ON THE FORM OF MYCENAEAN SHIPS

Knowing that according to the Homeric Epic ships from our home town in Korinthia have sailed to Troy under Agamemnon (B574-577), we were motivated to form an interdisciplinary team in order to study Mycenaean ships. We soon found out that more information could be derived from the available data than it was widely believed, but still many questions remained open. So despite the lack of an excavated wreck, we came to the idea of the reconstruction of a Mycenaean ship (eikosoros). We realized that the study, with the prospect of constructing a vessel that will be able to sail to Troy and the shipbuilding process itself, can illuminate more aspects of our subject, can lead to safer conclusions and can integrate our up to date knowledge about Mycenaean ships.

The aim of this paper is to present the methodology and the results of the research on the form and the types of the Mycenaean ships of the LHIIIC period. The sources of information are representations of ships, mainly the LHIIIC and B vase paintings, models and engravings, but also the Geometric and the earlier Bronze Age and written data: that is the Linear B tablets, the Homeric poems and later texts.

The research has addressed the serious problems of the sufficiency and reliability of the available data. Thus for the study of the ship representations the following methodology was employed:

1. The thorough study of the general pattern of the Mycenaean ship representations and of every single part of them in order to determine their characteristic form.
2. Technical studies and experiments in order to clarify the form as well as the function of certain elements of the ships.
3. The comparison between the LHIIIC representations and the earlier (Early Cycladic, Theran, Minoan) and the later, Geometric, ones for the same reason.

For the study of the written data the process was the following:

The Homeric epic is the main written source of information on the ships that participated in the Trojan War, though the question arises whether

the epic refers to Mycenaean or to Geometric ships. The content analysis of the epic lead to the taxonomy of the information, of which the consistency was first examined through internal checks. This was followed by the etymological analysis of the terms and the comparative study of the relevant references in the Linear B and the later texts. This whole process resulted in the synthesis of the form and the function of the parts of the Homeric ships. These results were then compared with the information that derives from the Mycenaean and the Geometric representations in order to test to which ships they refer.
The most essential results on the form of the significant elements of the Mycenaean ships will be presented briefly within the comparative schema: Mycenaean representations, Homeric epic, Geometric representations.[1]

THE KEEL

The Mycenaean representations show that the ships had a keel. On the models (Kynos A,B, Fig. 20,21) the keel is indicated with a painted line or a clay zone along the internal bottom of the hull or with a protrusion on the external surface of the bottom of the model (Mycenae, Fig. 23).[2] In the Homeric poems the existence of the keel is mentioned many times (ε130, η252, μ421, μ422, τ278) and in the Geometric representations there is also a keel.

On some Mycenaean representations there is a protrusion at the stem as an extension of the keel. We believe that this is not a fighting ram for the following reasons:[3]

a. It doesn't occur in the ships that are recognized as warships, like the ships represented on the Kynos sherds (Fig. 2,3) and the Enkomi crater (Fig. 22).
b. The upper end of the stem that extends forward above the sea excludes its use as a fighting ram.
c. The length of this protrusion is too short for ramming.

A ram is not mentioned in the Homeric epic.
On the contrary in the Geometric representations there is a longer and more massive protrusion being thus more proper for a ram or for its predecessor. It has to be investigated whether the presence of this protrusion on the Mycenaean ship representations unified with the bow (Late Cypriot askoi, Akropolis, Kynos models and vase paintings, Fig. 13,12,20,21,2,3) or not (depictions from Tragana, Asine and Gazi, Fig. 1,5,19) is due to constructional reasons, as one of the major problems of ancient shipbuilding was the stable connection of the bow to the keel and/or is due to the improvement of the seaworthiness of the vessel.

THE BOW

In the Mycenaean representations the stem post is rendered almost vertical to the keel, wide and big. The Homeric word «στείρη» (β427-428, στερεός: solid, stable) can refer to this characteristic stem post. Due to the massive ram the stem of the Geometric ships doesn't have the same shape but the stem post is still vertical to the keel.

