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Final Report on the Remains of Four Vessels Found in the Ancient Harbour of Naples, Italy, Dating to the Late 2nd Century BCE and the Late 2nd-Late 3rd Century CE

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An underwater photograph of an archaeological site. In the foreground, a large, orange, textured object, possibly a piece of pottery or a large shell, is prominent. A diver with two blue and white scuba tanks is visible in the mid-ground, working on the site. Various artifacts are scattered around, some with identification tags like '1119', 'P0092', and '092'. The water is clear blue, and the scene is lit with artificial light.

UNDER THE MEDITERRANEAN I

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Final Report on the Remains of Four Vessels Found in the Ancient Harbour of Naples, Italy, Dating to the Late 2nd Century BCE and the Late 2nd-Late 3rd Century CE

Giulia Boetto, Chiara Zazzaro**, and Pierre Poveda**

Between 1999 and 2016, preventive archaeological excavations before the construction of lines 1 and 6 of the Naples metro in Piazza Municipio provided new evidence about the coastal landscape by the ancient harbour basin. These investigations led to the discovery of the remains of seven wrecks (Napoli A-C, and E-H) dating to the Hellenistic era and the Roman Empire. This paper presents the study of the architectural characteristics of four wrecks uncovered in 2013-2015 in the passageway connecting the metro stations to the modern tourist harbour (Stazione Marittima) and will suggest hypotheses concerning the function of the vessels.

Keywords: Harbour, Naples, Hellenistic era, Roman Empire, ship, wreck.

The archaeological excavation undertaken in Naples before the construction of the city's metro lines 1 and 6 provided a unique opportunity to explore the ancient Neapolitan coastal landscape. Besides the discovery of impressive ancient harbour infrastructure, these investigations provided evidence of seven vessels dating back to the Hellenistic era and the Roman Empire. The excavation was conducted under the scientific direction of Daniela Giampaola of the archaeological Superintendency of Naples and involved a large number of specialists belonging to different institutions including universities, research centres, and private companies. The project to conserve the waterlogged wood is underway in the form of a collaboration between the Naples archaeological superintendency and the Istituto Superiore per la Conservazione e il Restauro of Rome (ISCR) of the Italian Ministry of Cultural Heritage (MIBACT), in collaboration with the Centre Camille Jullian (Aix Marseille University, CNRS), and the ARC-Nucléar laboratory of Grenoble (France).

** Aix Marseille Univ, CNRS, CCJ, Aix-en-Provence, France
Centre Camille Jullian, Maison Méditerranéenne des Sciences de l'Homme, 5, rue du Château de l'Horloge, BP 647, 13094 Aix-en-Provence, Cedex 2, France, boetto@mmsh.univ-aix.fr; poveda@mmsh.univ-aix.fr*

*** Università di Napoli 'L'Orientale', Dipartimento Asia Africa Mediterraneo, Piazza S. Domenico Maggiore, 12, 80134 Napoli, Italia, czazzaro@unior.it*

The harbour

The Naples metro-line archaeological excavations have allowed us to understand the development of the coastal landscape between Neapolis, the new city founded in

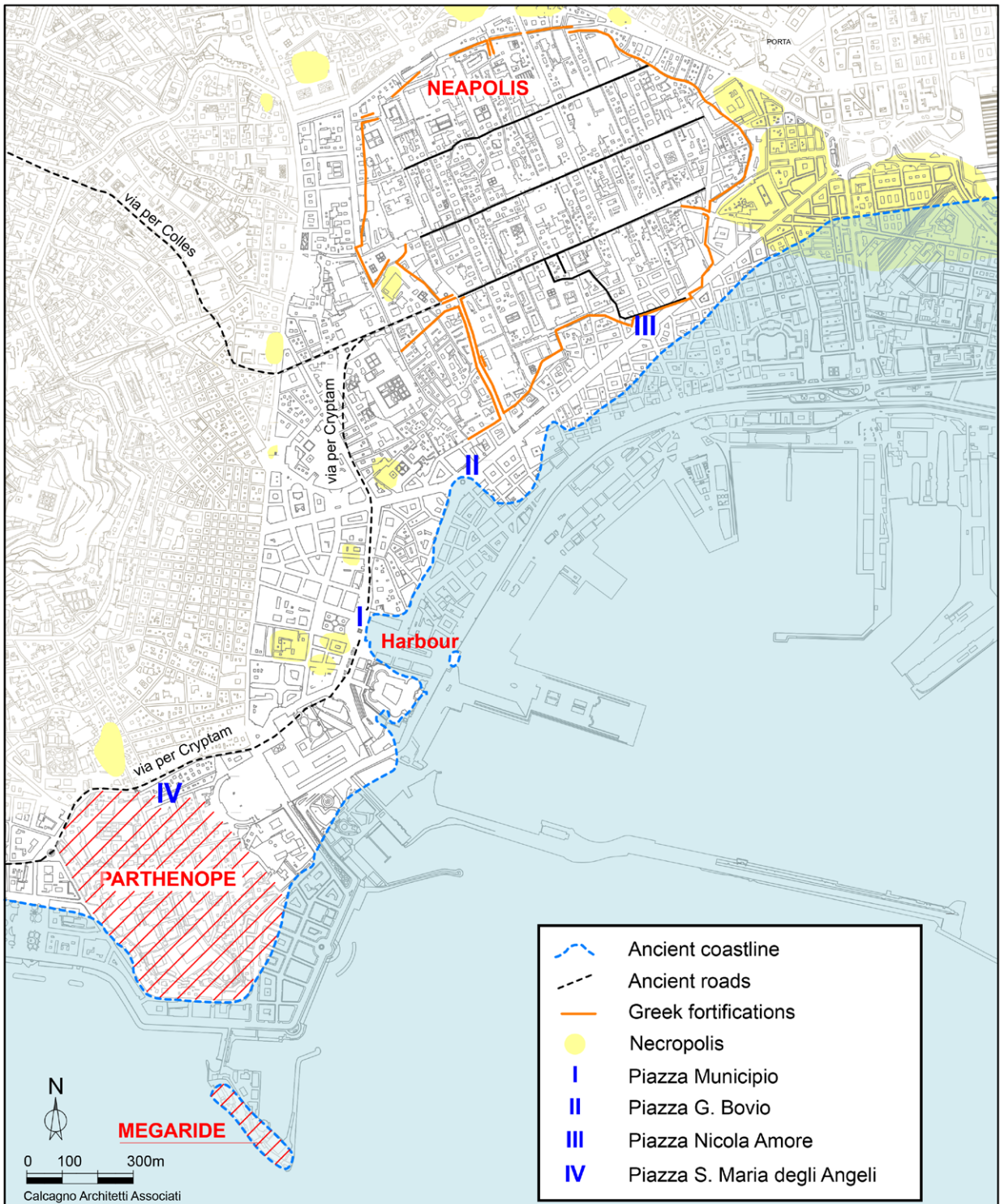


Figure 1. Reconstruction of the coastline between Neapolis and Parthenope (Giampaola, 2017b, fig. 1, Scientific development D. Giampaola, graphic rendering Calcagno Architetti Associati).

the late 6th-early 5th century BCE, and Parthenope, the earlier settlement founded by Greeks from Cumae in the early 7th century BCE on what is today the hill-fort of Pizozalfalcone (Giampaola and D'Agostino, 2005) (Fig. 1).

