Coastal archaeology in the Farasan Islands:
report on the 2008 fieldwork of the joint Saudi-UK Southern Red Sea Project

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Fieldwork Objectives
In this report we describe the fieldwork undertaken in the Farasan Islands during March 2008, with an outline of key results and a preliminary assessment of their significance. This work builds on the first season's fieldwork undertaken in 2006 (Bailey et al. 2007a, 2007b, Bailey et al., this volume and covers survey and excavation on land, and offshore exploration of the submerged landscape in inshore waters at depths down to about 20m. Our primary objectives in 2008 were to:

- Continue the systematic survey, location, mapping and description of the numerous shell mounds located in 2006
- Undertake excavation of selected shell mounds to obtain a better picture of their chronology, mode of formation and cultural contents
- Conduct geoarchaeological observations of the coastal environments associated with the shell mounds to clarify the relationship between the history of the shell mounds and the dynamic changes in local shoreline environments in recent millennia
- Survey more extensively the hinterlands of the Islands for evidence of archaeological sites and materials, with particular emphasis on prehistoric lithic and ceramic material
- Explore the underwater landscape by diving in order to extend knowledge of underwater geological conditions and likely locations for the preservation of the ancient landscape and archaeology formed when sea levels were lower than the present

We discuss the fieldwork methods and results under three headings: (1) shell mound survey, geoarchaeology and excavation; (2) hinterland survey; (3) underwater survey.

Shell mounds: survey, geoarchaeological context and excavation
In 2006, we established the extraordinary abundance of shell mounds and shell sites distributed throughout the islands, particularly on the main Islands, Farasan al Kabir, Saqid and Qumah, and began a programme of systematic investigation. In 2008 this programme was extended with new surveys and excavation of selected sites.

Survey aims and methods
The ultimate aim of the shell mound survey is to locate and describe all the surviving shell mounds on the Islands, and the particular objective this year was to provide more accurate and complete records of some of the areas visited in 2006, to examine areas not previously visited, and to provide more detailed information on the relationship between shell mounds of different types, and on variations in the physical topography and geology of the associated shorelines. This year we continued the survey with the use of satellite imagery and more accurate global positioning data. Many of the larger shell sites are easily visible on satellite images, and we used SPOT and Google Earth images to aid in the location of sites and the identification of areas to be surveyed, and GPS measurements to record the location of individual site locations. The general distribution of shell mounds is shown in Figure 1, together with other areas surveyed (Figure 1).

As in 2006, sites are described according to a systematic recording system, in which each site has a letter prefix describing the geographical sector, followed by a unique four-digit number. The sequences of numbers assigned to each sector are non-overlapping in order to avoid ambiguities. The main sectors are JE (Janaba East), JW (Janaba West), Khur Maadi (KM), Qumah Bay (QB), North Farasan (NF), East Farasan (EF), Saqid North (SN), and Saqid South (SS). Finds bagged and retained for later study or analysis include the year prefix, F08, indicating a Farasan find for the year 2008. In total, 93 surface or sub-surface samples were recovered from surveyed shell mounds. Most of these are small samples of shell taken for purposes of dating or shell identification, together with occasional finds of artefacts found on mound surfaces. For the hinterland survey, 83 locations generated samples of cultural material, mostly worked stone or ceramics. Most of these samples involve small quantities of material (<20 specimens), and some comprise only a single specimen. All artefacts have been placed in the care of the Museum authorities in Gizan.

Sites were located on satellite images and inspected at close hand by vehicle and on foot. Observations include description of shell species present, other surface features of note, estimates of mound size, and collection of samples as appropriate. Estimates of smaller deposits were made by eye and by pacing out the main dimensions. Larger mounds were additionally measured using differential GPS. The differential GPS uses local coastguard beacon signals to plot a position with up to 10cm accuracy. By taking multiple GPS readings along a 'track', it is possible to obtain rapid high resolution data for the dimensions of a mound. We use the term 'shell midden' to refer to any concentrated deposit of shells that has been collected and accumulated by human shellgatherers. For purposes of descriptive recording of large numbers of sites we classify shell middens into one of three categories:

1. Scatters. These are concentrations of shells that appear to be little more than the thickness of one or a few shells and show no evidence of forming a deposit that rises significantly above the level of the surrounding surface. Scatters typically fall in the size range of 5 to 10 m in diameter and are usually roughly circular or oval in plan, though they may sometimes be more extensive
2. Low mounds. These are mounded deposits that are less than 1 m thick but with more depth of deposit than that implied by a scatter. Typically the depth of deposit is estimated to be about 0.5 m.
3. Mounds. These are deposits that are estimated to be at least 1 m thick.

These are, of course, arbitrary subdivisions and there is probably some overlap, especially between scatters and low mounds, which are difficult to tell apart in some cases without excavation, test-pitting or augering to establish the true depth of deposit. Some deposits turned out to have thicker deposits after test pitting than appeared to be the case on first inspection. Thus some of the 'scatters' as defined above and recorded during surface survey may in fact be low mounds. In total, we systematically recorded 767 shell mounds, 467 by a single GPS point (accurate to 10–30 cm) and 300 by differential GPS survey. We concentrated our most detailed survey work in the Janaba and Khur Maadi sectors of Farasan Island, on the east side of Farasan Island and around the southern bays of Qumah Island. Elsewhere we recorded only GPS point locations for shell mounds and more summary descriptive information, notably on the southern side and western end of Saqid Island. This survey work supplements the shell mound surveys undertaken in 2006 and in some sectors provides more accurate and more detailed information than that obtained previously.

A brief comment should be addressed here to the question of whether any of the shell midden deposits we have examined are piles of dead shells accumulated by natural agency rather than by human action. The description of the Farasan shell mounds in the geological literature as 'shell banks' (e.g. Jado & Zötl, 1994) carries the implication that the shells are natural beach deposits, and the hypothesis of natural accumulation is frequently proposed for shell mounds in other parts of the world, usually in the belief that the quantities of shells are just too large to be accounted for by human shellgathering activities. These issues have been exhaustively discussed elsewhere (e.g. Bailey et al., 1994), and the criteria for distinguishing natural and artificial deposits of shell are well understood and can usually be applied in the field without ambiguity.

In brief, natural shell banks typically take the form of linear features, usually in association with thick or extensive sediments of marine sand, show clear evidence of water action in the form of erosion of shell surfaces and rounding of broken edges, high proportions of fragmented shell 'shingle', a wide range of shell sizes and ages typical of a natural death assemblage, and often a wide and non-selective range of mollusc species. Humic sediments or cultural materials such as artefacts, animal bones and ash layers, typical of human activity, are rare or absent. In the Farasan Islands, there is no known natural process that would account for the presence of neatly mounded and discrete shell deposits comprising edible-sized molluscs. Most of these deposits including the large mounds are located on a land surface of fossilised coral that forms the predominant bedrock on land, and show no evidence whatsoever of marine sediments or water action in the immediate vicinity. Many mounds, as discussed below, are discrete deposits of shell located some distance inland from the shoreline on the coral bedrock. Excavations, detailed below, also demonstrate the presence of a variety of indications of human activity. As for the large quantities of shell, detailed measurements on similar concentrations of shell mounds in other parts of the world demonstrate that even quite small human communities can generate huge quantities of discarded shells during the course of day-to-day subsistence activities extended over periods of hundreds of years. Moreover, once the time span of shell midden deposits and the likely size of the resident human population are taken into account, the amount of food represented by the discarded shells is not sufficient to support all the food needs of the human group, and indeed represents only a relatively small proportion of the total food intake, just one of a range of food resources that supported the overall subsistence economy (Meehan, 1992; Bailey, 1975; Bailey et al., 1994).

Detailed measurements of this type are yet to be carried out on the Farasan shell deposits, and will not be possible until we have a more extensive chronology for the sites, but there is no reason to suppose that the results will differ substantially from those obtained in other parts of the world.

Survey results

The great majority of the mounds are distributed in a linear fashion along the shoreline, typically on the edge of an older fossilised coral platform that forms the present-day land surface, and which has been undercut by chemical and physical erosion of seawater at the shore edge to form a distinctive overhang. The largest mounds and the largest concentrations of mounds are found on shorelines close to large shallow embayments, which would have offered extensive habitat for large numbers of intertidal molluscs. On open rocky shorelines, where the extent of the mollusc habitat was presumably much less, only low mounds or scatters are present.

As noted in the 2006 survey (Bailey et al. this volume) these larger mounds that are present on the shoreline are often complemented by smaller mounds or shell scatters located up to several hundred metres inland, and sometimes at other points along the shoreline. Often this combination of shoreline and inland mounds and scatters takes the form of discrete clusters of sites, with one or more mounds forming the focus of the cluster, suggesting that each cluster represents a coherent settlement system involving the use of different locations for different activities, perhaps at different times of year, by the same group of people. On this interpretation the shell mounds might have been used as short term sites for the processing of large numbers of shellfish close to the source of supply during periods when conditions were especially favourable for shellgathering, while the sites further inland might represent the main areas of habitation, better suited to a range of local factors, which might include better shelter from the weather than that available on the immediate shoreline, or better access to other resources such as water supplies and terrestrial plants and animals. It is even possible that the shell mounds were reserved for use at certain times of year associated with the gathering together of people from a wider territory for ceremonies and feasting, with intensification of shellgathering to feed the larger numbers of people present on such occasions, much in the manner described for the Anbarra people of northern Australia (Meehan 1982). People might thus have moved to and fro between different sites in response to a variety of practical and social factors.

An alternative possibility is that the mounds and the inland scatters refer to two or more different settlement strategies belonging to different time periods in the overall sequence of occupation of the Islands. On this interpretation, the mounds might represent an earlier period when settlement was focussed on the shoreline and on marine activities including intensive collection of molluscs, and the inland scatters might refer to a later period with a more diversified pattern of settlement and economy including more emphasis on hinterland as well as marine resources and less emphasis on the collection of shellfish.

The fact that potsherds are often present on these inland shell scatters but almost never in association with the shell mounds might be seen to support this idea of a chronological separation between a 'pre-ceramic' and a 'ceramic' phase of settlement on the Islands. However, the absence of potsherds on the shell mounds might equally well be due to the different nature of the activities carried out there compared to the inland locations, and does not necessarily have chronological implications. Only a systematic programme of dating will help to discriminate between these alternative hypotheses.

Geoarchaeological context

A striking pattern in the overall distribution of shell mound distributions is that the largest mounds and the largest concentrations of mounds are found in association with extensive, shallow bays, many of which are now silted up. These shallow bays must originally have been shallow marine and intertidal inlets with extensive sand flats and coral reefs capable of supporting very large numbers of molluscs. Now they are filled with more recent deposits of sand, and the original undercut shoreline and its associated mounds are up to a kilometre or more inland from the present day shoreline. This is the result either of accumulation of marine sand by longshore drift and progradation of the shoreline, or of tectonic uplift of the land surface. Given the history of tectonic movements associated with salt doming, the latter process is quite likely to be involved in some if not all cases. Some of the most dramatic examples of this effect are to be found in Janaba West, in the Southeastern sector of Janaba East, in the central sectors of Khur Maadi and Saqid Island, and on the south side of Qumah Island. In certain areas, recent tectonic effects are clearly visible in the tilting, warping or displacement of the original shoreline, especially on Qumah.

A more detailed insight into these factors is offered by the site groupings in the centre of Farasan al Kabir on the Khur Maadi and Janaba West shorelines, which are opposite each other in the central part of the Island (Figure 2). On both sides of the Island there are deep embayments that are now filled in with sand, leaving a fossil shoreline in the form of a low undercut coral cliff to mark the original position of the sea shore. Large numbers of shell mounds are distributed along this ancient shoreline, and many of these are big mounds, especially on the west side of the Janaba West Bay, where there are some 40 discrete shell mounds forming an almost continuous line of sites. These sites are easily visible on satellite images and similar concentrations are visible on the east side of the Janaba West Bay and on both the western and eastern sides of the infilled Khur Maadi Bay. In both areas smaller mounds or shell scatters are present somewhat inland of the shoreline representing site clusters as discussed above.

In addition it is possible to identify small clusters of shell scatters and small shell mounds situated between the two bays of Khur Maadi and Janaba West, as if there was once a continuous marine channel connecting the two opposite shorelines, which divided Farasan al Kabir into two islands separated by a narrow stretch of shallow water. Satellite images show fault lines in this area, suggesting that uplift has occurred and that this is the main reason for the closing of this narrow strait. This process has probably contributed to the infilling of the adjacent bays, either because of increased run off from land or because the closing of the channel cut off the flow of water that previously helped to keep the bays clear of sediment. A similar process of infilling is visible in the eastern part of the Farasan al Kabir, which appears once to have had a narrow inlet extending inland from the present-day port of Farasan in the north, and a similar shallow inlet extending inland from the coastline in the south between R'as Shida and Ra's Abrah. It is possible though not certain that these inlets were connected, forming a single, continuous, shallow sea channel. At any rate, these inlets are now filled in and form sandy corridors flanked by fossil shorelines with shell middens on them.

During the course of survey a number of sedimentary basins were noted and three of these were sampled in detail to provide a sequence of soil and sediment samples that might throw light on changes in coastal geomorphology and palaeoenvironmental changes more generally (see Figure 1 and Figure 2 for locations). Two of these locations are in the infilled shallow bays adjacent to the major shell mound clusters at Khur Maadi and in Janaba West respectively. They comprise small oases with date palms where water-laid deposits have accumulated to provide a stratified sequence of sediments recording the transition from marine to terrestrial conditions. These offer the opportunity to date the sequence of events associated with the infilling of these large shallow bays and their transformation from productive marine bays full of marine molluscs to dry land. In both areas eroded sections in the deepest part of the infilled sediments were exposed, and these were cleaned back and a series of samples was removed in stratigraphic sequence through the full depth of the sedimentary sequence.

At Khur Maadi (KM1367) a 1.5m deep section was exposed to the bedrock and revealed a sequence of sediments comprised mainly of sand but with two layers of organic silt. At the base of this sequence were large numbers of *Strombus fasciatus*, the small gastropod that forms the dominant species in the shell mounds (see below). Here the shells represent a natural death assemblage, and a radiocarbon date was obtained on one of the shells (Table 2). Allowing for correction and calibration (discussed in greater detail below in relation to the radiocarbon dates from the excavation of the shell mounds), the date at the base of this sequence is 1375 cal BC. The implication of this date is that this part of the bay was still home to marine shellfish at that time but that the process of progressive infill and drying out of the bay took place some time after that date. This is an important date when considering the chronology of the shell mounds located around the original shoreline of this bay.

A third sequence of soil samples was recovered from Homer at the eastern end of Farasan Island, a shallow depression inland from the shoreline and at higher elevation. Analysis and dating of soils, sediments, shells and other organic materials from all these locations will provide palaeoenvironmental information to relate the history of mound formation to the geomorphological and palaeoecological evolution of the adjacent shoreline.

Excavation

Excavation of shell mounds is a notoriously labour intensive process, which can generate large quantities of material in need of careful sorting and analysis even from quite small excavation trenches. With such a large number of sites at our disposal (over 1000), the question of excavation poses formidable challenges of sampling.

Site selection

As a first step, we decided this season to concentrate our efforts on two major clusters of mounds, with excavation of the major mound within each cluster and more limited test excavations of smaller shell deposits in the near vicinity within each cluster. We have chosen two such clusters for detailed examination, each in a contrasting location, one in Janaba Bay (Janaba East) and the other in Khur Maadi Bay (Khur Maadi) (Figure 1). In each cluster we have selected one of the larger mounds for detailed excavation, with more limited test pitting of some of the smaller adjacent mounds. The two areas have contrasting coastal settings. The Janaba East group of sites comprises 8 small mounds spaced out along the present-day shoreline, located on an open coastline, dominated by a 2–3m high fossilised terrace that has been undercut by marine erosion (Figure 7). The Khur Maadi group is situated on a low undercut coral terrace about 1m high on the inner edge of a large shallow bay now dry and filled with sand, with a number of low mounds and clusters at varying distances inland from the shoreline (Figure 13). The total number of individual mounds and scatter in this cluster is 112. The different settings of these two clusters of sites should highlight the influence of local ecological variations on shell mound formation as well as the long-term impact of tectonic movements.

The choice of sites was further determined by considerations of easy access and because of evidence of actual damage or the potential threat of such damage. The Janaba Bay cluster is close to harbour and industrial facilities where the risk of future damage is high both from industrial development and from natural erosion. The largest mound in this group (JE0004) is a low intact mound c. 2m high, and it is located on the edge of an old coral terrace which has been deeply undercut by marine erosion (Figure 3). Part of the overhang has already collapsed immediately in front of the mound. Continued erosion will eventually result in the collapse of the mound, or part of it, into the sea, and some deposit from around the seaward edge of the present mound may already have been lost in this way. This mound was sampled with a narrow test trench in 2006, and this trench was widened and extended to provide a transverse section across the full width of the mound in 2008 (Figure 4). The aim of the excavation was to examine the full depth and stratigraphy of the mound, to reconstruct the chronology and pattern of mound formation, and to recover detailed samples of artefacts, shells, animal bone and other cultural material. Excavation will resume in 2009 to extend the investigation.

In the Khur Maadi cluster, we selected one of the largest shell mounds in this group for excavation (KM 1057) because it is a tall mound and was already partially damaged by bulldozing activity, offering the opportunity to clean back to a vertical section and obtain samples through the full stratigraphic sequence without the need for extensive excavation (Figure 5).

Excavation strategy and methods

At JE0004 our main objectives were to establish a continuous section through the mound across its full width on a shore-to-hinterland axis and from the top to the base at its thickest point, in order to give an insight into overall mound stratigraphy and processes of formation, and to use the section as a known starting point from which to excavate in selected areas to provide samples of well-provenanced shells and other materials. We re-opened the step trenches excavated on the south side of the mound in 2006, and opened up a new trench with the aid of a mechanical digging machine to expose a section through the northern half of the mound.

The rationale for this approach is based on the fact that reading stratigraphy in shell middens is very difficult to achieve when coming down on top of deposits during the course of excavation, especially in small trenches. Also, unconsolidated midden deposits are vulnerable to slumping and collapse. Quite large trenches have to be dug even to expose relatively shallow sections no more than 1–2m high. Step trenches can be used to mitigate these effects, as in the 2006 excavation, but the resulting sections give only an incomplete window into the stratigraphy. They also fail to capture lateral variations in the composition of particular layers, which may be a very significant variable in understanding processes of shell mound formation. Moreover, there is no a priori guarantee that the basal deposits immediately above bedrock at the outer edge of a mound are necessarily the earliest deposits in the sequence. A mound can grow outwards over time as well as upwards, with the result that the basal deposits at the edge of a mound may be quite late in the overall sequence.

