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In 1998 an Indonesian sea-cucumber diver stumbled across a mound of ceramics on an otherwise flat, featureless seabed (fig. 1). A number of bowls and ewers were recovered. The distinctly coloured ceramics were readily identified as originating from the Changsha kilns of Hunan province, China. This ware was only made during the Tang dynasty (618–906), with the earliest dated piece bearing an iron oxide inscription, 'kaicheng sannian jiuyue' (the ninth month of the third year of Kaicheng era), equivalent to 838.[1]

The position of the site was sold to Seabed Explorations GBR, a German company that holds a survey and excavation license issued by the Indonesian Government. The company carried out excavation work in September and October of 1998. Work was suspended during the north-west monsoon and recommenced in April 1999. The author directed the excavation during the second season.

The fact that this very significant wreck has only recently been found is surprising. It lies only 4

1 Satô Masahiko and Hasebe Gakuji 1976, pl. 249.

Fig. 1 A large part of the shipwreck mound comprised stacks of Changsha bowls (Photograph: M. Flecker).

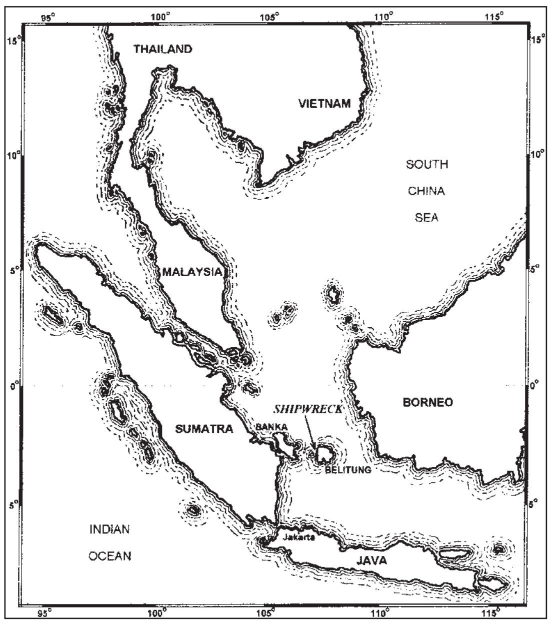

Fig. 2 Shipwreck location plan (Drawing: M. Flecker).

nautical miles north of the main town and port of Belitung Island, Tanjung Pandan, and less than two miles offshore, in position 2° 41’ S, 107° 35’ E (fig. 2). The depth of the site is only 17 m, with reasonably clear water over a silty-sand seabed. The mound was over a metre above the surrounding seabed level, with several coral conglomerates standing proud of that. The hull remains were approximately one metre below seabed level, or two metres below the top of the mound. The area is frequented by fishermen and sea-cucumber divers, but is clear of commercial shipping due to an extensive reef system.[2] A reef – Batu Hitam (Indonesian: Black Rock) – just 150 m to the northwest of the wreck site was more than likely the cause of the loss.

The bulk of the ceramics cargo was recovered during the first season of excavation. The site was gridded and records were kept of the recovered from each grid square. During the second season a new grid was installed parallel to the longitudinal hull remains. The original skewed grid had been damaged during the monsoon, although it remained sufficiently intact to correlate with the new grid. Large coral conglomerates and lime based concretions, which entrapped lead ballast ingots, made it impossible to record the hull in its entirety. But despite these limitations several key areas were recorded in detail, while many other areas were documented on film and video. Wood samples were also taken from most of the main structural elements for identification.

The construction technique was immediately evident. Every timber was fastened with stitching, with no sign of wooden dowels or iron fastenings. This was the first suggestion of an Arab or Indian vessel. The later discovery of through-beams reinforced the supposition. Identification of wood samples has removed all doubt. This is the first ancient Arab or Indian shipwreck to be found and excavated. Its cargo of Chinese ceramics and its location in Indonesian waters at last provides irrefutable evidence for direct trade between the western Indian Ocean and China during the latter part of the first millennium.

While Arabia and Persia must certainly be regarded as two distinct and independent trading nations, it is impossible to differentiate between ancient Arab and Persian ships based on historical evidence. Indeed, it is very difficult to differentiate between Middle Eastern ships and those of India, the interaction and inter-influence across the Arabian Sea being so great. Therefore, for the sake of convenience Arab and Persian are both incorporated in the term ‘Arab’ in this chapter, unless clearly stated otherwise.[3]

2 A French chart of *c.* 1820 names the anchorage off Tanjung Pandan, “Treacherous Bay”.

3 This practice has historic precedence. The Abbasid caliphs (750–870) encouraged the fusion of their Arab and Persian subjects into a Muslim unity, speaking Arabic. Thus when we come to the ninth-century Arabic records of sea trade with the Far East, we find mention of Muslims and Arabs far more than of Persians (Hourani 1995, 65).

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The ship

The hull remains are extensive and relatively well preserved (fig. 3). The 15.3 m long keel is believed to have survived intact. The bow, inclusive of a section of the stem-post, heads 170°. Much of the hull and cargo have collapsed to port, clearly evidenced by a twisted garboard strake at the bow (fig. 4) and a general lateral displacement of hull timbers and cargo. This makes theoretical reconstruction problematic. The hull planking also collapsed prior to any significant sediment build-up, and consequently lies flat on the seabed. At the widest point the hull extends 5.1 m to port from the ship's centreline.

Keel, keelson, and stem-post

Due largely to the aforementioned lead ballast and lime based concretion, the keel was only observed at the bow (fig. 5). It is of remarkably light U-section, being only 15 cm moulded and 14 cm sided. There is no sign of any cant. Rather it runs level to the prow where it rises slightly to fit the stem-post at a horizontal mortise and tenon joint (figs 6, 7). The mortise and tenon, measuring only 5 cm square and 3 cm deep, facilitates alignment and prevents lateral movement, but otherwise lends little strength to the junction of stem-post and keel. Strength is provided to some extent by stitching with 1.6 cm

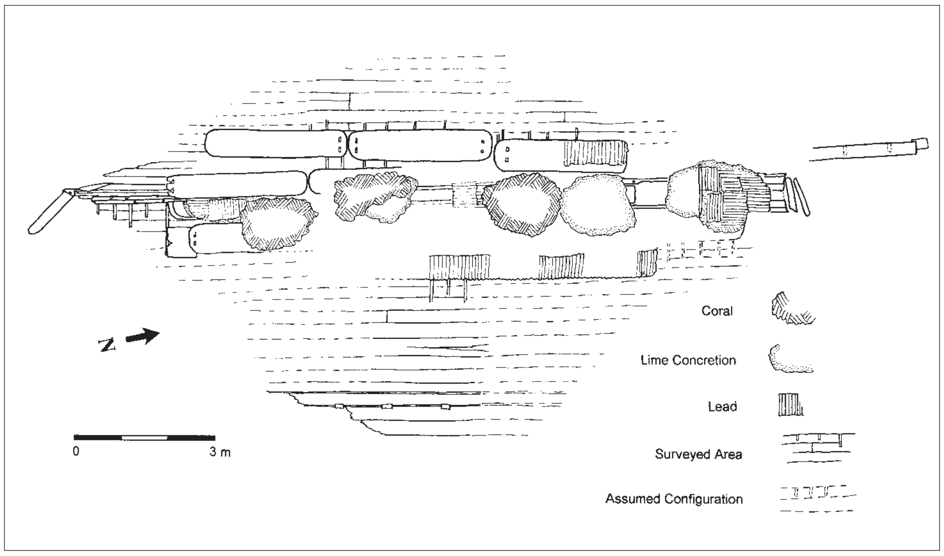

Fig. 3 Overview of the hull remains (Drawing: M. Flecker).

Fig. 4 A sharp twist in the garboard strake caused by the hull collapsing to port (Photograph: M. Flecker).

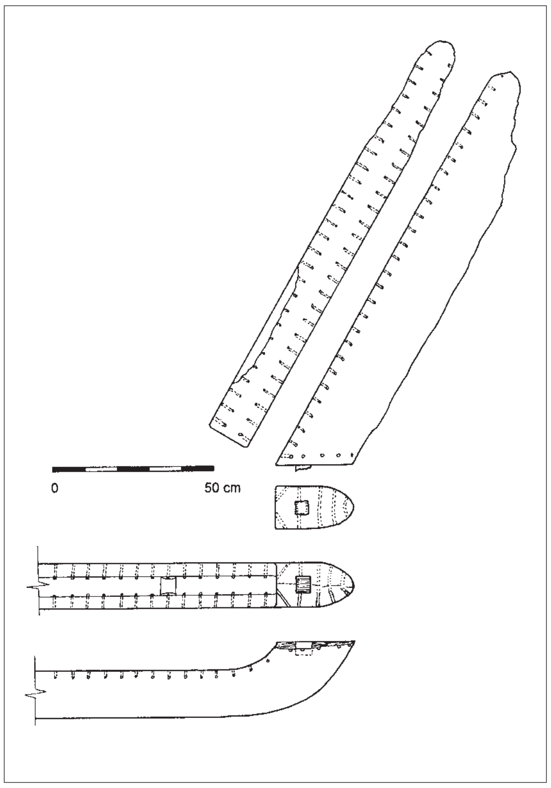

Fig. 5 Keel at the bow, and stem-post (Drawing: M. Flecker).

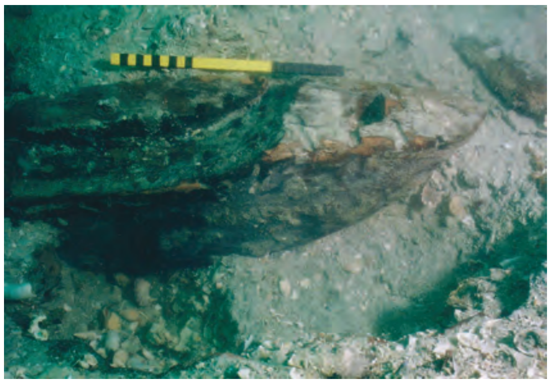

Fig. 6 The foremost end of the keel showing its finely carved lines (Photograph: M. Flecker).

