FIFTY YEARS OF EMIRATES ARCHAEOLOGY

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FIFTY YEARS OF EMIRATES ARCHAEOLOGY

Proceedings of the Second International Conference on the Archaeology of the United Arab Emirates

Edited by Daniel T. Potts and Peter Hellyer

FOREWORD

Abdul Rahman Al Owais
Minister of Culture, Youth and Community Development

On 2 December 2011 the United Arab Emirates celebrated its 40th National Day to commemorate its formation in 1971. The occasion provided the country and its people, led by the President His Highness Sheikh Khalifa bin Zayed Al Nahyan, with an opportunity both to look back over four decades of achievement and to look forward to a promising future.

While much of that achievement relates to the country's economic and social development, it is appropriate to also pay attention to the remarkable progress that has been made in investigating the country's culture and heritage, stretching back into the distant past. The country's founding father, the late Sheikh Zayed bin Sultan Al Nahyan, frequently emphasised the importance of this, saying that "He who does not know his past cannot make the best of his present and future, for it is from the past that we learn".

The Second International Conference on the Archaeology of the UAE, as well as this book of proceedings of that conference – held in 2009 under the patronage of the Minister of Presidential Affairs, His Highness Sheikh Mansour bin Zayed Al Nahyan, and organised by the Ministry of Culture, Youth and Community Development – reflected our commitment to the study of that past.

Since the earliest archaeological exploration in the UAE – now a little more than fifty years ago – much information has been unearthed, some of which is reported in this volume. Once almost a terra incognita in terms of its heritage, the UAE is now known to have played an important part in the evolution of human settlement and history in the region, from the early migrations of Man out of Africa. It is in that context that we should assess the achievements in more recent times.

As shown both by sites in the UAE itself and in terms of the way in which its people were linked to commercial networks stretching to Europe, Africa, Central Asia and throughout the Indian Ocean, the country has a fascinating history, and one of which we are immensely proud. It is my hope that this volume will go some way to introducing that history to a wider audience.

At the inauguration of the 2009 Conference, the Minister of Presidential Affairs, His Highness Sheikh Mansour bin Zayed Al Nahyan, gave a special award to British archaeologist Beatrice de Cardi for her contribution to knowledge of the country's heritage. She first began working in the UAE in 1968. The Minister of Culture, Youth and Community Development, Abdul Rahman Al Owais, is on the right.

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INTRODUCTION

Daniel T. Potts

Since the publication in 2003 of the proceedings of the First International Conference on the Archaeology of the UAE, a huge amount of new fieldwork and analysis has been undertaken. As an editor, it would be easy enough to simply say that this volume constitutes a major addition to what was known about the country's archaeology since the first conference was held, without any further justification of its importance. That, however, would be to sell very short the progress reported on in the pages that follow. In fact, although there has been relatively little fanfare made about some of those discoveries, the work published here represents an important set of new milestones in the UAE's archaeological heritage.

To begin with, as a result of recent and ongoing research in both Abu Dhabi and Sharjah, there seems no doubt now that a hominid population indeed inhabited the UAE in the Pleistocene. The papers by Wahida, Al Tikriti, Beech and al-Meqbali, as well as McBrearty, are thus important statements on this crucial issue.

Secondly, work on Akab Island in Umm al-Qaiwain by Méry and Charpentier and at Masafi in Fujairah by Benoist, Bernard, Brunet and Hamel have revealed important evidence of probable religious shrines dating to the late prehistoric era and the Iron Age, complementing the analysis of the temple at ed-Dur by Haerinck. Suddenly, the religious dimension of the UAE's past is coming into much sharper focus.

Other papers included in this volume present us with equally fascinating material. Flemming Højlund provides us with many new insights into the origins and activities of the Danish archaeological expedition to Abu Dhabi during the 1950s, a landmark expedition that constituted the first-ever exploration of the archaeology of this part of Arabia.

Andrew Hill and his colleagues have written a comprehensive overview of Abu Dhabi's environment and fauna during the Miocene, again emphasising how deep the roots of the UAE's past lie.

Instances of personal violence and trauma are the subject of a fascinating paper by Adelina Kutterer and Hans-Peter Uerpmann, based on their meticulously excavated material from the Neolithic settlement of BHS 18 at Jebel al-Buhais in the interior of Sharjah. Hans-Peter Uerpmann and his longtime collaborator and wife Margarethe Uerpmann also discuss the important evidence of animal traction and the use of animals as beasts of burden in the prehistoric UAE. Their study makes it clear that, as was the case all over the ancient Near East, animals were important in many more ways than merely as a source of protein.

Walid Yasin Al Tikriti, who has excavated many important Bronze Age sites in the UAE including Umm an-Nar island, Ghanadha and Qidfa, reviews the evidence of this important period and sets it in context. Viewing the UAE and Oman from the perspective of the Indus Valley, an area with which south-eastern Arabia interacted regularly, Rita P. Wright looks at evidence of contact particularly from the Late- and Post-Harappan periods (end 3rd/early 2nd millennium BC). Staying on the theme of the Umm an-Nar culture, Manfred Böhme provides a fascinating report of the restoration of an Umm an-Nar-type tomb at Bat in the interior of Oman, while Sabah Abboud Jasim reports on recent excavations at Jebel al-Buhais by the Sharjah team.

The Iron Age settlement of Al Madam 1-Thuqaibah is the subject of contributions by Carmen del Cerro and Joaquín María Córdoba. This site, with its impressive *falaj* system, is equally extraordinary because of the unusual manner of brickmaking that was practiced there.

The UAE during the 3rd and 4th centuries AD, i.e. the early Sasanian period, is the subject of an important study by Michel Mouton and Julien Cuny. Three papers are devoted to a discussion of settlement and society, as well as trade, in the UAE during the Islamic era. Derek Kennet provides an overview of developments in the Northern Emirates, while Andrew Petersen focuses on coastal settlements and Hanae and Tatsuo Sasaki give us a masterful overview of the highly varied Far Eastern ceramics that found their way from China and south-east Asia to Arabia during the medieval and early modern periods. Christian Velde takes a long-term view of the development of oasis settlements from Shimal to Ra's al-Khaimah, and discusses the various locations of Julfar through time.

Finally, Richard Cuttler, Faisal Abdulla Al-Naimi and Simon Fitch present a fascinating case study in which late Pleistocene and early Holocene palaeolandscapes are being mapped around Qatar using 3D seismic data. The potential for achieving advances in our understanding of the early population history of the UAE is enormous.

Having first visited the UAE myself in 1984, I never cease to be amazed by the rich archaeology of the country. Moreover, as this volume shows, while we know the broad outlines of the periods from late prehistory through the medieval era, the nature of the new discoveries being made each year is such that many of our views are bound to change as data – often startling in its nature – accrues. The developments in the UAE's modern infrastructure with which people all over the world are familiar continue to make headlines, but the richness of the country's more ancient past is still less widely known than one would expect. Publications such as the present one will hopefully go some way towards making scholars around the world give the UAE the attention it deserves.

Fifty Years of Emirates Archaeology

THE FIRST EXCAVATIONS IN THE UAE, 1959–1972: GLIMPSES INTO THE ARCHIVE OF MOESGÅRD MUSEUM

Flemming Højlund (Århus)

THE DANISH EXPEDITIONS TO THE ARABIAN GULF

The first archaeological excavations in the United Arab Emirates took place in 1959 and were directed by P.V. Glob and Geoffrey Bibby (Fig. 1).Ten years prior, Glob had become Professor at the University and Director of the Museum in Århus, Denmark. Though this museum had a focus on Danish prehistory, Glob was determined to begin archaeological research outside Europe.

His doctoral dissertation from 1945 had led him to pursue the origin of the Jutlandic Single Grave Culture all the way to the Caspian Sea, and he was inclined to study cultural history in the widest possible perspective, including the use of ethnographical data as inspiration. In the vision of the Århus museum laid down by the mayor of the city, Svend Unmack Larsen, and Glob, it was stated that the museum should carry out archaeological and ethnographic research and prepare exhibitions in order to increase the understanding of the diversity of human life and culture.

Geoffrey Bibby had studied oriental languages in Cambridge before the Second World War, but from 1947 he worked for the Iraq Petroleum Company in Bahrain. In 1949 he married the Dane Vibeke Tscherning, and when they were expecting their first child in 1950 they moved back to Vibeke's home town, Århus, where Bibby began to work for Glob (T.G. Bibby, pers.comm.).

The stories told by Geoffrey and Vibeke of the island of Bahrain and its enigmatic 100,000 burial mounds caught the imagination of Glob, and he decided to mount an expedition to the island.

The work there began in 1953, and within a few years the neighbouring countries of Qatar, Kuwait, the Trucial Coast (later to become the seven-member United Arab Emirates), Saudi Arabia and Oman were included in the operational area of the museum in Århus (Glob 1968; Bibby 1969; Højlund 1999a–b, 2008a–b).

It is difficult now to comprehend how such a relatively small museum could manage to organise these expeditions. The museum was so under-funded that tables and chairs were procured second-hand from the surplus stock of the Danish State Railways. There was, however, a strong will to push forward in spite of all difficulties. Glob's motto was: We move ahead!

Fig. 1. P.V. Glob (right) and Geoffrey Bibby photographed in 1959, when the first excavations in the United Arab Emirates took place. Glob was 48 at the time; and Bibby was 42.

SHEIKH SHAKHBUT POINTED TO UMM AN-NAR

In several authoritative publications, Temple (Tim) Hillyard (Fig. 2) is given the credit for finding the graves on Umm an-Nar and thereby drawing the attention of Glob and Bibby to Abu Dhabi. From 1954 to 1958, Hillyard was the local director of an oil exploration company, Abu Dhabi Marine Areas Limited, owned by British Petroleum and Compagnie Française des Pétroles, which held the concession for exploration in the offshore

Fig. 2. Temple (Tim) Hillyard surveying Umm an-Nar, photographed by P.V. Glob in 1958 (reprinted in Hillyard 2002).

waters of the Emirate of Abu Dhabi. Hillyard had known Bibby during the latter's first years in Bahrain with the Iraq Petroleum Company, and whenever Hillyard was in Bahrain he visited the Danish archaeologists in their camp at Qala'at al-Bahrain (Bibby 1969: 213; Hillyard 2002: 226).

In the final publication of the graves on Umm an-Nar, Karen Frifelt stated that Hillyard invited Glob and Bibby in 1958 to visit Abu Dhabi to show them a group of burial mounds that he had discovered on the small island of Umm an-Nar, adjacent to the island of Abu Dhabi (Frifelt 1991). The same version is given by Bibby (1964).

However, two letters in the archive of Moesgård Museum suggest that this rendering is too brief to explain what actually happened. A letter from Hillyard to Bibby dated 24th February 1958 (Fig. 3) makes it clear that a trip by Bibby to Abu Dhabi had been planned for some time before Hillyard had ever visited Umm an-Nar island.

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Our Reference 336/TWH/58.
Your Reference

أبوظبي
(عن طريق دبي)
الخليج العربي

February 24, 1958.

Dear Geoffrey

I have spoken to the Ruler and to the Political Agent about your proposed visit to Abu Dhabi in April and they are both very pleased that you should come. The Ruler has said that he will be delighted to offer you carte blanche to travel in his state and his only proviso is that if you find anything of real intrinsic value he would prefer you not to take it away. The Political Officer (Buckmaster) has said that he would be delighted to take you to Buraimi if you have the time and I am sure you will find a trip with him most interesting if you can manage it after the island tour. I understand he is clearing the question of your visa with the Agency Bahrain whom you will no doubt approach in the matter. B.P. have written to confirm that you will be welcome in our concessional area etc and so I think the way is clear. I expect to come up to Bahrain in early April in order to see my family off and will meet you then if convenient to you.

Please give my regards to Professor Glob.

Yours ever,

Temple

G. Bibby, Esq.,
Bahrain.

Fig. 3 Letter dated 24 February 1958 from Temple Hillyard to Geoffrey Bibby: Planning of the first visit to Abu Dhabi.

In the same letter Hillyard writes that the Ruler of Abu Dhabi, Sheikh Shakhbut bin Sultan Al Nahyan, was most interested in this proposed visit from the Danish archaeologists, but there is no evidence that Hillyard had at that time found anything that he wanted to show Bibby.

Umm an-Nar is first mentioned a week later in a letter from Hillyard to Glob dated 1 March 1958 (Fig. 4). It appears from this letter that it was only after the visit by Bibby and Glob had been organised that Sheikh Shakhbut mentioned to Hillyard that there were some

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أبوظبي
(عن طريق دبي)
الخليج العربي

1/3/58

Dear Professor Glob,

I hope you have had a successful visit to Kowait. Unfortunately you and Mr Bibby were away when I last called at the Fort and hope to dee you but I have since written to Mr Bibby to tell him that all is apparently set fair for his visit here in April since I have cleared the matter with B.P. in London , the Political Authorities whom he will no doubt approach for a visa in due course, and last but not least the Ruler himself. The latter is most interested in this visit and when I discussed the matter with him recently he mentioned some antiquities on a nearby island. I had known that there was a water cistern of modern date there but as the Ruler was so emphatic about the antiquities I sseed the first free moment I had to look at the place from the ground (I had spotted nothing from the air when I looked some time back) I found that there was a most interesting group of ruins which I feel you or Mr Bibby should see.

This consists of a group of tumuli, some 29 in all, sited round a natural water catchment basin in one portion of which there is a cistern. This latter was done up some years ago by a local worthy, since exiled, and although it may in fact be ancient there is no obvious sign of its antiquity. The tumuli are mostly of the small type which one sees on the Awali Manama road and which you have I believe determined as Iron Age. Among them however are a few obviously of a superior type having a good quality masonry kerb about the base or perhaps a third up the slope, and being reminiscent of the Bronze Age ones at Bahrain. I have not been able to examine the chambers within as yet, but I think that they were fairly small kists and I saw nothing to indicate a real passage grave or anything like it. These few mounds are much more substantial than the little " Iron Age " ones. A pair of the latter crown a nearby hill top.

Not far away is a building or rather a ruin which I take to be a primitive sister of the Temple at Barbar. What remains of rough walling there are show a small square building within a surrounding set of rooms having a rather irregular outline, frequently curved. Inside one corner is separated by a wall, or perhaps this is merely fallen material, and in the middle is a broken plinth such as you have at Barbar. Another fragment of a plinth, much weathered lies on one side. I suspect that any limestone used in this building has been burnt for "juss " and this would explain the very ruined condition of the walls which are no more than traced. The Ruler says that there was at one time an idol here, a shaft with a rough he head, and the Beduin say that there are drawings on the rocks nearby. I have not yet seen these, they are said to be of rabbits. There is also said to be a large cave or tunnel nearby, but its mouth must be covered over as although I went prepared with a torch the other day my guide failed to find it.

I have been too busy of late to do more than take a very cursory view of the place which I mention is rather inaccessible, you have to do a good deal of heavy walking through deep mud to get there even though it is quite close to Abu Dhabi itself, but I hope that as soon as I can get a free week end I shall be able to get down to photographing & preparing a rough plan. The Ruler whose appetite for antiquities has been whetted by seeing your own & Bibbys articles in the Illustrated London News urges me to press you to see the place and to give him your opinions. I very much hope therefore that you or Bibby will be able to spare the time to do so

With best regards

Yours sincerely

Temple Hillyard

Professor Glob
The Danish Archaeological Expedition
Bahrain

Fig. 4. Letter dated 1 March 1958 from Temple Hillyard to P.V. Glob: The discovery of the Umm an-Nar graves.

antiquities on Umm an-Nar and urged Hillyard to show this place to the Danish archaeologists!

Before that, Hillyard had only known about the Late Islamic water cistern on the island and had seen nothing of interest from the air. It was only because the Ruler was so emphatic that Hillyard visited the island and there saw the ruined graves and the settlement (Fig. 5). It seems only fair that some of the credit of finding the graves on Umm an-Nar should, therefore, be given to Sheikh Shakhbut.

The same letter also explains how Sheikh Shakhbut's interest in archaeological investigations had been fuelled after he had seen the two articles on the archaeological discoveries in Bahrain published two months earlier by Glob and Bibby in *The Illustrated London News* from 4 and 11 January 1958 (Glob 1958, 1959; Bibby 1958) (Fig. 6).

Fig. 5. Cairn burials on Umm an-Nar photographed by Glob during the first visit in 1958.


16 THE ILLUSTRATED LONDON NEWS JANUARY 4, 1958

BAHREIN'S PROSPERITY FIVE THOUSAND YEARS BEFORE THE OIL AGE.

FIGS. 8 AND 9. PERHAPS THE FINEST SINGLE OBJECT FOUND IN THE BAHREIN EXCAVATIONS: A COPPER BULL'S HEAD, BEFORE AND AFTER CLEANING AND CONSERVATION. THIS HEAD, FOUND WITH MUCH COPPER SHEATHING, RECALLS SIMILAR HEADS FROM THE EARLY DYNASTIC GRAVES AT UR.

FIG. 10. A DETAIL OF THE COPPER FIGURE SHOWN IN FIG. 12. THIS WAS FOUND IN THE SACRIFICIAL PIT OF TEMPLE III AT BARBAR.

FIG. 11. AN ALABASTER JAR, COMPLETE WITH LID. THIS VERY PLEASANT OBJECT OF FUNCTIONAL FORM WAS ONE OF SEVERAL FOUND IN THE SACRIFICIAL PIT OF TEMPLE III. SEE FIG. 2.

FIG. 12. A COPPER FIGURE OF A MAN WITH HIS HANDS FOLDED OVER HIS BREAST. SEE ALSO FIG. 10. PROBABLY AN OFFERING, IT WAS FOUND IN THE SACRIFICIAL PIT, SEEN IN FIG. 2.

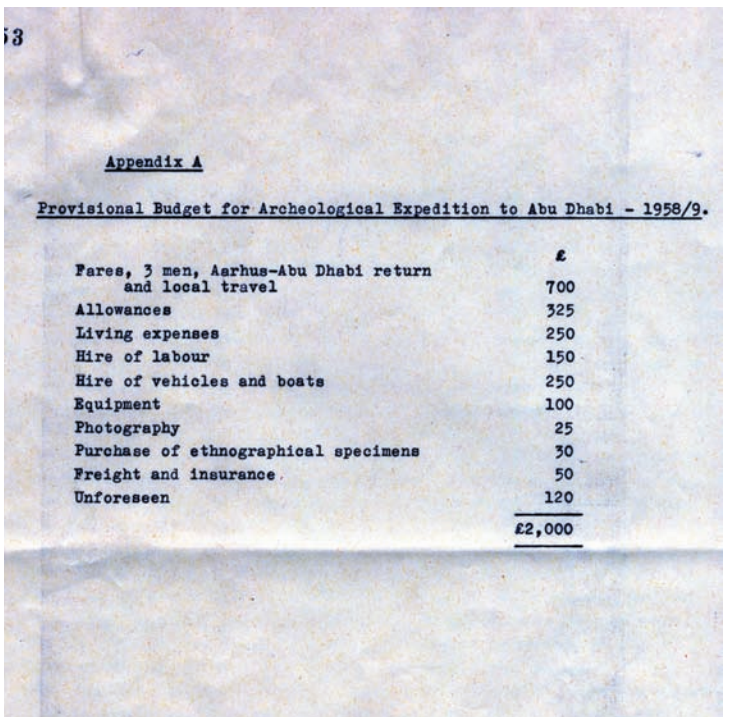
FIG. 13. THE DOMINATING TYPE OF POTTERY IN ALL THE THREE TEMPLES OF BARBAR: A JAR OF REDDISH-BROWN FABRIC WITH APPLIED HORIZONTAL RIDGES.

Fig. 6. The archaeological discoveries on Bahrain published in the Illustrated London News 1958.

EXCAVATING ON UMM AN-NAR

It is obvious that the goodwill of the Ruler was crucial for beginning archaeological investigations in Abu Dhabi, and Bibby remarks in a letter of 8 October to G.G. (Geoffrey) Stockwell, a director of British Petroleum, that '…our work has clearly captured the imagination of the enlightened Ruler of Abu Dhabi and he is very anxious that our investigations should continue'.

Of equal importance was the assistance of Abu Dhabi Marine Areas Limited (ADMA). Stockwell was instrumental in securing the support, which was then supplied by Ian Cuthbert, the local director of ADMA during the first years of excavation. The first exports of oil from Abu Dhabi, from ADMA's offshore Umm Shaif field, did not take place until 1962, and in 1959, when the work at Umm an-Nar began, the Emirate of Abu Dhabi was so poor that the Ruler was unable to supply any funding for archaeological investigations.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Appendix A

Provisional Budget for Archeological Expedition to Abu Dhabi - 1958/9.

	£
Fares, 3 men, Aarhus-Abu Dhabi return and local travel	700
Allowances	325
Living expenses	250
Hire of labour	150
Hire of vehicles and boats	250
Equipment	100
Photography	25
Purchase of ethnographical specimens	30
Freight and insurance	50
Unforeseen	120
	£2,000

Fig. 7. The budget for the first archaeological expedition to Abu Dhabi 1959.

The budget for the excavation in 1959 was £2000, this being over-spent by a sum of £174 (Fig. 7). That first campaign lasted from 15 February to 29 March. Bibby and Knud Riisgård were the first to arrive in Abu

Dhabi to prepare the camp, and the other two members, Harald Andersen and Mogens Ørsnes followed later.

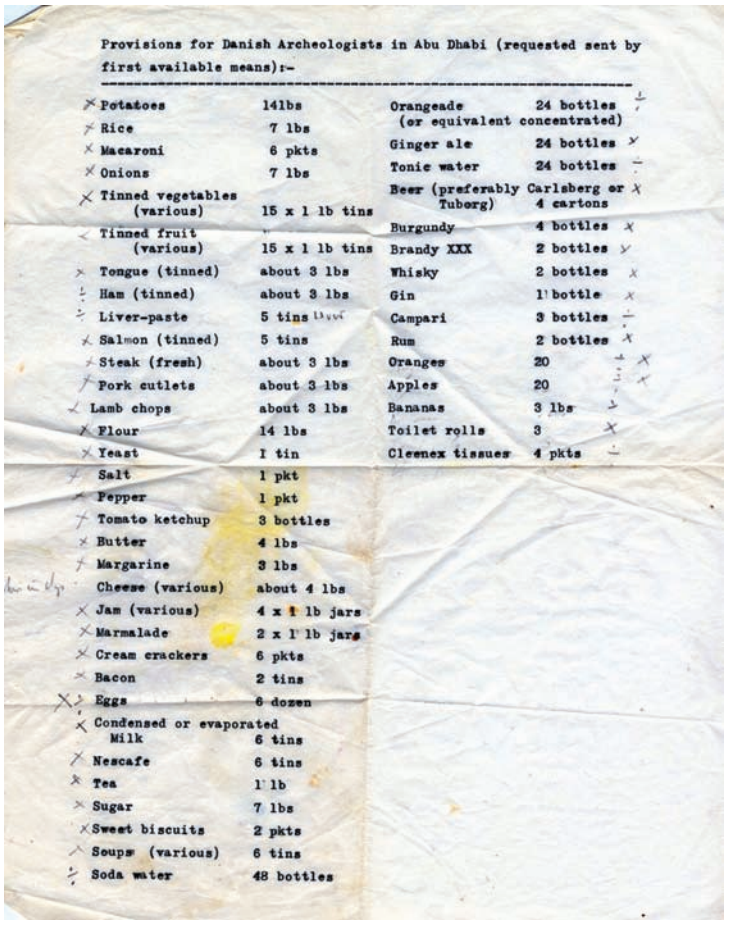
An *'arish* palm hut was constructed on the wide beach of Umm an-Nar island facing the mainland (Fig. 8). Supplies were brought by car across the twenty kilometres of desert between the island and the small town of Abu Dhabi, which was then confined to a small area of the island of Abu Dhabi itself, facing out onto the Gulf.

There was little to buy in the suq of Abu Dhabi in 1959, and almost all food and water had to be brought from the ADMA base on Das Island, over 100 kms offshore (Fig. 9). Eggs could be purchased fresh in the suq, although only frozen ones were available from Das. Bread was not available locally, but was delivered from Das, two loaves on every day that there was a flight, chartered by ADMA, from Das to Abu Dhabi, i.e. on

Fig. 8. Knud Riisgård in the 'arish hut on Umm an-Nar 1959.

Saturdays, Sundays, Tuesdays and Wednesday. Water was supplied from Dubai to Abu Dhabi but it was delivered in oil barrels and often tasted of oil. There was also a limited amount of distilled water available.

A dozen workers came every morning by car from Abu Dhabi to assist in the excavation. Their names were ticked off every working day in the diary: Mudhi bin



Provisions for Danish Archeologists in Abu Dhabi (requested sent by first available means):-

Potatoes	14lbs	Orangeade (or equivalent concentrated)	24 bottles
Rice	7 lbs	Ginger ale	24 bottles
Macaroni	6 pkts	Tonic water	24 bottles
Onions	7 lbs	Beer (preferably Carlsberg or Tuborg)	4 cartons
Tinned vegetables (various)	15 x 1 lb tins	Burgundy	4 bottles
Tinned fruit (various)	15 x 1 lb tins	Brandy XXX	2 bottles
Tongue (tinned)	about 3 lbs	Whisky	2 bottles
Ham (tinned)	about 3 lbs	Gin	1 bottle
Liver-paste	5 tins	Campari	3 bottles
Salmon (tinned)	5 tins	Rum	2 bottles
Steak (fresh)	about 3 lbs	Oranges	20
Pork cutlets	about 3 lbs	Apples	20
Lamb chops	about 3 lbs	Bananas	3 lbs
Flour	14 lbs	Toilet rolls	3
Yeast	1 tin	Cleenex tissues	4 pkts
Salt	1 pkt		
Pepper	1 pkt		
Tomato ketchup	3 bottles		
Butter	4 lbs		
Margarine	3 lbs		
Cheese (various)	about 4 lbs		
Jam (various)	4 x 1 lb jars		
Marmalade	2 x 1 lb jars		
Cream crackers	6 pkts		
Bacon	2 tins		
Eggs	6 dozen		
Condensed or evaporated Milk	6 tins		
Nescafe	6 tins		
Tea	1 lb		
Sugar	7 lbs		
Sweet biscuits	2 pkts		
Soups (various)	6 tins		
Soda water	48 bottles		

Fig. 9. List of provisions brought from Das Island.

Sultan, Muhammed bin Obeid, Said bin Obeid, and so on (Fig. 10). Their salary was 5 rupees per day.

During the first season in 1959, excavation was commenced on two of the burial mounds and on the settlement site near the mounds. It soon appeared that the mounds were of a quite unusually complicated structure, so work was gradually concentrated on the larger of the two mounds (Fig. 11). The lack of precise parallels to the scarce finds of pottery and to the structure of the burial made dating problematical. In fact, after that season, Bibby considered for a while the possibility of a dating

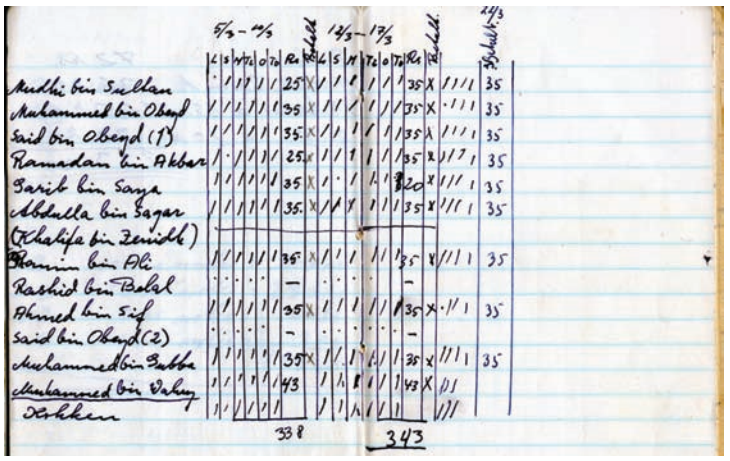


Fig. 10. Diary with names of local labourers from Abu Dhabi.

Fig. 11. Grave I on Umm an-Nar under excavation in 1959.

in the second half of the first millennium BC (letter of October 8th 1959 to G.G. Stockwell).

It was not till the second season, in 1960, that a further six mounds were excavated. These had the same type of construction and produced a very large quantity of painted pottery that proved to have close parallels in the Bampur Valley in south-east Iran and in the Kulli culture in Baluchistan (letter of February 13th 1961 to G.G. Stockwell). It became clear that an important new culture dating to the 3rd millennium had been found, in the legendary land of Magan (Glob 1960; Thorvildsen 1962).

SHEIKH ZAYED POINTED TO THE CAIRNS AT HAFIT

In a letter dated 8th October 1959, Bibby wrote to British Petroleum Director Geoffrey Stockwell that the excavation on Umm an-Nar had been followed with the greatest interest by Sheikh Shakhbut and his sons and brothers, who visited the excavation several times (Fig. 12).

On one of these visits, Sheikh Zayed bin Sultan Al Nahyan, the Ruler's youngest brother then his representative in the Emirate's eastern settlement of Al Ain – then more widely known as the Buraimi Oasis, named after a nearby settlement in Oman – told them that similar burial mounds were to be found in greater number in the Al Ain area.

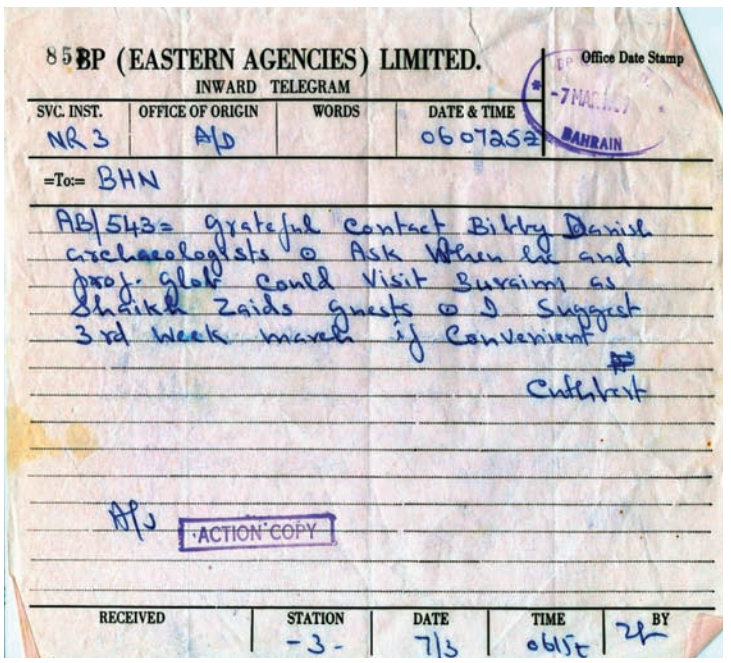
On 7th March 1959, Sheikh Zayed sent a telegram through ADMA to Glob and Bibby inviting them to pay him a visit in Al Ain (Fig. 13). The visit took place a few days later, and Sheikh Zayed took them to a place called Nudud al-Jahal, south of Al-Ain (Fig. 14). Here lay a group of about 200 stone burial cairns on the lower slopes of the two lines of cliffs which bordered the valley leading south from Al Ain to Jebel Hafit.

The excavation of these burials began two years later, in 1961-63. About 25 were excavated, one of them with a short bronze sword which suggested a late 2nd mill. dating for the Hafit graves (Bibby 1965: 104-5, 109, Fig. 6).

In the northern part of the Al Ain/Buraimi oasis, east of the village of Hili, an area was located with a number of stone-built burials belonging to the Umm an-

Fig. 12. The Ruler of Abu Dhabi HH Sheikh Shakhbut bin Sultan Al Nahyan (centre, atop the rock) and his brothers, HH Sheikh Zayed (left) and HH Sheikh Khaled (right) standing on top of one of the graves at Umm an-Nar, 1959.

Nar culture. Foremost among these was a magnificent burial, the Round Structure or Site 1059, decorated with elaborate reliefs that was excavated in 1964–65 (Bibby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=To:= BHN

AB/543= grateful contact Bibby Danish archaeologists & Ask When he and Prof. Glob could visit Buraimi as Sheikh Zaids guests & I Suggest 3rd week march if Convenient

Cuthbert

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Fig. 13. Telegram dated March 7th 1959 inviting Glob and Bibby to visit Sheikh Zayed in Al Ain.

Fig. 14. The burial mounds at Nudud al-Jahal, south of Al Ain 1959. In the distance, Jebel Hafit.

1966, 1967). Subsequently restored, it is now commonly called the Hili Tomb.

The work in the Al Ain oasis was supported by ADMA and also by Petroleum Development (Trucial Coast) Ltd (PDTC), wholly-owned by a subsidiary of the Iraq Petroleum Company (IPC), which held the concession for onshore oil exploration throughout the Emirate of Abu Dhabi.

Following the first visit to Al Ain/Buraimi in 1959 and again in 1964, Glob and Bibby made a survey along the coast towards the north, in the sheikhdoms of Dubai, Sharjah, Ra's al-Khaimah and Fujairah and located many prehistoric sites, of which Dibba on the Indian Ocean coast is the most well-known since Iron Age material was here found for the first time on the Oman peninsula (Bibby 1966: 151-152. 1969: 332-337).

KAREN FRIFELT

From 1968, Karen Frifelt was in charge of the expeditions to Abu Dhabi (Fig. 15), and she excavated in the Al Ain oasis until 1972 (Frifelt 1969). The first site Frifelt investigated was a low tell, now known as Rumeilah, which Sheikh Zayed had brought to the attention of the archaeologists. A most interesting columned hall was uncovered, probably dating to the 1st millennium BC, of a type that has later been found in other places along the UAE coast (Frifelt 1969: 171). Close to the Round Structure at Hili, a contemporary mud-brick tower was revealed surrounded by settlement structures (Frifelt 1975: Fig. 3). This was the first of a type of tower from the Umm an-Nar culture that has since been found all over the Oman peninsula.

ADMA continued to support the investigations, as did the Abu Dhabi Petroleum Company Ltd (ADPC), as Petroleum Development (Trucial Coast) had been renamed, but from 1969 the Government of Abu Dhabi

Fig. 15. Karen Frifelt and Geoffrey Bibby in the oasis of Al Ain, 1969.

took over responsibility through the Department of Information & Tourism.

In 1970 P.V. Glob reached the age of 60, and Frifelt prepared a summary of the finds from Abu Dhabi for his Festschrift. When looking for parallels to the finds made in Abu Dhabi, she realised that the small bi-conical pots from the Hafit graves belonged to the Jemdat Nasr culture (Frifelt 1971). This was a major breakthrough: the identification of a new cultural phase belonging in the early 3rd millennium BC and one, moreover, that showed an intimate relationship between the Emirates and Mesopotamia. Excavations of a further 21 Hafit graves followed the next season, 1971-72.

Fig. 16. Rock painting at Qarn bint Saud 1970.

The present writer was fortunate to participate in Karen's expedition to Al Ain in 1970. One weekend in February we went into the desert north of the oasis. An English family named Lancaster, who lived in Hili, invited us on a trip to a rocky outcrop, Qarn bint Saud,

Fig. 17. Camping in the cave at Qarn bint Saud 1970. From left to right: Jørgen Nordkvist, Erik Johansen and Flemming Højlund.

where they had seen some rock carvings (Fig. 16). On top of the rock, we found several cairns and around one of these lay many fragments of decorated steatite vessels and copper arrowheads (Frifelt 1971, 1975). We decided to spend our weekends there, sleeping in the cave (Fig. 17), cooking on an open fire and digging during the daytime. During this adventurous undertaking, a new cultural phase was found, dating to the Late Bronze Age/Iron Age.

That year we visited the palace in Abu Dhabi (Fig. 18). Karen showed Sheikh Zayed, who had succeeded his brother as Ruler in 1966, the arrowheads from Qarn bint Saud, and they provoked an animated discussion between the Ruler and his Bedouin tribesmen who sat around with their silver-coated rifles in their hands. It was an unforgettable moment!

It has been a privilege for thirty archaeologists from the Danish Moesgård Museum to have been involved in the first excavations in the United Arab Emirates. Great discoveries were made, and meeting the people while experiencing the culture and the nature of the Emirates gave these Danes a multitude of mind-opening experiences.

Since these early days, the archaeology of the UAE has developed tremendously, and it gives great hope for the future when one considers that this revolution of knowledge has happened within the relatively short space of only fifty years.

Fig. 18. Qasr al-Hosn in Abu Dhabi 1959.

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Fifty Years of Emirates Archaeology

BEFORE ARCHAEOLOGY: LIFE AND ENVIRONMENTS IN THE MIOCENE OF ABU DHABI

Andrew Hill (New Haven)
Faysal Bibi (New Haven)
Mark Beech (Abu Dhabi)
Walid Yasin Al Tikriti (Al Ain)

"…I had the good fortune to find some very perfect bones, of what I believe is some sort of Mastodon or Elephant. There is nothing like geology; the pleasure of the first days partridge shooting or first days hunting cannot be compared to finding a fine group of fossil bones, which tell their story of former times with an almost living tongue."

– Charles Darwin, in a letter to his sister Catherine Darwin, from East Falkland Islands when on *HMS Beagle*, 6 April 1834.

INTRODUCTION

Evidence of mammals that lived in the past is, in general, very rare. Most animals, when they die, succumb to decomposition and dissolution. Although Arabia is a large place, comparable in size to the Indian subcontinent, there are very few sites of any age that document fossil mammals. Reports of ancient fossil vertebrates from Abu Dhabi were recorded as early as 1946 in oil company reports, but it was not until the 1980s when, stimulated by the finds of a 1983 archaeological survey of the Western Region (Al Gharbia), the work of Andrew Hill, Peter Whybrow, and Walid Yasin Al Tikriti began to treat the occurrences extensively and comprehensively. More recently, investigations have been renewed by Faysal Bibi, Hill, Mark Beech and Al Tikriti, working in association with the Abu Dhabi Authority for Culture and Heritage (ADACH). The finds are late Miocene in age; the animals lived sometime between 8 and 6 million years ago (Ma).

Research over the years has revealed a landscape and ecology quite different to that found in the region today. Many kinds of animals lived in the area then, including elephants, hippopotamuses, antelopes, giraffes, pigs, monkeys, rodents, small and large carnivores, ostriches, turtles, crocodiles and fish. Although there is evidence that desert conditions existed then as now, these creatures were sustained by a very large river system flowing slowly through the area, along which was flourishing vegetation, including large trees. The animals resemble those known from Africa during the same period, but there are also similarities with Asian and European species of that time. The Abu Dhabi specimens are the only vertebrate fossils known in the whole of Arabia between around 15 Ma and the Pleistocene. They are extremely important as they represent a window on terrestrial life and Arabian environments at the junction of the three major biogeographical zones of the Old World – the Ethiopian (African), the Palaearctic (Europe and north Asia), and the Oriental (south and south-east Asia) – at a time when the Old World terrestrial fauna was beginning to take on its modern character.

HISTORY OF RESEARCH

A fiftieth anniversary celebration such as this, of archaeology and the study of things dug up in the United Arab Emirates, invites a retrospective look at the history of discovery and the development of current knowledge. A couple of earlier publications have described the history of palaeontological investigations in the Western Region of Abu Dhabi, now Al Gharbia, in one way or another (Hill et al. 1999; Al Tikriti 2005). What follows is a brief recapitulation incorporating more recent work.

Fossil vertebrates were first remarked upon in the Western Region in the course of early explorations by oil company geologists (Glennie and Evamy 1968). Their largely unpublished reports (for example, that of Holme and Layne in 1949) were followed up by Peter Whybrow of the then British Museum of Natural History who worked at Jebel Barakah for a number of seasons beginning in 1979 (Madden et al. 1982; Whybrow 1984, 1989; Whybrow and Bassiouni 1986; Whybrow and McClure 1981).

In 1983 an archaeological survey involving Walid Yasin Al Tikriti, then of the Al Ain Department of Antiquities and Tourism, and a German group, headed by Burkhardt Vogt, found fossils at a number of localities further east of Barakah (Vogt et al. 1989). With the facilitation of Hans-Peter Uerpmann, the fossil material they collected was examined in Al Ain by Andrew Hill in 1984 at the invitation of the Department, at which time he and Al Tikriti also briefly visited the area and discovered other specimens and new sites (Fig. 1).

Hill, Whybrow and Al Tikriti subsequently collaborated in further research in a joint Natural History Museum – Yale University project, at first mainly funded by the Department, and after 1991, by the Abu Dhabi Company for Onshore Oil Operations (ADCO) (Fig. 2). The project came to involve a variety of other specialists, who covered different aspects of the work – fossil taxonomy, geology, geochemistry and other relevant matters – over a programme of sustained research that continued to 1995.[1]

This phase of investigations resulted in a number of publications (de Bruijn and Whybrow 1994; Gee 1989; Hill, Whybrow and Yasin Al Tikriti 1990; Whybrow et al. 1990; Whybrow, Hill and Yasin Al Tikriti 1991; Whybrow, Hill and Kingston 1999; Whybrow and Hill 2002) and culminated in the First International Conference on the Fossil Vertebrates of Arabia, held under the auspices of His Excellency Sheikh Nahyan bin Mubarak al Nahyan at Jebel Dhanna in March 1995.

Subsequently, these conference contributions appeared in the monograph *Fossil Vertebrates of Arabia* (Whybrow and Hill 1999a), forming the most detailed description of the Baynunah fauna, geology and regional context to date.

Fig. 1. Walid Yasin Al Tikriti holding a fossil elephant femur at Hamra, when on the first brief palaeontological survey with Andrew Hill (18 April 1984). Behind is a typical coastal outcrop of the Baynunah Formation (picture: Andrew Hill).

More popular accounts of the work were published in Whybrow (2003) and in Whybrow, Hill and Smith (1996, 1998, 2005). Also as part of the public outreach of this research an exhibition on the work was mounted at the Natural History Museum, London. A film was made to accompany this exhibition – *Hot Fossils from Abu Dhabi* – featuring and narrated by David Attenborough.[2] Another film – *Abu Dhabi - The Missing Link* – was made in both English and Arabic for ADCO in 1991.

Subsequently, work was conducted by Mark Beech and others with the Abu Dhabi Islands Archaeological Survey (ADIAS) directed by Peter Hellyer, and by another team working under the sponsorship of His Highness Sheikh Sultan bin Zayed Al Nahyan, Deputy Prime Minister, and led by Faysal Bibi (then of the University of California at Berkeley). These two projects found additional sites and fossils of considerable importance.

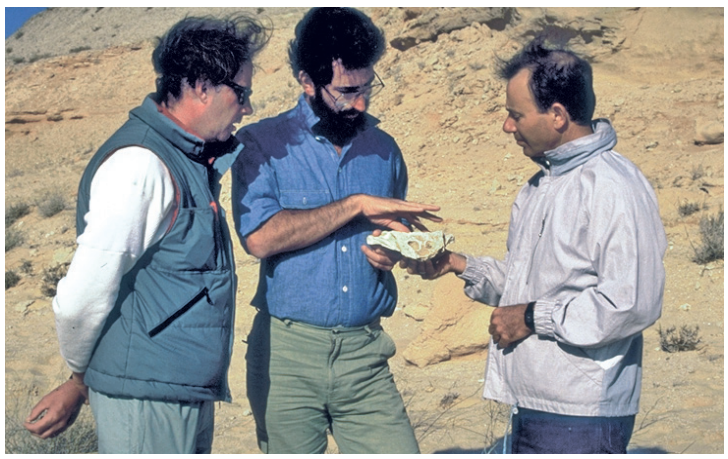

Fig. 2. Peter Whybrow, Andrew Hill and Walid Yasin Al Tikriti examining part of a fossil crocodile skull (Crocodylus, AUH 32) on Shuwaihat (9 January 1989) (picture: The Natural History Museum, London/Phil Crabb).

Among other things, the ADIAS project located new fossil occurrences, including one at Ruwais which provided additional rich evidence of proboscideans and birds (Beech, 2005a; Beech and Higgs 2005; Stewart 2005; Stewart and Beech 2006). Also the ADIAS work resulted in the identification of a number of impressive tracks made by fossil elephants and other animals (Higgs 2005; Higgs et al. 2003; Higgs et al. 2005). An exhibit on the fossils of the region was organised by Beech and Hellyer in the Environmental Research and Wildlife Development Agency – Abu Dhabi (ERWDA, now the Environment Agency – Abu Dhabi EAD) (Beech 2005b; Goodall and Larkin 2005; Hafeez et al. 2005), and a related book was published, *Abu Dhabi 8 Million Years Ago* (Beech and Hellyer 2005).

Bibi's expedition in 2003 worked principally at the coastal sites of Shuwaihat, Jebel Barakah, Kihal, Talfaha and Ras al Qal'a. Important fossils were found, such as additional elephants, much of a giraffe skeleton, and most unusually, a possibly unique synsacrum of a very large ostrich-like bird. Part of this research involved a much more detailed treatment of the Baynunah fossil ratite egg shell than had been carried out before (Bibi et al. 2006).

In 2006 the newly constituted Abu Dhabi Authority for Culture and Heritage (ADACH) kindly invited Hill and Bibi back to the Emirate once again to survey the sites and to help provide recommendations for their future investigation and conservation. This led to the current joint ADACH – Yale University expedition and since then we have conducted fieldwork annually. In addition to a planned conference and future publications, we have continued to provide reports on our work, and to advertise the importance of Abu Dhabi to the understanding of Old World palaeontology and palaeobiogeography at international scientific meetings and elsewhere (Bibi et al. 2008; Bibi et al. n.d.; Fox et al. 2008; Kraatz et al. 2009, Schuster et al., 2011).

STRATIGRAPHY

So far fossils have principally been found in rocks forming a series of *jebels* along the coast, standing above the surrounding *sabkha*, and extending from Jebel Barakah in the west of the Emirate, about 150 km east to Tarif (Hill and Whybrow 1999; Whybrow and Hill 1999a–b; Whybrow and Clements 1999) (Fig. 3), and perhaps beyond, as far as Rumaitha (Hellyer 2002). These rocks were described

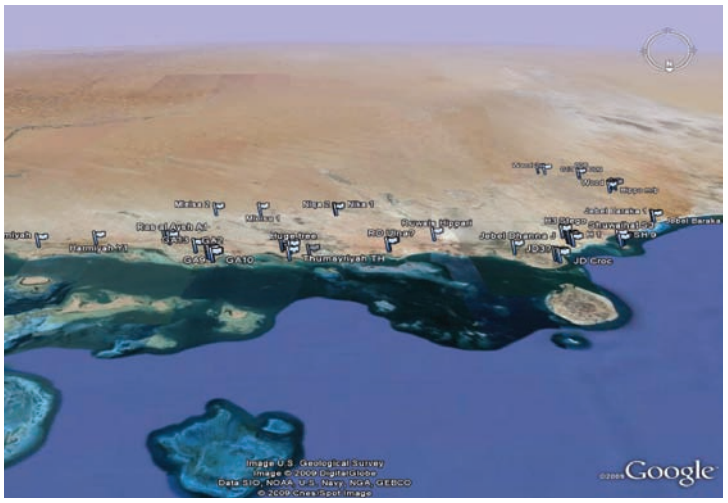

Fig. 3. A satellite view of Al Gharbia looking obliquely south from above the Arabian Gulf. It shows some of the fossil sites extending between Jebel Barakah and Tarif along the coast, and also other localities, such as Niqa and Mleisa, which are some way inland (picture: Google Earth).

by Whybrow (1989) as a geological unit he named the Baynunah Formation, with its type section at Jebel Barakah. It is likely that additional fossiliferous outcrops will be found elsewhere in the region.

Later, the lower part of the unit was removed into a separate geological formation, the Shuwaihat Formation, named after a locality where it is well represented – Jazirat Shuwaihat – and where the type section is located (Whybrow, Friend, et al. 1999; Bristow 1999). The base of this unit is not seen, and up to about 7.5 m of thickness is exposed. It is so far unfossiliferous. Whybrow and colleagues believed that it was distinct stratigraphically from the Baynunah, being separated from the overlying formation lithologically, and by an unconformity up to 6 m in relief. The Shuwaihat Formation is characterised by cross-bedded sandstones and laminar mudstones, best interpreted as aeolian sediments, possibly barchan dunes, encroaching across *sabkha* sediments (Bristow 1999; Bristow and Hill 1998). A palaeomagnetic age estimate of about 15 ± 3 Ma (Hailwood and Whybrow 1999), also gave support to the idea of the distinctiveness of the two units.

The part of the succession then remaining in the Baynunah Formation consists predominantly of riverine sediments, sandstones and mudstones, which contain the fossils (Whybrow, Friend et al. 1999; Friend 1999). More recently, fossiliferous exposures have also been discovered inland. We believe these also to belong to the Baynunah Formation, where it appears at the surface and forms the desert floor. Work on the nature of the Baynunah Formation lithology and its inferred mode of deposition is obviously important for understanding the palaeoenvironments at the time.

FOSSILS

Work in the area over the last few decades has produced an extremely rich collection of high quality fossils that give a very good indication of the animal community in the late Miocene of Abu Dhabi (Hill and Whybrow 1999; Whybrow and Hill 1999a–b). In general, fossils are well preserved, particularly those excavated from some way beneath the surface layer (e.g. Andrews 1999). Especially at the surface, however, they can be impregnated with gypsum salts, which leads to fragmentation and presents particular challenges to preservation and conservation (Larkin 2005; Fox et al. 2008).

The fossils (Table 1) provide a vivid impression of a diversity and range of large animals that today can only be witnessed – in ever-dwindling numbers – in some parts of Africa. There are also smaller creatures, some of them invertebrates, such as a terrestrial gastropod (Buliminidae) (Mordan 1999). Bivalves belonging to the families Mutelidae and Unionidae (Jeffrey 1999) are aquatic and lived in the river system which existed there at the time.

A few species of fish were identified earlier (Forey and Young 1999) and a sawfish (Pristidae) has been recovered more recently. Sawfish are ray-like creatures that are mainly marine, but can swim for considerable distances up rivers. More predominant in the collections are catfish belonging to the families Clariidae and Bagridae. In the latter a new species of the genus *Bagrus* has been described – *B. shuwaiensis*, although Gayet and Meunier (2003) have reservations about the attribution to family, and therefore to genus. Another fish in the assemblage belongs to the genus *Barbus* (Cyprinidae).

Reptiles also include aquatic forms, such as up to four species of crocodiles (Rauhe et al. 1999). There are two species which are similar to the present-day Nile crocodile *Crocodylus niloticus* (Crocodilidae), and which are adapted to eating mammals, some of which could have been quite large. Another one or two species are gavials (Gavialidae) which have quite slender and very long jaws particularly suited to devouring fish. One of these may be a new genus and species. The only living species of this group is highly endangered and confined to northern parts of the Indian sub-continent. Other reptiles include tortoises and turtles, both terrestrial and aquatic (Broin and van Dijk 1999). Among these is the very large terrestrial *Geochelone* (Testudinidae), now best known from superficially similar, though not necessarily closely related, forms from Galapagos and from some of the Indian Ocean islands. Smaller turtles from the Baynunah Formation – *Mauremys* (Testudinidae) and *Trionyx* (Trionychidae) – are aquatic. There are also

Plantae		
"Algae"		gen. et sp. indet.
Leguminosae		?*Acacia* sp.
Protista		
Foraminifera		
Mollusca		
Gastropoda		
	Buliminidae	?*Subzebrinus* or ?*Pesudonapaeus*[3]
	Thiaridae	*Melanoides* sp.[4]
Bivalvia[5]		
	Mutelidae	*Mutela* sp.
	Unionidae	*Leguminaia* sp.
Crustacea		
Ostracoda		
	Cytherideidae	*Cyprideis* sp.
Pisces [6]		
Pristiformes		
	Pristidae	
Siluriformes		
	Clariidae	*Clarias* sp.
	Bagridae[7]	*Bagrus shuwaiensis*
Cypriniformes		
	Cyprinidae	*Barbus* sp.
Reptilia		
Crocodilia[8]		
	Crocodylidae	*Crocodylus* cf. *niloticus*
		Crocodylus sp.
	Gavialidae	?*Ikanogavialis*
		Gavialidae, gen. et sp. nov.?
Testudines[9]		
	Trionychidae	*Trionyx* sp.
	Testudinidae	*Mauremys* sp.
		Geochelone (*Centrochelys*) aff. *Sulcata*
Squamata		
	cf. Colubridae	
Aves[10]		
Ratitae		
	Incertae sedis	*Diamantornis laini*
		'Aepyornithid-type' eggshell
Pelicaniformes		
	Anhingidae	*Anhinga* sp.
Ciconiiformes		
	Ardeidae	gen. et sp. indet.
Mammalia		
Proboscidea		
	Deinotheriidae	gen. et sp. indet.
	Gomphotheriidae (Amebelodontidae)[11]	cf. *Amebelodon* / ?"*Mastodon*" *grandincisivus*
	Elephantidae[12]	*Stegotetrabelodon syrticus*
Primates[13]		
	Cercopithecidae	gen. et sp. indet.
Rodentia[14]		
	Sciuridae[15]	gen. et sp. indet.
	Dipodidae	Zapodinae gen. et sp. indet.
	Muridae	*Abudhabia baynunensis*
		Myocricetodon sp. nov.?
		Parapelomys cf. *charkhensis*
		Dendromus aff. *Melanotus*
		Dendromus sp.
	Thryonomyidae	gen. et sp. nov?[16]
Soricomorpha[17]		
	Soricidae	gen. et sp. indet.
Carnivora[18]		
	Felidae	Machairodontinae gen. et sp. indet.
	Hyaenidae	gen. et sp. indet. 'very large'
		gen. et sp. indet. 'medium-sized'
	Mustelidae	*Plesiogulo praecocidens*
Perrisodactyla		
	Equidae[19]	*Hipparion abudhabiense*
		Hipparion sp.
	Rhinocerotidae	gen. et sp. indet.
Artiodactyla		
	Suidae[20]	*Nyanzachoerus syrticus*
		Propotamochoerus hysudricus
	Hippopotamidae[21]	*Archaeopotamus* aff. *Lothagamensis*
	Giraffidae[22]	*Palaeotragus* cf. *germaini*
		? *Bramatherium*
		gen. et sp. indet.
	Bovidae[23]	*Pachyportax latidens*
		Prostrepsiceros aff. *libycus*
		Prostrepsiceros aff. *vinayaki*
		Gazella aff. *lydekkeri*
		Tragoportax cyrenaicus
		cf. Neotragini

Table 1. Fossil plants and animals from the Baynunah Formation.

fossil traces of snakes, and probably at least one lizard, so far undescribed.

Birds are best known from locally abundant remains of fossil ostrich-like eggshell. These ratite remains have been principally studied by Bibi and colleagues (Bibi et al. 2006) who conclude that there are two kinds. The most common one is attributed to *Diamantornis laini*, a form that is also known from the late Miocene of Namibia and Kenya; the other is more rare and is an Aepyornithid-type shell similar to that of the extinct giant elephant-bird *Aepyornis*, of Madagascar, though it would be perhaps premature to ascribe it to that genus.

Other ratite fossils include a remarkable, complete, and large synsacrum – perhaps thirty per cent larger than the modern ostrich – possibly unique in the fossil record, and which is currently under study. Among other birds that have so far been identified are representatives of the genus *Anhinga* – the darter (Anhingidae), and of the family Ardeidae – herons and bitterns (Stewart and Beech 2006).

The most prominent mammal fossils, certainly in size and maybe in number of individuals, are those of proboscideans. The most common is an early elephant, *Stegotetrabelodon syrticus* (Elephantidae) (Tassy 1999). This is a quite large beast, differing most obviously from its modern relatives in that it has long straight tusks in the lower jaw as well as the upper. The specimens from Abu Dhabi, particularly a fairly complete skeleton from Shuwaihat (Andrews 1999), are among the best and most informative in the World, contributing significantly to our knowledge of this taxon.

Other examples of the genus *Stegotetrabelodon* are known from Miocene sites in Africa, with the same species being found in Libya. Another proboscidean is one of the first fossils found in the region. This is a tooth of a 'Mastodon', *Amebeledon* or *'Mastodon' grandincisivus* (Gomphotheriidae/ Amebelodontidae), found in the very early geological explorations of Jebel Barakah, and first mentioned by Glennie and Evamy (1968; see also Madden et al. 1982; Tassy 1999). Even more inconspicuous is the fossil evidence for *Deinotherium* (Deinotheriidae), an elephant-like animal with down-curving tusks in the lower jaw, known throughout the Old World from the Miocene and later. This large animal is known in the Baynunah Formation only from a single, but distinctive, scrap of tooth enamel.

At the other end of the mammal size spectrum are monkeys and rodents. Monkeys (Cercopithecidae) are exceedingly rare. A single canine tooth of a monkey was found in 1989 (Gee, 1989; Hill and Gundling 1999), and then a cheek tooth was discovered by the current expedition twenty years later. There is no reason they could not belong

to the same species, something perhaps superficially rather like the modern *Macaca*, the rhesus monkey.

A number of rodents are known, first investigated by de Bruijn (de Bruijn and Whybrow 1994; de Bruijn 1999) and on our current expedition by Kraatz (Kraatz et al. 2009) (Fig. 4). There are representatives of jerboas or jumping mice (Dipodidae), and of a range of murids (Muridae), attributed to five species. One is *Abudhabia baynunensis*, a gerbil; gerbils are generally regarded as being adapted to arid environments. There are also specimens attributable to the family Thryonomyidae, cane rats, which may be a new genus and species (Kraatz et al. 2009). And we have recently recovered the first fossil squirrel (Sciuridae) known from Abu Dhabi; the only other known in Arabia – *Atlantoxerus* – comes from the Hofuf Formation in Saudi Arabia (Sen and Thomas, 1979). Among other small mammals is a Soricomorph, a shrew (Soricidae) (de Bruijn and Whybrow 1994; de Bruijn 1999).

Fig. 4. Some of the rodent teeth discovered in 2009, displayed on a one dirham coin (picture: Brian Kraatz).

Carnivores are, of course, rare in any living community of animals and consequently as fossils, but a number are known from the Baynunah Formation (Barry 1999). There are small mustelids (Mustelidae), similar to the modern wolverine, now confined to northern latitudes. Representing large carnivores are machairodonts (Felidae), sabre-toothed cats. At present we have no sabre-tooth fossil teeth and it is difficult to identify the beast to species. There are also two species of hyaenas (Hyaenidae), one very large and another of medium size.

There are horses (Equidae) in the assemblage, probably two species, both in the genus *Hipparion*, one so far unnamed, the other a new species, *H. abudhabiense* (Eisenmann and Whybrow 1999). These are both relatively small three-toed horses.

It is interesting that some very large animals, that may have lived in herds and so would have been quite abundant at the time, are represented in the fossil assemblage by just one specimen. The elephant-like *Deinotherium* is one example; another is a rhinoceros (Rhinocerotidae) which is known in Abu Dhabi so far only by a single fragment of characteristic tooth enamel. Further exploration may reveal more about this creature.

Pigs (Suidae) are oddly uncommon in the collection, but there are some good specimens among the less than twenty that are identified so far. Two species are represented (Bishop and Hill 1999); one is *Nyanzachoerus syrticus*, a genus known from eastern Africa, and again the same species is found in Libya. The other is *Propotamochoerus hysudricus*, which shows a connection with Asia, being known from northern Indian and Pakistan Siwalik exposures dated between 10.4 and 6.8 Ma (Badgley et al. 2008).

More abundant in the Baynunah fossil record are hippopotamuses (Hippopotamidae) which are known from several mandibles, isolated teeth and post-cranial bones (Fig. 5). Originally it was described as the same genus as the extant West African hippopotamus, then known as *Hexaprotodon*; similar to a fossil species found at the site of As Sahabi in Libya, and also at the Kenyan site of Lothagam, *Hex. sahabiensis* (Gentry 1999a). Further taxonomic work has suggested that the Lothagam occurrence was sufficiently distinct to merit its own species, *Hex. lothagamensis* (Weston 2000; Weston 2003). A more recent analysis by Boisserie (2005) partitioned *Hexaprotodon* into a number of discrete genera, restoring the genus *Choeropsis* for the living species, and creating a new genus – *Archaeopotamus* – for the Lothagam and Abu Dhabi examples.

Fig. 5. Lower jaw of a hippopotamus (Archaeopotamus aff. lothagamensis, BMNH M49464) from Barakah (picture: The Natural History Museum, London/Phil Crabb).

There are two or three species of giraffes (Giraffidae). There is something like the extinct genus *Palaeotragus*, a relatively long-legged and long-necked form, and among the specimens is a remarkably complete skeleton found by Bibi's expedition, which is currently under study. Another resembles *Bramatherium*, a large- and short-limbed giraffe, fossils of which are also known from the Siwalik beds of Pakistan and India, and indicates another connection

with Asia There is possibly another species less known so far.

A diverse range of bovids (Bovidae) is recognised, some with Asian affinities (Gentry 1999b). There are at least six species, most belonging to now extinct genera. They are attributable to Boselaphini, Antilopini (including *Gazella*), and there is probably a member of Neotragini, at present being investigated further. The study of these is revealing some interesting palaeogeographical implications (Bibi, 2011).

Of all these creatures, some are particularly interesting as being unique to Abu Dhabi, or were when first discovered, and this is reflected in their scientific names. There is the fish *Bagrus shuwaiensis*, for example, the gerbil *Abudhabia baynunensis*, and one of the three-toed horses, *Hipparion abudhabiense*. There is possibly a new genus and species of a thryonomyid rodent, not yet formally named. Representatives of *Abudhabia* and *H. abudhabiense* have now been discovered in other parts of the world. Various species of *Abudhabia* are now described from several other sites; for example, late Miocene localities in Afghanistan (e.g. Flynn et al. 2003), Pakistan (Flynn and Jacobs 1999), India (Patnaik 1997), probably Libya (Flynn and Jacobs 1999), and in Kenya (Winkler 2003). *H. abudhabiense* has been named as also coming from the late Miocene site of Toros Menalla in Chad (Vignaud et al. 2002; Le Fur et al. 2009).

Fig. 6. Tracks of an elephant, probably Stegotetrabelodon syrticus, at Mleisa, east of Ghayathi. A contingent of the Dubai branch of the Emirates Natural History Group is in the distance (8 December 2006) (picture: Andrew Hill).

FOOTPRINTS

Among the more extraordinary forms of evidence of the animal past preserved in Abu Dhabi are footprints of extinct creatures. Elsewhere in the world, dinosaur footprints are known (Thulborn 1990), some as close as Yemen (Schulp et al. 2008), and also those of mammals (e.g. Leakey and Hay 1979), but such occurrences are even more rare than fossil bones. The Abu Dhabi footprints are visually stunning; it is quite obvious to anyone, without any technical knowledge, that these are the footprints of large animals, and to learn that they are over 6 Ma old presents a visitor with the sensation of walking back in time, across a Miocene landscape where elephants might have strolled by just a little time before. Footprints give scientific information that skeletal fossils often do not. Bones can be transported by rivers and other agencies for considerable distances from the environment where they were once a part of a living animal, and where that animal actually lived. A footprint, however, signifies that the animal was actually there at that spot at some particular time in the past. Footprints can also provide clues to behaviour that complement different kinds of information derived from the functional anatomy of the bones.

The most prominent of the Abu Dhabi footprint occurrences, at Mleisa east of Ghayathi, were first investigated as part of the work of the Abu Dhabi Islands Archaeological Survey; they had been shown them by Mubarak bin Rashid al-Mansouri (Higgs 2005; Higgs, et al. 2003, 2005). There are a number of trackways exposed on a large calcareous exposure between sand dunes, which is believed to be a surface outcrop of Baynunah Formation sediments. The most significant track is about 170 m long, crossed by another extending about 290 m, and they obviously represent the prints of a proboscidean (Fig. 6). It is reasonable to attribute them to the most common elephant in the fossil assemblage, *Stegotetrabelodon*. Higgs and colleagues (Higgs 2005; Higgs et al. 2005) have compared the prints to those made by an Asian elephant (*Elephas maximus*) in the Blackpool Zoo, England. All measures of the fossil tracks – pace, stride and width – are greater than those made by the captive living animal. Additional relevant information, along with behavioural inferences, will appear shortly (Bibi et al., in MS).

At another nearby site are additional elephant tracks and others made by a different kind of animal,

perhaps a bovid. And at Niqa there are more footprints, including some that appear to be formed by a large cat. The only large cat otherwise known in the fauna is the machairodont saber tooth, and it is reasonable provisionally to suppose that this creature might be responsible for these.

THE AGE OF THE FOSSILS

Unfortunately no rocks have been found in the Baynunah Formation that can be dated directly by radiometric techniques. This makes it difficult to obtain precise estimates of the age of the fauna. However, there are other regions of the world that are reasonably well supplied with dateable rocks and with similar fossils, principally eastern Africa, and to which comparisons can be made (Hill 1999a).

It is quite clear that some of the Baynunah fossils are similar to those found at sites in eastern Africa. The hippopotamus, for example, is the same species as, or closely related to, a species found at the locality of Lothagam in northern Kenya – *Archaeopotamus lothagamensis*. This is known from strata there dating between about 7.5–6.5 Ma (Weston 2000; Boisserie 2005). The most common elephant fossil in Abu Dhabi, *Stegotetrabelodon*, is a genus also known from sites in eastern Africa dating to around 6 and 7 Ma (Tassy 1999). And looking to Europe, de Bruijn and Whybrow (1994), who considered the rodent fossils in association with the large mammals, suggested an age correlating with the European faunal (Mammal Neogene) zone MN 13 at around 6–8 Ma. On the basis of examples such as these we can infer that the date of the Baynunah fauna is somewhere between 6 and 8 Ma, probably nearer to 6 Ma than to 8 Ma.

However, if we are to understand some aspects of palaeobiogeography, and a possible relation of faunal shifts to past climatic or geographical events, then it is desirable to achieve more precision than a two million year window. Hailwood attempted this by examining the palaeomagnetic stratigraphy and making estimates of palaeomagnetic pole positions through the formation (Whybrow et al. 1990; Hailwood and Whybrow 1999). Conclusions from this work suggested an age of 6 ± 3 Ma for the fossiliferous Baynunah levels. Unfortunately this is no more precise than the faunal correlations; in fact less so.

Techniques in palaeomagnetism have advanced since 1990 when that work was carried out, and accordingly our current expedition invited David Evans (Dept. of Geology and Geophysics, Yale University) and Daniel Peppe (Dept. of Geology, Baylor University) to re-sample the strata. They took controlled samples of rock from a number of geological sections which they are currently analysing, and we hope this may produce a better estimate.

An offshoot of work by Peebles (1999) on stable isotopes throughout the whole succession held out the hope that it might give information about the time of deposition. However, estimates proved to reflect the more recent time of diagenesis of the sediments, and therefore were not relevant to the age of the fossils.

A further and current possibility has come from a recent examination of carbonate beds just above the vertebrate fossil horizons by Stephen Lokier (Petroleum Institute, Abu Dhabi, UAE) who discovered that they contained ostracods and foraminifera. The biostratigraphy of such microfossils as these is well understood, particularly in oil-producing regions, so if they can be identified sufficiently they may also provide very helpful clues to age.

PALAEOENVIRONMENTS

Kingston and Hill (1999) summarised the then available information regarding Baynunah palaeoenvironments. It is tempting to interpret the evidence of this abundance of mammals, particularly the large ones, as an indication that during the Miocene, it was a land of profusion and plenty, with a luxuriance of vegetation and animal life – whereas nowadays the region is one of desert condition. Since then, with changing climate, aridity has supervened and the fauna has dwindled. To a certain extent some aspects of this supposition are obviously true, but not entirely. It is quite clear that there must have been enough water and vegetation to support herds of quite large mammals; bovids and giraffes, and horses, and such bulky beasts as elephants.

Water is not an issue, as we have abundant sedimentological evidence of a large river flowing through the region in Baynunah times (Friend 1999). The picture that emerges from a study of the lithology is of a large river system – possibly part of an ancestral Tigris-Euphrates – flowing predominantly towards the east-south-east. With the possible exception of the fossil sawfish (Pristidae), there is no sign of any marine influence, and indeed at the time the sea could have been a good distance away, possibly beyond the present Straits of Hormuz. The river system was composed of a substantial belt of numerous channels 2–10 m deep, separated by sand bars 2–5 m in relief. The aquatic fauna reinforces this view of the river. The crocodiles, particularly the gavials, would have required constantly flowing, large, and deep bodies of water (Rauhe et al. 1999), and although clariid catfish can withstand periods

of drought, the bagrid fish are mostly bottom dwellers in slow persistently moving water (Forey and Young 1999).

There are a few fossil plants available, which are so far not thoroughly studied taxonomically. However, our recent work has discovered the trunk of a large tree at a site on Kihal. The trunk was of a good diameter, implying a considerable height in life (Fig. 7). Additional botanical information is provided by work on stable carbon isotopes from carbonate nodules in fossil soils and from herbivore tooth enamel (Kingston 1999). The ratio of carbon isotopes preserved in fossil soil nodules reflects the nature of the vegetation at the time, whether the environment is a closed, wooded habitat, or one of open

Fig. 7. Mark Beech and Andrew Hill discuss a large fossil tree on Kihal (31 December 2007) (picture: Faysal Bibi).

grassland. The same information from herbivore tooth enamel indicates whether the animals were browsers or grazers; eating leafy vegetation or grass. This research suggests a grassy woodland near to the river channels, with more open grasslands further away from the water. The presence of grasslands is also supported by isotopic work on ostrich eggshell (Ditchfield 1999).

The large mammals would find a habitat of this kind quite congenial, and a plausible reconstruction based on this evidence was produced by Goodall and Larkin for the ERWDA exhibition (Goodall and Larkin 2005), and which is reproduced on the cover of the accompanying book (Beech and Hellyer 2005). A slight palaeoenvironmental complication arises from the possible lithological evidence of barchan dunes in the Baynunah succession. If this is substantiated it would suggest that a lush woodland habitat is maintained by the constantly flowing river, grading off into grassland further from its influence, with arid and fully desertic conditions taking over further still. This is a situation also envisaged for the site of Toros Menalla in Chad (Vignaud et al. 2002; Le Fur et al. 2009).

PALAEOBIOGEOGRAPHY

Arabia is pivotally situated at the junction of the three major biogeographic zones of the Old World; the Ethiopian (African), the Palaearctic (Europe and north Asia), and the Oriental (south and south-east Asia) regions. Faunas within these areas are distinctive, as a result of being separated from each other for long periods of time. However, occasionally at times in the past shifting geographic and environmental circumstances made contact between these large regions possible, and faunal interchange took place. Arabia holds the key to understanding the long history of terrestrial vertebrates in the Old World as a whole. More particularly, given its age, the Baynunah Formation documents the emergence of what is an essentially modern terrestrial vertebrate fauna, when the Old World mammal biota was beginning to take on its present character.

