Mariners of the Pleistocene

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In the dynamics of human evolution, two distinct schools of thought have emerged, especially in recent years. According to one of these, capabilities such as hunting of large mammals, the making of prismatic blade tools and non-lithic artefacts, "reflective language," personal ornamentation, rock art, portable art—indeed any form of evidence suggestive of symbolism—are all typically restricted to fully modern humans. Whatever is encompassed by the term "modern human behavior"—and this includes a considerable range of interpretations of the "archaeological record"—is attributed exclusively to the last thirty or forty millennia of the Pleistocene. In its purest form, this school refers prominently to an "explosion" of human capabilities with the advent essentially of the Aurignacian of southwestern Europe and contemporary "cultures" in eastern Europe. It has derived particularly strong support from the hypothesis that extant humans originate exclusively from a small sub-Saharan population, and that all other forms of *Homo sapiens* became extinct, be it by competition or more drastic processes (i.e. genocide). This "African Eve" theory, which is entirely devoid of any archaeological evidence in its favor, is conveniently reinforced by the opinion that any form of cultural, cognitive or technological sophistication is limited to the hypothetical progeny of Eve, and especially to the final phase of the Late Pleistocene, because such a scenario provides a ready-made answer to explain the perceived superiority of these modern humans who poured out of Africa and overwhelmed their primitive cousins wherever these lived.

Over the last decade, the alternative school of thought has been similarly overwhelmed, by the popularity of the "African Eve," and by the ready plausibility of a paradigm in touch with the cynicism and economic rationalism of the 1990s: the inevitability of the genetic triumph of Eve's descendants over the culturally, technologically, socially, and cognitively inferior rest of Late Pleistocene humanity. We can conveniently define these two, fundamentally opposed models as the *short-range* and the *long-range models of cultural evolution*. The long-range model essentially coincides with the multiregional hypothesis of hominid development. It perceives the evolution of communication, technology, complex social systems, symbolic systems, self-awareness, and intellect as a gradual process, taking hundreds rather then tens of millennia. Indeed, some of these developments may occupy much or all of the 2.5 million years of human history, and while there may well have been episodes of a punctuated equilibrium type, this model favors a gradualist over a cataclysmic view. What renders the great preference for the short-range model particularly fascinating is not just that it is implausible, empirically unsound, and logically deficient in major parts, but that the heuristic dynamics of the discipline have allowed it to become the favored model despite its readily evident major shortcomings. This surely needs to be examined closely if we are to understand the epistemology of Pleistocene archaeology.

It seems to be generally agreed that language is a fundamental prerequisite for humans to colonize islands through the use of maritime technology. It is self-evident that many conditions need to be met to achieve a successful long-term settlement of islands, of which actual landfall is only one. Even the most extreme protagonists of the short-range model of cognitive human evolution are in complete agreement with the author on the need for language in such achievements. They have proposed that language beginnings must have been preceded by figurative depiction, of which we have no evidence prior to approximately 32,000 years (32 ka) BP, and that the earliest evidence of language is the first landfall of humans in Australia. This is currently thought to have occurred per-

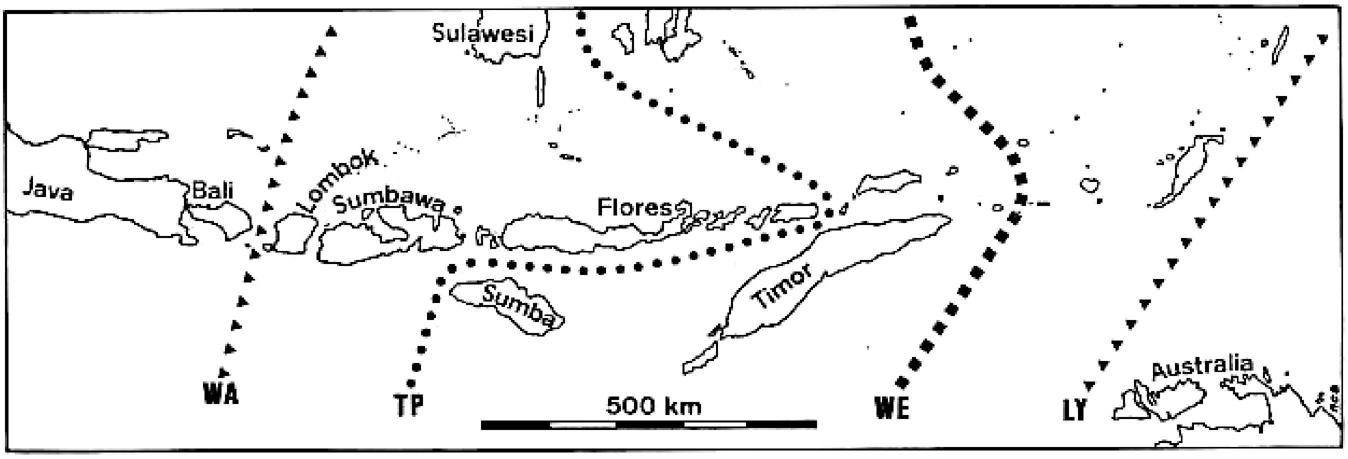


Fig. 1. *The locations of biogeographical filters in Nusa Tenggara: WA = Wallace's Line; TP = presumed tectonic plate separation between Asian and Australian plates; WE = Weber's Line; LY = Lydekker's Line.*

