

Seafaring, craft and cultural contact in the Aegean during the 3rd millennium BC

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The most probable sea routes taken by the early Greek sailors in their pre-sail and early sailing craft have been plotted using sea current and wind data. An attempt to show that these routes were indeed frequented in the 3rd millennium BC has been made, by correlating them with the distribution of traded and exchanged items in the Aegean as well as with the distribution of sites which possess architectural features or artefactual evidence for advanced social or technological achievements. An integral correlation between all three parameters is found. Further, a reconstruction of the types and variety of craft used in the Aegean during the 3rd millennium BC is put forward. The evidence given suggests clearly that there was a variety of craft ranging from the simple dugout to the dugout plus superstructure ('longboat'), and that these craft performed a major task in encouraging and facilitating trade and contact in the Aegean. They carried with their cargoes both influences and knowledge which contributed to cultural change.

The narrow strips of level, fertile plain amidst the stark ridges of mountain waste were the first areas of the Greek mainland to adopt the new agricultural technology of the Neolithic, which came via the southern Aegean islands. At no time in the past has the Aegean played such a major role in stimulating and sustaining cultural change as in the 3rd millennium BC. It was then that the Aegean became a focus for social and economic changes, with new centres along its coasts and on its islands beginning to show evidence of a wider range of contacts and economic relationships, both amongst themselves and with their neighbours.

By the second half of the 3rd millennium BC, urbanization had advanced in scale, and we witness the beginnings of larger Aegean towns with architectural features which imply social hierarchy. The changes which took place in agriculture were significant, too, for although the basic herding and cereal economy which had developed in the Neolithic continued, it was supplemented by the cultivation of the olive and the vine. These were both 'storable' and 'tradable' foodstuffs, which permitted fundamental changes in the economy and society. They are associated with the architectural evidence for storage and fortification. The ability to produce 'wealth' in this form and the need to protect it led to social stratification apparent in both important monumental buildings such as those at Lerna, Akovitika, Tiryns and Orchomenos, and in certain rich graves such as Levkas and Manika.

Imports, or exchanged items, are easily recognizable due to regional differences evident in the Early Bronze Age assemblages of the Aegean. When one plots the respective distributions of certain local types throughout the Aegean, the result is a complicated network of cross-cultural links which Renfrew (1972) likened to an 'international spirit'. Tables 1 and 2 shows some examples of the exchange network. It will be clear from this that the southern and northwestern Aegean had particularly marked evidence for exchange and external contact, while northern Greece and Thessaly were not involved. It is in the southern Aegean that we have marked evidence for cultural change and progress in the 3rd millennium BC. Thus, more important than the exchange of artefacts and goods was the interchange of ideas and knowledge which stimulated cultural and technological development. Archaeologists and archaeometrists have started to

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Table 1. *Chronology of some of the traded and exchanged artefacts in the Aegean during the 3rd millennium BC*

Artefact	EBA I	EBA II	EBA III
Marble rhytons	X		
Sauceboats		X	
Folded-arm figurines		X	
Depas cups		X	
Early Minoan II pottery		X	
One-handled cups		X	
Duck vases			X
Roll-rimmed bowls	X		
Cist graves	X		
Obsidian	X	X	X

identify the spread of technical knowledge both in ceramics and metallurgy. The development and spread of the techniques of metallurgy had perhaps the most far-reaching effects of all. There is a great expansion in metallurgical activity in the 3rd millennium BC Aegean.

Sea routes in the 3rd millennium BC

It is possible to reconstruct broadly the most probable sea routes taken by the early Greeks in

their pre-sail and early sailing craft. From the very fragmentary evidence available to us through the archaeological record, we can begin to suggest what types of craft were used on these journeys.

The data for sea currents and wind strengths used in this study were derived from the publications of the Hydrographic Service of the Greek Navy (NGGS, 1976). Greater details on particular routes can be obtained from local sailing guides. The present data are relevant to our interpretation of the situation in the 3rd millennium BC, because the consensus of opinion on eustatic stability is that there has been little or no change between the present sea level in the Aegean and that of the 3rd millennium BC, so sea currents will be essentially the same (Loy, 1967; Dufaure, 1970; Kraft, 1972; Flemming *et al.*, 1973; Inman, 1983). Paepe & de Meyer (1983) have shown that the present climate is similar to that of the 3rd millennium BC, so our wind data are reliable. Local coastal changes will no doubt have occurred through erosion and deposition, caused by climatic changes in the intervening period, and more seriously, as a result of tectonic instability (McGeehan Liritzis, 1988).

Table 2. *Examples of Aegean influences on mainland Greece in the 3rd millennium BC*

Artefact/feature	To	From
<i>Pottery</i>		
Sauceboats	Mainland Greece	Cyclades (also seen in Anatolia)
Depas cups	Mainland Greece	Anatolia
Duck vases	Mainland Greece	Cyclades (also seen in Anatolia)
<i>Stone etc.</i>		
Objects of chlorite and schist	Mainland Greece	Cyclades/Crete
Vessels with spiral relief decoration	Mainland Greece	Cyclades/Crete
Folded-arm figurines	Mainland Greece	Cyclades
Shallow marble bowls	Mainland Greece	Cyclades
<i>Metals</i>		
Spherical-headed pins	Mainland (Zygouries)	Anatolia (Blegen <i>et al.</i> , 1950: 27, t.1)
Knife	Mainland (Eutresis)	Anatolia (Blegen <i>et al.</i> , 1950: fig. 356)
Axes Renfrew t. IV/IVa	Mainland (Levkas, Manika)	Cyclades and Aegean generally
<i>Architecture</i>		
Fortifications	Mainland (Lerna-Aigina Raphina Manika)	Chalandriani Troy II Thermi V Poliochni
Herringbone masonry	Mainland (Askitario) Eutresis house L	Troy I Thermi I, IV

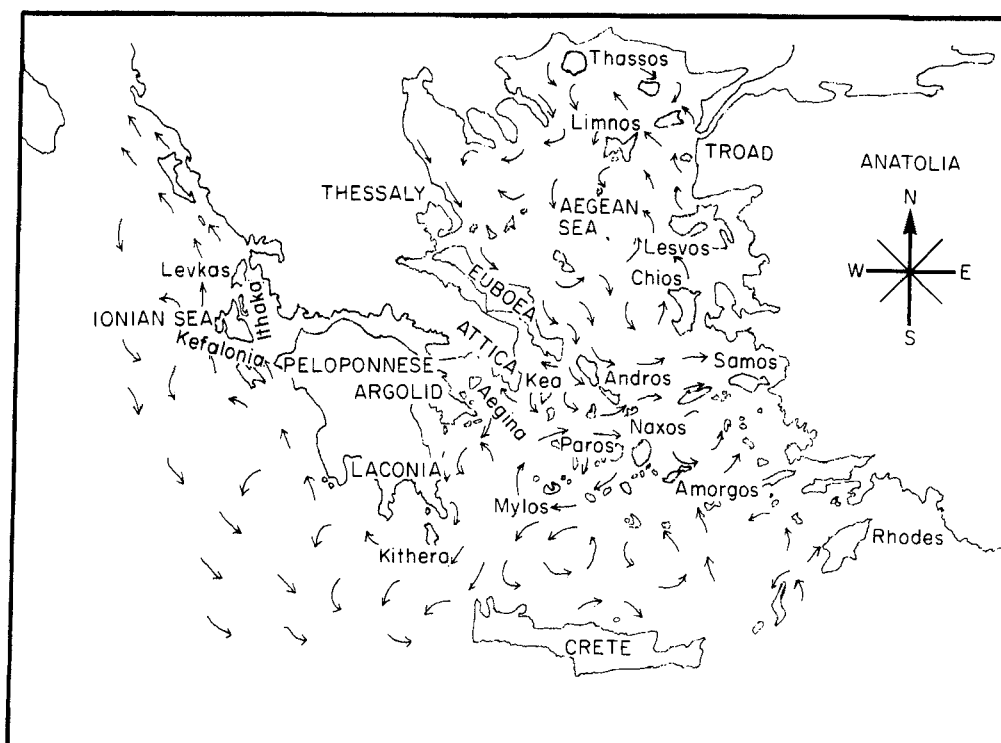


Figure 1. Winter sea currents (data: NGGS, 1976).

