The Shipwrecks of Heracleion-Thonis: An Overview

David Fabre, Alexander Belov

Russian Academy of Sciences
Center for Egyptological Studies

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Topographical surveys and soundings in the Bay of Aboukir led to the discovery of the Heracleion–Thonis site and allowed for an initial understanding of the religious, economical and urban organisation of the site. The results of the first ten years of excavations (1996–2006) are published in a separate monograph[5] and here we will consider only those peculiarities of Thonis-Heracleion's topography that shed some light on the position of the shipwrecks discovered at the site.

2. General information on the shipwrecks

2.1. Topography of the Site

The site of Heracleion-Thonis covers an area of 1000 by 1200 m. The most impressive constructions on the site, including the Temple, are situated on the peninsula that was separated from the Nile by a Southern Basin and a narrow passage between the sand dunes. The Central Basin, North Basin and Western Lake surround the central part of the city on three sides. It is worth remembering that the toponym of Thonis is believed to originate from the name of the coastal artificial lake (*ḥn.t*).[6] A large canal crosses the peninsula from the Central Basin to the Western Lake in the vicinity of the temple.[7] The complex of the city is well protected from the dominating north-western wind. These are the main features of the city while its actual topography is complicated by secondary canals and passages.

Numerous remains of quays have been discovered while the bottom of the port areas and canals are very clearly indicated by the presence of ancient anchors of different types. More than 700 of them have been found so far bearing witness to the great activity of the port. Among these, a specific type of a stone anchor with wooden flukes is preponderant but there are also considerable amounts of stone and lead stocks from wooden anchors. Usually it is not possible to date these anchors without good context as they remained in use over many centuries. However, wooden flukes have been preserved for some of the anchors discovered so far thus allowing carbon-dating them between the middle of the 6th century BC and the end of the 4th century BC. Apart from the anchors, navigation areas are distinguished by sediment deposits which are very rich in pottery sherds and small fragments of lead. The area of the Grand Canal, apart from anchors, is characterised by numerous ritual and votive objects.

The information provided by the distribution of the anchors is of major interest and deserves attention but the main archaeological potential of the port areas of Heracleion lies in their great number of ancient shipwrecks.[8] More than 60 ships were identified, an accumulation never encountered before at any other archaeological site.[9] The preliminary studies of the shipwrecks

[5] Goddio, *Topography and Excavation*. See also J.-D. Stanley, *Geoarchaeology: Underwater Archaeology in the Canopic Region in Egypt* (Oxford, 2007).

[6] J. Yoyotte, 'Notes de toponymie égyptienne» in Festschrift zum 80. Geburgstag von Professor Dr. Hermann Junker' in *MDAIK* 16 (1958), II, 414–430.

[7] Goddio, *Topography and Excavation,* 74–75.

[8] D. Fabre, 'The shipwrecks of Heracleion-Thonis. Preliminary Study and Research Perspectives' in Wilson A., Robinson D. (eds.) East meets West along the Maritime Silk Route. Waseda University. Tokyo 2–3 July 2009. Oxford, forthcoming.

[9] The number of Roman ships found in Pisa, Italy, in 1999 amounts to 16. See S. Bruni (ed.), *Le navi antiche de Pisa: ad un anno dall'inizio delle recherche. The Ancient Ships of Pisa: after a year of work* (Florence, 2000). The number of Yenikapi wrecks in Turkey run to 34 ships dating from 5th to 11th century AD, See U. Kocabaş, 'Byzantine shipwrecks project' in *Byzantium and the Sea, conference held in Vienne 19-21 February 2010*, forthcoming.

which consisted in determining their shapes, sizes, the wood species they were made of and their date showed that, in most cases, the degree of the wood's conservation is very good, sometimes exceptional. The good state of preservation of the material is due to the presence of a very dense clay layer that covers considerable parts of many of the hulls. On the downside, this clay layer slows down significantly the excavation process.

2.2. Dating of the Shipwrecks[10]

As the quantity of material is overwhelming, it was not possible, in the first stage, to collect more than a few samples from each shipwreck, and thus dates and especially paleobotanic studies, are still subject to change. However, the first results indicate that the majority of shipwrecks date to between the 6th and the 2nd centuries BC. Forty five shipwrecks that have calibrated radiocarbon dates are presented on Figure 1 and some preliminary conclusions can be drawn at this point. We can distinguish five chronological groups for the ships. The first includes seven shipwrecks that definitively belong to the Ptolemaic period. Eleven ships that most probably belong to the same period form the second group. Dating of eighteen ships falls into the Late Period (664–332 BC). Another eight ships can belong either to the Late or to the Third Intermediate Period (1069–664 BC). The last group is represented by a single shipwreck which dates from the 14th to the 11th century BC and is thus of special interest.

