Ancient Shipbuilding: New Light on an Old Source

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I

Shipbuilding scenes are extremely rare in ancient art. And the best one that has come down to us, though known for years and often published, has never been correctly explained.[1]

It is a relief (Plate 1) on the tombstone of P. Longidienus, a *faber navalis*,[2] who died in Ravenna sometime in the late second or early third century A.D. We see him standing alongside a hull that, to all outward appearances, is complete. Yet he holds in his hand a massive timber which he is carefully shaping into a graceful curve with the adze. To my knowledge no one has ever satisfactorily explained why Longidienus is shown working on a timber for a hull that ostensibly is finished and needs no more timbers.[3] Today, thanks particularly to the discoveries of underwater archaeology, we know a good deal about the way Greco-Roman carpenters went about building a ship, and with this all becomes clear.

II

There are, basically, two ways of putting together a wooden hull. One is to set up a skeleton of keel and frames (ribs) and fasten a skin of planks to it. The other dispenses with the

[1] Ravenna, Museo Nazionale d'Antichità, No. 64. Cf., e.g., M. Rostovtzeff, *Social and Economic History of the Roman Empire*[2] (London 1957) Plate xxx, 3; L. Casson, *The Ancient Mariners* (London 1959) Plate 15a; and the work of Blümner cited in note 3.

[2] *CIL* XI.139 = Dessau, *ILS* 7725.

[3] H. Blümner, in his *Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern* (Leipzig 1875–87) 2.341, misled by a faulty line drawing of the relief (Fig. 55), thought that Longidienus was busy making a ladder to serve as gangplank. E. Kornemann, *RE* 6.2 (1909) 1896, s.v. "Fabri," says that he is working on a plank —which makes little sense since the planks are obviously all in place. H. Gummerus ("Darstellungen aus dem Handwerk auf römischen Grab- und Votivsteinen," *JDAI* 27 [1913] 63–126, esp. 92, offers the desperate suggestion that the timber is for a second ship that Longidienus is just beginning to construct.

Plate 1

Tomb relief from Ravenna showing the *faber navalis* Longidienus at work.

