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Notes

Super-Sized Egyptian Ships

Excavation and documentation of the pharaonic harbour at Mersa/Wadi Gawasis on Egypt's Red Sea coast continued in December and January of 2009–10 under the direction of Kathryn Bard (Boston University) and Rodolfo Fattovich (University of Naples l'Orientale) and the joint Italian-American team active there since 2001. In addition to identifying new ship-components, maritime-team members focused on examining plank-segment T64, first recorded in 2006–07 (Calcagno and Zazzaro, 2007), and a deposit of ship timbers outside the entrance to Cave 6, as these provide a substantially extended view of seafaring capabilities.

The harbour and its galleries (referred to as 'Caves') functioned as an intermittent base of operations for state expeditions staged from Koptos and focused on the acquisition of exotic materials and animals from Punt, or God's Land, for *c*.500 years, beginning in the late Old Kingdom (Bard and Fattovich, 2007) and continuing into the 16th century. Ships built of imported cedar of Lebanon at yards on the Nile were disassembled, transported 90 miles across the Eastern Desert to Gawasis, and re-assembled for a round-trip voyage to the southern Red Sea of at least 1500 miles. Extensive remains of shipworm damage to exterior planking surfaces, and a range of recycled ship timbers and other maritime artefacts, attest to shipbreaking activities at the end of voyages as well (Ward and Zazzaro, 2010).

The remains of large ships in the form of hull-planks 140–225 mm thick exhibit classic Egyptian hull–construction techniques documented on rivercraft (Ward, 2000), and smaller vessels used a previously-unrecorded system of hull fastening relying on small mortise-and-tenon joints augmented by a sewing system that is the oldest example of construction techniques more frequently associated with the Indian Ocean and Persian Gulf. Because all of these timbers show consistency across fastening dimensions, spacing and proportions, and because they were found in a context of re-use or storage, it is particularly difficult to assign individual timbers to an individual ship. T64 and the deposit of steering-gear outside Cave 6 offer a significant exception to that problem.

Excavated and briefly examined in 2006–07 (Calcagno and Zazzaro, 2008), T64 (Fig. 1) is a segment of a strake fastened to the keel, originally positioned at the waterline. Cut down from the original plank, T64 is 1060 mm long, 505 mm wide and 225 mm thick. This massive plank-segment in good condition was along the edge of Cave 3 with extensive tool-marks on its upper (inner) face, suggesting its re-use as a work-bench. Its south end was embedded in and linked to plank T61 by mud plaster. Sediment around it included a short rope noose with a frayed knot, a sandal-sole, and part of a tenon, as well as many bits of rope and string.

T64 is roughly trapezoidal, and both ends were sawn, chiselled and adzed apart from adjacent plank-segments at an angle of *c*.60 degrees to the wide faces. Its fastenings include deep mortise-and-tenon joints, some pegged, dovetail fastenings, and ligature for copper strips. Angles of dovetail mortises to adjacent plank positions, and patterns of shipworm damage and staining, indicate its original position in the area of the waterline. The size of the mortise-and-tenon joints corresponds to loose tenon fragments on the surface of Cave 3; complete tenons probably measured 45 cm long, nearly twice the length of other tenons recorded in the Type 2 ship-hull planks at Gawasis as well as other Egyptian watercraft.

Its outer face (OF) is identified by its convex curvature and the presence of shallow shipworm tunnels and holes at End 1 and along the inboard edge. Its surface is now brittle with insect damage and termite tunnels visible all along it and on the plastered IB edge. The relatively limited amount of shipworm damage on the OF suggests it was only submerged in water near End 1, where a 12-cm-diameter knot preserves the original surface and dimensions. The inner face is smoothly finished, but many tool-marks across its surface, as well as the remains of original dubbing marks, suggest its secondary use.

