

## The Marausa Wreck, Sicily: interim report on a boat built in the Western Imperial Roman tradition

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In 1991, the wreck of a late 3rd–early 4th century AD Roman merchant vessel was discovered on the west coast of Sicily that had carried North African amphora, *tubuli*, and other ceramics. The hull was dismantled and raised in 2011, including a keel hook-scarfed to stem and sternposts, 39 pegged mortise-and-tenon joined planks, 43 frames with an irregular pattern of floor-timbers, half-timbers, and futtocks fastened to the planking with trenails and copper nails, sister-keelsons and evidence of two stringers, 36 ceiling strakes, and the base of a bilge pump. Many repairs are indicated. The fairly flat bottom and round bilges, mortise-and-tenons, sister-keelsons and lack of a coherent framing pattern, place the boat in the Western Imperial tradition.

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*Key words:* Roman wreck, mortise-and-tenon joint, Western Roman Imperial tradition, hull repairs.

In the summer of 1999, two sports divers discovered the wreck of a Roman vessel, located 150 m from the shore of Marausa, and south of Trapani, Sicily, Italy (Fig. 1). The timbers had been uncovered as a result of a sudden change in the local marine currents caused by the construction of a modern pier. The site lies at a depth of only c. 3 m, 400 m north of the mouth of the river Birgi, an area characterized by the presence of Roman riverine structures. The Roman river banks may have functioned as a ship canal, allowing access to the lower part of the Birgi, and provided a landing place or commercial stop, possibly serving local villas or rural settlements (Tusa *et al.*, 2004: 151–60, Tusa and Tiboni, 2014: 49–50).

On discovery, the wreck appeared well preserved, the sides having collapsed outwards under the weight of the remaining cargo, leaving with the keel entirely preserved and the stem and the sternpost still in place. Planking and ceiling were also found in position, and framing only partially eroded at the upper ends, some 4 m from the line of the keel. The starboard side was the better preserved. The cargo, at a depth of c. 2.70 m, had been sealed by a deposit of mud and *Posidonia oceanica*, covering a thin layer of clay and mud possibly of alluvial origin (Tusa and Tiboni, 2014: 49). A preliminary quantitative analysis of the cargo suggested that part of the load had been salvaged previously, possibly at the time of the wreckage (Tusa and Tiboni, 2014: 49).

No archaeometric dates are currently available for the timbers; however, the pottery and cargo permit us to propose a date between the late 3rd and early 4th centuries AD. Cross dating the different types amphoras found, including Keay 3, Keay 6, Keay 25 and Beltran 72, suggests this range can be narrowed to the late 3rd century AD for the date of the last voyage undertaken. This date is confirmed by an analysis of the *Posidonia oceanica* layer: according to the growth-curve of this particular seagrass, the lower part of the layer sealing the timbers was formed about 1650/1700 years BP (Tusa *et al.*, 2004: 159–63; Tusa and Tiboni 2014: 50–1).

The remains were investigated underwater during three campaigns, in 1999, 2000 and 2009, then fully excavated and raised from the seabed in 2011, during a 40-day operation led by the *Soprintendenza del Mare* and carried out by a team of nautical archaeologists and diving technicians, and with the assistance of conservators specialized in waterlogged wood (see acknowledgements). Prior to raising the timbers, the boat was completely dismantled under water to minimize risks linked to tide and water movements. This strategy permitted the authors and their team to examine all the elements of the hull both *in situ* and, once disassembled, on the surface. The timbers were then stored in water in boxes ready for transportation and conservation. They are currently undergoing conservation treatment, and will

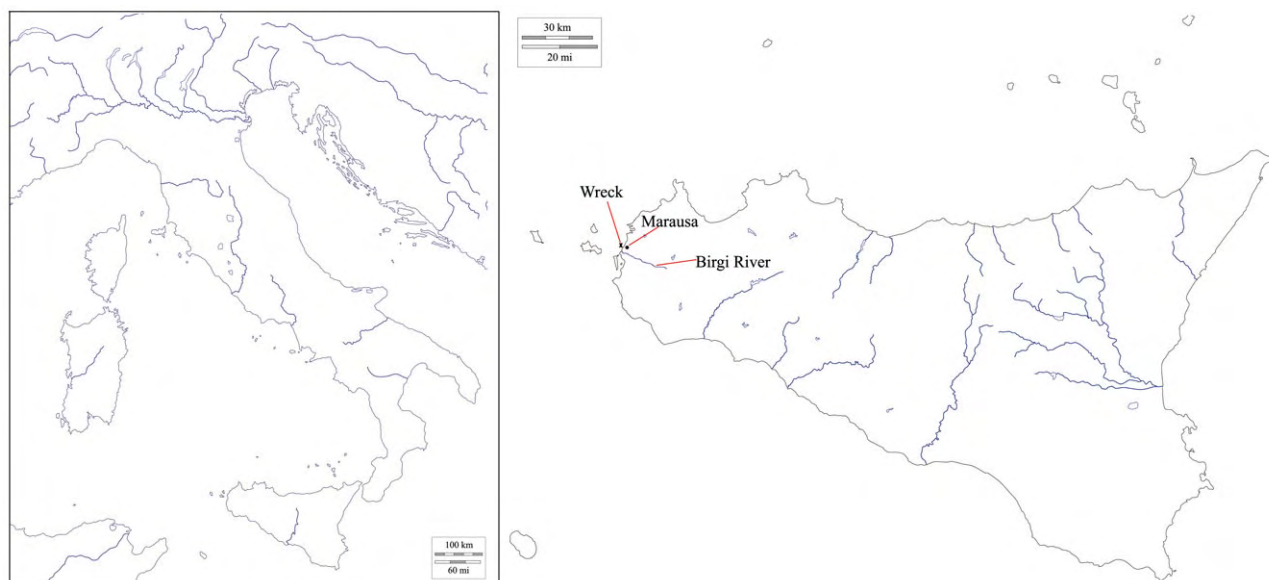


Figure 1. Location of the wreck-site. (Authors)

be reassembled in the Baglio Anselmi archaeological museum in Marsala, next to the Punic Ship.

#### ***Cargo and small finds***

The vessel was carrying Roman amphoras of different types and sizes, mainly of North African production (Tusa and Tiboni, 2014: 51). But the amphoras were not the only merchandise stowed on board: the presence of *tubuli*, as well as of other pottery items not pertaining to the crew's equipment or possessions, indicates that the ship was carrying a mixed cargo, part of which may have been contraband (Tusa and Tiboni, 2014: 51).

