



PROCEEDINGS OF THE FIRST INTERNATIONAL SYMPOSIUM

THE WALL PAINTINGS OF THERA

VOLUME II

PROCEEDINGS OF THE FIRST INTERNATIONAL SYMPOSIUM

THE WALL PAINTINGS OF THERA

PETROS M. NOMIKOS CONFERENCE CENTRE
THERA, HELLAS

30 August - 4 September 1997

VOLUME II

Editor
S. SHERRATT

ATHENS 2000

C O N T E N T S

SESSION 4: ENVIRONMENTAL DIMENSION (Chairmen: P. Warren and P. Nomikos)

NATASHA ANGELOPOULOU, Nature Scenes: An approach to a Symbolic Art	545
P.S. ECONOMIDIS, The 'Little Fisherman' and the Fish he Holds	555
DIMITRA MYLONA, The 'Fishermen' Frescoes in the Light of the Fish Bone Evidence	561
MARIA P. BELOYIANNI, Baskets in the Fresco of the 'Saffron Gatherers' at Akrotiri, Thera: Relevance to the Present	568
JOHN G. COUTSIS, The Insects Depicted on the Wall Paintings of Thera: An Attempt at Identification	580
EVA PANAGIOTAKOPULU, Butterflies, Flowers and Aegean Iconography: A Story about Silk and Cotton	585
MOSHE NEGBI and ORA NEGBI, Domestication of Ornamental and Aromatic Plants in the Aegean: The Case of the Madonna Lily	593
RAY PORTER, The Flora of the Thera Wall Paintings: Living Plants and Motifs – Sea Lily, Crocus, Iris and Ivy	603
ANDREAS VLACHOPOULOS, The Reed Motif in the Thera Wall Paintings and its Association with Aegean Pictorial Art	631
A. SARPAKI, Plants Chosen to Be Depicted on Thera Wall Paintings: Tentative Interpretations	657
KENNETH J. HARTE, Birds of the Thera Wall Paintings	681
DAGMAR KLEINSGÜTL, Some Remarks on the Felids of Thera	699
K. TRANTALIDOU, Animal Bones and Animal Representations at Late Bronze Age Akrotiri	709
GENERAL DISCUSSION	737

SESSION 5: SOCIAL DIMENSION (Chairmen: M. Bietak and R. Laffineur)

IRENE J. WINTER, Thera Paintings and the Ancient Near East: The Private and Public Domains of Wall Decoration	745
BARBARA and WOLF-DIETRICH NIEMEIER, Aegean Frescoes in Syria-Palestine: Alalakh and Tel Kabri	763
SHELLEY WACHSMANN, Some Notes on Mediterranean Seafaring During the Second Millennium BC	803
IMMA KILIAN-DIRLMEIER, Thera and Warfare	825
CHRISTINA A. TELEVANTOU, Aegean Bronze Age Wall Painting: The Thera Workshop	831
CHRISTOS BOULOTIS, Travelling Fresco Painters in the Aegean Late Bronze Age: The Diffusion Patterns of a Prestigious Art	844
ELLEN N. DAVIS, The Organisation of the Thera Artists	859
MARISA MARTHARI, The Attraction of the Pictorial: Observations on the Relationship of Thera Pottery and Thera Fresco Iconography	873
ROBERT LAFFINEUR, Dress, Hairstyle and Jewellery in the Thera Wall Paintings	890

SOME NOTES ON MEDITERRANEAN SEAFARING DURING
THE SECOND MILLENNIUM BC

ABSTRACT

Three aspects of Bronze Age seafaring are considered: 1) Aegean ship construction techniques, 2) sailing routes and capabilities, and 3) the seemingly enigmatic lack of stone anchors in the Aegean region.

We lack direct evidence for Bronze Age Aegean hull construction. 'Shell-based' construction, with pegged mortise-and-tenon joints used to edge-join the planks to each other, as well as to the keel/keel plank, is already well developed on the late fourteenth century BC Uluburun shipwreck, but this ship is not of Aegean origin. Some information on carpentry techniques may be derived from a study of how timber was used in Aegean architecture.

Routes employed by Bronze Age cultures were dictated by the capabilities of the sail system then in use. During the entire Bronze Age, ships used variations of a single type of rig – the boom-footed square sail. While ideal for utilising winds coming from well astern, this rig was particularly ill suited for sailing to windward. Only with the introduction of the boomless brailed sail, at the end of the thirteenth century BC, were ships better able to beat to windward, resulting in new trade routes and a dramatic increase in seagoing trading abilities during the Iron Age. Textual/archaeological evidence for Bronze Age sea routes in the eastern Mediterranean is examined. The Minoans probably reached Egypt via a direct route across the Mediterranean. The proposal, made by several scholars, that a reciprocal Egypt to Aegean route existed in the Bronze Age is, however, unlikely given the prevailing winds during the sailing season in the eastern Mediterranean and the primitive rig then in use.

Bronze Age stone anchors litter the eastern Mediterranean seabed, and are found on numerous land sites in Egypt, Israel, Lebanon, Syria and Cyprus. In contrast, in the Aegean there is a notable – and seemingly enigmatic – lack of such anchors. Why? Clearly, the Aegean cultures used ships, which must have required some type of anchoring device. Perhaps a different anchor tradition evolved among the Aegean cultures, that of killicks. Killicks are wooden anchoring devices weighted with (often nondescript) stones. Once the wood decomposed, it might be virtually impossible for an archaeologist to identify the stone, by itself, as part of an anchoring device, thus making ancient killicks virtually invisible in the archaeological record. A reference by Herodotus to pierced stone anchors used on the Nile for braking ships in his day seems to support this proposal.

1) Aegean ship construction techniques

Hard evidence for the construction techniques used by Aegean shipwrights during the second millennium can be summarised in three words. There is none. We do not possess a single splinter of wood that can reasonably be assigned to a Bronze Age Aegean hull from among the many known shipwrecks in the Mediterranean (Parker 1992). Lacking direct evidence, we must fall back on subsidiary sources.

In constructing a ship, a modern shipbuilder will first lay down the keel, attach the stem and stern-posts to it, and then fasten the frames directly to the keel. The planks are then attached to the skeleton. Thus, such a vessel derives its shape, as well as much of its strength, from its pre-erected framework. This is known as 'skeleton-first' or 'skeleton-based' construction (Fig. 1:A).

On shipwrecks excavated in the Mediterranean, however, archaeologists have documented how ancient Mediterranean shipwrights constructed their vessels in an exactly opposite sequence.¹ After laying down the keel and posts, the ancient shipbuilders would first build up the shell of planking by joining the strakes at their narrow edges. Only then, after much of the planking was in place, were the frames inserted. This is termed 'shell-first' or 'shell-based' hull construction (Fig. 1:B).

In place of metal fasteners, the ancient shipwrights in the eastern Mediterranean – for as far back as we have evidence – used mortise-and-tenon joints (Fig. 2). Once the planks were edge-joined to each other and the tenons hidden, they were secured by drilling through both ends of each tenon as well as the surrounding planks. Then wooden pegs, usually driven from inside the hull, were used to lock the tenons in place. No caulking was needed in this form of hull construction, for when the vessel was placed in water, the planks swelled, creating watertight seams.²

This extremely laborious and time-intensive manner of attaching planks at their edges is already found, in a well developed form, on the Uluburun ship, which has been dated by dendrochronology to 1305 BC (Kuniholm 1997; see also Kuniholm 1996; Kuniholm *et al.* 1996; Pulak 1996; 1998; and *contra* Renfrew 1996)³ Here small portions of the hull were preserved beneath the rows of oxhide ingots and the stack of stone anchors amidships (Pulak 1987, 129-131, ill. 73; 1988b, 14; 1989, 6; 1990a, 9-10; 1990b, 52; 1993, cover, 4-5, 7, 8, figs. 4-5, 10-11; 1994, 9, 11, 12, figs. 7-9, 13; Bass 1986, 275; 1987, 733; 1989; Fitzgerald 1996). Surprisingly, the most recent studies of the scant hull remains, made after they were raised from the seabed, indicate that the tenons were chiselled remarkably deep (Fitzgerald 1996, 8-9). At times they are only 1.5 to 2 centimetres short of breaking through the opposite side of the plank. Another interesting characteristic of this hull is that tenons carved into a plank from opposite edges are consistently placed so close to each other that often one is cut by the other. This resulted in rectangular hollows 13-15 centimetres long and 1.5-2 centimetres thick over most of the length of the surviving hull.

This system of placing pairs of mortise-and-tenon joints next to each other up the hull appears with regularity, spaced centre-to-centre about every 25 centimetres. This would seem to have weakened the structural integrity of the hull. Indeed, the reason for this system remains enigmatic. It has been hypothesised that this pattern facilitated keeping a specific standard distance between joints or, alter-

1. On the evolution of early Mediterranean hull construction, see Steffy 1994, 23-100.

2. When the reconstructed *Kyrenia II* ship was first placed in the sea it took on water through its seams until it had almost sunk. Soon the timbers swelled, the seams sealed shut, and the ship became watertight (Katzev and Katzev 1986, 8-10; Katzev 1989, 170-171; Wachsmann 1995, 152-153).

3. The earliest documented Mediterranean vessel to be built *without* mortise-and-tenon joints is the *Tantura A* shipwreck, found in Tantura Lagoon, the ancient harbour of Tel Dor, on Israel's Carmel coast. This vessel dates to the mid-fifth through mid-sixth centuries AD (Wachsmann 1996; Wachsmann and Kahanov 1997, 3-8). The hull is small, originally perhaps only about 12 metres long. It was probably a coaster. During the 1996 campaign at Tantura we studied a slightly later, but much larger vessel, termed *Tantura B*, which dates to the early ninth century AD. This vessel is the earliest documented Mediterranean blue water vessel to have been built in a frame-based manner, without mortise-and-tenon joints.

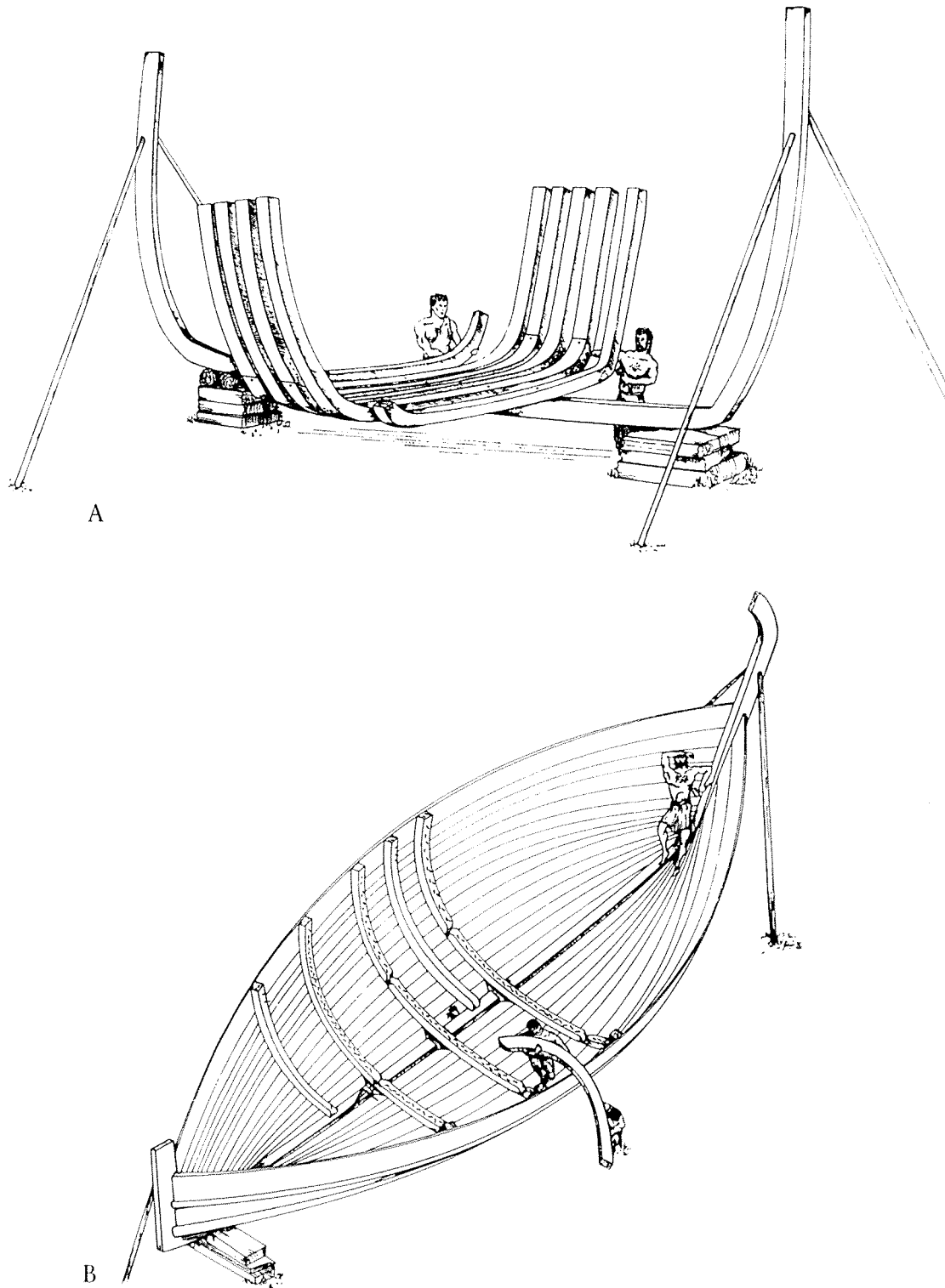


Fig. 1. A) Skeleton-based construction.
B) Shell-based construction.
Drawing: D. Johnson. Courtesy Institute of Nautical Archaeology.

