The University of Chicago

ANCIENT EGYPTIAN SHIPS AND SHIPPING

A DISSERTATION

SUBMITTED TO THE FACULTY OF THE
GRADUATE SCHOOL OF ARTS AND LITERATURE
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

DEPARTMENT OF ORIENTAL LANGUAGES AND LITERATURES

BY

WILLIAM F. EDGERTON

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By William F. Edgerton
University of Chicago

Structurally speaking, all boats known to have been employed by the ancient Egyptians may be divided into two classes: reed-boats, and boats built of wooden planks.

There is no evidence that boats of hide or bark ever existed in Egypt. There is a positive reason for believing that the Egyptians never learned to make them, in the fact that their wooden ships never had ribs; if the Egyptians had once learned to build the necessary wooden frame for a hide or bark boat, it would be remarkable that they never used a similar wooden frame in the construction of a wooden boat.

Dugouts may occasionally have been imported into Egypt—for instance, from inner Africa. This is a possible explanation of the first dynasty model, *Abydos*, II, Plate III. But even that model may not represent a dugout: the shortness of the open space may be due to the fact that the *model* is of dugout construction.

Reed floats have probably been in use in Egypt continuously since men first moved down into the valley.[1] But we cannot assume a priori that wooden ships go back to such an early date. It is therefore necessary to consider briefly the arguments of Torr, Loret, and Naville, who have sought to prove that the common predynastic pictures[2] described as boats by Petrie and Quibell,[3] J. de Morgan,[4] and many others, cannot be boats but must be fortified towns.

For Torr's argument, see *L'Anthropologie*, 9 (1898), pp. 32–35. He enumerates five points:

1. Although we often see human beings, gazelles, and ostriches both above and below the alleged boats, there are never any fish.

[1] This is apparently not doubted even by Reisner, who does not believe that the pottery models *Naqada and Ballas*, Plate XXXVI, 81*a* and 81*b*, represent reed-boats. See Reisner, *Models*, pp. xvii–xviii. Reisner's opinion that the papyrus raft "could hardly have been used as a river boat" has been refuted by Bates, "Ancient Egyptian Fishing" (*Harvard African Studies*, Vol. I), p. 225.

[2] See Figures 5, 6, and 7. [3] *Naqada and Ballas*, p. 48. [4] *Origines*, I, 161.

I have never seen a fish on a vase of this ware. A crocodile is, I believe, represented *Naqada and Ballas*, Plate LXVII, Figure 12; but what I call a crocodile Torr may with equal right call a land lizard. Fish as well as saurians accompany the much earlier boat reproduced here in Figure 3. But the mere fact that two objects are represented close together on a predynastic vase, by no means proves that the artist thought of them as belonging to the same scene. Our first task is to identify the objects; when that has been done, we may perhaps be able to discover relationships between them. Meanwhile it is better not to assume any connection unless the same objects recur in the same relative positions on many different vases.

2. There are never any rowers on the alleged boats; and the alleged oars regularly start from the lower curve, which would correspond to the keel, and not from the upper curve, which would be the gunwale.

For oars without rowers, see, for instance, *Ti*, Plates 21 and 22; or *L.D.*, II, 62, where the oars seem to hang from the collar of a calf. For oars stopping at the bottom line of the hull, see de Morgan, *Fouilles à Dahchour en 1894–1895*, Plate XIX.

3. The sides of the model boat *Naqada and Ballas*, Plate XXXVI, 80, and Plate LXVI, 1, are decorated with vertical bands between which are seen men who hold oars with large round blades. Now, if the objects represented on the vases were really boats, we should surely find vertical bands decorating their sides, and there would also be some blades on the oars: in fact, there are neither decorative bands nor blades.

Doubtless it may be alleged that these men hold steering-oars, not rowing-oars, and that such steering-oars are represented on the sterns of the so-called boats (*Naqada and Ballas*, Plate LXVII, 14). But if the objects in this figure 14 were really steering-oars, we ought to see some helmsmen manipulating them: as a matter of fact, we see only ostriches. Furthermore, one of the alleged boats of this same figure 14, which shows three alleged steering-oars at one end, is provided with another alleged steering-oar at the other end, although the drawing does not show it clearly. Surely it would be curious to find steering-oars at *both* ends of a boat.

The vertical bands of cross-hatching on the model mentioned by Torr are obviously decorative, as Torr realized; he had therefore no reason to assume that similar lines must appear on other boats. As a matter of fact I do not know of a single other example in the history of Egyptian art, from beginning to end. These bands of cross-hatching are the contrary of characteristic.

For "large round blades" on the oars, see Figure 1 and Figure 2.[1] Large blades which happen not to be round appear on the boat in Figure 3.

The "other alleged steering-oar" which Torr saw hanging from the prow on the original of *Naqada and Ballas*, Plate LXVII, 14, may be either a rowing-oar whose blade happens to be indicated, or more probably a tying-up rope with the circle at the lower end instead of the middle: without an accurate drawing, it is impossible to decide.

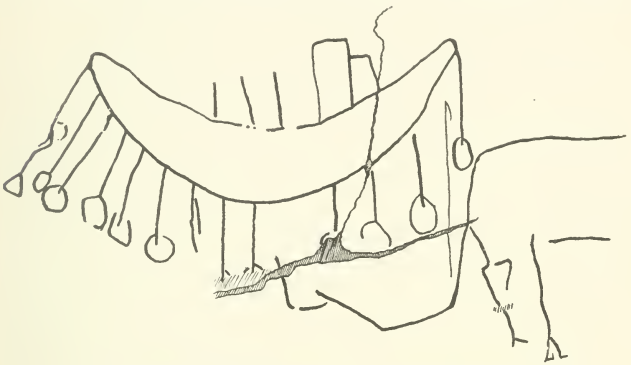

FIG. 1.—Incised drawing on a predynastic vase (Haskell Museum 10542)

Torr's theory ignores the tying-up rope, and the steering-oars. He does not even mention the tying-up rope, unless this mention of the "other alleged steering-oar" be so construed.

