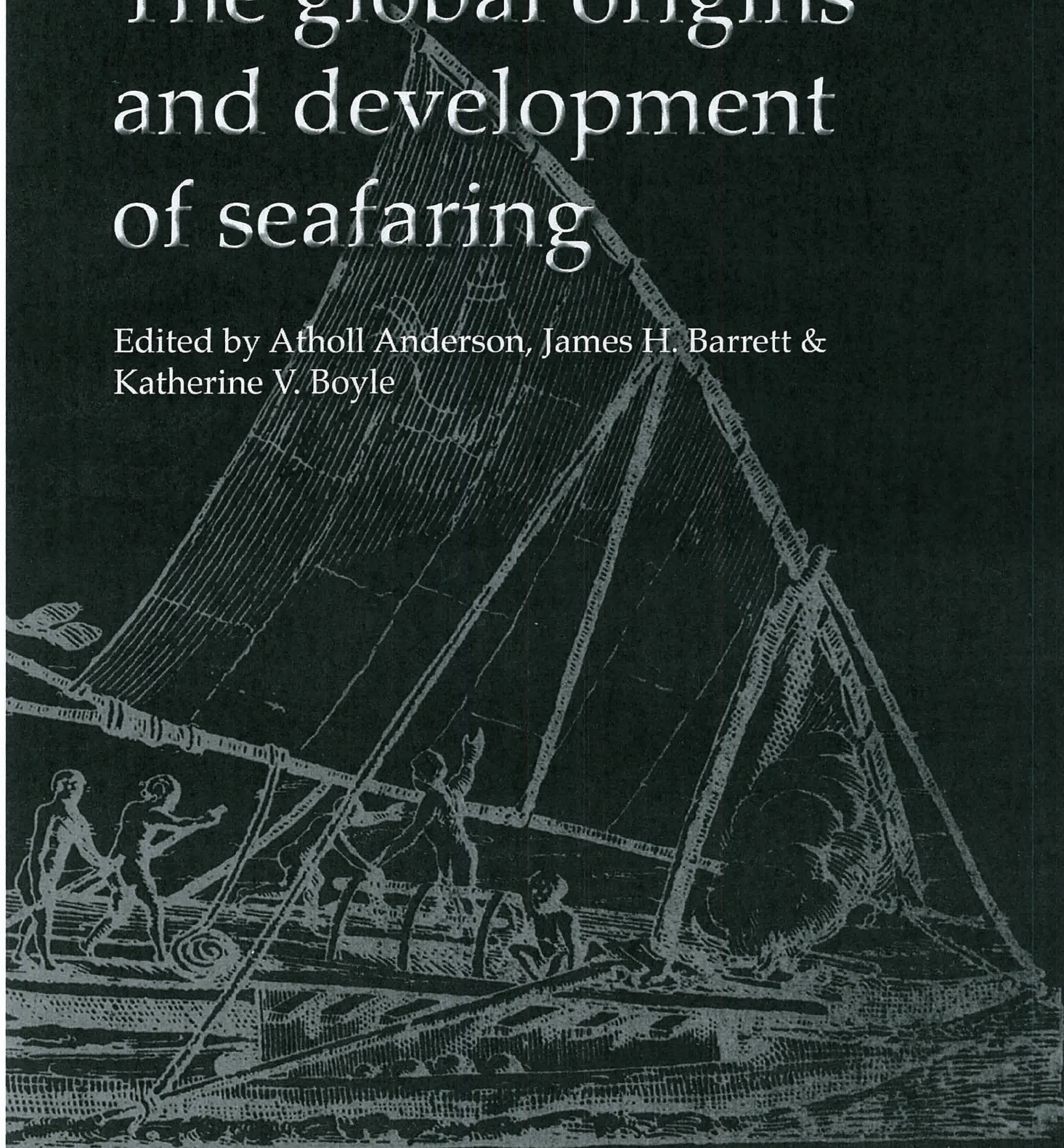




McDONALD INSTITUTE MONOGRAPHS

The global origins and development of seafaring

Edited by Atholl Anderson, James H. Barrett &
Katherine V. Boyle





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Chapter 1

The Origins and Development of Seafaring: Towards a Global Approach

Atholl Anderson

Travelling upon and making a living from the sea is the business of seafaring¹ and it is passing measurably out of our everyday cognizance, at any rate in the western world. Bulk carriage and to a lesser extent tourism remain important, but seafaring is no longer the usual means of long-distance travel, short-distance transport, coastal subsistence or military adventure. In my time, the motor-sailing scows that plied the New Zealand coast have gone, casual work on the wharves ('seagulling') has been displaced by containerization, and the passenger vessels that took antipodean scholars to distant relatives and warm beer in Britain, by aircraft. Yet, until the late twentieth century and for anything up to 500 centuries earlier than that, connections with and by the sea had reached profoundly into coastal and island life, and often beyond.

Seafaring produced a substantial broadening of the human habitat. It opened up the world of resources beyond the shore. It facilitated settlement of otherwise forbidding coastal corridors, increasing the range and connectivity of human dispersal. Movement of bulk commodities was much easier over-water and seaborne colonization reached hitherto uninhabited continents and islands. Long-distance warfare, trade and migration led to the rise of sea kingdoms and empires and the beginnings of globalization. It might be thought, then, that the study of seafaring would be one of the more prominent interests of world archaeology, but it is not.

While archaeological interest in seafaring is increasing (Adams 2006), it begins from well behind many topics of comparable significance. The first long-term history of global seafaring that is much more than a chronicle of boat technology remains to be written. There is no global synthesis, epitome, or theory of seafaring as a venerable human activity, as exist for foraging, agriculture, settlement patterns, warfare or art. Nor is it possible to construct a seafaring archaeology simply by re-combining the methods, models and

interests of research areas that bear relevantly upon it. Rather, it is necessary to begin by considering the nature and dimensions of seafaring as a research field in its own right. That was the intention of *The Global Origins and Development of Seafaring* conference. By 'seafaring' it was intended that the focus should be on the active or dynamic side of the broad field of maritime archaeology, i.e. upon the history, modes and results of seaborne mobility and their implications for prehistory. By 'global' was meant both worldwide coverage and attention to understanding seafaring as a global phenomenon. The latter is very much a matter of philosophical preference. Mine is for the warm rock-pool of processualism, and my suggestion of this conference arose from an interest in exploring those recurrences of behaviour, inferred processes, and explanations of the deep history of seafaring that are so obviously missing from its study at present. There are, of course, other perspectives upon the archaeology of seafaring that provide no less useful insights.