Another factor that guided our excavation strategy is the extremely time-consuming nature of excavation and post-excavation analysis involved in processing even small volumes of shell-midden deposit. A trench at least one or two metres wide would be required to expose safely a vertical section up to two metres in height through loosely consolidated shell deposits. A hand-excavated trench of this width excavated through the mound at its narrowest point – about 20m – would represent a total volume of excavated deposit of, say $30m^3$, and require many years of labour-intensive activity to excavate and process, even with ruthless sampling of deposits for detailed processing and consequent discard of the remainder. A machine-excavated trench necessarily destroys much of the information obtainable from the deposit so removed. But it is better to sacrifice a small amount of deposit in a large mound in this way in order to provide a clean section from which complete and stratigraphically well-provenanced bulk samples of any desired volume can be removed, than to spend the many years of excavation and post-excavation analysis that would be required to hand-excavate a large hole, only to end up, in any case, with poorly provenanced samples of variable integrity and completeness.

With these factors in mind, we used a mechanical digging machine to open up a trench measuring about 10m x 2m in the northern half of the mound, aligned on the same axis as the 2006 step trench. As expected, the deposits turned out to be quite loose and unstable, and we stopped the digger and continued clearance of the trench by hand, using progressively more careful techniques and smaller tools to approximate a vertical section along the desired horizontal axis.

We established a new metre-square grid with its central north-south axis aligned slightly west of north at 339 degrees to align it with the trenches opened in 2006. Each square has a number and letter. Gridlines on the x axis are lettered from west to east, and gridlines on the y axis, north to south, are numbered. Each metre square is labelled according to the gridlines intersecting in the northwest corner, resulting in a unique letter-number identifier for each metre square. Each square is further subdivided into four 50cm x 50cm quadrants to facilitate excavation and provenancing of material, and these are labelled A B, C, D, beginning in the northwest corner and working from left to right. Vertical sections are labelled according to the adjacent quadrants and the direction in which they are facing. The main section through the mound is a west-facing section aligned on gridline G (Figure 4).

Excavation at JE0004 proceeded according to stratigraphically discernible layers defined by changes in shell and ash composition or sediment colour, with a local sequence of numbers to identify layers within their respective quadrants and squares. Where undifferentiated stratigraphic units appeared to be particularly thick, these were subdivided into arbitrary layers of 5 cm or 10 cm thickness. Samples of shell or charcoal for radiocarbon dating were removed directly from the exposed sections, after measuring and photography, in order to ensure stratigraphic integrity and to minimise contamination or use of materials that had been displaced during excavation (Figure 6).

Initially, all shell deposits recovered from each stratigraphic layer were sorted in situ by using hand held sieves with 2mm and 1mm mesh to remove the larger fraction of shell debris and facilitate sorting of small material such as fish bones. Samples of sediment and shell retained by the 1mm sieve, and sediment passing through the 1mm sieve, were retained and bagged separately for later analysis. A bulk sample of shells (c. 1–2 kg) was also bagged from each layer after sieving in the above manner and retained for later analysis. For subsequent layers we took a 1–2 kg bulk sample from the unsieved deposit, that is a sample of everything including shells, sediment and other materials, and strewed the rest of the material on a large plastic sheet placed next to the mound in order to search for rare items such as artefacts and animal bone. Subsequently, we bagged all material in large bags (15–20 kg in weight) and transferred these to a compound in Farasan town with running water where we could experiment in a more systematic way with sieving methods including water sieving.

After experimenting with several different methods, we found that the most efficient technique was limited dry sieving to remove the largest shells or other items, and sorting of the remaining dry material on a plastic sheet. Wet sieving was found to add no significant advantage in sorting and identification of small specimens such as the spines and vertebrae of small fish, but simply imposed the additional disadvantage of slowing down the process while the material was allowed to dry. Dry sieving through a 2mm mesh was also found to offer no advantage in the separation of shell fragments from rare finds. Bulk shell samples (1–2 kg) and smaller samples of sediment were retained from most layers.

Three small mounds (JE0001, JE0002 and JE0003) extending over a distance of about 100 metres to the east of the main mound were also test pitted (Figure 7). Sections were drawn and bulk samples (1–2 kg) were retained from stratigraphically distinct layers. Samples of shell or charcoal for dating were recorded and collected from the exposed sections in the same way as at JE0004 (Figures 8–10).

At KM 1057, the damaged part of the mound was cleaned back to a vertical section about 1m wide and 3m tall through the highest part of the mound (Figures 11 and 12). Because the shell deposit is quite loosely packed and liable to collapse, the section was cleaned in stages beginning from the top of the mound. Each stage was cleaned through a depth of about 50 cm to provide a vertical section and then photographed and sampled. The next section down was stepped out by 10–20 cm, so that any collapse of shell from the upper section would be retained by the step. Bulk samples of shell (each sample comprising a bag of about 1–2kg in weight) were collected from successive stratigraphic levels, at approximately 10 cm intervals, following stratigraphic layers where discernible or otherwise at arbitrary 10 cm levels. Smaller samples of shell for dating purposes were recorded and collected from the exposed sections as with the Janaba sites. Sites in the immediate vicinity were test pitted (Figure 13), with the drawing of sections and collection and retention of bulk samples and dating samples in the same way as with the Janaba mounds (Figures 14–16).

The excavation work at all sites resulted in the recovery of 108 bulk samples, 186 dating samples, 32 sieve residues, and 22 samples of small finds (fish bones, artefacts etc.). A majority of these were freighted back to the UK for more detailed study in the York laboratories, with the exception of the small number of artefacts recovered from excavation, which have been placed with the Museum authorities in Gizan.

Stratigraphy and dating

The main mound at Janaba is c. 20m in diameter, and 1.5m deep in the centre. The combined north and south trenches exposed a continuous section through the mound along a north-south axis (Figure 6). In the northern half of the trench, excavation reached to bedrock, while the steps excavated into the southern trench in 2006 were extend and deepened to a depth of 0.5m and have not yet reached bedrock except at the shallow southernmost edge of the mound. Nevertheless, some distinctive patterns in site formation are clearly apparent. There is a clear overall stratigraphic sequence of deposits but with a complex pattern of lenses, interleaving layers of different deposits and considerable lateral variation within particular stratigraphic horizons. This pattern of variation is largely determined by variations in the activities carried out in different parts of the mound and variations in the shell and ash composition of the different deposits. On the southerly, seaward facing side of the mound stratigraphically distinguishable deposits form relatively thin layers, 2–5 cm in thickness, consisting of alternating shell and shell mixed with ash, often in a grey-brown or red-brown sedimentary matrix. The shells are predominantly *Strombus fasciatus*, a small gastropod 2–3cm long, with occasional lenses of larger shells of other species. *S. fasciatus* is the dominant species in the mound and indeed the dominant species in very nearly all the mounds we have recorded. The relatively high quantities of ash, small shells and shell fragments suggest that this area of the mound was a processing and living area where camp fires were placed and food prepared. In the northern part of the mound, by contrast, the layers are thicker, and show an alternation between layers dominated by *S. fasciatus* and layers dominated by larger shell species, particularly the large, bulbous gastropods *Pleuroploca sp* and *Chicoreus sp*, the largest of which can exceed 10 cm in length, and the large bivalve *Spondylus marisrubri*. Other species are present in this area, often highly fragmented, and there are pockets of ashy material. The large shells appear to have accumulated relatively rapidly with voids between the shells to form quite steeply sloping layers. This pattern suggests a dump behind the main processing area at the front of the site, where larger shells were thrown away together with deposits of smaller shells, shell fragments and ash, periodically cleared out from the activity area.

At present we have only two radiocarbon dates from the site (Table 1), from the top and base of the sequence so far exposed (Figure 6). The date from the basal sample of the Janaba sequence appears to be slightly younger than the date near the surface, although the difference is probably not statistically significant. Further corrections have to be made to both dates to account for the offset between radiocarbon years and calendar years (calibration), and for the fact that shell carbonate includes older carbon from the marine reservoir and gives dates that are older than those obtained from terrestrial carbon (see Table 1 for details). Taking the mid point of the calibrated dates gives a date of 3310 cal BC for the top of the mound, a date of 3503 cal BC for the base, and an average for the two figures of 3407 cal BC. However, given the statistical uncertainties of measurement, notably the fact that the two dates overlap at two standard deviations, the dates at top and bottom should not be taken as significantly different within the range of error of the measurements. This may indicate that the mound has accumulated relatively rapidly, perhaps over a period of no more than several hundred years and possibly much less. An alternative possibility is that the piece of charcoal from which the basal date was obtained belongs to a later phase in the deposition of the mound, but has slipped through the deposits to a lower level. Given that the composition of the mound in this area includes deposits of larger shells with voids, such a possibility cannot be ruled out. Only a larger sample of radiocarbon dates will allow a more refined estimate of the chronology and duration of the mound. For the moment the total date range at 2σ indicated by the two radiocarbon measurements is 3373–3561 cal BC, giving a mid point of 3503 cal BC.

The Khur Maadi mound shows an interesting contrast in overall composition. Here the deposits are dominated by shells of *S. fasciatus* as in the *Strombus*-dominated layers at JE0004. The *Strombus* shells are broadly similar in terms of their degree of fragmentation but are somewhat larger on average than at JE0004. The deposits have less sedimentary matrix, usually of a yellow-orange colour, and only a very small number of shells of other species. There are just two lenses of larger shells, both comprising *Chama reflexa*, one near the top of the sequence at c. 50 cm below surface and the other near the base at c. 275 cm (Figure 12). There is also very little ash material in the deposits with the exception of one layer near the top of the sequence. The total depth of the mound at its highest point is 3m and the extent of the exposed section indicates a uniform composition without the variability noted at the

Janaba mound. This suggests a relatively rapid accumulation of shells and perhaps a more specialised function of the site compared to the Janaba mound. The radiocarbon dates (Table 1), treated in the same manner as at Janaba, again indicate a date for the base of the mound, of 3020 cal BC, which is slightly younger than the date at the top of 3070 cal BC. As at Janaba, the difference between these two dates is not statistically significant, suggesting rapid accumulation within the resolution of the available radiocarbon dates, a total date range at two standard deviations of 2880–3300 cal BC, and a mid point in that range of 3090 cal BC, which is closely similar to the results from Janaba. If we take the dates at face value, they suggest a more rapid accumulation of deposits than at Janaba, but this remains to be checked against a larger sample of dates.

Of the three small mounds test pitted at Janaba, *S. fasciatus* formed the key constituent. One mound has a layer of *Chicoreus* and *Pleuroploca* shells at the base, overlain by a *Strombus*-dominated layer in an ash matrix, possibly mirroring the pattern at JE0004.

At Khur Maadi, the three small mounds test-pitted in the vicinity of the main mound were predominantly composed of *S. fasciatus*, with some shells of *Chama reflexa*. Visual inspection of surrounding mounds showed surface indications of what appear to be traces of hearth complexes lined with small blocks of coral, and these are targets for future investigation.

Marine molluscs

The mollusc species so far identified include a range of bivalve and gastropod species typical of coral reef habitats. The dominant species in both excavated sites is the small gastropod *Strombus fasciatus*, while the next most common species are the pearl oyster *Pinctada* cf. *nigra*, and *Chama reflexa* (Table 2). The large carnivorous gastropods *Chicoreus sp* and *Pleuroploca sp* are also present in some quantity at JE0004, where they often form concentrations in particular layers. Other species are present only in very small numbers. At JE0004, *S. fasciatus* accounts for an average of 60 per cent by weight of all shell in samples measured so far, with a range of 38–88 per cent. At KM1057 the average is 95 per cent with a range of 38–100 per cent. The dominance of *Strombus fasciatus* at KM1057 confirms the visual impression given by inspection of the sections that this is a more specialised site, at least as regards shellgathering activity.

S. fasciatus is generally found grazing in the shallow water of well sheltered sandy bays where the water is calm and sea grass is able to grow on the seabed. It can be found in large numbers and is easy to collect while wading in shallow water. Most of the other species are found only on hard rocky or coral surfaces, which is generally the case with the bivalve species. The gastropods can be found on both sandy and hard substrates. Some of the species can only be found at some depth and would most probably have required diving to collect them, most probably *Pinctada*, *Spondylus*, *Chicoreus* and *Pleuroploca*.

The wider range of species present at JE0004 may be due in part to sampling bias: a larger volume of material has been excavated and sorted in the laboratory and species that are absolutely rare are more likely to show up in larger samples. But the higher proportion of species other than *S. fasciatus* suggests that there is a genuine difference between the two sites. Either KM1057 was a specialised site focussed mainly on the collection of *S. fasciatus*, as noted above, and JE0004 was used for a wider range of activities, perhaps for longer periods at a time, than KM1057, or the local shoreline environment at Janaba was more varied, with less extensive areas of *S. fasciatus* habitat and a greater extent of rocky substrates underwater. Possibly both factors were at work. KM1057 is located next to what would, at the time of its accumulation, have been an extensive, shallow sandy bay. It is likely, therefore, that there were more extensive areas of productive *Strombus* habitat nearby than at Janaba Bay, and the habitats of the other species were more distant from the site. Conversely, the offshore environment adjacent to JE0004 is likely to have been more exposed to incoming waves when the site was occupied, and there is a more limited extent of shallow water (see Underwater Survey below), both factors that would have restricted the area of suitable *Strombus fasciatus* habitat in the near vicinity of the site.

Vertebrate faunal remains

These are relatively few and mainly comprise fragmentary fish bones, with one or two fragments of mammalian bone. The fish bone material is most abundant at Janaba, and comprises mostly vertebrae and spines and occasional jaw bone fragments. Most of the fish caught were small to medium in size, perhaps little more than 10cm in length, suggesting the use of nets for capture. Preliminary identifications suggest that the following are represented:

Myliobatidea, Eagle Ray
Serranidea, Groupers
Sparidea, Sea Bream
Scaridae, Parrot Fish
Chondricthyes sp., probably from the Ray family

The fact that very nearly all the fish bone comes from the Janaba excavation reinforces the impression that this site was used for a wider range of activities.

Other small finds

Artefacts are extremely rare at either site and consist of 'manuports', irregular lumps of material, made from a type of hard white-yellow limestone or fossilised coral. Most of these are from JE0004, and are formless pieces, sometimes with occasional flake scars, ranging in size from about 5 to 15 cm in length. One or two similar pieces were also recovered from the disturbed deposits at KM1057. The material from which they are made is not available in the immediate vicinity of either site, although it can be found elsewhere on the Island, and these specimens must have been brought onto the site from elsewhere, presumably for use as expedient tools for a variety of heavy duty tasks. Artefacts often occur in relatively low densities in shell middens because of the relatively rapid accumulation of the shells in comparison with other types of deposits. In this case the rarity of artefacts is compounded by the rarity on the Islands of suitable fine-grained stone materials for flaking. Only two other pieces of worked stone have been clearly identified in association with shell mounds, a piece of ground greenstone (illustrated in Bailey et al., this volume), and a flake of volcanic material found on the surface of another shell mound in the Khur Maadi area. Both artefacts were made on materials that must have been imported from the mainland.

No ceramics have so far been found at all in excavation. Ceramics are commonly present on the surface of shell scatters elsewhere on the Islands, but are notably absent from the surfaces of the larger mounds, and their absence from the excavations at Janaba and Khur Maadi reinforces the belief that these sites pre-date the introduction of ceramics to the Islands, or else that they had specialised functions that did not require the use of pots. The latter explanation seems plausible for the KM1057 site but less so for JE0004 given the wider range of activities indicated there. The radiocarbon dates also indicate that the sites were in use at a period when we know that pottery was in use on the mainland.

Evaluation and conclusion

The survey data demonstrate a considerable variety in the size and location of shell middens, and a wide range of mollusc species present on the middens, judging from surface observations, though *Strombus fasciatus* appears to be the dominant species in very nearly all cases, especially in the larger mounds. Many of the middens form clusters that include sites of different sizes ranging from large mounds to surface scatters. The larger mounds are usually located along the shoreline with smaller sites situated some way back from the shoreline, suggesting the use of different localities within a localized area for different activities or at different times of the year, with the most shellgathering activity and shell processing focussed on sites on the shoreline immediately adjacent to the littoral zone where the majority of molluscs are to be found. The largest shell mounds and the largest clusters of shell middens are found around the edges of very shallow bays that would formerly have provided an extensive habitat for *S. fasciatus*, but which are now filled with sediment and transformed into a dry land environment with sand dunes.

Excavation of two sites, one in Janaba Bay (JE0004), the other in Khur Maadi Bay (KM1057), confirm that there are considerable differences in mound composition despite superficial similarities. KM1057 is composed almost exclusively of *S. fasciatus* shells with little other sedimentary matrix or cultural content, whereas JE0004 comprises a wider range of shell species and evidence of hearths, displacement of material during site maintenance, more evidence of fish bone and some fragments of mammal bone, suggesting more prolonged periods of occupation and greater variety of activities. It is not yet entirely clear whether the greater variety of materials at the Janaba site is largely a sampling issue due to the greater volume of shell deposit investigated, or reflects genuine differences in the way in which the two mounds were used, but the latter interpretation seems highly likely.

The duration of both excavated sites is surprisingly short, at least on the evidence of the small number of radiocarbon dates currently available. In both cases the dates for the top and the base of the sequence are statistically identical, suggesting relatively rapid accumulation within the margins of error of radiocarbon dating, though that duration might be as much as several hundred years. In both cases the dates centre around 3000 cal BC. It is not yet clear whether the similarity of date and duration of the two excavated sites is a coincidence, or representative of a wider pattern in which the accumulation of shell mounds was a relatively short-lived phenomenon. Nor is it clear whether this apparently short-lived occurrence of the shell mounds reflects a limited period when shellfish were unusually abundant, an increase in population density or intensity of human activity on the coastlines of the Islands, or simply an increased visibility of human activity during a period when unusually large quantities of shells were being collected and accumulated in one place. In the case of KM 1057, where there are 30 mounds of varying size within 200m, and a larger number within 1km, it may well turn out to be the case that other shell middens within the cluster have different and non-overlapping sequences of dates, and that in their totality the sites within this cluster represent a much longer sequence of occupation than any individual site. Investigation of these various possibilities will require more extensive sampling and excavation and a more detailed programme of dating. Similarly, questions about variations in subsistence economy, the place of shellfood within the wider economy, and the possible ritual or ceremonial function of some of the mounds remain to be investigated in more detail.

