A FURTHER INVESTIGATION OF
THE CAIRO DAHSHUR BOATS*

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Based on primary data and direct observation, a re-examination of two boats excavated by Jacques De Morgan outside Senwosret III’s pyramid complex at Dahshur, and now in the Egyptian Museum, Cairo, is offered. The original excavation report is reconciled with subsequent scholarly records, and the boats’ construction techniques are evaluated. De Morgan’s account has previously been dismissed due to discrepancies between his descriptions and the findings of modern examinations of two other boats from the same cache now located in the United States. Unique features found on the two Cairo Dahshur boats explain the discrepancies and permit a new interpretation of the boats’ construction.

The boats discovered at the pyramid complex of Khakaure Senwosret III at Dahshur by Jacques De Morgan in 1894 presented the first direct evidence of Egyptian boatbuilding techniques. These vessels, interred beyond a temple complex outer wall constructed during a secondary building phase,1 most likely took part in the king’s funeral.2 The Dahshur boats, each about 10 metres in length, have been interpreted as royal vessels. However, their humble appearance and size, especially when compared to the Khufu vessels which measure more than 43 metres in length,3 suggests that they may evoke the form of contemporary working boats. Notwithstanding this, their interpretation as royal vessels is not unreasonable. Diana Craig Patch has convincingly presented the case for their providing transport for Senwosret III’s funeral, and has also made the case against their use as ceremonial solar barques.4

The number of boat burials De Morgan located remains in question. His initial excavation report mentions six, but his site maps include a maximum of five.5

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4 Patch and Haldane, Pharaoh’s Boat at the Carnegie, 9, 15–20.
5 De Morgan, Fouilles 1894, vii, 82–3, fig. 105; id., Carte de la nécropole: Dâhchour, Sakkahah, Abou-Sir (Le Caire, 1897), pl. 4; id., Fouilles à Dâhchour 1894–1895 (Vienna, 1903), pl. 1.
Subsequent reports by De Morgan in 1897 and 1898 place the number at five,⁶ a figure later confirmed by several contemporaries with apparently direct knowledge of the excavations.⁷ For example, Edward E. Ayer, who was responsible for organizing the purchase of the Dahshur boat now in Chicago, and who informed Andrew Carnegie of the availability of the one now in Pittsburgh,⁸ wrote in his personal notes: ‘It is one of the five oldest boats known to exist….this [boat] with four others was excavated’ by De Morgan at Dahshur.⁹

Four of De Morgan’s Dahshur boats are available for study today, displayed in the Egyptian Museum, Cairo (GC 4925, GC 4926; figs 1 and 2),¹⁰ the Field Museum of Natural History, Chicago (FMNH 1842),¹¹ and the Carnegie Museum of Natural History, Pittsburgh (CMNH 1842–1).¹² Although the sixth vessel is likely a ‘phantom’, perhaps inspired by the ‘boat-shaped’ mudbrick vaulted structure,¹³ or the wooden transport sledge also found in association with the boats,¹⁴ a fifth hull might remain buried at Dahshur.¹⁵ A report that it was sent to a European museum¹⁶ remains unsubstantiated.

In the light of many outstanding questions, and the lack of a detailed investigation of the boats in Cairo, several small teams under my direction invested over 5,000 man-hours recording and studying the Cairo Dahshur boats between May 2004 and December 2006. Our examinations revealed that while many of the construction methods and elements are consistent among the four extant boats, the Cairo Dahshur boats offer new and important data that contribute to our understanding of Ancient Egyptian boatbuilding.

Understanding De Morgan’s report: Identifying the ‘red’ and ‘white’ boats

After excavation, the Dahshur boats remained largely unpublished until the mid-1980s, when Cheryl Ward examined the two hulls in the United States.¹⁷ The two boats in Cairo, however, received no particular attention from scholars.¹⁸ Recent studies which included the Cairo boats primarily repeated information given in prior works, which

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⁸ Patch and Haldane, Pharaoh’s Boat at the Carnegie, 2–3.
¹⁰ G. A. Reisner, Models of Ships and Boats (CGC Nos 4798–4976 and 5034–5200; Cairo, 1913), 83–7.
¹¹ C. A. Ward, Sacred and Secular: Ancient Egyptian Ships and Boats (Archaeological Institute of America Monographs New Series, Number 5; Boston, 2000), 83–102.
¹² Patch and Haldane, Pharaoh’s Boat at the Carnegie; Ward, Sacred and Secular, 83–102.
¹³ De Morgan, Fouilles 1894, 81–2 figs 201–2.
¹⁴ De Morgan, Fouilles 1894, 83 fig. 204; Reisner, Models of Ships and Boats, 88 (GC 4928).
¹⁸ Ward did, however, spend ‘an afternoon’ recording the Cairo boats in 1986 (Ward, Sacred and Secular, 84).
can be traced back to George Andrew Reisner’s records, with limited detail coming to light. De Morgan’s records from his excavation report have generally been discounted, because construction details in his sketches failed to correspond to the well-documented hulls in the United States, and his measurements appeared not to match those available for any of the extant vessels.

De Morgan published dimensions and technical drawings for only one of the five boats from his excavations, but which boat it was has been unclear. In his report, De Morgan states that two of the boats from his 1894 excavations, specifically one he called ‘red’ and one he called ‘white’, went on display at the Gizeh Museum, a forerunner of the Egyptian Museum. Comparison between De Morgan’s technical drawings, my own technical drawings of the Cairo boats (figs 3–4), and published drawings of the two boats in the United States, leads to the reasonable conclusion that the boat he chose to represent in his report is GC 4925. This is most likely De Morgan’s ‘white’ boat, discussed below.

Fig. 1. GC 4925 (courtesy of the Egyptian Museum, Cairo).

Fig. 2. GC 4926 (courtesy of the Egyptian Museum, Cairo).


20 De Morgan, *Fouilles 1894*, 83. See pl. 29 for the ‘white boat’ and pl. 30 for the ‘red boat’.

21 De Morgan, *Fouilles 1894*, 83 fig. 203.

22 As the boats have become heavily distorted while pedestal on display over the past century, some liberty has been taken with the technical drawings to remove these effects, especially in fig. 3b. Modern repairs, particularly replacement timbers in the hulls, have necessitated some interpretation.