Arabia is a large place, comparable in size to the Indian sub-continent, but there are very few sites documenting fossil mammals. The Baynunah fossil fauna is the only example of terrestrial vertebrate animals between about 15 Ma and the Pleistocene. So these sites provide a very important glimpse into a huge gap in our knowledge of Arabian fossil faunas

Overall the Abu Dhabi fossil fauna shows strong resemblances with some of those in Africa (Hill 1999). References have already been made to the sites of As Sahabi, in Libya, for example (Boaz et al. 2008), to Lothagam in Kenya (Leakey and Harris 2003), to Toros Menalla in Chad (Vignaud et al. 2002; Le Fur et al. 2009), and to the Tugen Hills sequence in Kenya (Hill 1999a-b; 2002; Hill et al. 1985). So the Arabian fauna at this time was strongly African in general character.

However, there are differences. Some resemblance can be found to distinctly Asian faunas of this period, such as those known from the Siwalik sequences of Pakistan and India; the bovids and suids provide examples, and some genera are also found in Europe. Gentry (1999), mainly on the basis of the bovids, noted that there were very few similarities to the well-known Graeco-Iranian faunas of this time – which are well understood from occurrences at such localities and Samos and Pikermi in Greece, and Marageh in Iran. He suggested instead an east-west band of similar faunas extending just south of these sites, across North Africa and into the Indian sub-continent. Other elements of the fauna support this notion.

It will be interesting as research progresses to tease out the faunal affiliations of the Baynunah assemblage with various sites in northern and eastern Africa, and into south-west Asia, and so be able to address other questions. The Baynunah fauna largely came from Africa; as most

probably did humans later in time. What environmental or other conditions allowed the African Miocene fauna to expand into Arabia? What route did the animals take to get there? The straits of Bab el Mandeb were probably not an option (Fernandes et al. 2006). Did all elements of the fauna get there at once, or were there separate migrations? What was the timing of this event or events? These are some of the biogeographical questions that the Miocene faunas of Abu Dhabi provoke, questions equally applicable to the arrival of humans and their archaeological traces in Arabia somewhat later in time.

IMPORTANCE AND CHALLENGES

The sites and fossils described here are important, and at a number of different levels. They have considerable local appeal, as is shown by the attention given to this research by people in Abu Dhabi and by the press, as they provide an uncommon window into wildlife and environments in the remote past of the Emirate, and form a significant element of the Emirate's heritage. Regionally they are significant too, as the only evidence of the past history of terrestrial life in the whole of Arabia between 15 Ma and the Pleistocene. Their great international importance stems partly from this simple rarity of sites in the region, but also because of the highly significant location of Arabia at the junction of the three classic Old World biogeographic zones. The geography and environments of Arabia through time have to a large extent controlled the nature of the current regional differentiation of animals in the Old World, and the age of these localities is additionally important in helping document the emergence of the essentially modern terrestrial vertebrate fauna. So the Baynunah fossil sites are important locally, regionally and internationally. They remain productive, and it is to be hoped that the localities and their fossils can be preserved, and that scientific work on them can be sustained.

Regarding the preservation of sites, since the Baynunah fossils were first recognised in the 1980s considerable construction has taken place in the Al Gharbia region, particularly on the coast, and much is planned for the future. There are already buildings on Hamra, Jebel Dhanna, Ras Dubay'ah, and major developments on Shuwaihat. The two most important fossil sites around Jebel Dhanna are now lost as a result of earth moving and various structures. While the desirability of the initiatives for development in Al Gharbia is of course recognised, it is also important that the more significant and productive fossil and related sites be preserved if possible from commercial, civil and military expansion. While it is reassuring to note that the protection of some key sites is proposed in the Al Gharbia 2030 Plan prepared by Abu Dhabi's Urban Planning Council, it is as yet unclear to what extent these proposals will be effectively implemented. Perhaps continued access to the internationally recognised geological type sections of the Baynunah Formation on Barakah, and of the Shuwaihat Formation on Shuwaihat could be guaranteed. Fences could be erected to protect other sites, and rangers employed to ensure their security. In this way they could be set aside as active scientific research areas, as monuments to these important aspects of local prehistory, so being protected not only for science, but as an asset to tourism and for the benefit of future generations.

A second aspect is the preservation of the fossils and the provision of facilities for their scientific study and relevant communication with the public. Once the fossils are collected, facilities are needed that:

- would bring together all Baynunah fossils under one roof in secure and accessible surroundings
- would incorporate a laboratory, along with a trained staff with expertise
- would help in preparing the fossils, so they can be studied scientifically
- would conserve them, so that they do not deteriorate, and
- would produce replicas, for display and exchange with other scientific institutions
- would house accessible comparative collections of modern animal skeletons, and replicas of significant fossils from other areas of the world
- would provide adequate space and facilities for active research and instruction.

Some of these needs are already being accommodated through ADACH initiatives, but the ideal situation would be to unite and integrate these facilities in a Centre for Palaeontology which, given the fossil and other resources of Abu Dhabi Emirate, could quickly become internationally renowned. This centre would house, prepare, and conserve the fossil material, and provide space and other services for those who study them. It would also act as the focus for publishing and disseminating the results of this research at all levels, locally and internationally. Such a centre could advantageously be part of a more public museum where the fossils could be displayed and explained in close proximity to where scientific work was being carried out. Both interests would benefit from this synergy of research and public outreach. In this way it would be similar to some of the best research museums in Europe, the USA and elsewhere.

If there were the interest and will to build on the already existing resources and opportunities of the Emirate, Abu Dhabi is poised to become the regional centre for palaeontological excellence in the Arab World.

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1 In the context of the broader issues of this current volume, one of these specialists was Sally McBrearty, who described the first palaeolithic artefacts from Abu Dhabi (McBrearty 1993, 1999, and this volume).
2 Produced and directed by Dave Holmes, RKD Productions Ltd, London, 1991. Arabic version produced by Mark Beech (ADIAS), 2005.
3 Mordan, 1999.
4 Higgs et al., 2003.
5 Jeffrey, 1999.
6 Forey and Young, 1999.
7 but see Gayet and Muenier, 2003.
8 Rauhe et al., 1999.
9 Broin and van Dijk, 1999.
10 Bibi et al., 2005; Beech and Stewart, 2006.
11 Madden et al., 1982; Tassy, 1999.
12 Tassy, 1999; Andrews, 1999.
13 Hill and Gundling, 1999.
14 de Bruijn and Whybrow, 1994; de Bruijn, 1999; Kraatz et al., 2009.
15 Kraatz et al., 2009.
16 Kraatz et al., 2009.
17 de Bruijn and Whybrow, 1994; de Bruijn, 1999.
18 Barry, 1999.
19 Eisenmann and Whybrow, 1999.
20 Bishop and Hill, 1999.
21 Gentry, 1999a; Weston, 2000; Boisserie, 2005.
22 Gentry, 1999b.
23 Gentry, 1999b.

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Fifty Years of Emirates Archaeology

THE MIDDLE PALAEOLITHIC ASSEMBLAGE OF JEBEL BARAKAH IN THE CONTEXT OF THE ARABIAN PENINSULA AND ADJACENT AREAS

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INTRODUCTION

It is fair to say that our knowledge of the Palaeolithic of the Arabian Peninsula is still in its infancy. The amount of archaeological research carried out so far does not match the size and importance of the Peninsula. Beginning in the late 1970s and through the 1980s, a large number of Lower and Middle Palaeolithic sites were discovered in Saudi Arabia that threw light on the importance of the Peninsula during the Palaeolithic period (Zarins et al. 1980, 1981; Whalen et al. 1983; Whalen and Pease 1992).

Importantly, a number of these sites were located along the corridor zone of the Bab el-Mandeb Straits, the Red Sea and the Arabian Sea. This evidence may support the current southern migration theory, with the Peninsula acting as a bridging corridor, from and to Africa. Others, e.g. Marks (2009), argue that these sites clearly show connections to the Levant and not to Africa. In addition, important research into the Middle Palaeolithic along the Red Sea coast has progressed and Alsharekh is currently working on possible Lower Palaeolithic material in central Saudi Arabia (Petraglia and Alsharekh, 2003; Alsharekh n.d.). The only *in situ* excavated Acheulian site is that of Saffaqah, near Dawadmi, in central Saudi Arabia (Whalen et al. 1982, 1983). Uranium-thorium dating has placed Acheulian artefacts at over 200,000 years old (Whalen et al. 1992).

Prior to the more recent work on the Palaeolithic of Abu Dhabi, Sharjah and Ra's al-Khaimah (UAE), and in the Sultanate of Oman, carried out since the early 1990s, the fate of the Palaeolithic in the entire Arabian Gulf region went through a period of uncertainty and even denial by the various French expeditions working in the Gulf region. This period of uncertainty lasted two decades from 1976–1992. The controversy began when various French expeditions began archaeological work in Qatar between 1976 and 1978. Holgar Kapel's Group A (the oldest cultures), which he assigned tentatively in his Atlas of the Stone-Age Cultures to the Palaeolithic Period (Kapel 1967), was reclassified by the French as Neolithic (Inizan 1980). According to J. Tixier, 'we found Kapel's hand axes associated with Ubaid pottery', and 'it seems to me that during the Ubaid period they were making tools similar to hand axes' (pers. comm. between the primary authors of this article with Tixier at the Arabian Seminar held in Cambridge in 1979). The French statements led many archaeologists to believe that the there was no Palaeolithic in Qatar or for that matter in the entire Arabian Gulf region. Other archaeologists were not convinced since the Palaeolithic was well represented in neighbouring Saudi Arabia.

French expeditions conducted archaeological work in Sharjah and Mleiha (UAE) in 1984–1988 and also in 1990–1992. According to the French, the lithic material they discovered largely belonged to the 6th–4th millennia (see Scott-Jackson et al. 2009). This added more weight to the view that the entire Arabian Gulf region was devoid of any Palaeolithic remains. The question that some sceptical archaeologists asked then was: why should the south-eastern part of the Arabian Peninsula lack the Palaeolithic when it was flourishing in its north-western part? This question was again touched upon recently by the primary authors of this article in presenting the Barakah assemblage to the audience of the Arabian Seminar, held in London in 2007, without mentioning the French expeditions. It was Prof. Hans-Peter Uerpmann who took the podium afterwards and cited the French Expeditions for their misguided statements on the absence of the Palaeolithic in the entire Arabian Gulf region.

More recent work on the Palaeolithic of the Arabian Gulf region began in the early 1990s when a number of international expeditions discovered Pleistocene sites in Abu Dhabi, Sharjah and Ra's al-Khaimah (UAE), and in Oman. In Abu Dhabi Emirate, archaeological work carried out in 1991 by Sally McBrearty at Jebel Barakah (a site which she discovered in that year), situated in the Western (Al Gharbia) Region of Abu Dhabi Emirate, had suggested four possible dates for its lithic assemblage, ranging between Middle Pleistocene, Acheulian or Middle Stone Age, to Mid- or Late Holocene (McBrearty 1993, 1999).

More recent work carried out on the Jebel in the last two years by a team of archaeologists from the Abu Dhabi Authority for Culture and Heritage (ADACH), with the primary author working for ADACH on short-term contracts, have discovered four new Localities (Localities 2–5) around the Jebel in addition to the McBrearty site which represents the north-eastern end of our Locality 1. More lithics have been discovered which facilitated an analysis of the entire assemblage. The ADACH research team has now assigned the Jebel Barakah lithic assemblage to the Middle Stone Age. Accordingly, Jebel Barakah is now internationally recognised as a Middle Palaeolithic site in the Arabian Peninsula (Wahida et al. 2008, 2009).

In Sharjah Emirate, Hans-Peter Uerpmann began the first *in situ* stratified excavations of Palaeolithic assemblages at the rock shelter of Jebel Faya. This has been dated by Optically Stimulated Luminescence (OSL) to around 85,000 years ago, although bedrock is still about 2 m below the present level of excavation (Uerpmann et al. n.d.a–b; Marks 2009), suggesting that this date will

rise. On the ridges of the Al Hajar Mountain range in Sharjah and Ra's al-Khaimah Emirates, nine *in situ*, surface-collected lithic assemblages were discovered and have been assigned to different phases ranging from the late Lower Palaeolithic and the early Upper Palaeolithic. The findspots have been interpreted as tool manufacturing sites (Scott-Jackson et al. 2007, 2008, 2009).

In neighbouring Oman, a number of Pleistocene sites have been discovered and attributed to a late phase of the Acheulian and to the Middle Palaeolithic (Biagi 1994; Rose 2004, 2007; Rose and Bailey 2008; Usik et al. 2008).

In the Yemen, at least five Acheulian sites have been identified in the Hadhramaut Mountains (Whalen et al. 1992). Many more Middle Palaeolithic sites were discovered near the Bab al-Mandeb and along the Red Sea shore and the Arabian Sea zone (Amirkhanov 1994). The Middle Palaeolithic assemblage of Shi'bat Dihya in western Yemen has been dated by OSL to 80–70 ka (Marks 2009). More Middle Palaeolithic sites have also been discovered in the hinterland areas of the Yemen along dried-up rivers, streams and lakes (Amirkhanov 1994).

Genetic studies have lately been introduced in Greater Arabia and revolutionary geneticists have begun to appreciate the major role that Arabia must have played in the origin of modern humans. New genetic evidence has highlighted the significance of the Arabian Peninsula as a corridor for early human migration to and from Africa (Abu-Amero et al. 2007).

The present volume underlines the importance of prehistory in the Arabian Peninsula in general, and in the Arabian Gulf region, in particular. Furthermore, it will hopefully encourage more archaeological research in this vital and vast Peninsula covering 2.3 million km^2, which serves as a bridge between Africa and south-west Asia.

GEOMORPHOLOGY OF BARAKAH

Jebel Barakah is located on the west coast of Abu Dhabi Emirate, overlooking the sea, between Jebel Dhanna and the Qatar peninsula (Fig. 1). The coastline of Abu Dhabi is generally low and dominated by *sabkha* (salt flats) with occasional sand hills and low grass vegetation. Jebel Barakah, at 62.6 m above sea level, is the highest point along this stretch of coastline. It is an isolated outcrop composed of red sandstone (originally wind-blown sand) and thin bands of conglomerate (originally water-transported, *wadi* pebbles). The outcrop, oval in shape, occupies a low plateau, some 2.5 km from north to south and 2 km from east to west (Fig. 2).

The Jebel, a small outcrop with a flat, narrow summit and sloping surfaces, occupies about 1 km^2 of the north-western side of the plateau. As in the case of most of the outcrops belonging to the Baynunah Formation, which overlies the Shuwayhat Formation, the sequence is capped by a thick layer of resistant tabular chert-flint (cryptocrystalline siliceous rocks produced by diagenetic solution).

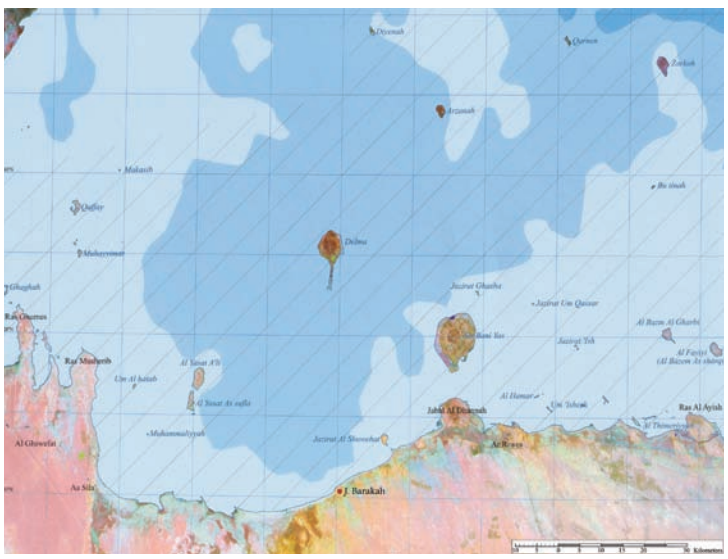

Fig. 1. Location of Jebel Barakah in the Western (Al Gharbia) Region of Abu Dhabi Emirate (after Whybrow and Hill 1999).

Fig. 2. View of Jebel Barakah looking northwards from the main Abu Dhabi to Silaa highway.

Lithic material from Jebel Barakah was first reported by McBrearty. She noted that a large number of artefacts occurred on the level bluffs on the south-eastern side of the Jebel. The artefacts lie directly on Baynunah Formation rocks; upslope they are overlain by a thin, superficial layer of soft, unconsolidated sediment derived from the exposures of the Baynunah Formation above (McBrearty 1993, 1999). In addition to her site, which represents the

north-eastern end of our Locality 1 (Fig.3), McBrearty also noted that the Barakah artefacts 'demonstrate a highly consistent and formalized flaking method, being composed almost entirely of radial cores and the flakes derived from them' (McBrearty 1999: 378). All 16 cores collected by McBrearty are radial or are of high-backed radial form. There was no trace of any blade element.

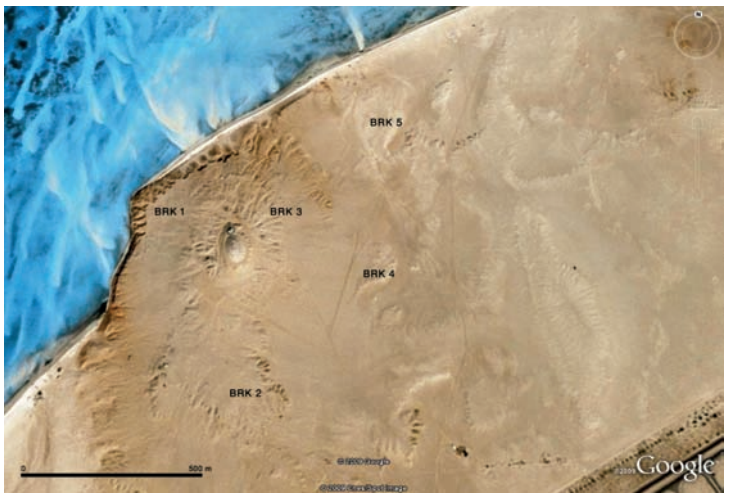

Fig. 3. Localities 1–5, with artefacts dotted.

The aim of this article is to introduce new data from Jebel Barakah, providing evidence to argue that the Barakah assemblage belongs to the Early Middle Palaeolithic in the Arabian Peninsula, and comparing it with other Middle Palaeolithic assemblages from the Levant and East Africa.

THE JEBEL BARAKAH ARCHAEOLOGICAL LOCALITIES

The lithic material came from five localities around the Jebel (Fig. 3). The material from Localities 1–3 has already been discussed elsewhere (Wahida et al. 2008). Two further Localities (4–5) with more material were discovered in 2008 which, together with the material from Locality 2, have recently been published (Wahida et al. 2009).

The present paper mainly deals with the Barakah assemblage from a comparative perspective, and looks at it in the context of Middle Palaeolithic assemblages elsewhere in the Arabian Peninsula, the Levant, the Zagros and East Africa. It should be noted here that, subsequent to the initial reconnaissance, a small number of artefacts were also discovered east of Locality 5 and south-east of Locality 2.

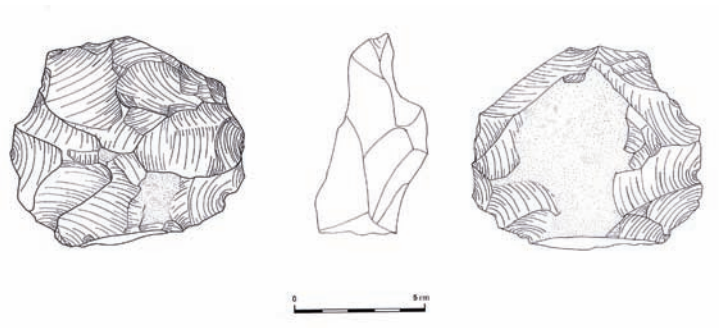

Fig. 4. Bifacial centripetal core.

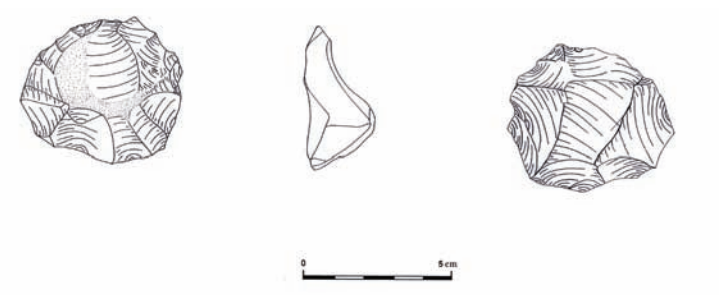

Fig. 5. High-backed radial core.

THE LITHIC ASSEMBLAGE

The assemblages from the five localities at Barakah appear to represent a single techno-typological industry. It should be stressed here that study of the Barakah assemblage is still in its preliminary stages.

The lithic collection strategy was determined by the erosion and deflation that the five localities had suffered. Laying down a grid for a systematic collection of artefacts would have been of little use. Instead, a system of latitudinal and longitudinal coordinates for each artefact was obtained using a Global Positioning System (GPS). In cases where a number of implements were located within a 5 m radius, one reading was obtained for the group as they lay within the possible margin of error of the system (Fig. 3).

The Barakah artefacts were made of good quality flint or chert with black to blue-black patina. The artefacts outnumber those collected by McBrearty. In addition to sixteen radial cores, McBrearty collected 218 objects, eight of which are modified flakes and considered tools. As noted above, McBrearty suggested several dates for the Barakah assemblage, including the Acheulian, the Middle Stone Age and the Mid- to Late Holocene. McBrearty is credited for discovering the site and for her tentative Palaeolithic identification of the assemblage based on the limited collection of tool types with which to draw conclusions. In her article, McBrearty provided an excellent outline of the palaeoenvironment of the Western Region of Abu Dhabi Emirate, including Barakah, to which little can be added.

TECHNOLOGY AND TYPOLOGY

The main technique of core reduction at Barakah was the prepared core method by radial flaking known as the Levallois. This technique requires the working face of the core to be specially prepared beforehand, allowing a predetermined flake of probable shape to be detached. The underside of the core was partially flaked off around the edge, never extended to cover the entire ventral surface, and this was the case with all radial cores. Only one core had a flat ventral surface. The other technique used may have been the bipolar, whereby two flakes were struck off from the two opposing ends of an elongated Levallois core.(Figs. 4–8) A third technique may have been Nubian Method Type 1, where one Levallois flake core, oval in shape, had the last flake struck off from the thinner distal end. Two earlier removals from the thicker proximal end were probably part of the preparation technique (Fig. 9–10).

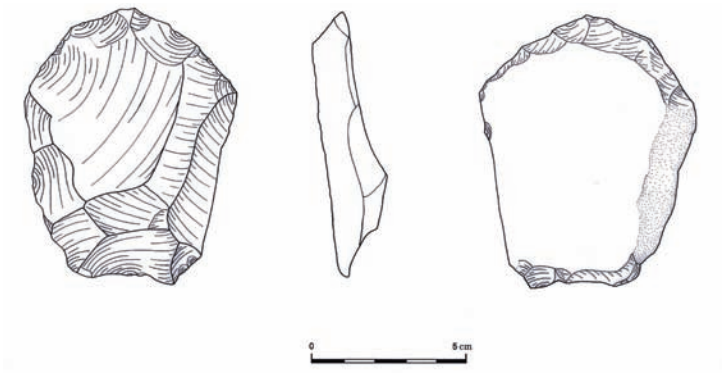

Fig. 6. Elongated bifacial core.

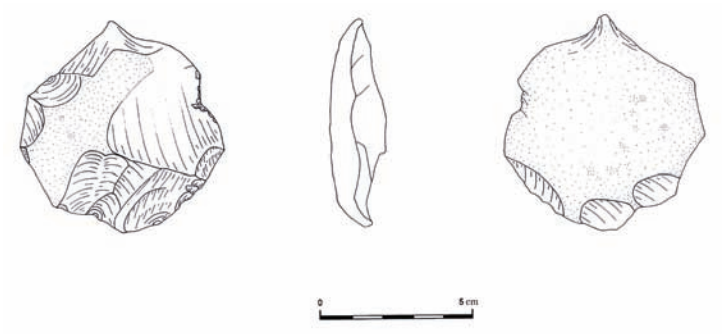

Fig. 7. Pointed bifacial discoidal core.

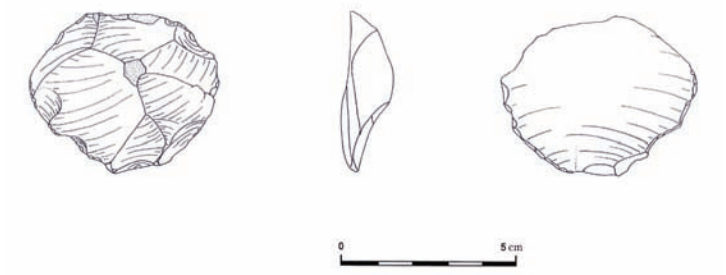

Fig. 8. Unifacial centrioital radial core.

Fig. 10. Picture of core shown in Fig. 9.

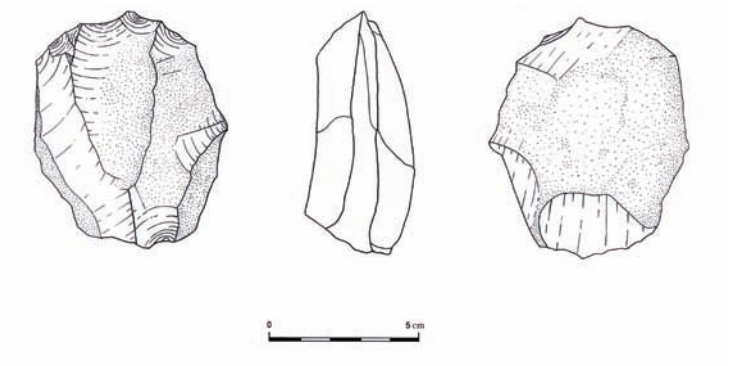

Fig. 9. Levallois flake core, Nubian method type 1.

The lithic assemblage was dominated by the Levallois centripetal radial technique and the resultant radial and discoid cores. Applying the Levallois technique of obtaining as many flakes as possible, the original large nodule of raw material was reduced in size, such that no more desired flakes were possible. Among the 158 specimens collected from Localities 2, 4 and 5, forty-nine radial, high-backed radial or discoid cores were found. These cores were distributed as follows: Locality 2 had seventeen specimens, ten of which were cores. Among the ninety-seven specimens collected at Locality 4, twenty-eight were cores.

Locality 5 produced forty-four specimens, eleven of which were cores. One bipolar Levallois core from Locality 4, and one Levallois flake core from Locality 5, would bring the total number of cores to fifty-one (both Localities 4 and 5 were discovered by Dr. Walid Yasin Al Tikriti).

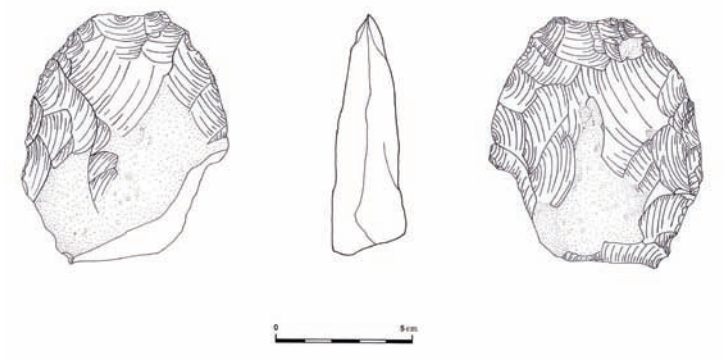

Fig. 11. Hand axe.

Fig. 12. Picture of hand axe shown in Fig. 11.

The smallest radial core comes from Locality 4, and measures 4.1 x 4.0 x 1.4 cm, whereas the largest radial core, from Locality 3, measures 13.2 x 12.3 x 5.2 cm. One hand axe was found in Locality 5. The base was broken towards the proximal end and would have been of the cordiform type, if complete. Combined shallow flaking and sinuous retouch have been applied to both sides, with the original cortex remaining on both sides, in the area close to the proximal end. Retouch was confined mainly to the left side of the hand axe. A hard hammer was probably applied in the primary flaking and a soft hammer was likely used to produce the final flaking and retouching (Fig. 11–12)

Apart from some diagnostic types, the majority of the tools identified (N = 19) were side-scrapers (N = 2) (Fig. 7), notches (N = 11) (Fig. 8), denticulates (N = 1, not included in Table 1) (Fig. 9), points (N = 2) and drills (N = 2) (Fig. 10). (Figs. 13-17) One unfaceted Levallois flake point, with some obverse retouch on one side, was found in Locality 1. One side-scraper, a bifacially retouched fragment on a thin piece of tabular flint, was found in Locality 5. The ventral retouch is shorter than that on the dorsal surface. Apart from the retouched area, the remainder of the fragment was covered with cortex. The notch concavities were made mainly by a single blow, and lack any form of deliberate retouch. The notch may be dorsally or ventrally directed or straight. These implements were an important component within the Barakah assemblage. Microwear and refitting studies (Cohen et al. 1969; Keeley 1977, 1980) show that similar tools had multiple functions including woodworking, splitting bone for the extraction of marrow and fashioning bone tools, hide cutting and piercing, butchering of animals and the preparation of plant food.

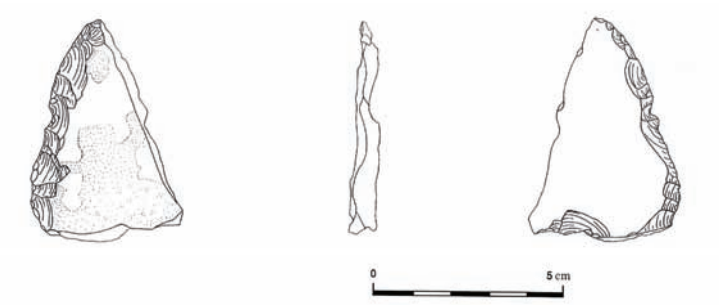

Fig. 13. Bifacial side-scraper.

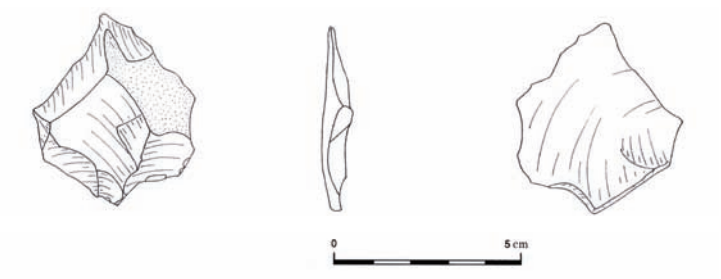

Fig. 14. A dorsally directed notch.

The number of primary flakes from Localities 2, 4 and 5 was 110, including specimens (complete and broken) that lack deliberate retouch. Three flakes have sharp edges or wide distal ends suitable for cutting or scraping. Three others have probable use-retouch on their sides. Nine flakes have a long axis that is shorter than their

breadth. This small number of flakes is not unusual since their manufacture technique depends on the shape of the core and the force of the blow on the platform. Two of them have dorsal cortex.

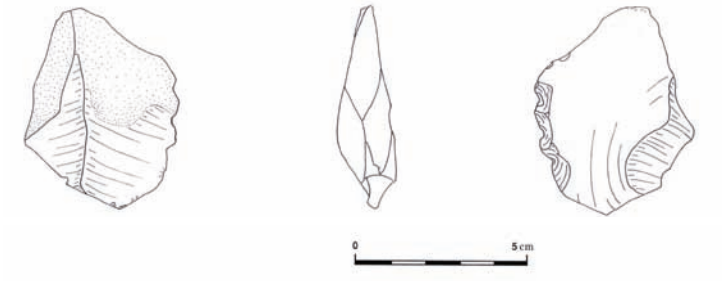

Fig. 15. A denticulate.

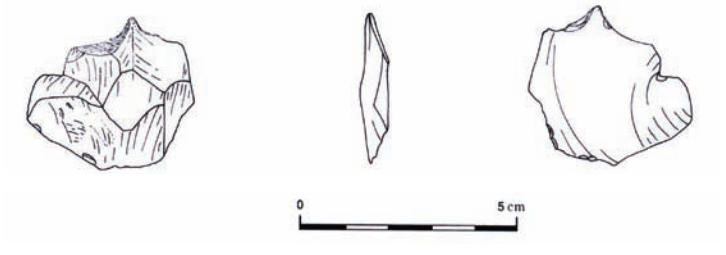

Fig. 16. A drill.

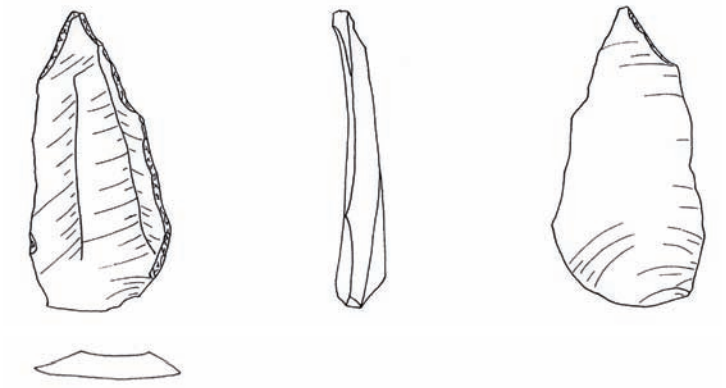

Fig. 17. Levallois flake point.

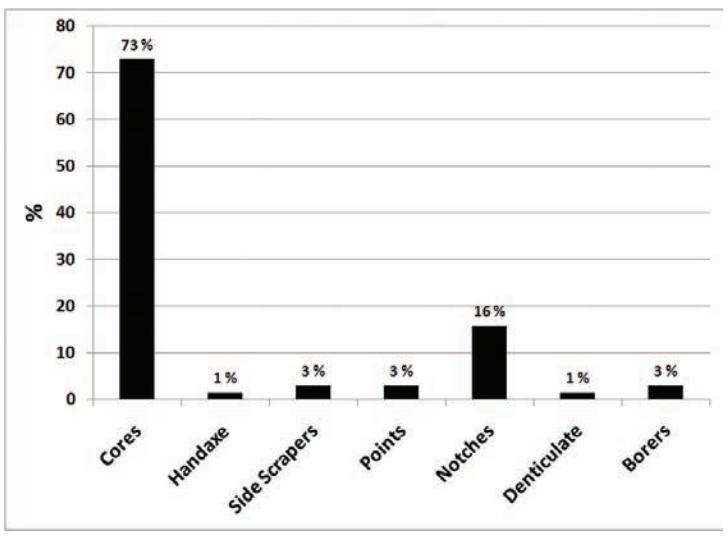

Table 1. Graph showing the percentage of cores and tool types.

DISCUSSION WITH MCBREARTY

An opportunity arose to meet with Sally McBrearty, at the 2nd International Conference on UAE Archaeology (1–4 March 2009). Before the conference, one of the authors sent McBrearty a copy of our joint article on the Barakah assemblage (Wahida et al. 2009). McBrearty cast some doubt on our description of the Barakah assemblage, which was a healthy contribution to the subject. She agreed to examine the above-mentioned artefacts and Dr Walid Yasin Al Tikriti kindly offered to bring the material from the Al Ain Museum to Abu Dhabi City. McBrearty went through and photographed every single artefact and agreed with our descriptions and the possible date given to the assemblage, except in the case of the one core of Nubian Method Type 1. When asked if it was totally different from all the others and what it should be called, McBrearty was hesitant to answer the question as the raw material was coarse chert.

CONCLUSIONS

It may be confidently stated that the Barakah assemblage belongs to the Middle Palaeolithic of the Arabian Peninsula. This conclusion is supported by the presence of the Levallois centripetal radial strategy, and the resultant radial and discoidal cores, the presence of two Levallois flake cores, one of possible Nubian Method Type 1 and one possible bipolar as well as one typical hand axe of cordiform type. The assemblage also included one bifacial side-scraper fragment similar to the Nubian Mousterian, of Type B (Marks 1968) and one unfaceted Levallois flake point. The assemblage is marked, as McBrearty had noted beforehand, by the total absence of blade elements and blade manufacturing techniques which is reflected in the 'character of both the flakes and the cores' (McBrearty 1999: 378). This is so despite the fact that the Barakah flint-knappers had access to good quality raw material for tool production. It would, therefore, appear that the Barakah toolmakers had not acquired the knowledge of blade-core reduction. It may also suggest that blade-core methods may not have been present in the vicinity of Jebel Barakah at the time in question.

On purely techno-typological grounds, we would like to propose that the Barakah assemblage may have preceded in time other known or suggested Middle Palaeolithic assemblages in the Arabian Peninsula, characterised by the more recent blade and blade-core strategy. Anthony Marks (2009) agrees that an Early Middle Palaeolithic

date for the Barakah assemblage is reasonable, and that 'the absence of blade production is in marked contrast to virtually all Pleistocene sites in the southern area, as well as to the Levantine related sites in the West'. Given the unusually high ratio of cores to actual tools types, we propose that the flint-knappers at Barakah had most probably used the Jebel as a raw material workshop for a short period of time.

The Barakah hunting and food gathering group represents the easternmost expansion of emigrants in the Arabian Peninsula of the period. Currently known lithic technology from Arabia might suggest one of the following two centres for their possible origin – the Levant or East Africa – though we do not know much of the Palaeolithic of the eastern part of the Arabian Gulf. Whichever it might have been, it is most likely that the Barakah group had brought with them their lithic technology, which is dominated by the consistent and exclusive use of Levallois centripetal core reduction with no blades.

The Middle Palaeolithic core strategy across Arabia has been described as 'plain flake, discoidal, Levallois and blade … with generally a low frequency of Levallois cores' (Petraglia 2007: 384–5). The best-illustrated Levallois cores have been discovered in the Hadhramaut region of the Yemen, where 'centripetal, recurrent and convergent flaking patterns have been identified' (Petraglia 2007: 384–5).

The assemblages from the Yemen, according to Inizan, have close affinities with those in the Levant (Petraglia 2007; Marks 2009). Other researchers working in Arabia have repeatedly noted that Levallois core technology was not as well-represented in comparison with the Levantine Mousterian. Whalen had suggested that flake-core methods in Arabia may have followed their own technological development (Whalen et al. 1982; Petraglia and Alsharekh 2003; Petraglia 2007).

In Oman the techno-typological analysis of the available material from open-air sites throughout the Omani hinterland and the south indicates, according to Rose (2004), possible technological connections with East Africa. This suggestion is based on the spread of bifacial foliates and the production of a combination of façonnage and centripetal core strategies.

In Sharjah Emirate, the stratified Palaeolithic material discovered at the rock shelter of Jebel Faya in level C has been dated by Optically Stimulated Luminescence (OSL) to around 85,000 ya (Uerpmann et al. n.d.a-b). The date, though likely to rise as the excavators head towards bedrock, has provided an approximate age for Palaeolithic origins in the United Arab Emirates. The Jebel Faya assemblage with blade elements among its components (Marks 2009; Scott-Jackson et al. 2009) seems, according to Marks (2009), to have affinities with East and North-east Africa.

In the Al Hajar Mountain range of Sharjah Emirate, Group 3 was regarded by the Scott-Jacksons and Rose as probably being the oldest among three other groups of assemblages on techno-typological grounds. The high frequency of 'blade-proportionate' elements was 'merely the by-product of convexity maintenance and not related to a true prismatic blade industry' (Scott-Jackson et al., 2009).

In the Levant, the Early Mousterian assemblages that were dated to c. 250–130 kya, have a laminar aspect debitage resulting from the dominant use of unidirectional and bidirectional Levallois-core reduction strategy (Shea 2007). Such 'Upper Palaeolithic' retouched tool types include end scrapers and burins, which were relatively common.

In East Africa, the beginnings of the Middle Stone Age industries were dated to before 285 kya. At this early date, the hand axe was abandoned and composite tools were adopted, including points, proper blades, lancelets, foliate points and even tanged points (McBrearty 2007; van Peer and Vermeersch 2007).

The above-mentioned assemblages had among their components blades or flake-blades, produced by one technique or another with retouched tools such as points, burins, side-scrapers, end-scrapers and even some microliths. Obviously, the Barakah assemblage lacks evidence of the knowledge for producing such elements.

The Barakah assemblage represents the easternmost extension of migrants into Arabia, probably during one of the pluvial phases associated with Marine Isotope Stage 5 (MIS 5). Palaeoenvironmental conditions from southern Arabia indicate at least three pluvial conditions were associated with MIS 5e, 5a and 3 (Rose, 2004; Petraglia 2007). The Barakah assemblage may well be dated technologically to over 100,000 years.

The Abu Dhabi Authority for Culture and Heritage (ADACH) is currently striving to protect important archaeological and palaeontological sites throughout the Emirate of Abu Dhabi. The discovery of the first Middle Palaeolithic site in the Abu Dhabi Emirate should ensure the site receives the highest level of protection.

Thanks go to Mr. Mohammed Khalaf Al Mazrouei, Director General of the Abu Dhabi Authority for Culture and Heritage (ADACH), Dr. Sami El-Masri, Deputy Managing Director of the Abu Dhabi Authority for Culture and Heritage, and to Mr. Mohammed Amer Al-Neyadi, Director of Historic Environment at ADACH, for supporting our work at Jebel Barakah.

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Fifty Years of Emirates Archaeology

PALAEOLITHIC AND NEOLITHIC STONE ARTEFACTS FROM AL GHARBIA (WESTERN REGION), ABU DHABI, UAE

Sally McBrearty (Storrs)

INTRODUCTION AND BACKGROUND

The geographic focus and interpretive framework for the practice of archaeology have experienced a number of shifts from the early twentieth century to the present day. In the period that may be termed the infancy of the discipline, archaeologists, rightly impressed with the record of early civilisation in the Near East, regarded the region as the source of all significant prehistoric developments, and saw events outside the Near East as the result of diffusion from this single source of cultural innovation (Smith 1911, 1933). In the middle years of the twentieth century, in part as a reaction to the prior extremes of this 'pan-diffusionism', archaeologists came to view the archaeological record as a document of parallel developments, with little if any contact or influence among regions (Trigger 2006). Nation states played a role in this interpretation, as it allowed each nation to claim that all significant developments had occurred within its borders. Since the mid-1980s, developments in the field of genetics, in conjunction with an expanded human fossil record, have led to the realisation that our species evolved in Africa (Cann et al. 1987, Stringer and Andrews 1988; Vigilant et al. 1991; Tishkoff et al. 1996, 2009; McBrearty and Brooks 2000; Tishkoff and Verrelli 2003; White et al. 2003; Clark et al. 2003; Brown and Fuller 2008), and early prehistory outside Africa is increasingly seen in terms of a series of population expansions from Africa to adjacent regions (Lahr and Foley 1994; Petraglia and Alsharekh 2003; Forster 2004; Rose 2004, 2007; Forster and Matsumura 2005; Mellars 2006a–b; Field et al. 2006; Weaver and Roseman 2008) (Fig. 1. A.).

The decrease in genetic diversity with geographic distance from East Africa (Fig. 1. B.) clearly shows the 'pruning' of human genetic variants through a succession of founder events by populations of early Homo sapiens. Further, both the mitochondrial DNA (mtDNA) and nuclear DNA (nDNA) contained in the Y chromosome document the appearance of a series of genetic markers that can be used to trace past population movements (Harpending 1998; Underhill et al. 2001; Endicott et al. 2007; Tishkoff et al. 2009; Forster 2004; Forster and Matsumura 2005). The genetic data, despite their own inherent ambiguities, do suggest a new way of looking at the archaeological evidence, which has led to an increasing desire to integrate the two sources of information about the human past. Traces of population-specific mutations has led to the suggestion of an early proliferation of human populations in Africa between

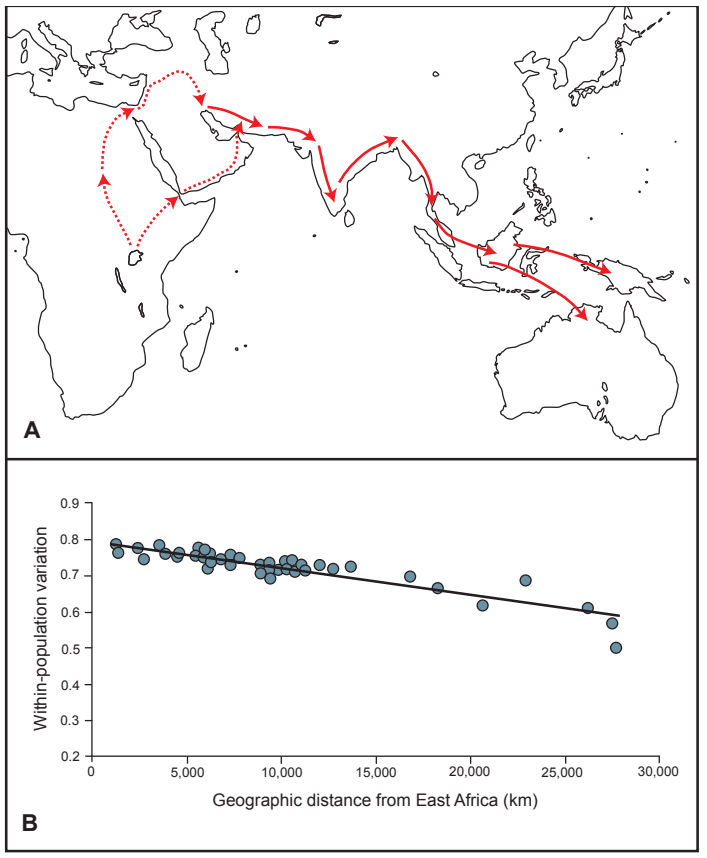

Fig. 1. A. Postulated human population movements out of Africa after 100 kya based upon fossil, archaeological and genetic evidence (after Mellars 2006a: Fig. 1); B. The degree of human genetic variation within populations, measured as heterozygosity at multiple loci, reflects geographic distance from East Africa (after Weaver and Roseman 2008: Fig. 2, from data in Prugnolle et al. 2005).

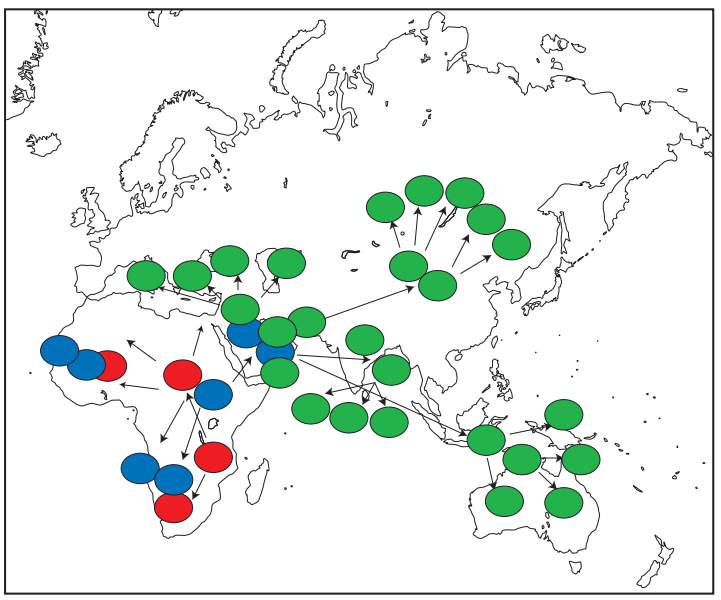

Fig. 2. Postulated population movements based upon mtDNA evidence. Red: initial proliferation of mtDNA lineages within Africa; blue: expansion of daughter lineages within and out of Africa; green: subsequent proliferation of descendant lineages outside Africa (after Forster 2004: Fig. 2).

200 kya and 100 kya bp, an initial expansion out of Africa into Arabia about 80 kya bp, and a subsequent series of population expansions out of Arabia into the rest of the Old World between 60 kya and 30 kya bp (Fig. 2). The genetic evidence is useful to suggest the order of events, but such estimates of absolute age from genetic evidence must be regarded with caution. For an accurate chronology, we must look to the fossil and archaeological records (McBrearty 2007).

Two competing hypotheses currently exist concerning the route taken by early human populations in their expansion out of Africa. Middle Stone Age technological evidence for Upper Egypt reviewed by Van Peer (1998) has led him to suggest population movements up the Nile Valley shortly after 130 kya bp, followed by an expansion via a 'northern route' across Sinai into the Arabian peninsula. Others, including Mellars (2006a-b) and Petraglia (2005, 2007; Petraglia and Alsharekh 2003; Field et al. 2006), see similarities in technology between southern Africa and southern Asia and argue for population movements following a 'southern route' across the Bab-el-Mandeb some time after 75 kya bp (Fig. 1. A). Neither scenario is supported by robust archaeological evidence.

In order to document the expansions of early human population, and, if possible, to link them with the genetic evidence drawn from their living descendants, it is necessary to keep in mind two basic questions: 1) which population is represented? and 2) which way is it going? Population expansions, contractions, and dispersals were no doubt numerous, proceeded in a variety of directions, and were indelibly affected by environmental change (e.g. Osborne et al. 2008). To apply archaeological evidence to these questions, a number of conditions must be met: 1) the archaeological signal must be distinctive; 2) archaeologists must identify it correctly; 3) the signal must be in good context; and 4) the signal must be reliably dated. These conditions, while essential, are demanding, and thus far, have rarely been met. A further additional caution must be borne in mind. Remnants of older populations do not always die out when new ones appear, and thus it will be common to encounter the traces of multiple populations within a single geographic area and time interval.

THE ABU DHABI EVIDENCE

In the late 1980s, representatives of the Al Ain Museum, Yale University Peabody Museum, and the British Museum (Natural History) were actively seeking Miocene fossils in Abu Dhabi's Western Region, (now renamed Al Gharbia). In the course of documenting the region's rich fauna and varied habitats (Whybrow and Hill 1999), members of the expedition occasionally encountered fragments of chert[1] which they suspected might exhibit human workmanship. Thus Walid Yasin Al Tikriti, Andrew Hill, and Peter Whybrow invited me to seek lithic artefacts in their study area, and thereby to document traces of the earliest human inhabitants of the area. In a short visit during the winter of 1992–1993, I discovered a series of lithic artefact sites (Fig. 3). I discussed these in two publications (McBrearty 1993, 1999), and briefly describe them here.

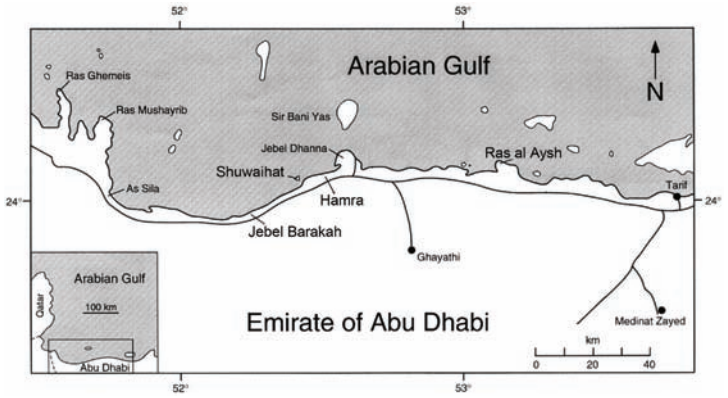

Fig. 3. Map of coastal Al Gharbia (Western Region), Emirate of Abu Dhabi, showing the location of the lithic artefact sites discussed in the text.

The capping chert or flint that lies at the top of the Miocene Baynunah Formation sequence is resistant to erosion and is responsible for the characteristic flat tops of the jebels in the region (Fig. 4. A). Weathering of Baynunah Formation sandstones, probably under conditions moister than those at present, resulted in the solution of quartz grains and the redeposition of silica in the form of silcrete (Ditchfield 1999). The lithic artefact sites lie immediately adjacent to these flint outcrops. Net sediment loss since the time of artefact manufacture has prevented burial. Artefacts and naturally fractured flint have drifted downslope where they blanket the surrounding topography, lying either directly upon outcrops of the Baynunah Formation or within a shallow mantle of unconsolidated sands and silts derived from the Baynunah Formation. The archaeological localities are quarry or extraction sites, contain few or no retouched tools, and have not been dated chronometrically. Therefore their cultural affinities and age must be judged primarily from flake and blade production methods alone. The Western Region/Al Gharbia lithic artefact sites may be divided into two groups: 1) sites of Holocene age and Neolithic affinities, including Ra's al-Aysh, Hamra, and Shuwaihat; and 2) sites of Pleistocene age and Palaeolithic affinities, represented thus far only by

occurrences near Jebel Barakah. At each site, controlled surface collection enables me to characterise the numbers and characteristics of the artefacts present. In addition, a surface scrape and sieving operation at the base of Jebel Shuwaihat allows description of sub-surface objects buried in superficial slopewash sediments derived from the *jebel* slopes.

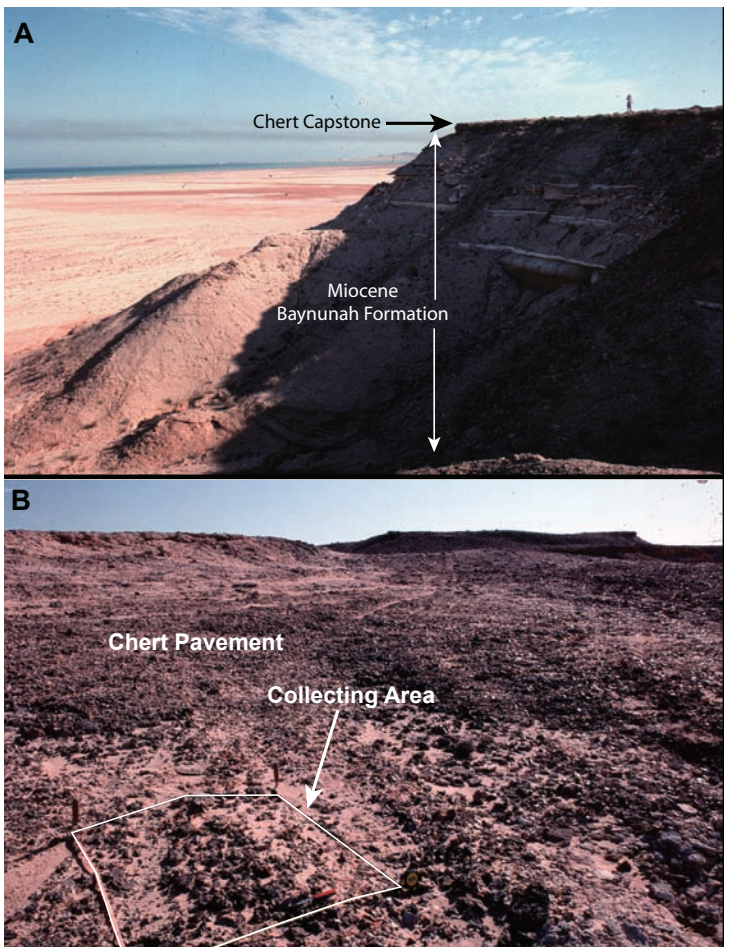

Fig. 4. A. Hamra, January, 1993. View to south-west, showing tabular chert capping Baynunah Formation succession; B. Hamra, January, 1993. View to north-east, showing artefact collecting area. Outlined area is 1 m².

EARLY HOLOCENE SITES

At both Ra's al-Aysh and Hamra, artefacts and naturally fractured chert fragments were observed to extend for many hundreds of metres around the *jebels* (Figs. 4. B.–5). Collection took place in areas where large numbers of artefacts were observed. At Hamra, naturally fractured angular chert fragments occur as a virtual 'pavement' surrounding the *jebel*. Scatters of artefactual flaking debris were observed both adjacent to the chert outcrop immediately below the *jebel* summit, and at several locations within a radius of ~1.5 km of the jebel itself. A controlled surface collection within an area of 1 m^2 near the *jebel* summit yielded a collection of 815 fractured flints; of these 103 (12.6 percent) were artefacts. A second collection within an area of 1 m^2 farther downslope revealed fewer flints (n=103), but a similar proportion of artefacts (11.7 percent). At Ra's al-Aysh artefacts were observed within a radius of ~500 of the *jebel* summit. Numbers of both naturally fractured and artefactual flints are lower than at Hamra. A surface collection within an area of 11 m^2 yielded only 418 objects, eleven of which (2.6 percent) are artefacts. At both Hamra and Ra's al-Aysh the objects rest upon loose unconsolidated sand and silt derived from weathered Baynunah Formation sandstones.

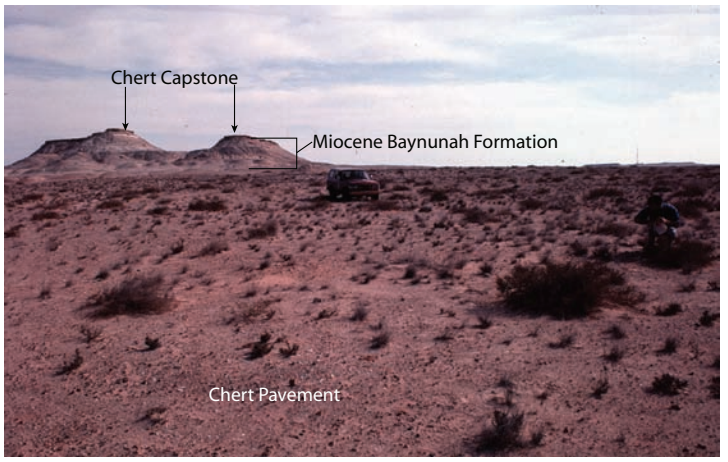

Fig. 5. Ra's al-Aysh, January, 1993. View to north-west.

Raw material at both Hamra and Ra's al-Aysh is good quality flint that is ideal for artefact manufacture. That at Hamra is yellow to black in colour with a fairly deep patina; at Ra's al-Aysh the flint has weathered to a green or greenish-yellow shade. At both sites the artefacts are fairly small; at Hamra none exceeds 10 cm in maximum dimension, and at Ra's al-Aysh only two are greater than 10 cm in size. The technology is also similar at the two sites. Apart from one core from Hamra (Fig. 6. d.) that could be classified as a scraper, no formal tools were observed at either site. Flake production at both Hamra and Ra's al-Aysh is by reduction of radial and multiplatform cores (Fig. 6. d., h.). Blades were produced from both unidirectional and bidirectional blade cores (Fig. 6. f–g., i., j.). Distinctive naviform cores are also present at both sites (e.g. Fig. 6. e.). Naviform cores are prepared around their perimeters like radial cores, then turned 90°, and blades are removed from an axis perpendicular to that of the radial striking platform. The first blade removed from such a core has a dorsal crest of intersecting flake scars, the remains of the radial striking platform; subsequent blades have parallel dorsal scars. First described from a number of sites in Palestine and Syria, naviform cores are characteristic of the Pre-

Pottery Neolithic (PPNB) of the Levant (Moore 1982; Crowfoot-Payne 1983; Kobusiewicz 1996; Masson 1996; Noy and Kozlowski 1996; Gopher 1999). The PPNB is tightly constrained chronologically at a number of sites by multiple radiocarbon dates. These range from from 10.5 cal kya bp to 8.7 cal kya bp (9.5 – 7.9 uncal kya bp) (Kujit and Goring-Morris 2002; Twiss 2007). It seems likely that naviform cores at Hamra and Ra's al-Aysh are the by-product of the initial stages of blade manufacture, and that the unidirectional and bidirectional blade cores represent subsequent stages of core reduction. Refitting would be required to confirm this hypothesis.

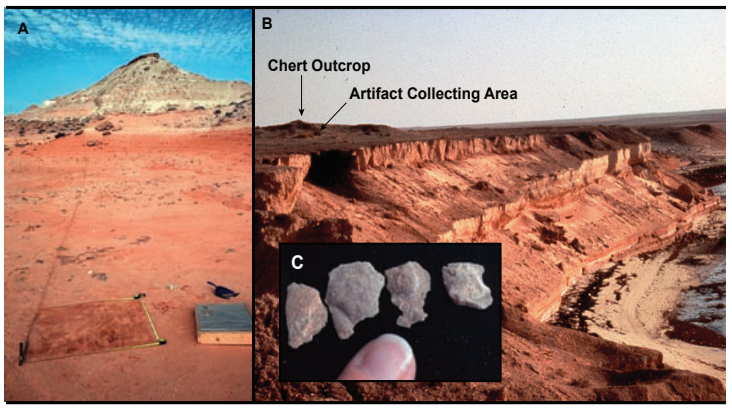

Fig. 6. Lithic artefacts from Shuwaihat, Hamra, and Ra's al-Aysh, most likely of early Holocene age: a. radial core, Shuwaihat; b. high-backed radial core, Shuwaihat; c. naviform blade core, Shuwaihat; d. high-backed radial core or score scraper, Hamra; e. naviform blade core, Hamra; f-g. bidirectional blade cores, Hamra; h. radial core, Ra's al-Aysh; i. unidirectional blade core, Ra's al-Aysh; j. bidirectional blade core, Ra's al-Aysh.

At Shuwaihat, artefacts were found over a large area of sea cliffs and wave-cut platform on the south and west faces of the jebel (Fig. 7. B.). Raw material at Shuwaihat is poor quality silicified limestone, giving the artefacts a crude appearance, but in fact the technology represented is identical to that at Hamra and Ra's al-Aysh. A variety of simply flaked artefacts, including trimmed slabs and cores ≤ 15 cm in maximum dimension, were collected near the summit and on the *jebel* slopes. Radial cores for the production of flakes at Shuwaihat take a variety of forms, including disc, subradial, and high-backed radial types (Fig. 6. a–b.). While few whole blades were found, blade cores include unidirectional, bidirectional, and naviform types (Fig. 6. c.). Surface collection over an area of 5 m^2 was undertaken to determine artefact density. Where artefacts were found to lie in unconsolidated surface sediments (2 m^2 of this 5 m^2), the sediment was trowel-scraped to a depth of 2 cm and passed through 25 mm mesh (Fig. 7. A.). A total of 272 stone objects was recovered; of these ninety (thirty-three per cent) are artefacts). Mean artefact density is 18 per m^2. Most artefacts recovered in this area are < 3 cm in maximum dimension, and the presence of a number of whole flakes < 2 cm in size (Fig. 7. C.) confirm that artefact manufacture was carried out on site.

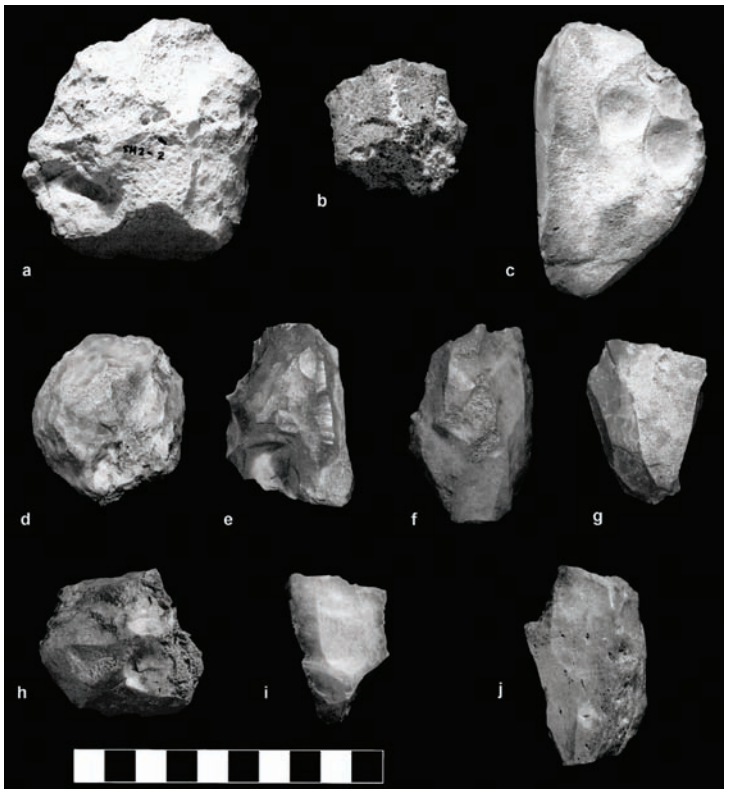

Fig. 7. A. Shuwaihat, surface scrape in progress, January, 1993. Delineated cleared area is 1 m^2; B. Shuwaihat, December, 1992. View to east north-east; C. Selected microdebitage recovered in surface scrape at Shuwaihat.

PLEISTOCENE ARTEFACT SITE

At Jebel Barakah, artefacts were encountered in 1992–1993 over a very broad area to the north-west of the *jebel*, between the summit and the sea cliffs (Fig. 8A). The artefacts are made of good quality flint that weathers to a bluish-black colour and was obtained from the outcrop near the *jebel* summit. Unlike the collections from Hamra, Ra's al-Aysh, and Shuwaihat, the suite of artefacts from Barakah contains no blades or blade cores. Rather, it is almost exclusively comprised of radial cores and the flakes derived from them (Fig. 9. a–h.). Radial cores (cf. McBrearty, 1988), sometimes termed discoidal or centripetal cores by others (e.g. Leakey 1971; Mehlman 1989) are flaked around their perimeters on both sides. According to Boëda (1995), the volume of a radial core is conceived as two convex surfaces, the intersection of which defines a plane. This differs from Boëda's definition of the Levallois volumetric concept

in that there is no hierarchical relationship between the two opposing surfaces. Using these criteria, there is no evidence for Levallois reduction among the artefacts recovered by me at Jebel Barakah in 1992–1993. I did recover two fragments of formal tools, however. One, a flake fragment with marginal unifacial trimming (Fig. 9. i.) is not very informative. The other (Fig. 9. j.) is a biface tip with a length of ~60 mm, a maximum thickness of ~14 mm, and a fairly straight edge when viewed in profile. It has been flaked over its entire surface on both sides by direct percussion with soft hammer. From its shape and dimensions, it can be inferred that the biface of which this fragment was a part was ≥ 110 mm in length.

Fig. 8. A. Jebel Barakah, December, 1992. View to north-north-east, collecting area in foreground; B. Jebel Barakah, January, 1993. Surface artefacts during the collecting operation.

The absence of blades or blade cores, and the presence of radial cores and a biface fragment combine to create the impression of Middle Palaeolithic or Middle Stone Age affinities for the lithic artefact assemblage recovered at Jebel Barakah in 1992–1993. However several considerations precluded a definitive diagnosis at that time (McBrearty 1993, 1999). First, radial cores are very poor temporal indicators. They are encountered in the Oldowan of East Africa more than 2.5 million years ago (Leakey 1971; Kibunjia 1994), and they persist into the Neolithic of the Near East (e.g. Moore 1982; Gopher 1999). Second, while the Barakah biface tip might be part of a handaxe, it might equally be part of a large foliate point like those known from the western Rub' al-Khali Neolithic biface tradition as described by Edens (1982, 1988) for the interior of the Kingdom of Saudi Arabia, and provisionally dated by McClure (1976) to 10 kya – 6 kya bp. Bifaces ~120 mm in length are common among the foliates of the western Rub' al-Khali Neolithic biface tradition. Similar large bifaces have been found in association with Ubaid sherds at the site of Khor, Oman, where they are interpreted to represent the early stages in the production of projectile points (Inizan 1980, 1988).

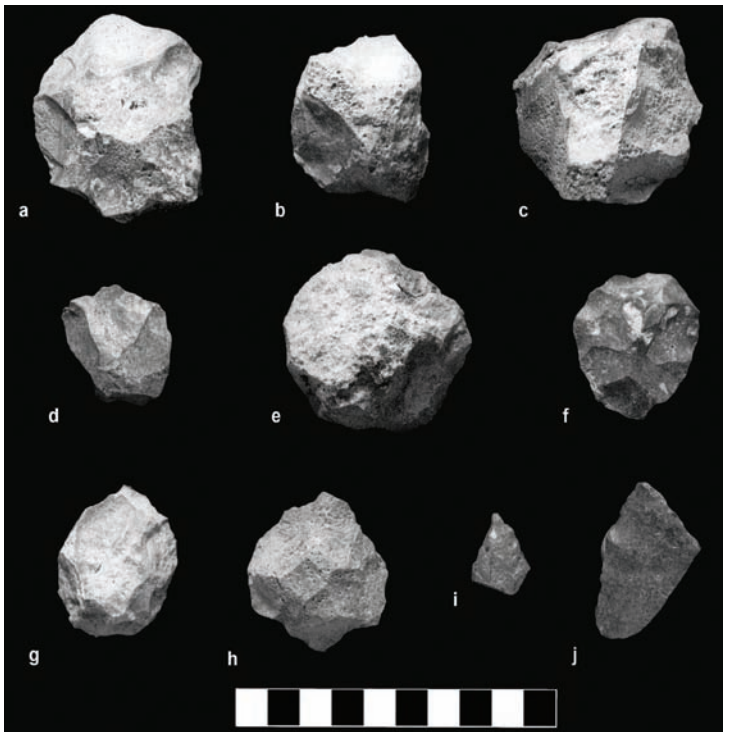

Fig. 9. Lithic artefacts from Jebel Barakah, most likely of Middle or early Later Pleistocene age. a-h. radial cores; i. flake fragment with marginal unifacial trimming; j. biface tip.

Recent finds reported by Wahida et al. (n.d., and in this volume), however, seem to support an early age for the Barakah lithic artefacts. They report discovery of lithic artefacts at four additional localities east and inland of the *jebel*. Artefacts include a small cordiform handaxe, a bifacially trimmed scraper, and several Levallois cores. I am grateful to Walid Yasin Al Tikriti and Ghanim Wahida for allowing me the opportunity to examine some of their finds. A single core, illustrated in Wahida et al. (n.d.: Fig. 5.), resembles a Nubian core as defined by Guichard and Guichard (1965, 1968). These distinctive artefacts predate 100 kya bp in the Nile Valley (Van Peer

1998). If confirmed, the presence of Nubian technology in Abu Dhabi suggests cultural links with North-east Africa in the late Middle or early Later Pleistocene.

DISCUSSION

Explicit features of the stone technology described here provide insight into two distinct periods of Abu Dhabi's past, and its links with the wider world. First, a specific type of blade production technology, known elsewhere from Pre-Pottery Neolithic sites in Palestine and Syria, is found at the Al Gharbia sites of Ra's al-Aysh, Hamra and Shuwaihat. Its presence permits a precise age estimate of 10.5 kya – 8.7 kya bp for blade manufacture at these sites. The radial core technology used to produce flakes here may predate or postdate the blades, however, and it is quite possible that these sites have been attractive sources of raw material for lithic artefact production for a very long period of prehistory. But the presence of distinctive naviform cores demonstrate cultural links with the Levant in the early Neolithic, and permits us to see this region of western Abu Dhabi in relation to adjacent regions in the early Holocene (Fig. 10.). Whether foragers of the period in the Emirates had begun to include domesticated animals in their economy as they had elsewhere remains a fascinating question that only the recovery of faunal material can address.