The outboard edge is identified by the angle at which dovetail mortises are set. Inboard, the bottom of the mortise is at 89° to the edge, indicating a relatively-flat transition to the adjacent plank, almost certainly the keel. The opposite dovetail mortise angle is 98° to the edge, indicating a rising hull curvature and the outboard edge. The mortises each have pry-marks, and Rainer Gerisch has identified dovetail tenons found on the gallery floor, and of an appropriate size to fill these mortises, as *Acacia nilotica*. The outboard edge has dubbing marks across its surface and a series of adze-marks at about 45° to the wide faces near the IF. These probably represent removal of a damaged surface during disassembly and reworking.

The inboard edge has gribble and teredo-type damage visible up to 45 mm from the outer face near End 2, but similar damage is recorded only for the first

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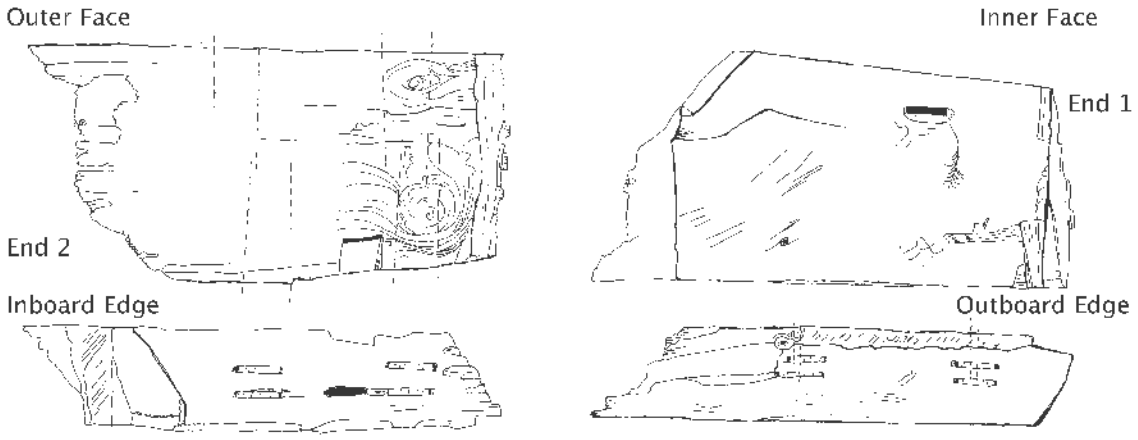

Figure 1. Plank segment T64 has maximum dimensions of 106 mm long, 505 mm wide and 225 mm thick. Its fastenings include free tenons in mortises 250–260 mm deep for a total reconstructed tenon length of *c.*450 mm, mortises for dovetail tenons, and a copper ligature that passed through the entire thickness of the piece, helping to locate it as a strake-end attached to a keel.

20 mm at End 1. A dark stain crosses this edge at an angle of 22–24° from the outer face to the inner face. The stain appears to indicate the waterline, as it corresponds to the degree of teredo damage, permitting an identification of End 1 as that part of the plank closest to the end of the ship, though it is not possible to tell whether it is the forward or aft end. Neither 'End' is original to the hull-plank but reflects reshaping. A modern 22-mm-diameter hole has been drilled into the plank from the inboard edge for dendrochronological sampling. End 1 is relatively evenly cut, while End 2 changes angles sharply near the inner face and has extensive and frequently deep chisel-, saw- and adze-marks over its surface. Both ends seem to have been cut from the outer face towards the inner face at an angle, and then sawn at *c.*90° from the inner face to meet the saw-cut, which in each case was *c.*150 mm long.