Hinterland site survey

There is a great abundance of other archaeological material on the Islands. Much of it takes the form of structures of various types, usually made of blocks of coral or faroush, probably of pre-Islamic or early Islamic date, and some of these may be burial cairns, often in close proximity to the coastline. Traces of hearths are also sometimes visible in flat areas with some accumulation of sediment. Some of these features may be of quite recent date, and we have not attempted a systematic survey of this material, since it represents a major project in its own right, but we have recorded some of these features during the course of survey. The primary objective of our own surveys was to locate flaked stone material that might indicate evidence of activity on the Islands during the Palaeolithic period, and other materials of prehistoric age including ceramics that might indicate hinterland sites or settlements related to the shell mounds.

Archaeological and geological context

We know from the evidence of sea level change and local bathymetry that the Farasan Islands were connected to the mainland for long periods during the Pleistocene and would have been accessible to people travelling on foot over large territories without the need for boats. In addition, we know from the surveys that have been conducted by the Comprehensive Survey Program on the mainland that there are numerous occurrences of Palaeolithic material. Petraglia (2003), and Petraglia and Alsharekh (2004, and see references cited therein) have documented extensive evidence for both Lower Palaeolithic (especially Acheulean) and Middle Palaeolithic archaeology on the mainland. These reviews note that the Comprehensive Survey of the Kingdom, as well as other projects in the Yemen and Oman, have identified a number of surface archaeological sites of Lower Palaeolithic age. A slightly higher number of Middle Palaeolithic surface sites have been found in Saudi Arabia and the Yemen. Within the Arabian Peninsula, sites have been found in a number of different topographical settings including inland basins, coastal margins and in mountainous areas (Petraglia & Alsharekh 2003: 67). They have been most commonly found along stretches of the Red Sea coastal plain to the west of the Asir mountains, further inland, and in the Rub' al Khali (Zarins et al., 1980, 1981). Along the Red Sea coast, in particular, artefacts have been found lying on the surfaces of corral terraces close to lava outcrops along the Wadi Fatimah and in the coastal region of Al Birk (Bailey et al. this volume). With such clear evidence of hominin occupation of the Red Sea coastal plain during both the Lower and Middle Palaeolithic, and with evidence of similar aged material on the other side of the Red Sea in Eritrea (Walter et al. 2000), there is every possibility that at times of lower sea level there could have been some hominin use or occupation of the Farasan islands. Previous archaeological survey work on the Farasan Islands (Zarins et al. 1980) makes no mention of any Palaeolithic finds, although it is not clear whether a deliberate attempt was made to look for materials of this age. If survey were directed towards the specific objective of finding Palaeolithic artefacts, it should be possible to discover such evidence, given favourable geological conditions for the preservation and exposure or relevant material.

It needs to be remembered, of course, that because the majority of sites identified during field survey on the mainland are surface sites, the determination of their age has been made on the basis of technological form alone. Lower Palaeolithic materials have been identified on the basis of their Acheulean (biface) technology (Petraglia 2003), and Middle Palaeolithic materials have been identified on the basis of prepared core (Levallois) technology and the form of certain retouched artefacts. While these are reasonable grounds for assigning a broad age, independent verification by radiometric dating is lacking.

The topography and landscape character of the Farasan Islands directly affects the nature of the field survey that can be undertaken. The islands are primarily comprised of old coral terraces and limestone, with wave cut coral terraces along the coastal margins. In a number of places, these terraces form bays with a sandy infilling, as noted above. In certain inland areas, there are isolated wave-cut terraces, most probably the remnant of a palaeoshoreline formed at modern sea level, which has now been marooned some distance inland by the accumulation of sand and the seawards extension of the shoreline (Figure 17). Finally, in a small number of places there are lifted coral terraces rising to a maximum height of approximately 80m above modern day sea level. An example of this form of raised terrace landscape is present close to the village of Al-Hesen in the northwestern part of Farasan Island (Figure 18). In no places on the Islands does the geology present rockshelters or other classic sediment-rich locations. However, it should be noted that wave cut notches formed at the modern shoreline provide overhangs that offer attractive shelter. These features are abundant around the modern shoreline but are obviously too young to host archaeological material from the Palaeolithic era. Submerged features formed when sea level was lower than the present are known and are potential targets for underwater survey (see the Underwater Survey section below).

Lower and Middle Palaeolithic artefacts in the Arabian Peninsula are usually made on basaltic lavas or fine-grained siliceous rocks and are found in locations that would have been close to water sources. In places where these raw materials were abundant, field survey has found sites that can be realistically interpreted as factory locations. In the Farasan Islands, however, these materials are absent or very rare. If Palaeolithic hominins came to the Islands they would either need to bring artefacts made from basalt or other materials that are exotic to the islands, or make artefacts out of the locally available materials. The Farasan Islands have very few such sources of raw material, and what is available comprises fossilised coral, and some types of limestone, particularly a hard white or yellow limestone that has been found in shell midden deposits in the form of crudely flaked manuports (see above). Observations in the field also suggest that fossilised shell, particularly the shell of the giant clam, *Tridacna*, which can reach sizes of 30–40cm, is quite massive and fine-grained and can be flaked to form sharp-edged artefacts. These shells can be found eroding out of the surface of fossilised coral terraces in various parts of the landscape in the hinterland and near the modern coast.

Survey aims and methods

In 2006, only limited survey in search of Palaeolithic material was possible and focussed on areas of standing water or areas that had water courses at some time in the past, and on the location of rock outcrops that might provide suitable material for flaking stone tools. Most areas examined were covered by sand or in a few cases by soil, or were on exposed coral surfaces close to the modern shoreline (Bailey et al. this volume). In 2008, more extensive field survey was possible and concentrated on landscape forms of a different character that might be more promising for the discovery of archaeological materials of Palaeolithic age. Previous and extensive field survey experience by one of the authors (Anthony Sinclair) in Southern Africa (Namibia) has shown that the archaeological evidence for Middle Stone Age activity can often be found at considerable distance from raw material sources. This evidence usually takes the form of isolated flakes (sometimes made from prepared cores) and occasional heavily-reduced cores. There is little evidence of flakes produced in the earlier stages of core reduction or other waste by products of tool manufacture that one typically finds close to raw material sources.

Therefore the 2008 survey targeted areas of higher elevation with good views of the surrounding landscape, with particular attention directed to: (1) raised outcrops of rock with little superficial sediment cover and flat surfaces where discarded artefacts would have remained in position undisturbed for long periods; and (2) exposed areas of flat ‘gravel terrace’ on which a thin covering of sand and sediment lies over the top of the underlying coral platform. Areas of raised rock outcrop also offer the best source of materials suitable for knapping. It should be emphasised that we do not assume that these were the preferred places for human habitation or human activity. Rather, we assume that these locations offer the best possibility of discovering Palaeolithic age materials in a landscape where outcrops of suitable raw material sources are rare or absent, and where thick sediments such as fluvial gravels or slope sediments that have been partially eroded to expose in situ cultural material are also rare.

Raised rock outcrops are present in two main areas on the Islands, in the northern and western part of Farasan al Kabir close to the modern settlements of Sair in the far north of the island and Al-Hesen to the north west, and in the central part of Saqid island where large rock outcrops rise out of a flat plain. Flat gravel terraces can be found on Farasan al Kabir, especially to the south and southeast of Farasan Town and to a limited extent north of the town of Sair. All of these areas were targeted for survey. A trip was also made to the island of Zufāf, where an uplifted coral-terrace landscape similar to the Northwest of Farasan al Kabir is also present. Work was conducted in March with lower temperatures than during the field survey season of 2006, and this made it possible to undertake extended episodes of field survey, and to explore areas of different topographic and surface character to those examined in 2006.

Areas targeted for field survey involved walkers separated from one another by approximately 25 to 50m following transects over distances of 1000 to 1500m across the landscape. All archaeological material was recorded by location using a handheld GPS device (Garmin GPS III, or Garmin eTrex) with brief descriptions of the location. Photographs were taken of all locations, and where appropriate, a sample of artefacts was collected for later analysis.

Survey Results

Survey in 2008 was successful in locating flaked stone artefacts, some of which may date to the Lower Palaeolithic or (more likely) the Middle Palaeolithic. Others almost certainly relate to later occupation. The artefacts found, however, are relatively small in number, and the majority are isolated finds. The materials recovered include basalt, lava and a small number of obsidian artefacts. There are also a number of finds that are made of the local fossilised coral or limestone and a chert-like material, and it is these finds that would appear to be the oldest in date from their shape and technological characteristics.

The most convincing Palaeolithic-age artefacts have been found in the northern part of Farasan Island on the raised coral terraces close to the villages of Al-Hesen and Sair (Sayyer). The artefacts found are few in number, and are not classic examples of Lower or Middle Palaeolithic artefact types, but they do have a clear Palaeolithic look to them. The most convincing artefacts of this type are made on the locally available fossilised coral, which varies from a clearly fossilised coral preserving fossilised plant materials and shells, through to a compressed homogeneous rock that both feels to the touch and fractures like dolomitic limestone. Flaked edges are not particularly sharp and are brittle. It is notable that a small number of artefacts made on basalt or lava were also recovered during survey in other parts of the Islands, but these are probably much later in date since they do not have the characteristic technological features that one would associate with earlier material.

The largest and most convincing artefacts of early type have been found on the Jabal Tayyar to the northwest of the village of Al-Hesen, with a smaller number of isolated artefacts found further to the north on the north side of the town of Sair. At Jabal Tayyar, a series of coral terraces has been lifted and tilted at an angle to present a series of parallel ridges aligned in a northwest-southeast direction (Figure 18). Here, there are exposed areas of fossilised coral as described above, separated by narrow valleys, some of which are filled with sediment and have walled field systems in a few places. The artefacts were found on the top of the highest ridge, which is about 50m above sea level and about 2km inland from the modern coast on the western side of the Island. The ridge is comprised of a fossilised coral that fractures into large angular boulders of homogeneous material. On the uppermost terrace, there are a number of broken fragments of rock, amongst which the survey located some clear examples of flakes (Figure 19), as well as one large retouched, elongated flake, similar in form to pieces described as Middle Palaeolithic retouched blades on sites on the mainland (Figures 20 & 21). This particular artefact, 16cm long and 8cm wide, has a clearly preserved striking platform (Figure 22), clear evidence of a bulb on the ventral surface next to the platform (Figure 23), and a series of large negative flake scars creating a central ridge. There is also clear evidence of direct retouch around the margins of the piece (Figure 24). The remaining artefacts are large flakes. There are no classic examples of cores found at this site, although one chunk preserves negative flake scars. It seems likely that these early human visitors made opportunistic use of naturally occurring rock faces as striking platforms and associated flaking surfaces.

To the north of Sair in a context similar to the finds from Jebel Tayyar, we found a small number of artefacts as isolated finds. They were located during survey of raised coral surfaces in the northernmost part of Farasan al Kabir. The pieces are small flakes (Figure 25). One artefact is made on a locally available fossilised shell and has the features of a Middle Palaeolithic convergent point.

Finally, even though none of the artefacts described above is made on either lava or basalt, as was thought likely for Palaeolithic materials on the Farasan Islands, the survey has located a number of lava fragments on Farasan al Kabir itself (Figure 26), as well as a large basalt cortical chunk on Saqid Island (Figure 27), and a larger assemblage of pieces on the southeastern peninsula of Qumah Island. There is, therefore, some evidence for limited transport of these materials to the Farasan Islands at some period.

In addition to the small quantity of Palaeolithic finds, the surveys in both 2006 and 2008 have found an extensive array of evidence that almost certainly relates to the largely maritime adaptations of Islanders in recent millennia, which perhaps complements the abundant shell middens. This evidence takes the form of hearth scatters usually with charcoal fragments, heat-fractured stones, sometimes with ceramics, and often with fragments of shell. These vary from small scatters, perhaps 50cm in diameter (Figure 28) through to scatters that are more extensive and contain larger quantities of shells. They are commonly found in areas of flat topography throughout the islands, and may occur in isolation, or in clusters of up to15 to 30 hearth scatters. When found near the shoreline these scatters have larger quantities of shells and are often associated with shell mounds in clusters of sites, as described earlier.

Evaluation

Three questions need to be asked of the isolated finds from Sair and Jebel Tayyar. Firstly, are they genuinely made by human action or could they be the result of accidental flaking by natural forces at work in these upland locations? Secondly, do these artefacts actually date to the Palaeolithic? Thirdly how representative are they likely to be of Palaeolithic settlement in the area?

For the isolated finds recovered near Sair, the flakes, including the possible convergent point, all are made on local chert rather than fossilised coral. The quality of this material is still poor, but the material is 'out of place' in relation to the background materials. These finds are clearly artefacts. For the flaked pieces on Jebel Tayar, the situation is more complex. There are a number of large clasts of the same fossilised coral on this flat surface. A small number of these clasts have been separated from the natural rock by processes of freeze and thaw. This process, of course, produces distinctive scar patterns that are easily distinguishable from flakes produced by impact with another hard material. Otherwise, there is no evidence to suggest that the clasts on this surface have been moved or turned over by natural agencies in such a way as to produce the specific flakes, edge retouch and associated evidence that the survey team has identified as artefacts. Furthermore, these artefacts were also found on the highest surface (approximately 80m above current sea level) and have not rolled down slopes, or had other clasts fall on top of them. Indeed in the course of survey work, we have come across a small number of other similar locations with the same quality raw material and lithic clasts scattered on open surfaces. Yet despite careful examination, no pieces could be identified as artefacts. There are good reasons, therefore, to think that the flaked pieces from Sair and Jebel Tayar are genuine artefacts.

With regard to the age of the artefacts, the finds are all surface finds lacking a stratigraphic context that might provide additional confirmation of date. The size and the morphology of these artefacts would suggest a Middle Palaeolithic age, but morphology by itself is not an infallible guide to chronology. We know from examples in other parts of the world that occasional stone artefacts with a Lower or Middle Palaeolithic form may turn up in much later periods. It might be argued, then, that the Farasan examples were made by later occupants, given the large number of locations throughout the Islands that have produced ceramics of Islamic and pre-Islamic age, to say nothing of the shell mounds. However, this seems unlikely because many of these sites with ceramics are in areas where raw material comprising fossilised coral like that on Jebel Tayyar and at Sair is available, but artefacts made on this material are never present in association with these ceramics. The excavations of the shell mounds at Janaba and Khur Maadi have produced formless 'manuports' of fossilised coral or limestone, which were probably used as expedient tools, as described earlier, but none of these have the flaking characteristics or shape of typical Lower or Middle Palaeolithic artefacts.

Finally, we must consider the possibility that more abundant evidence of Palaeolithic occupation may once have existed more widely on the Islands but is now obscured or destroyed. It is clear that the coastal margins of the Islands are lacking in recognizable Palaeolithic artefacts, even though they are densely covered with archaeological material from later periods. It is possible, of course, that more recent accumulations of sand in these areas or the weathering and erosion of the extensive coral terraces along the coastline, including those that would have been available for human occupation during earlier periods of high sea level, have obscured or removed artefact material from earlier periods.

Likewise, despite deliberate prospection, no Palaeolithic evidence has been found on the gravel terraces in either the northern or southern parts of Farasan al Kabir. This geological context might be more informative of early human activity, since if humans had been active in these areas during the Palaeolithic period and discarded lithic tools or debris, we would have expected to have found some evidence of this activity. The fact that the field survey teams have always found isolated lithic evidence from later periods in these same areas indicates that the absence of Palaeolithic artefacts is not the result of observer bias.

It is in the uplifted coral terraces in the northern part of Farasan al Kabir that field survey has been successful, locating one small collection of lithic artefacts found on an exposed and uplifted coral terrace, as well as a small number of isolated artefacts in the raised terraces in the same part of the Island. None of the artefacts found could be described as classic examples of Lower or Middle Palaeolithic typology, but they are convincing artefacts. It seems reasonable to assume that the reason for the occurrence of artefacts in these places is the presence of a locally available raw material that can be worked. Although this material is certainly not as good as the lavas and basalts that can be found on the mainland, it is still the best material locally available for knapping on the Farasan Islands. As such, the location of Palaeolithic artefacts on the Farasan Islands follows the same basic principle as the location of Palaeolithic sites found by the Comprehensive Survey on the mainland, namely proximity to suitable raw materials.

Conclusion

The evidence strongly suggests that people visited the Islands from as early as the Middle Palaeolithic period, and perhaps earlier, most probably during periods of lower sea level when the Islands were accessible on foot from the mainland, but not in any great number or for any length of time. The evidence reflects, at best, the movement of occasional bands of hunters and gatherers moving through the landscape and monitoring the movements of animals or possibly the occurrence of plant foods, but not staying put in any one place for long enough or with sufficient frequency to generate a more substantial archaeological record. Further land-based survey on the Islands is unlikely to augment this picture significantly. If we are to find locations that were more attractive to prolonged human activity during the Palaeolithic period, these are likely to be in areas with abundant water supplies, diversity of resources, and some form of natural shelter, together with a local supply of raw materials suitable for making artefacts. From what we currently know of the seafloor topography around the Farasan Islands, many such locations could have existed in parts of the landscape that were exposed during periods of low sea level but are now submerged, and it is to underwater investigation that we will have to turn if we are to find better evidence of Palaeolithic occupation in the wider coastal region.

Underwater survey

(minor repetition in the first paragraph when compared to 2006 report although it is suitable as an introduction where there is a gap between the texts)

In 2006, we carried out preliminary exploration of deeper areas of the offshore environment using mixed gas technology. This work demonstrated the feasibility of using deep-diving techniques for archaeological purposes, identified submerged palaeoshorelines associated with different sea-level stands at depths down to 60m below the present sea level, and outlined the directions for future underwater research. For the deeper areas of the submerged shelf, an essential next step is to map larger areas of the seabed using techniques of acoustic survey to identify palaeoshorelines and other relict features of the original landscape. That forms part of the longer-term strategy of the project, but we did not have the necessary equipment and logistical support to pursue this strategy in 2008. Instead, we concentrated on working in shallower water easily accessible to divers, and focussed and intensive investigation of localised underwater features. The aim was to better understand the processes of landscape transformation associated with inundation, to characterise the geomorphological history of underwater features with archaeological potential, and if possible, to locate evidence of underwater archaeological sites. The specific objectives of this second year of diving fieldwork on the Farasan Islands thus were to:

- Investigate the shallow waters around the fringes of Qumah Bay on the south side of Qumah Island and to assess the archaeological potential of additional locations across the archipelago
- Locate and assess submerged geomorphological features that might have been attractive for occupation prior to inundation by sea-level rise, and that might preserve cultural material

We selected diving areas so as to record a range of features that might have been attractive for human settlement during periods of lower sea level, and assessed the potential for the preservation, location and recovery of artefacts in such locations.