In particular, geological coring and archaeological excavations in the metro stations Piazza Bovio and Piazza Municipio revealed that, in antiquity, a large bay lay between the church of Santa Maria di Porto Salvo to the east and the hill of Castel Nuovo to the west. In Piazza Municipio, the excavation provided evidence of uninterrupted stratigraphic datasets and structures from the 3rd century BCE until modern times (Giampaola and Carsana, 2005; Giampaola *et al.*, 2005: 47-54; Carsana *et al.*, 2009; Giampaola, 2010; 2017a; 2017b: 32-35; Di Donato *et al.*, 2018).

The construction of an artificial harbour started in the 3rd century BCE with huge dredging works, as attested by the discovery of large intersecting pits: traces left by devices used for their excavation were visible on the bottom of these pits. The dredgers removed marine sediment until they reached the layer of the Neapolitan yellow tuff. The aim of this process was to create a

proper harbour basin with enough draught for ships and to ensure the harbour remained effective by avoiding siltation. The dredging was accompanied by the construction of some structures – a ramp that was perhaps a slipway, and terraced walls.

In the early 1st century CE, new infrastructures were erected including buildings for *thermae*, jetties, quays, and a road. This sector of the port was used until the early 5th century CE when the harbour basin became a marshland and was filled with sediment (Amato *et al.*, 2009; Carsana *et al.*, 2009; Cinque *et al.*, 2011; Russo Ermolli *et al.*, 2014; Di Donato *et al.*, 2018). As a consequence, the port was displaced to the east, probably close to the current Piazza Bovio (Giampaola, 2017b: 35).

The vessels

The remains of three vessels were discovered between 2003 and 2004 in the line 1 metro station in Piazza Municipio (Fig. 2). Napoli A and C had been abandoned at the end of the 1st century CE, while Napoli B, with its cargo of lime and stones, was wrecked in the late

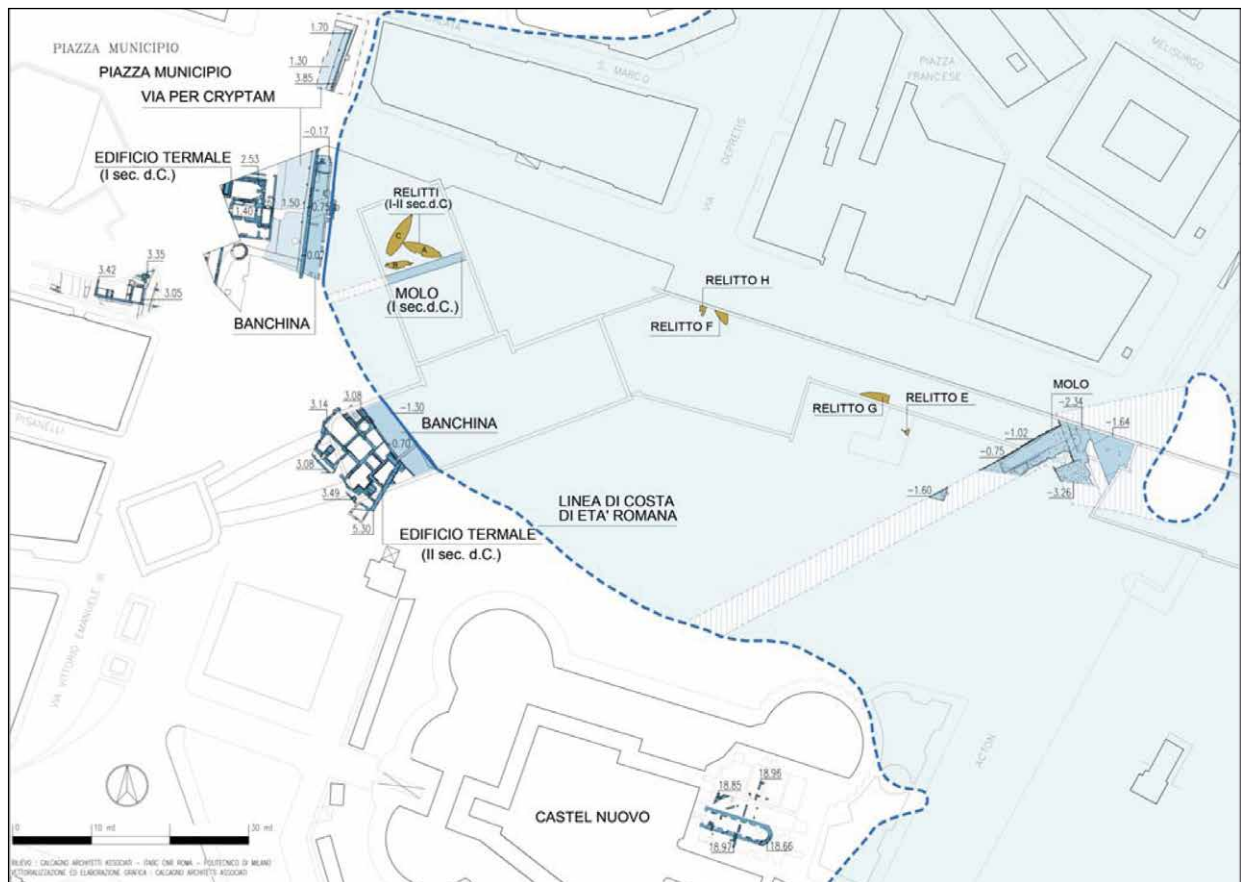


Figure 2. The archaeological excavations in Piazza Municipio, Naples, with the position of port infrastructures, buildings, and wrecks (Giampaola, 2017b; fig. 64, Scientific development V. Carsana, graphic rendering Calcagno Architetti Associati).

2nd to early 3rd century CE. The ships were excavated and recovered in 2004 and are currently preserved in water, in a store belonging to the archaeological superintendency at Piscinola, on the outskirts of Naples (Boetto, 2005; Giampaola *et al.*, 2005; Boetto, 2007; Boetto *et al.*, 2009; 2010). Napoli A and B correspond to one-masted sailing vessels (Boetto, 2005; 2007; Poveda, 2012; Boetto and Poveda, 2018), whereas Napoli C is a transom-bow boat used for harbour service identified as a *horeia*-type vessel (Boetto, 2009; Poveda, 2012; Boetto and Poveda, 2014).

Ten years later a fourth vessel (Napoli E) was uncovered in the passageway (Area 4) connecting the stations on lines 1 and 6 to the modern tourist harbour (Stazione Marittima) (Fig. 2). It was dated to the Hellenistic era and was, at that time, the earliest evidence of an ancient vessel within the harbour basin. At the end of 2014, another wreck was discovered (Napoli F), while two further wrecks (Napoli G and H) and a wooden anchor were uncovered in the following year (Boetto *et al.*, 2019). These four wrecks were dismantled and stored at Piscinola. Devoid of cargo or other datable material, all the wrecks have been dated stratigraphically: Napoli H and E are dated to the 2nd century BCE, and Napoli F and G are dated between the late 2nd and late 3rd century CE.

It is worth noting a large quantity of various materials that had been lost or discarded in the harbour basin that testify to the vitality of the city. Around 30 fragments of oars and small masts, as well as stone anchors, lead stocks, rigging elements (ropes, pulleys, deadeyes, sail rings), and carpentry tools were found. None of these objects was directly connected to the vessels.

