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Chapter 3

Earliest Coastal Settlement, Marine Palaeoeconomies and Human Dispersal: the Africa–Arabia Connection

Geoff Bailey

How far back in time can we trace a human ability to exploit marine food resources and a human capacity to travel across water? Both questions are important to a wider understanding of an evolving human interest in the sea and to the large question of the timing and pattern of dispersal of the human species. But these are two separate questions, and we should not assume that evidence for one presupposes the existence of the other. Some of the most abundant marine resources can be obtained within the intertidal zone or in very shallow water at the shore edge: marine molluscs, other marine invertebrates, seaweed, fish trapped in pools by the receding tide or scooped out of shallow water, marine birds brought down by storms, and sea turtles and sea mammals that have come ashore for breeding or other purposes. Moreover, all of these resources are obtainable by collection or scavenging with the simplest of technology or with no implements at all, and some can be eaten raw without the need for further processing. Evidence that such resources were exploited tells us nothing with certainty about the existence of seafaring skills or technology, since all could have been obtained at the shore edge without venturing into deep water. Even in the Holocene, when there is good independent evidence for the existence of seaworthy boats, the presence of marine indicators in archaeological deposits should be used with caution. The presence of bones of adult cod in European shell middens was once taken as evidence of deep-sea fishing from boats, but that evidence can equally plausibly be interpreted in terms of line fishing from land during periods of the year when adult fish move close inshore (Pickard & Bonsall 2004).

Conversely, evidence for the crossing of sea barriers does not necessarily indicate much if any interest in marine foods, let alone their systematic exploitation, especially if the sea crossings in question are short enough that they could have been accomplished by swimming, simple rafts, or even by accident.

The presence of indicators of either type of activity has often been taken as evidence of a significant advance in technological skills, social organization or economic arrangements, on the assumption that the sea is an alien environment that played no role in the earliest stages of human evolution, and that its resources only began to be incorporated into human existence with the development of new abilities and skills or with increased pressure of population numbers on existing food supplies on land. In fact, consumption of marine resources and short sea crossings require no more by way of biological adaptations, technological skills or cognitive abilities than those associated with the development of the earliest members of the genus *Homo* in the African Rift more than 2 million years ago. Some authors, notably Carl Sauer (1962), have even seen in the resources of the sea shore a primary stimulus to human evolution. Nevertheless, the prevailing opinion in archaeological circles until very recently has been a persistent bias against the use of marine resources in the earliest periods of the archaeological record and an assumption that they appeared relatively late in the global history of human development, only reaching their fullest expression in the latter part of the Postglacial period after about 7000 years ago. The reasons for such a bias stem from a variety of sources and have been well rehearsed elsewhere (Bailey 2004; Bailey & Milner 2002; Erlandson 2001; Erlandson & Fitzpatrick 2006). The aim of this paper is to examine some of the ambiguities in archaeological indicators of marine activity and difficulties in their interpretation, to assess the problems of palaeogeographical change and differential visibility of evidence posed by the Pleistocene history of sea-level change, and to summarize some of the findings of new research at the southern end of the Red Sea, where we have examined more closely the nature of the sea channel under different sea-level conditions, and begun exploration of the onshore

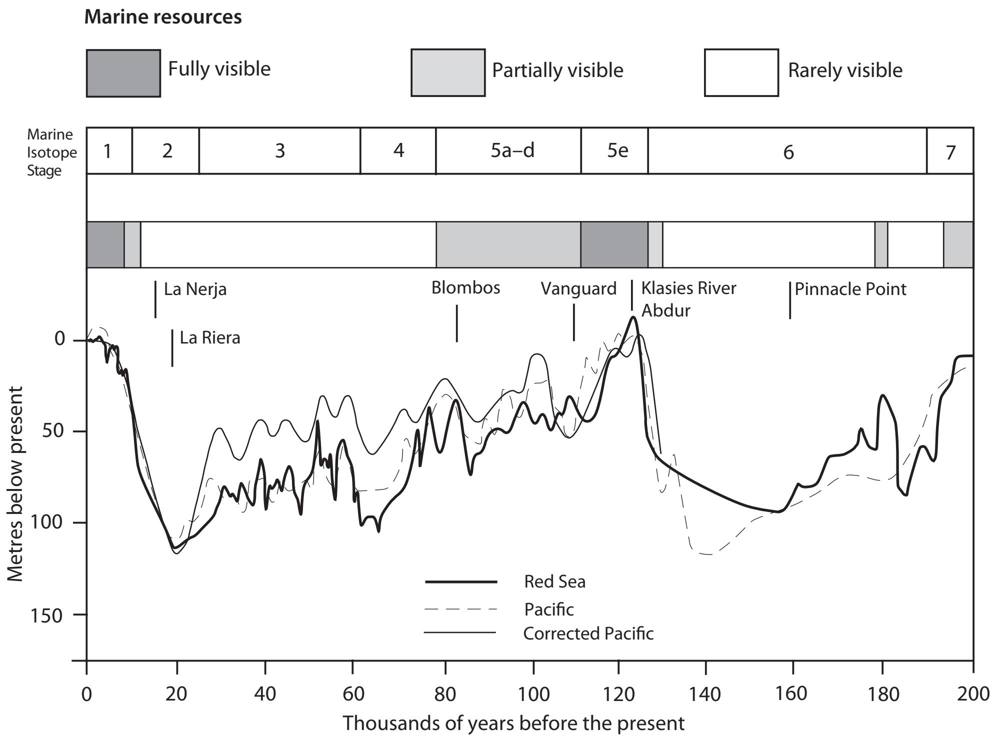

Figure 3.1. *General curve of sea-level change over the past 200,000 years, showing likely impact on the visibility of marine resources. Site names refer to coastal sites in Africa and the Gibraltar Peninsula with early evidence of marine resources. (Sea-level data from Lambeck & Chappell 2001; Shackleton 1987; Siddall* et al. *2003; Van Andel 1989a; Waelbroek* et al. *2002. © G. Bailey.)*

coastal archaeology and the submerged landscape of the Farasan Islands (Bailey *et al.* 2007a,b).

