The first mariners. *The American Neptune*, Volume 61, Number 3, pp. 317-324, 2002.

The First Mariners

by Robert G. Bednarik

Maritime colonization by *Homo erectus* commenced in Indonesia well over eight hundred thousand years ago. It led to the peopling of much of the region by early hominids and, by possibly sixty thousand years ago, to the occupation of greater Australia through *Homo sapiens.* Current replicative experiments are demonstrating that all of this maritime expansion must have involved the use of seaworthy watercraft. One implication of these first maritime expeditions is that the hominids concerned are suggested to have had language and a much more sophisticated technology and culture than hitherto thought. The technological and cognitive background of these achievements is being examined through a long-term replicative study.

Robert G. Bednarik is director of the International Institute of Replicative Archaeology in Melbourne, the convener of the International Federation of Rock Art Organizations (IFRAO), and the editor and secretary of the Australian Rock Art Research Association (AURA). His principal research interests are the epistemology of Pleistocene archaeology, hominid cognition and technology, and the origins of human constructs of reality. He has produced over four hundred refereed scientific articles in nine languages, and almost six hundred further publications in thirty-two languages.

The islands of Nusa Tenggara, formerly known as the Lesser Sunda Islands, are separated from Sumatra, Java, and Bali by the world's most important biogeographical filter, named after the British naturalist Alfred Russel Wallace. The Wallace Line, which runs between Bali and Lombok, indicates the furthest extent of typical Southeast Asian mammals. These had been able to colonize the islands west of the barrier during Pleistocene periods of low sea level.[1] The geologically young islands of Indonesia are still rising from the sea, those east of Bali have never been joined to either the Asian or the Australian mainland, and most have not been connected to other islands in the past. Apart from a very few exceptions, they were never settled by any large mammalian species.

Proboscideans swam across many of the sea barriers, presumably in herd formation, and the remains of elephants, *Stegodon,* and *Stegolophodon* have been found in Pleistocene deposits on many of the region's islands. They form the most conspicuous component of the strictly endemic fossil faunas, occurring both as full-size and dwarf species. Elephants are superb long-distance swimmers that have colonized dozens of islands around the world, including the Santa Barbara Islands off the Californian coast.[2]

Humans also settled the islands of Nusa Tenggara, not by swimming but after they had developed maritime navigation capability. By about 840,000 years ago, hominids had established a sub-

stantial population on Flores, which suggests that they had earlier settled Lombok and Sumbawa, the two major islands between Bali and Flores. In the Soa Basin in central Flores, their stone tools occur under up to 150 meters of sedimentary rock, together with the remains of *Stegodon trigonocephalus florensis* and other extinct species.

The antiquity of the Early Pleistocene artifacts from the Soa Basin indicates unequivocally that the hominids who made and used them were *Homo erectus,* the species from which modern humans evolved, and which had existed in Java since at least 1.81 million years ago.[3] Further east, on the island of Timor, their stone tools were again found together with a fauna of *Stegodonts,* and a fragment of a very large marine shell was found to bear evidence of fire.[4]

Homo erectus thus colonized a good part of the Indonesian island world, presumably helped by the region's outstanding wealth of bamboo species suitable for building seaworthy rafts. The repeated occurrence of the stone tools together with *Stegodont* bones, at six sites so far, might indicate that this elephant species was a major food source, but giant rats (*Hooijeromis nusatenggara*) have also been suggested as a possible terrestrial staple of these early mariner people.[5]

Stegodont molar from the Middle Pleistocene Weaiwe Formation at Motaoan, Timor, recovered next to a stone implement.