The Hellenistic wrecks

Napoli E

Napoli E lay north-west/south-east at a depth of 5.7 m below the present relative sea-level (RSL) (3.6 m below the ancient RSL). This wreck extended beyond the limits of the trench and was poorly preserved. The visible remains had a maximum length of 1.5 m and comprised a keel, 16 strakes, one floor-timber, and fragments of a few other frames (Figs 3-4). The keel, rectangular in section (110-120 mm wide, 180 mm deep), is broken into two parts (L9, L4). The upper corners are carved with a rabbet (50 mm deep, 30 mm wide) to accommodate the garboards. The garboards were assembled to the keel with pegged tenons and copper nails.

The planking comprises seven strakes on the north-eastern side and nine on the southwestern side. Planks, 30-36 mm thick and 90-150 mm wide, are connected with a set of pegged tenons. On average the pegs, which have a diameter of 8.5 mm measured on the inboard, are spaced 110 mm apart, centre-to-centre. The floor-timber, 330 mm moulded and 130 mm sided, has a V shape due to its position at one of the extremities of the ship. Because the shipwrights marked the position of the frames with two parallel lines scribed on the planking, it was possible to estimate the space between the frames at 145-170 mm. The frames were connected to the planking with treenails. The remains of lead sheathing fixed to the hull with small copper nails have been observed on the exterior surface of the keel (Fig. 5) and of the planking. A thick layer of pitch covered the interior of the hull.



Figure 3. *Napoli E* from the west (Photo courtesy of Superintendency of Naples).

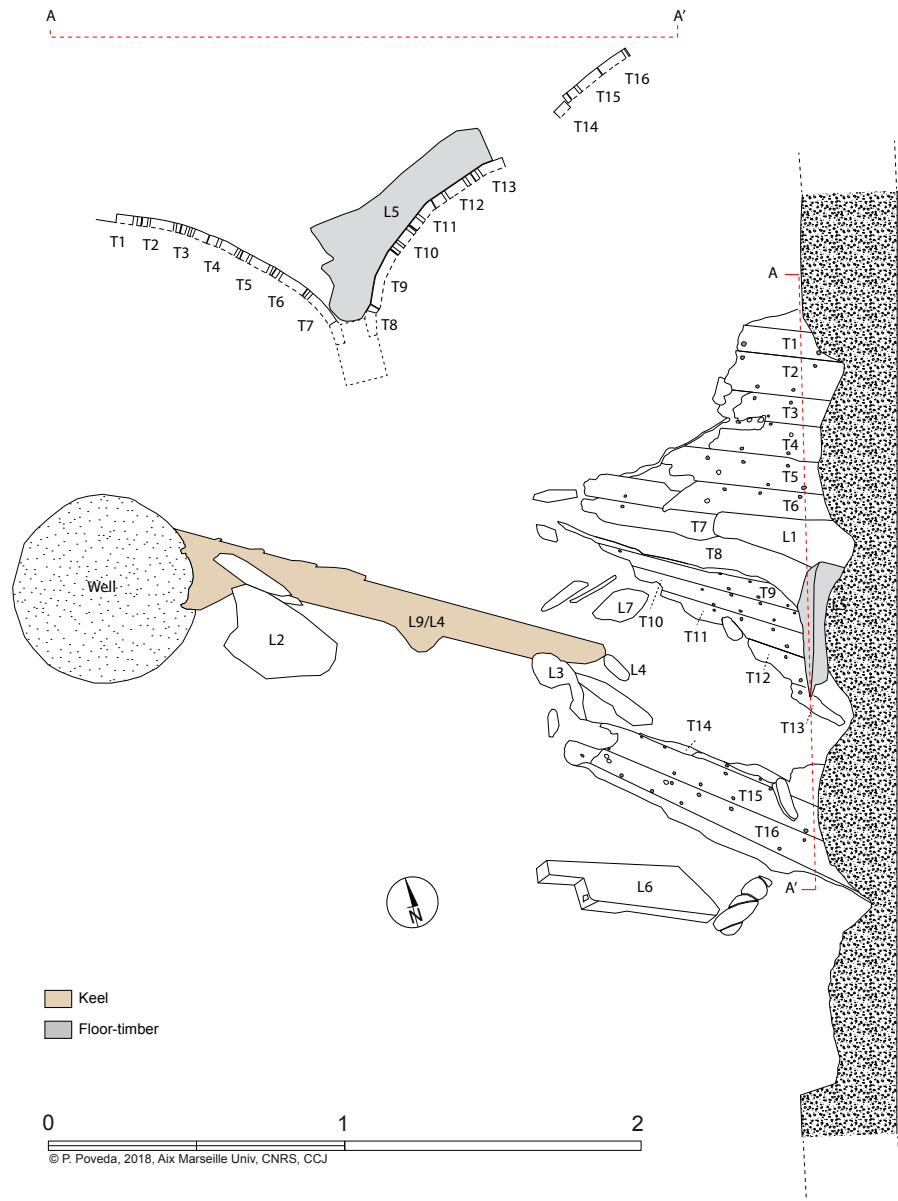


Figure 4. Napoli E. Plan and cross-section of the preserved L5 floor-timber (Survey Politecnico di Milano, drawing P. Poveda AMU, CNRS, CCJ).

Napoli H

Napoli H was found at a depth of 5.79-5.98 m below the present RSL (3.69-3.88 m below the ancient RSL). The orientation was north-east/south-west (Figs 6-7).

The trench wall cut across the wreck, as with Napoli E, and only one end, 2.74 m long and approximately 2 m wide, is preserved.

The two sides of the wreck were found around 1 m apart because of the loss of the keel. The flush-laid planking consists of six strakes on each side: some planks are joined by oblique scarfs to make a strake. The planks are a maximum of 185 mm wide and 28 mm thick on average and joined with pegged tenons. The pegs (average inboard diameter 9.7 mm) are spaced 125 mm apart on average. Some planks (T4, T12, and T13) present

tenons used for repairs that are inserted from inside the hull. The repair tenons are long, thin wooden tongues that are inserted through quadrangular recesses opened on the outer or inner face of the plank to be repaired. They were first attested on the 4th-century-BCE Kyrenia wreck in Cyprus (Steffy, 1985: 83 and 97-98, fig. 9; 1999: 397-398, fig. 4), and were widespread in Roman times.

To the western side, only one floor-timber is still connected, while on the eastern side the assemblages with the planking are broken. This floor-timber has a rectangular cross-section (93 mm sided; 200 mm moulded) and presents a single rectangular-shaped limber hole on its western branch at the level of the plank T3. The frame is fixed to the hull with treenails (14 mm diameter) and copper nails. The position of five other frames could be



Figure 5. Napoli E. Detail of lead sheathing covering the keel fragment L9 (Photo P. Groscaux AMU, CNRS, CCJ, courtesy of Superintendency of Naples).



Figure 6. Napoli H (Photo M. Gentile, courtesy of Superintendency of Naples).