Consequences of sea-level change

The general pattern of eustatic sea-level change in response to Pleistocene glaciations is well known (Fig. 3.1). A similar cycle of sea-level change, with persistently low sea levels, lasting for up to 100,000 years, interrupted by short-lived periods of high sea level rarely lasting more than about 10,000 years, can be traced back over at least the past 1 million years, and most probably back to 2 million years ago and more, although the amplitude of variation appears somewhat less in the 1–2 million year range (Lambeck 2004).

The most obvious consequence of lowered sea level, and the one that has most often been articulated in archaeological interpretation, is the creation of land-bridges between continents and offshore islands, and hence the greater ease of movement and dispersal between these land masses for terrestrial organisms, especially humans. There are, however, two other consequences of sea-level change that have less often been recognized or integrated into archaeological thinking, and which have far more power to disrupt current conventions of interpretation.

Differential visibility of marine resources

The first consequence is the near-invisibility of evidence for exploitation of marine resources except during short-lived periods of high sea level. The great explosion of shell mounds on the coastlines of the world after about 6–7000 years ago is a universal phenomenon. It is naturally tempting to suppose that this indicates some major shift in human activities and a world-wide intensification in human impact on marine resources, supposedly associated with population growth or technological change. However, the fact that their appearance coincides quite closely with the stabilization of modern sea level leads to the strong suspicion that equivalent evidence could have been associated with earlier periods but has been submerged or eroded away.

Earlier sites with marine shells are, of course, known, though the number of sites and the quantities of shells involved are far fewer. An Upper Palaeolithic cave site with 400 limpets does not represent an equivalent archaeological signature of marine activity to a Mesolithic shell mound with 4 billion shells. Sites with marine indicators appear to show a general increase during the final millennia of the late Pleistocene and in the early Holocene and that might reinforce a belief in the reality of a gradual trend of intensification, culminating in the widespread appearance of mid-Holocene shell middens. However, such a trend could equally well be interpreted as the result of increased visibility of shellgathering and other marine activity as sea levels rose and shorelines approximated their present position (Bailey & Craighead 2003). The presence of early-dated shell middens is usually the result of elevated positions that have protected sites from inundation or erosion during the later stages of postglacial sea-level rise, or to locations on coastlines with a very narrow continental shelf or on isostatically elevated shorelines, or at tectonic plate boundaries where coastal uplift and subduction of the oceanic plate has created an offshore topography so steep that the shoreline position at the maximum sea-level regression was little different from the present one. Interpretation of differences in the quantity of shells is further complicated by geographical and ecological variations in mollusc habitats and marine productivity (Bailey & Flemming 2008).

There is nothing in the available evidence that cannot be accounted for in terms of differential visibility of marine activities resulting from sea-level change and its interaction with local offshore bathymetry. There could well have been some trend towards intensification in the late glacial or postglacial period, or variations of human interest in marine resources and impact on them at different times and in different places, but such variations have been so swamped by factors of differential visibility of evidence and differential environmental conditions that they are unlikely to be discerned without very close and careful analysis of local case studies. The interaction between changes of sea-level, mollusc habitat and human activity are complex, and the archaeological samples available to distinguish their relative influence limited. New studies with better samples are needed and may change interpretations in future.

Differential visibility and fertility of coastal environments

A further consequence of sea-level change is its impact on prime terrestrial territory for human settlement. Coastlines are attractive not only because of their potential marine resources, but because they are also often attractive places for plant and animal life on land, with more equable climatic conditions and often more extensive supplies of freshwater than their adjacent hinterlands, and distinctive habitats such as salt marshes and wetlands resulting from the interface between land and sea that have very high levels of fertility and a suite of distinctive plant and animal resources. The question of the width of this attractive coastal zone and how far it extends inland is clearly variable and depends on local and regional topography. But it is unquestionable that when sea level was lower than the present, and especially when it was very low, the most favourable of these coastal conditions would have been concentrated in those areas of the continental shelf that are now submerged.

This feature is of added significance if we also consider the general trend of global climatic variation. During glacial periods, as moisture became locked up in the continental ice sheets, global climates became more arid. Hinterland regions that are relatively dry today would have become more so during glacial periods, accentuating the environmental differential between hinterland and coastal regions. Moreover, Faure *et al.* (2002) have recently suggested that the emerged coastal landscapes revealed as sea level dropped in response to glaciation would have remained well-watered areas, and perhaps better-watered than their present-day coastal equivalents, because of the emergence of spring water from underground reservoirs, even in regional conditions of climatic aridity. If this hypothesis is correct, it has important implications for human settlement and dispersal and especially in lower latitudes, which would have been areas sensitive to climatic aridification as well as key zones for earliest human settlement and dispersal.