4. There is *always* a lacuna in the middle of the alleged line of oars. If the objects called oars really deserved that name, this lacuna would be inexplicable. It cannot be claimed that the so-called cabins occupied the entire width of the boat and left no room for oars or rowers. In that case there ought to be *two lacunae*, corresponding to the two "cabins," whereas there is *a single lacuna*, corresponding to the open space between the "cabins."

[1] This vase (Haskell Mus. 10542) was bought by Professor Breasted from Moharb Todrous, Luxor, January 30, 1920. At that time the vase was perfect; and it is Professor Breasted's recollection (May 16, 1922) that each and every oar had a blade. Doubtful traces of blades are still visible on the first and second oars to the left of the central lacuna. The next oar to the left probably never had a blade; but if all three had been bladeless, Professor Breasted would surely have remembered the fact. In my drawing, I have omitted the fore part of the quadruped: see the photograph. The surface of the vase is full of straw-marks and chance lines, which are not always easy to distinguish from the excessively crude drawings.

The boat shown in Figure 3 is considerably older than any of the paintings which Torr discussed. This oldest boat has four oars forward of the cabins, and three aft of the cabins, *but none under the*

FIG. 2.—Rough pottery vase with incised drawings (Haskell Museum 10542). Cf. Fig. 1

cabins. There is precisely "a single lacuna." Obviously the cabins *were* too wide to allow rowers to sit beside them, and it was not thought convenient to place a rower in the space between the cabins. Consequently we have one lacuna, corresponding to the two cabins

and the space between them. (To be sure, there are three cabins on this boat; but two of them are so close together that I think Torr himself would not look for a rower between them.)

Now, it requires no deep knowledge of Egyptian art or archaeology to see that the painted vases of the type discussed by Torr belong to a very highly conventionalized art. The subjects which could be

FIG. 3.—Inner surface of a polished red bowl with white line decoration. Original in Cairo Museum. Reproduced here from *L'Anthropologie*, IX (1898), Plate III, Fig. 2.

represented, and the manner in which each could be represented, were fixed by age-old custom. Photographic accuracy had no place in that custom; see, for example, the pictures of human beings. Torr himself did not think it worth while to point out that the lacuna in some of his pictures (notably in his Fig. 4*a*) does *not* correspond to the space between the cabins, but comes, instead, directly under one of the cabins (as Torr would say, under one of the little towers). Torr was entirely right in that respect: the fact is not a valid objection to his theory. But it ought to have put him on his guard against a too precise insistence on the width and position of the lacuna. The

true explanation, not at all obvious when Torr wrote, seems to me perfectly obvious today. The artist had to represent two rows of oars, one row forward of the cabins, the other row aft. The two rows of oars early degenerated into two rows of straight lines, of indefinite number, carelessly applied in a series of hasty strokes of the brush. The distance measured by these strokes along the ship's keel was of no more importance than the number of strokes: the lacuna caused by the cabins was early reduced to a tiny vestige of what it was on real ships on the Nile. The Sokar-barque, as preserved to us in dynastic reliefs, shows essentially the same process in a later stage: as Petrie[1] has pointed out, the after oars seem to have been driven out entirely by the three great steering-oars; but the bladeless oars forward—crowded so close now that they may actually be in contact, and some of them not even pointing toward the water—remain to tell us, in a language which Torr certainly should be able to understand, the meaning of the bladeless oars on the predynastic painted vases.[2]

5. The structures in the form of little towers, with a sort of merlon at each corner, are represented entirely outside the "boats" on the vases *Naqada and Ballas*, Plate XXXIV, 43, 45, and Plate LXVI, 6, 9, 10. It seems improbable that precisely the same model would be adopted for the cabins of boats and for isolated structures in the open country.

Why is it "improbable"? Our house-boats do not look so very different from simple cabins on dry land.

I do not know what the "isolated" objects are. As a matter of fact they are seldom if ever isolated: they have a way of occurring in pairs, often separated by another object which I am equally unable to explain.[3] Torr may be right in taking these objects for "constructions" on dry land; but to say that the ship-cabins cannot be ship-cabins because elsewhere they stand isolated in the open country, is to interpret the known by the unknown.

Torr concludes:

For my part, I believe that the long curved lines which have been thought to represent boats, are in reality the indication of a rampart; that the shorter

[1] In Caulfeild's *Temple of the Kings*, pp. 15 f.

[2] See, for instance, Caulfeild, *op. cit.*, Plate VI.

[3] So also on the vases to which Torr refers. For the interpretation of these objects, see the references collected by Capart, *Débuts de l'Art*, pp. 115 f.; and in addition, Naville, in *Archives suisses d'anthropologie générale*, Vol. II, Nos. 1–2 (1916–17), pp. 77–82.

straight lines, called oars, indicate a sort of *glacis;*[1] that the lacuna in the row of straight lines marks the path giving access to the rampart; finally, that the objects called cabins are neither more nor less than little towers on either side of the entrance.

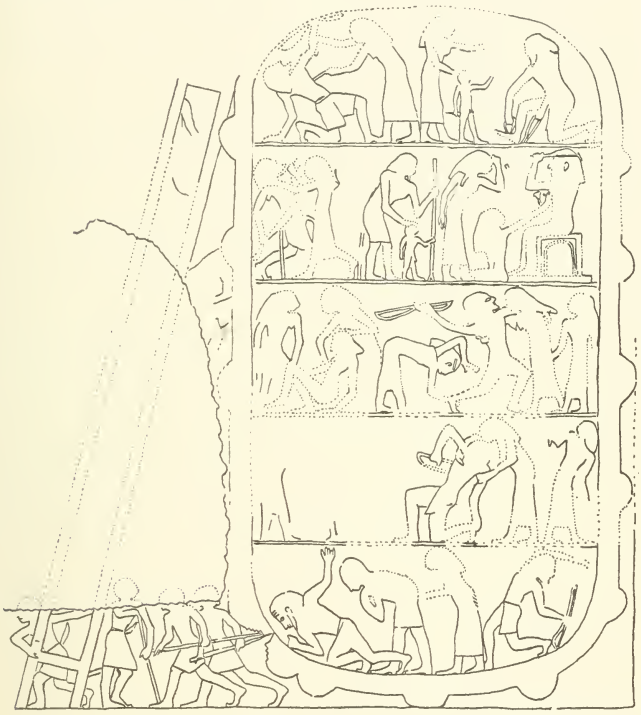

FIG. 4.—A walled town in Asia, as represented by an Egyptian artist of the fifth dynasty. From *Deshasheh*, Plate IV.