To summarize 40% of the ships are most probably Ptolemaic in date. Although the Greco-Roman type of construction is well known from numerous excavations in the Mediterranean, ships of the Ptolemaic period have never been excavated in Egypt so far. The large number of ships of this period at Heracleion can be used to illustrate some peculiar features of construction of purely local origin and testifies to the use of a selection of indigenous wood species. On the other hand, good conservation of the material can help testing unproved hypotheses concerning the Greco-Roman boatbuilding tradition. Another 40% of the shipwrecks belong to the Late Period. Very few shipwrecks of this age were excavated throughout the Mediterranean and almost each new one brings precious information. As far as Egypt is concerned, the lack of such type of archaeological data for this period is especially striking and studies of naval architecture are mainly based on scarce iconographic and epigraphic material. However, the Late Period is characterised by numerous technological improvements in naval architecture. The study of the transition from the indigenous Egyptian boatbuilding tradition to the Greco-Roman one opens up avenues of investigation. It is quite possible that some of the eight ships that are dated between the end of the 9th and the end of the 5th century BC actually belong to the Third Intermediate Period and as such, may bear witness to constructional features that appeared only during the time of the Persian domination. Finally, one ship has a calibrated dating falling between the 14th and the end of the 11th century BC. Such discovery is absolutely exceptional as only few examples of underwater excavations of ships of this age can be cited.

[10] We draw attention to the fact that the range of dates suggested by radio carbon is quite large, even after adjustments have been made for environmental factors (plus or minus 50 years, or even more). Furthermore, the date derived from C^{14} methods only relates to the period during which the wood was living matter, that is, when it was still sapwood. The data, with C^{14} analyses references, will be published in a monograph devoted to the shipwrecks of Heracleion-Thonis (*OCMA Monograph*, Oxford).

In addition, neither the Phoenician shipwreck of Uluburun (1300 BC)[11] nor the Cape Gelidonia shipwreck (1200 BC)[12] show many constructional details.

2.3. Distribution of the Shipwrecks

The shipwrecks form zones of accumulation that are located mainly in the Central Basin and in the Grand Canal. Two major accumulations in the western and eastern part of the Central Basin include 11 ships each. The main conclusion that one can draw looking at Figure 2 is that the majority of the shipwrecks in each accumulation form synchronous groups. Thus probably, the accumulations were not formed by natural factors acting over long periods of time, such as tides or currents, but by some sudden historical events. However, the latter could be either of natural origin (for example earthquake with resulting swell or hurricane) or of human making (sinking of a fleet during a war or for some specific purpose in peaceful times). Still, the context of the shipwrecks makes us believe that natural hazard is much less probable than human activity, as will be shown below.

3. Preliminary Studies of Naval Architecture

3.1. Wood Species Used in the Construction of the Ships

Two groups of wood species are attested as building material for the construction of the ships: those that are native to Egypt and those that could have been imported.

The natural dearth of large trees in Egypt forced the local shipwrights since prehistoric times to make use of the native poor quality wood in spite of its numerous disadvantages. At the same time, it is this factor that stimulated the inventiveness of the Egyptians and led to the appearance of their unique boatbuilding tradition.

Acacia (Acacia sp.). Acacia wood dominates as a construction material for the ships discovered in Heracleion as almost 80% of them have at least some strakes of planking made of acacia (Acacia sp., Acacia totilis/radiana). The following table and Figure 3 illustrate the number and percentage of ships as per the wood species used for their construction.

Wood	*Number of Ships*
Acacia	47
Sycomore	1
Pine	2
Oak	4
Undetermined	6
Total	**60**

Keeping in mind that acacia is a very peculiar wood and that nowhere in the Mediterranean could it have been considered as appropriate material for boatbuilding, one may presume that these ships probably had all their planking or even their entire construction made of acacia.

[11] C. Pulak, 'The Uluburun Shipwreck, an Update' in *6th International Symposium on Ship Construction in Antiquity Proceedings* (*Tropis* VI, Athens, 2001), 439.

[12] G.F. Bass, *Cape Gelidonya: A Bronze Age Shipwreck* (*Transactions of the American Philos. Society New Series* 57, Philadelphia, 1967).

Acacia wood is very difficult to work. Herodotus, however, left us the description of the construction of the authentic Egyptian river craft baris, built of acacia.[13] Theophrastus and Pliny the Elder mention acacia among the trees used for boatbuilding in Egypt and describe a region near Thebes where this wood was worked.[14] During the Ptolemaic and Roman Periods, there were still acacia groves around Lake Sirbonis in the eastern Delta.[15] It is probable that acacia forests also existed in the Canopic region.

Sycomore (Ficus sycomorus). The other local wood found in the boats construction is sycomore. It is a poor quality wood but, nevertheless, it was used in Egypt since the Neolithic era. Documents of the 18th Dynasty and of the Ptolemaic period prove that sycomore was used for boatbuilding.[16] The first archaeological evidence for it comes from the boat found at Matariya (near Heliopolis) in 1987. This river boat dated to the 5th century BC was 11 m long.[17] At least one strake of shipwreck 11 from the Grand Canal of Heracleion was cut of *Ficus sycomorus*. This shipwreck has not yet been excavated and dates from the 2nd century BC. Moreover, the excavations of the Roman ship of the Island of Antirhodos (1st century BC–1st century AD) in the Portus Magnus of Alexandria, showed that one of its aft floor-timber was cut of sycomore. Both vessels are not boats but ships of considerable size, the latter exceeding 30 m in length.[18] Likewise, Romans were using the wood of sycomore's relative — *Ficus carica* — for boat construction as evidenced by the recent excavation of the large Roman oared vessel from Pisa (Ship C).[19]