haps 50 or 60 ka (thousand years) ago. But firstly, this reasoning seems specious: before the final crossing to Australia, perhaps over the Timor Sea, the ancestors of these seafarers had to cross several other stretches of sea, including the biogeographically most important barrier in the world, the Wallace-Huxley Line (fig. 1). It seems unreasonable to assume that all these crossings were achieved in one single sweep from the Asian to the Australian mainland, and yet this is what this notion implies. The African Eve model encounters some first problems here: if the people who first left the Asian mainland (which for long periods included Java and Bali) were the descendants of Eve, they did so at least 20 ka before they entered Europe to "replace" the Neanderthals. While this would still seem possible, much earlier sea crossings, however, would render the proposal implausible; hence the insistence by the proponents of the Eve scenario that Wallacea and Australia were colonized in one single sweep.

Pleistocene navigation in Europe

More importantly, there are two fundamental problems, one of which is fatal for the model. First, there is a widespread misconception that the "replacement" of archaic forms of *H. sapiens* by *H. sapiens sapiens* coincided with the introduction of Upper Paleolithic technology (blade industries, bone tools, art, decoration, burial of the dead, underground mining, seafaring) and "modern human behavior." Not only is this a complete fallacy in every respect, it must be emphasized that nearly all evidence of Pleistocene sea crossings we have today relates to sailors of a *Lower or Middle* rather than an *Upper* Paleolithic technology. Second, and more importantly, we have sound evidence that the first sea crossings and subsequent long-term occupations of at least three, but probably *most* of the islands of Nusa Tenggara (formerly Lesser Sunda Islands, in Indonesia), occurred significantly earlier than the first landfall in Australia (fig. 2). This is not only in sharp contrast with what most commentators have persistently maintained until now, but the early sea crossings occurred in fact in the Lower rather than the Middle Paleolithic period, i.e., all these commentators were wrong by a chronological factor of at least ten. This knowledge alone, available to us for decades but ignored or misunderstood by many, is clearly fatal to the short-range model of cognitive evolution, and it is a mortal blow for the controversial African Eve model as well. The proliferation of hypotheses contradicted by the information from Indonesia, available for the past forty years, is a phenomenon that is hard to explain.

No direct physical evidence of navigation, such as fragments of water craft, paddles, or oars, has ever been reported from the Pleistocene, and no credible depictions of vessels occur in the known corpus of Pleistocene paleoart. The earliest such evidence is exclusively from western Europe, consisting of Mesolithic paddles from the peatbogs at Star Carr, England, and Holmgaard, Denmark. A worked reindeer antler from the Ahrensburgian at Husum, Germany, has been suggested to be a boat rib of a skin boat, and may be in the order of 10,500 years old. The canoe from Pesse, Holland, is 8265 ± 275 radiocarbon years old. More recent boat finds are those from Noyen-sur-Seine and Lystrup 1 (6110 ± 100 BP).

Limited indirect evidence is available for earlier European seafaring in the Mediterranean. The presence of obsidian from the island of Mêlos at the mainland site Franchthi Cave around 11 ka ago indicates that a distance of about 120 km was covered by 'island-hopping'. Considerably earlier is the Mousterian occupation of another Greek island, Kefallinía, presumably by Neanderthals, which has been suggested to have involved a sea crossing of perhaps 6 km. Islands to the west of Italy, too, may have been occupied by Paleolithic seafarers, and of greatest importance is the occupation evidence from the island of Sardinia, which is clearly of the Middle Pleistocene period. Sardinia was connected to Corsica at times, but never to the mainland. In addition, the possibility has been considered occasionally that Lower Paleolithic hominids