There is no seafaring evidence of such antiquity anywhere else in the world, although it has been mentioned from time to time that the Strait of Gibraltar may have been crossed early by hominids.[6] The presence of stone tools at a site on Sardinia provides the earliest known secure indication of seafaring in the Mediterranean. These finds have been suggested to be on the order of three hundred thousand years old but are not as yet as securely dated as those in Indonesia.[7] Sardinia was connected to Corsica at times of low sea level, but never to the Italian mainland. Human skeletal remains from Crete combine both modern and Neanderthaloid features and are thought to be about fifty thousand years old, indicating seafaring ability in the late Middle Paleolithic period.[8] To reach Crete, a crossing of at least thirty kilometers was required even at lowest Pleistocene sea level. Upper Paleolithic evidence we have of European seafaring is also from the Mediterranean, consisting of a 20,000-year-old human finger bone from Sardinia, and the discovery of obsidian from Melos, about eleven thousand years old, in a cave on mainland Greece.[9]

Similarly, the presence on Honsho of obsidian from Kozushima, about fifty kilometers from the main island of Japan, some thirty thousand years ago, renders sea crossings in both directions necessary, indicating the availability of advanced navigation technology.[10] Another Japanese island reached by Pleistocene seafarers is Okinawa, as shown by the remains of four humans at Minatogawa, dated between sixteen and eighteen thousand years B.P. Finally, the two human femora fragments and one humerus from Arlington on Santa Rosa Island, reportedly thirteen thousand years old, indicate Ice Age maritime navigation on the west coast of North America. While the details of the early settlement of the Americas remain shrouded in mystery, the evidence on the Santa Barbara Channel islands may well imply that the original colonizers were primarily a coastal people

who traveled much by watercraft. Moving down the continent's west coast from the Bering Strait, they perhaps only began to settle the vast interior when growing population pressures prompted them to cross the Rocky Mountains.

The Pleistocene has so far yielded no material evidence of navigation, such as boats, paddles, rafts, or identifiable parts thereof. There are no rock art images resembling watercraft known that could safely be attributed to the Pleistocene. The earliest navigational material finds are all from northwestern Europe, and from the early Holocene. They are Mesolithic paddles from the peat bogs at Holmgaard (Denmark) and Star Carr (England); a worked reindeer antler that might have been a rib of a skin boat in the Ahrensburgian of Husum, a site in Germany; and the somewhat younger canoes and dugouts from Pesse (Holland, 8265 ± 275 carbon years), Noyen-sur-Seine (France, 7960 ± 100 carbon years), and Lystrup 1 (Denmark, 6110 ± 100 carbon years).[11]

This pattern of occurrence implies a severe preservational bias, no doubt emphasized by the effects of the Pleistocene sea-level fluctuations. Nevertheless, in the waters to the north of Australia, maritime journeys were conducted almost habitually during the late Ice Age. We can only know about long-term settlements that resulted in archaeologically visible populations. Numerous attempts no doubt failed, either initially or at least in the long term, but evidence from about thirty-three to twenty-seven thousand years ago indicates that many islands had been settled by that time by seafarers with an essentially Middle Paleolithic technology.[12] Most of these islands are small, and they could not have been sighted until a raft reached their proximity: the Monte Bello Islands (one hundred kilometers from Australia), Gebe Island (west of New Guinea), New Ireland (east of New Guinea), and Buka Island (180 kilometers from New Ireland).

This evidence demands a rewriting of the story of human evolution. Pre-modern hominids were not, as frequently claimed, devoid of complex culture and technology, language, symbolism, and self awareness—they were not mere carrion-scavengers at the mercy of their environment. They had the ability to plan projects that took months to complete, and they had the courage to entrust themselves and their families to contraptions designed to harness four forces of nature: buoyancy, wind, waves, and ocean currents. The first mariners in history, most likely in Bali, set the course not only for Lombok, but also for the destiny of humanity. Since their momentous decision, the human ascent itself has been a continuous history of the skilled application of cultural systems to utilize natural ones. Thus, seafaring was the most decisive factor in initiating the technological ascent of humans that ultimately gave rise to our culture.