Seafaring in archaeology

Historically, seafaring involved particular skills and knowledge, as of passage-making and reading coast-lines and seas; distinctive kinds of material culture such as boats and jetties; craft specialities in foraging, fishing and trading; seasonal mobility and social patterns suited to seafaring; and ideological understandings expressed in structures, ritual, tradition and art about the meaning of the sea and seafaring in life and death. For some communities seafaring was pervasive, for others peripheral, and for some it had one kind of predominant meaning, such as maritime subsistence while for others it had another, such as long-distance trade or the threat of piracy and invasion. Although broad in content and varied in significance, seafaring had its core activities in the transport of goods and people and the seaborne exploitation of marine resources.

In approaching the archaeology of seafaring two severe evidential deficiencies need to be acknowledged. First, as travelling on the sea left relatively few recoverable traces, seafaring is unusually intractable to archaeological investigation. Its former existence and nature must be inferred from evidence of technological capability and from coastal or overseas displacement of people and things, but it is often the case that these leave a wide margin for debate about how the one was deployed and the other accomplished. Second, the long-term terrestrial record of seafaring has been substantially concealed or erased by sea-levels exceeded only slightly during the last 340,000 years and which are now *c.* 140 m above those of the last glacial maximum, 18–26,000 BP. Only where sea-level rise was outpaced by tectonic uplift, as in eastern New Guinea, or isostatic rebound, notably in Scandinavia north of central Denmark, or in regions where prehistory entirely postdates the mid-Holocene high-stand, as in Remote Oceania, is a long or full record of coastal occupation potentially available, subject, of course, to all the other environmental and anthropogenic sources of its depletion.

Seafaring is studied obliquely under 'maritime archaeology', a subject once focused largely on the boat (e.g. Muckleroy 1978; McGrail 2001, fig. 1.1), but now construed to embrace all, 'human activities on the seas, [and] also those related to interconnected waterways, adjacent locales and associated communities' (Adams 2006, 2; cf. Gale 1993 on 'hydro-archaeology'). Nevertheless, the dominant model and practice remains nautical archaeology, involving the naval architecture and operation of boats and, of more significance latterly, the interpretation of boat iconography. Coastal archaeology, which encompasses a wide range of relevant cultural behaviour such as the rise of offshore fishing and migrational routeways (Bailey & Parkinson 1988; Fischer 1995; Erlandson 2001; Westley & Dix 2006); and 'island archaeology' with its emphases upon colonization, socio-political development and historical ecology (Patton 1996; Fitzhugh & Hunt 1997; Broodbank 2000; Moore 2001; Cherry 2004; Fitzpatrick 2004), are also important approaches. Around them range pertinent specialisms of trade and empire (Crosby 1986; Lyman 2002; Ray 2003), insular palaeodemography (Williamson & Sabath 1984; Keegan 1995), and the molecular biology of maritime migrants (e.g. Friedlaender *et al.* 2007), amongst others.

Diversity of subdisciplinary interests is matched by regional variation in the evidence and construction of seafaring. In the Indo-Pacific and Caribbean, where there are very few prehistoric boat remains or much depth to historical archives, ethnohistorical observa-

tions (Haddon & Hornell 1975; Doran 1981; Lewis 1994; Anderson 2000; 2006) and historical linguistics (e.g. Pawley & Pawley 1994; Blust 2002) provide a framework for models of oceanic mobility (Keegan & Diamond 1987; Irwin 1992; Anderson *et al.* 2006), which compare results of actual or simulated experimental voyaging (Levison *et al.* 1973; Finney 1979; Irwin 2000; Di Piazza *et al.* 2007) with patterns of colonization archaeology and population genetics. In south and east Asia, and in continental America, subfossil boats are relatively scarce (all but non-existent in sub-Saharan Africa and Australasia), and naval architecture is similarly coupled with history and ethnography (Edwards 1965; Needham 1971; Blue & Mishra 1997), iconography (Ballard *et al.* 2003; Lape *et al.* 2007) and voyaging simulation (Callaghan 2003). In contrast, boat and ship remains are numerous in northwest Europe and the Mediterranean and their analysis is systematized (Crumlin-Pedersen 1990; McGrail 1998), experimentally-tested and to some extent theorized (Muckleroy 1978; Gibbins 1990; McGrail 2001; Adams 2001; Crumlin-Pedersen & McGrail 2006; Roberts 2006). Abundant iconography sustains the study of symbolic relationships (Crumlin-Pedersen & Munch Thye 1995; Randsborg 1995; Kaul 1998) and the maritime cultural landscape (Westerdahl 1995; 2005; Phillips 2003; Noble 2006) while historical evidence up to 4000 years old (Cherry 2004) facilitates the study of maritime linguistics (e.g. Sayers 2004) and gender relations (Ransley 2005). Seafaring is constructed confidently as social activity (e.g. Farr 2006).

In the light of such variability in pertinent methods and evidence, an explicitly global approach to seafaring needs to begin with a simple conceptual model and broad questions. The model I propose (Fig. 1.1) recognizes the crucial importance of history, of temporal variation in seafaring range and capacity either side of the advent of sailing. The questions that I want to discuss briefly here are: (1) in which circumstances did seafaring begin?; (2) what made seafaring a significant activity worldwide?; (3) how can seafaring research be framed at a global scale?

