez 1998: 192).
72. The so-called *delta titulus* (Remesal Rodríguez 1998: 192).
73. Rickman (1998) discussed indirect papyrological and archaeological evidence for the monitoring of the arrival of grain at Portus and Ostia. For discussion of the work of members of the *corpus* of the *mensores frumentarii*, although much of the evidence derives from Ostia, see also: Sirks 1991: 260–4.
74. This has been dated to the Neronian period on the basis of a brick stamp of L. Iulius Rufus (Verduchi 2005: 257). Bianchi (2007: 123) has redated this to the period AD 117–18, suggesting that the Darsena, and presumably adjacent structures, were Trajanic in date.
75. See also the comments of Rickman (1998: 321–2) on unloading.
76. These are referred to in the Theodosian Code as the *horrea* or *condita Portuensium* (*Codex Theodosianus* 14.4.9).
77. This range excludes the Grandi Magazzini di Settimio Severo on the assumption that this was not a warehouse.
78. The site of the Tenuta del Duca excavated in 2008 by Fabrizio Felici of the Parsifal Cooperativa di Archeologia (Rome).
79. It is possible that this canal is that mentioned by Pliny (*Letters* 8.17.1–2) in his panegyric to the Emperor Trajan of AD 105. If so, it suggests that the canal was one of the first elements to be built in the new Trajanic enlargement, with the remainder following in the period between 106 and c. 117.
80. An inscription discovered in the Episcopio Portuense (Thylander 1952: B.324), dating to AD 224, mentions the existence of a *statio frumentariorum*.

81. Recent work by Bukowiecki and Boetto at the latter site has confirmed that grain was a major commodity stored from the Trajanic period onwards (Boetto and Bukowiecki 2010).
82. There have been virtually no other excavations with material of early Imperial date; for others with late antique material, see: Ciarrocchi *et al.* 1993.
83. The comparative rarity of Baetican Dressel 20 amphorae has been noted also for Ostia, as discussed in this volume by Rizzo (Chapter 4), and contrasts with their abundance at Monte Testaccio and elsewhere in the City. This lends some empirical support to the idea that a proportion of the imported Dressel 20 amphorae was transported directly to Rome without being warehoused at Portus (Taglietti 1994: 191). If so, it is unclear why African and Tripolitanian oil amphorae also were not so privileged. The broader issue of the production of Dressel 20 along the Guadalquivir valley and the mode of their export to Rome is discussed by García Vargas (Chapter 12) and Remesal Rodríguez (Chapter 13) in this volume. Bernal (Chapter 11) focuses upon the production of *salsamenta* and the containers that carried it in the vicinity of Gades (Cádiz); the latter are well attested at Portus and Ostia.
84. Discussed by Fant (1992).
85. This is an issue discussed by Pensabene in this volume (Chapter 3). He also mentions the discovery of additional marble debris on the banks of the Trajanic basin and between the Canale di Comunicazione Trasverso and the Episcopio on the north side of the Fossa Traiana. See also: Fant 1992; Pensabene 1994: 11–207; Pensabene 2007: 389–430, 599–603, 631–89. Some of the supply networks upon which these kinds of imports depended are discussed by Barresi (Chapter 19), while Beltrán (Chapter 14) discusses varieties of southern Spanish decorative stone that rarely seem to have reached Portus.
86. This was discovered during recent geophysical survey of the Isola Sacra (Germoni *et al.* 2011: 238, fig. 12.5). See also n. 98.
87. See, most recently: Boetto 2006.
88. Boetto (2010) has undertaken a first attempt at combining known ship sizes and basin capacities at Portus; working partially on the basis of these and data on the scale of the port in this paper, Wilson, Schörle and Rice (Chapter 20) suggest that there was space for some 330 large ships in the two main basins and several hundred smaller vessels berthed elsewhere, and dozens of others riding at anchor.
89. These have been discussed by Le Gall (2005: 275–83); see also: Casson 1965.
90. See, for example: Meiggs 1973: 290–6; Le Gall 2005: 314. Aguilera Martín (2002: 40) related the establishment of the western towpath to the abandonment of one on the eastern bank, a development that he ascribed to the establishment of Portus under Claudius and, later, Trajan. See also Aguilera Martín (Chapter 5) and Remesal Rodríguez (Chapter 13) in this volume.
91. A major deposit of worked marble at the Gasometro di San Paolo, between the Via Ostiensis and the Tiber to the south of the later Aurelian walls (Pensabene 1994: 209–54), suggests that some kind of river port for marble existed here, as well as at the *statio marmorum* in the Emporium to the north.
92. The evidence for this idea is unclear; Meiggs (1973: 195) briefly discussed the matter.
93. The *Traiectus Togatensium* (*CIL* XIV 403) may refer to one of these ferries. Aguilera (2002: 37–49) suggested that it is to be identified as the stretch of river between Ostia, the Isola Sacra and Portus; see also Aguilera (Chapter 5) in this volume.
94. See: Lugli 1953: 69–97; Le Gall 2005: 155–200.
95. See, for example: Le Gall 2005: 209–35.
96. It has been suggested that the *collegia* of all the river-craft fell under the authority of the *curatores alvei Tiberis et cloacarum* from the second century AD onwards (Robinson 1995: 93; Daguet-Gagey 2001: 92). Meiggs (1973: 303), however, expressed his doubts.
97. They perhaps should be understood in the context of Caesar's unfulfilled project to reroute the Tiber in Rome to lessen the danger of flooding to the City (Le Gall 2005: 130–3) and Nero's aborted attempt to connect Puteoli and Rome by means of a canal from the Lacus Avernus on the bay of Naples (Meiggs 1973: 57; Johannowsky 1990). Key parallels for the use of canals in connecting harbours and the sea would be Ephesus (Groh 2006: 105, figs 23 and 24), Seleucia Pieria (Uggeri 2006: fig. 2) and Alexandria (Khalil 2010), but also Arles (Long 2009), Aquileia (Carré 2005) and Narbo Martius (Narbonne) (Cavero 2011).
98. See n. 68. One wonders whether this stretch of water might have been the concern of the *corporis traiectus marmorarius* referred to in an inscription from Ostia (*CIL* XIV 424).
99. Depending upon how one reads the evidence for a secondary northern entrance to the Claudian basin, adduced on the basis of environmental cores (Goiran *et al.* 2011).
100. It is likely that part of this stretch was referred to in fourth-century AD sources as the *Via Portuensis*.
101. More recent estimates include those by Mattingly and Aldrete (2000: 154–6) and Rickman (1991: 111–12). A problem with some of these approaches is that they build upon figures that are related to the *amna* and do not take into account shipping associated with small localized journeys, for example. Wilson, Schörle and Rice (Chapter 20) in this volume, by contrast, attempt to calculate the capacity of Portus for harbouring ships.
102. Tchernia and Viviers (2000: 779–81) suggested a total of 200 ships of 100–50 tonnes.
103. This could take up to a month (Casson 1971: 298–9).
104. Antium (Brandizzi Vitucci 2000: 21–31) is the best example. Tarracina is sometimes assumed to have been redeveloped under Trajan as well. Coarelli (1996e) argued convincingly against a Trajanic date for the harbour basin here, attributing it instead to the late first century BC, with a restoration under Domitian (Coarelli 1982: 323) and another under Antoninus Pius (*Scriptores Historiae Augustae, Antoninus Pius* 8.2). There is little doubt, however, that Trajan undertook a