The early Egyptian method of representing a walled town is well known. See, for instance, *Royal Tombs*, II, Plate II, Figure 4; Plate VII, Figure 11; both early dynastic. The specimen reproduced here (Fig. 4) dates from the fifth dynasty. The contrast with the

[1] A terrace so designed as to expose an attacking force to the direct fire of the defenders.

boat-pictures, which Torr would take to be walled towns, speaks for itself.

Loret, in *Revue Egyptologique*, X (1902), p. 92, summarized the important points of Torr's argument (points 1 to 5, inclusive) and found them, for the most part, entirely convincing. He then added two new points, which he numbered 6 and 7:

6. The curve of the alleged boat is such that if the water-line were drawn at the base of the buildings, which would be already too high, 19 oars out of 41 would not reach the water.[1] On the other hand, if the water-line were drawn at the bottoms of the oars placed at the two extremities, more than half the boat would be deeply submerged in water.

The draftsmen of the Old Kingdom were not offended by oars which did not and could not extend below the surface of the water. Take, for instance, *Ti*, Plate 21. It may be objected that the ships there shown are thought of as tied up at the bank; but the ropes which kept the oars from slipping away are visible, and the last oar at the stern of the right-hand boat would just graze the surface even if extended perpendicularly downward from the point where it is tied to the gunwale. In *L.D.*, II, 22*d*, upper register, a ship is being driven before the wind: the two steering-oars barely touch the water. Such discrepancies are of course even less surprising in a picture where *the water-line is not even represented.*

I have already remarked that some of the oars on the Sokar-barque do not even *point toward* the water.

7. A study of the proportions of certain Egyptian pictures of row-boats shows that the oars were placed 60 centimeters apart. The alleged boat under discussion here has 41 oars, which would give a length of 41×60, or 24 meters 60 centimeters. Adding the spaces left without oars at the center and the two extremities (equivalent to about 10 oars or 6 meters) the boat would be more than 30 meters long. No boat so long was ever represented on any Egyptian monument, "même aux époques de civilization intense."

Ancient Egyptian pictures were not drawn to scale. If Loret had consulted the actual dimensions of Egyptian ships, as recorded by contemporary scribes, he would have learned that Snefru built ships 100 cubits (52.4 meters) long[2] and that still longer ships are

[1] Loret reproduces the boat at the left of Torr's Figure 1, and it is to that that his figures apply.

[2] *Palermo Stone*, Obv., VI, 2 and 3.

recorded in the reigns of Thutmose I[1] and Ramses III.[2] But I agree with Loret to this extent, that ships as long as 30 meters were probably never very common in ancient Egypt, and may not have existed at all in the predynastic period. I have already explained, in answering Torr's fourth point, the insignificance of the number of oars on the predynastic vases.

But Loret differs from Torr on one point. Torr explained the row of straight lines underneath the curve as a sort of *glacis*. Loret believes that this row of straight lines represents a palisade surrounding the mound on which a typical Egyptian town stands; and that such a palisaded town is also represented by the hieroglyph  . So far as the hieroglyph is concerned, Loret's explanation is at least plausible: the bottom of the hieroglyph is flat, not curved, and the "palisade" rises from the bottom of the "mound" instead of descending from it.[3]

Naville discussed these pictures in *Recueil de travaux*, XXXIII, (1911), pp. 196–98; but his later article in *Archives suisses d'anthropologie générale*, II, Nos. 1–2 (1916–17), pp. 77–82 and Plates I–IV, makes it unnecessary to consider the earlier article separately.

In the later article, pages 77 and 78, Naville deduces, primarily from the pictures on these painted vases, that "The life of these primitives was passed, then, above all on dry land. It does not appear that the life on the water played a great part." These sentences appear to me to beg the question by assuming at the outset that the objects we are discussing are not boats. Naville continues: "A population which must have been fairly considerable could not dwell exclusively on boats; and how does it happen that we never find representations of their dwellings on dry land, cabins, huts or tents?" I will assume temporarily, for the purpose of Naville's argument, that Torr's "isolated constructions" are not buildings on dry land, and that buildings on dry land are nowhere to be found on these painted vases. Let us turn for a moment to the Old Kingdom reliefs. Here we have pictures of boats by the score; plenty of bird-cages, granaries, and the like; and many scenes which presumably took place within doors, or at least in the courtyard of a house; but the house itself is indicated at most by a door or by a row of columns supporting a roof,

[1] *Urk.*, IV. 56. [2] *Pap. Harris*, 7, 5; 48, 11. [3] Cf. p. 119 below.

and even these are exceptions.[1] Naville's rhetorical question could be used, practically without modification, to prove that the Old Kingdom boats are not boats.

Naville continues: "Always and exclusively boats, whereon we sometimes see antelopes and trees,[2] to say nothing of two huts. All this would presuppose boats of dimensions comparable to those which were used for transporting obelisks. That would presuppose also a knowledge of naval construction such as can scarcely be attributed to these hunters." The reference to the obelisk-transports was probably not meant to be taken seriously: Naville surely knows that the task of transporting a few antelopes and ostriches, half a dozen men, and a pair of deck-houses cannot be compared to the transportation of Hatshepsut's obelisks. Cattle, as well as substantial deck-houses, are often seen on board ships of the Old Kingdom. Ostriches are rare in dynastic pictures, and I do not know that they appear on shipboard. Whether the predynastic Egyptians had ships large enough and strong enough for the transportation of ostriches, is a question whose answer depends precisely on the present argument; I do not wish to "attribute" anything to them a priori.