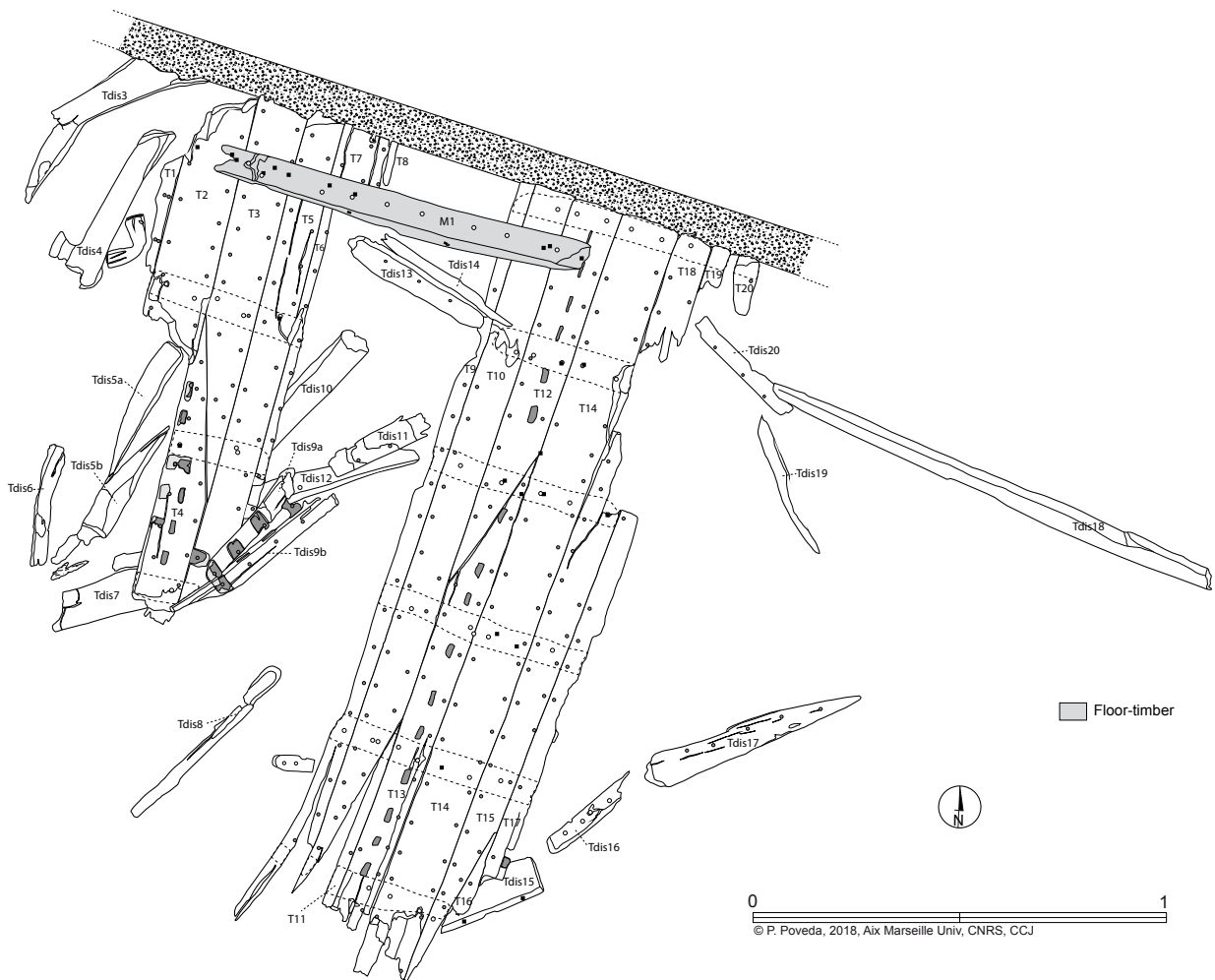


Figure 7. Napoli H. Plan of the wreck (Survey Politecnico di Milano, drawing P. Poveda AMU, CNRS, CCJ).

deduced by rows of nail and treenail holes still visible on planking. The average frame spacing is 390 mm. A layer of pitch protected the interior of the hull.

The Romano-Imperial wrecks

Napoli F

The Napoli F wreck, oriented north-west/south-east, was discovered at a depth of 3.3 m below present RSL (1.7 m below ancient RSL). One extremity of the vessel lay beyond the limits of the excavation trench, so the visible hull remains measure 5.89 m long, 2.6 m wide, and 670 mm deep (Fig. 8). Just a small portion of the keel and the eastern side of the planking survived, while the western side, on which the hull lay when it sank, is preserved up to the second wale. The wreck also includes 12 frames to which ceiling is attached. A large number of timber fragments (137) belonging to the vessel have been found out of their original positions both in and around the hull (Fig. 9).

The longitudinal axial timbers consist of a portion of the intermediate timber and a fragment of the endpost. This post has not been identified as either the sternpost or the stem. The hook scarf connecting the two pieces is locked with a horizontal wedge or key (110 mm long, 40 mm wide, 18 mm thick) (Fig. 10). An extremely corroded iron bolt (or nail) crosses the scarf vertically. It is likely that this bolt would also have fastened a floor-timber (not preserved) to the keel. The intermediate timber (107 mm wide, 165 mm deep) is worked on its sides with triangular rabbets to take the hood-ends of the strakes, which were locked in place using nails and mortise-and-tenon joints.

The planking is flush-laid and fastened with mortise-and-tenon joints. The western side is composed of 20 strakes, 22 mm thick on average (Fig. 11). The two west-side wales (T33o and T41o) are 170 mm wide and 70 mm thick. The pegs locking the tenons were driven from the outboard (inboard diameter 5 mm; outboard diameter 8 mm on average) at 177 mm intervals, measured centre-to-centre. Mortises (57 mm wide; 38 mm deep; 4 mm thick) are spaced 56 mm apart on average.

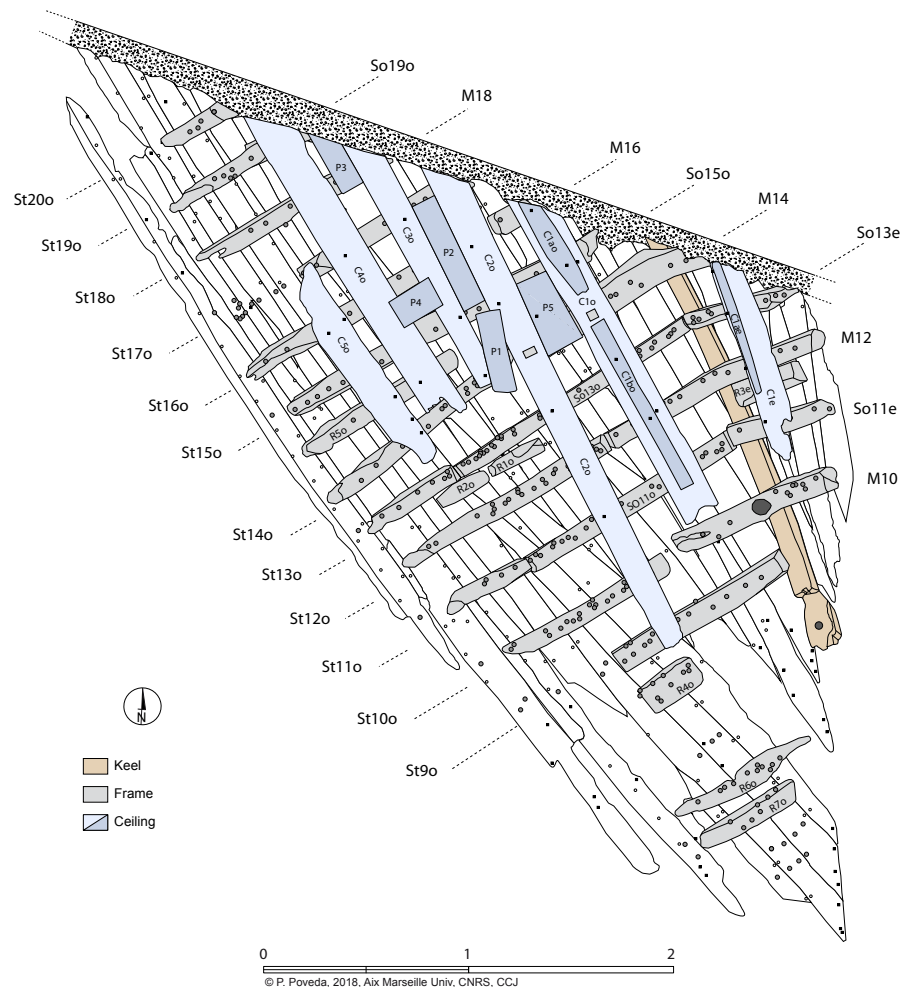


Figure 8. Napoli F. Plan of the wreck (Survey Politecnico di Milano, drawing P. Poveda AMU, CNRS, CCJ).



