Coastal archaeology and prehistory in the Southwest Region of Saudi Arabia and the Farasan Islands: report on the 2004 and 2006 surveys of the joint Saudi-UK Southern Red Sea Project

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Introduction

This is a preliminary report of a joint Saudi-UK project initiated in 2004 to investigate the coastal prehistory of the Red Sea region of Saudi Arabia. We report on our observations of sites on the mainland between Qunfudah and Gizan during a brief survey in 2004, and the more detailed results of archaeological investigations undertaken in the Farasan Islands during May 2006 (Figure 1), which included survey and test excavation on land and underwater survey.

Background

Our interest in this region is motivated by two principal themes. The first is the possibility of early movement across the southern end of the Red Sea region – the 'southern corridor' of human dispersal – into the Arabian Peninsula as part of the initial process of colonisation by which human populations spread out from Africa to populate Europe and Asia. This process may have occurred several times, the earliest dispersal taking place as early as 1.8 million years ago, followed by a more recent dispersal of anatomically modern humans out of Africa some time after 150,000 years ago (Lahr and Foley, 1994; Petraglia, 2003; Petraglia and Alsharekh, 2003). By convention, archaeological attention has focussed on the pathway from the Nile Valley to the Levant as the main route of population movements out of Africa, on the assumption that the Arabian Peninsula was a cultural cul-de-sac largely bypassed by early human population movements because of climatic aridity. However, genetic studies tracing human ancestry from variability in modern DNA along with new archaeological discoveries have stimulated intense international interest in the southern corridor of human dispersal (Lahr and Foley, 1994; Walter et al. 2000; Oppenheimer, 2003). It is also clear from the early work of the Comprehensive Archaeological Survey of Saudi Arabia that there is a substantial and widely distributed but poorly dated record of Palaeolithic archaeology in Saudi Arabia. This picture is confirmed by early work in the Yemen (Amirkanov 1991) and by more recent investigations in Oman (Rose, 2004). It is also well established that Arabia benefited from a wetter climate than today during many periods of the Pleistocene (Sanlaville, 1992). Also, during the maximum lowering of sea level during the glacial periods, the Red Sea, although it appears not to have been closed off from the Indian Ocean, would have been reduced for over 100 km to a narrow channel extending from the vicinity of the Hanish islands to the Bab al Mandab Strait, and this would most probably have been relatively easy to cross without the need for boats or seafaring skills (Bailey et al. 2007a, 2007b; Bailey, 2009) (Figure 2).

A second theme of interest is the role of coastlines and marine resources, such as marine molluscs, fish and sea mammals, in the broader pattern of human social development. Coastal archaeological sites, often shell mounds representing the food debris of eating molluscs and usually containing artefacts and other food remains such as the bones of fish and terrestrial vertebrates, are known in their tens of thousands throughout the world. Almost all of these sites are confined to the period from about 6000 years ago onwards. Evidence for coastal sites and the use of marine resources is much rarer in earlier periods. Many archaeologists have seen in this pattern evidence for a growth in human populations and an intensification of subsistence economies in the postglacial period, and have assumed that in earlier periods of prehistory marine resources were ignored or were considered too labour-intensive or technologically demanding to be worth exploiting.

However, this view is now being challenged from a variety of perspectives (Erlandson, 2001; Bailey & Milner, 2002). Perhaps the most important point is that the great explosion of coastal sites in the archaeological record after about 6000 years ago coincides with the period when sea level stopped rising after the melting of the continental ice sheets formed during the last glacial period. Figure 3 shows the pattern of sea level change over the past 140,000 years, with short periods of high sea level associated with modern or interglacial climatic conditions, and much longer periods of low sea level associated with the last glacial period, when sea levels were at least 50 m below the present and occasionally as much as -130m (Figure 3). During these periods of low sea level, extensive areas of the continental shelf were exposed as dry land, and the coastlines of the period are now deeply submerged and far out from the present-day coastline (see also Figure 2). It follows that earlier coastal sites with potential evidence for the exploitation of marine resources are now destroyed, or submerged on ancient shorelines that are now in deep water and many kilometres offshore. Pioneering investigations in the Baltic and the Mediterranean have demonstrated that prehistoric coastal sites can survive the process of inundation and can be discovered and investigated, often with excellent conditions of preservation of organic materials such as wood, fibre and other plant materials (Fischer, 1996; Flemming, 2004). Similar results are being revealed in other parts of the world, but these underwater investigations have for the most part been confined to relatively shallow water within easy reach of conventional diving techniques using normal air mixtures, and therefore to sites that are quite late in date, namely in the earlier part of the postglacial period when sea levels were approaching the present level. The possible existence of earlier archaeological sites on shorelines formed when sea level was much lower has yet to be explored in any systematic way.

Objectives

The above considerations form the basis for our investigations and the strategy that we have adopted. Many coastal sites have been previously reported on Saudi Arabian coastlines, including some potentially very interesting early sites that appear to be associated with an earlier period of high sea level about 125,000 years ago, particularly on the Red Sea coastline. More recent coastal sites are also present around the coastlines of the Arabian Peninsula. The best known are on coastlines of the Gulf and Oman (Beech, 2004; Biagi & Nisbet, 2006), but some coastal shell middens were also reported on Red Sea coastlines by the Comprehensive Archaeological Survey Program (Zarins et al., 1980, 1981). We therefore established three main objectives at the beginning of this work:

1. To visit known coastal archaeological sites on the Red Sea coastline in order to evaluate their likely significance and potential for shedding light on early patterns of coastal settlement and exploitation, and to assess the prospects for new investigations.
2. To begin a comprehensive survey of the archaeology on land to find out more about the history of coastal exploitation in recent millennia
3. To carry out underwater exploration including experimentation with deep diving techniques and mixed gas technology, using the results of work on land as a guide to what to look for underwater

We made a preliminary visit to the mainland coastal sites in the vicinity of Al Birk in 2004, and in the course of that survey we also visited the Farasan Islands with a view to assessing the potential for underwater exploration. The Farasan Islands are an attractive prospect for such an investigation for a variety of reasons. When sea level was lower than about 50 m, the Farasan Islands would have been connected to the mainland, so that we can expect that the Islands and their surrounding territory would have been accessible to human populations from the very earliest period of human occupation in the Arabian Peninsula without presupposing the need for seafaring technology. Secondly the waters of the southern Red Sea are warm and fertile with a rich marine fauna including fish, intertidal molluscs and sea mammals, and this is likely to have been the case even during glacial periods of low sea level, at least at the southern end of the Red Sea. These are the ideal circumstances in which one might predict ease of sea crossings by swimming, early experimentation in the development of simple rafts or boats, and the collection and consumption of marine resources. Thirdly, the complex configuration of the shorelines of the Farasan Islands, the complex offshore topography, and the varied oceanographic conditions suggest a high likelihood that some archaeological sites, palaeoshorelines and other features of the terrestrial landscape could have been protected from the destructive force of wave action during inundation by sea level rise. In addition, these variable conditions mean that there are many areas that lack the thick blanket of coral growth that would otherwise obscure the nature of the underlying deposits.

The Mainland Coast: Investigations in 2004

Our main focus of interest in 2004 was the lava fields in the region of Al Birk, which reach down to the present-day coastline in places (Figure 4). These are associated with coral terraces elevated some 4–6m above present-day sea level, most likely formed at the time of the previous high sea level about 125,000–130,000 years ago (MIS 5e). Zarins et al. (1981) examined a number of these lava fields and terraces and reported artefacts of Lower Palaeolithic (Acheulean) and Middle Palaeolithic or Middle Stone Age (Mousterian) type. They suggested that some of the Middle Palaeolithic artefacts were embedded in the coral terrace deposits, indicating occupation of the shoreline 125,000 years ago, with the further implication that these sites might provide some insight into early coastal adaptations and an interest in marine resources. This expectation has been reinforced more recently by the discovery of the site of Abdur on the Buri Peninsula of Eritrea on the opposite side of the Red Sea (Walter et al., 2000). Here artefacts have been found embedded in coralline beach deposits well dated by Uranium-series dating to 130,000 years ago and associated with bones of large mammals including elephant, hippo, rhinoceros and bovids. Large oyster shells were also present in this deposit and Walter et al. (2000) originally suggested that they were the remains of food eaten by the human occupants. However, subsequent study by the same team has demonstrated that these oyster shells are a natural death assemblage and have no demonstrable relationship with human activity at this particular site (Bruggemann et al., 2004). Our specific objective in the Al Birk region was therefore to visit as many as possible of the sites originally identified by Zarins et al. (1981) to see whether we could replicate the results of the work in Eritrea.

Locating the original sites proved more difficult than we had anticipated. In part this is because the sites were recorded before global positioning devices and satellite maps had become generally available. A more serious problem, however, is that considerable development has taken place along the coastline, with the building of new roads and the creation of tracks and other facilities by bulldozing activity over the two decades since the original surveys. Some sites have been damaged or perhaps destroyed, and at least one is an area that has been heavily disturbed to create a local municipal rubbish dump.

The most important site of this group, and the one where we concentrated our investigations, is the site referred to by Zarins et al. (1981) as site 216-208 in the lava field between Ash Shuqayk and Al Birk (Figures 4, 5 and 6; Zarins et al., 1981). Here, Middle Stone Age material was reported on the surface of a coral beach terrace 3 m above present sea level, and presumed to be of Last Interglacial age (MIS Stage 5). Zarins et al. (1981) reported stone artefacts embedded in this beach deposit, but we were unable to replicate that observation in 2004 either at this site or anywhere else along this stretch of the Red Sea coastline where stone tools have been reported in association with lava fields and coral terraces.

At site 216-208, we found numerous stone artefacts of Middle Stone Age type lying on the surface of the elevated terrace (Figures 7 and 8), but none embedded within the deposit, although the area has undergone considerable disturbance and damage from bulldozing activity, road building and other development since the original surveys. It is also clear that the beach terrace at Al Birk is banked up against lava flows from the nearby volcanic cone, is stratigraphically later than them, and is not stratified beneath the lava as originally believed (compare Zarins et al., 1981, plate 5A). This is consistent with K/Ar ages of 1.37 ± 0.02 million years (KSA04/AR1) and 1.25 ± 0.02 million years (KSA04/017) for the lava cone. These dates give a maximum age for the artefacts of Acheulean type found in the vicinity by Zarins et al. (1981), and by us (Figures 9 and 10).