The majority of amphoras were fragmented as a result of the wrecking process and post depositional factors. Most of the sherds were found above the ceiling, partially covered by mud and clay. In the bow and stern areas particularly, some sherds had entered the bilges, probably post deposition, and were found in contact with the frames. A small number of sherds, all pertaining to the cargo, were found under the planking once the hull had been removed: their position was probably determined by the sinking.

The excavation of the bilges led to the recovery of elements of the crew's equipment and possessions, some of which have confirmed the general dating of the wreck. Among them is a well-preserved imperial coin, decorated with a still-visible crowned head, possibly dating to the late third century AD. Two oil-lamps, one of which with evident burning on its nozzle (Fig. 2), and fishing equipment, such as a pair of iron fish-hooks and a pyramidal lead weight, were also found under the ceiling. The presence of a low number of artefacts pertaining to the crew could be an effect of the location of the site. Lying in shallow water, not far from the shore and next to a Roman villa, we can assume



Figure 2. One of the oil-lamps pertaining to the crew's equipment. (Photo: Authors)

that the wreck was easily reached for a long time after its sinking. Thus, it is likely that most of the objects present on board at the time of the sinking, especially any precious ones, were recovered soon after the wrecking, together with some structural elements of the ship.

#### ***The hull***

Once the residual cargo was removed, the operation involved the complete documentation of the hull and its disassembly, performed in reverse order to the ship's construction (Figs 3 and 4). All the timbers were catalogued, labelled, drawn and photographed under water. Applying the methodology of stratigraphic excavation, ceiling, framing and planking were treated as three overlying layers. Fasteners, such as



Figure 3. Plan of the Marausa wreck. (Drawing: F. Tiboni, L. Sanna)

mortise-and-tenon joints and scarfs, were carefully disassembled (Fig. 5). Iron and copper nails, trenails, dowels and pegs were numbered and removed. Fasteners were only cut in a limited number of cases in which the degree of concretion made their removal impossible. Once on the surface the timbers were

again documented, studied and then stored prior to conservation treatment.

The keel, posts and both sides of the hull were preserved, from garboard to sheerstrake, a total of 39 strakes. Most of the 43 frames were still in place, only partially eroded at the upper ends. Many of the futtocks

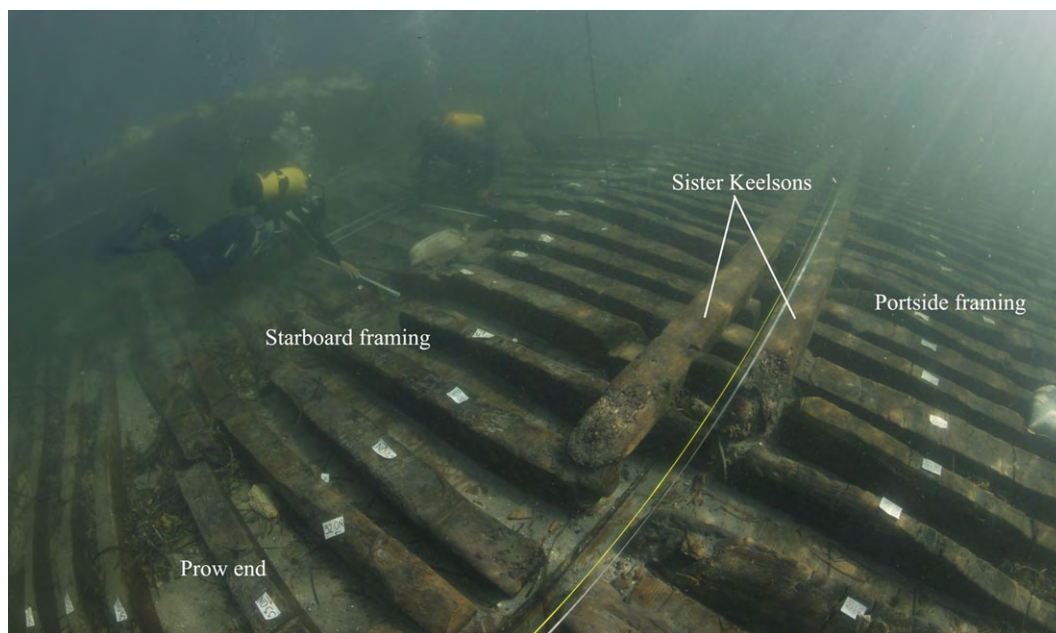


Figure 4. The wreck during excavation. (Photo: R. Rinaldi with permission)



Figure 5. Dismantling mortise-and-tenon joints on the Marausa wreck. (Photo: L. Sanna with permission)

of the starboard side were broken at a distance of *c.* 1.40 m from the keel, because of the underlying profile of the seabed (Fig. 6). Two sister-keelsons, two sleepers, and remains of two stringers were found. Some 36 ceiling strakes and the base of a bilge pump also survived, similar to that found on the Madrague de Giens (Carre and Jezegou, 1984: 116–20).

#### *Keel and posts*

The keel is 9.20 m long, an average width of 0.18 m (maximum 0.2 m), and depth of 0.27 m, with a trapezoidal section with its wider side on top (Fig. 7). The upper corners were chamfered, to accommodate the garboards that were fastened with

60 mortise-and-tenon joints on each side. It resembles the keel of the La Bourse wreck (Rival, 1991: 252–5).

At its ends, the keel was connected to the stem and the sternpost by means of two keyed hook-scarfs, each reinforced with a metal bolt, giving a total length of 10.40 m (Fig. 8). This feature is comparable to those seen in the Monaco and Siciliano Bay wrecks (Liou, 1973: fig. 69, Riccardi, 1998: 86, Pomey *et al.*, 2012: 246). At the bow, a long copper nail, about 0.27 m in length, inserted from the underside at an angle of about 60°, reinforced the scarf. A similar configuration is described by Beltrame and Gaddi for the Grado wreck where iron nails were used in the sternpost (Beltrame and Gaddi, 2007: 138–42).

Both stem and sternpost (0.24 m sided and 0.27 m moulded) were preserved for only about 0.60 m in length and appeared truncated and eroded at their upper ends. They are rabbeted to host the garboards.

Further, the connection between the keel and stem was partially reinforced by two overlapping planks, a false keel and a sort of false-garboard, nailed from the outside by means of iron and copper nails. The false keel, now almost completely lost, ran all along the bottom of the keel, fastened using long iron nails with square heads and shanks.