Figure 9. Napoli F. As found, showing displaced pieces found inboard and outboard the hull (Photo M. Gentile, courtesy of Superintendency of Naples).



Figure 10. Napoli F. Hook scarf between the transitional timber and the endpost, and the corroded iron fastener (bolt or nail) connecting the two pieces (Photo C. Zazzaro, courtesy of Superintendency of Naples).

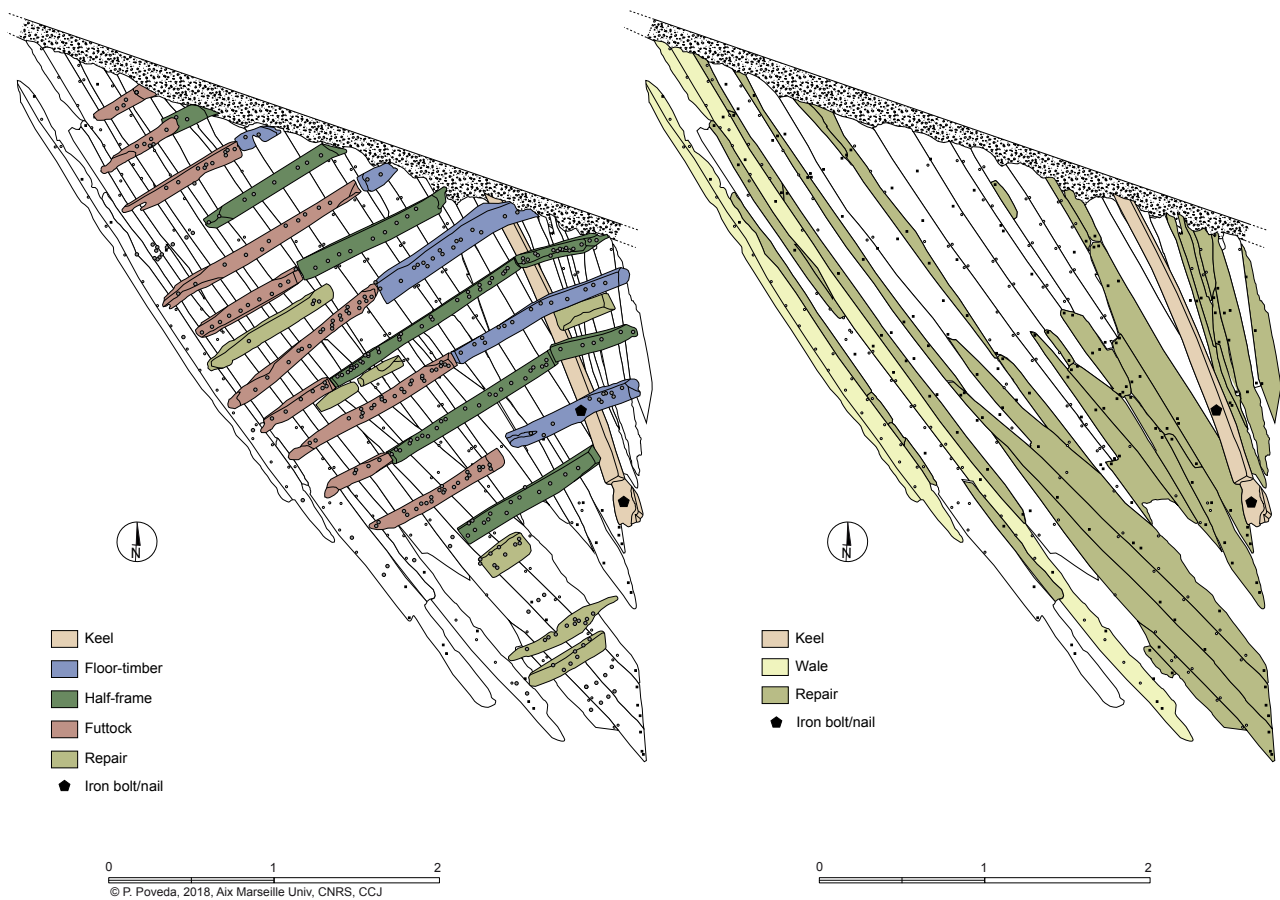


Figure 11. Napoli F. Plans of planking and frames (Survey Politecnico di Milano, drawing P. Poveda AMU, CNRS, CCJ).

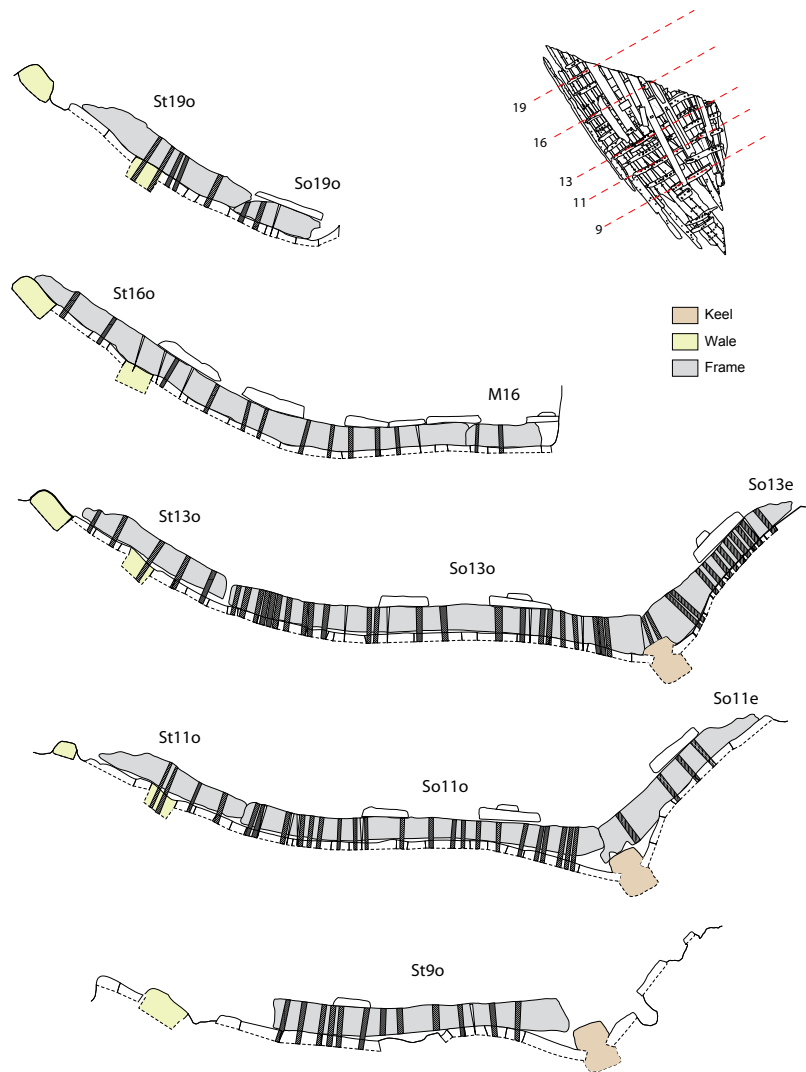


Figure 12. Napoli F. Cross-sections of frames (Survey Politecnico di Milano, drawing P. Poveda AMU, CNRS, CCJ).

