The International Journal of Nautical Archaeology (2008)
doi: 10.1111/j.1095-9270.2008.00193.x

A 9th-century Arab or Indian shipwreck in Indonesian Waters: Addendum

Some seven years after first writing about a 9th-century Arab or Indian wreck (*IJNA* **29**.2 (2000): 199–217) it is finally possible to be more definitive in ascribing an origin to the vessel. During that time an exhaustive conservation programme has been completed and the entire artefact collection, some 60,000 pieces, has been acquired by the Singapore Government. They plan to establish a travelling exhibition featuring the key artefacts before the collection ultimately takes up residence in a dedicated maritime museum. The acquisition has sparked a surge of new research, including a new analysis of the ship's timbers.

The original article was largely descriptive, detailing the principle features of the ship, commonly known as the 'Belitung' or 'Tang' Wreck, such as hull planks joined by stitching over wadding both inboard and outboard, a sharp bow with little rake, stitched-in frames, through-beams stitched to the hull, removable ceiling planks, a keelson and stringers (or sister-keelsons), and a composite grapnel-type iron and wood anchor. The wreck was dated to the early-9th century through Chinese coins, radiocarbon analysis, and a Changsha bowl inscribed with the Chinese equivalent of AD 826. She was lost a mile off Belitung Island in the Java Sea. Her cargo consisted mostly of Chinese ceramics from the kilns of Changsha, with a smattering of fine Yue white-and-green-splashed ware. Three blue-and-white dishes are the earliest intact examples of this style ever found. Large green-glazed jars from Guangdong were used to stow some of the Changsha bowls as well as perishable goods. Gold and gilt-silver vessels, together with the finest ceramics, were perhaps intended as an imperial gift.

Discussion centred on determining where the ship was built. Construction technique and hull-form were studied in relation to ethnographic and iconographic data, leading to a provenance conclusively Arab or Indian. However, the great inter-influence across the Arabian Sea precluded a more specific answer. The Belitung Wreck stands alone in the archaeological record and hence there could be no recourse to this traditional source of comparative data. It all boiled down to identifying the various woods used in her construction and their native distribution. Even

Table 1. *Wood identifications*

Sample	CSIRO	Liphschitz
Stempost	*Dalbergia* sp. or *Petrocarpus* sp.	*Afzelia africana*
Frames	*Amoora* sp. or *Afzelia* sp.	*Afzelia africana*
Hull planks	Possibly *Amoora* sp.	*Afzelia africana*
Anchor shank	*Amoora* sp. or *Afzelia* sp.	*Afzelia africana*
Dunnage	Not analysed	*Afzelia africana*
Keelson	Not analysed	*Afzelia hipindensis*
Through-beams	*Tectona grandis*	*Tectona grandis*
Ceiling planks	*Cupressus* sp.	Probably *Juniperus procera*
Keelson chock	*Ficus* sp.	Not analysed

then it was impossible to be conclusive, as historical records reveal that Indian timbers were shipped to the Middle East for ship- and house-construction.

Several timber samples from various structural elements were originally analysed by the Forestry and Forest Products Division of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia. The latest analysis has been performed by Professor Nili Liphschitz of the Institute of Archaeology, Botanical Laboratories, Tel Aviv University. The results of both analyses are shown in Table 1. The CSIRO described the samples as so badly deteriorated that there was barely any cellulose left in the cell walls and only lignin holding the cells together. Sectioning and comparative identification proved extremely difficult. As can be seen from the results the samples have only been identified to genus level, and in some cases there were two possibilities.

Liphschitz has been far more successful in making definitive identifications. In her opinion the wood samples, taken from the same parent specimens as the CSIRO samples, were in quite good condition despite being in untreated wet storage for seven years. She attributes this to the sectioning method, using a razor-blade instead of a coarser sliding microtome which may have been used by the CSIRO. It should also be noted that Liphschitz specialises in identifying waterlogged shipwreck timbers, whereas the CSIRO's work is far more general. Drawing on cross, tangential and radial reference sections Liphschitz has no doubt about the genus identifications and is 'pretty confident' about the species. While the CSIRO identifications cannot be discarded, the author believes that Liphschitz's results should be given considerably more weight.

Before going further it must be acknowledged that timber identification is far from an exact science, a fact clearly illustrated by the different results obtained for the same Belitung Wreck samples. Liphschitz has qualified her robust conclusions by stating that there might be very similar, related timbers which are not commercially exploited and therefore do not have circulating anatomical charts with which to compare. Variations can also occur within the same species according to specific environmental conditions, such as water availability, which might result in changes in the relative volume of fibres compared to parenchyma cells, a key identification criteria.