Fastenings

Deep mortise-and-tenon joints, locked deep mortise-and-tenon joints, a ligature for copper strips, and dovetail-tenon mortises are present on T64. On the inboard edge, two pairs of mortise-and-tenon joints (M7-M8, M9-M10) are spaced *c.*330 mm centre-to-centre at 75 and 90 mm from the outer face. The mortises measure *c.*10.5 mm wide, 22.5 mm thick, and 280–290 mm deep. On the outboard edge, two pairs of locked mortise-and-tenon joints (M3-M4, M5-M6) are locked by 20-mm-diameter pegs driven from the inner face at 95 mm from the outboard edge. The Nile acacia pegs pass through both tenons in each pair of outboard joints. Tenons 3 and 5 were extracted to discover whether the peg passed through both tenons. They were cleanly sawn at the plank edge. About 25% of Tenon 3 was insect frass, but the rest was very hard and fitted so tightly in the mortise that the tenon had to be broken to remove it. Tenon 5 was about 50% frass on its outer edges but still close-fitting in the central portion. Mortise dimensions are comparable to those on the inboard edge.

A ligature for copper-strip bindings is located between the tenon pairs on the inboard edge. The 95-mm-wide ligature channel is cut vertically through the plank thickness. It is located in a recess on the outer face that extends *c.*85 mm from the inboard edge. The channel is about 13 mm thick, and copper corrosion products indicate five 22-mm-wide strips passed through it. A second channel intersects it. This channel is in line with M8 and M10 on the inboard edge, and it is angled from *c.*130 to 160 mm above the outer face within the channel. It is roughly cut with a blade that was 1 cm long. This channel may have been for access to the ligature or for a wooden chock as no copper-corrosion products are present on its surfaces.

Timber deposit outside Cave 6

A deposit of carefully-stacked timbers outside the entrance to Cave 6 proved to incorporate a pair of steering-oar blades (T72 and T85), probable segments of a loom, and a number of unidentified smaller planks (Fig. 2). The upper layers of this deposit were first excavated in 2005–06, when team archaeologists removing sand from the slope began to encounter small wood boxes. All timbers are extensively damaged by a heavy layer of salt encrustation and some are heavily eroded and preserved only in fragments. Conservator Howard Wellman protected the exposed areas with a layer of cyclododecane and then the timbers were reburied for more delicate excavation with full conservation support in the coming year.

Figure 2. A deposit of timbers mostly related to steering equipment was aligned outside the entrance to Cave 6. It lay beneath a completed hull-plank from the end of a strake (T34) and a pile of boxes, some painted with the name of Amenemhet IV, who ruled between 1786 and 1778 BC.

Steering-oar blades T72 and T85 were shaped from *Faidherbia albida*, like the lower half of blade T2 discovered in 2004–05 (Zazzaro, 2009). T72 is 3250 mm long and roughly triangular, 20.5 mm thick and *c.*650 mm wide at the lower end; its inner edge is convex to fit around the loom and a 90-mm-diameter hole for a line is present at the upper end. T85 is an impressive 4.2 m long and at least 85 cm wide, with paired mortise-and-tenon fastenings and copper-strip ligatures to link the blade and the loom. Its upper end has two holes for rope lines to secure the blade to the hull.

Analysis

Plank fragment T64 is close to the end of a strake which touched the keel and connected to the keel and to another plank by dovetail tenons at what is now designated End 1. The overall shape and the ligature position, if analogous to that of complete plank T34 (Ward and Zazzaro, 2010: fig. 5), suggests T64 was cut from a knife-shaped plank; the tip of T34 is 500 mm beyond the ligature. The length of the tenons used to fasten this plank is at least 450 mm, and a number of tenon-fragments found on the surface of Cave 3, previously classified as 'large' tenons with a more regular rectangular shape, are probably broken examples of T64-sized tenons.

Similar gigantism is reflected in the size of the steering-oar blades. Blades T1 and T2 were 2 and 1.8 m long, and 400 and 350 mm wide. Blade T85 is more than twice the size of T1, and T72 is almost twice the size of T2. The reconstruction of a steering-oar fitted with T1 and T2 was more than 5 m long for a ship 20 m long; the size differential suggests that these blades would have been used on a hull of *c.*30 m.

A full-scale reconstruction of the original plank T64 was cut from is planned, and models of the proposed steering-oar from outside Cave 6 will be built to test the proposed configurations through December, when excavations will begin again at Mersa/Wadi Gawasis.

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