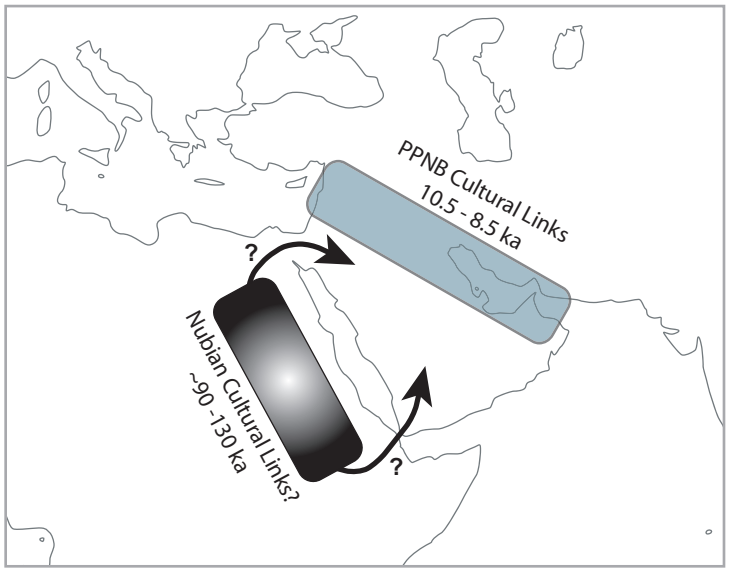

Fig. 10. The pre-Pottery Neolithic (PPNB) culture area includes Abu Dhabi, ~10.5–8.7 kya (dates from Kujit and Goring-Morris 2002, Twiss 2007). The Nubian culture area may include Abu Dhabi, ~90–130 kya. Whether contacts took place north or south of the Red Sea is uncertain.

An important consideration is that the present landscape of coastal Al Gharbia does not bear a very close resemblance to the region as it existed in the early Holocene, and culture contacts are unlikely to have taken place by sea. While the rapid deglaciation of the early Holocene had slowed by 10.5 kya bp, sea levels may have been as much as 10 m below those of the present day (Gornitz 2007; Carlson et al. 2008; Clark 2009; Yu et al. 2009). Thus the shore of a much-reduced Arabian Gulf lay closer to the present day coast of Iran, and the *jebels* of Al Gharbia rose above a sandy plain. We might expect the migration routes for foragers of the period to include the *wadis* and ephemeral lakes of the Rub' al-Khali many kilometres to the north and west.

Second, the Al Gharbia lithic artefacts provide insight into the role of Arabia in the Pleistocene expansion of populations of early *Homo sapiens* out of Africa. Although my discoveries at Jebel Barakah were the first evidence of Palaeolithic occupation to be discovered in the Emirate of Abu Dhabi, they should come as no surprise, since widespread Palaeolithic occupation of the Kingdom of Saudi Arabia has long been known (e.g.Whalen et al. 1981, 1988; pers. obs.), and more recent finds have documented a Palaeolithic presence in Oman (Rose 2004) and Sharjah,UAE (Scott-Jackson et al. 2008; Anonymous 2008; Uerpmann pers. comm.). While there is keen interest in detecting an archaeological signal for Pleistocene human migration out of Africa, thus far the evidence from Arabia has been equivocal. As stated earlier, demonstrating population movements requires a distinctive archaeological signal that is accurately identified, in good context, and reliably dated. Nubian technology is distinctive and existed in a specific geographic area during a limited time window, that is, the Nile Valley during the interval 130–90 kya bp. A single core of apparent Nubian type from Jebel Barakah may not serve to build an airtight case, but it is a promising start in documenting a Pleistocene link between Africa and Arabia. Additional finds and an age determination would be a valuable contribution.

The find, if confirmed, does not alone resolve the issue of whether human population movements took place north or south of the Red Sea (Fig. 10.). If humans are seen as having travelled exclusively on foot, one must favour a northern route (Derricourt 2005), since geomorphological evidence shows that the Bab-el-Mandeb straits existed even at times of lowest sea levels (Fernandes et al. 2006), when they were perhaps 5 km wide, but subject to fierce currents. Some have stressed the importance of coastal habitats to early human adaptations (Stringer 2000; Walter et al. 2000; Broadhurst et al. 2002). If this view is accurate, African human groups of the Middle or Later Pleistocene may well have been undeterred by the prospect of travel by water, and may naturally have included adjacent regions in their seasonal rounds, especially as their population

numbers increased. The peopling of Australia by ~50 kya bp (Bowler et al. 2003) suggests that some human populations were competent in the use of watercraft in the Later Pleistocene. However, the much earlier peopling of Flores (Jungers 2009; Lieberman 2009) indicates perhaps the occurrence of inadvertent or 'sweepstakes' rafting across oceans (Fernandes et al. 2006), which is known to have played a significant role in the dispersal of animals of a range of body sizes and metabolic requirements throughout evolutionary history (de Queiroz 2005). It is to be hoped that additional finds from Al Gharbia will help to resolve these important issues.

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1 The terms flint and chert are used interchangeably throughout this chapter.

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Fifty Years of Emirates Archaeology

SOCIAL IMPLICATIONS AND POTENTIAL CAUSES OF VIOLENCE AT NEOLITHIC AL-BUHAIS 18

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INTRODUCTION

The United Arab Emirates looks back on fifty years of archaeological research. This is a very short period in comparison to Europe, the Eastern Mediterranean and Mesopotamia, where archaeology has a long tradition. Nevertheless, an incredible amount of knowledge about the prehistoric past has been accumulated during this period. This is due, in part, to the enormous interest and support of the local authorities as well as more popular interest. It has also been achieved thanks to the persistence, patience and fascination of the researchers who have coped with the difficult archaeological conditions encountered in this part of the world. The lack of natural sedimentation is one of the big problems. Quite often, man-made artefacts from the Quaternary can be found on the same surface as the remains of yesterday's picnic. It is difficult to find stratified sites with good preservation. Nevertheless, there is now a basic understanding of the last 100,000 years – of course with great differences with regard to the density of information.

Concerning the Stone Age, a better picture is emerging in particular for the period called the Neolithic. Research was mostly concentrated in coastal areas, reaching from Kuwait, eastern Saudi Arabia, Bahrain and Qatar to the United Arab Emirates, and from there along the coast of the Gulf of Oman to the east coast of the Sultanate of Oman. Within the Emirates, coastal Neolithic sites are known from the Abu Dhabi Islands to Sharjah, Umm al-Qaiwain, Ra's al-Khaimah and Fujairah. But, however important the coastal sites are because of their good preservation, we have to realise that they cannot reflect all of the Neolithic period. Ten thousand years ago, when the Neolithic started in this part of the world, the coast was not where it is today. Due to a lower sea-level, it was much farther out. Coastal sites older than about 8000 years are now under water.

Sites in the interior have not been affected by sea-level rise but they are affected by all the other problems of sedimentation and preservation mentioned above. Many Neolithic sites in the interior are nothing more than scatters of flint artefacts in the desert. Luckily a few sites are better preserved, like FAY-NE1, FAY-NE10 and FAY-NE15 (Fig. 1.) at Jebel Faya (Sharjah), where excavations have yielded interesting stratigraphical sequences, although these are not yet fully explored (Uerpmann, H-P, Potts and Uerpmann, M 2009). Nevertheless, initial analyses of the stone artefacts and radiocarbon dates from these sites provide a new time frame for the Holocene Stone Age. It is, however, still difficult to describe archaeological cultures beyond the differences indicated by the occurrence of some 'typical' stone artefacts. The preservation of organic remains at FAY-NE10 and FAY-NE15, nonetheless, have already provided some additional insight into burial rites, adornments and subsistence (Kutterer and de Beauclair 2008).

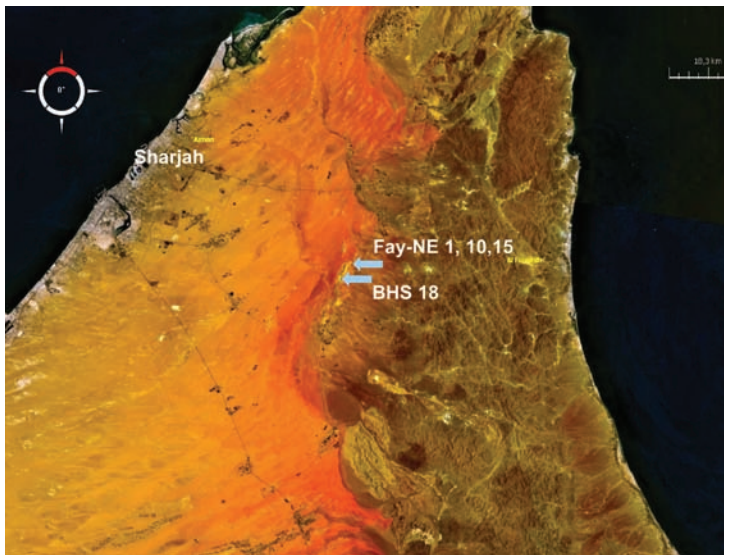

Fig. 1. Map of the sites BHS18, FAY-NE1, FAY-NE10 and FAY-NE15 in the central region of Sharjah, UAE (Satellite image World Wind, NASA)

In this respect, however, the site of al-Buhais 18 (BHS18) is still pre-eminent. The setting and other features of the graveyard as well as burial rites and treatment of the deceased were analysed and have been published to a large extent (Uerpmann, Uerpmann and Jasim 2006, 2008). Palaeo-botanical studies (Tengberg 2008) and palaeoclimatic considerations (Parker and Preston 2008) explain the environmental setting of BHS18. A comparatively large amount of faunal remains yielded evidence with regard to subsistence economy (Uerpmann and Uerpmann 2008). The human remains from the larger part of the graveyard excavated up until 2000 are also published in detail (Kiesewetter 2006). Important general information and data about the physique and demography of the Buhais population are found in this paper as well as many detailed palaeo-pathological observations of traces of violent interactions on the bones.

Meanwhile, the rest of the human remains excavated since 2000 are under study; they can be compared to the earlier results. Some aspects can now be dealt with in more detail, in particular with regard to indications for a high degree of inter-group violence. More detailed insights into environmental developments on one side and the ongoing theoretical discussion about violence and warfare in prehistory, social anthropology and psychology on the other hand require a discussion of these problems beyond Kiesewetter (2006).

At present, our interpretation of BHS18 is that the people who buried their dead there were mobile herders

making seasonal use of different resources and areas ranging from the coast to the Hajar Mountains. Analyses of the faunal remains from al-Buhais 18 indicated that mostly the meat of cattle, sheep and goat was consumed, as well as milk from the small ruminants. Hunting provided only a small amount of additional meat (Uerpmann and Uerpmann 2008). There is evidence neither for agriculture nor for the use of wild edible plants, although it must be assumed that the latter were exploited – apparently without leaving retrievable traces. It seems that this particular subsistence economy was practiced without much change throughout most of the 5th millennium BC. Its end has been seen in relation to a dramatic climatic event at about 4000 BC which led to severe desiccation (Uerpmann, M 2003).

ANTHROPOLOGICAL EVIDENCE OF VIOLENT FIGHTING

According to the present state of examination of the skeletal remains excavated at BHS18, there are thirty-five cases of skull injuries and one fractured mandible among 341 crania that were well-enough preserved to be studied in detail. This means that at least eleven per cent of the crania from BHS18 exhibit injuries. Eleven of the skulls even display multiple fractures. The high percentage of cranial trauma is a singular feature of the site. So far, no other skeletal population from excavations within the Oman Peninsula showed such an amount of head traumas (McSweeney, pers. comm. and this volume).

In demographic terms, the head injuries are not distributed randomly within the collection: only adults and juveniles over the age of fifteen are affected and men had a much higher risk of injury than women, the sex ratio being 2:1. Unhealed traumas were not found on skulls of women older than forty years. Thus, elderly women do not seem to have been affected. Only the skull of one female aged 40–50 exhibits a fracture, but it is healed and may have happened in her younger years. Obviously the strongest members of the society – mostly adult males – had the highest risk of injury in this way. Interpersonal aggression is the most plausible explanation of these injuries.

Generally, most skull fractures detected in archaeological material seem to be related to intentional violence rather than to accidents (Ortner 2003: 141). Almost all of the fractures seen at BHS18 are located above the so-called hat-brim line (see Figs. 6.3–6.5 in Kiesewetter 2006), which indicates that they are the results of interpersonal violence (Kremer et al. 2008). If they were due to accidents, they would rather be located below this line. Skull injuries are of particular interest in this context, because they are also indicative of the degree of aggression with which they were inflicted. 'The importance of skull injuries from the forensic standpoint is that they indicate that sufficient force was applied to the head to break bone, thus providing an objective criterion of the amount of violence involved' (Adelson 1974: 403).

The injured skulls show different kinds of trauma: mostly blunt-force depression fractures, but also some injuries caused partially by sharp-force (chop-wounds). These varying fractures are due to the use of different weapons. Wooden clubs and perhaps handheld stones are the most likely objects used. There are also some puncture wounds, but until now there is no clear evidence for spears or for shooting with bow and arrow. No projectiles were found embedded in bone and the injuries do not exhibit the typical form of lesions caused by flint arrowheads (Smith, Brickley and Leach 2007). More detailed analyses of the different kinds of wounds with the help of microscopic examination are under way.

Traces of injuries left on the skulls of females – in particular the location of the wounds on the backsides of the skulls – suggest that women were mostly hit when fleeing from the assailant, while males were normally wounded in combat. Here the lesions were mostly observed on the left parietal bone, which is typical for injuries resulting from face to face combats with a right-handed opponent.

Apparently many of the wounds to the head were fatal. However, some victims survived, which can be seen when the bone around the lesions displays traces of healing. Such injuries are called ante-mortem cranial trauma because they happened a certain time before the individual died. Only about one-third of the skulls with head injuries show such signs of healing, which means that most fights ended with at least one of the persons involved dying. Injuries occurring at or around the time of death are called peri-mortem fractures. They are often more difficult to recognise than healed traumas and can easily be confused with post-mortem damage to the bone. Since only explicit cases are usually counted, the occurrence of lethal head injuries may often be under-estimated. In the opinion of Schulting (2006), both forms of trauma to the skull – ante-mortem and peri-mortem – are generally under-represented in the recent literature concerning the European Neolithic and Mesolithic. In addition, soft tissue wounds usually do not manifest themselves on skeletal remains. Therefore, injuries observed in pre- or proto-historic populations generally only reflect the obvious part of interpersonal aggression.

As already discussed by Kiesewetter (2006: 190–192), the high rate of fatal head injuries at BHS18 indicates that they mostly resulted from severe inter-group fighting, rather than from ritual fighting or more 'harmless' intra-group fights. Another observation supporting this view is the high occurrence of multiple adult burials. In some cases, up to five individuals were buried together, indicating that they died at the same time. The simultaneous death of several members of the Buhais population is most probably the result of inter-group aggression, since accidents or death due to infection or starvation seem to be less likely. In one triple burial as well as in three double burials one of the individuals exhibits clear indications of peri-mortem skull trauma. According to Schulting (2006: 232) this is a strong indication of the violent death of all the individuals buried together.

A relatively small number of healed postcranial fractures – 16 cases (3.3 per cent) – were also observed in the material. To what extent this low incidence is due to the poor preservation of postcranial skeletal elements is unclear. Most of these fractures – 14 cases – are located in the upper limbs and only two cases were found in the lower extremities. This fracture pattern also suggests that violence, rather than accident, was the cause (cf. Kiesewetter 2006). The low incidence of observed parry fractures is probably due to the fact that they would only be recognised after healing. As most of the fights at al-Buhais ended in a death, potential parry fractures would not have been identifiable due to the poor preservation of the human remains.

PALAEO-PATHOLOGICAL CASE STUDIES ON INJURIES CAUSED BY VIOLENT INTERACTION

Below, two skulls and a mandible excavated after the year 2000 will be dealt with in greater detail in order to better illustrate cases of interpersonal aggression and its results. The first case study, a large skull fragment of undetermined sex, highlights that the level of emotion – or rather aggression – was very high when the individual was killed. This becomes evident when looking at the skull injuries in detail. The cranium exhibits two peri-mortem fractures which are located very close to each other on the left side of the skull (Fig. 2.). It is likely that the individual was already unconscious or dead after the first blow and was hence unable to move when struck on the head the second time. The second blow hit nearly the same spot. Had the person been able to move after the first injury, she or he would have tried to dodge the next blow and it would not have landed so close to the first one. Obviously, the assailant wanted to make sure that his opponent was really dead.

Fig. 2. Skull of individual MG from BHS18, showing two peri-mortem fractures on the left side of the skull (indicated by arrows)

The second skull is that of an adult male. This individual had already survived at least one earlier attack, as shown by two small depressions resulting from blunt force blows to the head. They had already healed by the time the man was killed by another, more severe, blunt force skull injury. The resulting peri-mortem depression-fracture is located on the left side of the skull (Fig. 3.), where gross crushing is visible. The lesion exhibits internal bevelling (Fig. 3. a.) and a thin concentric fissure. The location on the left side of the skull suggests that the man was injured when fighting face-to-face with a right-handed opponent.

Apparently a member of the victim's group tried to save his life. Two cut-marks along the lesion indicate first-aid treatment (Fig. 3. b.). Apparently, the scalp was opened above the wound with the help of a flint artefact – probably in order to remove loose pieces of bone. It is, however, not possible to determine whether the loose pieces could actually be removed or not, because the skull was found as part of a secondary burial where only the calvarium was preserved. In any event, this patient did not survive the operation.

There are at least three other cases of skull surgery in the form of trepanations (Fig. 4.). Two of them display indications of healing and the patients survived the operation for quite some time (Kiesewetter 2006: 197–198). With two healed depression fractures and a final, fatal blow in the end the present case reflects a life history of repeated violence. It also sheds light on

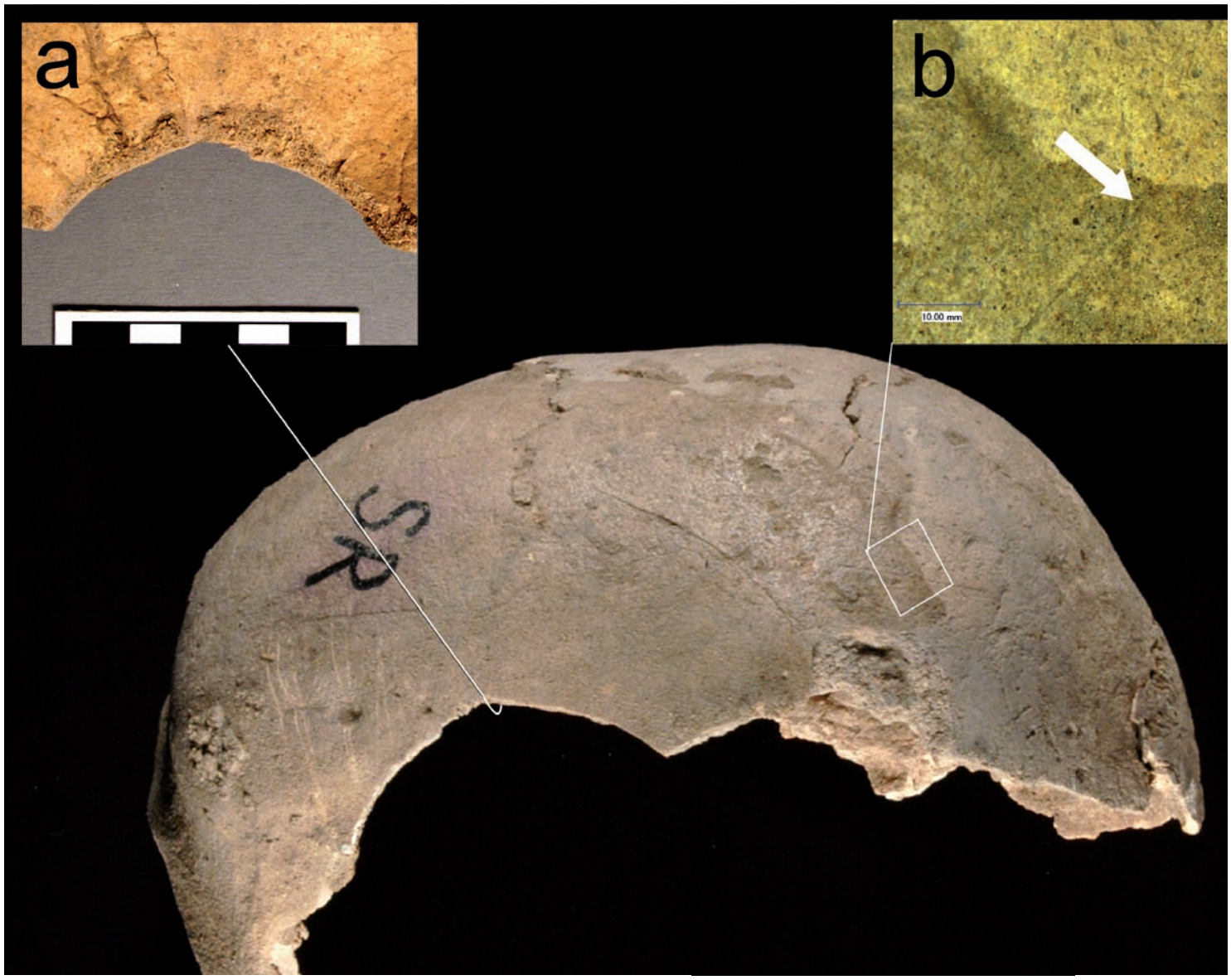

Fig. 3. Cranium of individual SR (BHS18) with large peri-mortem blunt-force trauma on the left side of the skull as well as two cut-marks along the margins of the fracture (picture: H. Jensen). The lesion displays internal bevelling (Detail a). The microscopic image shows one of the cut-marks (Detail b).

Fig. 4. Individual HD (BHS18) with trepanation on the right parietal bone.

interpersonal care within the group, where individuals were so precious that their fellow group members made elaborate attempts to save their lives.

The third example is the mandible of a mature male exhibiting ante-mortem trauma (Fig. 5.) in the form of a healed fracture of the corpus in the chin area. When the mandible was fractured, it was split into two pieces which rejoined during the healing process. The fracture is well-healed with only moderate callus formation (Fig. 6. a.). The fracture line is still clearly visible, starting at the lower edge of the corpus mandibularis below the level of the first right molar, and running around the chin, ending on the left side within the alveolus of the canine (Fig. 5., bottom).

Ante-mortem tooth loss of the second left incisor can be seen; here the alveole is nearly filled up with newly-formed bone. Whether this tooth was lost when the

mandible was fractured is unclear since one cannot tell how long the individual survived after the injury.

Fig. 5. Mandible (individual MA, BHS18) with healed fracture (picture: H. Jensen). The dotted line (bottom) indicates the fracture line.

The fracture must clearly be addressed as an open (compound) fracture, because the mucosa communicated with the break in the alveolar area (Tawfilis, Byrne and Kim 2006). Bacteria can enter such wounds and may lead to dangerous infections. Nevertheless, the mandible from BHS18 displays no such signs of infection. Apparently, the individual had a strong immune system and the people of al-Buhais may have had knowledge of medicinal plants or other remedies for the disinfection of wounds.

In order to heal, a fracture of this sort would require about four weeks during which the mandible was immobilised (Prof. Reinert, pers. comm.). This might have been achieved by bandaging the head of the victim around the forehead and mandible. Since food intake would have been impossible with full occlusion of the upper and lower teeth, small pieces of wood or other flat objects may have been placed between the jaws. An intake of water and milk or solids – possibly in the form of pre-chewed food – would then have been possible. Of course, this is entirely speculative. Nevertheless, historical tradition as well as pictorial representations from later times and other geographical areas show that fractures of the jaw could be treated with bandages (Mukerji, Mukerji and MacGurk 2006).

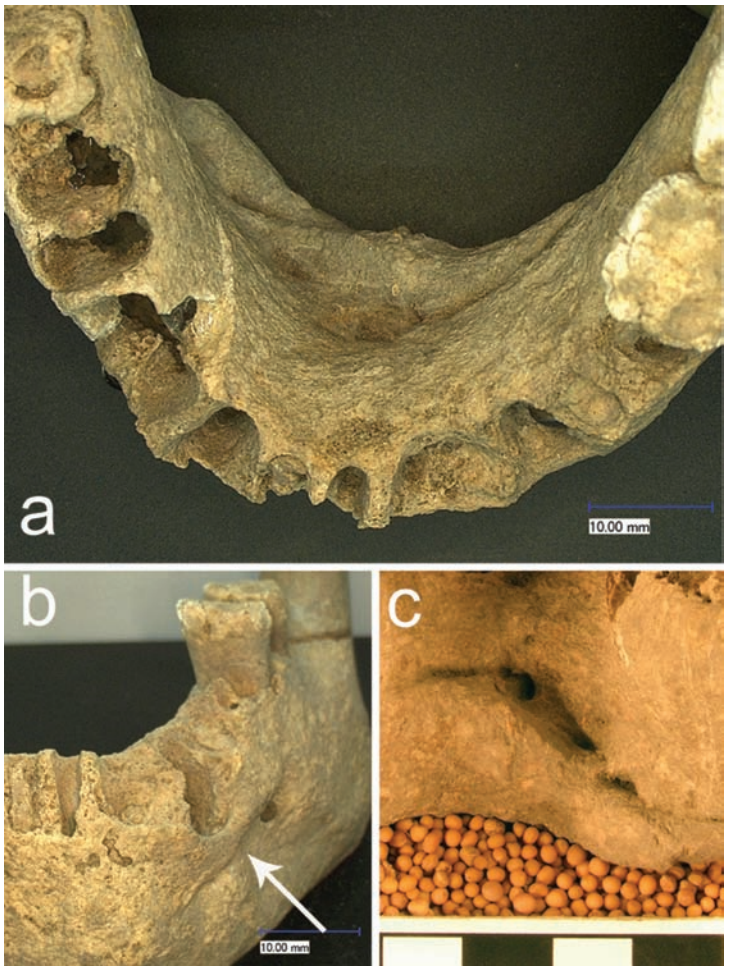

Fig. 6. Mandible MA: Callus formation (a), detail of the alveolar region of the left canine with a bridge formed of newly-built bone (b) and internal view of the fracture (c).

The oldest description of a fractured mandible, dating to the 17th century BC, is in the Edwin Smith papyrus from Egypt. The hieroglyphic text indicates that the 'Egyptians' attitude to mandibular fractures was rather pessimistic' (Mukerji, Mukerji and MacGurk 2006: 222). Apparently, they feared death from infections of the fracture. The fact that the mandible from al-Buhais does not show severe infection and that this person obviously survived a period of reduced food intake demonstrates the good health of the individual as well as the provision of medical and social care by his group.

From a modern perspective, the primary causes of mandibular fractures are assaults and accidents with

vehicles (Tawfilis, Byrne and Kim 2006), suggesting that this mandible reflects yet another act of interpersonal violence. Whether the fracture resulted from inter- or intra-group fighting is difficult to assess, since a punch in the face can also occur in a fistfight between members of the same group. It is, however, noteworthy that this is the only case of an ante-mortem mandibular fracture in all of the material from BHS18, where a large number of mandibles were found. Apart from a fist-blow – which is rarely powerful enough to break the corpus of a male mandible – it is also possible that the injury was inflicted by a furious enemy stamping forcefully on the side of the face of a victim already lying on the ground, where the force of the kick would be reflected by the substrate, thus providing enough energy to break the mandible in the middle (Prof. Wahl, pers. comm.). It should also be mentioned that, apart from interpersonal fighting, a kick from an animal could also cause a mandibular fracture (Domett and Tayles 2006). This does not seem likely at BHS18, however, since the only large domestic animals kept were cattle, which – unless milked from the side – don't usually kick in a way which could hit a human in the face. Since cattle do not seem to have been used for milking at BHS18, this kind of accident is quite unlikely. In the context of the other injuries described before, the healed mandibular fracture at BHS18 was most probably a result of fighting between different groups of people.

POTENTIAL CAUSES OF INTER-GROUP VIOLENCE AT BHS18

As indicated by the numbers cited above, the Neolithic group who buried their dead at BHS18 were exposed to a high degree of inter-group violence. One might even say that violence was 'embedded' in their lives, which relates in equal measure to the population and to the individuals, some of whom – as the healed injuries show – were obviously involved in multiple episodes of fighting during their lifetime.

The occurrence of multiple graves with up to five corpses buried together can also be interpreted in this sense, reflecting the simultaneous death of whole families or kin-groups – even if no clear peri-mortem injuries were detected in all of these cases. Indirect evidence of recurrent violence can be seen in the high standard of medical knowledge displayed by the trepanations, which are evidence for successful surgery in the case of skull fractures or in the case of the healed mandible-fracture described above.

Judging from their spatial distribution within the graveyard, head injuries resulting from violent conflicts seem to have occurred throughout the whole period of the site's use. The secondary burials, representing individuals who were brought back to BHS18 from other locations for final burial, provide evidence that violent clashes happened not only close to al-Buhais but also across a wider area, reaching as far as the Hajar Mountains. This is indicated by small ophiolite pebbles brought back together with the bones (Uerpmann and Uerpmann 2008: 130). Skull injuries – both healed and unhealed – are even more frequently observed in secondary burials than in primary ones.

The question of what the causes of such a high degree of inter-group violence may have been is difficult to answer. Conflicts leading to violent actions – like feuds or warfare – are significant topics in both anthropology and archaeology, where the origins of warfare are of special interest (e.g. Thorpe 2003; Otto, Thrane and Vandkilde 2006). Major topics of the ongoing discussion will briefly be dealt with here (for detailed citations, see Thorpe 2003).

Influenced by ideas from sociobiology, evolutionary psychology and neo-Darwinian thought, several generalising theories of war have been developed. Some are of particular importance because they tend to be used in ongoing discussions of conflict and violence in prehistory. The 'territorial' model argues that ethnocentricity was a product of natural selection, leading to the fact that people tend to fear the actions of strangers and to solve conflicts by aggression. The continuity of a territorial instinct from a common progenitor of chimpanzees and humans is an argument in this debate. The 'reproductive' theory of warfare explains violence as a result of male-centred competition over access to females. Another theory views warfare as an outcome of violent competition between young males striving for status and prestige even if there is no prospect of substantial gains. None of these theories meet their claim because – as demonstrated by Thorpe (2003) – they are not generally applicable. Thorpe discusses various counter-arguments and cites ethnic groups which contradict the respective theories. Whereas there are arguments from materialist archaeologists reasoning that people would risk their lives in fights when desperate for land and food, others have stressed that conflict should rather be seen in relation to the appearance of sedentary communities. Other authors even dismiss any relationship between war and a shortage of land or resources. A completely socio-political and non-materialistic hypothesis sees primitive war as an attempt to prevent the accumulation of power and the creation of large, unified, hierarchical states (Clastres 2008).

Some particular forms of violence – called 'ritual' or 'ritualised fighting' – are understood as a means of avoiding more serious warfare. These enable males to display courage and masculinity without risking severe wounds and incurring a large number of casualties (Vayda 1971; van der Dennen 2005). An interesting example is discussed by Tung (2007: 952). Violence and ritual fighting may actually be seen as way of stabilising existing social structures, although the concept of ritual 'war' is rather unclear (Otto, Thrane and Vandkilde 2006: 15). However, judging by the severity of head-wounds and the exceptionally high incidence of lethal injuries, the violence observed at BHS18 cannot be attributed to ritual fighting.

None of the above-mentioned concepts are by themselves sufficient to adequately interpret the inter-group violence seen at BHS18. The different notions expressed in this debate often seem opposed, especially biological reasoning versus cultural meaning, but are in most cases not so very antithetic (Corbey 2006). Instead of believing in recurring constellations and events, it seems more appropriate to avoid generalising theories in support of analysing the special circumstances of each conflict. The aim should be to understand conflicts and violence by focusing upon the actual evidence (Vandkilde 2006: 67ff). It should also be remembered that the primary causes of violence need not have been the same in all periods.

When applying such theorising to archaeological cases, it has to be kept in mind that most of the potential evidence of social interactions has not been preserved. Apart from the outcomes of conflict – skeletal remains with injuries found in potentially indicative situations on the skeleton – there may be very few discernible indications of the reasons that led to violent interaction between past societies. Multi-causal approaches seem therefore more appropriate under such circumstances.

THE AL-BUHAIS POPULATION

Before discussing potential causes of the inter-group violence observed at BHS18, it is necessary to develop some ideas about the group involved and its potential opponents. According to the estimates of Kiesewetter (2006: 149), the size of the group using the graveyard at BHS18 may have been between about 50 and 150 people, consisting of children, females and males. Apparently this group did not inhabit the surroundings of the graveyard all year round. There is evidence that they lived part of the year on the coast – most likely during winter – from which they moved to the area of al-Buhais in spring, and then – probably during the hottest part of the year – on to the higher elevations of the Hajar Mountains, from which they moved back to the coast in autumn (Uerpmann, Uerpmann and Jasim 2006).

The whole group may have lived quite closely together during the coastal part of their seasonal cycle, as suggested by the formation of localised shell middens (Jasim 1996; Uerpmann and Uerpmann 1996). During their mobile phases, a close association of the entire group is less probable. The flat area along the eastern foot of Jebel Buhais in the wider vicinity of the graveyard of BHS18 is dotted with fire-pits of Neolithic date. It may, therefore, be assumed that the group dispersed into smaller units, perhaps families, who camped there in loose association. The whole of Jebel al-Buhais seems to have been used as a pasture area for their small ruminants (Uerpmann, Uerpmann and Händel 2008: 57), while cattle were more likely herded on the plains. Later in the year – probably after exhausting the feeding grounds around Jebel al-Buhais – the entire group may have moved further east across the Fili plain into the Hajar Mountains, but thus far up there is only indirect archaeological evidence to support this assumption (see below).

The primary burials excavated at BHS18 most probably reflect cases of death during the season when the group stayed in the area around the site. Evidence of violence in primary burials may, therefore, be interpreted as an indication of local conflicts. The secondary burials might reflect deaths during other seasons – in particular the period spent in the Hajar Mountains, from which at least some of these skeletons were brought back to BHS18 (see above and Kutterer 2010). As primary burials are also found in the coastal shell middens (Kutterer 2010. with further references), and as remnants of shell-midden sediments around the bones in secondary burials at BHS18 would certainly have been recognised as such, it is unlikely that skeletons were transported from the coast back to al-Buhais in order to be re-buried there. Thus, the cases of violence observed in secondary burials may, in particular, reflect the periods when the group roamed the Hajar Mountains. Group size, group structure and the way of life in seasonal cycles must be kept in mind when considering potential causes for the cases of inter-group violence observed at BHS18.

Another important factor is the fact that there is no evidence whatsoever for the existence of contemporary, sedentary farming populations in the wider area of south-eastern Arabia. Sedentary farmers generally leave more traces in the landscape than mobile herders, usually in the form of tells, which would have attracted archaeological attention from early on. It is, therefore,

quite unlikely that the indications of inter-group violence at BHS18 are due to conflicts between herders and farmers. The same is true for clashes between herders and hunters, because there is no reason to assume the parallel existence of exclusive subsistence hunters in this part of the world during the 5th millennium BC (Uerpmann, Potts and Uerpmann 2009). Therefore, the opponents of the al-Buhais population were probably people with the same way of life using adjacent territories along the coast, different corridors from there to the mountains, and other *wadi* systems and massifs within them. Notwithstanding occasional outbreaks of violence, these other groups may also have been exchange partners for marriage, particular goods, etc.

With regard to the internal social structure of the Buhais group, it should be mentioned that the grave-goods found at BHS18 indicate a fairly egalitarian society. There are certainly no 'warrior-graves' because there are no finds of weapons which were clearly associated with individual burials. As far as could be observed, none of the arrowheads found are from clear burial contexts. Of the two adze blades found, one is from the area of a multiple, secondary burial. The other was found in an atypical secondary burial, which is exceptional (Kutterer 2010.) but is not indicative of a 'warrior'. The rich personal adornments observed in some primary graves are obviously differentiated according to the age of the deceased. Young adults of both sexes were more decorated than either children or older adults (de Beauclair 2010). There does not seem to be a particular correlation between adornments and the injuries observed.

Subsistence economy is another important, basic factor which has to be elucidated in more detail in order to understand potential causes for inter-group conflicts. The available evidence indicates that the Buhais population mainly lived on the products of their herds – largely the milk of goats and sheep. These animals were kept to an advanced age when their fertility declined. Apparently, cattle were not milked and were already slaughtered at a young age, but their contribution to the meat consumed at al-Buhais was only about half of what the small ruminants produced. Hunting complemented this, contributing a little over ten per cent of the meat consumed. The collection of edible plants (Tengberg 2008: 88ff) growing along the pathways of their seasonal movements must have also been an important subsistence activity of the Buhais people, although there is no archaeological evidence of it. During their seasonal time on the coast, shellfish and fish largely substituted for the 'normal' sources of food. However, no evidence was found at al-Buhais of dried marine fish, indicating that the transportation and storage of food was not a major factor in the subsistence economy. This also seems to apply to vegetal food, in particular to jujube-fruits (*Ziziphus* sp.) and wild dates (*Phoenix* sp.), which probably grew in the mountain valleys and could have been brought from there to the site. Despite extensive flotation of ashes from fire-pits in the al-Buhais area, not a single seed or other indication of plant exploitation was found (Tengberg 2008). It should be mentioned in this connection that no animal means of transportation of staple food was available to this population, because domestic camels and donkeys were still unknown during the Neolithic period in south-eastern Arabia (Uerpmann and Uerpmann, this volume Chapter 7).

Based on these observations, one may say that the Buhais population practiced a kind of ad hoc subsistence, in which food derived directly from living or freshly killed animals or from fresh plants. Judging by the good health of the people buried at BHS18, this system seems to have been successful. However, one has to be aware of the fine margin between success and failure in such a system. Assuming equilibrium between available vegetation and herd sizes – and a similar equilibrium between the population dynamics of herds and herders – any distortion of the system would have had short-term consequences on the human side. In contrast to farmers, who live on stored food between harvests, herders in marginal environments have no reserves if something happens to their animals because the desert environment will not have allowed them to keep a substantial livestock surplus. Thus, the difference between wealth and starvation must have been quite small for the desert herders. This explains why the good health of the people buried at al-Buhais is not contrary to the indications of inter-group violence – if environmental stress was a basic reason for the violence.

Today, environmental stress is seen as one of the major causes of social unrest and readiness for violent interactions in modern African societies (Brinkman 2005). Eco-cultural factors may even affect individual psychology (Goldschmidt 1965; Edgerton 1971) and may have lasting consequences for important aspects of cognition (Uskul, Kitayama and Nisbett 2008). Generally, herders are thought to resort to direct aggression more readily than farmers (Moritz 2008). But apart from considering these factors from a theoretical standpoint, actual environmental conditions during the 5th millennium BC must also be examined and social and environmental aspects have to be combined in order to understand the situation encountered at al-Buhais.

On the social side, the obvious assumption must be made that there were potential opponents of the Buhais group, who lived close enough for (occasional)

violent interaction. Another Neolithic burial site at the northern end of Jebel Faya (FAY-NE15) might represent the remains of such a group. According to some of the animal remains there, this group resembles that of al-Buhais in terms of subsistence economy. Adornments were also similar – but not identical – to those from al-Buhais 18 (Kutterer and de Beauclaire 2008). Judging by the small number of victims of individual clashes – witnessed by the numbers of corpses buried together in multiple burials at BHS18 – hostile interactions between these groups would mostly have happened in the form of raids or feuds, involving just a few group members on each side. Manifold reasons for such hostilities between neighbouring groups can be imagined, ranging from purely cultural to purely biological. As the archaeological remains do not yield objective clues on the cultural side, we will concentrate on the environmental side where a number of observations provide a background for a better understanding of inter-group violence in this part of the world during the 5th millennium BC.

Thanks to the study of stalagmites from Hoti Cave in the Jebel al-Akhdar in Oman (Neff et al. 2001), detailed palaeoclimatic information is available for the region of our concern. The generalising opinion that climatic conditions during the early Holocene were better than today because of the Indian Ocean Monsoon (IOM) reaching south-eastern Arabia during that period has been qualified by this research. As indicated by the red curve in Fig. 7., the IOM fluctuated throughout the Early Holocene resulting in short-term episodes of desiccation, in particular after the so-called 8200bp (or 6200 BC) climate event, when the final collapse of the (North American) Laurentide ice-shield led to a sudden cooling of the North Atlantic Ocean. During the 5th millennium BC, the IOM fluctuated heavily but was generally less intense than in the earlier periods. Before the 6200 BC event, and, in particular, during the periods of high monsoon activity in the first three quarters of the 6th millennium BC, inter-dunal lakes were widespread in the Rub al-Khali and throughout its northward extension along the south-eastern coast of the Arabian Gulf (Parker, Wilkinson and Davies 2006; Parker et al. 2006).

These were periods when Neolithic herders could use large areas of the Rub al-Khali, leaving artefact scatters there which gave rise to the term 'Rub al-Khali Neolithic' (Zeuner 1954). These ubiquitous water resources shrank

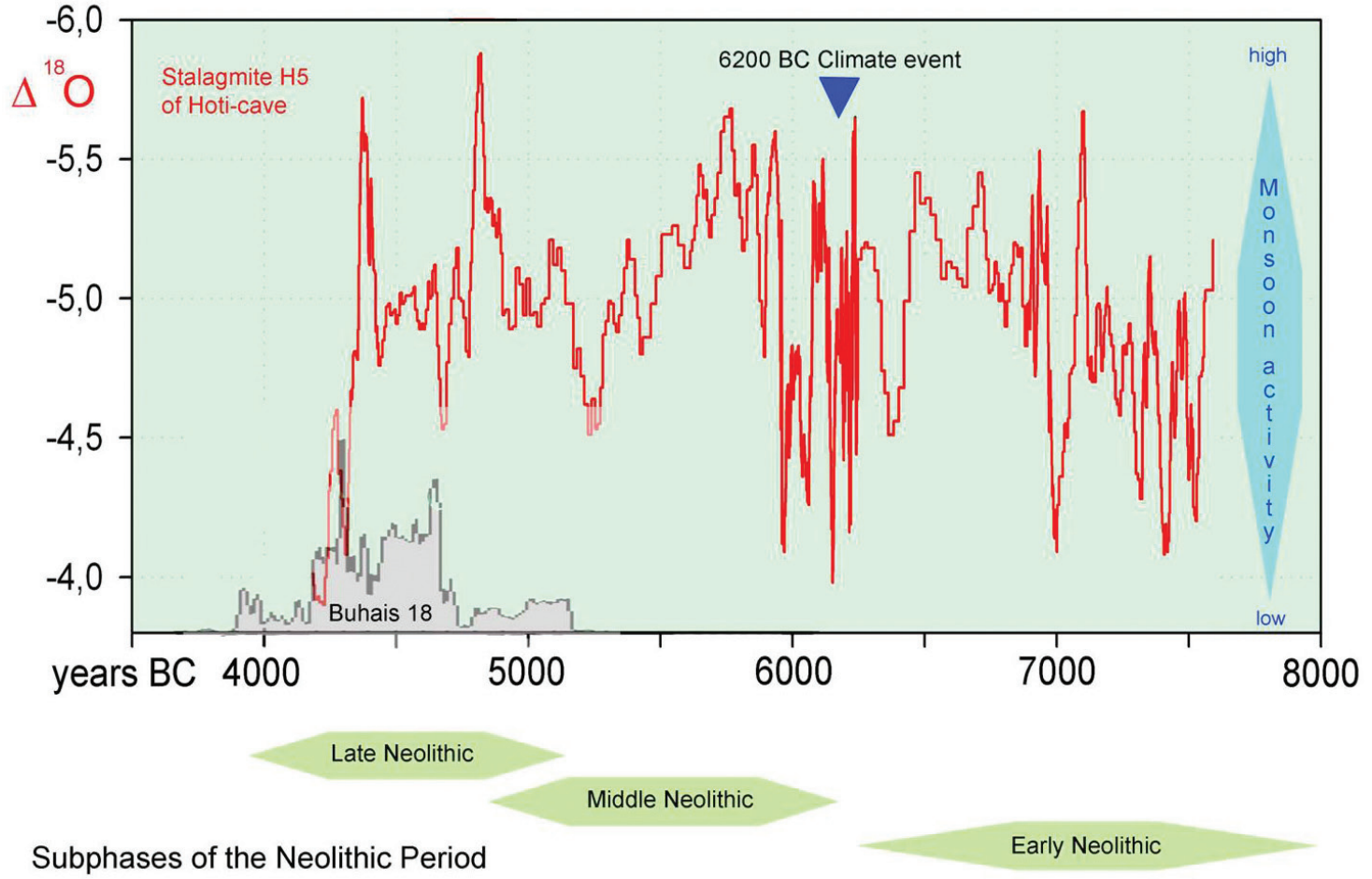

Fig. 7. Fluctuations of the Indian Ocean Monsoon (IOM) in south-eastern Arabia as indicated by δ^{18}O-fluctuations in a stalagmite from Hoti Cave in the Jebel al-Akhdar in Oman (after Neff et al. 2001) in relation to the cumulated probabilities of radiocarbon dates from al-Buhais 18.

at times of low monsoon activity, making natural springs like the one at al-Buhais (Uerpmann 2008: 13) very attractive for nomadic herders, who needed water not only for themselves but also for their animals. The oldest radiocarbon dates for the Neolithic site at al-Buhais are from the time just after the major low in the IOM-curve, c. 5250 BC. This climatic event is thought to mark the end of the Middle or 'Rub al-Khali' Neolithic, while the 6200 BC event marks the end of the Early Neolithic (Uerpmann and Uerpmann 2009).

The first major peak of the radiocarbon curve for BHS18 coincides with a major low of the IOM curve at about 4700 BC. During the final peak of the IOM-curve at about 4300 BC, the radiocarbon-curve for Buhais is low, while its highest peak again coincides with a steep decrease of IOM activity. As all radiocarbon samples from BHS18 measured up to the year 2006 were included in the graph, and as all of them are from anthropogenic contexts, it is legitimate to consider their cumulated probabilities as a quantitative indicator of human presence at the site. Thus, people apparently visited the site more often (or in higher numbers) at times of low monsoon activity. On the other hand, when monsoon activity was high, water seems to have been available at more widespread localities. Generally speaking, reductions of IOM activity led to concentrations of herders and their herds in areas where permanent spring-water was available.

To the present day, spring water is generally found at many places throughout the Hajar Mountains. Along the coast, fresh groundwater is often available near the shoreline from shallow wells, because it 'swims' on salty groundwater seeping in from the sea. For the nomadic herders of the Late Neolithic, with their presumed seasonal movements between the coast and the mountains, the desert belt which separated these two environments became a critical area at times when there were no inter-dunal lakes due to the lack of monsoonal rainfall. Figs. 7. and 8. clearly indicate that lows of the IOM curve coincide with highs of the BHS18 radiocarbon curve – an observation first made by Parker and Preston (2008: 77).

Based on the assumption that the graveyard at al-Buhais was created by a particular Neolithic group as a territorial marker, the spring there and the pastures around it may not have been equally accessible to all Neolithic inhabitants in the wider area. This may in itself have been a sufficient reason for inter-group conflicts. However, not only was the availability of fresh water influenced by monsoon activity, but also the amount of available pasture. As shown in Fig. 8, where a timescale with fifty-year intervals was inserted into an enlargement of Fig. 7., fluctuations of monsoon activity happened within the lifetime of individuals and were certainly recognised as good or bad periods by the Neolithic population. They happened too quickly to be followed by human population dynamics – but slowly enough to lead to the growth of the herds of domestic animals in good periods. Sheep and goats start reproducing at the age of two to three years and could thus quickly respond to environmental amelioration. Animal overpopulation at times of decreasing monsoon activity must have been a frequent result. At such periods, pasture land was in high demand – a situation which may well have been a basic cause for territorial conflicts between different nomadic groups. After the initial clashes occurred, such conflicts may have become culturally transformed and established to such an extent that the reasons behind individual outbreaks of violence would not necessarily have been connected to immediate environmental stress. Socio-psychological studies argue that a cycle of assault and revenge may create a 'culture of honour' leading to violent interactions without any relation to environmental stress or other objective reasons (Figueredo et al. 2004; Nisbett and Cohen 1996).

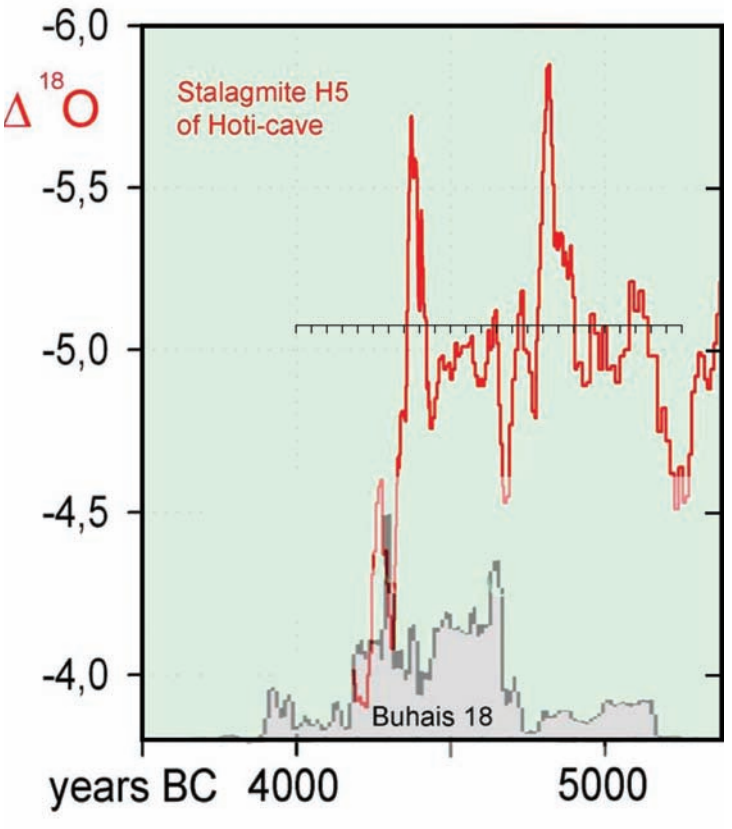

Fig. 8. Enlargement from Fig. 7. with fifty-year timescale inserted.

It should also be mentioned that the nomadic herders of the south-east Arabian Neolithic did not have much choice in avoiding resource-related conflicts.

Alternatives, like those discussed by Helbling (2006: 118), were not realistic options in the south-east Arabian desert at the time. The Neolithic herders were bound to their territories because the other inhabitable parts of the Oman Peninsula were already occupied by people practicing the same type of subsistence. Nor could they adopt a different form of subsistence because agriculture was impossible in this landscape with the technologies available in the Neolithic period, while they could even not 'regress' to a hunter-gatherer mode of subsistence because the density of wild animals and plants was much too low to support the population level reached by a Neolithic society. The situation in south-eastern Arabia at this time was certainly one of major climatic stress, corresponding to what Walker (2003: 591) envisioned in his final remarks on cultural or environmental reasons for violence among human groups.

When the impact of the Indian Ocean monsoon finally ceased soon after 4000 BC, the particular way of life of the Neolithic herders collapsed completely. Apparently the spring at al-Buhais stopped flowing and the site was no longer visited by Neolithic people. One can only speculate about what happened to the Neolithic population at this time. Many may have starved, some may have been able to move south into Arabia felix with its slightly less arid climate, and some few may have been able to focus on the marine sector of their subsistence system, in particular niches along the mountainous coast of north-eastern Oman. Large shell middens in areas near the mouth of large *wadi* systems were still occupied in the 4th millennium BC. The inhabitants still had the same species of domestic animals as before, but their subsistence role was minor. Exploitation of the sea, in particular highly intensified fisheries and the hunt for marine mammals and sea turtles, became their main subsistence activities (Uerpmann and Uerpmann 2003), complemented by shellfish collecting in large quantities.

Interestingly enough, palaeo-anthropological indications of inter-group violence are almost non-existent at the well-studied graveyard of Ra's al-Hamra in Oman (Salvatori 2007). The only indication is an arrowhead made of the triangular tooth of a shark, which was shot into a human vertebra (Charpentier et al. 2009). The lack of head injuries is evidence of a situation which was completely different than the one described here at BHS18. Obviously there were no major nomadic movements between coast and interior, which could have led to territorial conflicts – and the next nearest inhabitable area at Bandar Khairan was too far away for an overlap of the respective spheres of economic interest leading to potential conflict to have occurred. Unlike the human remains excavated at BHS18, those from Ra's al-Hamra reveal more diseases (Salvatori 2007), comparable in this respect to sedentary farming populations (McSweeney, pers. comm.). Signs of inbreeding (Coppa and Cucina 2007: 203) are also noteworthy. This indicates isolation reflected in reduced genetic exchange with outsiders, but it also means that the potential for inter-group violence was reduced. While violent acts between prehistoric people always have a strong cultural and behavioural background, there can be no doubt that ecological considerations as well must always play a major role in any attempt to explain them.

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Fifty Years of Emirates Archaeology

AKAB ISLAND, A NEOLITHIC SANCTUARY IN THE GULF

Sophie Méry (Nanterre)
Vincent Charpentier (Nanterre)

INTRODUCTION

In January 1840, after having discovered two new territories in Antarctica, Adélie and Clarie, the expedition of Jules Sébastien C. Dumont d'Urville continued to the Auckland Islands and New Zealand. The expedition then followed the coasts of New Caledonia and Loyalty Island and reached New Guinea on 29 May. On their ships the Astrolabe and the Zélée, sailors and scholars then began 'crossing the Torrès Straits, from east to west, visiting and studying Banks, Mulgrave and Jervis islands; it was there, on Touwarriors Island of the English – now Tudu Island – where they were beached for ten days, that they discovered an unusual ossuary entirely formed of bones and particularly the skulls of dugongs stacked up as trophies' (Dumont d'Urville 1846) (Fig. 1.).

Fig. 1. A dugong bone mound on Tudu island, Torres Strait, Australia, in 1840 (after Dumont D'Urville 1846: Pl. 189).

One hundred and forty years later, the excavation of a dugong bone mound on an island in the Arabian Gulf led us in 2006 to formulate a similar hypothesis: the arrangement of bones on the island of Akab, in the lagoon of Umm al-Qaiwain (U.A.E.) (Fig. 2.) was a ritual structure dating to the Neolithic. It remained to discover and understand the meaning and function of this structure, the first interpretation of which was recently published (Méry et al. 2009).

Beginning in 2002, the resumption of archaeological excavations has shown that the dugong bone mound of Akab was only a small part of a much larger Neolithic site (Fig. 3.). There were two main periods at Akab; the first, dating to the 5th millennium, was related to occupation by fishermen, the other, dating to the 4th millennium, to the ritual structure. The densest occupation in terms of settlement remains dates to 4700–4100 BC (5710 ± 30 BP, Pa 2439, ca. 4160–3814 BC).

In the 4th millennium, the settlement was much less dense, but the occupations related to daily activities are well represented on the site. The ritual structure itself dates to the second half of the 4th millennium (5140 ± 55 BP, Pa-2433, ca. 3568-3116 BC) according to radiocarbon dating on a dugong bone (Méry et al. 2009).

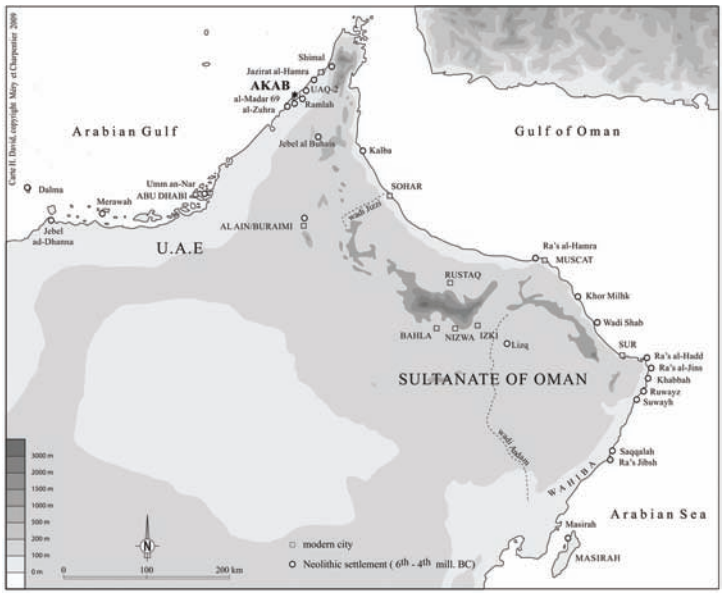

Fig. 2. Location of Akab in Umm al-Qaiwain, southern side of the Arabian Gulf. Drawing: H. David.

Fig. 3. Kite photograph of Akab under excavation, showing the 5th millennium settlement (Sector 1, top of the picture) and the 4th millennium dugong bone mound (bottom). Photograph: T. Sagory.

AKAB, A 5TH MILLENNIUM OCCUPATION

With the islands of Ghallah, Siniyah and al-Humaidi, Akab is one of the largest islands in the large lagoon of Umm al-Qaiwain. Facing the capital of the emirate and separated from it by a narrow channel, it has been profoundly transformed by a landscaping project over several decades, its shores reshaped and its surface turned

over and levelled. Today no traces of archaeological remains are discernible on most of the island. However, a wind-formed butte dating to the Pleistocene was left intact in the south-western part, where the Neolithic site is located. In 1989, as part of the French Mission directed by Rémy Boucharlat and Olivier Lecomte, a dugong bone mound was discovered on the north-east slope of this butte by Albert Hesse and Abel Prieur, 15 m2 of which was excavated in 1990 and 1992 (Prieur and Guérin 1991; Jousse et al. 2002).

Excavations were resumed in 2002 in order to understand the stratigraphy of the site as a whole (and not only that of the dugong bone mound) and to discover whether the site of Akab contained a sizeable Neolithic occupation, with habitation structures like those on the island of Dalma, in western Abu Dhabi. Six deep test trenches were dug in the eastern part of the site. Although two of them were sterile and two others contained only poorly preserved levels, the last two produced well-preserved, ancient anthropic levels. Covered by 1.20 m of sterile sand, the levels situated at the base of Trench 2 contained a hearth and post holes; this occupation, dated to 6275 ± 50 BP (4748–4441 cal BC, 2σ), is the oldest on the site of Akab. The levels of Trench 5 were however more accessible, and it was in this zone that an excavation was begun in 2006. Today, more than 60 m^2 have been opened in this zone. Sealed by a deposit of thick, wind-borne sand of between 65–70 cm thick, the Neolithic horizons are 25–35 cm thick, and lie directly on the Pleistocene wind-borne sand. Three dates attribute the levels of Sectors 1–2 to the second half of the 5th millennium and to the very beginning of the 4th millennium BC; 5970 ± 35 BP (4428–4414 cal BC); 5900 ± 50 BP (4331–4033 cal BC); 5710 ± 30 BP (4160–3814 cal BC) (Charpentier and Méry 2008).

No fine, wind-borne, sandy horizon lies between the anthropic levels, which suggests that there were either no long periods of abandonment or a low amount of wind-borne sand and low sedimentation during this period. After the abandonment of the site, the top of the Neolithic levels was disturbed by the establishment of colonies of nesting birds. Several eggs were found in the excavations. Although these have not yet been identified, Socotra cormorant (*Leucocarbo nigrogularis*) and several species of terns (*Sternidae*) still nest today on other islands in the Umm al-Qaiwain lagoon, such as Siniyah. The Neolithic settlement of MR11 on the island of Marawah also contains these eggs (M. Beech, pers. comm.), which are often intact on Akab and are probably indications of a re-occupation by sea birds of old isolated or insular human occupations. At Akab, the occupation levels consist of a succession of floors, mainly composed of scatters of *Marcia hiantina* shells, and concentrations, in the form of small pits, of oyster shells (*Saccostra cucculata*) and *Murex kusterianus*. Articulated fish skeletons and rejected, broken crab pincers were frequently found. The floors consist of a succession of zones that are very dense with remains that are often burned or trampled, alternating with spaces that are empty or poor in remains (north-east corner of sector 1).

Over 250 post-hole impressions have been identified at the base of the 5th millennium occupation, but their extreme density in the sterile layer renders the reconstruction of complete plans difficult. However, the presence of circular structures is indicated in the heart of the occupation levels, and these structures have plans similar to those found in Dalma and Suwayh 1, sites contemporary with Akab (Beech and Elders 1999, Charpentier et al. 2006).

A NEOLITHIC SOCIETY

As on most coastal Neolithic sites in the United Arab Emirates, goat (*Capra hircus*), sheep (*Ovis ares*), cattle (*Bos* sp.) and dog (*Canis familiaris*) comprise the domestic fauna of the 5th millennium levels of Akab, while gazelle (*Gazella gazella*) and wild donkey (*Asinus africanus*) comprise the hunted fauna. Although terrestrial fauna is well represented, fish predominate in the faunal assemblage. Needlefish, grouper, jack/trevally, tuna/mackerel and catfish occur most frequently (Beech 2005; Méry, Charpentier and Beech 2008; Beech, Charpentier and Méry n.d.). Fishing generally took place in the shallow waters of the lagoon. The fishing of tuna, however, took place in open water, and required boats. Fish preparation, especially tuna, is indicated by many headless skeletons, throughout the stratigraphy of the settlement.

Although relatively rare, dugongs were also found in all levels, but remains of the green turtle (*Chelonia mydas*) were uncommon. Finally, the shells of edible shellfish were very abundant and came mainly from the lagoon, consisting of *Marcia hiantina* and *Saccostrea cuculata*, *Murex kusterianus*, as well as *Terebralia palustris* and *Pinctada radiata*.

THE 'MATERIAL CULTURE' OF THE 5TH MILLENNIUM LEVELS

The 5th millennium levels at Akab have yielded pottery of the Ubaid culture of southern Mesopotamia. A painted

sherd discovered from the surface of the site is certainly representative of the Ubaid 3 style. Several Neolithic sites in Umm al-Qaiwain have produced Ubaid sherds, including al-Madar S69, ar-Ramlah 3 and UAQ2 (Boucharlat et al. 1991, Phillips 2002, Uerpmann and Uerpmann 1996). Ubaid pottery, with its beige-yellow or greenish paste, was not the only pottery. Several sherds of coarse redware from the central Gulf were found. This type, known at Jezirat al-Hamra and Dalma (Flavin and Shepherd 1994, Vogt 1994), was also reported at al-Madar S69, a few kilometres from Akab (Boucharlat et al. 1991).

Fig. 4. One of the most characteristic features of the 5th millennium levels at Akab is certainly the mother-of-pearl fishhooks.

One of the most characteristic features of the 'material culture' of the 5th millennium levels at Akab were mother-of-pearl fishhooks of different sizes, made on the site from large pearl oysters (*Pinctada margaritifera*) (Fig. 4). Prior to this discovery, it was believed that only a line with a straight fishhook was used in the Neolithic. It was also thought that the deep waters of the Indian Ocean were more favourable than those of the Gulf for using a line with a mother-of-pearl fishhook for fishing tuna, at the edge of the pelagic zone. The presence of fishhooks at Akab shows that this was not necessarily the case. Other characteristic tools made of shell on the site are knives fashioned from Veneridae (*Callista erycina* and *Amiantis umbonella*), several dozen of which were found (Charpentier, Méry and Phillips 2004, Charpentier and Méry 2008).

Made from hard rocks, net sinkers were found in stratigraphic context at Akab, but remain rare compared to coastal sites of the same period in Oman. In addition, a single crushing stone, used to crush gastropod shells, was found in the upper levels of the excavation. Lithics are poorly represented at Akab, consisting of 'splintered pieces' and a few drills. The raw materials are, however, generally of good quality, and come partly from the interior. Certain pieces in milky chalcedony come, for example, from the area of Jebel al-Ma'taradh (Emirate of R'as al-Khaimah) some 40 km away.

Fig. 5. An example of the fine, unperforated pearls made from Pinctada radiata found in the 5th millennium settlement of Akab.

The ornaments from Akab consist mainly of objects found in the 5th millennium levels. *E. mendicaria*, a characteristic shell of the Indian Ocean, is present, as are *Ancilla* sp. and *Conus* sp. Probably more interesting, the production of beads from *Spondylus* shells is well represented at the site, all the occupation floors having produced small concentrations of beads in different stages of manufacture as well as associated waste. The abundance of these workshop remains indicates that,

beginning in the 5th millennium, Akab was specialised in the production of a specific type of ornament. The manufacture of beads from *Pinctada radiata* is also attested at the site, in less quantities. Moreover, eighteen fine, unperforated beads made of *Pinctada radiata* were found through sieving in Sector 1 (Fig. 5.). Several long, tubular beads made of chlorite or from the columella of *Murex* sp. were also found in the 5th millennium levels. These 'Akab-type' beads present two very particular modes of attachment: the first is a double-angled distal perforation, the first of which follows the axis of the object, while the second follows one of its rays. The second type is a bevel with a bi-conical central perforation.

THE 4TH MILLENNIUM DUGONG BONE MOUND

A rare photograph of the capture of dugongs in the Arabian Sea at the very beginning of the 20th century can be seen in (Fig. 6.). On an embankment near Aden in Yemen, a boat brings in its catch: four adults – two males and probably two females. In this picturesque scene, two animals have been hauled onto the shore, while the other two are still in the water waiting to be pulled out. Could the heaping of several dozen dugongs on the shore of Akab Island be the illustration, for the Neolithic, of a similar scene, as is the case for certain archaeological sites excavated in northern Queensland in Australia (Cribb and Minnegal 1989)?

Fig. 6. Photograph of the capture of dugongs near Aden (Yemen), early 20th century.

The hypothesis of a site for slaughtering and butchering dugong was advanced by the first excavators of Akab, while that of a mass beaching of dugongs was dismissed by them (Prieur and Guérin 1991; Jousse 1999; Jousse et al. 2002). Because of the large size of the animals (over 3 m long, with adults weighing 300 kg) (Fig. 7.), butchering would have taken place on the spot, once the carcasses had been pulled up onto the beach. The interpretation of Akab as a butchering site is based on the presence of traces of cutting on the bones (not numerous, however) (Jousse 1999: 25) but perhaps also, although only implied (Jousse et al. 2002: Fig. 4.), by the fact that the spatial distribution of the excavated bones was random according to a χ^2 test carried out on a field drawing.

Fig. 7. Dugong dugon is an herbivorous sea mammal. The flesh, oil, hide and tusks of the dugong were long exploited in the Arabian Gulf and the consumption of dugongs has been confirmed at many archaeological sites dated to the 6–5th millennia. Photograph: Pierre Larue.

Showing through on the slope of the Pleistocene butte, the group of bones was cleaned in 2006 and excavated during the following three campaigns. This work revealed that it is not a disorganised accumulation of bones but a designed structure which was built up in stages. The structure is complex, having the shape of an ovoid platform, 10 m^2 and 40 cm high, at the maximum (Fig. 8.). It is made up of the remains of at least forty dugongs, a provisional figure as the material from the 2009 campaign is still in the process of being studied by S. Fraser. The structure was found to have been truncated on the south-west side, where only dispersed bone fragments remain.

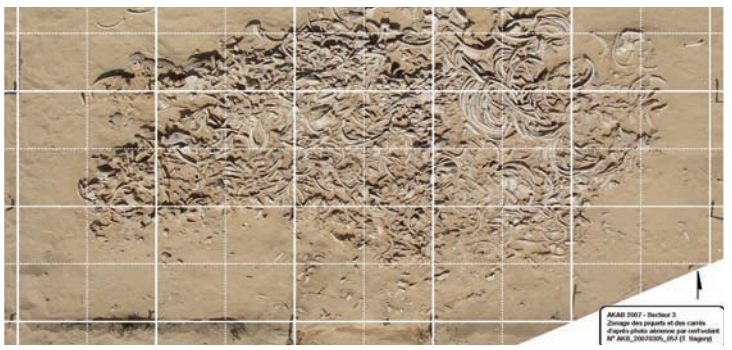

Fig. 8. Kite photograph of the dugong bone mound, Level 1. The mound was discovered in 2006 to be a complex and structured accumulation of bones, deliberately oriented. Photograph: T. Sagory/French Archaeological Mission in the UAE.

The upper level was made up of two rows of skulls turned to the east (Fig. 9.), a third row of skulls with the same orientation edging the structure on the north. All of the skulls were carefully wedged, with the premaxilla deeply embedded in the lower part of the arrangement, and a wedging of ribs, often double, sometimes triple, all

around (Fig. 10.). Groups of ribs were deposited just in front of the first row of skulls to the east.

Fig. 9. The skulls of the animals are placed in anatomical position aligned at the front of the structure and facing towards the east or the north-east. Photograph: S. Méry/ French Archaeological Mission in the UAE.

Fig. 10. The skulls were carefully wedged by rows of ribs (often double, sometimes triple) all around. Photograph: V. Charpentier/French Archaeological Mission in the UAE.

The lower level of the platform was, for the most part, impregnated with an ochre solution which reddened the different layers of bones and the natural sediment. This level, made up of bones which were often fragmented or trampled, is characterised by the presence of many dugong mandibles lying flat, and in certain zones, piled up in several layers. Some remains of gazelle and sheep or goat, sometimes in anatomical position, were incorporated into the structure at its eastern and western ends.

THE OBJECTS PRESENT IN THE DUGONG BONE MOUND

The density of artefacts within the ritual structure is exceptionally high, and in any case greater than that of the floors of the 5th millennium occupation or the latest levels which show through on the surface of Akab. The 10 m^2 of the dugong bone mound produced 2076 objects, 115 of which were discovered in the 1992 excavations (pers. comm., I. al-Naqeeb, Museum of Umm al-Qaiwain).

