Rawdah, Wadis and coastal taphonomy: An evaluation of the archaeological landscape of north-western Qatar

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Abstract

This paper summarises our understanding of archaeological sites within the natural & cultural landscape of Qatar, with particular reference to coastal sites during the Quaternary. Through the application of systematic survey, the use of Geographic Information Systems (GIS), environmental archaeology and traditional excavation, a robust and detailed dataset has been produced that enables the reconstruction of past environments. Through the use of such models archaeologists may begin to examine important proximal factors such as environmental refugia, sea level change, trade and communication and how such variables influenced past human occupation and development within the region.

Key words Landscape Archaeology, Qatar, Holocene coastlines, Flandrian Transgression

Background

The peninsula of Qatar comprises largely of Tertiary limestone, shale and dolomite of the Upper Dammam Formation, which formed in shallow marine conditions in the latter half of the Eocene Epoch. An anticlinal arch aligned north-south along the centre of the country is one of the largest structural features of the Arabian Plate (Fig. 1). Wadi systems can be traced from this anticline to the coast, and are places interspersed with dissolution hollows or collapsed karst where surface sediment has accumulated. Known locally as *rawdah*, these sediment basins have a important impact on the pattern of interior drainage, forming catchment areas for surface water runoff. This allows for aquifers to be recharged through seepage, rather than allowing surface water to be discharged along wadis into the sea. *Rawdah* account for c.335km^2 of the surface area of Qatar [1] totalling approximately 2093 individual areas. These are important for agriculture and low level vegetation. Karst formed during phreatic conditions in the Middle Pleistocene (around 560,000 to 325,000 years ago) due to the dissolution of carbonate-evaporite deposits by circulating groundwater, and takes the form of caves,

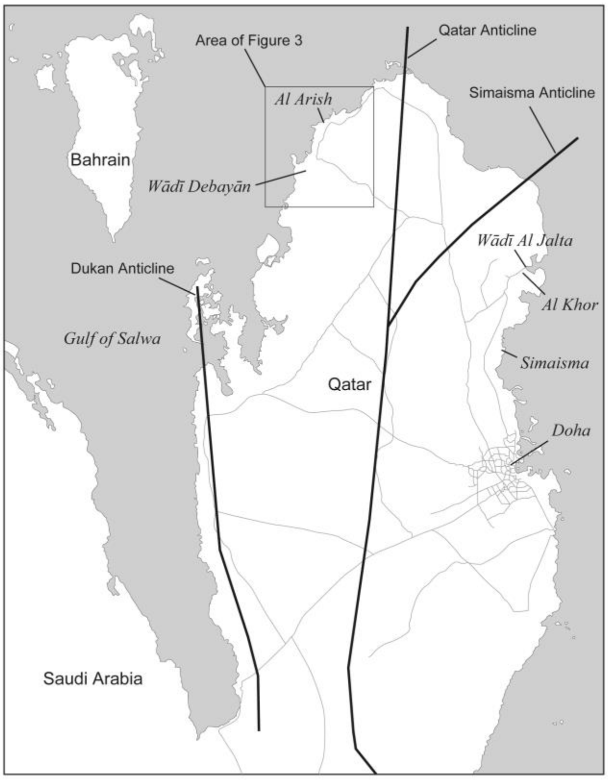

Figure 1: Sites and geological features

[1] Sadiq & Nasir 2002

sinkholes and sediment hollows (*rawdah*). It has been calculated that there are more than 9700 caves (*duhul*)/karst-related features most of which are located in northern Qatar [1].

The present shape of Qatar is largely a reflection of glacial retreat in the northern hemisphere and sea level change between c. 18000 and 4000 years ago. During the Last Glacial Maximum (LGM ~26 – 19ka) the Gulf was entirely free of marine influence, with the confluence of the Tigris-Euphrates Rivers flowing through the sub-aerial Gulf basin and discharging into the Gulf of Oman. Given the hyper-arid conditions across much of the Arabian Peninsula during the Late Pleistocene, this landscape is likely to have been an important focus for regional groups until sea level rise in the early Holocene[2].