major rebuilding of the military port at Ancona on the Adriatic coast (Sebastiani 1996: 27), commemorated on the surviving monumental arch of AD 115. There is still some debate about the precise position of the harbour at Cumae (Stefaniuk and Morhange 2005); wherever it was located, it is likely to have been of secondary importance to the neighbouring harbour of Puteoli.

105. But also with implications for lesser ports at Ardea, Caieta, Formiae, Minturnae and Liternum.
106. Pliny (*Letters* 6.31) records details of the harbour that was in the process of being built when he visited Trajan in his villa just outside Centumcellae.
107. In general, see: Bastianelli 1954: 11–49.
108. See: Raffelini 2002 (Luna); Pasquinucci and Menchelli 2003; Pasquinucci, Del Rio and Menchelli 2002 (the Portus Pisanus); Pasquinucci *et al.* 2006 (the Vada Volaterrana); Apro시오 and Mascione 2006 (Populonia); McCann *et al.* 1987 (Cosa); Enei 2008: 37–46 (Cosa).
109. Arnaud (Chapter 6) and Boetto (Chapter 8) both discuss this sea-route. For the Sardinian port of Carales, see: Colavitti and Deplano 2002; and for that of Olbia, see: D’Oriano 2002; Riccardi 2002.
110. One argument against the port’s playing what was in effect a role in the *annona* is the claim (Houston 1980: 163–6) that there was no epigraphic evidence for the involvement of imperial officials in the administration of Centumcellae. However, Bruun (1991: 274–5) mentioned the name of an imperial procurator stamped on a lead pipe from the port, possibly originating from the harbour, baths or an imperial villa.
111. This is still difficult to document in our current state of knowledge. An exporting role is suggested by the appearance of bricks manufactured in the Tiber valley at sites along the north African coast (Wilson, Schörle and Rice, in Chapter 20), which could have been used as ballast on returning ships; the same may be true also for lava millstones from the Orvieto region that are distributed around the western Mediterranean (Antonelli and Lazzarini 2010: fig. 3a). A redistributive role has been argued for marble by Pensabene (Chapter 3) and Gutiérrez and Rodà (Chapter 16), and for African red slip ware (Fentress *et al.* 2004).
112. Issues that lie beyond the scope of this paper. See, however: Robinson 1995: 83–94; Daguet-Gagey 2001: 82–95.
113. I owe this point to Christer Bruun.
114. See n. 110.
115. Bruun (1991: 282–3) mentioned the name of an imperial procurator from the port as well as the text STATIO URB, an office related to the installation of water supplies in some form.
116. See nn. 101 and 102.
117. The population of the city of Rome is in itself a polemical figure, as too the daily calorific requirements that are often used in these kinds of calculation.
118. Boetto (2010) modelled known vessel sizes to the area and depth of basins at Portus.
119. However, the careful excavations of warehouses at sites such as Ravenna (Augenti and Cirelli in Chapter 10), Thamusida (Papi and Martorella 2007), Caesarea Maritima (Patrich 1996) and Vada Volaterrana and the Nuovo Mercato Testaccio in Rome (Sebastiani and Serlorenzi 2008; 2011), which have provided information about contents as well as architecture, are starting to change our perceptions here.

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