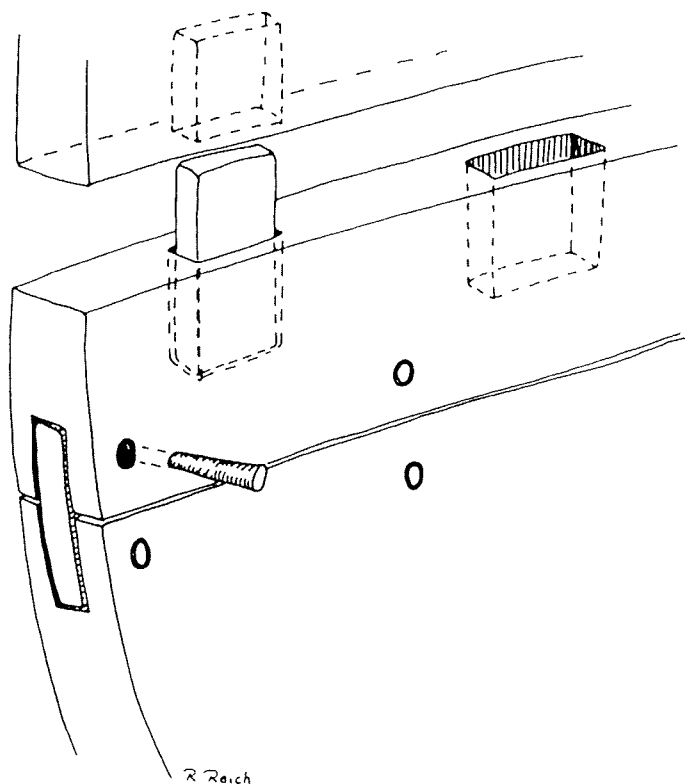


Fig. 2. Generic pegged mortise-and-tenon edge joinery.
Drawing: R. Reich.

natively, that the mortise-and-tenon joints represent a form of 'exoskeleton' of 'internal' frames. Interestingly, no timbers identifiable as frames have been recovered from the wreck (Fitzgerald 1996, 9; Pulak 1998, 248-249; 1999, 210-213).

Even the Uluburun ship is far removed from our focus in Thera, however. Not only did it sink at least three centuries after the destruction of Thera (if we follow the high chronology), but there are a number of considerations that indicate that this ship did not originate in the Aegean. Pulak identifies the ship as of eastern Mediterranean origin, but posits at least two Mycenaeans on board when the ship foundered (Pulak 1998, 253-255; 1999, 218).

Some information on Aegean carpentry techniques that could have been employed in ship construction may be derived from the use of timber in Minoan and Cycladic ashlar construction.⁴ Dowels and wooden clamps were used (Shaw 1971, 157-185). Mortises for dovetail-shaped clamps are also known, almost exclusively at Knossos. These first appear near the end of the Middle Minoan period. Round or square mortises, cut or drilled into the upper surfaces of ashlar blocks, apparently were intended for seating wooden tenons. This technique, which first appears in the Middle Minoan IB period, is commonly employed to seat the sills of window frames on ashlar blocks.

Excavations at Thera have also supplied us with information on woodworking. In buildings at Thera wooden rods, 3-7 centimetres thick, were placed transversely between floor beams (Marinatos 1976, 17, pl. 24:a). Planks and long wooden pegs were used in the construction of the West House at Thera (Marinatos 1974, 23, pl. 41:a-c). The planks were approximately 3 centimetres thick. One plank measured 48 by 28 centimetres, while another trapezoidal plank was 28 centimetres wide with long sides of 46 and 50 centimetres respectively.

4. This consideration was first noted by Morgan (1988, 129).

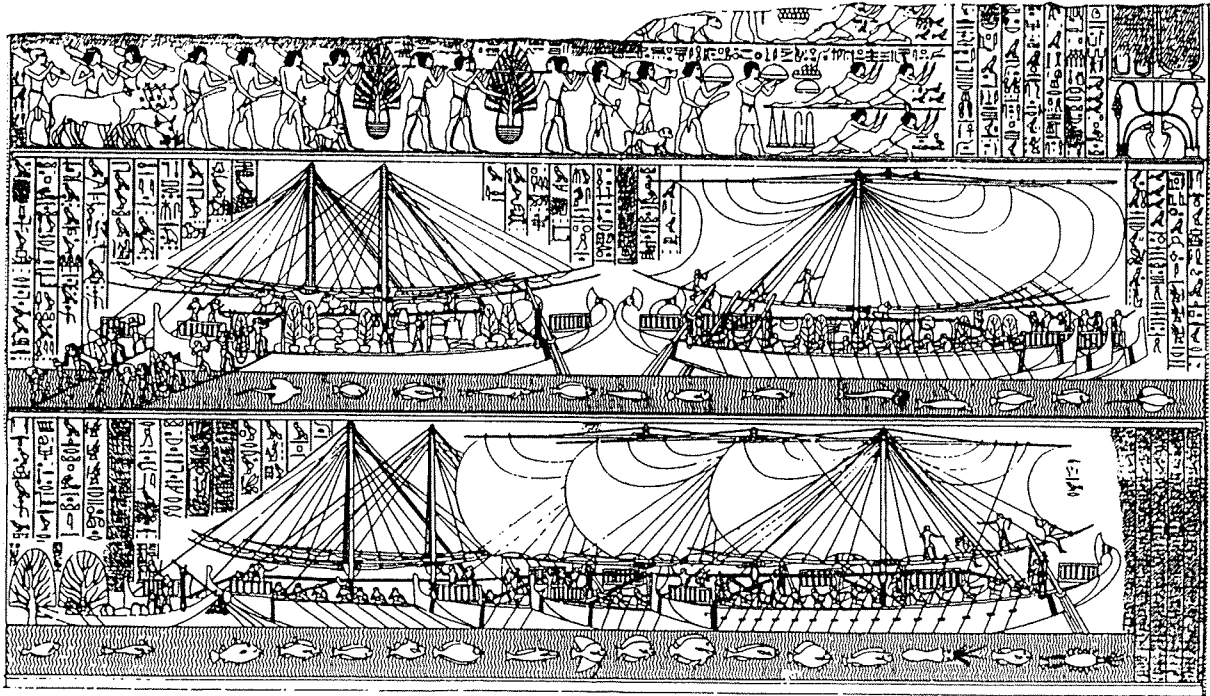


Fig. 3. Hatshepsut's scene of her Punt fleet depicted at Deir el Bahri. Note the boom-footed sails portrayed in both the raised (right) and the furled (left) positions. From Säve-Söderbergh 1946, 14 fig. 1.

The plaster cast of a bed uncovered on Thera has at least one unpegged mortise-and-tenon joint (Marinatos 1971, 41-42, pls. 34:b, 35-37, 104-105).⁵ A table from Grave V in Circle A at Mycenae had three legs attached by means of tenons at the tops of the legs that fit into corresponding slots in the bottom of the table (Muhly 1996, 198-199, figs. 1-2). The tenons were held in place by means of pairs of tiny pegs, which did not, however, go entirely through the tenon. I am not aware of any Bronze Age Aegean evidence for the use of pegged mortise-and-tenon joinery with loose tenons.

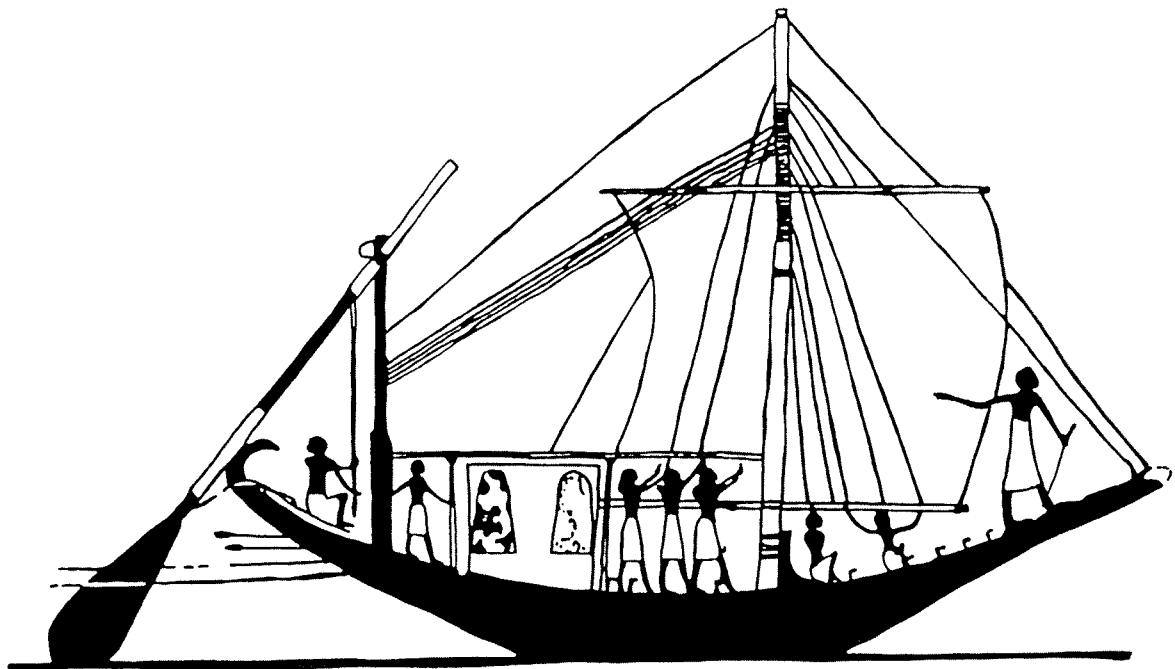
Thus, it is clear that the Aegean cultures were at least familiar with the concept of mortise-and-tenon joinery. Whether or not this method was employed in the construction of their ships must remain at present in the realm of conjecture.

Finally, in discussing Aegean ship construction one must note the remarkable Minoan two-handled saws that have been found in the excavations of Knossos, Kato Zakro and Ayia Triada (Evans 1928, 629 fig. 394:5, 630 fig. 393:d,i,j, 632; Platon 1971, 113, 128-129, 157-158; Wells 1974). These saws are up to 1.7 metres long and from 20-30 centimetres in width.

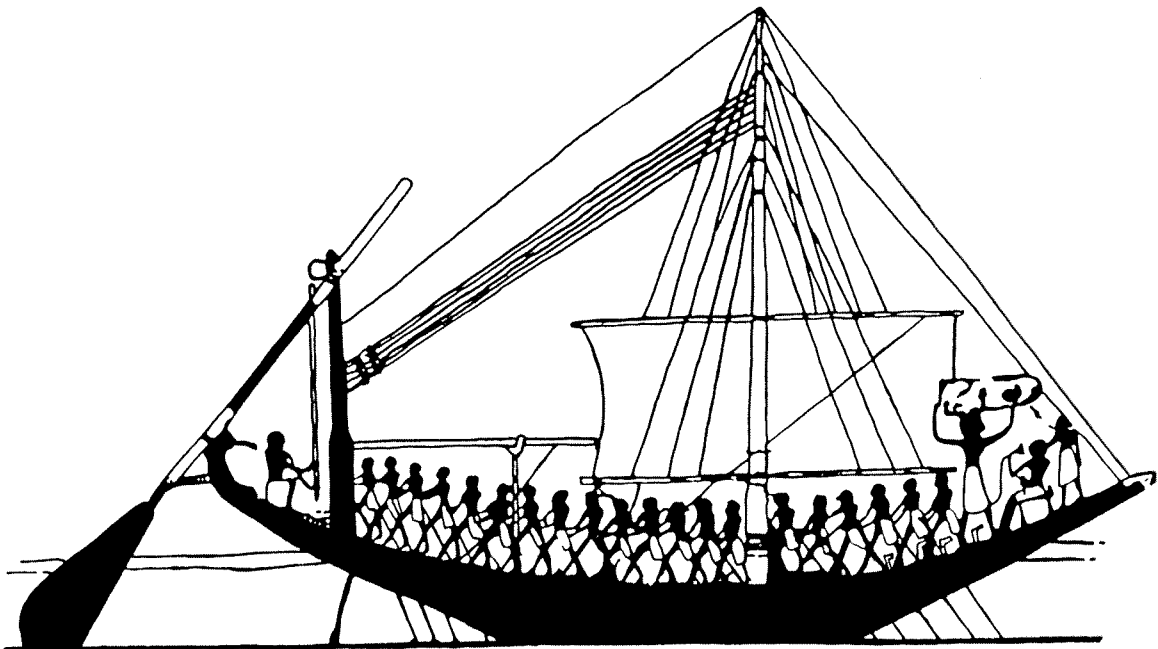
2) *Sailing routes and capabilities*

During the Bronze Age, the standard rig in use in the entire eastern Mediterranean was a square – or rectangular – sail spread between a yard and a boom on a mast planted firmly amidships. This rig is depicted most clearly on Hatshepsut's Punt ships at Deir el Bahri (Fig. 3). It is basically the same type of rig, with minor differences, as that depicted on the ship under sail in the miniature fresco on Thera (Doumas 1992, 76-77).