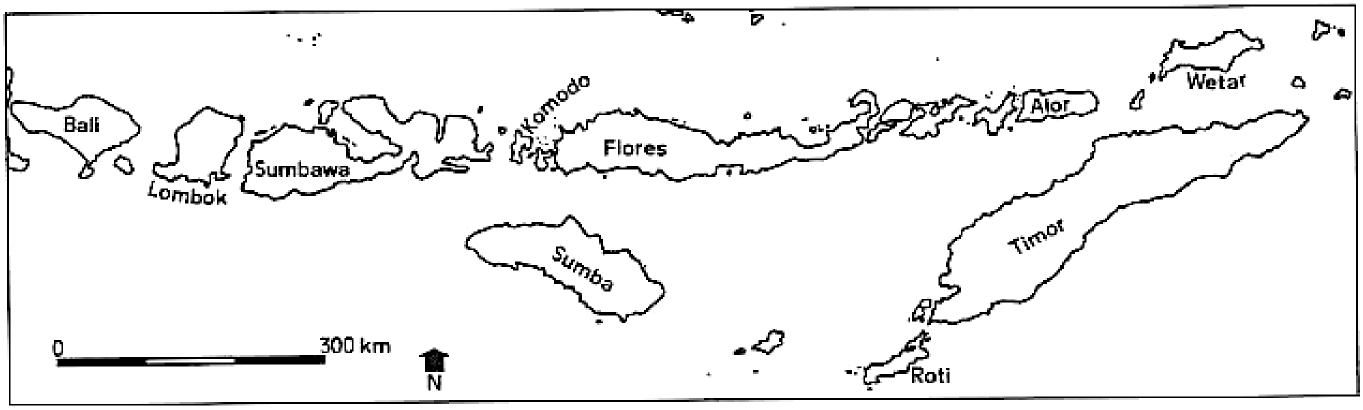


Fig. 2. *Nusa Tenggara, or the Lesser Sunda Islands, Indonesia.*

crossed from Africa to Europe by navigating the Strait of Gibraltar, but there is no solid evidence for this. However, in the light of the seafaring capability of *Homo erectus* in Southeast Asia that is discussed below, it would be worth reconsidering this question. The Gibraltar crossing was probably shorter and may have been less difficult than that of the Lombok Strait with its treacherous currents.

Pleistocene navigation in Indonesia and Australia

In comparison to the sparse European evidence of Pleistocene seafaring capabilities, that from Indonesia and Australia is decidedly much more impressive. The first landfall on practically dozens of islands, based on stone tool typology and preliminary dating evidence or reasonable deductions concerning the movement of first human colonizers, is attributable to people possessing a Middle Paleolithic and not an Upper Paleolithic technology. Indeed, many of these sea crossings in the general region even date from Lower Paleolithic times and are clearly attributable to *Homo erectus* groups. The latter include the first landfall in Flores, which according to Koenigswald occurred up to 830 ka ago; the presumably preceding settlement of Lombok and Sumbawa (which lie between Bali and Flores); the Middle Pleistocene settlement of Timor and Roti; and the presumably preceding landfalls on Alor, Wetar and various smaller intermediate islands. There are also very tentative indications of early settlement in Sulawesi and reportedly even in Ceram.

Subsequent navigation by marine colonizers of a Middle Paleolithic technology led to landfall in Australia by perhaps 50 or 60 ka ago—the evidence recently tendered from the Jinmium site is disregarded here as being unsound; on Gebe Island (Golo and Wetef Caves) prior to 33 ka; on the Bismarck Archipelago (Matenkupkum and Buang Marabak on New Ireland) at about the same time; and also on the Solomon Islands (Kilu Rockshelter on Buka Island). The sea distance between Buka and New Ireland is about 180 km, although there are small islands along the way, but these are of low visibility. The Monte Bello Islands, now 120 km off the northwest coast of Australia, are very small and they were settled before 27 ka ago (Noola Cave on Campbell Island). Between 20 and 15 ka ago, obsidian from New Britain was taken to New Ireland, and the cuscus, an Australian land mammal, appears in the Moluccas (e.g., on Morotai and Gebe), almost certainly having been transported by sailors from Sahul (Pleistocene Greater Australia) for food.

The past ideas of "accidental" drift voyages, implausible as they always were, are incompatible with this extensive evidence of navigation abilities. All currently available evidence probably refers to successful long-term colonizations, and not merely to individual trips, and we have to assume that essentially Middle Paleolithic navigators had developed the competence to travel the high seas almost habitually, sometimes targeting tiny, far-off islands, and often travelling to coasts that remained beyond the horizon for much of the journey (as in the case of Australia, which only became visible shortly before landfall). These many journeys were thoroughly intentional, planned, and competently executed expeditions. If any researchers still hold contrary opinions, they really ought to try crossing the sea on randomly drifting vegetative matter.

Not that any of this should surprise us. The history of maritime navigation in the region began at least 800,000 years ago, at a time of distinctly accelerated cognitive and technological evolution. It would be entirely unrealistic to assume that the great subsequent innovations in wood working, hunting equipment, bead and pendant making, harpoon design, mining and quarrying, the refinement in stone tools, or the proliferation of paleoart and pigment use over the subsequent hundreds of millennia had simply no parallels in seafaring technology. The first seafarers, who crossed Wallace's Barrier well over three quarters of a million years ago, were probably hominids of a maritime economy who had already invented the use of flotation equipment earlier—perhaps much earlier—to develop off-shore marine exploitation. Perhaps this was in response to population pressure and diminishing coastal resources, which would also explain the desperate initial bid to reach the opposite shore (the coast of Lombok is well visible from Bali even at present sea level).