Pine and Oak. It is not possible at the present stage of excavation to ascertain whether the oak and pine wood identified on the Heracleion shipwrecks was imported or whether it was of local origin. Wood importation intensified during the 18th Dynasty following the deep penetration of the Egyptians into Asia Minor. Oak, together with other species like maple, ash, elm, olive and others, was imported to Egypt. Nethertheless, the texts by Theophrastus and Pliny the Elder show that oak was naturally present in the Thebaid. The habitat of the Aleppo pine (*Pinus halepensis*) also included some regions of North Africa.

Four shipwrecks of Heracleion have planking of oak. It should be noted that classical Mediterranean boatbuilding tradition very reluctantly resorted to oak when creating the shell of the ship usually preferring resinous species and especially pine.[20] Most often, oak was used either for the keel and false keel or for transversal details, like frames and beams. It is notoriously difficult to change the natural form of oak wood and thus it was used for the planking either intentionally in separate strakes, like whales, or because of the absence of any other suitable material.[21] If we suppose that the wood for our ships was imported, would it not have been preferable to order softer wood, say pine, which is easy to work and which is sea friendly? Ancient Egyptian shipwrights had a long experience in working with resinous wood as we can see from the boat of Cheops.

[13] Herodotus, *Histories* II, 96.

[14] Theophrastus, *Enquiry into Plants* II, 4, 2, 8; Pliny, *Natural History* XIII, 63, 19.

[15] P. Chuvin and J. Yoyotte, 'Documents relatifs au culte pélusien de Zeus Casios' in *RevArch* 1 (1986), 50.

[16] R. Gale, P. Gasson and N. Hepper, 'Wood' in P. Nicholson and I. Shaw (eds.), *Ancient Egyptian Materials and Technology* (Cambridge, 2003), 340.

[17] S. Vinson, *Egyptian Boats and Ships* (London, 1994), 47–48.

[18] The results of the excavations of the Antirhodos Island ship are being prepared for publication by IEASM (D. Fabre, A. Belov, P. Sandrin).

[19] Bruni, *Le navi antiche di Pisa,* 83.

[20] M. Rival, La charpenterie navale romaine (Paris, 1991), 87.

[21] The shipwreck of Laurons (2nd cent. AD) had a whale of oak; the wreck of Ladispoli (1st cent. BC) — some strakes. The planking of two Roman ships of Pisa was cut of oak. See Rival, *La charpenterie navale*, 89; Bruni, *Le navi antiche di Pisa*, 81.

The construction of shipwreck 17 which was studied during the first season of excavations in spring 2009 shows features of indigenous construction. The keel of this ship consists of 10 pieces of an average length of 2,4 m. Oak was identified in the planking of the ship while the texture and colour of its wood shows that the keel is probably of oak too. We have to continue our studies of this ship in order to understand whether the shipwrights initially possessed only short saw-timber — and thus we may presume a local, African, origin for the wood — or whether they intentionally used very short keel sections.

Pine was identified in the construction of two ships of Heracleion. One of them is medieval in date and can be excluded from our study. The wood of the other ship could have been imported or the ship itself could have been of foreign origin. More astonishing is the absence of cedar and cypress among the resinous wood species used for the construction of the ships.[22] Phoenician wood had an excellent reputation for boatbuilding since the Predynastic period and it kept it into the Achaemenid period. Cypresses from the island of the same name were used for naval construction and the deliveries of wood from Cyprus to Egypt are mentioned in the El-Amarna letters (14th century BC). Cedar from Lebanon was identified also in the fragments of the planking of the seagoing ship from the Middle Kingdom harbor at Wadi Gawasis on the Red Sea.[23]

However, we should be cautious in reconstructing the direction of trade flows as a distinction need be drawn between construction wood (raw material) and pieces that have already been worked. This difference is already present in the customs accounts of the satrapy of Egypt[24], in the Stele of Naukratis[25] and in the Stele of Heracleion-Thonis.[26]

3.2. Elements of Construction

Keel. The keel of shipwreck 17 dating from the Third Intermediate or Late Period is made up of 10 pieces and only one of them exceeds 3 m in length. The fragments of the keel are joined by a Z-scarf with the key. The width of the keel is almost constant and changes within limits of 39–43 cm. During the first season of excavation the keel was not studied in its section and we can only guess at its internal structure and form. Yet this wide keel consisting of short timbers makes one think that the shipwrights did not confer significant importance to the structural role of the keel and, quite probably, it was not a proper keel but just a keel plank. In fact, it appears to be the same type of plank but wider and thicker than the others which, are positioned in the center and used as the starting point for the entire construction. At least at both extremities of the ship the thickness of the timbers was very modest. Keel planks are known from many shipwrecks dating from the 6th–5th centuries BC[27] and the same type of keel was found in the

[22] Gale, Gasson and Hepper in Nicholson and Shaw, *Ancient Egyptian Materials and Technology*, 334–352, 349–350.

