

Harbor Structures of the Augustan Age in Italy

Piero A. Gianfrotta

University of Viterbo

While King Herod the Great was building his new city and harbor of Caesarea, Emperor Augustus was engaged in a general reorganization of the Roman Empire. His plan included a new design for the complex maritime system in the Mediterranean Sea.¹ The core, indeed the starting point, of the system was the harbor facilities on Italian territory in the vicinity of Rome, mainly along the central Tyrrhenian Sea, where ports were extensively developed by Augustus.

However, the Empire's broader need for harbors could not be satisfied by the sites along the Tiber. In fact, since the beginning of the second century B.C.E. a greater volume of trade and business was channeled through the harbor of Puteoli, known also as the Delus Minor of the Phlegraean coast (fig. 1).²

In addition to its role as terminal for Rome's maritime trade, mainly oriented toward the eastern Mediterranean and the East generally, the coast of the Phlegraean Fields, especially Baiae, was a densely populated area. It was considered a pleasant vacation site for Rome's political and financial élite (the "villa society," to use the well-chosen expression of J. D'Arms).³

From literary evidence we also know that, from early Augustan times, the region was crowded with both small and large construction facilities. These included not only those that built the great luxury villas of the Roman *nobilitas*, but also daring and impressive shipyards never before realized on such a scale.⁴

These construction facilities, private and public, differed in both character and function. To private investors and entrepreneurs belonged fish farming facilities, which were very well known at Baiae where they had developed extensively thanks to the discovery of some special construction methods. These facilities were developed by an enterprising builder with an appropriately "fishy" surname, Lucius Sergius Orata (i.e.,

¹ J. M. Roddaz, *Marcus Agrippa* (Rome, 1984), 87-182, 383, 476; M. Reddé, *Mare nostrum: Les infrastructures, les dispositifs et l'histoire de la marine militaire sous l'Empire romain* (Rome, 1986), 472-502.

² C. Dubois, *Pouzzoles antique, histoire et topographie* (Paris, 1907); *Puteoli*, ed. F. Zevi (Naples, 1993).

³ J. D'Arms, *Romans on the Bay of Naples: A Social and Cultural Study of the Villas and the Owners from 150 BC to AD 444* (Cambridge, Mass., 1970).

⁴ F. Castagnoli, "Topografia dei Campi Flegrei," in *I Campi Flegrei nell'archeologia e nella storia, Atti dei Convegni dei Lincei 33, Roma 1976* (Rome, 1977), 51-72.