The effects of winds on surface water can counteract sub-surface sea currents quite dramatically and would have affected pre-sail craft plying the Aegean. Greater control of the winds' directional pull would have been gained by using a sail. Longer, quicker and more hazardous journeys could then be tackled.

The Aegean is notorious for extreme seasonal and local diversity which certainly influenced the effectiveness and timing of early sea journeys. Shorter distances must have been preferred and this is no doubt why 'island hopping' via the Cyclades began.

Wind and sea currents in the waters surrounding Greece vary seasonally, summer and winter, but not every area is equally affected by these alterations. The overall trends in wind changes may be summarized as follows:

During winter: northern winds predominate, due to a high pressure belt in the Aegean. These winds are intense when winds from the south abate. Cyclones over the northern Aegean are attributed to interaction of northern and southern winds of significant intensity.

During summer: southern winds increase and northern winds abate. Thereafter, good weather from the southern direction lasts all summer, except when the *meltemia* (Etesian winds) strike, creating storms in the central and northern areas of the Cyclades. These winds strike the central areas of the Aegean from a north and northeasterly direction and the Ionian Sea is struck from a northwest direction. Marinatos (1963: 162) noted, 'at definite periods of the year, navigation in definite directions is not very difficult . . .'

The interaction of sea currents and winds in the determination of sea routes

The directions of sea currents are indicated in Fig. 1 (winter) and Fig. 2 (summer). They incorporate the effects of wind direction, data for which are given in Table 3. This gives the most probable average seasonal variation in the direction of the surface waters. Thus, they indicate the most viable routes. Henceforth, the term sea currents includes the wind data.

The Aegean is divided into six areas in order to discuss the best sea routes. These are: (a) Levkas/

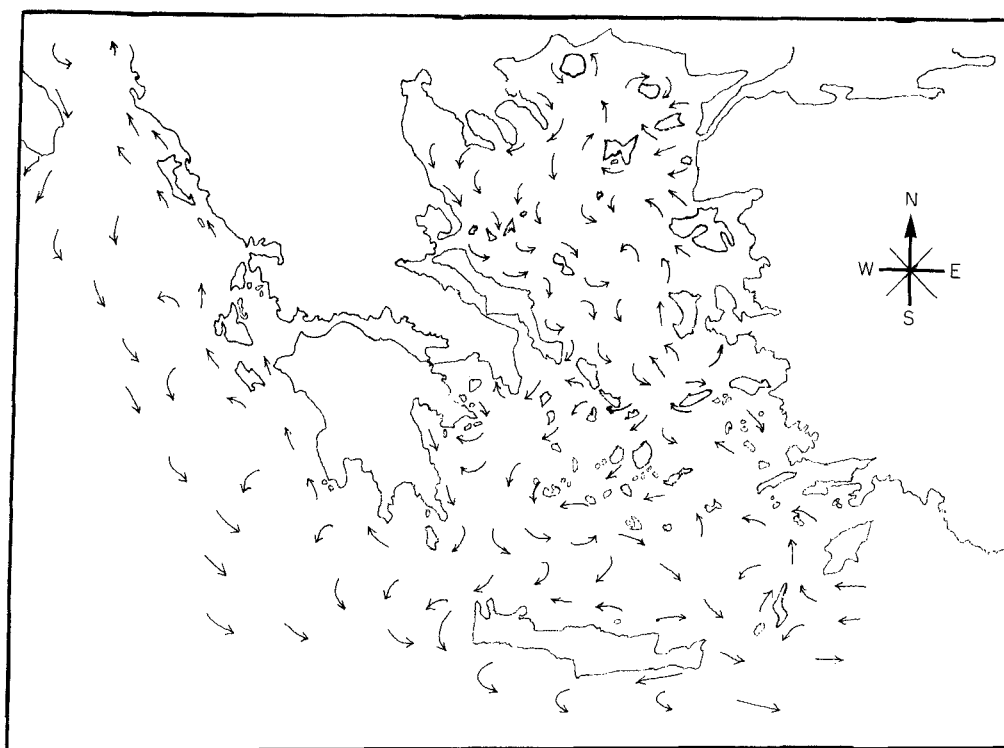


Figure 2. Summer sea currents (data: NGGS, 1976).

Ionian islands; (b) southern Mainland Greece and Crete; (c) Thessaly; (d) Troy and the Troad; (e) Argolid, Attica and the Cyclades, and (f) Inter-Cyclades.

(a) Levkas/Ionian islands

There are no apparent changes in the sea currents from winter to summer in the waterways of the west Peloponnese and Ionian Sea. Currents flow upwards along the coast, permitting passage on either side of the Ionian islands. Difficulties would have been encountered returning southwards, as there is a danger of being swept into Italian-bound waters. Tides produce some confusion at the mouth of the Corinthian Gulf and in the Levkas Strait, where surface waters are influenced more by the wind and that is why the direction of sea currents here are north-south. These anomalies would have produced difficulties for both pre-sail vessels and primitive sailing boats. Similarly, in the Amvrakikos Gulf (Preveza, near Levkas), tides at the mouth of the gulf alternate four times per day. North and

south winds help the strength of the output or input of the respective gulf currents.

The *meltemia* in the Ionian Sea blow in a northwesterly direction.

This region, in particular the island of Levkas, with its famous 'R' graves at Steno (Dörpfeld, 1927) had many contacts with the southern Peloponnese, the Cyclades and, to a lesser extent, the Troad. The material assemblage, in particular the pottery and metalwork, show clear and sustained links outside the region, all of which would have been possible only by sea. There is, as yet, only very limited evidence for contacts between this region and the north Adriatic or Italy.

(b) Southern mainland Greece and Crete

There are differences here between winter and summer sea currents. During the summer, access is easier from Messenia and Laconia to southern Crete, but there are dangers of being swept into the Libyan Sea. It is difficult to enter the waters to the north of Crete, as currents between

Table 3. *Winds in the Aegean. Annual mean value of wind intensity on Beaufort scale (percentages)*

N	NE	E	SE	S	SW	W	NW	Calm
<i>Palaeohora, south Crete (15)*</i>								
29.6	5.3	1.5	10.8	7.7	2.9	19.4	12.3	10.4
<i>Ierepetra, east Crete (35)</i>								
32.2	11.3	1.7	9.6	1.8	19.4	0.4	7.6	16.1
<i>Sitia, east Crete (40)</i>								
8.9	2.3	0.6	2.6	11.6	5.1	6.3	47.8	14.8
<i>Irakleon, Crete (39)</i>								
15.7	3.9	2.9	3.9	14.5	4.8	4.2	29.2	2.1
<i>Hania, Crete (40)</i>								
17.2	6.9	10.0	3.6	2.0	13.0	10.2	12.0	25.0
<i>Nauplion, Argos (30)</i>								
24.0	11.0	2.2	9.8	20.4	11.6	6.7	12.9	1.5
<i>Eleusis, Attica (25)</i>								
32.0	2.9	4.0	2.2	11.9	4.3	5.0	7.1	30.6
<i>Athens (30)</i>								
21.7	14.7	5.2	6.6	13.2	8.2	7.2	8.3	14.8
<i>Mylos (37)</i>								
32.4	12.1	2.8	8.6	1.5	18.7	7.8	12.9	3.2
<i>Santorini (25)</i>								
34.3	6.2	0.9	8.3	17.7	5.0	4.2	16.8	6.6
<i>Naxos (30)</i>								
43.2	13.9	0.8	7.6	14.6	6.6	1.3	5.1	6.9
<i>Syros (32)</i>								
40.4	13.4	3.2	4.1	11.0	9.2	4.7	8.9	5.0

*Years of observation.