Given the likelihood that now-submerged coastal regions may have been among the most attractive for human settlement and especially as population refugia during periods of extreme climate, that they provided potentially important corridors of dispersal between otherwise insurmountable barriers of mountain, desert and sea, and that they also hold the clue to the long-term history of human interest in marine resources, the lack of evidence from this submerged world means that we are missing a major part of the Pleistocene story, and arguably the most important part.

In the past decade, techniques have been developed or applied to the study of prehistoric archaeology under water, at least in shallow water, and to a lesser extent to the exploration of deeper parts of the shelf (Bailey & Flemming 2008). But a prevailing belief in the wider archaeological community is that the preservation or discovery of relevant evidence, and particularly archaeological evidence, especially at deeper levels, is very unlikely, that the costs and uncertainties of deep underwater exploration are so great that it is all but impossible, and that there may be very little surviving under water to be discovered, or that could make much difference to our understanding of human evolution. The period of our maximum ignorance for the last glacial-interglacial cycle is the period when sea levels were lower than about –20 m, that is, the period between about 80,000 and 12,000 years ago. Since this is the period during which new behavioural developments associated with anatomically modern humans gained momentum and dispersed more widely, and when Neanderthals became extinct in Europe, the absence of evidence from productive coastal environments that are likely to have been major refugia as well as centres of population growth and dispersal, and the near-invisibility of marine resources that are widely regarded as unusually sensitive archaeological indicators of changing human capabilities and environmental impacts, is a major gap in our knowledge. It is no longer acceptable to overlook this problem, or to dismiss it on the grounds that submerged landscapes are inaccessible or irrelevant. On the contrary, it is imperative that new investigations are undertaken to deploy the new technologies of underwater exploration that are now becoming more widely available, if we are to move beyond speculation and hypothesis.

The Red Sea Basin and the Arabian Peninsula

Intensive interest has recently focused on this part of the world (Fig. 3.2) and on the plausibility of the southern dispersal route from the Horn of Africa to southern Arabia and the Indian subcontinent (Lahr & Foley 1994), especially in relation to the proposed dispersal of anatomically modern humans out of Africa (Walter *et al.* 2000; Oppenheimer 2003; Petraglia 2003; Beyin 2006; Mellars 2006; Field *et al.* 2007; Petraglia 2007; Turner & O'Regan 2007).

Discussion has focused on the possibility that this pathway of dispersal may have been the preferred route out of Africa for anatomically modern humans, and that an ability to exploit marine resources may have been a powerful new adaptive trait that facilitated rapid dispersal around the rim of the Indian Ocean, although equally plausible arguments of this sort could also be advanced for earlier periods reaching back to the earliest putative dispersal out of Africa at about 1.8 million years.

There is much that is unclear about this body of interpretation, or in need of further investigation. Modelling of dispersal patterns is discussed in relation to present-day topography with little account taken of the geographical and ecological transformations brought about by sea-level change. Most of the Palaeolithic sites in the Arabian Peninsula are undated except in the most general terms and by reference to inherently unreliable typological and technological criteria. The geographical distribution of sites, however, is of particular interest in demonstrating a human presence in arid parts of the interior when climatic conditions were wetter than they are today. It is also quite unclear in what ways, if at all, demonstration of genetic similarities between modern African and Asian populations can provide other than a very general order of magnitude for the dating of dispersal events, or discriminate between a southern route of population movement, and a northern route via the Levant, the Tigris–Euphrates basin and the shores of the Persian Gulf, or between a shore-hugging route along the Indian Ocean and a more diffuse pattern that included the hinterlands of the Arabian Peninsula and adjacent regions. Nor have claims of evidence for early shell-gathering and marine exploitation been subjected to detailed evaluation. There is, then, a clear need for more detailed investigations in the region, for more detailed evaluations of palaeoclimatic and palaeoenvironmental variation, and for independent field data to test hypotheses derived from other sources.

Sea crossings at the southern end of the Red Sea

The shortest crossing of the Bab al Mandab Straits at the southern end of the Red Sea is today *c.* 29 km, a considerable distance of water, and probably a major barrier to transit without seaworthy boats. However, the shelf is quite narrow at the southern end of the Red Sea and the sea bed at its shallowest. The Hanish Sill, at the northern end of the Straits, is *c.* 137 m, indicating the possibility that at maximum sea-level regression the sea channel would have been narrow or possibly even at times dried out (Fig. 3.2).

Estimating where the shoreline would have been at different stages in the Pleistocene sea-level curve is complicated in this region because of limited information on bathymetry, especially in the 50 m to 150 m range, and hydro-isostatic effects. There are also problems of tectonic movement both locally, resulting from movement of evaporites and salt diapirs, and regionally as a result of rift propagation (Bailey *et al.* 2007b).