In the Mycenaean representations the upper end of the stempost protrudes above and in front of the cutwater bow. Its shape is complex, convex and concave with or without an internal bow and has been characterized as bird head. In all the vase paintings it has a row of small protrusions on its upper surface and in the models zones of lines. The scholars have made many assumptions for its interpretation.[4] G. Korres has shown that the akrostolion is clearly distinguished from the bird insignia, which are present on the bows of the Enkomi, the Tragana ships (Fig. 22,1) and on some Geometric and later ship representations.[5]

In the Homeric poems there are no references to animal-shaped ends. The epithets that refer to the ends of the bow and of the stern are «ορθοκραιράων» (with standing horns, Σ3, Τ344), «κορωνισι» (with curved upper ends, 17 references) and probably «αμφιελισσών» (with curved ends, 19 references), On the Geometric representations there is a similar but lighter construction, turned to the inside of the ship, that also corresponds to the Homeric epithets.

The interpretation of this part of the ship is rather puzzling. What is derived from the representations are its huge dimensions (very wide 5% of the length of the ships and high as the examples of Kynos, Tragana, Asine, Skyros vase paintings show, Fig. 2,3,7,1,54) and its V-formed shape with the edge at the bow (akrostolion from Kynos, Kynos A, Oropos, Mycenae, Asine models, Fig. 7,8,9,11). The height, the position and the form (even the position of the dotted row) are remarkably similar on the Tragana, the Kynos and the Skyros representations (Fig. 1,6,4). Regarding the major problem of the stability of such a high stem, whose end protrudes in front of the vessel, when confronted with the strong Aegean winds, we assumed that apart from its aesthetic formation, it should in no way hinder the sailing but rather facilitate it.[6]

This raised bow construction can be traced back to the Early Cycladic representations. It has been a question for decades whether this is a bow or a stern and it seems that the data alone cannot give the answer.[7] S. Bisiotis and C. Govotsos of our team using the aid of the technical studies and the modeling experiments concluded that:

1. According to the laws of physics, when the wind blows, a raised construction on the one side of an object tends to turn it, so that the high

end always stands at the front side of it and the wind blows behind it. The raised construction of both the Early Cycladic and the Mycenaean ships, no matter which side of the ship is placed (bow or stern), turns the ship so that it always stands at the bow, while the wind blows behind it.

2. The resting moment arm is increased in the Mycenaean ships by the V-shaped raised bow construction and the protruding vertical surface at its top (the akrostolion). The same effect is achieved in the Early Cycladic by the raised bow construction and the stern protrusion.
3. The raised bow construction alone propels the ship taking the position of a jib, given the fact that the sail could not be used with a relatively strong wind (over 4-5 Beaufort).
4. If there was not this high bow, the wind would turn the boat so that the hull lies parallel to the waves. Then the waves would overflow it and it would be in the danger of sinking.[8]

These rules of aerodynamics have a wide application in sailing even today, by the use of the jib, the butterfly setting jibs and the rotating mast that pull the boats.

This bow construction could be in the position of the Homeric «ξεστόν εφόλκαιον». In the relevant topic (Ξ350) a prisoner escapes from the «εφόλκαιον» of the beached ships, while the crew was dining at the beach. As the ships were beached stern first, the best way to escape was the bow. The word «εφόλκαιον» etymologically means pull behind, which is exactly its function in the Mycenaean ships.[9]

Consequently, apart from its aesthetic form (may be animal head) the raised bow construction had a very significant use, absolutely essential for navigation in the Aegean waters.

THE STERN

In the Mycenaean representations the curved sternpost raises to a lower height than that of the stem. In the epic it is mentioned that during a fight at the Greek ships ashore Hector held the «άφλαστον» twice with his hands and he tried to cut the «άκρα κόρυμβα» (upper decoration) (O704, O716-717). Consequently the height from the keel to the upper sternpost can be determined at about 2 meters.[10]

Similar forms of the sternpost occur in the Geometric representations.

THE IKRIA

In the Mycenaean representations the ships have a fore and aft platform with balustrades above the level of the gunwale. The aft deck is the position of the helmsman and of the handlers of the brails (as it is shown on the Tragana and the Kynos A depictions, Fig.1,2) and the fore deck for the

warriors (Kynos ship representations, Fig. 2,3,6) and the anchors (Tragana depiction, Fig.1).

The warriors on the Kynos paintings stand at a different level than that of the oarsmen. Do they stand on a full deck? This assumption cannot be supported. In the Homeric poems the bow and stern ikria are mentioned many times (μ229, ν73-75, β415, ο285, μ414) but never full decked ships. This is compatible with the information from Thucydides (A10) about the absence of full decked ships at the time of the Trojan War.

