



## Imagining a ship

They sailed the seas of our region during Viking times. Could a seaworthy reconstruction be built, based only on eighth-century stone carvings? **Nick Burningham** provides the answer.

WHEN THE FIRST FLEET set sail from England, Australia was not quite the isolated island continent that we often like to imagine. Aboriginal ancestors first crossed the seaways to Australia some 50,000 years ago, or more. Their arrival was not a single episode of migration. There seem to have been several subsequent waves of arrival by distinctly different people during the Pleistocene, and it wasn't only humans who arrived during prehistory. That Australian icon the dingo arrived about 4,000 years ago, according to science. Since dingoes are neither navigators nor boat builders it's reasonable to presume that they accompanied human visitors. It is probably no coincidence that they arrived when Austronesians (the Malayo-Polynesian peoples) were expanding into neighbouring seas.

The Austronesians were surely the most dynamic maritime explorers of prehistory. Their maritime expansion encompassed a greater part of the globe

than any other peoples'. They populated islands from Madagascar in the western Indian Ocean to Easter Island more than 200 degrees of longitude to the east, and from Taiwan in the northern hemisphere to New Zealand in the Southern Ocean.

Australia was effectively surrounded by the seaborne expansion of the Austronesians. It is difficult to believe

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that people with such highly developed maritime cultures would not have made voyages across the narrow seas between Australia and the islands that now constitute Indonesia. The history of the Makassan mariners collecting and processing cargoes of trepang on Australia's northern shores since the 17th century is relatively well known. Aboriginal narratives tell of earlier

relations with a people from Indonesia, the Bajjini, who settled for some years on the Arnhem Land coast.

Ludovico da Varthema, an Italian traveller in South-East Asia before European shipping first reached the region, recorded a conversation with the skipper of a Javanese ship he sailed on. Was there land to the south of Java? Yes

there was, said the skipper. He had never been there himself but he knew that ships went there. Varthema's testimony has often been dismissed as a fable because the skipper added that in the southern land the days were only three or four hours long in winter. However, the Javanese divided the day into ten 'hours' rather than twenty-four, so the skipper's assertion is perfectly reasonable.

**OPPOSITE:**  
*Raksa Samudra, the reconstruction of a medieval South-East Asian ship, on a powerful beam reach. Reproduced courtesy of photographer Danielle Eubank.*

**ABOVE:**  
*One of five ship reliefs at the 8th-century Borobudur temple on Java. Reproduced courtesy of photographer Reg Hill.*

**ABOVE RIGHT:**  
*Cheerful crew included people of English, Scottish, Australian, New Zealand, Iranian, Balinese, Bajo, Sundanese and Chinese origins. Photographer Reg Hill*

Despite the evidence of Varthema and others, pre-European voyaging to Australia remains scarcely discernible in our consciousness. Perhaps this is because we cannot easily visualise it in our imagination, or it is thought of as trivial visits by occasional fishermen in canoes. By comparison the Viking expeditions to the northeastern seaboard of North America are easily pictured, because we all know what Viking ships looked like. In truth, the largest ships of South-East Asia in Viking times were very much larger than any known Viking ships. But what did medieval South-East Asian ships look like?

During 2002–3 I had the opportunity to design and supervise the construction of a replica (or 'reconstruction' as many now prefer to say) of the type of ship depicted in five bas-relief panels at Borobudur, the huge eighth-century Buddhist temple in Java. Our Borobudur ship was built to re-enact the Indonesian voyages across the Indian Ocean which populated Madagascar. The expedition, initiated and led by a Briton called

Philip Beale, reached Madagascar without mishap in October this year with a mixed European and Indonesian crew.

Developing a seaworthy interpretation of the type of ship depicted at Borobudur was a daunting challenge. Those five panels all show a ship quite unlike anything else in maritime history, and at first glance they have some strikingly unlikely features. Most noticeably, there are outriggers, but the proportions are not like those seen on outrigger canoes in more recent times. The vessels depicted are not canoes but clearly ships engaged in long distance voyaging. They have two bipod masts and a bowsprit, rowing galleries outboard of the hulls, deckhouses, and they obviously required a large crew to row and sail them.

There have been at least two previous attempts to reconstruct a plausible design for a Borobudur ship, one a full-size reconstruction and the other a very fine scale model. Both had a major defect – they only floated upside-down! Outriggers provide adequate stability for canoes, but to do so they often need to be

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significantly longer than the canoe. The outriggers shown on the Borobudur ships were too short to be an important source of stability. So what were they for?

A reasonable answer can be found in the pages of Vice Admiral François Edmond Paré's 1843 *Essai sur la Construction Navale des Peuples Extra-Européens*, a rare book in the ANMM's collection (see

Signals 64 pages 24–27). Paré recorded some large pirate vessels fitted with outriggers as platforms for paddlers. Following this lead the Borobudur ships could be interpreted as war galleys, equipped with outrigger paddlers' platforms as well as rowing galleries along the sides of the hull, and tall woven shields providing protection from spears and arrows at the bow and stern.

As a galley, intended to be efficiently propelled by paddlers and oarsmen in calm conditions, our ship would be designed relatively long and sharp, but it also needed to have enough beam and bearing to confer the stability to carry a large sailing rig on the open ocean. To conform with the appearance of the Borobudur depictions, and to accommodate the rowing galleries, it would have to be a relatively high-sided ship. Combining all those features was a difficult balancing act.