[23] K.A. Bard and R. Fattovich (eds.), *Harbor of the Pharaohs to the Land of Punt, Archaeological Investigations at Mersa/Wadi Gawasis Egypt, 2001–2005* (Naples, 2007).

[24] B. Porten and A. Yardeni, *Textbook of Aramaic Documents from Ancient Egypt, III, Literature, Accounts, Lists* (Jerusalem, 1993); Briant and Descat in Grimal and Menu, *Le commerce,* 59–104.

[25] M. Lichtheim, *Ancient Egyptian Literature, III, The Late Period* (Berkeley–Los Angeles–London, 1980), 88.

[26] D. Fabre, 'Heracleion-Thonis: Customs Station and Emporion' in Goddio and Fabre, *Egypt's Sunken Treasures*, 219–234.

[27] S. McGrail, 'Sea Transport. Part I: Ships and Navigation' in J.P. Oleson (ed.), *The Oxford Handbook of Engineering and Technology in the Classical World* (Oxford, 2008).

construction of the Bronze Age ship of Uluburun. Probably this keel is devoid of rabbet and the garboard joins the keel edge-to-edge. No breaks were found elsewhere along the garboard. However, were the initial angle of the planking high (boarding rises quickly), the fractures and spaces would be visible between the planking and the keel. Together with the other facts considered below this provides us with some evidence for suggesting that the hull of the ship was rather full.

Planking. The carvel planking of all the ships that were found on the site of Heracleion was assembled by mortise and tenon joinery. This kind of assemblage is most typical of Greco-Roman shipbuilding. Earlier shipwrecks of the archaic period in Greek history (650–480 BC) from the northern coast of the Mediterranean show many examples of completely28 or partially sewn boats.[29] The Egyptians knew the technique of the 'sewn boats' since the third millennium B.C. and the best example of it is the funeral barque of Cheops. For the time being, we are not able to confirm the complete absence of sewing in the construction of the Heracleion ships. However, no sewing was evidenced on shipwreck 17 which is, for the moment, the only ship which has been partially excavated.

Still, one can immediately see the difference between the Heracleion's wrecks planking assemblage and those of the classical boatbuilding tradition. In our ships belonging to the Late Period the distance between mortises varies between 20 and 35 cm. Likewise, average distance on the archaic shipwrecks of Place Jules-Verne 7 and César I in Marseilles (525–510 BC) was also 20 cm,[30] on the ship of the Bronze Age of Uluburun this distance was around 25 cm.[31] It is generally recognised that, at that time, mortise and tenon joinery did not achieve the optimal density that was used by shipwrights in later periods. For comparison, average mortise to mortise distance of the hulls from the 4th century BC to the 3rd century AD is only 12,5 cm, almost twice as much less than what can be observed on the Heracleion ships.[32] Still, the idea of this type of joinery was to provide maximum lateral strength to the hull where tenons served as internal frames. In our case, very specific tenons have been used (Fig. 4). They are not small and rectangular pieces of wood that join only adjacent strakes of planking, but long and thick timbers that pierce several planks.

The joint between the planks of the same strake is also peculiar. Instead of the simple diagonal scarf used in Greco-Roman shipbuilding, we find here a half-lap splice. The extremity of each plank at the joint is supported by a tenon. In fact, planking usually has an extraordinary thickness; it is almost rectangular in section. The majority of the planks have dimensions within the following range: 12–17 cm wide and 10–15 cm thick. This is a consequence of the primary role of the planking in the structure of the ship and of using massive tenons inside relatively short planks. Some wider planks correspond to the whales intended to support the hull at the lines of maximum stress, especially near the waterline.

Such a construction of the hull corresponds to the technique described by Herodotus who visited Egypt in the 5th century BC According to him, Egyptian cargo boats were made of

[28] L. Basch, 'Le navire cousu de Bon-Porté' in *CAS* V (1976), 37–42.

[29] P. Pomey, 'Les épaves grecques archaïques du VIe siècle av. J.-C. de Marseille: épaves Jules-Verne 7 et 9 et César I' in *6th International Symposium on Ship Construction in Antiquity*, 425–437.

[30] Pomey in *6th International Symposium on Ship Construction in Antiquity*, 428.

[31] Pulak in *6th International Symposium on Ship Construction in Antiquity*, 439.

[32] R. Steffy, 'A Mediterranean ship construction database: dating and classifying shipwrecks by their hull remains' in *6th International Symposium on Ship Construction in Antiquity*, 547–562.

acacia wood[33] that had been 'sawed into planks two cubits long, which they used in the manner of bricks'. A tomb painting of the second millennium BC from Beni Hassan shows the process of assembling the hull of a boat with remarkably short planks.[34] We have already found several shipwrecks with planks not exceeding 100–105 cm in length (or two cubits; one cubit being equivalent to 52 cm). However, some other ships are built with longer planks (up to 6 m in the case of shipwreck 17 made of oak).