Identifying the ‘red’ boat is more problematic. Nevertheless, as the two boats in Egypt have been consistently documented in museums in Egypt since excavation,²⁴ it seems reasonable to identify the other boat in Cairo (GC 4926) as De Morgan’s ‘red’ boat. The number of beams²⁵ on each vessel support in this identification: the vessels photographed in De Morgan’s 1895 report appear to have only 11 beams.²⁶ Each of the two boats currently in Cairo originally had 11 beams, but many have been replaced with modern timbers. The boat in Chicago had 13 beams, and there is some uncertainty as to whether the boat in Pittsburgh had 11 or 12: although it has been recorded as having 11,²⁷ a later illustration appears to give it 12.²⁸ Despite these concerns, comparison of

²⁵ A beam is a structural timber that provides lateral strength and supports decks, see J. R. Steffy, *Wooden Ship Building and the Interpretation of Shipwrecks* (College Station, 1994), 267.
²⁶ De Morgan, *Fouilles 1894*, pls 29 and 30.
recent photographs and technical drawings of GC4926 with the original excavation photographs tentatively permits its identification as the ’red’ boat.

The unaccounted-for fifth vessel also complicates the above comparisons. Although the presence of charring on the ’white’ boat (GC4925) raises the possibility that the missing fifth boat could have been used as firewood, it most probably remains in the sands at Dahshur,29 and so would not have been published in De Morgan’s report.

Given all of these factors, the Cairo boats appear to be the two published in De Morgan’s 1895 report. The differences between the ’white’ and ’red’ boats appear minor today, but in De Morgan’s time they would have seemed much more pronounced. In the years between their excavation and the publication of Reisner’s catalogue, Models of Ships and Boats (1913), most traces of pigmentation had disappeared; however, Reisner found

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sufficient patches of pigment to characterise the decoration of the vessels. Reisner’s reconstructions indicated that both hulls were green in the middle and yellow or brown at the extremities, a colour scheme well known from Twelfth Dynasty boat models. Reisner’s colour scheme for the vessels has been the guide for most studies of the Dahshur boats since 1913. Most authors appear to have disregarded De Morgan’s comments regarding the colour designations of ‘red’ and ‘white’, presumably because they did not correspond to Reisner’s description. However, it is possible that neither Reisner nor De Morgan was mistaken.

Differences in construction distinguish GC 4925, the ‘white’ boat, from the other extant Dahshur boats, making its identification easier. Examination of the deck planks and beams reveals the most important differences, as well as providing the key to the colour conundrum.

In GC 4925, the beams have a rectangular cross section (fig. 5). In GC 4926 and the two boats in the United States, the beams have an inverted T-shape in section (fig. 6). The inverted T-shape provides a ledge, or ‘rabbet’, in which the deck planking is placed. GC 4925 also features numerous wooden pegs, each about 1–1.5 cm in diameter, which secure the deck planks to the beams. Most of the extant planks on the Chicago boat likewise have peg holes, as do ‘some of the beams’ of the Pittsburgh boat. This feature is largely absent on GC 4926: it is the only boat with a full complement of deck planks, of which less than twenty-five percent have peg holes. The pegged planks were probably concentrated at the fore-most and aft-most areas of GC 4926 where small holes in the beams correspond to peg holes in planks. Moreover, GC 4925 is the only boat in the group with deck planks that completely cover the top faces of the beams and, in doing so, span than the area between more than two beams. De Morgan’s designation as ‘white’ and ‘red’ boats could derive from these variations in the decking.

Only traces of the original pigments remain on the vessels today. The available records and scant remains indicate that deck planks on the Dahshur boats were originally coated with a white substance, while the tops of the exposed beams were either painted red or left as exposed cedar, which is red in colour. Boat GC 4926 had comparatively more red pigmentation visible, as the beam tops could be seen between the ends of the deck planking. As indicated by the excavation photographs, when De Morgan viewed the hulls in situ, he would have initially seen the decks (pl. II): this could have led to the convenient field labels of ‘white’ (later GC 4925) and ‘red’ (GC 4926). Such labelling would probably have simplified communication with his workmen regarding the boats.

30 Reisner, Models of Ships and Boats, xxv, 83–8.
31 For example, H. E. Winlock, Models of Daily Life in Ancient Egypt from the Tomb of Meket-Re at Thebes (Cambridge, 1935), pls 46–8; Landström, Ships of the Pharaohs, 92–3.
32 Landström, Ships of the Pharaohs, 92–3, provides some minor variations.
33 A peg is a wooden pin driven into a pre-drilled hole to fasten two members or lock a joint (see Steffy, Wooden Ship Building, 277, fig. G–17b–d), and functions in a fashion similar to modern nails.
34 During a visit to the Field Museum in December 2004, and again in June 2008, I viewed the boat through its glass case. Approximately 35 deck planks remain, which represent approximately 30% of the original total. 23 of the remaining planks have peg holes, and 5 other planks likely have peg holes. Degradation at plank ends prevents reliable analysis on most of the remaining planks. 5 deck planks appear devoid of peg holes.
35 Patch and Haldane, Pharaoh’s Boat at the Carnegie, 40.
36 Reisner, Models of Ships and Boats, 84; A great many boat models from the Middle and New Kingdoms confirm this trend; for examples, see ibid., xxiii; Winlock, Models of Daily Life, pls 33–7, 40–51; Landström, Ships of the Pharaohs, 74 fig. 219, 74 fig. 221, 92 fig. 287, 92–3 fig. 293; D. Jones, Model Boats from the Tomb of Tutankhamun (TTSO 9; Oxford, 1990), pl. 7.
The above identification of the ‘red’ and ‘white’ boats conforms to De Morgan’s and Reisner’s records while remaining consistent with the remaining evidence and corpus of contemporary boat models and iconographic representations.

Furthermore, De Morgan illustrated the features specific to the ‘white’ boat in his excavation report (fig. 7). Since he published drawings and measurements of only one boat from the cache at Dahshur, it is fortunate for current identification purposes that he recorded the one with unique elements in its construction. Ironically, it is precisely this that has led some scholars, familiar with the Pittsburgh and Chicago hulls but not those in Cairo (and specifically GC 4925), to largely discount De Morgan’s records.