Laconia and Messenia wash away from Crete. Between the Argolid and Crete, a downward washing of currents along southern Laconia and towards the northern Cretan coast occurs, although there is some pull to the west also. The easiest access to the north Cretan coast is via the Cycladic islands. As winds in the south and mid-central Aegean blow predominately southwards, sailing is facilitated by southerly bound currents. This is not the case during the *meltemia*.

In winter, similar problems would have been encountered by those wishing to sail south from Messenia or Laconia to Crete. The south-bound currents now favour accessibility from the Argolid and Attica, where there is a more direct downward wash to the north Cretan coast. There are no conflicting currents along the north

Cretan coast in winter, so landing would not have been as hazardous as in summer.

Throughout the year, landing areas for vessels coming from the direction of the Greek mainland are favourable on south-central north-central Cretan shores.

Clear evidence for contact between the southern Greek mainland and Crete is limited. In the later 3rd millennium BC, the Minoans colonized Kythera, off Laconia, and there are indications that the Cretans may have obtained some metal from the Attic sources, known to be exploited in the 3rd millennium (Gale & Stos Gale, 1981; McGeehan Liritzis & Gale, 1988). It is most likely that contact between the Greek mainland and Crete was indirect for most of the 3rd millennium BC, being conducted via the Cycladic islands.

(c) Thessaly

In both summer and winter, the tides in the Evripou Gulf run north and south at six-hourly intervals. These tides are accentuated in intensity when the northern winds blow. The alternating tides facilitate contact between southern Thessaly, Euboea, Boeotia and Attica. From the east Thessalian shore, along the east coast of Euboea, downward washing currents in summer lead to the Cyclades and south. It is difficult to sail east in the winter due to conflicting currents, although it may have been possible in the summer. Winds are predominately southwards, but periodically they change to blow southwesterly.

There would have been obstacles to sailing north from the Volos region, in summer or winter, unless very close to the coast, where the effects of the predominately downward currents may not have been so strong.

There is only limited evidence for cultural contact between Thessaly as a whole and the southern Aegean. However, the communities of southern Thessaly exchanged pottery with some parts of central Greece, and it is possible that they may also have been involved in the metalwork exchange of the second half of the 3rd millennium BC.

(d) Troy and the Troad

In summer, the tides around Troy (northwest Anatolia) and the Troad are strongly influenced by the southwest currents originating from the Bosphorus. Southward currents are located to the west of Lemnos, while currents east of Lemnos are directed northwards towards Thasos or European Turkey. Return currents from the north via European Turkey to Hellespont are possible, although not directly to the coast near Troy. There are problems in returning westwards, as this is only possible via Thrace and thereafter southwards along the coast to Thessaly. Mid-Aegean conflicting currents prohibit trans-Aegean crossings directly from Troy. The difficulty is accentuated by the lack of protection from the open sea as there are so few small islands in the northern half of the Aegean. Travel south along the east Aegean coast (even though currents are northwards) and then across the mid-Aegean to the west is possible by following the coast as far as Samos and crossing west from there.

In winter, northward currents are not so

strong, but they are directed towards the northern shores of the Aegean, near Thrace. It is easier to return south of Lemnos, as the circulating tides aid a return to Troy from mid-sea in the north Aegean. Currents southward from the mid-sea are more pronounced, sweeping down into the Cycladic zone. Access to the west by the same route as in summer is possible. This emphasizes the Cyclades as the preferable crossing point in the Aegean.

The archaeological evidence for contacts between the Troad and other areas of the Aegean is most marked in the later EBA. One could almost presume that the Troadic communities had direct contact or trade depots with the island of Chalandriani off Syros and several east central mainland sites, for example, Lefkandi and Manika in Euboea. This contact is marked by similarities in metalwork, pottery and architectural style.

(e) Argolid, Attica and the Cyclades

Summer currents favour crossings from Attica to the Argolid, but a return trip would not have been so easy, except via the coastal waters. Little access to the Cyclades in summer is possible due to opposing currents in the opposite direction.

In winter, contact between Attica and the Argolid is favoured with an easy return more probable due to the currents. Access to the Cyclades from Attica would have been facilitated by the currents sweeping into the north Cyclades (i.e. Syros, Kea, Delos) and via these islands into the other more southerly Cycladic islands.

The methods and know-how of Neolithic agriculture came first to southern Greece via the Cycladic islands, and the contacts between these two regions grew more strongly after the 3rd millennium when the majority of the Cycladic islands were first settled (Cherry, 1981, see below). The similarity in certain pottery, metal and architectural designs indicates strong cultural contact, and this was no doubt strengthened by the late 3rd millennium BC exploitation of lead and silver from both Lavrion and the northwest Cycladic islands.

(f) Inter-Cyclades

In summer, currents are predominantly westwards and southwestwards in the southern Cyclades. Currents off Euboea tend towards the

east and southeast and bypass the east coast of the southern Cycladic group of islands. Currents flowing southwards are on the west side of the group (Siphnos and Melos), with the southeast and southwest running in the area between the Cyclades and Crete. Westward sweeping currents in the northwest Cyclades draw towards Attica and the Argolid. The route to Anatolia and the east Aegean is most feasible via the north Cycladic islands and Samos.

In winter, there are strong currents westwards around Syros, Delos and Kea, as well as southward sweeping currents around and between Paros, Melos and west of Naxos. Upward sweeping tides west of the Cycladic group of islands would have aided return or circular journeys. Circular currents east of the Cycladic group of islands and off the Carian coast would also have aided return journeys. Circular currents sweep upwards and westwards towards the Argolid and northwards towards Attica. Thus, even amongst the islands themselves certain routes were more feasible than others, depending on the season.

Concluding this section, we may summarize as follows. Seasonal changes in sea currents and wind direction caused local diversity and played a major role in determining both the timing and the direction of sea voyages. Departure and return journeys may well have taken separate routes.

The Cycladic islands were important mid-way stops for both north-south and east-west Aegean navigation. Broken journeys reduce the risks and protect against danger. The most predictable journeys would have been those where seasonal variations were at a minimum.

Having established that certain routes would theoretically have been more feasible than others, it must now be shown that these routes were indeed frequented, and that the patterns these routes form can be meaningfully related to the evidence for cultural contact.

Correlations between sea routes and cultural phenomena

Bintliff first reconstructed the traditional movements of Greek fishermen in southern Greece and their pursuit of seasonal migrations of various types of fish (Bintliff, 1977: 130). He suggested that the communities engaged in this fishing network had correspondingly more participation in

the cultural exchange process of the Bronze Age. His map of the fishing runs is reproduced in Fig. 3(a).

If we compare Figs 1 and 2 with Fig. 3, we see that, for the south Aegean, they correlate well. None of the routes obey cultural boundaries, and their complicated networks no doubt encouraged or indeed provided the means for interaction in the Aegean at this time. Moreover, many of the most viable sea and contact routes had the added advantage of being supplied with fish in season. As we will see below, the relationship between water routes and fishing is substantiated by the fish ensigns, or *oculi*, on the ship representations on the Cycladic ceramics known as 'frying pans' (Fig. 4).

Further proof can be given to show that these routes were frequented on a regular basis. The distribution of 'special feature' sites (see below) and of artefacts exchanged in the 3rd millennium BC is shown in Fig. 3(b) and Fig. 5, respectively. Figure 5 is derived from Renfrew's figure 20.5 (1972). A comparison of these maps shows that there is a direct correlation between sea routes, fishing routes, artefact distribution and the distribution of 'special feature' sites.

The reason why there is more evidence for cultural contact and sea-going in the 3rd millennium BC is that rising population densities on the mainland forced colonization of secondary, marginal environments (Cherry, 1981: 53). Cherry maintains that the poorer environments had lower probabilities of maintaining themselves indefinitely without recourse to subsistence items from beyond the islands (Fig. 6).