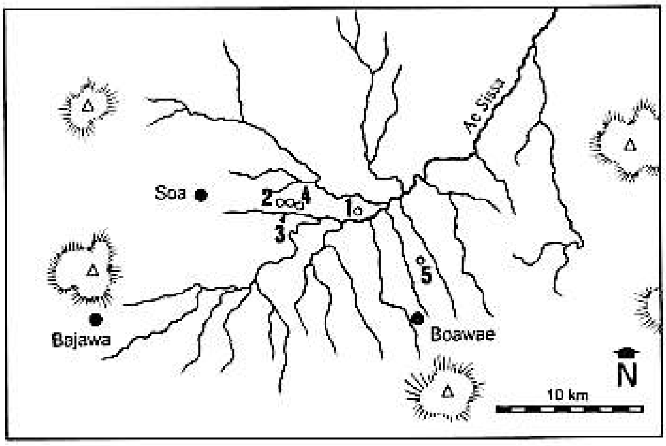
Hominids, lacking the buoyancy, trunks and long-distance swimming ability of elephants and stegodonts, who also colonized Nusa Tenggara, had to use watercraft to achieve these crossings. They could have used elephant or *Stegodon* bladders, or bundles of lightweight logs, or bamboo bundles and rafts. Of these, the latter are by far the easiest to procure and to use, and ever since the question of the initial colonization of Australia has been considered seriously, bamboo rafts have been the preferred explanation. This explanation has the additional benefit of accounting for the relatively impoverished navigation technology of ethnographic Australia, because the thick-stemmed bamboo species of Southeast Asia do not occur in Australia. Watercraft observed in Australia were limited to bark canoes, rafts from driftwood, bark bundles, or mangrove logs, suitable only for coastal journeys. Large log rafts seen on the Sepik River of New Guinea may have been seaworthy, but bamboo has much greater buoyancy and is significantly easier to fell with stone tools and to assemble.

Seafaring *Homo erectus*

In January 1957, Dr Theodor Verhoeven observed the first remains of Stegodontidae found in Wallacea, near the abandoned village Ola Bula on the Soa plain of central Flores (fig. 3). Henri Breuil, then the world's foremost prehistorian, recognized a number of Lower Paleolithic stone tool types among the finds. Von Koenigswald immediately suggested that the finds were of the Middle Pleistocene (fig. 4). In 1963, Verhoeven located further stone tools at nearby Boa Leza, but this time in situ, and in the same layer that produced the *Stegodon* remains, called the Ola Bula Formation. The possibility that the cultural and faunal components had been mixed by fluvial action could be excluded on the basis of the material's description, and because it was subsequently found together at several other sites nearby, so Verhoeven had satisfactorily demonstrated the coexistence of the *Stegodon*-dominated fauna and the hominids. In 1968 he was joined by Professor Johannes Maringer and the two scholars excavated with three large crews at Boa Leza, Mata Menge and Lembah Menge. All of Verhoeven's observations were validated completely. Koenigswald qualified his initial age estimation, postulating the age of the fossiliferous deposit to be between 830 ka and 500 ka, nominating his preferred estimate as 710 ka, on the basis of geology, paleontology, and the presence of tectites. This age estimate was confirmed through a series of 19 paleomagnetic analyses, which suggested that the Matuyama-Brunhes reversal to normal polarity (780-730 ka BP) occurs just 1.5 m below the artefact and fossil-bearing facies at Mata Menge. A very different and earlier fossiliferous facies at another site in the area, Tangi Talo, appears to be of the Jaramillo normal polarity period, and thus about 900 ka old. It contains no stone artefacts, and the pronounced faunal change has been suggested to be attributable to the arrival of hominids.

Mike Morwood from the University of New England recorded a stratigraphic section at Mata Menge in January 1997, again confirming the crucial claims made over the previous 40 years. Subsequent dating by zircon fission track analysis provided approximate ages from sediments immediately below and above the artefact-bearing sediments at Mata Menge. Accordingly, the *Homo erectus* artefacts should be between 880 ± 70 ka and 800 ± 70 ka old (at 1 standard deviation). A third fission track estimate, of 900 ± 70 ka BP, was obtained from the fossiliferous layer at Tangi Talo. Thus the earlier age estimates were once more broadly confirmed, as was the seafaring capability of the Mata Menge and Boa Leza hominids. This work is currently continuing, with the author's collaboration, and has produced a whole series of further dating results from several sites in the area.

Verhoeven had also discovered Stegodonts on Timor, again together with stone implements. After commencing a research project on West Timor and neighbouring Roti, the author is currently engaged in examining evidence of the early hominid occupation of all three islands—Flores, Roti, and Timor. Roti is now separated from Timor by shallow sea but these two islands of the "outer arc" were obviously connected for much of the Pleistocene. A spectacular find on Roti was a huge, 800-m jasperite quarry complex at Roshi Danon, with nearby stratified occupation evidence (fig. 5 & 6). Exposures of stone suitable



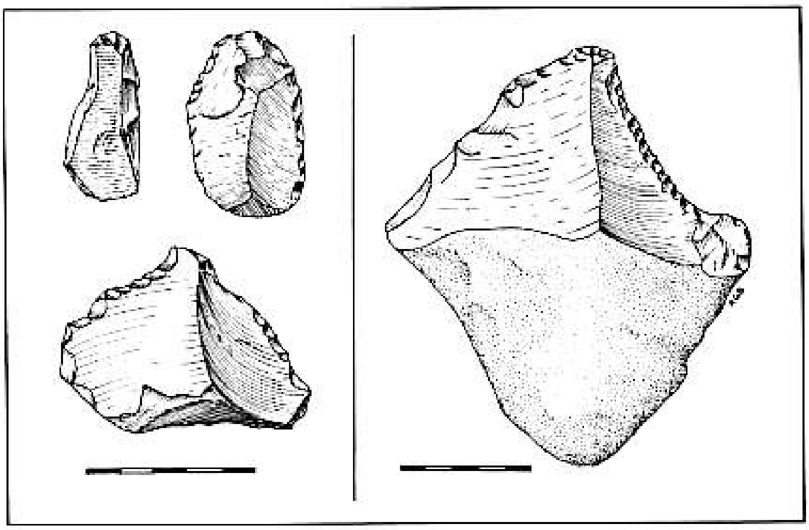


Fig. 3 (above). *The Soa Basin in central Flores, Indonesia. Occupation sites of* Homo erectus *are shown.*

