

THE ARCHAEOLOGY OF THE SABKHAT OF ABU DHABI

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Abstract

Archaeological investigations of areas of sabkha on the coast of the United Arab Emirates, in particular in the Emirate of Abu Dhabi, have failed to find sites of any significance on the surface of the sabkhat themselves. In many areas, however, there are raised areas within the sabkhat or in their vicinity, on or close to former shorelines, where archaeological sites have been identified. In Abu Dhabi, these date from the Late Stone Age to the Late Islamic period. While sabkha formation has been a continuing process since ca 4000 BP, affected in part, at least, by small-scale changes in sea level, the sabkhat provide an important indication of the position of older shorelines. Archaeological sites have been identified on these old shorelines. Finally, little or no investigation has been undertaken of the formerly shallow tidal or inter-tidal areas now concealed by the sabkhat. Archaeological sites may lie beneath the sabkha surface in some places.

INTRODUCTION

The presence of sabkha salt-flats in the United Arab Emirates has been well documented (e.g. Evans et al. 1969). These are of two main types. One are the coastal sabkhat, that stretch from the Sila'a peninsula in the west to the Ras Ghanadha area, in the north east, (all in the Emirate of Abu Dhabi), with intermittent sabkha also present on the northern Arabian Gulf coastline of the United Arab Emirates from Dubai to Ra's al-Khaimah, and in the Qurayyah and Kalba areas on the UAE's Gulf of Oman coast. The second type are the inland sabkhat to be found in the vicinity of the Liwa Oasis in the south-east of the UAE, just north of the megadunes of the Rub al-Khali. This paper seeks to examine briefly the nature of

archaeological and palaeontological sites identified on or adjacent to the coastal sabkhat, with particular reference to Abu Dhabi.

It is widely recognised that travel across the sabkhat themselves was far from easy prior to the recent development of a network of tracks and roads. Even the hard crust that forms in summer is often thin, and easily broken through, while after rainfall, or at times of unusually high tides, they can become treacherous, now for vehicles and, in the past, for other forms of transport, such as camels. It has been noted (King 1996) that the preferred methods of travel in the pre-development era would either have been by boat, in the shallow waters offshore, or along the raised aeolianite dunes inland of the sabkhat. Thus it can be deduced that the presence of archaeological sites on the sabkhat themselves is unlikely. Extensive surveys by the Abu Dhabi Islands Archaeological Survey, ADIAS, on the coastal sabkhat of Abu Dhabi since 1992 have failed to find a single archaeological (or palaeontological) site on the sabkha surface, although, as will be seen later, sites have been found within the sabkhat on areas of raised relief.

The dating of the initial sabkha formation has been set at around 4000 BP, (Evans et al. 1969), and is discussed elsewhere in this volume. One result of their formation was a major change in the coastline of the UAE. Thus, prior to recent dredging and landfill activity, the island of Umm al-Nar, a major port-settlement site during the latter part of the Third Millennium BC (Frifelt 1991, 1995), was divided only by a narrow channel of no more than a few hundred metres in width from an area of sabkha and supra-tidal flats extending several kilometres inland. There is a distance of approximately 12 kilometres between Umm al-Nar and the low range of Pleistocene (largely aeolianite) hills inland on which Abu Dhabi International Airport now stands. This area is now sabkha, much of which has recently been infilled and developed. Before its formation, around 4000 BP, at a time when sea level was an estimated 1 to 3 metres higher than at present, it would have been shallow water or, possibly, inter-tidal flats, with the aeolianite hills forming the old coastline. The width of the coastal sabkhat varies, but can extend in excess of 15 km inland from the current shoreline in places, while the Sabkhat Matti, in the far west of Abu Dhabi, extends inland from the coast for almost 150 km., much of it being within Saudi Arabia.

Thus prior to the formation of the sabkha, the coastline of the Emirates was significantly different from that of today. As discussed below, there is also substantial evidence for the continuing evolution of shorelines since that date, as a result of small, but in some areas significant, changes in sea level. Within the sabkha zone, survey for archaeological sites should, therefore, concentrate on areas adjacent to the sabkha edge. Survey work in such areas undertaken in the United Arab Emirates, in particular in the Emirate of Abu Dhabi, has identified numerous sites, dating both from before the beginning of the formation of the sabkha and from later periods.