Fishing would always have been important to the occupants of the Cyclades. Renfrew (1972: 358) believes that piracy in the southern Aegean explains the differences in the prehistoric Aegean growth patterns. Piracy, fishing and carrying would no doubt also have been 'trades' practised by the first Cycladic islanders over and above marginal farming. Twenty-one of the twenty-nine islands were colonized (more purposefully than passively) in the 3rd millennium BC (Cherry, 1981: tables 1 and 2). The inter-island routes would have provided more sustained contacts between the east and west (notably north-west) Aegean.

A change in settlement pattern is noticed on the Greek mainland during the 3rd millennium BC. Settlement was predominately eastern and

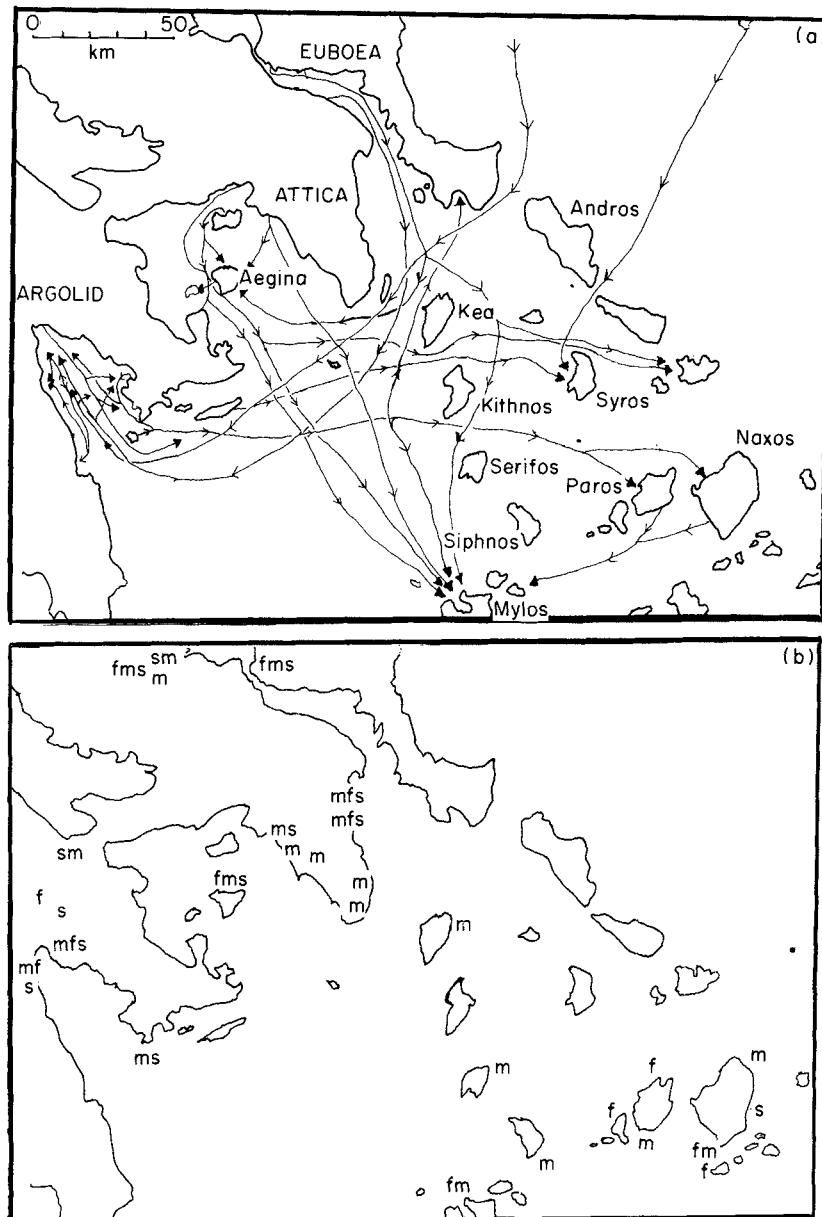


Figure 3. (a) Fishing runs in the South Aegean. Adapted from Bintliff (1977: 130, map 1). (b) Distribution of central buildings (s), metalwork (m) and fortifications (f) in the South Aegean in the 3rd millennium BC.

coastal, the main centres of population being the Copais/Khalkis; Attic and Corinth/Argolid regions in the second half of the 3rd millennium. It is obvious from this distribution that the sea was important to the settlements of the time, even

though, as the growth of fortifications indicates, it became increasingly dangerous to locate near the coast.

To demonstrate further that there is a sound relationship between the development of an

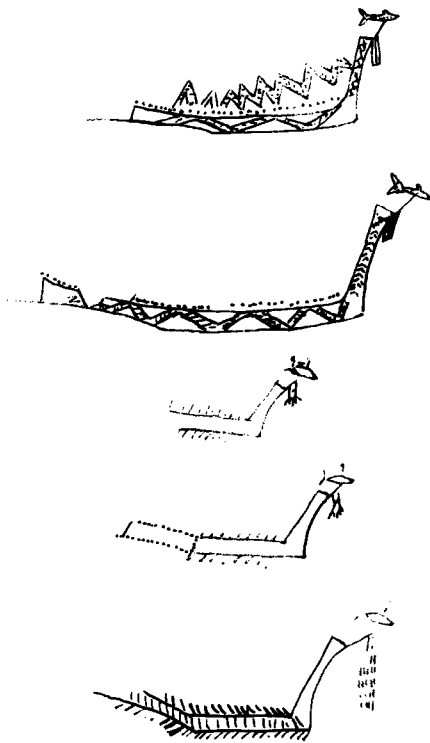


Figure 4. Representations of Early Cycladic 'frying pan' craft from Syros. Redrawn from Tsountas (1899). Scale 1:3

effective means of transport and an increase in cultural activity, we need only look at the distribution of what are considered 'special feature' sites, that is, sites which possess architectural features or artefactual evidence for advanced social or technological achievements. These are sites with large or central buildings, evidence for metalworking or hoards of metalwork and fortifications. The distribution of these sites is given in Figs 7, 8 and 9. When these are compared with the sea routes and fishing runs (Figs 1–3), it is quite obvious that their relationship to the routes is implicit. Sites on the sea routes were easily in contact with the extended Aegean, and so both benefited from, and contributed to, the 'international spirit' of the time. Conversely, areas outside the network of contact were at a distinct disadvantage, and this no doubt explains why only the south and northwest Aegean experienced a marked increase in exchange and contact. By this reasoning, sea routes determined, rather than were determined by, the

location of these 'special feature' sites. It seems that before the sailing ship permitted greater control over the tides and winds, these tides and winds controlled the direction of contact. This implies that it was not necessarily the case that most of Thessaly and northern Greece lacked any basic resources which southern Greece possessed, but rather that their inability to partake in the cross-cultural activities of the 3rd millennium BC was mainly due to the sea routes.

3rd millennium BC shipping

Let us now try to piece together what evidence the archaeological record has left us for the types of craft used in the 3rd millennium BC. There are still four questions unresolved regarding the type of craft and their development. These are: (1) what was the general design of the boat—in particular the design of the prow and stern? (2) Were the boats dugouts or plank-built? (3) What size were the craft, and (4) was the sail used, and when was it first used?

The evidence for the craft is derived from three sources: (1) representations of contemporary craft; (2) boat models, and (3) reported remains of the boats themselves. We will look at each of these in turn and compare the evidence with data for craft from other regions of the southeast Mediterranean and beyond.

(1) Representation of contemporary craft

A series of around a dozen ships engraved on Early Cycladic 'frying pan' pots was first published by Tsountas (1899). These have been supplemented by similar representations found on rocks in some of the Cycladic islands, and this type of ship was also in use on the coasts of the mainland as the incised sherd from Orchomenos demonstrates (Kunze, 1934: pl. xxxix, 3).

A controversy has arisen regarding the form of these vessels. Archaeologists cannot agree which end of these representations (examples given in Fig. 4) was the prow, or fore end, and which was the stern, or rear end. Tsountas (1899), Evans (1921: 240) and Hutchinson (1962: 92) were in favour of the 'high prow–low stern' theory and therefore understood the projection at the low end of these vessels to represent a fixed rudder. Adherents to the opposite 'low prow–high stern' theory (Edgar, 1904; Marinatos, 1933: 182; Renfrew, 1972) interpret this projection as a ram, cutwater or keel projection.