Working on paper and computer I tried various ratios of proportions and hull shapes. Most configurations either wouldn't work or didn't look right, or

would probably break off their outriggers rolling in heavy seas. When I felt I had a workable design that fulfilled all the requirements I built a scale model. Our replica was to be built in Indonesia by traditional shipwrights who do not usually work from scaled plans on paper. However, given a scale model they can rapidly read the whole design in three dimensions and then faithfully reproduce it at full size.



*The Borobudur ship takes shape, is launched, and floats with masts in place before being fully-ballasted. Photographs this page by Nick Burningham*



The accomplished builders on the tiny coral island of Pangerungan Kecil, a speck in the seas to the north of Bali, were brilliant. Our 19-metre ship was finished ready for launching in just four months. Indeed the ship they built was more elegant and shapely than my design, and even my most ill-thought-through ideas were turned into clever solutions. Construction was of very high standard.

The launching was hugely spectacular. In preparation a steer and three goats brought from a larger island were ritually slaughtered and some 50 women worked right through the night to produce great cauldrons of wonderfully rich, spicy curries, while a traditional Bajo orkes band played and people danced. Then, just after dawn, seven or eight-hundred men, lined out on hawsers and hauling in unison to the calls of an elder, dragged the ship slowly at first, then gathering

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pace, down to the water. I was pleased and relieved to see she floated the right way up even without ballast, and then stood back to admire the way she proudly rode the water.

During the following month, masts, outriggers, rudders, spars and sails were fitted. The outriggers were designed to fly clear of the water until the ship was heeling to a fresh breeze. We discussed fitting the tall shields in the bow and stern – they could have easily been made from sheets of woven bamboo screen and timber battens – but they would have been thoroughly impractical and would have constituted a most improper contravention of the regulations

governing watch-keeping and avoidance of collision at sea. It would have been like driving with your windscreen covered.

On the maiden voyage to Java the big rectangular sails proved very heavy and awkward to handle. I had used the same type of rig on two previous designs, *Hati Marege*, the replica 19th-century Makassan prahu now in the Northern Territories Museum of Arts and Sciences, Darwin, and *Alfred Russel Wallace*, built for professional 'replica' voyager Tim Severin's latest documentary. On a modest scale the rig had been handy and fun to use, but ours was brutal.

Had we not included in our crew six Pangerungan sailormen, brave and strong as steel hawsers, we could not have handled the rig at all. We made some

modifications which helped sail handling, and on the voyage along the north Java coast to Jakarta we learned to use the wind to push the sails around the mast when tacking. The Borobudur ship is definitely at the upper size limit for this powerful, traditional Indonesian rig.

In Jakarta the ship was officially named *Raksa Samudra* – 'cleaver of the ocean', in one possible translation – by President of the Republic of Indonesia Megawati Sukarno Putri. I accompanied *Raksa* on the first oceanic leg of the expedition. We worked south through Sunda Strait in mostly light headwinds but with a helpful current. Out on the Indian Ocean we picked up the south-east trades. Sailing

#### Origins of the Borobudur ships

Indian scholars have claimed that the ships depicted on this Buddhist stupa must be Indian in origin. Chinese scholars have been just as keen to claim them as their own. However, the outriggers, the canted rectangular sails set on bipod masts, the quarter-mounted rudders and certain decorative features all identify the Borobudur ships as indigenous Indonesian design.

#### Single or double outriggers?

Only one side of each ship is shown in each Borobudur ship image. Some have argued that the ships would have had only a single outrigger, like big Pacific voyaging canoes. However, the relief panels show both starboard and port sides, and both windward and leeward views. In every case we see an outrigger, so we may safely conclude that there were double outriggers.

#### Size of the Borobudur ships

The likely length can be calculated from the number of positions in the rowing galleries. An oarsman needs a certain minimum space to operate without hitting his neighbour. On this basis the largest ship depicted at Borobudur would be at least 15 metres long. I designed the replica at 17.5 metres length and Pak Asad, my Pangerungan master shipwright, generously decided to build us a more commodious ship of 19 metres! The beam, 4.35 metres, is the minimum necessary to provide adequate stability.

between latitudes 10° and 11° south we made a good passage to the Seychelles, averaging 133 miles per day, making a best noon-to-noon run of 177 nautical miles. Two big quarter mounted rudders or steering oars gave good steering

characteristics, never overly heavy even in strong winds with big seas on the quarter. The outriggers may have helped to damp rolling in some circumstances but they created significant drag and often rolled deep into the water. The rig

was at its best running and reaching in strong, steady trade winds where the wind direction hardly changes and only minor sail trimming is required. It is a rig that creates tremendous lift and drive.

From the Seychelles the Borobudur ship made a slow passage to Madagascar in light doldrum conditions. From there the expedition will attempt to sail around the Cape of Good Hope to Ghana in equatorial west Africa. Ancient Indonesian voyaging to Madagascar and East Africa is not controversial. The idea that they might have reached west Africa is so troubling that most academics prefer to avoid the question, but there are curious metallurgical, musicological and linguistic links between Indonesia and equatorial west Africa that have yet to be explained. ■

*Nick Burningham designed the Western-Australian-built replica of the Dutch jacht Duyfken, the first known European ship to have reached Australia, and has been involved as designer or builder in many historic reconstruction projects.*

*For more details of the Borobudur ship expedition, its design and construction, see [www.borobudurshipexpedition.com](http://www.borobudurshipexpedition.com).*

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