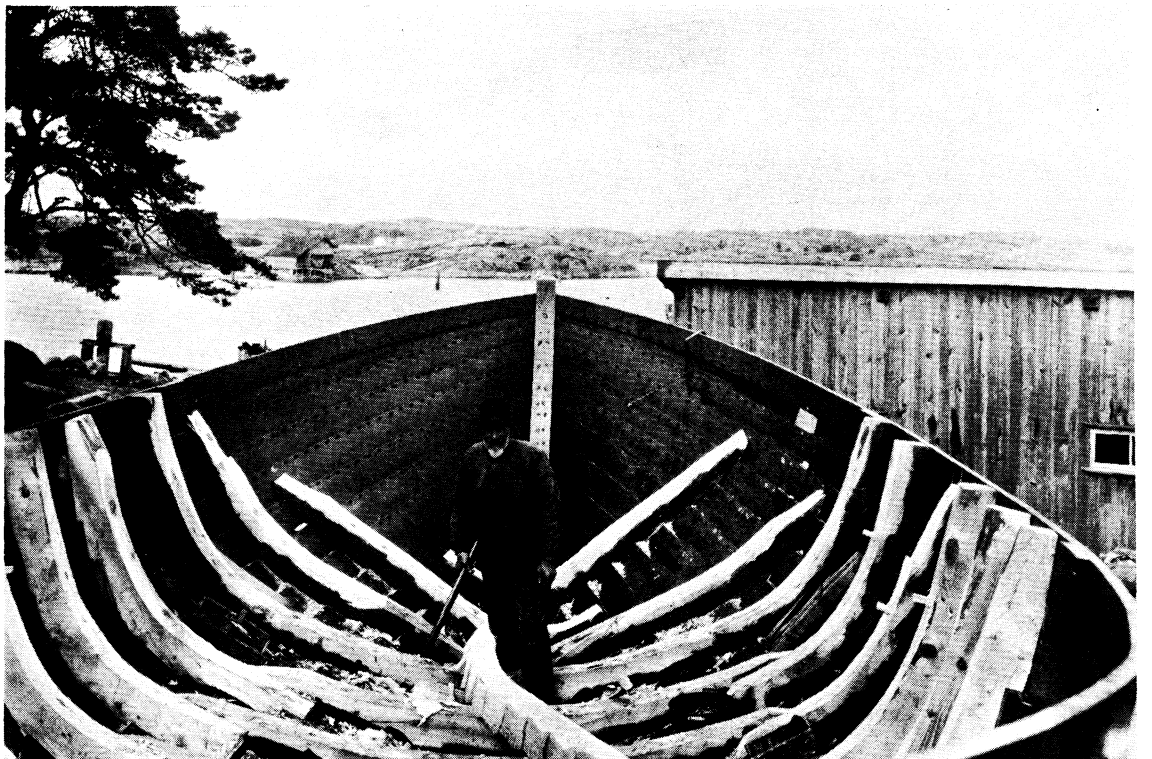

Plate 2

A modern Swedish boatbuilder at work. Photograph taken in 1929. From the archives of the Gothenburg Historical Museum; furnished by the courtesy of Olof Hasslöf.

skeleton and simply builds up a shell of planks, pinning each plank in some fashion to its neighbors; if more strength is required, a number of frames, frequently minimal, is inserted in the finished shell (cf. Plate 2).[4] The skeleton-first method is the one most of us are familiar with since it has been the standard practice of the better part of Europe and all of America for centuries. The shell-of-planks method was standard in northern Europe until the fifteenth century and in the Near and much of the Far East until the sixteenth, and is still used throughout all three areas for small boats.[5]

The shell-of-planks practitioners, moreover, fall into two schools according to the means used for pinning the planks to each other. The Vikings and all other builders of "clinker-built" craft, a type much favored in northern Europe, set the planks so that each overlapped the next (this is what is meant by "clinker-built") and then pinned them by driving rivets through the double thicknesses.[6] On the other hand, shipwrights of Egypt, East Africa, Persia, India, Japan and elsewhere in the East "edge-joined" the planks, i.e. set them edge to edge instead of overlapping them.[7] The means used for holding together the planks so set have varied from place to place. The ancient Egyptians joined them with dowels and other kinds of joints,[8] Arabs and Persians sewed them with twine,[9] Indians fastened them with metal pins or cramps.[10]

The prevailing view among students of nautical antiquities is

[4] Cf., e.g., James Hornell, *Water Transport* (Cambridge 1946) 188–98, esp. 193–94.

[5] With the increasing use today of materials such as fibre glass and aluminum and the like, the shell-first technique is probably the prevailing way of making small boat hulls in America these days.

[6] Hornell (above, note 4) 195–206.

[7] Hornell (above, note 4) 192–93, 234–37; Basil Greenhill, "The Boats of East Pakistan," *The Mariner's Mirror* 43 (1957) 106–34, 203–15, esp. 211–12, and "Japanese Inshore Fishing Boats," *The Mariner's Mirror* 45 (1959) 3–13; G. Hourani, *Arab Seafaring* (Princeton 1951) 87–98.

[8] Hornell (above, note 4) 215–25.

[9] Hourani, *loc. cit.* (above, note 7). The sewing of planks together was known to both Greeks and Romans, although by classical times it was an old-fashioned practice that they associated with primitive peoples or attributed to the mythological past. Pacuvius, for example, assumes that this was the way Odysseus made the boat which carried him from Ogygia (E. H. Warmington, *Remains of Old Latin* 2 [London 1936], Nos. 277–78 [page 268]); and Pliny suggests that the ships at Troy were so made (*NH* 24.65). Cf. my note, "Sewn Boats," in *CR* 13 (1963) 257–59.

[10] Greenhill (above, note 7) 108–9, 113–16, and "The Karachi Fishing Boats," *The Mariner's Mirror* 42 (1956) 54–66, esp. 58–66.

that Greece and Rome never practiced the shell-of-planks technique but always started with a skeleton of keel and frames; in fact, it is generally assumed that the modern method of building wooden boats in Europe and America is simply a continuation of what had been traditional in the Mediterranean from classical times.[11] The information that could be gleaned from ancient writings pointed in this direction, and the scant remains of ancient hulls that had turned up all showed signs of a strong internal skeleton. However, to complicate matters, these same remains *also* showed that the planks had been edge-joined.[12]