While the extent of Aeolian sand (dunes) across Qatar during the Late Pleistocene is less-well understood, it is considered to have been more extensive than the present day[3]. In Qatar barchan dunes are mostly limited to the southeast of the country, forming the northern-most extent of the *Rub' al-Khālī*. Prior to 13000 years ago, lower sea levels and the prevailing northwest '*Shimal*' wind probably facilitated the transport of oolitic sands across the exposed floor of the Arabian Gulf and into northern Qatar. As sea levels rose the Arabian Gulf became a sediment trap, cutting off the supply of Aeolian sand and exposing wadis and *rawdah* in northwest Qatar[4].

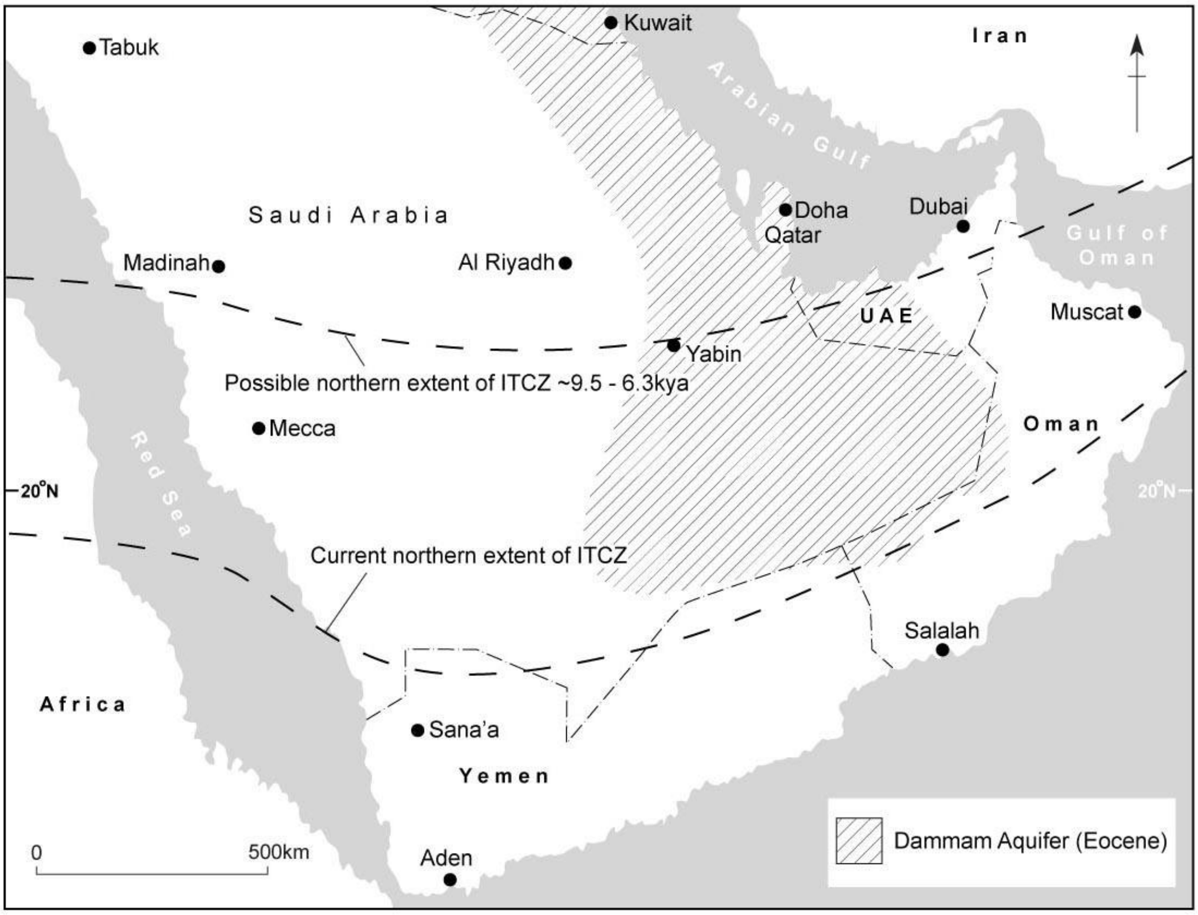

Figure 2: The projected advance of the ISM across the Arabian Peninsula during the early Holocene