The objects have no relation to the dismemberment or butchering of the dugongs but are mainly ornaments (Fig. 11.). Of the 1961 objects discovered since 2006, beads made of *Spondylus* sp. are the most numerous (770 occurrences), followed by beads of *P. margaritifera*, *Conus* sp., *Strombus decorus decorus*, *Ancila* sp., etc. The scarcity of unperforated discs made of *Spondylus* in the ritual structure (twenty-two examples, or less than three per cent of the total number of objects made of *Spondylus* at the site) contrasts markedly with their abundance in the 5th millennium occupation at Akab. Two hundred and fourteen 'Akab type' tubular beads were also inserted into the structure (Figs. 12–13). While this type is rare in Arabia, its geographical distribution is very wide, extending from Qatar to Ja'alan in Oman. Only one example has been found at each of the sites of al-Madar S69, Ramlah 2, Jazirat al-Hamra, Buhais 18, Dukhan (Qatar) and Ra's al-Hadd 6, while two examples are known from Suwayh 2 (Sultanate of Oman) (pers. comm. R. de Beauclair and M. Cattani; Charpentier, Blin and Tosi 1998: Fig. 9.5.; Charpentier and Méry 2008: Fig 16.1–2.; Madsen 1961: Fig. 18.; Uerpmann 2003: Fig. 3.; Vogt 1994: Fig. 9.5–6.).

Fig. 11. More than 2000 objects were deposited in or inserted into the dugong bone mound of Akab. These are mainly ornamental elements but tools are present.

Along with beads and pendants (Fig. 14.), the tools associated with the dugong bone mound include bone (sheep) points, side-scrapers made of shell, flint flakes, a miniature net sinker and two mother-of-pearl fishhooks (Figs. 15–20).

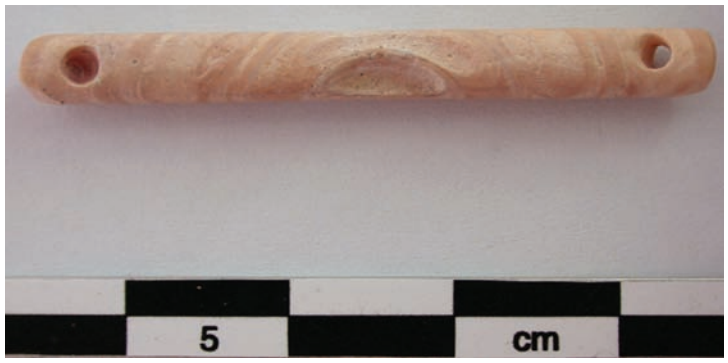

Fig. 12. More than 200 'Akab-type' tubular beads were also inserted into the structure. Part of them were fashioned from the columella of Murcidae shells.

Fig. 13. Some of the 'Akab-type' tubular beads are in chlorite or steatite, originating from the foothills of the Oman mountains.

Fig. 14. Mother-of-pearl pendant.

THE DUGONG BONE MOUND OF AKAB, A MARINE SANCTUARY OF THE 4TH MILLENNIUM

The excavations carried out recently at Akab have produced evidence of complex manipulations of carefully selected dugong remains, the building of a large structure

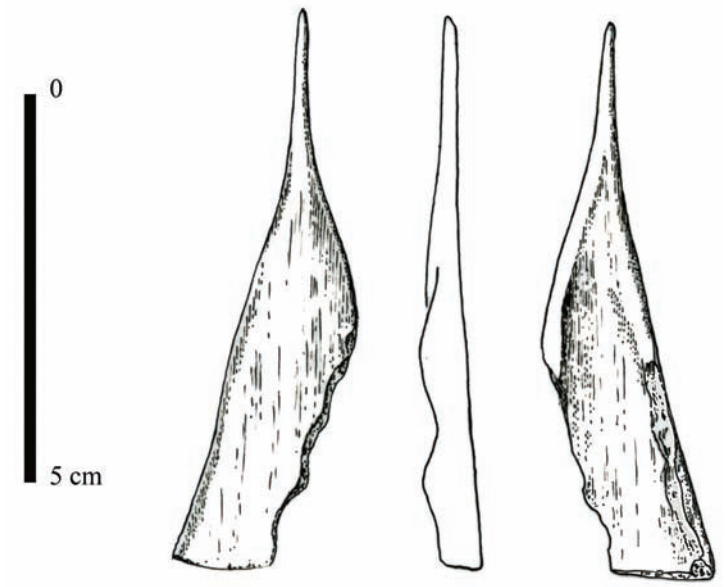

Fig. 15. Several points made of sheep bone were deposited in the dugong bone mound of Akab. Drawing: D. Zaros.

Fig. 16. One of the sheep bone points from Akab.

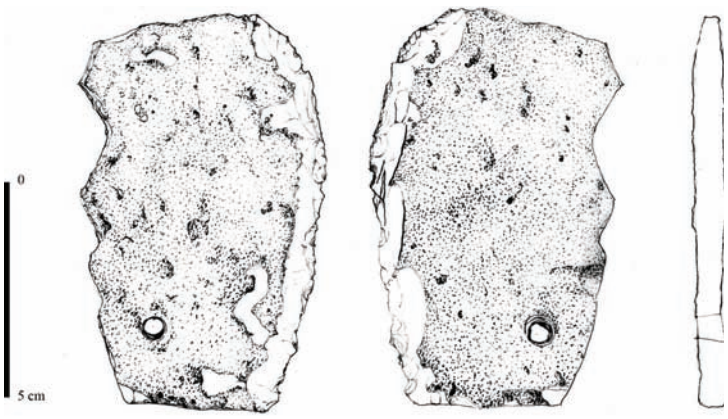

Fig. 17. One of the flint tile-knives found in the dugong bone mound.

Fig. 18. Photograph of the tile-knife shown in Fig. 17.

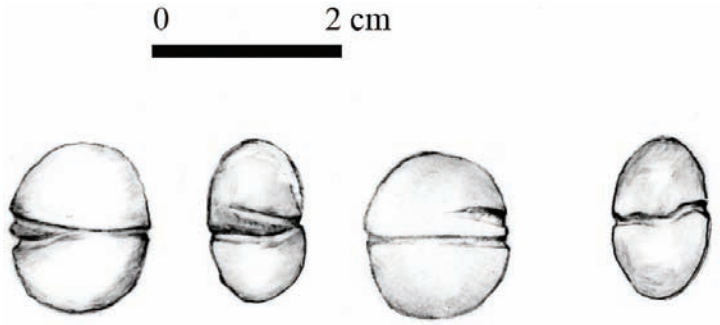

Fig. 19. Examples of miniature net sinkers from Akab.

Fig. 20. One of the miniature net sinkers.

and the preferential disposition of bones (Fig. 18–20.). Intentional deposits of a large number of objects (individual ornaments, selected tools, rare or exotic objects) and the remains of terrestrial mammals, both domestic and wild, are associated with the dugong bone mound, as well as the widespread use of ochre.

All of these elements indicate that the layout and use of this monument at Akab adheres to precise rules, possibly even instructions. The evidence suggests the presentation of a large marine mammal that is both quite spectacular and very ritualised. Another remarkable fact is that the skulls of the dugongs at Akab face fully eastward, like the bodies of the deceased in the Neolithic necropolis of Jebel al-Buhais 18 (Kiesewetter 2006: 120-21).

This situation is reminiscent of that of the green turtle (*Chelonia mydas*) in the necropolis of Ra's al-Hamra 5, contemporary with the Akab monument, with skulls set close to the face of the dead or on the grave, deposits of elements of the carapace on the body, and the presence of pebbles which resemble turtle eggs (Salvatori 1996, 2007). Akab and Ra's al-Hamra are also similar in that their structures contain only elements of animals, never entire skeletons. The role of the turtle at Ra's al-Hamra is thus not that of an animal companion, a function belonging only to domestic animals, which are found complete in the tombs, as at Shimal UNAR-2 in the Bronze Age (Blau and Beech 1999).

Unique in the Near East, the monument at Akab has no parallel in the Neolithic elsewhere in the world. The only comparable structures are found on the Australian coasts of the Torres Strait, on ritual sites, the kods (Fig. 1.), but these are recent in date (14th–20th c. AD) (Haddon 1904–1912; McNiven and Feldman 2003; David and Mura Badulgal Committee 2006). As at Akab, these are constructed monuments, composed of dugong remains which are sometimes very numerous and among which were deposited individual ornaments, tools and imported objects, as well as terrestrial and marine fauna. As at Akab, these are pre-planned structures which were made to last. In Australia, preparations for hunting dugongs are as much the object of propitiatory rites as the transport of their carcasses to shore, their butchering and their consumption. These rites were related to totemic beliefs, certain fishermen clans having marine totems, such as the shark, the marine turtle or the dugong.

The presence of a dugong bone mound at Akab gives rise to two levels of questions. The first concerns the role of the monument. Was an economic activity such as fishing the object of beliefs, attitudes and ritual acts in Neolithic Arabia? The similarity (structure, associated deposits) between the monument at Akab and the Australian dugong bone mounds is such that we consider

a link with fishing rites highly probable. We conclude that the monument at Akab, whose organisation was preconceived, whose fabric was constructed to last and whose status was very special, was a sanctuary. Was it exclusively dedicated to rites linked to the dugong, whose capture was not without risk, or to fishing/sea hunting in general? So far we cannot answer this question.

The second level of questions concerns the form of social organisation and the nature of the groups that formed the society. Could the monument at Akab be an indication of organisation into clans and lineages? Did the Neolithic fishermen of Akab belong to a society in which only beliefs and rites were related to animals, which has been established, but which was founded on the totem-clan pair, thus on exogamy? Nothing yet allows us to confirm this. There is no tangible evidence that allows us to identify the nature of the groups comprising Neolithic society in eastern Arabia, nor the beliefs, attitudes and ritual acts related to such designations (Adler 2004: 201). What we do observe, however, is a similarity between coastal populations, separated by several hundred kilometres, at Akab and Ra's al-Hamra, who shared material culture and technologies, as well as spiritual practices connected with marine animals. We also observe the territorial attachment of these societies, seen in the re-occupation of necropolises over many generations. This is the case at Ra's al-Hamra 5, occupied for 500 years (3800–3300 BC), and for Jebel Buhais a millennium earlier. Could this phenomenon be linked to the existence of lineages?

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Fifty Years of Emirates Archaeology

ANIMAL LABOUR AND BEASTS OF BURDEN IN SOUTH-EAST ARABIAN PRE- AND PROTOHISTORY

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The utilisation of domestic animals not only for the production of meat but also for milk and labour has been seen as an important step in human history (Sherratt 1966). Even though we now know that this development did not happen in one revolutionary step, the importance of animal labour for the early history of human economy is still pre-eminent. In Arabia, beasts of burden have always been of particular importance because of the mainly soft conditions of the land surface throughout the peninsula. In south-eastern Arabia, archaeozoological studies of the faunal remains from several key sites (Fig. 1) have provided insights into the animal economy of the respective cultures. They have also provided us with a better understanding of the role of beasts of burden in Arabian pre- and protohistory.

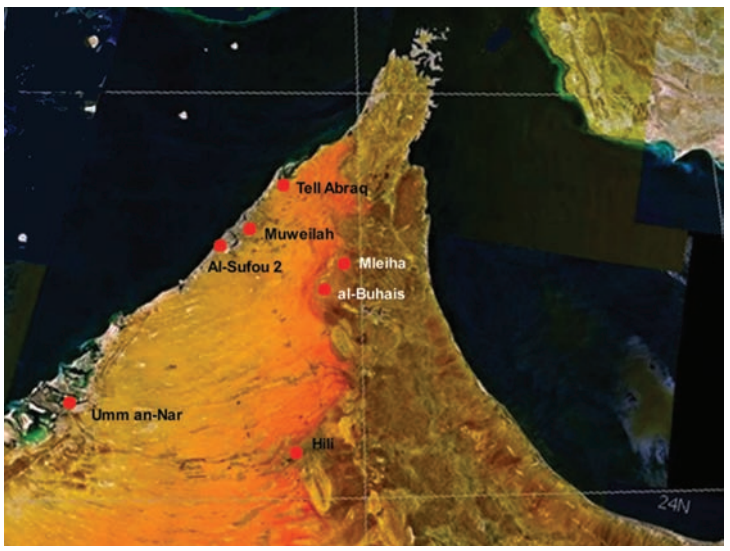

Fig. 1. Major sites dealt with in the text.

Beginning in the Early Bronze Age, there is positive evidence of animal labour. This is in accordance with the emergence of oasis culture, the mining and smelting of copper, the common use of pottery and other commodities as well as intensive trading activities of different goods, often over great distances. In order to use animals as beasts of burden, they have to be available among the livestock. The earliest proof for domestic animals in south-eastern Arabia comes from the Neolithic period. In quite a few sites during the latter half of the 6th and of the 5th millennium BC from the coast to the interior, cattle, sheep and goat have been identified among the excavated faunal remains (Beech and Elders 1999; Beech et al. 2005; Phillips 2002; Uerpmann, H-P and Uerpmann, M 2003). Unfortunately, none of the earlier Stone Age sites in the interior – tentatively also called Neolithic – have yet yielded any preserved animal bones. The animal remains found at al-Buhais 18 (Sharjah) indicate a clear preponderance of livestock exploitation over hunting, which was of minor economic importance. Whereas, judging by slaughtering patterns, the aim of keeping cattle was obviously only for meat while the analysis of sheep and goat remains indicates that they were used for milk and probably for wool and hair during their lifetime (Uerpmann, M and Uerpmann, H-P 2008a). They were also used for their meat when they were slaughtered at comparatively old ages.

The people who buried their dead at al-Buhais 18 were mobile herders making seasonal use of multiple resources within an area ranging from the coast to the Hajar Mountains (Uerpmann, Uerpmann and Jasim 2006). Cross-cultural observations on pastoral nomads usually emphasise the role of beasts of burden, mainly camels and horses, which are important for this specialised form of human existence. However, neither the horse nor the camel had yet been domesticated in any part of the world at the time of the Neolithic occupation of al-Buhais 18. We cannot exclude the possibility that some of their animals occasionally had to carry a small load. However, the use of sheep, goats or cattle as beasts of burden has remained uncommon right up to the present time, suggesting that they are not really useful for this task. In any case, the loads which these animals might have had to carry during the movements of the Neolithic nomads in Arabia were either not heavy or the movements were so irregular, that it did not lead to any alterations of their bones. The usual household commodities, which are carried by modern nomadic groups, were not yet part of the Neolithic herding culture in south-eastern Arabia.

The oldest evidence of animal labour in south-eastern Arabia comes from an Early Bronze Age context at Hili 8 in the Al Ain oasis (Cleuziou and Tosi 2007; Uerpmann, M and Uerpmann, H-P 2007). Cattle bones, the oldest of which were found in layers of the Hafit period c. 3000 BC (Cleuziou 2002; Cleuziou and Méry 2002), display 'stress-markers', i.e. morphological alterations which indicate that the individuals were used as draught animals. A typical example is the distal end of a metatarsal bone with enlarged articular facets on both sides (Fig. 2.). Identical alterations are found on the bones of modern oxen used for pulling carts or ploughs (Bartosiewicz 2008). Similar indications were also seen in other cattle bones from Hili 8, indicating that these animals were used to pull ploughs or other heavy loads. The use of cattle as draught animals, therefore, seems to have been typical of the animal economy at Hili 8. This makes perfect sense considering the fact that intensive oasis farming is thought to have originated during this period.

The donkey was apparently the second animal which came to be used for work at this time. The rider shown in a bas-relief on the Great Tomb at Hili noticeably sits on an equid (Fig. 3). Horses would have been depicted

much larger in relation to the human, and the horse did not arrive in south-eastern Arabia until much later, making it much more likely that this animal is a donkey. Faunal remains from other sites in the wider area also lead us to believe that the donkey was already used in south-eastern Arabia in the Early Bronze Age. At Hili 8 the number of donkey bones increased from Phase 1 to Phase 2, which might indicate domestication, and in any case it shows an increase in the importance of donkeys at this time. Because of a general scarcity of comparable finds from clearly wild Arabian asses of the Neolithic period and early donkeys from Mesopotamia, it is still difficult to confirm the identification of the Bronze Age specimens as either wild or domestic.

Fig. 2. Cattle metatarsal with broadened articular facets from Hili 8.

The general history of the donkey in south-western Asia is still incompletely known. The earliest osteological evidence comes from Uruk and is dated to the last quarter of the 4th millennium BC (Boesneck, von den Driesch and Steger 1984). The donkey may, however, have had a much longer history in Mesopotamia. Apart from North Africa, its wild ancestors lived in parts of Mesopotamia and throughout the Arabian Peninsula (Uerpmann HP 1987; Uerpmann, M and Uerpmann, H-P 2008a: 100ff.). A local domestication in south-eastern Arabia cannot, therefore, be excluded. It is, of course, also possible that the donkey was introduced into the Oman Peninsula along with other features that arrived in the context of inter-regional copper trade at the beginning of the Bronze Age.

Fig. 3. Bas-relief of a Donkey-Rider on the Great Tomb at Hili (Al Ain, UAE). Photograph: Walid Y. Al Tikriti.

At Maysar (Weisgerber 1981), a late Umm an-Nar site in Oman well-known for copper mining and smelting, donkey bones are a notable component of the faunal assemblage (Uerpmann, M and Uerpmann, H-P 2008b: 470ff.). Although the bones from Maysar cannot be attributed unhesitatingly to a domestic animal on morphological grounds alone, their relatively high frequency would suggest the domestic status of this animal and the utility of the domestic donkey for transport and load-bearing at a smelting and copper working site seems clear. For the moment, the depiction of a rider on the Great Tomb at Hili remains the strongest indication of the domestic status of this species in the Umm an-Nar period.

Elsewhere, finds of donkeys or asses occur only sporadically at other Bronze Age sites in south-eastern Arabia, such as Ra's al-Jinz (Oman) (Bökönyi 1992; Bökönyi & Bartosiewicz 1998) and Tell Abraq (Uerpmann M 2001), while on Umm an-Nar island itself equid bones are completely absent (Hoch 1979, 1995; Uerpmann, M & Uerpmann, H-P 2008b). How should the seeming variations in the economic importance of donkeys, as shown by their varying proportions or even complete absence at the above-mentioned sites, be interpreted? And can the assumption that donkeys were used as beasts of burden during the Umm an-Nar period still be upheld? There is no completely convincing answer to these questions. The biology of the donkey and the respective environments of the sites concerned may, however, give us a hint. Maysar and

Ra's al-Jinz are in mountainous areas, where most of the ground surfaces are hard or even rocky. Donkeys are well adapted to this kind of terrain. However, when we look at the sites in the west (Fig. 1) it is obvious that Umm an-Nar island is far from the mountains and reaching it by land requires crossing the desert. Donkeys are not well-adapted to walking long distances on soft sand, especially when carrying a load. Further north at Tell Abraq, also located on the Gulf coast, where some donkey remains were found in an Umm an-Nar context, the situation is slightly different. The gravels of the Wadi al-Dhaid form a kind of natural 'donkey-road' from the mountains leading almost to the coast of the northern Emirates. Such pathways would have enabled the use of donkeys for the transportation of goods from the hinterland to the more northerly harbours on the Gulf coast. On the whole, we may therefore assume that the donkey was already used during the Early Bronze Age as a beast of burden, particularly in the mountainous areas.

Before camels became available, cattle may have had some importance for the transportation of heavy goods in sandy areas. While carts would not have been useful in the sands, cattle-drawn sledges might have served the same function. This was certainly not as efficient as the use of a strong beast of burden, however, and it is not surprising that the dromedary became so important once it was domesticated.

Nowadays, dromedaries are the most-renowned animals in Arabia. Like the donkey at Hili, dromedaries are also depicted on Bronze Age tombs on Umm an-Nar Island. There is, however, no rider shown, nor a burden or a harness. The pictorial evidence does, therefore, not argue in favour of domestic dromedaries during the Umm an-Nar phase of the Early Bronze Age. On the contrary, one of the bas-reliefs depicts an oryx antelope together with a dromedary, thus favouring the assumption that the dromedary, like the oryx, was wild. Camel bones are frequent finds at Umm an-Nar (Hoch 1979, 1995; Uerpmann, M and Uerpmann, H-P 2008b) and in the Umm an-Nar layers of Tell Abraq, and they are present, but less common, at Maysar and Hili 8, whereas they are absent at Ra's al-Jinz.

The high frequency of camel remains on Umm an-Nar has sometimes been considered evidence for the domestication of dromedaries by the Umm an-Nar civilisation. The same argument could, however, be made for the dugong, *Dugong dugon*, both at Umm an-Nar and at Tell Abraq, though this is an animal which was certainly never domesticated. Where an animal species is available as a common member of the local wild fauna, high frequencies among archaeological bone finds should not be considered as evidence of domestication unless additional arguments are available. The fact that there are some remains of young animals at Umm an-Nar is also not an argument in favour of their domestic status because young camels would certainly have been taken by hunters, who wanted meat, and who were not concerned about the sustainability of the local wild camel population. Both camels and large sea-mammals are characterised by low rates of reproduction. Over-using these resources may well have contributed to the early end of the Bronze Age settlement on Umm an-Nar Island, which apparently was abandoned before the end of the Umm-an-Nar period and certainly did not persist into the Middle Bronze Age.

Quantitative observations at Tell Abraq, another important site in the Emirates which was settled from the late Umm an-Nar phase into the Iron Age (Potts 1990, 1991) provide a clue for understanding this development. Camels contributed a lot of meat – represented by the relative weight of the bone finds – during the Umm an-Nar phase at Tell Abraq (Fig. 4). Later this amount became less and less, until camel finds disappear completely at the beginning of the Iron Age (Uerpmann M 2001). Apparently, wild dromedaries were over-hunted to extinction within the local environment, which resembled that of Umm an-Nar, with a lagoon bordered by mangrove. Thousands of bones of wild dromedaries were also found at al-Sufouh 2 – another site in a mangrove environment that existed during the 2nd millennium BC within what is now the city of Dubai (von den Driesch and Obermaier 2007). In the Iron Age II period, dromedary bones reappear at Tell Abraq. There is clear evidence, however that these are from domestic animals, whereas all of the earlier remains represent wild dromedaries.

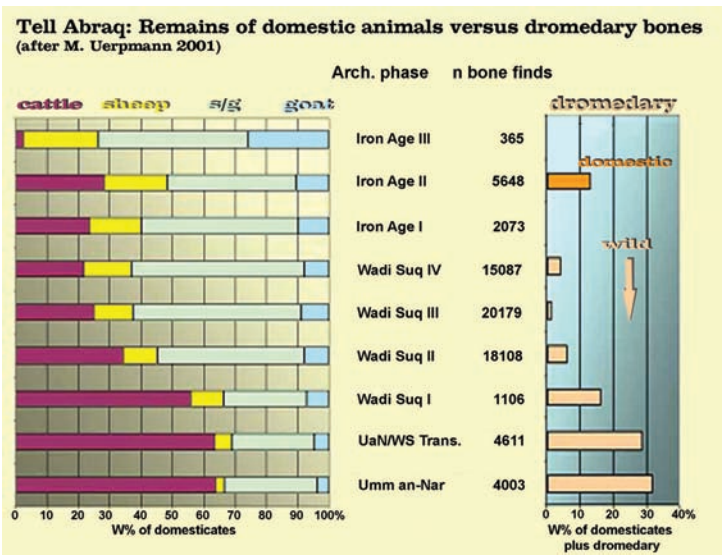

Fig. 4. Faunal changes in the stratigraphic sequence of Tell Abraq (percentages of bone weight) (after Uerpmann, M. 2001).

In spite of assertions to the contrary (e.g. Zeder and Hesse 2000), it is well-established archaeozoological knowledge that ungulates and carnivores generally undergo a reduction in average body mass during early domestication, a phenomenon that is mirrored in smaller cross-sections of the weight-bearing bones of the extremities. Many reasons have been discussed for this general observation, that cannot be repeated here. During domestication, the natural selection of the strongest males and females for reproduction was replaced by human selection for more docile and less dominant animals, which are usually the smaller members of a herd. The reduced size of the Iron Age camels is not only clear in the finds from Tell Abraq (Fig. 5) but also at Muweilah, a fortified Iron Age township located in the eastern suburbs of Sharjah city. Camel finds there are frequent, but their general state of preservation is quite poor, which reduces the number of measurable bones. The distributions of the LSI (Logarithmic Size Indices) of dromedary bones from Umm an-Nar, al-Sufouh 2 and the Bronze Age levels of Tell Abraq clearly indicate larger sizes for the Bronze Age animals than for the Iron Age camels from Tell Abraq and Muweilah. The dotted zero-line on the graph indicates the size of

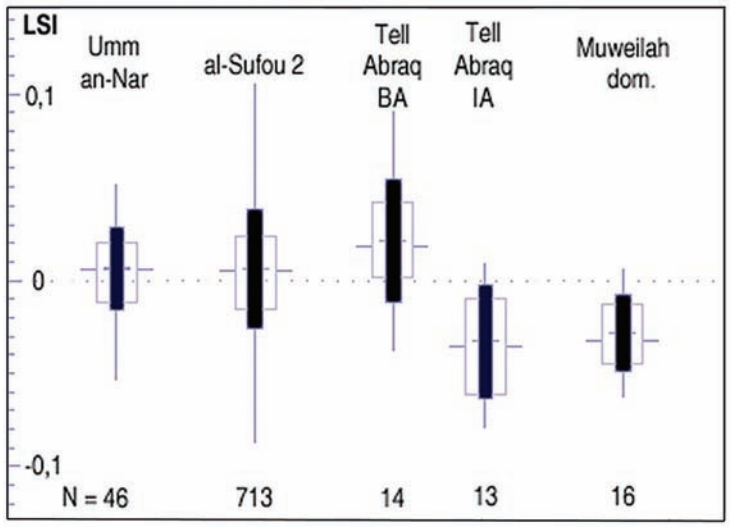

Fig. 5. LSI-distributions for bone measurements of dromedaries from Bronze and Iron Age sites in the UAE.

a large, modern dromedary from south-eastern Arabia, which is used as a standard for the calculations of the LSI (for details see Uerpmann, H-P and Uerpmann, M 2002 and Uerpmann, H-P 2008).

It is interesting to see that the wild camels from Umm an-Nar had the same average size as those from al-Sufouh 2. The occurrence of some small individuals at both sites – in particular within the very large sample from al-Sufouh – does not mean that there were already some domesticates among them. Rather, it means that smaller individuals were not 'produced' by domestication but were already there in wild populations and later selectively favoured during the subsequent domestication process. There is also good archaeological evidence at Muweilah for the presence of domestic dromedaries in the form of several statuettes representing one-humped camels with a load or saddle on their backs (Fig. 6).

Fig. 6. Camel statuette from Muweilah. Photo: Peter Magee.

With respect to the transportation of goods, we return to the question of potential camel domestication at Umm an-Nar. For many years, the necessity for overland transport of copper between the hinterland and the harbour site on Umm an-Nar Island has been cited as an argument in this discussion (Frifelt 1975). In fact, this seems to reflect a misconception based on the historic role of Abu Dhabi as the harbour for Al Ain and Buraimi. During the Bronze Age, when no international borders existed, the harbour closest to Hili would have been Sohar on the Gulf on Oman, the coast of which would also have been closest to all of the known Bronze Age copper-smelting sites in the Hajar Mountains. There may not have been much overland traffic at all between Umm an-Nar and the desert hinterland, a point that is also suggested by the lack of donkey remains and the small amount of bones of other domesticates on Umm an-Nar. Rather than a harbour for the sites in the hinterland, the ancient settlement on Umm an-Nar may have been important as a point for the exchange of loads between ships travelling different legs of the route towards the Indus Valley.

Looking beyond south-eastern Arabia towards Mesopotamia, there is also good evidence for domestic dromedaries on Neo-Assyrian reliefs and in contemporary cuneiform texts. The faunal remains from Tell Sheikh Hamad on the Khabur River in Syria from this period provide osteological evidence for the introduction of the one-humped camel into northern Syria, where wild dromedaries did not exist. There is, however, even earlier evidence for the two-humped or Bactrian camel at this site (Becker 2008), which is also an alien species to Upper Mesopotamia. This species is still the most enigmatic with regard to its history as a domestic animal. We may assume that it lived as a wild animal not only in Central East Asia – to which it is confined today – but as far west and south-west as Turkmenistan and possibly into the central highland deserts of Iran. The reasons for this last assumption are based on zoogeographical and ecological considerations and were published more than twenty years ago (Uerpmann, H-P 1987: 55). In any case it seems that the Bactrian camel was under human control in southern Turkmenistan at the transition from the 3rd to the 2nd millennium BC (Potts 2004:149f.).

The above-mentioned evidence from Tell Sheikh Hamad for an early appearance of the two-humped camel and – to a certain extent – the 'unprovenanced cylinder seal in Old Syrian style in the Walters Art Gallery on which a Bactrian camel is depicted…' which '…has been dated stylistically to c. 1750–1700 BC (Gordon 1939: Pl. 7.55; Collon 2000: Fig. 8)' (Potts 2004:150) could also be considered as evidence for an early appearance of the domestic two-humped camel in Mesopotamia as an occasional import from the highlands to the north and north-east. What this means with regard to a potential presence of the dromedary in highland Iran (Potts 2004) at the same time is one of the enigmas around the early history of the Old World camels. One might, however, in any case suggest that the (local?) domestication of the dromedary in south-eastern Arabia around the transition from the 2nd to the 1st millennium BC may have been influenced by contacts with southern Iran in the Early Iron Age, but without textual evidence this will always remain speculative.

There is no physical evidence for the Bactrian camel in south-eastern Arabia until several centuries later. This evidence takes the form of hybrids between the two-humped and the one-humped camel. Such animals, which are larger and stronger than pure dromedaries, were found at the pre-Islamic site of Mleiha in the Central Region of Sharjah Emirate (Uerpmann, H-P 1999). Apparently one of these camels was considered valuable enough to be buried in the corridor of a noble grave together with a horse which was adorned with large golden discs on its bridle (Jasim 1999: 77ff). We may expect earlier evidence for camel hybridisation – as assumed by Potts (2004:161) – once full-scale archaeozoological research resumes in Lower Mesopotamia after the long break inflicted by the political developments of the last decades. It will, however, be of prime importance that there is a common awareness among archaeologists of the potential presence of three different forms of camelids – Bactrians, hybrids, and dromedaries – and that the archaeozoologists come to terms with the criteria for their morphological separation.

A fragment of a bronze bowl decorated with images of two riders, one on an equid, the other on a camel, was also found at Mleiha (Fig. 7). Whether this camel represents a hybrid or a pure dromedary cannot be decided. However, the flat and elongated shape of the hump might indicate a hybrid. The equid, on the other hand, is an undisputable horse. This animal is a late arrival to south-eastern Arabia. A find from period IV at Qalat-al-Bahrain (Uerpmann, M and Uerpmann, H-P 1997: 248) seems to be the earliest osteological evidence for the appearance of the horse in eastern Arabia. There were no horse bones among the large complex of animal remains from Muweilah, dating to Iron Age II. At the later sites of ed-Dur (Van Neer and Gautier 1993) and Mleiha (Mashkour and Van Neer 1999), the occurrence of horses was only tentatively mentioned or considered probable. In any case, there are two horse skeletons from Graves 4 and 22 at the graveyard of Mleiha. These horses were similar in size to modern Arabian horses, but may have been slightly more robust (Uerpmann, H-P 1999: 115). In any case, one may say that the famous Arabian horse looks back on a history of at least 2500 years during which time it acquired its particular features through human and natural selection within a desert environment.

In the present day motorised vehicles have replaced animal labour and beasts of burden in Arabia. Nevertheless Arabian horses and Arabian camels have retained their cultural importance and have become real icons for this part of the world.

Fig. 7. Bowl-fragment from Mleiha (Sharjah, UAE) depicting fighters riding on a one-humped camel or camel hybrid and a horse. Photograph: Sabah A. Jasim.

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Fifty Years of Emirates Archaeology

UMM AN-NAR, AN ANCIENT CAPITAL OF ABU DHABI: DISTRIBUTION OF A CULTURE AND THE CURRENT STATE OF THE SITE

Walid Yasin Al Tikriti (Al Ain)

INTRODUCTION

Discovered fifty years ago, Umm an-Nar was the first archaeological site to be excavated in the United Arab Emirates and it remains the major Bronze Age site along the littoral of the entire Gulf. Other contemporary sites discovered later along the shoreline of the Gulf and in the interior of Abu Dhabi have not deprived the island of its importance and the glorious history that it must have had more than 4300 years ago.

According to a new document presented by Dr. Flemming Højlund at the 2nd International Conference on the Archaeology of the United Arab Emirates, organised in Abu Dhabi by the Ministry of Culture, Youth and Community Development in April 2009, (this volume), it was Sheikh Shakhbut bin Sultan Al Nahyan, the then Ruler of Abu Dhabi, who invited the Danish team to investigate the stone cairns which he had seen on the island of Umm an-Nar. He asked Mr. Temple (Tim) Hillyard, the representative of the oil company Abu Dhabi Marine Areas (ADMA), to contact the Danish archaeological team then excavating in Bahrain. Professor P.V. Glob, the head of the team, and Geoffrey Bibby, who had formerly worked for another oil company in the Gulf and had good relations with ADMA, came to Abu Dhabi to explore the island in 1958. Tim Hillyard, who was an amateur archaeologist, and his wife, Susan Hillyard, showed the island to the two archaeologists in February of that year.[1]

The cairns were soon identified as being archaeological monuments, although their date and significance was then unknown. The following year, in 1959, after obtaining permission from Sheikh Shakhbut, the Danes – supported by the oil companies in Abu Dhabi – started an excavation programme. The archaeological investigations on this island were not only the first of their kind to have been carried out in the United Arab Emirates but also in the whole of south-east Arabia. They proved to be significant since they revealed a previously unknown culture.

The Danish excavations of the cairns on Umm an-Nar revealed multi-room, circular monuments with exterior walls built of well-shaped stones (Thorvildsen 1962). These turned out to be the burials for the inhabitants of the island. Trenches were dug in the nearby ruins of what looked like an abandoned village and the remains of ancient houses were also discovered.

From the burials and the houses came a pottery collection that was new to the excavators. They had nothing with which to compare the structures and their contents, in order to determine their date, as the site had no parallels in the archaeological world when it was discovered. Luckily, a painted jar of fine pottery decorated with a hump backed bull – a motif known in Baluchistan and the Indus civilisation (modern day Pakistan) of the third millennium BC – was discovered in one of the burials (Kay 1986). This type of pottery that is currently referred to as 'black-on-red', as well as another type known in Mesopotamia (modern day Iraq) helped to date the Umm an-Nar sites.

Radiocarbon dating carried out on a sample later collected by the writer from the upper building layer in the settlement confirmed this date.[2] The architecture of the tombs and the burial customs practiced on the island led the Danes to call it the 'Umm an-Nar Culture', a term widely used today by archaeologists in referring to the second half of the third millennium BC throughout south-eastern Arabia.

Archaeological investigations carried out during the last thirty years by local and foreign expeditions have demonstrated that the Umm an-Nar Culture covers a much wider area than had originally been anticipated when it was first discovered, as we see in the next section.

DISTRIBUTION OF THE UMM AN-NAR CULTURE IN THE UAE

The aim of this section is not to discuss the entirety of the Umm an-Nar Culture and its distribution in all of south-eastern Arabia, since this is a wide-ranging subject and difficult to cover in this paper. Nevertheless, it is worth briefly reviewing the presently known evidence of the culture in the UAE.

Since the discovery of the archaeological sites on Umm an-Nar, many other contemporary sites have been identified in the UAE (Fig. 1). The Bronze Age complex at Hili with its Grand Tomb sitting in the middle of the archaeological park is a very significant site and was the first to have been excavated in the interior of the UAE.[3] This complex consists of six settlement sites (Hili 1, Hili 8 and Hili 10 have been excavated while H 3, H 4 and H 11 have been either partly examined through soundings or have not yet been studied). Included in the complex are 13 above-ground circular tombs of Type A[4] with exterior walls built of 'sugar-lump' stones.

Graves of Types B and C, attested on Umm an-Nar, are not present in the Hili Bronze Age complex,[5] although they might be represented in the large group of graves which litter Jebel Huglah, the first mountain ridge to the east of the complex. It seems, however, that the interior of south-eastern Arabia, rather than the coastal

areas, was the homeland of the Umm an-Nar Culture. It spread to the coasts due to interaction with Mesopotamia, the Indus Valley and Baluchistan. The resources of the sea, however, have always been considered important for the economy of the region and, therefore, we should not ignore this possible reasons for such expansion.

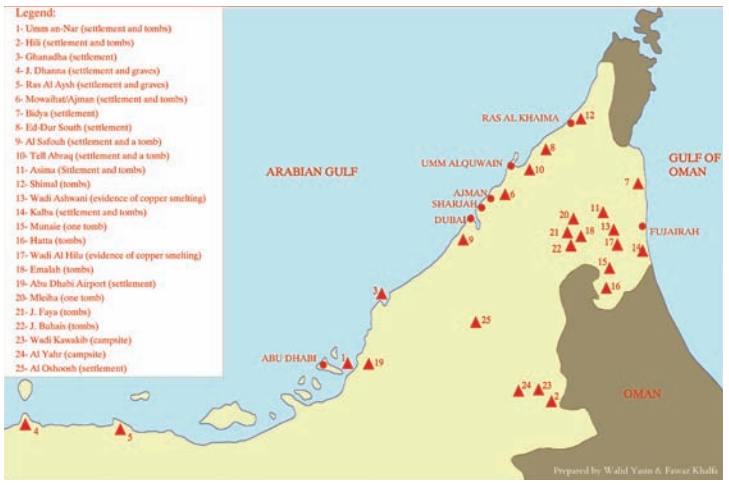

Fig. 1. Distribution of Umm an-Nar period sites in the United Arab Emirates.

Since the discovery by the writer of the Ghanadha site, on the coast to the north-east of Abu Dhabi city in 1982 – the first Umm an-Nar site to have been discovered outside of the Umm an-Nar island-Hili axis – a number of other sites have been discovered in different regions. Among these, there are two major coastal sites in the Northern Emirates: Tell Abraq in Umm al-Qaiwain (Potts 1990, 1991, 2000) and Kalba 4 in Sharjah on the East Coast (Eddisford and Phillips 2009).

Both sites fall in the category of fortified settlements, as does Site 2 at Bidya, a coastal site in the Emirate of Fujairah, north of Khor Fakkan (Al Tikriti 1989).[6] Apart from the seasonal settlement at Ghanadha (Al Tikriti 1985) and the above-mentioned major sites, a number of sites have been discovered along the southern shore of the Arabian Gulf, evidence for the expansion of the culture further west along the coast of Abu Dhabi.

Jebel Dhanna and Ra's al-Aysh were found soon after the discovery of Ghanadha (Vogt et al. 1989). The settlement at al-Sufouh (Iacono et al. 1996) was as dense as Ghanadha, or even more so, while occupation at Mowaihat in Ajman and ed-Dur South in Umm al-Qaiwain was very shallow. The former (Mowaihat) produced a small collection of fine red pottery and some coarser Umm an-Nar fabrics together with some hearths.

According to Carl Phillips, the ed-Dur South site yielded similar pottery and was described as shell midden (for the nature of these two ephemeral settlements and further notes on the different types of Umm an-Nar settlements, see Phillips 2007). The same site (ed-Dur South) was relocated during a survey season carried out by a local team organised by the Ministry of Culture, Youth and Community Development in May 2009.

Prior to the discovery of the Umm an-Nar settlement at Mowaihat by the writer, a tomb built of ashlar masonry and an adjacent subterranean burial similar to Tomb N at Hili were also identified and excavated in the same area (Al Tikriti 1989; Haerinck 1991). This, the first typical Umm an-Nar tomb to be discovered in the Northern Emirates, was soon followed by the identification of a number of other tombs including Muna'i (excavated by Carl Phillips); Unar 1 (Sahm 1988) and Unar 2 (Blau and Beech 1999; Blau 2001) at Shimal in Ra's al-Khaimah; Hatta[7] and al-Sufouh in Dubai (Benton 1996); and Jebel Emalah (Benton and Potts 1994), Tell Abraq (Potts 2000) and Mleiha in Sharjah (Jasim 2003). Other Umm an-Nar tombs of Type B are also known at 'Asimah (Vogt 1994), Jebel Faya,[8] Jebel Buhais and Kalba.

The settlement site of this period closest to Umm an-Nar Island was discovered in 1995 by Peter Hellyer (Beech et al. 2004). Located on the periphery of Abu Dhabi Airport, it overlooks the nearby sabkha that extends to Umm an-Nar, some 12 km away and is of particular interest because of its proximity to that site (Hellyer 1998: 46). Artefacts from the Neolithic Period, as well as pottery from the late pre-Islamic and Late Islamic periods have also been found on the surface. Most important, however, is the fairly large collection of pottery belonging to the Umm an-Nar period.

This collection is also mixed with a few sherds that might belong to the Hafit period (De Cardi 1997). One well and a possible second one were discovered at the site. They were only partially excavated and therefore it is impossible to relate them to one of the periods represented at this shallow site. Complete excavation to the base might yield some evidence of the period to which they belong.

The Umm an-Nar settlements are not confined to the coasts and inland oases. There are other sites located in the *wadis* of the Hajar Mountains that serve as links between the UAE's East Coast and the interior, among which are those in Wadi Ashwani and Wadi al-Hilo. Sites in these two areas seem to have been involved in copper production. Today, there is new evidence that the Umm an-Nar people were not only settled communities involved in the copper industry, farming and fishing but also that they were semi-nomadic. Evidence of this comes from the remains of a 3rd millennium site and fireplace, located between the sand dunes at Al-Yahar, near the road from Al Ain to Abu Dhabi, where a handful of Umm an-Nar sherds – mostly of the type designated Hili Sandy Ware by S. Méry – were recovered.

This campsite was identified by the writer during a visit arranged by Mr. Peter Rothfels to show us a Neolithic site in the region. Another campsite from the Umm an-Nar period has also been noticed by the writer at Wadi Kawakib, west of Bida bint Saud, a few kilometres north of Al Ain. The site was identified by a local team from the former Department of Antiquities while examining surface remains from the Iron Age. Originally, both the Wadi Kawakib sites (the Iron Age and Umm an-Nar ones) were desert sites but unfortunately they have been incorporated into a private farm.

One of the most interesting desert sites[9] was discovered at Al Ashoosh in 2001 by H.H. Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai. The site is located midway between the Hajar Mountains and the sea, a few kilometres north of the border with the Emirate of Abu Dhabi. It was shown to me by Dr. Husain Qandil, the resident archaeologist in Dubai. In order to protect the site, coordinates are not given here.[10] Based on the surface collection, the site seems to have been first occupied during the Neolithic and reused during the Umm an-Nar period. Not many 3rd millennium BC pottery types were found but sherds of 'Hili Sandy Ware' were present. Despite the presence of what seem to be Neolithic artefacts, we do not know if the technique of manufacturing certain types of stone artefacts continued in use during the 3rd millennium BC, especially at the desert sites.

In view of its location, it is worth mentioning some of the observations I have made during my various visits to the site in the last eight years. 'The site is a mound of 30 metres in diameter rising about 2–3 feet above the surrounding [area] with a separate extension at a distance of about 20 metres to the south-west. At this lower spot there are some potsherds and traces of ashes indicating fireplaces. The height of the mound from the east is thicker than the west as it overlooks an ancient depression or dry lake'.

The site may have originally been on the edge of a *ghadir* (seasonal lake). To the east and south-east of the main site are more fireplaces covering quite a large area of the lowland. During a recent visit (2008) with one of my colleagues, we discovered that the Dubai Department of Antiquities had opened two small trenches on the main mound. The eroded sections of these trenches indicate that the site was densely occupied and the archaeological layer (at least 15 cm thick) overlay a greyish layer of sand mixed with ash. Fragmented bones of terrestrial animals – predominantly sheep and goats – are scattered all over the main site and were still visible in the eroded sections.

Shells are very rare on the surface and I imagine this was the case was during excavation. My impression is that the inhabitants of Al Ashoosh were more involved in animal husbandry than in farming. The site must have been an important link between the sea and the Hajar Mountains, and the topography of the region suggests that there must have been ample grazing in the vicinity.

THE ISLAND AND ITS COMPONENTS

When the archaeological site was first discovered, Umm an-Nar was a small offshore island separated from the mainland by a shallow creek. At the time, it was accessible at low tide (Fig. 2.). It was 2 km^2 in area, with two main sections, a flat low plateau in the north, where the large cemetery is located, and a high outcrop in the south. It was surrounded by flat *sabkhas* to the east and south-east and its main beach ran just along the western side of the plateau.

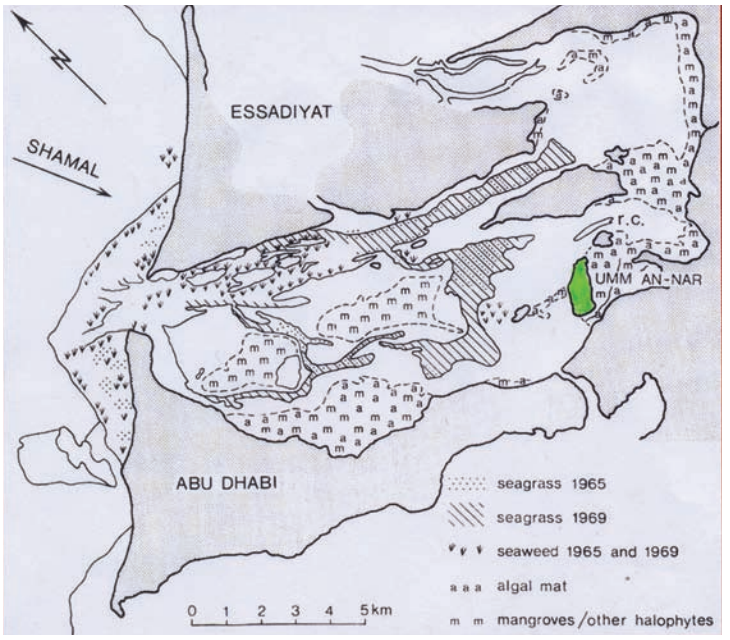

Fig. 2. Umm an-Nar in relation to the surrounding environment (after E. Hoch).

The present-day landscape is completely different, due to the encroachment of modern development. The island has been enlarged by land reclamation and dredging (Fig. 3.). Today, an oil refinery, a desalination plant and power installations, as well as the military occupy the island. Apart from the oil refinery, all other new installations have been placed on areas that would have been covered with shallow water 4500 years ago. Despite this encroachment and extensive land reclamation, the archaeological sites are well-protected and preserved.

Apart from four graves on the southern outcrop of the main island (bulldozed during the construction of the

refinery) and one more in the extreme north beyond the plateau, all other sites are preserved and protected by a well-built concrete wall with a total length of about 1760 m. During the construction of the oil refinery in 1974, a causeway was built over the creek. Soon afterward it was replaced by a bridge. At the time of writing this report, access to the island is via this bridge but is restricted to passholders only.

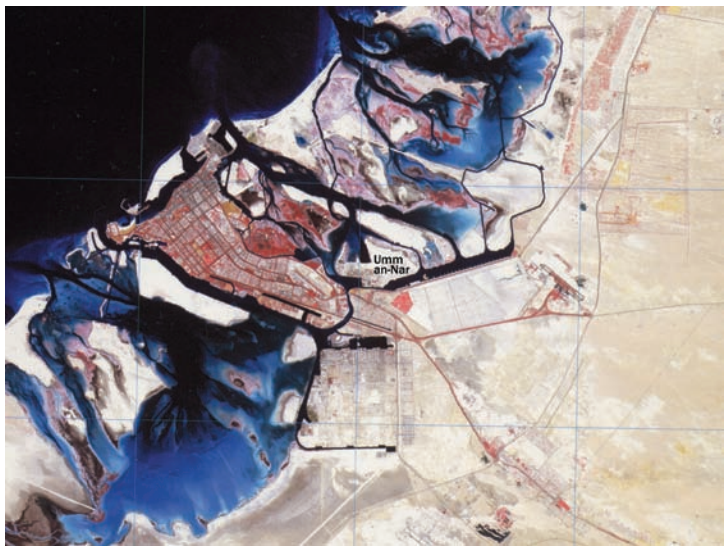

Fig. 3. Satellite image of Umm an-Nar, cf. Fig. 2 (after Marine Atlas of Abu Dhabi).

THE SETTLEMENT

The settlement on Umm an-Nar is located to the east and north-east of the cemetery in an area a few metres lower than the plateau. It was divided into three main areas called 1013, 1014 and 1019 by the Danes. These numbers apply to the trenches excavated by the Danish team and not to topographical features at the site (Frifelt 1991). Surveying and planning carried out in 1979 by the writer showed that the settlement of Umm an-Nar consists of three mounds (Fig. 4.).

Mound A (1014) is the largest. This seems to have been the nuclear part of the settlement and probably the earliest. The southern section of this mound was extensively occupied. The deposit here is 2.25 m deep, but is much shallower on the northern side. Traces of fireplaces can be seen on the narrow ridge and the northern tip of the mound. The Danish excavations here revealed a well-preserved house but did not define the exterior walls (Fig. 5.). A long trench cut through the southern section of this mound from east to west was also opened by the Danes (Frifelt 1995).

Limited excavations were later carried out by an Iraqi team about 20 m west of the house excavated by the Danes, uncovering one large room that may well have been used as a sanctuary (Room 14). The writer later opened a 5 m-wide trench linking the Danish house with the Iraqi excavations. In this trench, at least ten rooms were encountered but only partly excavated (Fig. 6.).

Fig. 4. Google image of the archaeological sites on Umm an-Nar.

Fig. 5. The 'House Complex' excavated by the Danish Expedition on Mound A after restoration (Photograph: W.Y. Al Tikriti).

Mound B (1019) is located to the north-west of Mound A and is separated from it by a narrow flat *sabkha*. This may represent an extension of the nuclear settlement occurring soon after the construction of the site since both mounds reveal the same cultural horizon. The shallowness of the deposit on Mound B, especially of its northern part, would seem to indicate a short habitation. Traces of walls forming large rooms reminiscent of the house excavated on Mound C (see below) are visible on the surface.

Located at the extreme southern margin of the settlement[11] Mound C (1013) seems to have been the site

of one large building, already excavated, and remains of another one.[12] Because of the regularity of this large, multi-roomed building and the presence of large storage jar lids, this was designated a 'Warehouse' by the Danish excavators (Fig. 7). The building's size and regularity also suggest that this building must have been of special importance. Perhaps the building also served an administrative function.

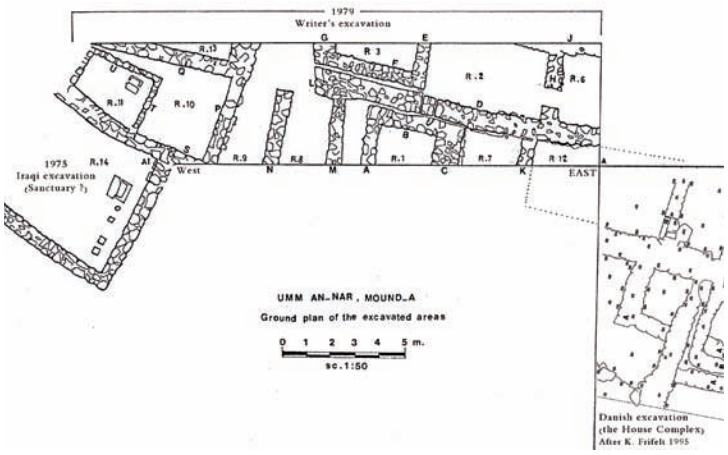

Fig. 6. Plan of the excavated areas on Mound A.

Fig. 7. The 'Warehouse' on Mound C (Photo: W.Y. Al Tikriti).

It should be noted that the three mounds were originally connected and formed one village. They were only 'disconnected' after the abandonment of the settlement by gullies created as a result of the rainwater flowing from the adjacent plateau. Among the surface materials collected from these three mounds are pottery, scraps of copper, various species of shells, stone sinkers (weight) and many fragmented animal bones dominated by dugong (*Dugong dugon*) and turtles. There are no comparable surface finds in the tombs area.

THE HOUSES

The houses on Umm an-Nar were built of unworked stones mined from the limestone plateau and nearby areas. Indeed, the majority of the stones used in the buildings are beachrock (*farush*) that must have been obtained from the surrounding beaches. Walls usually consisted of two parallel rows of stones with a core composed of smaller stones.

The excavations carried out by the writer on Mound A revealed other parts of the house complex that had previously been excavated by the Danes.[13] The architecture here consisted of thick walls with many alterations evident from the blocked doorways and the addition of new walls built up against the original ones (Fig. 8). It should be noted that, despite the many excavations carried out on this mound the limits of this complex have not yet been defined. As previously mentioned, it seems that this section of the site represents the nucleus of the whole village. It is much larger than originally anticipated and very complex.

Fig. 8. Blocked doors were common in the architecture of Mound A (Photograph: W.Y. Al Tikriti).

The houses excavated on the island yielded a large collection of pottery, both local and imported, as well as large quantities of animal bones, including marine and terrestrial species. Dugong and wild camel bones as well as different species of fish and cormorants were common. Bones of the extinct 'Bennu' bird or giant heron (*Ardea bennuides*) which may have inspired the story of the phoenix in ancient sources, were identified by Ella Hoch among the large collection of bird bones discovered.

Many net sinkers and fishing hooks were encountered in the houses, indicating that, apart from being traders, the people of Umm an-Nar were also good fishermen. The large, seven-room house interpreted as a warehouse by the Danes on Mound C covers an area of more than 250 m^2 (16 x 16m). In contrast to the House Complex on

Mound A, the upper parts of the walls on Mound C may have been made of mudbrick, according to K. Frifelt. This is suggested by the fact that the surviving walls are low and few fallen stones have been discovered, although no remains of bricks have been found.

THE CEMETERY

According to the catalogue prepared by Thorvildsen, a member of the Danish team in 1962, forty-nine stone cairns of different size were recorded on Umm an-Nar island.[14] In 2008 and 2009, the writer of this paper re-catalogued the cairns following the same numbering system used by Thorvildsen and found that there are forty-nine cairns on the plateau alone. If we add to this the other destroyed cairns (four on the southern outcrop and one on a small ridge to the north of the plateau) the total original number of graves reaches fifty-four (Al Tikriti, 2011).[15]

These cairns contained the burials of the local inhabitants of the island, the largest Bronze Age community so far identified on the southern coast of the Arabian Gulf. The tombs are usually described as circular structures with ring walls built of nicely dressed stones (sometimes described as 'ashlars' or 'sugar-lump stones'), and interior walls constructed of unworked stones. In my Ph.D. thesis (Al Tikriti 1981) I divided the tombs into three different types, based on architectural differences rather than finds or burial customs practiced.

Fig. 9. Tomb I (Type A). These original ashlar stones stood to at least 2 m above the plinth (Photograph: W.Y. Al Tikriti).

Type A (Figs. 9–10) are the most sophisticated and are considered representative of the typical Umm an-Nar tombs (five graves of this type have been excavated, three by the Danes and two by the Iraqis). Well-cut, worked stones, accurately curved horizontally and vertically, were used to produce circular structures with an original height of 2.50–3.50 m. These range in diameter from 6 to 12 m with small entrances, usually trapezoidal in shape, leading to a number of chambers created by parallel and intersecting walls built of unworked stones.

Fig. 10. Tomb V (Type A). Stones used here were different from those used in the other burials of this type (Photograph: W.Y. Al Tikriti).

Some of the stones used in the exterior walls have animals carved in relief. These animals, rendered in a realistic manner, include oryx – indigenous to the region – as well as a camel and an ox. A stone decorated with a snake may have been used as a gutter (on display in the Al Ain National Museum).

Type B (Figs. 11–12.) is less sophisticated than Type A, as graves belonging to this category were built entirely of rough stones and were much smaller in size. Like Type A, they are also multi-chamber burials (only two graves of this type have been excavated by the Danes).

Fig. 11. Tomb IV (Type B). Multi-chamber burial without dressed stones (Photograph: W.Y. Al Tikriti).

Type C (Fig. 13.) differs from the others as the graves excavated of this type are single chamber burials with a ringwall comprised of rough stones (five burials of this

Fig. 12. Tomb IV (Type B). Double-chamber burial without dressed stones (Photograph: W.Y. Al Tikriti).

Fig. 13. Tomb IV (Type C). Single-chamber burial (Photograph: W.Y. Al Tikriti).

type have been excavated, two by the Danes and three by the Iraqis).

The interiors of the standard Umm an-Nar tombs (Type A) comprise four to ten chambers, depending on the size of the tomb. The wider the diameter, the more walls are built inside, in order to support the roof. From at least two of the tombs excavated on Umm an-Nar there is evidence that they were roofed by corbelling the walls until they met, forming vault-like walls on the inside and a single dome on the outside (Fig. 14.). In certain cases, semi-flat roofs should not be completely excluded.

Fig. 14. One of the two tombs excavated by the Iraqi Archaeological Expedition (Photograph: W.Y. Al Tikriti).

The floors of the chambers are usually paved with flat stones. Some of the excavated tombs had two levels, i.e. a ground level and an upper one supported by shelves fixed

into the corner of the walls about 1 m above the original floor. Skeletal remains were found on some of these shelves. As mentioned above, apart from the sophisticated tombs, there are also less elaborate ones built of rough stones with or without internal divisions. Some of these, especially of Type B, have paved floors as well.

Although it is not easy to estimate the ratio of these three types as only twelve out of fifty-four graves on Umm an-Nar, I would estimate that Type A and B tombs each represent no more than fifteen per cent while the rest (seventy per cent) belong to Type C. This, however, is an approximation and can only be confirmed by further excavation.

SINGLE OR MULTI-PERIOD BURIALS

In his 1985 Ph.D. thesis, Dr. B. Vogt assigned the different types of tomb architecture on Umm an-Nar chronological significance (Vogt 1985). According to Vogt, the elaborate tombs (Type A) resulted from the gradual development of single chamber to multi-chamber tombs. This interpretation, which sounds logical, was quoted by Dr. D. Potts in his well-known book on the archaeology of the Arabian Gulf (Potts 1990). However, in my opinion, this hypothesis lacks convincing evidence. While I agree that the Hafit single-burial cairns developed into the more elaborate tombs of the Umm an-Nar Period, it should be noted that the Umm an-Nar single-chamber graves are different from those of the Hafit period, which are the earliest above-ground tombs known in the interior of Abu Dhabi.

Being on an isolated island, the tombs on Umm an-Nar seem to have been well-preserved and did not suffer much from the plundering of stone. Plundering was aimed at the precious objects and not for the purpose of reusing the stones. Calculating the number of stones left *in situ*, as well as the present condition of the graves themselves, suggests that they were shallower graves and different from the beehive tombs of the Hafit period, at Jebel Hafit and elsewhere.

Hafit-type graves with multi-circular walls are more elaborate than the Umm an-Nar single-chamber graves. The other factor which militates against Vogt's interpretation is the nature of the objects discovered. None of these Umm an-Nar island graves yielded pottery from the Jemdet Nasr Period, unlike the ones known at Jebel Hafit. I concede that Hafit graves do not always yield such types of pottery but they usually have different types of beads, two of which are very distinctive and well-known.

One type consists of small globular beads made of frit (a type of backed paste) in a light green colour (originally of a darker colour) attributed to Mesopotamia while the other type are flat lozenge beads, made of stone or shell (?) perforated at two opposite corners. None of these two types of beads have been discovered in the five single-chamber tombs so far excavated on the island. All the materials discovered in the above-mentioned tombs are from the Umm an-Nar Period and there is still no evidence of complete clearing and reuse. If they had been cleared to be reused, we would have expected to find some skeletal remains or small finds of the Hafit Period outside the chambers. No such objects have been discovered thus far during the excavations of the single-chambered graves.

Another reason that leads me to reject the idea of considering Type A tombs as a gradual development from Type C through Type B is the reuse evident at Tomb IV (Type B) of 'a small number of smoothed blocks ... used casually and probably secondarily in the walls among the uncut stones' (Frifelt 1991: 32).

Fig. 15. Pottery vessels of black-on-red ware.

A 'sugar lump' stone similar to those used in the elaborate tombs of Type A is still tucked in one of the interior walls of the same tomb (IV), indicating a younger date than the other elaborate tombs. Moreover, Frifelt mentions that one dressed stone reminiscent of those used in the ringwall of Grave V (Type A), was reused in the southern wall of Grave VII, a single-chamber burial (Frifelt 1991: 36). If she was not mistaken (I could not find this stone in 2009), this would be further evidence against the idea of a transformation from simple to more complicated graves taking place on the island.

According to the available evidence and the similarities in the objects discovered in the three different types of graves, the Umm an-Nar cemetery should be considered

Fig. 16. Pottery vessels of grey ware (Photograph: W.Y. Al Tikriti).

as one unit, belonging to a single period. If tangible evidence, like the discovery of Hafit-type pottery in the single-chamber Umm an-Nar graves is identified – which seems unlikely – this view may need to be amended. The architectural differences among the graves are more likely to reflect social than chronological factors.

BURIAL CUSTOMS

The Umm an-Nar people buried their dead in collective, above-ground tombs. Males, females and children were buried together with no specific orientation. The head is usually put against the wall while the rest of the body is buried in a contracted position in the middle of the chamber. In some of the tombs on Umm an-Nar, the remains of up to fifty individuals have been encountered while similar tombs at Hili yielded the remains of two hundred or more.[16] Each tomb was used over the course of a century or longer. Thus some of the dead may have belonged to different generations and did not necessarily live at the same time. There is little evidence of violence and it would be incorrect to consider the people buried in the tombs victims of local wars or exterior invasions.[17]

A large collection of pottery, different types of beads, and copper implements were discovered with the dead. Providing the dead with objects is an ancient tradition

deeply rooted in the beliefs of many prehistoric societies. This phenomenon is usually explained as the result of a belief in life after death.

Pottery vessels were the most common objects discovered in the tombs. They include black-on-red, grey vessels (Figs. 15–16.) and a number of jars imported from Mesopotamia (Fig. 17.). Fragmented vessels of buffware may have been imported from Mesopotamia and/or Baluchistan.[18]

TRADE AND INTERACTION

Copper, diorite and perhaps a wetter climate were among the factors that led to the upsurge of the Umm an-Nar culture and its prosperity. The demand for copper by the ancient Mesopotamians, as well as diorite to make statues of their kings, made them trade with Dilmun and Magan. Their need for lapis lazuli ornaments and precious stones also meant they had to look further east towards Meluhha.

While Dilmun is generally agreed to cover the island of Bahrain and the eastern coast of Arabia, Magan is generally identified with the land of the UAE. and Oman. The location of Magan on the sea route to Meluhha, famous for its cities like Harappa and Mohenjodaro (Pakistan) gave it an important role in the ancient trade between Mesopotamia and the Indus Valley. The items exchanged between Magan and Mesopotamia listed in some cuneiform texts – mostly belonging to the end of the 3rd millennium BC – are wool, sesame oil, hides and garments that were exchanged for copper, diorite, precious stones and ivory (for more details on the subject see Potts 1990). It should be noted here that there is evidence of copper casting taking place on Umm an-Nar island. Crucible fragments with traces of copper adhering to them were also found.

While copper is considered to have been the main item traded in the 3rd millennium BC in exchange for other items, it is worth noting that the interaction between the local cultures in the Gulf and Mesopotamia goes back to at least the 5th millennium BC. This is shown by the presence of 'Ubaid pottery, which originated in Mesopotamia, on a number of sites located along the southern shores of the Arabian Gulf.

Fig. 17. Mesopotamian jar imported more than 4000 years ago (Photograph: W.Y. Al Tikriti).

RESTORATIONS

The first Iraqi archaeological expedition to Abu Dhabi took place in 1970. Parallel to the survey team, which identified seventy-two sites in different locations around the United Arab Emirates, another team carried out restoration on the large Umm an-Nar Tombs I and II that were in a poor state of preservation.

Unlike the Grand Tomb at Hili, only original stones were used. Tomb V was in relatively good condition and most of its stones, smaller than those used in the former tombs but harder, have been put back in the ringwall. Today the tomb stands 1.30 m above the plinth. Recently, just before the foundation of the Abu Dhabi Authority for Culture and Heritage (ADACH), a team from the former Department of Antiquities and Tourism had to mitigate the disturbance that had affected the interior walls of Tombs I and II.

Stones were put back into these walls without using mortar, as was the method used in the reconstructions by the Iraqis. Further restoration was carried out at the settlement for the first time by the same Department, under the supervision of the writer. This included putting back some of the fallen stones on the walls of the House Complex and the Warehouse and stabilising them. The rest of the stones discovered during the excavation of Mound A were rescued from the excavation dumps, thus creating a large pile of stones which can be used once a new reconstruction plan is adopted in the future.

CULTURAL SIGNIFICANCE AND THE IMPACT OF SIGNIFICANT INSTALLATIONS

In my view, Umm an-Nar still represents the most important coastal site of the period in the Lower Gulf. The description of it as an ancient capital of Abu Dhabi is based on its large prehistoric community, its monumental cemeteries and the architectural remains of its settlement. It is an important site with distinctive funerary architecture, as well as being the first to have been discovered and excavated in the UAE. The artefacts discovered show evidence of trading networks between Arabia, Mesopotamia, Baluchistan, the Indus Valley and beyond. The foreign elements that demonstrate the nature of these trading links are of international significance as well.

The Abu Dhabi Authority for Culture and Heritage (ADACH), that was established in October 2005 and is the institution in charge of archaeology in Abu Dhabi, is aware of the importance of the Emirate's cultural heritage and is drafting plans to enhance its archaeological sites, especially those located in Al Ain, such as Hili and Hafit. Due to the sensitivity of the island and existing restrictions on access, no plan has yet been drafted for enhancing the treasures of Umm an-Nar.

When the oil refinery was established some 37 years ago, four tombs of Type C located on the northern tip of the southern plateau were destroyed. Although the tombs were unexcavated, they appear to have been less important than the rest of the cemetery. Apart from the destruction of these tombs, at the outer limits of the cemetery, the refinery unfortunately has a continuous impact on the ancient remains of the site.

The discolouration of the limestone walls that can be observed is mainly caused by emissions from the refinery and fumes emitted by aircraft using the nearby runway. The other impact of the refinery is its structure that clashes with the archaeology of the island. The high-tension power pylons that run very close to the site are another negative factor. Despite these factors, the archaeological area is very well-protected and maintained, and has largely retained its original shape, thanks to the fenced wall and the two watchmen who are based there.

The ancient harbour that was the main access route to Abu Dhabi from the outside world when the copper of Magan was exported to neighbouring lands some 4000 to 5000 years ago must be enhanced and presented to the public to tell the world of the glorious past of the UAE, thousands of years before the discovery of oil. I am still optimistic.

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1 The writer would like to thank Susan Hillyard for providing him, during her visit to the UAE. in May 2009, with an excerpt of her memoir related to the visit.
2 This sample which was measured on Libby's half life (5570) gave a date of 4240 ± 150 BP (un-calibrated). It was carried out by the University of Birmingham with the help of the Western Asiatic Department at the British Museum. Laboratory reference number: Birm-1054.
3 Thanks to late Sheikh Zayed bin Sultan Al Nahyan who advised the Danish team to examine Hasat al-Barka (the sitting stone). This proved to be one of the stones which belonged to what is now called the Hili Grand Tomb (designated site 1059 by the Danes).
4 The writer has divided the Umm an-Nar burials into three types (see below).
5 On the available contour maps at a scale 1:2500 that cover a 4.5 km-long stretch of this ridge, the writer has previously identified 905 graves. The actual number might exceed one thousand as the survey did not cover the southernmost section of the ridge(s). Although these are mainly Hafit-type graves, some might belong to the mid-3rd and 2nd millennia BC. None have been legally excavated but the writer has noticed a partly uncovered grave with evidence of a partition wall in the middle reminiscent of Type B on Umm an-Nar.
6 Bidya 2 was one of five sites discovered by the writer in 1987. Four of them belong to the Bronze Age and one to the Late Islamic period.
7 I would like to thank Dr. Husain Qandil for showing me an Umm an-Nar tomb of Type A at Hatta, in the interior of Dubai.
8 This was shown to me by Mr. Essa Abbas of the Sharjah Directorate of Archaeology.
9 I use the term 'desert site' because of their location, although, since the region enjoyed a wetter climate in the 3rd millennium BC, they might not have been in the 'desert' at the time.
10 Many sites in the Gulf region, mainly prehistoric, have been denuded of their surface finds by irresponsible amateurs.
11 There is some confusion here as excavations at Mound A started before Mound C by opening the Danish trench cutting the mound from east to west, therefore, the number 1013 should have been given to this area of excavations.
12 To prepare the house for restoration the writer had to uncover the exterior face of the northern wall of this house. Remains of another wall with evidence of large rooms attached to it run parallel to the Warehouse. This new house was in a very bad state of preservation and was only partially examined. Traces of the walls were hardly visible on the surface and do not indicate enough depth to understand the actual plan, as they peter out at the bedrock due to heavy erosion.
13 For a description of the writer's excavations on Mound B and their results see Al Tikriti 1981.
14 This catalogue was published in Frifelt 1991.
15 Re-cataloguing was carried out during several short visits made to the island, mainly in 2009. All graves were marked using small metal signs. Each has been defined with three characters (UNR) followed by the number (UNR 005–UNR 054).
16 A report on the skeletal remains from Umm an-Nar has been published in German by Manfred Kunter (in Frifelt 1991: 63–179). Another study was carried out on a collection of mandibles and loose teeth retrieved during the excavations by Karen Højgaard (Højgaard 1981).
17 For better understanding of the burial customs during the Umm an-Nar period, based on two Umm an-Nar burials at Hili, see McSweeney et al. 2008.
18 For more details on the connection with Mesopotamia and Baluchistan see the informative paper by the late Elisabeth During Caspers (1970: 205–276). See also Méry 1996 and Chapter VII of the writer's unpublished thesis (Al Tikriti 1981).

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Fifty Years of Emirates Archaeology

PERSPECTIVES FROM THE INDUS: CONTEXTS OF INTERACTION IN THE LATE HARAPPAN/POST-URBAN PERIOD

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INTRODUCTION

The evidence for cultural interaction in the late third and early second millennia BC between the Indus Valley and the Arabian Peninsula poses serious challenges to an understanding of trade relations during this period. Settlements on the alluvial plains of the Indus Valley, which had been at the centre of the civilisation's social, political and economic activities, were either reduced in size or no longer occupied. As Indus cities fell into disrepair or were abandoned, settlements were founded in other locations, populations shifted to previously more marginal regions, and trade networks were reorganised. The two regions most frequently cited as points of contact (Carter 2001; Potts 2005, 2009; Cleuziou and Tosi 2007; Højlund and Andersen 1994; Laursen 2008) are the Lower Indus and Gujarat, where the ceramic types Jhukar and Sorath Harappan have been discovered.