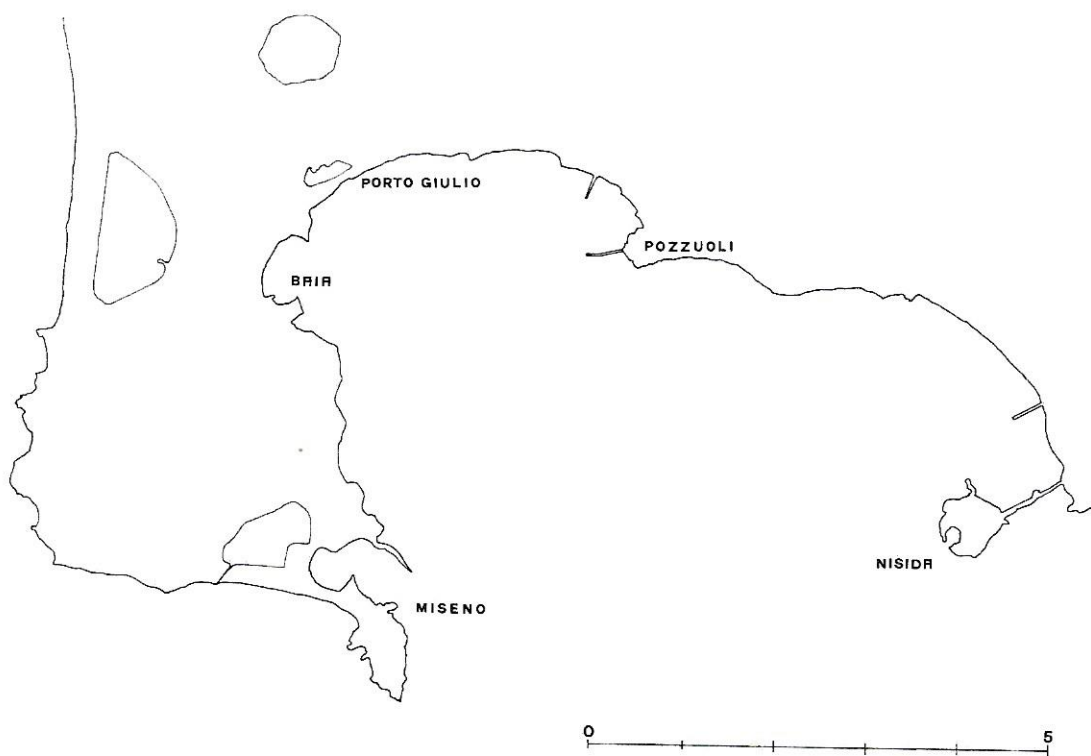


Figure 1. Gulf of Puteoli (Naples), general plan

Lucius Sergius Dory), who was attributed with inventing the *suspensurae* used in the underpaving of thermal baths (*calidaria*), which were quite numerous in and characteristic of the Phlegraean area.⁵

The large shipyard facilities were publicly owned and were operated for government purposes. They were, nonetheless, probably built with the aid of private funds, as with the public building program during the Augustan period. The first facility was the Portus Iulius, settled by Agrippa on the coastal lakes of Averno and Lucrino in 37 B.C.E.; then came the great harbor of Misenum, already operating for the military fleet during the second part of the Principate (ca. 10 C.E.); the long breakwater of the Puteoli harbor; the shipyards near the little island of Nisida; and the numerous facilities for the defense of the area outside the harbors along the entire coast from Nisida to Misenum.

⁵ Val. Max. 8.1.1; Pliny *NH* 9.168.

These great and certainly long-term building efforts, unprecedented and unrivaled in the ancient world, made Puteoli and the Phlegraean Fields important centers for maritime engineering. There are broad echoes of their importance persisting throughout Augustan literature, mainly in Horace (*Od.* 2.18, 20–22; 3.1, 33–35; 3.24, 1–4) and Virgil (*Aeneid* 9.710–16), but also in a geographer such as Strabo (5.4.6), or reflected in the technical literature, for example, in Vitruvius' *pulvis puteolanus* (2.6.1).

Archaeological research in the past few years, together with information from aerial photography and from the cartography of the previous centuries, has critically increased our knowledge, both topographical and analytical, of these maritime structures. As did much of the Phlegraean coastal area, these structures almost disappeared into the sea, having collapsed as a result of bradyseism (the geological phenomenon that affects the entire area).⁶

First of all, many of the installations discovered were part of a complex system that had different but complementary functions, both military and commercial. The harbors of Misenum and Puteoli played a critical role, but minor areas or harbors (Nisida, the Campanian islands, Ventotene, and Ponza) were also important for the general control of the lower Tyrrhenian Sea. This region was in an excellent strategic position for navigation in the Mediterranean: it is not a coincidence that, along with the adjoining Gulf of Naples, the area now hosts the NATO base for Southern Europe and the Sixth Fleet of the U.S. Navy.

The main and characteristic feature of the maritime topography of this area is certainly the harbor of Puteoli, as it appears with its spectacular architecture in the foreground on souvenir glass flasks such as those in Prague, Odemira, Populonia, the Pilkington Museum, Cologne, Ostia, and Ampurias, with a long breakwater spanned on arcades supported by *pilae* (pillars).⁷

The remains of the Roman breakwater are now completely overwhelmed by modern renovations, but it was visible for centuries, as is attested by many maps drawn by seventeenth- and eighteenth-century travelers. The breakwater was 372 m. long, set on a row of at least fifteen *pilae* on a square plan, slightly arched to support the force of the waves (fig. 2).⁸ The *pilae* each had a stone mooring link, and they were lined up east-west, to provide protection from the southerly winds that are common in harbors along the Tyrrhenian Sea. The breakwater was probably built during the Augustan age when Puteoli received a new colony. It was restored under Hadrian, and later under Antoninus Pius.

The same technique, which was also used for the external part of the Portus Iulius

⁶ Castagnoli, "Topografia"; P. A. Gianfrotta, "Puteoli sommersa," in *Puteoli*, ed. Zevi; G. Di Fraia, N. Lombardo, and E. Scognamiglio, "Baia sommersa," in *Archeologia subacquea. Studi, ricerche, documenti* 1 (Rome, 1993), 21–70.

⁷ S. E. Ostrow, "The Topography of Puteoli and Baiac on the Eight Glass Flasks," in *Puteoli: Studi di storia antica* 3 (1979), 77–126.

⁸ Dubois, *Pouzzoles*, 249–61; Castagnoli, "Topografia," 62–64.