Modelling of shoreline positions by Kurt Lambeck through the last glacial cycle taking account of isostatic distortion provides some insight into changes in channel width and geometry at different sea-level positions (Fig. 3.3). Over this period, we are confident that the modelling of isostatic effects provides quite accurate information, and that additional vertical

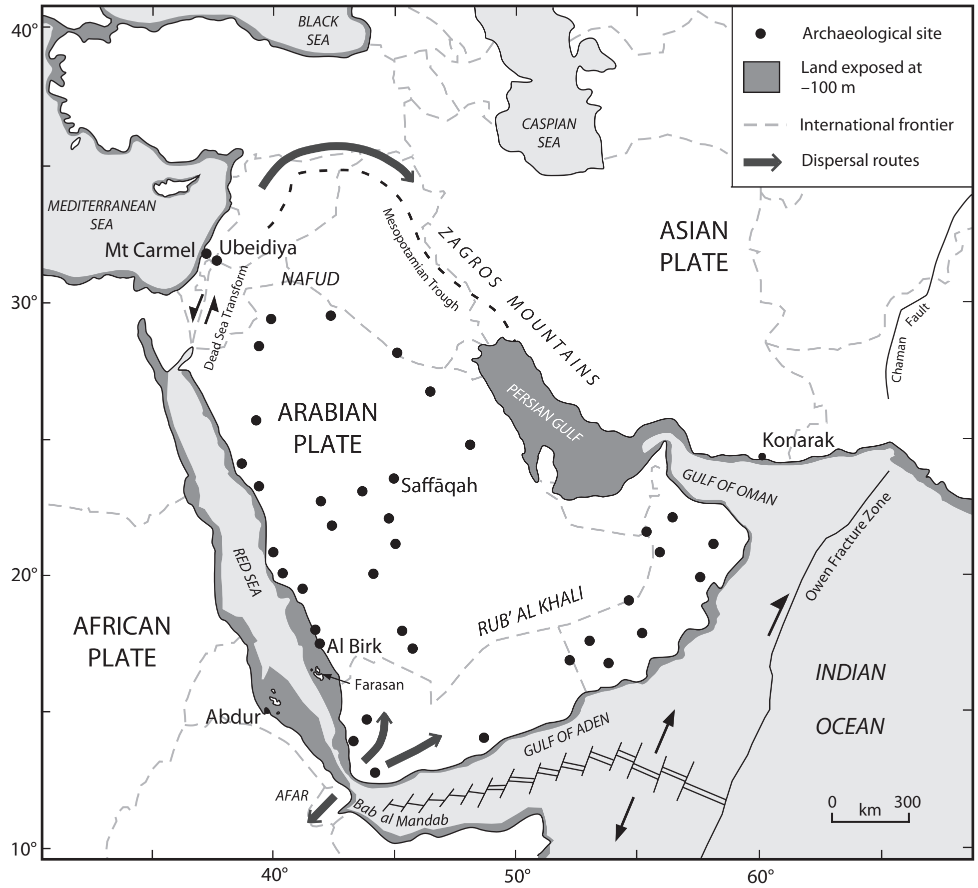

Figure 3.2. *The Arabian Peninsula and adjacent regions showing extent of continental shelf exposed at lower sea level, and general distribution of Palaeolithic sites and dispersal routes, including sites mentioned in text. (© G. Bailey & C. Vita-Finzi.)*

movements resulting from rift propagation and tectonic uplift are negligible. As can be seen, the channel became progressively narrower and shallower as sea level dropped. At the maximum regression the channel was a long and narrow waterway extending for some 100 km, and was barely open. Uncertainties in the method mean that it is impossible decisively to reject the formation of a land connection at this time, but any causeway of land would always have been so close to sea level that it would not have formed an effective barrier. This is consistent with isotope evidence from deep-sea cores from within the Red Sea Basin, which demonstrate that the salinity of the Red Sea at no time over the past 400,000 years increased to the level that one would expect if water exchange with the Indian Ocean had been cut off (Siddall *et al.* 2003). At lowest sea levels, the channel might have been quite shallow and just a few kilometres across, although neither the isotopic nor the hydro-isostatic modelling techniques can reconstruct the geometry of the channel with greater precision (Bailey *et al.* 2007b).

Whether such a sea crossing would have posed a barrier or an invitation remains a matter of opinion. Arguably the barrier would have been minimal and the possibilities of crossing by swimming, floating or simple rafting high. At intermediate sea levels, the sea crossings would have been longer; even with the enlarged Hanish Islands, two sea crossings of at least 10 km would have been required. At any rate, the length of the channel and estimates of likely current speeds at different water depths suggest that there would have been little risk of being carried sideways so far as to be swept out to sea (Bailey *et al.* 2007b). Over the Pleistocene period as a whole there would have been many occasions when the probability of human crossing whether by accident or intention would have been high without any need to invoke the construction of seaworthy boats or the possession of navigational skills. Conditions during the Lower Pleistocene are less certain, because tectonic effects