De Morgan does indeed make critical mistakes in his account. He recorded eight beams, whereas the extant vessels, including GC 4925, have no fewer than eleven. By comparing his deck plan to the peg holes in the extant deck planks and beams, several of the deck planks can be fitted to their original locations on GC 4925. By comparing De Morgan’s drawings, the peg holes in the extant beams and in the extant deck planks, the locations of three beams missing from De Morgan’s drawings can be placed with confidence. The ‘missing’ beams can be found in fig. 3a. Counting from the right of the boat, which in this illustration is the bow (forward end), they are beams numbers 3, 5, and 9. If added to De Morgan’s drawings (fig. 7), the construction plans match quite well. Coincidentally, the three ‘missing’ beams are also those where the deck planking
does not meet in a butt joint. These obscured beams could therefore be more easily overlooked, especially given the scope of work presented in De Morgan’s site reports, and given that the Dahshur boats were the first intact Ancient Egyptian watercraft archaeologically excavated, 60 years prior to the find of the Khufu vessels.

The ‘white’ boat is the longest of the extant boats from Dahshur, and the only one to measure over 10 metres in length, a factor reflected in De Morgan’s drawings. De Morgan’s illustrated vessel measures approximately 10.2 m, the same length Reisner recorded for GC 4925, and within two centimeters of my measurements, 10.22 m, taken in 2004 and again in 2005 (see table 1). A two centimetre difference over a length of 10.2 m is an acceptable (0.2%) margin of error and is likely explainable by human error in measuring or possibly by shrinkage and swelling of the wood because of relative moisture in the local environment. Generally, tangential shrinkage for cedar can be four percent, with radial shrinkage only two percent. Dimensions for width and depth of hold calculated from De Morgan similarly match those recorded by Reisner and by my teams. Therefore, the boat De Morgan recorded in his publications must be the same vessel later labelled in Reisner as GC 4925: the ‘white’ boat.

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<th>Table 1 Dimensions of the Cairo Dahshur boats (in metres)</th>
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As the labels of ‘red’ and ‘white’ likely originated out of convenience, there is little harm in employing them in reference to the respective Cairo boats discussed here for

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37 A butt joint is where two timbers whose ends have been cut perpendicular to their lengths meet; see Steffy, Wooden Ship Building, 268, fig. G-11b.
38 Discovered 1954, excavated 1955–7: Nour et al., Cheops Boat, 6.
39 De Morgan, Fouilles 1894, 83 fig. 203; Reisner, Models of Ships and Boats, 82–4; Ward, Sacred and Secular, 84 table 8, provides a far shorter measurement for the length of GC 4925 (9.40 m).
the same purpose, even if it is not possible to identify GC 4926 as De Morgan’s ‘red’ boat with absolute certainty.

**Ornamentation**

The boatbuilders included several additional elements that likely had little, if any, structural benefits, a common practice for watercraft from virtually all places and periods. It has long been assumed that the Dahshur boats had decorative finials at the bow and stern, as found on numerous contemporary model boats, and Ward has offered a strong case for their existence. De Morgan recorded an odd construction feature present in 1895 but missing from the boat since before Reisner recorded it: backing timbers, two V-shaped support timbers protruding from the bow (to the right; see fig. 7). Although the backing timbers are now lost, the Khufu vessels yield a parallel. The backing timbers of Khufu I support the large wooden papyriform finials that ornament bow and stern (aft, or rear, of the boat). Although these timbers vary slightly stylistically from the drawings made by De Morgan, as one might expect in boats of vastly different size built seven centuries apart, they appear similar in design. Two or three mortises at the ends of each central strake of the Cairo boats, and also of the Pittsburgh and Chicago boats, provide additional evidence for the former presence of decorative finials. These mortises could have functioned to secure finials, or to provide for towing of the boats as seen in tomb paintings, or both. Deep grooves carved into the stern of the ‘white’ boat probably indicate the presence of vertical ties, which would have been required to secure the finials, the hull planks, or both (fig. 8). Similar grooves exist on the Pittsburgh boat.

Further evidence for the presence of finials, as argued by Reisner, may be found in short, semi-cylindrical rails on either side at the bow and stern, secured by pegs. The rails measure approximately 70–85 cm in length, 5 cm wide at the base, 3.5 cm wide on top, and 4 cm high. They taper slightly from midships towards the ends of the vessel. Rails are extant only the ‘white’ boat, but peg holes on the ‘red’ boat suggest that they would have been present there as well. On the ‘white’ boat, a pair of pegs secures each of the two rails at the bow; four pegs secure those at the stern. The rails

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41 Reisner’s types IV and V, for example CG 4857 (Models of Ships and Boats, xviii–xxiv, 34–7, pl. 9); Ward, Sacred and Secular, 87.
42 Ward, Sacred and Secular, 87; Patch and Haldane, Pharaoh’s Boat at the Carnegie, 29–30.
43 Nour et al., Cheops Boat, pl. 50.a; A. M. Abubakr, and A. Y. Mustafa, ‘The Funerary Boat of Khufu’, Aufsätze zum 70. Geburtstag von Herbert Riche (BABA 12; Wiesbaden, 1971), plan 3; Lipke, Royal Ship of Cheops, 65–9 figs 41, 43, 44; Ward, Sacred and Secular, 49, 51 fig. 18.
44 A mortise is ‘a cavity cut into a timber’ (Steffy, Wooden Ship Building, 276, fig. g–17), typically to receive a tenon, which is ‘a wooden projection’ (ibid., 281, figs G–14e and G–17). Together, these usually comprise a mortise-and-tenon joint, also commonly called ‘tongue and groove’ (see ibid., 276, fig. G–17).
45 A strake is ‘a continuous line of planks running from bow to stern’ (Steffy, Wooden Ship Building, 281).
46 Ward, Sacred and Secular, 85, fig. 36.
47 Ward, Sacred and Secular, 96.
48 For example, see P. E. Newberry, Beni Hasan, I (ASE 1; London, 1893), pl. 39.
49 Reisner, Models of Ships and Boats, 85 fig. 317; Ward, Sacred and Secular, 87.
50 Patch and Haldane, Pharaoh’s Boat at the Carnegie, 30 fig. 14; Ward, Sacred and Secular, fig. 36.
51 Reisner, Models of Ships and Boats, 83.
52 Reisner used the term ‘rail’ in his report (Models of Ships and Boats, 83–7) to refer to the bulwarks.
53 The rails were recorded by Reisner (Models of Ships and Boats, 83 fig. 311 feature ‘d’), but not in detail.
54 Midship, in the general sense, ‘refers to the middle of the ship’ and is a contraction of amidships; specifically, for ship construction, midship refers to the ‘broadest part of a hull, wherever it may be’; see Steffy, Wooden Ship Building, 275.
fill the area between the end of the bulwarks and the beginning of presumed placement of the finials.