The most important new contribution made by Naville in this article is doubtless the argument that the zig-zag lines often seen on the painted vases, which have been taken for water, are in reality sand; he publishes two beautiful photographs of desert sand which certainly establish the *possibility*. But he himself very justly remarks (p. 78) that the surface of the desert at such points "is all in little waves *resembling those which a very slight breeze would produce on a basin of water.*" (Italics mine.) For my part, I do not think that water and sand exhaust the possibilities; cf. Capart, *Débuts de l'art*, pp. 110 ff. What I do insist upon, is that the different objects represented on these painted vases must first be interpreted *individually:* any explanation of the scene as a whole—indeed, the answer to the question whether or not each vase presents a unified scene at all—must wait upon the identification of the individual objects. We start out with men, women, quadrupeds, and ostriches: these are certainly represented, though their respective relations to each other

[1] See Klebs, *Die Reliefs des alten Reiches*, Register, *s.v.* "Haus."

[2] Naville does not really think that the trees are growing trees, any more than he thinks the boats are boats.

and to the other objects are, in most cases, anything but certain. Vegetable growths of one kind or another are also represented, however much botanists may differ about the kind. I say without fear of contradiction even by Naville, that no other detail is *more* nearly certain than the one we are discussing.

On his Plate I, Figure 2 and Figure 3, Naville republishes two drawings by Loret[1] showing Loret's idea of the appearance of such a neolithic town as the painted vases are alleged to represent. Figure 2 differs from the predynastic vase-paintings in at least two important respects: it is flat instead of curved,[2] and the palisade rises from the base of the mound instead of descending from it (cf. Torr's point 2). In both respects Loret shows his perfectly accurate knowledge of *the way in which an early Egyptian artist would have drawn such a town if he had drawn it at all.* Figure 3 looks much more like the pictures on the painted vases; but Figure 3 presupposes modern European ideas of perspective. The nearest approach to such a picture of such a town which could possibly have been made by an ancient Egyptian artist is shown (still, of course, with some intentional modernization) in Loret's Figure 2.[3]

Furthermore it is a singular coincidence that there is *always* a tree on one end of the mound and *never* another tree on the other end. Loret has shown his uneasiness over this circumstance by inserting, in Figure 3, other trees at the other end of the town: he makes them small and distant, so that they might be hidden by the parapet in Figure 2.

Naville's discussion of Loret's pictures (pp. 79–80) introduces no new impossibility. The points on which he differs from Loret, while interesting, are not important for my present purpose.

Bénédite, *Le couteau de Gebel el-ʿArak*, pp. 11 f., interpreted the vase-paintings as pictures of boats, but supposed that the hull was made of bundles of papyrus-reeds; and incidentally remarked that

[1] I do not know that Loret has ever published any discussion of these drawings. The drawings were published by Naville first in *Rec.*, XXXIII (1911), pp. 196 and 197, where they are numbered respectively Fig. 2 and Fig. 3, as here.

[2] The vase-painting shows a flat, or nearly flat, base in Naville's Plate II, Figure 5 (=*El Amrah and Abydos*, Plate XIV, D 49).

[3] Anyone to whom this point is not self-evident should study Schäfer's *Von ägyptischer Kunst, besonders der Zeichenkunst.* Schäfer would perhaps have put the matter more cautiously; nevertheless I cannot see that I have overstated it.

this type of boat "est resté de tradition dans la *bari* hérodotienne en tiges de papyrus." The reference to Herodotus is surely a careless slip: *Herodotus*, II, 96 says plainly that the *bari* was built of wood and *caulked* with papyrus; nor do the uses of the hieroglyphic word from which *bari* is derived suggest a papyrus-boat.

The papyrus-boats of historic Egypt never support deck-houses; no post such as might form the corner of a deck-house ever rises from the body of such a boat. That the predynastic deck-house was a substantial structure appears from the use which is made of it on the painted wall, *Hierakonpolis*, II, Plate 75; and again on the vase here published (Figs. 5–7).[1] To my mind this seems clear evidence that these ships have wooden hulls; and the white-lined bowl (Fig. 3) carries the type back to S.D. 34 or earlier—practically the earliest period in the life of Egypt of which we have any knowledge.

In *Ancient Egypt*, 1920, Part II pp. 44–50, Somers Clarke has described the building of a modern Egyptian boat which he was able to watch in 1911. In the following pages, I assume that the reader will have the substance of Clarke's article in mind; and from that starting-point I shall go chronologically backward.

Professor Breasted tells me that he descended the rapids of the Fourth Cataract, in 1907, in a boat whose hull was put together entirely with wooden pegs. The rudder was hung with metal; and when it had to be mended in the course of the voyage, metal was used for that purpose; but the hull itself contained no metal in its structure.

The account of Egyptian shipbuilding in the second book of Herodotus[2] has given rise to much argument. In the following interpretation, I follow mainly Assmann in *Hermes*, XXXI (1896), pp. 180 ff.[3]

[1] Light deck-houses are erected on reed-boats on Lake Tchad; see Bruneau de Laborie in *L'Illustration*, 15 juillet 1922, pp. 50–54; but no one could stand on the roof of such a deck-house. I owe this reference to my fellow-student, Ludlow S. Bull.

[2] *Herodotus*, II, 96.

[3] After I had written my translation in substantially its present form, I discovered that Wiedemann had published a correct interpretation of these sentences in 1890: *Herodots zweites Buch mit sachlichen Erläuterungen*, pp. 384 ff. I have also consulted How and Wells, *A Commentary on Herodotus*, I (Oxford, 1912), 213 f.; and the discussion by Somers Clarke in the article referred to above (*Ancient Egypt*, 1920, p. 44).

As I understand Herodotus, he says: "The boats of such of them as transport burdens are made of the thorn-tree, whose form is very like that of the Cyrenaean lotus, and its exudate is *commi*.[1] Having cut from this thorn-tree timbers of about two cubits, they put them

FIG. 5.—Vase in the Metropolitan Museum of Art, New York. Figs. 6, 7, and 8 are other views of the same vase. I am indebted to Mr. Albert M. Lythgoe, Curator of the Department of Egyptian Art, for permission to publish these photographs.

together brick-fashion[2] and build for themselves ships in the following manner: around long pegs set close together they fasten in

[1] I purposely avoid botanical questions, as I am in no way qualified to deal with them. It is, of course, well known that κόμμι (hieroglyphic *ḳmy*) is the same word as English "gum."