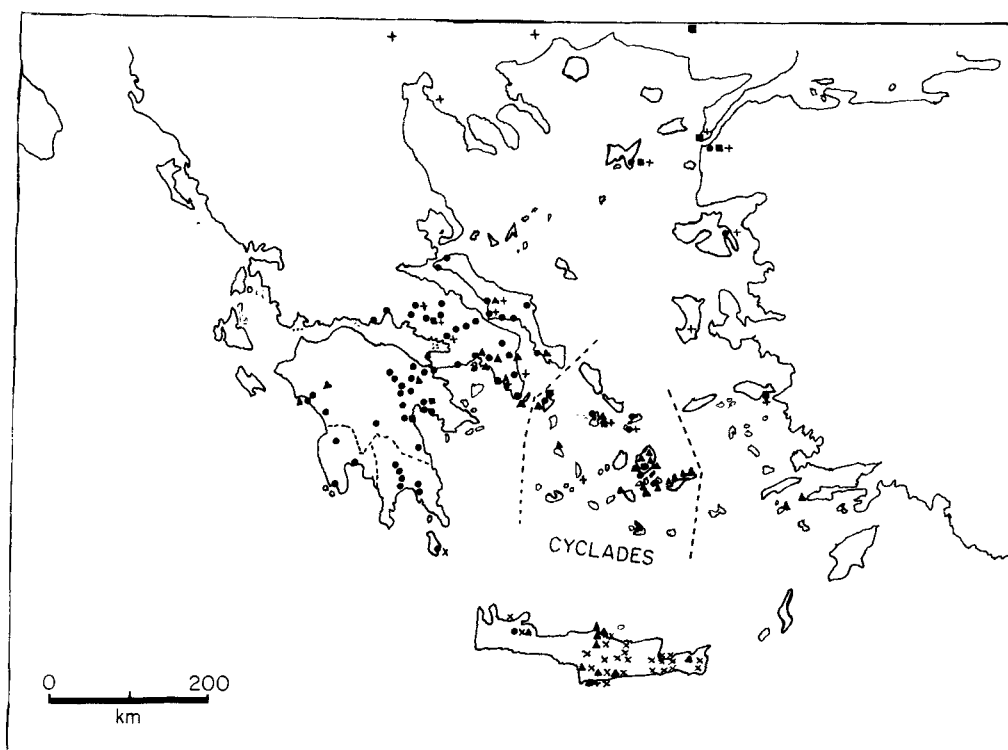


Figure 5. Artefact exchange in the 3rd millennium BC: (●) sauceboats; (▲) folded-arm figurines; (■) depas cups; (x) Early Minoan pottery; (+) one-handed cup. (Based on Renfrew, 1972: 453, fig. 20.5.)

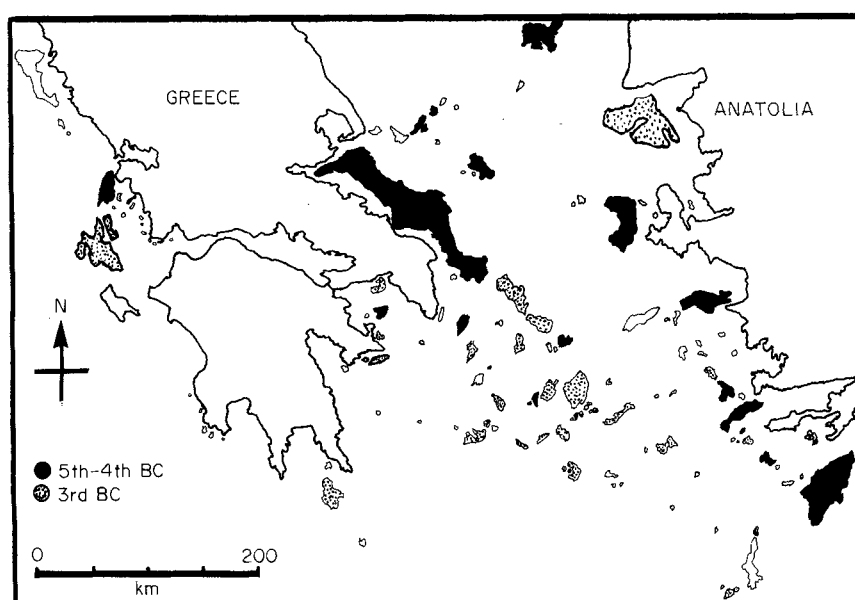


Figure 6. Map of the Aegean showing the islands colonized in the 5th-3rd millennium BC. (Based on Cherry, 1981: 53, fig. 4.)

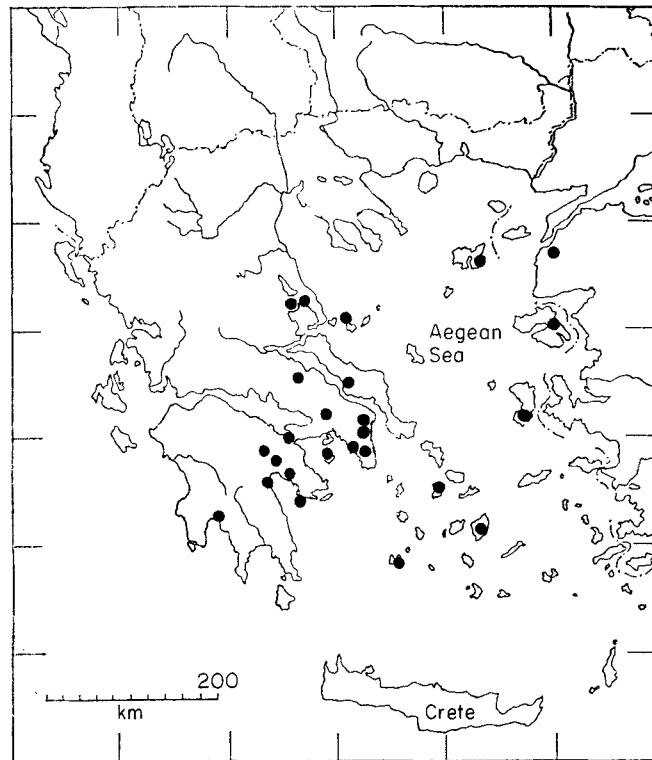


Figure 7. The distribution of large, central buildings or monumental architecture in the 3rd millennium BC (excluding Crete).

Sherratt (1982: 13) produced new data in the form of three boat models in lead from Amorgos and stated that these seem to supply the answer as they, 'clearly indicate that the raised end was the prow, and that the vessel had a low, square stern'. Certainly, this is true for the three particular examples illustrated, but when one considers contemporary Egyptian representations (as in Fig. 10), the higher end is most often the stern and is usually accompanied by a steering oar. Therefore, the new data do not solve the controversy once and for all. Other ethnographic parallels in Oceania and India support the popularity of the low prow-high stern for early wooden sea-going vessels (Hornell, 1946; Johnston, 1981). There seems no good reason to exclude either possibility. It is becoming increasingly apparent that more than one type of craft was in use during the 3rd millennium BC in the Aegean.