Origins of seafaring

Early hominins may have been adapted to a semi-aquatic existence (Hardy 1960) or favoured riparian habitats (Sauer 1962, 47), and freshwater adaptations probably preceded maritime activity. The data are biased by the differential survival of inland and coastal sites, but exploitation of freshwater fish and shellfish dates >1–2 million years BP and barbed spear heads or harpoons, to 80–90,000 BP in Zaire (Rick & Erlandson 2008). Whether or not consumption of shoreline

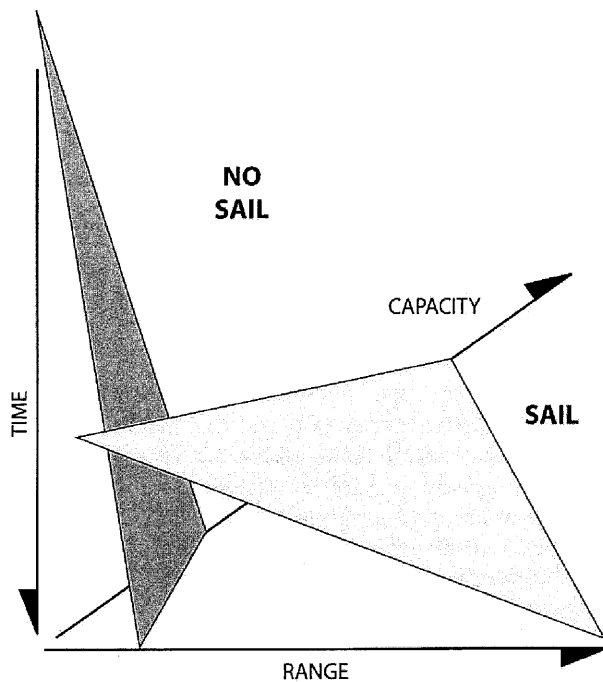


Figure 1.1. A model of prehistoric seafaring showing that, compared to human propulsion, sailing increased cargo capacity and range rapidly and substantially.

resources boosted hominin intelligence (Douglas 2000), it plausibly underwrote rapid coastal dispersal by *Homo sapiens* (Stringer 2000; Bulbeck 2007). It is impossible to measure the rate precisely, but if global coastline totals about 1,600,000 km (the figure depends on the scale of resolution), and if all coastline within each phase of expansion was traversed, then the annual average increase in occupied coastline began at about 1 km, 500–50,000 BP, rose to 5 km in the period 50–15,000 BP, peaked at 80 km, 15–5000 BP (primarily by the occupation of the New World), and fell back to 30 km 5000–1000 BP as the availability of unoccupied coastline diminished (Anderson 2007).

Maritime coastal activities were shore-bound for a long time. Shellfishing and coastal scavenging began 165,000 years ago in South Africa and elsewhere during the middle Pleistocene, while inshore fishing was in place by 75,000 BP (Erlandson this volume). Around 30,000 BP, remains of large, pelagic fish such as tuna appear (e.g. Gorham's Cave, Gibraltar, 25–30,000 BP) and there was shoreline hunting of seals and scavenging of cetacean carcasses (Rick & Erlandson 2008); by the early Holocene, dolphins were hunted in Japan (Habu 2004). At some stage watercraft were involved

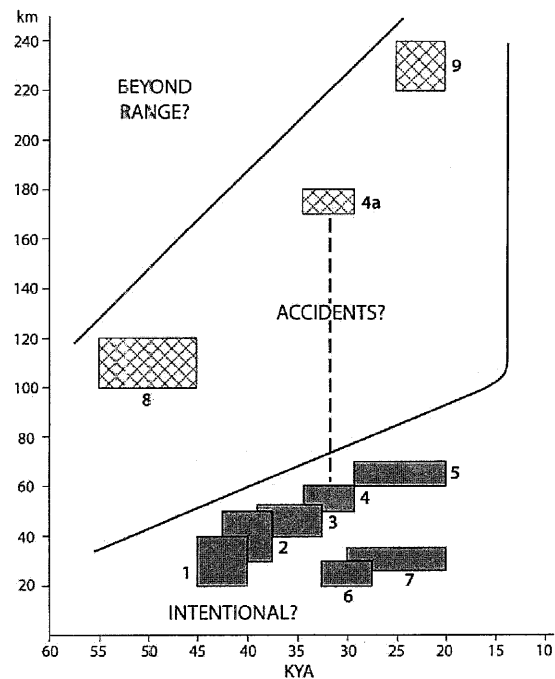


Figure 1.2. Pleistocene evidence of sea crossings in the west Pacific. Box sizes express the time/distance ranges of data for each example: 1 = Bismarcks, 2 = Timor, 3 = Halmahera, 4 = Buka, island-hopping, 4a = Buka direct, 5 = Okinawa, 6 = Sulawesi, 7 = Izu Islands, 8 = Australia, 9 = Manus Islands.

in this sequence, but the archaeological record of boats barely spans the Holocene and indirect arguments are not always secure. Hunting of small cetaceans and tuna required topographical opportunity more than watercraft. Toggling harpoons are apparent from the early Holocene in northern Japan, without corresponding evidence of boats other than quite rudimentary logboats, and those may not have been needed because tuna and other pelagic taxa can be caught by shore-based fishing from coastal rock platforms adjacent to deep water (as occurred quite frequently in modern Australia, South Africa and elsewhere until the commercial destruction of stocks: cf. European observations by Pickard & Bonsall 2004). If watercraft were not involved then at least stout cordage and one or more of spear points, gorges and hooks are implied.

The earliest clear evidence of sea travel is from the western Pacific where inter-island passages date >800,000 BP (Bednarik 2003) and were reaching 120 km, >40,000 years ago. Whether the long passages were accidental or intentional is open to conjecture. Passages of greater than about 60 km are few and scattered through the late Pleistocene period compared to those of shorter range (Fig. 1.2). That aside, the

extraordinary regional precocity of sea travel in the western Pacific, from Australia to southern Japan, presents an intriguing and much-debated issue in maritime archaeology. While it is often attributed to increased cognitive abilities and their consequences among modern humans this can be only a minor part of the explanation, for sea travel did not occur with the dispersal of modern humans anywhere else, indeed not until much later, as in the Mediterranean (Broodbank 2006).² It is argued (e.g. Allen & O'Connell 2008) that inter-group competition and anthropogenically-induced pressure on the diversity and biomass of insular resources impelled rapid maritime migration, but sea travel is neither the obligate result — an alternative strategy was inland hunting and foraging, as indicated c. 43,000 BP in New Guinea, New Britain (e.g. Pavlides & Gosden 1994), and Sarawak (Barker *et al.* 2009) — nor did it continue beyond Near Oceania until the late Holocene despite tens of millennia of human occupation on relatively small and ecologically depauperate islands until the late Holocene. I think that while modern human abilities and subsistence activities are clearly relevant, more significant reasons for the singular antiquity of sea travel in the west Pacific lie in environmental contingency (Anderson 2008).