Although these final stages of the Indus Valley civilisation are poorly understood, my purpose here is to briefly review what is known about the Late Harappan in order to move toward a better understanding of Indus relations with the Arabian Gulf and its trading partners. After a discussion of the Late Harappan, I focus on the Jhukar ceramics in the Lower Indus and the Sorath Harappan and Late Harappan in Gujarat.

THE LATE HARAPPAN/ POST-URBAN – REGIONAL VARIABILITY

It is important to stress that the evidence for the Late Harappan is uneven and many questions about these terminal phases remain unanswered. What we do know is that there were significant changes that began at around 1900 BC in the Indus and Ghaggar-Hakra alluvial plains and in Kutch, where the major Harappan centers were located. These changes included a reduction in the size of cities, the abandonment of some and more sustained occupation of others, the displacement of populations and the founding of new settlements. The changes were gradual and not cataclysmic. They were the result of a complex of factors that included environmental, economic, social, political and ideological changes that differed regionally. Finally, as the interaction with Arabia demonstrates, although the Indus civilisation was transformed, some institutions appear to have survived.

I begin with a discussion of the Upper Indus, a region in which I have been engaged in field research and where the results of recent research at Harappa are providing new evidence with which to refine our understanding of the latest phases of occupation in this region. Observable changes are based on artefact inventories, architectural structures, archaeobotanical and zooarchaeological collections, regional surveys and palaeo-environmental data. Four of the mounds in the city remained occupied in the Late Harappan (Cemetery H, Mounds AB, E and F), although the site was reduced in size to less than 30 hectares. In each area, there is both continuity and change. Studies of Cemetery H indicate that, in spite of some changes in burial practices, there is continuity between the Urban and Late Harappan pottery styles. On Mound AB, the discovery of a hearth that is radiocarbon dated to ca. 1730 BC and a cache of materials that included beads and other objects, some of which were produced using the same techniques applied in the Urban period, also show continuity.

One of the changes that did occur is modifications in aspects of the economy. The agro-pastoral economy at Harappa was based on a multi-cropping strategy in which cereal grasses were the staple food produced. Wheat and barley were grown in winter and millets and other drought-resistant crops during the summer monsoon season. In the Late Harappan, summer crops became more important and barley, a drought-resistant crop, became the dominant cereal grain. There also was an increase in crop diversity but, as new plants, such as rice were introduced, existing plants were not abandoned (Weber 2003: 181–2). Finally, changes in cropping patterns suggest a shift from the centralised or communal processing practiced during the Urban period to one that was smaller in scale in the Late Harappan. This observation is based on the presence of residues of chaff among the seed remains, a possible indication that processing was taking place in households (Weber 1999, 2003; Fuller and Madella 2000). Thus far, only a small sample of zooarchaeological evidence has been published for the Late Harappan, but those results show a shift in the dominance of cattle in the Urban period to sheep and possibly goat in the Late Harappan (Miller 2004). This change may indicate a reduced need for traction animals used for transport and ploughing. Horses, donkeys, and camels were probably introduced into South Asia by the 2nd millennium BC (Meadow and Patel 2003: 83), but there is no evidence for their presence at Harappa in the Late Harappan.

Other economic changes and more broad-based political and social differences also are evident. The black-slipped storage jars used in interregional and intercultural transport systems are no longer produced. There is a diminished presence of some craft technologies and the Harappan administrative system (writing, weights,

seals) all but disappears. Architecturally, new structures were built that encroached on streets and public spaces, and there was a general disorderliness although many neighbourhoods continued to be populated (Meadow, Kenoyer and Wright 2001).

Finally, the results of palaeoclimate studies have shown that there were frequent fluctuations in climate, precipitation levels and stream migrations throughout the Urban and Late Harappan periods of occupation at Harappa. These fluctuations were most dramatic in the Late Harappan. Results of survey data from the now dry bed of the Beas River based on studies of soil sediments and archaeoclimate modelling show a sharp decrease in rainfall patterns involving changes in precipitation levels that are linked to variations in stream discharge beginning at around 2000 BC (Wright, Byrson and Schuldenrein 2008). These results are complemented by soil studies at Harappa (Amundson and Pendall 1991, Pendall and Amundson 1990). Additionally, the regional settlements on the Beas diminished in size and all but four were abandoned (Wright, Byrson and Schuldenrein 2008).

Taken together, the evidence at Harappa and its surrounding countryside documents a period of continuity and change. Harappa itself remained occupied for several hundred years after the Urban period until at least 1700 BC (Kenoyer 1998) and possibly as long as 1300 BC (Meadow, Kenoyer and Wright 2001). As I noted earlier, farmers appear to have been fine-tuned to their environment, judging by the adjustments made to cultivation and cropping patterns throughout the Urban and Late Harappan periods. Other evidence – the disappearance of its administrative technology and the absence of black-slipped transport jars – indicates significant changes in the broader political economy.

In the Lower Indus, Mohenjo-daro may have undergone a more rapid transformation than at Harappa. In any event, major buildings, such as the Great Bath, were abandoned, and there was a general disorder in its urban plan. At the nearby site of Chanhu-daro, that appears to have been a centre of craft production, Ernest Mackay (1943) found a similar disorder in which buildings were less substantial than in the Urban period. The discovery of a unique pottery style first identified at the site of Jhukar and found in the upper levels at Chanhu-daro suggested to him that there had been an intrusion of a new culture into the Lower Indus in the Late Harappan. Subsequent studies of this evidence by a number of Indus scholars have cast serious doubt on Mackay's interpretation. As Gregory Possehl noted many years ago, the close similarities between the Urban Harappan wares and the Jhukar are a manifestation of a transitional phase that marked the end of occupation at Chanhu-daro but not an intrusion of a new cultural group (Possehl 1977: 244). Another study, by Rafique Mughal (1990), compared the Jhukar pottery from Mohenjo-daro, Jhukar, Amri and Chanhu-daro to 'traditional' urban types. In view of the overlap in styles and the mixed lots in which many were discovered, he concluded that the two types overlapped. Finally, based on a re-analysis of the site plan at Chanhu-daro, Heidi Miller (2005) has argued against a break in the cultural sequence in spite of the disruptions in architecture. Later in this chapter, I describe the Jhukar pottery in more detail in view of its possible relevance to trade with the Gulf in the Late Harappan.

While we can now assume that there was continuity between the Urban and Late Harappan periods in the Lower Indus in its terminal stages of occupation, there were also significant changes in material culture that speak directly to the political economy in its final days. First, there is an absence of Jhukar pottery in any other region of the Indus, marking a break with the centres in the Upper Indus and Ghaggar-Hakra plains, since, thus far, no Jhukar ceramics have been identified there. Second, terracotta figurines are absent from Lower Indus assemblages, a feature that represents a break with aspects of an Indus ideology. Third, cubical stone weights and square stamp seals disappear, signalling the end of an administrative system that fostered interregional exchanges. Finally, the Jhukar phase is sparse, even when viewed regionally. The sites listed earlier are among a very few others aligned with this final era of urbanism in the Lower Indus. Recent surveys conducted by a team from the Shah Abdul Latif, Khairpur University, led by Nilofer Shaikh, did not yield any sites that could be assigned to this period (pers. comm.; Wright 2009: Figs. 4.6 and 5.12 for Early and Urban Harappan distributions).

This limited amount of information suggests that Mohenjo-daro continued to be occupied in the Late Harappan, but that it did so with a population reducing at a faster rate than at Harappa. It is impossible to attach an exact date to when settlements in the Lower Indus were abandoned but most, surely, around the beginning of the 2nd millennium.

The extensive research in the Lower Indus by Louis Flam and his colleagues (Flam 1993, Shroder 1993, Jorgensen et al. 1993) provides us with some of the environmental challenges that may have influenced the decline of populations in this region. The survey was focused on changes in the Lower Indus river system and was based on field research, historical sources, geomorphic and landform reconstructions and aerial photography. Interpretations of these data showed that over a period of several thousand years, there

were episodic and abrupt channel displacements in the Lower Indus, involving realignments in the river system. Between 4000 and 2000 BC, Mohenjo-daro was strategically located between two parallel river courses (Flam 1993, 1999), the Sindhu Nadi on the west and the Nara Nadi on the east. While these locations provided the city with extensive tracts for cultivation and animal husbandry, the shifting of the channels may have placed Mohenjo-daro in an imperilled position.

The shifts that occurred in the Lower Indus may have been related to others that occurred upstream on the Ghaggar-Hakra. Based on historical records, Wilhelmy (1969) proposed that flooding cycles documented during several periods in the history of the Ghaggar-Hakra had occurred in the Late Harappan, although there are no specific records dated to the Late Harappan. Other evidence based on sediment samples from different micro-environments on the Ghaggar plain by Marie-Agnès Courty documented drying conditions and disruptions of the predictable seasonal flooding cycle (1995) of the Ghaggar in the Late Harappan, although the precise timing of these events is uncertain. The drying of the Ghaggar-Hakra system affected major changes in the flow lines of the Nara Nadi, bringing about a 'widespread abandonment of many sites and a movement of population out of the Lower Indus basin into adjacent and more "stable" areas' (Flam 1999: 317). In Cholistan and settlements on the Hakra alluvial plain, Mughal set the end of the Late Harappan in Cholistan between 1700 and 1500 BC. He based his dates on the results of excavations at settlements on the Ghaggar plain, where there is stratigraphic continuity between Late Harappan and Painted Gray Ware (PGW) ceramic styles (Shaffer and Lichtenstein 1999). Reports of terminal dates for the PGW vary from 1100–500 BC (Possehl 2003), 1200–800 BC (Kenoyer 1998), and 1700–1400 BC (Bisht 1982: 122), leaving doubts of the precise timing of these events.

These environmental disruptions of annual flooding cycles made an impact on Mohenjo-daro's agro-pastoralist economy and its inter-regional networks in the Lower Indus and most likely on the Ghaggar-Hakra plains. In Cholistan and on the Ghaggar plain, there were settlement shifts to upstream locations, the movement of people and the founding of new settlements. Unfortunately, we do not have the kind of detailed data available in other areas, to be discussed below in Gujarat and in my earlier discussion of the Upper Indus, with which to determine whether people on the Ghaggar-Hakra plains and in the Lower Indus were making adjustments to their agricultural and husbandry practices and the political consequences to the society as a whole. Issues like these cannot be resolved without additional excavations, geoarchaeological research and the collection of archaeobotanical and zooarchaeological evidence and more details on other changes that would have affected the social, political and economic factors there.

Two other regions of relevance are on the margins of the alluvial plain. To the west of the Indus in northern and southern Baluchistan, important settlement shifts and realignments of cultures were taking place. In south-eastern Baluchistan, the Kulli complex that dominated the area in the Indus Urban period appears to have ended by 1900 BC (Franke 2008: 669). In northern Baluchistan, however, while some settlements were abandoned coincident with the Late Harappan, the excavations at Pirak, to the north-west of Jhukar, raise an interesting set of problems, since they may provide stylistic links to the Jhukar phase (Kenoyer 1998: 177) that would establish continuity of this tradition. Pirak was occupied between 1800 and 600 BC (Jarrige, Enault and Santoni 1979). Mackay had noted the similarities of the Jhukar decoration with examples from northern Baluchistan but he discounted this possibility based on distance and difficulties of travel (Mackay 1943: 131). It is an interpretation that takes us beyond the limitations of this paper, but clearly is an issue worthy of some additional investigation.

To the south-east of the Indus plain in Kutch and Gujarat, the trajectory of change varied within the region. At Dholavira, the dramatic changes in its urban layout are suggestive of a breakdown in civic authority. At Kuntasi, a major centre for the production of shell objects, industrial activities known from the Urban period ceased, putting an end to the trade networks established between the site and the interior. These changes coincide with the evidence from Harappa, where marine shell all but disappears (Kenoyer 1998: 175). Lothal continued to be occupied until 1750 BC, though it was diminished in size (from less than 4.2 ha). In addition, chert and agate cubical stone weights at Lothal are replaced with 'truncated spheroid weights of schist and sandstone larger in size than the earlier ones' and the type of seal used differs from the more traditional square stamp seals (Rao 1985: 36), signalling the end of an administrative system that fostered inter-regional exchanges.

Along with these changes, there is an increase in the number of settlements in Gujarat in the area of Saurasthra. This was either the result of an influx of new groups or the settlement of hunter/gatherers. If the former, these shifts parallel those that were taking place in north-west India, which are suggestive of a movement away from the alluvial plain and the principal centres of the Indus. In any event, new aspects of material

culture and architectural building projects indicate a revitalisation of the culture. At Rojdi, where there is a good stratigraphic sequence, a new building project was undertaken that included an outer gateway and has been dated to 1750 BC (Possehl and Raval 1989). Other sites in Saurasthra, such as Rangpur, may have survived to the end of the 2nd millennium BC (Rao 1963).

Rojdi is a small site (7.5 ha) – though larger than Lothal – on the margins of the Indus, both physically and culturally. The physical environment there is characterised by low levels of precipitation and sporadic heavy rains during the monsoon. In the Urban period, its economy was based on an agricultural and pastoral economy that included small-scale irrigation during non-monsoon months and dry farming of millets during summer monsoons. In Rojdi C, the Late Harappan, plant-use involved the continuation of this pattern but there also was 'a broadening and intensification of plant-use strategies' (Weber 1991: 183). Interpreting these patterns is complex, but Steven Weber, the archaeobotanist who analysed the plant remains at Rojdi, suggests several possibilities that could account for these changes. The abundance of some species that are 'low-preference foods' could be a response to food stress, while the intensification of cropping patterns might suggest 'changes in the ratio of population to resources' (Weber 1991: 165) or a shift to household processing in which less preferred foods are present in seed residues, as discussed at Harappa (S. Weber, pers. comm.). Still, the presence of non-indigenous plant species may be related to the shifts occurring in other parts of the Indus as described earlier. The increased density of people brought about by immigration could also be a contributing factor (Weber 1991: 166).

In Gujarat, then, there were significant differences within the regional settlement pattern. At a time when important settlements, such as at Kuntasi and Dholavira, were abandoned, new populations – possibly from the Lower Indus where there appears to have been a break down of the economic, social and political organisation – moved into the region. At Rojdi, the multi-cropping was a resilient strategy that sustained its agricultural economy during these changing times. More marginal to the great centres of the Indus in the Urban period, the Sorath Harappan sites may have remained 'solidly buffered' against the changes occurring on the alluvial plains (Meadow and Patel 2003: 86).

Finally, the recent evidence from the site of Gilund in Rajasthan presents new challenges that raise additional questions concerning the nature of contact and introduces a new field of players. Based on comparisons of seals and unfired clay tokens from Tell Abraq, Failaka, Saar and Qala'at al-Bahrain, Dan Potts (2005) has pointed out parallels to recent finds in Rajasthan at Gilund in the Ahar-Banas culture. As far as is known, there were no previous contacts between Rajasthan and the Gulf. The round seals, sealings and tokens with geometric motifs have been discovered in a wide geographical sphere including at Chanhu-daro, Pirak, Nindowari and the Bactrian Margiana Complex (BMAC). A study conducted by Marta Ameri clarifies aspects of the glyptic evidence (Ameri 2010). For now, we are left with an additional complication of an already complex issue regarding exchange relations in the Late Harappan and the Gulf.

UNDERSTANDING 'COLLAPSE', TRANSFORMATIONS AND TRADE NETWORKS IN THE LATE HARAPPAN

As I noted early in this paper, our evidence for the Late Harappan is spotty and the chronology imprecise. There are few absolute dates and a limited number of sites based on recent excavations involving multidisciplinary teams with which to refine our understanding of the Late Harappan. What can be said is that the changes were variable regionally and there is no single cause. At Mohenjo-daro and along the Ghaggar-Hakra, there clearly were disruptions of the river systems, but we lack precise data to determine whether they were coincident with similar changes elsewhere. On the other hand, at Harappa, where precipitation levels and changes in river systems are documented, the city appears to have continued to be populated – albeit by smaller numbers of people – for several hundred years after these environmental changes occurred. In Gujarat, an influx of populations, possibly the result of migrations of people from the Lower Indus, also may have resulted in changes in cropping patterns. In the latter two instances, the Harappans seem to have been fine-tuned to their environment and demonstrated resilience in the face of changed circumstances.

What we can say with some certainty is that there was a breakdown in communication networks on the Indus alluvial plains. As I noted above, the absence of the weights, seals and script signalled a disruption of trade patterns and some production systems in general. More specifically, at Mohenjo-daro, it seems

unlikely that flows of resources to and from other Indus settlements or resource zones continued. But questions remain concerning the ceramics (Jhukar) from the Lower Indus, the Sorath Harappan and other Late Harappan wares from Gujarat that may have made their way to the Arabian Peninsula. Following Possehl, the Sorath Harappan refers to sites in Saurasthra, specifically here Rojdi, while I use the more general term, Late Harappan, with reference to materials from Lothal (Possehl 1977: 248–253).

THE SORATH HARAPPAN, JHUKAR AND LATE HARAPPAN INTERACTION

The population shifts and major changes at Harappan centres clearly altered Indus social and economic networks, but trade with cultural groups in the Gulf continued in the Late Harappan. It has generally been assumed that during the Indus Urban period trade was carried out by merchants that either operated autonomously or were very loosely controlled by urban rulers. The continuation of trade with the Gulf raises questions about its direction, its origins and social and economic circumstances under which it took place in the Late Harappan.

New ceramic forms, principally large storage jars, originating in the Indus are found distributed at coastal and interior sites on the Arabian Peninsula. This new type of storage jar is present at Saar, Qala'at al-Bahrain, Tell Abraq, and Shimal (Carter 2001). They appear in stratigraphic levels that correspond approximately to the early 2nd millennium BC. At Saar, intrusive ceramics have been compared to the Sorath Harappan in Gujarat at Rojdi and to Lothal B. Similarities have been noted as well to the Jhukar at Mohenjo-daro and Chanhu-daro (Carter 2001: 187, Table 1). At Qala'at al-Bahrain, large jars assigned to an 'eastern domain' (Højlund and Andersen 1994) have been identified as Sorath Harappan (G. Possehl, pers. comm.). Storage jars from Shimal and Tell Abraq also have close parallels to Late Harappan/ Sorath Harappan (Potts 1994, Carter 2001). At Ra's al-Jinz, fine red-ware bowls and a small jar with graffito have been identified as 'pottery of possible Indian origin' (Cleuziou and Tosi 2007: 272) in the Wadi Suq period (ca. 2000–1700 BC). Of the pottery illustrated, two vessel forms (Cleuziou and Tosi 2007: Fig. 292.1–2) may be comparable to Sorath Harappan Fine Ware Bowls from Rojdi C (Possehl and Raval 1989: 96-99; Fig. 51.4, 7–9); a looped design on a large jar (Cleuziou and Tosi 2007: Fig. 292.4) to examples from Lothal (Rao 1985: Fig. 91), and the small jar (Cleuziou and Tosi 2007: Fig. 292.3) to the Fine Ware Jars at Rojdi (Possehl and Raval 1989: Fig. 52.4–5). This potential connection requires additional study.

There do not appear to be significant changes in the vessel forms and design from previous periods in the Sorath Harappan (Possehl and Herman 1990: 300). New forms evolved from older styles and include open and closed-mouthed large storage jars, bowls that are 'straight-sided and S-shaped … medium-sized pots with long necks, jar stands and the Suarasthra lamp'. Rims are beaded and everted downward; others are 'outsplayed' (Possehl and Herman 1990: 309). Almost all of the Sorath Harappan are slipped, smoothed, painted, polished and burnished. The vessel pictured in Fig. 1 is a typical example of a Painted Fine Ware Storage jar with a geometric design and graffito from Rojdi C. The exterior of the vessel, which was colourised by Possehl to conform to the original vessel, has colour effects in which different parts of the body differ, a style that is characteristic of the Sorath Harappan pottery. On this jar, the neck (reddish-brown slip), shoulder (light yellow-

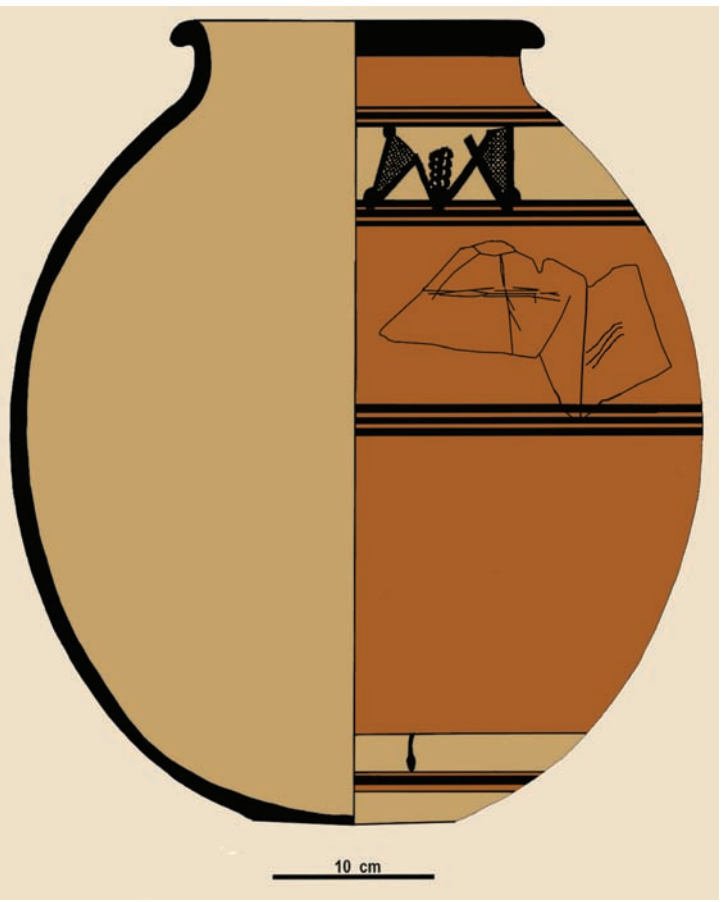

Fig. 1. Large jar (colourised) from Rojdi C. (after Possehl and Raval 1989: Fig. 72). Courtesy: G.L. Possehl.

brown unslipped band), body (light-red slip) and base (reddish-brown unslipped), and unslipped horizontal band at the shoulder and base is described as a '"slipped-cum-unslipped" surface treatment' that 'conveys a "bichrome effect"' (Possehl and Raval 1989: 131). This bichrome effect and differences in colour shading appear to be the result of variations in the mixing of pigments and regulation of firing atmospheres. A difference between the Sorath Harappan and the Late Harappan Lothal wares is that a 'small quantity' of large jars at Lothal were treated with a buff slip (Rao 1985: Fig. 85). An analysis by B.B. Lal of the buff slip was described as a 'yellow ochreous calcareous clay … with some white mica' (Lal 1985: 472). The design elements on the Rojdi jar are typical of the Sorath Harappan and are described as 'dots, crossing lines, net crossed and wavy lines' (Possehl and Raval 1989: 139). In addition to the slips on this jar, others are described as reddish-yellow and various hues of red. Paints are red, black, brown, purple brown, grayish-brown and reddish-grey.

Fig. 2. Jar fragment from Rojdi C. Courtesy: G.L. Possehl.

The Sorath Harappan jar shown in Fig. 2 from Rojdi is a fragment with similar colour effects and a typical hatched rhomb. In addition to the net or 'crossing lines' pattern in Fig. 2, the eight intersecting lines with balls at their tips is comparable to the Late Harappan jars at Lothal, where the motif is described as a 'conventional flower' (Rao 1985: Fig. 94.128–129; see also Nanavati, Mehta and Chowdhary 1971: Fig.18.IR 5). Leaves are the most common naturalistic motifs, but rarer forms are wheat chaff, peacock, bulls or fish. Other geometrics include: balls, squares or labyrinths, loops, intersecting loops, and straight and wavy, vertical or horizontal lines. Fillers include: hatches, dashes, chevrons, diagonal, horizontal or straight lines. The jar from Saar (Fig. 3) has a 'bichrome effect' similar to the Rojdi C jar (Fig.1) and Fig. 4, a jar fragment from Saar, bears the hatched rhombs and wheat sprig typical of Sorath Harappan types from

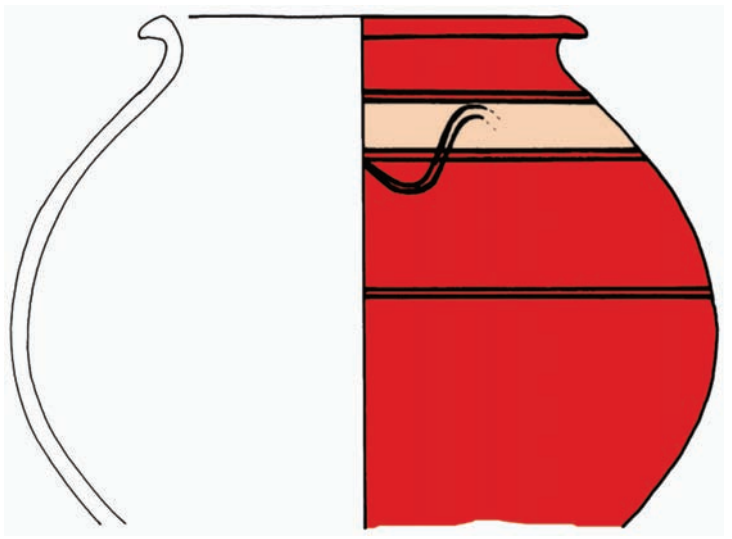

Fig. 3. Large jar (colourised) from Saar with 'bichrome effect'. Courtesy: R.A. Carter and R. Killick.

Fig. 4. Jar fragment from Saar with hatched rhombs Courtesy: R.A. Carter and R. Killick.

Rojdi and examples from Lothal. In both instances, the surface slip does not match the examples from Rojdi and published descriptions. This same discrepancy in the use of exterior slips occurs with a jar fragment from Bahrain. The motif on the jar (Fig. 5), from a burial mound in the Buri Cemetery at Hamad Town (S. T. Laursen, pers. comm. [Season 1982–83, BNN, Burial Mound 230]) carries the 'conventional flower' design like the Rojdi example shown here and others at Lothal, but its exterior surface is black-on-orange. Although the vessel shapes and motifs on the examples from Saar (Figs. 3–4) and the burial mounds at Hamad Town match the Sorath Harappan examples from Rojdi, the exterior slips on the examples from Saar (Figs. 3–4) and the burial mound in Bahrain (Fig. 5) differ from those at Rojdi. On the other hand, the large jar (Fig. 6) from Karzakhan Cemetery at Hamad Town (S. T. Laursen, pers. comm. [Season 1982-83, BNN, Burial Mound 1, Grave 20, Square D5]) carries a peacock design that is represented at both Rojdi and Lothal and the slip could match wares from

both Rojdi and Lothal. These various examples raise questions about the origins of the ceramics in Bahrain and elsewhere. Either of the above-illustrated jars might match the red slip on Late Harappan types from Lothal, where they are described simply as 'light to dull red'.

Fig. 5. Large jar with 'conventional flower' motif (#A 4780: Buri Cemetery, Hamad Town, Season 1982–83, Excavation Area: BNN, Burial Mound: 230). Courtesy: S.T. Laursen.

As I discussed in the above, the Jhukar pottery is found in mixed lots at Chanhu-daro and re-analyses of the site plan, stratigraphy and comparisons with Harappan pottery suggest that it was not intrusive. Many of the Jhukar vessel forms are the same as the Harappan with slight variations in base construction and motifs. Still, there are visible differences and it is reasonably easy to differentiate them. The two sherds from Chanhu-daro (Fig. 7) illustrate some of these differences. The surface of the Jhukar ceramic on the left is matt and the red slip and black paint have a slightly different red/orange hue from the lustrous surface of the traditional Harappan wares on the right. On closer inspection, the Jhukar fabrics are coarser and more porous than the Harappan ceramics. Many have voids from chaff that are clearly visible on their surfaces, although others do not. Mica visible on the surface is less dense than in Harappan ceramics. In addition to red-slipped wares with black paint, other designs are painted on a plain buff body (Fig. 8) or a cream colored slip (Fig. 9). Paints are red, dark red and blacks with brown and purple hues, the latter most likely due to manganese oxide pigments. Technical features such as trimming at the base and neck of the vessel are consistent with the earlier Harappan pottery.

Fig. 6. Large jar with peacock motif (#A 19067: Karzakhan Cemetery, Hamad Town, Season 1986–87, Excavation Area: BSW, Burial Mound: 1, Grave 20, Square D5). Courtesy: S.T. Laursen.

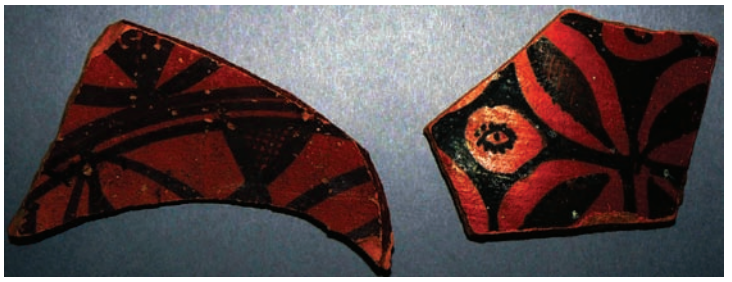

Fig. 7. Jhukar and Harappan ceramics from Chanhu-daro (Peabody Museum Collection, #40-30-60/6948). Copyright 2009: President and Fellows of Harvard College.

There are many different vessel shapes and design motifs in the Jhukar corpus. The principal forms include footed and pedestalled bases, spouted vessels, lamps (these forms differ from the Sorath Harappan lamps),

and storage vessels. The latter differ from the black-slipped storage jars from the preceding period. Many have narrow necks, while others have a slight 'ribbing' between the neck and shoulder as in (Fig. 8). Bases are flat or occasionally rounded. A major difference between the earlier Harappan pottery and the Jhukar are the design motifs. Although there is a resemblance between the motifs employed in the previous period, Jhukar motifs are principally geometric, in distinction to the Harappan designs in which figurative motifs represent narrative scenes of water plants and other natural phenomena. Like the Sorath Harappan ceramics, bent and straight leaves are common on Jhukar pottery and there also are occasional peacocks and animals. Geometrics include: balls with or without stems, rhombs, squares, loops, straight, wavy and horizontal lines, but not intersecting loops, labyrinths or the abstract conventional flower motif common on the Sorath Harappan and Late Harappan wares at Lothal. The same fillers employed on the Sorath Harappan and the Lothal, Late Harappan wares are all part of the Jhukar potter's repertoire and motifs are rarely left without some filler. Squares, for example, may be completely filled with paint. Different from the Sorath Harappan and Late Harappan at Lothal is a playful aspect of surface treatments, in which fillers or dashed and wavy lines are painted with alternating red and black colours. The Jhukar potters produced bichrome effects and true polychromes. For example, leaves may be outlined in black and filled in with red paint and drawn on a field of cream-coloured slip. These eye-catching designs show an innovative side to the potter's craft and a technical virtuosity in achieving the results.

Fig. 8. Jhukar, large jar fragment from Chanhu-daro (Peabody Museum Collection, #40-30-60/6851). Copyright 2009: President and Fellows of Harvard College.

Fig. 9. Jhukar ceramics with cream slip from Chanhu-daro (Peabody Museum Collection, #40-30-60/6796). Copyright 2009: President and Fellows of Harvard College.

This very brief outline of the attributes of the Sorath Harappan, Late Harappan at Lothal and Jhukar pottery styles demonstrates that there are motifs, specificities of form and technical elements that are common to both while others set them apart from one another. The Sorath Harappan and Late Harappan conventional flower motif is not represented on the Jhukar; fillers are common on both types but motifs that are totally filled are only represented on the Jhukar. Cream-coloured slips and true polychromes (the use of red, black and cream slip on a single vessel) are only found on the Jhukar with the exception of a few illustrated examples from Lothal described earlier. The Jhukar polychrome designs are rendered in primary colours (true reds and blacks) often on cream slips. Their slipped exteriors are red/orange and painted black. The style of decoration involving unslipped panels at the shoulder found on Sorath Harappan jars (Carter 2001: 185) appears to be a unique feature that is not part of the Jhukar 'style'. Other design elements noted by Carter such as the 'enclosed net pattern' (referred to here as squares, triangles, rhombs, etc. with fillers of various types, i.e.

lines, dashes, etc.) and more 'complex combination of motifs' are, as he noted, decorations that are common to Jhukar, Sorath Harappan and Late Harappan ceramics at Lothal (Carter 2001: 186). The design elements as 'dots, crossing lines, net crossed and wavy lines' (Possehl and Raval 1990: 139) are typical of the latter two and rare on the Jhukar (Rao 1985: Figs. 88–89).

Based on preliminary study of the Jhukar and the limited chemical analyses of the wares at Lothal, these two types (possibly also the Sorath Harappan that have not been analysed) appear to share a common technology in which manganiferous pigments are manipulated for different colour effects. Additionally, there are surface features and technical elements, such as the occasional use of chaff, that suggest all three types are based on a similar technology. There also are illustrated examples of sherds with similar designs, for example, occasional chevron patterns common on Jhukar and isolated Late Harappan examples from Lothal (Rao 1985: Fig. 92.B90). Others include comparisons by Rao of types at Lothal and Jhukar motifs (Rao 1985: Fig. 88 and Mackay 1943: Fig. 47). These comparisons among the Jhukar, Sorath Harappan and Late Harappan ceramics need to be verified by a more thorough study based on macro- and microscopic analyses of their stylistic and technological attributes.

CONCLUSIONS AND FURTHER QUESTIONS

Returning to parallels with the design and form of ceramics present on the Arabian Peninsula, this comparison suggests that the closest parallels are to the Sorath Harappan with some caveats. There are many similarities in vessel form and design motifs, but the surface characteristics, their colour and lustre, of the Sorath Harappan from Rojdi, though possibly not from Lothal, differ from the examples from Bahrain. Hand examination of Sorath Harappan from Rojdi and at other sites, especially Lothal, may clarify these differences. Still, the presence of the signature 'conventional flower' motif, the use of rhombs and fillers demonstrate contact between Arabia and the region of Gujarat during this period and requires more intensive study. Finally, Cleuziou and Tosi (2008) have suggested that the bowls discovered in Oman are imports. Their closest parallels are also to the Sorath Harappan. There are no comparable forms among the Jhukar types.

What also remains unclear and could be resolved by sourcing and technical analyses is whether the Sorath Harappan ceramics represent new exchange relations or a continuation of those established in the preceding period. Based on comparisons of the mineralogy of a selection of pottery from Mature Harappan contexts from Ra's al-Jinz and Lothal, V.D. Gogte (2000) have documented close comparisons between the two. Is the trade in the Late Harappan a continuation of earlier contacts with Lothal or a reorganisation in which Rojdi, Lothal and possibly other settlements became trading partners with settlements in Arabia? The replacement of the traditional Harappan weights with 'truncated spheroid weights of schist and sandstone' that are larger in size than the standard Harappan weights (Rao 1985: 36) and the careless rendering of script indicates some restructuring of trade networks may have taken place. Are the Sorath Harappan and Late Harappan (Lothal) ceramic types in Gujarat from a single source or multiple sources? Are the production technologies of the Sorath Harappan, Late Harappan and Jhukar ceramics a shared, independently invented style, or a product of emulation? Did potters from the Lower Indus migrate to Gujarat or exchange their wares, taking up routes travelled in earlier Urban times? And finally, are these changes connected to the new finds at Gilund and possible restructured relations within neighbouring regions of Rajasthan and the Ahar-Banas culture (Potts 2005)? There clearly are more avenues of research needed in order to fill in important gaps in our understanding of this critical period and its relations with cultures in Arabia.

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Fifty Years of Emirates Archaeology

THE RESTORATION OF TOMB 154 AT BAT

Manfred Böhme (Halle/Saale)

INTRODUCTION

This chapter examines the construction principles of a collective burial of the Umm an-Nar period. The example chosen is Tomb 154 in the Bat necropolis, part of the 'Bat, Al-Ayn, Khutum' UNESCO World Heritage Monument in the Sultanate of Oman. This tomb was excavated and subsequently restored between 2005 and 2008 under the aegis of the 'Bat Research and Restoration Project', and I am very grateful to the people of Oman who worked on the Bat Project. The work was financed by the Ministry of Heritage & Culture (Muscat) and was conducted under its auspices. The German Mining Museum (Bochum), acting as a cooperative partner, led the excavation.

With the discovery of tombs on the island of Umm an-Nar, archaeological research in the United Arab Emirates began. It soon became clear that the newly defined culture was widespread all over the Oman Peninsula (Frifelt 1991: 8–11). The Bat cemetery played an important part in this development as the Danish Expedition began the very first comprehensive study of Oman's prehistory (Cleuziou/Tosi 2007: Fig. 141). The investigation of two Umm an-Nar period tombs at the Bat site was led by Karen Frifelt in 1973. A sounding outside tomb 154 (previously identified as Frifelt's activity no. 1144 and her tomb no. 54) was undertaken in order to examine details of the facing stones (Frifelt 1975: Fig. 80; Cleuziou and Tosi 2007: Fig. 113). Over the following years, field research by teams directed by Beatrice de Cardi excavated and recorded Umm an-Nar-period tombs in the wider environs of Bat, e.g. Amlah and Banah (de Cardi, Collier and Doe 1976). The appearance of trimmed white limestone was always a distinguishing feature in identifying Umm an-Nar-type architecture. Due to their being frequently sited on flat *wadi* terraces, the stones from Umm an-Nar-period tombs were often robbed. This is why only a few survive in well-preserved condition. Consequently, determining the original shape of the Umm an-Nar tombs is much more difficult than it is for Hafit-period tombs.

This topic will be discussed using the example of monument 154. In the central part of the Bat necropolis (Frifelt 1975: Fig. 5) we can find twelve tombs of this construction type, faced with trimmed white limestone, with an additional eleven nearby. Grave 154 is the best-preserved. The corbelled vault was in such relatively good condition that two chambers could still be distinguished even though the tomb was only partially intact. An architectural sketch of a section through the tomb was published in 1983 (Doe 1983: Fig. 8; Vogt 1985: Fig. 43.1). The ground plans of Umm an-Nar tombs are often discussed (Frifelt 1975: Fig. 1). The spectacularly good condition of tomb 154 was proven by a trench excavated inside the western chamber in 2005 (Fig. 1). Whereas the inner construction has, so far, been relatively easy to describe, opinions about its external appearance have been divided.

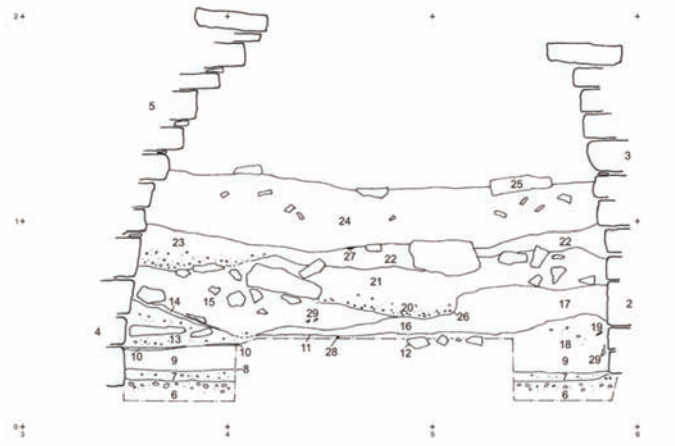

Fig. 1. Bat, tomb 154; section of western chamber. Fill, with traces of reuse for burials and traces of robbers' pits. Grid 1 m.

EXCAVATION AND ORIGINAL CONSTRUCTION OF TOMB 154

During the excavation of the ruins, appropriate documentation of the stone rubble and recording of the stratigraphy was of great importance. The stones (in particular the non-local ones) within the rubble provide important evidence concerning the former shape and especially the design of the tomb.

While excavating tomb 154, we stored all stone according to its origin, size and quality. This would allow us to make calculations regarding the tomb's structure. About fifteen per cent of the original white limestone facing-stones were recovered within the stone rubble and sediment. Their original positions can be tentatively determined by considering their size and location within the fallen rubble. The missing cubes were robbed. The entrance passage was still preserved and is triangular-shaped. Opposite the entrance, and on the same axis, is a support wall that runs north-east to the ring wall, where the masonry is interlinked, creating a two-chambered tomb. The unpaved floor was prepared only with *wadi* gravel.

The area requiring roofing in each chamber was 2.4 m wide. The base diameter of the entire building was 8.8 m. The ring wall at the base level was 1.3 m thick. The

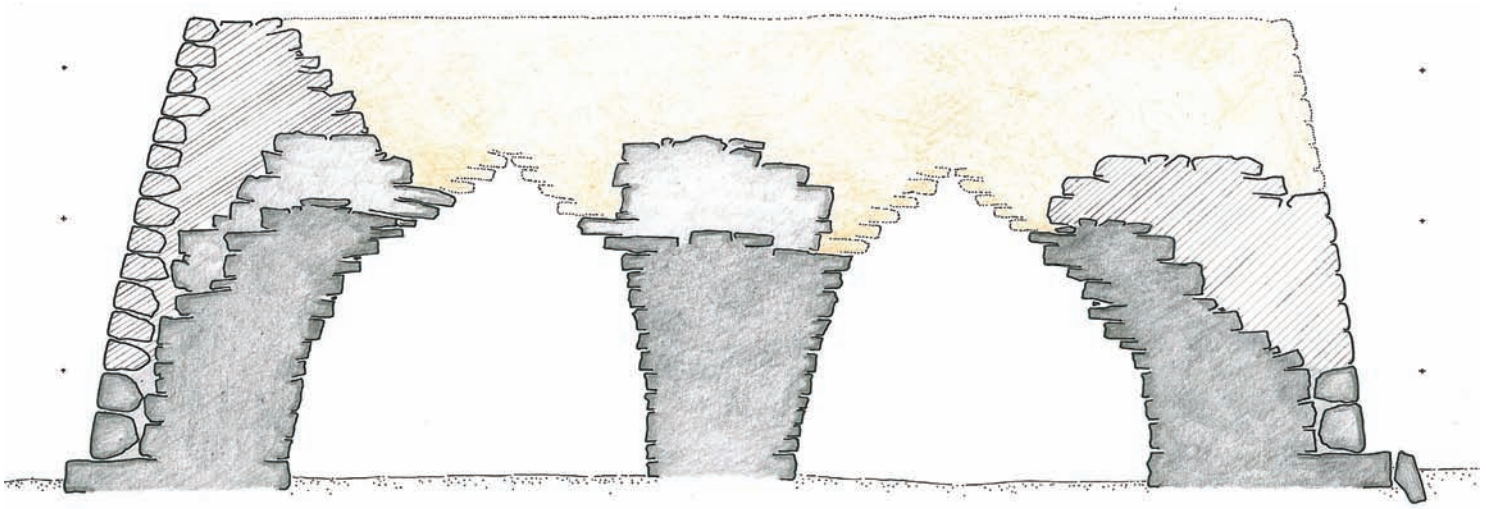

Fig. 2. Bat, tomb 154; east-west section. Status of preserved, reconstructed parts and the proposed former shape. Key: dark = original; preserved parts in east-west section; grey = evidence of preserved masonry outside the section; hatched = reconstruction 2008; yellow = missing parts, completed in drawing; grid = 1 m.

foundation is slightly larger, due to the protruding plinth (Fig. 2). We discovered two courses of white limestone facing stones *in situ*. The third course (Frifelt 1975: Fig. 80) was certainly not in its original position.

We recorded some indications in the masonry that could be evidence of an interruption in construction activity. Some time probably elapsed between the building of the foundation and the erection of the masonry above it, perhaps one or more years. By that time, the foundation had already begun to sag. This was not corrected during further phases of construction. Rather, the differences were compensated for by adapting the facing stones. Time passed, probably due to another interruption in the construction, and the orientation of the door was changed. It seems that the first plan gave way to another concept. This is shown by the two threshold slabs, of high-quality preparation, which may have fixed the original position of the axis. The orientation of the new entrance deviated from the former axis by several degrees (Fig. 3). These two observations suggest that the erection of the foundation and/or the first courses of masonry, were a 'statement of intent' to the community.

The construction of the internal wall took place at the same time as the construction of the facing stones, layer by layer. This was necessary to achieve stability. The construction of this kind of facing is risky from the static load point of view as the form of the 'sugar-lumps'[1] are rounded with a tapering triangular shape on the reverse side. This means that the facing stones are predominantly in contact with each other at the surface joints. This negative effect was partly compensated for by a dense dovetailing of the facing cubes with the internal masonry. In addition, mortar made of a mixture of quicklime and loam was used (Fig. 4).

Fig. 3. Bat, tomb 154; detail of the passage threshold from the interior. Scale 0.5 m.

After the facing stones were robbed or fell down due to processes of decay, a 'negative' imprint was left on the masonry core (Fig. 5). We can see a steep, straight line of masonry running upwards, preserved to a height of 1.7 m. This means that the vertical line of the facing outer skin was also almost straight with only a very slight curvature. This provides conclusive evidence for determining the outer shape of this type of tomb, indicating that it must have been a truncated cone with a flat top. A minimum height of 3.0 m is indicated by the fact that the last course closing the vault is c. 2.1–2.4 m high and an additional 0.5 m of extra covering above the dome would have been necessary to ensure the static function (Fig. 2).

In order to estimate the former maximum height, we need to calculate the volume of the stone rubble around the ruined tomb. This volume is a useful parameter in calculating the entire missing volume of the original structure. Depending on the character of the masonry

type or packing, 1 m^3 of rubble represents 3–5 m^3 of former structure. After our restoration work and reuse of all the original stones, approximately 2 m^3 of rubble was left. This would be enough for a constructional volume of 6 to 8 m^3, enough to complete the missing parts of the vault and the packing above. The hypothetical maximum height could not, therefore, have been over 3.2–3.4 m. The indications suggesting a flat roof are also confirmed by the evidence of rain gutters, one of which was found in the Bat cemetery (Cleuziou and Tosi 2007: Fig. 116). Because quicklime was used in the tomb construction, it is presumed that the flat roof was made watertight by a dense layer of quicklime.

Fig. 4. Bat, tomb 154; the evidence of mortar with quicklime. Scale 10 cm.

Fig. 5. Bat, tomb 154; the ring wall and the remains of facing stones after excavation.

With a diameter of 8.8 m and a height of a maximum of 3.4 m, this Umm an-Nar monument consists of 160 m^3 of mainly unworked stones and 18 m^3 of white limestone for the facing. In addition, 4 m^3 of white limestone were left behind as waste material. This means that 22 m^3 of white limestone were moved from the quarries, some 2.5 to 5.5 km away, whereas the material for the interior construction was sourced locally. Altogether (subtracting twenty per cent of the potential volume to allow for hollow spaces between the stones), the monument has a weight of 300 tonnes.

Even allowing for the use of a simpler construction technique for the internal wall, every stone used still had to be lifted, held and turned around several times by several persons, until a suitable place was found to insert it. About twenty per cent of the stones from the inner construction were trimmed, too. The outer skin consists of approximately 800 to 1000 pieces. The production of the white limestone-facing cubes also required a lot of work. From our restoration work and reproduction of the white limestone-facing stones, we are able to estimate the manpower expended at the time of the original construction. If eight persons worked full time, the monument could have been finished in two or three years. This calculation includes the procurement and transport of all building materials as well.

Altogether, it building tomb 154 was an immense achievement. This profligate use of economic potential – the manpower to construct the monument – represented an enormous sacrifice and a gift for the deceased, a very important fact often forgotten in the face of the burial finds contained in such tombs.

DATING: USE AND REUSE

Tomb 154 was used over a long period of time. Periodically, the floor was completely cleaned for the next funerary cycle. All of the skeletal remains and grave goods were deposited in pits outside the tomb. Some of the finds in the pits must be representative of the very first funerary rites, when the use of the monument began. Consequently, these items provide us with a terminus ante quem for the date of the tomb construction. The range of ceramic types present suggests the first use of the tomb was during the later Umm an-Nar period, corresponding with Cleuziou's Stage 4 (according to Cleuziou 2002). Later use is attested by ceramics belonging to Stage 5. Still later finds from the Wadi Suq period were found inside the chamber.

The date of the tomb is also suggested by its position vis-à-vis the internal sequence of tomb group to which it belongs. The discovery of spolia, originating from tombs in the neighbourhood, is important in this regard. To

summarise, tomb 154 belongs to Stage 4 (Cleuziou 2002). Iron Age burials were interred when the monument was already a ruin and the chambers had filled up with soil.

Because tomb 154 was the last construction in this area, it was not subject to the stone robbing that was common in the Umm an-Nar culture (Fig. 9). The signs of stone robbery point rather to a gradual, long-lasting process which was limited to a certain degree by respect and avoidance. The ruin continued to exert a certain attraction and that is why we find traces of later activities (e.g. hearths) beside and in front of the monument's entrance. The rites involved seem to have been linked to the location's meaning for local people through time. Frequent visits and walking on the stones led to some 'sugar-lumps' having polished surfaces. There were also some attempts to replace missing white limestone-facing stones.

ORGANISATION AND TECHNOLOGY OF THE STONEMASONS' WORK

In contrast to the Hafit-period graves, the architectural and technological know-how displayed by the Umm an-Nar-period tombs was more sophisticated (Cleuziou and Tosi 2007: 129). We should also consider an additional point: the complexity of the organisation and planning. Survey and excavation in the Bat area can contribute insights about the organisation of the building project, beginning with the choice of raw material, the procurement of white limestone at quarries, the transportation of the stone, and the working of the stones in workshops leading to the finishing and fitting of the masonry.

We were fortunate to find the quarries at which the white limestone was procured. To date, eight exploitation areas have been mapped. They extend along the southern slope of the Jebel Hawra as far as Wahrah to the north and north-west of Bat. The rock formations there are from a light middle Triassic to late Cretaceous limestone. Natural pieces of boulders on the slopes were used. Weathering of the block fields contributed to the fact that many different sizes were available. Some larger, irregular boulders of up to 2 m^3 were split and carried away. Flakes and semi-finished products indicate the positions of workshops in the quarry areas (Fig. 6). Flat areas on the slope were prepared as workshops. This is truly a monument of Bronze Age technology worthy of protection!

Fig. 6. Bat, a workshop at the quarry with some semi-finished products.

The prepared, rough cubes were transported over a distance of 2.5 to 5.5 km to the construction site in the Bat necropolis. The further treatment of the limestone consisted of three or four separate stages of preparation, each of which produced a different, yet typical, type of waste stone. The different phases of work took place in several workshop areas, and were probably executed by different specialists. Final finishing occurred when the stones were fitted into the wall. The evidence for this stage of work is the workshop layer close to the tomb, indicated by fine limestone dust.

Considering the immense amount of stone trimming that must have taken place, only a relatively small number of stone hammers have been found. This probably reflects the fact that stone hammers could not be used for most of the stages involving preparation of the facing stones. The toolmarks on the stones certainly attest to the use of metal tools. The Umm an-Nar stonemasons must have had copper tools. The surfaces of unweathered facing stones show a dense pattern of point-shaped scars, 2–4 mm in diameter, which is convincing evidence of the use of pointed metal chisels.

So far, only one working phase can be associated with a particular tool type, namely a stone hammer

for pounding, 7–12 cm in diameter, made of greenish quartz. This tool was used to achieve a smooth surface on the joints and visible faces in the finishing process. The evidence of this is provided by greenish quartz flakes embedded in the workshop layer near the tomb, mentioned above. As with the majority of debris from the stonemasons' workshop, worn-out stone tools were thrown into the fill of the masonry.

TECHNOLOGY TRANSFER?

High-quality stonemasonry is an important feature of the Umm an-Nar culture of potential chronological significance (Yule and Weisgerber 1998: 196–197). This is a topic worthy of further investigation.

The quality of the limestone used for facing the Hili tombs is quite similar to that seen in the Bat area and exemplifies the same technical challenges for the stonemasons involved (Gagnaison, et al. 2004). The stonemasonry on Umm an-Nar island, however, is different. In the coastal area, a softer, more porous limestone from the Miocene sediments was used. This was easier to cut using entirely different techniques, allowing the preparation of ashlar-shaped facing stones. The surfaces of these stones bear a rich archive of wear marks caused by tools. Most common are the toolmarks from a bladed chisel, one or more centimetres wide (Frifelt 1991: Fig. 17; 23). Some wear marks are comparable to those seen on the masonry of the Barbar temple on Bahrain (Doe 1986: 191). This suggests a new hypothesis, namely that a stonemason-workshop-sphere existed in the western-coastal region of the Oman peninsula that was distinct from an eastern-interior tradition.

It is worthwhile examining stonemasons' work through time. If indications of preliminary stages and directions of technology transfer become visible, this could contribute to discussions about the genesis of the Umm an-Nar culture. In this regard, Bat suggests two approaches:

1. There are Umm an-Nar-period tombs using travertine for the facing stones. Freshwater limestone is easy to cut because of its soft quality. From the viewpoint of stonemasonry traditions, this 'travertine type' at Bat is comparable to that seen in the Umm an-Nar island monuments and consequently the Bat examples with travertine belong to the hypothesised western-coastal tradition. In regard to the direction of technology transfer direction, it should be stressed that the tombs using travertine belong to an older horizon of the Umm an-Nar culture in the Bat tomb sequence.
2. There are the 'Bat-type' tomb constructions, the second, outer wall of which was erected with a layer of very white limestone (Fig. 7). Six tombs built in the same manner have been recorded at Bat. The white stones are untrimmed, but obviously split. For the time, the effort made to get the raw material was remarkable considering the transport distances involved. The origin of the specific limestone can be located precisely at a site 7 km away. According to a sequence analysis within the northern group, this type belongs to a middle horizon within the Hafit period. For this reason the 'Bat-type' cannot be considered a transitional type between Hafit and Umm an-Nar funerary architecture, even though it looks as though it could be. However, this Bat-type manner of construction anticipates the later innovation of using white, well-trimmed facing stones in the Umm an-Nar period.

RESTORATION

In considering the concurrent requirements of heritage preservation, sound archaeological practice and the public interest, the Bat restoration was able to achieve several goals simultaneously:

1. Heritage preservation: The reconstruction, or completion of the tomb, was necessary from a structural point of view, in order to preserve the original fabric. As a result of relatively recent stone robbing during the last 150 years, the vault was at risk of deteriorating further and possibly collapsing. Because of stone robbing, some of the outer parts of the ring wall were missing. As a consequence, the corbelling courses of the vault lacked a counterweight. To prevent further damage, the function of the outer masonry skin had to be re-established (Fig. 8). Therefore, reconstructive measures were predominantly in the nature of consolidation. Furthermore, long-term protection against visitors or animals climbing on the ruin was achieved. Now, the steep outer facing stones offer no opportunity for climbing, unlike the stair-like, decayed ring wall in the past. For the purposes of consolidation, the introduction of additional material was allowed, even if it is new.
2. Archaeology: Restoration offers a reliable means, and sometimes the only one, for archaeologists to obtain new knowledge about the former shape of a grave monument. In particular, the four already-restored Hafit tombs (Fig. 7) are a reference point for the Bat Project. The collection of data concerning the time, manpower and material needed to construct such a tomb is also useful.
3. The public: Visitors expect guidance or some support with information in order to understand the meaning and history of a heritage site. Restoration should reveal the cultural values and improve the legibility of a monument's original design (Feilden and Jokilehto 1998). This can be done with selected examples (several types from different periods) to give visitors some idea of the necropolis in general.

The work carried out at Bat followed UNESCO guidelines for dealing with protected monuments. We understand the reconstructive parts of tomb 154 using the so-called 'anastylosis' method (Feilden/Jokilehto 1998). The white cubes were especially attractive to collect and remove until modern times. Due to the absence of a high percentage of the originals, we decided to reproduce

Fig. 7. Bat, a Hafit tomb group with the predominant 'Bat Type'. The Bat area could be one location where the stonemasons' tradition originated.

the facing stones. To ensure as much authenticity as possible, the same resources were exploited for the raw material used and the stonemasonry was only carried out manually, as in ancient times. Only with additional, new, facing stones could the original cubes from higher levels be incorporated once more (Fig. 8). Fifteen courses, with a height of 3.2 m at the northern end, might reflect the original configuration of the tomb.

The design of the doorway could not be expressed in a more concrete form than as a triangle (Fig. 9). Several doorway variants are known, either comprised of a stepped or straight outline, or with monolithic segments framing an arch. The restored entrance shows the first variant, but the original shape may have resembled the second or third variant.

The vault was partially completed, in order to enhance stability by re-establishing the annular tension within the circle. Where the ring wall was damaged down to a low

Fig. 8. Bat, tomb 154; completion of the outer layer. The quarries for white limestone are situated in the mountains in the background.

Fig. 9. Bat, tomb 154; the completed work in October, 2008. In the foreground, the remains of the first courses of a tomb of the same construction type as 154.

level in the north-west, the masonry was rebuilt, as it was above the doorway, to achieve stability. In all, the volume of all re-assembled and restored parts amounts to less than twenty-five per cent of the original (Fig. 2).

The vault was not closed again. If visitors look through the doorway, the inner construction of the chambers and the display of grinding stones on the floor become visible from the incidental daylight that comes through the vault opening (Fig. 10). The spolia discovered are exhibited inside the western chamber. Furthermore, the debris, semi-finished products and stone hammers, left by the stonemasons, are now displayed beside the tomb, like an abandoned workshop. This is a limited didactic explanation at an open-air monument.

When the restoration was finished, the top of the ring wall was not at a uniform level. This was done to emphasise the ruined status of the monument (Fig. 9). Soon after the building's use ended, decay began. Stone robbery began in antiquity. All these events are part of the monument's 'biography' too.[2] Therefore, the appearance of a ruined building has acquired a specific cultural value, and is essential for the feeling of the *genius loci* (Feilden and Jokilehto 1998). The considered presentation of this process provides the key to understanding history.

Fig. 10. Bat, tomb 154; a number of grinding stones are now displayed inside the restored tomb.

1 The term 'sugar-lumps' (Frifelt 1975) has often been incorrectly used in regard to both material and shape. We therefore suggest limiting this term to its original meaning, as used by Frifelt.
2 But we do not want to conserve the increasing effects of stone robbery during the last 150 years or so. The time span of 4000 years is an argument for not doing so.

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Fifty Years of Emirates Archaeology

JEBEL AL-BUHAIS 2008: A YEAR IN REVIEW

Sabah Abboud Jasim (Sharjah)

INTRODUCTION

Jebel al-Buhais is situated about 20 km west of the al-Hajar mountain range and represents the southern end of the Faya mountain range that stretches westwards from the al-Dhaid and al-Madam plains in the central sector of the Emirate of Sharjah. The Jebel has a maximum width of 1,375 m and extends approximately 2 kms along its north-south axis. The peak rises to approximately 340 m above sea level, that is roughly 230 m above the desert to its west and the plain to its east. The sixty million-year-old *jebel* is composed mainly of limestone layers, intersected by several narrow valleys (Fig. 1).

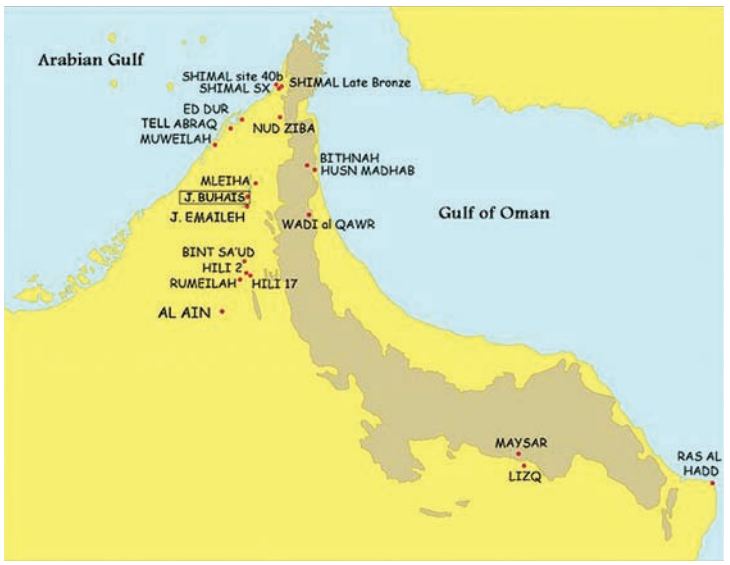

Fig. 1. Map of the UAE showing the location of Jebel al-Buhais. Grid 1 m.

Archaeological campaigns took place between 1995 and 2005 and yielded a large number of tombs belonging to periods ranging from the late 6th millennium BC to the pre-Islamic era. Excavations were temporarily suspended during 2006 and 2007 in order to build protective shelters for the tombs that had been thus far uncovered (Fig. 2). During the building of these shelters, two metal hoards were discovered near tomb BHS 2 (Fig. 3 and Fig. 4). These hoards contained a large collection of bronze vessels and weaponry. Although the majority of these artefacts dated to the Wadi Suq period, the collection also included artefacts from the Umm an-Nar period. It is believed that these metal items represent extramural deposits, that are usually found in association with burial chambers, indicating that they may have been placed there for ritual purposes (Al Tikriti 1982: 106). As these hoards were discovered in the perimeter of BHS 2, it is also possible that they were the victims of a clearance operation and removed from the burial chamber in order to make room for fresh burials and new grave goods.

Fig. 2. Sheds over tombs at Jebel al-Buhais. Grid 1 m.

Fig. 3. Metal Hoard 1 near Tomb BHS 2.

Fig. 4. Metal Hoard 2 near Tomb BHS 2.

During the halt in excavations, restoration work was also completed on the large stone fort that occupies the top of a rocky escarpment on the north-eastern slope

of the *jebel* (Fig. 5). This fort was initially excavated in 1973 by an Iraqi team of archaeologists (Madhloom 1974), and subsequently by both the French and Spanish missions to Sharjah (Benoist and Mouton 1994). It has a rectangular plan measuring 44 m by 19 m and consists of a large courtyard (30 m long) to the west and a group of six rooms to the east (located to the rear of the escarpment). The largest of the rooms has a paved stone floor and two pillars in the centre. The fort can be accessed by two entrances, one to the east and one to the west. The date of this fort is still a matter of dispute, but it is generally agreed that it belongs to the Islamic period. This attribution was based on some Islamic sherds found previously (Benoist and Mouton 1994: 46) and is supported by the discovery of more Islamic sherds associated with the floor of the paved room inside the fort during the recent restoration work. However, the fort has also been dated to the Iron Age on the basis of the presence of some Iron Age sherds on the surface (Boucharlat 1997: 23).

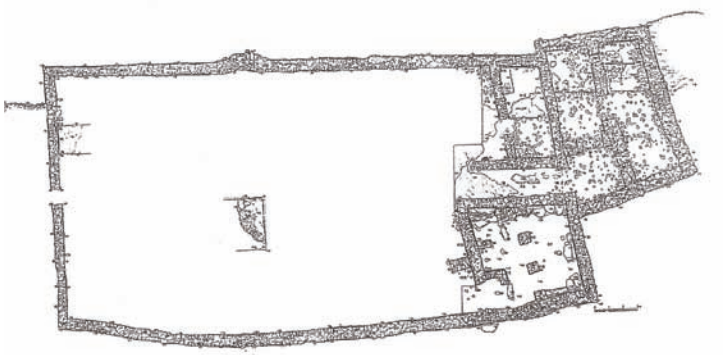

Fig. 5. Plan of the stone fort at Jebel al-Buhais (after Benoist and Mouton 1994).

It should be pointed out that restoration has only involved the lower sections of the walls, up to a height of 1.5–2 m above the foundations (Fig. 6). No attempt has been made to restore the walls to a higher level as there are no definite clues that can assist in determining their

Fig. 6. The fort after restoration.

Fig. 7. Tomb BHS 88 after excavation.

original height. During restoration, local stones from the same escarpment were used in accordance with original construction methods.

Archaeological activities were subsequently planned and a new campaign began in January 2008, at the north-western end of the *jebel*, where previous surveys had

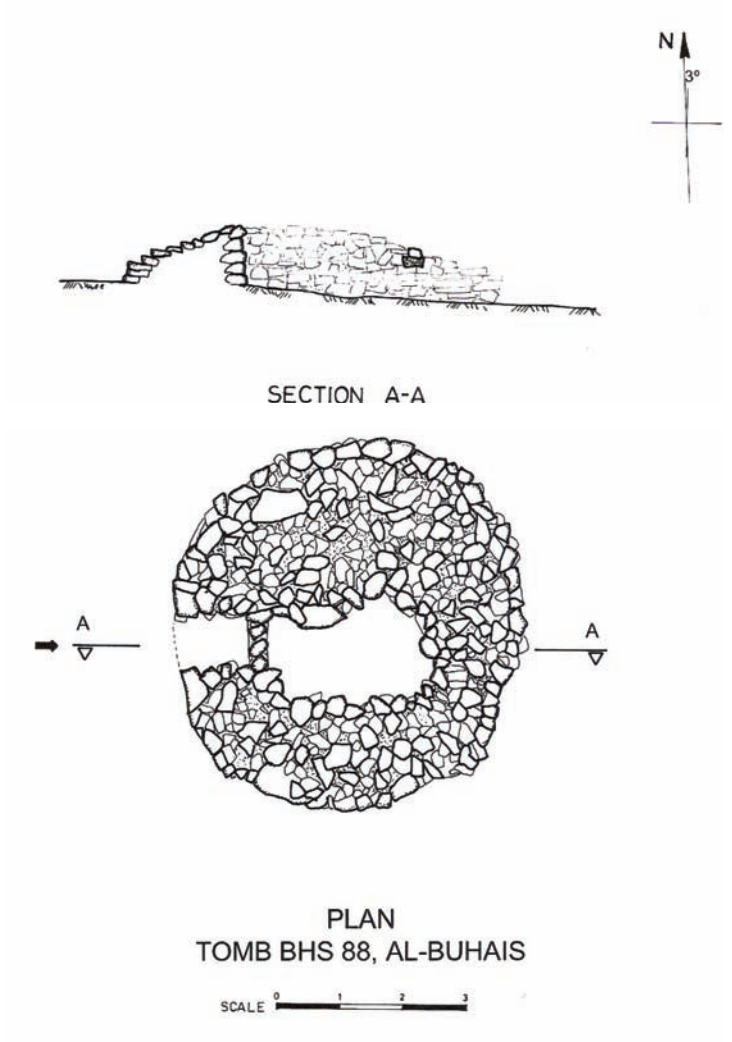

Fig. 8. Plan and section of BHS 88.

recorded the existence of a number of possible cairns and subterranean tombs. An account of the outcome of this campaign is given here, beginning with BHS 88.

BHS 88 (FIG.7–8)

This is a circular-shaped cairn standing approximately 0.90 m above ground level. The burial chamber measures 1.40 m with a simple floor sunk slightly below the ground. The external diameter is 5.50 m and the tomb is built of multiple stone rows, the width of which is 2.50 m. Prior to excavation, the structure looked like a Hafit-type tomb. However, with continued excavation inside the burial chamber in July 2009, it became obvious that we had been dealing with an Umm an-Nar type tomb.

The internal area is divided by two north-south wall-butts into four small burial chambers, each measuring about 1.50 by 1 m. The entrance is located in the western side of the tomb and consists of a well-designed, rectangular-shaped opening, 0.70 m wide. The floor of the burial chamber was covered with stones, most of which are still *in situ*. The northern chambers are the best preserved, their walls standing to a height of about 1 m, while the southern ones were disturbed by a later interment. The external ring wall, as well as the internal dividing walls, are pitched, thus reducing the area that needed to be roofed. There is a striking resemblance between this tomb and tomb I at Jebel Al-Emaileh, in terms of both plan and contents (Benton and Potts 1994).

Fig. 9. An articulated skeleton of a male with his iron sword, inside BHS 88.

The rectangular-shaped entrance is located to the western side and is represented by a well-designed, almost-square opening measuring 0.7 m. This leads to a narrow corridor with a length of 1.45 m, giving access to the burial chamber at ground level. This entrance is similar to cairn No. 6 at Hafit (Cleuziou, Pottier and Salles 1978: Pl. 15). The entrance was blocked from outside with large stones.

During a later, intrusive burial, a fully articulated skeleton in a flexed position was placed in the upper burial level. The deceased, a young male aged 20 to 25 years, was interred pointing north, with his head facing east, wearing an iron sword which was discovered *in situ* under his knees and lower legs on the floor of the tomb (Fig. 9).

HUMAN SKELETAL REMAINS AND GRAVE GOODS

Removal of the skeleton revealed a rectangular, copper alloy sheet surrounding the end of the sword with iron rivets still *in situ*, which is most likely the scabbard tip. Similar examples were found in Tomb 1 at Jebel Al-Emaileh where they are thought to have been used as fasteners to secure the handle to the hilt of the sword (Benton and Potts 1994: Fig. 43; Potts 1997). The sword itself was in a poor condition – the iron was flaking away and it was completely corroded. In the centre only a surface flake of iron remained and the remainder of the underlying material was no longer preserved.

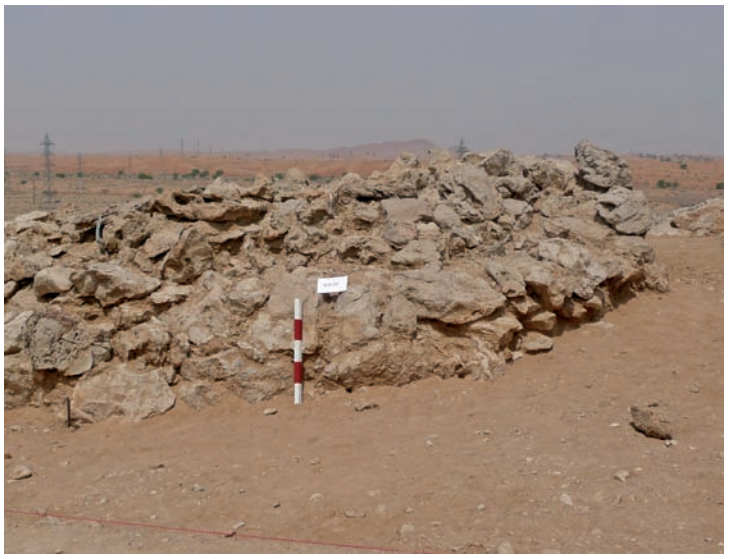

Fig. 10. Tomb BHS 89 after excavation.

The total length of the sword is 0.81 m. The presence of this long iron sword should be viewed in the context of the important changes that occurred during the aftermath of the Iron Age, when iron replaced bronze as the favoured metal for making both swords and arrowheads (Potts 1998: 195). Tomb 1 in Jebel Al-Emaileh presented

a similar discovery, where a male skeleton was recovered at the base of a pit and was accompanied with c. 70 cm long iron sword dating to the late pre-Islamic period (Benton and Potts 1994: 31; Potts 1997).