The age of the elevated coral terrace has not yet been confirmed by radiometric dating, but a shell sample from a terrace of similar height to the north of this site, north of the town of Al Birk, has produced a radiocarbon date of 38,380 ± 1290 BP (Beta 191459), in effect a non-finite date in the sense that the deposit is beyond the range of radiocarbon dating. This is consistent with the hypothesis that the elevated terrace was formed during a high sea level period within MIS Stage 5. If this argument is correct, it indicates a maximum age for the Middle Stone Age artefacts lying on the surface of the elevated terrace at site 216-208, but no better than that. In other words, the artefacts could have been dropped on the surface of the coral terrace at any time after its formation. Given our current, and admittedly incomplete, understanding of Middle Stone Age chronology in the Arabian Peninsula, the artefacts could date to any time within a period that extends from about 125,000 years ago to as little as 40,000 years ago, or possibly even later. In other words the artefacts could have been made, used and discarded during a period when sea levels were much lower than the present and the coastline of the time was many kilometres seaward of its present position. Given these uncertainties, it is inappropriate to refer to these sites as ‘coastal’ sites in the sense of sites close to the seashore.

A second site of interest in the vicinity of Al Birk is to the north of the town. Here an irregular scatter of shells and stone tools made on local basalt was found extending over an area of about 100 m x 40 m (Figures 11 and 12). The stone tools are mostly small, irregular flakes and have no diagnostic characteristics that would allow a chronological attribution. They could have been made at any period. This material lies directly on the surface of the elevated 3 m coral terrace referred to above. This is the same location from which the material used for the radiocarbon date (Beta–191459) was recovered; the shell used to provide this date was extracted from a vertical section eroded into the terrace by marine action, so that there is no doubt about the stratigraphic integrity of this sample. A second radiocarbon age was determined on a shell found on the surface of the terrace in association with the stone tools. This shell like others in the immediate vicinity is believed, from its close association with the stone tools, to have been collected for food by the human occupants of the area. The date is 5560 ± 70 (Beta–191460), and is consistent with the use of the site at a time of modern sea level when the shoreline was close to its present position.

We also conducted brief surveys in the coastal region of Qunfudah and its immediate hinterland. The prospects for the discovery of sites of Palaeolithic age are limited in this region, at least within a radius of 10–20 km of the coast, because of the very extensive cover of Holocene sediments. Cemented dunes of probable Pleistocene date were recorded in places along the coast, but all the archaeological material observed was much later in date and some of it is clearly of recent historical age. Of particular interest are sites used during the pilgrimage to Mecca (Figure 13), and some modern shell mounds used within living memory, in which the dominant shell species is the triton shell (*Strombus tricornis*), which is the main mollusc species sought after as food today (Figure 14).

From a consideration of all the above evidence, we conclude that none of the sites with Palaeolithic artefacts that have been found along the present-day coastline can be associated with coastal settlement in the sense that they represent sites formed on the contemporaneous coastline by people who consumed marine resources. Palaeolithic sites of presumed Acheulean or Middle Stone Age type are all surface finds, and therefore cannot be dated with any precision. The main attraction for settlement at these locations could have been the local sources of basalt suitable for making stone tools, rather than marine or coastal food resources. Many may have been used when sea level was lower than the present and the coastline was many kilometres distant from the present position.

A pressing need is to find archaeological finds of Pleistocene age that are embedded in Quaternary deposits, whether these are on the coastline in beach deposits, as at Abdur in Eritrea, or in hinterland locations in wadi gravels, lake sediments, or in caves and rockshelters. Without in situ evidence of this sort, there is no prospect of obtaining more precise dates for the earlier part of the Stone Age sequence in Saudi Arabia, and no prospect of recovering associated finds of animal bones, remains of other food resources, or sediments, which can throw light on the palaeoenvironment and palaeoeconomy associated with the sites. Surveys aimed at locating such material will form a part of our future investigation strategy, but an equally important objective is to begin exploration of the now submerged landscape, which would have formed an extensive and potentially vital part of the wider territory inhabited by Stone Age people for long periods during the Pleistocene. This submerged landscape may hide important sources of information about Pleistocene palaeoenvironmental and palaeoclimatic conditions, and archaeological finds including material that bears more directly on the use of coastal resources during periods of lower sea level.

The Farasan Islands

General Environmental Features

The Farasan Islands (Figure 15) are composed of coral and limestone platforms uplifted and deformed by salt tectonics, resulting in a complex onshore and offshore topography, which has been subjected to considerable modification by local tectonic movements associated with uplift of underlying salt deposits (evaporites) and localised solution resulting in deep depressions (Dabbagh et al. 1984; Macfadyen 1930). The islands are composed of wave cut coral terraces along the coastal margins. Extensive accumulation of marine sediments in recent millennia, accompanied by tectonic uplift, means that many areas that were formerly shallow bays or shallow marine channels have now become filled with sand, extending the area of dry land and leaving the original shoreline and its undercut coral terraced marooned some distance inland. This is typically the case on the east side of Janaba Bay (Figure 16), and in western Janaba (Figure 17). In a small number of places there are uplifted coral terraces comprising much older coral material, most probably relating to much earlier episodes of high sea level, which rise to a maximum height of approximately 80m above modern day sea level (Figure 18).

Naturally-occurring resources include a species of gazelle, a rich inshore and intertidal marine environment with great variety of fish and marine molluscs, turtles and sea mammals, and migratory birds. The gazelle presumably reached the Islands during periods of lower sea level when they were connected to the mainland, and are still present in considerable numbers as a protected species. The gazelle on the islands have been classified as a sub-species of gazelle, *Gazella gazella farasani*, based on their smaller size, the smaller size of the horn cores in the females, and a rounded upper tooth row (Thouless and Al Basri, 1991), presumably as a result of isolation on the Islands following the postglacial sea level rise.

However, studies of mitochondrial DNA do not support this sub-specific status, indicating shared haplotypes with mainland species (Torsten Wronski, pers. comm. 2009). Bird life is especially abundant in April and May, because the Islands (especially Qumah) are on the flight path of birds that migrate between Africa and Europe (Muftah 2005). Here bird traps are still in use and can be found scattered across the landscape in some numbers (Figure 19). Occasional traps of this type have also been observed near the coastline on Farasan Island, though here they are less numerous.

The Islands are also famous for the Harid Festival, which takes place on Farasan Island during March or April of every year, and is named after the longnose parrotfish, *Hipposcarus harid* (Gladstone 1996). This is a reef fish, which is present throughout the year around the Islands. During the spawning season it aggregates in large numbers in one of the inner bays of Farasan Island (Figure 15). For several days during this period the fish school in large numbers and move into the shallow water of the bay, where people can easily harvest them in large quantities by wading into the water with nets.

All of these resources would have been present during the prehistoric period, at least from about 6000 years ago onwards, when the Islands took approximately their present configuration after the postglacial sea level rise. They would have made an attractive variety of resources for non-agricultural people dependent on hunting, fishing and gathering.

Probably the major limitation on prehistoric settlement on the Islands would have been the limited supplies of surface water. Annual rainfall today as elsewhere in the Red Sea coastal regions rarely exceeds 180 mm, and most of it occurs in the winter months, when a flush of green vegetation spreads more widely across the landscape. For the rest of the year, vegetation is mainly confined to areas where ground water is close to the surface. The traditional villages of the Islands, such as the village on Qumah, and the now-abandoned village of Gsaar on Farasan Island, have wells, with standing water visible at a depth of about 3 m. Many natural fissures and cracks in the coral bedrock, resulting from minor tectonic deformation, are present in the wider landscape, and standing water is visible at about 3m at the bottom of some of these fissures. They are often visible at a distance because of the concentration of shrubs and other vegetation along the line of the fissure (Figure 20). Isolated clumps of palm trees occur sporadically on flat coastal plains where former marine bays have filled with sediment to create dry land, but where water is present close to the surface. Springs also occasionally emerge at the shoreline at the base of wave-cut coral cliffs.

Archaeological survey in 2006

Little previous work on the archaeology of the Islands had previously been undertaken. The Comprehensive Survey Program of Saudi Arabia visited the Islands briefly in the late 1970s, and reported a number of upstanding remains made of blocks of coral or faroush (beach rock consisting of a cemented breccia comprising fragmented coral, shell and sand) and a small number of sites including shell middens in the vicinity of Janaba Bay and on the opposite island of Qumah. Discoveries included potsherds of the South Arabic Civilization dated to the first centuries AD, and some prehistoric material described as ‘Neolithic’ (Zarins et al., 1980). A test excavation in a shell mound in Janaba Bay produced a sequence of radiocarbon dates as follows: Level 3: 5235 ± 225 BP; Level 3: 4810 ± 170 BP; Level 2: 2410 ± 100 BP (Deputy Ministry of Antiquities and Museums, 1990). However, no further details were published about the location of the shell mounds, the stratigraphic provenance of the dates, the materials used for dating, or the stratigraphy of the site. More recently Rashad Bantan, from the College of Marine Sciences at King Abdulaziz University, undertook some geological survey on the Farasan Islands, during which he obtained a radiocarbon date from near the base of a shell mound on the eastern side of Janaba Bay of 5400 ± 200 BP (UCL–435) (Bantan, pers. comm., 2004).

During the 2004 field season, we paid a brief visit to the Farasans and identified some small shell mounds in the central area of Janaba Bay, northwest of the boat jetty, and a wider range of shell mounds on the island of Qumah. Accordingly, Janaba Bay was the starting point for our 2006 land survey. Janaba Bay and the waters around Qumah Island, particularly off Slick Point, were also the initial focus of the diving work (Figure 15).

The general strategy of the 2006 work was to combine survey on land with exploration underwater, so that the search for underwater evidence could be informed and guided by the archaeological evidence of shell middens and other coastal evidence on land. Examination of the associated topographic and geological context of these sites could then served as clues to the sort of evidence to be found under water and where to look for such evidence. The field team therefore comprised two separate groups, the diving team, and the land team, with the intention that the two groups should work alongside each other and learn from each other’s findings and expertise.

Land survey

In 2006 the field survey had two key objectives: to record the locations of shell middens around the Islands; and to explore a range of different land types for field survey, with particular attention paid to coastal areas and locations that appeared to have been areas of standing water or water courses at some time in the past. During this season the team surveyed areas on Farasan Island (especially around Janaba Bay and around the southern and eastern part of the Island, on Saqid Island (along the south-western coast and north eastern coast), along the southeastern shore of Qumah Island, and along the central and western area of Dumsuq Island. Brief visits were also made to the Islands of Solubah and Zifaf (Figure 15). On Farasan and Saqid Islands, field survey was usually conducted by accessing survey areas by four-wheel-drive vehicle and walking in transects radiating out from the vehicle. On the islands of

Qumah and Dumsuq, the survey party arrived by small boat, and survey proceeded by walking along transects radiating out from the place where the boat had been beached. It should be noted that the high temperatures and strong sunlight present when the field survey was undertaken in May made long episodes of field survey impossible. On the other hand, the survey for shell mounds and shell middens was greatly facilitated by their visibility in a landscape largely devoid of vegetation, in which the white or light gray colour of the shell stood out from the red-brown or yellow-brown background colour of the natural land surface. The larger shell mounds are easily detectable from a distance and form an impressive sight, sometimes stretching out in a row as far as the eye can see. Along some lengths of coastline, these features allowed large areas to be covered quite rapidly by vehicle, with limited requirement for extensive survey on foot. Most of the shell mounds appeared to be intact, but there was occasional evidence of site disturbance and bulldozing, to remove either the shell material or the surrounding sand for building purposes, particularly on the north side of the central narrow section of Farasan Island, facing Saqid Island.