5. See Doumas 1989, 59 fig. 39 for an illustration of a modern reconstruction of the bed.



A



B

Fig. 4. In order to reduce sail on a boom-footed rig, the crew had to remove one sail and replace it with a smaller one. This aspect of Bronze Age seafaring is admirably portrayed in the Middle Kingdom tomb of Amenemhet at Beni Hassan, where two Nile ships carrying sails of different sizes are depicted towing a funerary barge. After Newberry 1893, pl. XIV.

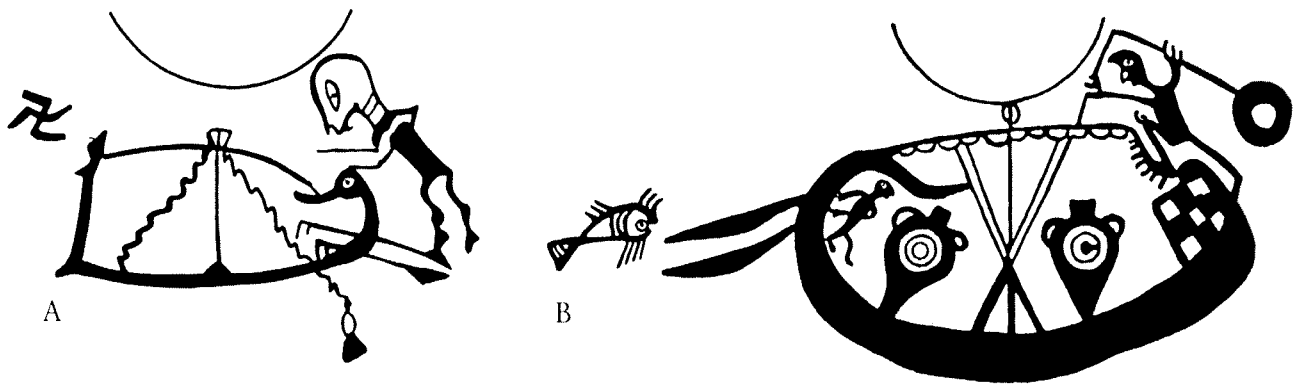


Fig. 5. Raising an anchor as depicted on two Cypriot Iron Age jugs. After Karageorghis and des Gagniers 1974, 122 nos. XI:2,1.

This sail system was ideally suited for sailing with the wind well astern. Its ability to sail into the wind, however, was extremely limited. When winds were contrary, ships either sat at anchor, or their crews – if they were galleys – could take to their oars.

Furthermore, the only way to take in sail on the boom-footed rig – as with the later lateen sail – was to remove the sail and bend a smaller sail to the yards (Casson 1995, 21). This is illustrated in a wall painting from the Middle Kingdom tomb of Amenemhet at Beni Hassan, in which two virtually identical ships are towing a funerary barge (Fig. 4). The lead ship (A) has a sail twice the height of the following vessel (B).

One common misconception about seafarers in antiquity is that they hugged shores for safety. In fact, there were good reasons for ships to avoid sailing too close to a coast. There was the ever present danger of shore-based pirates/privateers/enemy ships with which to contend, a problem already recorded in the Late Bronze Age (Moran 1992, EA 101, 105, 114).⁶ In addition, the last thing the ancient mariner wanted to discover in a good blow was a rapidly approaching lee shore from which he could not escape. As long as he was in blue water, he had an even chance of running before the wind and waves, but a lee shore, with a rising seabed and crashing waves was a recipe for disaster. This situation is described vividly by St Paul in *Acts* xxvii, in relating the wrecking of his ship off Malta. This is certainly a primary reason that the majority of shipwrecks are found within the first 300 metres from shore. The boom-footed rig, with its limited manoeuvrability, made being trapped against a lee shore in any kind of weather a particularly dangerous venture. Then there was also the problem of a lack of good rope-hauling equipment. This must have made dealing with sail, as well as the heavy stone anchors in use at that time, uniquely difficult activities (Fig. 5). I know of no evidence for the use of pulleys on ships in the Bronze Age.⁷

Sailing capabilities broaden towards the end of the Late Bronze Age, as Liverani notes (Liverani 1987, 70):

6. Note also Tuthmosis III's capture of two heavily loaded merchant ships during his fifth campaign (Breasted 1906-1907 II, §460). Wenamun evokes the 'law of reprisal' when shipwrecked on Alashia (Simpson 1973, 155). On this ancient law, which was an accepted fact of maritime life in Classical times, see Ashburner 1909, CXLV-CXLVI; Ormerod 1978, 74-77; Wachsmann 1998, 324.

7. The manner in which the anchor's hawser is rigged through the ship's mastcap in Fig. 5:A makes it clear that a pulley is not being used. This is curious, as by the Iron Age pulleys were certainly known. One is depicted in a siege scene of Ashurnasirpal II (884-860/859 BC), employed to raise a bucket (Gadd 1936, 144, pl. 4; Albenda 1972).



Fig. 6. Detail of a Sea Peoples' ship carrying a brailed sail in a naval battle scene on Ramses III's mortuary temple at Medinet Habu. The invention of the boomless brailed sail, which first appears towards the end of the Late Bronze Age, gave Mediterranean seafarers new-found freedom, and opened new possibilities for exploration and exploitation. From Nelson *et al.*, *Medinet Habu I*, pl. 39. Reproduced by permission of the University of Chicago Press.

"As for sailing techniques, I personally am not aware of precise innovative elements introduced about 1200 BC which could be said to characterize Iron Age I shipping in contrast to Late Bronze Age navigation. However, I am strongly inclined to postulate some such innovation, since we get the impression of a sudden widening of the sea routes and of a technical and operative freedom..."

Perceptively, Liverani is bearing witness to the introduction of the brailed sail which came into general use on Mediterranean ships *ca.* 1200 BC (Fig. 6).⁸ This rig did away with the unwieldy boom and used a system of lines (brails) that allowed the shape and wind-surface of the sail to be controlled from the deck. This sail allowed for far more manoeuvrability than its predecessor. With it, ships were better able to sail into the wind. The increased manoeuvrability of this rig was undoubtedly the single most important factor in permitting the ever expanding seafaring abilities of ships in the Iron Age.

In antiquity, the sailing season in the eastern Mediterranean was limited primarily to the summer months – from March to November – when north-westerly winds predominate in the eastern Mediterranean (Casson 1995, 270-273). Thus, the prevailing winds during the sailing season, as well as the effectiveness of the rig in use, had profound influences on the sea routes that could be employed during the Bronze Age. Several Bronze Age sea lanes are documented (Fig. 7).

8. There appears to have been a period of experimentation at the end of the Late Bronze Age, during which brails were used and sail was raised to the yard as in the brailed sail, but the boom was still retained (Vinson 1993; Wachsmann 1998, 251-253).

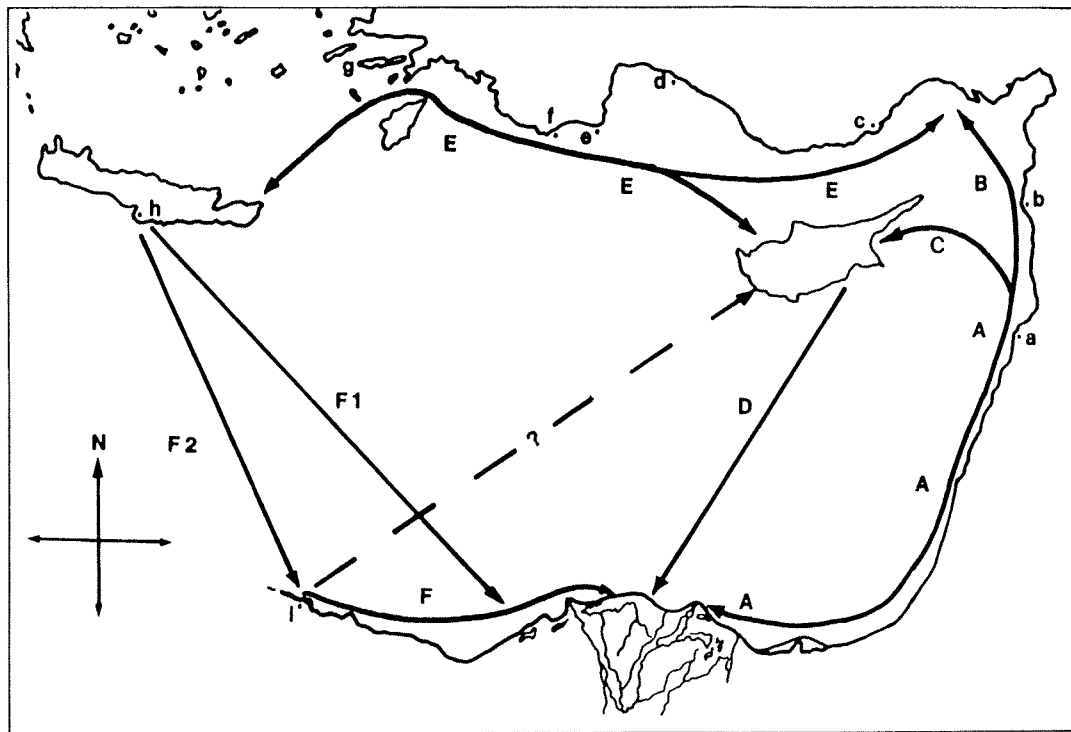


Fig. 7. Map of documented eastern Mediterranean Bronze Age sea routes. Sites: a) Byblos; b) Ugarit; c) Ura; d) Side wreck; e) Cape Gelidonya; f) Uluburun; g) Deveboynu Burnu; h) Kommos; i) Mersa Matruh. Drawing: S. Wachsmann.

There are numerous indications that the Syro-Canaanite coast, from Egypt in the south to Ugarit in the north, was navigated on a regular basis, from as early as the Late Uruk period onwards (Fig. 7:A).⁹ Evidence for this includes (archaeological) an axehead belonging to an Egyptian ship's crew found in the Adonis River in Lebanon (Rowe 1936);¹⁰ Egyptian-style anchors found at Byblos and Ugarit (see below, with note 24); (textual) numerous references to Egyptian ships sailing to and from Byblos (Wachsmann 1998); a text from Ugarit that describes the wreckage off Tyre of an Ugaritic ship bound for Egypt (Dietrich, Loretz and Sanmartín 1976, no. 2.38; see Vroilleaud 1965, 81-83)¹¹ and, of course, the tale of Wenamun (Simpson 1973, 142-145). The northern continuation of this route can be traced towards the southern coast of Turkey (Fig. 7: B). Ugarit traded by sea regularly with Ura, the Hittite empire's principal Mediterranean port.¹²

A route existed from the north Syrian coast to and from the Aegean along the southern coast of Turkey or via Cyprus (Fig. 7:E). The appearance of a Caphtorite (Minoan) at Mari is the earliest recorded evidence for this route (Malamat 1971). In using it, Minoan seafarers apparently visited Cyprus; this is suggested by the consideration that the Cypro-Minoan script derives from Linear A,

9. On connections between the Mesopotamian colonies in northern Syria and proto-Dynastic Egypt, see Mark 1993; 1997.

10. Artefacts found on foreign shores only indicate that transfer has taken place from one culture and land to another (Wachsmann 1987, 108-109). Few artefacts found in foreign contexts allow us to determine the national identity of the ships that transported them. Cargoes are generally useless in this regard, and tend to confuse, rather than clarify, this aspect of trade. There is, however, a small class of ship-related artefacts – the Adonis River axe is one example of this, stone anchors of identifiable nationality are another – that may indicate 'beyond reasonable doubt' the nationality of the ship that left them behind.