The diving team conducted 58 dives totalling 1934 minutes underwater during 9 days of diving, and explored and recorded 11 sites together with extensive visual inspection across large tracts of Qumah Bay (Figure 29). Here we describe the geomorphological evolution of each site and assess the likelihood that archaeological material could have been retained following inundation. This data is applied to evaluate the potential for archaeological material. Comparisons with known archaeological sites on land and their topographical and geological settings are explored and the results are used to identify the need for further work. The combined results of these assessments provided a broad understanding of the dynamism of the underwater environment around the archipelago and a predictive tool for future underwater exploration.

Underwater geoarchaeological features

Wave and solution cut features

Laterally consistent incised wave cut and solution notches with sizable overhangs are visible along sections of the modern shoreline (Figure 30). These substantial features have been formed by the physical and chemical effects of sea water. They indicate the relationship between the land and the sea around much of the coastline for the last 5000 years. During this time, global sea level has been relatively constant. In addition, older coral terraces are present at an average height of 3–5m above sea level across large swaths of the main islands. This compares favourably with the elevated global ocean levels during the MIS 5 high sea level about 125,000 years ago, suggesting that there has been limited vertical movement in large parts of the Farasan Islands over this period.

In contrast to the land, the sea level has undulated considerably during the last 125,000 years. There have been times when the water level rose or fell relatively quickly and times when it was stable for many hundreds if not thousands of years. Between about 110,000 and 20,000 years ago, the general trend was for sea levels to drop, but with periodic episodes of stability. Some of the most long-lived periods of stasis occurred at c. 100,000, 80,000, 50–60,000 and 40,000–45,000 years ago, corresponding to sea level depths of approximately–10m, –20m, –30m and –45m respectively. At these times, wave cut notches and erosion platforms would have formed. When sea level dropped following these still stands, these wave cut or solution cut features would have been left high and dry, providing potentially attractive shelters for human occupation.

The maximum low stand of 130m below present sea level was reached about 20,000 years ago and lasted for about 4000 years. This was followed by approximately 10,000 years of relatively rapid sea level rise before the rate of change began to slow and ultimately sea level stabilised at about the present level about 6000 years ago. The rate of this most recent transgression would have been relatively rapid and therefore, opportunities for the formation of deep notches have been limited. It follows, that over the last 120 thousand years, the more substantial wave or solution cut notches and overhangs now found underwater were fashioned during periods of stasis as sea level fell rather than when it rose.

Impact of salt tectonics

In principle, it should be possible to determine the age of wave or solution cut notches found underwater by correlating their depth with the sea level curve. This would mean that a notch, cave or wave cut platform at 10m below sea level would date to around 100,000 years old. However, this assumes long term stability of the land surface. Notwithstanding the relative stability of the land as indicated by the 3-5m coral terraces mentioned above, the Farasan Islands have been subject to varying degrees of tectonic activity as a result of rising salt dome migration and collapse (Bailey et.al., 2007). The results are evidenced by localised warping of the landscape and deep circular depressions now hundreds of metres below the water. This has caused vertical movement and tilting of some marine cut notches, as land deforms around migrating salt domes.

Evidence for geological tilting was recorded at the mouth of Qumah Bay at Slick point in 2006 (this volume?). Here, a series of linear underwater wave cut notches dips from 12m to 30m below sea level over a distance of a few hundred metres (Bailey et al., 2007a, 2007b). The slope is mirrored on land by the surface topography, which shows a seaward tilt of 5º. A wave cut platform lies immediately offshore, which continues to descend into deeper water.

The passage of the slope from land to water is only broken by a wave cut notch at sea-level; otherwise it follows a continuous line along the same inclination as the higher terrace (Figure 31)

The evidence demonstrates that the peninsula at the southeast end of Qumah has tilted on an axis centred at or near Slick Point at the end of the peninsula. Here the surface of the upper coral platform is about 3m above sea level. It rises to the north, and dips to the south, where it disappears under water. The depth of the submerged wave cut feature at the axis of movement is about 19–20m, implying a date for its formation of around 80,000 years ago. If we were to take the depth of this lower notch below modern sea level at some other point along its length, and attempt to date it by correlation with a general sea level curve without reference to the subsequent tilting effect of localised tectonics, we would end up with a date that was seriously in error. This case highlights the need for caution when using sea level curves to calculate the date of submerged geomorphological features within the Farasan Archipelago.

Sea level change and locations of archaeological potential

The significance of wave cut notches to human populations lies in their potential as shelters. Accessible marine cut notches above and along the palaeoshoreline would have been the places used for shelter from sun, wind or rain. The overhangs would have provided attractive places for cooking food, making tools and other human activities. This is true in the present day as one can see by the remains of fireplaces, piles of driftwood, discarded cans and other materials located beneath such overhangs along the modern shoreline [Add a figure to illustrate this?]. Shelters formed by marine erosion when sea level was lower, and which were then left dry as the sea level dropped further and the shoreline retreated, would have offered good vantage points over the adjacent coastal lowland. The bathymetry of the sea bed suggests that this now submerged landscape would have had a complex topography including depressions that could have filled with freshwater, narrow valleys that would have facilitated monitoring and capture of animals, and spring lines at the foot of coral cliffs, making an attractive focus for human activity and settlement. (Image to show bathymetry around Farasan??)

Given suitable physical conditions, artefacts and other cultural material accumulated on the floors of these shelters could date back to as early as 100,000 years ago, and perhaps even to earlier periods of low sea level during the Pleistocene. Accumulation of subaerial sediments would have encapsulated these finds in a stratigraphic matrix either within the shelter or in front of it.

Other site types that were searched for in underwater locations are shell mounds. Many of the undercut coral terraces around the bays and inlets of the modern Farasan coastline are crowned with shell mounds. These are known to date back to at least 5000 years ago and were built up over long periods of several hundred years or more, as discussed earlier. However, few substantial shell mounds of comparable type are known from earlier periods anywhere in the world, most probably because, if they existed, they are now lost beneath the sea. The absence or rarity of earlier shell mounds or coastal sites could suggest that human populations took little interest in marine resources before the establishment of modern sea level. The balance of current opinion, however, is that earlier sites are missing from the archaeological record because they have been submerged and lost to view (Bailey and Flemming, 2008). Unfortunately, locating these sites is difficult but it is necessary if the widespread use of earlier midden building is to be proved, or disproved. A major objective of the project is therefore to identify areas underwater that might have hosted earlier shell middens. To achieve this we have targeted sites that would have compared topographically to the locations on the modern shoreline where shell mounds are found.

The impact of rising sea level on archaeological sites

A consequence of rising sea level is the likely displacement and dispersal of archaeological material and the sediments that enclose them. The biggest threat is physical erosion caused by swell or vertical movement in the water column as the sea transgresses a site. Degradation and deflation of deposits will be particularly acute when they are crossed by the surf zone. Traces of the original land surface are likely to be eroded away, and any artefacts dispersed and subjected to water erosion, degradation and possibly total destruction, leaving little if any recognisable physical traces of former human activity.

Conversely, where there is shelter from wave energy, sea level rise can afford protection. Here, ancient land surfaces and any associated archaeology may be left undisturbed, buried and protected by marine sediment, sealing them for many tens of thousands of years (Fischer, 1997, 2004; Momber, 2000, 2004; Maarleveld & Peeters, 2004). The problem is that the best preserved material in the most protected locations is likely to be completely covered by sediment and therefore hidden from view.

Given these circumstances, the best chances of recovering archaeological evidence are where the sediment deposits are thin. This can occur in underwater locations that lie between the extremes of erosion and rapid sediment accumulation. This can also be the case in locations where the capping of protective sediment is being cut into by submarine channel erosion to expose the underlying land surface. At sites where the relationship between the two forces of erosion and sedimentation are finely balanced, energy within the water may remove fines but not be sufficiently strong to dislodge heavier objects. The greatest opportunities exist where there is a gradient between the two systems at a point where areas of erosion and areas of sedimentation meet. If cover is thin enough, archaeological material is more easily accessible. In favourable conditions, material which is heavy enough to have withstood the forces of dispersion may remain undisturbed beneath thin lenses of sand or caught within crevices. If anthropogenic material, however scattered, can be located, recovered, recorded and analysed from submerged archaeological sites, informed interpretations can be made. This has been demonstrated on a number of submerged archaeological projects (Muckelroy, 1978; Momber & Green, 2000; Tomalin et al, 2000).

However, we also need to remember that the seabed is in a constant state of flux which can cause changes in a relatively short space of time. Areas that are particularly susceptible to sudden change are coastal morphological features that become impacted or overtopped by sea level rise. Increased water movement or the opening of new marine channels can change the processes of sedimentation on the sea floor. In such cases, submerged landscapes that have been protected by overlying marine sediment since inundation may become subject to erosion and exposed while a previously eroded area may become covered. The challenge for the archaeologist is to locate and investigate areas with the greatest potential to reveal exposed but well preserved relic land surfaces. It is therefore very important to examine the geomorphological evolution of any submerged landscape that is likely to be a target for archaeological exploration.

Survey strategy and methods

Given the objectives of this year’s work, diving investigated submerged landscape areas likely to have some or all of the characteristics that would be favourable for archaeological occupation and artefact survival. The key factors assessed during each dive were the underlying geology and the sedimentary environment. Wave cut notches or caves that could have acted as pre-transgression human shelters were regarded as likely nodes of activity. This was seen as particularly relevant where the shelter overlooked an area that could have held fresh water when sea levels were lower. Other criteria considered when assessing the sites were the similarity of their locations to archaeological sites on land, the balance between erosion and sedimentation and past coastal geomorphological processes, as outlined above, that could have influenced the preservation potential.

Inspection of the sites was visual and carried out by divers. Video and stills images were taken to record salient features. Measured survey was completed at selected sites that offered the greatest archaeological potential.

The diving was conducted on air and the depths were restricted to minimise the risk of decompression sickness. Accordingly, the searches concentrated around the –10m contour. Diving was carried out in line with the HSE (Health and Safety Executive UK) Scientific and Archaeological Approved Code of Practice. A team of five personnel was always present during diving operations. This included a supervisor, qualified skipper, assistant and two divers. Visual contact or physical communication was maintained with the divers at all times and the team was in constant communication with the Farasan Border Guard.

Site characteristics and archaeological potential

Janaba Bay

This area was selected for survey because it is adjacent to a group of well studied shell mounds including the excavated site of JE0004. Two locations were selected for underwater exploration: the first immediately adjacent to the Janaba East cluster of shell middens excavated by the terrestrial team (see above) and the second site in the south east area of Janaba Bay, off Ra’s Shida.

One hundred metres offshore from the beach at Janaba East, the sand covered seabed drops gently before a relic coral platform is exposed in two metres of water. This is a strip of exposed coral bedrock that runs parallel with the shoreline and supports a strip of coral reef. It forms a lip, beyond which the sand covered seabed drops away into deeper water to the west, reaching a depth of 7m within 400m from the shore.

The date of the 2m deep wave cut platform is hard to determine. If it existed when sea levels were a few metres lower during the final stages of the last sea level rise, 5000–6000 years ago, it would have formed a coastal strip around the bay. This would have been comparable to the coral platform around the islands today, which supports hundreds of shell middens. However, the lengthy fetch, which allows the build up of large waves, would have made it vulnerable to erosion as sea level rose. It is unlikely but not inconceivable, that substantial shell mounds would have survived at this point of the bay.

At the south east end of Janaba Bay, to the north of Ra’s Shida, a gently dipping slope covered in sand was recorded. Occasional rock outcrops were noted including ‘stepped’ rock features protruding from the thick bed of sand. The sedimentary environment in the shelter of the peninsula would afford protection for archaeological material although the depth of the sand would make exploration difficult (Figure 32).

The extant shell middens and archaeological remains around the current Janaba Bay demonstrate its importance to humans at some point during the last 6000 years. However, it should be noted that the largest concentration of sites and the largest shell mounds are located around the inner edge of a shallow embayment on the east side of Janaba Bay that is now dry, rather as at Khur Maadi (see above). On the more exposed south-facing shorelines, as in the vicinity of JE0004, our currently available radiocarbon dates from this site suggest that its main period of use was for only a limited duration. Perhaps this reflects relatively unstable ecological conditions for *Strombus fasciatus*, possibly compounded by minor tectonic movements, and a relatively short-lived period when abundant supplies of *S. fasciatus* were available. The presence of an earlier shoreline in 2m of water that could have been a suitable platform for shell middens increases the potential for submerged archaeology. However, the hydrodynamic conditions were probably not conducive either to the preservation and discovery of archaeological material, although there remains the possibility that locations with the right conditions for site preservation exist elsewhere in Janaba Bay.

Qumah Bay

Qumah Bay, the main inlet on the south side of Qumah Island, was first investigated in 2006. The north end of the Bay is a wide sandy beach with a shallow, gently sloping seabed. The southern end of the Bay is deeper and flanked by two rocky peninsulas. The depth of water along the edges of the outer bay at the base of these promontories is 18–20m, and the seabed is covered with sand (Figure 33).

The promontories extend beyond the mouth of the Bay, where they dip below the water, reducing in height until they become covered by the sandy sea floor. The Ra's al Mazlaq promontory (Slick Point) was recorded underwater to a depth of –35-40m in 2006 after which point it became covered by silty-sand (Bailey et al., this volume). South and east of Ra's al-Mazlaq the seabed carries on dropping into deeper water.

The diving fieldwork conducted in 2008 continued inspection around Qumah Bay to characterise the seabed and look for indications of palaeo-landscape features that might preserve archaeological remains. The floor of the inner bay is covered in sand and silty sand. Much of this derives from the adjacent cliffs or from the coral terrace (Figure 34) and was deposited following marine inundation. The cover it affords can protect the palaeo-landsurfaces and any archaeology therein, but, large quantities of sediment make exploration of what lies beneath problematic.

The archaeological evidence on land is rich with prehistoric shell middens that have been recorded all around the Bay. These are located on coral terraces next to the water. The terraces, which measure from 3–15m above sea level, are truncated by the sea to form overhangs or cliffs. Comparable wave cut features were recorded when diving underwater below the south east promontory of Ra's al-Mazlaq in 2006 and more were recorded along the south west promontory in 2008.

The area has demonstrably been attractive to humans while sea levels have been stable over the last 5,000 to 6,000 years. To assess the potential for earlier occupation we need to consider a land with a lower sea level. The depth and contours of the palaeo-landsurface below the modern sediment are yet to be fully characterised but sufficient bathymetric information exists to define a circular depression to the south east of the bay. This lies between Qumah Island, Dumsuq Island to the south and Ra's Shida, on Farasan al Kabir, to the east. An echo sounding survey by the *MV Midyan* during the fieldwork of 2006 recorded a depth of 115m towards the centre of the depression. This is 70m lower than the seafloor which encircles the deep water. The surrounding seabed forms a flat shelf approximately 45m below present sea level. The depression would therefore have been a basin when sea levels dropped 45–50m and it became cut off from the sea.

Given our knowledge of sea-level change, separation from the sea could have occurred for long periods between 50,000 and 10,000 years ago. It is possible then, if climatic conditions were favourable, that the sea water trapped in the basin would eventually have evaporated and been replaced by fresh water. Any resultant wetland or lake would have been supported a range of resources and been attractive to humans.

Towards the mouth of the Bay the seabed deepens. Here, as recorded at Ra's al-Mazlaq in 2006, more of the submerged relic land surface is exposed. Approximately 300m north of the western peninsulas and Ra's al-Mazlaq, the sloping sand around the edges of the bay gives way to cliff walls (Figure 35). These are punctuated with notches and caves incised by the sea when levels were lower.

The western peninsula and rock shelter RS QB01

A series of well defined marine notches were located within the submerged cliff on the western side of Qumah Bay, 200–300m north of the point. A number of the more cave like features could have given shelter, the most significant of which, recorded as RS QB01, was found in 9.5–11m of water (Figure 36).

In addition, when sea levels were lower, RS QB01 would have provided a good vantage point from which to scan the basin to the south east (Figure 37). As such, the cave has the potential to have attracted humans and consequently could contain archaeological material. This may have remained in situ until the site was impacted when the sea level passed across it during the last transgression. The effect would have been magnified as it would have been exposed to southerly gales. During such events, any unconsolidated archaeological material deposited within the shelter would have been disturbed and dispersed. Artefacts would have remained associated with the original site only if they were caught in cracks or ravines within or in front of the cave. In the case of RS QB01, the presence of a steep slope below the cave mouth increases the prospect of recovering artefacts. The slope drops sharply to 17m below sea level where another small undercut and cave is cut into the cliff. This feature is now full of sand, trapped shells and fine sediment (Figure 38). Any archaeological material washed from the upper cave during the transgression would have fallen into a less turbulent environment 6–7m below, where it could have been trapped in the crevices.

It is worth noting that the terrestrial cliff above RS QB01 rises close to the 10m contour (see Figures 33 and 34). It is slightly domed suggesting salt tectonic uplift. If the coral platform above the cliff dates to MIS 5, it would suggest the land has risen in the order of 10m. The distance from the base of RS QB01 to the top of the cliff is approximately 20m which would suggest it was formed during the last –20m still stand. This dates to c. 80,000 years ago. The overhang would therefore have offered welcome shelter for about 70,000 years before becoming inundated during the last transgression.

The Sulayn al Janub and Mundar Islands

These Islands are surrounded by shallow tidal water (Figure 39). When sea level was 10m lower, they would have been connected to the Farasan al Kabir. The small islands and adjacent mainland contain shell middens, some of which may have been used when the landmass was joined as one (Figure 40).

The areas selected for diver inspection were sheltered from wave disturbance but subject to currents that could keep fine sediments from obscuring seabed features. The object of the diving at these locations was primarily to search for shell middens that may have grown up next to the earlier bays that formed when sea levels were a few metres lower.

