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The First Mariners Project

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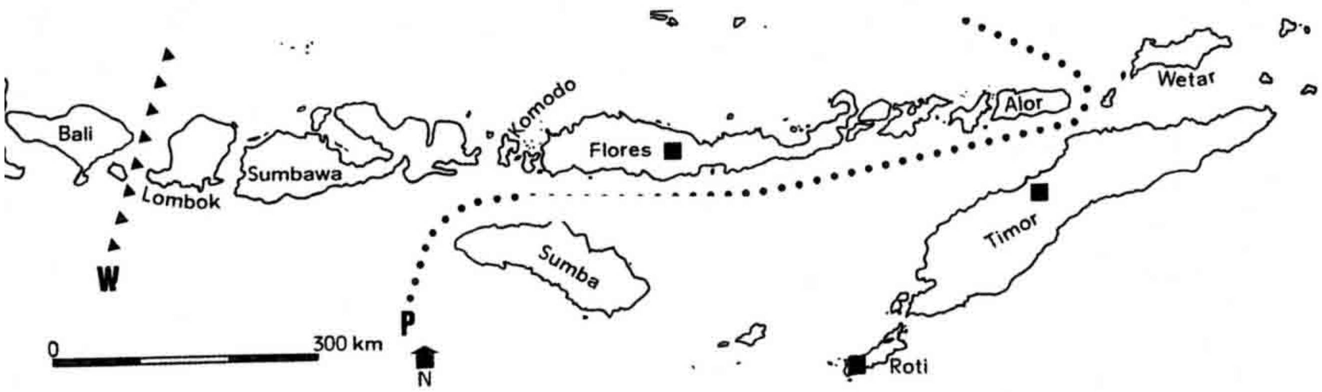

Figure 1. Nusa Tenggara, Indonesia. The Wallace Line (W) and the presumed dividing line between the Eurasian tectonic plate (Sunda section) and the Australian (Sahulian) plate (P) are shown. Find sites of Early and Middle Pleistocene stone tools are indicated.

Maritime colonisation by *Homo erectus* commenced in ndonesia well over 800 000 years ago. It led to the peopling of much of the region by early hominids, and by possibly 60 000 years ago to the occupation of Greater Australia hrough *Homo sapiens*. Current replicative experiments by the First Mariners Project are demonstrating that all of this maritime expansion must have involved the use of seaworthy watercraft. One implication of these first naritime expeditions concerning Pleistocene navigation s that the hominids concerned are suggested to have had anguage, and a much more sophisticated technology nd culture than hitherto thought. The technological nd cognitive background of these achievements is being xamined through a long-term replicative study.

The Indonesian evidence

The islands of Nusa Tenggara, formerly known as the Lesser Sunda Islands, are separated from Sumatra, Java nd Bali by the world's most important biogeographical ilter. The Wallace Line, between Bali and Lombok, was named after the British naturalist Alfred Russel Wallace. t indicates the furthest extent of typical South-east Asian utherian fauna, which had been able to colonise the slands west of the barrier during Pleistocene periods of ow sea level (Wallace, 1869; see Fig. 1). The Indonesian slands are geologically young, being the result of the ecent collision of two continental plates, those of Sunda South-east Asia) and Sahul (Greater Australia). Formed long a subduction zone, they are still rising from the sea. Those east of Bali have never been joined to any mainland, nd most have not been connected to other islands in the ast (Lydekker, 1896). Apart from a very few exceptions hey were never settled by large mammalian species, but humans have introduced some to Nusa Tenggara.

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 (Koenigswald, 1949; Hooijer, 1957, 1972; Verhoeven, 1958, 1964, 1968; Glover, 1969; Groves, 1976; Hantoro, 1996). 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 colonised dozens of islands around the world (Johnson, 1980). Their presence on the islands contrasts with the absence of the many Javan species that can cross sea barriers, but only those that are less then 30 km wide (e.g. hippos, tapirs, deer, pigs). This suggests that the width of Lombok Strait was never under 30 km.

