# THE RELIABILITY OF SHIPS' ICONOGRAPHY: THE THERAN MINIATURE MARINE FRESCO AS AN EXAMPLE

## 1. INTRODUCTION

The purpose of this paper is to examine whether the depiction of ships during the Bronze Age are accurate representations of vessels of this time, in other words, if they can be used for quantitative or diagnostic purposes. The Theran Miniature Marine Fresco was chosen because of three main reasons:

1. It is a very well known painting, having been frequently reproduced and extensively studied.
2. It appears not to be subject to the usual constraints of limiting substrates, such as pottery, seals, ring-stones, etc.
3. It has been praised for its exactitude, reliability etc., and presumably bound to be free of the related major sources of error.

The discussion is based on Prof. Gillmer's descriptions and calculations of the most intact vessel in the fragmented fresco which appeared in a recent publication (1989, p. 129ff.). As Gillmer writes: "We are convinced of the artist's reliability by the objects we recognize, each painted correctly" (p. 130). Which prompts him to remark a little earlier that, "It is time to put more confidence in the finest form of expressive Minoan art, their fresco painting" (p. 129). Although one appreciates the generosity of sentiment expressed, it seems clearly desirable to test a little this reliability, before too much confidence is placed on it.

## 2.1 THE THERAN MARINE FRESCO FRIEZE

This truly magnificent mural was found during the 1972 excavation season at Akrotiri by S. Marinatos and his co-workers, in what was first called the West House and later the House of the Fisherman (Marinatos 1974; Doumas 1978 and 1980). The miniature style fresco depicts among other things seven major and seven minor ships, judging from the number of persons on board, in what has been called and could very well be, a ceremonial flotilla, a nautical festival, a victorious procession, a joyful regatta, etc (Fig. 1α-β).

Most major ships in the fresco were found badly fragmented with many parts missing or beyond recovery. One of the major ships, however, the third from the

left, usually referred to as ship A, was found remarkably intact with only minor pieces missing, and as it may be expected the other ships were reconstructed on this model (Fig. 2). As already mentioned the following discussion is based on Gillmer's description and calculations pertaining to the intact vessel, with additions and dissensions as found necessary.

2.1.1. Structure and dimensions

The ship is shown on the starboard side moving from left to right as one faces the fresco. "The hull profile shows a distribution of body volume which is concentrated towards the stern" (Gillmer 1989, 130). That is to say, a ship whose center of volume and presumably of gravity is aft rather than forward of the midship line. The impression is of a ship that sits well on the sea, that travels light. This concentration of volume aft causes the stern to rise more steeply than the bow, that is to say, the radius of the keel line of the stern is shorter than that of the forward (stem) line.

What is noteworthy is that this feature is present in all vessels, both large and small, something which is apparent on even a casual inspection of the frieze. This appears to be a significant part of the identity of such ships of this and later times, while the profile configuration is most important in establishing its cross-sectional body distribution.

There seems to be little doubt that these LBA I Theran ships portrayed in the fresco bear some kinship in hull configuration to Egyptian vessels. A comparison with the almost 1000 year earlier Khufu ship certainly encourages this thought. Gillmer believes, however, that this was simply the result of "state-of-the-art" in shipbuilding for this time in the East Mediterranean basin, and presumably not the result of copying from either side, since there are discernible differences that indicate a local Aegean development (see below).

This configuration recognized by the sternward concentration of volume, a sailor, shipwright or designer would describe as "fine forward with a good broad run aft", and Gillmer calls it a classical one. "It is a concept that shipwrights understand and control for proper and practical reasons". (1989, 130-1). One of these reasons is that with a hull swinging sharply upwards at the stern, the helmsman occupying the traditional and necessary platform for steering control would have good lateral visibility. Another reason is that this type of hull would ride more comfortably and steer more easily. A third is that the broad aft deck gives ample room for quick sail-handling by the crew, particularly important in areas of fast changing winds and treacherous coasts.

Having established the nature of the hull and the reasons which made it necessary, it is important for calculation purposes to find and draw the waterline in the fresco profile of the ship, which is not shown in the mural. "This line was simply determined by locating the water surface level where the paddlers' blades seemed to be properly immersed. The true waterline must be close to this". A logical suggestion, within the limitations of what is "properly immersed" - Gillmer acknowledging this uncertainty by saying that the waterline must be "close to this". His very next statement, however, that "the leading paddlers forward seem to have their blades immersed slightly deeper than the others in graduated order", so that "this conforms to the style of multiple in-line paddling as opposed to rowing where the crew remove and dip their blades sequentially", is open to question.