The west Pacific is distinguished from other regions reached >45,000 BP by its plethora of inter-visible islands, its unusually high water temperatures in the extensive West Pacific Warm Pool (sea surface >28°C), and by the availability of bamboos, especially those of large diameter. The Pleistocene distribution of bamboos is unknown, but as multiple genera are distributed across Wallacea (26 species) to western New Guinea (21 species) and northern Australia (3 species) it is a fair assumption that they have a long tenure in the region. Natural bamboo rafts, which sometimes carry small animals, could have moved larger prehensile species, including people and possums, between some islands during the late Pleistocene, or bamboo rafts might have been constructed. Doing so required only the technological expertise present already in the Middle Palaeolithic. Warm sea temperatures, which persisted through the late Pleistocene, from the equator (de Garidel-Thoron *et al.* 2005) to southern Japan where coral was growing during the last glacial maximum (Iryu 2006), reduced the danger of death by exposure significantly, compared to other regions in which sea travel might have been attempted. That allowed swimming, in groups for humans as well as other large terrestrial mammals, for up to a 50 km range. Bamboo rafts are unusually seaworthy and capable of carrying quite large human groups. A raft of green bamboo, 8 × 2.4 × 0.4 m (8 m³) at 50 per cent of displacement to submergence would carry 3150 kg

(Anderson 2007). As this is the weight of 50 adults, or more practically 20–40 adults with children and supplies, problems of colony establishment and survival (Moore 2001) would be greatly reduced. Importantly, it obviates the theoretical necessity, raised in much current discussion, of assuming multiple, more-or-less synchronous, and therefore deliberate passages to put a sufficiently large colonizing propagule in place.

Considering seafaring origins more broadly, one point that is clear enough is that a capacity to cross open water tracked the demographic curve of *Homo sapiens*. The human population was about one million during the terminal Pleistocene when evidence of water crossings becomes apparent from the Mediterranean, western North America and the western Pacific. Sailing began by the mid-Holocene, when the human population was about 15 million, during a period in which the crude birth rate was increasing significantly worldwide (Bocquet-Appel & Naji 2006); Indo-Pacific voyaging around 3000 years ago when there were 50 million people and the long-distance passages by Norse and East Polynesians, when there were 300 million people. The gross population figures are meaningless for particular situations but they describe the global context in which seafaring developed and encourage the hypothesis (implicit in Shennan 2001), that late Quaternary population growth might have stimulated or reinforced technological innovations that increased range or capacity.

Some of these probably arose first in freshwater. Late Pleistocene (Aterian) exploitation of Saharan waterways involved reed boats or something similar, and later evolution of boat technology along the Nile and Tigris–Euphrates (Fabre 2005; Carter 2006), included paddling, steering and sails, before there is clear evidence of putting to sea in the region. In Eurasia, early Holocene logboats have a mainly estuarine or lacustrine distribution (e.g. Jiang & Liu 2005) and skin-covered boats (e.g. Ellmers 1984) were probably essential to early Holocene expansion along the abating ice fringe of western Norway (Bjerck 1995), where migrating reindeer could be attacked efficiently in the water. Later evidence suggests fairly measured progress into open waters. Scandinavian Bronze Age maritime iconography is widely dispersed, but stone ship settings, which might locate an actual association with seagoing boats, occur almost exclusively in the inner Baltic, notably in Gotland, and expand into Denmark and Norway in the Iron Age (Capelle 1995; Kaul 1998). Thereafter, Iron Age boat graves are widely spread in Norway and Sweden up to the Vendel stage but in the Viking era they are concentrated in Norway and distributed across the North Atlantic (Muller-Wille 1995).

The burden of these hypotheses is that short-range seafaring, probably developed upon older freshwater and coastal activity, emerged first where key conditions were coincidentally and unusually favourable, despite the broad dispersal of human modernity and its technical and subsistence flexibility. It was only in the terminal Pleistocene that short range activity became more general in the Old World, and later still that intentional long-range seafaring was possible.

The rise of sailing

Sailing was something quite new in human experience. It entailed: learning to live on a three-dimensionally-mobile surface, navigating out of sight of land, surviving the threat of hypothermia, devising new diets (reducing proteins decreased the necessity to carry water) and learning about what to carry on board, amongst other skills, e.g. milch goats consumed dry rations and were less prone to seasickness than cows. Above all, it exploited a new source of energy for transport; the kinetic energy of the wind. The global development of sailing boosted speed of movement (Carver 1990), and therefore range and frequency of mobility. The consequences of this revolution in mobility have been as far-reaching as the evolution of flight amongst birds (or in modern technology). It was a structural shift that so altered the shape of human geography, mobility and interaction as to be considered a new and qualitatively different domain of human activity.

Yet it was also connected to other manifestations of cultural change in the Holocene, notably Neolithization. By the terminal Pleistocene the movement of some animals and probably plants onto Mediterranean and western Pacific islands, prefigures an association of terrestrial subsistence and seafaring that was fundamental to the further development of each. Just as biological translocation was often involved in domestication, so increasing seafaring might be seen as attempting domestication of the sea, in the sense of making it more useful. Population growth, social complexity and interaction were associated, on the one hand, with the rise of agriculture and its spread along coasts and waterways (Davison *et al.* 2006) and, on the other, with the development of offshore seafaring (a relationship which continued into the modern era: Smith 1984). It is tempting to see both of these as forced by mid-Holocene climatic volatility, especially in the Mediterranean and western Asia where there was also sustained population growth and climatic cooling and drying (e.g. D.G. Anderson *et al.* 2007). However that may be, food production mediated

the rise of societal complexity, which led eventually to urbanization and regional *imperium*, while sailing facilitated the expansion of short-range maritime mobility into migration, colonization, long-distance trade (particularly in luxury goods), sea power, colonialism and eventually nascent globalization. The common connection in time, space and perhaps reaction to economic pressure, between food production and offshore seafaring, and the close relationship of development in sailing to centres of agriculture and societal complexity in Eurasia (though not conspicuously so in the Americas and Indo-Pacific islands — why not?) suggest that the two phenomena represented parallel and connected routes towards modernity.

The origins of sailing, insofar as they are accessible archaeologically, appear to have been during the mid-Holocene. The earliest depiction of a sail in Egypt dates to the late fourth millennium BC, and sails are inferred in the eastern Mediterranean, Persian Gulf and possibly India by the late third millennium BC (McGrail 2001). There were planked boats during the Shang dynasty in China, mid-second millennium BC, and there is a possible character for the sail (Needham 1971, 4 (III): 599), but sails may have been used earlier on rafts (Worcester 1966). Evidence of a sudden and six-fold increase in the range of seaborne contact during the mid-Holocene in the Indo-Pacific (Fig. 1.3) seems a likely manifestation of the advent of sail (Anderson 2004).