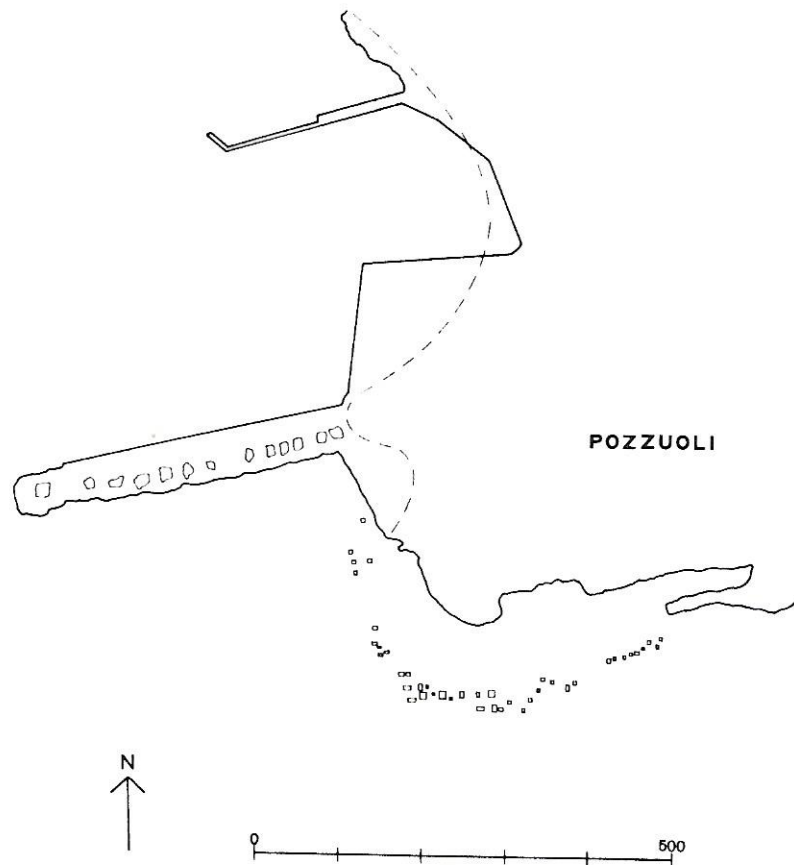


Figure 2. Puteoli, harbor and area below Terra Rione

and more frequently along the Baiae coastline, was used to lengthen the structures built out into the sea around Terra Rione by installing a number of *pilae*.⁹

Other similar structures were built on the northeastern side of the island of Nisida: situated on the southeast side of the Gulf of Puteoli, the island today retains its primarily military role. On the narrow strip of land that connects the island with the coast are modern buildings housing the offices of the NATO military forces for Southern Europe.

Here, until now, remains of the ancient harbor's installations were unknown: recent underwater archaeological research, carried out to permit the construction of large

⁹ G. Camodeca, "Per una storia economica e sociale di Puteoli fra Augusto e i Severi," in *Civiltà dei Campi Flegrei* (Naples, 1992), 149-50, pl. I.