Along many sections of coastline, the land surface comprises a gently sloping coral platform, which represents an ancient and now elevated coral terrace, and ends abruptly at the present-day shoreline, with undercutting of the coral bedrock by the chemical and physical action of seawater to create a terrace behind the beach that is typically up to 3m above present sea level, although the height is variable in different parts of the Islands because of tectonic distortion. This 3m coral terrace appears to represent the same feature observed along the coastline of the mainland, namely a coral platform created during the period of high sea level at about 125,000 to 130,000 years ago. The undercut notch visible today is the result of erosion by modern sea level.

Many shell mounds are located directly above this shoreline feature (Figure 21). In other cases the original shoreline is still visible though now some distance inland because of infilling of the adjacent bay by sandy sediments (Figures 16 and 17). In other cases again, the original shoreline is difficult to discern because it has become masked by the accumulation of sand, accentuated perhaps by tectonic downwarping (Figure 22).

Our initial protocol for describing the shell mounds during survey was to provide a GPS reading for each site, maximum dimensions and thickness of the shell deposit, the main types of molluscs visible on the surface, and the surface presence of any other cultural material such as potsherds or stone artefacts. Any artefacts recovered in a brief inspection were bagged and labelled. Samples for dating purposes, mostly samples of shell, were also collected from a number of sites However, we had to modify and simplify this procedure because of the large number of sites discovered. After the first day we had observed 69 sites, and by the end of the first week over 400 sites, comprising a mixture of shell mounds and surface deposits. This concentration of sites was far in excess of what we had expected and could survey during this first season in comparable detail. We therefore adopted a simpler procedure, involving the measurement of GPS position as before, but with simple descriptions of sites according to whether they were mounds forming discrete features on the land surface or surface deposits with limited thickness of shell accumulation, and more selective use of more detailed descriptions. Where shell mounds formed an almost continuous line of deposits, GPS readings were taken of the mounds at either end but not at any of the intervening ones.

First impressions of overall characteristics are that the shell-rich sites form at least three distinct categories. First, there are mounded shell sites, reaching up to a maximum height of at least 4m and forming substantial and impressive features in the local landscape (Figure 22). These almost always occur on the original shoreline, directly adjacent to shallow intertidal bays that would have provided rich and extensive habitat for marine molluscs. Secondly, there are sites that represent thin deposits or scatters of shell. These are of variable extent and may be as small as 5 m in diameter or extend over quite large areas (Figure 23). Often they are closely associated with mounded sites but situated a short way inland, sometimes up to several hundred metres back from the shoreline. Some of these shell scatters are associated with the remains of structures built from blocks of coral and with signs of hearths composed of burnt material visible on the surface. The result is clusters of shell deposits of different sizes and types, some large, some small, some directly on the shoreline, others situated further away from the shoreline.

A third category of site is small shell deposits, often scatters of shells or mounds of limited thickness and extent, which are associated with open coastlines, rather than the shallow bays where the large mounds occur. These sites are invariably located directly on the shoreline, often above a wave-cut coral terrace, like the larger mounds, but adjacent to a shoreline with a smaller area of shallow, sheltered intertidal habitat, and therefore with fewer molluscs available for collection and consumption.

The species of shells present include reef and sand-dwelling shellfish. Shell composition varies somewhat from area to area, and according to local ecological conditions, but there is considerable uniformity in the shell species that are most commonly present, with the small conch *Strombus fasciatus* forming the dominant species in most cases, especially in the larger mounded deposits. The pearl oyster (*Pinctada* cf. *nigra*) is also well represented, as are species of larger conch shells.

Whether any or all of these sites were used as specialised sites primarily for preparation and consumption of molluscs, or whether it is simply the case that the discarded shells are the most durable and most visible by product of a human presence that included many other subsistence activities, remains to be established. Fishing, the hunting of sea mammals, and hunting and gathering of resources on land, are all possible activities, and the variability of the shell middens and shell mounds in this respect can only be established through excavation.

Ceramics are often present on the inland shell scatters and in association with the stone structures. The ceramics we have so far recovered include Islamic and pre-Islamic material, and most probably prehistoric material that is older than the period of the South Arabic Civilization. A fairly consistent pattern seems to be emerging in which the large shell mounds invariably lack ceramics. At this stage we believe that this is because they are much earlier in date than the other sites, but it might equally reflect differences in the function of different locations in the landscape. For example, the shell mounds might reflect shell dumps close to the water's edge where mollusc shells were prepared and consumed by people who then moved a short distance away to locations more conveniently situated for other purposes or for activities conducted at other periods when molluscs were not being collected and prepared for consumption. Many of our inland shell scatters are located near fissures in the coral bedrock that trap water and support vegetation in an otherwise barren-looking terrain. However, radiometric dates will be needed to distinguish between these alternative hypotheses.

Small test excavations were carried out at the site of Janaba 4, in the central part of Janaba Bay (Figure 24), and on the southeastern side of Saqid Island, close to its connection with Farasan Island (Figure 25, see also figure 15 for locations). These sites were chosen because of ease of access and their contrasting characteristics and locations. In both sites narrow step trenches 50cm wide were excavated into the steeper side of the mound – in both cases this is the side facing the shoreline (Figures 26 and 27).

Both mounds consist of numerous layers and lenses of shell, typical of deposits that have built up over a long period of time as the result of numerous successive episodes of use and deposition. There is considerable variability in the composition of the individual layers. Some are quite loosely packed layers of pure shell. Other layers contain more sedimentary matrix including ashy sediments and pieces of charcoal, representing the remains of camp fires. Again this is typical of shell middens in other parts of the world. No certain artefacts have been recovered from these small test trenches, and the artefact content of the mounds generally seems quite low, judging by the absence or rarity of artefacts on their surfaces. But this probably reflects the large volume of shells and their relatively rapid rate of accumulation relative to the rate of discard of other materials. Fish bone is present in Janaba 4, but not in the samples so far excavated from the Saqid mound.

One notable artefact find is a complete ground-stone axe made from a fine-grained greenstone, a material that is not naturally available on the Farasan Islands (Figure 28). This artefact was found on the surface of a shell mound that had been disturbed by bulldozing activity.

Underwater Survey

Fieldwork was conducted from the MV Midyan during May 2006 (Figure 29), and included inspection of features on land and under water. The overall aim of the fieldwork was to locate submerged archaeological sites although it was recognised that a better understanding of the submerged landscape was needed. Sites were chosen that would help inform decisions when selecting areas for investigation and developing recording strategies that were suitable for the environment. Accordingly, the objectives of this phase of the fieldwork were: to describe and interpret coastal geomorphological features; to locate areas with potential for the preservation and discovery of archaeological material in underwater locations associated with periods when sea level was lower than the present; and to carry out trials with exploration at depth using mixed gas diving.

Two factors were identified as key to the discovery of archaeological remains underwater. The first is an understanding of the types of locations in the landscape that would have been attractive places for human settlement and activity. The field surveys on land, as described above, were drawn on to help inform our interpretations. These identified that wave cut shorelines associated with shallow bays were significant factors for the location of late prehistoric shell middens. Therefore, one of the tasks was to see if similar geomorphological features could be identified beneath the water.

The second factor we considered were the processes that impacted on the landscape as sea level rose. This was studied to help inform our understanding of the areas where preservation potential was believed to be greatest and areas where features are most likely to remain visible on the seabed. A key factor was the force of waves and shallow-water currents during and immediately after an area was inundated by rising sea levels. These high energy forces can remove or destroy vulnerable anthropogenic remains particularly in exposed locations. Conversely, in more sheltered and depositional conditions, archaeological material will be protected where it becomes buried under marine sediment. Both scenarios will remove material from sight; therefore, the best chances of discovery are in locations where artefacts have been protected but the sediment cover is thin.

A scenario that would provide access to old land surfaces is one where a relic sedimentary deposit has been eroded in more recent times. An example would be in bays either side of an isthmus that subsequently breached as a result of rising waters. The shelter afforded by the bays prior to any breach would have allowed marine sediments to build up. Sediments deposited in calm conditions as the sea level rose would cover any old land surfaces. Were rising waters to overtop the connect isthmus a channel would form. As this grew, new currents would be introduced that could erode and wash away the deposits laid down when the bays acted as a sedimentary sink. The introduction of new forces could remove covering sediments in selected locations to expose land surfaces beneath. Where this is the case, any surviving archaeological artifacts would become accessible. Unfortunately this process is transitional so any archaeological horizons would only be exposed for a limited time before being compromised.

Another area that has increased potential for the survival of robust artefacts is in locations where material could have become trapped in the back of caves, wave cut notches or crevices. The possibility for survival would be increased if the transgression was relatively fast, thereby minimizing the amount of time a deposit is exposed to attrition.

The geological and geomorphological characteristics of the seabed plus any known association with archaeological material on land informed the choice of locations for diving activity and the methods used. Diving work was conducted both in shallow water conditions using conventional compressed air and at greater depth using mixed gas techniques, including nitrox (combination of oxygen and nitrogen) and trimix (combination of oxygen, nitrogen and helium). Although it is theoretically possible for divers using compressed air with normal air mixtures to reach considerable depths, the risks of narcosis, impairment of mental acuity and nitrogen-related decompression sickness increase with depth. The deeper a diver descends, the greater the toxicity of the gases breathed. These risks can be reduced by adjusting the proportional mixture of oxygen and nitrogen. At greater depths, to dive safely, helium can be added to the gas mixture in order to reduce the proportion of oxygen and nitrogen in the total gas volume, and hence the quantity of these gases absorbed by the body. This gas mix is known as trimix and can be blended to suit the safety requirements of the dive. It enables deeper diving and enhances mental awareness at depth while reducing the risk of nitrogen-related decompression sickness. In short, it enables divers to reach depths safely and investigate features there that would otherwise be inaccessible. Single beam acoustic survey was also used to help target underwater features and targets for diving reconnaissance, and to provide information on depths.

Slick Point

The first site identified as having promising characteristics was Slick Point. It is located off the south-east tip of Qumah Island where it protrudes from the southern edge of a long peninsula (Figure 15, 30). Beyond the point and below the water, the seabed drops steeply where the charted bathymetry shows a depression over 100m deep to the south (**Ref for chart**). This is an area that could have contained fresh water when sea levels were lower and the conditions were conducive. To the west, another peninsula defines the mouth of Qumah Bay. This is a large bay that runs north before it shallows and is terminated by a wide sandy beach. Shell middens are visible around the fridges of the bay. Vertical cliffs that extend below the waterline run back from both peninsulas and into the bay. The site contains a variety of geomorphological features and environmental niches.