Human language, it seems, was already sufficiently developed a million years ago to express abstract concepts. This is twenty times as long ago as most archaeologists find acceptable to preserve their current paradigm. It is at massive odds with this dominant model, but that is not entirely unexpected. The cultural and cognitive sophistication of Lower Paleolithic hominids has been implied by the discovery of beads (in three continents), petroglyphs, hunting spears, composite artifacts, portable engravings, and the evidence that mineral pigments were used and crystals and fossil casts were collected. Indeed, the collection of "proto-symbolic" objects was apparently even practiced by australopithecines of South Africa, almost three million years ago. Thus, the Indonesian evidence reminds us that models of hominid evolution that disregard this cultural, technological, and cognitive evidence have become irrelevant and superseded, having been refuted consistently for decades. The Flores evidence, specifically, has been available to us for forty years, and has remained ignored for this period in Anglophone archaeology.[13]

The complete lack of any direct physical evidence of maritime technology from the entire Pleistocene renders it pointless to speculate about the circumstances of these endeavors without addi-

Wooden paddle made entirely with Lower Paleolithic stone tool replicas.

tional information. No sustained replicative experimentation of archaeology has been conducted in relation to this subject before 1996. The First Mariners project then commenced to determine the most likely means employed by *Homo erectus* in crossing Lombok Strait more than 840,000 years ago, and the most likely circumstances of first landfall in Australia more than sixty thousand years ago. Our rather limited knowledge from other areas of technology of the periods in question, particularly in stone tool knapping and wood and bone working, serves as a reference source for these projects. Some aspects of relevant material use can be replicated precisely on the basis of form of, and work markings on, archaeological finds as, for instance, bone harpoons. Others must be determined according to derived probability estimates systematically based on experimentation. A series of expeditions currently endeavors to create authentic conditions for the construction of primitive vessels and their sailing across the sea barriers in question. This involves the use of appropriate stone tool replicas in felling and working bamboo and in constructing and sailing the rafts.

Literally hundreds of issues of technology need to be addressed in the course of these experiments, including the means of carrying freshwater, primitive fishing at sea, locating sources of stone tool materials for raft construction, and, of course, issues of maritime design. The understanding of Pleistocene technology to be acquired in this way by far exceeds the understanding accessible by traditional archaeological approaches.

Construction of the first full-size experimental vessel was commenced in August 1997, and the *Nale Tasih 1* was launched at Oeseli in southern

Roti on 14 February 1998. It sailed for sea trials with a crew of eleven on 6 March.[14] Middle Paleolithic stone tool replicas had been used in the construction of this twenty-three-meter, oceangoing bamboo raft of about fifteen tons plus cargo. The objective was to establish whether it would be capable of sailing from Roti to Australia in a reasonable time. Some aspects of this raft were judged to be unsuitable under the unfavorable conditions brought about by the El Niño effect. Four days later, the vessel was beached for destructive sampling, and the entire raft was dismantled and dissected for inspection and material testing. The results provided a great deal of information that would affect the design and material choices for the additional rafts to be constructed by the First Mariners project.

A radically different, simpler design was adopted for *Nale Tasih 2,* an eighteen-meter bamboo raft of only 2.8 tons. Construction of this vessel began in August 1998 near Kupang, West Timor, and on 17 December, it left Kupang Harbor with a crew of five. The raft had been constructed from bamboo, rattan forest vines, handmade gemuti ropes of palm fiber, wood, lontar pipa string, and palm leaves, especially of the lontar palm. On board were two mangrove logs (hollowed out by termites and sealed off with wood, beeswax, bark, and tree resin) that contained 350 liters of drinking water. The A-frame mast bore a small sail made from

The *Nale Tasih 2,* sailing under extreme conditions in heavy seas, approaching Australia on 28 December 1998.

palm fiber. The *Nale Tasih 2* was well equipped with spare parts, including two sails, a steering oar, vines, and other cordage, and to effect repairs, it carried sixty-five stone artifacts, replicas of Middle Paleolithic types made from black chert, and a stone mortar and pestle. Food provisions included fruit, cassava, salted meat, native millet, palm sugar, and salt, but the intention was to derive most food from the sea. For this purpose, the raft was equipped with several harpoons and fish spears, and it also carried a wooden fire box, some firewood, and dry coconut husks.