Wooden hawk or falcon-head carvings, certainly representing the god Horus, capped the tops or ends of the quarter rudders,\textsuperscript{55} rudder stanchions,\textsuperscript{56} and crossbeams\textsuperscript{57} (fig. 9). The minimum number of carvings associated with each boat is six: one on top of each quarter rudder, one on top of each rudder stanchion, and one on each end of the crossbeam. There may have been additional Horus-head carvings placed on the ends of a second or upper crossbeam,\textsuperscript{58} but an upper crossbeam cannot be confirmed based on the remaining archaeological evidence. Two Horus-head carvings are currently on display with the ‘white’ boat, affixed to the crossbeam resting aft of the bulwarks,\textsuperscript{59} and one can be found on the top of a rudder stanchion with the ‘red’ boat. The carvings have suffered some damage and have been given careful modern restoration. At least four additional Horus heads associated with the boats are in storage. Each measures approximately 14.5 cm in height, 13.3 cm wide at bottom, 7.5 cm wide at top, and 11 cm thick. The bottom or side of each has a square mortise which fit a square tenon to secure it to the vessel, but repairs prevent a reliable measurement for the ancient mortise. Early accounts describe the Horus heads as having blue wigs, yellow faces, and green eyes,\textsuperscript{60} but those on display retain no colour. The carvings in storage have enough pigment to confirm the reported coloration.

\textsuperscript{55} A quarter rudder is a steering element that, mounted on either side of the stern or often on both sides, can be rotated about an axis to control the direction of a vessel; see Steffy, Wooden Ship Building, 279, fig. G–18.
\textsuperscript{56} A stanchion is ‘an upright supporting post’; see Steffy, Wooden Ship Building, 280, fig. G–5 no. 7.
\textsuperscript{57} A crossbeam is a ‘substantial timber’ placed across a pair of strong upright posts (see Steffy, Wooden Ship Building, 268–9, fig. G–10), in this case the stanchions; see also Reisner, Models of Ships and Boats, 84.
\textsuperscript{58} An upper crossbeam placed between the tops of the rudder stanchions would have provided added stiffness and greatly assisted with the steering of the boats.
\textsuperscript{59} A bulwark is ‘the side of a vessel above its upper deck’; see Steffy, Wooden Ship Building, 268, fig. G–5.
\textsuperscript{60} De Morgan, Fouilles 1894, 5, pl. 31; see also Reisner, Models of Ships and Boats, 84.
Steering arrangement

The steering arrangement of the Cairo boats is of a standard type expected for Egyptian riverine craft. Two-dimensional representations and boat models from the Middle Kingdom reveal a standard of one quarter rudder on either side of the stern, supported by large stanchions that are in turn steadied by crossbeams. The Cairo boats conform to this.

The quarter rudder in best condition is representative of the other three and displayed on the deck of the ‘white’ boat (see fig. 1). It measures 3.6 m long, has a blade length of 1.2 m, and originally consisted of three pieces: a long central loom piece and two blade pieces affixed on either side. Carved from the core of a tree, the loom is straight, circular in section, with maximum diameter of 10 cm at midpoint. Approximately one meter from the top of the blade, the round section of the loom begins to flatten slightly. At the point where the loom and blade meet, the section is noticeably more rectangular, ending in a wedge shape at the rounded tip. The loom tapers slightly in the opposite direction, towards its top, but retains its circular shape. The blade’s wings were probably fixed to the loom with both unpegged and pegged mortise-and-tenons, measuring 7.5 cm wide and 1.8 cm thick, of varying lengths. In 2004, it was found that an ancient pegged mortise-and-tenon joined a blade piece to the loom in a quarter rudder associated with GC 4925. Its antiquity was confirmed by the presence of original pigmentation on the peg in place. In 2006, neither the peg nor the tenon was present, presumably due to conservation efforts in the interim. Similar pegged tenon joinery has recently been found on blades at Red Sea harbour of Mersa/Wadi Gawasis, though

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61 A blade is the broad lower piece of a quarter rudder.
62 See also Reisner, Models of Ships and Boats, 86–7, GC 4927.
63 A loom is the stock, or pole piece, of a quarter rudder; see Steffy, Wooden Ship Building, 275.
these may date to the New Kingdom. The remaining pigment on the Dahshur blade suggests another instance of accurate recording by De Morgan.

A square tenon about 8 cm tall by 3 cm square is carved from the top of the loom to accept a carving of a Horus-head, as depicted by De Morgan. About 80 cm below the top of the loom is a 4 cm tall by 5 cm wide square socket angled downward at roughly 45 degrees. This socket would have held a tiller. The arrangement is probably identical to the tiller on a quarter rudder found at Lahun, which was mistakenly identified as an oar.

Each quarter rudder was secured to a boat at two, or possibly three, points. One wing of a blade on each rudder has a 2.5 cm by 2.7 cm hole cut through it about 40 cm from the top. A rope would have run through this hole to secure the quarter rudder to the vessel, a technique also found on boat models and the Mersa/Wadi Gawasis artifacts. It is uncertain if the blade was tethered directly to the hull or if it was tied to the crossbeam: both methods are practical and serve the same function. In order to further secure the quarter rudder, the loom could have been lashed at least three-quarters of the way up to the top of the rudder stanchion, with the bottom of the loom resting on or somehow affixed to the upper aft edge of the crossbeam. The top of the loom may have rested on an upper crossbeam secured between the two rudder stanchions, but modern repairs obscure reliable analysis. Reisner may have found evidence for this in mortises near the top of the rudder stanchions.

The rudder stanchions measure approximately 1.70 m in height. However, processes of modification and restoration have made it impossible to distinguish, in many cases, original features from modern. At their tops they are round in section and gradually change into a square section about 50 cm above where they pass through sockets in an aft beam. The diameter of the rounded area is approximately 10 cm and the width of the square area is 12 cm. The stanchions fit snugly through the second-to-last aft beams and rest in shallow divots fashioned in the hull planks below. As noted by Reisner, the stanchions on the ‘white’ boat do not appear to be a matching set.

The extant crossbeam on the ‘white’ boat is, in all likelihood, a post-excavation reconstruction, and none is found with the ‘red’ boat. The original crossbeam would have needed to be at least 1.5 m long and probably square in section. The high degree of symmetry exhibited throughout the boats suggests that if a second or upper crossbeam existed it would probably have had measurements similar to the first.