Fig. 4 (left). *Stone implements of* Homo erectus, *Soa Basin, Flores. These were covered by over 100 m of sedimentary rock formations.*

Fig. 5. *Large jasperite stone implement from Middle Pleistocene deposits at the jasperite quarry of Roshi Danon, Roti, Indonesia. The deep-red stone has been patinated white.*

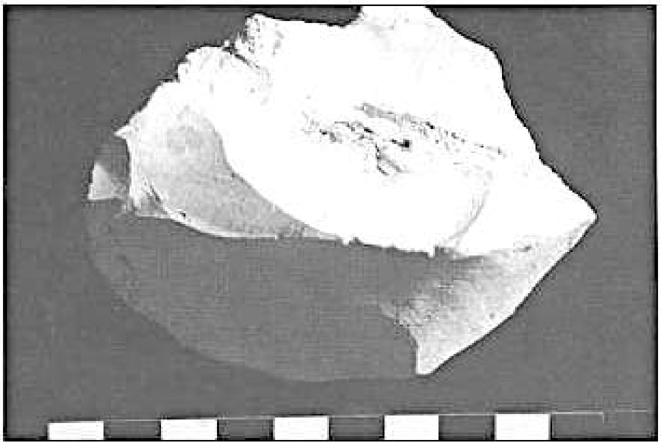


Fig. 6. *Three jasperite stone implements from Middle Pleistocene deposits at the jasperite quarry of Roshi Danon, Roti, Indonesia.*

for implement knapping are rare on the islands, and this quarry has evidently been in use since the Middle Pleistocene. Its discovery also solved the difficulty of explaining where the Middle Paleolithic seafarers of Timor or Roti could have acquired their stone tool materials for creating the kinds of watercraft they would have needed to cross to Australia.

The cumulative evidence from Flores, Timor, Roti, and possibly also Sulawesi suggests that of the alternative routes considered for the initial settlement of Australia, the southernmost continues to be the most favoured. Thus we would expect the first crossing of Lombok Strait, between Bali and Lombok, to most likely represent the first event of seafaring. As yet we have no early occupation evidence from Lombok (nor have we looked for it), but it is logical that in order to reach Flores, hominids would have proceeded via Lombok. Nor do we have any skeletal evidence from Wallacea to tell us what kind of people the first seafarers in the world were, but since they began their maritime exploits almost a million years ago, only one species (or subspecies) can be responsible, *Homo erectus*. In Java, connected to Bali for much of the Pleistocene, hominid remains have been unearthed for a full century now, and they fall into two broad groups: the early *Homo erectus* specimens from the Pucangan and Kabuh beds which have been suggested to be up to 1.81 million years old; and the much later hominids from the High Solo Gravels, which have often been compared, in terms of their skeletal architecture, to Pleistocene Australians. Their dating remains controversial, but various results place them between about 300 ka and 30 ka ago. They are often described as very late *H. erectus*, but are more correctly seen as representatives of archaic *H. sapiens*.

The emerging picture is that *H. erectus* probably experimented with flotation devices at least a million years ago, at the easternmost end of the world then settled (to best of our knowledge) by hominids, in the vicinity of Java (fig. 7). The initial impetus to develop small watercraft, presumably bundles of bamboo, was perhaps the ability to fish for off-shore species. Development of this technology seems to have led to the confidence of crossing the Wallace Line, apparently by navigating Lombok Strait, in suf-

Fig. 7. *Artist's impression of* Homo erectus *building a bamboo raft on Bali to reach Lombok.*

ficient numbers to found a new colony on the first island of Wallacea. This occurred in the order of 850 ka or 800 ka ago. Crossings to the remaining Sunda Islands of the "inner arc" were much easier and shorter than the 20-30 km journey across the strong currents of Lombok Strait, so the eastward expansion of these seafaring people could have been rather swift, and eventually, perhaps at a low sea level, they crossed to the "outer arc", most likely from Alor to Timor. After developing their navigation technology for hundreds of millennia, venturing progressively further out to sea and learning to understand the behavior of the tropical trade winds, they were poised, for the first time, to cross the sea without seeing land for most of the journey, and thus reached Australia.

Replicative maritime archaeology

In view of the above data, it is reasonable to speculate thus far. Traditional archaeology can tell us about the presence of hominids, and perhaps even provide an inkling of their lithic technology. However, it cannot tell us how these incredible achievements of Pleistocene hominids were accomplished. A different research approach is required.