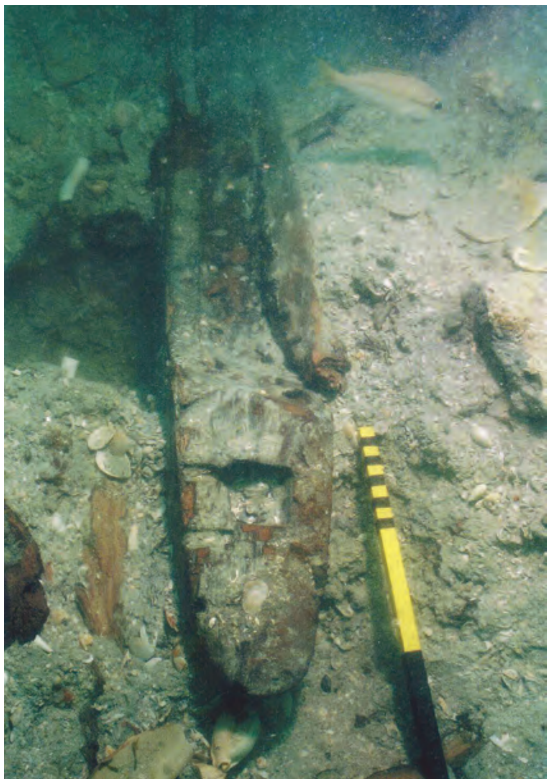

Fig. 7 The foremost end of the keel showing the mortise and tennon joint. Part of the port garboard strake is still stitched in place (Photograph: M. Flecker).

diameter rope, but mostly by the stitched in hull planking. The stem-post base is cut at an angle of 29°, which gives a 61° angle of rake to the bow.

There is no rabbet for hull planks in either the keel or the stem-post. The plank edges are simply faired to the correct angle and butted directly against the flat surface of the keel and stem-post (fig. 8). Diagonal holes at 5 to 6 cm spacing provide for the stitching. Two small carved lugs were observed on the keel between the garboard strakes near the bow. There are no holes through these lugs, so their purpose remains unknown, unless they were simply to provide some minor lateral support for the garboard strakes.

The stem-post is made from rosewood (either *Dalbergia sp.* or *Pterocarpus sp.* of the Leguminosae family). This is a durable hardwood that is easily worked and takes a high polish, hence its present importance to the furniture manufacturing industry.

With such a weak keel a substantial keelson becomes essential to provide longitudinal stiffness to the vessel. Indeed there is a keelson, or at least

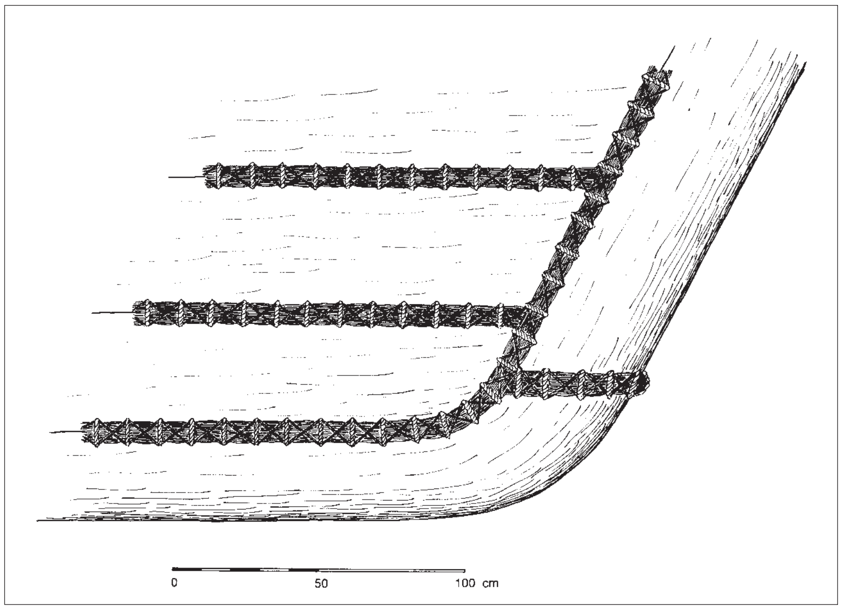

Fig. 8 Reconstruction of the forefoot of the bow (Drawing: M. Flecker).

an Eastern equivalent (fig. 9). Part of it is exposed near the bow, although it has been displaced to port and lies at a 45° angle (fig. 10). It is larger in section than the keel, being 18 cm moulded and 21 cm sided, and narrows towards the bow. The forward end terminates in what appears to be a complex scarf, and yet there is no space for another timber to be attached. Notches are cut out on each side of the underside of the keelson where it rests on the half frames. It is interesting to note that these half frames are not transversely aligned, but are longitudinally offset with the port frame forward of the starboard frame.

There is a 7 cm wide notch cut through the full depth of the keelson, 40 cm from the forward end, implying that there was a vertical element originally fixed there. A grown knee, or rather chock, was found under the keelson where the ceiling timbers begin. It seems to have supported the keelson some 20 cm above the keel, and provided additional lateral support.

The keelson chock seems to be made of fig (*Ficus sp.* of the Moraceae family), although this identification is tentative.

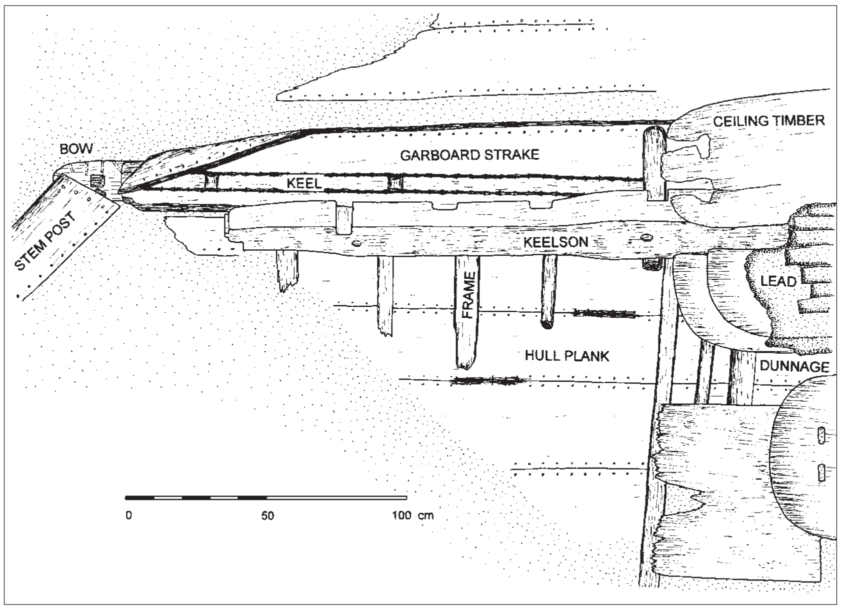

Fig. 9 Detail of the hull remains near the bow (Drawing: M. Flecker).

Fig. 10 A curved frame underlying the keelson, which is canted 45° to port (Photograph: M. Flecker).

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Two shallow circular recesses have been cut into the upper surface of the keelson. They are 5 and 5.5 cm in diameter, only 1.5 cm deep, and have remnants of lime compound within. They closely resemble good-luck *baosongkong* found on the keel scarf joints of Chinese ships.[4] However, they are not at a scarf joint, and there is no evidence that this practice was followed by Arab shipbuilders. They could have formed the base of light stanchions, a theory that is reinforced by another timber found loose on the site, which otherwise proves enigmatic.

This loose timber was found some 5 m to port of the aforementioned piece, however it may have been moved from anywhere on the site during the first season of excavation (fig. 11). It is 2.38 m long, 24 cm sided, and 21 cm moulded, and very similar in shape to the exposed keelson, particularly the scarf-type end (fig. 12). But in this case the scarf at the end of the loose timber is rotationally offset 90°. Notches for frames can be used to orient the timber. They occur on both sides of one surface only, which is presumably the underside. Strangely the notches are considerably larger on one side than on the other, implying a degree of asymmetry in the framing. The upper surface displays two shallow circular recesses, slightly larger than those on the keelson, with diameters of 6 and 6.5 cm respectively from the scarf end. One of them is full of lime compound.

The original location and function of the loose timber must be deduced. The only area of the ship's centreline that appeared to have been

4 Green et al. 1998, 283. In traditional Chinese shipbuilding circular recesses are carved into the scarf joint, often in the configuration of a star constellation, for placing coins and mirrors as a symbol of good-luck or longevity.

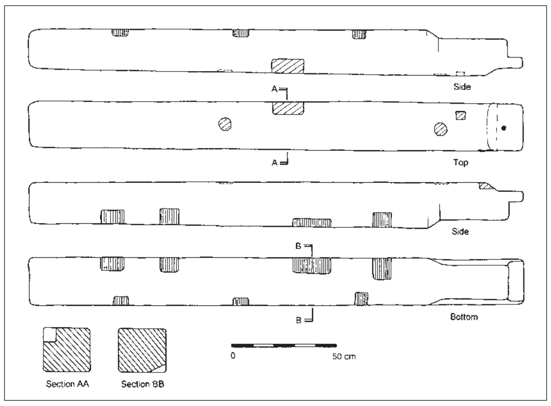

Fig. 11 Stringer found loose on the site (Drawing: M. Flecker).

Fig. 12 The scarf-type end of the loose stringer (Photograph: M. Flecker).

disturbed during earlier excavation was the bow. And yet there is insufficient space in the V-shaped bow for two parallel keelson timbers, so the loose timber must have come from further aft. The asymmetry of the notches on the loose timber provides the only clue. On one side they are uniformly sized and spaced, as would be expected for frames. On the other they are variously shaped and spaced. It is possible that this piece was a starboard-side stringer, originally placed in the area between the two foremost extant ceiling timbers. The asymmetric notches may have been for separate floor timbers.

Indeed there are stringers near the stern. A heavy timber, 28 cm moulded and 35 cm sided, just protruding from a large lime concretion is flanked by two relatively light section stringers (fig. 13). The starboard side stringer is 15 cm sided and 13 cm moulded, and narrows in section before entering another concretion further aft. Interestingly, it displays a shallow circular recess on its upper surface as per the keelson and loose stringer. The heavy central timber terminates at the concretion. Whether this is the aft end of the keelson or part of a mast-step is unclear. Two more very light stringers were observed under the lead ballast amidships, but these were above the level of the ceiling timbers. They are sided and moulded 8 cm.

There is no sign of any fastening for the keelson. In Western ship construction large iron bolts run through the keelson, frames and keel to rigidly clamp it in place, effectively creating an integral stiffening member. Without stout fastening the

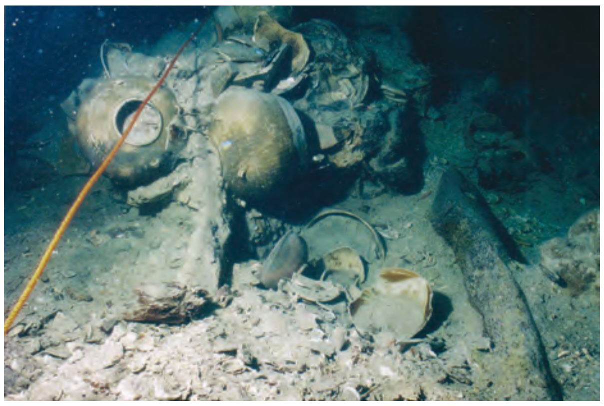

Fig.13 Two stringers protruding from a lime-based concretion in the aft part of the ship (Photograph: M. Flecker).