The *Nale Tasih 2* traveled without an escort boat or radio. It reached the continental shelf of Australia, which formed the continent's shore sixty thousand years ago, on the sixth day, thus having completed its primary objective. To gain more knowledge in handling such a raft, the crew continued on towards Darwin. On the eleventh day, the seas became rough, and the raft was sailed under extreme conditions for two days. The steering oar broke, the upper yard broke in two, and at one stage, all four forward guy ropes of the mast snapped in unison.[15] However, all repairs were effected successfully, if under the most dramatic conditions. On the thirteenth day, rough seas of five-meter waves forced the raft towards Melville Island, north of Darwin, a coast heavily populated by saltwater crocodiles. As a precaution, the crew was taken off three hours before the raft was to reach the shore, transferring to an oil ship, the *Pacific Spear,* on the evening of 29 December 1998. Three days later, the raft was recovered in calmer seas, from where it had beached itself on the south coast of Melville Island, and towed to Darwin for public exhibition. Lashed together by nothing but

Jacobus Zakawerus (tribal name Om Mberu) on the *Nale Tasih 4* as it approaches its target coast, successfully crossing Lombok Strait on 31 January 2000.

forest vines, it had withstood almost one thousand kilometers of travel, partly under the most severe maritime conditions, without serious damage.

In March 1999, the eleven-meter bamboo raft *Nale Tasih 3* set out from the eastern-most point of Bali to attempt a crossing of Lombok Strait. Propelled by six oarsmen, it reached the halfway mark of its journey and was then forced north by strong seas. Once it became evident that it would miss the northwestern corner of Lombok, the attempt was abandoned under appalling weather conditions, and the crew transferred to the escort vessel. By the end of that year, a similar, twelve-meter-long simple platform of bamboo, *Nale Tasih 4,* lacking any sail or means of steering, was being built for a second attempt. This vessel was as rudimentary as a raft can possibly be, weighing only 1,080 kilograms, and was to be propelled by twelve paddlers. It crossed Lombok Strait successfully on 31 January 2000, taking just under twelve hours to cover fifty-one kilometers. The raft and paddles had been made with stone tools modeled on Lower Paleolithic finds of the region. This included all work processes, such as stripping and splicing the rattan bindings, and shaping the wooden paddles. The raft was assembled in under two weeks and on its journey reached a maximum speed of 4.2 knots, but its progress was badly hampered by strong currents in the deep-water section of the strait. The experiment showed how even a treacherous stretch of sea such as Lombok Strait could be crossed with purely Lower Paleolithic means.

This expedition completed stage one of the First Mariners project. Field work for the second stage, which is taking place in the Mediterranean, commenced in September 1999 on the coast of Morocco, where two prototype rafts were constructed entirely with Lower Paleolithic stone implement replicas, and then taken for sea trials. One of these vessels, a pontoon-type raft, was made of bundles of cane, the other of inflated animal skins. The next research activity of the project will focus on Italy, including archaeological work in Elba and Sardinia.

The First Mariners project, which is not expected to be completed before the end of 2005, involves several further raft expeditions as well as extensive archaeological research on land in several more countries, including the United States. Its primary purpose is to examine quantitatively each of the many variables involved in Pleistocene seafaring, to create the conditions for constructing multiple scenarios within a realistic framework of probability. In this procedure, the confidence that the most probable scenario can convincingly be identified is a function of the variables or determinants accounted for satisfactorily. Therefore, numerous experiments are essential, and all need to be conducted under fully controlled conditions. While the most sensible, economic, or logical course of action is not necessarily the one always taken by hominid mariners, there are several arbitrary limiting factors. For instance, these journeys had much to do with survival, and we can reasonably assume that they were on the very limits of the technologically possible at the times in question. The most probable scenarios can then be tested by reference to known parameters of technological competence at the time. These are derived from the archaeological research forming part of the overall project. This would seem to be the only scientific method available to us to generate informed and plausible explanations for the very early maritime feats of hominids. The work has already prompted significant revisions to our ideas about these highly enterprising ancient mariners.