A series of dives were carried out using nitrox and trimix gas mixtures to record the underwater features in more detail and to follow the underwater shorelines to the greatest possible depth. Dives were conducted to explore wave cut features, to make tape measure surveys, to trace the extent of the underwater shorelines, to collect samples of relic coral and to obtain video footage of divers at work (Figures 31, 32, 33). Particular attention was paid to wave cut terraces, notches and large structural features.

The most distinct feature identified underwater was a submerged reef extending below the tip of Slick Point. The top of the reef lay in shallow water of c. 5-6m immediately below Slick Point and extended south. It was traced for a total of 180m along slope and to a depth of 30m before disappearing below the sand covered seabed (Figures 34 and 35). It was apparent that the rock formation continued on below the sand as occasional exposures of outcrops were visible down to 35m depth. Beyond this point, the flat sandy seabed dipped gently to the south and west.

The west face of the submerged reef was truncated by a vertical cliff that measured 10m high below Slick Point. The cliff tapered to the south as the reef dipped until it ran below the seabed. To the north, the cliff ran into Qumah Bay where it extended above water beyond Slick Point.

Underwater, the cliff face was etched with two levels of distinctive laterally consistent wave cut solution notches and terraces. To the south, the linear wave cut features followed the line of the reef and as such were covered by sand as the reef dipped below the seabed. To the north the uppermost notch followed the same trajectory as the top of the reef, continuing past Slick Point to rise above sea level after about 100m. The notch is sizable indicating a prolonged period of attrition. The lower set of notches were recorded running north for approximately 500m before breaking through the water level as a wave cut platform. The features rose at the same angle as the land surface demonstrating that the linear notches along the cliff underwater mirrored the laminated geology visible in the cliff above water. The sequence was terminated at a break in the rock formation that was expressed by faults in the cliff line.

The conjoined geology made it clear that the reef to the south of Slick Point was an extension of the headland bedrock. The continuity between the current wave cut features around Slick Point, the wave cut platform that now dips to the south and the extrapolated wave cut notch rising to the north suggests they were all formed during the same sea level still stand. This in turn suggests the wave cut features associated with Slick Point formed together and at a time when the strike of the geological units was running horizontally in parallel with the sea level. However, the dipping angle of the wave and solution cut features is at odds with the current level of the sea. So how were the different erosive features formed?

First we should look at what is happening at current sea level. East from Slick Point, a deeply incised notch runs along the shoreline. Here, the land slopes to the water's edge rather than being truncated by a vertical cliff. This wave cut feature is much more distinctive than the notch at current sea level that extends from the west side of Slick Point to the north along the cliff into Qumah Bay. The notch in the bay was also less distinctive than the linear notches recorded in the underwater cliff. Therefore, the notch at current sea level on the west side of Slick Pint must have been subject to marine erosion for a shorter period of time than the notches recorded underwater and the notch extending to the east of Slick Point. If we accept that both sets of features are linked through Slick Point and that it lies at the fulcrum of these geomorphological signatures, it would appear there has been land movement which has only affected the coastline on the west side of Slick Point. This is because the movement does not appear to have been significant around the coast to the east of Qumah Island while to the north of Slick Point, the dipping and fracturing of the cliff face is substantial. Furthermore, the fact that the wave cut incisions that dip to the north and south from Slick Point are much deeper than the wave cut features at sea level to the north, on the west side of Slick Point, suggests that the shift of the land relative to sea level has occurred relatively recently. Indeed, this would suggest that the sea has only been at the current intertidal zone for the latter part of the current marine still stand and that uplift may still be ongoing.

In summary, the interplay between the linear features shows that the land has risen to the north of Slick Point and dipped to the south at some time following the creation of the dipping wave cut notches. There does not appear to be any noticeable elevation to the east while the highest point on the peninsula lies about 2km to the north, north west of Slick Point, where it rises to 31m. This suggests that the land has 'bulged' around a high spot somewhere north of Slick Point.

It should be noted that the erosive forces acting around the Slick Point peninsula do not differ greatly in the areas under consideration. Despite referring to the west facing cliff as being 'in the bay', the exposure to the prevalent winds is arguably greater on this side of the peninsula and the fetch is no less than along the east coast. Therefore this would not explain why the wave cut notches are greater in the east rather than the west.

The relationship of the wave cut features with current sea level has significant implications for our assessment of the submerged archaeological potential. If we can establish which geomorphological formations can act as benchmarks, they can be used to help calibrate the age of associated features. We can then work out which submerged caves and overhangs would have existed above sea level for extended periods in the past when we assess their suitability for human occupation.

Archaeological potential of the wave cut features

The largest wave cut notches that were found cut into the cliff below Slick Point were in the lower series at the foot of the reef. The most prominent of the notches is a deeply incised undercut with overhangs and small caves extending for over 200m. It lies at a depth of between 10 and 20m and dips at an angle of c.1 in 20 from north to south. At the most southerly point, the wave cut features are buried beneath the sand. The largest undercut measures up to 3m high. There is a maximum distance of 4.5m from the edge of the wave cut platform at its base to the back of the undercut (Figure 36). This feature is very similar to those observed on the present-day shoreline.

This lower line of wave cut sequence mirrors the top of the submerged reef and the upper wave cut notch. The base of the lower sequence is 10m below the upper sequence. Given that the upper sequence is related to current sea level (as discussed above) and thus provides a terminus post [ante?] quem for previous marine features, the lower undercut must have been formed along a shoreline during an earlier period when sea level was lower. The parallel nature of the wave cut features indicates there was little distortion or warping of the rock face between the periods when the two features were formed. The relatively large size of the lower undercut suggests it was eroded during a comparatively long still stand.

The other geological horizon that needs to be considered in the context of dating is the current land surface. This is fossilised coral that was believed to have been formed during the last interglacial around 125,000 years ago (Marine Isotope Stage 5e). At this time, sea levels were approximately 5m higher than present and the live coral reefs that existed at that time would have grown within a few metres of the sea surface. Notwithstanding the aforementioned uplift that has been causing the peninsular to bulge in relatively recent times, the land surface is generally flat and low lying whereby fitting the Marine Isotope Stage 5e hypothesis. Today, the rock thickness between the land surface and the upper wave cut notch around Slick Point is 7-10m. The thickness thins towards the end of the point where erosive forces would be much greater. Consequently, the relationship between the land surface and the lower notch is about 17-20m. Allowing for weathering and the depth of water that would have existed above the coral when it grew around 125,000 years ago, the distance between highest sea levels of Marine Isotope Stage 5e and the lower wave cut notches would have been in the order of 25m. The parallel arrangement of all three horizons shows that there was isostatic stability for a long period within which the features were formed. Having established the relative points of past sea levels against the geological features and acknowledging that the largest notches can only be formed during the longest still stands, the relative depths of the notches could be compared to the global sea level curve (Figure 3). This indicates a large still stand at about 20m below current Chart Datum occurred 90,000 to120,000 years ago after which the sea level was consistently lower until about 10,000 BP.

If the caves and overhangs were formed 90,000 years ago they would have been habitable for around 80,000 years. This presents opportunities for long lived occupation giving the potential for the discovery of artefacts within or near the most suitability shelters. An example of a cave that would have been attractive to humans for possible shelter and occupation was located approximately 600m to the north of Slick Point (Figure 36). The floor of the notch lay in 11.5m of water and the upper lip was in 8m of water. The notch measured 13m wide and was 4.5m deep, taking on the appearance of a small cave. The notch was of a similar type to those found along the current shoreline at modern sea level (Figure 37).

The results of this initial exploration revealed that undercut features which formed during periods of lower sea level can be clearly defined under water in the Farasan context, and as such, can provide a marker for tectonic and sea level change. The tilting of the wave cut features shows that the structure has been uplifted to the north while there was submergence to the south. This is invariably a result of tectonic movement associated with the Farasan salt dome.

Qumah Bay

A number of shell middens are present around the edges of the wave cut terraces that skirt the bay. They can also be found bordering a large infilled embayment that stretches from Qumah Bay and into the centre of the western peninsular. The embayment is now above sea level it is dry and is surrounded by remains of a wave-cut fossil platform. The shell middens would have been built when the bay was at a lower level and supported a tidal marine system.

Investigations around the north-eastern side of Qumah Bay identified further shell middens sitting on the edge of the wave cut platform and marine notches. Inspection by divers identified a fine silty seabed in 8m of water a few hundred metres from the back of the bay. Exposures of soft mineral-rich deposit were evident along the shore where wildfowl including flamingos were feeding. The tidal range is about half a metre and large expanses of bay are exposed when the tide is out. In addition to wildfowl, the bay is home to turtles and rays, both of which were spotted in the shallow water.

Dumsuq Island
Reconnaissance of the inlet on the north of Dumsuq Island was conducted from the dive boat. Terrestrial inspection along the west side of the inlet revealed a barren landscape. The island is currently unpopulated and there were no signs of shell middens like those found on Farasan and Qumah. However, a large mound of fossilised coral rocks had been piled up to form a pyramid c.8m high. A second such structure was visible to the south. On the beach in the inlet, temporary modern structures had been abandoned and rubbish including scatters of oyster shells could be found in clumps along the shore. Underwater, the sandy beach shelved quickly to a depth of 10m (Figure 38).

Zufãf Island
Zufãf Island was targeted as a dive site by merit of the steep offshore topography visible on existing bathymetric charts along the east coast, which appear to represent an extension of the steep hillsides that rise directly from the water's edge (Figure 39). Echo sounding transects at different points along the coast demonstrated that the steepest drop-off was next to Doewa Reef off the south east corner of the island. The echo sounder recorded a steep incline averaging about 33°, which levelled off at 56m below sea level to form a gently sloping terrace, inclined at 6° for 165m to the east until it reached 82m. At this point it dropped vertically to below 100m levelling off again at c.140m. This site was selected for diver investigation both because of the steep offshore profile and because it was several hundred metres offshore in a position where the seabed was less likely to be masked by material eroding from the cliffs along the shoreline.

The diving operation used Trimix to access the wave cut terrace in 60m of water (Figure 40). Divers dropped directly onto the sand-covered terrace in 55m and swam to 60m inspecting the seabed. They then turned and swam west back up the slope, which steepened markedly to approximately 30º at a depth of 53m. The ascent up the slope recorded little change in the seabed type although the occasional outcrop of rock rising from under the sand was noted. In 30m of water, the angle steepened again to about 40º, still with no change to the sandy seabed. At 10m below sea level, the number of rock outcrops increased and at 6m the slope was terminated by a wave cut platform and notch running north to south (Figure 41). Coral growth was concentrated around the 6m terrace although much had been smothered by sand.