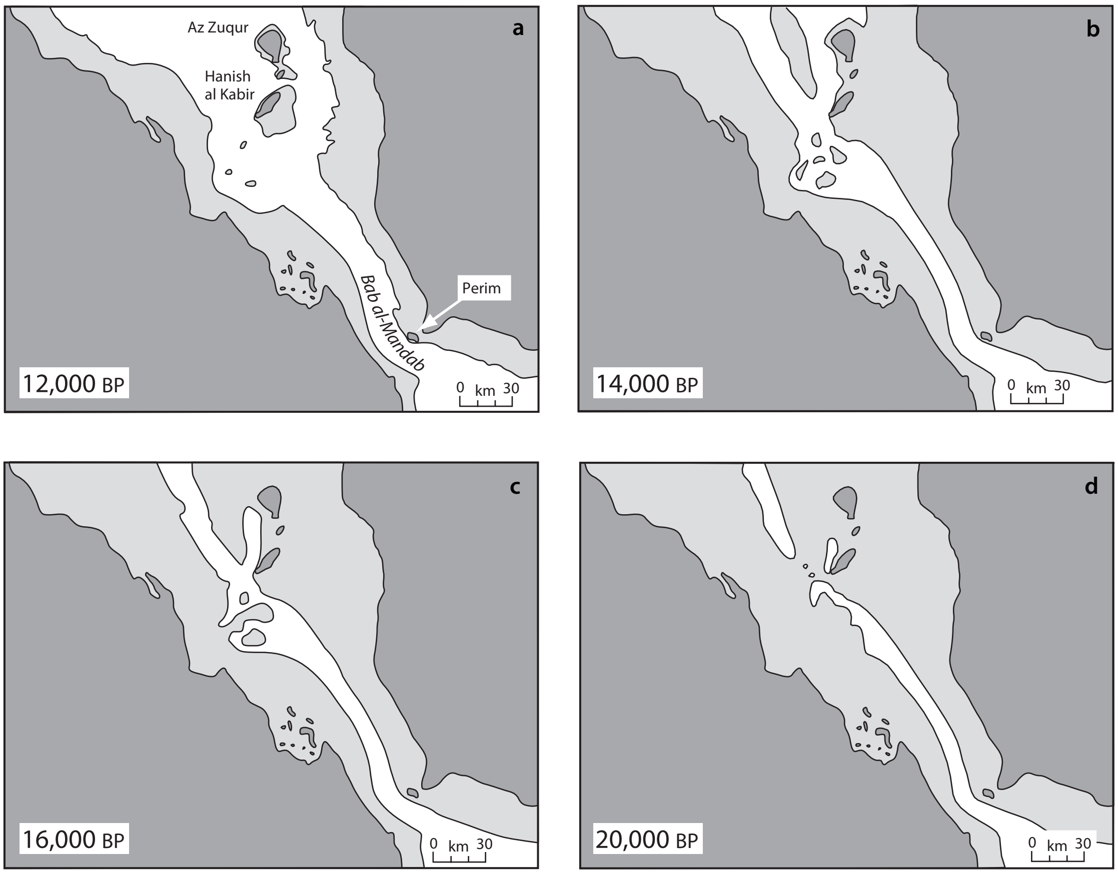

Figure 3.3. *Shoreline positions in the southern Red Sea during the last glacial. Dark grey is present-day land, light grey is land exposed by lowering of sea level. Dates are calibrated radiocarbon years. (Data provided by Kurt Lambeck. © G. Bailey.)*

associated with rift propagation are more likely to have had an impact on this time scale, and the amplitude of sea-level variation was probably lower, but it is unlikely that there was a land-bridge at any time in the past 2 million years (for detailed discussion see Bailey 2009).

Finally we should also acknowledge the possibility that southern Arabia could have been colonized by population movements via the classic northern route of the Sinai Peninsula, the Levantine coast and the Jordan Valley, then southwards along the eastern coastline of the Red Sea, or via the Tigris–Euphrates Basin and Indian Ocean coastline, or through the drainage basins of the interior of Arabia when climatic conditions were more favourable there than at present. Such a pattern would effectively bypass the crossing of the southern end of the Red Sea and might be thought to render irrelevant the issue of its traversability under different sea-level conditions. That is arguable, but equally the use of the southern Red Sea corridor would have greatly increased the permeability of the Africa–Arabia interface and multiplied the ease and frequency of contact or movement between Africa and Asia.

Marine resources

What of the potential impact of marine resources on patterns of dispersal? Around the coastlines of Africa and the Mediterranean, a number of coastal caves contain evidence of marine resources, with a particular concentration of deposits associated with MIS Stage 5 (Fig. 3.1). These include the coastal caves of Die Kelders, Klasies River Mouth, Blombos Cave and Pinnacle Point in South Africa (Avery *et al.* 1997; Henshilwood & Marean 2003; Henshilwood *et al.* 2001; Klein *et al.* 2004; Marean *et al.* 2007), the Haua Fteah Cave in Libya (McBurney 1967), most probably Vanguard and Gorham's Cave on Gibraltar (Stringer *et al.* 2008) and the open-air site of Abdur in Eritrea (Walter *et al.* 2000; Bruggeman *et al.* 2004). Deposits in these sites, variously dated to different sub-stages of MIS-5, between about 130,000 and 75,000 BP, contain variable quantities of marine shells, mostly rocky-shore species of limpets and mussels.

The most detailed evidence is from South Africa, where the shells sometimes form layers of quite dense shell midden, incorporating other marine indicators, usually in association with terrestrial fauna. At Klasies River Mouth, which has the earliest Middle Stone Age (MSA) deposits with remains of marine resources, bones of seals, penguins and fish are present. A similar pattern is recorded at Blombos Cave, where the fish species present in the MSA levels could all have been speared or trapped in rocky inlets near the shore, or collected as dead animals washed up on the beach. All of this is consistent with scavenging and collection along the beach and in the intertidal zone. Limpet shells are consistently larger in MSA levels in comparison with LSA middens, which Klein *et al.* (2004) attribute to less intensive rates of MSA shell-gathering. In general the evidence from all these sites suggests a regular use of marine resources in the MSA, but a less-intensive pattern of exploitation compared to the LSA, and one based on collecting and beach scavenging with an absence of less easily accessible resources.