As the possible central or lateral corridors are not depicted on the side view of the ship representations, their probable existence has to be concluded from other indications. It has been suggested that the semicircles represent the torso of the oarsmen. If their heads are hidden behind the screen, then the warriors can only stand on a central and not on lateral corridors. We believe that they do not render human beings[11]. Lacking any indications of the human character, these semicirculars repeat the shape of the side view of the shields. We have come to the conclusion that there were side corridors because of two different references in the epic: the woman that was struck by Artemis (ο478-479) and the sails during a storm (μ410-411) fell directly into the bilge. This wouldn't be possible if there was a central corridor. The side corridors are necessary for the handling of the brails, particularly when the loose-footed brailsail is used. They also facilitate the movement of the crew from bow to stern.

In the epic the stern ikria, that should be wide enough for Odysseus to sleep on (ν73-75), is the position of the captain (μ414).

In the Geometric representations there are also ikria at the bow and the stern. There are also similarities in the position of the warriors.

THE HULL

The hull of the Mycenaean oared ships is elongated[12] and characterized by a zone of vertical and horizontal lines between the bow and the stern. This has been interpreted as:

1. Oars. However in the representations the oars are clearly distinguished from these vertical lines with oblique parallel lines that transect the hull (as the examples of Kynos A and C, Phylakopi vase paintings show, Fig. 2,3,15).
2. Crossbeams and rowing thwarts. This converges with the Mycenaean pictorial style where the side and the overview are not shown together.[13]
3. Stanchions. They are necessary for the support of the gunwale and the side corridors and they also have the role of interscalmia. On the Kynos vase paintings, where the rendering of the ships is more realistic, the hull, the zone of the stanchions where the oars are attached (also

tholepins?) and the screens are clearly distinguished.[14]
In the epic the ships are often characterized as «πολυκληισι» (with many tholepins, υ382, B74,175, H88, Θ239, N742, O63, Ψ248) which corresponds to their characteristic picture.
In the Geometric representations the zone of the vertical lines exists.

THE ROWING EQUIPMENT

The number of oars in the Mycenaean representations (9-26) can correspond to 20/oared (α280, δ778, β212, δ669, A309) and 50/oared galleys (B719, θ37) of the Homeric poems. The double decked or two-banked ships first occur in the Geometric depictions.

The rowing thwarts are not shown in the Mycenaean vase paintings and cannot be recognized with certainty in the models. In the Homeric poems the word «ζυγά», which is used for the rowing thwarts (ι99, ν21-22) means the connection between two parts, thus showing that the thwarts connected both sides of the hull as crossbeams. According to the epic they should leave enough space for a fastened prisoner underneath (ι99).
In some Geometric representations the oarsmen, the benches and the supporting stanchions are depicted.

THE STEERING OAR

In the Mycenaean representations a large oar with a triangular end is positioned at the stern and angled to the back.

Were there one or two steering oars? In the vase paintings only one is shown. But this could be due to the Mycenaean pictorial style, where only one of a pair of similar is represented or a small part of the hidden second (probably on the Asine ship, Fig. 5).[15] The two zig-zag lines behind the ships (Tragana, Gazi depictions, Fig. 1,191) could mean the traces of the steering oars in the water[16]. The existing mechanism for their manipulation has to be further investigated.
In the Homeric poems the existence of a steering oar is assured with the words «πηδάλιον», «κώπη», «πηδόν» (ε255, ε270, γ281), «οιήιον» (ι483, ι540), «οιήια» (μ217, T43). Although in most cases the singular is used, the crucial verse where the use of plural indicates the existence of two steering oars is the μ217.[17]
In the Geometric representations both one and two steering oars occur.

THE MAST

In the Mycenaean representations (Tragana, Kynos, Asine, Skyros vase paintings, Enkomi engraving, Fig. 1,2,5,4,14) a single mast almost amidships that raises a little higher than the stem is depicted. It has a circular

brail at its top, is embedded in a maststep and is supported by fore and back stays. In the Homeric epic there is also a single mast, standing in an «ιστοπέδη» (maststep, μ50-51, μ162, μ179) and «μεσόδμη» (β424, ο289), supported by «επίτονο» (backstay, μ423) και «προτόνους» (fore stays β425, ο290, Α434) and recumbened in an «ιστοδόκη» (Α434). The reference that when it fell it struck the captain's head (μ409-412), gives a height of, at least, half the length of the ship.
The Geometric representations give the same evidence.