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keelson seems to be of little use other than as a support for the ceiling timbers.[5] No rope holes were observed on the *in situ* keelson, however one hole was recorded near the end of the scarf of the loose stringer.[6] It seems that lashings must have passed over the keelson and under the frames to hold it firmly in place. None of those lashing have survived, but there are two 6 cm wide indentations on the upper edge of the visible keelson section which may have been caused by large ropes.

While neither the keel nor the keelson were detected at the stern, the truncated ends of what may have been the garboard strake and several adjacent planks were observed. This termination of the hull planks is taken to be the stern of the ship. A single stitched plank and a short beam lying athwartships just aft of this point may have been part of a transom. But this is unlikely as Arab ships of this period are thought to have been double-ended. A long, highly eroded timber, with unusual transverse timber inserts, lies roughly parallel to the hull and aft of the main structure. It is 34 cm wide and 22 cm thick. There is a reasonable chance that it is the stern-post.

Ceiling

The ceiling of this ship is a far cry from the ceiling of a Western ship, but the purpose is similar so the terminology is thought to remain appropriate in this context. The ceiling timbers are in fact large slabs of wood that have been placed across the keelson, stringers and frames as a supporting bed for the lead ballast and cargo (fig. 14). There are as many as five ceiling timbers athwartships and four along the ship's length. They range in length from 2.80 to 3.08 m, in width from 46 to 65 cm, and in thickness from 5 to 6 cm, and have rounded ends. Several are half sections, having only one corner rounded and all

5 A naval architect has suggested that the weight of the lead ballast and cargo may have pressed the keelson against the frames with sufficient force to render fastening redundant (June 1999, personal communication).

6 This hole must have had an exit point, but it was not observed.

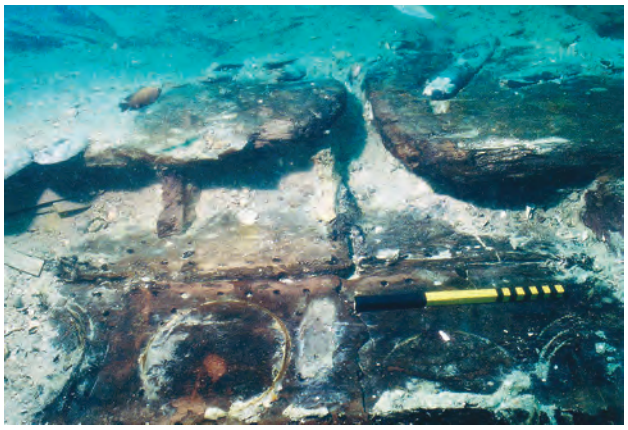

Fig. 14 The ends of two ceiling timbers supported by frames. Hull planks are marked by upturned bowls in the foreground (Photograph: M. Flecker).

other corners square. Two such pieces are stacked on top of each other just to port of the keelson near the bow, and another was found loose. A short square shaped piece is located adjacent to the ceiling timbers near the bow. The forward end has been broken off, but given the fibrous nature of the wood, and its location so near the bow, this break is thought to be original. Most of the timbers have a pair of small rectangular holes at each end, although some have the holes at one end only.

The author is of the opinion that these ceiling timbers were removable. The primary evidence for this is the large quantity of neatly stacked ceramic bowls found well under the timbers. A few stacks could be easily explained by cargo shifts during the wrecking process. But these bowls were stacked several layers deep and under the inner ceiling timbers. Furthermore they are stacked just high enough to fit beneath the ceiling. They may well have been stowed prior to installing the ceiling. The pairs of holes in the ends of the timbers provide the only points for lashing, but none was observed. It is thought that there was no lashing, and the ceiling timbers were simply held in place by the weight of the cargo. The holes would have facilitated handling in harbour, and may have encompassed a rope handle.

The ceiling timbers are made from *Cupressus sp.* (possibly *C. torulosa*) of the Conifer family.

Hull planks and frames

The hull planks are typically 4 cm thick and vary in width from 20 to 40 cm. Marks on the plank surfaces clearly indicate that they were sawn (fig. 15). They are stitched edge-to-edge with rope passing through holes at 5 to 6 cm spacing. The main stitch is straight across the edge-joint, with

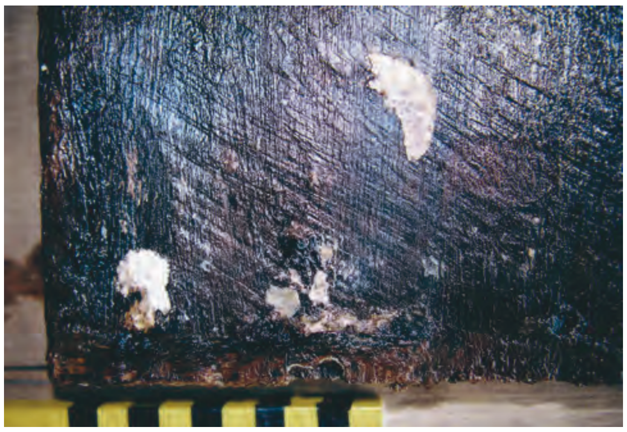

Fig. 15 Saw marks clearly visible on a recovered hull plank (Photograph: M. Flecker).

secondary cross-stitching between each main stitch. Wadding material is placed under the stitching both inside and outside the hull. The same system fastens the garboard strake to the keel and stem-post.

Hull planks are butt jointed, with the joint sometimes occurring in-line on alternate planks. The butt joint stitching is the same as that for the edge-joint (fig. 16), however two additional stitches fasten the joint from further back in the plank (fig. 17).

The timber species used for the hull planks has not been definitively identified, however it strongly resembles *Amoora sp.* of the Meliacaea family. This wood is hard and durable.

The frames vary markedly in size, shape, and spacing in an almost haphazard manner. Some are of clean-cut rectangular section (fig. 18), while others are little more than a quarter section of a log. A typical siding would be in the order of 4 to 5 cm, while the moulded depth varies between 10 and 16 cm. Centre-to-centre frame spacing varied from 28 to 43 cm along the full length of the hull. V-notches are cut out of each frame where it passes over a plank edge-joint to allow for the stitching and wadding. There are typically two holes of diameter 1.0 to 1.1 cm between each V-notch for fastening the frame to the hull plank, the rope running through the plank and outside the hull. Towards midships the ceiling timbers sit directly on the frames, but the load is shared by dunnage, in the form of

Fig. 16 Cross-stitching and wadding at the butt-end of a recovered hull plank (Photograph: M. Flecker).

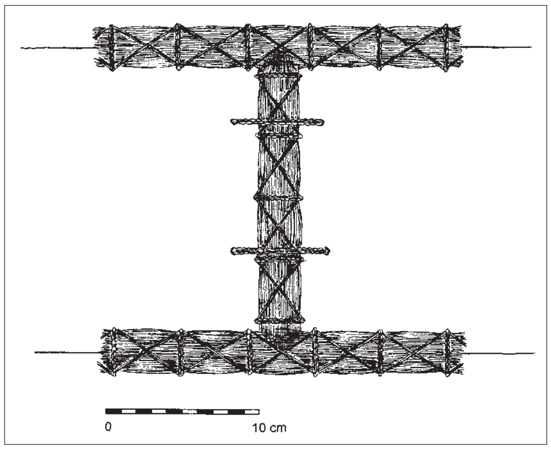

Fig. 17 Stitching at the hull plank butt-joint (Drawing: M. Flecker).

branches, that has been placed between the hull planks and the ceiling in several places.

One of the frames has been found to be made from either *Amoora sp.* of the Meliacaea family (same as the hull planks), or *Afzelia sp.* of the Legum family. *Afzelia sp.* is very durable, resistant to the toredo worm, and in strength is comparable to oak.[7]

Through-beams

Evidence of three through-beams remains near the outer edge of the surviving hull on the port side. They are all sheared off flush with the inside hull planking, but the foremost beam end was partly visible where the hull planking was missing (fig. 19). This beam end was photographed *in situ* and then removed for documentation. From the stern, the beam ends measured 15, 24, and 18 cm wide respectively, with a surface-to-surface spacing of 97 and 81 cm. The hull planking is doubled on the strake just below the through-beams to provide additional support, a so-called beam shelf. The 5 cm thick beam shelf is stitched onto the inside of the hull, with the lower edge bevelled. Both the hull plank and the beam shelf are notched for the through-beam.

The recovered through-beam end retained the wadding and binding that sealed it against the outside hull (fig. 20). Diagonal holes passed through each corner of the beam end, presumably for fastening to the hull. The configuration

7 TRADA 1979, 9.

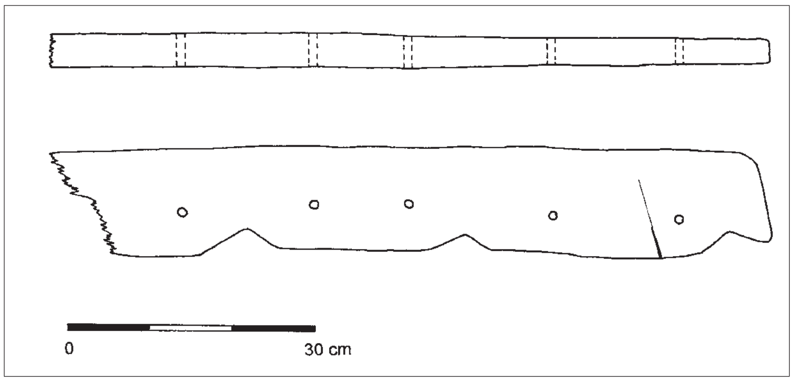

Fig. 18 Frame, showing notches for hull plank wadding and holes for lashing (Drawing: M. Flecker).

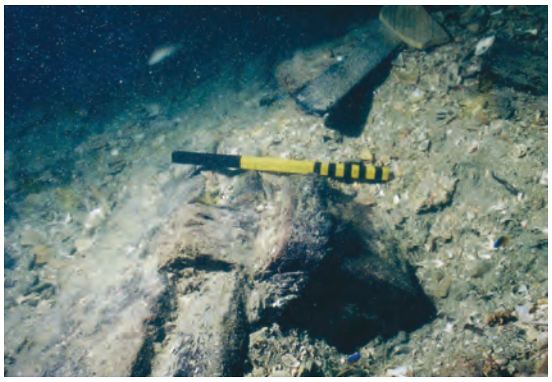

Fig. 19 The remnants of a through-beam penetrating a hull plank and a beam shelf (Photograph: M. Flecker).

is remarkably similar to the through-beams on a still extant Omani fishing craft called a *battil* (fig. 21).[8] The angle of the through beam rebate is 72°, which is important in determining the original hull form, as discussed below.