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[2] Cuttler 2013
[3] Cuttler & Al-Naimi 2013a
4 Cuttler & Al-Naimi 2013°, Glennie & Singhvi 2002

Most early to mid-Holocene sites are found along wadis, the coast, or on the edge of *rawdah* where water, vegetation and fauna were more abundant. Two large wadis in northern Qatar (the *Wādī Debayān* in northwest Qatar and the *Wādī Al Jalta* in northeast Qatar [Fig. 1]) have to date yielded the largest density of early to mid-Holocene occupation. The arrival of ʿUbaid-related coastal settlement during the 8th millennium BC (as at *Debayān* and *Al Jalta*) coincides with climatic amelioration in some parts of the Arabian Peninsula and a rising sea levels. The ameliorating climate is associated with a northwards shift of the Indian Summer Monsoon belt (ISM). However, environmental proxies record a significant variation in the range, duration and intensity of the ISM at different latitudes across Arabia. This suggests it is unlikely that such pluvial conditions occurred simultaneously across the entire peninsula, and should be considered as a time-transgressive event. Proxy evidence suggests the ISM affected southern Arabia around 10000 years ago, but probably took a further ~500 to 1500 years to advance as far as the northern Emirates (Fig, 2). Thus it is unlikely that the northwards movement of the ISM during the early Holocene influenced areas north of ~23-24° latitude[5] and probably rarely had much direct impact on central to northern Arabia or Qatar.

Climatic deterioration during the 3rd to 1st millennium BC, does however, coincide with a paucity of sites in Arabia and Qatar, and may reflect a population decline, or possibly a change of lifestyle from sedentary to nomadic. There is also little evidence for late pre-Islamic settlement, however, the 1st millennia BC sees a sharp rise in the construction of burial cairns, particularly in northern Qatar[6].

Pioneering work by Peter Glob[7], Holger Kapel[8] and Beatrice de Cardi[9] indicated a preference for coastal settlement during the prehistoric and later Islamic periods. The effects of fluctuating sea levels were pivotal to the research of early expeditions and laid the foundation for missions in the 1970s and 1980s which focused their exploration on the coastal zone[10]. This existing body of work sought largely to establish landforms within the country associated with former coastlines and the scope of human exploitation during prehistory. Surveys by the QNHER project suggest archaeological sites are not simply found around the coast but are fairly evenly distributed across the northern extent of the Qatar Peninsula. Of particular note is the distribution of Abbasid sites, mostly located within the interior and away from coastal areas.