Conclusions
Survey on land has demonstrated an extremely rich onshore archaeological record comprising many hundreds of shell mounds, often in dense clusters that include large deposits up to 5m high with smaller mounds or scatters in the vicinity. Other sorts of archaeological features are distributed more widely across the landscape including structures of many different types made from blocks of coral or faroush, and open-air hearths. The time depth of this record is at least 6000 years, corresponding to the period of modern sea level. The largest concentrations of shell mounds are located on or close to the edge of a coral platform that has been undercut by marine erosion adjacent to shallow intertidal bays, where marine resources, particularly shellfish,

would have been most easily accessible and available in greatest abundance. Coastal sites earlier than this, if they existed, must now be deeply submerged under water. Future work will focus on: more detailed survey and excavation of the shell mounds on land to better characterise associated patterns of settlement, social organisation and economy; inland survey for Palaeolithic artefacts that would have been deposited at periods of lower sea level when the Farasan Islands would have been in the centre of an extensive coastal landscape forming an extension of the mainland; and continued investigation of the submerged landscape.

Geomorphological assessment of the submerged landscape within the Farasan archipelago is helping to identify changes in the landscape over the past 125,000 years and areas that would have been suitable for human habitation during periods of lower sea level. The Islands have been subject to isostatic and eustatic fluctuations of relative sea level, and localised tectonic movements caused by the mobility of underlying salt deposits. A record of this change can be extracted from the geomorphological signatures etched into the terrestrial and submerged landscape in the form of wave cut platforms, terraces and undercuts. Submarine archaeological fieldwork has demonstrated that these features exist under water and can be readily interpreted.

Mixed gas diving has enabled the project divers to remain underwater for longer than with normal compressed air, with increased awareness and an increased safety margin, and an ability to investigate wave cut features that would otherwise have been inaccessible. The effective use of selected tools underwater has enabled the acquisition of survey data, samples, a photographic record and video.

A well defined, laterally consistent terrace has been identified between 80–55m below modern sea level immediately east of Zufāf Island, a wave cut notch in 10–14m of water below Slick Point, which corresponds to a sea level still stand at 20m, taking into account recent tectonic uplift, and a wave cut platform at a depth of 6m at both sites. A number of other wave cut features have been identified although lateral consistency has yet to be confirmed. The wave- or solution-cut features would have been incised during periods of lower sea level and reflect the sea level at the time of their formation. The 20m shoreline below Slick Point corresponds to a stillstand in the time range from 90,000 to 120,000 years ago, although it could have been reworked at about 10,000 years ago during the final stages of postglacial sea level rise (Figure 3). The undercuts and terrace platforms would have been accessible to human exploitation for many tens of thousands of years when sea level was lower. The potential for archaeological remains associated with these sites is therefore significant.

Underwater investigation in Qumah Bay has demonstrated that a shallow bay environment, comparable to that which we see today, existed when sea levels were at least 20m lower than the present, and is likely to have offered similar attractions to those that were exploited during the postglacial period by the people who created the many shell mounds of recent millennia visible along its margins.

The identification of a deep wave cut platform off Zufāf is both an indicator of sea level change and an area with potential for archaeological material. When sea levels were at their lowest during the glacial maximum, such an elevated plateau would have provided an ideal vantage point for early humans to scan the plains or water-filled depressions below.

The seabed in the areas investigated is covered by thick and extensive layers of sand and silt. The elevated coral terraces are the source of this material, and visibly eroding cliffs are evident wherever coral terraces are exposed to the sea. This suggests that the waters adjacent to the main Islands act as a trap for the accumulation of eroded sediments, which cover the seabed and fill bays, and this thick covering of sediments will have obscured many features of the original landscape and any associated archaeological materials. Sandy bay environments with raised coral terraces are attractive for humans and it is anticipated that they will harbour prehistoric archaeological material remains. However, the type of environment that attracts humans and is able to preserve artefacts, once it has been submerged by sea-level rise, can also accumulate a thick covering of later sediment that masks the evidence deep under sand. There is then a need to identify locations that have a high potential for archaeological material in areas where access to the palaeo-landscape is still possible.

This can best be achieved with a combination of the following procedures:

- Identify patterns of human exploitation of the marine resources around the current coastline and use these patterns to predict the location of comparable landscapes and archaeological sites in areas that are now inundated.
- Conduct a geophysical survey in selected areas, using techniques such as swath bathymetry, sub-bottom profiling and side-scan sonar.
- Deploy divers or a remotely operated vehicle to visually inspect promising sights.
- Deploy divers to inspect, survey and sample potential archaeological sites or other landscape features, including use of mixed gas for work at depth.

Exposed outcrops such as those recorded in Qumah Bay and Slick Point present an opportunity to access the landscape in areas where the sand has been removed. Further work in this area may result in the discovery of archaeological evidence underwater and has a high priority in the future search for underwater landscapes and archaeological features in the Farasan Islands.

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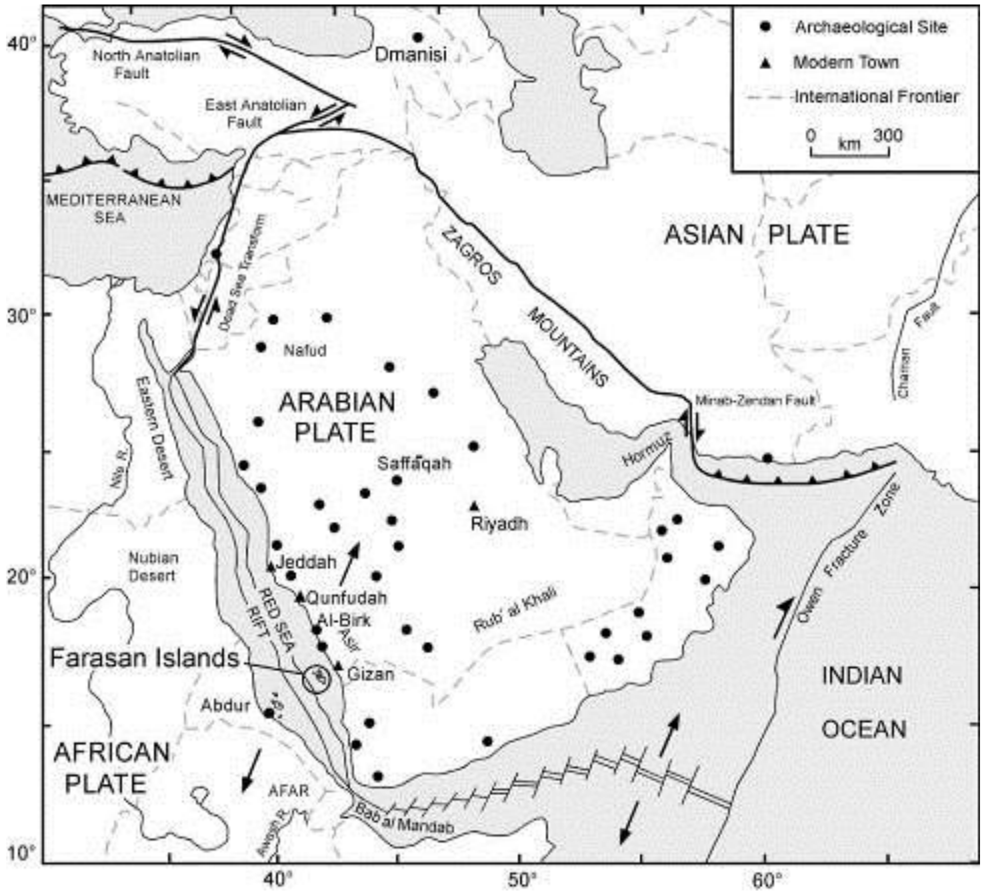

Figure 1. General map of the Red Sea and adjacent regions, showing principal tectonic features, a simplified distribution of Lower and Middle Palaeolithic archaeological sites in the Arabian Peninsula, the location of the Farasan Islands, and key sites on the Southwest coastline. © C. Vita-Finzi and G. Bailey.

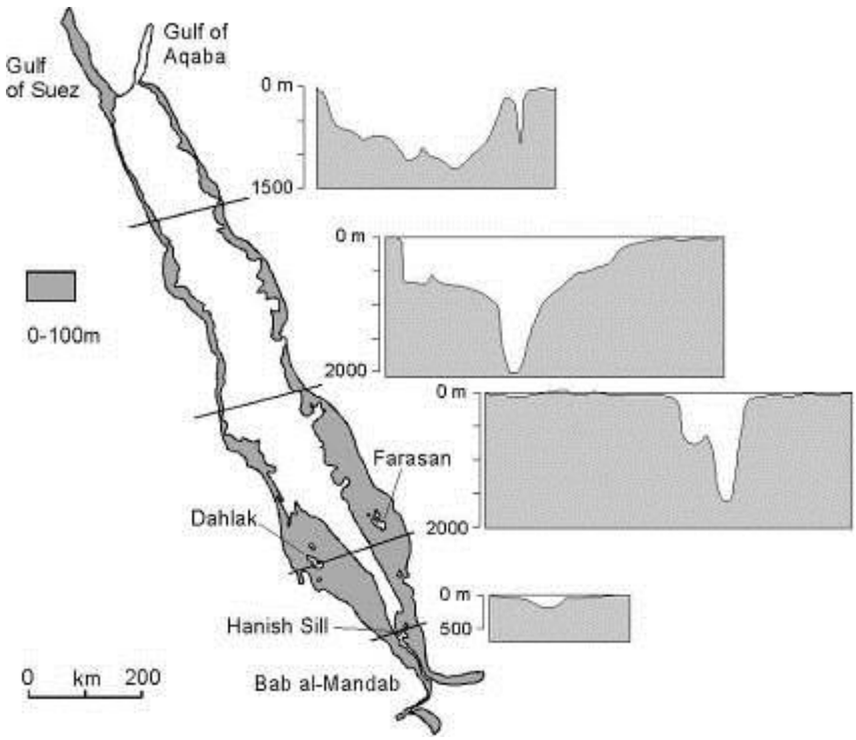

Figure 2. The Red Sea, showing the amount of land exposed at the –100 m bathymetric contour (which approximates the position of sea level at the maximum of the last glacial period). At this time the southern end of the Red Sea would have been reduced to a long narrow channel not more than 3–4 km wide and extending for over 100 km from the Bab al-Mandab to the Hanish Islands. Information from Head 1987. © G. Bailey.