Sailing can hardly have arisen merely by observation of the effect of the wind on waterborne objects, since that had been apparent always and everywhere, but archaeological explanations of its origins are quite uncertain. For example, sailing existed in western Europe at least 50 BC, and Haywood (1991) argues for cross-Channel sailing by the second century AD, but on linguistic (Their 2003), iconographic and archaeological evidence (Crumlin-Pedersen 1990) the advent of sail is later first millennium in northern Europe. Scandinavian data indicate planked rowing boats 2000 years ago but trends of rocker flattening, keel extrusion and robustness of construction that were pre-requisites to sailing occurred no earlier than the sixth century AD. As Scandinavians must have known about sailing since at least Roman times, why was its adoption there so late?

From former hypotheses, not necessarily invalid, about the push of population pressure or the pull of climatic change, attention has turned to social and political conditions (see Barrett 2008 on the Viking phenomenon). The rowing ship occurred within pre-state conditions where many small polities were in continual competition. The requirement of large crews was also an advantage in terms of warfare and

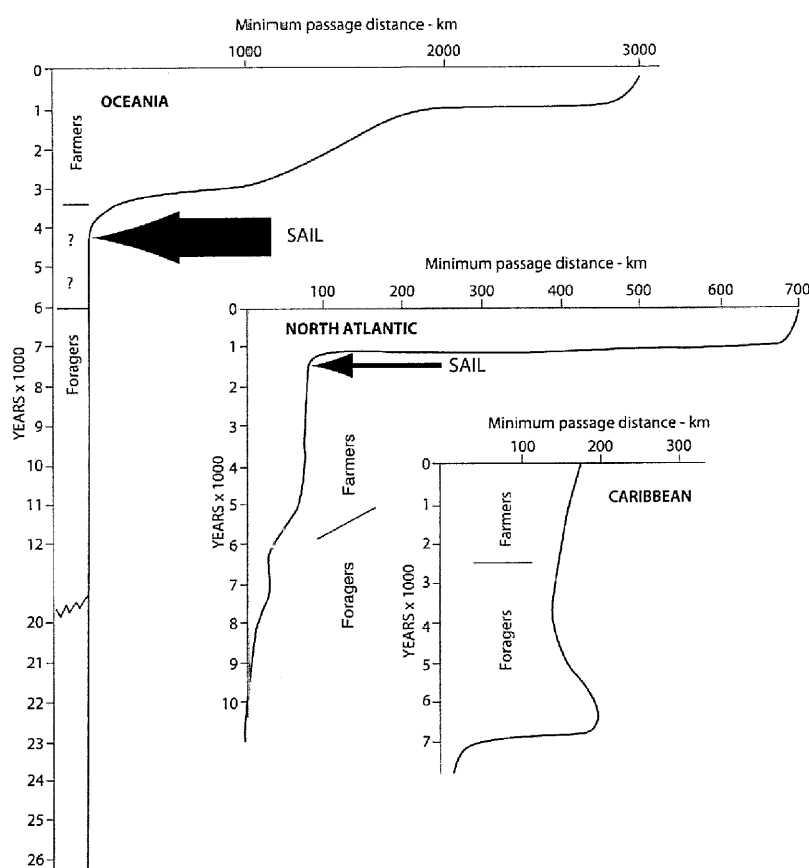


Figure 1.3. Impact of sailing advent (arrows) on achievable maximum passage distance; no sailing in Caribbean.

the protection of cargo, often of luxury goods, and the concept of a territorial chief with his band of followers was reproduced in the captain and crew of the large rowing boat (Westerdahl 1995). Similar circumstances are manifested in the use of large canoes as means of prestige exchange, social interaction and warfare amongst chiefly societies in the Indo-Pacific and Americas (e.g. Arnold & Bernard 2005), in fact almost globally in clan societies, suggesting a convergent influence of social structure on seafaring. With the later development of larger polities, involving greater safety from attack and more bulk trade, the advantages in sailing were apparent; fewer crew and greater carrying capacity.

But whether sailing was usually developed independently or spread by diffusion is a more difficult issue, as the example of lateen-like sails in the Indo-Pacific serves to illustrate. The west Asian lateen is loose-footed and attached to a vertical mast with fixed stays. The vessel goes about by wearing (i.e. stern to wind). The lateen sail, probably developed by fixing the tack of a square sail fore-and-aft to pro-

vide windward ability, is possibly of fifth-century AD Byzantine origin (Kingsley 2004), and it had dispersed into the Indian Ocean by the late first millennium AD. The Oceanic 'lateen' has a yard and boom and it is mounted on a canted mast with running stays. The vessel goes about by shunting, which keeps the wind on the same side of the sail. It has been argued that the Oceanic lateen developed independently in Indonesia or further east (Bowen 1953; Johnstone 1980; Campbell 1995), but I have some doubts (as, now, does Campbell pers.comm. August 2005).

The earliest-observed lateen sails in the central Pacific were mounted on a fixed-stay mast in a double-hulled canoe that tacked or wore about, allowing the sail to rest against the mast on the bad tack (Fig. 1.4). This form looks like a west Asian lateen adapted to the Oceanic custom of lacing all sails to spars along both sides, and it probably emerged in Micronesia, where there was contact with southeast Asia. Voyaging simulation confirms abundant historical evidence of a high probability of drifting from southeast Asia to west Micronesia (Callaghan & Fitzpatrick 2007), and

Indian Ocean vessels were reaching southeast Asia in the first millennium AD. As Asian glass beads and rice cultivation reached west Micronesia about AD 1000 (Rainbird 2004), it is likely that the west Asian lateen propelled the implied voyages and diffused there into Oceanic technology, eventually reaching Polynesia.

But what about the lateen-like sails recorded on Ecuadorian rafts (Fig. 1.5) in the early sixteenth century AD, assuming neither recent Asian nor European origins? Do they represent diffusion of Oceanic lateens to South America along an equatorial route? Possibly, but there might be a separate development. The centre of occurrence was on the Guayaquil River, Ecuador. It has the largest estuary in western South America and a predominantly upriver breeze which traditional workboats use to sail inland, returning on the current with sails stowed. By analogy with early development of sailing on the Nile (Fabre 2005), an independent centre of sailing has been proposed (Anderson *et al.* 2007).