#### *Planking*

The shell of the Marausa vessel (Fig. 7) was carvel-built: strakes were assembled by means of pegged mortise-and-tenon joints, and made watertight with a coating of plant fibres impregnated with pitch. Twenty-one strakes were preserved and recorded to starboard and 18 to port. On the starboard, strake 21 appears wider and has



Figure 6. An example of the breaks seen in the starboard frames. (Photo: R. Rinaldi with permission)

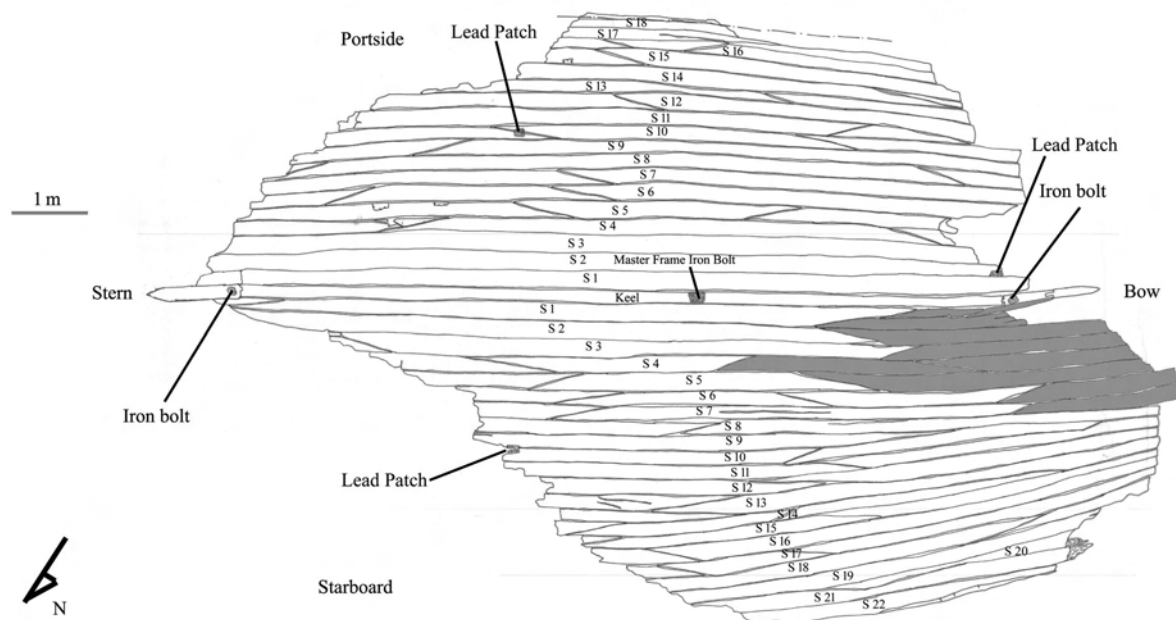


Figure 7. Plan of the planking of the Marausa wreck (drawing: F. Tiboni, L. Sanna)

a rounded upper profile, indicating it is the sheerstrake. The two garboards were connected to the keel at an angle of about 80° amidships, with no rabbet. The second strakes have an angle of 85° to vertical (Fig. 9), thus creating a fairly flat profile with a round turn-of-the-bilge.

The planks are 35–40 mm thick on average, 60 mm for the second strake, while the garboards thicken to 75 mm where they join the keel. A thicker garboard strake is also seen in the Saint-Gervais 3 (Liou *et al.*, 1990: 232), La Bourse (Gassend and Cuomo, 1985, Rival, 1991: 252–7), Laurons 2 (Gassend *et al.*, 1984:

75–105) and Grado wrecks (Dell’Amico, 2001: 42–3). Strakes are 0.20–0.30 m wide.

Rectangular mortises, 75 mm wide, 10 mm thick and 60 mm deep were cut in the middle of the plank edges, spaced 70–80 mm, with an average centre-to-centre distance of c.150 mm (see Pomey *et al.*, 2012: 240–9). The mortises host tightly fitting rectangular tenons. The tenons were secured with wooden pegs, 10 mm in diameter, placed c.20 mm from the plank seams. All the mortises used to join the keel and garboards were 75×10×60 mm, as for the rest of the planking, but the centre-to-centre spacing varied to

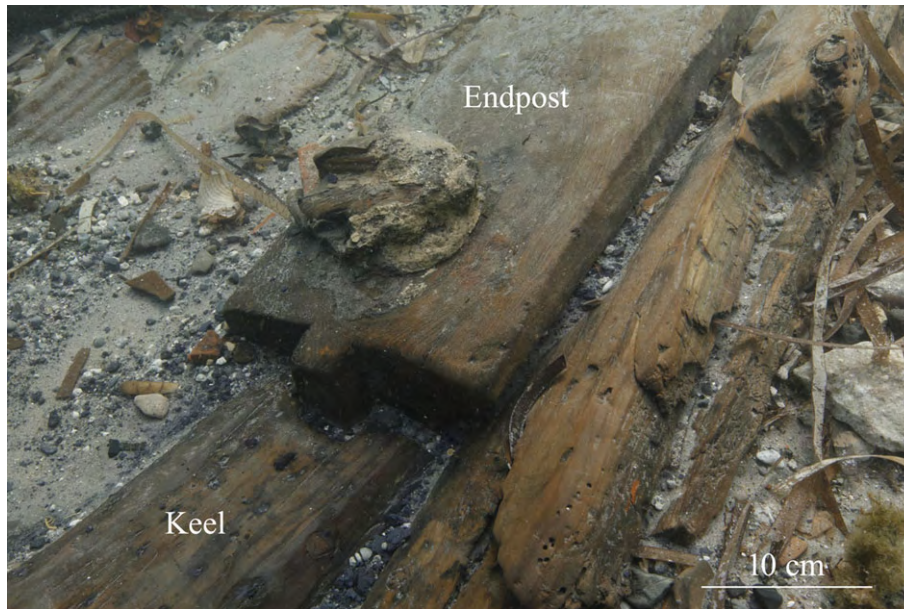


Figure 8. The keyed-hook-scarf and bolt fastening the keel and stem. (Photo: Authors)

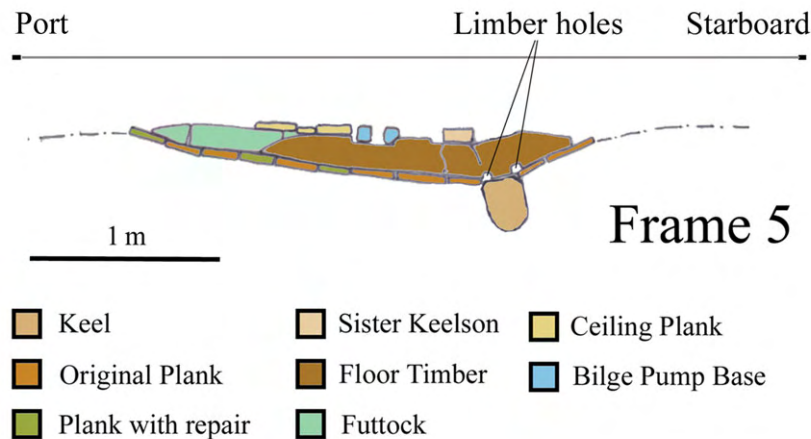


Figure 9. Section showing the keel, garboard and second strakes at F5. (Drawing: F. Tiboni, L. Sanna)

port and starboard: 130–150 mm on the portside and 140–150 mm to starboard.