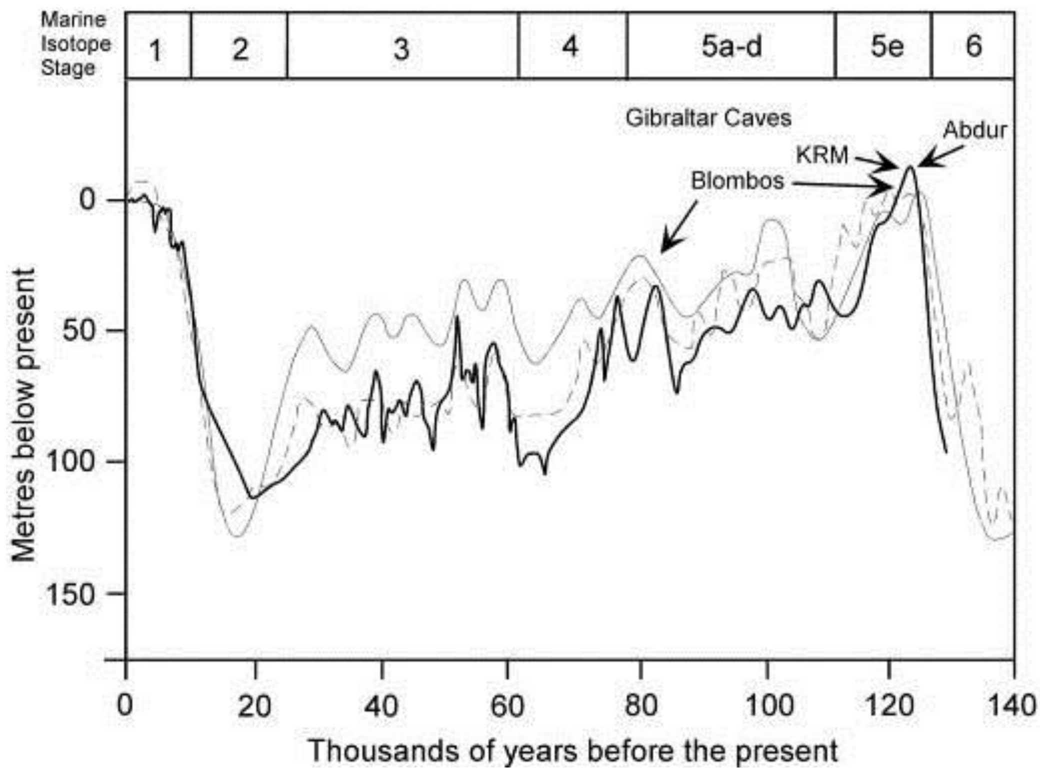

Figure 3. Global sea-level change over the past 140,000 years. The dashed grey line is based on deep-sea oceanic oxygen isotope records of planktonic and benthic fauna. The solid gray line shows the same curve corrected for temperature effects using dated and elevated marine terraces in New Guinea. The dark solid line is based on oxygen isotope records from the Red Sea. MIS refers to Marine Isotope Stage. Coastal archaeological sites in Africa and the Mediterranean dated to MIS 5 with archaeological evidence and marine indicators are also shown (Blombos and Klasies River Mouth (KRM) are coastal caves in South Africa, and Abdur is on the Red Sea coastline of Eritrea). Sea level data are based on Chappell and Shackleton 1986, Lambeck and Chappell 2001, Shackleton 1987, Van Andel 1989, Siddall et al. 2003. © G. Bailey.

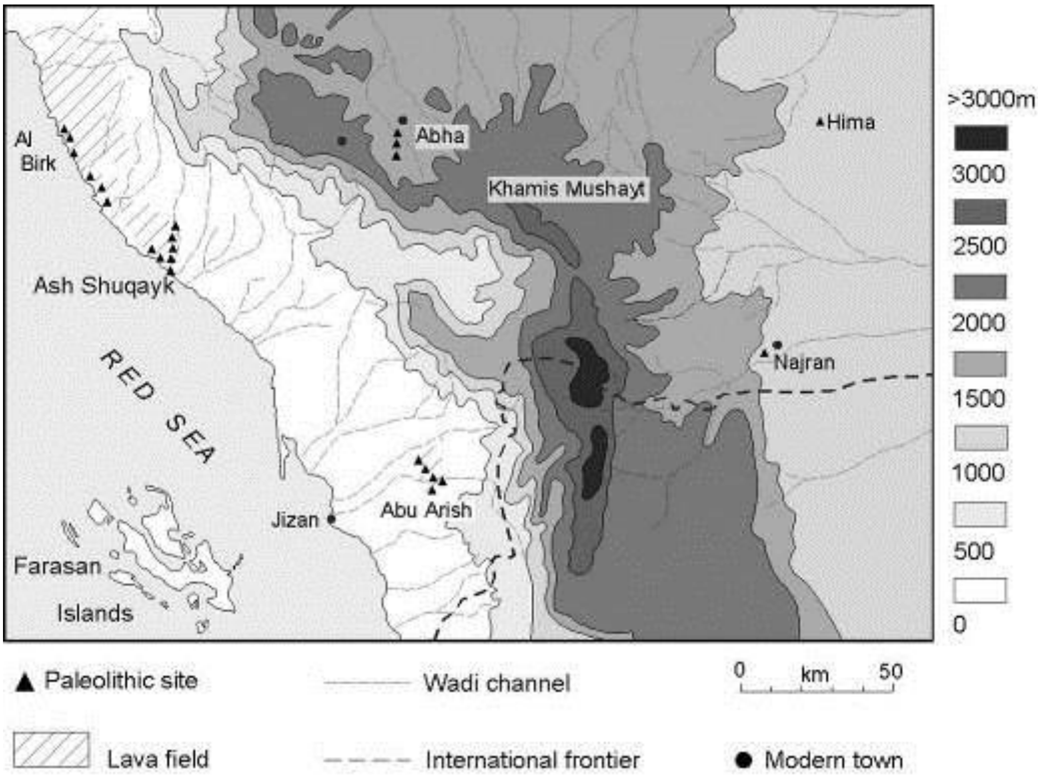

Figure 4. The Arabian escarpment between Al Birk and Jizan showing simple relief, wadis, major lava fields and main concentrations of Paleolithic sites. © G. Bailey.

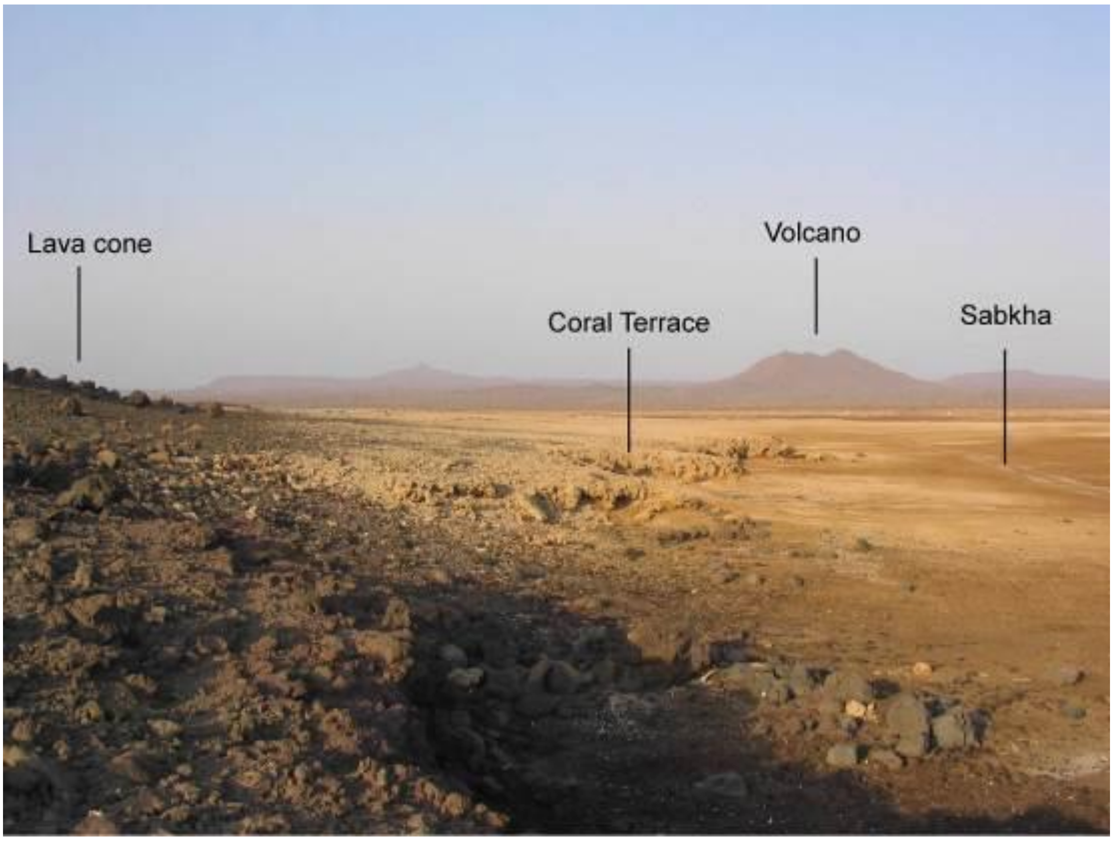

Figure 5. Geological features in the vicinity of site 216-208, looking north. Extinct volcanoes are visible on the far horizon. The lava cone on the left is dated at 1.3 Mya and the sea is to the left on the other side of the lava cone. Banked up against the lava cone is an elevated coral terrace believed to be of Last Interglacial data with Middle Stone Age artefacts on the surface. Photo by G. Bailey, March 2004.

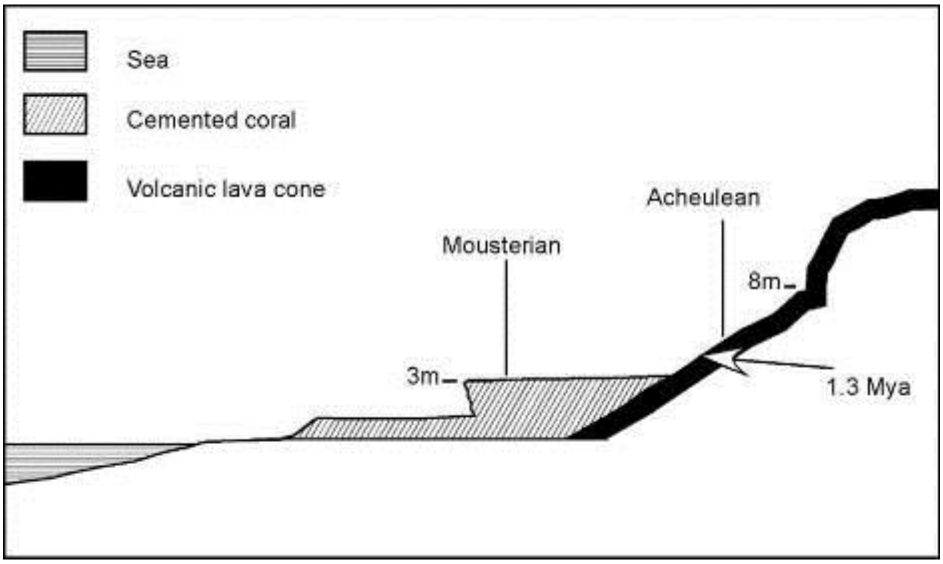

Figure 6. A cross-section of the deposits at site 206-218. Data from Zarins et al. (1981, plate 5) and from personal observations in 2004. The section is viewed looking north with the lava cone on the right and the elevated coral terrace and sea on the left. The photograph in Figure 5 shows the same pattern of relationships on the eastern side of the lava cone. © G. Bailey.