Sulayn al Janub

The Sulayn al Janub Archipelago is situated on a large shallow plateau that would have been largely dry c. 8000 years ago. The area under investigation is a ria basin surrounded by three major islands and containing a number of smaller islets (Figures 39 and 41). There are three entrances to the basin, each at different depths, suggesting that they formed sequentially. The one to the south is widest at almost 500m and shallowest, charted at 1–2m deep. The channel to the north east is the deepest, recorded at 5–6m deep and relatively wide at around 250m. The smallest entrance leaves the basin to the north. It is the narrowest at a little over 100m wide and 2–3m deep.

As the sea level rose, the deeper northeast facing channel would have allowed the first ingress of water into the centre of the old landmass at 6000–7000 years ago. A bay would have formed around the inlet. A breakthrough in the north followed as the inlet continued to push its way through the centre of the island. Finally the wide and shallow western channel would have been overwhelmed. The process of inundation would have been steady and would have taken many hundreds of years as the bay migrated inland. The inlet was sheltered from destructive waves and the rise in water levels would have caused minimal disturbance to all but the finest materials. The basin that formed within the three islands is now blanketed with fine sand.

The scenario described above is based on a review of the current bathymetry. However, it is possible that the entrance to the north formed later than its depth implies. This channel is the narrowest and accordingly is subject to the strongest tidally induced currents. These currents have a greater capacity to scour and deepen the channel suggesting it may be deeper now than when it was first formed. Today, the floor of the northern channel is littered with exposed rocks while the seabed within the other two channels is covered in sand. It is the erosive characteristics of the northern channel that make it significant for search and investigation.

The dive search around the northern entrance identified varying depths of sand where the thickness increased away from the centre of the channel. Few scatters of shells were noted, although burrows excavated by crustaceans and small fish revealed a thick deposit of shells beneath a thin veneer of sand.

Mundar Island

Mundar Island is oriented east to west and lies in an area of shallow water between Farasan al Kabir and Saqid. The head of the large bay, within which it sits, feeds into a channel that runs between the main islands. Tidal channels pass to the north and south of Mundar. The shallow, sand-dominated seabed is not dissimilar to that recorded at Sulayn al Janub, as is the proximity to shell middens on the present day shoreline, which are found on the island and ringing the larger bay. The large carnivorous gastropods, *Chicoreus* and *Pleuroploca,* are particularly abundant in the shell middens on the island.

Visual inspection of the seabed was conducted on the east side of a south facing peninsula which lies towards the east of the island (Figure 42). The peninsula itself hosts at least six shell middens on the present shoreline. Below water, a wave-cut coral platform is exposed. The relic coral surface is stripped bare of sand down to a depth of 2m where it is subject to the greatest wave action. The platform is crossed with small gullies within which shells have accumulated, and grey silt is evident in depressions that run at right angles to the beach. Down-slope in a depth of 4m, the covering deposit gets thicker, and shell deposits are exposed beneath a relatively thin layer of sand. No evidence of shell middens was found but the sand and fine silts suggest that stable deposits may remain protected in deeper water and in gullies.

Evidence of human occupation in the form of shell middens on and around the Sulayn al Janub Islands and Mundar Island demonstrates the importance of these areas for exploitation of marine molluscs at current sea levels. Both these areas would have presented comparable environments across larger expanses of land for many thousands of years before becoming inundated. The areas would therefore have been suitable for exploitation in a similar way during that time.

The sediments that built up within and around the bays in the latter stages of the final sea-level rise may have covered and protected sites of human activity such as shell middens. These archaeological features are difficult to identify where they are concealed in sand, but could be visible where the sand is gently winnowed from the larger shell materials.

Islet of Dahek, Khur Maadi Bay and the Haylar Cliffs

The islet of Dahek, the narrows of the Khur Maadi Bay and the Haylar Cliffs of Shijajn were additional sites inspected by diving. The locations were selected because of their differing physical characteristics. Dahek is an isolated islet approximately 8km offshore (Figure 43). It would have been a distinct feature in the landscape when sea levels were lower but has no immediate association with terrestrial archaeological material. The narrows of Khur Maadi Bay opened up when sea level passed over them. Prior to this, the area would have supported a large closed bay which would have been favourable for the exploitation of marine resources. The seabed below the Haylar Cliffs of Shijajn drops steeply to a ledge at 18m at the northern end of the 'Khur '. Within a few hundred metres of the coastline, a depression drops to a depth of over 100m. Like the Islet of Dahek, the Haylar Cliffs would have been adjacent to deeper water and a range of resources that differed from the shallow bays. All these three sites show evidence of earlier wave and solution cut features but the seabed at each site is dominated by thick deposits of sand masking potential archaeology.

Evaluation

The dive operations targeted locations around the coastline, within bays, around headlands and near notable outcrops. The dominant feature in all locations examined was sand. Accordingly, following initial assessment, attention was focused on areas were the sand cover might be thinnest or absent. These were the promontories and the seabed adjacent to channels.

A number of sites were identified where removal of sand presented the possibility that robust artefacts or archaeological deposits could be visible. The first is Qumah Bay where the caves and crevices below rock shelter RS QB01 would make an ideal trap for dispersed archaeological artefacts. This area warrants excavation, recording and sampling for human artefacts or evidence of a human presence.

The other areas of interest are the Sulayn al Janub archipelago and Mundar Island. The sand deposits around both have the potential to conceal archaeological evidence. Between the two, the site which presents the best opportunity to inform our understanding of archaeological potential is the northern channel that exits the Sulayn al Janub archipelago. Here, evaluation trenches should be opened across one side of the channel to characterise the internal structure, to reveal any stratigraphic gradients and sample shells or other potential evidence of human activity.

In addition to investigation by divers, geophysical survey including swath bathymetry, side scan sonar and sub-bottom profiling should be conducted within Qumah Bay. It would also be beneficial to deploy these techniques of acoustic survey in Janaba Bay and around the Sulayn al Janub archipelago across areas which would once have been suitable for human exploitation and the location of shell middens.

The influence of salt tectonics on the movement of the coastline and the variation in depths of submerged wave or solution cut features is another issue that should be addressed. Further recording and dating of material from the sites identified here would help to calibrate the dates of potential shelters that have now drowned.

Conclusion

The underwater survey has provided an insight into eleven different drowned landscape locations around the Farasan Islands. Their ability to attract human activity and preserve any cultural evidence has been assessed. The research has led to the conclusion that there is potential for the deposition of archaeological material when sea levels were lower and that conditions exist where such material may remain protected. Collectively, the different site types have provided data that is leading to a better understanding of the geomorphological processes below the waterline. This in turn is providing a valuable tool to help predict the archaeological potential of locations with similar characteristics. However, more work needs to be done to develop the assessments presented in this report and there is a need to validate the results with geophysical and archaeological investigations.

General Summary and Conclusions

The fieldwork so far has revealed an extraordinarily rich, little known and little investigated archaeological sequence in a key area for understanding the pattern of human dispersal between Africa and Arabia and the nature of changing coastal adaptations to changes in sea level. Much of the data is still being analysed but we have systematic information on the distribution of an unusually large and well preserved body of shell mounds, believed to be of mid-Holocene or later date, which is consistent with the small number of radiocarbon dates currently available, and many other surface finds of varying age in hinterland locations

The shell middens alone are estimated to number approximately 1000, and represent one of the largest, most concentrated and best preserved groups of mounds anywhere in the world, equivalent to the largest groups of shell mounds in northern Australia, Brazil and Japan. Their intact state is due to the relative isolation of the Islands, low population density, and lack of development. However, a rapidly expanding programme of new development and civil engineering works, including the proposal to build an airport, is already causing minor damage to some sites, and will lead to big changes in the future, so that there is urgency to investigating as much as possible, getting the sites protected, and promoting their significance to the local community.

Small-scale excavations into selected mounds have produced large quantities of shell suitable for a variety of geochemical and geophysical studies, some fish bone, and variable quantities of sedimentary and ashy matrix. Identifiable artefacts are so far very limited in number. This is probably due to the inherently low density of artefact material in rapidly accumulating shell deposits, the limited amount of excavation, and the scarcity of local stone raw material.

The dominant mollusc species in the excavated shell mounds and in the great majority of the shell middens inspected, whether tall mounds or surface scatters, is a small gastropod, *Strombus fasciatus*. This species thrives in shallow, sandy sheltered bays, where it can easily be collected in very large numbers by wading in shallow water. Other species present in some numbers are the pearl oyster, *Pinctada cf nigra*, a variety of bivalve species that attach themselves to rocky surfaces, notably *Chama reflexa*, and large carnivorous gastropods of the murex and conch families, notably *Chicoreus sp*. and *Pleuroploca sp.* Variations in the presence and proportions of these species in different middens probably reflect local variations in habitat conditions on different stretches of shoreline. But they may also relate to the function of different middens, the length of time people stayed there and the numbers of people involved. Some shell middens appear to have been the focus for collection or dumping of *S. fasciatus* shells almost to the total exclusion of any other activity, such as the excavated mound at Khur Maadi (KM1057). Other sites, such as the excavated Janaba Bay shell mound (JE0004) appear to have been used for a wider range of activities, with a greater proportion of other mollusc species, more fish bone, and evidence of hearths used in the preparation of food, and site maintenance activities involving the clearance and displacement of discarded materials.

Shorelines formed at current sea level are very dynamic both geologically and ecologically, because of local tectonic warping by salt doming and changing regimes of erosion and sand accumulation at the shore edge. This is likely to have had a significant impact on the extent of suitable habitat for *S. fasciatus*, and there are good reasons to think that these molluscs were available in much greater abundance at certain periods in the past than today. Many of the large mounds are located around the edges of extensive shallow bays which would have supplied large quantities of *S. fasciatus* but were subsequently filled in with sand, displacing the old shoreline and its associated shell mounds some distance inland from the modern shoreline. This infilling is due either to the natural process of shoreline evolution with progressive accumulation of sediments eroded from the adjacent landscape or to minor crustal movements caused by salt doming, or both factors working together. The implication is that there have been considerable variations in the quantity of molluscs available for human consumption at different periods during the past 6000 years as well as significant variations between different types of shoreline. Some uplifted areas may give us an insight into early Holocene or even late Pleistocene shorelines and associated archaeology that were actually formed when sea level was below the present. Earlier shorelines, however, are now mostly submerged.

We are pursuing both these lines of enquiry – tectonically uplifted and submerged shorelines. In particular we are building on the results of deep diving experiments in 2006, which demonstrated the presence of deeply submerged palaeoshorelines. In this year's research programme we have carried out underwater survey in shallow water depths, which are easily accessible with simple diving technology. These are coastal landscapes that we expect would have been occupied at earlier periods when sea levels were lower than the present. We are concentrating on locating areas of the seabed where the water currents are not so vigorous that they have eroded away the old land surface, nor so calm that they have allowed a thick build up of recent marine sediment. We have not yet identified any unequivocal shell middens underwater, but it is likely that even in calm underwater conditions, consolidated shell midden deposits would have undergone some degree of erosion and deflation by water action during and shortly after inundation by sea level rise. We have identified two especially promising locations worthy of more detailed investigation, and we expect to continue this work in 2009.

Other sites identified in hinterland survey include Islamic, pre-Islamic, and earlier prehistoric material. Some of the ceramics are probably prehistoric in age, and other sites appear to pre-date the use of pottery. Distinctive stone raw materials (such as siliceous or volcanic rocks) are rare on the Islands, although it is clear that fossilised coral and a hard, fine-grained whitish-yellow limestone are both workable raw materials and have been formed into artefacts. One such specimen is a large worked flake that would not be out of place in a Middle Palaeolithic or even a Lower Palaeolithic context, and a small quantity of similar material has been identified in the same general area on high ground in the north west part of Farasan Island, an important indication that the Islands were occupied at a much earlier period when joined to the mainland during periods of low sea level. However, the extent of human activity on the present land surface of the Islands during these earlier periods was probably very limited, and it is unlikely that more substantial Palaeolithic sites will be found on the islands because of the lack of suitable stone for working artefacts and the lack of abundant water supplies and diversity of resource more generally. More promising locations for such sites are likely to be found on the now submerged landscape.

Dating is of central importance to this programme, but radiocarbon dating is proving problematic. Much of the midden charcoal is finely comminuted, suitable samples are rare, and some of those have turned out to contain insufficient carbon even for AMS dating, while shell samples are subject to various errors or potential baiases. We are continuing to research this problem, developing an amino acid racemization stratigraphy for the shell mounds, having established that a number of shell species that are common in the archaeological deposits are suitable for this purpose, and looking at the possibilities of OSL dating as an additional tool.

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Table 1. Radiocarbon dates

Lab No.	Provenance	Sample Material	$^{13}C/^{12}C$ Ratio	Conventional radiocarbon age BP	Calibrated age cal BC	2σ range cal BC
Beta-255383	Top JE 0004	shell	+1.6 ‰	5010±50	3310	3380–3080
OxA-19587	Base JE 0004	charcoal	-24.53 ‰	4709±31	3503	3373–3561
Beta-255385	Top KM 1057	shell	+2.4 ‰	4880±50	3070	3300–2900
Beta-255384	Base KM1057	shell	+1.3 ‰	4850±50	3020	3270–2880
Beta-255386	Khur Maadi bay (KM1367)	shell	+2.1 ‰	3580±50	1400	1520–1270

Calibrated dates are those supplied by the laboratory using the INTCAL04 dataset (Reimer et al. 2004), and taking account of the available regional offset for the marine reservoir effect (Hughen et al. 2004)

Table 2. Principal mollusc species. Species are listed in taxonomic order according to SMEBD 2009. Taxonomic names and other information have been checked against a variety of sources: Abbott & Dance, 2000; Bosch et al., 1982, 1995; Dance, 1992; De Bruyne, 2003; Debelius, 2003; Lieske & Myers 2004; OBIS, 2006; Wye, 2003. A: abundant; C: common; R: rare;

Class	F	Family	Species	Common Name	Size and Habitat	JE0004	KM1057
Bivalvia							
	R	Cardiidae	Indeterminate	Cockle	Variable substrate, usually sandy	√	–
	C	Chamidae	*Chama reflexa* Reeve 1846	Reflexed jewel box	6–8cm. Littoral (intertidal) to 30m depth Cemented to coral or rock surface	√	√
	R	Carditidae	*Beguina gubernaculum* Reeve 1843	Rudder cardita	Variable substrate	√	√
	R	Arcidae	*Arca avellana* Lamarck 1819	Hazelnut ark shell	4–7cm. Low littoral and sublittoral Byssal attachment to coral or rock surface	√	√
	R	Spondylidae	*Spondylus marisrubri* Röding 1798	Thorny oyster	6–8cm. 2–40m depth Cemented to coral or rock surface	√	√
	C	Mytilidae	*Brachidontes variabilis* Krauss 1848	Mussel	Littoral. Byssal attachment to coral/rock	√	√
	A	Pteriidae	*Pinctada* cf. *nigra* Gould 1850	Pearl oyster	6–9cm. Most common at 5–25m depth Byssal attachment to coral or rock surface	√	√
	C	Plicatulidae	*Plicatula plicata* Linnaeus 1767	Kitten’s paw	Low littoral. Cemented to coral blocks	√	√
Gastropoda							
	R	Cerithiidae	Uncertain	Variable cerith	Sublittoral on sandy substrates	√	–
	R	Triphoridae	*Viriola corrugata* Hinds 1843			√	–
	A	Strombidae	*Strombus fasciatus* Born 1778	Lineated conch	2–3cm. 1–3m depth in sheltered sandy bays with sea grass	√	√
	A	Fasciolariidae	*Pleuroploca* cf. *trapezium* Kiener 1840	Horse conch	10–20cm. Subtidal sand and reef bottoms down to 6m depth	√	√

R	Conidae	*Conus ardisiaceus* Kiner 1845	Cone shell	~2 cm. Sublittoral. Sand beneath rocks	√	–
A	Muricidae	*Chicoreus sp*.	??	~10cm	√	√
R	Muricidae	*Rapana rapiformis* Born 1778		5cm. Deep sublittoral. Sandy substrate		
R	Neritidae	Various species	Nerites	1–2cm. Littoral or sublittoral.	√	√
R	Fissurellidae	*Diodora singaporensis* Reeve 1850				
R	Trochidae	*Trochus dentatus* Forskål 1775	Knobbed topshell	3–5cm. Shallow subtidal, sandy bottom	√	√

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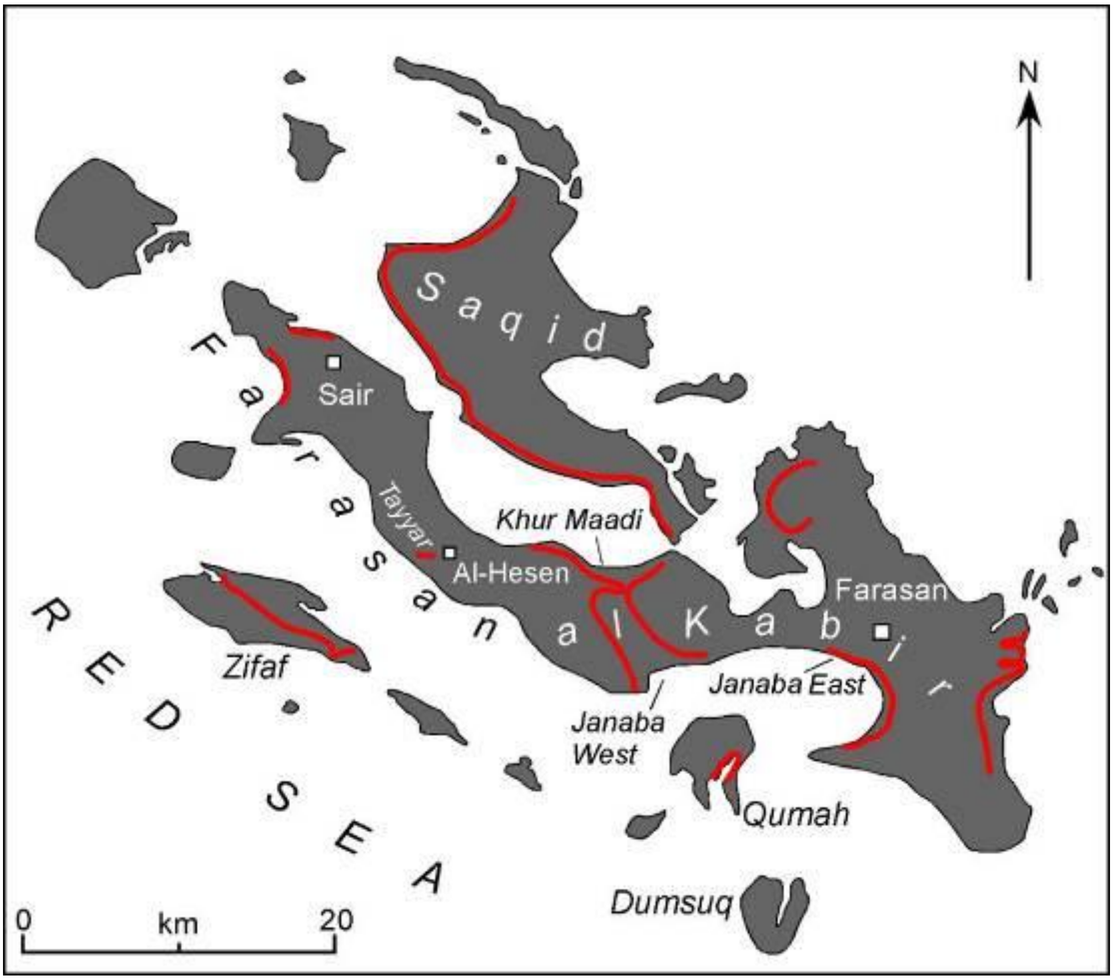

Figure 1. Map of Farasan Islands showing shell mound sites and other places mentioned in the text. Red lines indicate shorelines surveyed in detail in 2008 and main areas of hinterland survey. Most shoreline areas have shell mounds of varying size. The largest concentrations of sites are in the central region of Farasan al Kabir in the Khur Maadi and Janaba West areas, and in the Southeast of Saqid, opposite the Khur Maadi group of sites. Drawn by G.N. Bailey and M.G.M. Williams.