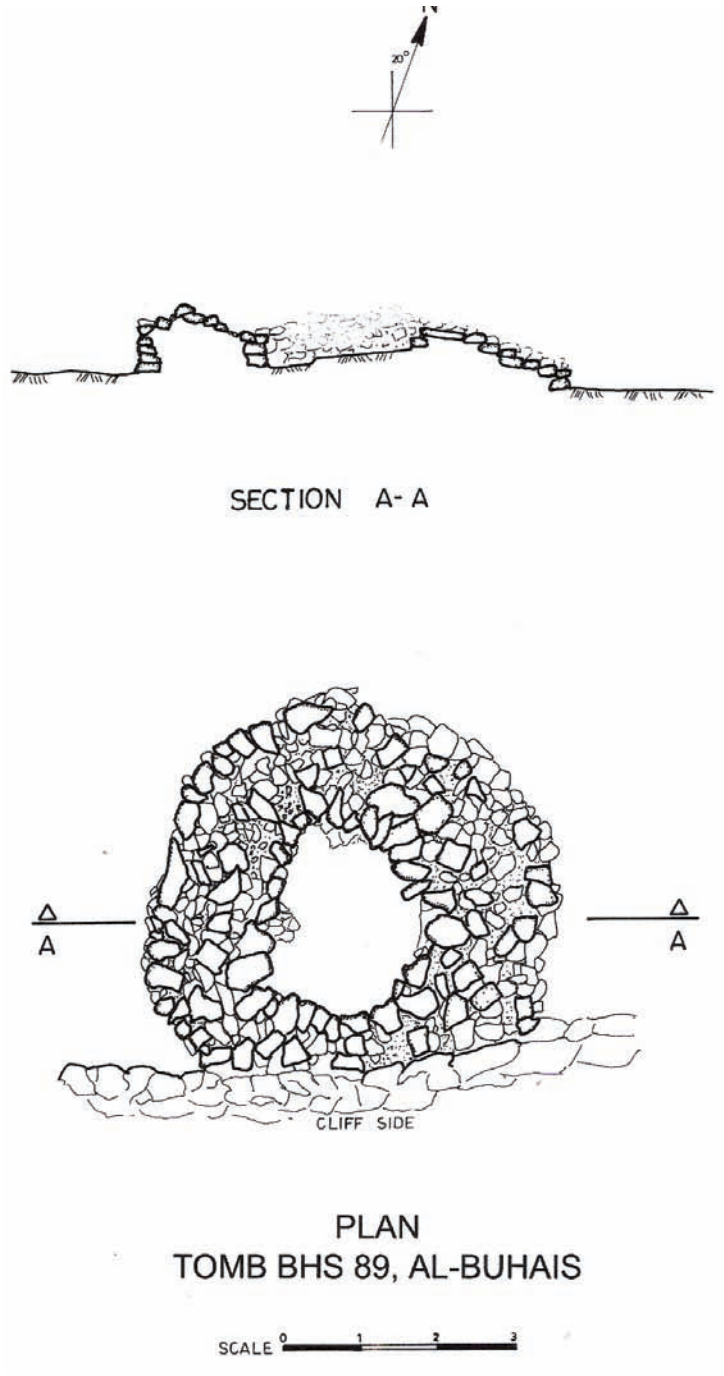

Fig. 11. Plan and section of BHS 89.

Long iron swords attested at ed-Dur were dated to the third/fourth centuries AD, based on the associated finds of Sasanian (Mesopotamian)-type glass (Lecomte 1993: 202). Iron swords have also been reported from Mleiha (Madhloom 1974: Pl. 16A) and ed-Dur (Boucharlat 1989 et al.: Figs. AB–AD). Apart from a single shard of extra fine ware, and a polished perforated piece of shell, no other artefacts were found inside BHS 88.

Fig. 12. Skeletal remains and funerary goods inside BHS 89.

Having consolidated and removed the skeleton and sword in the southern section of the structure, we reached the original floor. Only a few skeletal fragments were found here in the south-eastern and south-western burial chambers of the tomb. However, the best-preserved, northern section contained both skeletal remains and funerary goods. The north-western chamber produced skeletal remains in disturbed condition including an incomplete skull and more than one jaw scattered throughout the chamber, together with a red ware jar of Umm an-Nar type. Two skeletons were found oriented north-south on the floor of the north-eastern chamber, in flexed position, their heads oriented to the south with one facing to the east and the other to the west. A long copper/bronze knife or dagger with four holes and rivets was stuck to the tibia of one of them. A whetstone, bronze awl, and hundreds of red and white stone micro-beads, in multiple rows, were found on the floor of the eastern end of the corridor facing the entrance.

BHS 89 (FIG. 10–11)

BHS 89 is a circular-shaped cairn measuring 5 m in diameter and rising to 0.9 m above ground level. It is situated on the northernmost side of Jebel Al-Buhais, occupying a gap on top of a rocky area between two mountain peaks. Judging by the architecture and burial contents, the tomb seems to have been built during the Hafit period and continued in use during the subsequent Umm an-Nar period. The internal burial chamber measures 2.1 m in diameter and is surrounded by multiple rows of heavy stones measuring 1.5 m in width. The original floor of the burial chamber was covered with large, flat stone pieces, some that are still *in situ*. No door was found. This tomb resembles a Hafit cairn burial

from Ra's al-Jinz, although this burial has an entrance (Cleuziou and Tosi 2007: Fig. 104).

HUMAN SKELETAL REMAINS AND GRAVE GOODS

Human skeletal remains were found scattered inside the burial chamber. An incomplete child's skeleton appears to have been placed in a flexed position and was buried with a small copper-alloy bangle which tapers to form blunt edges, still *in situ* (Fig. 12). A steatite box was also associated with this skeleton. The box is decorated with double-dotted circles, a well-known motif during the Umm an-Nar period. A single, fine ware sherd representing part of a jar rim and upper shoulder was also found.

As is always the case with cairns of the Hafit period, the grave was practically empty, with the exception of a limited number of scattered human bones and other items. The absence of grave goods may be attributed to ancient looters and it can be assumed that these graves were once collective burial sites containing a wealth of funerary contents.

BHS 90 (FIGS. 13–14)

This tomb, dating to the Wadi Suq period of the 2nd millennium BC, is located at the north-eastern corner of the Jebel al-Buhais series. It consists of a large, subterranean, quadruple 'ω'-shaped burial chamber occupying an area of 10.5 m long by 6.5 m wide. The internal dividing walls of the burial chambers were

Fig. 13. Tomb BHS 90 after excavation.

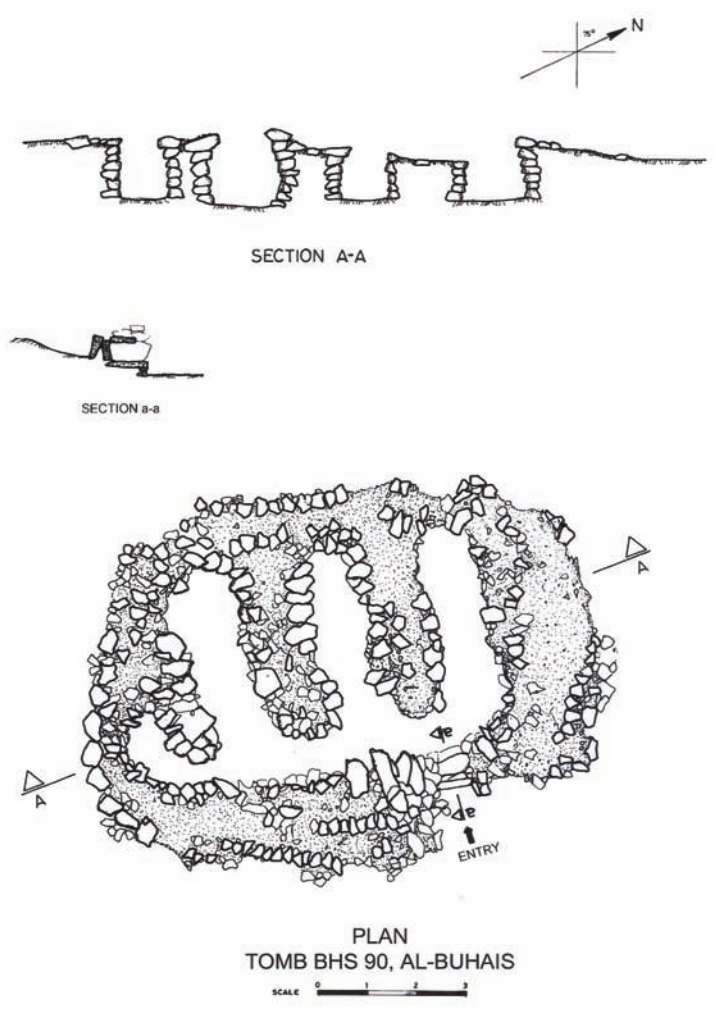

Fig. 14. Plan and section of BHS 90.

constructed to an average thickness of 1.3 m and were linked into the northern side. The entire burial chamber was roofed with flat slabs over corbelled stones. Some of the roofing stones were found fallen inside the burial chambers while others seem to have been dislodged and removed from the chambers during the course of looting. The entrance in the southeastern corner measures 0.6 by 0.6 by 0.6 m and is lined with stone slabs on all sides. It has a lintel and sill and steps immediately down to the floor of the burial chamber. It had been blocked from the outside by a large stone slab still *in situ*. Interestingly, the entrances to all Wadi Suq tombs discovered in the cemetery of Jebel al-Buhais were blocked from the outside in a similar manner.

HUMAN SKELETAL REMAINS AND GRAVE GOODS

Skeletal remains were abundant and scattered all over the burial chambers (Fig. 15). A preliminary study indicates

Fig. 15. Skeletal remains inside BHS 90.

the presence of twenty-seven individuals (information kindly provided by A. Kutterer, Tübingen). However, it is believed that this figure is far lower than the original number interred. The skeletal remains were found in

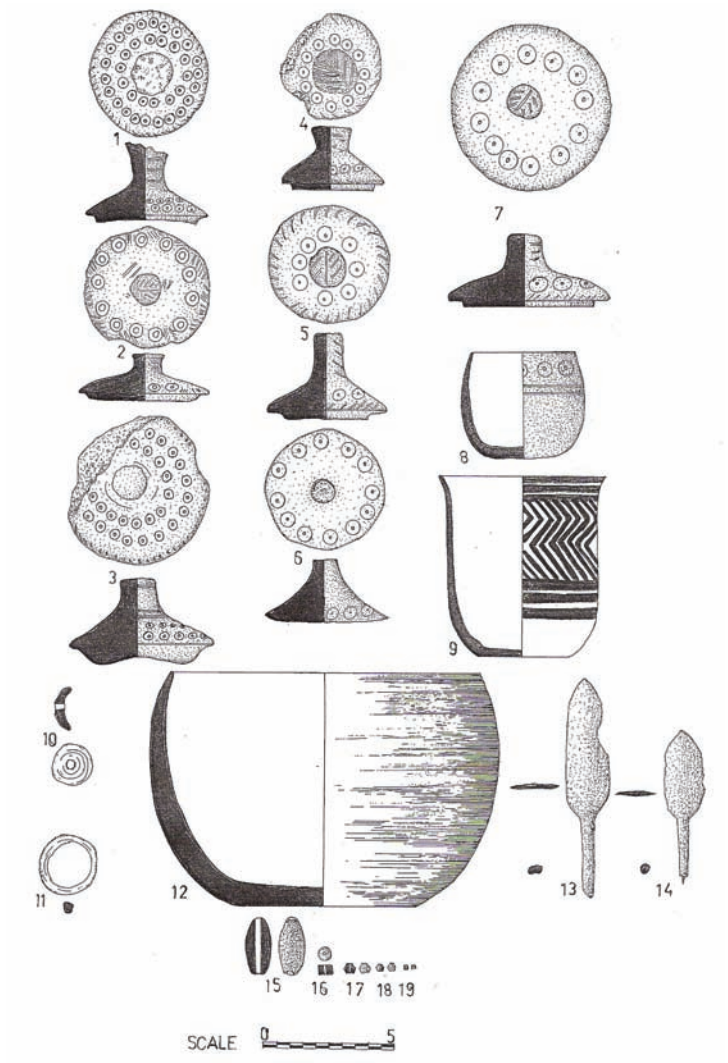

Fig. 16. Variety of funerary goods inside BHS 90.

Fig. 17. Tomb BHS 91 after excavation.

association with a variety of grave goods including both painted and unpainted Wadi Suq pottery (Fig. 16). This included a small beaker with zigzag and rectilinear decoration, similar to examples from Jebel al-Buhais and

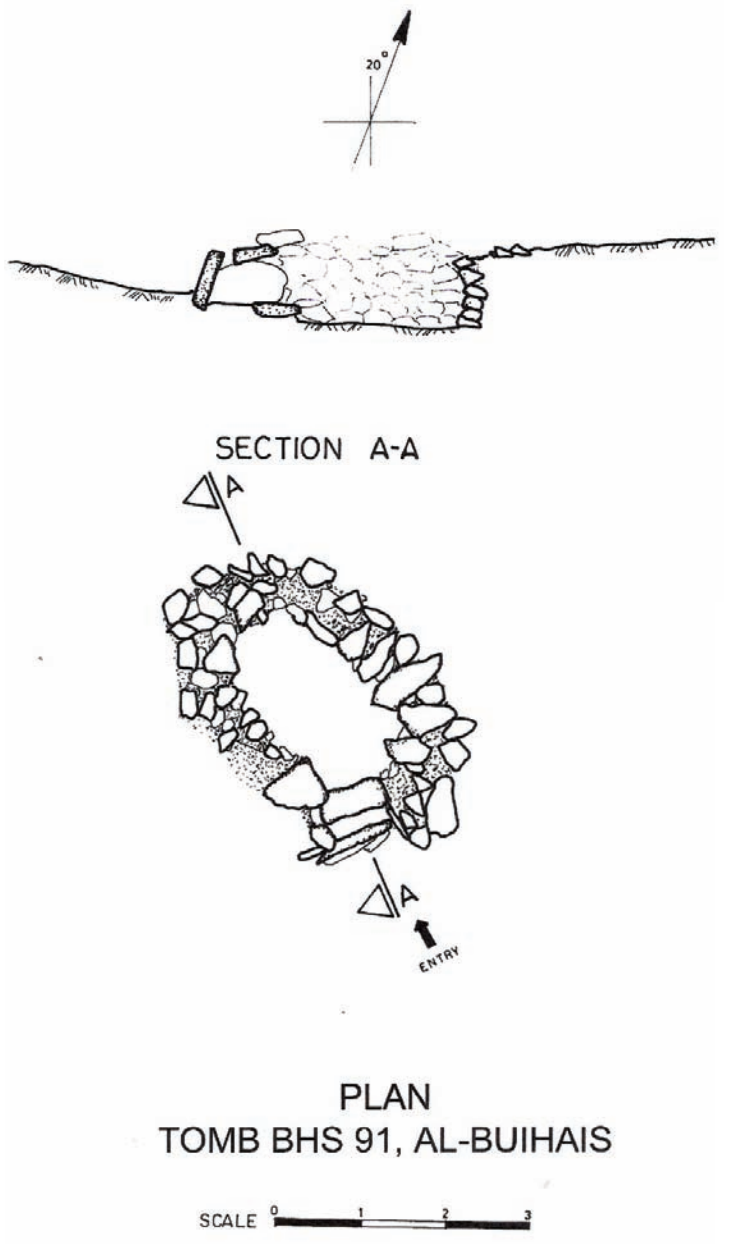

Fig. 18. Plan and section of BHS 91.

other Wadi Suq sites in the UAE, such as Shimal in Ra's al-Khaimah. Plain Wadi Suq pottery, softstone vessels and lids decorated with double-dotted circles were also discovered. Other items included personal ornaments, such as beads and shell items. It is believed that these findings represent only a small number of the artefacts which must have originally been present before this huge tomb was plundered through time.

BHS 91 (FIGS. 17–18)

BHS 91 is another Wadi Suq subterranean chamber situated about 10 m to the north of BHS 90. It is an oval-shaped burial chamber measuring 2.45 m in length by 1.3 m in width. The internal walls consist of six stone courses standing almost 1 m high, narrowing at the top to enable the placement of roofing slabs.

The rectangular entrance is situated on the east and measures 0.5 by 0.45 by 0.6 m. It is paved with a flat sill which is raised about 0.15 m above the floor of the burial chamber and topped with a flat stone lintel. The entrance was blocked with a large stone slab from outside. The floor of the burial chamber was covered with a layer of gravel. This tomb is similar to tomb BHS 68, that is situated in the northern part of the cemetery of Jebel al-Buhais and also dates to the same period.

A few skeletal remains were found scattered on the floor in association with a few sherds of Wadi Suq pottery and softstone vessel fragments. Two bronze arrowheads dating to the Iron Age were also found suggesting the re-use of the tomb at that time.

SIGNIFICANCE OF THESE NEW DISCOVERIES

These newly discovered Hafit-type tombs at Jebel al-Buhais represent an addition to those previously known at Jebel al-Buhais (Jasim 2003) and nearby Jebel al-Emaileh where a group of Hafit/Umm an-Nar tombs were found (Benton and Potts 1994; Benton 2006). The cairn graves of Jebel al-Buhais have been found in various locations; grouped high at the top of the jebel, in isolation on a rocky hillock and in the foothills adjacent to the mountain. The graves ranged between 5 and 7.4 m in diameter at the base.

Undressed stones, carefully selected in some cases (e.g. BHS 88), were arranged in a circular pattern surrounding the burial chamber. Some graves were provided with an entrance while others were not. All of these graves have been subjected to plunder and destruction throughout their history, accounting for the absence of the 'Jamdat Nasr'-type jars usually found in such tombs elsewhere in the UAE and Oman. However, it is clear from the skeletal remains and associated materials left behind that they were used for collective burials.

The presence of Hafit-type tombs in the Emirate of Sharjah is a clear indication of the widespread distribution of Hafit culture up to and including the northern Emirates. Hafit-type tombs have also been reported in other northern Emirates including Fujairah

Fig. 19. The clover leaf-shaped tomb BHS 66.

(Brass et al. 1995) and Ra's al-Khaimah, although these have not yet been excavated (de Cardi et al. 1994; Hilal 2005: 38).

Previous excavations at Jebel al-Buhais had unearthed varied and numerous tombs dating to the Wadi Suq period (2000–1300 BC) throughout the cemetery of Jebel al-Buhais, where both above ground and subterranean tombs existed. Of special interest is tomb BHS 66, an underground, clover leaf-shaped tomb consisting of four burial chambers. This is the first example of its kind to be discovered so far in the UAE or Oman (Fig. 19).

The 2008 excavations have revealed the presence of another Wadi Suq tomb of extravagant 'ω'-shaped plan (BHS 90). It should be pointed out that a single 'u'-shaped subterranean tomb belonging to the Wadi Suq period had previously been excavated at Jebel al-Buhais (BHS 8, 12, 37) (Jasim 2006). However, BHS 90 is the first example of a subterranean 'ω'-shaped tomb in the UAE. Consequently, it can be said that BHS 90, together with tomb BHS 66, are rather remarkable examples that may be described as 'magnificent' or 'prestigious', and therefore must have been the burial sites of privileged or high-status individuals. These two tombs are unique and exuberant examples of Wadi Suq funerary architecture.

CONCLUSION

The 2008 Jebel al-Buhais cemetary excacations have brought to light new and important information pertaining to the Hafit culture and the Wadi Suq period. The appearance of more Hafit-type tombs at the cemetery of Jebel al-Buhais is significant, as are the nearby examples at Jebel al-Emaileh, as these represent the first excavated tombs of this type outside of the Jebel Hafit area. Their appearance in the central sector of Sharjah has now made it clear that the Hafit Horizon, which lasted from the last centuries of the 4th millennium BC to the first half of the 3rd millennium BC, covered a larger area than previously thought, extending from the north of the UAE down to Ra's al-Hadd and Ra's al-Jinz in Oman.

It is worth mentioning that the succeeding Umm an-Nar period, occupying the second half of the 3rd millennium BC, was already known in this part of the northern Emirates through the presence of a variety of tombs at Mleiha and Jebel al-Buhais (Jasim 2003: 86–99). Tombs of the Umm an-Nar period have also been excavated in the foothills of Jebel Faya (unpublished).

The discoveries of sites from the subsequent Wadi Suq period, where a large number of richly furnished tombs are found, now provide an uninterrupted archaeological record for the territory of Sharjah. Furthermore, the presence in the same cemetery of two unparalleled tombs (BHS 66 and BHS 90) from the Wadi Suq period is significant and unequivocally underscores the importance of this area as a major and dignified burying place, which was in continuous use from the end of the 6th millennium BC until the 4th century AD.

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Fifty Years of Emirates Archaeology

SOME EVIDENCE OF CRISIS AND ABANDONMENT AT THE END OF THE IRON AGE IN AL MADAM 1–THUQAIBAH (SHARJAH, UAE)

Carmen del Cerro (Madrid)

INTRODUCTION

Today Al Madam is a tree-covered steppe, dotted with farmlands and palm groves watered by wells and *aflāj* from pre-Islamic and late Islamic times, that serve the farms of the region of Al Madam, Fili, Um Safah and Thuqaibah. The inhabitants of Al Madam obtain water from a water table that was near the surface in antiquity. With the support of the Directorate of Antiquities of Sharjah Emirate, the current Spanish archaeological excavations in Sectors 1 and 2 are attempting to document the existence of wells and galleries for the collection of water during the Iron Age. Wells and *aflāj* were used contemporaneously, enabling agricultural continuity in a difficult environment before the introduction of the water pump.

Explorations and excavations since 1993 (Benoist and Mouton 1994a: 1–12; Benoist and Mouton 1994b) enable us to draw a picture of the various communities that moved through the region or settled in it. During the 1st millennium BC, Al Madam experienced the interaction of different groups: settlers, who farmed, raised cattle and dug wells like the ones that we have found at the Al Madam 1 – Thuqaibah settlement; seasonal settlers who camped there, mainly in the area of Um Safah; and people who used this region as a route between the coasts of the Indian Ocean and the Gulf, and between the oases of Ra's al-Khaimah and Al Ain-Buraimi. All of them searched for the assurance of a water supply that was relatively easy to obtain and the protection of an area set in a very specific geographical locale.

The human group that chose to stay in Thuqaibah at the end of Iron Age II understood that the conditions of the Al Madam steppe were excellent for settlement and the building (Córdoba and Mañé 2000: 225–260) of structures composed of large, very hard mudbricks made of a rock-like material containing large amounts of gravel extracted from the bedrock (del Cerro 2008: 45–50). This group came to dominate the environment of Al Madam and its water resources in such a remarkable way that today it still amazes us and has made us reflect on its existence, technologies and disappearance.

The 90 m of continuous stratigraphical soundings we have excavated allow us to connect houses and document pottery from all phases of the Iron Age (Fig. 1), particularly Iron Age II and III (Benoist and del Cerro 1998). But the stratigraphic soundings opened between the different structures have provided us with other data. In soundings three and four south-east of House 2 we have found pits excavated in the bedrock. These pits are 70 cm lower than the earliest phase of house construction and have no connection with them. The Iron Age I pottery (Fig. 2) was associated with several fireplaces, which seem to represent a non-permanent occupation of the area having no connection with the Al Madam 1 – Thuqaibah houses during Iron Age I. This represents the first contact of a population with an environment that offered an ample supply of water and building supplies and hence the possibility of establishing a permanent settlement.

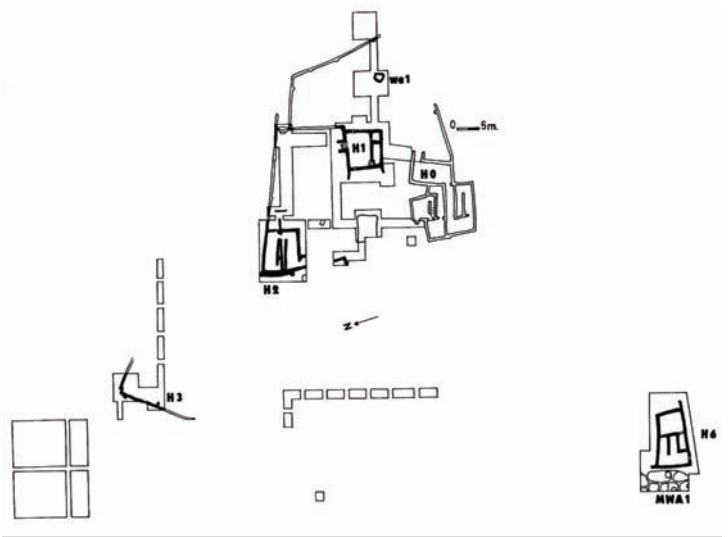

Fig. 1. Map of Al Madam 1 – Thuqaibah.

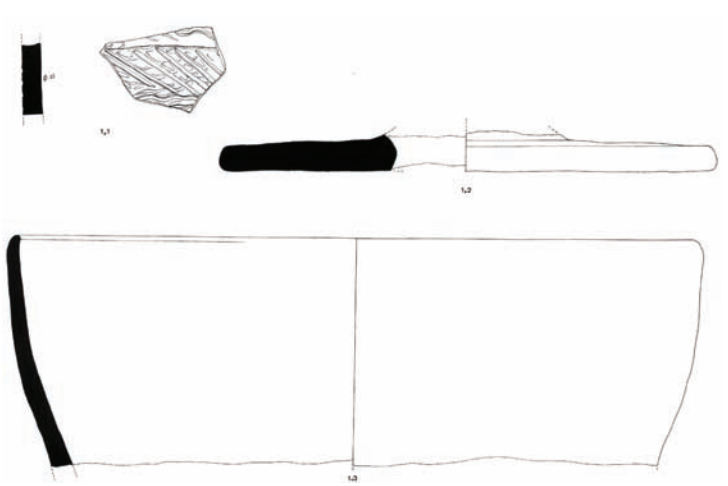

Fig. 2. Iron Age I pottery from Al Madam 1 – Thuqaibah. 1. Incised Red Ware; 2. Common Coarse ware; 3. Coarse Brown-Black ware (M. Nuñez Villanueva, Spanish Archaeological Expedition at Al Madam).

In the area limited by the perimeter walls of Houses 1 and 0, two stratigraphic soundings (and several extensions) were opened, with the initial purpose of verifying the nature and uses of the area, that seemed to lack all traces of construction. In Sounding 6, between House 1 and the perimeter wall of the open space W 127, we found a communal well in 2002 (Córdoba and del Cerro 2005: 515–532)

Both in terms of the techniques used in construction and the stratigraphic evidence obtained inside and outside of the excavation, the well doubtless dates from the Iron Age and the last stage (at least) of the construction of the dwelling complex. The curb of the well (c. 1.70 x 1.30 m at a maximum) (Fig. 3) would have been built of plaster, mudbrick and bedrock. It is surrounded by a trough used to water livestock, pouring the water directly into it from a skin. The curb, consequently, was built using the same techniques and materials documented in the houses and perimeter walls of the settlement. Our well would have had a tripod formed by three trunks to which the ropes and skin used to obtain water were fastened, probably similar to an Omani *zayarah* but not operated by animals. The *zayarah* also has a small tank close to the well curb that is not used for watering the cattle but for holding water prior to distribution. The external stratigraphy which links the well to House 1 enabled us to see how the structure was rebuilt on several occasions. The connection between the well and the structures is corroborated in the external stratigraphy by pottery of Iron III and remains of *Terebralia palustris*.

The well is 7 m deep and extends into the natural bedrock. Because it is surrounded by sand, it was provided with a covering of plaster. The well has a rectangular shape – 1.20 x 1.10 m – and all four sides show traces of the sharp tool used to excavate it. Similar traces were documented in the *falaj* of Sector 2 and in the so-called Mudbrick Working Area next to House 6. Both on the western and the eastern walls are nine small carved steps which enabled the users of the well to go deep down into it. The same sort of steps are found in the *zuqāb* of the *falaj* at Al Madam 2. The well was

Fig. 3. Mouth and curb of the communal well in stratigraphic Sounding 6 in Al Madam 1 – Thuqaibah.

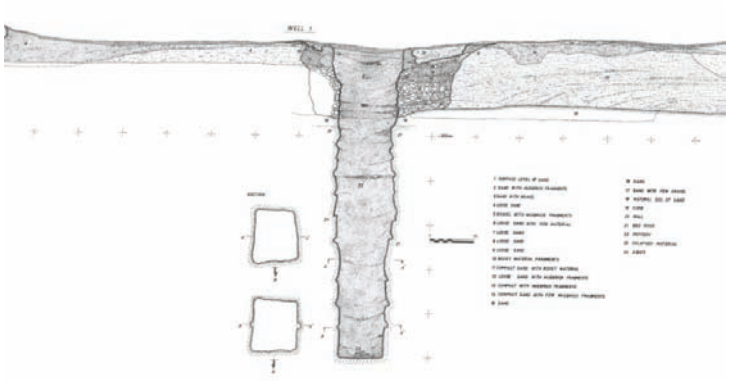

Fig. 4. Inner stratigraphy of Thuqaibah well (M. Nuñez Villanueva, Spanish Archaeological Expedition at Al Madam).

re-excavated in a second stage, when it was only 4.50 m deep and was squarer in shape (Fig. 4). This indicates a period of drought and a lowering of the water table that corresponds with what we observed in the water catchment gallery at Al Madam 2.

The inner stratigraphy of the well also provides some revealing data (Fig. 4). The fill consisted mainly of aeolian sand (i.e. the well was not intentionally backfilled). Inside it, a few, but nonetheless significant, finds were made.

1. At the very mouth of the well were fragments of Islamic pottery, from a fireplace (post-dating the infilling of the well), that was made out of the still visible remains of the well curb
2. 2.43 m below the surface we encountered ash and a few Iron Age III sherds
3. 3.45 m below the surface we encountered what seemed to be a deposit of 34 Iron Age III sherds mixed with ash and shells, seemingly thrown into the well when it was no longer in use. Among them was a carinated bowl of red ware, with brown slip and brown-black paint on the carination (a horizontal line and a broad wavy line) with good parallels at Rumeilah II, Rafaq 2, Bithna and Maysar 43
4. 5.90 m below the surface we came upon a carinated sherd from a large incised jar, typical of Iron Age III throughout the Oman Peninsula
5. At the bottom was a 40 cm-thick layer of fine, greenish sand, produced by organic decomposition and humidity. A nearly intact, typical vessel for collecting water was found at the bottom of the well. It is a medium-sized jar with a very thick base and heavy walls with parallels from Al Madam 1, Rumeilah I, Rumeilah II and Rafaq 2. It showed signs of having been in water for some time. This also dated to early Iron Age III. All of the ceramic evidence suggests that the well wasn't used after the Iron Age III period.

Judging by the pottery in the fill, the Thuqaibah well was in use during the late Iron Age II and part of Iron Age III. During this period the inhabitants of the village already suffered their first loss of water when the water table dropped sharply. This happened when the well was 4.50 m deep. At this time, the population of Al Madam deepened the well until it reached the water table again, which was then at c. 6.60 m below the ground surface. In fact, the well was 7 m deep and the last 40 cm show signs of humidity, decomposition of organic material and remains of algae on the walls of the water collecting vessel discovered during excavation.

Next to House 6 we were able to document a Mudbrick Working and Building Material Area carved in the natural soil surface. Water would have been one of the most important elements in the Mudbrick Working Area. For this reason, the inhabitants of Al Madam dug a second well in the south part of the complex. Water was necessary to work the building material, and was brought to this area via at least two channels (Fig. 5). Due to its scarcity, the workers in this area might have taken particular care to store and recycle it. Thus, if the main channel overflowed, the water was not wasted but was collected in small wells, spits or basins. At some point, one of the main channels was blocked and, therefore, the contribution of water decreased. We do not know if this was because the manufacture of a large number of mudbricks was no longer necessary or because water was scarce, which could be connected with what we have documented within the rest of the village, particularly in the well.

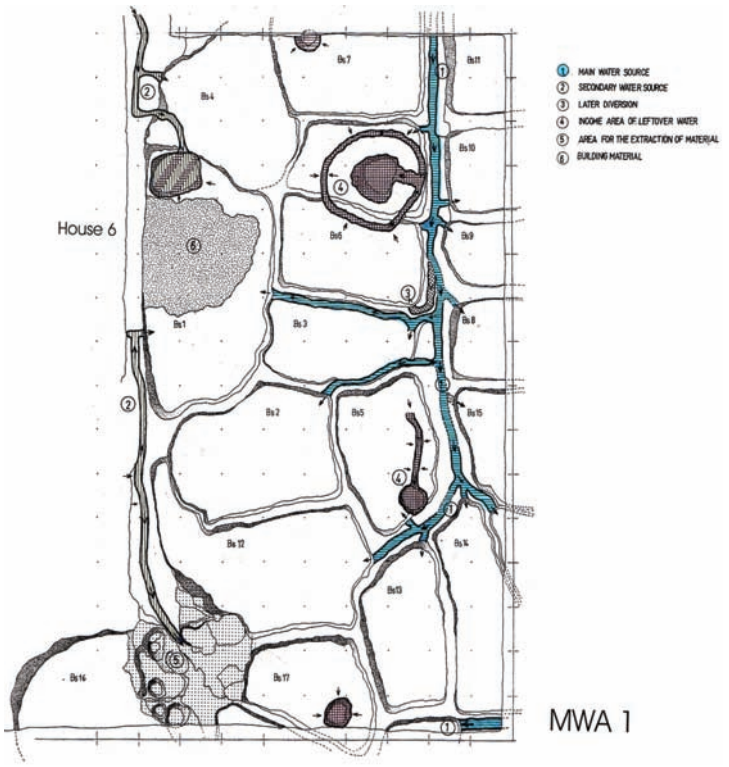

Fig. 5. Schematic map of Mudbrick Working Area 1, close to House 6, showing one of the main channels, that brings water to the MWA 1, and several pits or basins where the water was held (M. Nuñez Villanueva, Spanish Archaeological Expedition at Al Madam).

AL MADAM 2, THE FALAJ OR WATER CATCHMENT GALLERY

In the region of Al Madam wells and *aflāj* combine to guarantee the lives of the population in such a hostile environment. The *falaj* system seems, without doubt, the best way to get water, since evaporation is non-existent and the water table was very high.

The archaeological map made by the French Mission indicates seven lines of whitish hills (AM 2, 21, 31, 34) (Mouton 1992: 3–10) (Fig. 6), in which three soundings were made. Moreover, the inhabitants of Al Madam told

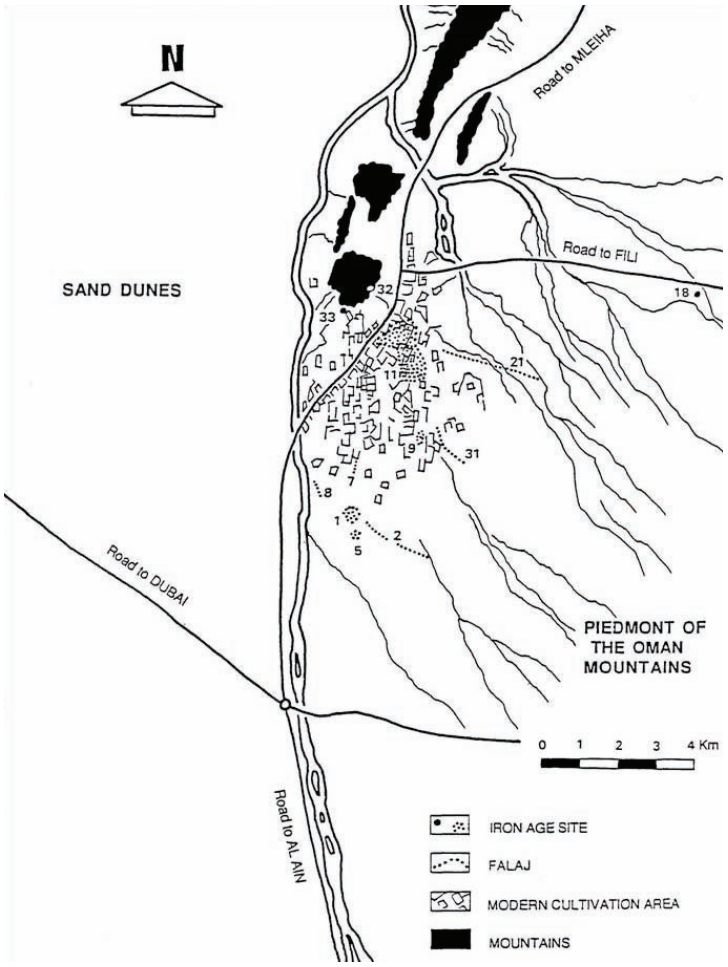

Fig. 6. Map of Al Madam aflaj by French Mission at Mleiha (M. Mouton 1992).

us about the existence of seven *aflāj* in the area. In 2002 we decided to check the lines on the French plan and, therefore, opened a sounding in one of the whitish hills in Sector 2. Here, by opening a 70 x 3 m trench, we found the first of seven wells that were documented by the end of the 2005 season (Fig. 7).

The well-mouths were excavated through the sand and, after cutting through a layer of gravel, the well descends straight into the bedrock. Like the well found in the village, the *zuqāb* are covered with plaster made out of natural rock, which protects them, and have small steps carved on the walls. We opened the *zuqāb* Tqb – 1, 1, 2, in plan but Tqb – 4 was sectioned, and as a result we can state that the wells were blocked on purpose. This is clear from the stratigraphic evidence. Below more than 2 m of loose, probably aeolian sand, we discovered evidence that the wells had all been deliberately blocked at an undetermined date, using the same procedure. The three excavated sections in the trench demonstrate that, after the blocking of the wells, the empty interior was preserved for a long time.

The vault of the *falaj* gallery is 1.30 m below the surface and 0.70 cm from the mouth of the well, carved in the natural rock in the same way as the well in the village of AM 1, with a very thin, sharp pickaxe, traces of which run in different directions. The 35 m-long stretch of excavated gallery follows a zigzagging course which

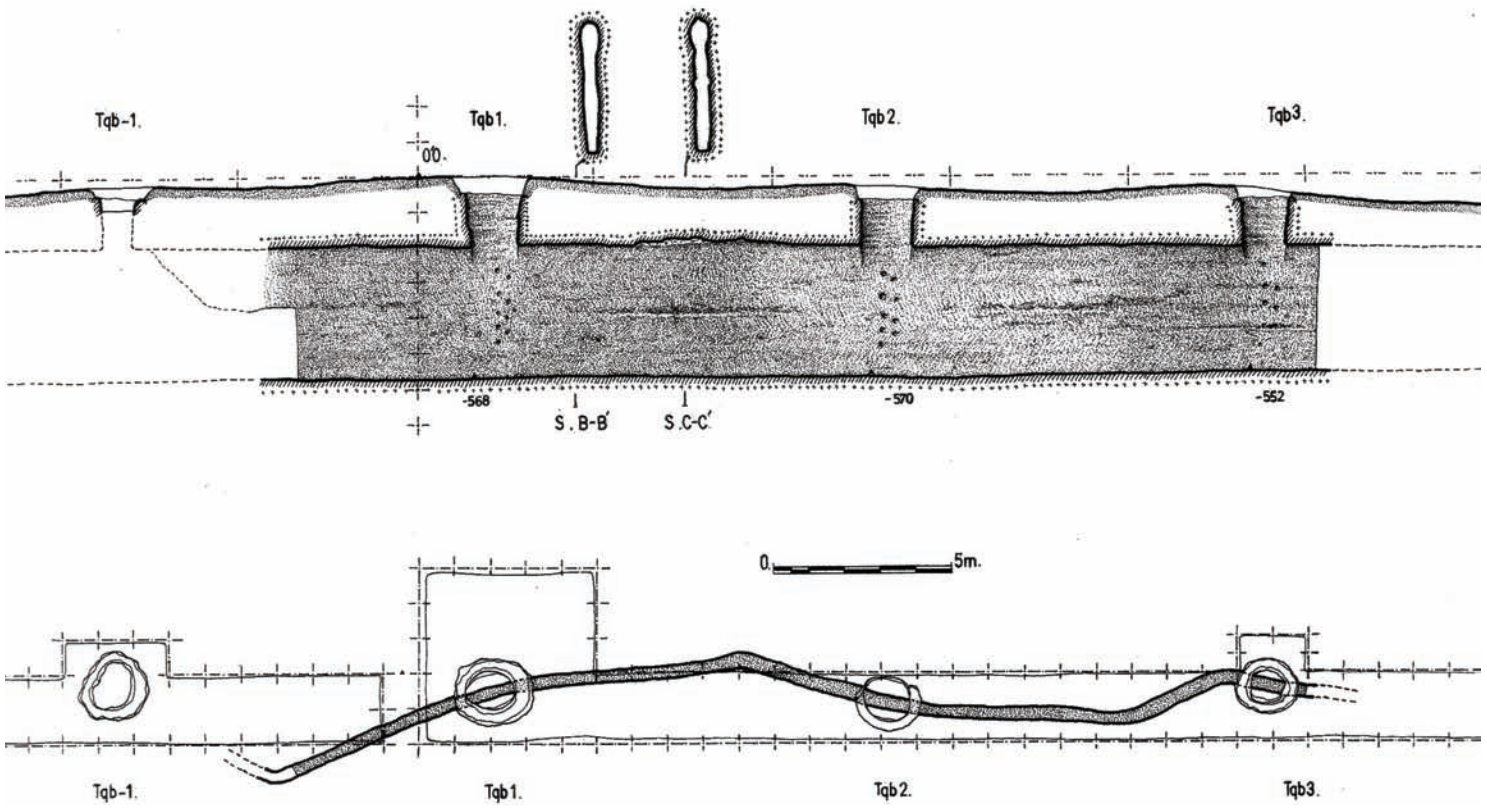

Fig. 7. Map and section of falaj in Al Madam 2 and excavated by the Spanish Archaeological Expedition (M. Muñez Villanueva, Spanish Archaeological Expedition at Al Madam).

differs from that of traditional *aflāj*, suggesting a water catchment gallery (so-called 'captage', see Boucharlat 2000: 157–183; 2003: 162–172), that, with this shape, would collect as much water as possible throughout its course and not only at its head. The amazing height of the gallery is owing to the fact that we are actually dealing with two superimposed galleries. The original one was 1.50 m high but at some point the inhabitants of Al Madam lowered it by up to an additional 4.80 m in a second attempt to find water.

The lowering of the gallery reminds us of what occurred in the village, where the well was re-excavated in response to an undoubted lowering of the water table. After multiple surveys in the area and by means of aerial photographs we can say that the catchment gallery approaches the village of Al Madam 1 – Thuqaibah and continues to its periphery where we can detect traces of cultivation in a flat area.

The source of this water has not been identified yet. The Oman Mountains are too far away, c. 10 km, and the Wadi Yudayyah runs to the south. If we follow the lines of the whitish hills we find that these lead to an area filled with huge dunes, within which can be located an area of whitish depressions which look like small, old lakes or places where the water table reached the surface. The water might have come from this place, almost 3 km away from the village. As was often the case with traditional *aflāj*, the contribution of water was never very large, and the well in the village probably supplied both people and livestock. Thus, the water from the catchment gallery may have been mainly used for irrigation.

The presumption that this system dates to the Islamic period has not been confirmed by the data obtained in the excavations at Al Madam 1 and 2, or by the data from the general survey of Al Madam or by the local history of the area. Thus, despite the fact that no pottery has been found inside the gallery, the subterranean structure at Al Madam 2 is in all respects similar to the Al Madam 1 settlement. The same kind of tool was used in the gallery and in the well in the village, suggesting that the same manner of excavation was used in both constructions. Also, the system that enabled the users to go up and down, the small steps carved on both sides of the gallery and the well, is exactly the same.

Other specialists, who have been asked and have been provided with images and a description of the site, share our impression that Al Madam 2 is an Iron Age construction. Also, regarding the structural features and the slight difference in elevation between the furthest points of the excavated area, as well as the comparison of relative depths and the process of collapse in the village well and in the soil of the gallery, the following was noted: the water table of Al Madam was surprisingly high; the water source did not come from the mountains; and the water supply decreased very noticeably during the existence of *falaj* on at least two occasions. The inhabitants of Al Madam strove to settle in an area that was attractive for them. That is why they expended great effort in building their houses, without becoming discouraged by the lack of stone or clay to make mudbrick, although they had to cut the natural rock to obtain building materials. To achieve this, they diverted the necessary water through channels or excavated wells. They knew that the rock was relatively easy to handle, and that the water table was very high and that it would guarantee their survival. They knew how to excavate the rock and how to dig a communal well in the central sector of their settlement that supplied both the people and their livestock with water.

The well and the *falaj* show they had a sophisticated knowledge of hydraulics and soils, which was anything but elementary. The Al Madam inhabitants knew their environment perfectly and how to profit from it. Furthermore, their tools were of a high quality, no doubt made of metal and very tough, but also light.

Once settled in Al Madam, the only thing which could go wrong – and could not be solved – was a decline in the supply of water. For this reason the inhabitants of Al Madam lowered the well and the *falaj* gallery until water was found again. The chronology is documented in the well, thanks to the pottery that appeared in the fill and at its bottom. The construction, development and transformation of the gallery resembles that of the well, but the lack of material does not allow us to confirm their contemporaneity. However, in regard to Sector 1, during the late Iron Age III, a period of drought might have affected the region. The water table must have fallen considerably. The second lowering of the well required excavation of a further 2.50 m and only the last 40 cm closest to the bottom of the well showed signs of humidity. A third lowering of the structures was not possible. Both the collapse of the well and perhaps the gallery were precursors to the abandonment of the village, a phenomenon reflected stratigraphically and in the slow collapse of the structures, the advance of the dunes and the unfinished materials found in the Mudbrick Working Area.

During the late Iron Age III period, sand had almost blocked half the well of the village, judging by the pottery found at a depth of 3.43 m below the surface. We do not know if the *falaj* continued to be used, but only one of the channels conveyed water to the Mudbrick Working Area. The water table fell again and staying in the village would have been 'suicide'. So, calmly, and with no signs of destruction, the population of Al Madam left in search

of somewhere else where the requisite natural resources would enable them to settle down.

The abandonment of the village in the late Iron Age III period seems to be connected to the scarcity of water and the impossibility of keeping people and livestock in such an arid area. In every open sector of Al Madam 1 the impression is the same, that both men and animals abandoned the area calmly and after a great effort to obtain water, that became too difficult to obtain. The evidence that best shows this to be true is the Working Area, that, as if it were a photograph, reveals how the inhabitants of Thuqaibah, who lacked water, stopped moulding bricks when water was no longer available. The material hardened, as if it were petrified, and retained the hand and footprints of the people who were working there until the very last moment, as well as traces of the tools they used. Once they left, Al Madam 1 – Thuqaibah was swallowed by the sand of a desert that continuously encroached upon it from the westward mountains to create the site we see today.

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Fifty Years of Emirates Archaeology

AL MADAM 1–THUQAIBAH (SHARJAH, UAE): RECENT FINDINGS IN THE MUDBRICK WORKING AREA

Joaquín María Córdoba (Madrid)

INTRODUCTION

The Autonomous University of Madrid has been working at Al Madam oasis (Sharjah, United Arab Emirates) for the last decade. This area is located on the old caravan route following the north-eastern border of the Rub al Khali and the western limits of the foothills of the Hajar mountains. The oasis developed where there is a convergence of surface and underground water. Hence, there has been a human presence here since ancient times, as shown by the archaeological evidence (Benoist and Mouton 1994; Uerpmann 2008).

Last season, our work focused on an area related to House 6 in AM 1 (Thuqaibah, Iron Age II–III), where we have previously documented a Mudbrick Working Area (MBWA) (Córdoba 2006, 2008; del Cerro 2008). The first evidence of where and how the ancient population of this oasis made their characteristic mudbricks was first observed and documented at Al Madam. The significance of this discovery is clearly shown by the absence of any reference to this kind of area in the technical and material architecture repertoire of archaeological or historical literature. Bearing in mind the state of preservation of these remains, our aim last season was to determine its limits. This has given rise to some new questions in the light of the unexpected surface extension of the area and other aspects revealed by our work.

QUESTIONS AND PRELIMINARY ANSWERS: THE INITIAL STRUCTURE

In our opinion, the typology of this village is unusual because it consists of small houses, either independent or in groups of two or three, sharing open yet well-defined spaces (Córdoba and Mañé 2000; Córdoba 2003) with a mixed economy focused mainly on rearing livestock (Fig. 1). On the other hand, AM 1 smallfinds, pottery and architecture find exact parallels elsewhere in the oasis culture during Iron Age periods II and III. Moreover, the walls of Al Madam are very similar to those of Rumeilah, Hili 2, Hili 14 and Hili 17.

When our excavations began, we wanted to know how and where mudbricks were made, as most of the excavated houses had been built directly on the sand with just a single mudbrick layer as foundation (Fig. 2). That means that the sand itself represents the inhabited surface during the Iron Age. Our experience, combined with data from the ethnographic literature, suggested that, because of their fragility, mudbricks were usually made in the vicinity of the buildings, in the construction of which they were used (Krafeld-Daugherty1994: 14–15; Córdoba 2006: 97). The mudbrick also needs to be sun-dried. Therefore a place for drying is necessary. But the AM environment was, and still is, sandy and frequently affected by sand storms that quickly erode the surface.

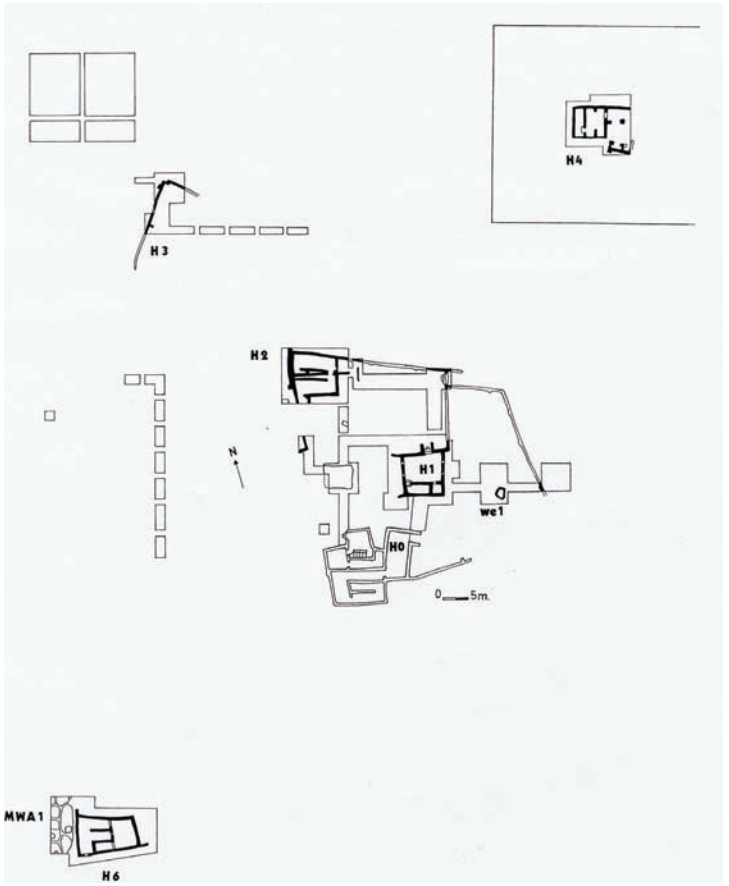

Fig. 1. AM 1 Thuqaibah at Al Madam. Excavated areas of the Iron Age village.

Fig. 2. The houses were built directly on the sand.

In mud and clay-rich areas of the Near East, traditional mudbricks consist of 70 percent sand, 15 percent straw and 15 percent clay (Sauvage, 1998: 17–19) But in the oases of the Oman Peninsula, the mudbricks are quite different. We were very surprised by the hardness and whitish appearance of local mudbricks (Fig. 3), so we tried to determine their geochemical composition and the origin of the components used. There is a high proportion of calcite/lime elements and a small proportion of gravel, sand and vegetal inclusions (Pozo and Córdoba, 2002). However, bearing in mind the evidence from other parts of the Near East, we still could not identify where the white lime/calcite elements were coming from and how they were manufactured.

Fig. 3. A typical, very hard mudbrick of the Iron Age at AM 1.

Eventually, an extension of the area excavated on the west side of House 6 revealed a unique structure in the archaeology of this region: an MBWA with basins, small supply pits, mudbricks and rocky material, gravel and mudbrick fragments ready to be ground up (Fig. 4). There is an obvious association between this MBWA and the construction of House 6. At the end of the 2005 season, we opened a 50 m^2 extension where the mudbricks used to build House 6 and other houses nearby were made during the Iron Age, as shown by the stratigraphy, the *in situ* mudbricks and the pottery. Although we have not completed the excavation and study of this MBWA, we have published several provisional accounts (Córdoba 2004, 2006, 2008; del Cerro 2004/2008).

The area (Fig. 5) contains the following elements: a mound of mudbricks and mudbrick fragments; a smooth surface probably used as a place for drying; an extraction area with lots of tool marks; some basins delimited by small walls; small wells; water distribution channels (water was obtained from the gardens immediately to the south); and a preserved basin full of mudbrick (Fig. 6). Footprints, especially those of children, and handprints of adults were preserved in this material, just as they were in other basins without material inside. Experiments *in situ* have shown that the natural, humid soil easily turns into a soft mass with the addition of water. The whitish bedrock was the essential, long sought-after component in the mudbrick manufacturing process. The constant humidity of the area permitted the preservation of footprints and handprints in the abandoned surface, that soon reverted to its hard texture under the sun's rays. Dune encroachment eventually covered both the MBWA and the abandoned houses by the end of Iron Age III.

Fig. 4. The eastern part of the Mudbrick Working Area (MBWA).

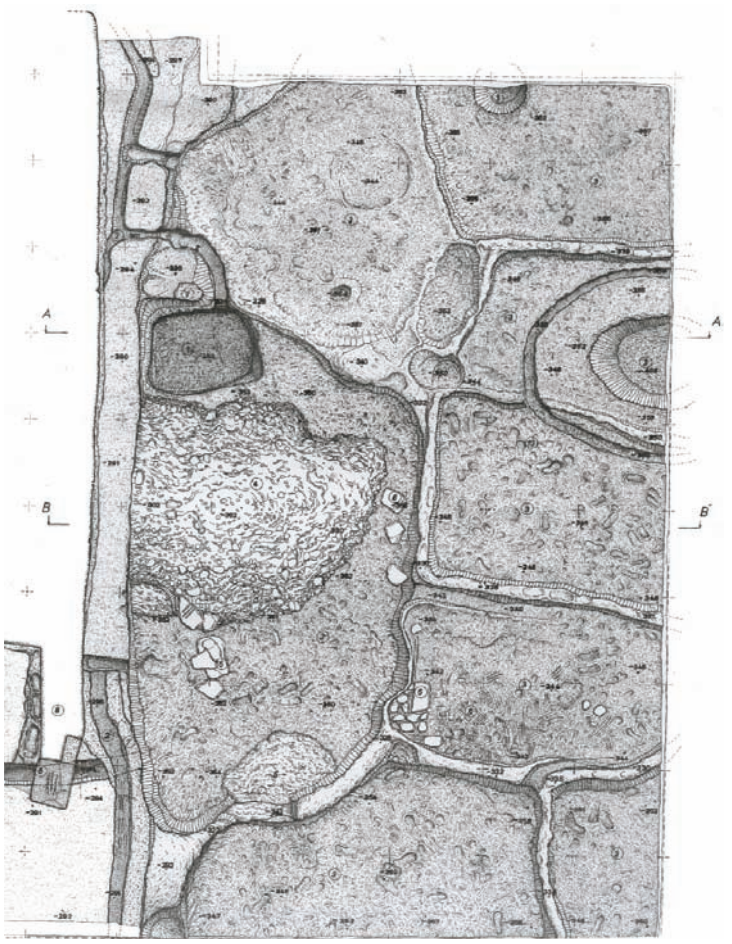

Fig. 5. Plan of the East Area of the MBWA 1.

Fig. 6. Basin in the MBWA 1 full of mudbrick material. Foot and handprints were preserved.

In short, the discovery of House 6 at AM 1 Thuqaibah has revealed where and how mudbricks were manufactured during the Iron Age. We anticipate that similar MBWAs will be found in the neighbourhood of other houses.

PREVIOUS QUESTIONS NOW UNDERSTOOD

The hypotheses based on our previous findings in the central area of the village now seem correct in light of the above-mentioned discoveries. Some years ago we opened stratigraphic soundings in the central sector of the village to determine the relationship between the houses and to be certain that the houses belonged to the same period.

While trying to determine the stratigraphic relation between Houses 2 and 0, we found a sort of basin dug into the bedrock in the middle of Sounding 4 (Fig. 7).

Fig. 7. The first basin found in Sounding 4.

Because the basin was large and we could not find its limits, we enlarged the sounding. The basin proved to be 4 m on its sides and 50 cm deep. A sample was taken at the base of the basin for analysis: it was bedrock. Hence, we might suppose, in light of the House 6 findings, that the basins in the middle of Sounding 4 and in the middle of the area between Houses 1, 2 and 0 belonged to a mudbrick working area. This hypothesis will only be corroborated through future excavation.

In 2005 we discovered another MBWA close to House 4 (Fig. 8). House 4 is a very interesting structure because of its architecture, associated finds and pottery (Mañé 2005). With respect to the building techniques used, the material recovered and the new basin found cut into the bedrock certainly support the hypothesis that every house or group of houses had an open mudbrick working area cut into the bedrock.

FINDINGS AND NEW QUESTIONS PROPOSED IN THE LAST SEASON

As an Iron Age MBWA, abandoned while still in use and preserving traces of human activity, is unique in Arabian archaeology, our main purpose last season was to continue the excavation area until we reached virgin soil. As it was impossible to work beyond the fence delimiting the southern gardens – where the water source for the mudbrick working area was probably located – we opened as large an area as possible to the south (18 m^2 in a 2 x 9 m sounding), and the west (Fig. 9), totalling over

Fig. 8. A new MBWA found beside House 4.

100 m^2. Nevertheless, we still did not reach the limits of the working area in the north, the west or the south. However, the apparent regularity of the basins discovered in the last season gave rise to several questions.

Fig. 9. Last season's enlargement of MBWA 1. New basins and extraction area.

The area between the Channel 1 and the eastern side of House 6 is an MBWA in which the material was obtained (5), prepared in basins Bs 1–7, 12–14 and 16–17, and then stored with the remains of other bricks (6). The area was also provided with small pits and wells for storing water. The *in situ* remains of mudbricks, the footprints and handprints and the analysis of the contents of the basins leaves no doubt about this (Fig. 10).

Last season we discovered a new extraction zone in the south-eastern corner, with preserved tool marks (Gallego 2010), well-preserved basins to the west of Channel 1, a new channel with a similar design and orientation and some other basins further to the west. More footprints have been discovered on the surface of these new basins, and more extraction evidence appeared in the south-western and north-western corner. Some of the natural and/or artificial limits of the basins were levelled to make a wider, continuous working surface.

The builders of every house or group of houses used a nearby MBWA to prepare their mudbricks, although it seems that the large dimensions of MBWA 1 are rather atypical. Only those bricks used in the nearest constructions were manufactured here. The problem is to understand how this area was used and what its relationship was to the houses other than House 6. If mudbricks were dried on the platform to the north of House 6, the recently discovered levelled area between the new basins may have been used as a new drying area closer to the operative basins (Fig. 11).

The very regular, square grid design discovered in the last season suggests that farming was done in small plots of land separated by a network of irrigation channels. The excavated fill of the basins is very clean, consisting of clean sand without traces of agricultural soil or sediment. Cultivation was most probably carried out on the surface and not in a cavity carved into the bedrock, below the sandy soil.

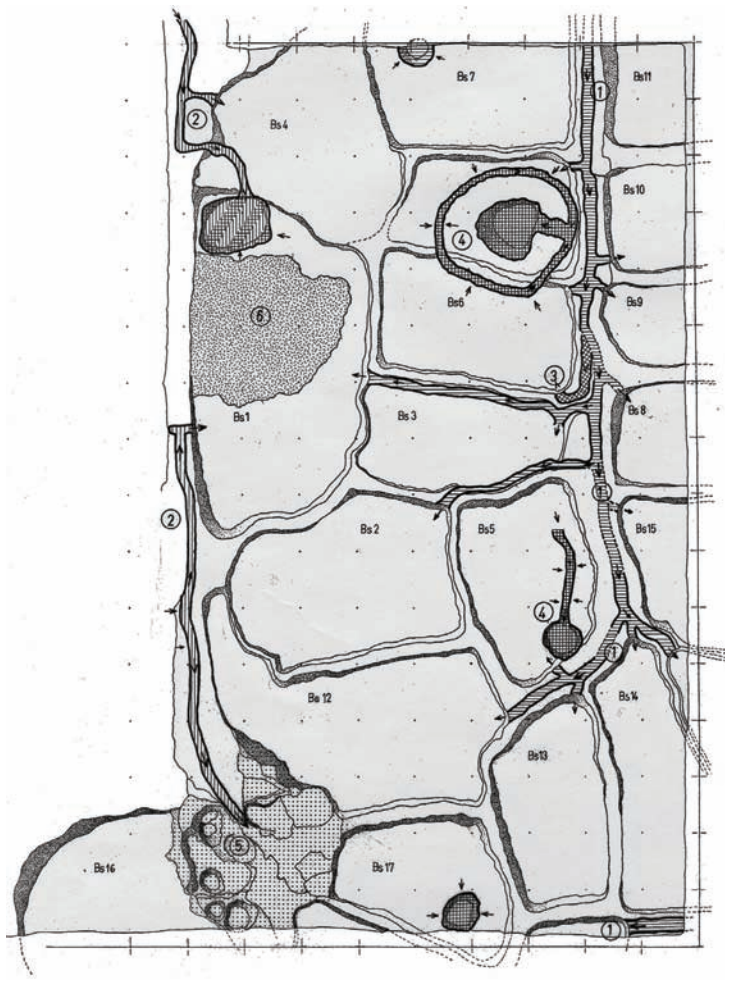

Fig. 10. MBWA 1. Interpretation proposed of the East Area. 1 and 2. channels; 5. extraction area; BS 1, 2, 3, 4, 5, 6, 7, 12, 13. basins; and 6. building material.

The stratigraphy of all excavated areas confirms that, in the past, the environment was much as it is today, dominated by sand dunes. Although we looked for agricultural soil and dark earth deposits in the bottoms of the basins, only clean, aeolian sand was found.

CONCLUSIONS

The questions raised last season still require more work before they can be answered. However, some elements corroborate our previous views. The large mudbricks (48 x 45 x 4–5 cm) used at AM 1 were very hard, and resistant to wind and rain erosion. The Iron Age people used

Fig. 11. General view of the last enlargement of the MBWA 1. Rear: new basins and extraction area. Centre: the levelled area. Foreground: the new channel and the regular basins.

the limited resources of their environment: sand, black gravel, soft and easily worked bedrock, and the recycled remains of old mudbricks. By grinding and mixing all these elements together using their feet, in water in the excavated basins, a whitish mass was obtained with which mudbricks were manufactured.

The difficulty of mudbrick transportation meant that every house or group of houses had its own MBWA, as we can observe for the group of Houses 0, 1, and 2, and at Houses 6 and 4. Similar MBWAs might have existed at other Iron Age oasis villages as well.

Finally, the substantial size of Al Madam MBWA1 remains to be explained. Although it is unlikely to have been used for distant buildings, the increased exploitation of the bedrock nevertheless needs to be investigated. As it is illogical to relate this area to agricultural uses, the preparation of building materials remains the most probable function.

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Fifty Years of Emirates Archaeology

THE IRON AGE OCCUPATION IN MASAFI: REPORT ON TWO SEASONS OF EXCAVATION

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INTRODUCTION

The excavations and survey at Masafi are part of a collaborative programme between the French Archaeological Mission in the United Arab Emirates and the Fujairah Tourism and Antiquities Authority for the study of the remains of Iron Age communities in the Emirate of Fujairah. The aim of this programme is to understand the formation, organisation and evolution of local traditions during this period.

Masafi is located in the western part of the Hajar mountain range which separates the western side of the UAE and the East Coast (Fig. 1). It is situated in a watershed between two main *wadis*: Wadi Abadilah to the north-east, which leads to Dibba – where Iron Age collective graves have been reported – and Wadi Ham to the south-east, which provides a route to Fujairah city, within which is the collective grave at Meraishid, and the nearby Iron Age fortress of Husn Madhab. Further to the south sits Kalba, where an important Bronze and Iron Age settlement has been partially excavated. To the west, Masafi is linked to the region of Dhaid and the western foothills of the Hajar Mountains, where areas of Iron Age settlement are scattered (e.g. at Khatt and Shimal in the north; al Madam, Mleiha, Shwaib and Al Ain to the south). Other Iron Age sites lie westwards across the desert and close to the present-day Gulf coastline (e.g. Muweilah and Tell Abraq).

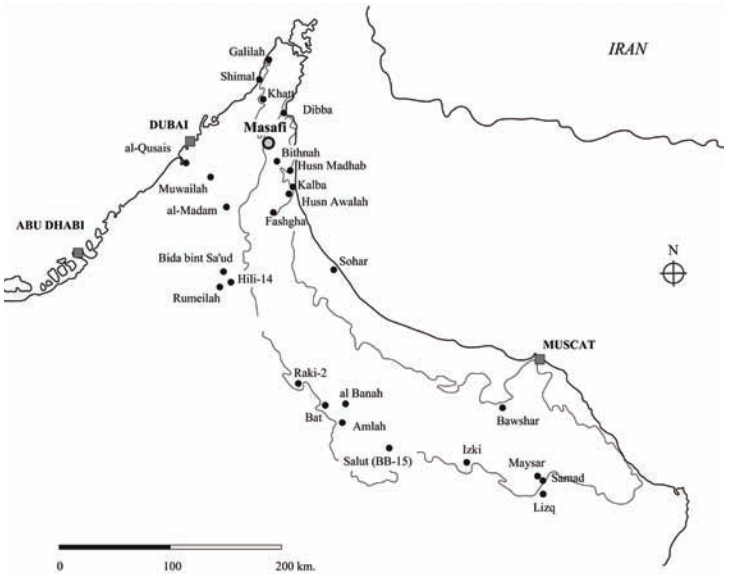

Fig. 1. Location of Masafi and other Iron Age sites in eastern Arabia.

Iron Age pottery was accidentally discovered in Masafi during a visit made by the French team while working at Bithnah in 2003. Iron Age sherds were collected on a low terrace to the north-west of the Masafi Roundabout, on the eastern side of Wadi Abadilah, in an area between the modern village and the area of gardens extending to the west of it. Among the sherds were a semi-complete, bridge-spouted vessel and a fragment with relief decoration in the shape of a snake. Both types tend to be associated with administrative buildings (e.g. at Rumeilah, Muweilah, Bida bint Sa'ud and Building B at Bithnah (Layers 2 and 3) or cultic places (e.g. at Bithnah and al-Qusais in the UAE, and Salut in central Oman). The possibility thus arose that an Iron Age administrative or cultic centre was present at Masafi and measures were taken by the Department of Antiquities and National Heritage to protect the area from damage.

During an initial survey in 2006–2007, the south-western part of Masafi was explored. The area was defined by the border of Ra's al-Khaimah, in the north, and the Masafi-Dhaid road in the south. Surface traces of Iron Age occupation are present over an area measuring c. 600 x 200 m. This includes the western half of Masafi village, the eastern half of the date palm gardens, and, to the north-west, a rocky hill that separates the cultivated area from the Wadi Abadilah. Iron Age occupation seems to continue, although more sporadically, towards the north, in the territory of Ra's al-Khaimah. To the south, Iron Age occupation seems to be limited to the area of palm gardens, and does not extend as far as the road to Dhaid. An Islamic settlement was identified south of the Iron Age occupation area, between the southern half of the palm gardens to the road. Towards the north-east, in Ra's al-Khaimah, traces of Bronze Age occupation have been reported by C. Phillips (pers. comm.) but these have not yet been located. Finally, a rectangular, steatite box of Iron Age type was shown to the team by a local resident. It was said to have been found in the mountains south of the Masafi-Dhaid road, beyond the area surveyed.

In 2006 a trial trench was made in the area first examined, a low terrace located in the southern part of the Iron Age occupation area, to the west of the village, next to the palm tree cultivation area. This resulted in the discovery of a large stone building dated to the late Iron Age II Period, as well as remains of a mudbrick building below it. On the strength of this, a proposal was submitted to the Fujairah Tourism and Antiquities Authority requesting permission for survey and excavations in Masafi. Permission for similar work in the Ra's al-Khaimah portion of Masafi is pending. In 2007 excavation continued in the area of the stone building (Masafi–1). Three successive architectural layers were found, each characterised by distinctive construction techniques. To the north-west of this building, a fortress identified on a rocky hill (Masafi–2) was also mapped during the 2007 campaign. Finally, a trial trench on a farm to the west of Masafi–1 revealed a third structure,

surrounded by a thick wall (Masafi–3), that was partially excavated in 2009. Here we present the main results of the research undertaken in these three areas.

MASAFI–1

A rectangular area (25 x 20 m) was excavated at Masafi–1. Within this were three successive layers of occupation, each consisting of a structure with a large, central room (Fig. 2).

Fig. 2. View of Masafi–1.

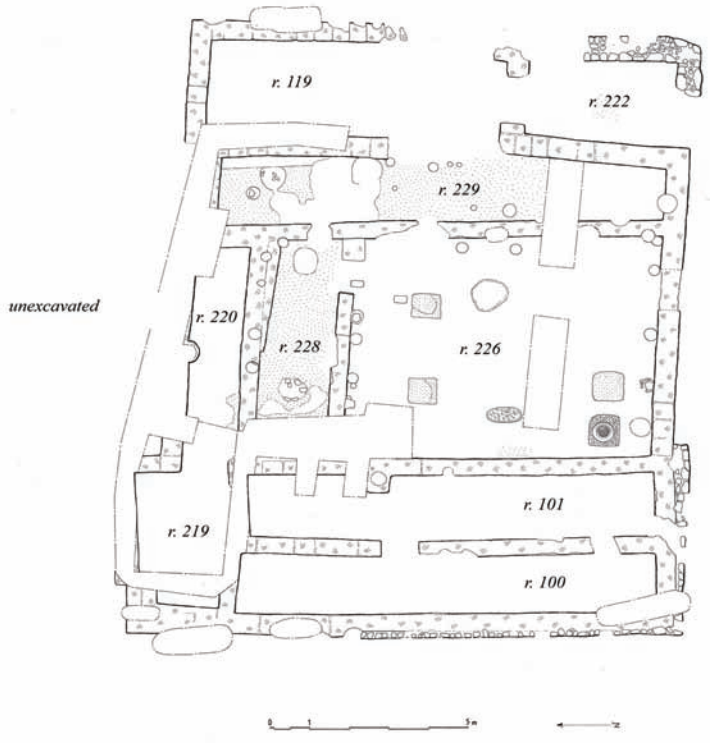

Fig. 3 Masafi–1, plan of Level 1 (Drawing: Vincent Bernard).