Inspection of the hull has permitted the observation that the port side was better built, with strakes composed of fewer planks, and with a more regular pattern than the starboard. The portside garboard, second strake and third strake each have a single plank of *c.* 7 m in length, running from sternpost to stem (see Rival, 1991: 254). From the fourth up, all the strakes on both sides are composed of two or more planks, 1.6–5 m in length, joined with diagonal scarfs reinforced by passing tenons, usually fastened with copper nails, 90–130 mm in length, driven from the top edge of the plank (see Steffy, 1994: 65–69, fig. 3–55a). Most of the scarfs correspond to the position of the frames,

so that, at least above the waterline, the scarfs are also reinforced by means of copper nails (length 80–110 mm), inserted from the outboard, to secure the futtocks to the planking.

#### Frames

Once the ceiling planks had been removed and the bilges excavated, it was possible to record and disassemble the framing system of the ship. A total of 43 frames were recovered working from the stern to the bow (Fig. 10). As a result of the weight of the remnant cargo and overlying layers of clay and mud, which has had the effect of flattening the wreck, the upper ends of all the starboard frames and futtocks were broken at *c.* 1.4 m from the keel.

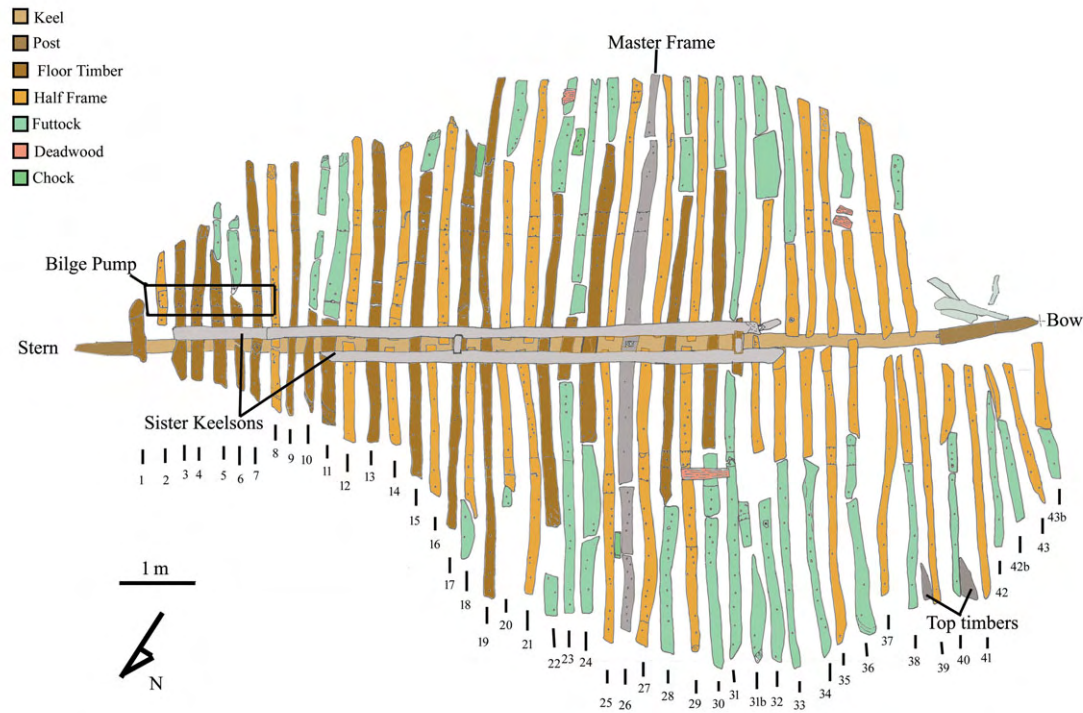


Figure 10. Plan of the framing of the Marausa wreck. (Drawing: F. Tiboni, L. Sanna)

The master-frame, F26, is easily recognized, consisting of two half-frames joined in a three-planed scarf keyed with a large iron bolt, which also fixed it to the keel (Fig. 11). It is about 0.25 m forward of the centre point of the keel. Only three frames, the master-frame (F26), F40 (now lost), and F1, found *in situ*, were iron bolted to the keel, and in the last two cases, the iron bolts also secured the keyed hook-scarfs that connected the keel to the stem and to the sternpost. All the other frames are fastened to the planking with round-section treenails, diameter 12–16 mm, usually two for each strake, inserted from the inboard and, in at least 90 cases with no obvious pattern, not completely passing through the hull planking. On both sides, from the bottom of the hull up to the height of two hold-stringers, treenails are the sole fasteners used. From the stringers up, copper nails, driven from the outboard, were also used, particularly to secure the tapering ends of some of the planks, and for repairs.

The framing pattern is irregular, as seen in the Grado wreck (Dell'Amico, 2001: 40–1), consisting, in some cases, of symmetric floor-timbers and futtocks, and elsewhere asymmetric floor-timbers with long arms and short arms of varied lengths, or pairs of half-frames. The frame timbers do not appear to alternate to port and starboard in any regular pattern, as was noted, for instance, for the County Hall vessel (Marsden, 1974: 55–6). The room and space between the frames varies along the hull c.0.30–0.45 m. The frames themselves

range from 0.10 to 0.16 m sided and from 0.12 to 0.15 m moulded. Frames often have floor-timbers and futtocks of different scantlings used in the same bend, as seen in F22, F24 and F28. In at least two cases (at F28 and F32), both on the portside, the futtocks have been partially replaced by rectangular wooden blocks, 0.20–0.24 m sided and 0.10–0.12 m moulded.

The framing is, however, more regular from the stern to the preserved forward end of the two sister-keelsons. Under the sister-keelsons, in fact, half-frames and floor-timbers follow a more regular, if not perfect, alternating pattern. From the forward end of the sister-keelsons, to the scarf connecting the keel to the stem, the framing scheme changes again. In this section it consists of half-frames, with futtocks placed in-line, like those seen on the La Bourse wreck (Rival, 1991: 250, Pomey *et al.*, 2012: 243). In at least two cases, both on the starboard side, there are also top timbers that rise from the level of the last ceiling plank, placed on the forward side of F38 and F40, but not joined to them.