In the absence of any direct (i.e., material) evidence of maritime technology from the entire Pleistocene we have just two realistic strategies to learn about this subject: by reference to other aspects of technology (such as, for instance, wood working) of the chronological windows in question; and by applying the methods of *replicative archaeology*. By pursuing both of these approaches, the difficult process has been commenced of reconstructing Pleistocene seafaring capabilities in the absence of actual material evidence. This includes replicative work in stone tool knapping, butchering, fire making, bone harpoon making, petroglyph production, bead and pendant manufacture, and wood and bamboo working, which have provided us with many insights into the technology particularly of Lower Paleolithic hominids (fig.8). (Some archaeologists are surprised to hear of beads or petroglyphs of the Lower Paleolithic, which only shows that one cannot trust the textbooks, for they are far too often wrong.) The *Nale Tasih* Expedition and the First Sailors Expedition both seek to "replicate" specific Pleistocene sea crossings. They have commenced the acquisition of a vast amount of data concerning all conceivable empirical variables involved in such feats, including raft design and size, materials and tools used in construction, sea performances of such vessels under various conditions, carrying capacities, sources of construction and stone tool materials, means of carrying food and water as well as replenishing both at sea. The projects study the technologies involved in all of these factors, even standard psychological tests of crews under conditions of stress and anxiety.

The author is the chief scientist of both these expeditions, commenced in 1996, which include a series of actual raft constructions in various locations of Indonesia, and their sailing by experienced crews with the objective of crossing a particular sea barrier in each case. These rafts comprise various materials and are of a range of sizes and

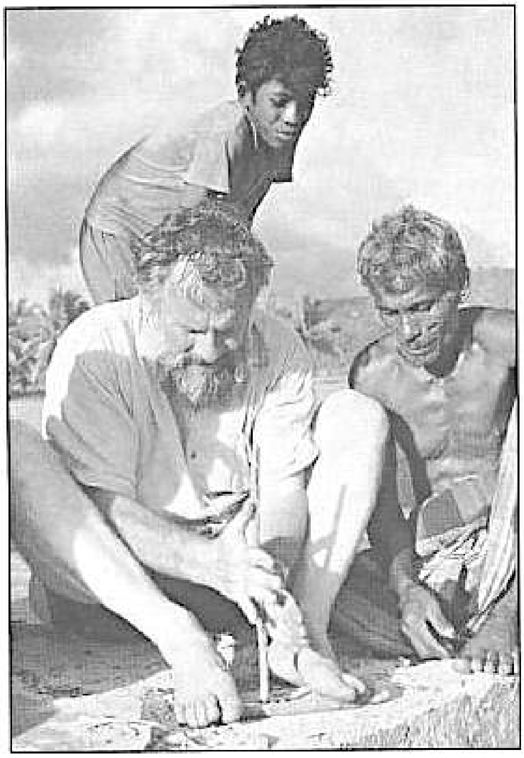
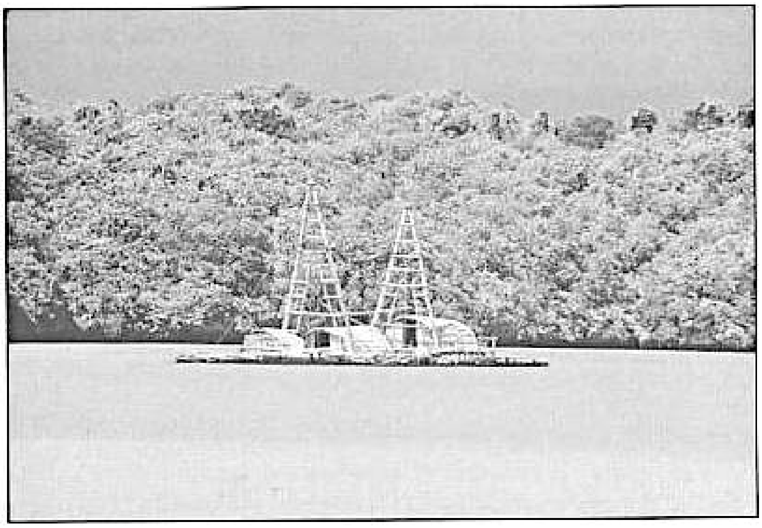


Fig. 8. *The author is taught to make fire with two sticks, by an old Rotinese craftsman who could still remember using this skill in his youth. This is one of countless replication experiments conducted as part of this project.*

Fig. 9. *The* Nale Tasih 1, *15 tons and 23 m long, is anchored in Oeseli Lagoon, Roti, Indonesia, shortly before departure.*



designs. All components and equipment could be procured by either Middle or Lower Paleolithic hominids, as the case may be, and could be worked with their respective stone implements to produce such craft. All of this must be practically demonstrated. The overall purpose of this detailed research program of replicative archaeology is to provide the data to create probability scenarios for at least two of the earliest successful sea crossings of the Pleistocene—the one that led to landfall in Lombok more than 800,000 years ago, and the one that resulted in the first presence of humans in Australia. It is not the aim of these journeys to 're-create' these early achievements, but merely to attempt the crossings under various conditions. The data so acquired should ultimately facilitate the creation of a probability framework permitting the determination of the highest probability in respect of all crucial variables relating to these maritime accomplishments. Under the circumstances this is as far as science can take us in this respect.