Figure 7. Photographs of flakes of Middle Palaeolithic type made on basaltic lava and found on the surface of the elevated coral terrace at Al Birk. Upper row, dorsal surface, lower row, ventral surface. Photo by G. Bailey.

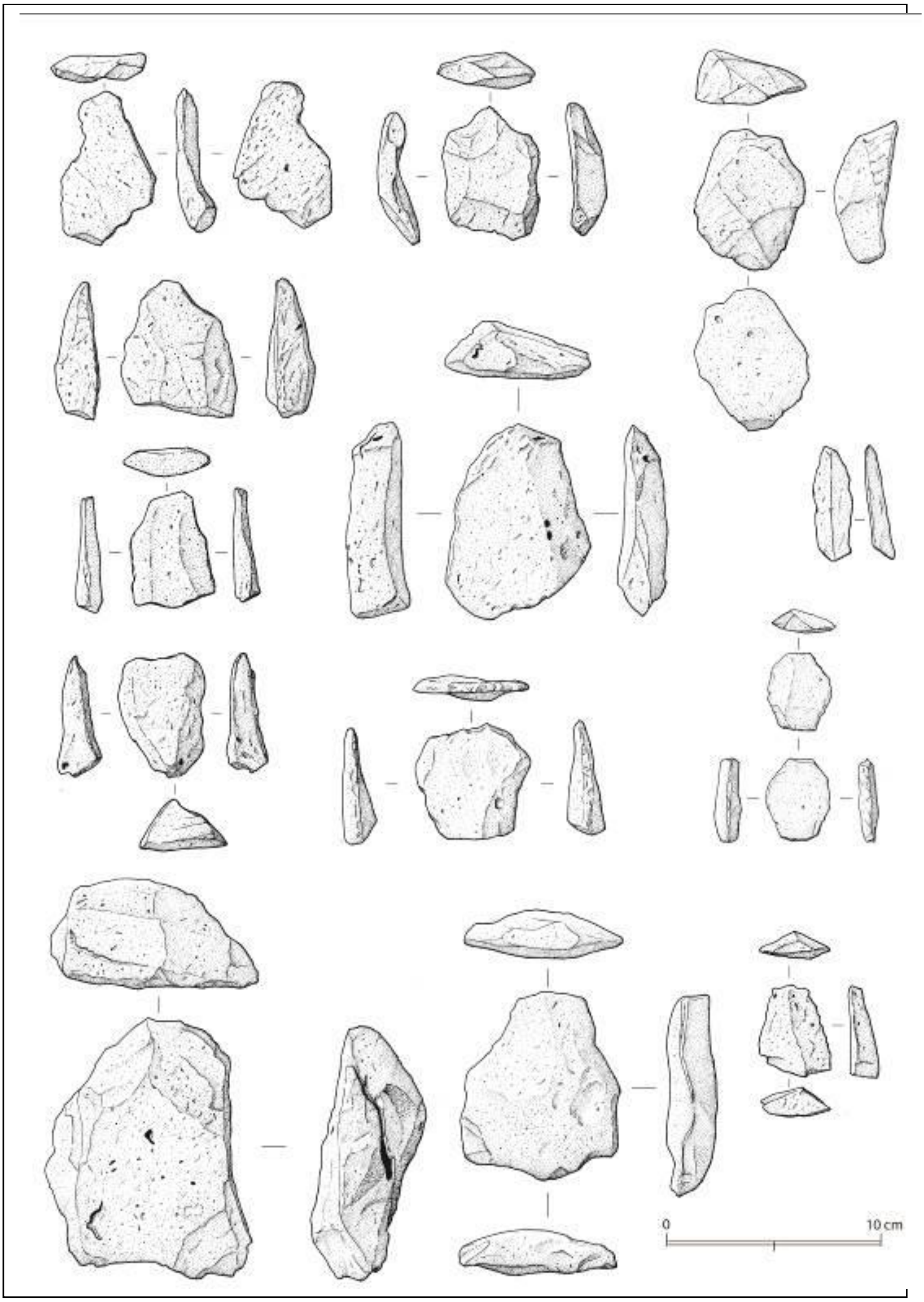

Figure 8 Drawings of Middle Palaeolithic artefacts made on basaltic lava and found on the surface of the elevated coral terrace at Al Birk, including flakes shown in Figure 7. Drawn by Mark Hoyle.

Figure 9. Photographs of bifacially worked flake of basaltic lava found on the surface at Al Birk. Left-hand image shows the dorsal surface. Right-hand image shows the ventral surface. The stepped longitudinal flake scar forming the point of the flake is clearly visible on the right, and visible in profile on the right hand edge of the dorsal surface in the left hand image. Scale in centimetres. Photo by G. Bailey.

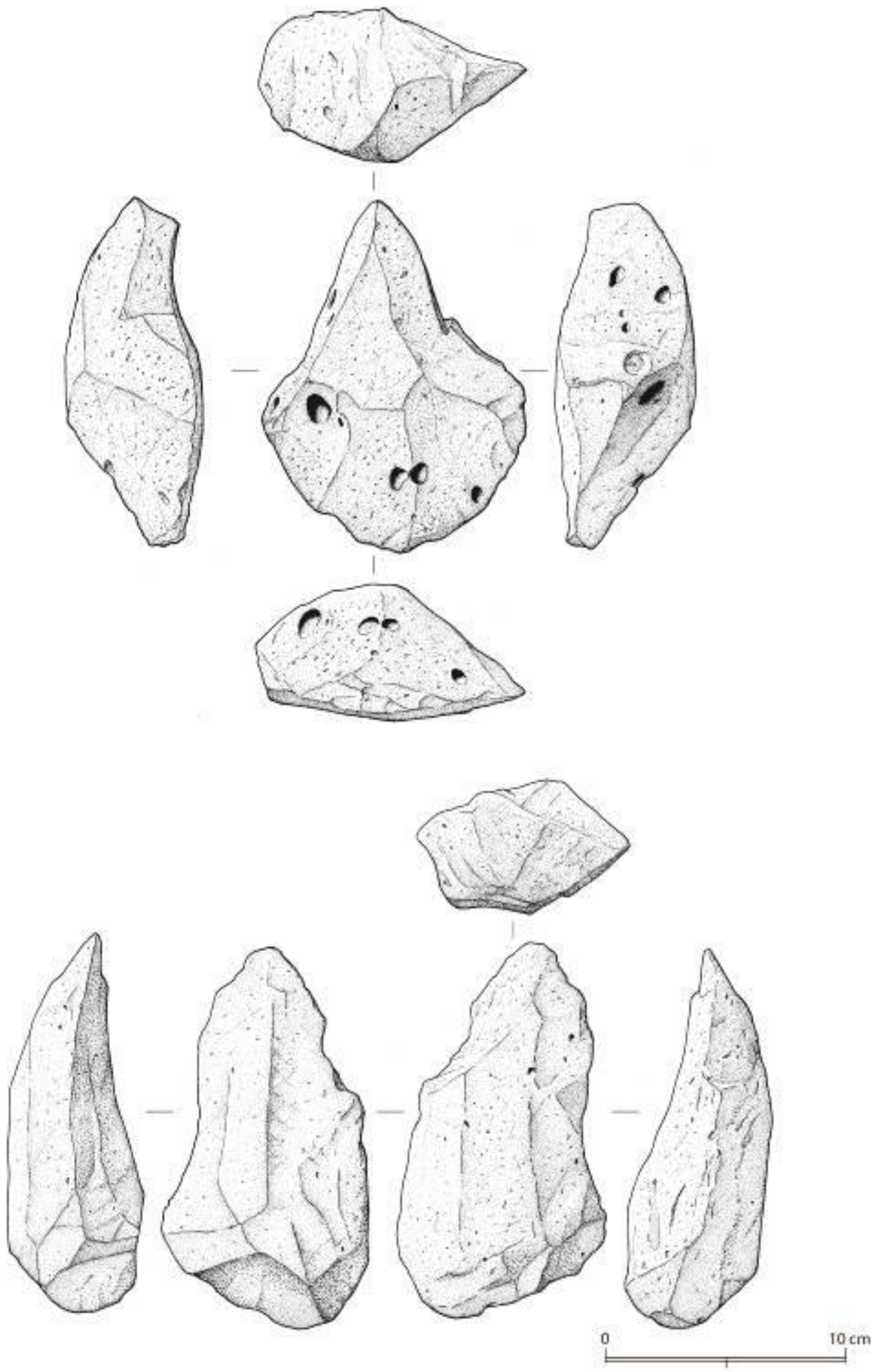

Figure 10. Drawings of bifacially worked flakes of basaltic lava found on the surface at Al Birk. The upper artefact is the specimen shown in Figure 9. Drawn by Mark Hoyle.

Figure 11. General view of shell midden north of the town of al Birk, 2004. Photo by G. Bailey, March 2004.

Figure 12. Close up of shells and basalt artefacts on surface of Al Birk shell midden. Photo by G. Bailey, March 2004.

Figure 13. Close up of coins and potsherds at the pilgrimage site of Mogesher Balahsbah, north of Qunfudah, 2004. The blue pen is for scale. Photo by G. Bailey, March 2004.

Figure 14. View of recently formed shell mounds at Sahel Mogesher on the coastline north of Qunfudah, looking northwards. The sites were in use about 40 years before the photograph was taken. The dominant shell species is *Strombus tricornis*. There are four main mounds, each about 10m in diameter and 1m thick. Each forms a U-shaped mound with an opening to the south. According to local information, the fresh shells were left in the open sun to kill the animal and release the meat from the shell. The meat was used as bait for fishing, or dried and eaten elsewhere or traded to Jeddah. Photo by G. Bailey, March 2004.