Humans also settled the islands of Nusa Tenggara, not by swimming but after they had developed maritime navigation capability (Sondaar *et al.*, 1994; Bednarik, 1995). By the end of the Early Pleistocene (present dating indicates by about 840 000 years ago) hominids had established a substantial population on Flores, which suggests that they had earlier settled Lombok and Sumbawa, the two major islands between Bali and Flores. The Soa Basin in central Flores, north of Boawae, consists of a series of mostly volcanic facies, transected by numerous deep drainage valleys documenting the uniformity of the geological sections. Fossiliferous deposits in the lower part of this sequence, under up to 150 m of sedimentary rock, have produced Lower Palaeolithic stone tools together with a wealth of remains of *Stegodon trigonocephalus florensis* from several sites since 1957 (Bednarik, 1997a; Bednarik & Kuckenburg, 1999). Their age was initially estimated at

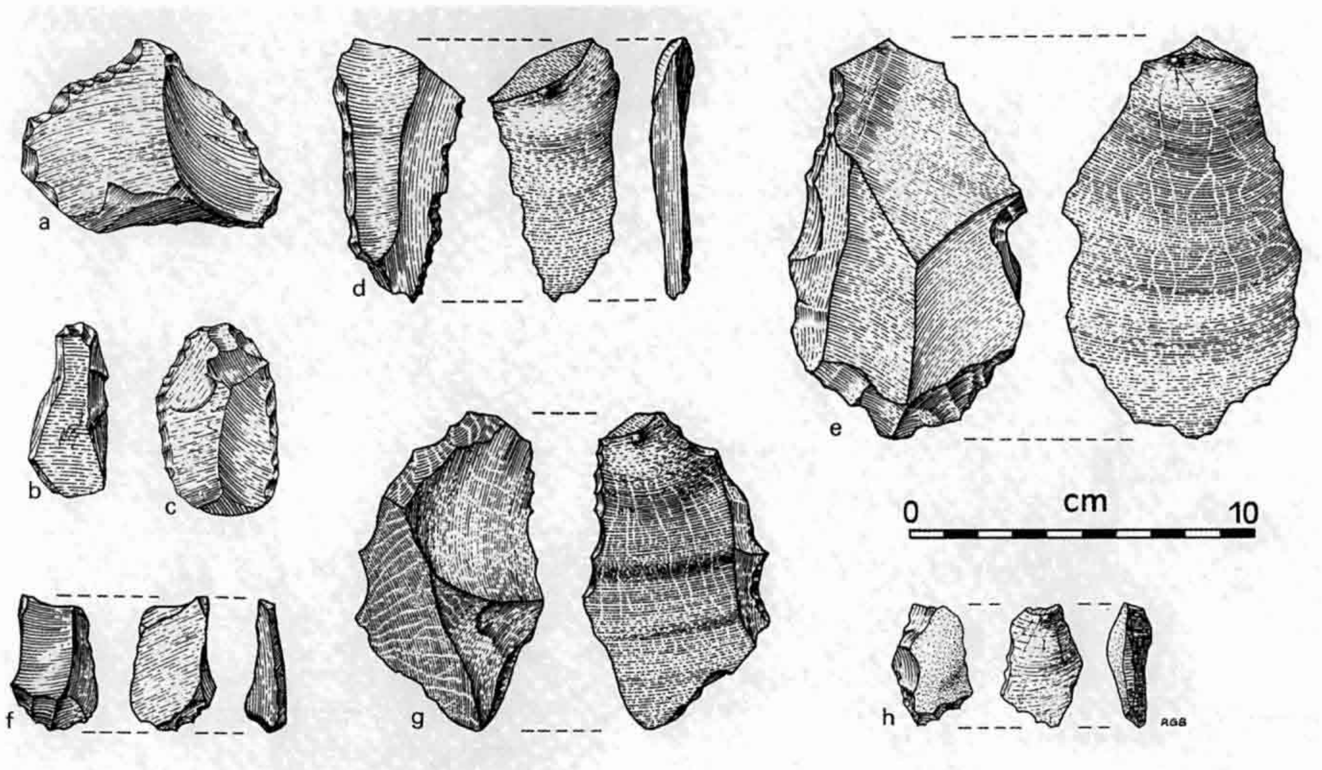

Figure 2. Stone tools of the final Early Pleistocene of the Soa Basin, Flores, thought to be about 750–840 ka old.

perhaps 710 000 years, although an age of up to 830 000 years was already considered possible in 1973 (see Fig. 2). This was based on the geology, fauna, and presence of tektites (Koenigswald, 1958; Koenigswald & Gosh, 1973). A series of nineteen palaeomagnetic samples from two sections indicated an age of slightly later than the Matuyama-Brunhes reversal (780 000 years ago) for a sediment containing stone tools at the site Mata Menge (Sondaar *et al.*, 1994). Subsequent zircon fission track analysis of the same deposit produced a date of 800 000 ± 80 000, while the nearby Boa Leza site yielded 840 000 ± 70 000 BP for stone tools and Stegodont fauna. Four earlier deposits apparently free of anthropogenic evidence are about 850–920 000 years old (Morwood *et al.*, 1999).