There are numerous planking repairs, mainly toward the end (Fig. 11). They include planks simply nailed to the frames, planks with mortise-and-tenon joints only on the lower edge (the other edge being nailed to the frame), and planks with repair tenons inserted from the inboard.

Three small, rectangular, lead patches were also observed on the outer side of the hull: these were attached to the planking with small nails. The patches on planks T29o and T23o measure, respectively 290 x 55 mm and 280 x 65 mm. The lead patch on the seam between T5e/T8e is longer (400 x 46 mm) and is engraved with a cross-hatched pattern on its outer surface. This characteristic has been observed on lead patches found on the 4th-5th-century wreck at Pakoštane, Croatia (Boetto *et al.* 2012b: 123, fig. 47; Radić Rossi and Boetto, 2018).

This type of repair for the planking is relatively common during the Empire and Late Antiquity (Boetto *et al.*, 2012b: 123-127; Radić Rossi and Boetto, 2018).

The transverse timbers consist of 12 frames (Figs 11-12). The rows of nail holes visible on the planking identify the position of three or four other frames, which have not been preserved. The cross-section of frames is rectangular (on average 100 mm sided and 90 mm moulded) with room-and-space of 180-260 mm. Floor-timbers and half-frames alternate systematically. Due to their position at an extremity of the vessel, floor-timbers M10, M12, and M14 are V-shaped.

Floor-timber M14 is carved with a triangular limber hole at its base. Futtocks, preserved only on the west side, extend the floor-timbers. Only one of the floor-timbers



Figure 13. Napoli F. Detail of floor-timber M10 with its iron bolt (Photo C. Zazzaro, courtesy Superintendency of Naples).



Figure 14. Napoli F from the south-east: note the two small planks nailed on top of stringers C1o and C1e (Photo M. Gentile, courtesy of Superintendency of Naples).

(M10) is connected to the keel by an iron bolt (Figs 11, 13). This type of joint was also observed in the scarf between the transitional timber and the endpost. Lastly, the frames are fastened to the planking by treenails (13 mm average diameter).

Among seven repaired frames, three are connected to the planking only by nails (R1o, R2o and R3e) (Fig. 8). Nails also serve to attach the numerous pointed ends of plank repairs (Fig. 11). The large number of treenails observed on the other four frame repairs, as well as on some other frames, is a clear indication of extensive repairs carried out not only on the planking but also on the frames. The ceiling consists of five stringers on the west side and one on the east side (maximum 195 mm wide, 23 mm thick) (Figs 8, 14). They are fastened to the frames with iron nails. Two small planks are nailed on top of the two stringers C1o and C1e, located near the keel (Figs 8, 14). This feature may have allowed the accommodation of movable transverse planks that have been lost. The stringers alternate with removable ceiling planks, of which only four are preserved in their original position (410 mm long, 143 mm wide, 20 mm thick).

The use of pitch to protect and waterproof the vessel is also attested in this wreck.



Figure 15. Napoli G from the east (Photo M. Gentile, courtesy of Superintendency of Naples).

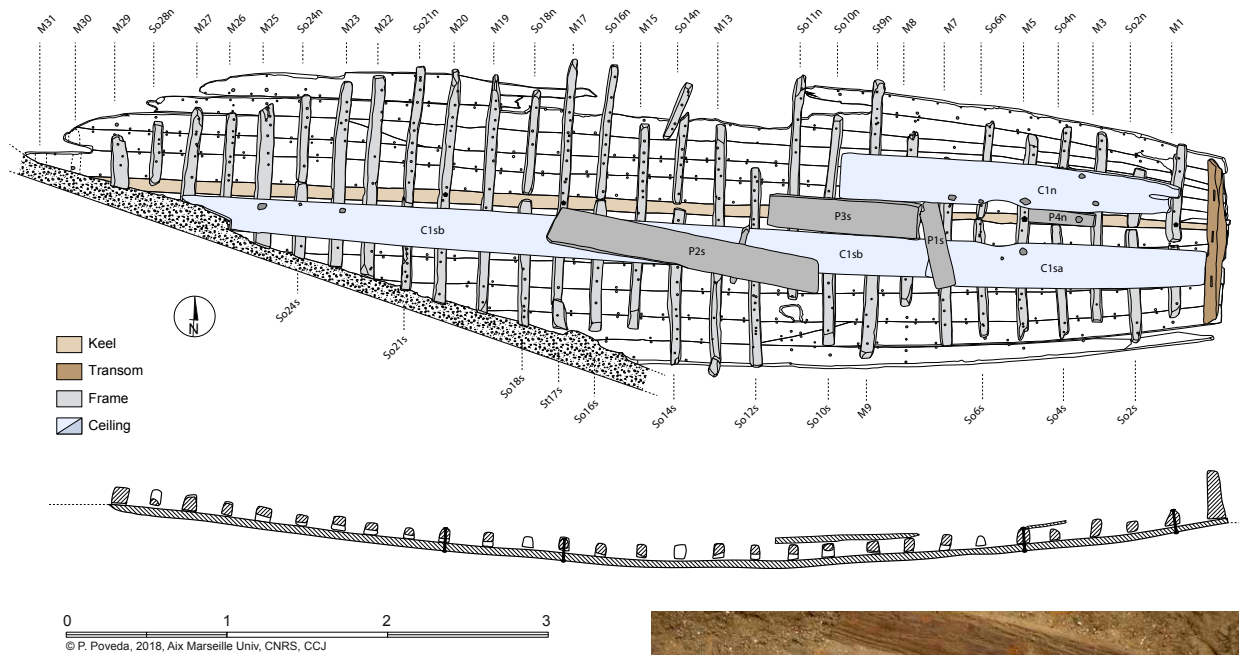


Figure 16. Napoli G. Plan and longitudinal section of the wreck (Survey Politecnico di Milano, Drawing P. Poveda AMU, CNRS, CCJ).

Napoli G

Napoli G, oriented northeast-southwest, was found at a depth of 3.14 m below RSL (1.54 m below ancient RSL). Although the south-west end lay beyond the limit of the excavation trench, the boat is well preserved and measures 7.5 m long, 1.93 m wide, and 420 mm deep (Figs 15, 16). The transom end, located to the east, is exceptionally well preserved. The longitudinal hull-profile is asymmetrical, while the midships section is rounded. Hull remains comprise a keel, transom, 12 strakes, 29 frames, and some planks identified as ceiling. The position of two more frames was identified on the planking toward the western extremity.

The keel is one single piece without chamfered edges. It is wide – 80 mm at its maximum – and it narrows toward the transom (30 mm). It is worth noting that at the level of half-frames SO6s and SO2n, the keel is only 40 mm wide (Figs 16 and 17). This is probably due to the presence of knots or other flaws in the wood, a problem that was corrected by reducing the timber used to build the keel and by widening the garboards at that point.