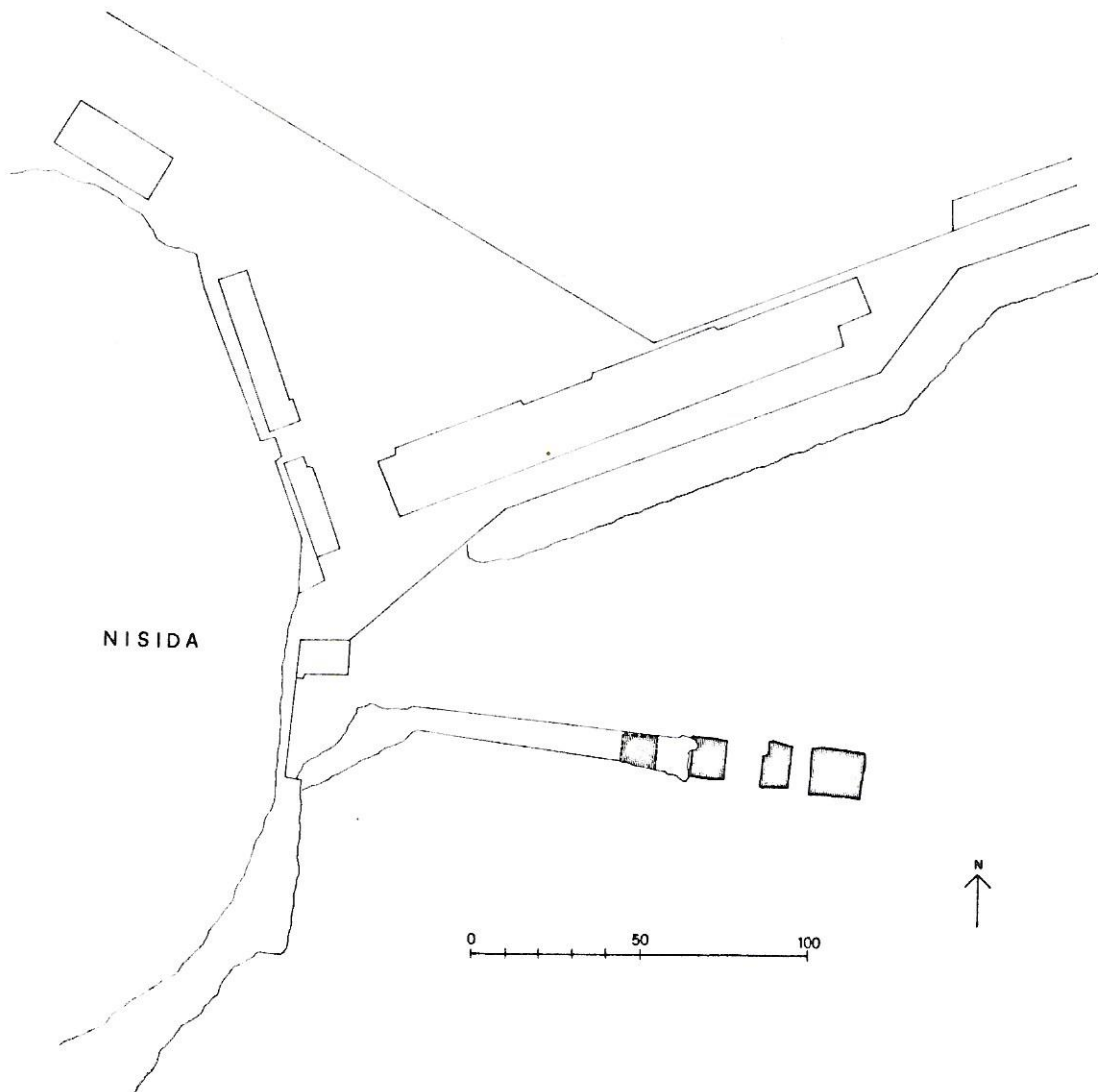


Figure 3. Nisida, the pilae still in situ

rock breakwaters, has noted three *pilae* still *in situ* on the seabed (fig. 3). These are the surviving structures; many others have been overwhelmed, not only by the breakwater, but also by the fill that was brought in during the second half of the last century to form the land strip where the main NATO offices are now located. The earlier situation is documented by maps of the Bourbon period, such as Antonio Rossi's 1838 map which clearly shows several rows of *pilae*: they had a square plan, similar to those