In the past decades the activity of divers has increased enormously the amount of evidence available; we now have a body of material with a fair chronological and geographical range. It all presents a consistent picture; Greco-Roman shipwrights, at least in making merchant craft (no remains of warships have yet been recovered), had their own distinct way of assembling hulls, a way that combined elements from the two basic methods: they used a sturdy skeleton of keel and frames and, at the same time, edge-joined the planks. The joinery, moreover, was carried out with extraordinary care: the sole type of joint used was the mortise and tenon; each was transfixed by a dowel to keep it from ever working loose; and on sea-going vessels the joints were set so closely together they practically stood cheek by jowl.[13]

So far so good. But a key question still remains: though the Greco-Roman shipwright took elements from both techniques, he must have followed the *procedure* of one or the other. Did he start with a skeleton of frames, as later in the West? Or did he first fashion a shell of planks, as in the East? There is enough evidence now to make possible a conclusive reply: the prevailing view of scholars is wrong. He did not start with an inner skele-

[11] C. Torr, *Ancient Ships* (Cambridge 1895) 40; A. Köster, *Das antike Seewesen* (Berlin 1923) 47, 56–57, 72–73; F. Miltner, *RE* Supplbd. 5 (1931) 906, 909, 919–20, s.v. "Seewesen." I repeated the statement myself before I knew better; cf. *The Ancient Mariners* (above, note 1) 14.

[12] See R. C. Anderson, *The Sailing Ship* (London 1926) 52–53; G. S. Laird Clowes, *Sailing Ships* 1 (London 1932) 28–29; M. Clerc, Massalia: *Histoire de Marseille dans l'antiquité* (Marseilles 1927–29) 2.172–76; G. Ucelli, *Le navi di Nemi*[2] (Rome 1950) 152–59, 380; cf. Casson (above note 1) 195–97.

[13] Eight examples of wrecks so constructed are listed by F. Benoît, *L'épave du Grand Congloué à Marseille*, xiv[e] Supplément à *Gallia* (Paris 1961) 152 (cf. my review in *AJA* 66 [1962] 432–33).

ton; despite the ubiquitous presence of elaborate framing, the procedure he followed was that of the East.

The first clue I had that this was the case was indirect; I observed that in many instances the nails pinning a plank to a frame had been driven right through a mortise and tenon;[14] the sole explanation that made sense was that the planking had been put together first and the frame subsequently inserted and fastened in place. Then, in 1961 came the final confirmation: a sharp-eyed diver discovered on a fragment of a wreck the very line which the ancient shipwright had scored across the inside of the hull to show where a frame was to go.[15]

Now let us return to the relief. In the light of the above, the scene makes perfect sense: *Longidienus is busy shaping a frame to insert in his completed shell of planks.* As a matter of fact, the tops of a number which he has already put in place are clearly visible. Plate 2, a photograph taken in 1929 in Sweden, where the shell-of-planks technique is still practised, shows a perfect parallel, a Swedish boatwright at precisely the same stage in building his craft as the Roman.

III

If the procedure in Greece and Rome was the same as that of the East, this was, however, the only affinity between the boat-builders of the two areas. The fragments of planking recovered from the Mediterranean reveal a measure of strength and a standard of workmanship that are without parallel among all other types of edge-joined craft we know of. The hulls of ancient Egypt, held together by twisted cables,[16] or the sewn hulls of the Arabs, are veritable cockleshells in comparison.[17] The Greco-Roman

[14] E.g., Benoît (above, note 13), Plate XXIV on page 136, Plate XXVII on page 140, Plate XXVIII on page 143. I found numerous examples when I examined the two large barges (probably of the late Imperial period) brought to light during the construction of Rome's new international airport at Fiumicino (cf. V. Scrinari, "Strutture portuali relative al Porto di Claudio messo in luce durante i lavori dell' Aeroporto Intercontinentale di Fiumicino [Roma]," *Rassegna dei Lavori Pubblici* 3, [Marzo 1960]).

[15] H. Frost, *Under the Mediterranean* (London 1963) 266.

[16] Ch. Boreux, *Études de nautique égyptienne* (*Mémoires de l'institut français d'archéologie orientale du Caire* 50) (Cairo 1925) 474–78.