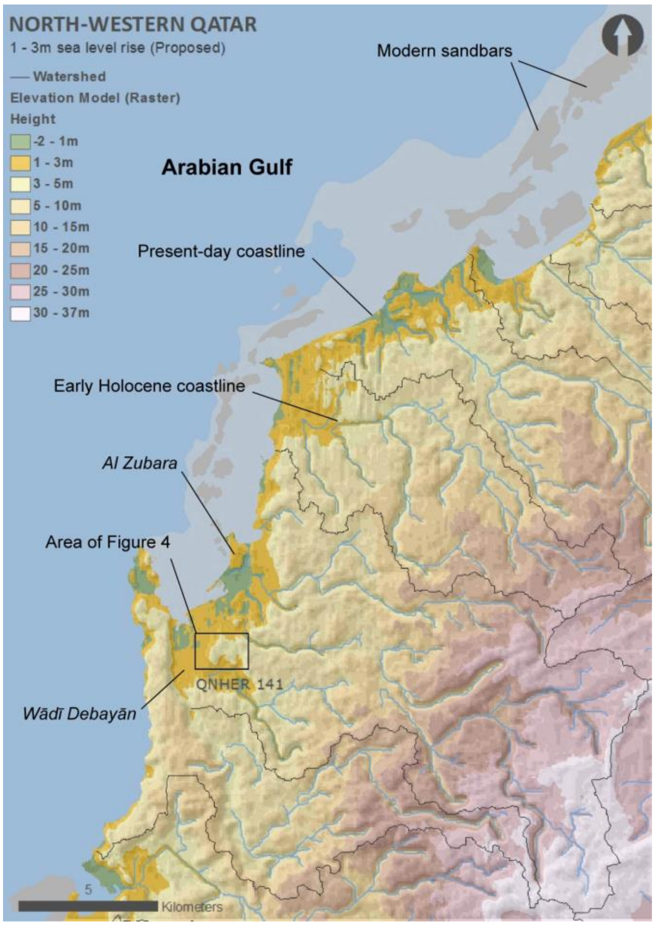

Figure 3: Elevation model of the northwest coast of Qatar showing water catchment areas (watershed) and the predicted effect of the mid Holocene 1 – 3 metre sea level rise

5 Fleitmann et al. 2004
6 Cuttler *et al*. 2013b
7 Glob 1957
8 Kapel 1967
9 de Cardi 1978;
10 Inizan 1988

Coastal geomorphology in northwestern qatar and sea level rise in the mid-holocene

As late as 8200 years ago extensive areas of the Gulf between Qatar, Bahrain and the Emirates were most likely free from marine influence, with research suggesting present sea levels were reached between ~7000 and 6000 years ago[11]. Positive sea-level tendencies continued, with a highstand of between [+] 1 – 3m between ~5800 and 4600 BP[12], marking the extent of the Flandrian Transgression. Lambeck and Vita-Finzi both produced a set of synchronous dates from *Al Khor*, *Wādī Lusail* and *Bir Zekrit*, with negative sea-level trends commencing *c*. 4280±160BP and 4690±80BP (Lambeck 1995; Vita-Finzi 1978). Taylor and Illing[13] produced dates from *Ras Abrouq* and *Bir Zekrit* which suggested the trangressive phase and highstand were slightly later. At *Ibn Ghanim*, north of the current town of *Al Khor*, evidence suggests maximum height was reached *c*.5000 BP with negative trends established by *c*.3000BP[14].

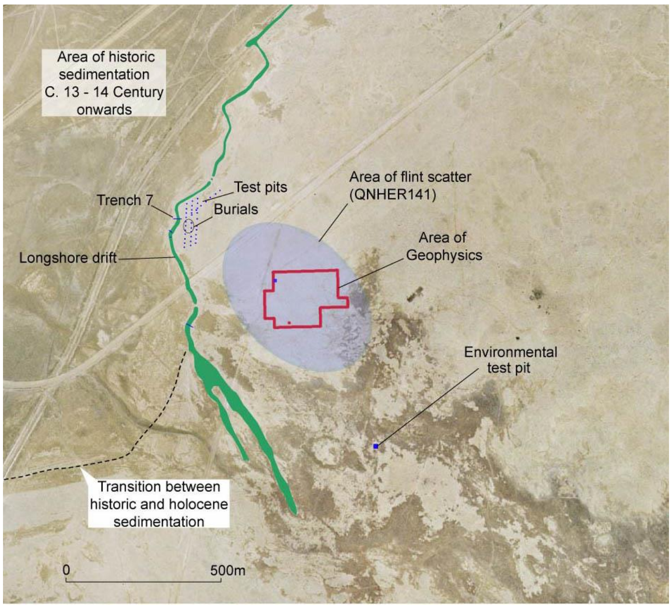

Figure 4: Palaeoshorelines and areas of intervention at Wādī Debayān

Such evidence indicates a dynamic coastal environment with oscillations in sea-level impacting on the location, extent and nature of the early Holocene human coastal settlement[15] . This is perhaps most clearly understood from research at *Wādī Debayān*, northwest Qatar (QNHER141, Fig. 3). Since 2008 the area has been the subject of intensive survey, excavation and palaeoenvironmental reconstruction, which has revealed evidence of human occupation along ancient shorelines.