Estimating the proportional contribution of marine and terrestrial resources from such evidence is notoriously difficult. Even in the largest shell mounds of the mid to late Holocene, where much more detailed quantitative investigations and diverse sources of evidence have been brought to bear on the problem in many parts of the world, the molluscs provide much less food than the bulk of their remains might otherwise suggest, although they are nevertheless valuable in providing a predictable and relatively accessible supply (Meehan 1982). Evidence of marine specialization is rare and usually associated with coastlines largely lacking in terrestrial resources rather than with specialization on marine resources at the expense of available terrestrial ones (Bailey & Milner 2002; Bailey & Flemming 2008). There is nothing in this early body of evidence from the South African caves that suggests that molluscs or marine resources were other than a supplementary, or at best a complementary, source of food.

Does this amount to a new level of interest in marine resources and a more intensive exploitation compared with earlier periods? Here we face exactly the same difficulty as with the increase in shells in late Pleistocene and Holocene deposits, namely one of differential visibility associated with sea-level change. The continental shelf on the South African coastline is quite shallow and at a maximum regression of –130 m would have presented a coastal plain over 100 km wide. The topography shelves more steeply close inshore, but Van Andel's (1989b) detailed bathymetric analysis shows that while a shoreline at –20 m would have been within 1 km of the cave sites in question, a progressive drop in sea level below that would rapidly take the shoreline beyond a gathering range of 5 km, which is probably a maximum limit for transportation in quantity of mollusc food in the shell as a daily subsistence activity (Bailey & Craighead 2003).

The time depth of shell-gathering has recently been extended by the discovery of a shell-bearing layer dated at 160,000 BP at Pinnacle Point (Marean *et al.* 2007). The quantity of material is reported as just 79 mollusc shells at a time when sea level was considerably lower than the present and the contemporaneous shoreline many kilometres away. This is no more than the sort of quantity we might expect at a site that was many kilometres inland from the shoreline at the time of its use, and compares with similar quantities in Upper Palaeolithic deposits of the last glacial maximum on European coastlines (Bailey & Flemming 2008). All of this suggests variation in distance to the seashore with varying sea level as a major control on shell quantities.

As with the great worldwide increase in shell middens in the mid-Holocene, so with the evidence from the Middle Stone Age levels of the South African caves, what we are seeing is the earliest visible evidence of marine indicators, most of it accumulated during a period of high sea level. The assumption that these deposits signify a new trend in human evolution is at best an unreliable one, given that the earlier periods with which they are being compared were mostly associated with much lower sea levels and shorelines that are now deeply submerged. We simply do not know whether or not we would find equivalent evidence for the consumption of marine resources on these earlier shorelines if they were accessible to archaeological investigation.

The case of Abdur is rather different. Here artefacts have been found stratified within a series of elevated marine coral terraces, and well dated to *c.* 125,000 BP (MIS-5e). Finds include Acheulean bifacials, vertebrate bone fragments, including hippopotamus, crocodile, elephant, rhinoceros and bovid, and oyster shells. Taken at face value the material suggests a mixed diet that included a substantial dependence on land mammals together with marine shellfood. Walter *et al.* (2000) originally suggested that the oyster shells were very early evidence of a significant use of marine resources. However, Bruggeman *et al.* (2004) indicate that the oysters are a natural death assemblage and are not therefore certainly food remains. The Abdur evidence is at best the earliest *visible* expression of shoreline activity in this region, made visible by proximity to the coastline during a period of high sea level, rather than the earliest actual evidence. Similar finds occur on raised marine terraces on the Saudi side of the Red Sea (Bailey *et al.* 2007b; Bailey 2009), but none of them show any confirmed association with marine resources or indeed any evidence of food remains due to the poor conditions of preservation in most cases.

The current evidence at Abdur is not evidence for shellfood consumption, let alone a significant dependence on it, and certainly not evidence that it formed the basis for a new adaptation to the exploitation of marine resources or the key to dispersal of anatomically modern humans. It is not even evidence for a distinctive adaptation of anatomically modern humans, even supposing that these were the originators of the Abdur material, which seems plausible even though direct evidence is actually lacking at Abdur itself. Evidence for the exploitation of marine resources including molluscs, fish and sea mammals has been recovered from Gorham's Cave and Vanguard Cave on Gibraltar, and there is little doubt that the populations responsible in this case were Neanderthals (Stringer *et al.* 2008).

The submerged coastal landscape

As sea level dropped during glacial periods, so new land would have become available around the rim of the Red Sea Basin and the Arabian Peninsula. In shallow areas such as the Gulf of Suez and the southern Red Sea in the vicinity of the Dahlak and Farasan archipelagos and in the Arabian Gulf (Fig. 3.2), the width of the new strip of low-lying land added to the coastal plain was up to 100 km wide, or even more. Elsewhere, the rim of new land was much narrower, and along stretches of the Indian Ocean coastline of the southern Arabian Peninsula may have been no more than 2 or 3 km wide. Even here, however, that additional strip of land would have been of disproportionate significance if it offered productive conditions for terrestrial life, water supplies and ease of movement for human groups. The suggestion that dispersal routes would have been forced inland by impassable topography or water barriers on the coastline is based on present-day sea level and topography and clearly needs to be adjusted to take account of the very different conditions that existed when sea level was substantially lower than the present (cf. Field & Lahr 2005).