An intact through-beam was found loose on the site (fig. 22), just aft of the bow on the starboard side, but again this position is of no real significance. It is 2.7 m long, 22 cm sided on the upper surface, 25 cm sided on the lower surface, and 21 cm moulded. The beam end, where it passed through the hull, is significantly smaller in section (fig. 23). The other end has eroded to a stump, so there is no indication whether one long beam traversed the ship, or whether there was a scarf joint. It is very interesting to note that the rebate cut for the hull timbers is angled at 70° for the lower plank and is nearly vertical for the upper plank, implying that there was a hard chine of sorts at this point. More importantly it implies that it was installed near midships, and that the beam of the vessel did not extend further at that point.

The through-beams are made of teak (*Tectona grandis*). This is a magnificent timber, eminently suited to shipbuilding, particularly for hull planking, as the teak resin makes the wood resistant to toredo worm attack. It is relatively light, strong, and easily worked.

Lime sealing compound

A lime-like sealing compound was found on the plank edges along the longitudinal joints and, in

8 Vosmer 1997, 227.

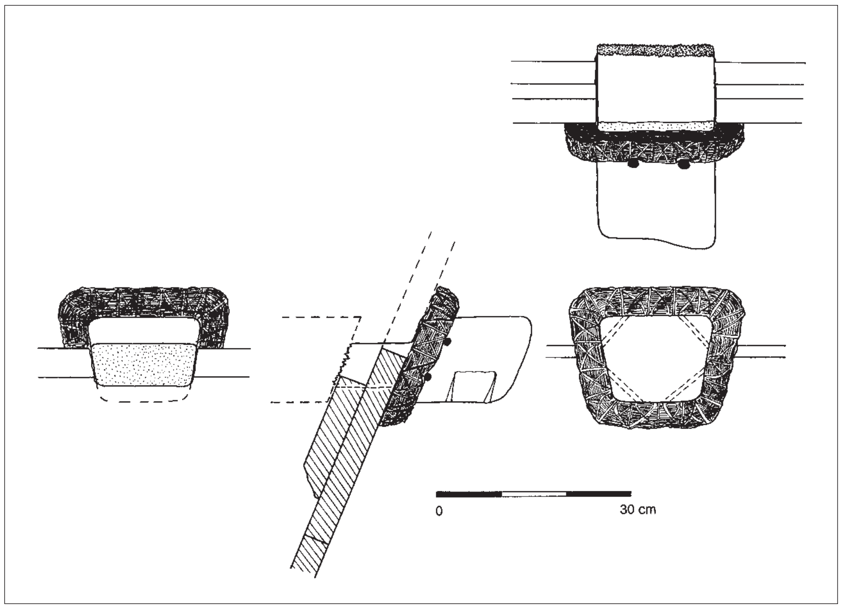

Fig. 20 Through-beam end *in situ* (Drawing: M. Flecker).

Fig. 21 Through-beams protruding through the side of a still extant Omani fishing craft called a *battil* (after Vosmer 1997, 227).

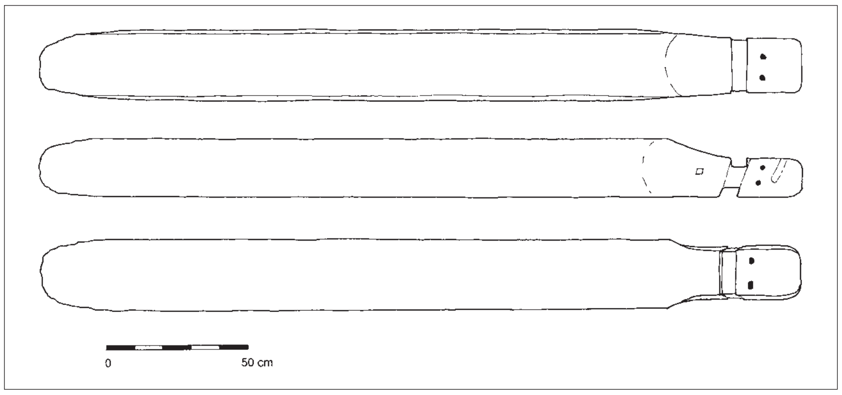

Fig. 22 Through-beam found loose on the site (Drawing: M. Flecker).

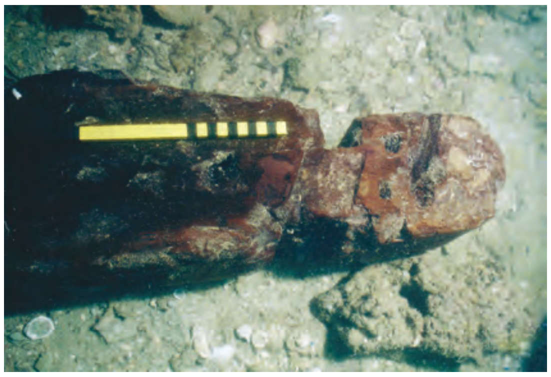

Fig. 23 The end of a loose through-beam, showing two distinct angles where it slots through the hull planks (Photograph: M. Flecker).

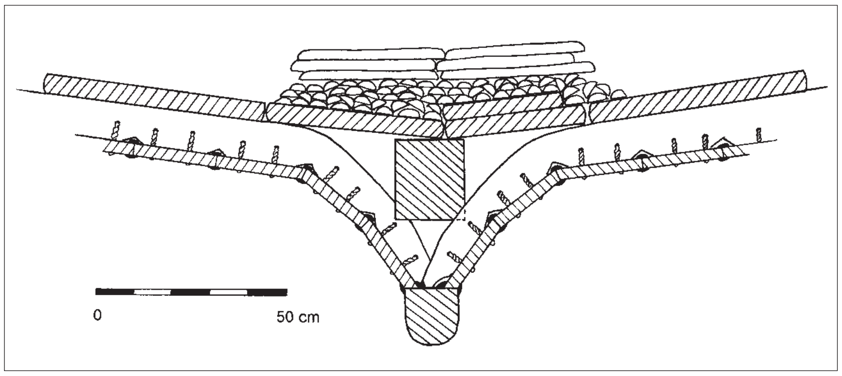

Fig. 24 Reconstruction of the hull cross-section 4 m aft of the bow (Drawing: M. Flecker).

larger quantities, at the butt joints. It was also observed where the through-beams passed through the hull planks, and at the joint between stem-post and keel.

Hull form

As the stitching rotted away relatively early in the wrecking process, the hull collapsed onto a flat seabed before there was time for sediment to build up around it. Consequently there is no cross-sectional data to work with. The hull form must be deduced from the garboard strake alignment at the bow, from the hull width amidships, and from the angle of rebates in the through-beams where they passed through the hull.

The entrance of the bow was remarkably fine, and not overly raked, having an angle of 61°. The angle of the garboard strake is just off vertical a metre aft of the bow. The narrow stem-post and keel have been shaped into a streamlined U-section. But from the full width of ceiling timbers only 2.5 m from the bow it is evident that the hull flared rapidly, and probably with substantial hollow (fig. 24).

The 72° angle of the through-beam rebate some 6 m aft of the bow indicates that the hull was flared at that point, although the through-beam cannot have been more than three or four strakes below the gunnel. Amidships the through-beam slots occur 4.5 m from the ship's centreline. From the vertical rebate on the loose through-beam discussed above, it is reasonable to assume that this is near the point of maximum beam. Allowing for the collapse of the hull, the maximum beam of the ship would have been in the order of 8 m.

The stern is very difficult to interpret, but it is clear where the hull planks terminate, so the keel length of 15.3 m can be stated with some confidence. Iconographic and ethnographic evidence can be called upon to determine that the vessel was more than likely double-ended, and that the stern had roughly the same rake as the bow. This being the case, it is possible to deduce an LOA if the moulded depth is known. The coral conglomerates stand 0.5 to 1 m above the original mound level, which was up to 2 m above the hull timbers. They encompass ceramics even near the upper surface, an indication of how high the cargo was stowed. It is therefore reasonable to assume that the moulded depth was in the order of 2.5 m. Allowing for the keel structure, the depth to the base of the keel could have been approximately 3 m. From a scaled drawing this gives a waterline length of approximately 17 m. The extremities, particularly the stem, are likely to have extended well above deck level, so the LOA could have been in the order of 20 to 22 m.

The resultant beam to length ratio of approximately 1:2.6 is remarkably low. The hull structure is also extraordinarily light. It is indeed similar in these respects to the thirteenth-century Quanzhou ship, which had a beam to length ratio of approximately 1:2.7 and a light structure, although it was significantly heavier and larger than the Belitung wreck. Green says of that ship '[it] was a rather broad-beamed, but shallow drafted ship; seemingly designed to carry a relatively light cargo and to sail lightly over the water rather than drag a deep and capacious hull through the water'.[9] These comments seem to be quite apt for the Belitung wreck.

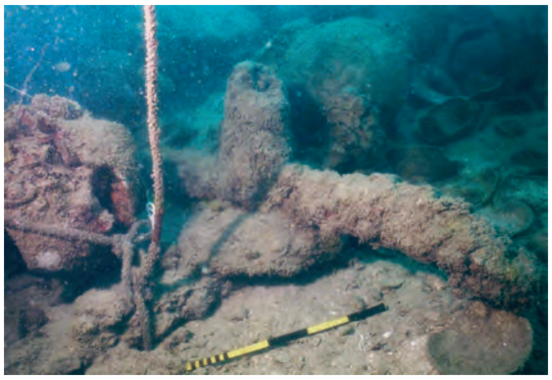

Fig. 25 The composite wood and iron anchor sitting upright on the seabed (Photograph: M. Flecker).

Anchor

The anchor was constructed from iron and wood (fig. 25). Only the lower end of the wooden shank survived, and one of the iron arms is broken, but otherwise it remained in good condition (fig. 26). The configuration is that of a grapnel.

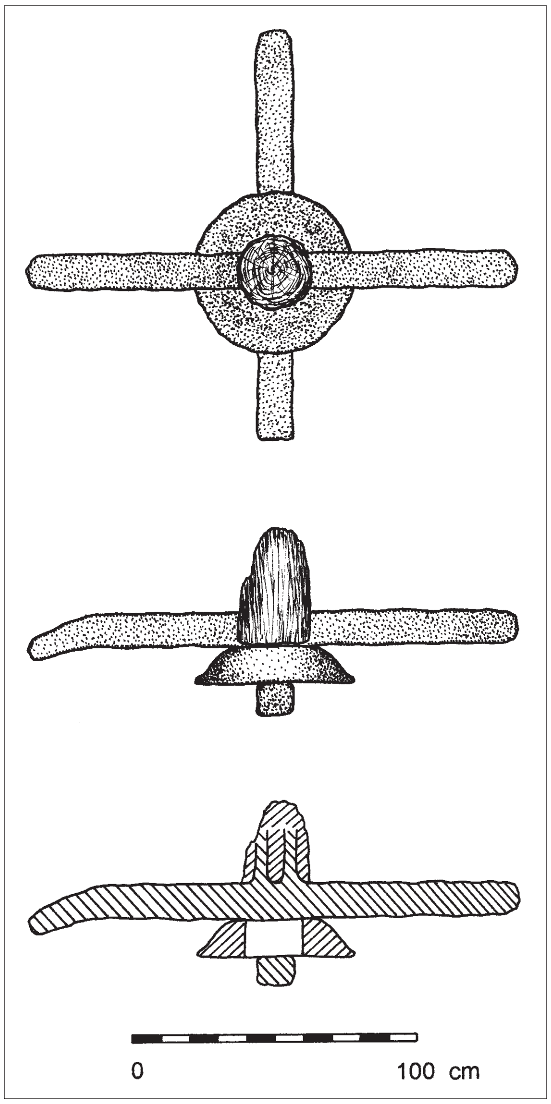

Fig. 26 Composite iron and wood anchor (Drawing: M. Flecker).