Remains of unidentified organic material were found in the joints of the planking. Egyptians sometimes used papyrus leaves to make their ships watertight. Liquid pitch or bitumen was poured additionally to protect the seams from water. In any case, this organic matter was probably some kind of oakum that was not forced into the seams as per later tradition but simply applied on the external surfaces of the seam. Forcing oakum into the seams would have affected the structural integrity of the hull. The material is being analyzed.

Framing. According to our current knowledge, the ships of Heracleion were built in a 'shell-first' technique. This means that planking was added to the keel first and framing was inserted at a later stage of the construction. Some frames are very coarse and carelessly worked. At the same time, it seems that, in a majority of cases, they are positioned symmetrically from both sides of the keel. Treenails were used to attach the frames to the planking. Still, we do not know where the framing was attached to the keel.

The excavation of shipwreck 17 shows that at least on some ships very interesting frames have been used which are not known elsewhere. Four frames of impressive dimensions have been discovered in a symmetric position across the keel. The width of these frames is in the range of 30–35 cm (sided) and their thickness is about 10 cm (molded). The surface of the frames is accurately worked. Their dimensions are quite unusual, as well as the spacing between them which reaches 4 m. However, additional frames of smaller size were inserted between the large ones. Each large frame has one central mortise on top and several lateral mortises in the center and at each of their extremities. Most probably, the frames were attached to the keel and had a continuation outboard that was not preserved or was removed intentionally in antiquity.

Upper structures. The remains of the beams on several of the Heracleion's shipwrecks attest to the existence of a deck. The same finding is confirmed by the the presence of a hatch found on shipwreck 17 and by numerous top mortises in the frames and the keel that most probably housed the stanchions that supported the deck.

Form of the hull. Preliminary studies show that the majority of the ships had rather broad hulls and relatively flat bottoms. These characteristics are perfectly suited to the natural conditions of the shallow coastal lake that existed at Heracleion.[35] The average length of the ships varies from 16 to 26 m. The length to breadth ratio is not high and is in the range of 2,2 to 2,8 which is characteristic of a merchant ship.

We already noted the very short timbers of the planking of the majority of the ships and this fact is of outmost significance. If we are dealing with seagoing ships, as suggested by the presence of stone anchors on board and in vicinity of the ships, then their hulls would require additional longitudinal support. Traditionally in Egyptian boats this support was provided

[33] Herodotus, *Histories* II, 96.

[34] L. Casson, *Ships and Seamanship in the Ancient World* (Princeton, 1971), fig. 11, 13.

by a hogging truss that passed from the stern to the bow above the deck along the central axis of the ship. These trusses are known from a number of representations. Girdling was another important feature that reinforced the structure of the ship. During our excavations, many remains of vegetal trusses were found. However, judging by their modest size (5–7 cm), none of them could have served as a hogging truss.

In several cases, the stem of the ship is preserved within the construction and will be excavated and studied in due time. As far as the construction of the stern is concerned, a very important detail has emerged during the excavations of shipwreck 17, namely a massive timber at the stern of the ship which measured over 3 min length and possessed two through openings with respective diameters of 33 and 39 cm. Most probably these openings correspond to the wells of the steering oars known from a number of depictions.

It was probably the full beams, modest keels and comparatively flat bottoms of these ships that required the use of the ballast that was found on some of the ships.[36] So far, three different types of ballast were identified on the shipwrecks. The first looks like a bulk load of pebble that was found along the keel of some of the ships, though it is still debatable whether it should be interpreted as ballast or not. The second type includes limestone rubble that was found in a compact mass in a bilge area in sufficient quantity to serve as ballast. However, quite frequently it was cargo itself that ancients used as ballast and it can be the case here too. Finally, blocks of limestone were discovered as well (Fig. 5).

It is difficult for the time being to evaluate the tonnage of the ships discovered. However, taking into consideration their flat bottoms it could not have been high. An estimate can be provided by the Papyrus of Elephantine which includes a customs register for Egypt from the Achaemenid period and contains references to foreign ships that entered Egypt — most certainly via Heracleion. According to this document larger boats had a tonnage of 60 tonnes and smaller ones of 40 tonnes.[37] Such figures, for instance, seem to correspond well to the dimensions of the ships of Heracleion.

4. The Context of the Shipwrecks

4.1. Position of the Shipwrecks

Two distinctive accumulations of ships are situated in the center of harbour H3. What could be the reason for this situation? Little can be ascertained for the time being but several facts are worth mentioning. First, it seems that there is not much material on board of the ships and except one shipwreck loaded with limestone blocks there is no general cargo. A strange fact, keeping in mind that these trade ships were anchored in the harbour of the largest emporion of the ancient Mediterranean. If a sudden natural disaster would have sunk them at least some of the ships would have been partially loaded. The same shipwreck 17 that is located in the passage has a well-preserved hull but not a single artefact could be definitely associated with it. On the other hand, the analysis of the hull's internal structure (see above) showed that some details are missing and only the largest elements are still in place. Secondly, shipwreck 17 is surrounded by wooden posts and other posts were found between the earlier shipwrecks 44 and 45. It

[35] Fabre in Wilson and Robinson, *East Meets West.*

[36] J. Rougé, *La marine dans l'Antiquité* (Paris, 1975).