It has often been assumed that with the onset of glacial conditions, palaeoclimates would have become hyper-arid in the Arabian Peninsula, deterring human settlement throughout the southern dispersal corridor, regardless of any improvements in accessibility created by lowering of sea level (cf. Derricourt 2005). In a general sense it is true that wetter conditions in the Peninsula, and particularly in the desert interior, are generally associated with interglacial climates and the extension of the Indian Ocean monsoon. But wetter conditions occurred periodically at or close to the last glacial maximum, at least in the northern Arabian Peninsula, resulting from the extension of Mediterranean cyclones bearing winter rains (Parker 2009; Sanlaville 1992). In any case, and regardless of these climatic variations, we should take account of the point made earlier that surface water may have been more abundant on these submerged coastal lowlands because of the increased flow of springs from underground water sources. It therefore becomes critical to establish the nature of local palaeoenvironmental conditions in these now submerged areas.

Investigations have recently got underway to explore this point in the vicinity of the Farasan Islands (Bailey *et al.* 2007a,b). The continental shelf between the islands and the mainland is quite shallow, and the islands would have become part of the mainland when sea levels dropped below about 40 m (Fig. 3.4). To the west the shelf slopes more steeply towards the deep axial trough of the Red Sea. The offshore bathymetry suggests a complex topography, related to localized salt tectonics, which could have trapped sediment and water to create fertile local basins attractive to plant and animal life. There are also a number of very deep depressions that could have filled with fresh water under suitable conditions of water supply. Underwater exploration has already established a successively deeper series of wave-undercut notches representing shoreline features formed at lower sea levels, and we have targeted these for future and more extensive exploration on the grounds that they may be associated with archaeological deposits like the numerous shell middens of mid-Holocene date that are found on the present-day shorelines of the main Farasan Islands. Other archaeological evidence of human activity may have been preserved under water, especially given the complex topography of the submerged landscape, which is likely to have created many locations protected from the destructive effects of inundation by rising sea levels. Clearly, investigations are still at a very early stage, but we intend to extend them with the use of remote sensing, diving and drilling in the expectation that we will recover, at the very least, traces of the submerged landscape and evidence of palaeoenvironmental conditions, and ultimately archaeological data. Without such underwater investigations, much of our understanding about Pleistocene settlement and dispersal in the Arabian Peninsula, and its role in the wider pattern of early human dispersal, must remain essentially speculative.

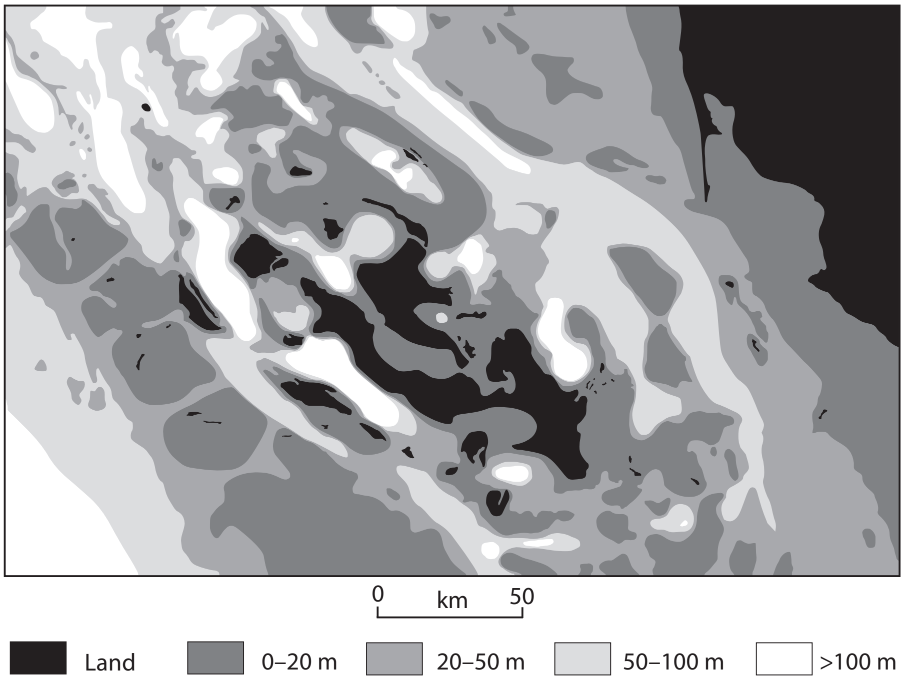

Figure 3.4. *Offshore bathymetry of the Farasan Islands. (Data from British Admiralty Chart 15. © G. Momber.)*

Conclusions

Assessment of the palaeoenvironmental and palaeoeconomic evidence outlined above casts considerable doubt on three hypotheses that have figured prominently in recent discussions of early human dispersals, if not to their outright rejection. First, the evidence currently available cannot be used to support the notion that anatomically modern humans were the first to take a significant interest in marine foods, even less that they were marine specialists, or that a new interest in marine foods or a more intensive exploitation of them helped to facilitate a rapid dispersal from Africa to the Indian subcontinent via a southern corridor around the rim of the Indian Ocean. Equally there is no evidence presently available that would allow us decisively to reject this hypothesis. Until we know more about the use of the now submerged shelf exposed during the periods of lower sea level that prevailed throughout the last glacial period, this hypothesis will remain at best speculative. Marine resources may well have added to the attractions of coastal regions, but there is no reason to suppose that such resources were not accessible to earlier hominin populations, or that coastlines were not an equally powerful attraction from the earliest period of putative hominin dispersal out of Africa.