The first of the major replicative experiments was completed in March 1998 and the next are well under way. Construction of the 23-m raft *Nale Tasih 1* commenced in August 1997 at the remote Oeseli base camp, near the southern tip of Roti (fig. 9). The raft consisted of 11 tons of bamboo forming five pontoons, lashed together with *rattan* and hand-made ropes, such as *pipa lontar* and *gemuti*. These were held fast by 13 cross-members which in turn supported the deck and superstructures: three weatherproof huts of palm leaves, two raised deck sections of split bamboo, two A-frame masts and three alternative rudder supports (fig. 10). One hut contained a traditional fire box and most of the food supplies, the second held communication, recording and scientific equipment, the third provided shelter for the crew of eleven (two Rotinese seafarers, eight European sailors, which included three females, and one scientist fig. 11). All parts of the structure of, and equipment carried on, the *Nale Tasih 1* were capable of being procured, worked and assembled with purely Middle Paleolithic technology, and this was demonstrated on camera. All materials used were likely to have been available in Nusa Tenggara during the Late Pleistocene.

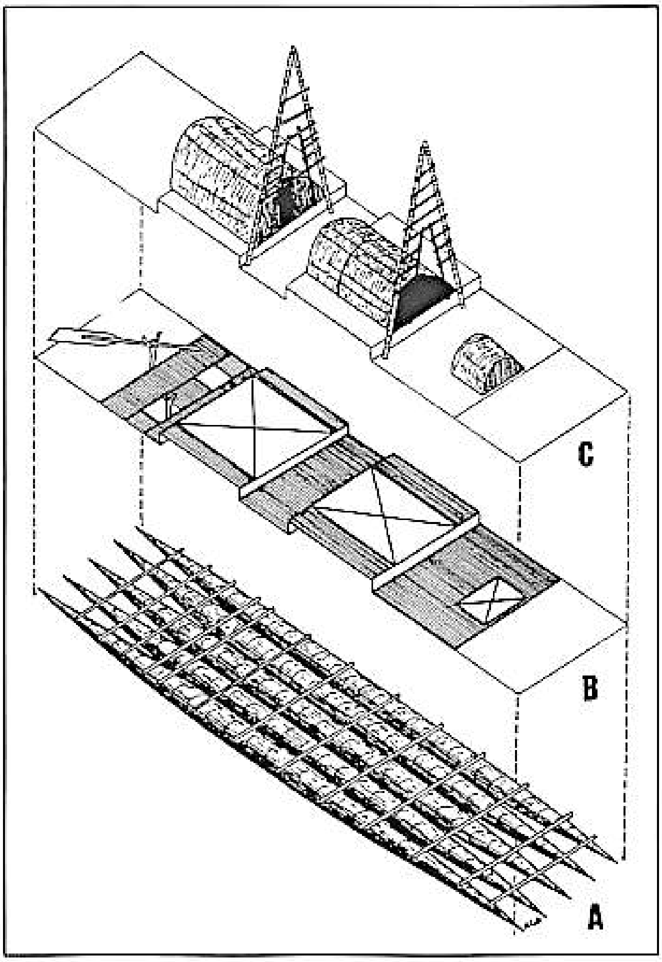


Fig. 10 (above). *Exploded view of the* Nale Tasih 1 *bamboo raft, showing the pontoons (A), decks (B) and superstructures (C).*

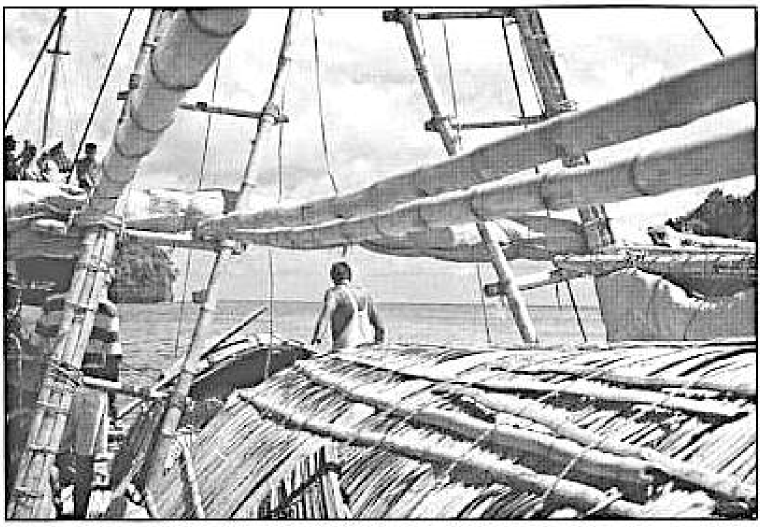


Fig. 11 (left). *The* Nale Tasih 1 *departs from southern Roti through the heads of Oeseli Lagoon, 6 March 1998.*

Fig. 12. *The* Nale Tasih 1 *is dissected by chainsaw as part of a program of destructive testing, 12 March 1998.*

After sea trials the 15-ton *Nale Tasih 1* was sailed back to Roti and beached at Oeseli for destructive sampling of all components. It was cut up with a large chainsaw to remove samples of bamboo for testing, and totally dismantled to the last part (fig. 12). The knowledge gained from this will significantly assist the future experiments in this series.