Assisted by the discovery that in the Ulu Burun, Kas, shipwreck the mortise and tenon fastened side planks begin in a centerline timber which might have functioned as an embryonic keel (Bass 1984), Gillmer develops the midbody sections of the ship so that as the planks rise towards both ends, they meet in a "V" form ridge instead of the old Egyptian spoon shape, which appears to justify his previous claim of an exclusively "Aegean form". However, the existence of even an embryonic keel in the Ulu Burun shipwreck, may well signify that this type of ship was not an exclusive Aegean form, but one favoured all over the East Mediterranean basin at the time, even if one has to exclude Egypt (but see Hornell 1943, 28 & 30 for a different view of Egyptian ships).

After establishing the profile of the ship and with the number of the oarcrew clearly visible from the 21 paddles, the space required for each member of this crew to work in comfort taken as the usual 90 cm, and the relationship of overall-length to length-at-the-waterline for this type of ship is a ratio of about 1.4-1.5, Gillmer calculates the following dimensions from three conventional projections that provide a basis for dimensional criteria and limited analytical hypotheses:

| | |
|---|---|
| Overall length, | 24 m |
| Length of waterline, | 16,2 m |
| Draft of water, | 1,0 m |
| Beam extreme, | 5,0 m |
| Beam on waterline, | 4,2 m |
| Displacement, | 24 tons |
| Height of sternpost ab. w/1, | 3,5 m |
| Mast height, | 9.6 m |
| Sail height, ave., | 4,4 m |

| | | |
|---|---|---|
| Sail width, ave., | 14 | m |
| Sail area, | 61,5 | sq. m |

Based on these dimensions, Gillmer calculates and examines several coefficients, which help show what kind of a ship this is not only from the fresco profile, but also from the viewpoint of performance.

Displacement-length, 157.1
Sail area-displacement, 7.19
Prismatic coefficient, 0.48

The displacement-length ratio states that this is a light ship built for speed. Modern highly efficient ocean racing vessels range from 150-190, old war galleys and clipper schooners always measured less than 200, while the average merchant ship and cargo vessel hovered around 500.

The sail area-displacement coefficient, however, is by comparison exceedingly low. This is not surprising for Gillmer. With a single low-aspect sail on a low mast, this simply helps to "indicate the practicability of operating cautiously in the seasonal winds of this sea, at the same time being able to seek shelter easily while partially beaching sternward in shoaling water". The low prismatic coefficient in combination with the steering blades well aft, means that the vessel was easily and highly maneuvrable. One should also emphasize here the presence of an oarcrew and their considerable number: the vessel portrayed is no simple sailing craft, whatever else it might have been.

2.1.2 The position of the oarcrew

As previously mentioned, Gillmer observes that the leading paddlers forward seem to have their blades slightly deeper immersed than the others in graduated order. This is not borne out by the ship on the fresco. The first seven paddles appear indeed to be immersed deeper, but only in relation to the keel line of the ship which curves already upward at this point, not in relation to the waterline which would be the only way the previous claim could stand. But even if it were so, all other paddles appear to end on the keel line and there is certainly no graduated order.

An even more serious objection may be expressed towards the statement that this slightly deeper immersion appears to conform to multiple in-line paddling. "The sequence of immersion begins forward and moves aft following an elongated wave of progression". This is such an incredibly difficult exercise, requiring split second timing by each crew member separately, in contrast to simultaneous

paddling, that it is seriously doubted if 42 men could succeed in accomplishing it, never mind manage to keep it up for any length of time. Besides, given the parallelism of the blades, if the artist wished to portray simultaneous paddling, how else could he have shown it? For these reasons, the previous suggestion of "an elongated wave of progression" cannot be accepted.

However, Gillmer has correctly identified the propulsion method portrayed in the fresco as "paddling". The visible arms, their hold of the blades, the angle of the arms with the paddles, clearly show the end of a paddle stroke. In accordance with this observation, Gillmer, a naval architect, and Gilkerson, an artist, have shown in drawing number 11 of Gillmer's publication (Fig. 3), a realistic portrayal of such paddlers (Gillmer 1989, 138). The question is, what are paddlers doing on board a ship built for speed? There is hardly any doubt that paddling in these circumstances is the most inefficient method of human propulsion imaginable.