The antiquity of the Early Pleistocene artefacts from the Soa Basin indicates that the hominids who made and used them were *Homo erectus*. At present we are not aware of any other hominid's existence at that time. That species' remains have over the past one hundred years been found in Java, where they are suggested to be up to 1.81 million years old (Swisher *et al.*, 1994). So far, no early hominid remains have been found in Nusa Tenggara, but stone tools similar to those in Flores occur on other deep-water islands in the region. They have now been found in central Timor, in western Timor, in Roti, and in Sulawesi, north of Nusa Tenggara. At least the finds from central Timor and Roti are from Middle Pleistocene deposits (Bednarik & Kuckenburg, 1999).

A recent study of the geology and unusually clear stratigraphy near Atambua, West Timor, has yielded finds of Stegodontidae at six sites: Weaiwe 1, 2, and 3, Motaoan, To'os, and Odak (Bednarik, 1999a). In all cases they derive from a distinctive, banded calcite-cemented conglomerate facies, the Weaiwe Formation. At Motaoan, an indisputable chert artefact was recovered from the same stratum, about 2 m from a nearly complete and superbly preserved Stegodont molar. The broad, Clactonian-like flake is thin, bears a bulbar area and percussion point, and a well-retouched concave working edge. However, the severely weathered artefact has been transported among the gravel, whereas the osteal finds from the same deposit have generally not been moved. Therefore the two types of evidence do co-occur, but not in primary association in this instance. Nevertheless, a fragment of a very large marine shell found in the same stratum at another nearby site, To'os, had been smashed by considerable force and at one end bore extensive evidence of calcination. It had been lying in a fire, almost certainly through hominid agency. The site is now one day's walk from the sea, and over 300 m above present sea level. The contemporaneity of Stegodontidae and humans in Timor has thus been demonstrated (Bednarik, 1999a).

Pleistocene seafaring and its implications

Homo erectus thus colonised 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 (Morwood *et al.*, 1999; Bednarik & Kuckenburg, 1999), might indicate that this species was a major food source, but giant rats (*Hooijeromis nusatenggara*) have also been suggested as a terrestrial staple of these early mariner people (Sondaar *et al.*, 1994).