DISCUSSION

The first evidence of a human presence in the United Arab Emirates has been dated to the mid-Holocene, to around 7500 BP (5500 BC), in the Late Stone Age, thus pre-dating by at least 3500 years the suggested date for the beginning of the formation of the sabkha. Archaeological surveys have thus far failed to find any conclusive evidence of a human presence prior to this period, in the Lower Palaeolithic, for example, although earlier sites have been identified in Saudi Arabia (Nayeem 1990). It has been suggested that this may be due partly to the fact that prior to the mid-Holocene there was a lengthy period during which an inhospitable climate prevailed. Thus it has been proposed that "adverse climatic conditions during the last glacial era, with harsh weather and winds strong enough to transport sand, would have made living in the region at that time comparable to picknicking in a sandstorm for much of the year." (Potts 1998). It remains possible that there was Palaeolithic occupation of the Emirates, but evidence of it, if it exists, lies concealed beneath the major dune formations that cover much of the country.

Populations in the area prior to around 7500BP may have been concentrated in the more fertile and lower-lying plains of the extended Tigris-Euphrates valley, which, prior to the ice-melt at the end of the Last Glacial Maximum (LGM), around 21,000 to 14,000 years BP, extended to the Straits of Hormuz. Infilling of the Gulf, and the drowning of its floor, commenced around 14,000 BP, with the most rapid rise occurring between ca 12,000 - 8000 BP (Lambeck 1996). Populations living on the floor of the Gulf would have been obliged to move higher to escape the rising waters, leaving behind them the submerged evidence of their presence. Indeed, it has been suggested that the memories of the rising waters may have been the origins of the flood event recorded in the Sumerian Epic of Gilgamesh and of the Biblical Noah's Flood (Teller et al. 2000).

Rising sea levels appear to have reached their maximum of 1 to 3 m. above the modern level around 6000 - 4000 BP, following which there was a slow retreat (Uchupi et al. 1996 & Lambeck 1996, cited in Teller et al. 2000). Formation of the coastal sabkhat then commenced.

If, as appears to be the case, the inner edges of the coastal sabkhat roughly represent the shoreline that existed at this period (6000 - 4000 BP), it is reasonable to suppose that there should be some evidence of Late Stone Age occupation of the Emirates on, or adjacent to, this former shoreline. It should, of course, be noted that the movement of aeolian sands may have obscured the archaeological evidence in some areas.

It is perhaps significant that the oldest archaeological sites thus far identified, and securely dated by C14 dating of charcoal, in the Emirates date to between 7500 - 7000 BP, not long after this period of a rapid rise in the waters of the Gulf. The two oldest sites are on offshore islands in the waters of the Emirate of Abu Dhabi. The oldest, on the island of Marawah, has produced a date of a minimum of 7570 +/- 50

BP, while the second oldest, on Dalma, also in Abu Dhabi, has produced a date of 7115 +/- 65 BP. Dalma was probably already an island at this time, although it has been suggested that the chain of islands including Marawah may have still been a peninsula projecting from the mainland northwest to enclose the already-flooded Khor al-Bazm.

Both in the northern Emirates and in Abu Dhabi, sites from the Late Stone Age period have been found in the vicinity of the sabkha edge, although secure dating is rare. In the northern Emirates, one typical site is that of JH-57, a 5th - 4th Millennium BC shell midden at Jazirat al-Hamra in Ra's al-Khaimah (site 5 in figure 1), approximately a kilometre inland from the current coastline (Beech & Kallweit, H, in press). In Abu Dhabi, examination of the sabkha edge has produced few middens, all, in fact, on islands rather than on the mainland, where the movement of sand has more effectively obscured the shape of much of the former shoreline. Other types of archaeological sites have, however, also been identified both on islands and the mainland. At Abu Dhabi International Airport, for example, a site has been identified on a Pleistocene aeolianite dune immediately adjacent to the sabkha and representing the former shoreline. This has yielded evidence of occupation from at least five distinct periods. Three of these pre-date the formation of the sabkha around 4000 BP. The oldest, represented by lithic implements, can be dated to the Late Stone Age, ca 7000 BP (Hellyer 1998). A second phase is represented by the presence of ceramic material from the Jebel Hafit period (ca 5200 - 4500 BP) and a third by the presence of ceramic material from the Umm an-Nar period (4500 - 4000 BP) (De Cardi 1997).