(2) Boat models

There are seven 3rd millennium BC boat models in lead which hail from two Cycladic islands—four from Naxos (Renfrew, 1967: pl. 3) (Fig. 11) and three from Amorgos (Sherratt, 1982: 13). Two clay models are known from Crete (Fig. 12). One dates to the Late Neolithic/beginning of the Early Bronze Age (Mochlos), and the other dates to the middle of the Early Minoan period (Palaikastro). As noted above, the recent publication of three boat models from Amorgos (Sherratt, 1982) helps very much in the interpretation of the actual structure of this kind of craft. Sherratt contends that the Amorgos craft were built on a dugout base with minimal superstructure, and that these models demonstrate clearly that the high part of the ship was the prow. Hutchinson (1962: 91) suggests that the long-boats, which are very similar to the boat models, were basically dugouts, with a pointed prow and

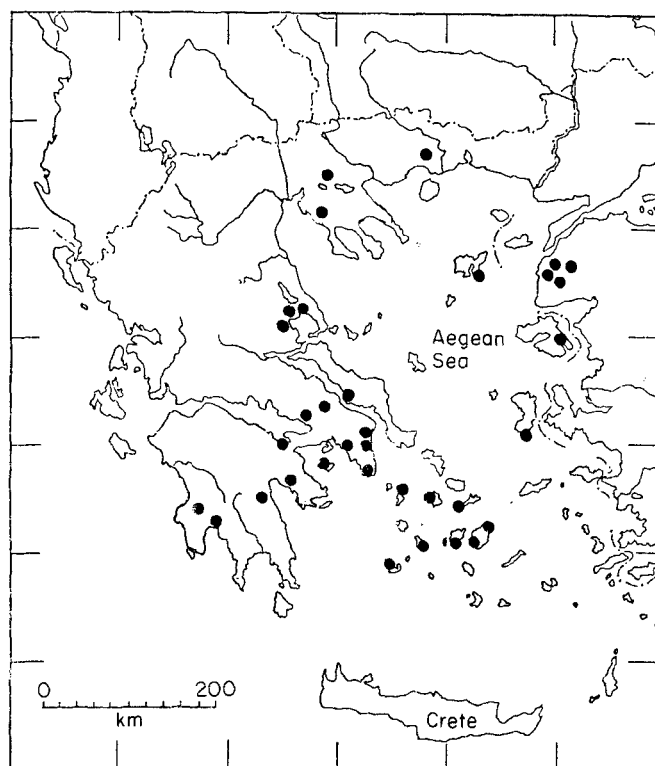


Figure 8. The distribution of metalworking sites or sites with hoards of metalwork in the 3rd millennium BC (excluding Crete).

stern added separately. Here we see some agreement. As the models are three-dimensional, they permit us to say more about their structure. They are flat-bottomed, the bottom usually comprising slightly more than half of the boat's length. Both ends rise at a low angle from the bottom. One end terminates in a flat, transom-like fashion, while the other end forms a point (Johnston, 1981). The sides are low, which suggests that the main body of the craft, at least, was manufactured from a dugout of a tree. The sharp angles between the sides and the bottom suggest that they were dugouts of an advanced type. The plane at the base of the boats is smaller than at the top, suggesting that the tree trunk, if it was used, was hollowed inside and shaped on the outside. This type of craft could represent an intermediary step between the monoxylous craft and the planked boat—producing a much more seaworthy vessel.

One way of distinguishing a dugout from a

plank-built boat, which has a broader plane and a curved hull, would be to measure the length to width^[1] ratios of the various boat types. Typical ratios could be identified, as deviation from the average width could be calculated. This method is of course only applicable to models. The wider the boat and the more the variation from the average width suggest it is probably plank-built, as the dugout would necessarily be close to a standard, narrow rectangle.

Various archaeologists have tried to estimate the approximate length of the larger craft, that is, from advanced dugouts onwards (Marinatos, 1933; Hutchinson, 1962; Renfrew, 1967, 1972). If one accepts that these crafts were essentially dugouts, the total length would not exceed a full-grown tree plus the superstructure at the front and rear. The superstructure would be estimated relative to the average length of the tree. Hutchinson (1962) suggested the use of Cypress

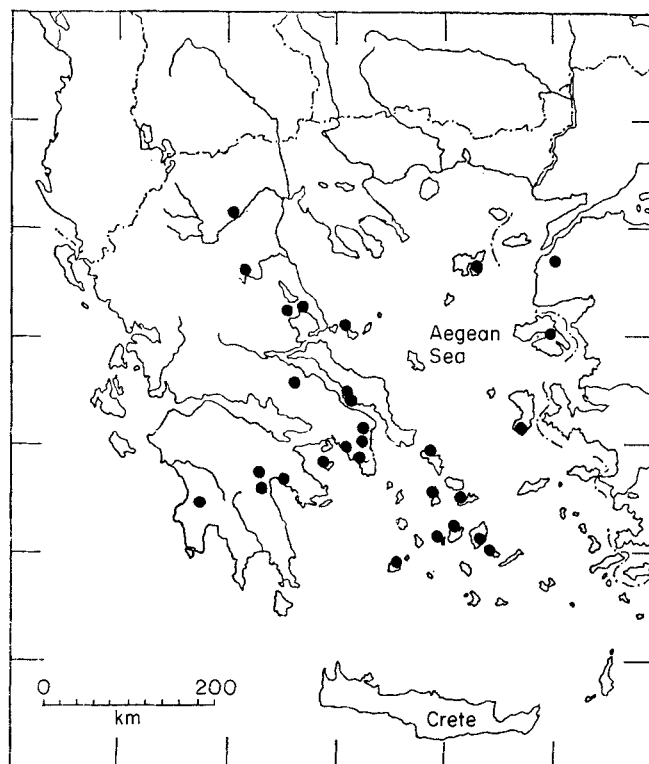


Figure 9. The distribution of fortifications in the 4th and 3rd millennia BC.

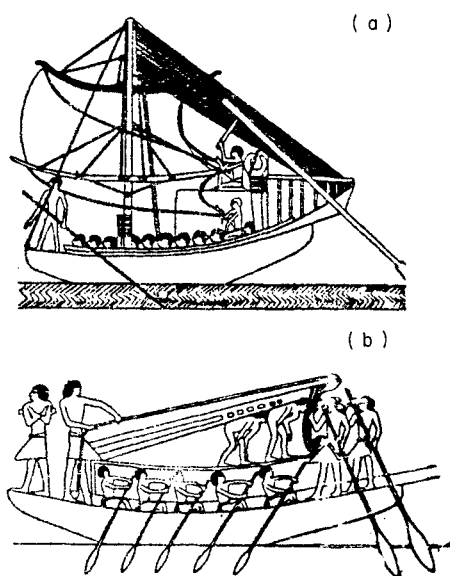


Figure 10. Egyptian representations of sea-faring craft: (a) from Ipi at Saqqara, c. 2500 BC; (b) from Abibi at Saqqara, c. 2500 BC.

trees. It is known that the Egyptians most probably obtained their ship-building wood from the Levant through the port of Byblos, and the most likely type of tree was the Cypress. Marinatos (1933: 191) hoped to estimate the length of the longboats represented on the 'frying pans' by counting the number of oar markings and multiplying the distance by approximately 1.65 m, called the *interscalmum* and used as the standard distance between oars in Classical Greek ship-building. The figures he arrived at were so great that he concluded the markings to be purely token representations. Renfrew (1972: 357) noted that there are some representations which mark the number of oars more carefully. He estimated (using *interscalmum*) the average size of these boats to be around 20 m if the strokes were oars, less if they represented paddles. Johnston (1981) estimated the length of those 'frying pan' boats which had between 12 and 26 oars or paddles. He suggested that the craft were between 15 and 30 m in length. The

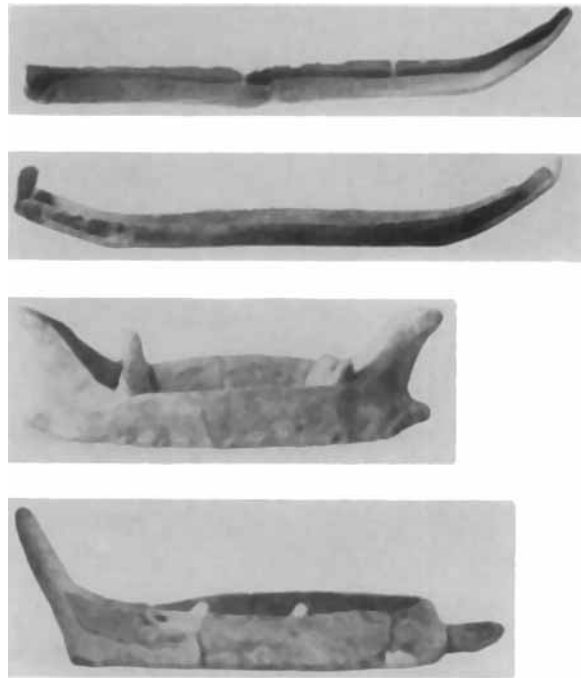


Figure 11. Lead boat models from the Cyclades (Ashmolean Museum Photo, nos 1938.725 and 1929.216).