#### Longitudinal timbers

On either side of the keel, the frames have been notched to seat a stringer, which probably supported a series of beams. In one case, to starboard (F29–31), there is a short, thin wooden plank nailed to the futtock to fill the space between frame and stringer. A similar solution is seen in the upper end of one of the frames of the starboard side, which probably functioned to seat the last ceiling plank of that side.

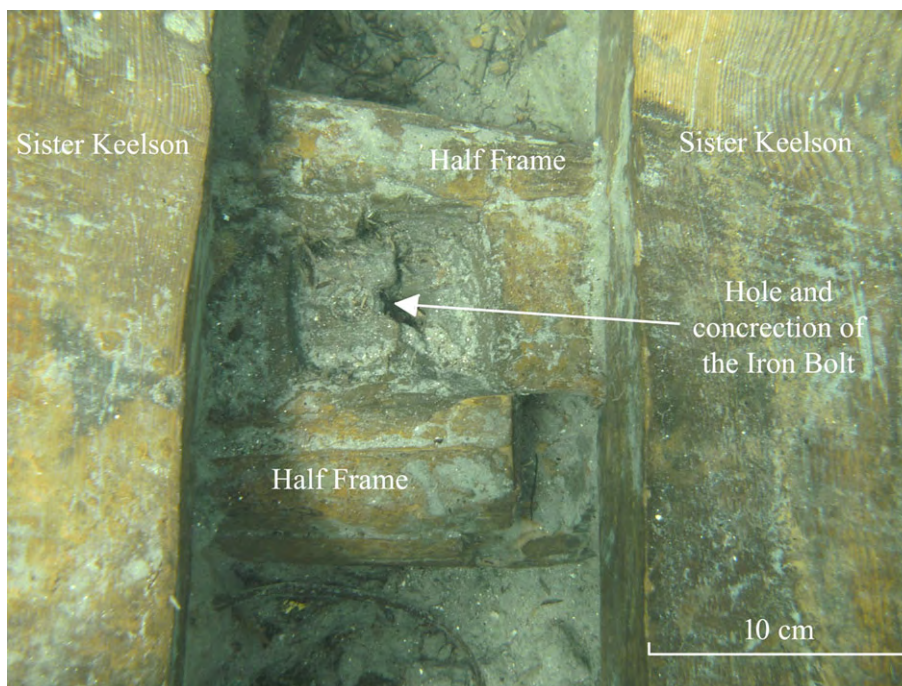


Figure 11. Detail of the central bolted scarf of the master-frame. (Photo: Authors)

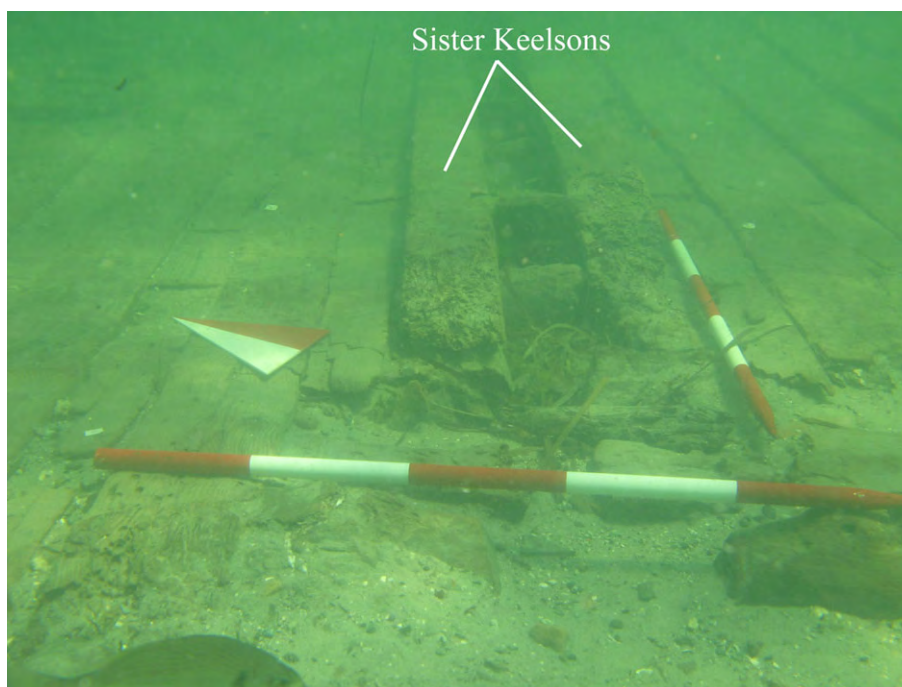


Figure 12. Detail of the sister-keelsons. (Photo: Authors)

Sister-keelsons are found on either side of the keel, each 7 m in length, partially eroded at their stern end, rectangular in section, 0.10 m sided and 0.07 m moulded, and originally joined to three of the floor-timbers with iron bolts (Fig. 12). Dismantling the two sister-keelsons has allowed the observation that they

were also iron nailed to six frames on either side of the keel, but not to the master-frame.

Two transversal sleepers connecting the two sister-keelsons, one abaft and one ahead of the master-frame were noted above F17 and F31 (Fig. 10). The mast-step was not found.



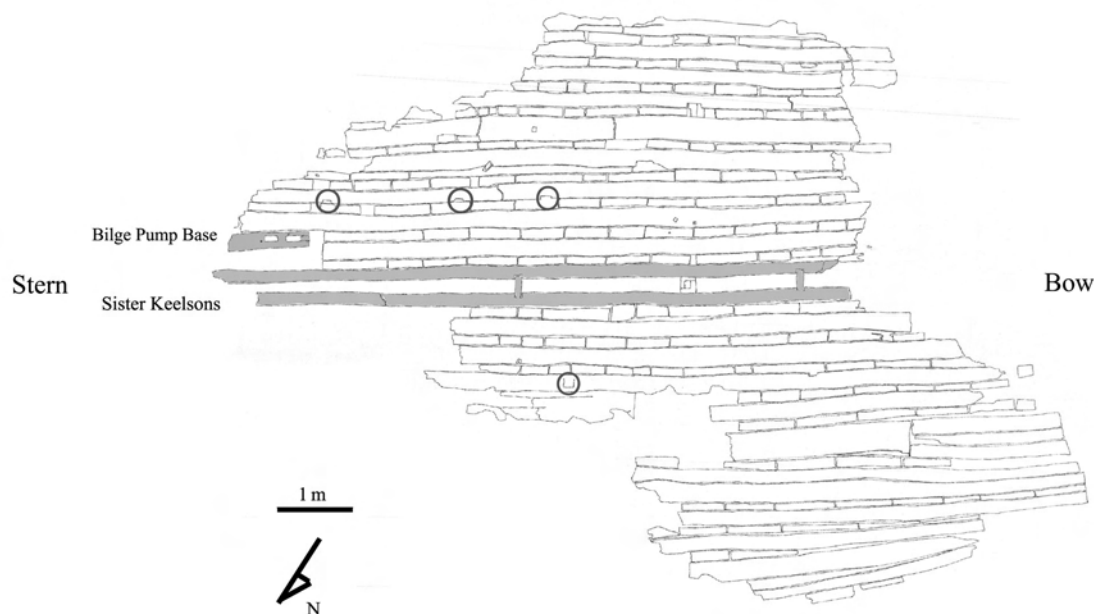


Figure 13. Plan of the ceiling of the Marausa wreck. (Drawing: F. Tiboni, L. Sanna)