As uncertainty about the origins of lateen-like sails suggests, the development of sailing globally, including its remarkable scarcity in the pre-Columbian Americas, is open to various potential explanations applicable to the distribution of material culture that invoke contingencies of situation or society, independent development, cultural selection and diffusion. For example, if early hull forms worldwide seem more diverse than types of sails, as is my impression, then this is possibly because of differential selective pressure on buoyancy versus propulsion traits; as argued analogously by Rogers & Ehrlich (2008) in regard to functional versus symbolic design features in Polynesian canoes.³ Another possibility is that sailing rigs, being more visible and easier to comprehend than subtleties of hull shape and construction, often hidden by decks and water, were more readily susceptible to random copying which favoured a high proportion of few variants (cf. Bentley *et al.* 2004).

Diffusionary arguments have fallen largely out of favour in archaeology but they remain plausible in this context (Sorensen & Johannessen 2006), for sailing was the main potential agent of long-distance diffusion. It connected areas otherwise so culturally distant as to have little chance of something new passing between them, and shielded cargo, skills or ideas from distortion *en route*. For the sake of argument, the null hypothesis can be taken as this: that sailing was diffused worldwide, having appeared *de novo* only in the Mediterranean–west Asia. The advent of sailing, as it is currently and imperfectly known, is consistent with that hypothesis in terms of the chronology, albeit far from precise (Fig. 1.6), and the distribution of maritime technology at a broad scale of variation.

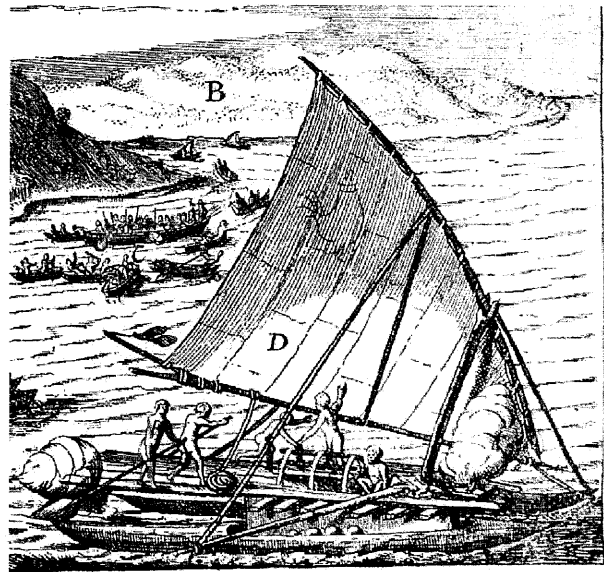


Figure 1.4. Oceanic lateen, Tonga in 1616. (Courtesy of the Alexander Turnbull Library, New Zealand.)

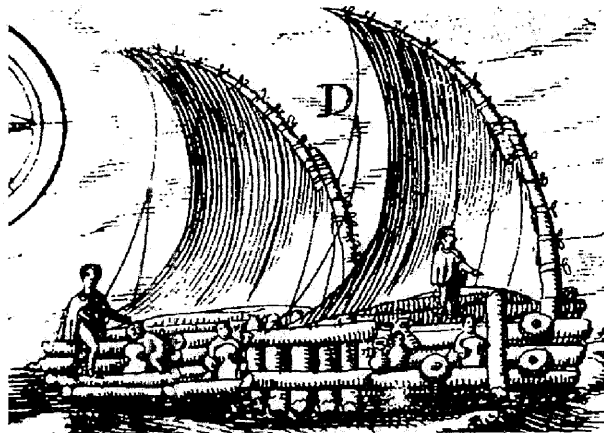


Figure 1.5. A 'lateen' rigged raft, Ecuador. (Drawing by Spilbergen (1619).)

At an approximately hemispherical level (Fig. 1.6) there is a division between square sails, mainly to the north, and triangular sails mainly to the south (there were also some square sail rigs in the New Guinea region), although triangular sails probably originated in the Mediterranean and spread most influentially to the south. The division corresponds largely with northern single-hulled, planked, vessels adapted to many kinds of sailing conditions, and southern rafts and multi-hulled canoes that sailed almost entirely in trade winds. Whether the co-variations were in origin functional, historical or explicable in some other way remains open to conjecture and ripe for research.