[37] Porten and Yardeni, *Textbook of Aramaic Documents*, III.

seems possible that several posts could have been used to moor the ships that waited their turn to be loaded or unloaded, although this is rather inconvenient for navigation, and sometimes even dangerous. Using anchors would have been a preferable option. In fact, surrounding ships with posts can be explained in two ways only. Either it meant that the ships were intentionally positioned in order to block the entrance to some strategically important point or that they were used as floating peers. The first possibility is well documented in naval practice,[38] though the second one is also well-known.[39]

Some of the shipwrecks can perhaps be associated with the anchors found nearby. Several anchors are positioned within the contours of the hull and could have been on board of the ships when they sank. The anchor from shipwreck 43 is a special case as it seems to be in the ready to use position at the bows of the ship (Fig. 6). The number of anchors found at our site is not surprising as stone anchors were lost easily and each ship could have carried a dozen of them on board. More interesting is the distribution of anchors by type. This typology may provide much information about navigation practices in the Heracleion's area and it is currently being studied.

4.2. Artefacts Found on Board

The ceramic objects recovered from the shipwrecks date from the late 5th to the 4th century BC.

Of special note is the discovery between shipwrecks 4 and 6 of a gold coin (H3_10717) with the depiction of Zeus. A Greek inscription indicates that the coin was minted by Pixodarios, the Persian satrap of Caria (340–335 BC). Another interesting fact is that in the east accumulation of the shipwrecks, a Greek helmet was discovered dating to the 5th–4th centuries BC (HXX_8295, SCA 1026).[40]

4.3. Historical Context of the Shipwrecks

For the moment it is too early to develop hypotheses concerning the historical events that led to the sinking of the boats at Heracleion-Thonis. To name but just a few of the events that took place in the Delta region in the 5th–4th centuries BC we must mention the Inaros revolt and the Athenian intervention in 466 BC41, the reconquest of Egypt by the Persians (343–342 BC)[42] or the reign of Khabbabash during the intermediate period between 343 and 336–335 BC. All these events were connected with the Canopic region and Heracleion-Thonis which occupied a strategic area at the entrance to the Nile (and Egypt). The ships of Heracleion-Thonis could have been sunk for various reasons: in a naval battle, intentionally or in accordance with a defence strategy, in order to destroy enemies transports or as a punishment.[43] Further excavations will allow for a deeper understanding of both the features of the construction of the ships and their place in Egyptian history.

[38] From recent times we can refer here to the siege of Sebastopol during the Crimean War (1854–1855) when an entire fleet was sunk to block access to the harbour.

[39] Pomey in *6th International Symposium on Ship Construction in Antiquity*, 425–437.

[40] Secunda in Goddio and Fabre, *Egypt's Sunken Treasures*, 336 nr. 307.

[41] Diodorus, *Bibliotheca historica* XI, 71, 3–6.

[42] Diodorus, *Bibliotheca historica* XVI, 40, 6.

[43] The historical and geographical context of the shipwrecks is presented by Fabre in Wilson and Robinson, *East Meets West*.

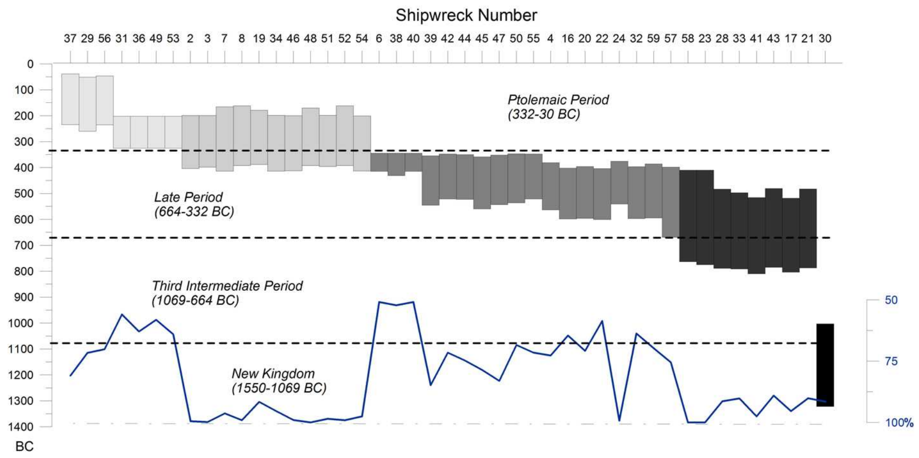

Figure 1. Calibrated dating C[14] of 45 shipwrecks of Heracleion-Thonis and their dating probability curve (%)