#### Ceiling

Eighteen ceiling strakes were preserved on each side of the hull (Fig. 13), covering a width of about 3 m from the central axis, closed at the bottom by the two sister-keelsons. The ceiling pattern is fairly regular, with long sturdy limber-strakes, 50 mm thick, sporadically nailed to frames and interspaced with strakes of short, thinner bilge boards of maximum length 0.70 m and thickness 30 mm. In some cases, in correspondence with the larger strakes (Fig. 12), possibly the hold stringers, little wooden planks were fixed between ceiling and framing (Navri *et al.*, 2013). The bilge boards were disposed end to end and not joined together, but fitted between the limber-strakes without any other retaining device. The presence of six rectangular mortises cut in two of the limber-strakes, three on each side of the ship, probably indicates the position of stanchions or deck-beam supports. In at least one case, the location of the mortises suggests that such a beam may have functioned as a mast-partner. Unfortunately, none of these pieces have survived.

The regular planking pattern of the ceiling is interrupted twice. In the upper starboard side, a wider plank, possibly a stringer (Liou and Gassend, 1990: 258), fills the space normally occupied by three alternating ceiling strakes. In the upper strakes to starboard, also fore of the master-frame, the ceiling follows the general inward curve of the bow end of the ship. The last three strakes tapered and terminated with a type of nibbing-strake that covers the base of the top timbers, four of which were visible.

#### Pump

In the stern section of the hull, from F2 to F7 to port, the excavation revealed evidence of the location of a

bilge pump (see Carre and Jezegou, 1984: 116–20). The upper face of three frames have been carved to create a square pump well able to host the base of a chain pump, while one of the frames is shaped to permit the passage of rope and discs (Fig. 14). The discovery of a series of small, thin wooden planks (0.12×0.20 m and 10 mm thick) in this area also suggests that the pump well could have been closed (see Carre and Jezegou, 1984: 130, Gassend *et al.*, 1984, fig. 21). The location of the base of the bilge pump interrupts the pattern of ceiling planks on the lower port side. Only the wooden base block of the bilge pump is preserved. The pump block was nailed to the framing in two places with copper nails. The block has two square holes and shaping to allow the passage of the chain-pump system discs or valves.

#### Repairs

The starboard planking presents evidence of several repairs and a general refit of the bow section (Tiboni, 2014). The garboard presents a double repair, clearly indicated by two short planks. These are partially covered by a sheet-lead patch, as was seen on the Siciliano wreck (Riccardi, 1997: 84–6), fastened to the keel and to the garboard itself by means of treenails and iron nails. The joints between keel and stem, between keel and garboards, as well as between the three lower planks of the bow end on the starboard are reinforced and sealed using a sheet of lead (Fig. 15). This sheet, now lost and indicated by a thick layer of dark-bluish-grey oxidation, was originally attached by means of a double row of small copper tacks to the timbers from the inside, and covered a coating of vegetal fibres, still partially visible under the oxidation. The fibres and lead sheet were secured to the planking beneath the framing, so were placed either before the framing was installed,

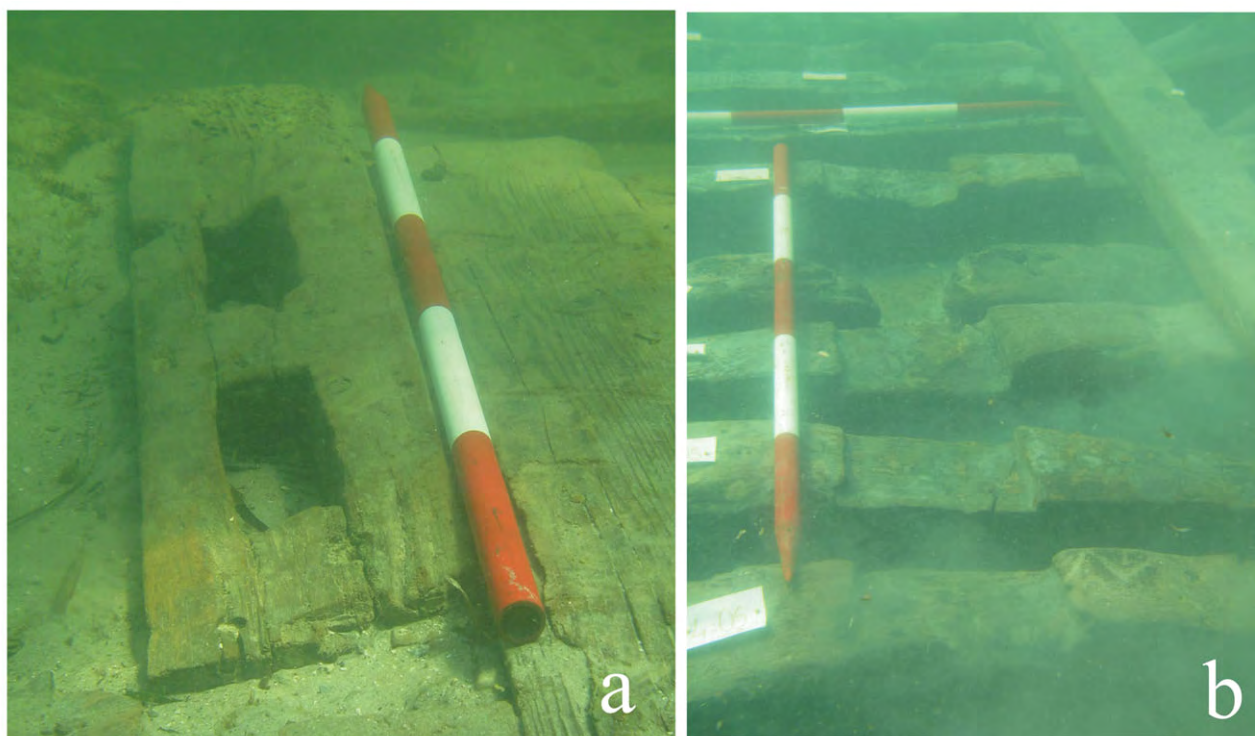


Figure 14. a) Bilge-pump base and b) frames shaped to host the bilge-pump base. (Photos: Authors)

or as a repair that required its partial removal and refitting. The two sister-keelsons have also been cut and the frames forward of them have been replaced. In the bow area, most of the planks are shorter than in the rest of the hull, and are disposed in an irregular pattern. In this area all the scarfs are aligned creating a weak area (Fig. 7), whereas elsewhere on the hull plank scarfs are dispersed in a precise pattern.