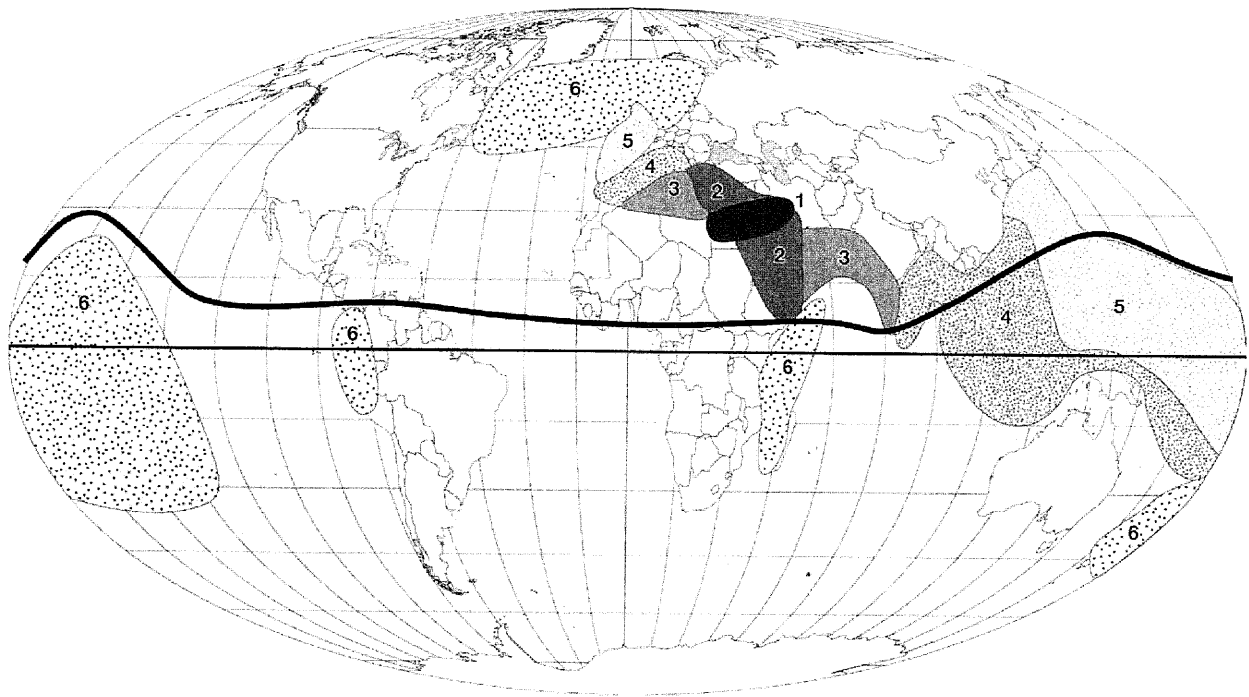


Figure 1.6. *Approximate age of earliest sailing: 1 = 5500–5000 BP, 2 = 4500 BP, 3 = 4000 BP, 4 = 3000 BP, 5 = 2000 BP, 6 = 1000 BP. Heavy line divides northern, square-sail rigged, single-hull vessels from southern Oceanic multi-hulls, nearly all with triangular sail rigs.*

The key area in investigating that issue may turn out to be the Indian Ocean, the ‘forgotten ocean’ of global scholarship in maritime history and archaeology, although research based on reconsidered historiographies that embrace a ‘new thalassology’ (Vink 2007; Ray 2003) are beginning to make progress. On current data the Indian Ocean looks odd because relatively fewer of its islands (72 per cent) have a record of prehistoric occupation than in the Pacific (98 per cent) despite earlier and more sophisticated maritime technology in the Indian Ocean, which is, moreover, smaller, more accessible and has long seasons of predictable sailing conditions (Anderson 2009). If a diffusionary model of seafaring technology is valid it will probably hinge around an as yet unknown and possibly surprising way in which technology developed and became deployed in the Indian Ocean.

Models for an archaeology of global seafaring

I want now to come back to the question of how a more systematic study of global seafaring might be framed. Current analytical models take up different approaches and themes of seafaring, and each has its drawbacks. Nautical archaeology has derived general technological hypotheses, such as the distinction in planked craft between shell or edge-joined and frame

or non edge-joined construction (McGrail 2001, 8), but with some exceptions it retains an essentialist imperative of technological progress. Anthropological perspectives on maritime iconography broach a topic as uncertain as it is fascinating. For instance, medieval finger-rings engraved with a ship design were not symbolic of any seafaring guild, trade, or practice, but worn, rather, for protection against leprosy (associated with eating fish: Mark 2002, 307). Without such historical illumination, so often lacking archaeologically, such iconography might have borne a very different interpretation.

The ‘maritime cultural landscape’ (‘islandscape’: Broodbank 2000; ‘seascape’: Gosden & Pavlides 1994) seeks to map the socially-constructed space of human relationships with, and within, the maritime world (Phillips 2003; Chapman & Geary 2004). To the extent that it depends on the sensibility of the archaeologist in ‘reading’ spatiality, and is therefore framed in the present, it shares the weaknesses of both the general landscape approach and older locational analysis, to both of which it bears a generic affinity. The distribution of ritual places might refer to topographical prominence or liminality of several kinds that are not necessarily or substantially maritime, and visibility from the sea is, in practice, usually so restricted that the maritime cultural landscape is effectively terres-

trial and inshore. Its relevance to the wider range of seafaring experience is questionable.

Geographical ecology, especially in using the equilibrium model (MacArthur & Wilson 1967) of island biogeography, is a common approach in the Indo-Pacific region. The model has important drawbacks (Whittaker 1998) and the case for long-term biotic stability on islands now seems, ironically, stronger than that for continents (Walter 2004; Heaney 2007). Still, the fundamental spatial relations of island biogeography remain valid (Vitousek 2002) and constitute a predictive geometry of island area and distance for the probability of success in over-water mobility. Similarly, where distance is relatively comparable, the frequency of seafaring is plausibly related to the density, length per unit area, of shoreline (cf. Anderson 1982 on 'edge effect'). This proposition implies that boat technology and early seafaring should be concentrated where complex coastlines and insularity are high, as in the western Pacific and Scandinavia. However, the coastlines of northwest Australia, the northeast Americas and southern Chile are also rich and complex but seafaring seems to have developed relatively little diversity or sophistication in those areas, as judged by archaeological evidence of exchange and ethnographic data.

A disadvantage of insular biogeography is that it is unable to deal effectively with historical or cultural contingency. This has been a constant problem in Oceania as shown by our experience of debate about prehistoric voyaging. Simulated seafaring has a simple target angle/distance structure in relation to prevailing wind conditions; but sailors are not birds or insects, and different assumptions about sailing capability, as in boat technology, sailing strategy or sailing conditions, can alter the geometry of voyaging substantially (Anderson 2000; Anderson *et al.* 2006; Montenegro *et al.* 2006; Callaghan & Fitzpatrick 2007; Di Piazza *et al.* 2007). The model does not predict, nor can it control, those sources of variability.

Optimal-foraging theory is another approach in geographical ecology that is potentially relevant to understanding rapid maritime migration, as argued for Polynesia in relation to anthropogenic pressure on coastal and insular resources (Anderson 1996; 2003; O'Connell *et al.* this volume). However, the impetus to move in conditions of resource pressure is variable within a settlement sequence, as demographic modelling suggests (Keegan 1995) and it is not the only, or even the most probable, of responses where large or ecologically diverse islands are involved, or in the absence of suitable watercraft. The contrast between New Guinea and its main islands with a long history of internal inter-

sification, versus rapid, serial, long-range migration in the central Pacific is instructive.

In short, while these various approaches have much to contribute to a global archaeology of seafaring I do not see any of them as offering a general conceptual framework. At the risk of gross overstatement, nautical archaeology is too restricted by materiality, geographical ecology is too resolutely behavioural, and the maritime landscape is too coastal. In addition, only naval architecture, and then mainly typologically, takes substantial account of long-term temporality. That quality, the great asset of an archaeological approach to human affairs, ought to be more clearly incorporated into the global study of seafaring. If the latitude of deep time offers some privileged way to describe and, if not ultimately to explain, at least to offer a 'coherent unfolding' (Sherratt 1995, 1) of how seafaring arose and developed then almost by definition such an account would have to be written substantially in chronological terms. Further, it would need to acknowledge that the ocean is neither as neutral nor uniform as it seems often to be regarded in archaeological discussion. At every scale of analysis the heterogeneity and dynamics of the ocean, the agency of the sea it might said, shaped and re-shaped the nature and trajectories of seafaring.