11. For a new translation and additional bibliography, see Hoftijzer and van Soldt 1998, 334.

12. Ura may be located in Cilicia, near modern Silifke, or in the area of Aydinçik, about sixty kilometres farther west (Beal 1992).

and not Linear B (Chadwick 1973, 394-395; 1987, 50-52; Palaima 1989, 40-41; see also Hooker 1985). The route is also mentioned in the Egyptian 'Admonitions of Ipu-Wer' (Vercoutter 1956, 417; Wachsmann 1987, 123 n.77).¹³ By the latter part of the Late Bronze Age, Syro-Canaanites were also plying this route. Thus, Sinaranu, a wealthy sea merchant of Ugarit, received a royal dispensation from taxes for his ships, *unless they returned from Caphtor* (RS 16.238+254; see Hoftijzer and van Soldt 1998, 340 with additional bibliography). Ahhiyawan ships also plied this route as is clear from a Hittite vassal treaty with the land of Amurru, which has a stipulation concerning the eventuality of Ahhiyawan ships arriving at Amurru's shores.¹⁴

The east to west transit of this route is evidenced, as noted by Bass, by shipwrecks and underwater find sites of individual oxhide ingots at the following locations: Side in the Bay of Antalya (Fig. 7:d), Cape Gelidonya (e), Uluburun (f), and Deveboynu Burnu (Cape Krio) (g) (Bass 1986, 270-272, ill. 1). Bass suggests that these sites indicate that the route hugged the Anatolian coast. An alternative interpretation of this evidence is that these ships had come to grief after having been blown off a course that had kept farther out to sea to avoid the dangers inherent there (Taylor 1957, 4).

Routes also existed that linked Cyprus with the Syro-Canaanite coast and directly with Egypt. In EA 114 (see Moran 1992), Rib-Addi, the embattled king of Byblos, emphasises the precarious nature of his position by noting that he has sent an Egyptian emissary named Amanmasha "*via Alashia*" to Egypt (Holmes 1969, 159; Wachsmann 1986; 1987, 99-102). In this case Alashia can only refer to Cyprus or part(s) thereof. If Alashia was located north of Byblos on the Syro-Canaanite coast or in Cilicia, as some scholars suggest, this action would make no sense at all, for not only would the ship be headed in the wrong direction, but it would also have to sail along the coast. This was the area that Rib-Addi was clearly intent on having Amanmasha's ship avoid. Thus, to avoid Aziru's ships, which had already interfered with his own, Rib-Addi had Amanmasha's ship cross to Cyprus and then strike out southward to Egypt (Fig. 7:C-D). We may further conclude that Rib-Addi must have been familiar with both legs of this route for him to have felt comfortable in sending Amanmasha that way.

Alashians appear frequently in both Egypt and in Ugarit (EA 33-40 (Moran 1992); Wachsmann 1987, 115-117 with additional bibliography). An Alashian ship and its lading is mentioned in an Ugaritic text (Dietrich, Loretz and Sanmartín 1976, no. 4.390; Virolleaud 1965, 74; Hoftijzer and van Soldt 1998, 339). Furthermore, a Byblian stone anchor has been found underwater off Cape Lara, on the south-east tip of Cyprus (Frost 1970a, 60).

Early sea lanes in the Aegean may have evolved around the paths of seasonal fish migrations (McGeehan Liritzis 1988, 243). One of the most important documents for our knowledge of sea routes in the Late Bronze Age Aegean comes from Kom el Hetan in Egypt (Kitchen 1965; 1966; Astour 1966; Edel 1966, 33-60). Statue base E_N in the forecourt of Amenophis III's mortuary temple bears a topographical list of Aegean place names. The front side of the base has the name of Amenophis II, above a *sm3* sign to which are bound two Syro-Canaanite captives. To the right of this are two names: Keftiu and Tinay. To its left, and continuing around the corner and down the left side of the base, are nine more additional names and the beginning of a tenth: Amnissos, Phaistos, Kydonia, Mycenae, Tegai, Messenia, Nauplia, Kythera, Ilios, Knossos, Amnissos and Lyktos.¹⁵ Plotting these sites on a map reveals that the list is best understood as the itinerary of a voyage made primarily by sea (Fig. 8). It begins with a clockwise cruise around Crete (Amnissos, Phaistos and Kydonia) and then describes a trip along mainland Greece (Mycenae, Tegai, Messenia and Nauplia). The ship then visits Kythera and, perhaps, describes a visit to the Asiatic coast (Ilios). The list then returns to Crete and, in doing

13. The 'Admonitions of Ipu-wer', which describes a period of social unrest when foreign trade with Egypt had ceased, was apparently composed sometime between the collapse of the Sixth Dynasty and the rise of the Eleventh Dynasty (Redford 1992, 66). The document contains the following fascinating observation (Pritchard 1969, 441): "No one really sails north to [Byb]los today. What shall we do for cedar for our mummies? Priests were buried with their produce, and [nobles] were embalmed with the oil thereof as far away as Keftiu, (but) they come no (longer)."

14. For an extensive bibliography of this text see Steiner 1989. On its nautical aspects, see Wachsmann 1998, 129-130.

15. I intentionally avoid here discussion of the Kom el Hetan list's significance *vis-à-vis* Aegeo-Egyptian relations during the reign of Amenophis III. I intend to deal with this question in depth in a separate paper.

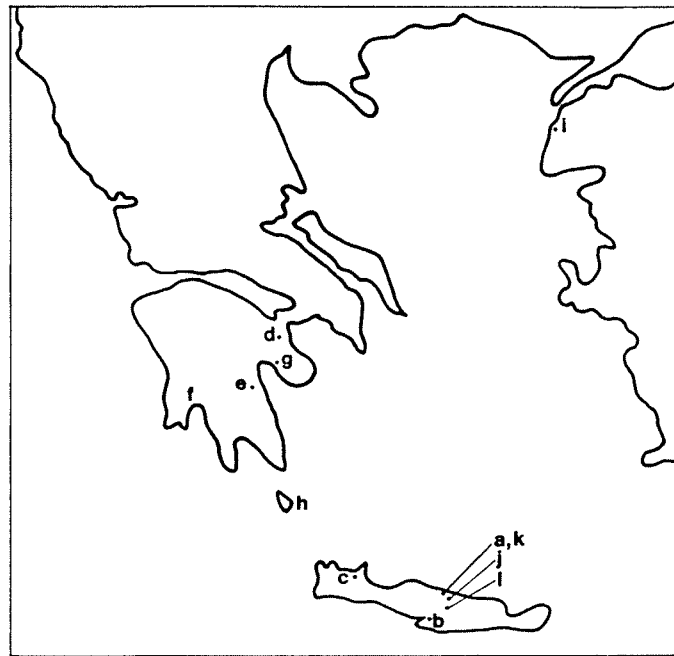


Fig. 8. Sites mentioned on the Kom el Hetan Aegean site list. Amenophis III. a & k) Amnissos; b) Phaistos; c) Kydonia; d) Mycenae; e) Tegai; f) Messenia; g) Nauplia; h) Kythera; i) Troy (Ilios)?; j) Knossos; l) Lyktos.

so, repeats Amnissos for the second time (Knossos, Amnissos and Lyktos). Although the list is somewhat jumbled, the general order of the sites and the consideration that the list begins and ends in Crete – along with the curious double appearance of Amnissos – indicates that it must be derived from an itinerary. It is not based on a pilot, as several of the sites are situated inland.

Minoans depicted in tombs of the nobles in the Theban necropolis during the reigns of Hatshepsut, Tuthmosis III and the opening years of Amenophis II, require *at least* two separate voyages to have taken place (Wachsmann 1987, 121-122). The recent discovery of Minoan-style frescoes at Tell el Dab'a, however, now suggests that this contact was much more intense and longer-lasting (Giddy 1991, 13; Bietak 1992; 1995; Hammond 1993; Hankey 1993; Dickinson 1994, 244, 246-247, pl. 7.1; Morgan 1995; Cline 1998).

By which route were the Minoans reaching Egypt? Furumark, assuming that Late Bronze Age shipping never sailed out of sight of land, argues that the link with Egypt was solely via the Syro-Canaanite coast (Furumark 1950, 204, 223). The more obvious route for the Minoans (and Therans?), if they dared to take it, was to strike out directly across the Mediterranean with the predominant north-westerly wind full astern (Fig. 7:F1). A passage from the 'The Teachings of Merikare', dating to the twenty-second century BC, seems to suggest that they indeed did use the open water route (Pritchard 1969, 416):

"I pacified the entire west, as far as the coast of the sea. It works for itself, as it gives *meru*-wood, and one may see juniper. They give it to us."

As Vercoutter notes, *meru* and juniper are conifers (Vercoutter 1956, 420-421). *Meru* wood was imported by the Egyptians from the Syro-Canaanite coast. Vercoutter logically concludes that the timber was imported, as it is highly improbable that conifers grew in the western Delta and were harvested there. And, as it would make little sense to import timber from the Syro-Canaanite coast *via* the *western* Delta, Vercoutter argues that Merikare is alluding to goods arriving from the Aegean, via the direct overseas route.

A second consideration, also raised by Vercoutter, is perhaps the most compelling reason for assuming that the Minoans employed the blue water route in their outgoing journeys to Egypt. It is this: the Egyptians always considered Keftiu a western country (Vercoutter 1956, 51-53 (Tuthmosis III's 'Hymn of Victory'), 56-57 (tomb of Rekhmire), 81 (tomb of Kenamun [T. 93]), 87-88 (Abydos), 91-

92 (Luxor)).¹⁶ The Egyptians would have thought that Keftiu was located beyond northern Syria had Minoans used the circuitous clockwise shore-hugging route.

Bass and Pulak raise the interesting consideration that the cargo carried by the Uluburun ship was, at least in part, not intended for the Aegean, but instead that the vessel was on a counter-clockwise route of the eastern Mediterranean, a trade route proposed previously by Vercoutter (1956, 419-422, fig. 162; Bass 1987, 697-699; Pulak 1988a, 36-37). After dropping off its main cargo in the Aegean, such a ship – perhaps now laden with Mycenaean pottery – could have continued across the Mediterranean, making a landfall at Mersa Matruh, which is the only natural harbour between Tobruk and Alexandria (Fig. 7:F2) (White 1986a; Conwell 1987). Excavations have revealed an international mix of pottery – including Egyptian, Canaanite, Minoan, Mycenaean, but primarily Cypriot in origin – on Bates's Island, the Late Bronze Age site near Mersa Matruh (White 1986b, 76-79, figs. 26-34; 1990). The Cypriot ceramics date to the Eighteenth Dynasty. The excavators believe that Bates's Island served as a way station for ships arriving from the Aegean.

How did the Minoans first discover this route? There are several possibilities to consider. Originally, they may have reached Egypt via the Syro-Canaanite coast. Eventually, however, they could have realised the advisability of sailing straight across the Mediterranean. They may have taken this course as a result of observing bird migrations.¹⁷ Alternatively, a Minoan ship blown off course from the southern coast of Crete could have been carried to the shores of Egypt or Libya, resulting in the route's discovery.¹⁸ Homer gives us our earliest literary references to this open water route (*Odyssey* xiv.252-258; xvii.426).

Some scholars have argued for a reciprocal direct route, during the Bronze Age, *from Egypt to Crete* (Georgiou 1991; Watrous 1992, 177-178; Cline 1994, 91; Warren 1995, 10-11). To do so ships would have had to sail against the prevailing winds. Voyages accomplished regularly by sailing ships during the eighteenth and nineteenth centuries AD have been brought as proof that such voyages were possible also in the Bronze Age. Such comparisons are not viable, however, for Mediterranean vessels of the recent past had sail systems and hulls that were designed specifically to enable them to sail more efficiently into the wind (see also Lambrou-Phillipson 1991, 13; Roberts 1995, 310; Wachsmann 1998, 299 n.35).¹⁹

In contrast, Bronze Age mariners appear not to have been much concerned with the problems encountered when sailing to windward, one of the most important of which is leeward drift. Now, a keel protruding beneath the hull, particularly if the hull is rounded in section, is a valuable break against leeward drift. Yet there is mounting evidence that in the Bronze Age seagoing ships were built with their keels/keel planks protruding *internally*, inside the hull.²⁰ There is also a total lack of evid-

16. Note that after the early years of Amenophis II - that is, the latest scenes in the tomb of Rekhmire which equate with the transition between Late Minoan IB and Late Minoan II (Wachsmann 1987, 104-105, 127-129) – in Egyptian art the 'west' is either replaced by Libyans, as in the tombs of Ramose and Horemheb, or entirely missing, as in the tomb of Huy (Peck 1978, 80-81, pl. 6; Martin 1991, 76 ill. 48, 77 ill. 49, 78, 80; Davies and Gardiner 1926, 21-29, pls. XIX-XX, XXIII-XXIV, XXVI-XXX). Of particular interest in this regard is the tomb of Meryra II at el-Amarna, in which – in addition to Syro-Canaanites, Nubians and Libyans – Hittites(!?) are depicted presenting vessels of types brought by Minoans in the tomb of Rekhmire (Davies 1905, 37, 39-43, pls. XXXVII-XL).

17. The great Polynesian migrations, for example, clearly followed the migratory paths of particular birds. The discovery of the Hawaiian islands by Polynesians, either from Tahiti or from the Society Islands, was most likely the result of observing the migration path of the golden plover. Hornell (1946, 144) notes: "The sailor-folk of the Society Islands would naturally reason that if birds could fly to this group from some distant land, they, in a large and well-found double-canoe could certainly sail to the land whence the birds came."