9 Green et al. 1998, 299.

However, the arms are not angled upward, but protrude straight outwards. In fact one of them is angled downwards at its extremity. There are no flukes as such. Perhaps two of the arms were intended to act as a stock. They are separated vertically by a heavy iron bell-shaped disc, which has a hole through the centre. It is not at all clear how the arms are attached to the disc. The disc is a form that lends itself to casting, while the arms are thought to be wrought iron. The connection of these two materials is very problematic. Furthermore, only China is thought to have had the technology to cast iron at the time. The upper bar has two tangs protruding into the wooden shank to facilitate attachment.

The wood of the anchor shank is very similar to the identified frame timber, either *Amoora sp.* or *Afzelia sp.*

Lead ballast

Lead ballast ingots were stacked on the ceiling timbers the full length of the ship (fig. 27). They were typically stacked fore-and-aft on the lower layers and athwartships above that. They were not placed near the large balk of timber aft, the area of a large lime deposit that has entrapped many ceramics, but instead flanked it. While varying a little in size, ingots typically measure 40 cm long by 5 cm wide by 2 cm high and are half-round in section. The average weight of each ingot is approximately 4.5 kg. A significant number have been doubled over. Much of the lead ballast is concreted in place by the lime compound and therefore could not be recovered. The total weight of lead ballast is roughly estimated to be 10 tonnes.

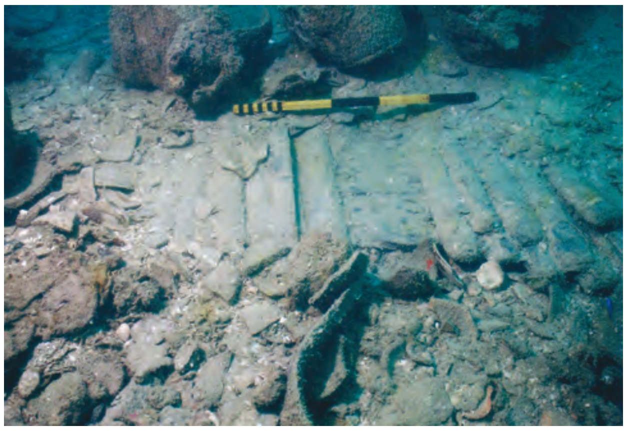

Fig. 27 Lead ballast ingots stacked athwartships on the ceiling timbers (Photograph: M. Flecker).

The lead is thought to be paying ballast, that is, it served the role of ballast, but would have been unloaded and sold at the final destination. The reasons for this assumption are twofold. Firstly, as has been discussed before, bowls were stacked beneath the ceiling, and therefore beneath the lead. Both had to be removed to unload the bowls, a back-breaking task that would not be performed just for the sake of cramming in a few extra low quality ceramics. Secondly, a green-ware jar was found to contain nine lead ingots of the same shape as the ballast ingots, although they had been cut in half (fig. 28). The ingots therefore had export value.

China is known to have been a lead producer. Lead was used as a major alloying element in the manufacture of coins when the cost of making bronze coins became prohibitive.

Fig. 28 Lead ingots and the green-glazed jar that contained them (Photograph: M. Flecker).

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The cargo

Ceramic cargo and stowage

Nearly the entire surviving cargo of the Arab or Indian ship consisted of Chinese ceramics. Some 60,000 pieces have been recovered. The breakage level was particularly low, perhaps twenty per cent, so the original ceramics cargo would have been in the order of 70,000 pieces. The vast majority of the ceramics are in the form of bowls. There are also many large storage jars, but the additional weight of these is offset by many tiny jarlets. The weight of the ceramic cargo can therefore be estimated. Each bowl weighs approximately 0.35 kg, giving a total ceramic cargo weight in the order of 25 tonnes.

While the ceramic cargo is dominated by Changsha bowls, there are many other shapes from the Changsha kilns, and many pieces from other kilns throughout China. The quality varies from the most basic utilitarian ware to some of the finest white ware produced at the time. The ceramic cargo is the subject of special studies elsewhere in this volume (pp. 230–655), so provenance and style will not be discussed in detail here. Of more relevance is the stowage pattern.

Fig. 29 Changsha bowls stacked longitudinally and overlying a frame. More bowls have been stacked athwartships on top of these (Photograph: M. Flecker).

Polychrome Changsha wares

The very distinctive underglazed copper and iron decorated ware of the Changsha kilns dominates the cargo. Bowls make up the majority, followed by ewers, jarlets, and a variety of less common forms (nos 171–291).

Bowls are decorated in a wide range of simple, freely painted designs (nos 171–224 and appendix I.1). A very limited number have a character in black ink or iron oxide either inside or outside the foot ring, usually a name (see pp. 502–503 and appendix I.2). They were stacked both athwartships and longitudinally in the hull adjacent to the ceiling timbers (fig. 29). Presumably they were originally packed in straw 'cylinders'. Bowls were also stowed inside large green glazed storage jars (cf. no. 161) (fig. 30). As many as 130 bowls could be stowed inside a jar when packed in a helical fashion (fig. 31). Several of these jars had Chinese characters incised into the neck, again usually a name (see appendix IV nos 10–20 and pp. 366–367). Interestingly many jars of the same type and in the same area did not contain anything at all, implying that they originally held perishable goods. The jars have fallen to both sides of the ship's centreline, but it is believed

Fig. 30 A large 'Dusun'-type jar full of Changsha bowls (Photograph: M. Flecker).

Fig. 31 The bottom half of a large jar that broke along an old crack, showing how the Changsha bowls were helically stacked (Photograph: M. Flecker).

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that they were originally stowed on top of the lead ballast ingots. Most of the bowls, and jars containing bowls, were recovered from the midships area and aft of that.

Ewers with moulded decorations in relief (cf. nos 239–241) tended to be stowed forward, and were stacked together with no sign of packing material remaining. They have three moulded medallions around the body, each covered with brown glaze, beneath the two side ear-handles and the typical short, octagonal spout of this ware (cf. appendix III.1).

Tiny jarlets, with simple sprig designs occurring three times around the rim, were found scattered about the midships area, and were probably stowed amongst the other wares where space allowed (nos 264–269). Less common forms included wide-mouthed jars with moulded decoration and two square lug handles (cf. no. 274 and appendix IV nos 1–5), four-legged incense burners (nos 283, 284), cup-shaped oil lamps with octagonal spouts (no. 286), and tiny ewers with dish-shaped mouths (nos 253, 256, 257).

There are a small number of brown-glazed ceramics, which are also thought to originate from Changsha kilns. These include simple oil lamps with a loop handle inside under the rim (no. 285), jarlets (no. 270), and two small water droppers with a sculptural dragon applied as the handle (no. 258).

Green wares

A limited quantity of pieces from the Yue kilns of Zhejiang province were also recovered in the stern area. They mostly comprised round and square dishes with finely incised floral decorations under an olive-green glaze (cf. nos 129–134 and appendix V). There are also two bottles with four lugs (nos 140, 141) and a flask with an incised double-fish decoration (no. 143) which belong to the Yue-type ware. Several large basins with six lugs around the rim (cf. no. 167) have the same glaze as the storage jars, and are therefore thought to originate from the same kilns.

A type of shallow bowl was of sufficiently low value to be stowed beneath the ceiling timbers, where there must have been a degree of breakage (fig. 32). They are olive green on the inside and unglazed on the outside, apart from uneven strips and drips around the rim (no. 170). On the interior, six small lumps of reddish clay have been applied in a circle to support the bowl above during firing.

As has been mentioned (p. 23), many storage jars were used to stow Changsha bowls. Others of the same size must have contained a perishable substance. There are a number of green-glazed jars that are bigger still. They are decorated with incised wavy lines around the shoulder, and one (no. 160) has a short spout near the base, an obvious sign that it held a liquid .

Smaller green-glazed jars have a small spout between two of the four loop handles (cf. nos 162, 163). Many of these remain entrapped in the lime compound aft of midships. One of these jars was found to contain nine lead ingots, and several were still full of star anis (figs 28, 35).

A quantity of small wide-mouthed jars with two loop handles has a green glaze in two deliberate shades that stops about midway down the body (no. 165). These were stowed together just aft of midships, and many remain there, firmly adhering to the lime compound (fig. 33).

White wares

The white ware is of high quality and includes different shapes of cups, bowls, dishes, lobed saucers for cups with an everted rim, and bottles with four small lugs (nos 86–106). As with the other fine wares, these pieces were recovered from the stern of the ship.

Three pieces of distinctly decorated blue-and-white ceramics were also found on the wreck (nos 107–109).

White wares with green design

High quality white-green earthenware was found in limited quantities in the stern area.

The glaze on these pieces generally survived in better condition than on the polychrome Changsha ware. Some of the finds may be unique. They include fine green-glazed wine cups modelled on metal ware (cf. nos 38–47), a large covered box (no. 84), as well as lobed dishes and bowls (cf. nos 53–55, 59–62, 71, 72, 74).

Fig. 32 Poor quality green-glazed bowls stacked between hull planks and ceiling timbers (Photograph: M. Flecker).

Fig. 33 Small glazed-glazed jars entrapped in the lime compound (Photograph: M. Flecker).

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A single tall ewer (no. 75) with a high stand, well rounded body, and tall neck is another unique find. The ewer is decorated with incised geometric patterns and lotus petals, and has a double strap handle incorporating a snake. The matching lid is in the form of a moulded dragon head.

Non-ceramic artefacts

Only a few non-ceramic artefacts can be regarded as items of general trade. The rest consist of items for personal trade or tribute, personal belongings, ship's gear, and provisions. Although found in relatively small quantities, the following artefact types can be regarded as general trade items: cast iron vessels, copper alloy bowls, grindstones, and lime.

Cast iron vessels occurred in a variety of forms and sizes, but were all heavily concreted and the iron had completely graphitized. Forms include tripod cauldrons with a flared rim and two lugs, tripod cauldrons without handles, cauldrons with a flared rim and no legs, wok-like vessels, and wok-like vessels with a pan-handle. With China being the only producer of cast iron at the time it is no surprise to find these vessels as part of the cargo.[10] Tripod cauldrons also seem to be a common form. The thirteenth-century Chinese chronicler Zhao Rugua, mentions that Chinese tripod cauldrons were imported by two places, one of which is thought to be in the Philippines and the other in Java.[11] The only other identifiable iron artefact is a parang, or machete. The wrought iron blade has disappeared, leaving a fine casting in iron concretion, but the wooden handle remains in part, under a layer of lime compound.