In 2008 the discovery of an unstratified flint scatter (QNHER141) on a raised plateau overlooking *Wādī Debayān* prompted a program of survey, geophysics, excavation and environmental research. A magnetometry survey within the area of the flint scatter (Fig. 4) failed to identify distinct features. Subsequent excavation of the plateau revealed that the inconclusive results of the geophysical plots related to a high density of hearths and burning that made individual features indistinguishable. Test pitting within *Wādī Debayān* was more successful and provided almost 2 metres of environmental deposits. The earliest marine deposits were radiocarbon dated to 6010 +/- 40 ^{14}C BP (Beta 281167, Cal BC 5000 to 4800 [Cal BP 6950 to 6740]) (Unit 7, Fig. 5). This would suggest that present day sea levels were reached in northern Qatar at some point early in the 5th millennium BC, with sea levels stabilising by the mid-5th millennium BC and the accumulation of more than 1.5m of marine sedimentation evident by 5650 ±40 ^{14}C BP (Beta 280029, Cal BC 4550 to 4440 [Cal BP 6500 to 6380]/Cal BC 4430 to 4370 [Cal BP 6380 to 6320]) (Base of Unit 5, Fig. 5). The appearance of humified organic material and the presence of plants (semi-terrestrial, emergent or aquatic), indicates increasingly tranquil conditions and the development of mangrove swamps within the wadi. The top of Unit 5, radiocarbon dated to 5310±40 ^{14}C BP (Beta 280030, Cal BC

[11] Lambeck 1996
12 Vita-Finzi 1978
13 Taylor and Illing 1969
14 Inizan 1988
[15] Cuttler 2013

4250 to 4040 [Cal BP 6200 to 5990]/Cal BC 4010 to 4000 [Cal BP 5960 to 5950]) suggest this environment remained fairly stable until the early-4th millennium BC, with subsequent deposits showing no evidence for later marine transgression.

To the south of the flint scatter (QNHER141) and along the northern flank of the wadi an extensive sandbar/palaeocoastline was recorded, which must have been the result of long shore drift within *Wādī Debayān* (highlighted in green on Fig. 4). The palaeocoastline is highly characteristic, consisting of a berm ~15 metres aligned along the former coastline for more than 500 metres, and was most likely backed by a lagoon, which lay between the palaeocoastline and the flint scatter (QNHER141). AMS samples from the basal layers indicate that the deposit formed towards during the second half of the 4th millennium BC, 4620±40 ^{14}C BP (Beta 297316, 3510-3340 Cal BC 3510 to 3410 [Cal BP 5460 to 5360]/Cal BC 3390 to 3340 [Cal BP 5340 to 5290]). As a result of these anthroprogenic deposits, five further interventions were excavated across the palaeocoastline. These interventions demonstrated that late-4th to mid-3rd millennium BC occupation is present along the entire palaeocoastline within *Wādī Debayān*.