Such qualifications could scupper conclusive discussion if only one or two samples had been analysed. But here we have seven samples. Four of them have been found to be the same species, and one a closely-related species. *Tectona grandis* has been confirmed for the through-beams by both analyses. The ceiling plank genus differs for each analysis but the family, *Cupressaceae*, is the same. The conclusion originally drawn from the CSIRO results was that, apart from the possible *Afzelia*, all other genus occurred in India and not Africa or the Middle East. This implied Indian construction, but with the historically-documented timber export trade, Arab construction was almost as likely. The new results support a very different conclusion.

Afzelia Africana (African mahogany), as the name implies, is native to Africa only, specifically north-east, east, west, and west-central tropical Africa including Sudan and Zaire (USDA). *Afzelia bipindensis* is also native to Africa only, being found in south, west, and west-central tropical Africa, Zaire being the closest region to the Middle-East (USDA). *Juniperus procera* (African juniper) is native to the mountains of

eastern Africa from eastern Sudan south to Zimbabwe, and to the south-west of the Arabian Peninsula—present-day Yemen (USDA). *Tectona grandis* (teak) is the anomaly, being native to India, Burma, Laos and Thailand (USDA).

From the earlier situation of only one possible genus not originating from India, we now have only one species which did—teak. That wonderful wood has justifiably been imported for the critical free-spanning through-beams. The only other large-section structural element, the keelson, also relies on a timber imported from afar, *Afzelia bipindensis*. If this originated in the region of Zaire it could have been transported at least part of the way on the Nile.

The twine that held the *Belitung* ship together must not be neglected. However, repeated attempts to identify this material scientifically have been thwarted by the severely deteriorated condition of the samples. They appear cohesive when dry but turn to mush as soon as they are prepared on a slide. Dr Changmo Sung, of the Center for Advanced Materials at the University of Massachusetts, did study a small sample of rope under a scanning electron microscope and has tentatively identified it as hemp. Hemp was originally native to the Caucasus region of far-eastern Europe, northern India, and Iran (BioTech Resources) so it would certainly have been available to Middle-Eastern shipwrights. It is a strong fibre but apparently rots in seawater, making it a questionable choice for stitching twine when the vessel relied so heavily upon it.

So from the new timber identifications the Belitung ship was definitely not built in India. It was most probably constructed in the Middle East, perhaps in the region of Oman or Yemen. Having drawn this neat conclusion, it is very interesting to note that the wadding that helped keep the ship watertight could have originated from Southeast Asia. It has so far proved impossible to identify the wadding scientifically due to its deteriorated state. However, Dr Shawn Lum, a botanist specialising in tropical forests, and Nick Burningham, a Southeast-Asian boat-building specialist, have visually identified the material as *Melaleuca* (paperbark) which occurs only in Australia, Malaysia, Indonesia and Papua New Guinea. The Southeast Asian swamp-dwelling species, *Melaleuca cajuputi*, is still used in boatbuilding as caulking between edge-joined hull planks. The Malays call it *kulit gelam*, literally the skin of the gelam tree.

Lum (2007) also suspects that the twine holding the Belitung ship together is hibiscus, a particularly strong fibre that is thought to have originated in southern China but spread early to tropical Southeast Asia. Burkill (1966) notes that *Hibiscus tiliaceus* (sea hibiscus) is one of the most important fibre-plants among the inhabitants of Malaysia, and would seem to have been put to use by them wherever they went. Lum notes that wherever *Melaleuca cajuputi* is found, *Hibiscus tiliaceus* is never far away.

If the stitching is indeed hibiscus and the wadding paperbark there is a ready explanation. It is quite feasible that the Belitung ship, which was lost in Indonesian waters, had been totally re-stitched in Indonesia using local materials prior to that tragic event. After such a long voyage, from the Middle East to China and part of the way back, re-stitching would almost certainly have been necessary. Systematic unstitching and re-stitching would permit a major overhaul without the need to dismantle the ship.

Michael Flecker
14 Watten View, Singapore 287130

Acknowledgements

Many thanks to Professor Nili Liphschitz for carrying out this new and enlightening analysis, and for promptly responding to a barrage of follow-up questions. Thanks also to Nick Burningham and Tom Vosmer for sharing their profound knowledge of traditional Middle-Eastern and Asian shipbuilding and seafaring.

References

BioTech Resources, www.biotech.icmb.utexas.edu/botany/hemphist.
Burkill, I. H., 1966, *A Dictionary of the Economic Products of the Malay Peninsula*. London.
Flecker, M., 2000, A 9th-century Arab or Indian shipwreck in Indonesian Waters, *IJNA* **29**.2, 199–217.
Lum, S., 2007, Summary of Visit to Pulau Duyong, Kuala Terengganu, Malaysia. Unpublished report, Singapore Tourism Board.
USDA, United States Department of Agriculture, www.ars-grin.gov.