No seafaring evidence of the antiquity demonstrated in Indonesia is available elsewhere in the world, although it has been mentioned from time to time that the Strait of Gibraltar may have been crossed early by hominids (Freeman, 1975; Johnstone, 1980; Fiedler, 1999; Bednarik, 1999b). The presence of *in situ* stone tools in Middle Pleistocene deposits at Sa Coa de sa Multa near Perfuga, Sardinia, provides the earliest known direct indication of seafaring in the Mediterranean (Martini, 1992; Bini *et al.*, 1993; Spoor & Sondaar, 1986; Sondaar *et al.*, 1995). The finds have been suggested to be in the order of 300 000 years old but are not securely dated. Sardinia was connected to Corsica at times of low sea level, but never to the Italian mainland. Similarly, Kefallinía near the mainland of Greece, where Mousterian tools have been found, must have been reached via the sea, even though the distance from the mainland was considerably smaller than in the Indonesian crossings (Kavvadias, 1984). Human skeletal remains from Crete combine both modern and archaic features and are thought to be about 50 000 years old, clearly indicating seafaring ability in the late Middle Palaeolithic period (Facchini & Giusberti, 1992). To reach Crete, a crossing of at least 30 km was required even at lowest Pleistocene sea level. Upper Palaeolithic evidence we have of European seafaring is also from the Mediterranean, consisting of a 20 000-year-old human finger bone in Corbeddu Cave, Sardinia; and the discovery of obsidian from Melos, about 11 000 years old and involving two journeys of over 100 km each to reach Frachthi Cave on mainland Greece (Perlès, 1979; Renfrew & Aspinall, 1990). Similarly, the presence on Honsho of obsidian from Kozushima, about 50 km from the main island of Japan, some 30 000 ago, renders sea crossings in both directions necessary, indicating the availability of advanced navigation technology (Anderson, 1987). Another Japanese island reached by Pleistocene seafarers is Okinawa, as shown by the remains of four humans at Minatogawa, dated to 16–18 000 years BP (Ikawa-Smith, 1986). Finally, the two human femora fragments and one humerus from Arlington on Santa Rosa Island, reportedly 13 000 years old, indicate Ice Age maritime navigation on the west coast of North America.

The Pleistocene has so far yielded no material evidence of navigation, such as boats, paddles, rafts, or identifiable parts thereof. Among the thousands of rock art images resembling watercraft not one can be attributed to the Pleistocene. The earliest navigational material finds are all from north-western Europe, and from the early Holocene. They are Mesolithic paddles from peat bogs at Holmgaard (Denmark) and Star Carr (England); a worked reindeer antler that may have been a rib of a skin boat in the Ahrensburgian of Husum (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) (Bednarik, 1997b).

This pattern of occurrence implies a severe taphonomic bias, no doubt emphasised 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 Pleistocene. We can only know about long-term settlements that resulted in archaeologically visible populations. Numerous colonisation attempts no doubt failed, either initially or at least in the long term. But evidence from about 33–27 000 years ago indicates that many small islands had been settled by that time, by seafarers with an essentially Middle Palaeolithic technology (Bednarik, 1997a). Most of these islands could not have been sighted until a raft reached their proximity: the Monte Bello Islands (100 km from Australia), Gebe Island (west of New Guinea), New Ireland (east of New Guinea), Buka Island (180 km from New Ireland).

It is relevant to appreciate that all these maritime accomplishments in the Indonesian-Australian region were by people with pre-Upper Palaeolithic stone tools, because the hypothesis of an exclusively African origin of modern humans links their perceived modern human behaviour to Upper Palaeolithic technology. Moreover, the first appearance of maritime navigation in Indonesia refutes another idea of most 'African Eve' supporters; namely that speech is an innovation limited to Eve's progeny (Bednarik & Kuckenburg, 1999). In view of the widespread occurrence of stone tools the population on Flores was no doubt well established by 800 000 years ago. It derived its navigational ability most probably from Javan ancestors who had been experimenting with rafts for a long time before succeeding in traversing Lombok Strait, the first step in reaching Flores. Initially these rafts may have been developed for offshore fishing.