65 De Morgan, Fouilles 1894, pl 31.
66 See also Reisner, Models of Ships and Boats, 86 fig. 320.
67 De Morgan, Fouilles 1894, pl 31.
68 A tiller is an extension ‘fitted into the rudder… by which the rudder could be moved from side to side’; see Steffy, Wooden Ship Building, 281, fig. G–18. The tiller is essentially a handle that someone standing on deck could use to direct the boat.
69 F. Petrie, G. Brunton, and M. A. Murray, Lahun, II (BSAE/ERA 33; London, 1923), 12, pl. 15.
70 Zazzaro, in Bard and Fattovich (eds), Harbor of the Pharaohs, 151.
71 Reisner, Models of Ships and Boats, 86, fig. 321.
72 See also Reisner, Models of Ships and Boats, 86 fig. 319.
73 Reisner, Models of Ships and Boats, 84 n. 1.
Construction materials and techniques

Although the four extant Dahshur boats have been known for more than a century, certain basic questions remain regarding their ancient construction methods. The nature of the basic timber joinery method found on each boat has long been a matter of contention. Scientific identification of the timber species used to construct the boats in Cairo occurred only recently when a small selection of hull planks from both vessels was identified as *Cedrus libani*.74

Cedar was valued for many reasons,75 and the Egyptians began importing it during the Predynastic Period.76 This material was sufficiently valuable to prompt, when possible, its reuse, a practice perhaps attested on Khufu I as well.77 Reisner noted some evidence of ancient reuse on the ‘red’ boat,78 but at least sixty percent of the planks in the Cairo boats were formed from repurposed timber. The figure is probably much greater, but the state of preservation and absence of some timbers prevents a complete analysis. Reuse is attested on most extant hull planks by the presence of surplus unmated mortises, leading researchers to dub these vessels ‘wretched’79 or ‘ill-conceived’,80 labels that exaggerate to the point of inaccuracy.81 In the extreme, some unmated mortises are stacked up to four deep on a single plank and reflect at least five previous uses or attempts (fig. 10), suggesting multiple previous uses. Such profuse evidence of reuse suggests that the trees providing the timber that eventually went into these boats were felled considerably earlier than the end of Senwosret’s reign. For example, on the ‘red’ boat, two beams near midships have peg holes, but there are not enough deck planks of sufficient size with peg holes to match: this is probably evidence of timber reuse. For what purpose the timbers were previously crafted is unknown and cannot be determined at present. Dating of the ancient tenon fragments in mortises that do not have a corresponding mate would yield the best estimate of when the planks were previously employed.

78 Reisner, *Models of Ships and Boats*, 86, fig. 322.
80 Landström, *Ships of the Pharaohs*, 90.
Repurposing is almost certain to create misleading radiocarbon dates for these hull timbers. Not surprisingly, radiocarbon dates from the Chicago and Pittsburgh boats yielded a wide range of dates clustered around the twentieth and nineteenth centuries BC, but these boats appear not to exhibit as high a rate of reused timber as those in Cairo. I am not aware of any radiocarbon dating that has been completed for the Cairo boats. Dendrochronology has enormous potential to provide useful dates, but several limiting factors have yet to be overcome for this species and period.

The builders achieved structural stability for the Dahshur boats by combining a few ingenious methods. Hull strength comes from thick planking that is edge-joined with regularly spaced deep mortise-and-tenon joints (fig. 11). Of the large mortise-and-tenon joinery in these boats Steffy wrote that they 'stiffened the hull in the manner of little internal frames, in addition to keeping the planks aligned'.

The centre strake, which is at least 10 percent thicker than all the other strakes in the hull, provides the backbone of the boat. It is not a keel, by strict definition of the term, but serves a similar purpose. Regularly spaced deep mortise-and-tenon joinery fastened each plank to adjoining timbers. The highest frequency of mortise-and-tenon joinery in each hull is found on the centre strake, further reinforcing the boat’s foundation. The joints add considerable longitudinal strength to the vessel but minimal transverse (lateral) integrity unless locked in place.

Pegged mortise-and-tenons, similar to those found on the Uluburun shipwreck which is probably of Canaanite or Cypriot origin and dates c.1320 BC, are rarely found in the Cairo Dahshur boats. Where tenons and pegs are present in the pegged mortise-and-tenon joints of the Cairo hulls they are modern replacements. They are typically

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82 Ward, Sacred and Secular, 83.
83 Steffy, Wooden Ship Building, 33; see also Ward, Sacred and Secular, 97.
84 A keel is ‘the main longitudinal timber of most hulls… the backbone of the hull’, and in cross section it is usually at least twice as thick as it is wide; see Steffy, Wooden Ship Building, 273.
located above the waterline\textsuperscript{86} and in all likelihood reflect modern repairs, not original craftsmanship. Their infrequency and location provide no significant contribution to transverse strength. If from antiquity, pegged holes in the Cairo hulls are apt to be evidence of timber reuse or repair.

At least ten ancient tenons remain in ancient mortises. Ancient tenons in the Cairo boats tapered slightly towards their ends, and originally fit tightly into a mortise with dimensions approximately equal to those of the tenon (tenons measured approximately 7.5 cm wide at center by 1.8–2.0 cm thick by 15 to 25 cm long; length depends on their location in the vessel); they were likely hammered into place.\textsuperscript{87} Ward recorded similar maximal dimensions for the mortises and tenons in the Pittsburgh boat, but noted a nearly 50 percent reduction in thickness and width at their ends.\textsuperscript{88} The Cairo Dahshur boat tenons fit more tightly than those of Khufu I\textsuperscript{89} and those of the boat timbers found at Lisht.\textsuperscript{90}

An unidentified black or grey substance, probably glue, tar, or pitch, coated the remaining ancient tenons and many mortises on the Cairo Dahshur boats. Chemical analysis should be able to determine its composition and whether or not it is a binding agent. The substance is found only on the interior and edges of some ancient mortises and coating some ancient tenons. Modern and ancient tenons are easily discernable. Repairs from 1999 introduced many new tenons that are light in colour and coated in a translucent brown substance, possibly lacquer or wood glue.