18. Lewis (1972, 24) considers unintentional drift voyages in the Pacific to be a complementary method of island discovery.

19. Similarly, presumed direct two-way contact between the Minoan culture and Libya cannot be sustained, as the return voyage from Libya to Crete would necessarily have been made along the Syro-Canaanite coast (*contra* Evans 1925); predynastic artefacts found in Crete have probably more to do with Egyptian tomb robbing during the Middle Minoan III-Late Minoan III periods than to early contact between the two cultures (Pomerance 1977).

20. Such was the case of the Uluburun shipwreck. A similar case may be argued for the hulls of Hatshepsut's Punt fleet (Hocker 1998). This feature also appears on Bronze Age ship models of several Mediterranean cultures (Wachsmann 1998, 241-243).

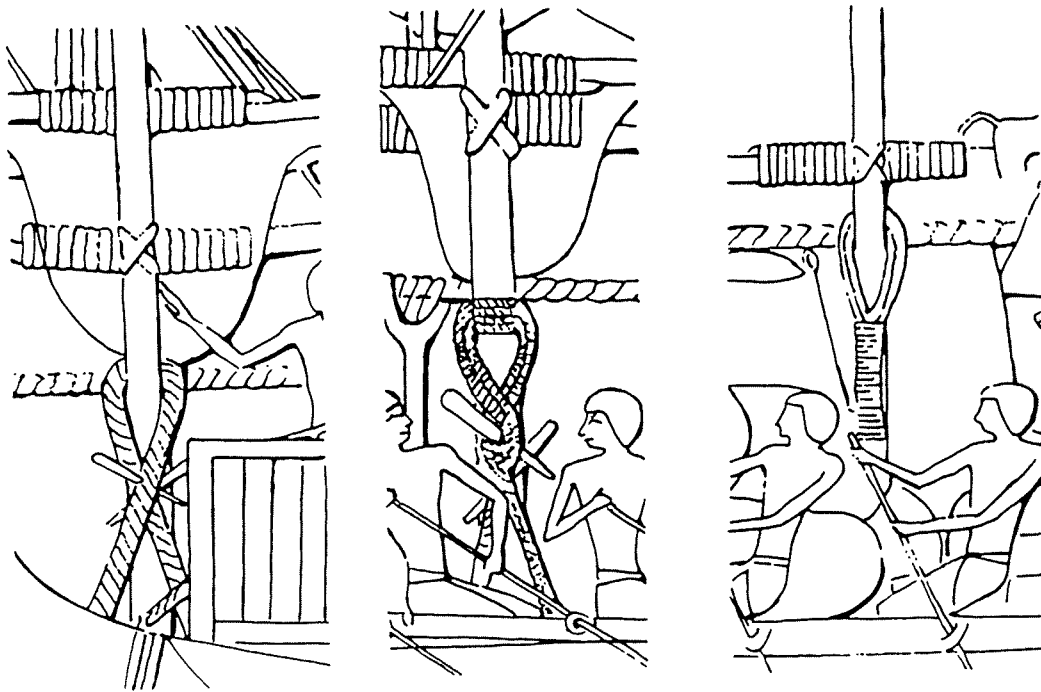


Fig. 9. Detail of massive hawsers wrapped around the masts of three of Hatshepsut's Punt ships. Deir el Bahri. After Naville 1898, pls. LXXII, LXXV.

ence for shrouds to support the mast laterally. This is not due to artistic convention as, in place of shrouds, we find hawsers attached to the bottom of the mast, as at Deir el Bahri and on the Syro-Canaanite ships depicted in the tomb of Kenamun (T. 162; Amenophis III) (Figs. 9-10).

Presuming direct contact back and forth between the Minoan and Egyptian cultures is therefore, in my view, untenable. The voyage from Egypt to Crete would have required a return *via* the Syro-Canaanite coast, Anatolia and/or Cyprus during the Bronze Age. Cyprus lies nine points off the predominant north-westerly wind from Mersa Matruh so, theoretically at least, a Late Bronze Age ship wishing to reach Cyprus from Egypt without following the Syro-Canaanite coast could probably do so by sailing from the Nile Delta to Mersa Matruh and from there to Cyprus (Fig. 7:?). There is no evidence, however, that Late Bronze Age ships indeed used this route.²¹

3) *The lack of stone anchors in the Aegean region*

One of the mysteries of Aegean Bronze Age seafaring is the remarkable lack of anchors in the Aegean archaeological record. Ships do not go to sea without anchors (Fig. 11).²² In the eastern Mediterranean, from Egypt in the south to Cyprus in the north, the normal anchoring devices employed during the Bronze and Iron Ages were pierced stones. Such anchors are important for several reasons. An anchor on the seabed presupposes the passing of a ship. Thus, if it is possible to identify the anchor's nationality, finding a trail of anchors in the sea would indicate a sea lane and also who used it. Anchors of definable origins discovered in archaeological excavations on foreign shores are

21. In the second century AD, using brailed sails, the large Roman super-freighter *Isis* sailed from Alexandria to Acamus, on the western tip of Cyprus, in seven days (Casson 1995, 289, 291 n.91).

22. For a recent survey of Mediterranean anchor development in antiquity, see Wachsmann and Haldane 1997.

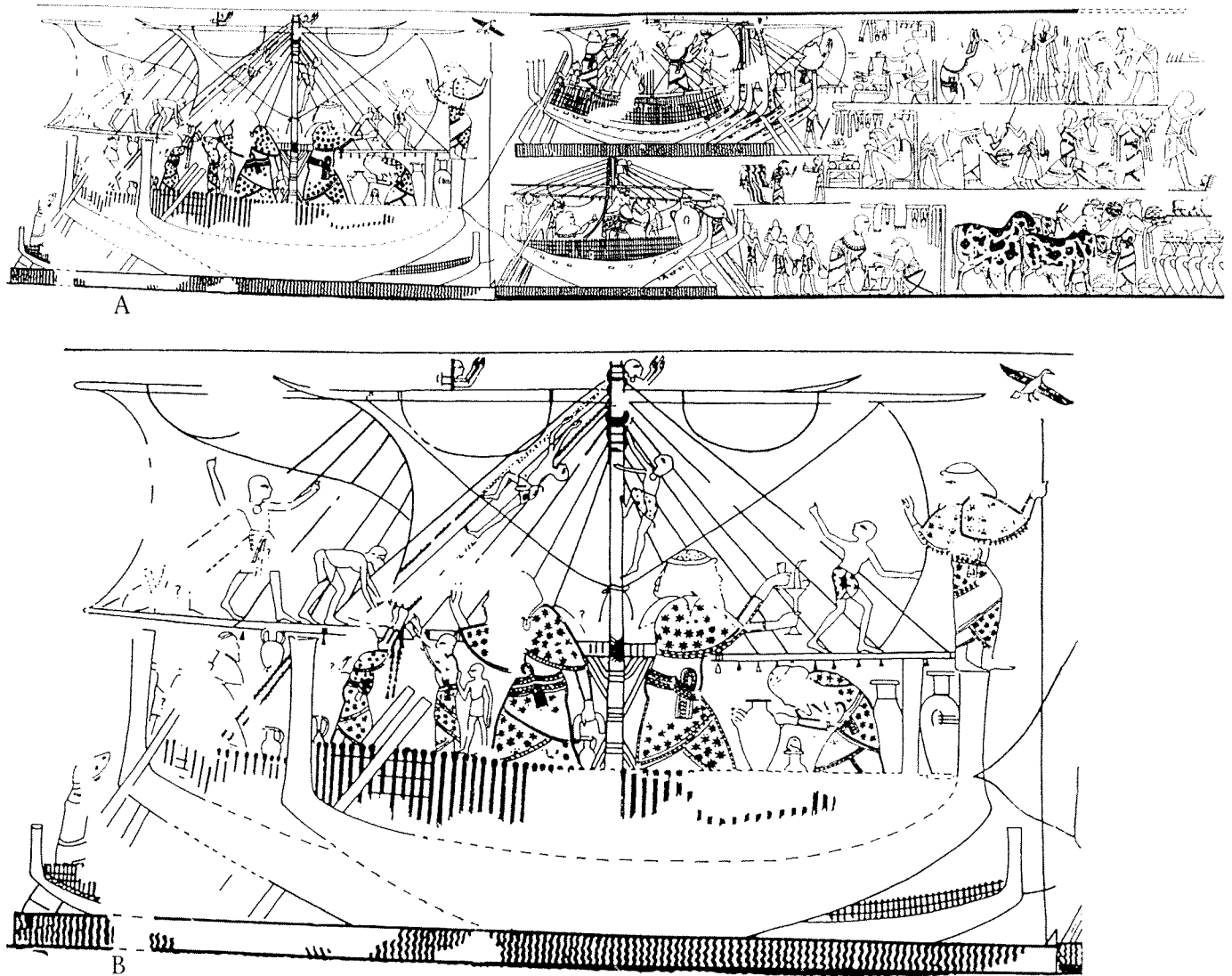


Fig. 10. A) Ships in the tomb of Kenamun (T. 162). Amenophis III.
 B) Detail. Note the hawsers wound around the lower portion of the mast in place of shrouds.
 From Davies and Faulkner 1947, pl. VIII; courtesy of the Egyptian Exploration Society.

valuable indications of direct sea contact. Those found on a shipwreck – as at Uluburun – similarly can contribute to identifying the ship's home port (Frost 1973, 399). Also, as anchors are often the only protection of a storm-tossed ship, they have often received cultic significance. In this manner, stone anchors found in cultic contexts can educate us about ancient religious practices.

There is a generally accepted three-part typological division of Mediterranean pierced stone anchors (Frost 1963a, 7-10; 1963b, 50-51). Some have a single hole for the hawser and held the ship to the seabed by dint of their weight alone; these are termed 'weight anchors'. Others, in addition to their weight, have one or two extra holes for the placement of wooden sticks, which are used to grasp the seabed like the arms of later wooden and metal anchors; these are termed 'composite anchors'. 'Sand anchors' are similar in shape to composite anchors, but the stone itself is of negligible weight, serving simply as a matrix for attaching the arms.

Pierced stones of various shapes and sizes are commonly found on the seabed of the eastern Mediterranean.²³ In Israel, for example, they are so common that sometimes one has the impression that ancient skippers had nothing better to do than to sail about tossing anchors into the sea. Of course, such was not the case. There existed a variety of reasons for these anchors to be left behind on the seabed.

Stone anchors are also found regularly on Bronze Age land sites situated near the sea, as for example at Ugarit (Frost 1969a; 1991), Byblos (Frost 1969b), Tell Abu Hawam (Hamilton 1935, 13, pl. XI; Balensi 1980 I, 519; Balensi, Herrera and Artzy 1993, 14) and Kition (Frost 1985). Some 147 anchors were found at Kition alone (Frost 1970b, 16 fig. 11, 17-19; 1982; 1985). Stone anchors of a distinctly Egyptian type, with an L-shaped basal hole, are known from Wadi Gawasis, on Egypt's Red Sea coast (Sayed 1977, 150-169; 1978, 70-71, pl. XI:1; 1980, 154-156, pls. XXI:2, XXII:1-2; Frost 1979, 147-151), at Mirgissa, an Egyptian fortress on the Second Cataract of the Nile (Nibbi 1992),²⁴ as well as from Ugarit (Frost 1969a, 241, 245 table 1:11; 1991, 378-379 no. 9, pls. IV:9, V:9a,10; Schaeffer 1978, 372 fig. 2, 376 fig. 9, 380), Byblos (Frost 1969b, 430-431; Dunand 1950, pl. XIV) and the Israeli coast (Galili, Sharvit and Artzy 1994, 96 figs. 7-8; Galili, Artzy and Sharvit 1996, 201, 208 fig. 5 upper right, 209 figs. 6 right, 7).

The Uluburun ship went to its watery grave with a complement of twenty-four weight anchors with a total weight of over four tons (Bass 1986, 271 ill. 2, 273 ill. 3; 1987, 705-707; Bass *et al.* 1989, 3 fig. 2; Pulak 1988a, 2 fig. 1; 1988b, 12, 17 fig. 9; 1990a, 12, 13 fig. 9; 1991, 8-9 fig. 8).²⁵ An additional group of stone anchors, weighing over a ton and presumably deriving from a single ship, have been found off Naveh Yam on the Israeli coast (Galili 1985; 1987; Frost 1986).