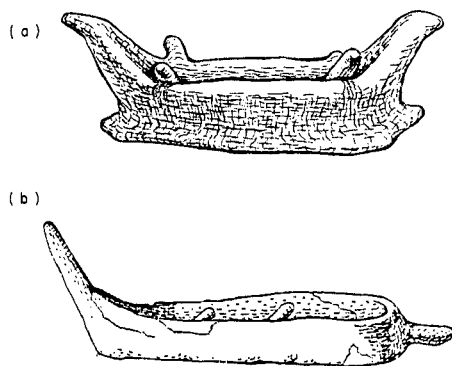


Figure 12. Clay boat models of dug-outs from Mochlos (a) and Palaiokastro (b), Crete (Herakleion Museum, Crete).

consensus of opinion, then, favours an average distance length of 20 m for the extended dugouts represented on the 'frying pans'.

(3) *Reported remains of boats*

Two or three 'wrecks' have been reported or rumoured, but they have never been published. One possible find was made by the Greek Department of Underwater Antiquities (Papathanassopoulos, 1976). A preliminary note on the find was published giving the location of the 'boat' just off the Greek mainland in the Dhokos Gulf. Early Helladic sherds dating to the second half of the 3rd millennium BC were located a few metres underwater. The excavator suggested that these sherds got there when the boat carrying them was wrecked. No tangible evidence of the boat was recorded, and it is possible that these sherds came to be found underwater as a result of topical submergence of the shore. No concrete evidence has been given, and the claim that an Early Helladic wreck has been found is premature and unconvincing.



Figure 13. Early Minoan III and Middle Minoan sailing craft represented on seals and gems. (a) Ashmolean Museum; (b) after Sherratt (1982).

The use of the sail in the 3rd millennium BC Aegean

A sail affords greater control of the ship, enables greater speed and longer, more difficult journeys, to be undertaken. With the sail, it is possible to tackle the open sea.

The sail requires structural alterations to the craft; a mast, a yardarm and at least elementary rigging. A steering rudder would have been necessary, but no doubt it was developed on the pre-sail craft.

On present evidence, the origin of the sail does not seem to be indigenous to the Aegean; it was most probably Egyptian (Hutchinson, 1962; Johnston, 1981; Sherratt, 1982). The earliest reference to a sailing ship comes from Egyptian Second Dynasty (c. 2950–2750) records of ships on the Byblos run (Hutchinson, 1962: 93). The first known constructed ship capable of sailing the open seas also comes from Egypt, in the Third Dynasty (c. 2750–2600 BC).

In the Aegean, the earliest evidence for the use of the sail comes from Early Minoan III, the last centuries of the 3rd millennium BC. Engravings on seals and gems from several sites which date to the beginning of the Middle Minoan period are similar to those from the preceding EM III period (Fig. 13). The masts are clearly shown, and the craft have curved hulls which suggests

that they were plank-built. According to Hutchinson (1962: 94), the rigging in many of these is typically Egyptian. In these engravings, the prow is high and the stern is low, usually with a projecting keel.

The craft on the seals and gems represents an advanced type of vessel, one which Hutchinson (1962) believes demonstrates a certain continuity from the longboats on the 'frying pans'. What is clear is that there is some development in the type of craft in the Aegean during the 3rd millennium BC. To what extent this development, particularly the adoption of the sail, can be attributed to contact with the Egyptians is not easy to say.

The earliest evidence for contact between Crete and Egypt dates to the end of the Neolithic in the Aegean (equivalent of the Predynastic/First Intermediate periods in Egypt). Stone bowls and vases, thought to be of Egyptian origin, are found in Crete (Evans, 1921–1935: II, 16; Penniman, 1952; Warren, 1965, nos 5 and 13). In the succeeding Early Minoan I period (equivalent to the Second Dynasty), ivory is used for seals and amulets and ivory was imported into Crete from Egypt and the Levant (Renfrew, 1972). The amount of ivory increases in the remaining Early Minoan periods and scarabs, distinctively diagnostic of contact with Egypt,

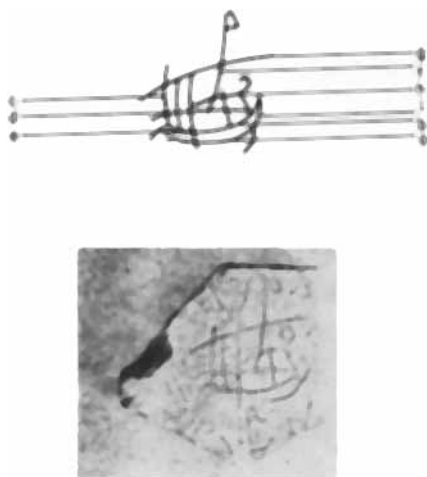


Figure 14. The Pelikati 'ship' (Heurtley, 1934–1935: fig. 80a).

are found in the later 3rd millennium BC in Crete. It is thus highly likely that the Egyptians influenced Cretan shipping. After all, Crete could only be reached from Egypt by an open sea crossing. Hutchinson (1962: 95) said that the outward journey from Egypt to Crete would have been via the Levantine coast; the return journey would have taken advantage of the southward circular winds in the Libyan and south Mediterranean seas. The question is, was the sailing ship introduced to the Aegean from Egypt via Crete or did Aegean sailors develop the sail independently. There are several pieces of evidence which could suggest that the change from the typical, elementary dugout to the curved hull, plank-built sailing ship may have taken place in the Aegean. Egyptian influence cannot be excluded altogether. The Thera fresco of the mid-2nd millennium BC demonstrates that quite a variety of craft, large and small, were then known. There is no reason to presume that a variety of craft were not also known in the preceding millennium BC.

The Pelikati representation. Fig. 14 shows the representation of a ship found on an Early Bronze Age potsherd from Pelikati, Ithaka (Heurtley, 1934–1935). The excavator discussed his find as follows; '... sherd with a roughly incised ship (?) and what seems letters or



Figure 15. Representation of sailing craft from Phylakopi I (National Museum of Athens).

numbers above; on other side roughly scratched marks', and

(the sherds) ... seem to be Early Helladic and though they were found in unstratified fill, there was nothing but EH with them. Nor were they found on the surface, ... (the sherd with the incised 'ship') ... being 0.5 metres ... below it. ... I do not believe they are modern forgeries, and there is nothing left but to suppose that the scratchings were made at the time to which the sherds belong ...

An attempt is made here to try and interpret the engravings and to distinguish the structure of the base, the stern/prow features and the mast/rigging.

The hull is curved, not angular, as in the Cycladic longboats. The craft was most likely plank-built as the hull seems curved. If line (a) represents the lower part of the hull, it is incomplete. Line (b) goes almost to the end, but not quite. These two lines do seem to represent the hull. There are a series of vertical lines (c, d, e) which may rather crudely represent rigging in a somewhat similar manner to that seen on some Middle Minoan Cretan gems. Hutchinson has already considered this rigging to be similar to Egyptian. Line (e) passes straight down and across the hull and then beyond. It is difficult to assess what it represents. It could possibly be a later scratch. Line (f) intersects line (g) and gives an impression of a 'T'-shaped mast. The three vertical lines (c), (d) and possibly (e) are attached to it, as rigging would be. Possibly line (f) is a

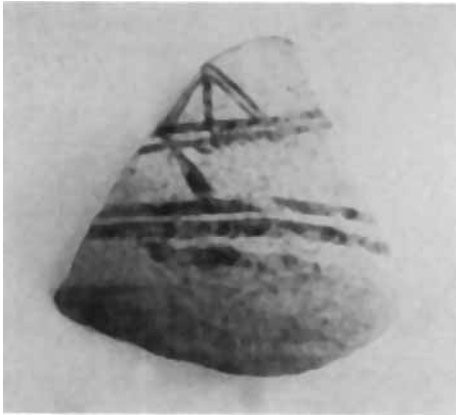


Figure 16. Representation of craft from Phylakopi (possibly Phylakopi I) (National Museum of Athens).

mast and line (g) is a yardarm. Alternatively, line (f) may be a single forestay and lines (c), (d) and (e) the numerous backstays. A similar system is used on Egyptian craft.