The use of adhesives in Egyptian ship joinery is also attested on the Khufu I vessel, in which case the substance was ‘confirm\textsuperscript{ed}’ as ‘probably a glue’.\textsuperscript{91} If the substance on the Cairo boats is indeed an adhesive, this would further lock the tightly fitting tenons and contribute significant transverse strength to the hull, rendering the tenons functionally identical to the pegged mortise-and-tenon joints in the timbers retrieved from the Uluburun shipwreck.\textsuperscript{92} An adhesive would not be as durable as pegging tenons in place, but for use on the relatively tranquil Nile it would have sufficed.

Beams contribute much of the confirmed transverse strength of the Dahshur boats (figs 5 and 6). Holes at each end of each beam indicate that large treenails,\textsuperscript{93} measuring approximately 2.5 by 3 cm and of unknown length, originally secured it tightly to the planks below. No treenails survive, but they were rectangular, nearly square in section. Some of the treenail holes in the ends of the beams have rounded edges and corners,

\textsuperscript{86} A waterline is a construction line on naval architecture drawings; see Steffy, \textit{Wooden Ship Building}, 281, 8–20. On drawings of less structurally complicated vessels, such as the Dahshur boats, these lines can double as load lines on the sheer (side) view (ibid., 276) and indicate how deep a boat sits in the water when empty or when fully laden. See figs 3b and 4b.

\textsuperscript{87} For examples from the Old Kingdom, particularly from the tomb of Ty, see E. M. Rogers, \textit{An Analysis of Tomb Reliefs Depicting Boat Construction from the Old Kingdom Period in Egypt} (MA thesis, Texas A&M University; College Station, 1996), 56, 62 figs 33 and 35. See also the Middle Kingdom ship construction scene from Beni Hasan: Newberry, \textit{Benti Hasan I}, pl. 39.

\textsuperscript{88} Ward, \textit{Sacred and Secular}, 90–2.

\textsuperscript{89} Mark, \textit{International Journal of Nautical Archaeology} 38/1, 134–7.


\textsuperscript{91} Nour et al., \textit{Cheops Boat}, 48. Italics original.

\textsuperscript{92} For discussion of mortise-and-tenon joinery development, see Steffy, \textit{Wooden Ship Building}, 83–5, figs 4–8.

\textsuperscript{93} Similar to pegs, treenails are larger and function in a fashion similar to modern spikes.
suggesting the squared treenails may have been hammered into slightly smaller rounded holes, further securing the joint. The rounding could also be a function of time and degradation, as it is not found on every beam.

Most of the beams appear to be supported from beneath by one to three ‘anchored stanchions’ (see midships sections on figs 3a and 4a). The anchored stanchions are much smaller than the rudder stanchions, being only a few centimeters square and less than 75 cm in length. None of the anchored stanchions remain, but these supports would have been prudent especially for the longer beams near midships. They are evidenced on the ‘white’ boat by shallow square notches on the interior face of beams and corresponding sockets on the hull planks directly below. Modern support boards obscure investigation of the center strake of the ‘red’ boat, making definitive confirmation of anchored stanchions there impossible, but the evidence of anchored stanchions to port (left) and starboard (right) of the center strake strongly suggests their use. I did not find any evidence to support Ward’s suggestion that the anchored stanchions supported a ‘now-vanished’ internal longitudinal support timber.

On the Cairo boats, possible evidence of ligatures, an apparently common form of joinery employed during the Early Dynastic Period, the Old Kingdom, and the early Middle Kingdom, is restricted to the bow and stern and the bulwarks. On the Cairo boats, the bulwarks enclose about eighty percent of the length of the decks. Though now deteriorated at their ends, they were originally situated over all but the first and last beams where the ornamental rails, backing timbers or finials may have spanned. Similar to the Chicago and Pittsburgh boats, individual bulwark planks were joined together to function as a single unit before being secured to the hull. This would have secured the beams further, preventing them from shifting vertically. As the beams had tapered ends and were secured with rectangular treenails, as noted above, this combination contributed significantly to the integrity of the hull. There is, furthermore, another evident element of transverse strengthening: the dovetail joinery (fig. 12).

In each of the extant hulls, dovetail joints are awkwardly set into the inboard faces of the planks, presumably to provide transverse strengthening. The antiquity of the dovetail joints has long been called into question. Reisner proposed that the dovetails are modern replacements. Following Reisner, Ward argues that the original fastenings were lashings (fig. 13a) and that sometime after excavation the lashing channels carved into the face of the planks were refitted for dovetails. However, Ward also notes that the shallowness of the mortises ‘might indicate their relative unimportance in the boat’s construction’. The dovetails, as currently found on the vessels, were probably added in the field shortly after excavation as part of the on-site reconstructions intended to strengthen the hulls for their transport to Cairo and beyond. A report dated 27 October 1894, only

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94 So termed by Ward, *Sacred and Secular*, 85, and used here for clarity. See also ibid., 86 fig. 37.
100 Ward, *Sacred and Secular*, 97.
four months after the boats’ excavation, states, ‘The planks of the hull [of the Dahshur boats in Cairo] are fixed together with dove-tailed dowels and wooden trenails [sic]’. In field modification could explain the low quality of craftsmanship typically associated with these joints, which appear on all of the extant Dahshur boats.

Unsecured dovetails are impractical as a boat’s structural elements because even minimal torsion on the vessel would cause the small wooden pieces to dislodge. In theory, dovetail joints could be used in boat construction if an additional down force is present or they were somehow fixed in place by nail or glue. Certain traditional Japanese boats are reported to use butterfly cramps shellacked in place, however, none of the extant Dahshur boats provides evidence for such additional features in association with the dovetails.

Although the prevailing interpretation of the Dahshur dovetails is that the dovetails are replacements of ancient lashing mortises (fig. 13a), the use of dovetails in association with ancient boat fragments and other maritime artifacts has recently been found at Mersa/Wadi Gawasis. A probable keel-plank segment ‘had two dovetail-shaped mortises on its upper surface in positions similar to … planks in the central strakes of [Dahshur] boats’. At least 12 dovetail tenon halves have also been recovered from the site, and excavators listed them as ‘ship components’, but they cannot be more narrowly associated.