The Indonesian evidence thus demands a rewriting of the story of human evolution. Pre-modern hominids were not, as frequently claimed, devoid of complex culture and technology, of language, symbolism, and self-awareness—mere carrion-scavengers at the mercy of their environment. They had the ability to plan projects that took months to complete, 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 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 utilise natural ones.

Human language, it seems, was already sufficiently developed a million years ago to express abstract concepts. This is twenty times as long ago as the adherents of the African Eve model of human evolution would find acceptable to preserve their paradigm. It is at massive odds with the currently dominant model, but this is not entirely

Figure 3. The *Nale Tasih I* moored in Oeseli Lagoon, southern Roti, Indonesia.

unexpected. The cultural and cognitive sophistication of Lower Palaeolithic hominids has been implied by the discovery of Acheulian beads (in three continents), figurines (in two continents) and petroglyphs, hunting spears, composite artefacts, portable engravings, and the evidence that mineral pigments were used, and crystals and fossil casts were collected or 'curated' (Bednarik, 1997a). Indeed, the collection of 'proto-symbolic' manuports was apparently even practised by australopithecines of South Africa (Bednarik, 1998). 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 40 years, and remained ignored for most of this period in Anglophone archaeology (see German and Dutch literature cited).

Replication experiments

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 endeavours without additional information. No sustained replicative experimentation of archaeology has been conducted in relation to this subject before 1996. The First Mariners Project commenced then to determine the most likely means employed by *Homo erectus* in crossing Lombok Strait >840 000 years ago, and the most likely circumstances of first landfall in Australia >60 000 years ago. By 1998 it had expanded its brief to investigating all demonstrated human sea crossings of the Pleistocene, and to replicating those at Crete, Sardinia, Gibraltar, Okinawa and Santa Barbara Islands in addition to some of the Indonesian-Australian crossings. Our rather limited knowledge from other areas of technology of the periods in question, particularly in stone tool knapping, wood and bone working, serves as a reference source for these projects (Bednarik, 1999c). 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 Middle and Upper Palaeolithic bone harpoons, or Lower Palaeolithic wooden artefacts. Others must be determined according to systematically derived probability estimates based on experimentation. Expeditions endeavour to create authentic conditions for the construction of a series of primitive vessels and their sailing across the sea barriers in question. This involves, for instance, 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, including the means of carrying freshwater, of fishing at sea, of locating sources of stone tool materials for raft construction, and of course issues of maritime

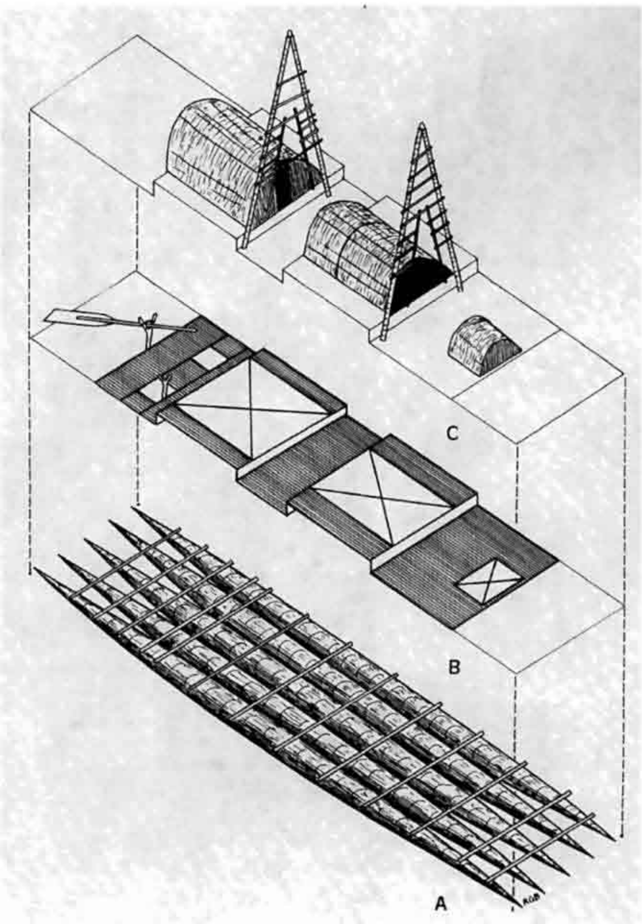

Figure 4. Exploded view of the *Nale Tasih 1* bamboo raft, 23 m long, showing the arrangement of pontoons (A), deck (B) and superstructures (C).