Notes

1. Alfred R. Wallace, *The Malay Archipelago* (London: Macmillan, 1890).
2. D. L. Johnson, "Problems in the Land Vertebrate Zoogeography of Certain Islands and the Swimming Powers of Elephants," *Journal of Biogeography* 7 (1980): 383–98.
3. C. C. Swisher et al., "The Age of the Earliest Hominids in Indonesia," *Science* 263 (1994): 1118–21.
4. R. G. Bednarik, "Maritime Navigation in the Lower and Middle Palaeolithic," *Comptes rendus de l'Académie des sciences Paris* 328 (1999): 559–63.
5. P. Y. Sondaar et al., "Middle Pleistocene Faunal Turnover and Colonization of Flores (Indonesia) by Homo erectus," *Comptes rendus de l'Académie des sciences Paris* 319 (1994): 1255–62.
6. Leslie G. Freeman, "Acheulian Sites and Stratigraphy in Iberia and the Maghreb," in *After the Australopithecines,* ed. K. W. Butzer and G. I. Isaac (The Hague/Paris: Mouton Publishers, 1975), 661–743.
7. Fabio Martini, "Early Human Settlements in Sardinia: the Palaeolithic Industries," in *Sardinia in the Mediterranean, a Footprint in the Sea: Studies in Sardinian Archaeology Presented to Miriam S. Balmuth,* ed. R. H. Tykot and T. K. Andrews (Sheffield: Sheffield Academic Press, 1992), 40–48; and C. Bini et al., "Sa Coa de Sa Multa e Sa Pedrosa Pantallinu: due 'Paleosuperfici' Clactoniane in Sardegna," in *Atti della XXX Riunione Scientifica, "Paleosuperfici del Pleistocene e del Primo Olicene in Italia, Processi si Formazione e Interpretazione," Venosa ed Isernia, 26–29 ottobre 1991* (Firenze: Instituto Italiano di Preistoria e Protostoria, 1993), 179–97.
8. F. Facchini and F. Giusberti, "Homo Sapiens Remains from the Island of Crete," in *Continuity and Replacement,* ed. G. Bräuer and F. H. Smith (Rotterdam/Brookfield: A. A. Balkena, 1992), 89–208.
9. F. Spoor and P. Y. Sondaar, "Human Fossils from the Endemic Island Fauna from Sardinia," *Journal of Human Evolution* 15 (1986): 399–408; and P. Y. Sondaar et al., "The Human Colonization of Sardinia: A Late-Pleistocene Human Fossil from Corbeddu Cave," *Comptes rendus de l'Académie des sciences Paris* 320 (1995): 145–50.
10. Athol Anderson, "Recent Developments in Japanese Prehistory: a Review," *Antiquity* 61 (1987): 270–81.
11. R. G. Bednarik, "The Earliest Evidence of Ocean Navigation," *International Journal of Nautical Archaeology* 26 (1997): 183–91.
12. R. G. Bednarik, "Maritime Navigation in the Lower and Middle Palaeolithic," *Comptes rendus de l'Académie des sciences Paris* 328 (1999): 559–63.
13. Theodor Verhoeven, "Pleistozäne Funde in Flores," *Anthropos* 53 (1958): 264–65.
14. Robert G. Bednarik and Martin Kuckenburg, Nale Tasih: *Eine Floßfahrt in die Steinzeit* (Stuttgart: Thorbecke, 1999).
15. Ibid.