Copper alloy bowls were found in stacks, and unfortunately are badly corroded. A heavy footrim supports a thin walled bowl with an everted rim. They are typically 22 cm in diameter, and do not appear to have been decorated. Two copper alloy handles that were once riveted to a large cauldron were also recovered.

Several grindstones were discovered aft of amidships and several more remain concreted in the lime compound on the aft starboard side. Two sets remained together, face-to-face, while the others were scattered. One of the intact pairs (no. 302) was carved from a granitic stone, whereas all the other grindstones were carved from a friable basaltic rock. Their diameter is a fairly uniform 37 cm. Remnants of a metallic bushing were evident in the central hole of a number of the grindstones.

A whitish, crumbly, rock-like substance, found on the wreck in discrete scattered lumps, was strongly believed to be alum, the most common type of which is a double sulphate of potassium

10 Flecker 2002, 87.

11 Hirth and Rockhill 1911.

and aluminium. It is typically used as a dying mordant for textiles, and has been a major export from China up to recent times.[12] Chemical analysis of this substance, however, clearly shows that it is not alum, but rather an aluminium oxide-rich mineral.

The lime compound that entraps a large portion of the lead ballast ingots (fig. 34) and many ceramics is somewhat enigmatic. Had it just covered the ingots, it may have been regarded as an intentional cementing process, although the lead has been ascertained to be a paying ballast. But because it also entraps a portion of the ceramics cargo, there is no doubt that the lime compound originally formed part of the cargo, and during the wrecking process flowed out before hardening. A very similar phenomenon was observed on a sixteenth-century Thai shipwreck where bamboo partitions and ovoid storage jars were entrapped in lime.[13] One would expect this material to be stowed in ceramic storage jars, but there was no evidence of this. Perhaps it was stowed in woven baskets or textile bags. A lime compound such as this is lavishly used by Chinese shipbuilders to fill seams and to cover recessed iron fastenings. A lime compound was indeed observed in the seams of the Belitung wreck.

Gilt-silver ware may have been an item of private trade, or perhaps was intended as a tribute gift. While two long handled spoons (nos 317, 318 a, b) were found scattered around the stern, all of the silver vessels were concentrated in a very small area right at the stern and slightly off to port. It is interesting that several high quality white-green wares and white wares were excavated adjacent to the silver ware. A pair of intricately embossed fragmentary platters with three feet were found

12 The Country ship *Diana*, which sunk near Malacca in 1817 carried 13.6 tonnes of alum from China to India (Ball 1995, 64).

13 Flecker, unpublished. This wreck is known as the Central Gulf of Thailand wreck, and has more intact hull structure than any other excavated Thai shipwreck, inclusive of longitudinal stringers, a mast support, and a rudder socket.

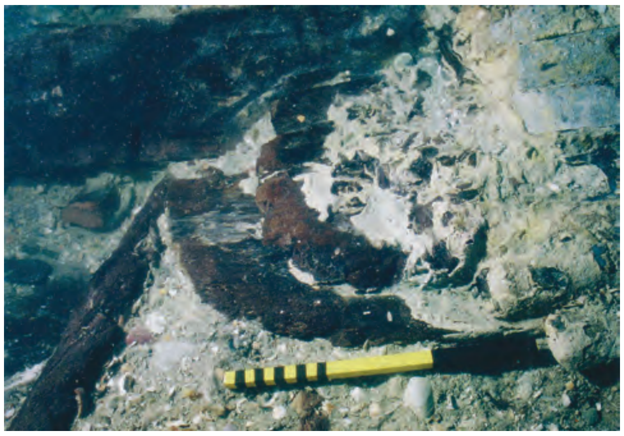

Fig. 34 Lead ballast ingots and ceiling timbers covered in hardened lime compound (Photograph: M. Flecker).

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14 Bronson 1996, 188.

stacked on top of each other. The rims and walls of both have suffered badly, but the base, while extremely fragile, often remains intact. Designs featured on the bases include circling lions, fish, peacocks, birds in flight and dragons (cf. p. 108 figs 11a, b; p. 137, fig. 1; p. 141, fig. 7). A number of silver covered boxes (cf. nos 12–18) were also found, including a large one that contained four small boxes inside, as well as a large silver flask with a pivoting handle (no. 21).

Chinese bronze mirrors comprise another high value item that was probably intended for private trade. Twenty-nine were recovered (nos 22–37a, b), two with the famous lion-and-grape design of the Tang dynasty (nos 26, 27).

Three copper alloy scale weights were recovered, along with a scale bar with decorated ends (nos 300 a–c, 301).

One tiny blue glass bottle was excavated (no. 319), very similar to a ninth- to tenth-century Middle Eastern bottle found at Laem Pho, Thailand.[14] Strangely, this bottle, and two earthenware jars (nos 292, 293) are the only artefacts that are of possible Middle Eastern origin (cf. p. 659).

Fig. 35 Star anis having just been removed from a green-glazed jar (Photograph: M. Flecker).

Other interesting artefacts include two pieces of black coral with clearly cut ends, a small die carved from bone or horn (no. 311), two small ivory rings of unknown purpose (no. 320a, b), and an inkstone with two short legs and a carved cicada design (no. 309). The only evidence of armament consisted of two fragile concretions with approximately thirty highly degrade wooden shafts protruding. They were originally two bundles of iron tipped arrows.

Considerable quantities of star anis (*Illicium verum*), found inside green-glazed jars with a small spout, must have been an export item (fig. 35). The plant is indeed native to southern China and Vietnam.[15] The eight-pointed star-shaped pods of the star anis are a spice often used in curries. They are also thought to have had medicinal properties.[16] The genus name is derived from the Latin 'illicere' which means 'allure', probably due to the sweet fragrance.

Several small chunks of aromatic resin were also recovered (cf. no. 322). This presents something of an enigma. Macroscopically and in scent, it strongly resembles *styrax benzoin*, the aromatic resin that was a major export item from Sumatra to China. It actually came to replace the fine aromatics that were originally supplied from the Middle East, frankincense and myrrh. It is hard to imagine why Sumatran aromatics would be shipped to the original source of this product, unless the resin was for use aboard ship. If the recovered resin is indeed a Middle Eastern product, then it may be the remnants of an outward cargo.

Beneath the exposed keelson at the bow several fragments of worked wood were found (cf. nos 331–335). Some of them appeared to be wood chips left over from the building of the ship, but one was worked into a pointed end. One other piece is pierced with holes and the remnants of wooden dowels, suggesting that it was part of a box. Towards the stern of the ship, to port of the silver cache, a reasonably intact wooden box was found. It was 31 cm wide and deep, and 72 cm long. The sides of the box were fastened to each other by an alternating pattern of two wooden dowels, two stitches, two dowels, etc., with some type of sealing compound between the joints. The wood is particularly hard and well preserved, and has been identified as *Artocarpus sp.* of the Moraceae family, varieties of which include the jackfruit tree and the breadfruit tree. The contents must have been perishable for nothing but sand was found inside the box.

Dating the Wreck

Many Chinese coins were recovered. Most are of the same type, although in two sizes. These coins are stamped *kaiyuan tongbao*, and where minted

15 Katzer 1999.

16 Burkill 1935, 1245.

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17 See in this volume p. 226.

from 621, at the very beginning of the Tang dynasty, and most likely prior to 845, for there is no additional character or mark on the reverse, a feature that appeared after that time. The other type of coin is stamped *qianyuan zhongbao* and was minted from 758.[17] The *terminus ante quem* provided by the coins is therefore 845.

Changsha ceramics are known to have been produced during the ninth century, with the earliest confirmed date up until now of 838 (see above p. 4). Chinese characters engraved on one of the Changsha bowls from the Belitung wreck, however, have been interpreted as 'baoli ernian qiyue shiliu ri', the sixteenth day of the seventh month of the second year of the reign of the emperor Jingzong, or the 16th of July 826 (no. 171).

Due to the significance of this find, both the ship as a whole, and the dated bowl in particular, three organic samples were sent for radiocarbon dating at Waikato University, New Zealand, in order to provide scientific corroboration. The three samples consisted of a piece of aromatic resin, star anis, and a section of the wooden chock that was located beneath the keelson of the ship. The resin and star anis were specifically selected as cargo items that would not have been 'old' before loading onto the ship. The outer growth ring area of the grown chock was selected as the 'youngest' ship's timber, and therefore the closest in age to the built ship. As it turns out, the ship's timber provides the most recent date. The star anis sample was too small to reduce the error range to that of the timber and the resin, but it is basically consistent with the timber. The resin presents an enigma, for it seems to be substantially older than the two other samples. Rather than a harvested piece of resin, this could have been an old piece collected from the forest floor. The fact that only a few chunks were recovered from the wreck, rather than any cargo-like quantity, is consistent with this hypothesis. Furthermore, the resin, being one of the only non-Chinese artefacts on the wreck, and an item normally exported to China, is already steeped in mystery.

The 1 sigma radiocarbon dates for the three samples are as follows:

Aromatic resin	680 to 780
Star anis	670 to 890
Ship's timber	710 to 890

The date written on the bowls, 826, is indeed consistent with the highest-probability radiocarbon dates.

Discussion

This shipwreck has the potential to 'prove' that Arabs or Indians traded directly with China as early as the ninth century. But in order to establish this proof, it must be concluded, beyond reasonable doubt, that the ship itself is indeed an Arab or Indian vessel, and that the cargo of Chinese ceramics was indeed destined for the western Indian Ocean. The cargo destination is not so important, for the mere presence of an Arab or Indian ship with a Chinese cargo at the southern-most extremity of the South China Sea is momentous enough.

Ship origin

The origin of the ship can be determined from three interrelated factors; construction technique, hull form, and construction materials. The construction technique can be studied in relation to ethnographic information, i.e. traditions that have persisted to this day, and historic records, which occasionally give detailed descriptions. Hull form can be studied with respect to ethnographic and iconographic data, the subtleties between forms making textural records difficult to interpret. Construction materials allow for a more scientific approach. Timber species can be identified and correlated to geographical distribution. However, the scientific approach must be combined with historic records, for in the case of Arab ships, much of the timber is reported to have been imported from India.