Turning to the Aegean, the relative paucity of stone anchors in the Bronze Age archaeological record is striking. I am aware of the following artefacts:²⁶

- A pierced porphyry stone, decorated with an octopus uncovered by Evans at Knossos, has been identified as an anchor (Evans 1935, 650-653, fig. 635; Davaras 1980, 61-67).²⁷ Evans considered it to be a weight for weighing oxhide ingots. This artefact is so elaborate that it may have been intended for cultic use.²⁸ Either way, it was certainly not a functioning stone anchor.
- Three stone anchors were found at Mallia (Frost 1963b, 46, pl. 8; 1973, 400-401 no. 6; Pelon 1970, 141, pl. VII:2; Poursat 1980; Shaw 1995, 281-282).
- Five pierced stones – possibly anchors – were found in Late Minoan III contexts at Kommos (Shaw and Blitzer 1983).²⁹ Then, in 1993, two additional three-holed composite stone anchors were discovered there in a Late Minoan IIIA1-IIIA2 period context (Shaw 1995). These anchors were found together with Canaanite, Cypriot, Egyptian and local pottery and are probably of Cypriot origin.
- A broken anchor from Makrygialos may date to the Late Minoan IB period (Davaras 1980, 47-53).
- Two anchors have been recovered from Cape Stomi at Marathon Bay (Braemer and Marcadé 1953, 153 fig. 13, 154).
- Two stone anchors were found in the vicinity of a Late Bronze Age cargo site at Cape Iria. One of them is a three-holed composite anchor (Pennas and Vichos 1991, 16; Vichos 1992).
- Two small stone anchors from Dokos have been dated, on the basis of dubious evidence, to the Early Helladic period (Papathanassopoulos *et al.* 1990, 15-21).

23. For a listing of published anchors, see Wachsmann 1998, 255-293.

24. Only one of the Mirgissa anchors has the typical L-shaped basal hole.

25. The weights of six of the anchors that have been published vary between 121-208 kilograms (Pulak 1992, 8, 9 fig. 6).

26. This list does not include pyramidal stone anchors, which are believed to be of Classical date. On these, see Frost 1989 and, most recently, Kourkoumelis 1992.

27. For a colour photo of the stone, see Sakellarakis 1979, 45 no. 26.

28. Note, however, that Frost (1963b, 46) considers it an anchor.

29. Blitzer later considered these stones to be olive press weights; J.W. Shaw considers them anchors (personal communications). See Shaw 1995, 281 n.5.

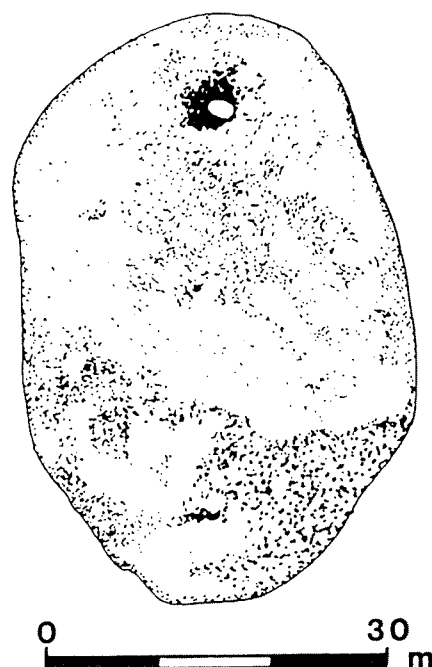


Fig. 12. Pierced stone from Thera. Weight 65 kilograms. After Marinatos 1974, pl. 29.

Fig. 11. Detail of an upright stone anchor, with an apical hawser-hole, located in the bow of a seagoing ship depicted in the causeway of Unas at Saqqara. Fifth Dynasty. Photo: S. Wachsmann.

- Marinatos identifies a pierced stone on Thera as an anchor (Fig. 12) (Marinatos 1974, 19, pl. 29). The 'hawser hole' is so small, however, that I believe this interpretation to be difficult.
- The Aegean Maritime Museum on Mykonos exhibits a three-holed composite anchor (Olympic Airways Magazine 1990, 82).
- Tomb 27 at Ialysos, on Rhodes, contained a stone anchor (Maiuri 1923-1924, 150, fig. 72; Buchholz and Karageorghis 1973, 49 no. 430).

This is indeed a paltry list. Obviously much seafaring was taking place in the Aegean by the resident cultures. And if they employed ships, we can be assured that they also had some method for anchoring them. Why, then, are we not finding more stone anchors in the Aegean archaeological record?

Several hypotheses may be advanced. Stone anchors are most often found by sport divers. Sport diving has traditionally been very tightly controlled in both Greece and Turkey. Furthermore, the generally steep nature of the coast may also explain why so few anchors have been found underwater. Additionally, unlike the eastern Mediterranean cultures that inhabited the areas of modern day Cyprus, Syria, Lebanon and Israel, Aegean cultures do not appear to have regularly dedicated anchors in temples. Yet, even keeping these considerations in mind, it appears that pierced stone anchors of the types prevalent farther east in the Mediterranean were not in common use by the Aegean Bronze Age cultures.

One possible explanation is that Aegean seafarers were using killicks (Fig. 13). A killick is a wooden device which utilises a stone as a weight for a wooden anchoring structure (Moll 1927, 315-318, pls. IX-X; van Nouhuys 1951).³⁰ Many ethnographical parallels exist for these devices, which can be

30. On killicks used in the Sea of Galilee see Wachsmann 1995, 337, 338-341.

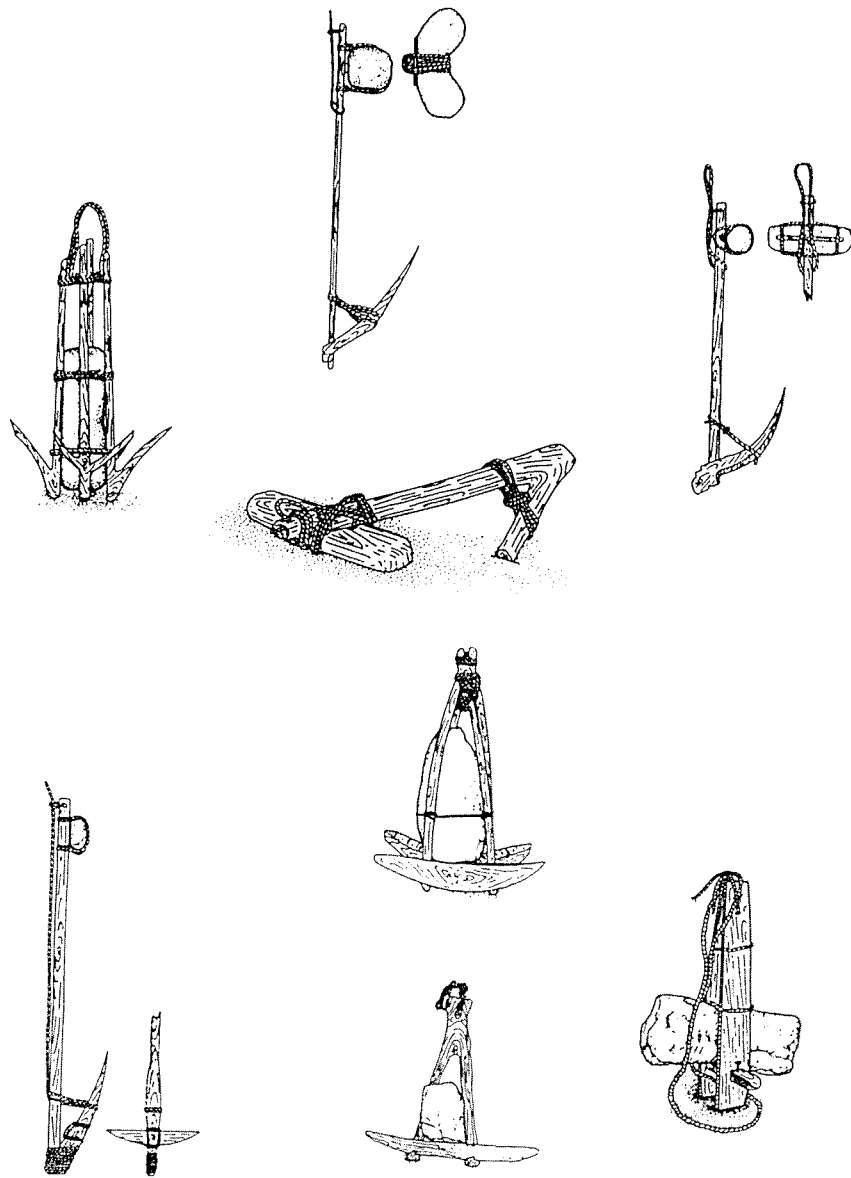


Fig. 13. Examples of killicks.
After van Nouhuys 1951, 23
fig. 3, 30 figs. 14-15, 19, 33
fig. 20, 38 figs. 27-29.

constructed in a variety of shapes. One type is fashioned like a one-armed anchor, with a tree crook employed as the shank and arm of an anchor, while an elongated stone serves as a simple stock for the 'anchor'. Such stones may have a slot or a notch cut into their centre.

Stones used in killicks do not require piercings nor any particular work. Sometimes elongated stones are preferred, or a notch is cut to attach them, but generally any field stone of suitable size and weight will suffice. If Aegean Bronze Age seafarers used killicks in the Aegean, then, once the wooden parts of the killick had decomposed, *it would be virtually impossible for an archaeologist discovering a killick stone to identify it as ever having been part of an anchoring device*. Perhaps the strongest argument for the use of killicks in the Bronze Age Aegean is the lack of other, identifiable, anchoring devices in the abundant remains of what were undoubtedly maritime cultures.

A linguistic reflection may also be considered in regard to this identification. In Homer, anchors are termed *εὐναί*, meaning 'beds' (Moll 1927, 294; Casson 1995, 48 n.45). Casson interprets this to

mean that the anchor stones looked like 'beds' when they lay flat on the seabed (Casson 1995, 48 n.45). In truth, we do not know why Homer called anchors by the word commonly used for beds. However, when Herodotus describes what is clearly a pierced stone anchor used as a ship's brake on the Nile, he is careful to use the Greek description *λίθος τετρημένος*, literally 'pierced stone', instead of the simpler word known from Homer (Herodotus ii 96).

Why did Herodotus not call what was obviously our concept of a stone anchor by its earlier name if *εἶναι* means 'pierced stone anchors'?³¹ One possible explanation is that *εἶναι* were killicks.

Acknowledgements

I thank Dr John Lenz for his perceptive and knowledgeable advice concerning the terms for anchors in Homer and Herodotus, and Dr Polymnia Muhly for bringing to my attention the mortise-and-tenon joinery on a table from Mycenae.

Shelley Wachsmann

Nautical Archaeology Program, Department of Anthropology, Texas A & M University, College Station, Texas 77843-4352, USA

REFERENCES

- ALBENDA, P.
1972 'A Syro-Palestinian(?) city on a ninth century B.C. Assyrian relief' *Bulletin of the American Schools of Oriental Research* 206, 42-48
- ASHBURNER, W.
1909 *The Rhodian sea law*, Oxford
- ASTOUR, M.C.
1966 'Aegean place names in an Egyptian inscription' *American Journal of Archaeology* 70, 313-314
- BALENSI, J.
1980 *Les fouilles de R.W. Hamilton à Tell Abu Hawam, niveaux IV et V*, 3 vols., unpublished PhD thesis, University of Strasbourg
- BALENSI, J., HERRERA, M.D. and ARTZY, M.
1993 'Abu Hawam, Tell', in E. Stern (ed.), *The new encyclopedia of archaeological excavations in the Holy Land I*, Jerusalem, 7-14
- BASCH, L.
1994 'Some remarks on the use of stone anchors and pierced stones in Egypt' *International Journal of Nautical Archaeology and Underwater Exploration* 23, 219-227
- BASS, G.F.
1986 'A Bronze Age shipwreck at Ulu Burun (Kas): 1984 campaign' *American Journal of Archaeology* 90, 269-296
1987 'Oldest known shipwreck reveals Bronze Age splendors' *National Geographic Magazine* 172, 693-733
1989 'The construction of a seagoing vessel of the Late Bronze Age', in H. Tzalas (ed.), *Tropis I. First International Symposium on Ship Construction in Antiquity, Piraeus, 30 August-1 September 1985*, Athens, 25-35
- BASS, G.F., PULAK, C., COLLON, D. and WEINSTEIN, J.
1989 'The Bronze Age shipwreck at Ulu Burun: 1986 campaign' *American Journal of Archaeology* 93, 1-29
- BEAL, R.H.
1992 'The location of Cilician Ura' *Anatolian Studies* 42, 65-73
- BIETAK, M.
1992 'Minoan wall-paintings unearthed at ancient Avaris' *Egyptian Archaeology* 2, 26-28
1995 'Connections between Egypt and the Minoan world: new results from Tell el-Dab'a/Avaris', in W.V. Davies and L. Schofield (eds.), *Egypt, the Aegean and the Levant: interconnections in the second millennium BC*, London, 19-28
- BRAEMER, F. and MARCADE, J.
1953 'Céramique antique et pièces d'ancres trouvées en mer à la Pointe de la Kynosoura (Baie de Marathon)' *Bulletin de Correspondance Hellénique* 77, 139-154
- BREASTED, J.H. (ed.)
1906-1907 *Ancient records of Egypt I-V*, Chicago
- BUCHHOLZ, H.-G. and KARAGEORGHIS, V.
1973 *Prehistoric Greece and Cyprus. An archaeological handbook*, London
- CASSON, L.
1995 *Ships and seamanship in the ancient world*, revised edn., Baltimore
- CHADWICK, J.
1973 'Part III: additional commentary', in M. Ventris and J. Chadwick, *Documents in Mycenaean Greek*, 2nd edn., Cambridge, 385-524
1987 *Linear B and related scripts*, Berkeley

31. Basch (1994, 221) in arguing against the use of stone anchors on the Nile— despite evidence to the contrary— would have Herodotus's 'pierced stone' termed thus due to its weight (about two talents). I do not see why this consideration would require a change in term on Herodotus's part.