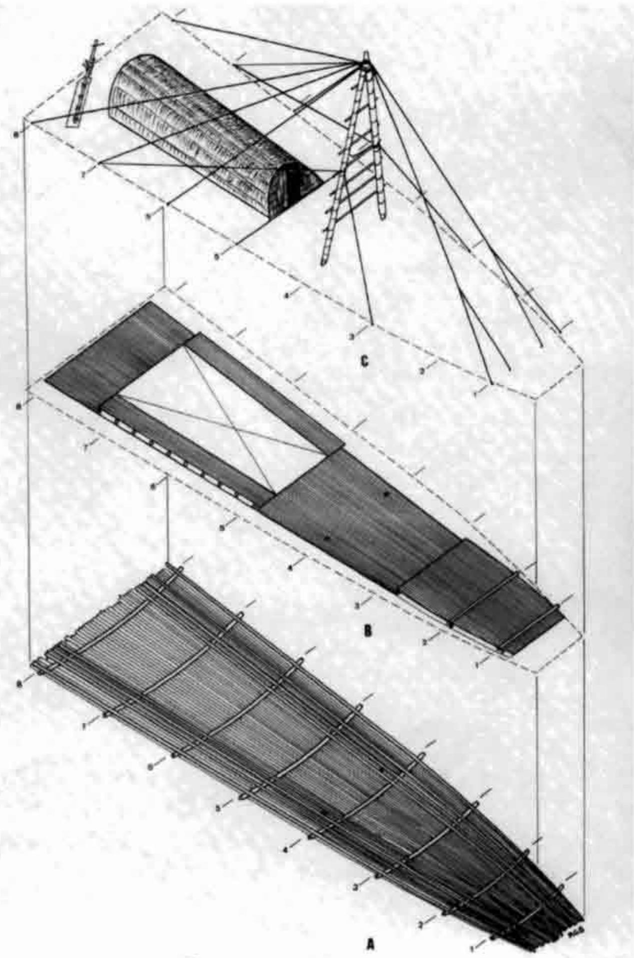

Figure 5. Exploded view of the *Nale Tasih 2* bamboo raft, 18 m long, showing the arrangement of raft body (A), deck (B) and superstructures (C).

design. The understanding of Pleistocene technology to be acquired in this way by far exceeds the understanding accessible by traditional archaeological approaches. Replicated stone and bone tools, for instance, are subjected to microwear study as part of this project, and the practical application of such replicas in combination with microwear analysis tells us more about the use of the archaeological specimens than any amount of theorising ever could.

The first full-size experimental vessel was commenced in August 1997 and launched at Oeseli in southern Roti on 14 February 1998. It was the *Nale Tasih 1,* which sailed for sea trials with a crew of eleven on 6 March (Bednarik & Kuckenburg, 1999; see Fig. 3). Middle Palaeolithic stone tool replicas had been used in the construction of this 23-m-long, ocean-going bamboo raft of about 15 tonnes plus cargo (see Fig. 4). 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 unfavourable 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 much information for the design and material choice for the further rafts to be constructed by the First Mariners Project.