Figure 4. Nisida, detail of a pila



Figure 6. Misenum, the head of the Punta Terone breakwater

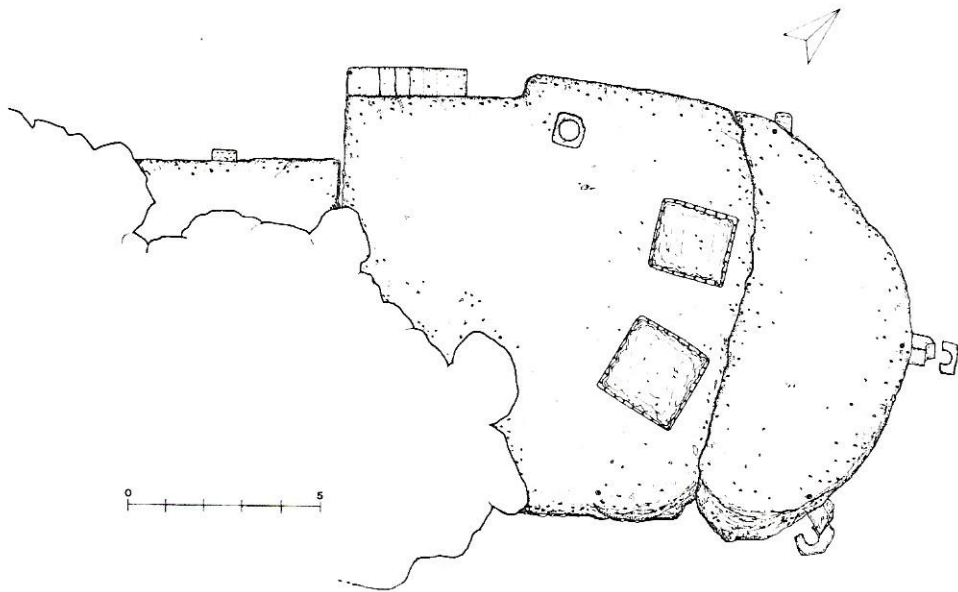


Figure 5. Misenum, the Punta Terone breakwater

at Puteoli, and were positioned both where the stone block breakwater is now located and further inside, toward the rear.¹⁰

The furthest of the *pilae* is perfectly preserved. It is 9.50 m. high and extends 1.80 m. below sea level; it has an irregular quadrangular plan, with sides measuring 7.70, 9.02, 14.20, and 15.20 m. (fig. 4). A solid and impressive tower was built of successive castings of *opus caementicium* and tufa fragments, which on the sides of the *pila* seem to form a sort of *opus reticulatum*. The angles are rounded, and the plan of the successive castings of concrete can be seen. In some sections there are holes that were used for wood posts and the beams of the scaffolding. This was a double bulkhead scaffolding, watertight so that it remained dry during construction. The tufa blocks (in these *pilae*, the term *opus reticulatum*, even if it gives an idea of the arrangement, is technically incorrect) could thus be placed in good order inside the scaffolding to achieve maximum cohesion.

The same type of construction is found for the breakwaters that protected the two entrances to the harbor of Misenum (fig. 10).¹¹ On the Punta Terone side, the underwater structures consist of a row of eight *pilae*, most of them still standing (only two are collapsed): a long breakwater runs alongside them, but today it is hidden by blocks from a modern cliff (fig. 5). The *pilae* are parallelepipeds, rectangular at the base, each one of different dimensions; they rise from the sandy bottom to different heights: from 3 m. to 6.50 m. going toward the center of the harbor entrance. Some of them have holes that were left by the vertical and horizontal beams of the scaffolding, and the horizontal lines of the casts of concrete (see figs. 8, 9).

Of the breakwater beside the *pilae* there remains today only the curvilinear head of concrete, from which some mooring stones are visible (figs. 5, 6): four can be distinguished, all cut systematically at the center (perhaps destroyed during World War II when submarines came for refueling to the Misenum harbor), with the cut part found on the seafloor (fig. 7). On the inner side of the breakwater one can recognize a flight of steps used for boarding or disembarking from ships. Even further within (ca. 100 m.), from an area of destroyed and collapsed structures (perhaps an inside arm of the wharf built on *pilae*), come some architectural fragments of honorary monumental buildings: two torsos of marble statues (an Aphrodite of the Hera Borghese type and a man wearing a toga), and two statue bases with inscriptions, both honorific.¹² On the side of the entrance known as the Punta Pennata, another row of *pilae* can be seen (fig. 10): they are very similar to the previous ones and form a right angle.

Thus, from the general plan, with the submerged breakwater mentioned above (fig.

¹⁰ Gianfrotta, "Puteoli," 123-24.

¹¹ K. J. Beloch, *Campanien: Geschichte und Topographie des antiken Neapel und seiner Umgebung*, 2nd ed. (Breslau, 1890), 194-96.

¹² See F. Zevi, in *Atti del XX Convegno di Studi sulla Magna Grecia, Taranto 1980* (Taranto, 1987), 262-63. One of the statue bases, dated to the first half of the third century C.E., is dedicated to a former *scriba* of the military fleet, C. Iulius Maro, by the fish traders of Misenum; another later inscription is almost completely abraded.



Figure 7. Misenum, Punta Terone, one of the mooring stones, cut and collapsed

10), the general form of the Misenum promontory surrounded on every side by the sea, and the harbor divided into two basins, we can now recognize the harbor of Misenum as seen in the well-known painting from Stabiae, today in the National Museum of Naples.¹³

Returning now to our starting point, we have seen that a great number of harbor structures were built in central Italy (and also the breakwaters of the island of Ponza and of Egnazia in the lower Adriatic, which are of the Augustan age).¹⁴ They are more or less contemporary with the construction of the Caesarea harbor, possibly a little earlier. They were built with the aid of a new, shared technical knowledge, which is shown by the use of the same building techniques and perhaps the same workmen.