Looking at construction technique and hull form first, the key features of the Belitung wreck are as follows: cross-stitched seams with wadding inside and out; no dowels used for edge joining; sharp bow with little rake; stitched in frames; through-beams stitched to the hull; iron and wood grapnel-type anchor; removable ceiling timbers; a keelson, and stringers. The latter two features can be disregarded as they have not been associated with any ancient vessel under consideration.[18]

For comparison, ocean-going Chinese ships of the early second millennium featured the following: a transom bow; bulkhead construction (not necessarily watertight); iron fastenings (hull planks edge-joined by diagonal nails, strakes sometime fastened to bulkheads by clamps called *guaju*); an axial rudder; and sometimes multi-layered planking. Without going any further, it is clear that the Belitung wreck is not of Chinese origin. Ships that were constructed by what Manguin appropriately calls the South China Sea Tradition[19] have bulkheads, planks edge-joined with dowels and fastened to bulkheads with iron

18 The so-called Vung Tau wreck of *c.* 1690 had a keelson, but this ship is thought to be a lorcha, which combined the best features of both Chinese and Western shipbuilding (Flecker 1992, 223; Jörg and Flecker 2001, 120).

19 Manguin 1996, 184.

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nails, an axial rudder, are multi-planked, and are usually built from teak. Furthermore, they are not thought to have developed until the fourteenth century, so clearly this vessel type need no longer be considered here. Lashed-lug ships of Southeast Asia come closest to the wreck type, but even that is not very close at all. Lashed-lug craft are well known from archaeological evidence. The earliest example, found at Pontian on the Malay peninsula, has been dated to around the mid-first millennium.[20] The planks on this type of ship are edge-joined by wooden dowels. They are carved, rather than bent to shape, and incorporate protruding cleats or lugs. Holes are carved out of the lugs so that they may be lashed to more or less flexible ribs and/or thwart beams, thereby holding the planks together. Additional strength and water-tightness is achieved by stitching the planks together. Holes are drilled near the edges of the planks for stitches of vegetal fibre. They are usually drilled in pairs and occur within the seam, not being visible from outside the hull. Steering is by means of quarter rudders. So while this type of vessel is indeed stitched, the manner of construction is distinctly different to that of the Belitung wreck.

Analysis of construction techniques and hull form alone is sufficient to confirm that the wreck is unlike any known ocean-going vessel from China or Southeast Asia. The task then remains to determine whether it is Arab or Indian. This task is made difficult by a complete lack of archaeological evidence of ships of these regions.[21]

Deloche states that not a single ancient shipwreck has been discovered near the Indian shores in the Arabian Sea or in the Bay of Bengal.[22] He relies largely on scanty iconographic evidence to examine the evolution of Indian shipbuilding. The only evidence of stitched hull construction is provided by two small riverine craft depicted on first- and second-century BC monuments at Bharhut and Sanchi, and a larger vessel carved on a twelfth-century memorial stone. The stitching is visible on the outside of the hull and therefore penetrates right through the hull planks.

According to Hourani fully stitched construction was observed by ancient and medieval writers in the Red Sea, along the east African coast, in Oman, the Persian Gulf, the Malabar and Coromandel coasts of India, and the Maldive and Laccadive Islands.[23] It remains unclear whether this tradition emerged from the east or the west side of the Arabian Sea. Later developments seem to have been more or less simultaneous, so there need not have been a more advanced shore. Stitched hull construction was the only technique used by both Indians and Arabs until iron nails were introduced by the Portuguese.[24] A twelfth-century memorial stone found near Eksar clearly shows a ship with an axial rudder, suggesting that Indians began to replace quarter rudders with the far su-

20 Gibson-Hill 1952.

21 To the author´s knowledge, the only discoveries that have been made are of anchors, some 80 Indian-Arab type anchors bing catalogued in the Indian Ocean and the Red Sea (Souter 1998, 339).

22 Deloche 1996, 199. This is indeed a surprising circumstance. Dozens of pre-European wrecks have been accidentally located by fishermen in Thailand, Malaysia, the Philippines and Indonesia. Given that ancient Indian vessels were often built out of highly resilient teak, it seems extremely unlikely that local fishermen have not stumbled upon an ancient hull. Perhaps with no surviving valuable cargo, none of the finds get noticed or reported.

23 Hourani 1995, 93.

24 The Chinese, with their nailed ships, frequented the Arabian Sea before the Portuguese, but perhaps the Portuguese forced the introduction by building their own ships locally.

perior axial rudder at about the same time as the Arabs. The Chinese are probably responsible for the introduction to both.

Deloche summarizes the characteristics of pre-European influence on ocean-going Indian ships based on pictorial evidence.[25] They were double-ended craft. Prior to the eleventh century the stern was raked, but after that time a long projecting bow became the predominant characteristic. Hulls were carvel built, and stitched with the stitches crossed and penetrating right through the planks. He illustrates the stitching and bow of a still extant small craft of the Indian littoral,[26] where the cross-stitching and through-beam configuration is very similar to the Belitung wreck.

Arab vessels are mentioned in the first/second-century Periplus, 'from Omana local-sown boats called *madarte* are exported to Arabia'.[27] In the same chapter there is mention of the cargoes brought to Arabia and Persia, including timber balks and beams of shisham. These may have been timbers imported for shipbuilding. In the sixth-century work of Prokopios the ships used in the Indian Seas 'are not covered with pitch or any other substance, and the planks are fastened together, not with nails, but with cords'.[28] The thirteenth-century account of Marco Polo is less than complimentary. 'The vessels built at Ormuz are of the worst kind, and dangerous for navigation, exposing the merchants and others who make use of them to great hazards'.[29] The planks are fixed with wooden dowels and then stitched 'with a kind of rope yarn stripped from the husk of the Indian nuts [coconuts]'. On anchors, Marco Polo comments, 'they have no iron anchors, but in their stead employ another kind of ground tackle; the consequences of which is that in bad weather they are frequently driven on shore and lost'.[30]

Traditional Arab ships were primarily built from teak or coconut.[31] The teak was probably imported from India and is arguably the best wood for shipbuilding. Coconut was also imported from India, and the nearby island groups.[32] Coconut wood is heavy grained and not particularly strong. Burkill, however, comments that the wood lasts fairly well and better still if soaked for a few months in sea water.[33] The palm trees and cypresses which grow around the Persian Gulf were generally not suitable for ship's timbers.[34]

The hulls were put together in the simplest manner possible. First the keel was laid on the ground, then horizontal planks on each side were fastened to it and to each other by means of stitches of fibre.[35] Unlike the stitches in early Indonesian lashed-lug craft, the stitches of Arab vessels pass right through the planks and can be readily seen on the outside of the hull. Early illustrations of this include one of the Sanchi

25 Deloche 1996, 209.

26 Ibid., 210.

27 Huntington 1980, 40.

28 Ray 1994, 173.

29 Griffith 1997, 34.

30 Ibid., 35.

31 Ray 1994, 173.

32 Hourani 1995, 91 comments that in the Maldives and Laccadives entire ships were built from the diverse products of the coconut tree. The ships thus made were filled with coconut wood and fruit and brought to the Gulf.

33 Burkill 1935, 621.

34 Hourani 1995, 91.

35 Ibid.

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sculptures of the second century BC, and paintings accompanying al-Hariri's *Maqamat* of 1237 (see fig. 1 on p. 58).[36]

Interestingly there is no evidence of ribs or frames in early sources nor in two nineteenth-century models of traditional Arab vessels in the Greenwich Museum.[37] There are, however, long stringers under the stitching on the inside of one of the models. This hardly seems sufficient to stiffen the vessels, particularly as no iron nails or treenails were used in the entire construction.[38] When carrying out a survey of traditional Omani fishing craft, Vosmer observed that dowels were used for joining, or at least aligning, the edges of stitched planks.[39]

Hourani speculates that stitching may have been introduced to the Arabs by Indians along with the wood used for shipbuilding.[40] On the other hand, he reasons that stitching could have first been used on the available palm wood and later transferred to superior timbers imported from India, or even spread to India itself. Many reasons are given for the use of stitching right through to the fifteenth century, when iron fastenings finally began to take over, but the most probable are availability of materials, economics, and the force of tradition.

From several accounts stitched vessels were poorly suited to ocean voyaging. John of Montecorvino writes:[41]

> 'The ships in those parts are mighty frail and uncouth with no iron in them and no caulking. And so if the twine breaks anywhere there is a breach indeed. Once every year, therefore, there is a mending of this, more or less, if they propose to go to sea.'

Arab vessels used quarter rudders, much like Indonesian craft. But it is interesting to note that an axial stern rudder had been introduced by the thirteenth century, at the same time it was making an appearance in Europe. There seems to have been a single tall mast, with a lateen sail. The lateen rig is largely thought to have been introduced to the world by the Arabs.

Ethnographic evidence of boat building in Oman[42] shows strong parallels with the Belitung wreck. The cross-stitching and through-beam attachment are nearly identical on small craft surviving to this day. Even the hull form of the *battil qarib* illustrated in Vosmer[43] is thought to be similar to the original hull form of the Belitung wreck.

36 Ibid., 92.

37 Ibid.

38 Ibid.

39 Vosmer 1997, 219.

40 Hourani 1995, 94.

41 Ibid.

42 Vosmer 1997.

43 Ibid., 228.

The anchor from the Belitung wreck should provide more clues, but the materials and form are different from anchors usually associated with the region and period. So-called Arab-Indian anchors typically have a long stone shank with wooden arms and/or stock.[44] Gemelli Carreri in the last decade of the seventeenth century noted stone anchors in the Persian Gulf, but metal anchors were perhaps known, as they had been in the Mediterranean for a long time.[45]

The Belitung anchor seems to be an iron grapnel with a wooden shank. This is quite like the anchor depicted on the thirteenth-century Harari Ship painting.[46] The Harari anchor has two arms that cross each other at different levels, and from colour variations in the painting, it seems that the shank is of a different material. It is lacking the iron disk that occurs between the arms of the Belitung anchor, but there is an element protruding below the arms that may serve a similar role, i.e. providing weight.

Ibn Majid, writing on Arab navigation in the fifteenth century, but drawing on earlier works, refers to an unknown anchor type as *al-anjar al-siniya*, 'the Chinese anchor', and to an iron grapnel as *hadid*, which literally means 'the iron'.[47] This allusion to Chinese anchors is very interesting if indeed the disk between the arms of the Belitung anchor is cast iron. During the first millennium and well into the second only the Chinese could manufacture cast iron, so it is possible that the Chinese actually supplied this anchor, or at least the cast iron disk. And yet the design bares no resemblance to traditional Chinese anchors, which were either all of hard wood, or all-iron grapnels.[48]

So the Belitung wreck has parallels with both Indian and Arab ships, but from the limited information available it is not possible to definitively determine the origin of the wreck from construction techniques and hull form alone.