Two later periods are also represented, also by ceramics, the Late Pre-Islamic period, ca 1st C. BC to 2nd C. AD and the Late Islamic period (16th - 19th C. AD) (De Cardi 1997).

Approximately 40 km south west of the city of Abu Dhabi, other Late Stone Age sites have been identified by ADIAS in the Rumaitha area (Fig. 1). In this area, the interface between the inner edge of the sabkha and the dune-covered aeolianite outcrops that represent the pre-sabkha shoreline is more complex than at Abu Dhabi Airport. Tongues' of sabkha extend in some places for a considerable distance into the dune-field, sometimes obscured by the presence of Holocene dune formations that sit on a sabkha surface so that pockets of sabkha exist that are today completely surrounded by dunes. In parts, the surface of these inter-dunal pockets is comprised of eroded and flattened Pleistocene aeolianite that merges almost imperceptibly into sabkha. Scatters of worked flint, including tools, have been found on the aeolianite on the edge of some of these sabkhat, as, for example, at the site of RM-5 in the Rumaitha area, providing evidence of a human presence during the Late Stone Age on and adjacent to the pre-sabkha shoreline (Hellyer & Aspinall, in prep.).

The majority of the archaeological sites that thus far have been recognised adjacent to the inner edge of the sabkha in coastal Abu Dhabi are of a Late Stone Age date. There is, however, some evidence that suggests that areas adjacent to the

inner edge of the sabkha were also used during subsequent periods, such is as provided by a site north-east of the Bab oilfield. It lies on an interdunal aeolian plain divided only by a narrow ridge of mobile sand from an adjacent sabkha "embayment". Worked flint, probably of a Late Stone Age date, has been collected from this plain, now traversed by a highway leading southwards from the coastal highway into the desert, but material from later periods has also been found, including imported glass ascribed a date in the 12th/13th Centuries AD and ceramic material of a Late Islamic date, or 16th - 19th C. AD (King et al. 1999). The presence of the later material suggests that the plain was used in the mid- and late Islamic periods by travellers making use of the easier going immediately inland of the sabkha edge, and to the north of the substantial dune field that lies to the south.

The inner edges of the sabkhat of the Emirates, therefore, represent areas where the presence of archaeological sites may be expected, even though, as has been mentioned, the mobility of the aeolian sand has undoubtedly obscured some sites.