CLINE, E.H.

1994 *Sailing the wine-dark sea. International trade in the Late Bronze Age Aegean*, British Archaeological Reports International Series 591, Oxford

1998 'Rich beyond the dreams of Avaris: Tell el-Dab'a and the Aegean world - a guide for the perplexed' *Annual of the British School at Athens* 93, 199-219

CONWELL, D.

1987 'On ostrich eggs and Libyans: traces of Bronze Age people from Bates' Island, Egypt' *Expedition* 29:3, 25-34

DAVARAS, C.

1980 'Une ancre minoenne sacrée?' *Bulletin de Correspondance Hellénique* 104, 47-71

DAVIES, N. de G.

1905 *The rock tombs of El Amarna, II: the tombs of Penehesy and Meryra II*, London

DAVIES, N. de G. and FAULKNER, R.O.

1947 'A Syrian trading venture to Egypt' *Journal of Egyptian Archaeology* 33, 40-46

DAVIES, N. de G. and GARDINER, A.H.

1926 *The Tomb of Huy: viceroy of Nubia in the reign of Tut'ankhamun*, London

DICKINSON, O.T.P.K.

1994 *The Aegean Bronze Age*, Cambridge

DIETRICH, M., LORETZ, O. and SANMARTÍN, J. (eds.)

1976 *Die Keilalphabetischen Texte aus Ugarit I*, *Alter Orient und Altes Testament* XXIV:1, Neukirchen-Vluyn

DOUMAS, C.G.

1989 *Santorini: a guide to the island and its archaeological treasures*, Athens

1992 *The wall-paintings of Thera*, Athens

DUNAND, M.

1950 *Fouilles de Byblos II, 1933-1938 (Atlas)*, Paris

EDEL, E.

1966 *Die Ortsnamenlisten aus dem Totentempel Amenophis III*, Bonn

EVANS, A.J.

1925 'The early Nilotic, Libyan and Egyptian relations with Minoan Crete' *Journal of the Royal Anthropological Institute* 55, 199-228

1928 *The Palace of Minos at Knossos II*, London

1935 *The Palace of Minos at Knossos IV*, London

FITZGERALD, M.

1996 'Continuing study of the Uluburun shipwreck: laboratory research and analysis' *Institute of Nautical Archaeology Quarterly* 23:1, 7-9

FROST, H.

1963a 'From rope to chain: on the development of the anchor in the Mediterranean' *Mariners Mirror* 49, 1-20

1963b *Under the Mediterranean*, London

1969a 'The stone anchors of Ugarit', in C.F.A. Schaeffer, *Ugaritica VI*, Paris, 235-245

1969b 'The stone anchors of Byblos', *Mélanges de l'Université Saint-Joseph, Beyrouth* 45, Paris, 425-442

1970a 'Stone-anchors as indications of early trade routes', in M. Mollat (ed.), *Sociétés et compagnies de commerce en Orient et dans l'Océan indien. Actes du huitième colloque international d'histoire maritime, Beyrouth 5-10 septembre 1966*, Paris, 55-61

1970b 'Some Cypriot stone-anchors from land and from the sea' *Report of the Department of Antiquities, Cyprus* 1970, 14-24

1973 'Anchors, the potsherds of marine archaeology: on the recording of pierced stones from the Mediterranean', in D.J. Blackman (ed.), *Marine archaeology. Proceedings of the XXIII*

Symposium of the Colston Research Society held in the University of Bristol (4-8 April, 1971), Colston Papers XXXII, London, 397-406

1979 'Egypt and stone anchors: some recent discoveries' *Mariners Mirror* 65, 137-161

1982 'On a sacred Cypriote anchor', in *Archéologie au Levant: recueil à la mémoire de Roger Saidah*, Collection de la Maison de l'Orient Méditerranéen XII, Série Archéologique IX, Lyon, 161-166

1985 'Appendix I: the Kition anchors', in V. Karageorghis and M. Demas, *Excavations at Kition VI: The pre-Phoenician levels, Areas I and II*, Nicosia, 281-321

1986 'Comment on "A group of stone anchors from Newe Yam" (IJNA 14, 143-53)' *International Journal of Nautical Archaeology and Underwater Exploration* 15, 65-66

1989 '"Pyramidal" stone anchors: an inquiry', in H. Tzalas (ed.), *Tropis I. First International Symposium on Ship Construction in Antiquity, Piraeus, 30 August-1 September 1985*, Athens, 97-113

1991 'Anchors sacred and profane. Ugarit-Ras Shamra, 1986: the stone anchors revised and compared', in M. Yon (ed.), *Ras Shamra-Ougarit VI: arts et industries de la pierre*, Paris, 355-410

FURUMARK, A.

1950 'The settlement at Ialysos and Aegean history c. 1550-1400 B.C.' *Opuscula Archaeologica* 6, 150-271

GADD, C.J.

1936 *The stones of Assyria: the surviving remains of Assyrian sculpture, their recovery and their original positions*, London

GALILI, E.

1985 'A group of stone anchors from Newe Yam' *International Journal of Nautical Archaeology and Underwater Exploration* 14, 143-153

1987 'Corrections and additions to "A group of stone anchors from Newe-Yam" (IJNA 14, 143-53)' *International Journal of Nautical Archaeology and Underwater Exploration* 16, 167-168

GALILI, E., ARTZY, M. and SHARVIT, J.

1996 'Reconsidering Byblian and Egyptian stone anchors: new finds from the Israeli coast', in H. Tzalas (ed.), *Tropis IV. Fourth International Symposium on Ship Construction in Antiquity, Athens, 28-31 August, 1991*, Athens, 199-209

GALILI, E., SHARVIT, J. and ARTZY, M.

1994 'Reconsidering Byblian and Egyptian stone anchors using numeral methods: new finds from the Israeli coast' *International Journal of Nautical Archaeology and Underwater Exploration* 23, 93-107

GEORGIU, H.S.

1991 'Bronze Age ships and rigging', in R. Laffineur and L. Basch (eds.), *THALASSA. L'Egée préhistorique et la mer. Actes de la troisième Rencontre égéenne internationale de l'Université de Liège, Station de recherches sous-marines et océanographiques, Calvi, Corse (23-25 avril 1990)*, *Aegaeum* 7, Liège, 61-71

GIDDY, L.

1991 'Digging diary 1990-1991' *Egyptian Archaeology* 1, 13-14

HAMILTON, R.W.

1935 'Excavations at Tell Abu Hawam' *Quarterly of the Department of Antiquities in Palestine* 4, 1-69

HAMMOND, N.

1993 'Newsbriefs: Minoans in Egypt' *Archaeology* 46:1, 20

HANKEY, V.

1993 'Egypt, the Aegean and the Levant' *Egyptian Archaeology* 3, 27-29

HOCKER, F.M.

1998 'Appendix: did Hatshepsut's Punt ships have keels?', in S. Wachsmann, *Seagoing ships and seamanship in the Bronze*

- Age Levant, College Station, 245-246
- HOFSTIJZER, J. and SOLDT, W.H. van
1998 'Appendix: texts from Ugarit pertaining to seafaring', in S. Wachsmann, *Seagoing ships and seamanship in the Bronze Age Levant*, College Station, 333-344
- HOLMES, Y.
1969 *The foreign relations of Cyprus during the Late Bronze Age*, unpublished PhD dissertation, Brandeis University
- HOOKE, J.T.
1985 'Minoan and Mycenaean settlement in Cyprus: a note', in T. Papadopoulos and S.A. Hadjistyllis (eds.), *Πρακτικά του Β' Διεθνούς Κυπριολογικού Συνεδρίου, Λευκωσία, 20-25 Απριλίου 1982*, Nicosia, 175-179
- HORNELL, J.
1946 'The role of birds in early navigation' *Antiquity* 20, 142-149
- KARAGEORGHIS, V. and GAGNIERS, J. des
1974 *La céramique chypriote de style figuré, Âge du fer (1050-500 av. J.-C.) I-II*, Rome
- KATZEV, M.K.
1989 "'Kyrenia II': building a replica of an ancient Greek merchantman", in H. Tzalas (ed.), *Tropis I. First International Symposium on Ship Construction in Antiquity, Piraeus, 30 August-1 September 1985*, Athens, 163-175
- KATZEV, M.K. and KATZEV, S.W.
1986 'Kyrenia II: research on an ancient shipwreck comes full circle in a full-scale replication' *Institute of Nautical Archaeology Newsletter* 13:3, 1-11
- KITCHEN, K.A.
1965 'Theban topographical lists, old and new' *Orientalia N.S.* 34, 1-9
- 1966 'Aegean place names in a list of Amenophis III' *Bulletin of the American Schools of Oriental Research* 181, 23-24
- KOURKOUHELIS, D.
1992 'Underwater survey in the Avlemonas region of eastern Kythera (1993 season)' *Enalia* 4, 32-36
- KUNIHOLM, P.
1996 *Aegean dendrochronology project. December 1996 progress report*, The Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern Dendrochronology
- 1997 *Aegean dendrochronology project. December 1997 progress report*, The Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern Dendrochronology
- KUNIHOLM, P., KROMER, B., MANNING, S., NEWTON, M., LATINI, C. and BRUCE, M.
1996 'Anatolian tree rings and the absolute chronology of the eastern Mediterranean, 2220-718 BC' *Nature* 381, 780-783
- LAMBROU-PHILLIPSON, C.
1991 'Seafaring in the Bronze Age Mediterranean: the parameters involved in maritime travel', in R. Laffineur and L. Basch (eds.), *THALASSA. L'Egée préhistorique et la mer. Actes de la troisième Rencontre égéenne internationale de l'Université de Liège, Station de recherches sous-marines et océanographiques, Calvi, Corse (23-25 avril 1990)*, Aegaeum 7, Liège, 11-19
- LEWIS, D.
1972 *We, the navigators: the ancient art of landfinding in the Pacific*, Honolulu
- LIVERANI, M.
1987 'The collapse of the Near Eastern regional system at the end of the Bronze Age: the case of Syria', in M. Rowlands, M. Larsen and K. Kristiansen (eds.), *Centre and periphery in the ancient world*, Cambridge, 66-73
- MAIURI, A.
1923-1924 'Jalisco: scavi della missione archeologica italiana a Rodi I-II' *Annuario della Scuola archeologica di Atene e delle missioni italiane in Oriente* 6-7, 83-341
- MALAMAT, A.
1971 'Syro-Palestinian destinations in a Mari tin inventory' *Israel Exploration Journal* 21, 31-38
- MARINATOS, S.
1971 *Excavations at Thera IV*, Athens
- 1974 *Excavations at Thera VI*, Athens
- 1976 *Excavations at Thera VII*, Athens
- MARK, S.
1993 *A study of possible trade routes between Egypt and Mesopotamia, ca. 3500-3100 B.C.*, unpublished MA thesis, Texas A & M University
- 1997 *From Egypt to Mesopotamia: a study of predynastic trade routes*, Studies in Nautical Archaeology 4, College Station
- MARTIN, G.T.
1991 *The hidden tombs of Memphis*, London
- McGEEHAN LIRITZIS, V.M.
1988 'Seafaring, craft and cultural contact in the Aegean during the 3rd millennium B.C.' *International Journal of Nautical Archaeology and Underwater Exploration* 17, 237-256
- MOLL, F.
1927 'The history of the anchor' *Mariners Mirror* 13, 293-327
- MORAN, W.L. (ed. and transl.)
1992 *The Amarna letters*, Baltimore
- MORGAN, L.
1988 *The miniature wall paintings of Thera: a study in Aegean culture and iconography*, Cambridge
- 1995 'Minoan painting and Egypt: the case of Tell el-Dab'a', in W.V. Davies and L. Schofield (eds.), *Egypt, the Aegean and the Levant: interconnections in the second millennium BC*, London, 29-53
- MUHLY, P.
1996 'Furniture from the Shaft Graves: the occurrence of wood in Aegean burials of the Bronze Age' *Annual of the British School at Athens* 91, 197-211
- NAVILLE, E.
1898 *The temple of Deir el Bahari III*, Egypt Exploration Fund Memoir 16, London
- NELSON, H.H. et al.
1930 *Medinet Habu - volume I. Plates 1-54. Earlier historical records of Ramses III*, Chicago
- NEWBERRY, P.E.
1893 *Beni Hasan, part I*, London
- NISSI, A.
1992 'A group of stone anchors from Mirgissa on the Upper Nile' *International Journal of Nautical Archaeology and Underwater Exploration* 21, 259-267
- NOUHUYS, J.W. van
1951 'The anchor' *Mariners Mirror* 37, 17-47
- OLYMPIC AIRWAYS MAGAZINE
1990 'Aegean Maritime Museum' *Motion. Olympic Airways Magazine* May 1990, 80-109
- ORMEROD, H.
1978 *Piracy in the ancient world: an essay on Mediterranean history*, reprint, Liverpool
- PALAIMA, T.G.
1989 'Ideograms and supplementals and regional interaction among Aegean and Cypriot scripts' *Minos* 24, 30-54
- PAPATHANASSOPOULOS, G. et al.
1990 'Dokos: 1990 excavation' *Enalia* 2, 6-23
- PARKER, A.
1992 *Ancient shipwrecks of the Mediterranean and the Roman provinces*, British Archaeological Reports International Series 580, Oxford