Line (h) could represent a shelter structure first seen in the Aegean on the Phylakopi representation (Fig. 15), more commonly on the Middle Minoan gems and also on the main craft in the Thera fresco. It was common in Egypt and Mesopotamia from pre-Dynastic times.

Line (i) at the front of the craft may represent a bowsprit.

If this representation is not a ship, it seems very difficult to surmise what it is meant to be. The lines do not appear to be random. If it is accepted as a ship, it is of the sailing variety, plank-built and being EH in date it could be contemporary with the earliest Cretan representations. Sailing to and from Ithaka would almost require a sailing boat, and we know from the evidence at Levkas that this route was frequented throughout the EH II–EH III period.

The Phylakopi representations. Two sherds from Phylakopi, Melos, carry representations of boats. One, dating to Phylakopi I (late Early Cycladic III) is shown in Fig. 15 (Renfrew, 1972:



Figure 17. The Phaistos disc (Herakleion Museum, Crete).

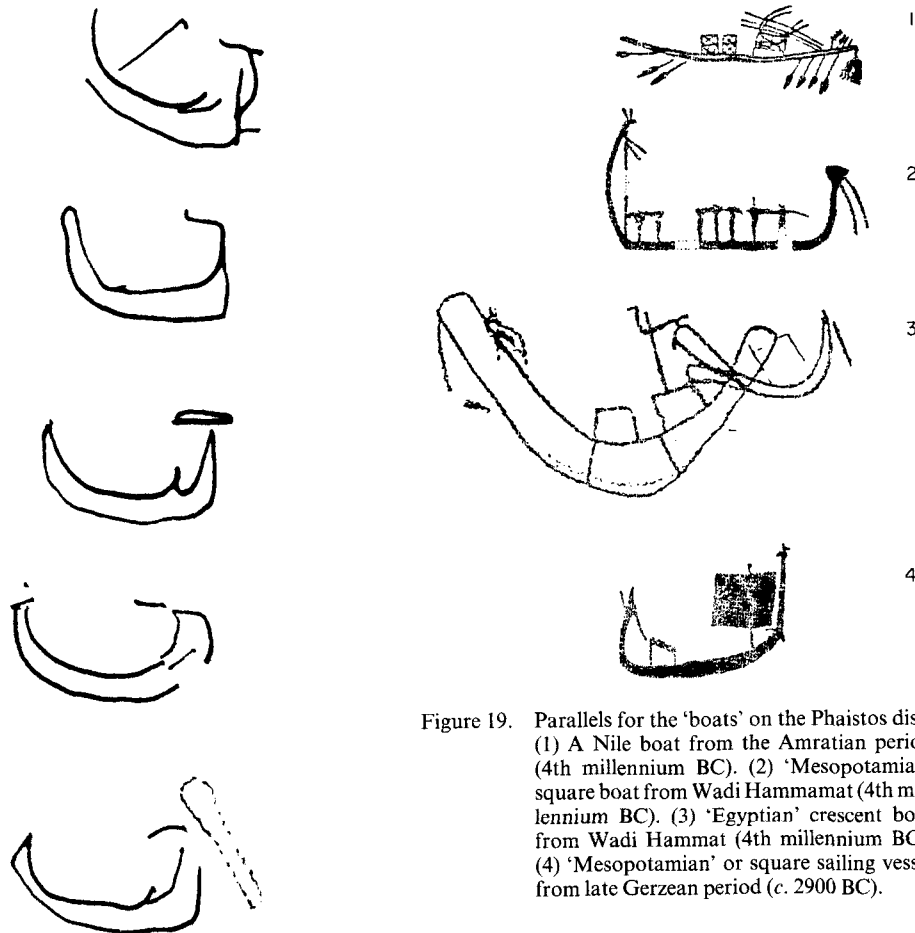


Figure 18. The 'boats' from the Phaistos disc.

pl. 28). Only one end of the craft is shown on the sherd. It shows a steering oar, and although the other end of the vessel is missing it supports the low prow theory. Most of all, it supports the view that in the Aegean both low prow and high prow craft were known in the 3rd millennium BC. The former are most like Egyptian craft, the latter may well be local Aegean types. Just as important is the curved line of the prow which suggests that the craft was plank-built. It has an oar clearly marked and other markings of what seem to be either a cabin or a poop (the latter is not seen in the Aegean until the Middle Bronze Age). Alternatively, this structure could represent a support for a mast.

Figure 19. Parallels for the 'boats' on the Phaistos disc. (1) A Nile boat from the Amratian period (4th millennium BC). (2) 'Mesopotamian' square boat from Wadi Hammamat (4th millennium BC). (3) 'Egyptian' crescent boat from Wadi Hammamat (4th millennium BC). (4) 'Mesopotamian' or square sailing vessel from late Gerzean period (c. 2900 BC).

The second sherd from Phylakopi (Fig. 16) most likely dates to the Phylakopi I culture (Renfrew, 1972). It is a sailing ship with a clearly defined mast. The mast can be paralleled with those on the Middle Minoan seals and gems. The steering oar at the rear is obvious and is again Egyptian in type. Oars are marked also. Most interesting is the angularity of the hull. It differs from the previous Phylakopi representation in that it does not seem to represent a curved hull, and therefore a plank-built boat. This may be because it is represented as sitting on the water, so that the exact shape of the hull would be hidden. Alternatively, it could represent early efforts to use a sail on the longboat. Because of the structure of the longboat, it would be best to put the sail at the stern and weigh down the prow artificially. This would seem to support the idea that the sail also developed in the Aegean.

Conclusion

As shipping seems to have been so important in this period, it is striking that there is so little evidence for it. It is quite possible that much evidence has been overlooked. For example, Koumouzelis (1979: 177–80) noted that several ‘weaving’ shuttles were boat-shaped. Another shuttle is known from Asea, although it was classed as a lamp. Also, the enigmatic Phaistos disc (Fig. 17), a unique inscribed object of terracotta dating to about 1600 BC but as yet undeciphered, bears representations of what appear to be ships (Fig. 18). They have not yet been interpreted as such, but they do have a basic form similar to the longboat, but the bar at the top of the high stern may be taken to represent a yard-arm—in which case these representations are of plank-built ships. These can be compared with Egyptian and Near Eastern parallels (Fig. 18). Their positioning on the Phaistos disc follows no particular pattern to help their interpretation, except that they often occur on initial and terminal sequences. This may represent a journey’s beginning and end.

The evidence from the above sources suggests

clearly that there was a variety of craft in the 3rd millennium BC of the Aegean. These ranged from simple dugouts, to dugouts with a superstructure (longboats) to sailing ships. Both high and low prow craft are known. No doubt, different types and sizes of craft were used for different purposes and types of journeys. Egyptian influence in the development of the sail seems clear—for Crete at least, although local development cannot be ruled out. These craft encouraged trade and contact in the Aegean and carried with their cargoes influences and knowledge which encouraged cultural change.

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Note

- [1] The width of the craft should be measured from above at one-quarter, half and three-quarters of its length. The total of the three measurements should be taken. The degree of variation from the mean for each of the three measurements should then also be totalled. The result will be an indicator of curvature of the hull. For a typical lead boat model (illustrated in Renfrew, 1972: 358, fig. 17.7), the figure was 0.75. Variation over 1.0 suggests that the boat was plank-built.

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