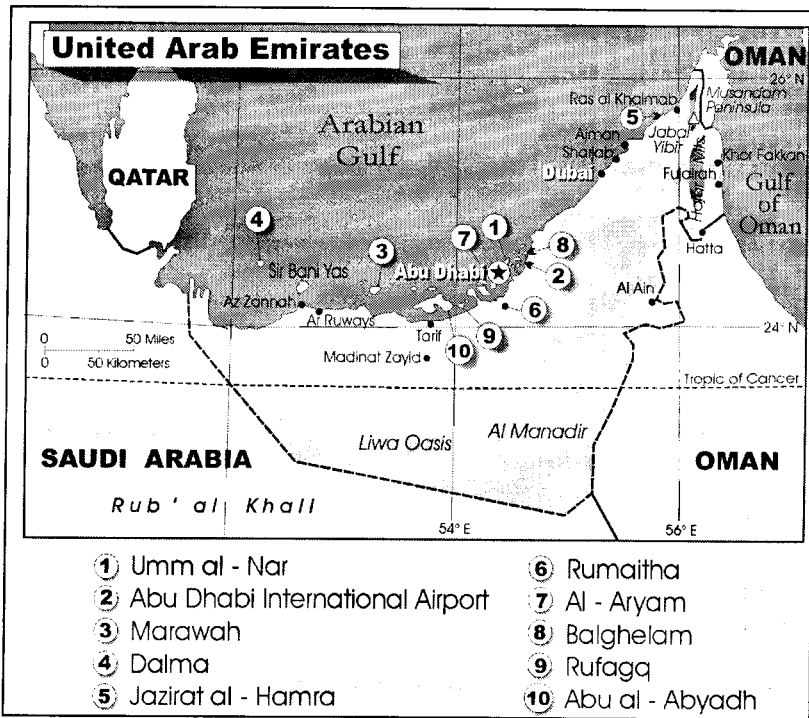


Figure 1. Location of archaeological sites in the UAE.

Other areas within the coastal sabkhat themselves have also produced archaeological, and palaeontological material. Rising out of the coastal sabkhat of

Abu Dhabi are numerous flat-topped mesas that represent the eroded remnants of a Miocene landscape, often capped with later geological strata, including limestone and flint. Prior to the formation of the sabkhat, these mesas would have been small islands, and, not surprisingly, several have produced archaeological artefacts and palaeontological material. The mesa of Barqat Rashid, (Site RM-12) to the south of Tarif, has extensive exposures of tabular flint, of a quality suitable for tool-making, while another, un-named mesa in the Rumaitha area (Site RM-2) has both tabular and nodular flint, and has also produced worked flint material. (Hellyer & Aspinall, in prep). Other mesa formations further west, such as those of Jebel Barakah and the island of Shuweihat, have produced vertebrate fossils of a Late Miocene date (Whybrow & Hill 1999).

Such formations, rising in some cases to over 60 metres above the sabkha, are sufficiently distinct to be distinguished easily from the sabkha, and are outwith the scope of this paper.

There are, however, less easily distinguishable formations within the sabkha that have also produced material or which may do so, if subjected to detailed examination. These are essentially of two types, the remains of Miocene outcrops that have lost their harder limestone or flint caps and have been eroded down to an elevation that may be only a metre or two above the surrounding sabkha and slightly raised beaches deposited during the peak of the mid-Holocene marine transgression that followed the LGM. This is now believed to have reached its height ca 6000 - 4000 BP.

Examples of the first type, the eroded Miocene outcrops in the Abu Dhabi coastal sabkhat, have been examined by ADIAS. One such outcrop, Muqatara-1, close to the coastal highway just south-west of Abu Dhabi, has a maximum elevation of no more than 3 metres above the sabkha. Fragments of Late Miocene fossilised eggshell, believed to be of a *Struthionid* ancestor of the ostrich, *Struthio camelus*, have been collected from the slopes of the outcrop. Another outcrop in the Rumaitha area, Site RM-1, a few hundred metres into the sabkha from the pre-sabkha shoreline, has yielded both Late Miocene fossilised eggshell and small pieces of tabular flint, the remains of the former hard cap, as well as worked flint, presumably of a Late Stone Age date (Hellyer & Aspinall, in prep.).

Good examples of the second type, the old and deflated beach ridges, are present in the coastal sabkhat to the south-west of Abu Dhabi from the island of Al-Aryam, in the east, to Abu al-Abyadh, in the west (site 7 and 10 in figure 1), and are visible on satellite imagery as linear features. On the surface, they can be identified by the sparse colonisation by halophytic vegetation, which is not present on the sabkha itself (Kirkham 1997). It has been suggested (see above), that the marine transgression that followed the LGM climaxed at around 6000 - 4000 BP at a level approximately 1 to 3 metres above present-day sea levels, at or above the current levels of these beach ridges. Subsequent deflation, however, would have reduced the ridges to their current levels. This climax of the post-LGM marine transgression

would have occurred during the latter part of the Late Stone Age (dated in the UAE to ca 7500 BP to 5200 BP) or the early Bronze Age (5200 BP to 3300 BP). It is certainly possible, although as yet unproven due to a lack of survey work on such deflated beach ridges, that some may contain artefacts or other material relating to a Late Stone Age or Bronze Age presence, such as lithic implements or shell middens.