THE SAIL

On the ship representations (Asine, Kynos, Phylakopi vase paintings, Encomi engraving, Fig. 5,18,17,14) the sail is rectangular, made from many pieces and hanging from a crossjack yard. It is the type of the loose footed brailsail, different than the boom-footed of the Minoan and the Theran ships[18]. In the epic the words «επίκριον» (crossjack yard, ε254, ε318), «υπέραι» (halyards, ε260 that are also indicated on the Tragana and the Kynos A depictions), «κάλως» (sailropes ε260), «πόδες» (sheets, κ32, ε260, b426, ο291) assure the existence of the loose footed brailsail, that also continues in the Geometric period.

CONCLUSIONS

The thorough and comparative research of the sources supported by technical studies and experiments leads to the following conclusions:

A. According to the ship representations:

Obviously they are not accurate representations, but they are a description of the characteristic parts of the ships and a narration of their action (ships sailing, fighting, parading). Thus the artist had to render the essential characteristics of the ship in order to be recognized by the viewers. Consequently the study has shown that, although they come from different sites and different artistic styles or represent different types of ships, there are clear similarities in the general pattern and in the rendering of the essential parts of the ships (in most cases and in their analogies-dimensions), that also distinguish them from the earlier and the later ships. Most of the representations concern oared vessels, warships that are easily recognized[19]. Although there are obviously many types of ships, due to the lack of data it is not easy at the moment to support a further systematic taxonomy of the Mycenaean ships in more types.

B. According to the written data:

The study came to the conclusion that the information on the ships from the Homeric epic, as far as it can be tested by the archaeological data (LHIIIC and Geometric) is compatible with the LHIIIC ship representations.

Is it also compatible with the picture of the Geometric ships, given the similarities?
The criterion is the reference to the innovative elements of the Geometric shipbuilding in the Homeric epic: that is, the ram, the steps at the bow and the stern, the so-called "eyes" at the bow, the double decked or double banked ships. These are not mentioned in the epic. Either due to a systematic effort to avoid the reference of the Geometric innovations or due to the reliability of the oral tradition for the communication of the history at a time when writing was not widely practiced, the above conclusion remains.

C. According to the technical studies and experiments:

They clarified the form and the function of particularly significant parts of the ships and their continuity from the Early Cycladic period. They also proved the necessity of an interdisciplinary approach to this subject and of the continuation of the research through further experimenting and constructing. The study of the archaeological and the philological data by also determining the dimensions lead to the designing of a 20/oared Mycenaean warship and to the construction of an 1/10 scale model for navigational experiments.

We intend to proceed in the construction of a Mycenaean ship in full scale, capable to sail to Troy. This will not be a replica or a copy. It will be the product of a SYNTHESIS of the available data supported by relevant technical studies and experiments, the reliability of which will be constantly controlled by:

1. The consistency to the archaeological and to the philological data.
2. The use of LHIIIC tools and shipbuilding techniques or at least principles.
3. The endurance and the seaworthiness of the ship under construction.

We believe that this process will give answers or possible alternatives to some of the remaining open questions.

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The abbreviations follow the system of the American Journal of Archaeology. Since new evidence has answered old problems and has changed views, the references focus on the contradictory views of the recent writings and not on the earlier ones.

NOTES

1 The Mycenaean ship representations that are mentioned in this paper are to be found in the list below of the LHIIIB and C ship representations. The Geometric representations are to be found in the known relevant publications (Kirk 1949, Basch 1987, Morrison /Williams 1968 etc.)

2 The chronological parallels of the Egyptian ship representations show the introduction of the keel at a time synchronous to the Mycenaean (Landstroem 1970:70) and the Ulu-Burun wreck has revealed the remains of a keel/protokeel (Pulak 1999: 216-217, 223-224).

3 Although earlier studies (Morrison/Williams 1968: 7) supported the existence of a ram on Mycenaean ships, the revealing of new evidence threw more light on this question and the more recent literature excludes the use of the protrusion as a fighting ram (S. Wachsmann 1998: 157-158, L. Casson 1994: 51, F. Dakoronia 1987: 120, Korres 1985: 179, Palaeologou 1985: 222).