Lead was also used to seal planking seams. At least three small lead patches were secured to the planks, usually from the outside, with round copper tacks. Once the planking was removed, the pattern of dark grey traces of oxidation left on the seabed by lead patches nailed to its outer face was recorded. These repairs, particularly those below the waterline, were made from the outboard and reinforced with a sheet of lead nailed from the inside.

In at least one case (Strake 9 portside), a hull plank has been removed and replaced with a new one, as demonstrated by the presence of a patch tenon inserted from the interior face of the plank and pegged only in its forward end.

One of the wooden rectangular blocks that appears to replace part of the port futtock of frame 13 is attached to the planking by eight copper nails, all driven from the outside, and no treenails.

A simple visual inspection reveals that many of the starboard planks have been replaced in consequence of refitting. The good condition of all these wooden elements, both planking and framing, suggests that the

new components were not in use for long before the ship was wrecked. Further, the good preservation of all the copper nails used to fix the lead patch to the hull, and of the vegetal cord used to seal the gap between the keel and garboard—which were found still twisted and perfectly round in section—suggest that this major repair was made not long before the ship was wrecked.

At the same time as the repair, the inner surface of the planking and the framing were made watertight with a layer of vegetal fibres and pitch (Riccardi 1997: 84–6). However, while in the starboard bow area this was applied prior to fastening the frames to the strakes, in the stern section it covers the frames, thus suggesting that part of the framing and of the planking must have been completely dismantled, considerably weakening the structure.

## Interpretation

As we have seen above, the great number of timbers and fasteners found *in situ* has enabled the detailed observation of most parts of the structure of the ship (Fig. 3), and the identification of the post depositional processes it has undergone. Thus it is possible to estimate the general shape of the ship, to offer a cultural interpretation of the wreck, and to propose its position within the building traditions recently determined by Pomey, Kahanov and Rieth (Pomey *et al.*, 2012). As has been noted, the Marausa vessel shares features with the Saint-Gervais 3, Laurons 2, Grado, La

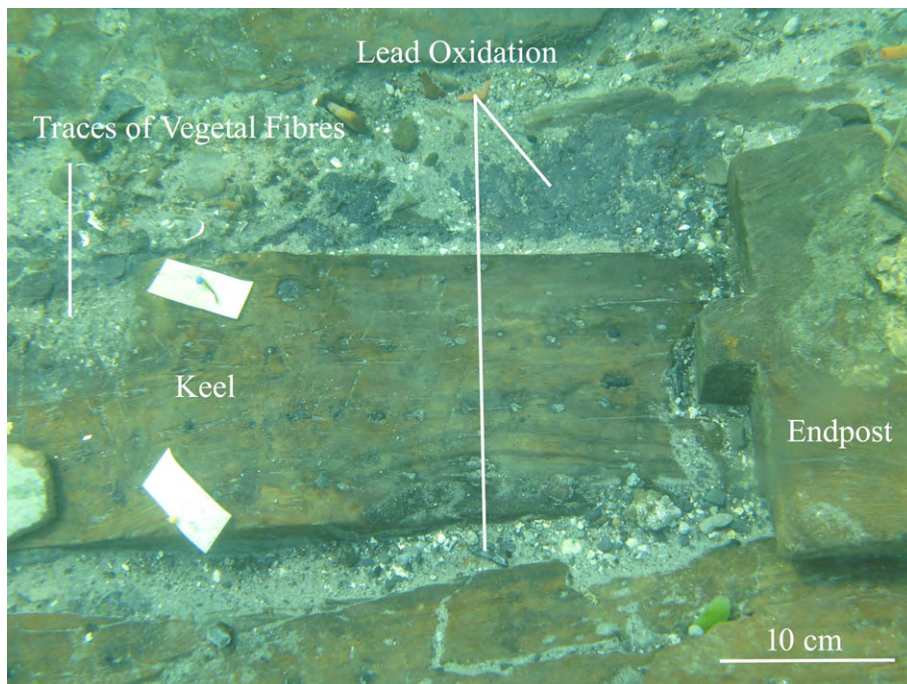


Figure 15. Traces of lead patch repairs in the bow end. (Photo: Authors)

Bourse, and County Hall wrecks (Pomey *et al.*, 2012: 240–50).

#### Shape

The general shape of the hull at the main frame appeared to be almost flat. The garboard rises from the keel at an angle of about 80° to vertical, and the second strake of the bottom planking turns outward at an angle of about 85° to vertical. The position of the base of the bilge pump, aligned with the third strake of the starboard ceiling, and the presence of the two sister-keelsons also suggest a flat profile with a round turn-of-the bilge. The positions of the three possible deck beams, suggested by the mortises carved in the hold-stringers, is also compatible with a flat bottom with a round turn-of-the bilge. The analysis of the starboard framing, the best preserved in length, confirms the general interpretation of the main frame (Fig. 9).

#### Shell conception

From a technological point of view, the Roman ship of Marausa provides evidence of boatbuilding with a shell-based conception. In fact, the framing plays a minimal supporting function within the hull: half-frames alternate with floor-timbers in no regular pattern; some of the frames are composed of two or three timbers that are not fastened to each other; and there is evidence of repair and substituted pieces. Frames from 33 to 43, on both sides, are not connected to the keel. While all the treenails attaching the frames to the planking were inserted from the inside through holes previously made in the frames, in some cases they

do not exceed the middle of the thickness of the planks of the shell.

The hull presents regular strakes, most consisting of only 3–4 planks, made watertight with a coating of pitch and vegetal fibres. The carvel-built strakes are tightly connected with a system of regular mortise-and-tenon joints. The rectangular tenons fit snugly in the mortises, and are pegged in place. In the case of repairs, patch-tenons are inserted and pegged from the inside. Within each strake, the planks are joined with diagonal scarfs secured with long tenons passing through three mortises. Below the waterline, a copper nail, inserted from the top edge of the plank, secures some of the scarfs. In some cases, the diagonal scarfs are made watertight with lead patches nailed to the timbers with round iron or copper nails and below the waterline, a corresponding lead patch nailed on the outboard of the hull confirms that the shell has been completed and made watertight before to fix the framing. None of the frames, or the wooden dowels or nails used to fix them interferes with these patches.