It is necessary to recall that the formation of the coastal sabkhat of the United Arab Emirates cannot be ascribed to a particular, finite period of time, even if their formation appears to have commenced around 4000 BP. Thus Late Holocene anhydrite is still forming on the seaward side of the storm beach system within the supra-tidal zone of the Khor Al Bazm and Khor Qirqishan (Kirkham 1997).

Investigation of the surface geology of a number of Abu Dhabi's offshore islands, carried out for the Abu Dhabi Islands Archaeological Survey, has produced evidence of changing sea levels during the Late Holocene period. Thus, on the island of Marawah, the dating of material from three beach ridges of varying levels has suggested they were formed at widely differing dates, viz. 4510 ± 100 BP, 2230 ± 50 BP and 1610 ± 60 BP (Evans et al., in prep).

Also on Marawah (site 3 in figure 1), west of the village of Ghubbah, and adjacent to the archaeological sites MR-9, MR-11 and MR-12, there is an area of sabkha that appears to represent a former embayment, now infilled by natural sedimentation. While some of the sites overlooking this embayment date to the Late Stone Age or early Bronze Age, i.e. pre-dating the beginning of the formation of the sabkha, others have been dated to the late First Millennium AD (Elders 2000). Although further investigation of this embayment is required, it appears at least probable that it was still a tidal inlet during the late First Millennium AD. Elsewhere on Marawah, overlooking another area of inland sabkha, a number of hearths have been identified. Although these have not yet been examined in detail, they are of types that have produced C14 dates, from both Marawah and the islands of Balghelam and Rufayq, that range from approximately 4000 BP to 1800 BP, or after the date conventionally used for the beginning of sabkha formation. Two hearths on Rufayq dated to the early 1st Millennium BC and mid 1st Millennium BC lie close to the inland edge of an area of sabkha extending inland from the current shoreline.

On another island, Abu al-Abyadh, another archaeological site has been identified on a low raised area within what also appears to be an infilled embayment. The site, ABY-21, on the south-west of the island, has produced ceramics of Late Islamic date, but no earlier material (Hellyer et al. 2000). It is tentatively suggested that this site was a supra-tidal outcrop in a tidal inlet until relatively recently, although the whole inlet is today now silted up and supra-tidal.

Further study of the evolution of sea levels in the Arabian Gulf is required before a clear picture can be proposed, but studies by the Abu Dhabi Islands Archaeological Survey on the offshore islands of Abu Dhabi certainly suggest that at least some of the infilled embayments that are now sabkha were at least inter-tidal in the recent past.

Thus a review of the sabkhat of Abu Dhabi with relation to the archaeological evidence that may be present requires not only an examination of the inner edges of the coastal sabkhat and of any areas of raised relief within them, but also a study of areas close to the present-day coastline that may represent embayments that have been infilled during the 4000 years or so that have passed since the main process of sabkha formation commenced.

For this, as in so much else, a multi-disciplinary approach will be required if a full understanding of the coastal archaeology of Abu Dhabi is to be obtained. Over the last 4000 years, changes in sea level and, therefore, in shorelines, have been well attested in the Emirates. It is probable, therefore, that the formation of at least part of some of the coastal sabkhat is also relatively recent, postdating 4000 BP. Certainly a number of archaeological sites are in locations that, despite their dating, for example in the First Millennium BC and the First Millennium AD, suggest that they were deliberately sited adjacent to a now-disappeared coastline.

Finally, it is possible that the sabkhat themselves may conceal archaeological evidence that pre-dates their formation. Thus, at the site at Abu Dhabi International Airport, mentioned above, it is reasonable to assume that, prior to the formation of the sabkha, there may have been simple jetties to facilitate the shipping of goods offshore to the island of Umm al-Nar. No evidence of such jetties has thus far been identified, but they may lie beneath the sabkha that, as it formed and the sea retreated, rendered the jetties themselves redundant. The utilisation of techniques such as ground-penetrating radar may yet show that archaeological sites lie not only on the edges of the sabkha, but beneath its surface.

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