A radically different, simpler design was adopted for *Nale Tasih 2,* an 18 m bamboo raft of only 2.8 tonnes (see Fig. 5). Construction of this vessel began in August 1998 near Kupang, West Timor, and on 17 December it left Kupang harbour with a crew of five. The raft had been constructed from Timorese bamboo, *rattan* forest vines, hand-made *gemuti* ropes of palm fibre, 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, which contained 350 litres of drinking water. The A-frame mast bore a small sail made from palm fibre. The *Nale Tasih 2* was well equipped with spare parts, including two sails, steering oar, vines and other cordage, and to effect repairs it carried 65 stone artefacts, replicas of Middle Palaeolithic types made from black chert. There was a stone mortar and pestle, and food provisions included fruit, cassava, salted meat, native millet, palm sugar and salt, but it was intended to derive most food from the sea. For this purpose the raft was equipped with several harpoons and fish spears. It also carried a fire box of

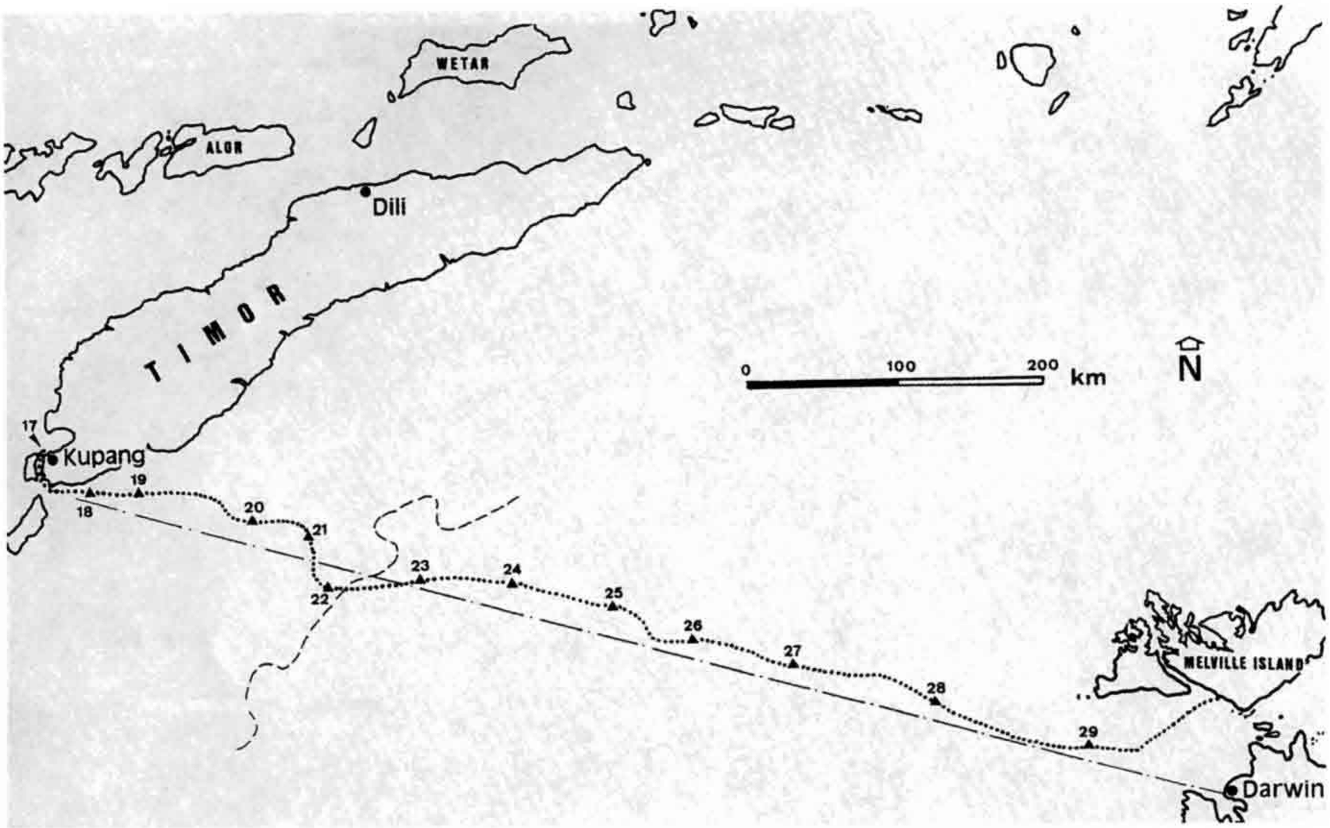

Figure 6. The route of the *Nale Tasih 2* journey, from the southern tip of Timor to the south coast of Melville Island, Australia. The numbers indicate the days of December 1998.

wood, some firewood and dry coconut husks.

The *Nale Tasih 2* travelled without an escort boat or radio. It reached the continental shelf of Australia, which formed the continent's shore 60 000 years ago, at noon 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 (Bednarik & Kuckenburg, 1999). However, all repairs were effected successfully, if under the most dramatic conditions. On the thirteenth day, rough seas of 5 m waves forced the raft towards Melville Island, north of Darwin, a coast heavily populated by saltwater crocodiles. As a precaution, the crew was taken from board 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. Lashed together by nothing but forest vines it had withstood almost 1000 km of travel, partly under most severe maritime conditions, without serious damage (see Fig. 6).

In March 1999, the 11 m 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 north-western corner of Lombok, the attempt was abandoned under appalling weather conditions and the crew transferred to the escort vessel. But by the end of that year, a similar, 12-m-long simple platform of bamboo, 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 1080 kg, and was to be propelled by 12 paddlers. It crossed Lombok Strait successfully on 31 January 2000, taking just under 12 hours to cover 51 km. The raft and paddles had been made with stone tools modelled on Lower Palaeolithic 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 maximum speeds 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 Palaeolithic 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 Palaeolithic