Paddling an Inuit kayak or an Amerindian canoe is one thing. In such cases a paddler who knows how to steer at the same time as he paddles can attain considerable speeds on water. But this is mainly because these vessels weigh something between 7 and 25 kg. The Theran ship weighs 24 tons according to Gillmer's calculation above (hydrostatic law states that the weight of a floating object is equal to its liquid displacement), which works out to something over half a ton (571 kg) per paddler for an empty ship, or over 22 times the previous maximum. It is not that the Theran ship could not be propelled by paddling, but rather that it will move so slowly as to completely nullify the pains taken to build for speed. What sense does this make?

To attain any kind of efficient propulsion through human effort it is necessary "to put one's back into it" as the expression goes. This means to pull an oar with one's whole body, preferably by swinging it around an immovable fulcrum (tholepin). But this necessitates turning one's back towards the bow and facing the stern. This is how all fast ships propelled by human effort moved, from ancient triereis to old war galleys to modern racing skiffs. This is exactly what is shown on another ship of the fresco (Fig. 4), the "rowed boat" as it is called (e.g. Morgan Brown 1978) in front of the "Departure Harbor". This is what contemporary Aegean fishermen do to row a heavy boat in relative comfort. But when they have to face the direction of movement for the purpose of careful navigation, they invariably stand up in order to throw their body weight into the push they deliver to the oar. Rowing with only the arms is not only inefficient but extremely tiring for any protracted effort. Also, paddlers have to provide for the fulcrum. This is done by

pushing at the top and pulling at a lower point of the paddle, for a very ineffective output for anything but the lightest vessels such as kayaks and canoes. So what are these paddlers doing on board a ship obviously built for speed?

Gillmer does not raise the question here, for he has done so previously (1975, 324). The point has been also raised by other scholars in the past, such as for example, S. Marinatos (1974, 51), Casson (1975, 7), Tilley and Johnstone (1976, 286), and very aptly by C. Morgan Brown in a paper discussing the ship procession in the miniature fresco (1978, 629ff.). Comparing the efficiently rowed ship in front of the Departure Harbor, she adds that, "the crew of the large ships face the prow making hard work of their journey by paddling. They are cramped together leaning uncomfortably over the gunwale in their effort to reach the water with oars which are too short for the freeboard of the hull. The method of paddling they have to adopt is unnatural, even for special harbour manoeuvres" (631).

This is unquestionably true. But this observation appears to imply that aside from the method of propulsion, i.e., paddling, what is obviously "wrong" with the process portrayed is the length of the paddles, "too short for the freeboard of the hull". This is also evident from the comment which follows the one quoted immediately above: "The type of craft for which these short paddles would be suitable can be seen in the Arrival Harbour [....] The small two-man boat is being paddled in the conventional fashion — the men push the water back while kneeling on thwarts".

Here one must question first of all that the men are kneeling on thwarts. The man at the prow may very well be standing with his legs apart and knees somewhat bent as a standing paddle stroke may require, while the man at the stern could very well be seating on a thwart, which would give him better control of his legs than if he were kneeling, for a more powerful paddle-stroke. But the main point of interest here is the length of the paddles. The paddles shown are certainly short for the freeboard of the hull, but longer paddles would not be more useful or more efficient. There is a definite limiting relationship between the spread of the two arms holding a paddle, usually 50-60 cm, and the total length of the paddle, ranging from about 140 to 170 cm, for a ratio of just above 1:2 to just over 1:3. Smaller ratios, i.e. longer paddles, make paddling progressively more inefficient, as it may be readily gathered from a consideration of the forces active during a paddle-stroke and the mechanics of levers.

However, what one sees in the case of Ship A of the Theran fresco, and particularly in the drawing of the paddlers over the gunwale by K. Eliakis reproduced in Morgan Brown's paper (no. 7), is a general ratio of about 1:5, and in the case

of the first paddler shown in the drawing, a ratio of perhaps as small as 1:6 (Fig. 5). This is not merely an inefficient ratio, but a downright absurdity. At 570 kg per paddle at the very least (based on the displacement of an empty ship) and such a ratio, the ship would hardly move at all, save if she were lucky enough to have the current flowing in the direction of her destination.