The argument for the existence of lashings in place of dovetails is based largely on ‘eroded original fastenings’ found on the Pittsburgh boat. Lashings would have rubbed consistently and smoothly, but current evidence on the Cairo boats reveals

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102 Ward, *Sacred and Secular*, 93.
104 S. Mark, personal communication, 16 November 2007.
106 See Bard and Fattovich (eds), *Harbor of the Pharaohs*, fig. 68, for an image of dovetail joints chiselled into a stone anchor, though this was likely an architectural adaptation. A variety of dovetail known as ‘cramps’ are also known from stone architecture: see D. Arnold, *Building in Egypt: Pharonic Stone Masonry* (Oxford, 1991), 124–8.
jagged edges, identical to damage caused by ancient or modern chisels. The Cairo Dahshur boats retain no obvious evidence of the use of such inboard lashings.

Reisner states that, as best he could learn from a conservator at the Egyptian Museum, most ‘if not all of the dovetail joints are modern’.\textsuperscript{110} Like Ward, I believe that Reisner was referring to the entire joint.\textsuperscript{111} However, when Reisner then states, ‘[t]he hull is constructed of mortised and tied planking’,\textsuperscript{112} I do not believe he was referring to a previous incarnation of the dovetail joinery, as, for example, inboard lashings. The conspicuous grooves on the bulwark (see figs 3a and 4a) are obvious candidates for this reference to ‘tied planking’, as are the grooves at the stern (fig. 8) and likely at the bow, which is too degraded on the ‘white’ boat to interpret conclusively. When summarizing the basic methods of Middle Kingdom ship construction, Reisner mentions only ‘mortised planking with deck framework’, just as De Morgan described the vessels, without any mention of dovetails or lashings.\textsuperscript{113} It seems unlikely that upwards of 80 curious interior lashings/dovetails per hull would have escaped the recordings of De Morgan and been omitted from Reisner’s summary of boatbuilding methods, had these researchers believed them to be original.

Lashing theory is congruent with earlier Egyptian boatbuilding techniques, and such joinery would have performed better than dovetails when stress was distributed

\textsuperscript{110} Reisner, \textit{Models of Ships and Boats}, xxiii n. 1.
\textsuperscript{111} Ward, \textit{Sacred and Secular}, 93.
\textsuperscript{112} Reisner, \textit{Models of Ships and Boats}, xxiii.
\textsuperscript{113} Reisner, \textit{Models of Ships and Boats}, xxii; De Morgan, \textit{Fouilles 1894}, 82–3.
through the hull. However, the particular style of lashing proposed under this hypothesis would have adverse effects. The joint would have been structurally weak compared to archaeologically confirmed examples found at Lisht and Giza (fig. 13b and c). This discrepancy could reflect the Dahshur boats’ smaller size. The Dahshur funerary boats might not have needed as much transverse strength as the robust Lisht workboats or large ceremonial Khufu vessels. If the Dahshur boats were built with the intent to be buried shortly after a single use in the king’s funerary voyage, or only to provide symbolic riverine transport for the king in the afterlife, the joints proposed by the lashing theory may have been sufficient. Regardless, evidence from the Cairo Dahshur boats supports neither such an interpretation of lashings in place of dovetails nor that the dovetails stood alone. Given the findings above, and further evidence to be presented below, another more reasonable alternative exists.

**Construction philosophy**

Despite De Morgan’s failure to mention either dovetails or lashings in his excavation report or subsequent documents, and his specific inclusion of the mortise-and-tenon joinery that was concealed between hull planks, it has long been assumed that some form of either lashings or dovetails was necessary to complement the transverse strength of the boats. A high frequency of these small structurally weak joints, it is argued, would hold the boats together under stress.

Lashings in the hull of a boat have to be changed frequently when a vessel is in regular use, and possibly during use if they were to break while the boat was engaged. Frequency of repair would be dependent on several factors, above all the material employed for joinery. Ancient cordage which was derived from plant fibers, such as that found in association with the Pittsburgh boat, would need to be changed more frequently than ropes and ligatures made from animal skin and sinew. Tomb paintings indicate that animal hide rope was a possibility, and one particular Coffin Text spell (CT 404) alludes to animal skins and sinews employed as ropes for boats. In general, a variety of materials are known to have been used to make rope. No evidence of rope or cordage of any composition was found on the Cairo boats, but some seams were inaccessible.

The study of recent finds from Mersa/Wadi Gawasis demonstrates that copper strips are yet another joinery candidate, as Reisner suspected, but at present their use cannot be confirmed in hull construction. Similarly, on Khufu I, copper staples were used to reinforce some grass-rope joinery, especially on the finials. Copper strips

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121 Reisner, *Models of Ships and Boats*, 85, 87
122 Nour et al., *Cheops Boat*, 49.
would require far less attention than organic lashings for use on the Nile, but the Cairo boats provide no apparent evidence for their use, structural or ornamental.

The interior of the Khufu I hull had over 5,000 m of lashing material, but the deck consists of prefabricated panels secured to the beams with only lashings, permitting easy access to the interior for inevitable repairs. However, all of the deck planks of the 'white' boat were secured to the beams with pegs, and this was also probably the case for the Chicago and Pittsburgh boats. Ward states that '[m]ost deck planks have peg holes … for fastening their ends to beam ledges', but it is unclear to which boat(s) she is referring: only the Pittsburgh and Chicago boats qualify. The 'white' boat does not have beam ledges (rabbets) and the 'red' boat has predominantly unpegged deck planks set into beam rabbets, as previously noted. Fastening deck planking renders it difficult to access the areas where the inboard lashings were purportedly located. This is especially remarkable given that three of the four Dahshur boats (Chicago, Pittsburgh, and the 'red' boat) employ another deck construction technique, deck planks set into rabbets (see fig. 6), which would have provided easy access to the hull. Even if these boats participated only in the funerary voyage, access below deck for repairs would have been necessary in case of incident.

My investigation of the Cairo boats suggests an alternative interpretation to lashing theory: the required transverse strength came from a combination of other attested construction methods, obviating the need for either dovetails or inboard lashings.

Alternate construction hypothesis

The application and benefits of arches to redistribute stresses in Ancient Egyptian architecture are well documented. Ancient Egyptian boatbuilders appreciated this concept, but most examinations of the Dahshur boats have overlooked it, with C. J. Bell’s remarks being a notable exception. In the Cairo Dahshur boats, application of the arch (inverted) is clearly visible in a cross-sectional view (see fig. 3a). More precisely, the Dahshur boats employ a tapering barrel vault in their construction. To paraphrase Dieter Arnold, a barrel vault is semicircular in cross section (with length greater than diameter), based on the arch system, and composed of wedge-shaped pieces. The Cairo boats use repetitive inverted arches, semicircular in cross section. Most hull timbers are slightly wedge shaped, that is, their inboard (interior) faces are narrower than their outboard (exterior) faces, held in place by the aid of mortise- and-tenons. While this application of the arch may not have provided as much strength as a traditional architectural arch, it would still redistribute stress throughout the hull, particularly when heavy loads were placed on the deck. At the bow and stern of the Cairo boats, there are even keystone-like timbers present (fig. 14).