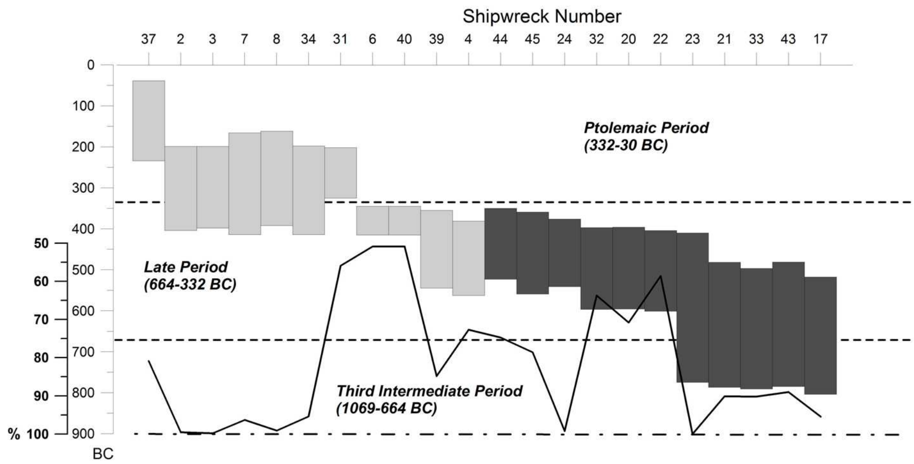

Figure 2. Calibrated dating C[14] of two accumulations of ships in the central harbour of Heracleion-Thonis and their dating probability curve

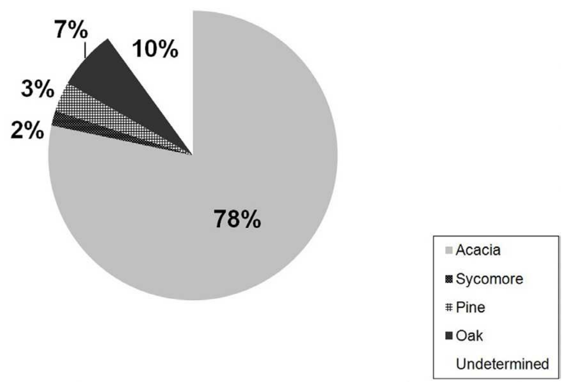

Figure 3. Percentage of ships as per the wood of their planking (one sample per ship) analyzed by Archeolabs and the IFAO