[2] That is, the building of the hull reminded Herodotus of the building of a brick wall. The hull was "carvel-built," and a joint in one strake was never allowed to come directly over a joint in the strake below.

rows the two-cubit timbers;[1] and when they have built for themselves ships in this manner, they stretch thwarts on top of them. But they use no ribs; and they caulk the joints from within with papyrus."

FIG. 6.—Another view of vase in the Metropolitan Museum of Art, New York. See Fig. 5.

In Benson and Gourlay, *The Temple of Mut in Asher*, Plate XX (Ethiopian or Saite period), *two* rows of beams are visible projecting through the side of the hull; evidently unusual strength was

[1] The meaning is that the pegs were driven into the holes which had been cut in the upper edge of the strake already in position; then corresponding holes were cut in the lower edges of the planks destined to form the next strake, and these were driven down onto ("around") the pegs with the aid of heavy mauls (cf. *Ti*, Plate 120).

required in this hull. The ship which carried Hatshepsut's obelisks[1] had three rows of beams. Nowhere else have I seen more than one row of beams. Even the sea-going ships of Hatshepsut had only a single row of beams.[2]

FIG. 7.—Another view of vase in the Metropolitan Museum of Art, New York. See Fig. 5.

Figure 9 shows the deceased noble Sen-nofer and his wife seated on a funerary barge which is being towed down stream from Thebes to Abydos; immediately below, they are being similarly towed up stream, home again. The journey is a unit; and I think no one who

[1] *Deir el Bahari*, VI, Plate CLIV.

[2] *Ibid.*, III, Plate LXXIII. Assmann, in Borchardt's *S'a³ḥu-re'*, II, p. 136, seems to have been the first to see that these rectangles represent beam-ends.

looks at the two pictures can doubt that the same barge and the same towing boat are represented in both. Going down stream, the driving force comes from four oars—that is, of course, four on each side. Going up stream, the same number of oars are in use, in addition to

FIG. 8.—Another view of vase in the Metropolitan Museum of Art, New York. See Fig. 5.

the sail. The rope row-locks are visible in the up-stream picture, but not in the down-stream one. Also in the up-stream picture the artist has tried to show something of the seams between the boards of the hull, and the ends of the beams projecting through the skin; but he has made no such attempt in the down-stream picture. I insist on the differences between these two pictures of one and the same boat, because if we had only the down-stream picture we might interpret

it as a dugout. This example will teach us caution in dealing with more ancient pictures.

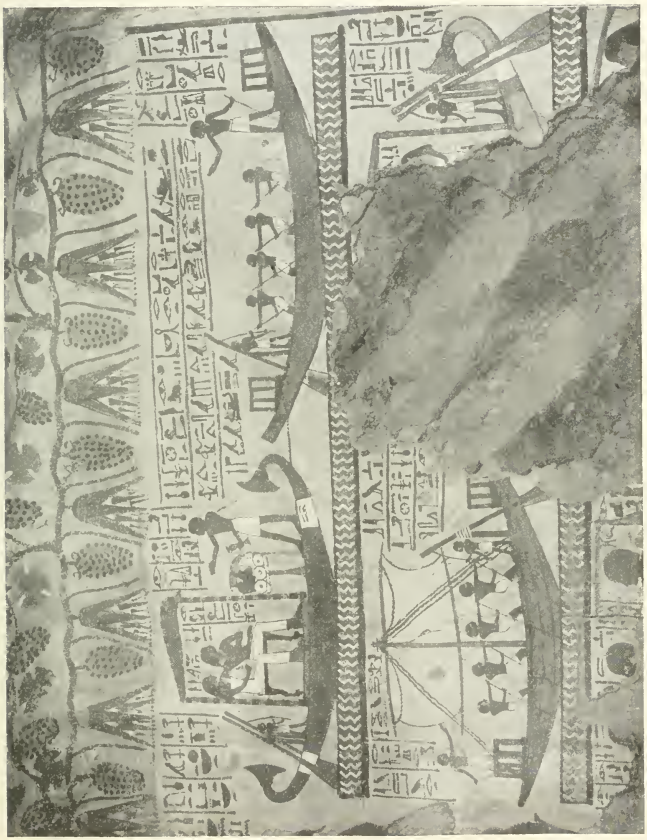

Fig. 9.—Wall-painting in the tomb of Sen-nofer at Thebes

In the hull of the boat which is sailing up stream, the next to the top strake is represented as consisting of four planks joined end to end: the vertical seams are visible. The corresponding seams are

not visible, at least in the photograph, in any of the other three strakes. The least unlikely explanation seems to be that the artist did not take the trouble to draw the vertical seams which were actually present in the other strakes.

On the other hand, the even curve of the longitudinal seams—indicating straight planks of even grain, very different from those described by Clarke—may be accurate. We know that wood was being imported into Egypt for ship-building, in Sen-nofer's time. Sen-nofer, a man of consequence, may easily have had a boat built of fine, imported wood. But people of less wealth will have been satisfied with the native growth.

One of the mortuary boats discovered by de Morgan in 1894 near the northern pyramid of Dahshur was purchased soon afterward from the Egyptian government and transported to Chicago. The Field Museum of Natural History, which owns the boat, has recently moved into a new building, and at the time of writing it has not yet been possible to put the boat again on exhibition, but it will probably be exhibited before these words are printed. I wish to express my grateful appreciation of the kindness of the Director, Mr. D. C. Davies, and the other officers of the museum, who not only allowed me to examine the boat and the museum records at my leisure, but took a great deal of trouble to make my work easy.

All of the dove-tails; most if not all of the dowel-tongues; and all but two of the thwarts, are modern. The flexible bands are missing. I have not examined the deck, but I understand that many of the original deck-planks are preserved.[1] The planks of the hull are all original, and for the most part well preserved. The hull is held together by a series of modern iron clamps on the under (outer) surface. The two original thwarts (those nearest the stern) have been nailed to the hull with modern iron nails; one of them is supported by a modern thwart underneath. There are two rudder-posts; and one steering-oar, with a hole for the (missing) tiller and a pin for the attachment of the (missing) ornamental head. All these losses, "restorations," and additions occurred in Egypt.

[1] The museum authorities offered to unwrap the deck planks, which were in a bundle wrapped in cloth; but I did not think I could learn anything from the planks.