LEVEL 1

In the deepest layer, a mudbrick building measuring c. 16 x 11 m was identified (Fig. 3). This consisted of a 6 x 6 m central room (Room 226) flanked on the west, north and east by three pairs of long, narrow rooms. To the east, north and south, the building was freestanding. Its western limits remain undefined. We cannot yet tell whether it extends westwards below the limit of the excavated area or whether it might have been built up against another building from which it would have been separated by walls with stone foundation, as in the case of Building II at Muweilah (Magee 2001: 118).

Inside the central room were three square column bases (c. 60 x 60 cm) made of white clay, similar to that used for the walls. Two were located in the northern part of the room, c. 2.50 m from the northern wall, and a third was located in the southern part of the room, c. 1 m from the southern wall. A fourth column base probably existed originally in the south-eastern part of the room. The impression of a wooden column (21 cm in diameter) was still visible on one of the column bases[1]. These column bases were partly levelled when the building was reconstructed during a later phase. They were associated on the north, south and east with postholes containing stones inserted against the walls or inside the walls. The entrance to the central room might have been to the east, through a door flanked by two postholes. The threshold was not preserved. All that remains are the foundations over which a threshold might have been built.

During this first phase of construction, the walls were made of a single course of white mudbricks c. 50 x 40 cm large, in layers separated by thick layers of mortar. The same construction technique is attested at Rumeilah (Lombard 1985: 152). The floors were covered with a layer of whitish clay. One of the lateral rooms in the south-eastern corner of the building contained a small, rectangular structure in the centre, perhaps also a column base. Similar rooms in the corner of the building have been documented in the columned halls at Muweilah, Rumeilah and Bida bint Sa'ud.

The only finds in Layer 1 were a small, painted, carinated bowl, found on the floor in the north-western corner of the central room; and a complete jar decorated with incised triangles which was buried in a square niche below the floor in the south-western corner of the same room (Fig. 4). Both are characteristic of the Iron Age II period (e.g. at Fashgha–1, Phillips 1987: Figs. 17.1 and 19.1; Bithnah–14, Corboud et al. 1996: Pl. 5.2–3, 8 [similar decoration] and 11 [similar form]; Rumeilah I, Boucharlat and Lombard 1985: Pl. 52.1 and 4).

LEVEL 2

The mudbrick building of Level 1 was replaced in Level 2 by a new building, partly following the same plan,

that was built of yellowish *pisé*, including mudbricks and mudbrick fragments irregularly spread, according to need. This new building (Fig. 5) comprised a large room with column bases (Room 117) and three smaller rooms to the north-west (Rooms 460, 461, 462). If additional rooms were present to the south-west and to the east, they have been destroyed by erosion.

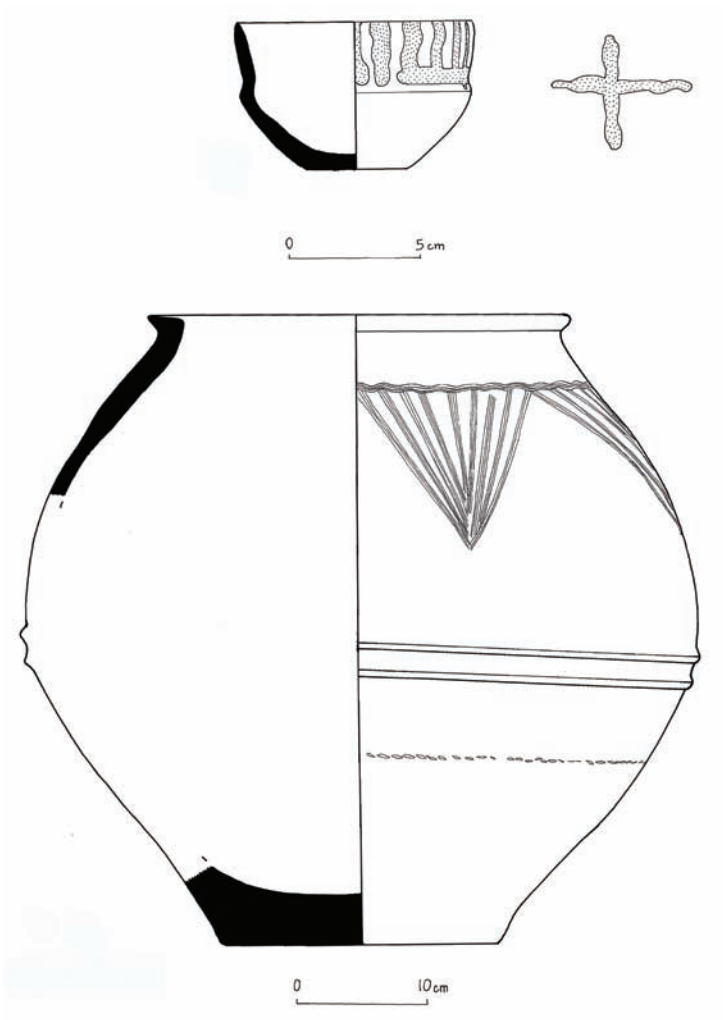

Fig. 4. Jar and bowl from Level 1 at Masafi–1.

The new columned room (7 x 7.5 m) partly overlay the remains of the previous one, and extended 1.5 m to the north and east of it. The room was slightly trapezoidal in shape. Its walls were generally thicker (0.80–1.20 m) than in the other rooms. The walls in the southern part of the room had stone foundations but these were not detected in the northern part of the room.

Inside the room were five circular column bases made of yellowish mud, with one or more flat stone slabs on top. These column bases were 60–65 cm in diameter and 20–25 cm tall (Fig. 6). They were arranged in two rows of two. A fifth one, not in any obvious alignment, might perhaps have had another function (a small podium?). Wooden columns were probably also present along the northern wall of the room. One probably stood on a circular column base topped by a stone slab which was found up against the western part of the northern wall. Along the central part of the same wall was a mudbrick bench. One or two wooden columns on stone slabs were possibly associated with this bench.

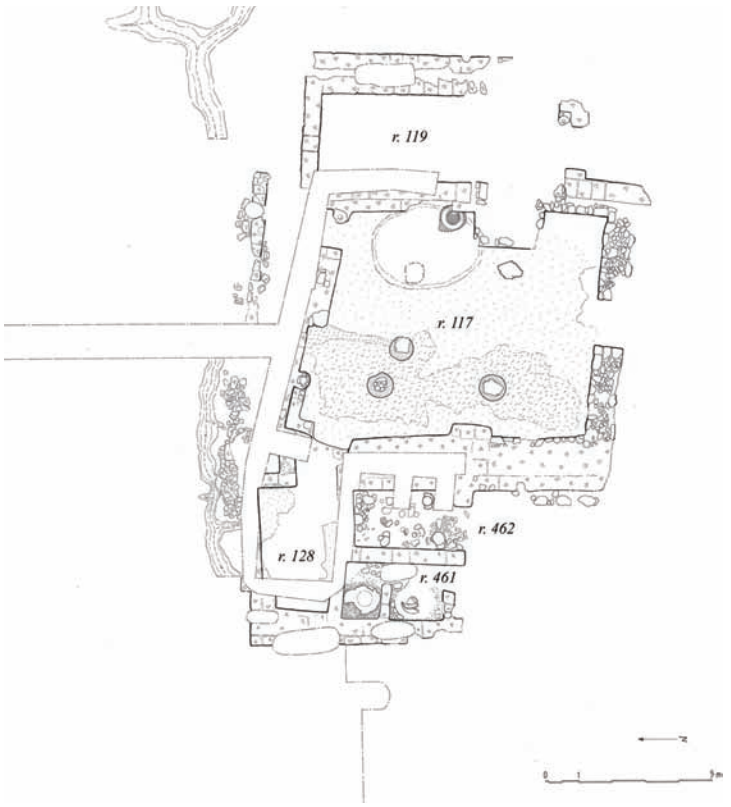

Fig. 5. Masafi–1, plan of Level 2 (Drawing: Vincent Bernard).

Fig. 6. Masafi–1, pillar base from Level 2.

The room had three entrances. The main one was a 1.40 m-wide doorway set in the central part of the southern wall. It probably housed a double door. No trace of the threshold or any other features related to the door were preserved. To the north, a smaller doorway (75 cm wide) was present in the eastern end of the wall. A door socket was found *in situ* on the eastern side of this entrance. Because this area was later covered by other stone structures, it is not clear whether this door opened directly to the outside or led to a narrow corridor to the north of the main room. Later building remains will have to be removed to better understand this area. A third door (1.10 m wide) opened to the north-west onto a small secondary room. It had a threshold made of two-and-a-half mudbricks.

Two podiums were found against the interior faces of the western and eastern walls of the room. To the west was a small rectangular structure (1.10 x .35 m) made of yellowish *pisé*, similar to that used in the construction of the wall. To the east was a badly preserved rectangular structure (2 x 1.3 m) of mudbrick or *pisé* with traces of a whitish coating of clay on top and some stones underlying the southern side.

The floor of the main room was covered with a layer of yellowish mud similar to that used in the construction of the walls. It showed traces of heavy burning and was partly blackened on the west side of the room. The floor was covered with a layer of collapsed mudbricks below which objects were trapped *in situ* (Fig.7). These included: bridge-spouted vessels and small carinated bowls; two chalice-shaped vases that were heavily burnt inside; probably braziers, decorated of snakes or snakes and birds; and a larger brazier in the shape of a goblet carried by a pair of camels with a snake decoration on the side (Benoist, Pillaut and Skorupka n.d.: Fig. 13; Benoist n.d.: Fig. 9). The latter was associated with a bell-shaped, perforated lid with a handle in the shape of an animal that clearly recalls an example from Building II at Muweilah which has a handle in the shape of a bull (Magee 2001: Fig. 14). A figurine of a naked man with a snake around the waist and a *keffieh* on the head, from the same area, might have been part of the lid.

A storage jar was buried in a pit (80 cm in diameter) in the floor in the eastern part of the main room. The vessel was kept stable in the pit by packed fill consisting of additional earth, ash, and fine grey gravel. The exterior of the jar was heavily burnt and patches of ashes still adhered to it. The interior was partly discoloured green by copper, and white by ash. The upper part of the jar had been disturbed by a recent pit. Bronze fragments, bronze crucibles and part of a bronze bowl were found inside the jar, as well as a modern battery and a large iron plate. Thus the dating of the bronze fragments and crucibles is unclear and must await further analysis.

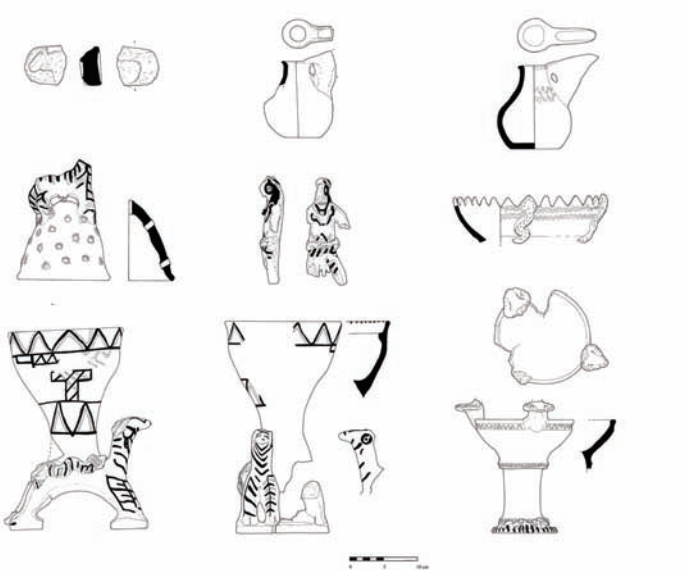

Fig. 7. Masafi–1, objects from Layer 2.

Undisturbed remains of bronze and other objects were collected in a secondary room to the west of the columned room. These included an arrowhead with a thickened tang, a bronze knife, and half of a bronze ingot, as well as several small fragments of bronze, that were found in and around four other storage jars. These bronze finds suggest some sort of management of bronze inside the building, an activity that was also identified in a building of the same type at Muweilah (Magee 2003: 189). Two bridge-spouted vessels, one with snake decoration, and a large, footed incense burner were also discovered in the small, north-western rooms.

LEVEL 3

During a further phase of construction (Level 3), a third building (Fig. 8) was erected directly over the ruins of the burnt and collapsed remains of the Level 2 building. Only the northern half of this last building is preserved. Like its predecessors, it included a large room with wooden columns, a small room to the north-west and an open space with niches to the west. To the south, the construction was completely eroded.

This new construction had double-faced walls of unworked stone, bound by earth mortar, with a central filling of small stones and gravel, a building technique found elsewhere in the area, e.g. at Bithnah (Benoist et al. 2004: 18) and Husn Madhab (Corboud et al. 1998: 173). These walls were covered with a thick coat of yellowish clay and although their building technique differed from that seen in Level 2, the walls probably appeared more

or less the same, superficially. A similar surface coating of buff-coloured or yellowish clay was observed at Bithnah on the lower part of the exterior face of the walls of two small structures (J and K) to the north of a columned building (Benoist et al. 2007: 39).

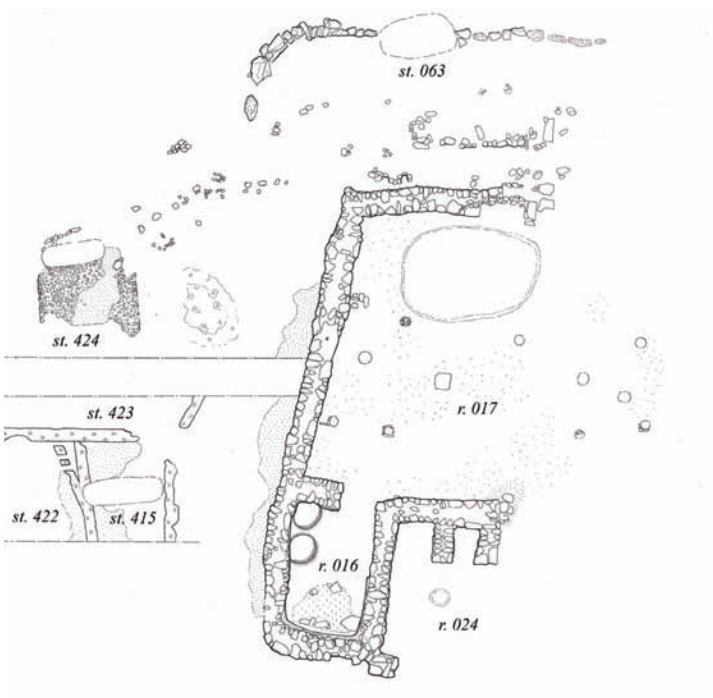

Fig. 8. Masafi–1, Level 3 (Drawing: Vincent Bernard).

Although no column bases were found inside the large room, there were three parallel rows of large circular postholes (20–25 cm in diameter) in the floor. The entrance was probably on the western side of the columned room, only the northern side of which was preserved. A door socket was found *in situ*, on top of a small mud feature that was probably part of the threshold.

A few objects were collected in the columned room, including a fragment of a chalice-shaped vase and a broken bridge-spouted vessel. Fragments of a large storage jar were found inside the north-western room. In general, finds were scarce in this building.

Outside, to the east of the building, was a long, oval-shaped alignment of stones, with several postholes outside it, while inside, a central line of six postholes was found. Whitish clay was visible on the floor. This structure was rich in material, including several fragments of bridge-spouted vessels and a large number of small bowls, some painted, others bearing inscribed graffiti. The structure has been interpreted as the remains of a large tent, erected for a special occasion – perhaps because the columned room was too small – and in which people shared food and drink during a particular event.

To the north, a succession of layers were superimposed against the northern wall of the stone building, over the remains of the mudbrick destruction layer of Level 2. These consisted of a succession of gravelly layers inside which remains of low, thin walls in *pisé* or mudbrick delimited a succession of rectangular structures, with floors of tamped earth (Fig. 8. st. 415, 423, 424). One of these structures was only indicated by a rectangular impression (st. 424). All of these structures yielded a rich assortment of sherds of various types, including jars, large open vessels, jugs, bowls and lids, more numerous here than anywhere else on the site. This collection was also remarkable because it included more fabrics than is present in most other sites of the period. In addition to red common slipped ware, well-represented in other areas at many Iron Age sites in the eastern UAE (e.g. Wadi al-Qawr, Bithnah, Husn Madhab), other fabrics appeared, such as sandy buff wares, common in Al Ain (Benoist 2000: 119–225, 367–373); and calcareous white-grit ware, commonly encountered in the northern and western parts of the country (e.g. at Nud Ziba, Hamriyah and Muweilah, see Benoist, 2000: 374–375; Magee 2001: 123, 'ware with white calcareous inclusions'; De Cardi, Kennet and Stocks 1994: 75–76, 'ware with white grits'). Moreover, most of the sherds of possible foreign origin were found in this area as well, including sherds with small white exploding grits (cf. 'pseudo-Barbar' ware from Bahrain) and some yellow-greenish fragments of necked jars with vegetal temper that may have come from southern Mesopotamia.

The identification of these sherds as imports, resulting from regional or interregional exchange, can only be confirmed by petrographic analysis. It also remains to be confirmed that the diversity of the ceramic assemblage is not a product of chronological evolution or mixing. Level 3 yielded a few sherds suggesting a date in the late Iron Age II/early Iron Age III period (the latter suggested by the presence in very small quantities of fine orange ware and burnished maroon slipped ware, two types dating to the Iron Age III period (Magee 1996; Benoist 2000: 323–327), and it has been observed at Iron Age III sites such as Rumeilah II that the ceramic assemblage tended to diversify at this time (Benoist 2000: 128–153, 381–383). Nevertheless, it could be proposed that perhaps these structures of a temporary type, with their rich and diverse if fragmentary assemblage, represent the remains of a market installation to the north of the columned public building.

Finally, surface cleaning to the south of the building led to the accidental discovery of a channel coming from the north-east and running in a south-westerly direction. This channel was 25–30 cm wide and was coated with white lime plaster (Fig. 9). Its date is uncertain, and a possible connection to an ancient *falaj* system remains

to be investigated by further excavation. The famous springs of Masafi, still exploited today, are located in the same direction, to the north-east, about 3 km away.

Fig. 9. Masafi–1, channel.

ISLAMIC REMAINS

Remains dating to the late Islamic period were found on top of the Iron Age levels and represent at least three phases of occupation.

A first occupation phase is marked by two circular dwellings dug into the layers of the pillared room of building III, partly destroying it. They do not seem to be older than the 16th–17th centuries AD, judging by a few glazed sherds of *Khunj* or *Bahla* ware and Blue Persian speckled ware comparable to examples of the late Islamic period at Kush (Kennet 2004: 42–43). One of the houses was re-occupied during the 20th century AD and is directly linked to the disturbance of the jar buried in the columned room from Level 2.

A second occupation layer, probably very recent (19th–20th century AD?), is represented by a graveyard. These tombs, mainly to the west of the excavated area, have been left in place. It is interesting to note that surface cleaning has allowed us to identify a small mausoleum built around a grave, with a whitish floor of compacted clay still *in situ* from which remains of three incense burners in common Late Islamic pottery were collected. This mausoleum had a small niche to the north-west. As far as we know, it is unique in the region.

Finally, the remains of a small, rectangular mudbrick house might represent a third Late Islamic occupation layer. The house is built of mudbrick (20 x 20 cm) resembling that seen in a building still standing in the nearby farm, and known to have belonged to His Highness Sheikh Mohammed bin Hamad al Sharqi, Ruler of Fujairah until 1974, and father of the present ruler, His Highness Sheikh Hamad bin Mohammed al Sharqi.

MASAFI–3

In February 2007, large stones belonging to an old wall were observed inside a well on the farm referred to above, c. 60 m south-west of Masafi–1. With the kind permission of the Ruler of Fujairah, a trial trench was opened next to the well, in order to determine the date and the nature of this wall.

The shape of the wall revealed in the trial trench (1.70 m wide) as well as the material associated with it (Iron Age II pottery including fragments decorated with snakes) convinced us that an Iron Age structure of some importance was located in this area. For this reason, a trench (9 x 15 m) was opened around the well, inside the courtyard of the residence of the late Sheikh Mohammed bin Hamad, during the 2009 campaign. The remains of a large building were revealed, only the southern and western edge of which are visible (Fig. 10). This was bordered to the south by a 1.70 m-thick wall (Wall 090) built of large, unworked stones (i.e. the wall visible in the well). This wall, which is curved slightly, is preserved to a height of 80 cm, comprised of three courses of stone. To the south-west, the wall has been partly destroyed by a large pit of Islamic date. To the south-east, it seems to continue below Sheikh Mohammed's house.

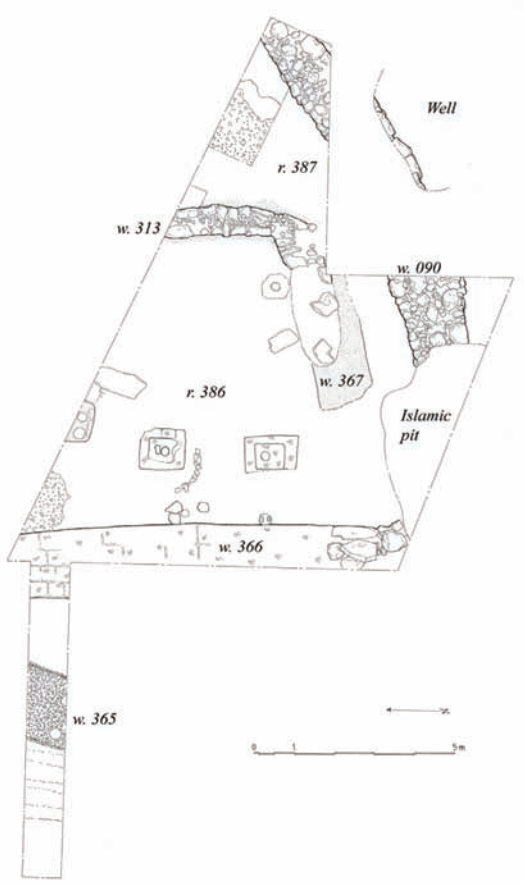

Fig. 10. Plan of Masafi–3 (Drawing: Vincent Bernard).

The western limit of this construction might be represented by a wall (Wall 365) found in a trial trench to the west of the excavated area. This wall (30 cm high, 1.70 m thick) was built of compacted, whitish mud, containing a high proportion of small stones and gravel. It may have served as a foundation on which a wall or fence was erected. A narrow ditch (2 m wide, 30 cm deep) was dug along the western face of this wall.

Inside the space delimited by these two structures were the remains of a large room or courtyard, more or less rectangular in shape, measuring at least 10 m from north to south, and 7.50 m from east to west (Room 386). This was bordered to the west by a mudbrick wall, to the south by a wall of stone and mudbrick, and to the east by a stone wall. The western mudbrick wall was 1.20 m thick and consisted of four courses of mudbrick, being preserved to a height of 10–40 cm. At the southern end of the wall, the remains of what could be stone foundations were identified below the mudbricks. The nature of these foundations has yet to be verified. They seem to stop at a distance of 1.70 m to the north of the southern end of the wall. The eastern wall of stones is only 65 cm thick. The southern wall, 65 cm thick, has been partly damaged by a pit of Islamic date. It is made of a combination of large, unworked stones, and white mudbricks. All walls seem to have been covered by a thick layer of whitish clay, traces of which were visible along the faces of the walls and on the floors. An entrance might have existed to the south, leading onto a corridor 1.20 m wide, that separated the room from the southern wall.

Several small structures were present inside the room. To the west were two small rectangular structures of mudbrick, each with a central posthole 25 cm in diameter. One was partly surrounded by a curved alignment of small stones. A third structure of similar type was present along the southern wall to the east. To the north were found the remains of a possible podium built of white mudbricks, and a large stone slab, the function of which is unclear, although it may have been a column base, a threshold or an altar. The floor was made of a layer of whitish clay, partly damaged by collapsed mudbricks walls in this area. It seems to have been built on a foundation of two courses of mudbrick and was covered by a thick layer of debris, which trapped dozens of objects *in situ*.

The material collected in room 386 constitutes an assemblage characteristic of cultic sites. It includes small copper figurines shaped like snakes, bronze knives and arrowheads and ceramic vessels, most of which are decorated with snakes. Almost all of the copper snakes were found in the north-eastern part of the excavation and are of two types. Most (N = 30) are made from a hammered bronze sheet, cut, sometimes twisted and re-flattened (Fig. 11). They range from under 5 cm to around 20 cm long. All appear to be crawling, some with the head curved over the body. Their heads vary in shape from oval to triangular. Most of the copper snakes are undecorated but a few have small circles incised on the body. These snakes find good parallels at al-Qusais in the 'Mound of Serpents' excavated by M.Y. Taha in 1982 (Taha 1983: Fig. 16; 2009: Pl. 53). A similar example has been reported from Salut (Avanzini et al. 2007: Fig. 18.1).

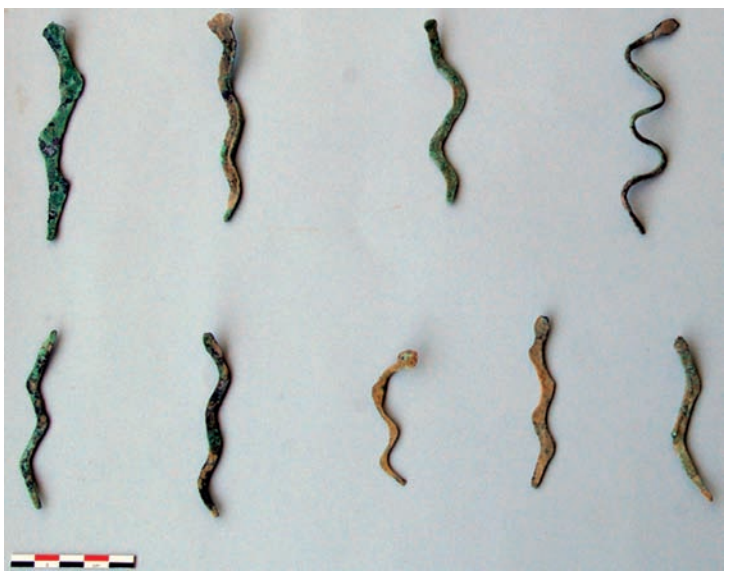

Fig. 11. Copper snake from Masafi–3.

The other snakes (N = 4) are of cast copper (Fig. 12). These have an oval or slightly triangular head and a crawling body, rounded or oval in section. All have small drops on the body and the head that might be interpreted as decoration but may also have had a function in fixing them to something. Most of them also have flattened ribs on one or both sides of the head and the tail. It is possible that they might have all belonged to a single object, such as a decoration fixed on a door, a box or a podium. Cast copper snakes are also known from Salut (Avanzini et al. 2007: Fig. 19.3), all with small drops on the body.

Bronze/copper weaponry included two tanged arrowheads of a type known at other Iron Age sites. Both are triangular and one has small signs engraved on one side, reminiscent of an arrowhead from the grave Bithnah–14 (Corboud et al. 1996: Pl. 24.11). Other weaponry from Masafi–3 is more original and might represent votive objects rather than items for actual use. These include long, tanged points with a rounded end, and miniature knives, one with a snake incised on the blade face (Fig. 13). According to Taha (Taha, 2009: 95), several hundred pieces of bronze or copper weaponry were recovered from the 'Mound of Serpents' at al-Qusais, the majority of which might have been *ex votos* rather than weapons that were actually used.

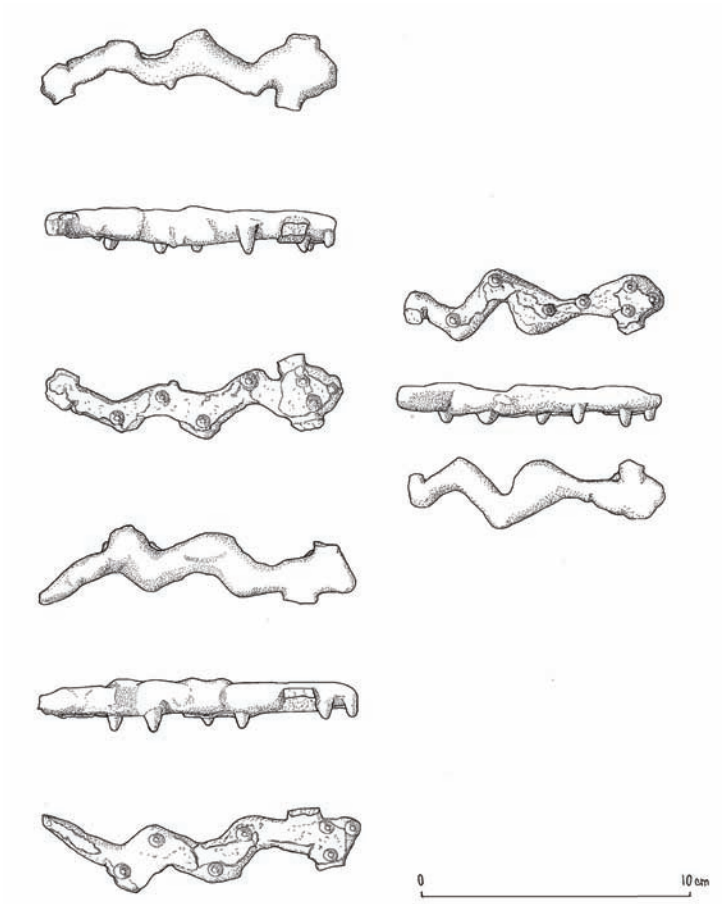

Fig. 12. Cast bronze snakes from Masafi–3.

A large number of ceramic vessels was also found, including many complete or almost complete examples. These form a distinctive assemblage almost exclusively composed of long-handled bowls and chalice-shaped vessels, to which can be added a few jars, bridge-spouted vessels and a single lid. Most of these items are decorated with snakes.

Fig. 13. Bronze knife from Masafi–3.

Long-handled bowls (Fig. 14) are also reported from Bithnah–44 (Benoist, 2007: Fig. 15.2–4 and 6), al-Qusais (Taha, 2009: Pl. 52.A–B) and Salut (Avanzini et al. 2007: Fig. 19.1–2) where they were particularly numerous. They seem to be restricted to cultic areas, and no examples of this type have been reported from houses, graves or columned buildings of this period. These vessels consist of a shallow bowl with a solid, horizontal handle fixed to the base. Some are undecorated, others have geometric patterns incised on the handle, and still others are decorated with snakes in relief, crawling on the handle, outside the vase, sometimes with the head pointing over the rim of the vessel and attached inside the bowl.

Fig. 14. Long-handled bowls from Masafi-3.

Chalice-shaped vessels are also present in large numbers. Most have a plain, cylindrical foot (Fig. 15). These include small, undecorated examples and larger ones with incised patterns and snake decoration, most frequently shown crawling on the exterior, or more rarely placed on the inside of the vessel. Similar vessels have been found at Bithnah–44 (Benoist 2007: Fig. 15.8–9 and 19) and al-Qusais (on display in the Dubai Museum). None have been reported from Salut. Small numbers of similar examples also appear in buildings with columned rooms at Masafi–1 (Benoist n.d.: Fig. 9), Muweilah (Magee 2003: 184 and Fig. 4), Rumeilah (Boucharlat and Lombard 1985: Pl. 51.5; Boucharlat, Lombard and Benoist 1994: Fig. 16) and Bida bint Sa'ud (Benoist 2000: Fig. 105). Two half-complete examples have a hollow foot pierced with lateral openings (Fig. 16), a feature also observed at al-Qusais (objects exhibited in the Dubai Museum) and Bithnah–44 (Benoist 2007: Fig. 15.14–15).

Fig. 15. Chalice-shaped vessels from Masafi–3.

The handled bowls and chalice-shaped vessels from Masafi–3 have only a few traces of burning, a fact that

Fig. 16. Footed vase with lateral openings from Masafi–3.

distinguishes this material from that of Bithnah–44, where almost all of these vases were heavily burnt. This might suggest some distinction in functional use of these vessels between different cultic sites: some of the Masafi objects might not have been used for burning products at all or they might have been used only on a single occasion, being offered to the deity, for example. One may speculate as to whether all the material present in this area had been used before the building collapsed, or if a stock of unused braziers was also present, to be sold to worshippers who wished to make offerings, for example.

Other ceramic types present include medium-sized, necked jars with snake representations and a lid with two crawling snakes on top, as well as a complete bridge-spouted vessel in fine red painted ware.

At Bithnah, all of the cultic vessels were made in a fabric which could be considered local. The ceramic assemblage of Masafi–3 also has a high degree of homogeneity, and is dominated by common red ware with red and white grits, perhaps originating nearby. A few examples, however, are in different fabrics. Among these are two- or three-handled bowls and a pair of chalice-shaped vessels with snake representations, made of a fabric with exploding white grits. The origin of this fabric is not yet known but it clearly recalls the 'pseudo-Barbar' ware of Bahrain. Comparisons through petrographic analysis should be made with examples from Bahrain because the importation of cultic vessels with snake representations from Bahrain would constitute an important marker of cultural relations between the two regions.

The snakes represented on the Masafi–3 pottery assemblage have an oval or triangular head, often horned, that might suggest that these represent the horned viper, a snake which is present in the region, and that is well-known for its venom. Such horned snakes were rare at Bithnah (only one possible example of a head, with ears or horns, which was interpreted as the head of a leopard, Benoist, 2007: Fig. 15.5). Nevertheless, none of the snakes found have a threatening aspect but rather a 'friendly' one: these are smiling snakes. This could be related to the positive connotations of the snake symbol during the 1st millennium BC, when it appears to have been a symbol of prosperity, and healing, related to magic, medicine, and technical knowledge, and a symbol of fertility related to subterranean water and vegetation. On one snake-shaped handle, a human face is visible under the snake's head (Fig. 17).

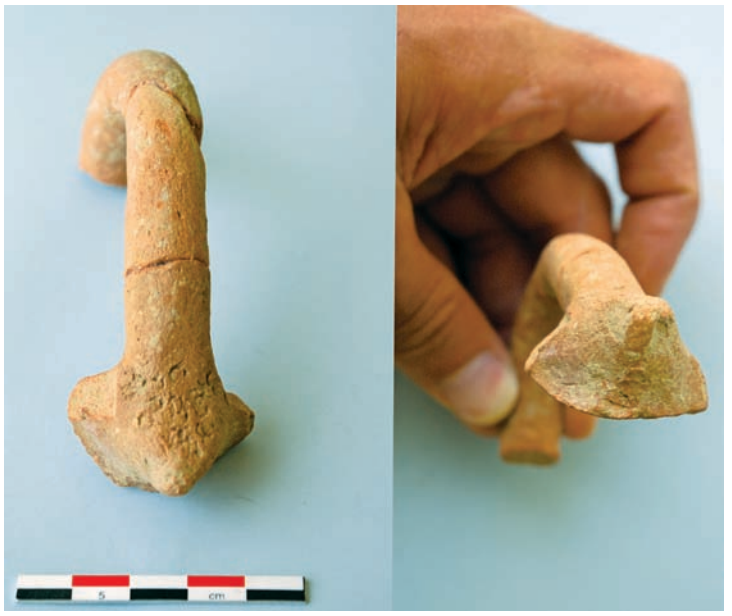

Fig. 17. Handle showing a snake with a hidden human face.

Of particular interest is a complete figurine in the shape of an animal with the characteristics of a caprine, a camel and a snake (Fig. 18). It has four legs with cloven hooves, a long neck and a flat head recalling the shape of camel saddles represented on figurines, like the one found at Muweilah (Magee 1996b: Fig. 28). The animal originally had two snakes on its back (one is missing but its impression remains), one around its neck, possible horns (broken) recalling those of the horned snakes discovered in the vicinity, and painted snakes all over its body. A crawling snake appears between its legs. One of the snakes on the back of the figurine has an open mouth inside of which are five rounded shapes. What these represent is unclear. Eggs appear to be a likely possibility given the association of snake symbols with fertility. Ingots, pearls or beads, each of which might relate to notions of prosperity and richness, might also be possible.

Fig. 18. Camel figurine from Masafi–3.

MASAFI–2

An elongated, rocky hill, overlooking a cultivated area, extends c. 500 m to the north-west of Masafi–1. Three watchtowers of Islamic date are situated on its higher parts and a stone village of Islamic date extends over the south-western slope of the hill. According to local informants, the towers were still in use two generations ago, when control of the area was disputed between tribesmen loyal to the Rulers of Ra's al-Khaimah and Fujairah. Iron Age sherds were collected at the north-eastern foot of the hill, leading us to suspect the presence of an Iron Age site above. These included fragments of large storage jars, suggesting a settlement or fortification. On the basis of these indications, a more detailed survey of the hill was undertaken in 2007 during which structures of probable Iron Age date were identified. These extend over an area c. 100 x 80 m on the north-eastern part of the hill, within a more or less rectangular space surrounded by 1 m-thick walls (Fig. 19). One wall (Wall 021) is built on the crest of the hill, and seems to have been re-used as a base for a path joining the three Islamic watchtowers. To the north-west, a second wall (Wall 032) blocks a small wadi, delimiting a 15 m-long terrace, where Iron Age sherds were found. To the north of the northernmost watchtower, the top of the hill has been flattened and the remains of a squared construction still appear on the surface. From here a stone wall, that could be followed for over 50 m, runs to the foot of the hill to the east, marking the northern limit of the Iron Age site. To the south, the limit of the site is located between the corner of a newly built house and the second watchtower. This too is marked by a wide wall (Wall 036). These perimeter walls are remarkably homogenous. All are built of large, unworked blocks that have been carefully lain and bound with a mortar of pinkish clay, containing fine gravel.

Fig. 19. Plan of Masafi–2.

Inside the enclosed area the remains of another thick wall, dividing the fortress into two parts, were noted. The upper part of it, towards the west, includes the remains of a massive construction, perhaps a tower or bastion, that might have been used for defensive purposes. The lower

part of it, towards the east, is associated with the remains of smaller walls on the slope, possibly representing houses. Iron Age sherds are scattered on the surface of this area, whereas Islamic pottery, well-represented further south, is absent here. The eastern limit of the site has been partly destroyed by bulldozing, and walls are visible in the bulldozed section.

CONCLUSION

The two campaigns in Masafi have significantly increased our knowledge of the organisation of the Iron Age settlement there, revealing three different kinds of structures – a columned building at Masafi–1, a fortress at Masafi–2 and a temple at Masafi–3 – each of which probably served a communal purpose.

The building at Masafi–1 can be related to similar structures at Muweilah, Rumeilah and Bida bint Sa'ud. With its large, central columned room, the building perhaps most recalls a *majlis*, a place able to accommodate large meetings. The material from Masafi–1 is comparable to that found at Rumeilah, Muweilah and Bida bint Sa'ud and it integrates elements which are absent or only rarely represented in other contexts, such as bridge-spouted vessels (over twenty now recorded, mainly from Levels 2 and 3); small bowls (almost 100) in common slipped or painted ware; footed braziers of various sizes in which something was burnt (all show clear traces of burning inside); and bowls with incised graffiti (Level 3). Each of these elements has been observed in other columned buildings of Iron Age date in the region. These appear to have been components of a quite standardised collection of equipment specifically used in such buildings. The association of bridge-spouted vessels and bowls suggests the sharing of drinks by a large number of people while braziers suggest the burning of aromatics.

In a recent publication, one of us has suggested that these two activities – communal drinking and the burning aromatics – occurred in the context of regular, collective festivities in these buildings (Benoist n.d.). Banquets, which might have been part of these events, have been clearly documented at Bithnah where remains of dozens of young, sacrificed animals were buried in pits next to a columned building (Benoist, Pillaut and Skorupka n.d.). However, the columned building and the signs of banqueting at Bithnah occurred in a specific cultic context, distinguishing this area from other columned buildings in the region for which no religious function could be demonstrated. Nevertheless, large pits containing ash and traces of burning were found next to the columned buildings at Rumeilah and Bida bint Sa'ud (Benoist n.d.). These might represent collective cooking structures used on special occasions. At Muweilah, a pit with a ritual deposit and some bronze ladles was related to banqueting by P. Magee (Magee 2003: 185–186).

At Masafi–1 we do not yet have clear evidence of the large-scale consumption of food during banquets, either inside or next to the public building, but it seems clear that on some occasions a large number of people could be grouped together inside or around the building. The presence of a large area, perhaps covered by a tent or other temporary structure, in Level 3 suggests that on at least one occasion the space used for meeting was too small and had to be enlarged.

These buildings have also been interpreted by some authors as administrative centres for the management of community resources, and some elements discovered during the present campaign (large-scale storage capacity, traces of bronze smelting, possible presence of a market nearby) also suggest that the collective management of economic resources took place in and around the building at Masafi–1. Bronze metallurgy could have been practiced here, and further research should be undertaken in future campaigns to investigate this. Exchanges of goods are suggested by the presence next to the building of a possible market. The location of Masafi along a major east-west axis makes it likely that the site played some part in regional exchanges. The local economy also probably included irrigation agriculture and ancient gardens might have been present to the west of Masafi–1 and 3, below the presently cultivated areas. Our data on agriculture are still poor, and in spite of systematic flotation of most sediments from the excavations, no evidence of cultivated cereals has yet been identified. The discovery of a possible irrigation channel is, however, a promising find. Whether or not it was connected to a *falaj* remains to be verified in the future (for connections between columned buildings and *aflaj* see al Tikriti 2002; Boucharlat and Lombard 2001). Curiously, only a few steatite objects were found during the excavations although steatite is available locally. The presence of steatite outcrops in the Masafi area has been reported to the French Archaeological Mission by the Swiss team (P. Corboud et al.) that excavated at Bithnah.

The discovery of Masafi–3 enabled us to locate a temple in the Masafi area. Its plan is not yet completely clear, but it seems that it was surrounded by a thick wall that might have separated it from the nearby public precinct where the Masafi–1 building was located. This kind of spatial organisation differs very much from that observed at Bithnah, where the cultic space and the columned building were closely associated. The full extent of Masafi–3 is unknown and may have included

more than one distinctive structure. As of the end of the 2009 season, it seems likely that Room 386 was unroofed, although it might have included some covered parts along the western and southern wall. Other spaces might have existed to the north of the excavated area.

The fortress at Masafi–2 was also occupied during Iron Age II. Thus, we can now distinguish three different area of communal activity. A small trial trench made at Masafi–2 during the 2009 campaign revealed compacted clay floors adjacent to the fortification wall, suggesting a better state of preservation than had at first been expected. The fortress appears to have been a defensive structure specifically orientated to the protection of the western border of the Masafi area. Its use still remains to be investigated further, and we plan to extend excavations in this area during a further campaign.

Finally, an extension of the survey area to the north, in Ra's al Khaimah territory, allowed us to collect more Iron Age material along the eastern slope of a second rocky outcrop to the north of Masafi–2 where many stone structures are visible. With the agreement of the Department of Antiquities of Ra's al Khaimah, detailed mapping of the area will be undertaken in the hope of identifying pre-Islamic remains in the area.

1 This appeared as a circular hole filled with a sort of yellowish mud similar to the floor of Level 2, installed directly over the remains of Level 1.

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Fifty Years of Emirates Archaeology

THE TEMPLE AT ED-DUR (EMIRATE OF UMM AL-QAIWAIN) AND PRE-ISLAMIC CULT IN SOUTH-EASTERN ARABIA

Ernie Haerinck (Ghent)

INTRODUCTION

When we started the first season of our excavations at ed-Dur in 1987 we did not realise that we would work there until 1995 for another seven field seasons and an additional campaign for study. This project was realised within the framework of a European consortium (Universities of Copenhagen, Lyon, Edinburgh/London and Ghent) to explore the remains and history of this major site in south-eastern Arabia, under the patronage and with the important support of the then Ruler of Umm al-Qaiwain, H.H. Sheikh Rashid bin Ahmad al-Mu'alla, H.H. Sheikh Saud bin Rashid al-Mu'alla, Crown Prince and Deputy Ruler, and H.H. Sheikh Khaled bin Rashid al-Mu'alla, President of the Diwan. Later on a museum was made in the restored old fort in the small city of Umm al-Qaiwain, where several of the discovered objects were put on display.

Thus far, the ancient name of the site remains unknown or at least disputed, but it is not excluded that it could have been Omana, as mentioned by Pliny the Elder in his *Naturalis Historia VI* and by the anonymous author of *The Periplus of the Erythraean Sea* (Boucharlat and Salles 1981: 67–68; Potts 1990: 302–320; Salles 1992: 204–213, 232–234; Salles 1995: 130–132; Haerinck 1998: 275–278).

The actual fieldwork of the Belgian team started on 8 November 1987, with the excavation of the remains of a small house and some plundered graves in what was called Area L. At first we were overwhelmed by the massive amount of ceramics as well as bits and pieces of pottery vessels that illustrated local production but also documented the international and inter-regional contacts and orientation of this site in the past. Numerous sherds and complete vessels continued to surface during all our subsequent seasons.

THE TEMPLE

While wandering over the site and trying to orientate ourselves in the vast expanses of the coastal desert where the approximately 2 km^2 site of ed-Dur is located, we came across a relatively small circular mound up against a neighbouring sand dune, in the most southern part of the site. However, our first impression was that it was located away from the main concentration of the site. It was decided to move to that part of the site as soon as we considered Area L was completed. On 14 November 1987 the work was started at Area M, and very soon it became clear that the building that was to emerge was peculiar and unique. After slightly more than twenty years since its discovery, it still has no rival or counterpart in the whole of south-eastern Arabia for the late 1st. c. BC/1st. c. AD. At the same time it was decided to open another trench 100 m (Area N) to the north of Area M, that turned out to be a concentration of graves within the centre of the remains of a tower-like tomb surrounded by another eighteen smaller tombs, several of which turned out not to have been plundered in the past (Haerinck 2001: 19–40).

On 15 November, 'Belgian Dynastic Day', just one day after the first spade hit the sand in the mound of Area M, the layout of a square structure had become visible and a number of decorated plaster fragments had already turned up. Within the next few days it became clear that we were in the process of discovering a special building that stood more than 2 m in height, almost to roof level, and that was covered by a dune that had invaded and sealed it as though in a time capsule. Careful and detailed excavation procedures were applied since it was immediately realised that this structure was not a domestic residence but most likely a religious building. An entrance on the east side, and a smaller door on the west side led to the assumption that this could be a temple/shrine dedicated specifically to a sun god. This hypothesis was substantiated in the second campaign in 1988 by the discovery of the Aramaic inscription next to the temple mentioning the name of the sun god Shamash.

During the remainder of the 1987 campaign the entire temple was excavated. After a while we were working in a pit and a ladder was needed. In that particular year there was quite a lot of wind activity and its whirling in the excavation pit made our skin feel like we were being ill-treated by a dust-devil. Still, that year as well as in the following years the site was very generous to our team.

It is not our intention to provide a full description here of the architecture and features, since a final report 'Excavations at ed-Dur. The temple and other architectural remains, Vol. III' is in preparation (for illustrations and preliminary remarks see Haerinck and Stevens 1989: 60–67; Haerinck et al. 1991: 31–39, Figs. 1–10; Haerinck et al. 1992: 44–49, Figs. 1–7). Rather, it is our aim to bring forward some thoughts on the function of this temple and the rituals that took place in and around it. Some general observations are, however, necessary (all illustrations were made by Erik Smekens, a photographer-draftsman at Ghent University).

The temple is an almost square building, 7.95 x 8.40 x 2.15 m, including the protruding plinth (Fig. 1). The walls are rather solid and approximately 0.70 m thick. The structure is built straight on the sand, without foundations. It is constructed of stones showing an almost isodomic bond. These stones were most likely made in a mould with mud from the lagoon, as suggested by experiments

conducted by Olivier Lecomte of the French team. Put in a mould, these were dried to form stones as hard as concrete, quite often containing numerous small shells or fragments.

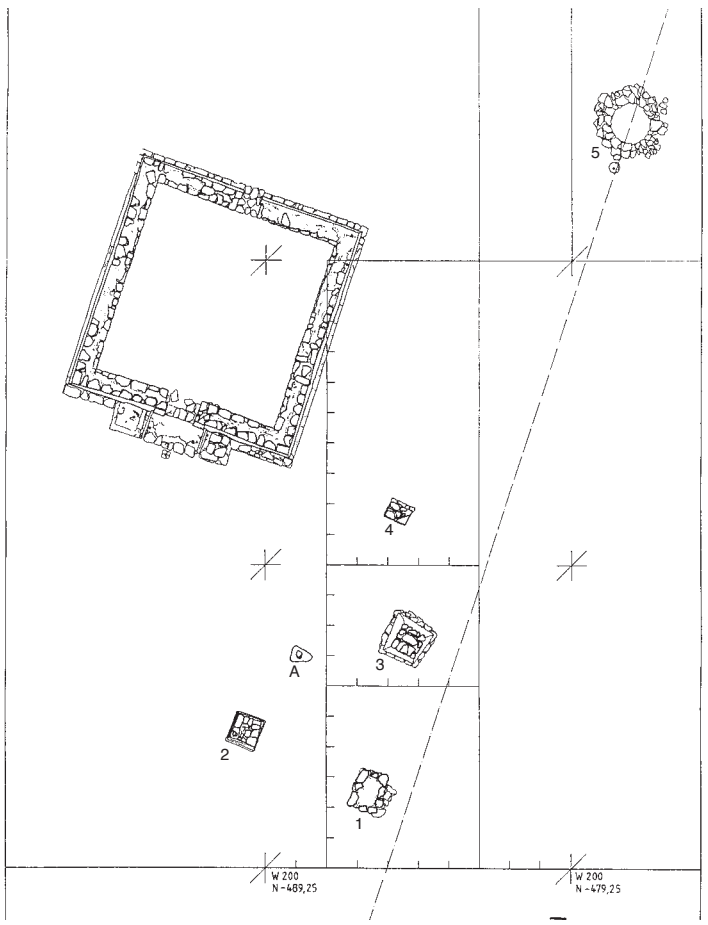

Fig. 1. Ed-Dur. Plan of temple in Area M. Drawing: Erik Smekens.

On the eastern (front) wall, along the main door, the masonry was preserved to a height of 2.15 m, whereas the western wall, with its smaller door, was only preserved to approx. 1 m (Figs. 2–4). Almost no pottery was found in the temple, an important observation since sherds are ever-present and abundant all over the site.

Fig. 2. General view of temple in Area M (1989).

Fig. 3. General view of temple in Area M (1989).

Fig. 4. Main entrance of the temple in the south-eastern wall, as well as the channel trough the north-eastern wall.

The walls were covered with a remarkably fine and, at the time of discovery, well-preserved gypsum plaster, with decoration (Fig. 6) in the form of alternating squares (c. 0.25 x 0.25 m) and rectangles (c. 1 m x 0.25 m), and projecting, central panels suggestive of marginally drafted, hewn stone masonry. Very faint traces of reddish brown and yellowish paint (?) were observed. However, these might be discolourations provoked by a natural cause. We are not fully convinced that the outside walls were originally painted, although we do not want to exclude the possibility. Indeed, paint was clearly observed in the decoration of the temple's eastern entrance. Therefore, paint could have covered the whole building. The painting of walls, sculpture etc. was common in antiquity (e.g. Egyptian temples, the Parthenon, Persepolis). The corners of all external walls were reinforced by plaster imitations of strong, upright pillars tapering towards the top. Like the monumental pylons or gateways in front of temples in Egypt, the walls slope inwards and the corner pillars become narrower at the top (approx. 0.25 to 0.30 m). This is particularly obvious in the eastern wall, that is well-preserved to a height of 2.10 m. This technique creates the optical illusion that the building is larger than it actually is.

The main entrance on the east side was also flanked on both sides by pillars like those used at the corners (Fig. 5). These pillars jutted out slightly and were decorated

with semi-cylindrical and vertical mouldings, combined with a vertical meander band in relief, only the lower part relief was still *in situ* enabling the reconstruction (Haerinck and Stevens 1989: Figs. 43, 52). This part was certainly painted with a yellowish paint.

Fig. 5. Detail of the main entrance of the temple in the south-eastern wall.

Fig. 6. Detail of plaster decoration on south-eastern wall.

The plinth on the front side is larger than on the other walls. Each side of the main eastern doorway had a square pedestal (c. 1 m x 1.00 m) on which statues probably stood originally. It is important to remember that in Area F, on top of the dune facing the coast, the French team discovered two upturned statues of headless eagles in a reused situation (Lecomte et al. 1989: 38-39, Figs. AE–AF, 19–20 and 25–28). It may be suggested, though not fully confirmed, that these statues once flanked the main entrance of the temple.

These square pedestals were linked by a plastered platform in front of the door. On both sides is a slot that could have been intended for wooden planks used as partitions that were fixed in the wall and the platform.

In front of the door a small square, cracked stone with a very slight depression was observed with obvious traces of intentional fire as for a burnt offering. The entrance had a plastered doorstep that continued inside and a small greyish door socket.

Opposite the platform, to the right side of the entrance, stood a conical dark grey *wadi* stone, in upright position. (Fig. 7).

Fig. 7. Baetyl (wadi stone) near the south-eastern wall.

On the west side was another, smaller door decorated with plaster moulding. A rectangular, channel/tunnel-like opening ran through the north wall, sloping towards the interior of the temple (Haerinck and Stevens 1989: Fig. 44).

On the inside, a plastered niche was found in the middle of the northern wall (Haerinck and Stevens 1989: Fig. 50). A similar niche was probably also present in the opposite southern wall, although this cannot be confirmed since that part of the wall was partially destroyed (cf. Tomb G 6130 in Area BM: Haerinck 2001: Pls. 203–207).

Inside, the walls of the building were most likely covered with a whitish to pinkish surface layer, traces of which can still be seen in some places.

Several plaster fragments with relief moulding were found both inside and outside the building. Some are

horizontal stepped ridges, more or less rounded at the top and certainly coming from the upper part of the building (Haerinck and Stevens 1989: 64, Figs. AS, 46, 48, 51 and 54). These and other fragments allow us to reconstruct the original height of the structure, that must have stood c. 2.2 to 2.3 m high.

Inside the temple were the remains of a rectangular fireplace made of upright stones, next to which was a large piece of burnt wood. Also, more or less in the middle of the room was a compact mass of mud, possibly from the collapse or removal of the roof. Poles for supporting the roof may have stood on some flat stones found inside the room. If large beams capable of spanning the entire ceiling were available in the mangrove forests along the coast, then the few stones found inside the room could simply be stray stones.

Another feature worth mentioning was the discovery of a reused, classic 'sugar-lump' Umm an-Nar gravestone (from a grave in the vicinity?) in which a circular depression had been made (Fig. 8). It stood on its short side and had possibly been turned over. In front of this lay a square stone, similar to the other building stones at ed-Dur, that showed traces of burning that had provoked cracking. Next to it stood a conical grey *wadi* stone intentionally put in an upright position, as was the case with the *wadi* stone found in front of the right platform next to the main entrance. Inside the temple, major finds included a Roman bronze oil lamp with a moon-shaped handle as well as one square and one bell-shaped bronze socle, without the statuettes they may have once supported. The square one was decorated with a male bust in relief with folded drapery. Furthermore, four fragments of a smashed bird statue (most likely an eagle) made of local limestone were found. The statue was made of the same material as the more or less round basin or box on which the bird may once have stood (Haerinck and Stevens 1989: Figs. AT, AU, 47, 53 and 56–59).

Fig. 8. Umm an-Nar stone, baetyl (wadi stone) and smashed eagle statue inside temple.

During the 1988 and 1989 campaigns attention was paid to the excavation of the immediate surroundings of the temple, where different structures were discovered, to better understand the rituals that may have been practised outside the building.

OFFERING TABLES (?) (STRUCTURES 1 & 2 AND A LARGE STONE A)

In the westward moving sand dune, which in antiquity must have been responsible for covering and sealing the temple, at some 10 m from the north-eastern corner of the temple, a more or less rectangular Structure 1 appeared during excavation (Figs. 1–3). It was preserved to a height of c. 1 m (6–7 courses of stone), but below it another three or four stones were visible that probably belonged to a similar but earlier structure.

Another, square Structure 2 was better preserved (Figs. 1–3, 9). This also probably had two phases of construction, probably due to the invading sand of the dune, which obliged the inhabitants of ed-Dur to build a new structure on top of the old one made of some five courses of more regular, thicker stones. The entire structure was c. 1.45 m high and 1.30 m wide. At the foot of the altar was a terracotta camel figurine, as well as the head of a male figurine (Haerinck et al. 1991: 34, Fig. 4; Daems 2004a: 94, Fig. 1; Daems 2004b: 231–232, Figs. 3–4).

Fig. 9. Structure 2 (altar?).

Both structures were probably 50 cm to 70 cm high in each phase. We should also mention that on rare occasions we excavated the remains of what seem to have been similar structures in several other parts of the site. Also the Danish team came across two to three solid stone structures that were considered platforms since they were only preserved to a height of three to four courses of stone. It was suggested that they had played a role in funerary practices (Potts 1998: 23–24, Figs. R & 8). These structures might also be interpreted as altars for sacrifices to a god or to deceased family members buried at the site. Functionality as *nefesh*, or memorial for the deceased, is also a possibility (Mouton 1997). However, we favour their interpretation as altars.

Upon our return to the field for a third season in 1989, wind erosion had exposed a large stone (A) with a bowl-shaped depression (Haerinck et al. 1992: 47, Fig. 4) (Fig. 1). Unfortunately, this very large stone can't be linked for sure to Structures 1 or 2. One could suggest that it was associated with square Structure 2, but this is by no means certain. We also do not know whether this stone was used in the rituals taking place in and around the temple, or was brought in from elsewhere. It could have stood on top of the square Structure 2. It shows no traces of fire, but we might suggest that it could have served for the collection of blood from a sacrificed animal slaughtered on the altar. It remains an open question whether Structures 1 and 2 were used as altars for animal offerings. This is a possibility that cannot be excluded since their rather low height would have easily allowed an animal to be put on top to be slaughtered. In the end, though, we cannot say for certain. This is merely a suggestion.

ALTAR FOR INCENSE BURNING (STRUCTURE 3)

The pyramidal Structure 3 with a niche in its upper part also showed clear evidence of two construction stages, prompted by the encroachment of the sand dune that shifted westward towards the temple. This structure was preserved to a height of c. 1.63 m (Fig. 10). Two incense burners were found nearby, one still containing the remains of burnt incense in its bowl. Also, at the base of the structure were several *wadi* cobbles, as well as a pyramidal coral stone and a pointed *wadi* stone, both set intentionally in an upright position. Furthermore, fragments of a large black ware jar were found containing a concentration of some 220 *wadi* cobbles c. 2.20 m to the north of the pyramidal structure.

ALTAR WITH INSCRIBED STONE BASIN (STRUCTURE 4)

Some 3 m from the north-western corner of the temple a rectangular socle built of eight courses of stone was discovered, on top of which, still *in situ*, was a freestanding rectangular stone basin with a major Aramaic inscription on its eastern side and a smaller inscription on the short southern side (Figs. 1–3, 10). The main inscription mentions the sun god Shamash. Unfortunately, the remainder of the inscription is still undeciphered, due to the rather poor state of the stone making it difficult, if not impossible, to read the text. The basin must have contained a liquid, possibly water from the nearby well or the blood of sacrificed animals.

Fig. 10. Structures 3 and 4.

WELL (STRUCTURE 5)

In 1988, a circular, stone-lined well was discovered c. 8 m from the north-west corner of the temple. It had an external diameter of 2.60 m and an internal diameter of 1.30 m. It was possible to excavate it to a depth of 6 m, when the stones stopped and further excavation became too dangerous. On the south-eastern side of the well lay a round stone with a circular perforation in its centre, which was probably used with a wooden device to raise water. This well must also have played a role in the rituals performed in and around the temple.

TRACES OF FIRES

All around the temple and along the walls (except on the western side), dark and sometimes rather thick patches of fireplaces – in which palm wood had been burned – were found, as shown by phytolith analyses (Haerinck et al.1998). Six metres south and almost directly opposite the main, eastern entrance of the temple was a large fireplace (2.70 x 1.50 m; c. 1 m thick) (Haerinck et al. 1992: 48–50, Figs. 7–8). Here, too, there was clear evidence of two phases of use.

INTERPRETATION

Archaeology is more than purely excavating and the registration of structures and other remains. We need also to provide interpretations as to function. We shall make an attempt here to propose ideas about the possible activities and rituals that took place in and around the temple. Enough information was revealed during our excavations to allow for a tentative interpretation and to present some thoughts on possible rituals.

ACCESSIBILITY

We do not know whether the temple was visited during a particular time of the year, for a festival, or during a pilgrimage or if it was used as a market, as was the case at other sacred places within Arabia. Nor do we know if visitors were allowed to enter the temple or whether they only performed rituals around the shrine (circumambulation: see below). The fireplaces in and around the temple point more towards the latter possibility. Perhaps only a particular class of people, such as priests, were allowed to enter the temple itself.

THE SUN GOD

It is beyond doubt that the whole temple was mainly dedicated to the sun god Shamash (most likely a male deity in north-eastern and south-eastern Arabia) (Haerinck 1994: 408–411). The orientation of the temple and, above all, the inscription mentioning this deity are the main proofs of this assertion. Some of the objects recovered as well (such as the eagle found inside the temple and the two eagle statues found in a reused situation in Area F) and the meander decoration on the entrance door also offer strong evidence pointing to that deity.

Both O. Mørkholm (1973: 196) and Chr. Robin (1974: 88–91, 119–124) have drawn attention to the fact that the solar deity was of prime importance in north-eastern Arabia. This was certainly also true in south-eastern Arabia (in texts found at Mleiha some other gods are mentioned as well, such as Wadd or Aktab/Kutba, see Mouton 2008: 247–252; or Manat, see Teixidor 1992).

Regarding local Arabian coins there is ample evidence for the cult of the sun god (Potts 1991: 32–36, 38–58, 77–78, 106). Furthermore, Michael Mitchiner (2004: 501–502 = Potts 1991: 84–85, Class L) has suggested that on a few of these local south-east Arabian coins the Greek name (*Helios*) of the sun is mentioned. In Central Arabia solar deities (female) are equally of prime importance (Petersman 1989).

We should also not forget that Ptolemy, in the 2nd century AD pointed out on his map of Arabia the location of the 'sacred promontory of the sun' in the vicinity of Ra's Musandam (Groom 1986: 69–70; 1994: 202–204). Today, there still exists the Khawr al-Sham (Elphinstone Inlet) and Jebel Sham(s) in the Hajar Mountains.

Hatra, a town of Arabian tribes in Iraq, was also a major city with special devotion to the solar god Shams/Shamash. Without a doubt, solar deities occupied a particular place of veneration in pre-Islamic Arab religion as the sun god Shamash did amongst virtually all ancient Semitic populations.

WRITTEN EVIDENCE CONCERNING RELIGIOUS CONCEPTS AND RITUALS

Written sources on religious ideas and rituals in pre-Islamic Arabia are rare. Moreover, it is likely that differences existed between different tribes and regions within the Arabian peninsula. Nonetheless, Hishām ibn al-Kalbi (9th. c. AD) in his *Kitāb al-asnām* or *Book of Idols* (Faris 1952), mentions a rather large number of deities venerated by many different tribes. His account is fascinating since we think that some of the rituals mentioned by him can be traced back at ed-Dur.

In the English translation of this work by Faris one reads (1952: 28–29):

The Arabs were passionately fond of worshipping idols. Some of them took unto themselves a temple around which centered their worship, while others adopted an idol to which they offered their adoration. The person who was unable to build himself a temple or adopt an idol would erect a stone in front of the Sacred House or in front of any other temple which he might prefer, and then circumambulate in the same manner in which he would circumambulate the Sacred House. The Arabs called these stones baetyls (ansāb). Whenever these stones resembled a living form they called them idols (asnām) and images (awthān). The act of circumambulating them they called circumrotation (dawār).

Whenever a traveller stopped at a place or station in order to rest or spend the night he would select for himself four stones, pick out the finest among them and adopt it as his god, and use the remaining three as supports for his cooking-pot. On his departure he

would leave them behind, and would do the same on his other stops. The Arabs were wont to offer sacrifices before all these idols, baetyls and stones.

… The sheep which they offered and slaughtered before their idols and baetyls were called sacrifices ('atā'ir, sing. 'atīrah); the place on which they slaughtered and offered the sacrifice was called an altar ('itr).

The Arabs also had relic stones (which they obtained from ancient ruins) and erected. They were wont to circumambulate them and offer sacrifices before them. These stones were called baetyls (ansa¯b), and the circumambulation thereof was called circumrotation (dawa¯r)."

These observations by Hishām ibn al-Kalbi allow us to bring forward a preliminary interpretation of some of the observations made during our excavations in and around the temple. One of the questions we could ask is if the pilgrims could enter the temple? We simply do not know, but we have suggested already that they could not. Maybe they had to circumambulate it, in the same way as described by Ibn al-Kalbi. One reason for this suggestion is the fact that numerous fireplaces, some of them very large, were observed around, i.e. outside, the temple.

Also, the temple could at the same time have been used for divination by a medium as is also well-attested amongst Arab tribes, a fact also referred to by Ibn al-Kalbi (Faris 1952: 10–11 = Ri'ām at Saʿnā' and p. 16: oracle of al-'Uzza, the greatest idol of the Quraysh). The channel in the northern wall of the temple could have served as a way to communicate with the outside world and to convey a message to the pilgrim/interrogator. Another possibility is, however, also not to be excluded: water from the nearby well or any other liquid (such as blood of sacrificed animals, slaughtered on Structures 1 and 2? that could then be considered the altars as mentioned by Ibn al-Kalbi) could have been poured inside the temple after it was blessed and taken from the inscribed stone basin.

One other important issue to be raised is the presence of *baetyls*. Upright standing (*wadi* or coral) stones at Structure 3, as well as stones found outside and inside the temple, were put there for a particular purpose. As far as we are concerned, these are to be interpreted as the *baetyls* mentioned by Ibn al-Kalbi. Equally the some 200 cobbles found at the foot of Structure 3 as well as those found at some distance from the same structure are also likely to be linked to a similar pre-Islamic phenomenon, as mentioned by Ibn al-Kalbi (Faris 1952: 4):

The reason which led them to the worship of images and stones was the following: No one left Mecca without carrying away with him a stone from the stones of the Sacred House (al-Haram) as a token of reverence to it, and as a sign of deep affection to Mecca. Whenever he settled he would erect that stone and circumambulate it in the same manner he used to circumambulate the Ka'bah (before his departure from Mecca), seeking thereby its blessing and affirming his deep affection for the Sacred House.

It is clear that the *wadi* cobbles found at ed-Dur had a particular meaning and could have well been intended to be taken away by the pilgrims upon leaving the area of the temple after completing the rituals. Further on in the text Ibn al-Kalbi mentions (Faris 1952: 36):

The use of older stones was equally attested at ed-Dur by a stone taken from an Umm an-Nar grave (in the vicinity of the site?) and placed inside the temple. In front of this stone lay a stone cracked by fire as well as an upright standing *wadi* stone, that could be identified as the *baetyl* to which Ibn al-Kalbi refers.

There remains also the question of the *asnām*, or idols as mentioned by Ibn al-Kalbi. The smashed statue of an eagle, as well as the two large headless eagles found by the French team in a reused situation in Area F, could reasonably be considered *asnām*.

SIMILARITIES AND DIFFERENCES BETWEEN THE 1ST CENTURY AD TEMPLE FOR THE SUN GOD AT ED-DUR AND THE KA'BA AT MECCA/MAKKA

We realise that by trying to see similarities and differences between these two places we venture on a slippery slope, though we feel that such an exercise is necessary and worthwhile. At ed-Dur the temple:

- stood originally to a height of c. 2.20 to 2.30 m;
- was square (c. 8 x 8 m)
- was probably roofed
- had two doors: a large one on the eastern side and a smaller one on the western side, i.e. one where the sun rises and the other one where the sun sets
- had doors at ground level
- had its axis ca. 10° clockwise from the meridian
- had altars (?), *baetyls* and a reused Umm an-Nar stone
- had statues (*asnām*): eagle inside and quite possibly the large eagle statues as found in a reused situation in Area F
- had a well
- had plenty of fireplaces on the outside, around the temple, except on the western side
- was dedicated to the sun god Shamash

For Mecca there is very little information available on the pre-Islamic/*Jāhiliyya Ka'bah* (Wensinck and Lewis 1965; Wensinck and Jomier1974; Watt and King 1987):

- the original *Ka'ba* is said to have stood only to the height of a man but to have had no roof
- it had two opposite doors at ground level; an eastern entrance and a western exit
- reconstructed c. 600 AD by the Quraysh, after an accidental destruction (fire? flash floods?). Muhammad, before he became Prophet, placed the Black Stone in it. The door was placed above floor level so that a ladder was needed to enter it. Built of alternating layers of wood and stone
- several deities were venerated; *baetyls* and *asnām* destroyed by the Prophet when converting the building to Islam
- in 64 H/683 AD during the time of ʿAbd Allāh b. Al- Zubayr (anti-caliph at Mecca) the city was besieged by al-Husain b. Numayr. The *Ka'ba* was badly damaged during the siege, but the Umayyad army withdrew and ʿAbd Allah rebuild it in accordance with the original layout of Ibrahim, as the Prophet had wanted but not achieved during his life (i.e. with two doors at ground level and fully entirely of stone)
- in 74 H/693 AD the *Ka'ba* was rebuilt in the Quraysh way and the western door was walled up
- main axis is at 30° counter clockwise from the meridian
- minor axis points to summer sunrise and winter sunset
- now door in north-eastern wall; blocked door in south-western wall
- presence of stones: black stone in south-eastern corner as well as another sacred stone
- presence of the Zamzam well
- several rituals during current Hajj are said still to have a relation to pre-Islamic solar and astral deities and rituals

It is clear that some similar or identical pre-Islamic rituals and concepts are clearly indicated at ed-Dur as well as in the *Ka'ba* at Mecca. The temple of ed-Dur seems to us to be thus a major piece of evidence for the evaluation of beliefs in *Jāhiliyya* times. We feel that the excavation of the temple at ed-Dur is a prime source and provides a major contribution to a greater knowledge and comprehension of Arabia's past.