[17] Marco Polo's comment was (ed. Yule [1871] 1.102): "Their ships are wretched affairs and many of them get lost; for they have no iron fastenings and are only stitched together with twine made from the husk of the Indian nut . . . It keeps well and is not corroded by sea-water but it will not stand up well in a storm."

shipwright carried out the joinery with such care that it more resembles cabinet work than carpentry, and then, for good measure, into this extraordinarily solid shell inserted framing every bit as complex, if not as massive, as that found in Western craft of later date, which depended solely on the skeleton to hold the planking together.[18] The work involved was laborious, but the reward was a hull of remarkable strength at a great saving in weight and bulk.

Sooner or later he was bound to realize that he did not have to go through the time-consuming process of mortising and tenoning the planks together, to realize that, if he used heavier frames, he could put these up first, quickly and easily fasten the planking directly to them, and end up with a hull which, though less strong, was perfectly adequate. We do not yet know the precise date when this happened, but we are gradually narrowing the possibilities. The shell-first technique lasted until at least the seventh century A.D., for divers have recently excavated a wreck, dated by coins found in it to the reign of Heraclius (610–41 A.D.), which was so built.[19] At the other end, certainly by the fourteenth

[18] E.g., in a wreck found off the island of the Grand Congloué near Marseilles, the mortises and tenons were sunk half the depth of the plank, were a full 6–8 cm. broad, and stood less than 5 cm. apart (Benoît [above, note 13] 136 and 152). The frames, 8 × 10 cm. in section, were placed no more than 8–10 cm. apart (Benoît 144, 149).

Our knowledge of the ancients' practice of edge-joining planks with mortises and tenons has cleared up a number of obscure passages in ancient literature. E.g., when Ovid, describing a ship in a storm, says (*Met.* 11.514–15) *Iamque labant cunei, spoliataque tegmine cerae | rima patet, praebetque viam letalibus undis*, we now know that the hitherto enigmatic *cunei* means "tenons," which can be wedge-shaped in appearance; the storm was so violent that the mortise-and-tenon joints holding plank to plank came loose, the seams opened up breaking the coat of wax that had been payed over the planks, and the water came in. Cf. Jules Vars' note in *Comptes-rendus de l'académie des inscriptions et belles lettres de l'institut de France* (1896) 386–87. The vexed question of how Odysseus built the boat that carried him from Ogygia (*Od.* 5.244–57) can now be resolved; see my note, "Odysseus' Boat," in *AJP* 85 (1964) 61–64.

[19] George Bass, "Underwater Excavations at Yassi Ada: A Byzantine Shipwreck," *Archäologischer Anzeiger* (1962) 538–63. In this article the author stated (551) that the wreck was probably built with planks nailed directly to frames, the earliest instance discovered so far. He now informs me, however, that this was an error: in the Yassi Ada wreck, as in all the others I have cited above, the planks were edge-joined by means of mortises and tenons.

However, there is one exception to record. In 1962 a large (55′ long, 22′ wide) flat-bottomed barge of the third century A.D. was found in the mud of the Thames near London's Blackfriars Bridge. This simple craft turns out *not* to have been built in the shell-first manner with planks edge-joined to each other, but more or less in the way we today build flat-bottomed rowboats: i.e. sides and bottom meet at a sharp angle, and the planks are nailed directly to floor timbers and frames. Until further

century, Mediterranean shipyards had switched to the method they were to use henceforth, the starting with a skeleton of keel and frames. Sometime, then, during the Dark Ages the all-important change-over took place.[20]

evidence turns up, we can only suggest that this rough-and-ready method was limited to simple, flat-bottomed craft. The discovery raises some interesting possibilities—e.g. was this the method used for the 100 quinqueremes and 20 triremes that in 260 B.C. were rushed to completion in a mere 60 days *ab arbore* and for the other fleets built with lightning speed (Polyb. 1.20.10 and Pliny, *NH* 16.192)?

[20] The change-over from the one technique to the other may not have been at all difficult, as is shown by Olof Hasslöf's fruitful study of ship-building practices and techniques of the past few centuries ("Wrecks, Archives and Living Tradition," *The Mariner's Mirror* 49 [1963] 163–77). Citing (170–72) some interesting hulls in which the shell-first and the skeleton-first construction were combined, he demonstrates that the two methods are not exclusive and suggests the possibility that the latter developed out of the former.