The boat was studied about twenty-five years ago by a Chicago physician, Dr. John Bartlett. Bartlett had the assistance of several persons, among them a naval architect who was a graduate of the United States Naval Academy at Annapolis. He intended to publish the results of his study; I have not been able to learn that he did so. I have had access to a typewritten manuscript, on file in the museum, which is not signed but which I take to be Bartlett's work. Bartlett "took off the lines" of the craft, but I have not been able to find the blue-prints which recorded the results of this labor.

A photograph of the boat is published in Breasted's *History of Egypt*, 2d ed. (1912), Figure 82, opposite p. 170. The dimensions there given are "30 feet long, 8 feet wide, 4 feet deep." Breasted states that the material is cedar of Lebanon. The planks are very straight; more like those of Sen-nofer than those described by Clarke.

The structure is very similar to that of Cairo 4925 and 4926.[1]

The central strake (where the keel would be, if there were a keel) consists of three planks laid end to end. I cannot see that these planks were ever fastened directly to one another; they seem to be held in position solely through the planks on either side of them; but their ends are not in contact at present, and it is probable that the original contacts have rotted away.

The first strake on each side of the center consists of two planks; the second of three; and the third of four. The third strake on each side formed the upper edge of the hull proper; its central portion was surmounted by a gunwale, which did not extend the entire length of the hull. The gunwale also differs from the body of the hull in its structure, as will appear presently.

Each strake was fastened to the one below it in the following manner: Mortises $\frac{3}{4}$ inch wide, 3 to 4 inches long, and 3 to 5 inches deep[2] were sunk at frequent intervals into the upper edge of the strake already in position. Into these mortises were driven wooden dowel-tongues (the γόμφοι of Herodotus, as Bartlett recognized), each about twice as long as the mortise into which it was driven. Then corresponding mortises were sunk into the lower edges of the planks destined for the next strake; and these planks were driven down tight.

[1] See Reisner, *Models*, and Clarke in *Ancient Egypt*, 1920, pp. 7–9, 40–43.

[2] These are Bartlett's measurements.

When the joint had been made snug, a row of double dovetails were let into the inner surface, across the long seam, in such a way that if force were applied to separate the two strakes (for instance, in driving in caulking material) the dovetails would tighten. Being on the inner surface, these double dovetails also had the effect of preventing the hull from flattening out from side to side. Some of the dovetails were practically flat, others were curved or angular: in each case the dovetail was shaped to fit flush with that part of the surface for which it was intended.

The planks in each strake abutted squarely end to end. I have said that there is no vestige of a bond between the planks of the central strake where they abut on one another. In the first and second strakes on either side of the center, the planks are joined end to end by dowel-tongues let into the upper edge; but by no other bond. There was nothing, so far, to resist a longitudinal tension, except the dowel-tongues and dovetails joining the strakes. But the four planks forming the third strake on each side were joined end to end, not only by dowel-tongues let into the upper edge, but also by double dovetails: thus the hull proper was bound off and held firmly together: for in case of a longitudinal pull, tending to separate bow from stern, these dovetails in the outermost strake would tighten.

The planks of the gunwale were fastened to the strake below them with dowel-tongues and double dovetails, in the manner described above; but they were bound to one another, end to end, by flexible bands, presumably of rawhide[1] in precisely the manner described by Reisner, *Models*, No. 4926. The holes cut for these thongs are near the upper edge of the gunwale.

At each end the gunwale was lashed to the strake below it in a similar manner: there is, in each case, one hole through the gunwale, and one hole diagonally under it (slightly farther from the center of the ship) in the strake below; in each case the two holes are connected by channels sunk into the surface to receive the thongs.

Thus the gunwale formed an additional reinforcement of the topmost strake of the hull proper; it helped to bind the whole together.

Twenty-three vertical dowel-tongues joined the gunwale on each side to the strake below it; this is an average of approximately one

[1] Clarke, *Ancient Egypt*, 1920, p. 43.

dowel tongue per linear foot. In the same seam there were only eight double dovetails.

The tomb of Khnemhotep son of Neheri, at Beni Hasan (twelfth dynasty, slightly earlier than the Dahshur models), contains a unique illustration of the brick-wall method of construction described by Herodotus and by Clarke.[1]

Ax and adze are being used to trim planks already in place: apparently the reverse of the modern method as described by Clarke. I suppose the function of the ax is to make the surfaces of the planks flush with one another.

The man with mallet and chisel is cutting mortises for the insertion of dowel-tongues, or possibly holes for thongs. The ancient Egyptians had no augers.

The man whose head is turned backward holds in his two hands the two ends of a rope or thong, with which he is binding two planks together, as was done in the gunwale of the Dahshur model. But this man apparently is fixing his rope or thong in the body of the hull, not in the gunwale.

In the line of text above the picture, two infinitives are represented by their respective ideograms: *mdḥ* or *nḏr*, "to hew" by an ax, and *śp·t*, "to bind" by a hand holding a rope or the like. Over the head of the "chiseler" is his appropriate infinitive, determined by a picture of a chisel. But neither here nor anywhere else have I found a hieroglyphic verb corresponding to the action of inserting dowel-tongues or dovetails. Undoubtedly there was at least one such verb; probably there were several. The mortising of wooden planks, as well as the tying of them together with cords, can be traced back even into the predynastic period.[2] Yet in the construction of wooden ships, the tying seems to have left a much stronger impression on the language.

Ti, Plate 120, middle register, right, a plank is being driven into place by two men with heavy mauls: a fairly clear sign that this plank was fastened to the ones below it by dowel-tongues.

[1] Rossellini, II, 44; *L.D.*, II, 126; Newberry, *Beni Hasan*, I, 29.

[2] Reisner, *Models*, p. xviii.

On the majority of the sea-going ships of Sahure[1] no seams are indicated between the planks: the exterior of the hull is smooth and uninterrupted, like that of a dugout. This appearance need not deceive us, since the seams are clearly indicated on a minority. Compare also the two pictures of one boat in the tomb of Sen-nofer.

S'aḥure', II, Plate 12, bottom register, the third ship from the right shows the longitudinal seams between the strakes. Toward the stern of that ship, just under the rope lacing, two small rectangles cross a seam and evidently bind two planks together. The two planks so joined are in the same strake; though this fact is somewhat obscured by the absence of the after part of the picture.