Wood samples from key structural elements have been identified by Dr. Jugo Illic of the Forestry and Forest Products Division of the CSIRO in Australia. In many cases the wood is so badly deteriorated that there is barely any cellulose left in the cell walls, and only lignin holding the cells together. Sectioning and identification therefore proved difficult. In summary, the positively identified species include rosewood (either *Dalbergia sp.* or *Pterocarpus sp.* of the Leguminosae family) for the stem-post, teak (*Tectona grandis*) for the through-beams, *Cupressus sp.* (of the Conifer family) for the ceiling timbers, and *Artocarpus sp.*

44 Souter 1998, 332.

45 Hourani 1995, 99.

46 Ibid., cover; see also in this volume p. 58, fig. 1.

47 Tibbetts 1981, 55.

48 Li Guoqing 1998.

(of the Moraceae family) for a wooden box. The frames and the anchor shank are either *Afzilia sp.* (of the Legum family) or *Amoora sp.* (of the Meliaceae family). Hull planks seem to be *Amoora sp.* The keelson chock is probably *Ficus sp.* (of the Moraceae family).

Of these timbers, only one, *Afzelia sp.*, is native to Africa and nowhere else. It is found in both east and west Africa, mainly in coastal, lowland, and savannah type forests.[49] If this identification was conclusive, it would provide strong evidence for Arab construction. It is well known that Indian woods were imported to Arab countries for shipbuilding, but it is highly unlikely that an African timber would be sent to India where there is such a plenitude of excellent shipbuilding timbers. But, the frames could also be *Amoora sp.*, which occurs from India eastwards, as far as Australia and New Caledonia,[50] but not in Africa. One species (*A. wallichii*), found mostly in east India and Burma, is 'a magnificent wood' used for furniture and boat-building.[51] *A. rohituka* is said to be used in India for knees of boats.[52]

Teak is an ideal shipbuilding timber that can be used in almost any part of a vessel. It is durable, strong, of moderate weight, easily worked, and resistant to the toredo worm. Teak is indigenous to India, Myanmar, Thailand, and Indonesia, and is specifically mentioned as an item exported from India to Arabia for shipbuilding.[53] Of course, it was also used extensively for shipbuilding in India.[54]

Rosewood is a name that applies to a variety of species of the *Dalbergia* and *Pterocarpus* genus, both in the Leguminosae family. Species of *Dalbergia* are indigenous to South America, Africa, India, and Southeast Asia. *D. melanoxylon* is distributed throughout east Africa, but its diameter rarely exceeds 30 cm,[55] so it is unlikely to be the species used for the stem-post. According to Burkill, African rosewood was traded across the Mediterranean in ancient times, and Indian rosewood was imported by the Persians.[56] *D. sissoo* is an Indian species with great strength and elasticity. It is cultivated in India more extensively than any other tree except teak,[57] and is used for furniture, panelling, and boat-building.[58] Another species of *Dalbergia* (*D. latifolia*) is used in India for furniture, house construction, and for knee-timbers in boats.[59] *Pterocarpus* has a similar distribution to *Dalbergia*. Burkill states that the Arabs, in the Middle Ages transported *Pterocarpus* from Africa to Canton.[60] Zhao Rugua, writing in the twelfth century, states that the rosewood (*Pterocarpus*) imported into Canton was a product of Zanzibar.[61] A species of *Pterocarpus* (*P. angolense*) is used in Africa for cabinet work and boat-building.[62] *P. marsupium* is used in India for house construction, furniture, agricultural implements, and boat-building.[63] Nearly all varieties of rosewood are strong, very durable,

49 TRADA 1979, 8.

50 Burkill 1935, 138.

51 Gamble 1922, 151.

52 FRI 1963, 97.

53 Ray 1994, 173.

54 The Country ships trading between India and China in the nineteenth century were made of teak and had an excellent reputation for seaworthiness and durability.

55 Flatau 1954, 15.

56 Burkill 1935, 764. Indian rosewood has been recognized in the handle of a tool from the ruins of one of the ancient cities of Sind (ibid., 765).

57 Ibid., 707.

58 TRADA 1979, 324.

59 Ibid., 316.

60 Burkill 1935, 1860.

61 Hirth and Rockhill 1911, 127.

62 Flatau 1954, 41.

63 Burkill 1935, 1864.

and easily worked, making it an excellent timber for the stem-post.

Ficus, commonly referred to as fig, is a very large genus of trees found in Africa, India and throughout Southeast Asia. A well known variety is the banyan tree of India (*F. benghalenis*). The wood of the banyan is said to be durable under water.[64] The most common edible fig is *F. carica*. The Malaysians have adopted the Persian word 'anjir' for the fruit, which indicates that their knowledge of it came from Arab vessels trading eastwards, carrying Persian sailors, and doubtless, Persian dried figs for their provisions.[65]

Cupressus torulosa is a very large conifer found in the Punjab and eastwards to Nepal, scattered and often isolated at 1,800 to 2,700 m elevations.[66] It is a durable softwood. Another species of *Cupressus* (*C. funebris*), according to Burkill, occurs wild in China, and was apparently introduced to the Himalayas from there.[67] It is hard to perceive why wood would be transported all the way from the Himalayas to an Indian coastal port, and perhaps from there to the Middle East, to be used for essentially non-structural ceiling planks. If the *Cupressus* was indeed from China, this would imply that the ceiling planks were not only removable, but were supplied at the place of loading, a very interesting supposition. But there is also a species of *Cupressus* (*C. sempervirens*) indigenous to Persia and Syria,[68] which raises more possibilities. A positive identification of this species would remove much of the speculation, but the degraded nature of the sample would not allow this.

As mentioned before, varieties of *Artocarpus* include the breadfruit tree and the jackfruit tree. It is a hardwood found from Pakistan to Indo-China to the Pacific. One species (*A. hirsuta*) is found on the west coast of India in evergreen forests. It is very durable, and is used for furniture, shipbuilding, and cabinet-making.[69] Many species occur in Southeast Asia, and have the common name 'keledang', while other species in the same region are referred to as 'terap'. Timber from the jackfruit tree (*A. integra*) is used for musical instruments, furniture, tool handles, and cabinet-making.[70] Its use in the construction of a finely crafted box on the Belitung wreck (see above p. 29) is consistent with current practice.

With conclusive identifications of *Afzelia*, or of the particular species of *Dalbergia* or *Pterocarpus* indigenous to Africa, it would have been possible to conclude that the Belitung ship was made by the Arabs. But twelve centuries of submersion have made this impossible. In actual fact, the number of positive identifications that have been made is remarkable under the circumstances. Given the archaeological and historical evidence, a conclusive Arab provenance for the vessel would have provided a 'neat' core to this chapter.

64 Gamble 1922, 640.

65 Burkill 1935, 1022.

66 TRADA 1979, 333.

67 Burkill 1935, 712.

68 Gamble 1922, 697.

69 TRADA 1979, 259.

70 Burkill 1935, 257.

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However, a completely objective assessment of the timber identifications lends some weight to Indian construction. Apart from *Afzelia*, which is not a positive identification, all other genus and species occur in India. Of course, if teak and coconut are documented as being exported from India to Arabia for ship and house construction, there is no reason to believe that other suitable, and readily available timbers would not also have been shipped. The presence on board of a wooden box made from *Artocarpus*, is perhaps more telling than the timbers used for constructing the hull. *Artocarpus* is indigenous to India, but not Africa or the Middle East. It is unlikely to be on board a vessel trading directly from an Arab country to China. But then again, such a vessel would almost certainly have called in at an Indian port of the way, and could have loaded the box there.

Destination

Excavations at the Tang city precinct of Yangzhou have yielded a significant quantity of Tang ceramics such as *sancai* ware, northern white ware, painted ware from Changsha, green glazed ware of the Yue type, and even pottery from Persia.[71] These finds, at an ancient Chinese port known to have held a large contingent of foreign merchants, provide a wonderful continuum. Nearly all of the ceramic types recovered from the Belitung wreck were loaded at Yangzhou during Tang times, and the fact that they all occur on the one wreck means that all these wares were exported simultaneously.

Tang ceramics have been found in Southeast Asia, the Indian subcontinent, Sri Lanka, the Indus valley, the Persian Gulf and the Red Sea, as far inland as Samarra, the Abbasid capital, Nishapur in Khurasan, as far west as Fustat (old Cairo) in Egypt, and Antioch on the Syrian coast,[72] and as far south as the Comoros Islands and Zanzibar.[73] Early finds are particularly abundant at Siraf, the principle Persian port up to the eleventh century. Ceramics in levels predating the great Friday mosque (*c.* 820) include olive-green-glazed jar sherds, Changsha stonewares, and some white porcellaneous pieces. All of these types, together with Yue celadon, continue in the ninth- and tenth-century levels.[74] Chinese ceramics found at Shiraz indicate that cargoes were distributed throughout the hinterland. The only Arabian port with significant imports of Chinese ceramics was Sohar, on the Gulf of Oman, whose wealth and trading activities rivalled Siraf. Finds from ninth- and tenth-century levels in fact reflect those of Siraf.[75]

While Carswell and Lam[76] state that Tang ceramics have been found in India, the quantities must have been small. Subbarayalu, in fact, notes

71 Ruan Pinger 1994, 8; see also in this volume pp. 83–85, 88.

72 Carswell 1999, 2.

73 Rougeulle 1996, 161.

74 Ibid., 162; see also in this volume p. 69 and pp. 80–81.

75 Ibid., 164.

76 Carswell 1992, 2; Lam 1990, 154.

that the earliest Chinese ceramics to be found in southern India date to the eleventh century, with most attributable to the thirteenth and fourteenth centuries.[77] So, from archaeological evidence there is a much higher probability that the Belitung ship was heading for the Persian Gulf.

Of course, there are also significant Tang ceramic finds in Indonesia, notably at Palembang and the Prambanan temple complex in central Java. But it is hardy likely, although not impossible, that an Arab or Indian ship would be used to deliver a cargo of Chinese ceramics exclusively to the Indonesian market when these wares were so much in demand in the Middle Eastern ports.

It is unlikely that lead and ceramics formed the only bulk cargo items on the Belitung ship. Silk was another major Chinese export at the time, largely due to a monopoly on silk production. Spices were also very much in demand in the Middle East. It is quite possible that the Belitung ship was heading for an Indonesian port to top up her cargo with spices from the eastern Archipelago before finally embarking on the long crossing of the Indian Ocean.

Conclusions

From an analysis of construction methods, hull form, and construction materials it has been conclusively determined that the Belitung wreck is an Arab or Indian vessel. The timber identifications hint at Indian construction, but as Indian woods are known to have been exported to the Middle East for shipbuilding, Arab construction cannot be ruled out. The archaeological evidence for the trade in Chinese ceramics indicates that the Middle East is a far more likely destination for the Belitung ship with its cargo of Changsha ceramics. There is even a chance that an Indian ship was conducting the trade between the Middle East and China, or that an Indian-built ship was owned by the Arabs, as is often the case today. Hourani's sweeping statement, 'The sea route from the Persian Gulf to Canton was the longest in regular use by mankind before European expansion in the sixteenth century.',[78] while not being conclusively supported by material evidence, certainly seems to hold water.

77 Subbarayalu 1994, 113.

78 Hourani 1995, 61.