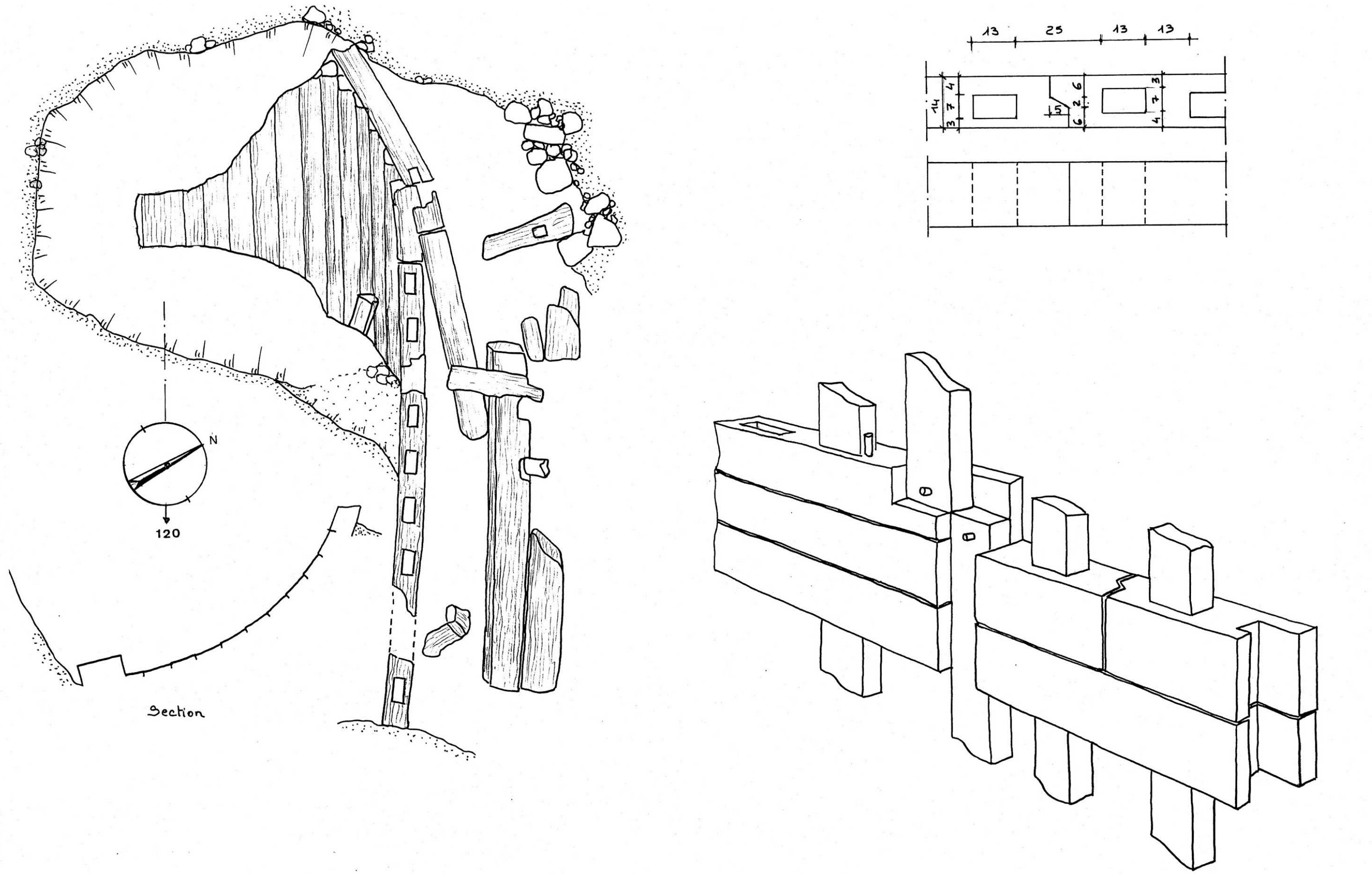

Figure 4. Upper part of the preserved planking of shipwreck 21 (*Acacia* sp., conventional 14C dating 540 +/- 50 BC, calibrated C^{14} dating 787 cal BC–482 cal BC) and joint reconstruction (right). Patrice Sandrin © Franck Goddio, Hilti Foundation

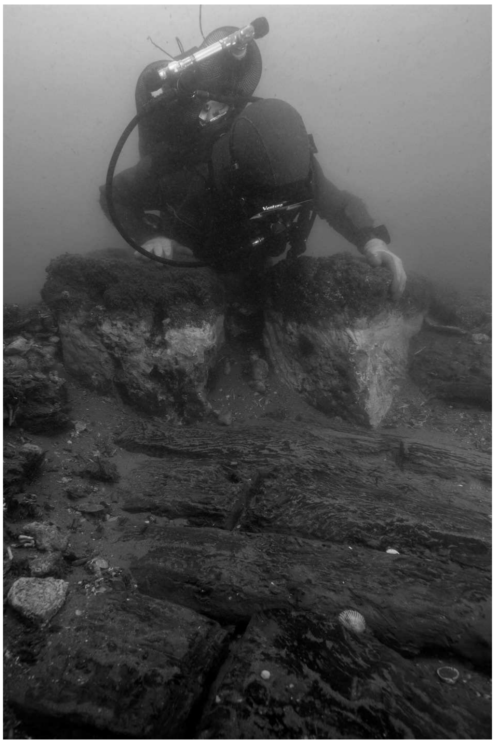

Figure 5. Limestone blocks (ballast ?) and Shipwreck 3
(*Acacia* sp., conventional C^{14} dating 300 +/- 50 BC, calibrated C^{14} dating 398 cal BC–184 cal BC).
Heracleion, Port H3. Christoph Gerigk © Franck Goddio, Hilti Foundation.

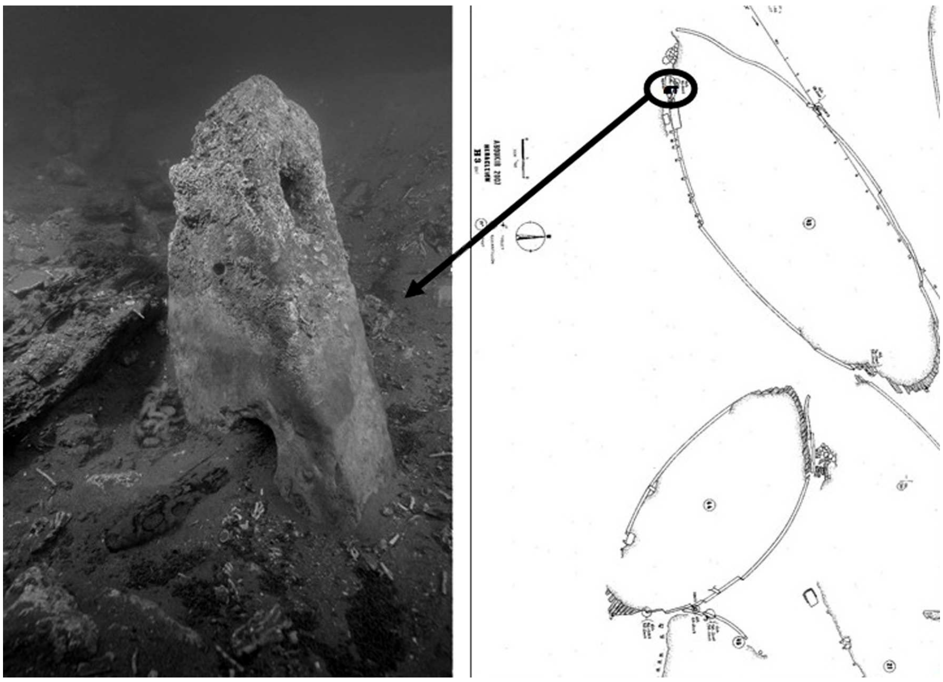

Figure 6. Anchor found on shipwreck 43 with its position on excavation plan.
Limestone and wood (*Pinus* sp., C^{14} calibrated date: 405 cal BC–208 cal BC), l. 75 cm, w. 50 cm, th. 18 cm.
Heracleion, Port H3. Christoph Gerigk / Patrice Sandrin © Franck Goddio, Hilti Foundation.