stone implement replicas, and then taken for sea trials. One of these vessels, a pontoon type raft, was made of cane, the other of inflated animal skins. The current research activity of the project focuses on the crossing to Crete, which is to be attempted from the island Andikíthira, formerly connected to the mainland at times of low sea level. Preparations for the Greek experiment were begun in late 2001 and it is expected that the first attempt will take place in 2002. About 6 000 stalks of *kalamia* (cane, *phyllostachys* sp.) were harvested on Kíthera in November 2001 and prepared to cure for six months. It is intended to bind them together with either a local bulrush, *psathi*, the fronds of the *Washingtonia filifera* palm, or split green cane as used in the Moroccan experiment.

The author's First Mariners Project, 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. Its primary purpose is to examine each of the many variables involved in Pleistocene seafaring quantitatively, 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 (Bednarik, 1999c). 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 people.

The principal finding of the project so far is that the level of maritime competence required to cross from Timor to Australia with a minimal number of males and females to found a new population is far in excess of what had been assumed available to these hominids. Hundreds of specific skills are involved, in procuring, transporting, processing, curating, fashioning, and assembling numerous materials for one singular, totally abstract goal: to reach a still invisible shore, at immense cost in labour and hardship, and with a perseverance to be maintained over periods of several months. It is perfectly possible to do this with Middle, even Lower Palaeolithic technology. But it is an achievement that renders the current dominant ideas about the cognitive, intellectual and linguistic abilities of these hominids superseded.

Lombok Strait can be crossed with considerably less sophisticated technology, but it seems nevertheless impossible to achieve this without such means as cordage, knots, maritime confidence, forward planning (for several months, because the bamboo has to cure), language ability and the social context necessary to organise a labour force around an abstract goal. Without the requisite communication it seems unlikely that a group large enough to found a new population could have been organised, motivated and convinced to attempt such a desperate endeavour. The hominids concerned, perhaps a million years ago, had the necessary cultural, cognitive, and technological means to succeed in crossing the sea to colonise new land. This is entirely incompatible with the orthodox paradigm of human evolution, which must now be considered effectively refuted.

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