4 Some scholars (Wachsmann 1996: 539-573) recognize an animal head (bird head) figure at the upper protruding end of the stempost, for which there are archaeological parallels in the Greek art (Sakellarakis 1971). F. Dakoronia (1987:118-120) believes that the dotted row indicates a leather cover of the stem and G. Korres (1985: 187) investigates whether this is a rotating part, whose evolution can be traced in the LHIIIB and C ship representations and whether it is a boat, ladder or it is related to the Homeric "efolkaion".

5 Korres,1985: 180-181

6 As Steffy (1998:23) states "Ships and boats were always the means to an end, and usually that end was profit, convenience, security or victory. It is important that we understand this practical explanation for the existence of watercraft. Far too often they are placed on historical pedestals that tend to segregate them from fact, which clouds accurate interpretations of their true value to society. Ships and boats were merely objects used to accomplish specific ventures-nothing more, nothing less."

7 Since Tsountas (1899:91) first published the "frying pan" vases and claimed that the high extremity is the stempost, the discussion went on through the two different views. This is clearly shown in Johnstone's article (1973) and in Basch (1987: 87-89).

8 The role of the steering oar/s in the Mycenaean and of the oars in the Early Cycladic ships under these conditions has to be further investigated, since the optimum would be to avoid sinking, to continue sailing and above all to the desired direction.

9 We are tracing this origin in the word «φάλκης», an element that according to Polydeukis (Onomastikon A85-93) is adapted to the bow, of uncertain etymology for the scholars till now. We thank Prof. Mary Lefkowitz for her comments.

10 Morrison and Williams(1968:47), based on the same evidence, also estimate it to 7 feet.

11 The principles of abstraction in Mycenaean art and the personal stylistic preferences of the Kynos crater artist have to be taken into account when interpreting the scene. The aim of the abstraction of the forms in ancient Greek art is to simplify the details of the narration and to limit them to the most essential and indicative so that the viewer recognizes the object and reads the story. Although this is the probable position of the oarsmen, as the oars are attached to the stanchions, the semicircles lack any indication of their suggested

human character (Wachsmann 1998: 132, Dakoronia 1987: 119). This exaggerated curvature of the human body is not explainable. If they are oarsmen at the end of their stroke, why do not they incline backwards as it is realistic and occurs in the parallels of the geometric abstracted representations of oarsmen (see Basch 1987: fig. 338, 354, 356, 353, 357, 358, 384, 385, 386)?

But the most valid comparison is to be done with the work of the same artist. The Kynos crater artist includes in his paintings whatever is essential in order to recognize a helmsman, a warrior and their act. The most close parallel to the role and the act of the oarsmen is the helmsman (Wachsmann 1998:132, Dakoronia 1987:119). But he differs in three crucial points from the suggested oarsmen: Very short but crucial lines show the most indicative characteristic, his arms handling the steering oar. The shape of his torso inclining forward is realistic. While most semicircles of the "oarsmen" narrow and often end before the base of the stanchions, his torso narrows only a little and continues to his fleshy legs.

But the main argument against this interpretation is given by the second sherd of the same crater, showing a ship eraldic (bow) to the first (Fig. 16). The semicircles on both ships have the same direction. It is obvious that the shape of the body leaning forward and inclining backwards cannot correspond to semicircles of the same direction.

On the other hand the semicircles seem to repeat the form of the side view of the shield. There are examples of protective covers (askoi, bags, leather screens, shields) on that part of the hull. There are parallels that show shields at the sides of the ships (bireme from the palace of Senacherib, British Museum, Basch 1987: fig:379) and particularly at the position of the oarsmen (attic hydria, 6th c., Louvre E735, ivory plaque from the Temple of Orthia Artemis of Sparta, National Museum of Athens, metope from the Treasure of Sikyone, Delphi, see in Basch 1987: fig. 460, 506, 504) and under the gunwale (vase painting from the Akropolis, National Museum of Athens 251, bronze fibula from Boeotia, Berlin 31013, see Basch 1987: fig. 377, 404). But it must be noted that in all known examples the shields are rendered in front view.

12 The representations are compatible with the reference in Thucydides about the long ships of the Trojan war (A14).

13 The Mycenaean vase paintings known till now (Vermeule/Karageorgis1982) show that there is not any example of such a representation.

14 S. Wachsmann (1998: 131-132, 155) after studying the available data came to the conclusion that this zone of stanchions (that resembles a ladder lying horizontally in its side) is characteristic for the Mycenaean ships.