For the large block at the left of that plate, I have been able to use a set of large-scale photographs made while the excavations were in progress and presented by Borchardt to Professor Breasted.[2] For the most part these photographs have only enabled me to confirm the minute accuracy of Bollacher's drawings. In several cases it is evident that Bollacher actually counted the number of strands in a rope. He did not always do that—life is too short, and it was important to complete the work before the blocks were packed for shipment—but he reproduced almost every detail with a fidelity which cannot be too highly praised.

Unfortunately some details had perished even before Bollacher's drawings were made. Sahure's sculptors did not trouble themselves to make the surface of the stone perfectly even before beginning their work; instead, they filled a few holes with plaster and carved over the plaster. The photographs before me were made at two different times. Some of them, evidently made as soon as the block had been lifted clear of the sand, show several such bits of plaster still in place and easily distinguishable from the stone; a later photograph shows only holes where the plaster had been.[3]

[1] Borchardt, *S'aḥure'*, Plates 11–13.

[2] Although these photographs are Professor Breasted's personal property, they are now deposited in Haskell Museum, where they bear the numbers B 567 to B 571, inclusive. Four of them were numbered by Borchardt (on the negatives) 7:102 to 7:105, inclusive; Borchardt's number is not visible on the fifth.

[3] For example: one bit of plaster carried away most of the top line of the cartouche at the extreme left of Plate 12, with the top of the sun-disk and with part of the water above the cartouche. Another carried away some of the water, above the *m*-sign in the same sentence. A third carried away the bottom of the stern-post (under the *'nḫ*-sign) on the ship under that same sentence. In these cases, the loss seems to have occurred *after* Bollacher had made his drawing; but examination of the original in Berlin will show holes at the places indicated.

One such bit of plaster, toward the stern of the hull which is best preserved in the upper row, carried away with it almost the whole of a joint between two planks in the second strake below the rope lacing. The ends of the planks overlap diagonally; and they are bound together by something which is not quite rectangular but rounded at the corners.

I think I see traces of a similar joint in the strake above, slightly farther forward; the original in Berlin should be examined with this in mind.

Amidships, under the heaver in the rope truss, is another joint between two planks in the second strake below the rope lacing. This time one narrow binder is visible at one end of the joint, and there

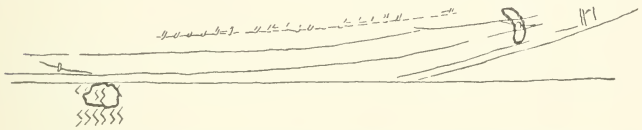

FIG. 10.—Part of one of Sahure's hulls. From Borchardt's photographs
Note: This sketch is intended only to facilitate comparison of my statements with the original stone in Berlin.

may have been another at the other end where the surface of the stone is rubbed.

Figure 10 shows as much of the three joints in question as can be made out with absolute certainty from the photograph; together with enough of the surrounding details to make it possible to locate these points on the original stone in Berlin.

To sum up these observations: The ends of Sahure's planks were chamfered, so as to overlap instead of abutting squarely. The planks in each strake were held together end to end by flexible bands, possibly of rawhide or metal.[1] But we have to infer that the planks in one strake were secured to those above and below by dowel-

[1] The possibility has occurred to me, and will doubtless occur to others, that these joints may be scarfs in the modern sense, and that the rectangular or rounded object crossing the seam may be, not a flexible band, but a wooden plug to lock the scarf. Two considerations seem to me to exclude that possibility: First, a scarf with the indicated outline would not be effectively locked, and consequently the wooden plug would serve no real purpose. Second, it is unthinkable that a locked scarf, once invented and put in use, could be displaced by such joints as are found, centuries later, in the royal models from Dahshur.

tongues or dovetails, since no bands are visible across the longitudinal seams; and this inference is confirmed by *Ti*, Plate 120, at least as far as the dowel-tongues are concerned.

The beams which must have supported the deck do not visibly project through the hull, as they do in the ships of Hatshepsut and in so many Nile boats. Assmann's explanation seems to me all but certain: the longitudinal rope lacing held, on the inner surface of the hull, a longitudinal plank or pole on which the beam-ends rested.[1] A similar lacing, serving probably the same purpose, appears on a Nile barge half a century later than Sahure, *L.D.*, II, 76*e*. Cf. also *ibid.*, 104*b*, third register, left; and Leiden, *Denkmäler des alten Reiches*, Plate 20, where the lacing may serve both for this purpose and for the attachment of the gunwale: it is not impossible that the lacing may have done double duty in Sahure's ships also.

The function of the rope truss with the wooden heaver must be evident to any seaman, and has been explained in detail by Assmann.[2] The best known examples are, of course, on the sea-going ships of Hatshepsut. Assmann cites a similar truss from Wilkinson, *Manners and Customs*, 2d ed., Vol. II, Figure 407; Assmann could not locate the source in Thebes. Two other examples are shown in *L.D.*, II, 108, fifth register; in this case the boats are under construction. Presumably all these boats were intended for sea-faring: such a truss would be superfluous on the Nile.

Medum, Plate XI, reproduces in colors a scene from the tomb of Rahotep (time of Snefru). A wooden boat of papyrus form is under construction. A man with a chisel at one end is either cutting holes, or carving the imitation ropes which decorate the hull. Another man with an adze is smoothing the other end. Two men in the center are binding the planks together with a rope which both hold; the missing left hand of the man on the right may have held a sharp-edged stone to cut the rope, as represented in the tying of a reed-boat Paget and Pirie, *Ptah-hotep*, Plate 32 = Davies, *Ptahhetep*, I, Plate 25. The central pair are properly labeled with their infinitive, *śp·t* "to tie"; and the man with the chisel, *mnḫ*, "to chisel." The artist has omitted the supports under the hull.

[1] *S'aʾḥu-reʿ*, II, Text, pp. 137–38. [2] *Ibid.*, pp. 140–42.