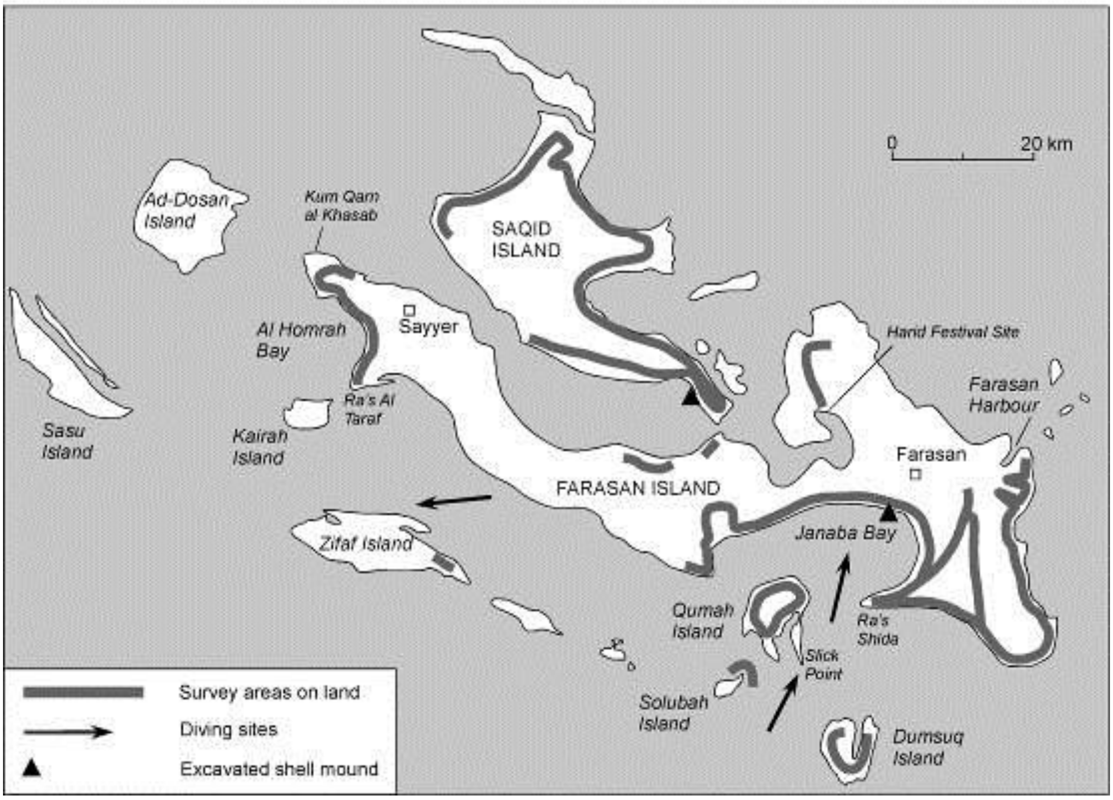

Figure 15. Map of the Farasan Islands, showing areas of survey on land and under water, and other places mentioned in the text. Farasan Island is also known as Farasan al Kabir. Drawn by G. Bailey.

Figure 16. Coastline on the east side of Janaba Bay, looking north, showing large shell mound in foreground and extensive infilling of sandy sediments beyond. To the right is a line of shell mounds located on the former shoreline, which is now some distance inland from the present-day shoreline. Arrows indicate selected shell mounds. Photo by G. Bailey, May 2006.

Figure 17. Shell mounds on a former shoreline in West Janaba, looking south. The shell mounds are sitting on the edge of a coral platform that has been undercut by marine action, clearly visible in the centre of the picture. To the left is a shallow bay that has now filled with sand, and the sea and the modern shoreline are clearly visible in the far distance. Photo by A. Al Zahrani, May 2006. .

Figure 18. Google Earth image showing older raised coral terraces on the Northwest coast of Farasan al Kabir.

Figure 19. Bird trap on Qumah Island. Photo by G.C.P. King, 2004.

Figure 20. View of landscape north of Farasan town, showing vegetation clustered along the edge of fissures in the coral bedrock, where roots can easily reach subsurface water. Photo by G. Bailey, March 2008.

Figure 21. Shell mound in Janaba Bay East showing location of mound directly above a deeply notched coral terrace. Photo by G. Momber, May 2006.

Figure 22. Shell mound in East Farasan, showing how the surface that extends behind the mound grades gently into a sandy deposit in front of the mound with no clear line of demarcation marking the position of the original shoreline. Photo by A. Sinclair, May 2006

Figure 23. Shell scatter situated inland of shell mounds in Janaba Bay East. Photo by G. Bailey, May 2006.

Figure 24. General view of the Janaba 4 shell mound, looking south. Photo by G. Bailey, May 2006.

Figure 25. Shell mound on Saqid island showing 50cm-widestep trench after excavation. The mound is 3m high. Photo by G. Bailey, May 2006.

Figure 26. View of Janaba 4 excavation, looking north. Scale shows 10 cm subdivisions. Photo by G. Bailey, May 2006.

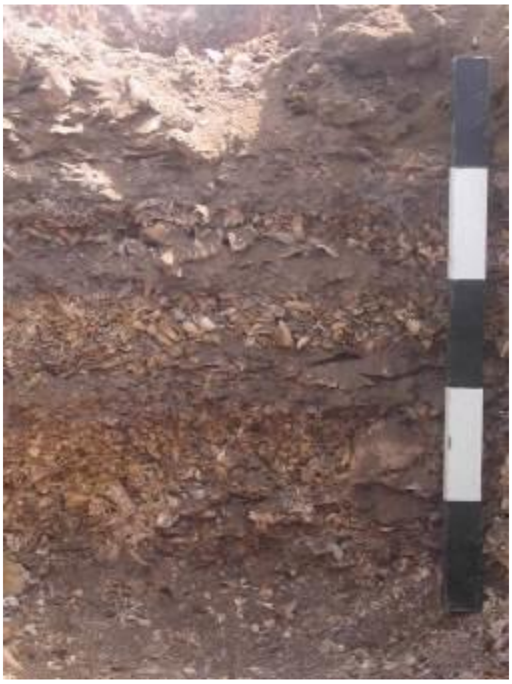

Figure 27. Close up of section of the Janaba 4 excavation trench. Photo by G. Bailey, May 2006.

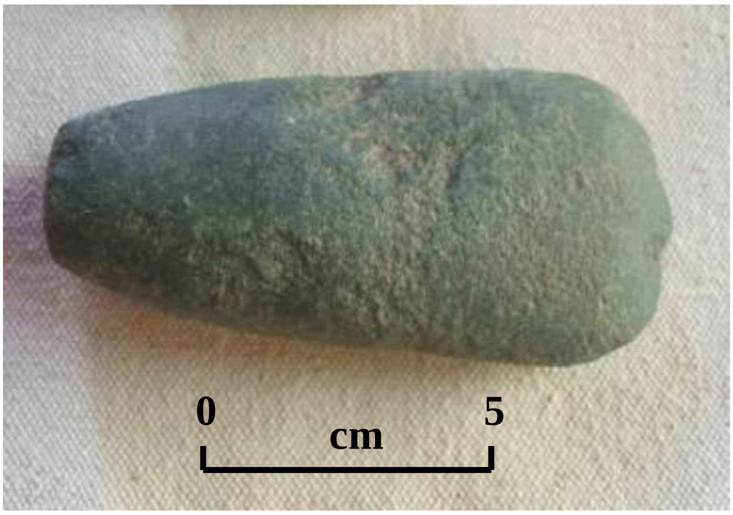

Figure 28. Ground stone axe from shell mound surface on Farasan Island. Photo by G. Bailey, May 2006.

Figure 29. MV Midyan off Qumah Island. Photo by G. Momber, May 2006.

Figure 30. Slick Point from the east. The white line indicates the approximate position of a stratigraphic break which continues underwater as a wave cut platform, and which has been tilted by subsequent tectonic uplift. An equivalent feature has been identified at a lower level, from a depth of 9.6m below sea level, recorded to a depth of 20m in a north–south direction, believed to relate to a period when sea level was 20m below present. Photo by G. Momber, May 2006.

Figure 31. Measuring underwater geomorphological features below Slick Point. Photo by T. Jenkins, May 2006

Figure 32. Diver collecting a sample from a wave cut platform in 16m depth of water. Photo by T. Jenkins, May 2006.

Figure 33. Diver removing rock sample from wave cut terrace 10m below sea level at Slick Point. The undercut and overhang (which can be seen in the top right) was formed by the sea when it was at the level with the lower terrace. Photo by T. Jenkins, May 2006.

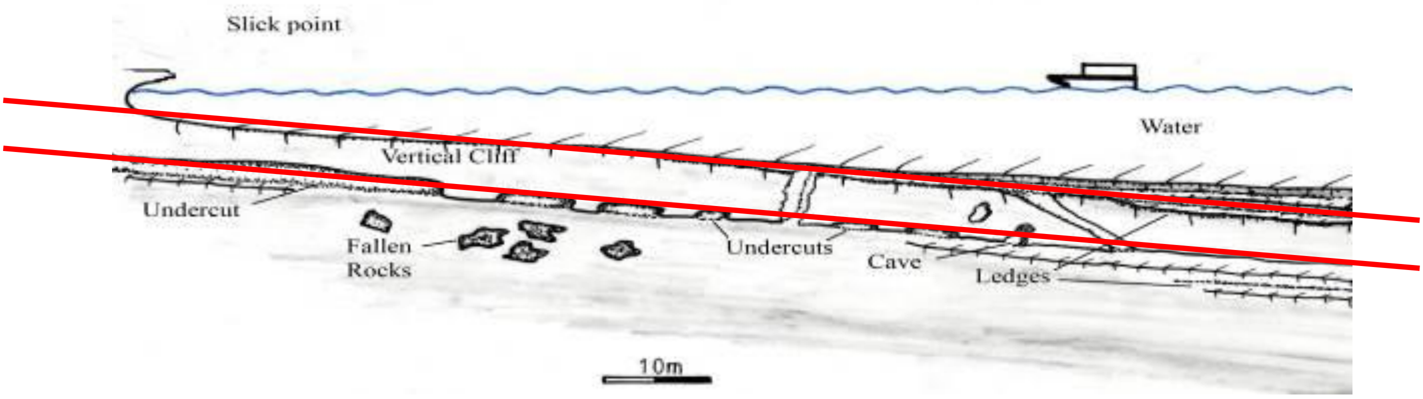

Figure 34. Plan of submerged cliff, terraces and wave cut notches off Slick Point. The laterally consistent linear features are clearly indicated with red lines. Extrapolation of the upper wave cut platform carries the notch above the sea level about 90m north of Slick Point (see Figure 30). Drawn by G. Momber.

Figure 35. Solution/wave undercut in Qumah Bay, representing a now-submerged palaeoshorelin. Photo by T. Jenkins, May 2006.

Figure 36. Wave cut notch located below Slick Point. It lies in 11m of water and stands over 3m high. Photo by T. Jenkins, May 2006.

Figure 37. Wave cut notch in Qumah Bay, of similar proportion and dimensions to that discovered under water. It should be noted that a large number of the overhangs support shell middens on their roofs. Photo by G. Momber, May 2006.

Figure 38. Sandy beach at the mouth of the main inlet on Domsok Island. The beach shelves steeply under water limiting the area of shallow water suitable for exploitation. Photo by M. Pratt, May 2006.

Figure 39. The craggy hills on the east coast of Zufaf Island reach down to the water's edge. Photo by H. Sjoeholm, May 2006.

Figure 40. Trimix gas diver inspecting sandy seabed on possible wave cut terrace in 60m of water. Photo by G. Momber, May 2006.

Figure 41. Trimix diver recording depth of wave cut platform in 6m of water off Doewa Reef, Zufaf, following 60m inspection dive. Photo by S. Maycock, May 2006.