15 Vermeule/Karageorgis 1982, Gray 1974.

16 Korres 1985:199.

17 Since the evidence does not lead us with safety to a conclusion, we experimented with full scale traditional Greek sailboats on the use of one and of two steering oars for the steering of the vessel. Our first experiments have shown that the steering of such a vessel with one oar is possible. If this is also the case for the Mycenaean ships, the probable function of the two oars not only for the steering but for the facilitating of windward sailing has to be further investigated.

18 Wachsmann 1998: 142 fig.7.29.

19 Some scholars (Basch 1987) recognize in the Skyros and in one of the Hyria engravings merchantmen due to the shape of their hull.

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22. Ship scene on a Mycenaean amphoroid crater from Encomi, LHIIIB (after Wachsmann 1998: fig.7.28)
23. Fragment of a terra-cotta boat model from Mycenae, LHIIIC (after Wachsmann 1998: fig.7.43).

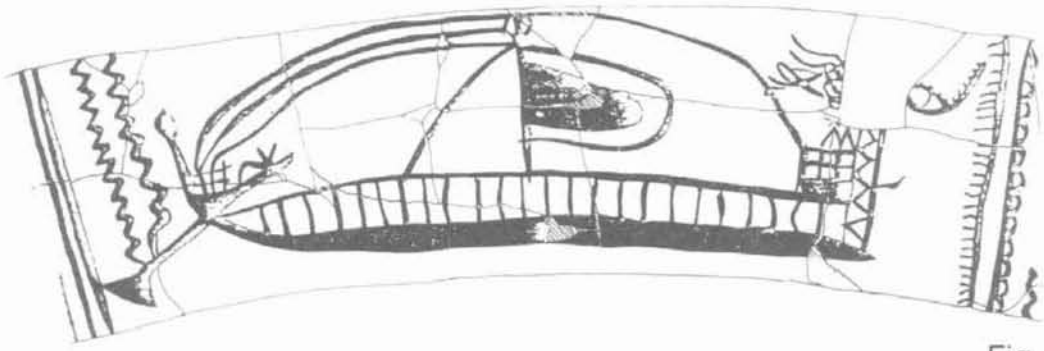

Fig. 1

Fig. 2

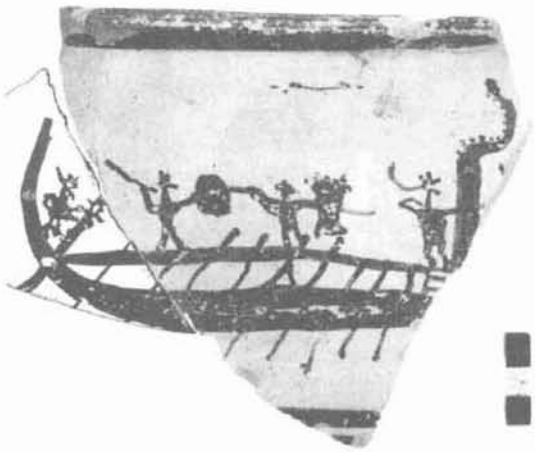

Fig. 3

Fig. 4

Fig. 5

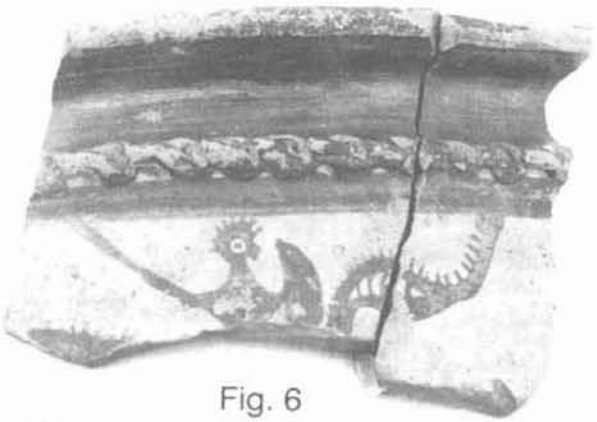

Fig. 6

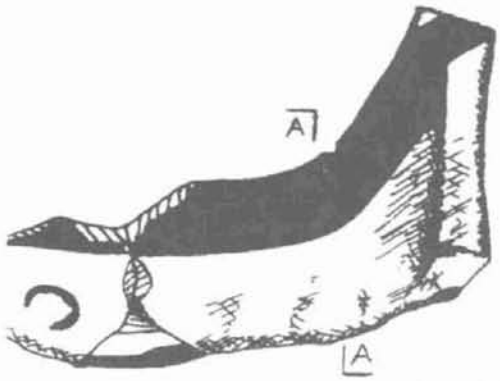