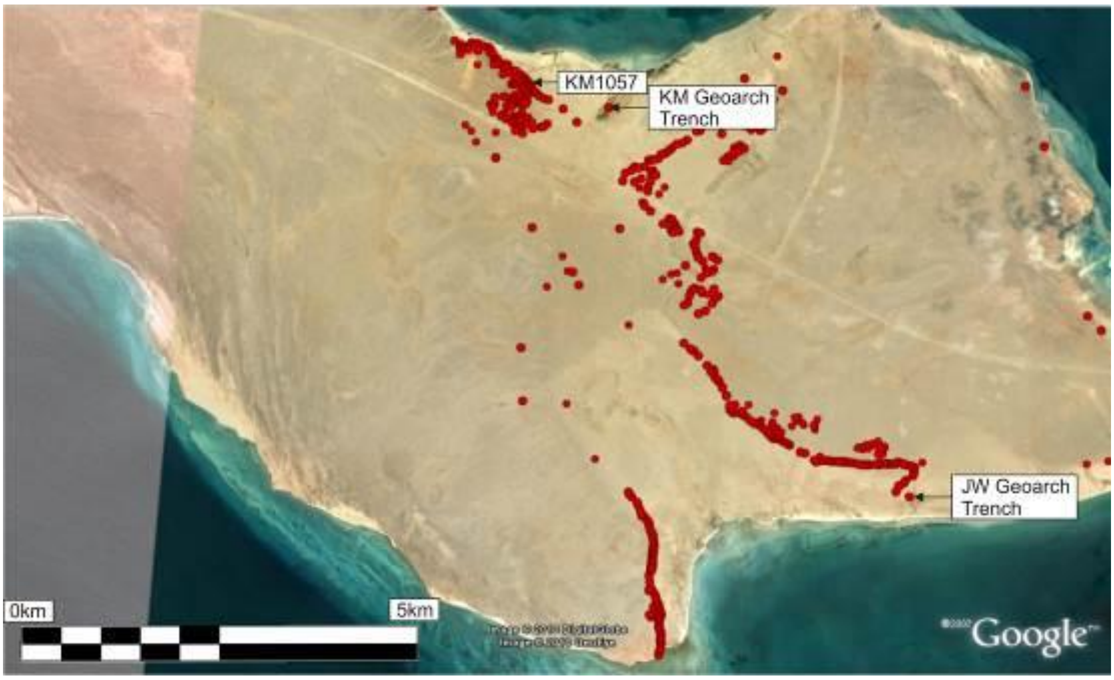

Figure 2. Google Earth image of the Khur Maadi and Janaba West areas showing the large bays that once existed and that have now been filled with sediment. The original shorelines extended some distance inland and the two bays appear to have been connected by a shallow channel. Larger shell mounds are easily visible on Google Earth images. Red dots indicate individual shell mounds and shell scatters or closely related clusters of mounds.

Figure 3. View of Janaba East shell mound (JE0004), viewed from the west, showing the position of the mound directly on the edge of a fossil coral terrace with a deep undercut notch resulting from chemical action by sea water. A block of collapsed overhang is visible on the right. Photograph by M.G.M. Williams, 2008).

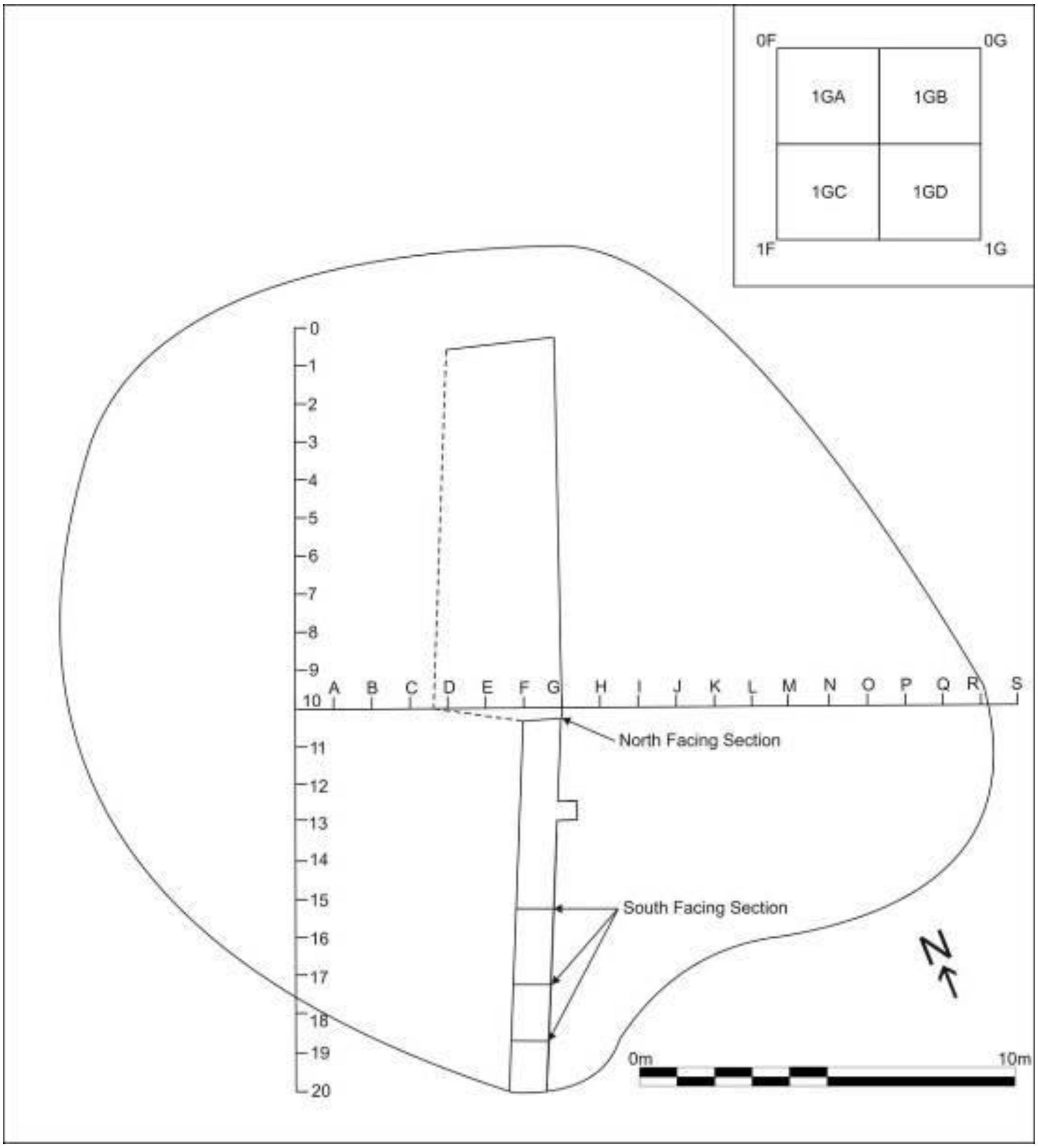

Figure 4. Plan of Janaba East shell mound (JE0004), showing layout of excavation trenches. The dotted line marks the edge of the machine-cut trench, solid lines mark hand-cleaned sections. The inset (top right) shows the conventions for labelling quadrants within a given metre square of the main grid. Drawn by M.G.M. Williams

Figure 5. View of the Khur Maadi mound (KM1057), looking west. The facing flank of the mound shows broad gouge marks typical of damage caused by removal of shell material by bulldozing activity. The figure on the left is cleaning back a section into the undisturbed part of the mound. Photo by M.G.M. Williams, March 2008.

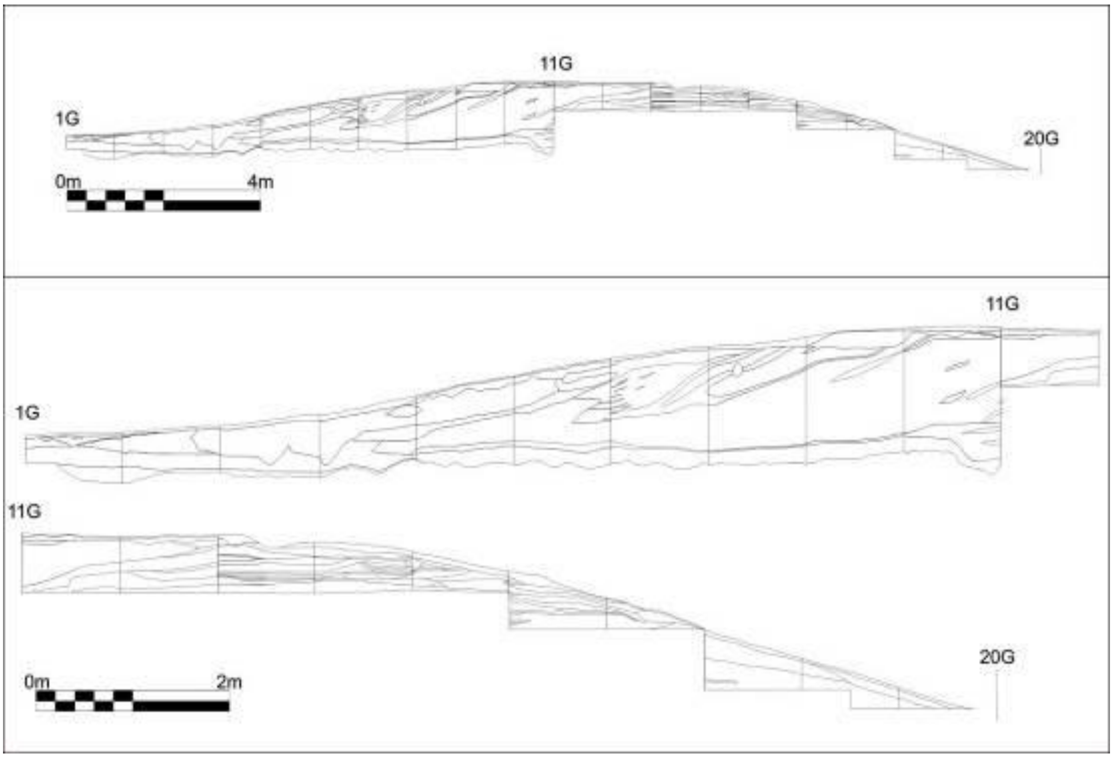

Figure 6. West-facing section of main excavation trench at JE0004. Drawn by M.G.M. Williams.

Figure 7. Distribution of shell mounds in the Janaba East cluster, superimposed on a Google Earth image.

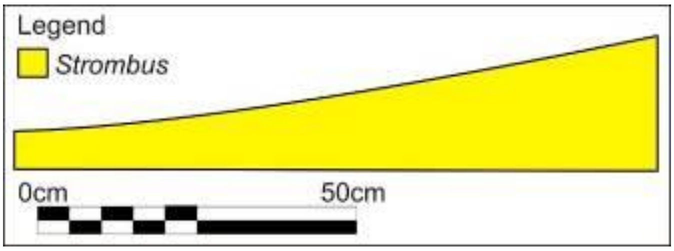

Figure 8. West-facing section of JE0001. Drawn by M.G.M. Williams.

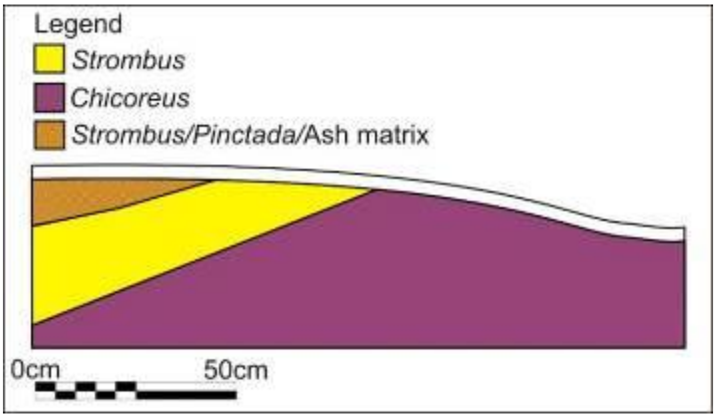

Figure 9. West-facing section of JE0002. Drawn by M.G.M. Williams.

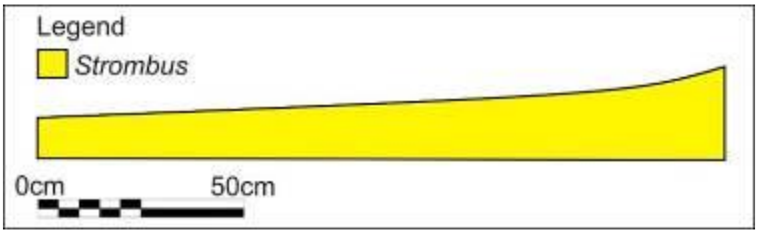

Figure 10. South-facing section of JE0003. Drawn by M.G.M. Williams.

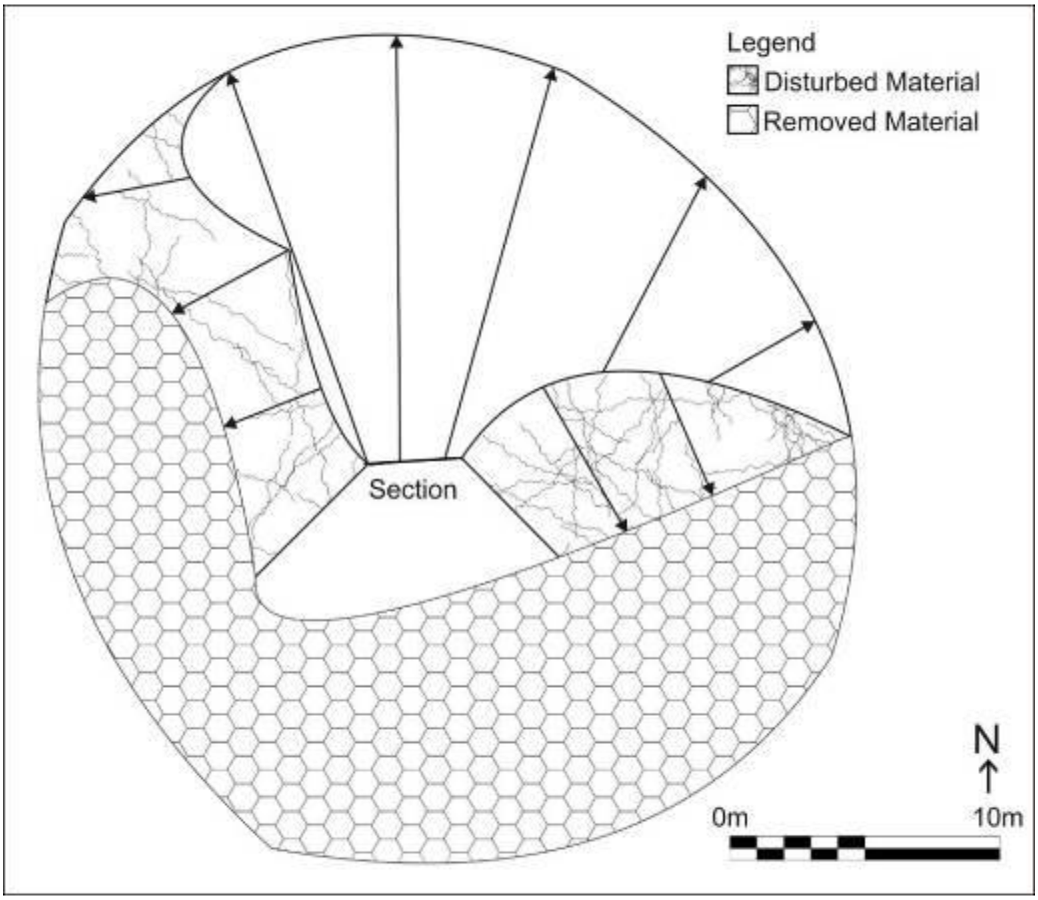

Figure 11. Plan of Khur Mahdi mound (KM1057), showing the location of the section. Arrows indicate the slope direction. Drawn by M.G.M. Williams.