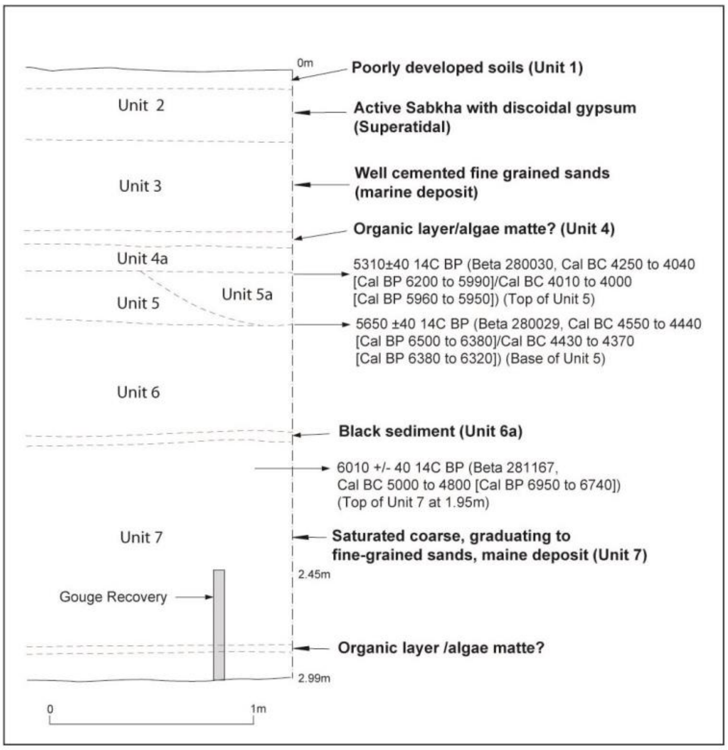

Figure 5: The palaeoenvironmental sequence from Wādī Debayān

Discussion

In Qatar the presence of several distinct ecosystems has been noted; the hyper-arid and largely sterile dune systems of the south; the extensive interconnected system of drainage basins and wadis; the isolated environmental refugia of the *rawdah* and the resource rich coastal mangrove forests and protected bays. The presence and development of such environments is directly linked to the nature of not only factors such as climate patterns, sea level and underlying geology but to the geomorphology of the land itself, of which all these factors form a contributing influence.

Geomorphological and environmental research within *Wādī Debayān* reveals an important dynamic between Holocene groups and sea level change from the late-6th to mid-3rd millennia BC. This research would suggest that present day sea levels were reached prior to or by the start of the 5th millennium BC. Due to much less sediment in the wadi, marine transgression probably affected the wadi as far as 4km inland. The earliest settlement, on the limestone peninsula of QNHER141, corresponds to a period when the Flandrian Transgression was at its maximum during the late 6th and 5th millennia BC. The southeastern side of the peninsula would have provided a natural harbour from the prevailing northwesterly winds, and indicates a preference for bays and inlets that provide such shelter. The evidence suggests that during the 5th millennium BC more than 1.5m of sediment accumulated within the wadi. By the end of the 5th millennium BC sea levels would appear to have stabilised and a lagoonal phase is evident within the environmental test pit. This shows the development of semi terrestrial, emergent or aquatic plants, with tranquil conditions conducive to the development of a mangrove forest continuing until the early 4th millennium BC.

The 4th millennium also sees the development of an extensive sandbar (palaeocoastline), probably resulting from a period of sea level stability or gradual regression. By the mid-4th millennium groups responded to lowering sea levels by abandoning the peninsula (QNHER141) and moving downslope to the sandbar that was forming within *Wādī Debayān*. Occupation along this sandbar continues until the mid-3rd millennium BC, after which futher marine regression left the sandbar as a relic shoreline (palaeocoastline) within the wadi.
The results of the work at *Wādī Debayān* have enabled the archaeology to be considered in the context of the environmental, topological and taphonomic conditions during relevant periods in prehistory. The implications for communication, access and site location provides us with a much wider picture of early populations in relation to the environment. In turn such parameters can be used to model the behaviour of a past population and form the basis of a research framework by which further such sites may be located.

The palaeointertidal features recorded at *Wādī Debayān* are relatively easily identified from satellite images and remote sensing. The application of GPS, GIS and UAV technology represents a major development in the accuracy and standard of data collection, and is a prerequisite for future extensive survey. Such tools offer the opportunity to supplement pre-existing data sets, such as geology, hydrology and topography, with high resolution topographic data, aerial imagery, placing not only a wide range of feature classes but also entire landscapes within their environmental and chronological frameworks.

The study of geomorphology in Qatar is not new, what is different about this work is the discovery of a palaeocoastline that is not only a preferable topographic location for occupation, but importantly, it is an accretionary feature that did not deflate during subsequent millennia. The connection between relic areas of longshore drift and occupation within the wadi is challenging archaeological concepts regarding the importance of palaeointertidal features to prehistoric research in Qatar. Furthermore, the potential for palaeoenvironmental data within former lagoonal areas on the leeward side of these palaeocoastlines is significant for developing regionally relevant research frameworks for environmental change during the early to mid-Holocene. The identification and analysis of such high-resolution proxy data is fundamental understanding how prehistoric societies influenced and were influenced by environments and landscapes.

Landscape is, therefore, not a static background against which human dramas are played out, but an underlying catalyst. How prehistoric societies adapted and transformed reflects not only cultural adaption and communication, but climate, geomorphology and topography and how landscape has an intrinsic influence on the nature of the society which develops within it.

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