The triangular transom (1015 mm wide, 305 mm high, 7-10 mm thick), is vertical and is fastened to the planking with iron nails and trenails driven from the outboard (Fig. 18). The piece is not fastened to the narrow keel-end. Only a small, wooden wedge was documented between the transom and the keel, probably to fill a gap. Three mortises (60-65 mm wide, 40-68 mm deep, 50-60 mm thick, spaced 187-212 mm apart) connected

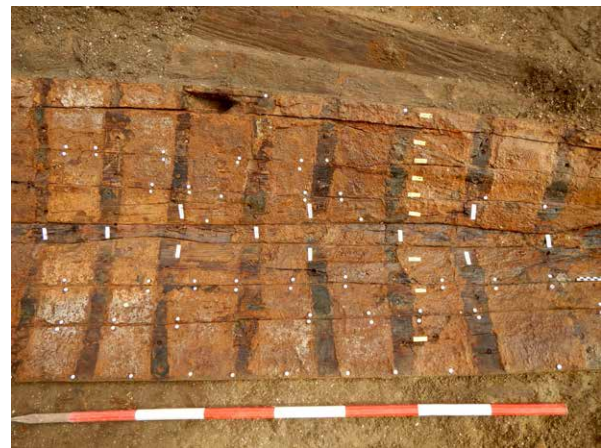


Figure 17. Napoli G. The keel at the level of half-frames So2n and So6s (Photo C. Zazzaro, courtesy of Superintendency of Naples).



Figure 18. Napoli G. The transom from the east (Photo C Zazzaro, courtesy of Superintendency of Naples).

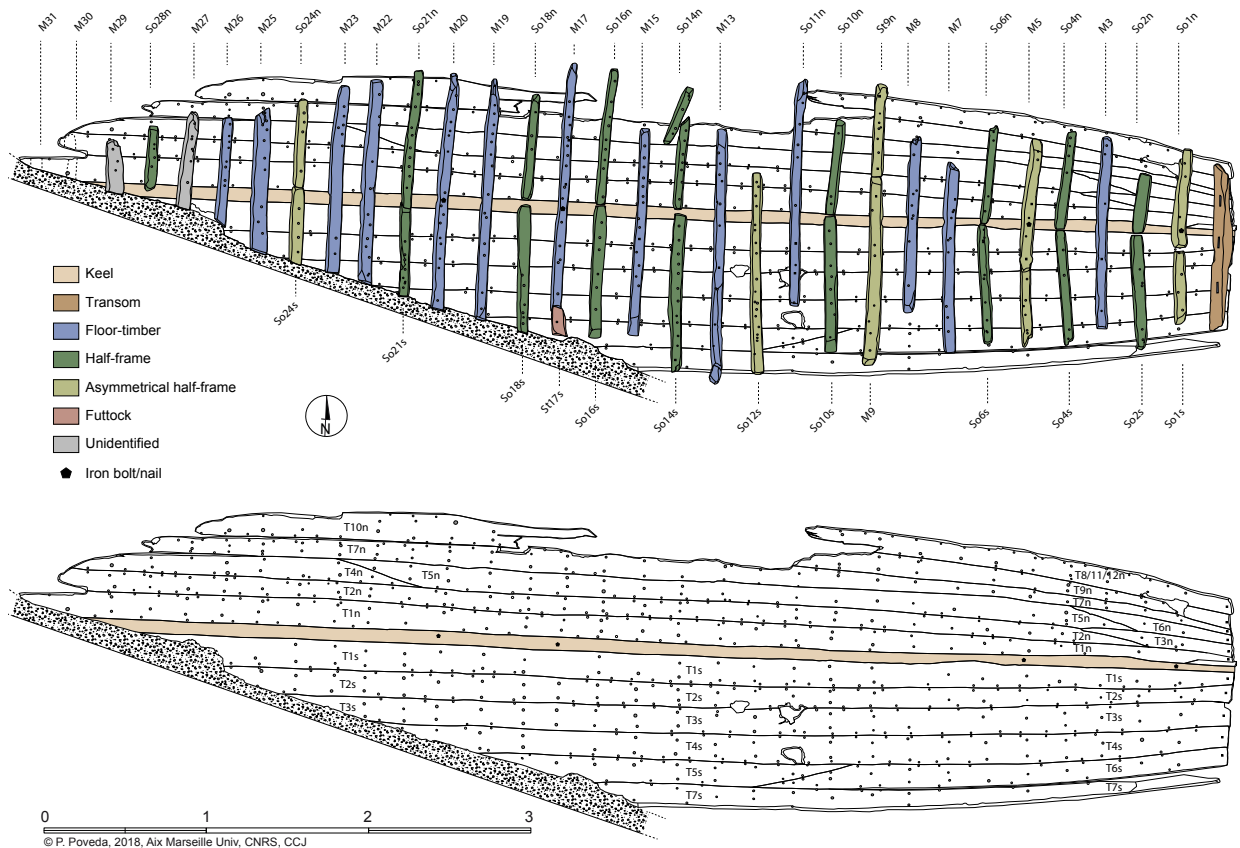


Figure 19. Napoli G. Plans of frames and planking (Survey Politecnico di Milano, drawing P. Poveda AMU, CNRS, CC).

the transom to another element positioned on top. The transom is entirely coated in pitch. Only a small triangular zone is free from pitch. This may point to the presence of an internal support: however, the frames close to the transom do not provide any evidence of fasteners (nails or treenails) that would have fixed such an element.

The flush-laid planking consists of six strakes (maximum 195 mm wide, average 18 mm thick) on both sides with some oblique joints (Fig. 19). No wales are preserved. The planking is assembled with closely set mortise-and-tenon joints. The mortises are on average 46 mm deep and 100 mm apart. Tenons are on average 56 mm wide and 30 mm thick, and the pegs (with an average diameter of 90 mm on the internal surface of the planking) are spaced on average 160 mm apart.

The 29 preserved frames (66 mm sided; 73 mm moulded) did not show the classical alternation between floor-timbers and half-frames (Figs 19 and 20). Asymmetrical half-frames (one branch crossing the keel) and consecutive floor-timbers are attested. Only one futtock (St17s) is present in relationship to floor-timber M17. The average frame spacing measures 170 mm. Limber holes are rectangular (31 mm wide, 26 mm deep) and are positioned along the keel. They are present on practically all

the frames, as well as on the asymmetrical half-frames. Cleaning the floor-timber M3 revealed the presence of two triangular limber holes beside the keel, which were completely filled by waterproofing pitch.

The frames are fastened to the planking with treenails (average 13 mm diameter) and iron nails (head diameter 15 mm; shaft diameter 5-8 mm). Fasteners are driven from the outside of the hull. Bolts or big iron nails connect three floor-timbers (M5, M17, and M20) and one asymmetrical half-frame (So1n) to the keel (Fig. 19). The ceiling consists of two parallel stringers and four removable planks (Fig. 15). These planks are 420-937 mm long, 136 mm wide, and 11-25 mm thick (Fig. 16).

Two stringers, 230-285 mm wide and 22-30 mm thick, consist of a single plank to the north (C1n) and two planks to the south (C1sa et C1sb). C1sa overlaps C1sb and they are fastened by a single nail.

Toward the transom, stringers (C1sa and C1n) are cut to form an approximately circular recess, 280 mm wide, and about 290 mm long (Fig. 21). In sailing vessels, such a configuration can be seen on sister-keelsons supporting the mast step and part of the bilge pump system, for example on the late-4th-early-5th-century-CE wreck Port-Vendres 1 found in France (Rival, 1991: 276, pl. 96).