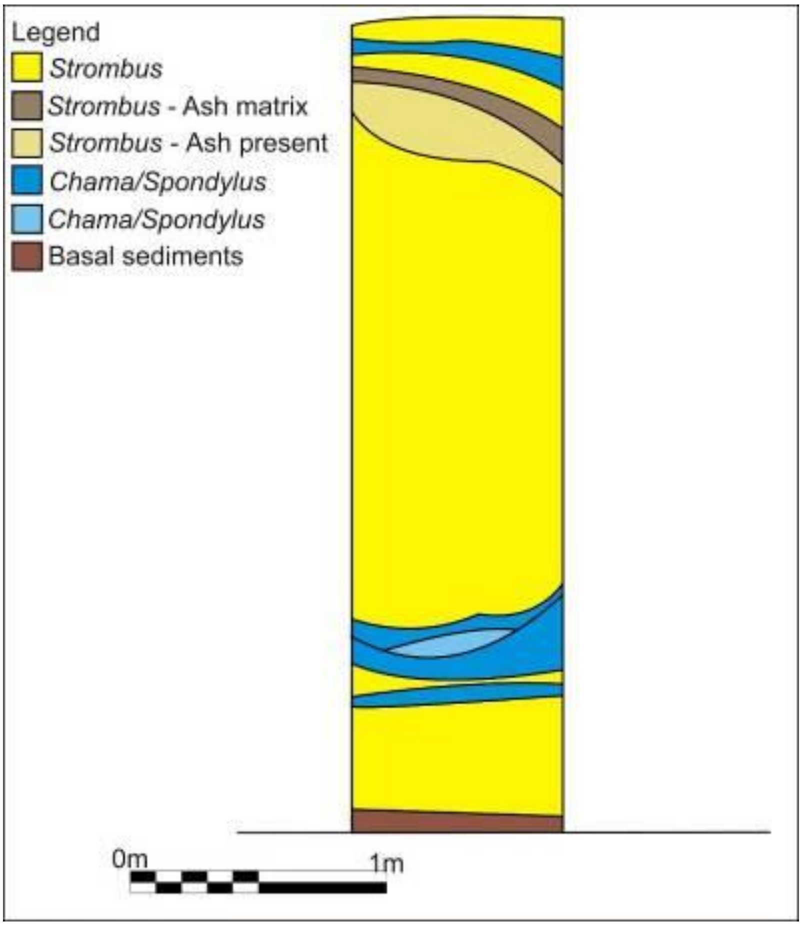

Figure 12. South-facing section of the Khur Mahdi mound (KM1057). Drawn by M.G.M. Williams

Figure 13. Distribution of shell mounds in the Khur Maadi cluster, superimposed on a Google Earth image, showing excavated mounds and the location of the geoarchaeological trench.

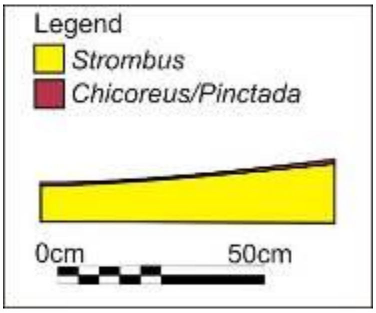

Figure 14. South-facing section of KM 1052. Drawn by M.G.M. Williams.

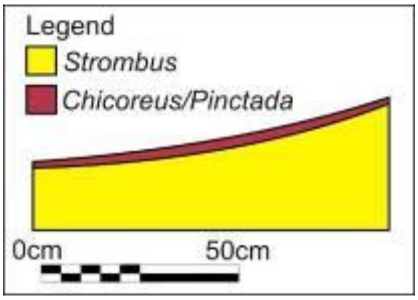

Figure 15. South-facing section of KM1053. Drawn by M.G.M. Williams.

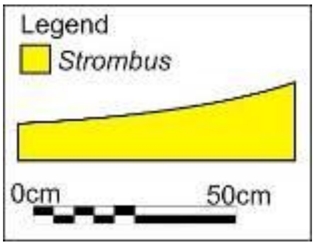

Figure 16. North-facing election of KM1054. Drawn by M.G.M. Williams.

Figure 17. An example of an isolated, inland wave cut coral terrace, located on the west of the peninsula extending north of Farasan town. Scale in 10cm subdivisions. Photo by G.N. Bailey, May 2006.

Figure 18. A view across the uplifted coral terraces at Jebel Tayar in the Northwest of Farasan Island. These terraces are inclined downwards in a westerly direction towards the cotemporary coast. Photo by A. Sinclair, March 2008.

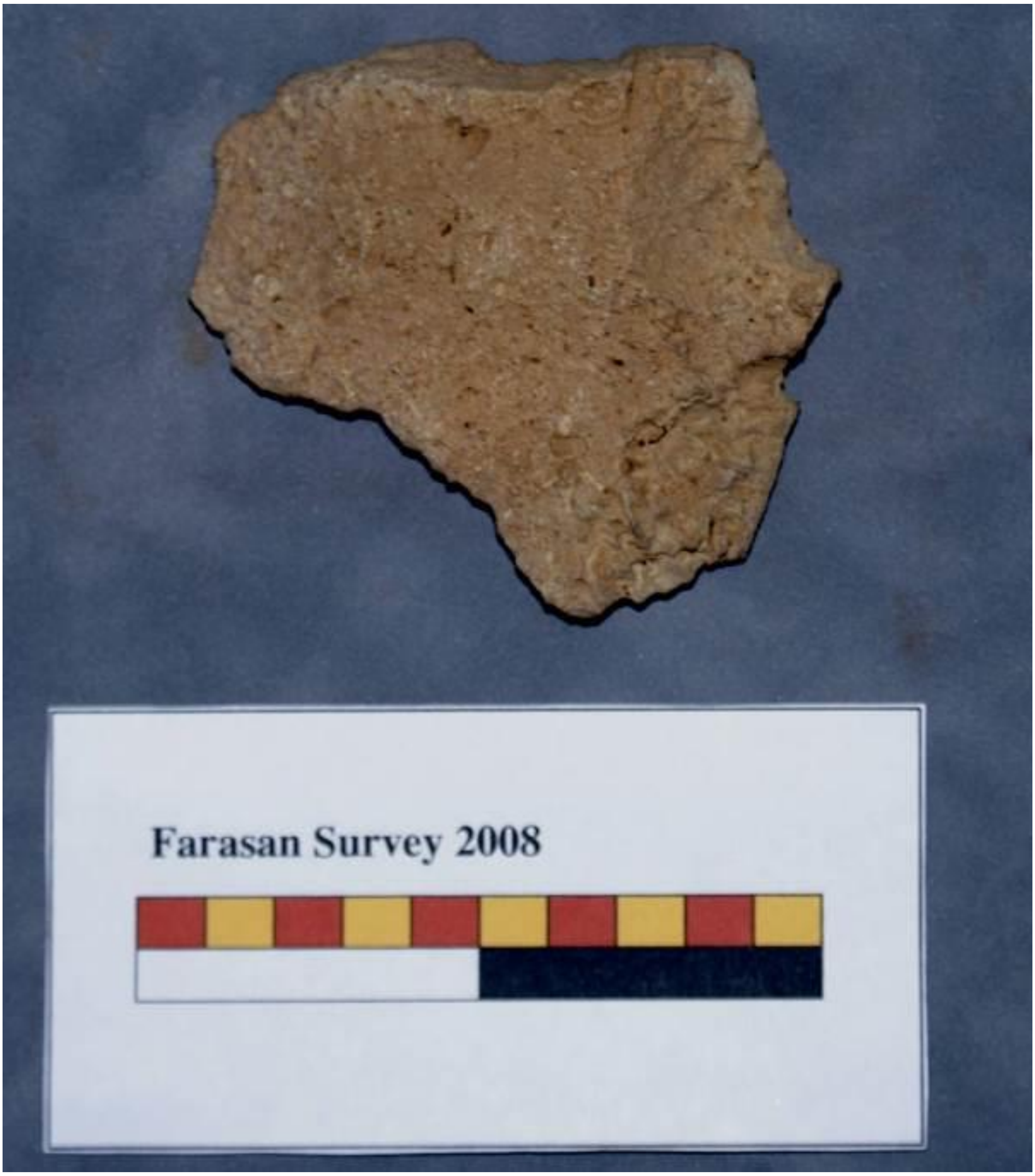

Figure 19. The ventral surface of a large flake found close to Al Hesen in the Jebel Tayar. This flake is made of fossilised coral. The flat platform is visible at the top of the flake, with the bulb immediately below. Scale in centimetres. Photo by A. Sinclair, March 2008.

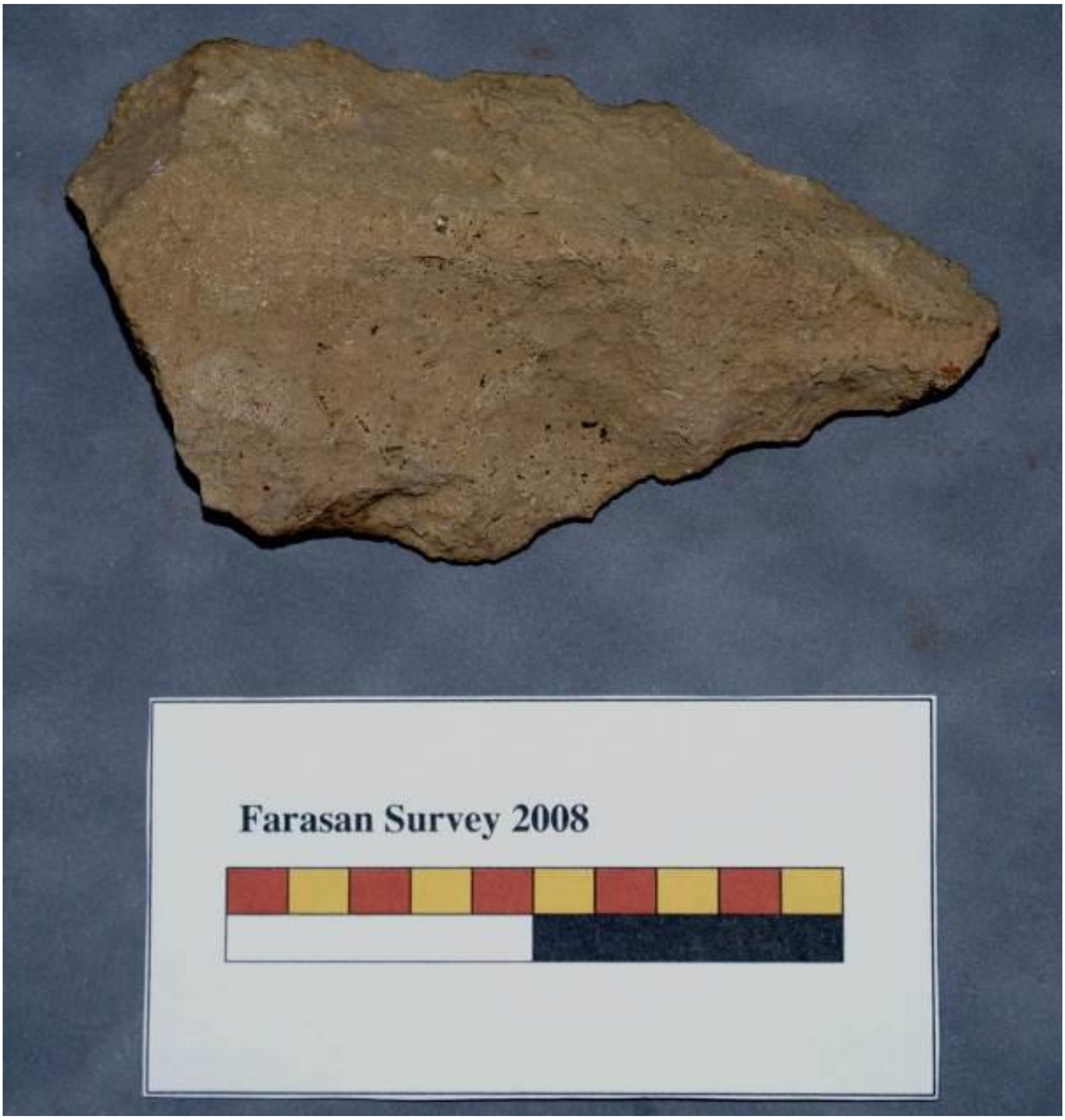

Figure 20. The dorsal surface of a large retouched flake, probably of Middle Palaeolithic age. The platform of the flake is to the left. Scale in centimetres. Photo by A. Sinclair, March 2008.

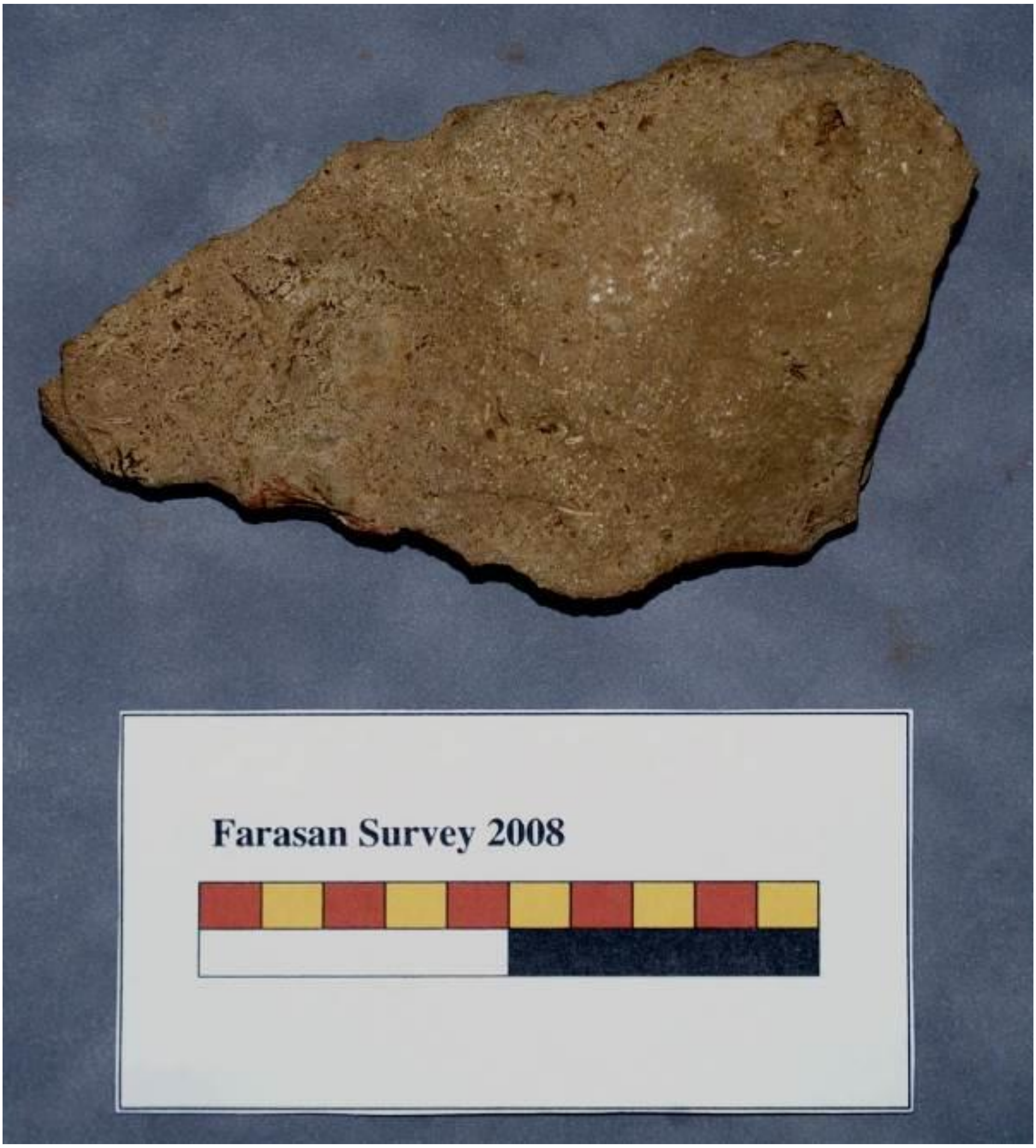

Figure 21. The ventral surface of the large retouched flake shown in Figure 20. The striking platform is to the right, with the bulb adjacent. Scale in centimetres. Photo by A. Sinclair, March 2008.

Figure 22. A close up view of the flat striking platform of the large retouched flake shown in Figures 20 and 21. Photo by A. Sinclair, March 2008.

Figure 23. A close up view of the bulb of the large retouched flake from Figure 21. Photo by A. Sinclair, March 2008.

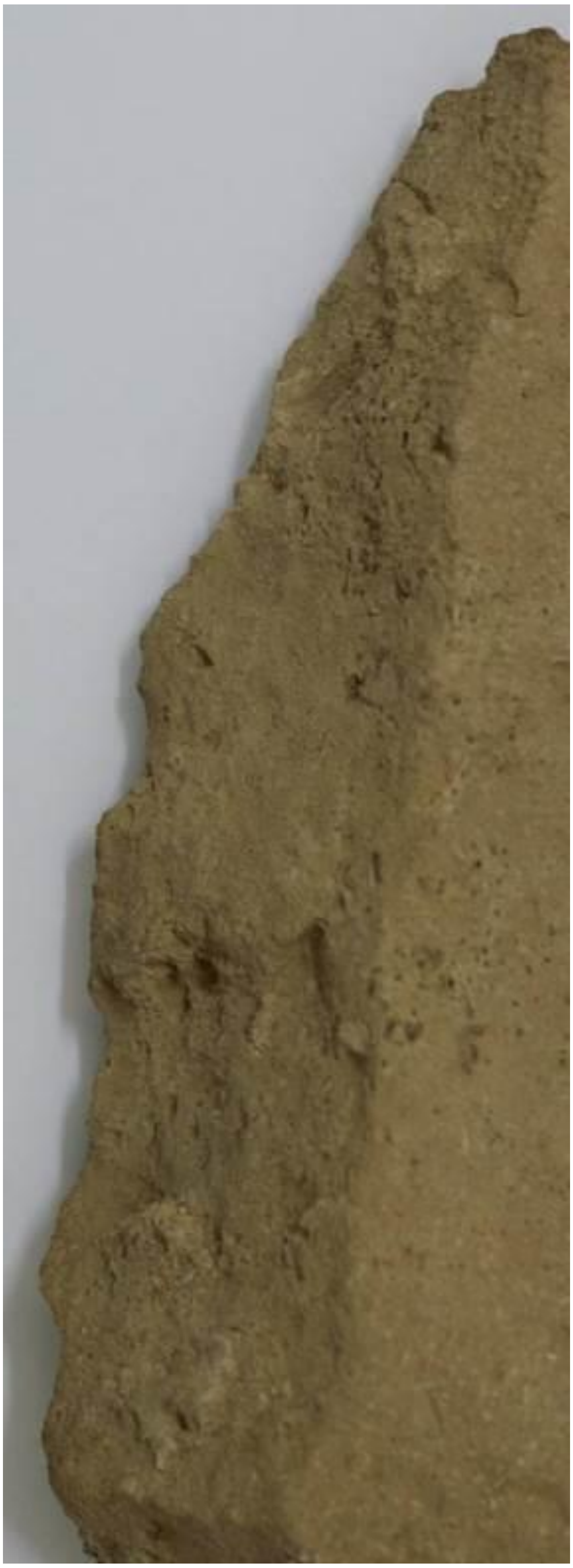

Figure 24. A close up of the retouched lateral margin of the dorsal surface of the flake shown in Figure 20. At least four large negative flake scars from scalar retouch flakes are visible along this edge. Photo by A. Sinclair, March 2008.