These builders were especially experienced in the use of the hydraulic materials peculiar to the Phlegraean Fields, thanks to which they could achieve extraordinary harbor structures.¹⁵ The properties of pozzolana, or *pulvis puteolanus*, a soft volcanic

¹³ K. Lehmann-Hartleben, *Die antiken Hafenanlagen des Mittelmeeres*, Klio, Beiheft 14 (Leipzig, 1923; repr. Aalen, 1963), 224-27, fig. 11.

¹⁴ Completely unpublished are the recent discoveries of the remains of *pilae* on the Roman breakwater of the harbor at Ponza: it was built during the Augustan age and is very similar to those of the Phlegraean coast, even if today it is part of the modern dock. For the harbor of Egnazia, possibly of the Augustan age or a little later during the first half of the first century C.E., see a preliminary general plan in A. Freschi, "Egnazia 1979: Ricerche subacquee," in *Atti del XIX Convegno di Studi sulla Magna Grecia, Taranto 1979* (Naples, 1980), 450-55.

¹⁵ J. P. Oleson and G. Branton, "The Harbour of Caesarea Palestinae: A Case Study of Technology

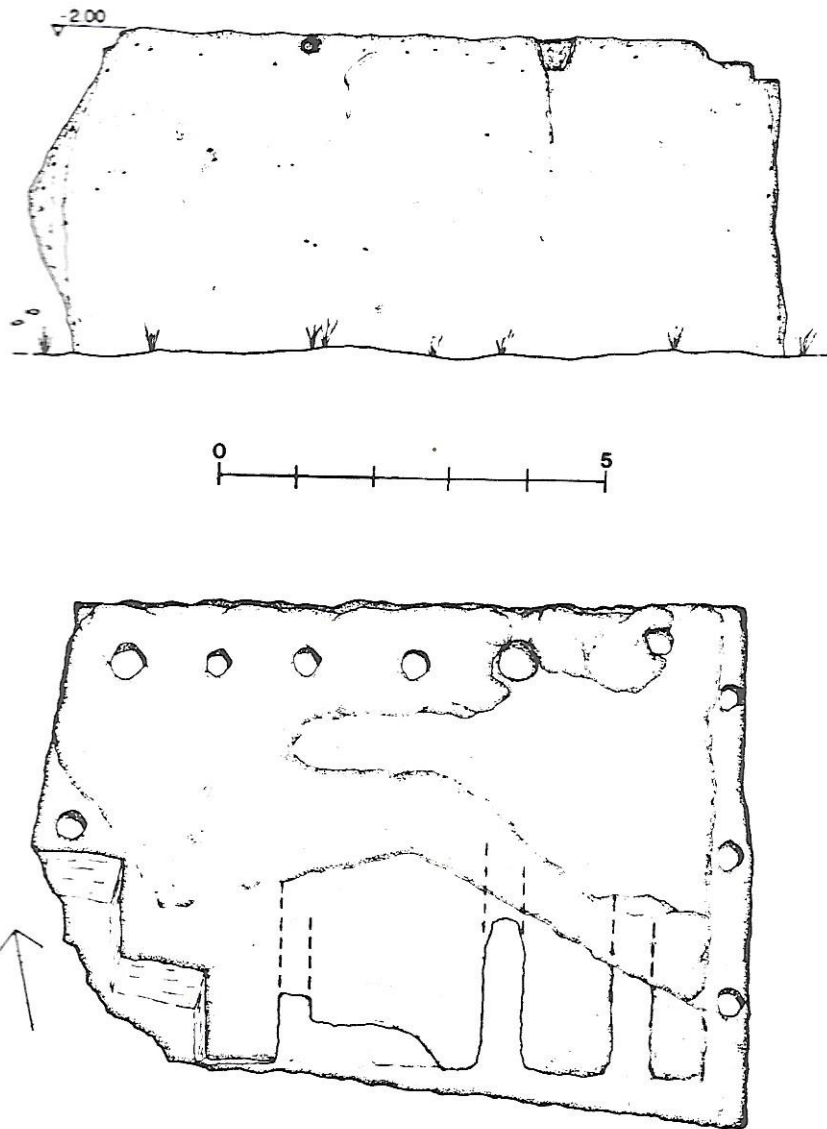


Figure 8. Misenum, Punta Terone, details of a pila with the vertical and horizontal holes of the beams and the horizontal line of the casting of concrete

Transfer in the Roman Empire," in *Geschichte der Wasserwirtschaft und des Wasserbaus im Mittelerranen Raum, VIII. Internationalen Symposium zur Geschichte des Wasserbaus* (Merida, 1991), Leichtweiss-Institut für Wasserbau der Technischen Universität Braunschweig, Heft 117 (1992), 396–405. The presence of "Italian" workmanship has rightly been detected in the construction of Herod's "winter palace" at Jericho: F. W. Deichmann, "Westliche Bautechnik im römischen und rhomäischen Osten," in *RömMitt* 86 (1979), 474; more recently Oleson and Branton, "The Harbour," 397–98.