When we try to carry our study of the structure of wooden hulls back beyond the third dynasty, the solid ground seems to disappear from under our feet. We can, nevertheless, risk some speculations; and perhaps we may find that we are not much worse off than we were in later periods. On the one hand, the sense of reality which we get from Old Kingdom pictures often proves, on analysis, to be without justification: each picture must be approached cautiously, and interpreted in the light of what is known from other sources. On the other hand, "what is known from other sources" will carry us back, not with certainty but with a fair degree of probability, into a period centuries and perhaps millenniums earlier than the third dynasty.

It will make for clearness if I begin by enumerating the evidences for the opinion which I propose:

1. The most primitive craft which can be shown to have been manufactured in ancient Egypt, are those of papyrus. These are held together solely by tying.

2. Aside from verbs meaning "to hew" and "to make," and the incomprehensible *šd dšr*,[1] the verb which seems most characteristic of shipbuilding in the minds of ancient Egyptian scribes is *śpy*, "to bind."

3. The sea-going ships of Sahure depended on flexible bands to join the ends of the planks in each strake; though the strakes seem to have been joined to one another by dowel-tongues and perhaps by double dovetails. In the royal models from Dahshur, dowel-tongues and double dovetails have driven the bands out from the body of the hull; only the gunwale preserves bands, which by comparison with those of Sahure we may fairly call *vestiges*. At the same time the tomb of Khnemhotep son of Neheri seems to show that the people who did the real work of transportation on the Nile were even then (or only a little earlier) using flexible bands in the body of the hull. When Herodotus visited Egypt, he found no vestige of flexible bands in the structure of wooden hulls.

4. Hulls held together with ropes and with wooden pegs were in use on the Red Sea as recently as 500 years ago.[2] The use of flexible

[1] Cf. Schäfer, *Ein Bruchstück altägyptischer Annalen*, p. 30.

[2] Makrizi, in Burckhardt's *Travels in Nubia*, London (1819), p. 521.

bands on wooden hulls can be traced from Egypt at least as far east as New Zealand.[1] Wooden hulls held together *solely* by sewing were in use in the vicinity of Madras within the past century,[2] and may for all I know be in use there today.

5. We have documentary proof that Egyptian ships sailed down the Red Sea to Punt in the reign of Sahure;[3] and no reason to doubt that they had been doing so centuries before that time.

6. Wooden ships were in use on the Nile practically in the earliest period of which we have any knowledge.

Such are the facts; the conclusion seems to me to follow almost of necessity. The Egyptians perfected the papyrus canoe at a period so remote that we have no direct knowledge of it whatever. Before S.D. 34, they had transferred the technique of the papyrus canoe to the manufacture of wooden hulls, and again perfected it to such a degree that the tied or sewn wooden hull would support a light deck-house.[4] By the fifth dynasty, they had learned to add strength and rigidity to the sewn hull by the insertion of wooden dowel-tongues, and perhaps also wooden dovetails. On the quiet waters of the Nile, rigidity was no disadvantage; the new method gradually displaced the old—more rapidly among the best craftsmen, who built ships for the king—more slowly in remote villages and, we may guess, among the poorer classes generally. At some time between the twelfth dynasty and the Egyptian visit of Herodotus, sewing ceased to be used in the construction of wooden boats on the Nile.[5] Also at some time between the eighteenth dynasty and the period represented by the oldest surviving Greek traditions, Egyptian shipping disappeared from the sea and has never been revived; we have still to combat the myth that the ancient Egyptians were never a sea-faring people.

[1] Polack, *Manners and Customs of the New Zealanders*, London (1840), I, 218.

[2] *Catalogue of the Naval and Marine Engineering Collection . . . . Victoria and Albert Museum*, London (1899), p. 122, No. 406.

[3] *BAR*, I, 161, 8.

[4] The most important change at this point would seem to be the passing of the flexible bands through holes in the planks instead of around the planks—the change from *binding* to *sewing*. A further improvement was the cutting of the holes diagonally through the inner edges of the planks, so that the sewing was invisible from the outside: we have, as yet, no proof that this step was ever taken in Egypt.

[5] The silence of Herodotus is, of course, not conclusive on this point. I cannot positively assert that sewing has disappeared even yet—let us say, in remote parts of the Fayum. But I believe that Herodotus, like Somers Clarke, never *saw* flexible bands on a wooden boat.

But before the Egyptians learned to use dowel-tongues or dovetails in their hulls—therefore certainly before the fifth dynasty—the art of sewing wooden hulls had passed from the Egyptians who were engaged in the Punt trade to other peoples whom we cannot now name. In the hands of non-Egyptian peoples it was carried across the Indian ocean, and beyond; together with *so much related material for the student of ancient Egyptian shipping*[1] it survived on some parts of the Indian Ocean down to the nineteenth century of our era.

I have not been able to think of any other theory which would account for all the facts. No people who had once learned to fasten together a solid hull with wooden dowel-tongues and dovetails would afterward begin to use flexible bands for some of the joints; where the two coexist, the flexible bands must have existed first. The theory of Col. A. Lane Fox[2] that all wooden ships developed from the simple log through the dugout; and that of Hahn[3] that the technique of sewing must have developed first on bark boats, are alike inapplicable to Egypt. It has not been shown that dugouts or bark boats ever *existed* in Egypt—to say nothing of their having been manufactured there. On the other hand the reed canoe—a native Egyptian product if there is any such—offers us so easy an explanation of the origin of this technique that I see no reason to seek farther.

The argument that this technique originated on the Nile and was not imported thither from some other land, is, to some extent, an *argumentum e silentio*. Hahn points out with perfect justice that the few thousand years through which Egyptian and Babylonian records carry us are as nothing compared to the known history of man. When it becomes possible to trace the details of naval construction in some other part of the world back to a period comparable to that of Sahure (to say nothing of S.D. 34), I stand ready to modify my present opinion to accord with such facts as may then be discovered.

[1] Assmann, in *S'aḥu-re'*, II, Text, p. 138, freely translated.

[2] "On Early Modes of Navigation," in *Journal of the Anthropological Institute*, IV (1874–75), pp. 399–435.

[3] "Ueber Entstehung und Bau der ältesten Seeschiffe," in *Zeitschrift für Ethnologie*, XXXIX (1907), pp. 42–56.