A model that appeals to me as balancing time, space, agency and interaction at an appropriate scale, and which, adapted to archaeological use, might form the basis of a conceptual framework for global seafaring, is 'macrohistory' (also in somewhat different forms, 'world history' and 'big history', the latter a nicely Melanesian term: Spier 1996; McNeill & McNeill 2003; Christian 2006). Macrohistory is concerned with the supra-regional or global nature and extent of horizontal/spatial integration in human experience and with its vertical/temporal patterning (cf. the *Annales* school: Holmes 2005), especially its divergences and convergences; e.g. with documenting a great convergence about 1000 years ago that stimulated the rise of globalization (Northrup 2005). The approach emphasizes themes of relative interaction, functional integration and developing identity that run through large-scale maritime narratives by historians (e.g. Coclanis 2002; Ray 2003; Bailyn 2005) and are incipiently present in a few archaeological treatments (e.g. Cunliffe 2001). Seafaring, especially sailing within the last several millennia, is seen to have propelled extensive social interaction (including imperialism and colonialism: Gosden 2004), substantial convergence and eventually, globalization. Equally, the emergence of new large structures of social inter-dependence probably induced further complexity in the development of seafaring in a continuing and reciprocal fashion.

Macrohistory is open to various theoretical perspectives in archaeology, including those that underpin the current methodological approaches to seafaring. Certainly, the 'three empirical realities of global human experience...' as seen by a macrohistorian (Bentley 2006, 24), '...rising human population, expanding technological capacity and increasing interaction between people of different societies...' appeal to a processualist perspective, although I would add adaptation to climatic change and make that four empirical realities. But the point here is not which of many useful lines of archaeological enquiry might be pursued, it is rather how to construct an archaeology which puts the deep history of worldwide maritime mobility at its centre. As that extends across the prehistory-history transition, particularly in regard to sailing, a theoretical framework that can accommodate both epistemological domains is appropriate.

Some of the substantive issues that a macrohistorical and macroarchaeological approach would probably include, and which have been foreshadowed here, are: complex questions about seafaring origins and why they are so comparatively early in the west Pacific, the late advent of the sail and its implications, the curiously patterned prehistoric distribution of sailing worldwide, the close connection in some regions, but not in others, between advanced seafaring and the origins of societal complexity, the extent to which sailing technology was diffused or independently invented, and the likely significance of seafaring development in the Indian Ocean with its bridging role between the Mediterranean world and the Pacific.

Conclusions

Seafaring is widely acknowledged in world archaeology, but it is less studied than assumed within other propositions about migration, colonization, interaction, trade etc., that involve seaborne travel, and it is seldom considered as a global phenomenon. Yet waterborne transport and resource acquisition was an almost universal phenomenon of the late Quaternary and the mid-Holocene rise of sailing also occurred extensively. Seafaring exerted a profound influence upon coastal and island society and landscape, upon technological history and the manipulation of resources and commodities, and upon the long-range mobility of human populations. In those respects, seafaring is no less significant than Neolithization and urbanization which otherwise dominate archaeological attention to the Holocene. It is probable that seafaring was connected quite intricately with these terrestrial phenomena, or at least with the larger

structures and processes that underlay them, but ultimately it harnessed a different source of energy and traversed a very different 'terrain' in the course of which worldwide human geography and cultural interaction were substantially re-shaped. There is, then, a case for taking seafaring seriously as a dedicated field of archaeological and related research on a global scale.

In order to do so, I have suggested, seafaring might be considered profitably as two related but different phases. In the Pleistocene generally and in some regions throughout prehistory — Arctic, Australia, and in much of sub-Saharan Africa and the Americas — it remained localized, mainly inshore, small-scale and dependent essentially upon natural drift or human propulsion. In which circumstances, and in what variety, did such basic forms of maritime mobility come into existence? Subsequently, from about the mid-Holocene in the Old World, wind power propelled seafaring into a different dimension of significance. How did this happen, why was it of more restricted distribution, and was the advent of sailing largely by diffusion from a single source area, such as western Asia, from several source areas, or the result of numerous independent developments?

I also argue that while global seafaring needs to be the subject of research in its own right, it cannot be studied in isolation from the terrestrial context to which it was continually moored. The advent of sailing around the time when other early forms of transport also emerged (ox-and-wagon 5000 BP, horse-drawn chariot 4000 BP) begs the questions of whether and how all of these phenomena were related, with sailing as the maritime parallel or consequence of terrestrial transformations. How influential were environmental and demographic processes in forcing the prehistory of maritime mobility, how much was owed to contextualization of seafaring in changing social structures and polities, and how critical was the operation of localized geographical, historical or societal contingency?

There are not yet any satisfactory answers to these questions and they constitute only one set of issues that happens to appeal to me; there are others raised throughout this volume. Prehistoric seafaring on a broad scale of time or space is not yet understood coherently in any but a few respects; the late Holocene prehistory of boat technology and perhaps the development of seaborne fishing are amongst the few. Opening a discussion explicitly about the global prehistory of seafaring, including the origins and development of its recurrent manifestations, then, might be regarded reasonably as premature, yet thinking about the broader questions is likely to

better guide directions of empirical research. This approach has generalizing objectives, unquestionably, and they are something regarded askance nowadays in archaeology. But generalization, it might be argued, is the duty we owe to wider scholarship and the means of productive reciprocity. Whether this volume is the catspaw of a freshening breeze in global seafaring research only time will tell.

Notes

1. There is considerable merit in the typology of terms for sea travel proposed by Broodbank (2006), but for ease of expression here I have used 'seafaring' to refer to all modes.
2. Recent news of Palaeolithic stone tools on Crete (*The Times*, 18 January, 2010) might overturn the proposition outlined here that early west Pacific seafaring was exclusively early, but as yet neither the chronology nor the cultural attribution of the Cretan tools is conclusive.
3. The problem in discussing this example (e.g. Shennan 2008), is that trait variation in historical Polynesian canoes arose substantially by diffusion from three very different sources; original Polynesian, late prehistoric Asian-Micronesian and historical European. As these operated differentially amongst archipelagos and over time, trait variation recorded ethnographically is only partly, and probably insignificantly, the result of selection.

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