Figure 25. Two flakes found in the Sair region in the north of Farasan Al Kabir. The flake on the left is made from fossilised shell, and possesses many of the technological characteristics of a middle Palaeolithic convergent point. Scale in centimetres. Photo by A. Sinclair, March 2008.

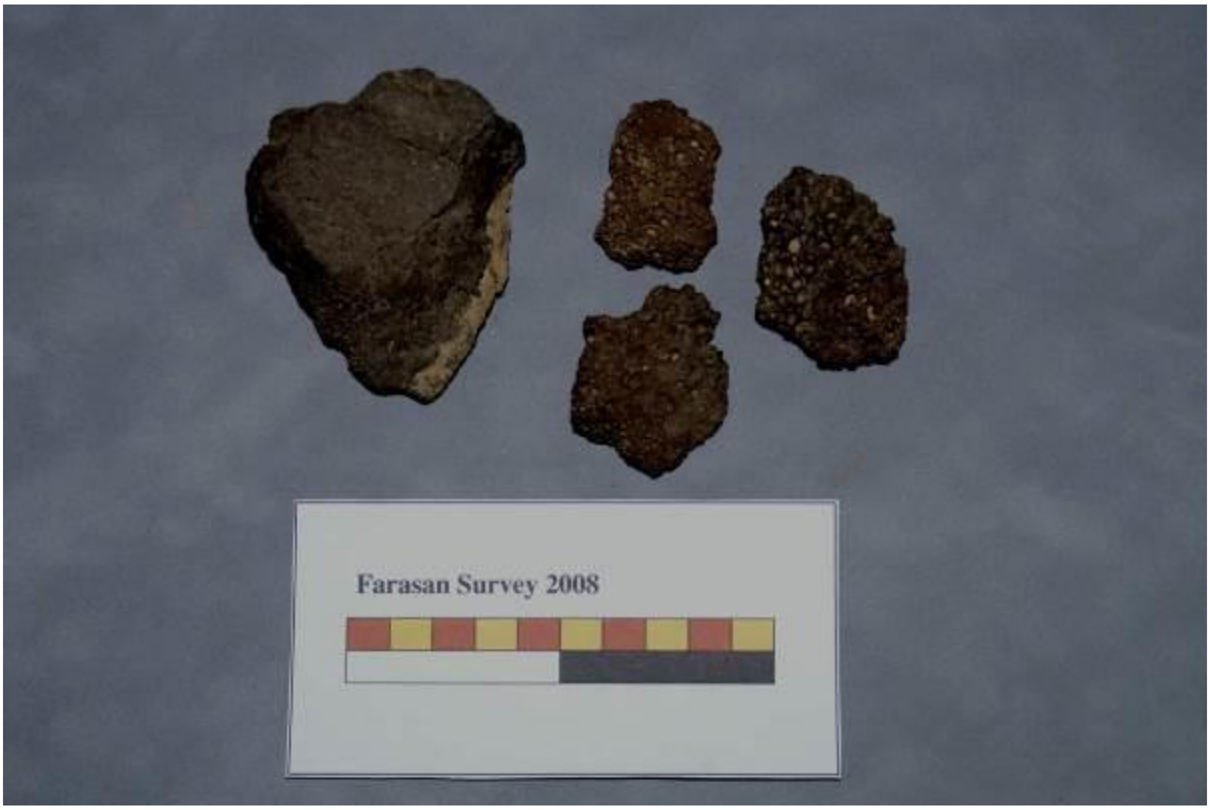

Figure 26. A series of lava flakes and one basalt flake, found on the island of Farasan Al Kabir. Scale in centimetres. Photo by A. Sinclair, March 2008.

Figure 27. An example of a cortical flake made of basalt. This flake was found on Saqid Island. Scale in centimetres. Photo by A. Sinclair, March 2008.

Figure 28. An example of a small hearth feature containing small fragments of shell. This example is one of a number to be found in the valleys between the raised and inclined coral terraces of the Jebel Tayar in the Northwest of Farasan Island. Scale in centimetres. Photo by Nabiel Al Shaikh, March 2008.

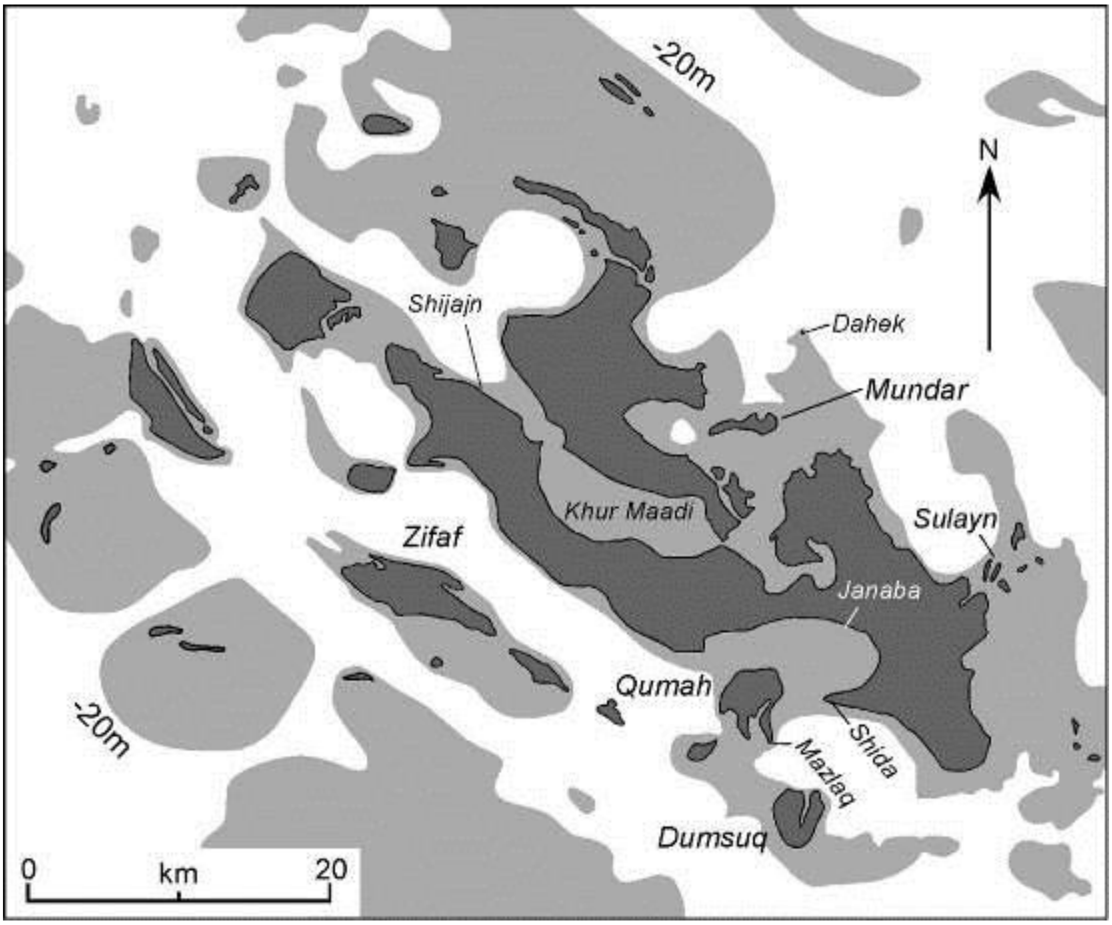

Figure 29. Farasan Islands showing dive sites and other features mentioned in the text. The light grey shading shows areas of submerged landscape down to a depth of -20m. The headland of Ra's Mazlaq is also known as Slick Point. Drawn by G.N. Bailey and G. Momber.

Figure 30. Wave and solution cut features now elevated above sea level in Qumah Bay. Photo by Nabiel Al Shaikh, March 2008.

Figure 31. Slick Point looking east. The white line indicates the angle of tilt brought about by subsequent tectonic uplift. The lower line tracks an equivalent wave cut feature at a depth of 9.6m below sea level and dropping to below 20m. The feature runs parallel to the terrestrial dip in a north–south direction. It is believed to relate to a period when sea level was 20m below present. Photo by Garry Momber, March 2008. Compare Bailey et al. [2006 report], figure 30.

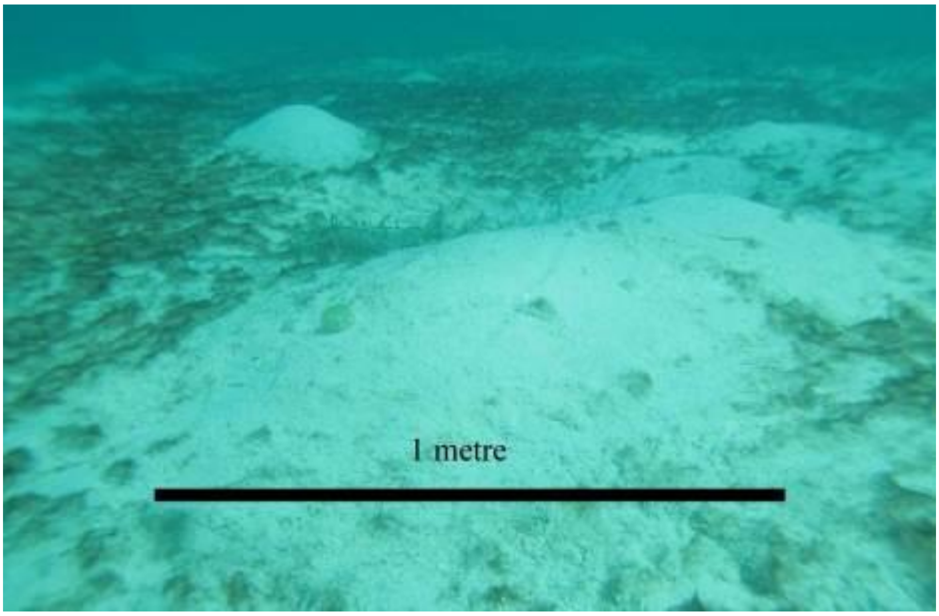

Figure 32. Sandy sea floor in south Janaba Bay with upcasts produced by marine benthic communities. Photo by Garry Momber, March 2008.

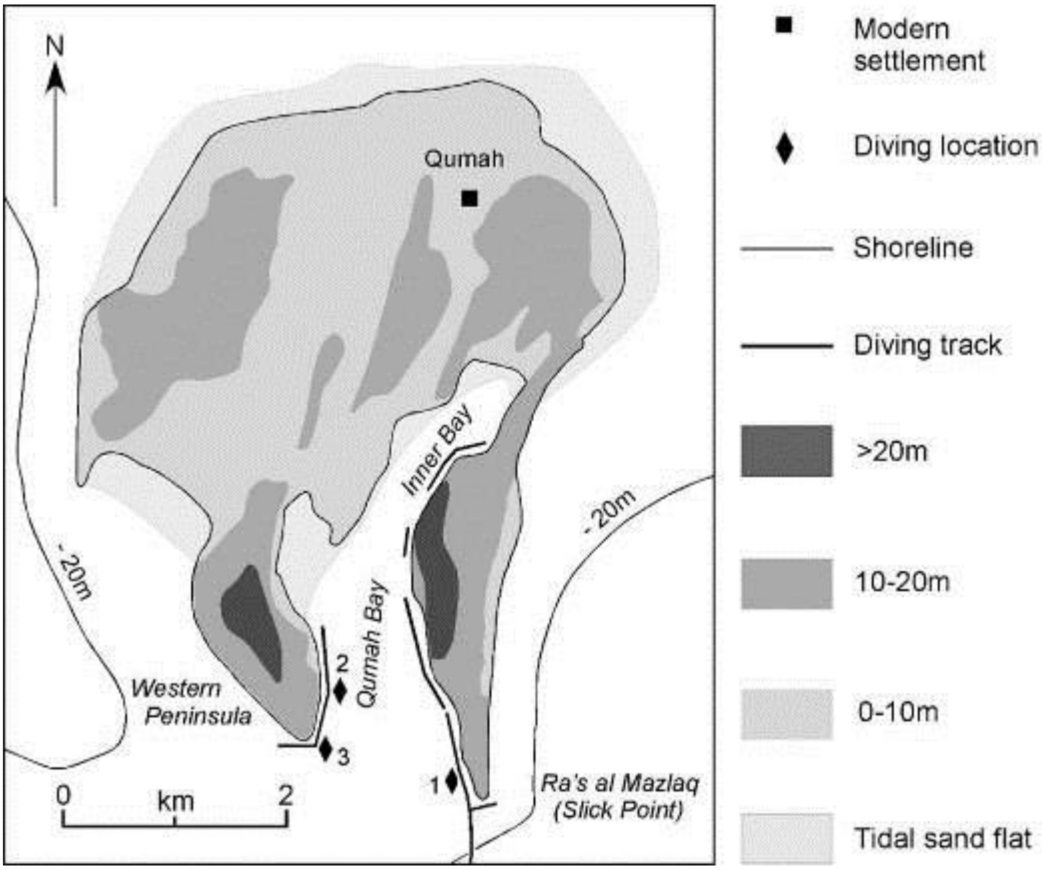

Figure 33. Map of Qumah Island, showing diving locations and places mentioned in the text. Diving locations are: 1. Slick Point; 2. Western Peninsula; 3. Shark Point. The site of RS QB01 is at location 2. Drawn by G.N. Bailey.

Figure 34. West peninsula cliff above submerged wave and solution cut features. Rocks and sandy deposits can be seen falling from the cliff. Photo by G. Momber, March 2008.

Figure 35. Archaeologist Lawrence Moran can be seen swimming past well defined marine notches in 10m depth of water. Photo by G. Momber, March 2008.

Figure 36. Nabiel al Shaikh within RS QB01 in 10–11m of water. Photo by G. Momber, March 2008.

Figure 37. Garry Momber looking south from RS QB01. When sea levels were lower this would have been a viewpoint over the basin to the south east. Photo by L. Moran, March 2008.

Figure 38. Possible artefact traps in rocks at foot of 16m deep submerged cliff. Photo by L. Moran, March 2008.

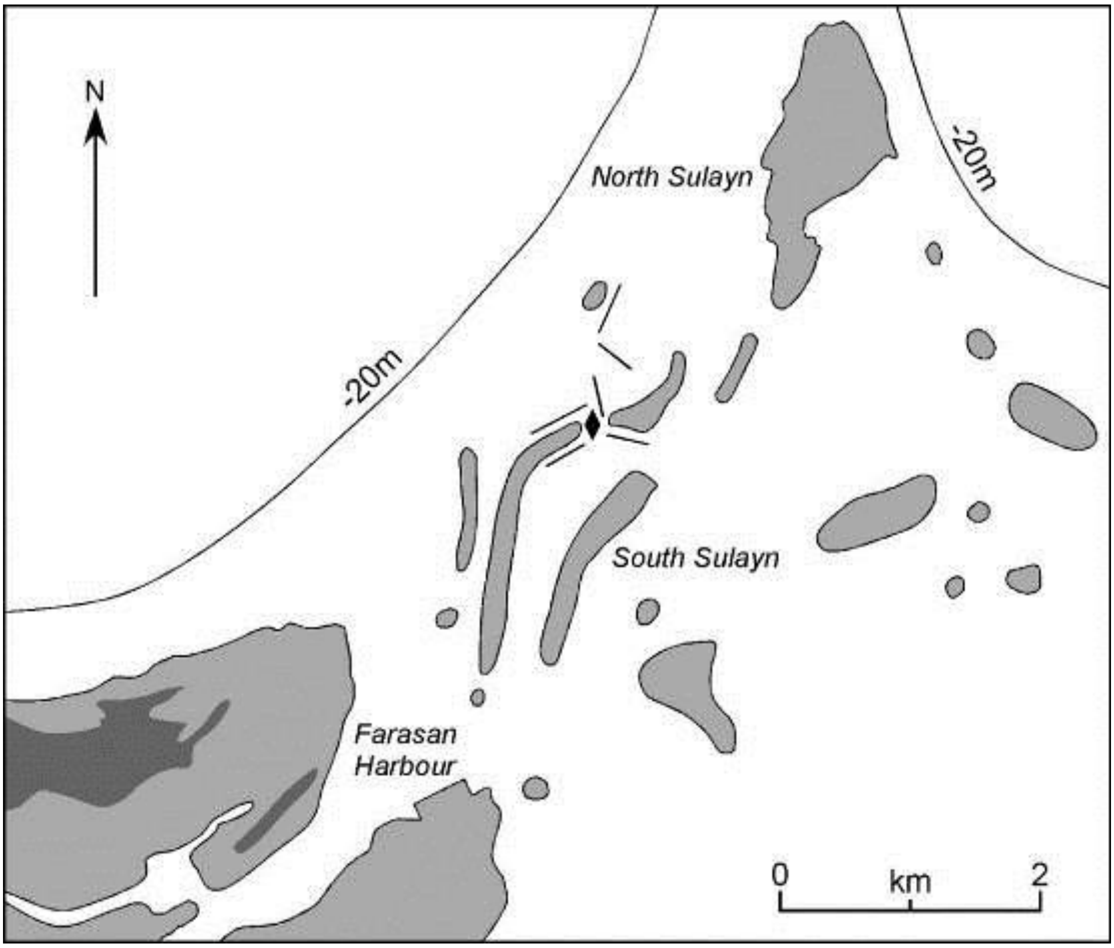

Figure 39. Sulayn Islands showing diving tracks and location of underwater excavation. Conventions as in Figure 33. Drawn by G.N. Bailey.

Figure 40. Substantial shell midden on south end of the Sulayn Island complex. Photo by G. Momber.

Figure 41. Channel cutting north from basin within Sulayn al Janub archipelago. Photo by G. Momber, March 2008.

Figure 42. Bay adjacent to south facing headland investigated on the south of Mundar Island. Photo by Nabiel Al Shaikh, March 2008.

Figure 43. Dahek Island 8 km from the main island. Photo by Nabiel Al Shaikh, March 2008.