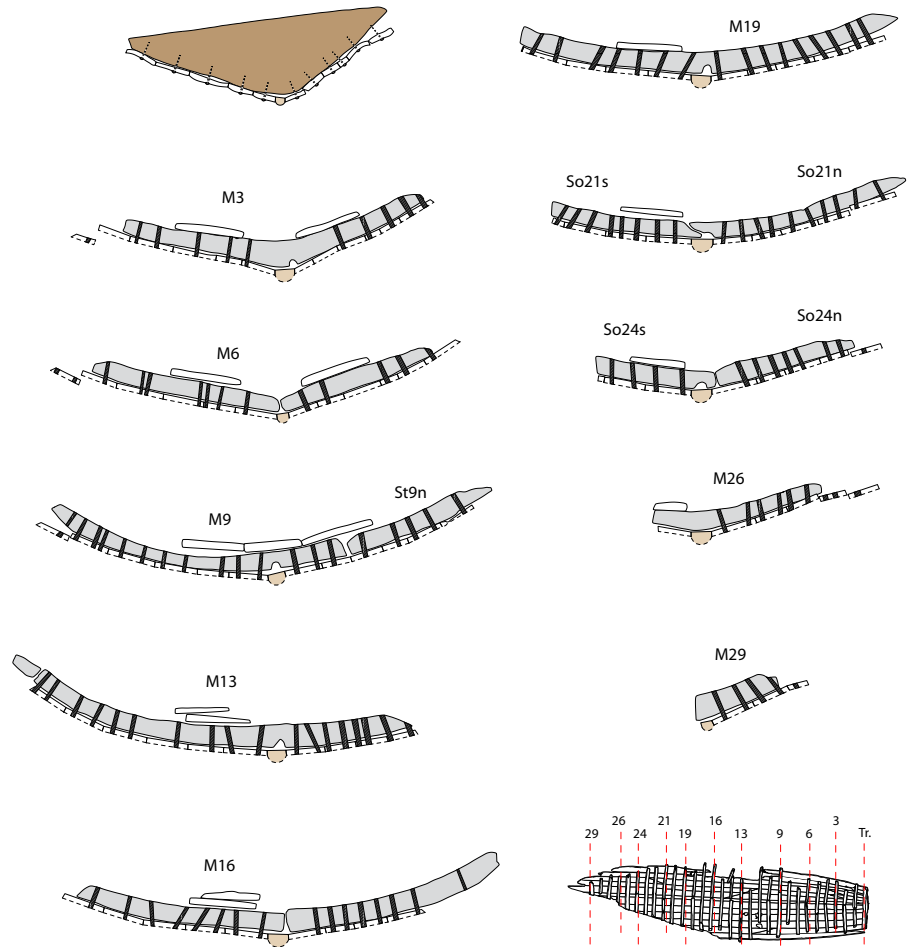


Figure 20. Napoli G. Cross-sections at frames (Survey Politecnico di Milano, drawing P. Poveda AMU, CNRS, CCJ).

However, given the small dimensions of Napoli G, we suggest that this feature did not house a bilge pump but rather could have been used to bale the water out manually. A similar recess is also present on Pisa C wreck (Italy, early 1st century CE), which is a 12 m asymmetrical vessel with a cutwater and with mixed propulsion (oars and sail) (Camilli, 2002; Camilli and Setari, 2005; Camilli *et al.*, 2006).

A single lead patch (340 mm long, 850 mm wide) was nailed externally to repair a diagonal break between planks T1s and T2s toward the transom. The remains show numerous tool marks (such as saw and axe). The inner face of T2n plank and of the side of the half-frame So14n show some signs that could represent letters or numerals. However, the pitch-based waterproofing coating, which is very consistent both inside and outside the hull, precluded the correct interpretation of these signs and it possibly covered other marks.



Figure 21. Napoli G. The semi-circular recesses cut in the stringers (Photo C. Zazzaro, courtesy Superintendency of Naples).

Construction principle, building process, architectural and functional type

The construction principle used for the four vessels presented in this paper is based on a shell structural concept for the hull structures, and on a longitudinal strake-oriented concept for their hull-shapes. The building process is shell-first (Pomey, 1988; 1998; 2004; Pomey and Rieth, 2005: 30-31; Pomey *et al.*, 2012; 2013). Closely set, pegged mortise-and-tenon joints firmly connect the planks and ensure the boat structure's internal stiffness, while the frames play a secondary role in the construction.

Since the oldest wrecks (Napoli E and H) are poorly conserved, their architectural and functional type and original shapes are unknown. However, it is important to note the presence of lead sheathing on the Napoli E vessel: this type of hull protection was used from the Hellenistic era to the end of the 1st century CE when it was replaced by pitch and encaustic mixtures (Gianfrotta and Pomey, 1981: 259; for a detailed catalogue of shipwrecks with lead sheathing see Fitzgerald, 1995: 184-195; Pomey and Rieth, 2005: 164). In fact, the vessels dated to the Imperial period from Naples show the exclusive use of pitch for the protection of the hull, while the small lead patches are only occasionally used for planking repairs.

From its structural characteristics, Napoli F can be interpreted as belonging to the western Mediterranean Roman Imperial architectural type defined by Patrice Pomey (Pomey and Rieth, 2005: 166-167) and to identify it as a transport sailing vessel. Nevertheless, the limited preservation of the hull structure does not allow us to be categorical on this point.

Napoli G shows previously unknown features, because of the presence of the transom end, which recalls other asymmetrical boats found in Naples (Napoli C), in 1st-century-CE boats Toulon 1 and 2 (Boetto, 2009), and in Ostia's Isola Sacra 1 (Boetto *et al.*, 2012a; 2014; 2017), where the transom corresponds to the bow. These vessels belong to the family of *horeia*-type vessels, a type of craft known from written and iconographic sources. Depending on their dimensions and propulsion, these vessels were used as harbour lighters or for fishing (Boetto, 2009). However, Napoli G is distinguished from the other known examples of *horeia*-type vessels by some of its features, including the shape of the transom, which is triangular without chamfered edges to accommodate the strakes, the absence of internal supports, and the presence of a bilge recess near the transom end. As the recovery of the bilge water is normally located in the lower part of the ship near the stern, it is possible that the transom would, therefore, correspond to the stern in Napoli G and not to the bow as in the other transom vessels. The reconstruction of the original shape will possibly provide additional data for the functional interpretation of this craft.

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UNDER THE MEDITERRANEAN I

This volume is a collection of 19 articles in three sections reporting on recent research on the archaeology of shipwrecks, harbours, and maritime landscapes in the Mediterranean region. The shipwrecks section looks at excavated vessels from Mazotos, Modi Island, the port of Rhodes, Naples, and Narbonne, as well as a sailing reconstruction of the Ma'agan Mikhael ship.

The harbours section includes articles on areas from the Levant to Seville looking at a variety of harbour defence systems and dockyards dating from the Hellenistic period to the 12th century AD.

Articles in the third section on maritime cultural landscapes combine data sets to examine human interactions with the sea: navigation from the perspectives of the accounts of early geographers, the skills required by the earliest sailors, and the contextual reconstruction of sea routes; coastal survey and resource use; and geoarchaeological evidence used to analyse the choice of harbour location.

This book will be of interest to students and archaeologists researching the Mediterranean region, and all interested in a wide range of recent advances in maritime archaeology.



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