#### Shell construction

Detailed examination of the methods used to construct the hull and to fasten the framing to the planking suggests a shell-first construction sequence. The seemingly haphazard framing pattern using timbers of different frame dimensions and shapes suggest that, in this vessel, framing had no primary supporting function. In some cases, the use of different wood species, such as *ficus carica* which is used for only one frame in the bow starboard section, as well as partially

worked timbers, denote repairs. In others, it appears to be the result of the technological choice of the shipwrights: having minimal supporting function, framing did not need to be standardized in shape or placement. Further, considering the location of the bilge-pump base, the presence of frames that have been cut to permit the passage of the pump rope and its discs, and worn by its passage, confirms that the role of this ship's framing was only to reinforce a self-supporting shell.

Others elements confirm a shell-first sequence. The planks are tightly fitted with tenon-and-mortise joints. The position of the copper nails securing some of the planking scarfs is such that they were inserted after the pegs fixing the tenons in their mortises were in place. As they are driven from the top edge of each plank downwards they also confirm that the construction sequence was from the bottom of the hull upwards. Further, the observation of semi-circular cuts in the shank of three of these nails, but not in nearby tenons, probably the result of drilling holes for the treenails to fasten the framing to the planking, confirms that the majority of framing was attached after the planking was assembled completely. Moreover, the presence of lead patches and repairs that are partially covered by frames and futtocks and not affected by the treenails fixing the framing to the hull confirms this sequence, as well as indicating the precision of the shipwrights.

The connection between the main frame and the keel, strengthened by means of a metal bolt, and those at each end of the keel strengthened with metal bolts that also secured the keyed hook-scarfs, however, suggest that the shipwrights may have installed these three frames at an early stage of the construction and used them to guide the general form of the hull. The observation of the portside garboard and of its adjacent strake, each consisting of a single plank running along the whole length of the keel, confirms this probable building scheme. It is, in fact, possible that garboard and second strake were placed immediately after the keel and the endposts were joined, and before the three frames that guided the general shape of the hull (F1, F26 and F40).

#### *Mast-step*

The two long sister-keelsons are typical of this group, and suggest that the ship had a removable T-shaped mast-step. No mast-step was found, and it was likely recovered after the wrecking, together with a large part of the amphora cargo. The shape of the half-frames and of the floor-timbers positioned under the sister-keelsons is irregular and without a discernible pattern, suggests that the mast-step was secured and blocked in place over them. Their irregular profiles confirm that, for this period, the existence of 'movable and reversible' mast-steps does not seem probable (Beltrame and Gaddi, 2007: 139), as the mast-step must have been notched to fit their individual shapes and dimensions.

## Conclusions

The study of the wreck of Marausa, a Roman merchantman estimated to have been c.14–16 m in length based on the keel and surviving posts, and dating to the late 3rd early 4th century AD, has revealed important information about the structure of its well-preserved hull. Although analysis of the wood, and information gained from reassembling the hull in the coming months will provide additional data, this preliminary study has allowed us to examine some distinctive elements of the concepts used and the means of construction of the hull. This has enabled the Roman wreck of Marausa to be placed within the 'Western Roman Imperial tradition, Root 1' of shipbuilding, as defined by Pomey *et al.* (2012: 302, tab. 1 root 1). The Western Roman Imperial tradition developed between the 2nd and the 5th centuries AD. Its main examples are the Saint-Gervais 3 (Liou *et al.*, 1990), La Bourse (Gassend and Cuomo 1982), Dramont F (Joncheray, 1975, 1977), Parco di Teodorico (Medas, 2001, 2003) and Fiumicino I (Boetto, 2000, 2003, 2008). To this group one might add the Laurons 2 (Gassend *et al.*, 1984), the Monaco wreck (Benoit, 1961), the County Hall ship (Marsden, 1974), and the Point La Luque B wrecks (Clerc and Negrel, 1973), according to specific elements that find close parallels within the tradition as defined.

The Roman wreck from Marausa permits us to highlight elements that, on the basis of its dating to at least the second half of the 3rd century, confirm observations from the other wrecks in the group. Thus, the Marausa hull confirms that during this period the Western Roman Imperial tradition comprises shell-concept construction, with planking assembled by means of tightly fitting mortise-and-tenon joints, reinforced by massive and closely spaced framing with no primary supporting function. As suggested by Pomey (1998, 2004, *contra* Gassend and Cuomo, 1985) for the La Bourse wreck, the presence of some frames fastened with iron bolts to the keel cannot be considered proof of a major structural function for these transverse timbers. The presence of three frames bolted to the keel appears to be linked to the need to reinforce the axial backbone of the ship (Pomey, 2004: 31), as noted in La Bourse Marseilles, and Laurons 2 (Pomey *et al.*, 2012: 240–5), as well as in Marausa. We cannot exclude for the Marausa wreck, that these three pieces were bolted to the keel just after the garboard and counter-garboard were placed, and prior to assembling the planking, however, some elements confirm that they did not play an active role. First, the position of the treenails connecting the framing to the planking do not always go right through the shell, even in these frames, and always avoid penetrating the planking tenons. Further, during repairs, the shipwrights removed the bolted frame to the fore by simply cutting the bolt, and, having reassembled the hull planks, the floor-timber was not replaced.

The dating of this wreck poses further questions about the diachronic development of the Western Roman Imperial tradition of shipbuilding (Pomey *et al.*, 2012: 306). Some of the features of the Roman Wreck of Marausa, such as the shell-first sequence, the absence of active frames, and the closely spaced mortise-and-tenon joints, seem more compatible with a date at an early stage of the Roman Imperial tradition. Traces of several repairs, including the major refit of the starboard bow section that involved all the strakes from garboard to sheerstrake, confirm a long use of this boat, and could explain these factors. Without archaeometric dating of the timbers, we cannot exclude that the ship was built

some decades before it was wrecked, maybe in the early 3rd century, while the refitting could have taken place not much earlier than its last voyage, dated to the late 3rd–early 4th century AD.

Finally, the comparative analysis proposed here permits us to enlarge the Western Roman Imperial tradition both from a numeric and from a geographic point of view. The structural affinities between the wreck from Marausa and those from Grado and Siciliano Bay suggest that these might be included in this group, while the African origin of the cargo of the Marausa wreck may permit us to push back the border of the Western Tradition of boatbuilding to Northern Africa.

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