Fig. 7

Fig. 8

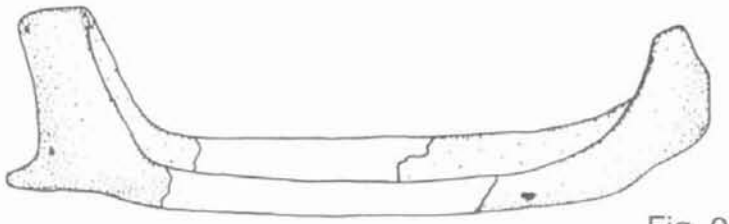

Fig. 9

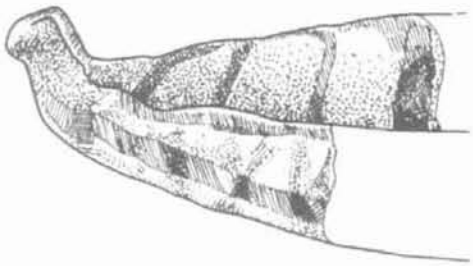

Fig. 11

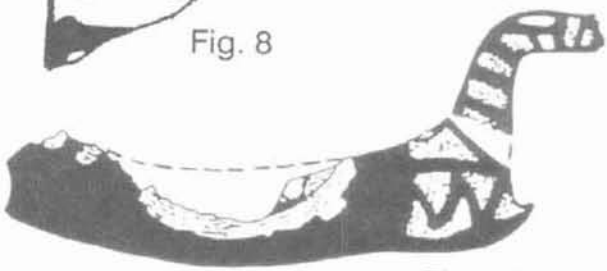

Fig. 10

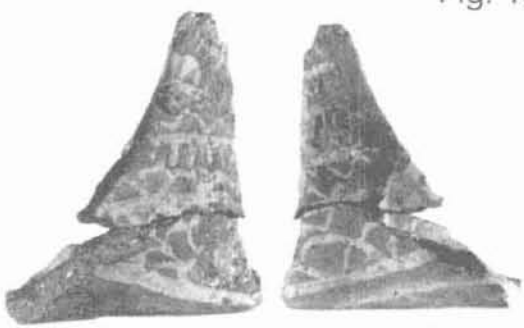

Fig. 12

Fig. 13

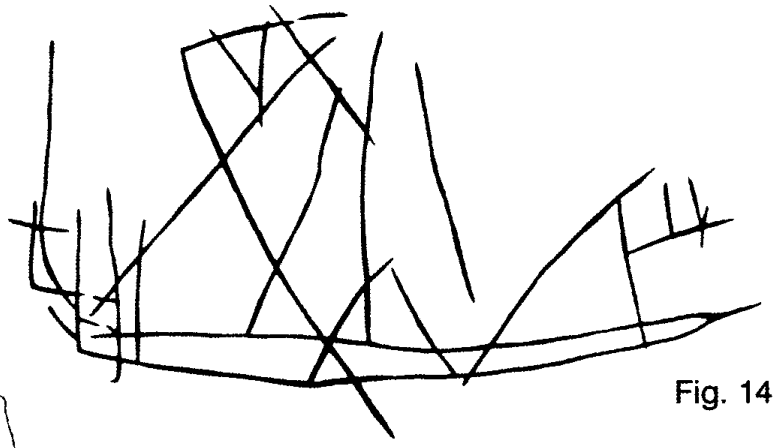

Fig. 14

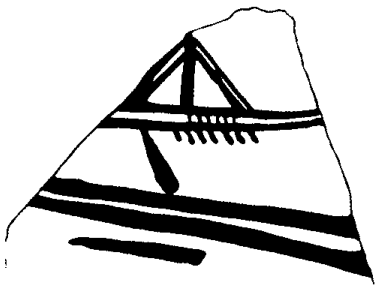

Fig. 15

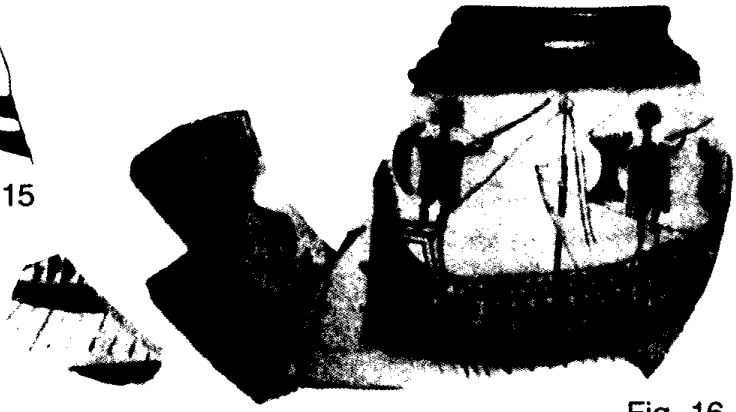

Fig. 16

Fig. 17

Fig. 18

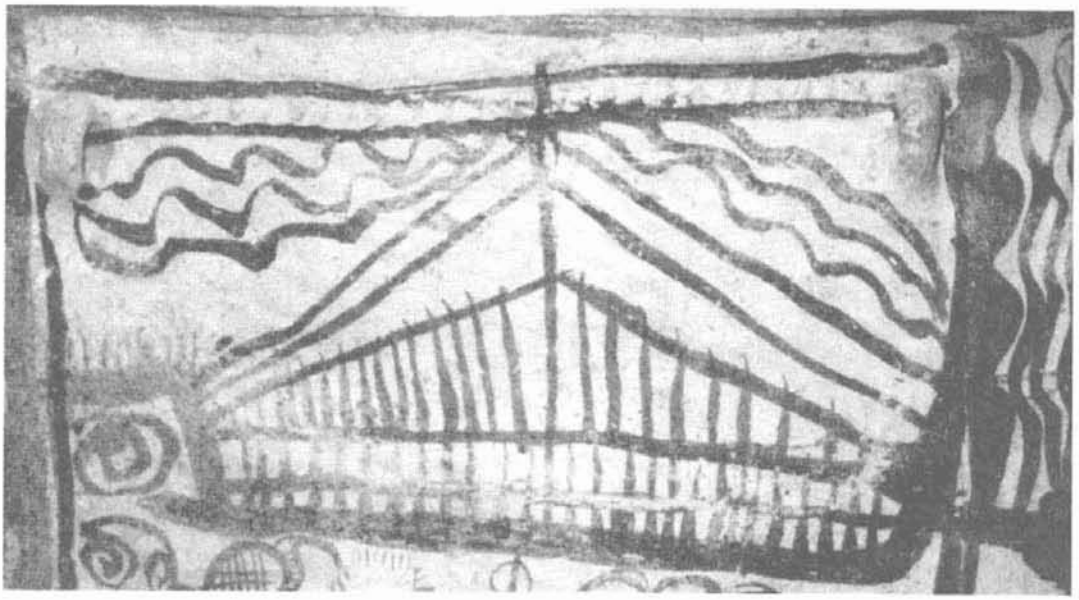

Fig. 19

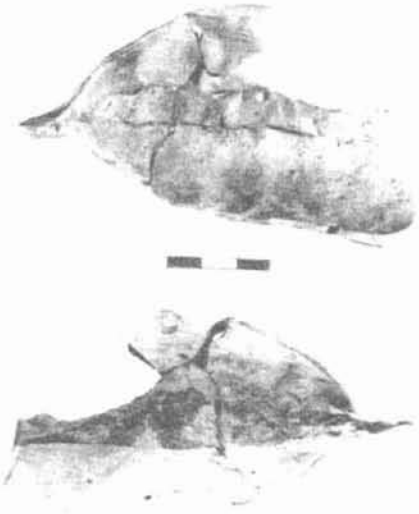

Fig. 20

Fig. 21

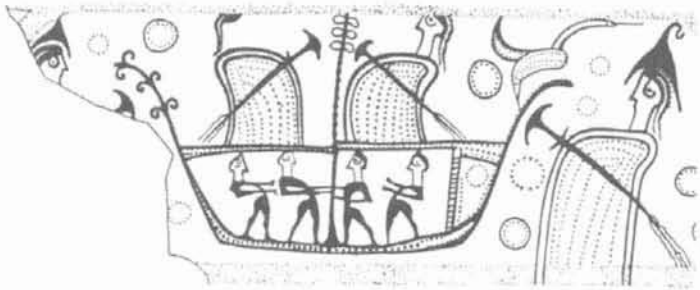

Fig. 22

Fig. 23