Perhaps at this point one may pause and ponder if too much is not being asked of a mere miniature fresco. This is the usual thing in such circumstances. As long as an illustration supports one's point of view, no amount of extracted detail or the extent of the accuracy portrayed are ever questioned; but the moment the evidence ceases being supportive, it is scholarly custom to stop and reflect on the imponderable. The case in hand unfortunately, seems particularly obdurate.

Thus, the illustration of the rowed boat before the Departure Harbor previously mentioned, is drawn to perfection at the beginning of the rowing stroke, and one can virtually feel the tension at the shoulders, as the backs of the rowers are already slightly curved by the effort. The paddled boat from the Arrival Harbor shows again the drawing of a master, the paddle-stroke advanced but not quite at the end, the ratio of the hand-spread to the total length of the paddle at about 1:3 or just a little more (Fig. 6).

In fact, it is the finer details which show how well the artist knew his subject. So in the two-man paddled boat above, the man at the bow is a little more advanced in his stroke, which is very frequently the case in reality, since the man at the stern has to steer the boat as well by turning and dragging his paddle in the water, which means that he often has to catch up with the man at the bow. Besides, as all experienced paddlers know, it is the business of the man at the stern to adjust his stroke to that of the man in front, never the other way around, since the man at the back can watch his companion without particular effort. This is beautifully portrayed here. But then what about the previous absurdity of 1:5 or even 1:6 ratios for Ship A and probably similar ratios for the other large ships shown in the fresco?

Morgan Brown wrote that paddling was an old-fashioned method of propulsion for the time of the fresco (1978, 613), which it certainly was. As a consequence, one would not normally expect to see this method used with massive sea-going ships, "especially when the superior technique of rowing was evidently known". But by comparing the Theran fresco with a depiction of paddling from Weserkaf's (or Userkaf) Vth Dynasty temple at Saqqara, and the LBA I age of the frieze, she concludes that, "At the time of the fresco, the occasional use of paddling ships in

Egypt was restricted solely to those in processions belonging to specific annua festivals when the old-fashioned method recalled tradition in a manner so typica of such occasions. It seems likely that a similar deference to tradition is being displayed here, for the entire character of the ships suggests that this is no ordinary naval venture".

All of which is distinctly probable of course, save for the rather disturbing absurdity of portraying men trying to move with paddles held at 1:5 and 1:6 ratios, a ship which easily gave each paddler a weight of 600 kg. This in the midst of otherwise very knowledgeable and even sensitively drawn bodies in movement, showing the tension expected from such rowing or paddling. The answer cannot be that the artist didn't know better, because this artist certainly did. Besides, why is the rowed boat from the Departure Harbor, a boat of medium size between Ship 1 and the paddled boat, not shown with paddles as well? It seems more than likely that this is the result of a certain "artistic convention", but which has little to do with the tradition mentioned above by Morgan Brown.

Some artists paint what they see. Others portray what they know. Some no doubt illuminate how they feel, while others have sketched only what they imagined. Many must have belonged to more than one of the above categories, and all must have taken liberties with their subjects. There is certainly no doubt about the liberties taken by the artist of the Theran marine fresco frieze. Aside from the obvious depiction of the sail in a fore-aft position instead of athwartships, a necessary convention in the circumstances, his portrayal of the paddlers "leaning uncomfortably over the gunwale" (Morgan Brown 1978, 631) and holding paddles in such a way that no propulsion was really possible, is certainly one such example. Whatever the artistic tradition or convention portrayed here, the artist knew only too well that what he was depicting here was patently false, in the sense that the ship he showed could not be propelled in this manner. His other portrayals of the rowed and paddled boats leave no doubt whatever about his knowledge. So why did he choose to execute an image he knew to be false? A deference for tradition is hardly an occasion for falsifying the present and actual. Thus Gillmer and Gilkerson in their drawing no. 11, show the paddlers prominent on board, as they certainly must have been, and the ratio of the hand-spread to the total length of the paddle is barely over 1:2.5, as one would expect for even half-effective paddling (Fig. 3). Whatever other liberties Gillmer and Gilkerson have taken, their portrayal of paddlers and paddles is certainly realistic. Why couldn't the BA artist of the Thera fresco do the same thing, considering his obvious accomplishments in the domain of realism, and the fact that there are no constraints imposed by the

medium here, as there are for example in the engraving of seals or ring-stones.