The fore-most (C1) and aft-most (C3) planks making up the center strake are beveled on the sides of their outboard surface, creating a flat bottom approximately 15 cm

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wide running the length of the boat. The bevel is significantly more prominent on C1 compared to C3, where it is barely noticeable owing to fuller sections aft of midships. If a cross section of the planks is represented by a trapezoid, the beveling would best be understood as a removal of the lower corners, creating a resemblance to a keystone at the top of an arch, but here inverted.

It is likely that the most important method of weight redistribution for the boats was the combination of beams and honeycomb-like shaping of planks, a pattern known as ‘top-and-butt’ planking. This method pairs the weakest points of each row of planks (the joints) with the strongest point of adjacent planks (the widest part). Adjacent strakes do not have joints in line with one another. The planks above and below each butt joint exhibit their maximum widths at these locations, giving the hull planking an elongated honeycomb-like construction (see fig. 4a).

The concept of redistributing stress within a hull was already old by the time the Dahshur boats were built. Boatbuilders dealt with this problem in a similar fashion at least 700 years earlier, by employing puzzle-like interlocking, or ‘joggling’, on Khufu I, and indeed on the Lisht timbers. Joggling was unnecessary for vessels of only 10 meters, especially when built using deep mortise-and-tenon joinery, which was absent from the earlier boats. The pairing of weak points with strong points in the hull was mirrored on either side of the central strake. Placing joints on adjacent strakes as far apart from one another as possible distributed the stresses on the vessel as equally as possible, thereby maximizing the strengths and minimizing the weaknesses of individual planks.

While keystones, arches, and top-and-butt planking with frequent mortise-and-tenon joints are strong and efficient ways to redistribute lateral stresses and keep the hull aligned, each requires sufficient gravitational down force (in this case at the deck level) to counterbalance the rising force of the water and buoyancy of the wood. The boatbuilders used the weight of the vessel itself and probably counted on additional

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130 See also Ward, Sacred and Secular, 89.
131 Steffy, Wooden Ship Building, 291.
132 Steffy, Wooden Ship Building, 273, fig. 3–3.
weight on deck, in the form of passengers, for example, or cargo, to provide the down force.\textsuperscript{33} However, the integrity of the hull relies more on each element being locked to the next than on loaded decks. It is the interaction of all of these technologies that ensures their success.

Figure 15 indicates a combination of methods present on the Cairo boats that could have provided sufficient hull stability, without the aid of dovetails or frequent inboard lashings. Each ‘1’ in the figure represents a presumed binding around the fore- and aft-most timbers.\textsuperscript{34} These may have served a dual purpose: to attach the decorative end pieces and to prevent the hull timbers from slipping.

With the bow and stern bound, and approximately 175 deep mortise-and-tenon joints securing each hull, the hull planks could not slip longitudinally. If the mortise-and-tenon joints were indeed glued in place, they would have provided significant transverse strength to the hull. These joints, not indicated in fig. 15, are distributed throughout the hull, with slightly greater concentration in the lower part of the hull, especially the centre strake.

In the same figure, a ‘2’ represents the joinery method used to secure the individual timbers within the bulwark, creating in effect a long unified timber. A number ‘3’ represents a diagonal ligature attachment of the bulwark to the fore-most and aft-most planks in the hull,\textsuperscript{35} which were locked to the remainder of the hull by bindings at the bow and stern. This prevents the beams from slipping in a vertical direction. Tapered ends (see figs 5 and 6) recessed into the planks below, and their rectangular-pegged extremities, prevent beams from shifting in a transverse direction. Each number ‘4’ represents a rectangular treenail penetrating the extremity of a beam and into the plank below. These further prohibit any movement of the primary transverse stiffeners.

\textsuperscript{33} Bell, \textit{Ancient Egypt and the East} 3–4, 101–2.
\textsuperscript{34} Reisner, \textit{Models of Ships and Boats}, 85; Ward, \textit{Sacred and Secular}, 87.
\textsuperscript{35} Also found on the Chicago boat; Haldane, \textit{The Dashur Boats}, 27 fig. 12.
When the boats were placed in the river, the planks would absorb water and swell, making the hull watertight, or nearly so, resulting in tighter joinery between all the timbers. Holland stated that the ‘seams and joints’ of the Pittsburgh boat were ‘filled with bitumen’ to make the craft water tight.\textsuperscript{136} While this could not be confirmed for the Cairo boats, it would have resolved any outstanding leaks that the swelling alone would not.

**Conclusion**

Irregularities and incompatible statements in the written record may be clarified by the subtle but significant differences found after investigation of the Cairo boats themselves. Based on the evidence in Cairo, De Morgan’s excavation report should be understood as a reliable resource when considered in the perspective of the knowledge available at the time.

The Dahshur boats were well built, but not designed to withstand the rigors of open sea travel, where wave action adds to the structural concerns. These are Nilotic craft, designed for efficient travel on relatively calm and predictable interior waters. For these conditions, given a combination of tight fitting deep mortise-and-tenon joinery (possibly glued in place), unified bulwarks, beams locked in position, careful positioning of planking strengths and weaknesses, and a bound bow and stern, the hull, when swelled by waterlogging, would have functioned as a single consolidated unit without the addition of interior fasteners.

Nevertheless, as Ward states, ‘it is difficult to speculate about [a technique] that no longer exists in its original form’.\textsuperscript{137} As such, I offer the above construction interpretation as a possible alternative to the current suggestions of lashing and dovetail use, accounting for the evidence found on the Cairo Dahshur boats. Perhaps the only way to definitively understand the construction of the Dahshur boats is to locate and study the missing fifth boat, provided it remains at Dahshur or has otherwise avoided modern rehabilitation.

\textsuperscript{136} Holland, *Biblia 15*, 78.

\textsuperscript{137} Ward, *Sacred and Secular*, 97.
Comparison of deck arrangements and colours: a) GC 4925, the ‘white’ boat and b) GC 4926, the ‘red’ boat (S. Koepick and author).

FURTHER INVESTIGATION OF THE DAHSHUR BOATS