Conclusions

Some preliminary implications of this ongoing research have already become apparent. First and foremost, the *Nale Tasih 1* experience has shown with forceful clarity one fundamental truism that should have been apparent to us all along. A modern expedition of highly experienced and motivated mariners has failed to sail a primitive raft to Australia (fig. 13). The team was simply unable to match the understanding of materials inherent in Pleistocene people, and their technical expertise in extracting the maximal performance from these materials. We know that seafarers of Middle Paleolithic technologies managed to populate dozens of islands, criss-crossing the seas near Australasia with apparent ease and confidence. Their technology, social organization, cognitive abilities, and long-term forward planning capacities must have been significantly more advanced than even the boldest archaeological commentators have suggested so far. Maritime feats such as the crossing to Australia or to Buka Island by ultimately successful founding populations were only possible through thoroughly planned, highly focused efforts by social groups. They could never have been achieved without the support of dozens, indeed hundreds, of specific skills 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 labor and hardship, and with a perseverance to be maintained over periods of many months.

Only a few decades ago the initial landfall in Australia, then still thought to have occurred during the Holocene, was considered to have been the result of accidental drift, of individuals having been washed out to sea helplessly, perhaps clinging to some log or floating vegetation. The absurdity of this desperate scenario was symptomatic of a neocolonialist, Eurocentric attitude to alien societies, a form of epistemology that still determines attitudes to, and interpretations of, archaic *Homo sapiens* populations. Concepts of relative primitiveness dictate our Darwinist thinking, as if Pleistocene hominids had been simple organisms exercising no control whatsoever over their individual destinies. Such a metaphysical framework is deeply rooted in the universal theory of orthodox archaeology, an inductive form of uniformitarianism, moderated by intuitive ethnographic analogy. Uniformitarianism, however, may be a superb tool in understanding the processes of purely "natural" systems, such as they exist in geology or astronomy, but it may be less appropriate in forming an understanding of what is often described as the "archaeological record." In particular, Pleistocene cultural systems should be considered inaccessible to uniformitarianist interpretation.

Similarly, the ideas archaeologists have occasionally expressed about Pleistocene seafaring were generally determined by uniformitarian minimalist reasoning of one form or another. For instance, the thought that sails or some method of steering might have been used in the Pleistocene is hardly acceptable to such a mode of thought, and yet we know that the Middle Paleolithic seafarers whose descendants populated Australia had inherited

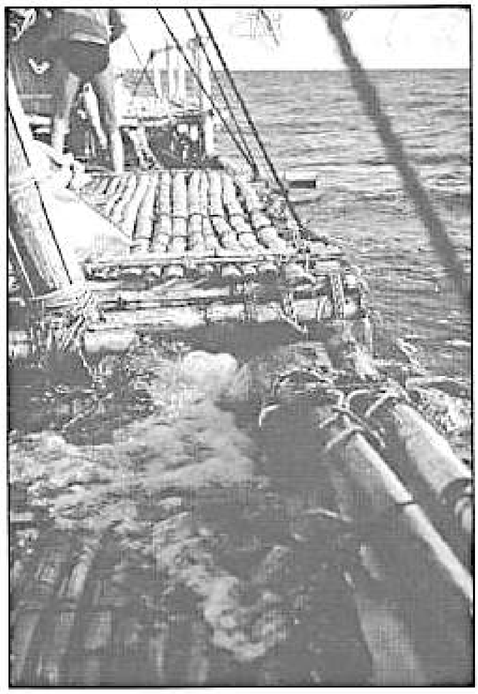


Fig. 13. *The* Nale Tasih 1 *on the Timor Sea, 8 March 1998. Most of the split bamboo deck is awash.*

Fig. 14. *The sail, made of palm leaves, is raised on the* Nale Tasih 1, *off the south coast of Roti.*

a maritime technology acquired cumulatively over hundreds of millennia. The effects of wind resistance are readily noticed on small watercraft; even a person standing up can increase speed. Holding up a palm leaf, as can be observed in the Indonesian islands still today, adds further momentum, and the technological sophistication of other facets of Lower Paleolithic culture renders it most unlikely that this observation was not utilized, leading to the realization that the greater the windsail area, the greater its propelling effect (fig. 14). Cordage, in some form or other, was certainly used by Lower Paleolithic hominids, as were knots, and cordage was in any case necessary for constructing any type of raft. The manufacture of wooden paddles, too, would have been well within the capabilities of Middle Pleistocene hominids.

During the period from 800 ka BP to 60 ka BP, hominids developed the ability to create personal ornamentation, such as beads and pendants; they began to create rock art and other forms of paleoart; they developed social structures and began to hunt the largest land animals of their time; they developed a conscious appreciation of the self; and, most importantly, they created constructs of reality. In comparison to these momentous changes in hominid abilities—by far the most important in the history of our genus—the corresponding development in navigation skills seems to have been rather incremental and unremarkable, otherwise it should not have taken three quarters of a million years to manage the crossing of the Timor Sea. The basic preconditions for it were already established by the first crossing of Wallace's Barrier. The most momentous development in maritime history probably took place at Lombok Strait, and it could easily be seen as the most significant step in the evolution of human technology. It appears that this is where humans, for the first time, entrusted their lives to a contraption harnessing the energies of nature—flotation, wind, water current and wave action. This was the moment in human history when man first became fully dependent on his technological creation. From here it was only a small step to Neil Armstrong's "giant leap for mankind."

Suggested Readings

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