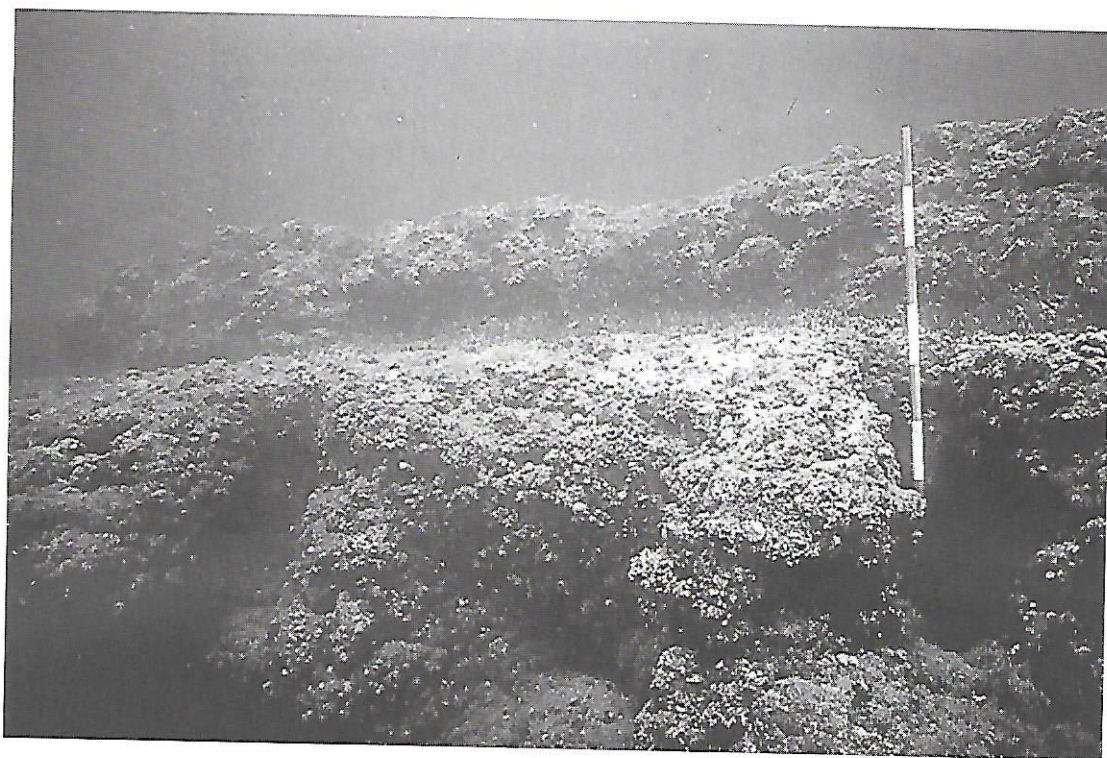


Figure 9. Misenum, Punta Terone, detail of concrete casting

rock, are extolled by Vitruvius (2.6.1; 5.12.2–3), who wrote only about the Phlegraean pozzolana and that of Cumae and Sorrento, and by Seneca (*Quaest. nat.* 3.20.3: “Puteolanus pulvis si aquam attigit, saxum est”). Strabo (5.4.6) attributed to pozzolana the main role in the construction of the harbor installations along the Phlegraean coast so that the shores could be transformed into basins where the biggest ships could moor safely.

The critical importance of pozzolana was so great for harbor structures that it was also transported to distant regions, as shown by the analysis made of the concrete of the breakwaters of the Caesarea harbor.¹⁶ This is not surprising. There were many connections between Puteoli and the Palestine area, as attested by the significant Jewish community that had already been settled in the Phlegraean city for quite some time (Joseph. *Bj* 2.104) when the apostle Paul arrived in 61 C.E. after a long voyage on grain ships that had sailed through the eastern Mediterranean from Alexandria. More or less from the same area came a flourishing community of Nabataean Arabs that had settled at Puteoli, along with the *mahramta* of the god Dusares, as witnessed

¹⁶ Oleson and Branton, “The Harbour,” 398–401.