Secondly, there is no reason to invoke boats or navigational skills to enable early populations to move out of Africa through the southern corridor. The sea channel in the vicinity of the Straits of Bab al Mandab would have been quite easily passable for long periods of the Pleistocene without the need for boats, although at no time does it appear to have been possible to make a dry-land transit, even at the period of lowest sea levels. Equally, it is also likely that lowered sea levels would have facilitated northern routes of colonization by creating wider pathways of easy dispersal across the Suez Canal and the Persian Gulf. Indeed, it is probable that overall patterns of Pleistocene dispersal were diffused over a wide area, both north and south, and across the interior of the Arabian Peninsula when climate conditions were wetter there than today.

Thirdly, the belief that the southern route was closed off by climatic aridity during glacial periods should also be rejected, on the grounds that it fails to take account either of existing evidence of wetter climatic episodes during glacial periods or of the changed local conditions of hydrology and improved supplies of surface water from underground reservoirs that have been linked to the emergence of the coastal shelf. Indeed, it is precisely this possibility that points to these submerged coastal landscapes as potentially critical refuge areas in relation to an arid or impassable hinterland, and as relatively easy and attractive pathways of dispersal and contact between Africa, Arabia, southern Iran and the Indian sub-continent. If that is so, then it is the improved terrestrial conditions in these now-submerged coastal regions, as much as the availability of marine resources, which may have promoted the attractions of the southern dispersal route. These hypotheses remain just that in the absence of relevant evidence, but they certainly reinforce the incentive to pursue underwater investigations, since it is only through more detailed reconstructions of the submerged landscape that decisive evidence for or against these hypotheses will be forthcoming.

These considerations also underline the importance of investigating local and regional variations in Pleistocene resources, microclimate and topography, rather than relying on broader regional and global climatic reconstructions or present-day patterns of physical geography. Present-day geographical and topographic conditions in coastal regions cannot be relied on to give a true picture of potential barriers and pathways of dispersal when sea levels were lower, and are likely to be quite misleading without a detailed assessment of offshore topography, isostatic and tectonic effects, and the environmental conditions of the now-submerged landscape.

In conclusion, the evidence reviewed here suggests that marine resources may well have formed part of the subsistence repertoire of hominin populations from a very early period. But up until at least the last period of high sea level that ended at about 80,000 years ago, there is nothing in the available evidence to suggest that marine exploitation involved any interest in or capacity for sea travel, or the exploitation of any resources that could not have been acquired on the shore or in shallow water in the intertidal zone. The belief that anatomically modern humans devised new strategies of marine exploitation that were superior to those of their predecessors and that helped to propel their rapid dispersal out of Africa is essentially without foundation. It cannot be decisively rejected on present evidence but so manifestly fails to take account of all the evidence that is available, let alone the more obvious biases that have most likely distorted temporal and geographical patterning, that it should be considered as highly implausible.

Nor is there any evidence in the pattern of dispersal indicating the use of boats, navigational skills, or a need for boats at any point in the pathway from Africa to Southeast Asia. Such sea barriers as exist on this route were either reduced to relatively modest crossings at periods of lowered sea level that would have required little effort or skill to overcome, as in the case of the channel at the southern end of the Red Sea, or were easily circumvented.

To the extent that coastal regions were attractive places during the Pleistocene, this probably had as much to do with improved water supplies and attractive conditions for terrestrial plants and animals when sea level was substantially lower than present, as with the availability of marine resources — if not more so. Moreover, these are attractions that would have been obvious to hominin populations at all stages of technological and cognitive development and at all periods over the past 2 million years. The notion of a coastal colonization out of Africa by modern humans with new skills in the exploitation of marine resources and movement across sea barriers represents a powerful and attractive synthesis. Undoubtedly much of the inspiration for that hypothesis lies in the clear evidence for a seaborne colonization of Australia, currently put at *c.* 50,000 BP (cf. O'Connor and O'Connell *et al.* this volume). The fact that this appears to have been accomplished by anatomically modern humans accompanied by early evidence of marine exploitation has resulted in a projection of the Australian evidence onto the African and Asian record. This, however, is almost certainly unwarranted. Oceanographic conditions in the southern Pacific including currents, wind direction and availability of driftwood were most probably quite different from other coastal regions, offering very different possibilities and opportunities for simple sea travel. Ecological conditions affecting the productivity and accessibility of marine resources were also quite likely different from those on many continental coastlines of Africa and Asia. So too are the conditions for the preservation of early coastal evidence, with coastlines formed at the margins of the tectonically unstable Pacific plate offering an unusual window into the exploitation of marine resources during periods of low sea level. The great hallmark of hominin success is adaptability and flexibility of behaviour. There is no reason to suppose that a process of dispersal that culminated in a seaborne occupation of new territory in New Guinea and Australia necessarily had to begin with sea crossings and the exploitation of marine resources at the putative point of origin in Africa. Moreover, on most coastlines of the world, with the notable exception of some of the coastal environments in the region of New Guinea, the relevant evidence that will help to test alternative hypotheses of dispersal now lies deeply submerged on the continental shelf, and the exploration of that underwater world has scarcely begun.

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