The reason seems fairly obvious. Portraying the paddlers full-bodied on the deck as Gillmer and Gilkerson have done would have completely obscured the important personages shown as passengers on board, sitting in ample comfort two by two, facing each other in the central booths for perhaps more amiable companionship. The artist knew that he could not possibly depict the crowd of paddlers and the exalted guests, officers, officials, or whatever the honoured passengers were, all on the same level as a realistic portrayal would have required. Something had to give. Thus the artist decided, no doubt with the full encouragement of his noble patron whose house he had been hired to decorate, that the paddlers could be relegated to somewhere below deck, in order to allow the depiction of the passengers. But since there was only one deck, the paddlers would have to double over reaching for the water, not because this was necessary as Gillmer and Gilkerson show in their drawing, but simply because this would help clear the deck of all encumbrances. This is called an artistic convention in painting and helps create one more class of artists, the ones who painted what their patrons wished. The question is, what other liberties might this particular artist have taken?

2.1.3. The length of the ship

Unfortunately, there are other matters which cast grave doubts on the reliability of the fresco. For example, as previously mentioned, Gillmer calculates the total length of the ship as about 24m. But one cannot possibly miss the fact that the length occupied by the crew is less than half the total length, and in fact these two dimensions bear a ratio of about 3 to 7, that is

$$\text{Length of crew} / \text{Length of ship} = 3/7$$

Now if one assigns the customary 90cm per paddler for the part occupied by the crew, then

$$\left.\begin{aligned}\text{Length of crew} &= 21 \times 0.9 \\ &= 18.9\text{m}\end{aligned}\right\}$$

But if the length occupied by the crew is 18.9m, it is simple calculation from the first equation to show that the total length of the ship is closer to 44m, rather than the 24m calculated by Gillmer, and the corresponding weight per paddle considerably greater. Put in another way, if the total length of the ship is 24m as Gillmer calculates, substitution of this figure in the first equation gives a length occupied by the crew of 10.3m, which will give each paddler barely half a meter of space. Needless to say there would have been a lot of bumping between hands

holding paddles and the backs of the men in front, since a man's arm is normally longer than half a meter, and the intervening space must also accommodate a man's upper body, as well as working space. Needless to say, if the total length of the ship, based on the length by the crew, is not 24m but closer to 44m, all other calculations shown by Gillmer are wrong.

### 3. CONCLUSION

The question is, if one of the most "realistic" and "reliable" paintings of BA ships, a painting moreover not subject to the usual distortions imposed by the substrate, could be so unreliable as has been shown, is it possible to place any confidence on iconographic analysis based on selective reliability of far more constrained illustrations on pottery, seals or ring-stones, and on any quantitative values obtained as a result?

But then why should art be reliable? Or for that matter, concerned with measurements and accurate representations? This is the methodology and object of engineering and technical drawing, not art. No one expects a modern artist to be concerned with any of these things; but their BA confreres are invariably counted upon to conform to scholarly expectations. It is true that modern scholars have often not much else to go on. But this is no reason to saddle BA art and artists with 20th century scholarly preconceptions, anxieties and problems. The need for information is real of course; but is a need fulfilled under these conditions worth scholarly consideration and discussion?

It must be clear by now that the author does not think BA artists have taken liberties with their subjects, since the object of art is not and never has been accurate representation; it is modern scholars who have taken liberties with the BA artist's work. One can certainly agree with Gillmer about the fine quality of the painting. And although one can feel a great deal of sympathy for his sentiments expressed in the phrase, "It is time to put more confidence in the finest form of expressive Minoan art, their fresco painting" (1989, 129), one has to wonder in view of the above, if the expressed generosity does not unduly saddle BA artists, with the qualities of accuracy and reliability that are simply not their own.