- PECK, W.H.
1978 *Egyptian drawing*, New York
- PELON, O.
1970 *Fouilles exécutées à Malia III: exploration des maisons et quartiers d'habitation* (1963-1966), *Etudes crétoises* 16, Paris
- PENNAS, C., and VICHOS, Y.
1991 'Underwater surface investigation of the wreck of the Late Bronze Age at Point Iria: part I: underwater investigation' *Enalia* 3, 8-16
- PLATON, N.
1971 *Zakros: the discovery of a lost palace of ancient Crete*, New York
- POMERANCE, L.
1977 'The possible rôle of tomb robbers and viziers of the 18th Dynasty in confusing Minoan chronology', *Antichità cretesi: studi in onore di Doro Levi*, I, Catania, 21-30
- POURSAT, J.-C.
1980 'Les ancres du quartier Mu', in B. Detournay, J.-C. Poursat and F. Vandenabeele, *Fouilles exécutées à Malia. Le Quartier Mu II*, *Etudes crétoises* 26, Paris, 235-238
- PRITCHARD, J.B. (ed.)
1969 *Ancient Near Eastern texts relating to the Old Testament*, 3rd edn. with supplement, Princeton
- PULAK, C.M.
1987 *A Late Bronze Age shipwreck at Ulu Burun: preliminary analysis* (1984-1985 excavation campaigns), unpublished MA Dissertation, Texas A & M University
- 1988a 'The Bronze Age shipwreck at Ulu Burun, Turkey: 1985 campaign' *American Journal of Archaeology* 92, 1-37
- 1988b 'Excavations in Turkey: 1988 campaign' *Institute of Nautical Archaeology Newsletter* 15:4, 13-17
- 1989 'Ulu Burun: 1989 excavation campaign' *Institute of Nautical Archaeology Newsletter* 16:4, 4-11
- 1990a 'Ulu Burun: 1990 excavation campaign' *Institute of Nautical Archaeology Newsletter* 17:4, 8-13
- 1990b 'The Late Bronze Age shipwreck at Ulu Burun, Turkey: 1989 excavation campaign', in T.L. Carrell (ed.), *Underwater Archaeology. Proceedings from the Society for Historical Archaeology Conference*, Tucson, 52-57
- 1991 'The Late Bronze Age shipwreck at Ulu Burun, 1991 field season: "ingot summer"' *Institute of Nautical Archaeology Newsletter* 18:4, 4-10
- 1992 'The shipwreck at Uluburun, Turkey: 1992 excavation campaign' *Institute of Nautical Archaeology Quarterly* 19:4, 4-11
- 1993 'The shipwreck at Uluburun: 1993 excavation campaign' *Institute of Nautical Archaeology Quarterly* 20:4, 4-12
- 1994 '1994 excavation at Uluburun: the final campaign' *Institute of Nautical Archaeology Quarterly* 21:4, 8-16
- 1996 'Dendrochronological dating of the Uluburun ship' *Institute of Nautical Archaeology Quarterly* 23:1, 12-13
- 1998 'The Uluburun shipwreck', in S. Swiny, R.L. Hohlfelder and H.W. Swiny (eds.), *Res maritimae. Cyprus and the eastern Mediterranean from prehistory to late antiquity*, Cyprus American Archaeological Research Institute monograph series, vol. 1, Atlanta, 233-262
- 1999 'The Uluburun shipwreck: an overview' *International Journal of Nautical Archaeology and Underwater Exploration* 27, 188-224
- REDFORD, D.B.
1992 *Egypt, Canaan, and Israel in ancient times*, Princeton
- RENFREW, C.
1996 'Kings, tree rings and the Old World' *Nature* 381, 733-734
- ROBERTS, O.T.P.
1995 'An explanation of ancient windward sailing - some other considerations' *International Journal of Nautical Archaeology and Underwater Exploration* 24, 307-315
- ROWE, A.
1936 'Addendum A: axe-head of the royal boat-crew of Cheops (or Sahew-Ra(?))', in A. Rowe, *A catalogue of Egyptian scarabs, scaraboids, seals and amulets in the Palestine Archaeological Museum*, Cairo, 283-288
- SÄVE-SÖDERBERGH, T.
1946 *The navy of the Eighteenth Egyptian Dynasty*, Uppsala
- SAKELLARAKIS, J.A.
1979 *Herakleion Museum: illustrated guide to the Museum*, Athens
- SAYED, A.M.A.H.
1977 'Discovery of the site of the 12th Dynasty port at Wadi Gawasis on the Red Sea shore (preliminary report on the excavations of the Faculty of Arts, University of Alexandria, in the eastern desert of Egypt - March 1976)' *Revue d'Égyptologie* 29, 140-178
- 1978 'The recently discovered port on the Red Sea shore' *Journal of Egyptian Archaeology* 64, 69-71
- 1980 'Observations on recent discoveries at Wādī Gāwāsīs' *Journal of Egyptian Archaeology* 66, 154-157
- SCHAEFFER, C.F.A.
1978 'Remarques sur les ancres en pierre d'Ugarit', in C.F.A. Schaeffer et al., *Ugaritica VII*, Paris, 371-378
- SHAW, J.W.
1971 *Minoan architecture: materials and techniques*, *Annuario della Scuola archeologica di Atene e delle missioni italiane in Oriente* 49, Rome
- 1995 'Two three-holed stone anchors from Kommos, Crete: their context, type and origin' *International Journal of Nautical Archaeology and Underwater Exploration* 24, 279-291
- SHAW, J.W. and BLITZER, H.
1983 'Stone weight anchors from Kommos, Crete' *International Journal of Nautical Archaeology* 12, 91-100
- SIMPSON, W.K. (ed.)
1973 *The literature of ancient Egypt: an anthology of stories, instructions, and poetry*, New Haven
- STEFFY, J.R.
1994 *Wooden ship building and the interpretation of shipwrecks*, College Station
- STEINER, G.
1989 "'Schiffe von Ahhijawa" oder "Kriegsschiffe" von Amurru im Sauskamuwa-Vertrag?' *Ugarit-Forschungen* 21, 393-411
- TAYLOR, E.G.R.
1957 *The haven finding art: a history of navigation from Odysseus to Captain Cook*, New York
- VERCOUTTER, J.
1956 *L'Égypte et le monde égéen préhellénique*, Institut français d'archéologie orientale, Bibliothèque d'Étude 22, Cairo
- VICHOS, Y.
1992 'Point Iria wreck 1993: the stone anchors' *Enalia* 4, 17-19
- VINSON, S.
1993 'The earliest representations of brailed sails' *Journal of the American Research Center in Egypt* 30, 133-150
- VIROLLEAUD, C.
1965 *Textes en cunéiformes alphabétiques des archives sud-sud-ouest et du petit palais*, Le palais royal d'Ugarit V, Paris
- WACHSMANN, S.
1986 'Is Cyprus ancient Alashiya? New evidence from an Egyptian tablet' *Biblical Archaeologist* 49, 37-40
- 1987 *Aegeans in the Theban Tombs*, Leuven
- 1995 *The Galilee boat: an extraordinary 2000 year old discovery*, New York

- 1996 'Technology before its time: a Byzantine ship from Tantura Lagoon' *The Explorers Journal* 74:1, 19-23
- 1998 *Seagoing ships and seamanship in the Bronze Age Levant*, College Station
- WACHSMANN, S. and HALDANE, D.
- 1997 'Anchors', in E.M. Meyers (ed.), *The Oxford encyclopedia of Near Eastern archaeology I*, New York, 137-140
- WACHSMANN, S. and KAHANOV, Y.
- 1997 'Shipwreck fall: the 1995 INA/CMS joint expedition to Tantura Lagoon, Israel' *Institute of Nautical Archaeology Quarterly* 24:1, 3-18
- WARREN, P.M.
- 1995 'Minoan Crete and Pharaonic Egypt', in W.V. Davies and L. Schofield (eds.), *Egypt, the Aegean and the Levant: interconnections in the second millennium BC*, London, 1-18
- WATROUS, L.V.
- 1992 *Kommos III: the Late Bronze Age pottery*, Princeton
- WELLS, H.B.
- 1974 'The position of the large bronze saws of Minoan Crete in the history of tool making' *Expedition* 16:4, 2-8
- WHITE, D.
- 1986a 'Excavations at Bates Island: the Late Bronze Age Egyptian trading station' *American Journal of Archaeology* 90, 205-206
- 1986b 'Excavations on Bates Island, Marsa Matruh' *Journal of the American Research Center in Egypt* 23, 51-84
- 1990 'Proceedings: the third season at Marsa Matruh: the site of a Late Bronze Age station on the northwest coast of Egypt' *American Journal of Archaeology* 94, 330

DISCUSSION

COLIN RENFREW: If we're going to look for stones that might have served as parts of killicks or as small anchors for light ships, what sort of weight range are we talking about?

SHELLEY WACHSMANN: I would imagine something within the range that one person could pick up, though it's hard to say categorically. What I would also look for are stones with some kind of carvings in them. For example, in the House of the Anchor at Akrotiri there was one stone with a hole in it, which could belong to one of the varieties of stone anchors of eastern type. The other one may have been put inside some form of wickerwork frame to prevent it from falling out. But all this is really an open ball game. One of the things to look for perhaps, as you're excavating, are possible hollows around it which might come from disintegrated wood. I should also point out that killicks were probably better than the stone anchors. The stone anchors were extremely primitive and very hard to raise, which is perhaps why we find so many on the seabed. I can imagine that a ship's captain would have preferred to cut the rope rather than have 250 kilos of stone suspended above his ship.

PETER WARREN: There's just one detail I'd like to draw attention to in what was otherwise an extremely informative paper. That is that at one time of the year, specifically in September, there does seem to be a direct sailing route from Egypt to Crete. This has been pointed out by Vance Watrous in the Kommos volume (Watrous 1992, 177-178). There is a time, just at that one point in the year, when both the wind and the currents are actually quite suitable for sailing directly from Egypt to Crete.

SHELLEY WACHSMANN: In my forthcoming book (Wachsmann 1998), one of the things I did not go into was archaeological evidence for a ship of a specific culture reaching a specific destination. I was extremely wary of accepting evidence for that. What constitutes evidence beyond reasonable doubt that a specific route was used? For example, would you accept, say, an Egyptian anchor found at Ugarit as evidence that that route was used? I cannot think of any evidence that would possibly prove it (though I'm not saying that it's impossible to do). What I read from the evidence is that not only were these people not worried about leeward drift, it simply wasn't something which ever concerned them. I'm not saying that they couldn't ever have sailed

directly from Egypt to Crete at a specific time of year. They may have occasionally. But I think as a general rule the counter-clockwise circuit of the Mediterranean is the one that accounts for the rich diversity of trade.

ARIS STAMATOPOULOS: Is it at all conceivable that those ancient ships did not need anchors? For one thing, their draught was very small. They did not need a great depth of sea. The other possibility is that they went from one beach to another, with the crew getting off the ship and pushing it on to the sand. Of course, there were no ports in the same sense as there are today, and anchoring as such could perhaps have been avoided.

SHELLEY WACHSMANN: The ships that we're seeing in the iconography are not only large ships, they're also very broad ships, and I think they had to have some kind of anchor. I don't believe that they went to sea without an anchor, and they probably had more than one. I think we have to revise this idea that Bronze Age ships were pulled up on the shore every night, and I don't think anybody would assume that this was the case with the Uluburun ship. These people had a very developed technology. Even if I'm wrong about this idea of killicks, there has to be some reason for us not seeing anchors in the Aegean record. It could be because there is not a lot of diving going on here, whereas in Israel there is. It could also be because Aegean cultures did not use anchors in a cultic sense, which they evidently did in the Near East.

ANTONIS KONTARATOS: I would like to suggest a good anchor is required to stop the line dragging along the ocean floor, which means that in order to achieve this you really need to tie two or three stone anchors to one line.

SHELLEY WACHSMANN: This is a topic that has come up a number of times. It's something that I find very interesting, in that today, when a ship anchors with an anchor and chain, it is really the chain that holds the ship down, not the anchor. That's why a ship can go up and down slowly. In that case, we'd expect to find a number of small anchors whenever we find a group of large anchors, for example at Uluburun. However, at Uluburun, of the twenty-four stone anchors only one is small; and in this case I would argue that it was probably used for a ship's boat. Thus, even though what you say makes sense to us, it seems that they were not aware of it.