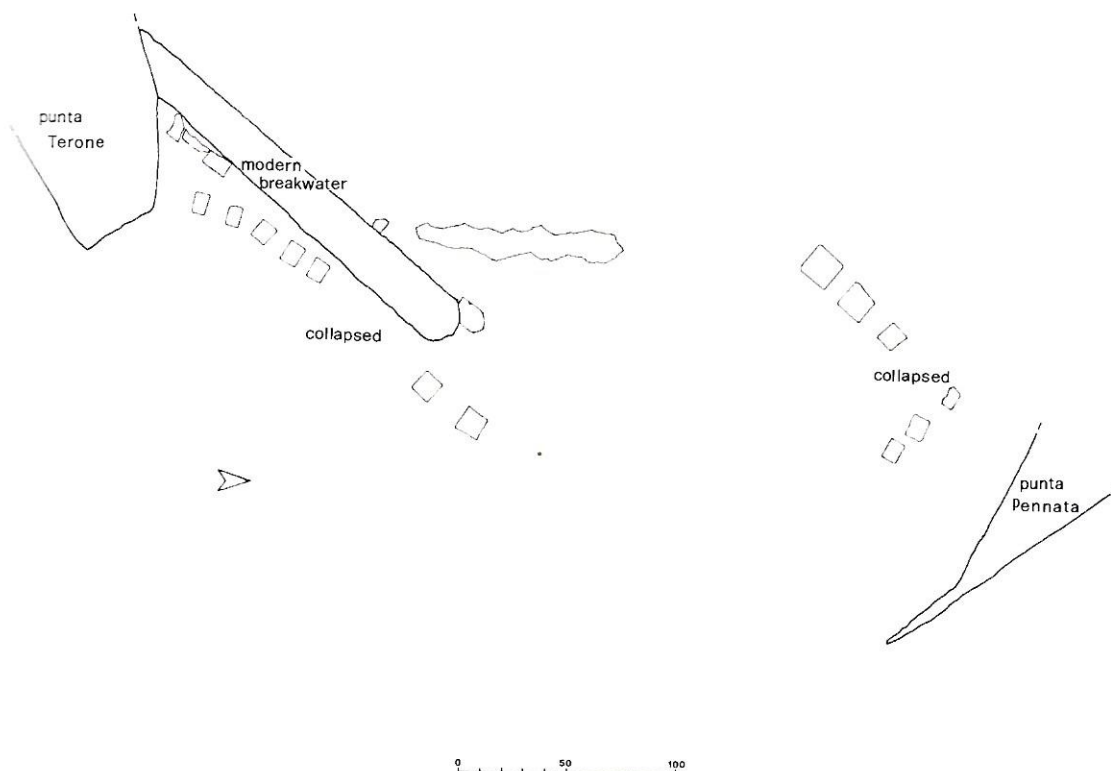


Figure 10. Misenum, general plan of the harbor entrance

by many inscriptions found in the commercial area now underwater due to bradyseism.¹⁷

Therefore, instead of other ballast (*saburra*), *pozzolana* would have been an appropriate return cargo for many ships (perhaps especially for the Alexandrian ones) that arrived at Puteoli from the Mediterranean, bringing food supplies for Rome and exotic goods from the Far East (“*navigia inania et vacua et similia redeuntibus*”: Pliny *Panegy.* 31). *Pozzolana* was transported on the return voyage of Egyptian grain ships, and hence could serve the purpose at Caesarea of building a very large new harbor substructure.¹⁸ Caesarea was part of the trend toward increasing trade, which was of critical importance for Rome and for the political world system of the new Augustan

¹⁷ F. De Romaniis, “Puteoli e l’Oriente,” in *Puteoli*, ed. Zevi, 64–65.

¹⁸ Emperor Caligula could rely on a quick connection between Italy and Palestine: he suggested to King Herod Agrippa that he not follow the long and difficult route along the coast from Brindisi to the province of Syria, but go straight to Alexandria, with the favorable winds, using the military ships reserved for people of his status (Philo Alex. *Contra Flaccum* 26).

order. In this new trade system an important role was played by Herod the Great, a faithful friend of Agrippa and a sure ally of Augustus in the eastern part of the Roman Empire.¹⁹

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¹⁹ Roddaz, *Marcus Agrippa*, 450-60. Recall that Augustus saved Palestine from famine by allowing Herod to buy grain in Egypt and by facilitating its transport by sea between 24 and the 21 B.C.E. (Joseph. *AJ* 15.305-7).