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## ILLUSTRATIONS

1a-b. Marine Fresco
2. Ship A
3. Gillmer's no. 11
4. Rowed boat (Morgan's no.4)
5. Drawing paddlers, no. 7 in Morgan
6. Paddled boat (Morgan's no. 5)

Fig. 1a

Fig. 1b

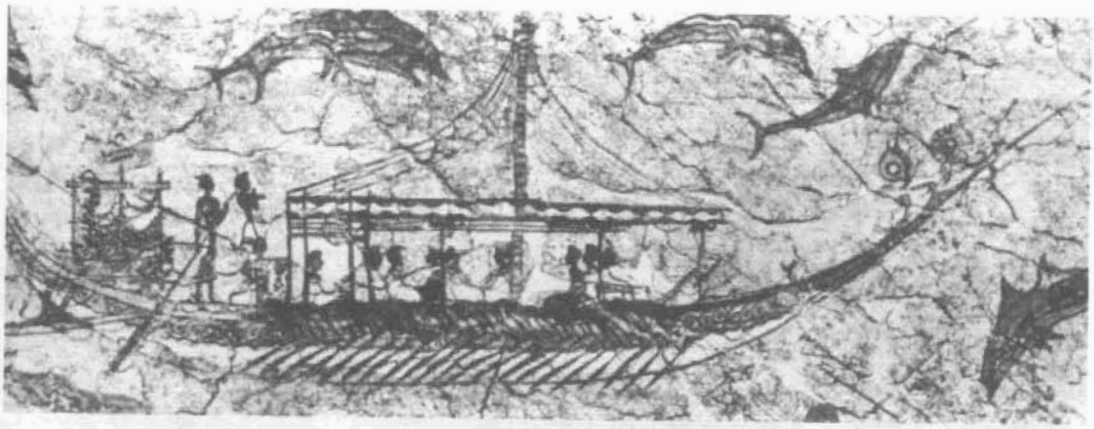

Fig. 2

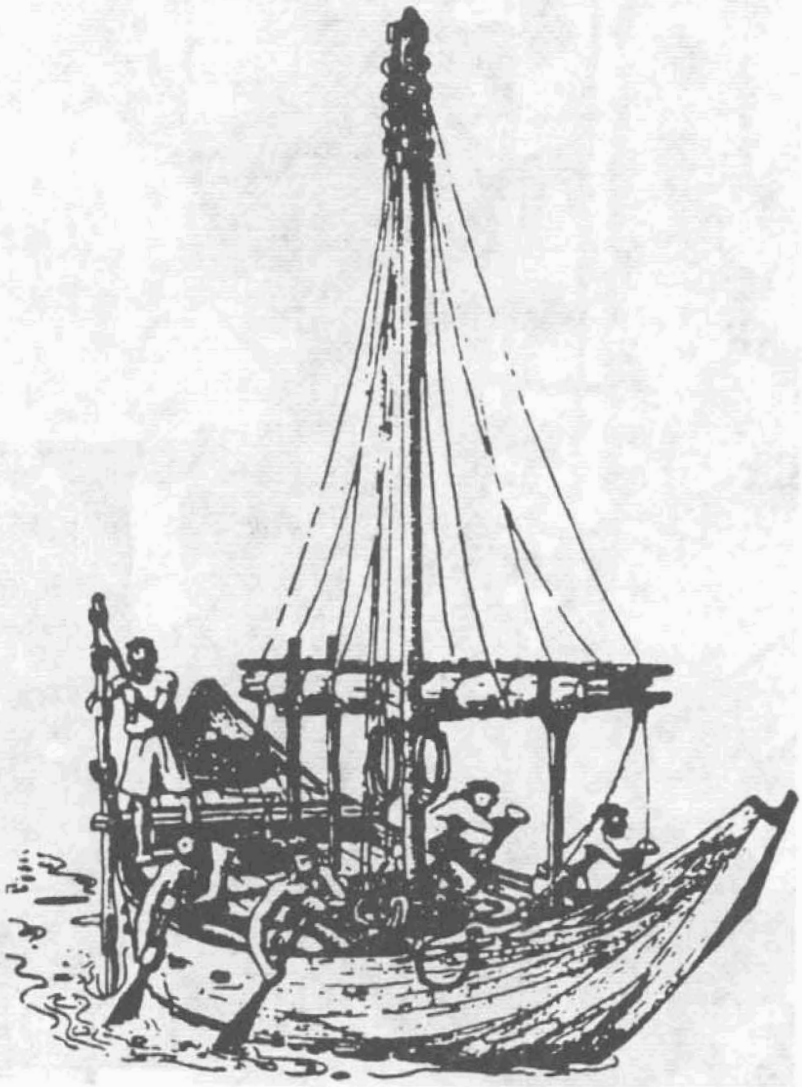

Fig.3

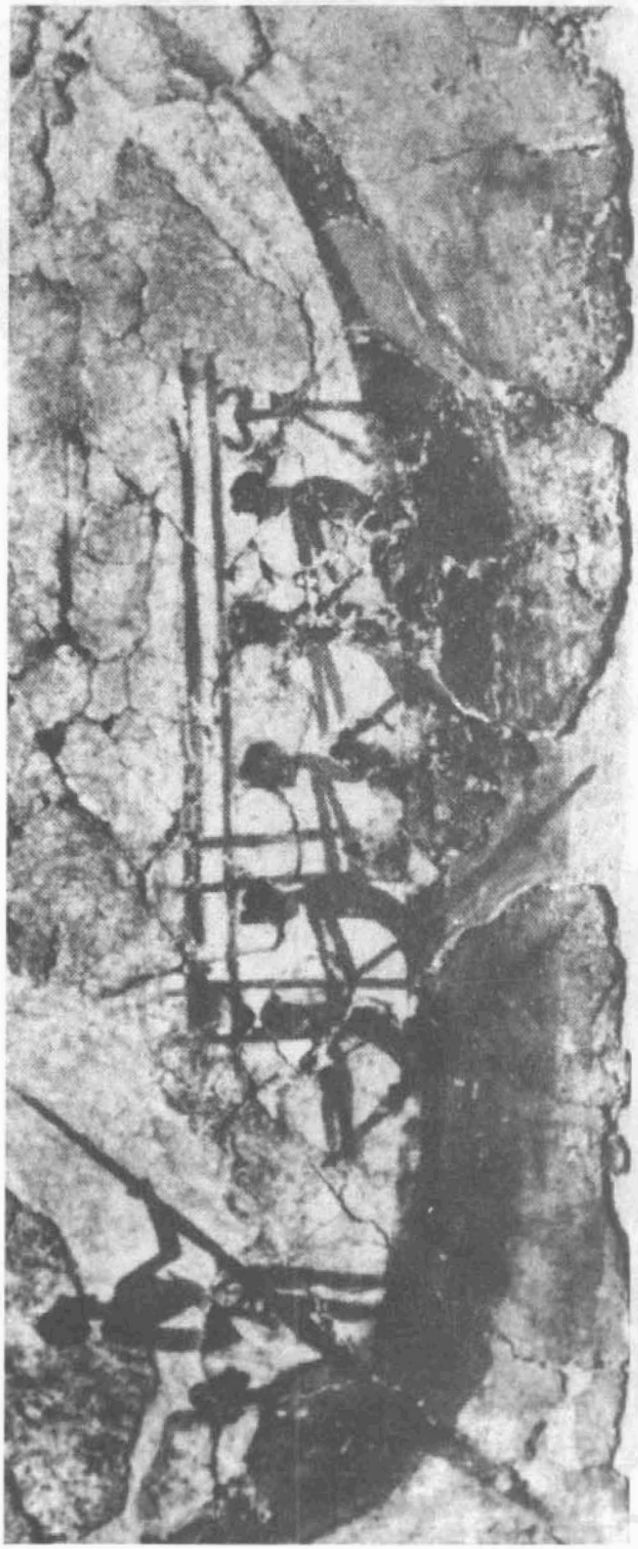

Fig. 4

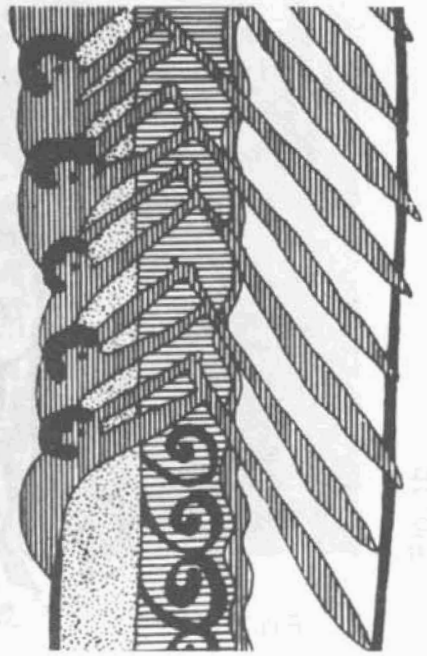

Fig. 5

Fig. 6