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Fifty Years of Emirates Archaeology

THE OMAN PENINSULA AT THE BEGINNING OF THE SASANIAN PERIOD

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Through the work that has been carried out in the Oman peninsula since the 1970s, a cultural and chronological framework has been established for the millennium preceding the Islamic conquest using archaeological material, with reference to the dominant regional cultural assemblages, mainly Hellenistic, Parthian and Sasanian. Based on the excavations of the two major sites of Mleiha and ed-Dur, both in the United Arab Emirates, a local culture has been defined and divided into four sub-periods (Late Pre-Islamic A, B, C and D).

Excavations conducted during the past decade allow us to refine the schema and to note a change in the settlement pattern in the latter part of this period. It is this period of change, contemporary with the height of the Sasanian power, that will concern us here. We will review the documentation, still very patchy, establishing a chronology of the sites using the Mleiha assemblage, for which we will present the diagnostic elements, as a reference. Two successive phases of population density become apparent, marked by very different site distributions. These highlight a chronological and cultural threshold in the 3rd century AD, the causes of which are not understood, but which must be taken into account from now on in any regional periodisation.

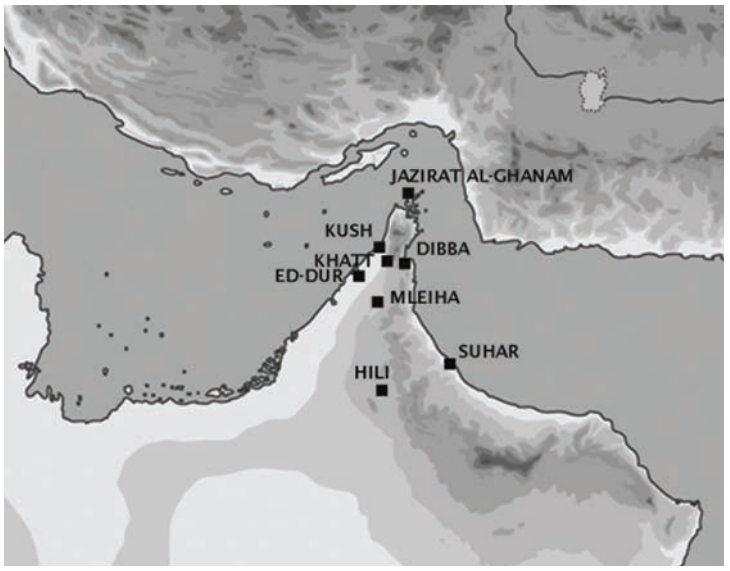


Fig. 1. Map of late pre-Islamic settlements in the Oman Peninsula.

Located near the western foothills of the Oman mountains (Fig. 1), the site of Mleiha in the Emirate of Sharjah (Mouton 1999a; Mouton 2008) is protected from being engulfed in sand by the limestone chain that blocks the sand dune field to the west. Whether it reflects a coincidence of archaeological exploration or the reality of ancient settlement patterns, Mleiha is the only settlement known following the abandonment of the Iron Age villages of the Oman peninsula. Excavation of the successive occupation phases, from the 3rd century BC to the 1st century AD, has revealed the process of sedenterisation of a group that was probably of nomadic origin (Mouton 1999b). The level of post-holes from the earliest phase, PIR.A (3rd–mid 2nd century BC), bears witness to installations that were initially movable and made of light materials. It was only from the PIR.B period (mid 2nd–1st century BC) onward that dwellings were built of mudbrick, becoming progressively more complex and multi-cellular. Beginning in period PIR.C (1st–mid 2nd century AD) larger houses with courtyards co-existed alongside modest one or two room dwellings.

Situated at the periphery of the nomadic zone, the community at Mleiha gradually took control of this part of eastern Arabia, exploiting its natural resources and exchanging them for the luxury goods from the Levant, Mesopotamia and Iran that we found in the cemeteries at the southern and eastern edge of the site. Local coins have the names of the lords, monograms and symbols of this regional power. The population spoke a Hasaitic dialect and used the South Arabian and Aramaic scripts.

What interests us here is the final occupation phase, PIR.D, when the site, bordered by the cemeteries of the founding clans, was concentrated between two large, fortified residences covering an area a little less than half-a-kilometre long (Fig. 2). To the south is a mudbrick fort c. 50 x 55 m, flanked by eight square, salient towers (Figs. 3–4.3). Surrounding its central courtyard are large storage rooms, workshops and forges, whilst on the first floor was a residence along one of the sides. Fragments of coin moulds used for local issues bear witness to political power centred on Mleiha. To the north, the second large residence (Fig. 4.4) was interpreted as a palace by its excavators in the early 1970s. The thickness of the external wall could indicate a fortified building. Between these two buildings are tightly packed mudbrick dwellings of three or four rooms associated with enclosed exterior courtyards, separated by irregular alleys.

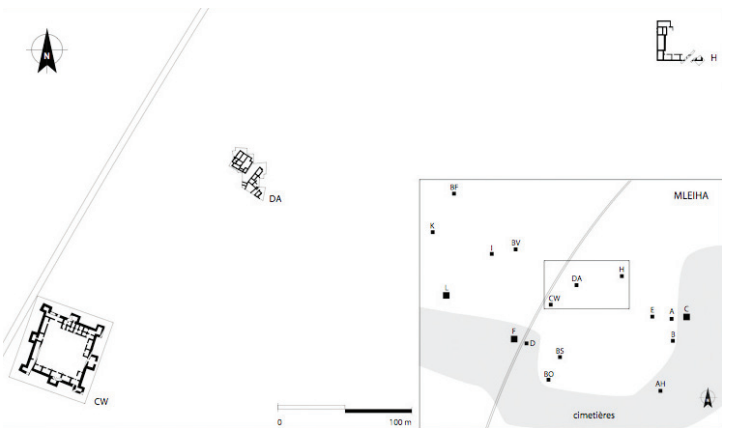


Fig. 2. Mleiha, the excavated areas, PIR.D period, c. mid-2nd–mid-3rd c. AD (S. Eliès).

Fig. 3. Mleiha, the fort in area CW, PIR.D period, c. mid-2nd–mid-3rd c. AD (French Arch. Exp. in Sharjah).

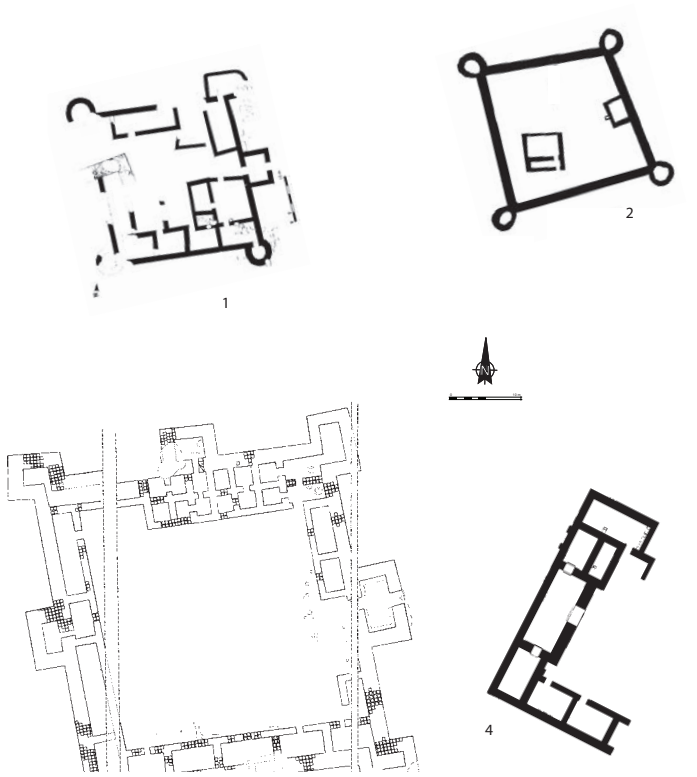


Fig. 4. The fortified buildings at ed-Dur (1–2) and Mleiha (3–4) dating from the end of period PIR.C (?) and period PIR.D, 2nd–3rd c. AD (French Arch. Exp. in Madhloom 1974).

Overall, the assemblage from the PIR.D period shows continuities with that of the PIR.C period, particularly with regard to the grey and black wares (Lecomte 1993: Figs. 8–9; Benoist et al. 2003: Fig. 8.11–12) such as numerous, very large storage jars more than 1 m in diameter. Glazed ceramics also remained a quantitatively important category. But the material inventory also includes new types that allow us to clearly distinguish the PIR.C from the PIR.D levels at Mleiha (also clearly distinguishable on the basis of stratigraphy).

These include:

• Late Mleiha Ware (Fig. 5). Never found in the PIR.C period, this is absolutely diagnostic of the PIR.D period. It is easily recognised by its brown, pinkish, red and sometimes slightly grey paste, with abundant reddish mineral temper, more or less thick and angular. There is a great variety of forms including pitchers with or without handles, small bowls of light brown paste, small and medium jars, a few pedastalled plates, lids, and, in particular, jars with a short straight neck that are often painted with brown to dark red motifs of hatched triangles, broken lines, chevrons and spirals (Benoist et al. 2003: 66 and Fig. 8.7; Cuny and Mouton 2009: Fig. 5). The abundance of this pottery at Mleiha and the variety of its forms suggest that it was produced locally, particularly since other sites in the region have only yielded a few isolated sherds which have not been found in any well-dated contexts. It is unknown outside of the Oman peninsula.

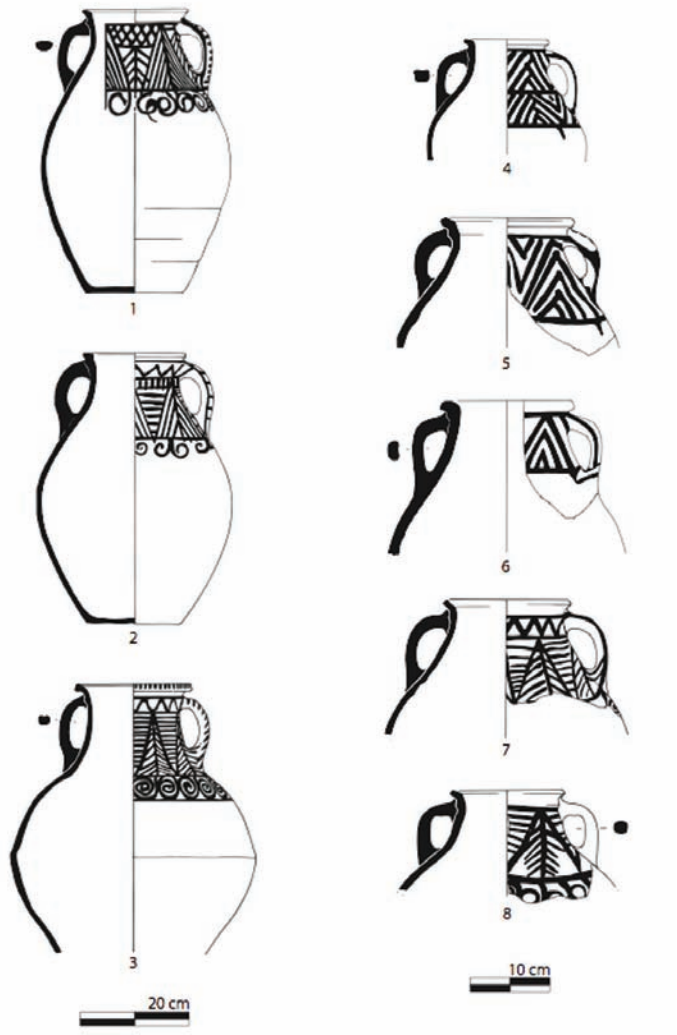
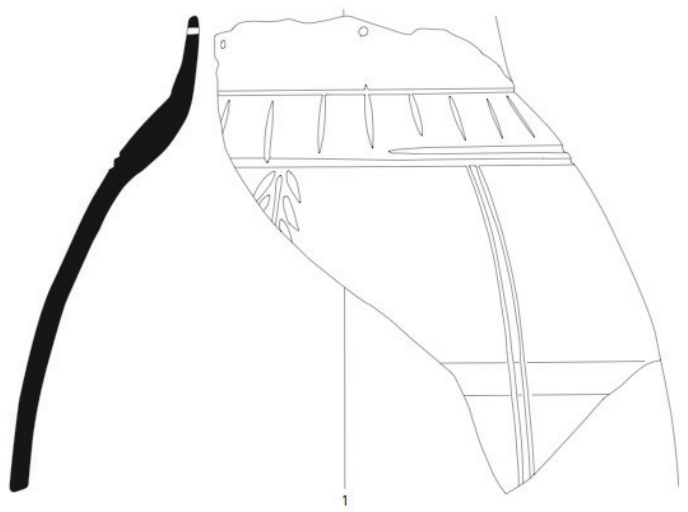


Fig. 5. Mleiha, Painted Late Mleiha Ware, PIR.D period, c. mid-2nd–mid-3rd c. AD (V. Bernard/S. Eliès/J. Cuny).

• Glazed ceramics decorated with feathers or branches, between incised horizontal and vertical lines, incised before glazing (Fig. 6). These decorated vessels, to which some undecorated forms should probably be added, constitute a group that only has parallels at sites on the Gulf and in the interior of Arabia, e.g. Qaryat al-Fau, Jazirat al-Ghanam and particularly Bahrain, where they are dated to the 1st and 2nd centuries AD (Al-Ansary 1982: 64 and Fig. 1; De Cardi 1972: Fig. 2.18; Boucharlat and Salles 1989: 101, nos 173–174). J.-F. Salles has suggested that these products might have come from Characene (Salles 1990: 329; De Paepe et al. 2003: 212).

• Fine Orange Painted Ware/Namord Ware. This is probably the most secure regional marker for post-PIR.C period pre-Islamic levels. It is characterised by its very fine, orange, well-levigated and resonant paste, with no visible temper, and is covered with a vertically smoothed, darker orange slip. The exterior is decorated with stylised plant or animal motifs painted in black, framed by bands of small spirals. The only form attested at Mleiha is the beaker with a concave body, flat base and simple everted rim (Fig. 7). This is the most widespread form in both Arabia and in Iran, where all researchers agree it originated (Sajjadi 1989; Potts 1998; Kennet 2002: 158–159; Kennet 2004: 61–62; Cuny and Mouton 2009: 102).



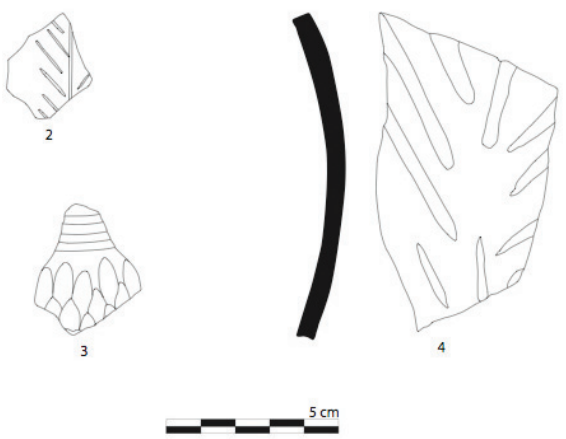


Fig. 6. Mleiha, Glazed Ware, PIR.D period, c. mid-2nd–mid-3rd c. AD (V. Bernard/S. Eliès/J. Cuny).

• Brown Ware with white chalky/shelly/sandy temper (Fig. 8). A thick red slip covers the outer body in some cases. The most common forms are pots and cooking dishes. Parallels can be found for the carinated plates in India and Pakistan (Sankalia et al. 1958: Fig. 80.T127; Sankalia et al. 1960: Figs. 126.T63 and T63a and 135. T86, T86a and T86b; Wheeler 1946: Fig. 21.25; Callieri 2000: Fig. 1.i). Lids and cooking pots are found in levels from the 1st to the 5th century AD all around the Gulf of Oman, in India, southern Arabia and east Africa (Sedov 1992: Figs. 3.6–7; Sedov 1996: Figs. 6.11–12; Davidde et al. 2004: Figs. 8.111, 9.3/8; Smith and Wright 1988: Figs. 5l, 8h and 9i-k; Begley and Tomber 1999: Figs. 6–5. 10; Tomber 2000: Fig. 2.6.; Cuny and Mouton 2009: 105). In both fabric and form, this ware is similar to material from the Indo-Pakistani area, although no exact parallels have been found. Petrographic analyses of carinated bowl fragments of this type found at Qani suggest an Indian origin (Davidde et al. 2004: 97).

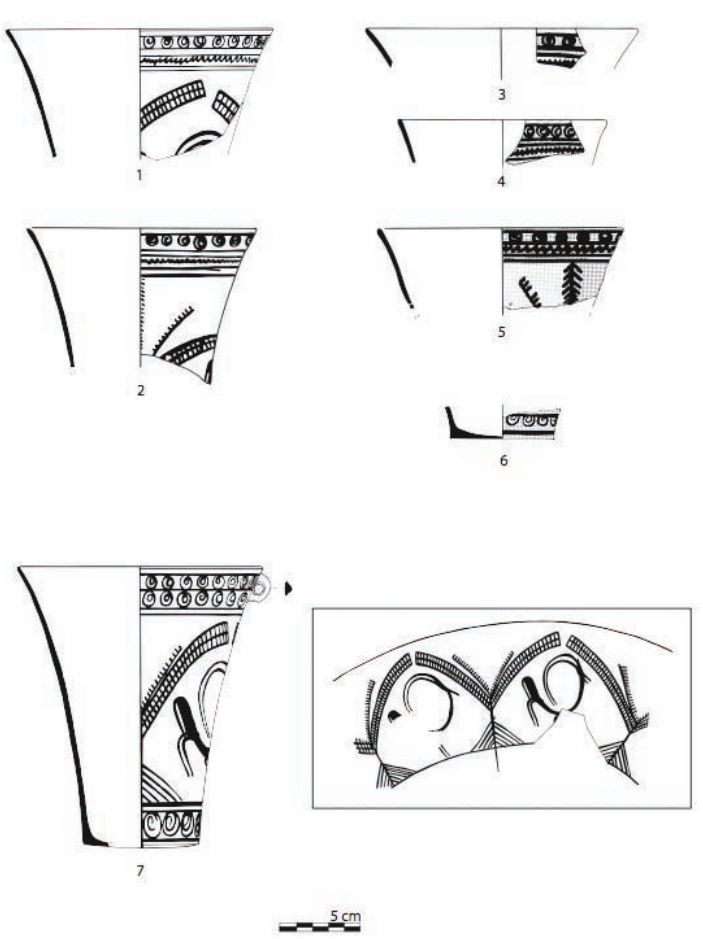


Fig. 7. Mleiha, Fine Orange Painted Ware, PIR.D period, c. mid-2nd–mid-3rd c. AD (V. Bernard/ S. Eliès/J. Cuny).

This assemblage and the PIR.D period that it characterises at Mleiha have previously been dated from the late 2nd to the 4th century AD (Mouton 1999a; Benoist et al. 2003). In light of more recent studies on the material, this dating seems to us in need of refinement.

Bowls with oblique walls and protruding or folded rims (Fig. 9.5–6) must be dated to the 2nd and 3rd centuries AD. There are good parallels for these in the 3rd century deposits of Area F at ed-Dur (Mouton 2008: Fig. 107.10, 12; Lecomte 1993: Fig. 4.8, 14), and at Susa in Levels 5b and 5a dated to the 2nd–3rd centuries (Boucharlat 1987: Fig. 70.1). They also appear at Qal'at al-Bahrain in Level Vd, dated to the first two centuries AD (Højlund and Andersen 1994: 299 and Figs. 1537, 1539 and 1544). We must emphasise the absence of characteristic BI-Ware ware of the 1st century BC–1st century AD (e.g. tripod bowls with shell feet, cooking pots with out-turned rims, imitation of the Roman *skyphos*), which are only present in the PIR.C period levels at Mleiha and ed-Dur (Mouton 2008: Figs. 62.14-19, 21; 71.13; and 72.9–16; Boucharlat and Mouton 1993: Figs. 13.6, 12).

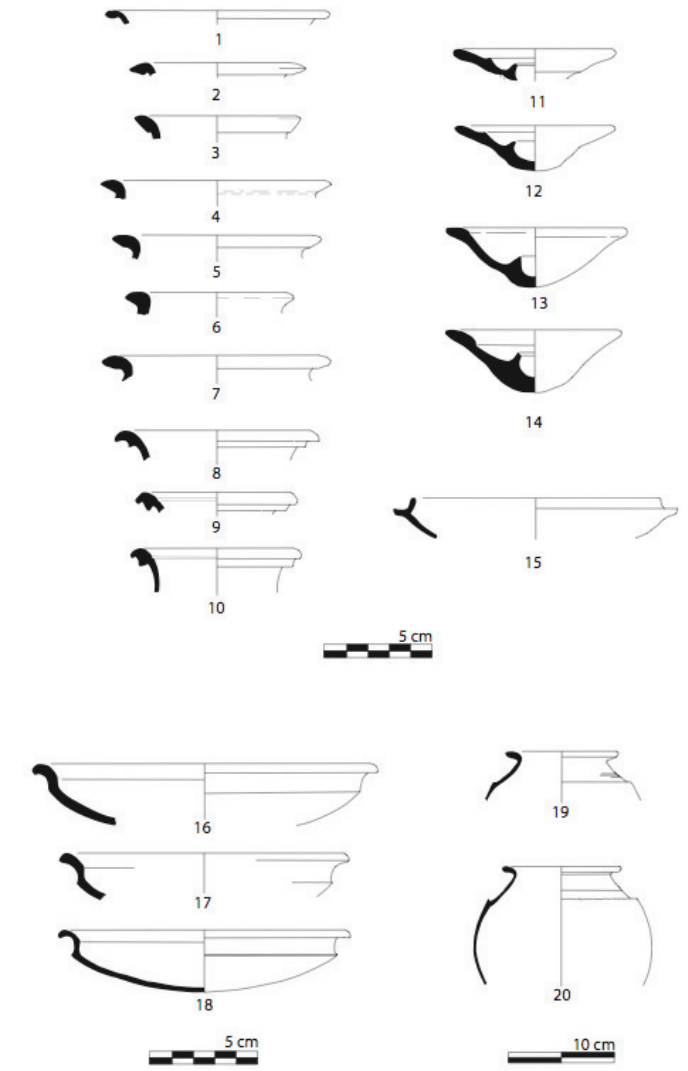


Fig. 8. Mleiha, Brown Ware with Chalky/Shelly/Sandy grits, imported from the Indo-Pakistani area, PIR.D period, c. mid-2nd–mid-3rd c. AD (V. Bernard/S. Eliès/J. Cuny).

Several fragments of Egyptian *amphorae* (Fig. 10.2–4 (Benoist et al. 2003: 69, Fig. 9.1) belong to variations of the AE3 type, also known as 'bi-tronconic *amphorae*', from the 1st–3rd centuries AD (Dixneuf 2007: 163, type AE 3–1.2/E dated 1st–3rd c. AD; Tomber 2007: 529–530; Brun 2007: 513–514, Fig. 3.2 dated more precisely from the 3rd c. AD).

A complete *amphora* of reddish ware with large calcite temper (Fig.10.1) was recovered from the first phase of occupation of the fortified residence. The only parallels are some *amphorae* from a shipwreck in the Mediterranean dated to the early 3rd century AD. According to paste analyses, these could be Cilician (Ollà 1997: Fig. 63, Tav. IV.16–17 and Tav. VII.16–17; Williams 1997: 101–102; Cuny and Mouton 2009: 106, Fig. 14.1).

The Fine Orange Painted Ware is a reliable marker for levels later than the PIR.C period but it does not provide a precise chronological indicator. It occurs in hearths related to ritual meals in Area F at ed-Dur, which are well-dated to the 3rd century AD by associated material, and also in the late Sasanian levels at Kush (Lecomte 1993; Kennet 2004: 61–62).

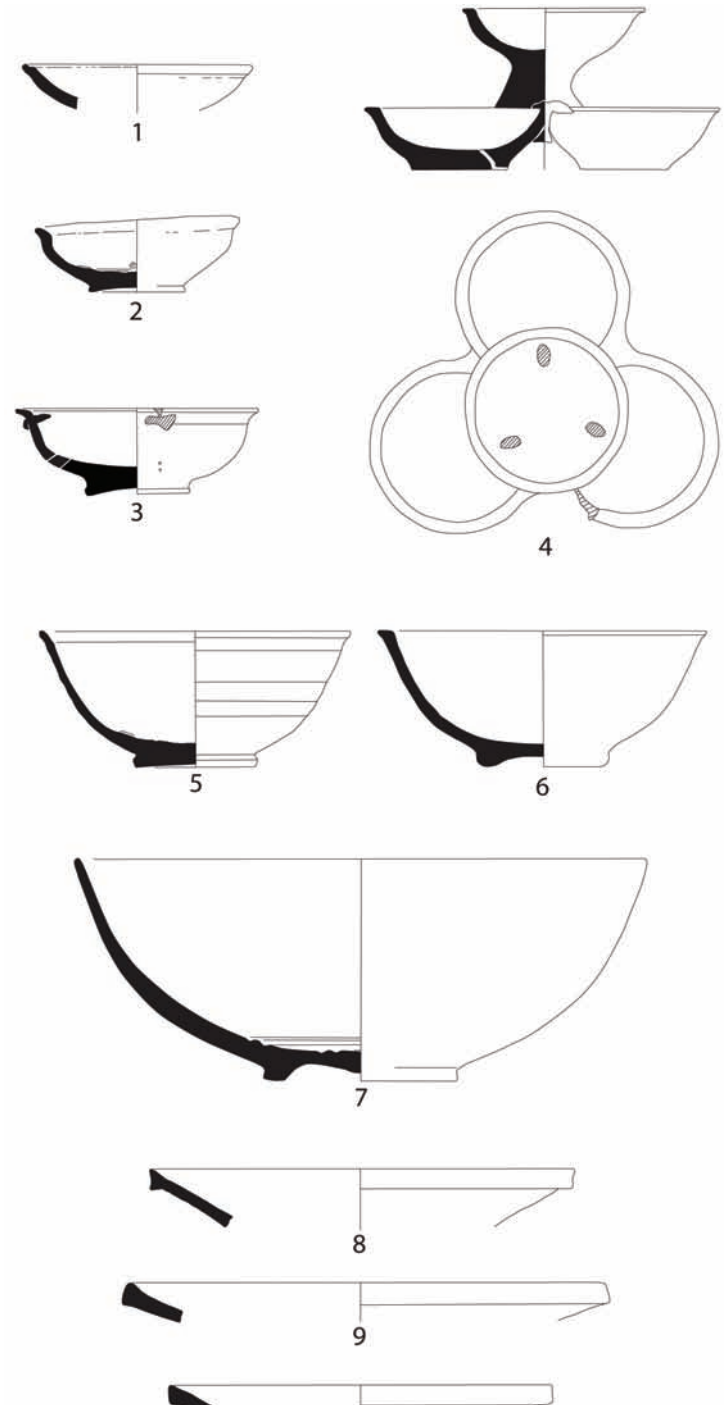


Fig. 9. Mleiha, Glazed Ware, PIR.D period, c. mid-2nd–mid-3rd c. AD (V. Bernard/S. Eliè /J. Cuny).

The appearance of types that are completely absent in levels securely dated to the 1st and early 2nd centuries (PIR.C period) allows us to distinguish this assemblage clearly and to place its beginning towards the middle of the 2nd century AD. Also, the presence of certain elements, such as the Cilician(?)-type amphora and the glazed bowl with horizontal grooves, that cannot pre-date the 3rd century AD, means that we can reasonably

extend its dating into the 3rd century. But the absence of elements that can be clearly dated to the 4th century is significant. Amongst the glazed ceramics, the bowls with convex walls, thickened rim on the inside, internal projection and flat or slightly concave base, abundant in hearths of the 3rd–4th century at ed-Dur Area F (Lecomte 1993: 198, Figs. 3.1–8, 4.11), are absent in the late period at Mleiha. The end of the occupation at Mleiha could, therefore, have preceded the period of these deposits. Thus, period PIR.D at Mleiha should be dated to about the mid-2nd–mid-3rd century AD.

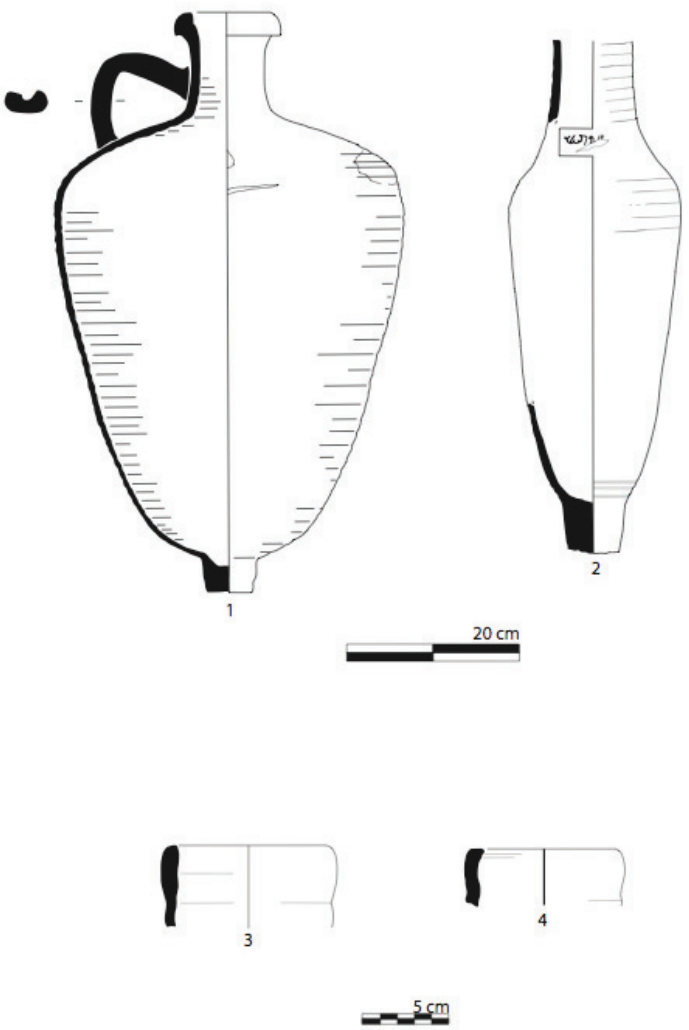


Fig. 10. Mleiha, Imported amphorae, from Cilicia (?) (1) and Egypt (2–4), PIR.D period, c. mid-2nd–mid-3rd c. AD (V.Bernard/S. Eliès/J. Cuny).

The site of ed-Dur (Fig. 1), at the end of the Umm al-Qaiwain lagoon on the shore of the Gulf, was certainly the other important site in the Oman peninsula at the beginning of the Christian era (Boucharlat et al. 1989; Potts 1990: 274–278; Haerinck 1992, 1993 and 1996, Haerinck et al. 1991, 1992 and 1993). It spreads over an area crossed by lines of sand dunes that have been stable since antiquity. Surface survey revealed only a small number of houses built of beach rock (*farush*), small units made up of one or two rooms, or of four to six rooms including an enclosed courtyard. A more or less ashy occupation layer mixed with abundant pottery and food remains covers the whole site (about 1 x 1 km), associated in places with patches of floors made of packed stones, as well as with small isolated paving slabs, which suggest installations of lightweight materials. Dispersed in the spaces between these installations are individual and collective graves grouped together in cemeteries. In the south was a sanctuary dedicated to the god Shamash.

Founded at the end of a shallow lagoon with difficult access for boats and devoid of buildings that could have been used as warehouses, ed-Dur does not appear to have developed in relation to the sea trade. On the contrary, the site presents the characteristics of a regional centre of a mobile group – a very extended space littered with material and traces of floors with no constructed walls and a few scattered permanent structures that probably belonged to the wealthiest families. That central place concentrated the cemeteries of the group, a tribal sanctuary, and was probably the site of a seasonal market that perhaps attracted a few merchant vessels to the distant anchorage.

The material recovered across the whole archaeological area parallels that from the PIR.C period at Mleiha (1st–early 2nd century AD). The imported Roman pottery could indicate that occupation began towards the end of the 1st century BC (Haerinck 2001: 3–5; Rutten 2007). The small 22 x 25 m stone fort (Fig. 4.2) in the west-central part of the site does not seem to have been a residence for the elite, but rather a collective refuge. As at Mleiha, in the late PIR.C period, after an extended but not very dense occupational phase, installations were perhaps concentrated in the area of the small fort.

The only evidence of later occupation is the fortified building constructed on the high dune at the edge of the lagoon (Fig. 4.1) and the very poorly preserved remains of a second structure below (Lecomte 1993, 2005; Boucharlat et al 1989: 53). Square in plan (25 x 25 m) this building is made of stone and flanked by round corner towers. It was probably an elite residence, illustrating the presence of a centre of power at ed-Dur after the 2nd century. On the island of Ghallah, in the southern part of the lagoon, a contemporary cemetery bears witness to a community that was more numerous than could be sheltered by these buildings alone. Inside the fortified building, the graves of two people with their weapons and mounts (dromedaries) were found. The objects in these graves and nearby hearths (Lecomte 1993: 198, Figs. 3.1–7, 4.11) find exact parallels in Sasanian contexts at Choche-Ctesiphon dated to the 3rd and 4th centuries AD (Venco Ricciardi 1967: Fig. 171.35; 1984: Fig. 3.9; 'alkaline glazed bowls with a notched rim' in Kennet 2007: 94, 96 and 99). A slightly different bowl,

more open with a vertical lip, resembles a bowl from Tell Mahuz dated by coins to the end of the 3rd and the 4th century (Lecomte 1993: Fig. 3.8; Venco Ricciardi 197i: 461, Fig. 94.77). Glass preserved in the hearths (globular bowls with concave bases and protruding rims, sometimes decorated with vertical grooves) also finds parallels at Choche and Tell Mahuz beginning in the third quarter of the 3rd century AD (Lecomte 1993: 201, Fig. 14.1–5, 8–11; Negro Ponzi 1968–1969: 330, 355, Figs. 153.19–23, 157.65, 68; Negro Ponzi 1972: Fig. 20.12–15, 40–41; 1984: Fig. 2.8).

The presence of two tombs that the community remembered in the fortified building gave it the status of a mausoleum and brought the development of a graveyard around it. The glass vessels found in these graves date to the late 3rd–early 4th century AD. The absence of facetted glass, so characteristic of Sasanian glass from the middle of the 4th century onwards (Negro Ponzi 1984: 35), provides a terminus ante quem for the cemetery.

The fortified building is contemporary with the PIR.D period at Mleiha. Although, on the one hand, the occupation levels of the fort produced only a few, not very significant finds, the graves of its occupants and their camels, as well as the hearths, produced many diagnostic finds – some of which have good parallels in the final period at Mleiha. At both ed-Dur and Mleiha, one finds fish plates, bowls with protruding or folded rims, basins with folded rims and a slight carination under the edge, as well as bottles with narrow necks in glazed ware (Lecomte 1993: Figs. 4.1–8, 12–14; 5.1, 5, 10). But, as mentioned above, the absence of bowls with convex sides and jars with an inward-curving neck and a marked rib under the rim at Mleiha is notable (Lecomte 1993: 199 and Figs. 5.9, 12.1–4).

However, even though both sites yielded fragments of Fine Orange Painted Ware, their style is different. All this seems to indicate a slight chronological difference between the PIR.D period levels at Mleiha and the Area F deposits at ed-Dur. This tends to corroborate the chronology established by the excavator of ed-Dur, who dates the construction and the first occupation of the fort to the first half of the 3rd century (Phase Ia), the installation of the main graves and the hearths a little later in the 3rd century (Phase Ib), the collapse of the building and its burial under the sand towards the end of the 3rd century (Phase II) and the installation of the cemetery along the walls (Phase III) from the beginning of the 4th century onwards (Lecomte 1993: 202). The abandonment of the latest building at ed-Dur therefore seems to be contemporary with the abandonment of Mleiha.

Further north along the shores of the Gulf, at the end of the coastal plain of Ra's al-Khaimah, is the site

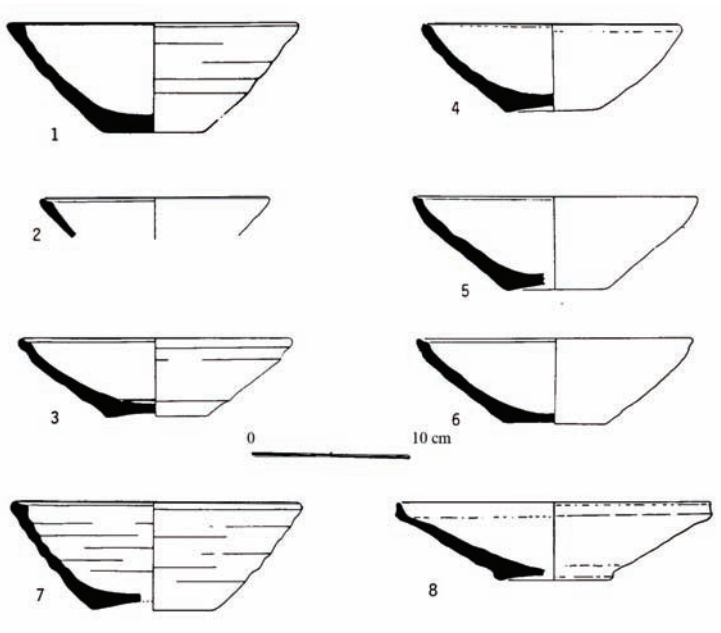


Fig. 11. ed-Dur (PIR.D), pottery from area F, 3rd–4th c. AD (after Lecomte 1993).

of Kush (Fig. 1). The excavation of this small mound revealed a stratigraphic sequence that extends to the 13th century (Kennet 1997, 2004, 2005 and 2009). The site was occupied mainly during the Islamic period, prior to the occupation of Julfar which followed it, but its deepest levels date to the Sasanian period (Phase I and early Phase II). The beginning of Phase I was dated to the 4th–5th centuries, on the basis of the finds recovered. Since virgin soil was not reached, it is likely that an earlier level remains to be discovered. In the lower levels of Phase II, a coin of the Sasanian king Kavad was found, struck between 507 and 519, and in the upper levels a C14 date from the late 7th/early 8th century was obtained (Kennet 2004: 13 and Table 2).

The excavation produced abundant finds, including some Fine Orange Painted Ware. The distribution of this category across all levels, although clearly more common in the deeper ones, shows that its production continued until the beginning of the Islamic period (Kennet 2004: 61–62, Fig. 34 and class FOPW in Table 3). The large jars with incised decoration are found in both phases, but they seem to increase in number towards the end of Phase II (beginning of the Islamic period) (Kennet 2004: 58, Fig. 31 class LISV). The assemblage from the oldest phase seems to post-date phase PIR.D at Mleiha and the abandonment of the fortified building at ed-Dur. Parallels with material from the late deposits at ed-Dur are rare (some glazed bowls with convex sides, thickened inside rim and interior projection, and glazed bowls with vertical rim; see Kennet 2004: 30, Fig. 5, class TURQ, type 94), and the Fine Orange Painted Ware shows some stylistic differences that presage an interesting

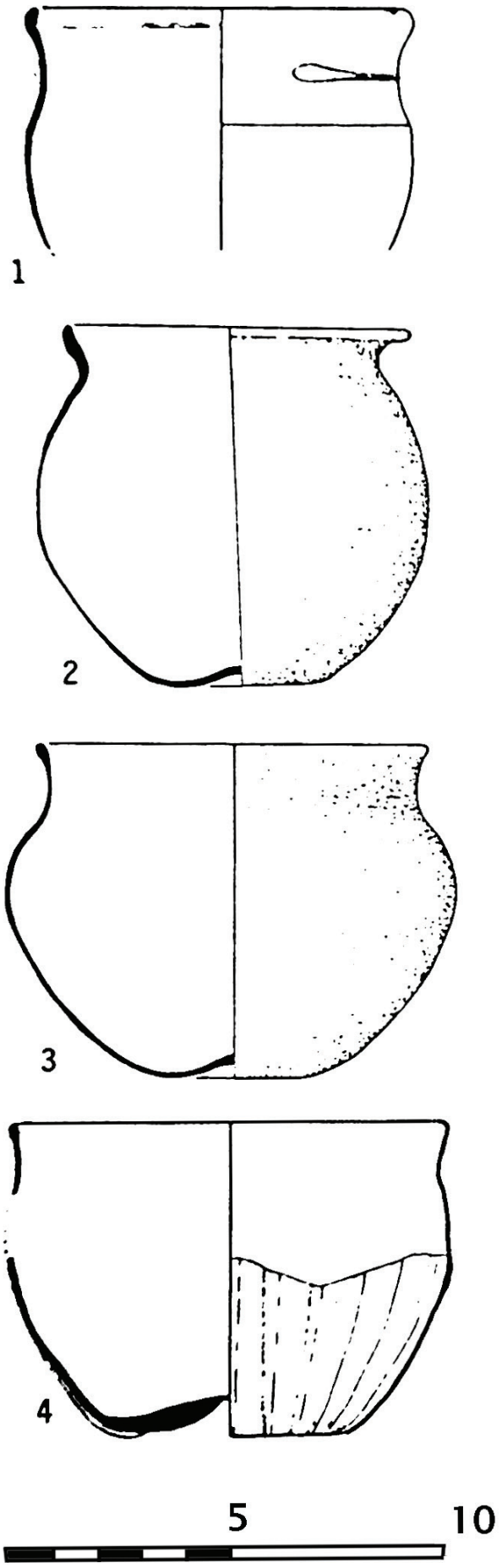


Fig. 12. Ed-Dur (PIR.D), glass vessels from Area F, 3rd–4th c. AD (after Lecomte 1993).

chronological typology that remains to be established for this type of material. As a result, we agree with D. Kennet that the oldest levels so far excavated in Kush are 'slightly later than the PIR.D occupation at ed-Dur' (Kennet 2002: 160; cf. 1997, 2005) but the deeper levels still remain to be excavated.

The area of Khatt was probably an agricultural extension of the site of Kush. Located in the foothills of the Oman mountains, on the Jiri plain (providing an easy route towards the coast some 30 km away), Khatt is one of the most fertile territories in the peninsula and has been occupied since prehistory. An occupation from the Sasanian period was recognised on one of the small hills still preserved between the palm groves and the cultivated zones. The real extent of the ancient site could not be clearly defined due to modern agricultural installations that have progressively destroyed it (Kennet 1998; Kennet 2004: 22). In a cut published by D. Kennet, there were several levels of occupation associated with mudbrick dwellings, in a deposit about 3.50 m deep, bearing witness to a permanent settlement over a fairly long period (Fig. 13). From the closed context of a pit came a dipper (small-handled jar with a pointed base) and two jugs of the *oinochoe* type. The jar is related to Sasanian forms at Choche-Ctesiphon (3rd–5th century/6th–7th century) (Kennet 1998: 109, Figs. 6.22 and 7; Venco Ricciardi 1967: 95 and Figs. 151–153; 1984: 51, Fig. 2.8–12) and at Kish in the pre-6th century levels (Moorey 1978: 124). The two jugs are of a form that is well-represented at Kush in the pre-Islamic levels (Kennet 2002: 157–158, Fig. 4; 2004: 62, Fig. 35.87). A large jar with an incised vertical neck from a later context can be compared with Sasanian and early Islamic types at Jazirat al-Ghanam and Hulayla (Kennet 1998 Fig. 5.6), but this has no parallel in the latest levels at Mleiha and ed-Dur Area F, suggesting that this shape only appeared in the region during the 4th century, most probably in the second half of the century. The entire sequence has been dated to the 4th–5th centuries AD. The presence of types absent at Mleiha and ed-Dur is an indication of Khatt's later date (Kennet 1998: 111; 2004: 58). Ceramic parallels suggest that the occupation of Khatt was contemporary with the pre-Islamic phases at Kush.

At the northern tip of the peninsula, in an insular position clearly separated from the inhabited continental area, the site of Jazirat al-Ghanam seems related to maritime traffic off Ra's Musandam. This site, that was only explored on the surface, has been well-dated to the Sasanian period (de Cardi 1972). A few sherds of Fine Orange Painted Ware have exact parallels in the PIR.D period assemblages from Mleiha and ed-Dur. However, numerous large, collared jars with incised decoration

(de Cardi 1972 Figs. 2: 23–24, 29, 33–34) characteristic of the Sasanian period, have no parallels at these sites, which places Jazirat al-Ghanam, like Khatt, in a phase that post-dates their abandonment. The Jazirat al-Ghanam assemblage has been closely related to that of the pre-Islamic levels at Kush and it is therefore probable that the site was not occupied before the second half of the 4th century.

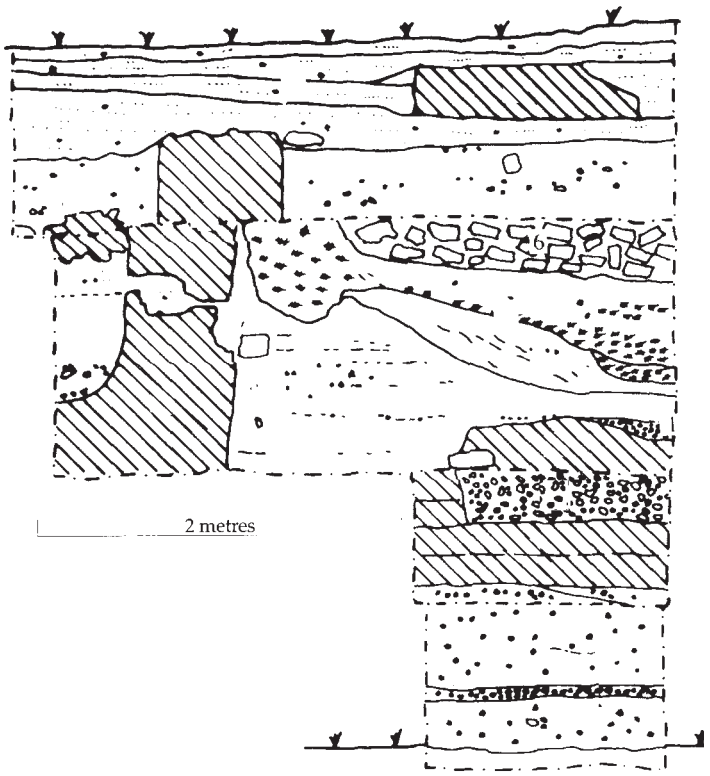


Fig. 13. Khatt, step-trench section showing the mudbrick levels and walls (hatched) (after Kennet 1998: Fig. 3).

North of the eastern coastal plain, Dibba is one of the best harbours along the Arabian coast of the Gulf of Oman. In 2004 the first remains of the late pre-Islamic period there were found and excavated (Jasim 2006; Jasim and Abbas 2009). The site has a collective tomb, comparable to those at ed-Dur. The participation of the site in maritime trade is clearly indicated by the quantity of western luxury goods and particularly by the presence of goods imported from the Indo-Pakistani region. Three ivory combs with incised decoration were found, comparable to a fragment from Mleiha (Jasim 2006: 216 and 218, Figs. 41–48; Jasim 1999: Figs. 9 and 10.11). Although precise parallels have not been found – the decoration can be compared with that of certain pieces of furniture from Begram, dated to the 1st century AD (Hackin 1954: Figs. 12–18, 20–27; Tissot and Darbois 2002: 30–35, 42–43, 49) – the style of decoration, the lotus motif and the scenes represented leave no doubt as to the area of origin of these objects. A cosmetic tube of turned ivory resembles similar objects from Taxila (Jasim 2006: Fig. 40.1–2, 53; Marshall 1951: 659, Pl. 199.50, 52).

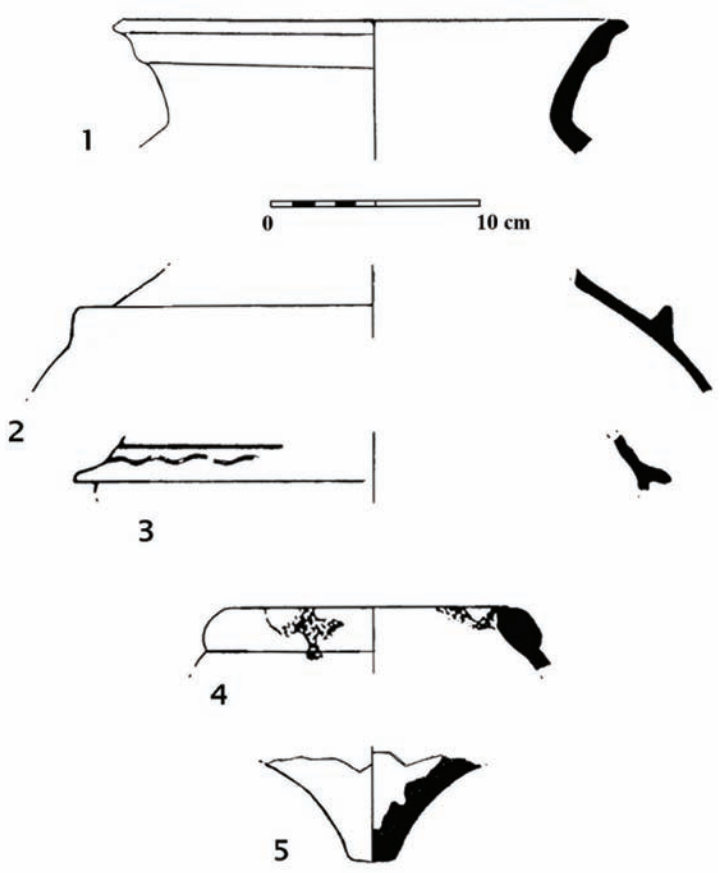


Fig. 14. Suhar, ceramics from Levels II–IV. Pinkish and red wares, slipped, with mica (1–3) and sandy orange red with thick coat of bitumen (4–5) (after Kervran 2004: Figs. 10–11, 14).

As a whole, and based mainly on parallels to ed-Dur, the finds (ceramic, glass and ornaments) belong to the 1st and the very early 2nd century AD (Jasim 2006), but a few pieces seem to indicate later use of the tomb, or perhaps a second phase of use (Cuny and Mouton 2009: 113–115). Thus, the *aryballos* with concave base, although produced in the 1st and 2nd centuries AD (Jasim 2006: Fig. 37.5–6; Arveiller-Dulong and Nenna 2005: 89, Psl. 18.154, 19.169–170), only appears in the Oman peninsula and on Ghallah in later contexts with finds characteristic of the PIR.D period (at Ghallah, Mouton 2008: 180–182, Fig. 137.6–7; at ed-Dur, without handle, Mouton 2008: Fig. 96.5; Haerinck et al. 1991: Fig. 32.3). The globular *aryballos* with two handles attached between the top of the shoulder and the base of the neck is a form that first appeared in the second half of the 1st century AD, but was produced until the 5th century. Examples found on Bahrain have been dated to the 2nd–5th centuries AD (Jasim 2006: Fig. 37.1; Boucharlat and Salles 1989: 121–122, Figs. 216–221, Lombard 1999: 184 Fig. 275; date and distribution: Isings 1957, type 61; Arveiller-Dulong and Nenna 2005: 137, Fig. 350). An unguentarium with

rounded base, straight neck and elongated body sting is similar to types that are well-attested in the 2nd and 3rd centuries AD (Jasim 2006: Fig. 37.3; Isings 1957: type 83. Arveiller-Dulong and Nenna 2005: 405, Pl. 99.1106). The balsamarium with high neck cannot be earlier than the 2nd century AD (Jasim 2006: Figs. 34.6–10 and 38; Isings 1957: shape 82; Arveiller-Dulong and Nenna 2005: 144–146 and Fig. 242.722, 726, 728; Pl. 26.378–383), with the exception perhaps of the example with the tapered handle which appeared at the end of the 1st century (Jasim 2006: Fig. 34.9; Dussart 1998: 165, Pl. 52: type B XIII 1211a; Arveiller-Dulong and Nenna 2005: 124–136: 298–303, 307–343; 230–231.673, 676; 241.718–719). These containers are common until the 3rd and can still be found in the 4th century AD.

Fig. 15. Suhar, steatite bowl fragment (PIR.C/PIR.D periods, 1st–mid 3rd c. AD) (Photo M. Kervran).

This single excavated grave cannot provide the chronological limits of ancient Dibba with any certainty. It attests to an occupation that can be placed mainly in the 1st century AD, but which also seems to stretch into the 2nd and probably the 3rd century. Excavations under way in the domestic area confirm continuity of occupation since they have yielded pottery from the Indo-Pakistani region comparable to that found in the PIR.D period levels at Mleiha (material seen thanks to S. Jasim and E. Abbas). In the current state of knowledge, the occupation of Dibba appears to date from the turn of the millennium until the 2nd–3rd centuries AD, but excavations currently under way may reveal a longer history of occupation.

The case of Suhar has been debated recently in a number of articles (Kervran 2004; Kennet 2007; Cuny and Mouton 2009). We will not revisit here the details of the discussion of the material from the deep levels of this port on the Gulf of Oman that was very active during the whole Islamic period. Everyone agrees on the presence, residual for some, more significant for others, of Parthian-period pottery from the 1st century AD. Sasanian period occupation remains controversial. The absence of some pottery types characteristic of this period, including Fine Orange Painted Ware and the CLINKY and SMAG categories of Kennet's typology, well represented to the west of the mountains of Oman, is indeed noteworthy.

Conversely, the Brown Ware with chalky/shelly/sandy temper found at Mleiha (Fig. 8) and Dibba, and identified as coming from the Indo-Pakistani area, finds some parallels at Suhar, e.g. from Phases I to IV cooking pots in pinkish to red clay with mica, with a circular fin on the shoulder (Fig. 14.2–3) (Kervran 2004: Figs. 10.22, Phase II; 12.14, Phase III; and 14.9, Phase IV); in levels from Phases II–III a jar of greenish to pinkish fabric with particles of mica, everted rim and red slip (Fig. 14.1) (Kervran 2004: Fig. 10.1, Phase II); and in Phase II a long and very open rim in the same fabric (Kervran 2004: Fig. 10.26). The last two forms are present at Khor Rori in pre-Islamic levels where they have been identified as Indian wares (Sedov and Benvenuti 2002: 191 and Figs. 12:.2, 5–7 and 15.4–6, dated 0–400 AD; Sedov 2008: 219, Pl. 2.7).

Two sherds of sandy red *amphorae* coated inside with a thick layer of bitumen (Fig. 14.4–5) are related to forms from the PIR.C and PIR.D periods at Mleiha (Kervran 2004: Figs. 10.15 and 11.6; Benoist et al. 2003: Fig. 8.8–10).

Finally, a fragment of steatite bowl decorated on the exterior with incised, horizontal lines and cordons, was found at Suhar (Fig. 15).[1] This kind of stone vessel is very characteristic of locally produced steatite vessels of periods PIR.C and PIR.D at Mleiha and ed-Dur (at Mleiha: Boucharlat and Mouton 1994: Fig. 6.4–6, at ed-Dur: Mouton 2008: Fig. 93.7). An almost identical fragment, imported from the Oman peninsula, has been found at Makaynûn (Hadramawt) in a building dated to the 3rd–4th centuries AD.[2]

Once again, with reference to the assemblage at Mleiha, and parallels in the Hadramawt, we can reasonably suggest that the most ancient levels in M. Kervran soundings at Suhar bear attest to a pre-Islamic occupation (perhaps residual?), that stretched beyond the Parthian period into the 3rd century AD (PIR.D period). The documentation available does not allow us to identify pre-Islamic occupation after that date with any certainty.

Leaving aside a few isolated finds (Kennet 2007: 90), only one other sherd collection attests to the presence of a settlement dating to these periods. This was made during construction work carried in Al Ain in 1982

(Mouton 2008: 173–174, Fig. 129). The predominance of sherds from ovoid, bitumen-covered jars of sandy orange clay is significant because it indicates a habitation. This material would not have been deposited in an isolated burial, and a large, underground grave would necessarily have been associated with a permanent site. Too few forms were recovered to allow for precise dating. The fragments of glazed ceramic of dark green, light green and light-blue colour are – in terms of their fabric and profiles – similar to the late assemblages from Mleiha and the deep levels at Suhar (Mouton 2008: Fig. 129.1–2; dated from the Parthian period [1st c. BC–2nd c. AD] in Boucharlat and Salles 1987: 295; from the PIR.D period in Mouton 2008: 178). At this point, we enter Kennet's discussion of these assemblages, that combine ceramics characteristic of late pre-Islamic collections, represented by the PIR.D period levels at Mleiha, with ceramics at local early Islamic sites dated to the 8th–9th centuries. If we omit the ovoid, sandy jars, the only three forms found are types known at Hulayla (Sasaki & Sasaki 2000: Figs. 10–11 and 15). Therefore, it is difficult, given the available documentation, to establish whether this small collection of pottery is contemporary with the PIR.D period at Mleiha, or whether it post-dates it.

By sorting all of the above-mentioned sites chronologically, two phases of settlement emerge. At Mleiha, which had been occupied since the 3rd century BC, there is no indication of any occupation later than about the 3rd century AD. At ed-Dur, the latest buildings, in Area F, were abandoned in the second half of the 3rd century AD. Only the remains of funerary meals (hearths), along with some graves belonging to a community whose dwellings have not been found, date to the late 3rd/4th centuries. Dibba, which is contemporary with Mleiha and ed-Dur in the 1st century AD, seems to have still been active during the final period of Mleiha, but there is no evidence of later pre-Islamic occupation. At Suhar, traces of Parthian period occupation are generally recognised, which should extend at least into the 3rd century given the parallels with the assemblage from the final phase at Mleiha. The case of Al Ain will not be taken into account. Therefore, in our current state of knowledge, this group of settlements, simultaneously occupied over centuries, appears to have been abandoned after the 3rd century.

Kush has pre-Islamic levels dated to the 5th–6th centuries, but deeper levels remain to be excavated, that might reveal an earlier phase of occupation. The settlement at Khatt has been dated to the 4th–5th centuries AD and Jazirat al-Ghanam does not seem to pre-date the 4th century. Thus, these three sites each post-date the 3rd century AD.

Two points seem particularly relevant to an understanding of the evolution of settlement patterns in the Oman peninsula in antiquity. The first is a chronological threshold that appears quite clearly between the second half of the 3rd and the 4th century AD, perhaps most noticeably towards the middle of the 3rd century. The main permanent sites of the culture that followed the Iron Age in Oman in the 3rd century BC and which constituted the framework of the regional settlement pattern in antiquity (Mleiha, then ed-Dur, Dibba and Suhar), seem to have all been deserted simultaneously or over a very short space of time. Following on from that network, from the 4th–5th centuries onwards, a small group of settlements was concentrated in the north of the peninsula.

The second point is the important change in settlement pattern. The sites which seem the most central ones, Mleiha and ed-Dur, belong to the first phase: they were extensive habitation areas, places of spontaneous settlement of sizeable communities with evidence of resident political and economic power (e.g. fortified buildings, luxury goods, mint etc.). The coastal settlements of Dibba and Suhar were complementary to these centres, assuming that they were all integrated into a single political and cultural unit, which remains to be demonstrated. The abandonment of this settlement network was followed by a single, modest settlement in the agricultural area of Khatt. At Kush, the structures from Period 1 (the oldest) do not seem to have been dwellings, and upon these deliberately levelled structures was a level of post-holes, followed by a rectangular defensive tower. According to the excavator, the remains are 'not suggestive of domestic contexts and may indicate a military or institutional function' (Kennet 2005: 109–111; 2009: 158), even though there is evidence indicating a subsistence economy, that supposes dwellings of some sort in the vicinity. Similarly, the island site of Jazirat al-Ghanam further north has been interpreted as a Sasanian military post (de Cardi 1972: 308). These two coastal sites thus seem to have been established by an authority, and resolutely turned towards the sea, since Kush was located on the shore in antiquity. Finally, occupation at these two sites was not continuous with the preceding settlement pattern and was characterised by a material culture strongly marked by Sasanian elements.

This evolution of the settlement patterns in the Oman peninsula, and associated changes in the material culture, was first described and discussed by D. Kennet, who saw it as evidence of a regional 'decline' (Kennet 2005, 2007). The main interest of the discussion he put forward is to have overturned the theory that had existed until then: that the Sasanian period had been one of a

flowering of the population in the Oman area. It is clear that this was not the case. The reasons for this evolution must now be sought. Of course, investigations are still necessary (and some are under way) at Dibba, Kush and Mleiha, in order to gather more substantial information on this pivotal period in the history of the region. But a few suggestions can be put forward here.

The relationship with the decline of Roman commerce towards the east, beginning in the 3rd century, has been mentioned by D. Kennet. But he also underlines that this decline, and the growth of maritime trade, cannot by themselves explain such changes in this region (Kennet 2007: 108–110). The question is worth asking in view of the chronological coincidence, but the impact of such trade does not seem to have ever been the determining factor in the development of late pre-Islamic society. Away from the main caravan trade routes of Arabia, the community of Mleiha, which was at the origin of this culture, was established in an agricultural environment and it exploited the mineral resources of the surrounding mountains – copper, iron and chlorite. Mleiha and ed-Dur took part in trans-Arabian exchanges and brought back the luxury goods which we find in burial deposits and dwellings. But they were not intermediaries who profited from such exchanges, rather they were clients, partial to 'exotic' products symbolic of richness and, no doubt, of power. Long-distance trade probably never represented an important part of their economy. It may have done so, however, in the case of the coastal installations at Dibba and Suhar that participated directly in maritime trade and acted as intermediaries for the inland populations.

Climatic factors have also been mentioned. Progressive aridity could have forced a movement of people northwards. Palaeo-environmental data from Bahrain suggests some 'environmental stress' in the 1st millennium AD (Kennet 2007: 110; Larsen 1983: 203–204). To this one can add the southward migration of the Intertropical Convergence Zone during the Holocene and up until today, that progressively reduces the duration of the monsoon in the Oman region, but this phenomenon seems to be very gradual and is particularly noticeable towards the south of Oman (Fleitmann et al. 2007). Climatic variations are long-term. The perception of gradual cultural changes over a period of three or four centuries (Kennet 2007: 106) allows such a suggestion. But a re-assessment of the latest levels at Mleiha (Cuny and Mouton 2009) has provided us both with a more precise periodisation of the late phases of the late pre-Islamic period and with a clearer chronological order for the related sites. The abandonment (of the permanent occupation) of Mleiha and ed-Dur seems to us to be more or less simultaneous and more sudden than gradual. In fact, the decline of the major sites, and even their abandonment, could not be the culmination of the progressive reduction of the inhabited spaces, as has been suggested (Kennet 2005: 115; 2007: 106). At Mleiha, period PIR.D is characterised not by a reduced habitation area, but by a more concentrated one (Mouton 1999, 2009). There was a change in the structure and organisation of the settlement, not necessarily in the size of the population and the scale of their activities. At ed-Dur, evidence of occupation in period PIR.D is concentrated in Area F. Although the structures from this period seem to be clearly less numerous than in the preceding phase, it must be remembered that the large quantity of surface remains from the preceding period of 'apogee' (PIR.C) is more a reflection of length of occupation than population size. Dibba and Suhar, unfortunately, cannot be considered due to a lack of data.

However, what is very significant about the PIR.D phase that precedes the abandonment of the sites of Mleiha and ed-Dur, and which D. Kennet highlights as well (Kennet 2005: 115), is the construction of fortified buildings. At ed-Dur, the base of an isolated tower is preserved below the fortified building in Area F, and there is a fort with round towers in the dwelling area towards the centre of the site. The two structures were associated with material from the PIR.C period. The fortified building in Area F was then built in period PIR.D on top of the razed tower. At Mleiha, the two fortified buildings were constructed in period PIR.D.

If one admits that the small fort and the isolated tower in Area F at ed-Dur can be from the 1st century (period PIR.C), the other three fortified structures all date to the 2nd century and the beginning of the 3rd century AD. In three cases, these constructions sheltered residences, probably of the elite. The hypothesis of a relationship between the appearance of this type of construction and the penetration of Arabic-speaking groups into the Oman region in the early centuries AD (Kennet 2005: 115) should not be dismissed. But, at first glance, what these installations imply is a period of insecurity, since they all include covered areas intended to shelter people and animals in case of danger (Kennet 2005 Figs. 5–7; Cuny and Mouton 2009 Figs. 2–4). These were not simply fortified houses. That a period of insecurity preceded the abandonment of these sites is significant. The large amount of material found at Mleiha on the upper floors of these buildings and in the dwellings surrounding them, as well as the traces of fire found in the building in Area H, bear witness to the suddenness of the site's abandonment.

The connection between these events and the possible military expedition of Ardashir, before 240 AD, on the

Arabian shore of the Gulf (preserved in Islamic-period traditions) has already been discussed (Cuny and Mouton 2009: 122–124). Together with the kings of 'Uman, Bahrain and Yamamah, the rulers of Mleiha and ed-Dur were perhaps defeated by the Sasanian expedition. This hypothesis has the advantage of explaining the simultaneous abandonment of the two main permanent sites of the regional culture (Mleiha and ed-Dur), the shifting of settlement towards the coastal areas which were of interest to the Sasanians, and the military or 'institutional' dimension of two of the three settlements (Kush and Jazirat al-Ghanam) that characterise the new regional settlement pattern. But the historical and archaeological reality of this expedition remains to be demonstrated. Even though the sites appear abandoned to us and the culture that they represented ended, populations that were organised differently nevertheless continued to live in the interior of the peninsula, as attested by the hearths and graves placed in the ruins of the fortified building at ed-Dur, and the remains of temporary installations found in the destruction layers of the fort at Mleiha.

In any case, the identification of a chronological-cultural threshold towards the middle of the 3rd century AD that is very clear from the point of view of settlement pattern, but also to a lesser extent of the cultural material, forces us to review the periodisation of the last centuries before Islam. This threshold corresponds to the end of a society and culture which originated in the 3rd century BC at Mleiha. Excavations there have provided a chronological and cultural framework, in which phase PIR.D (ca. mid 2nd–mid 3rd century AD) corresponds to the final phase of permanent settlement at Mleiha and ed-Dur, and to the end of the culture exemplified at these sites. A later phase must be distinguished, absent at Mleiha, but represented at ed-Dur by the hearths, ritual meals in front of the abandoned fortified building in Area F, the cemetery in the ruins and the cemetery on the neighbouring island of Ghallah. All of these remains attest to the presence of a population about whose dwellings we know nothing. Until the beginning of the 4th century AD, ed-Dur remained the territory of a group that kept the memory of the place and buried their dead there, as one buried around the *kouba* of a great and revered figure in the later Islamic period. Through these practices, this population shows its social and cultural affiliation with the previous, sedentary community, but it had adopted another way of life, or perhaps it went elsewhere in the region (further north?). It seems to us that the dating of this population needs to be clearly distinguished from that of the occupation of the deserted settlements. For this reason it is preferable to define a PIR.E or Sasanian phase, later than PIR.D, to define in chronology the period when the sites of Kush and Khatt were formed.

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1 It has been published by mistake together with the Islamic material from the upper levels of the sounding (Kervran 2004: Fig. 34.29): 'ce fragment, trouvé à la cote 4.22m (...) était bien associé à l'habitat pré-islamique clairement situé sous la fosse 311 et séparé du fond de cette fosse par une couche de terre à brique (ou brique crue effondrée)' (letter from M. Kervran dated 7 July 2009).

2 Unpublished material from Makaynûn presented at the Rencontres Sabéennes in Paris, June 2009.

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Fifty Years of Emirates Archaeology

ARCHAEOLOGICAL HISTORY OF THE NORTHERN EMIRATES IN THE ISLAMIC PERIOD: AN OUTLINE

Derek Kennet (Durham)

INTRODUCTION

The Northern Emirates, and particularly the Sir and Jiri plains of Ra's al-Khaimah, encompass some of the most naturally hospitable areas of UAE territory. It is not by chance that this area has one of the most consistent settlement histories in the whole of the Oman Peninsula. All major cultural horizons are represented and some, especially those characterised by economic stress such as the Wadi Suq, the late Bronze Age and the Sasanian periods, are better represented than almost anywhere else. This is certainly at least partly due to the large granular aquifer that lies underneath the alluvium of the coastal plains, and in part to the variety of environments – or 'eco-cultural zones' as Dostal called them (Dostal 1983: 9–10) – that are to be found in close proximity, offering a wide range of potential food supplies and economic niches. Date palms and cereals are cultivated on the fertile alluvial soils just a short distance from the lagoons and natural harbours of the coast where fishing, shellfish collection and trade have formed an important part of the economy since the earliest times. At the back of the plains, the deeply cut wadis and limestone mountains provide a range of specialist niches and resources, as does the great sand dune field, the northern tip of which, having swept up from the heart of the Rub al-Khali, finally peters out on the southern shore of Khor Ra's al-Khaimah.

The first archaeological survey ever carried out in this area was undertaken by Beatrice de Cardi and John Doe in 1968. For those interested in the Northern Emirates, this survey occupies a place in local archaeological folklore just as revered as the famous Danish Carlsberg Foundation expedition does for the Gulf more generally (de Cardi and Doe 1971). Through de Cardi's pioneering work, she and her collaborators brought the archaeology of this area to the attention of the world and made sure that its significance was fully appreciated (e.g. de Cardi 1975; de Cardi 1985).

At that time de Cardi was working in the equivalent of an archaeological vacuum, in the sense that this was an area about which absolutely nothing was known archaeologically. This made it impossible for de Cardi to allocate a date to most of the sites and structures she encountered. In the forty years since 1968, an impressive amount of progress has been made. For some time now a reasonably secure chronological and cultural framework has been in place and this is broadly accepted by most researchers. This means that it is now possible to date sites, layers, tombs and objects with some confidence. This is especially important in an area with such a sparse historical record. The establishment of this framework was a significant undertaking in itself but now that it exists, research efforts have increasingly been directed towards a deeper understanding and interpretation of the social, cultural and economic realities and processes of the region's past.

De Cardi devoted a considerable amount of space to Islamic-period remains in the reports of her surveys, even though this period is not of special academic interest to her. The reason is certainly because late Islamic remains are by far the most visible and abundant archaeological evidence in this area. Unusually for the Middle East, the Islamic period of this particular area has attracted a lot of archaeological attention over the years. A number of excavations of Islamic sites has been undertaken, such as: Julfar; Jumeirah; Kush and Hulaylah and Islamic material has regularly been reported and discussed in the publication of field surveys. Indeed, the accumulation of archaeological evidence for the Islamic period has reached a point where it is now possible to attempt to sketch an archaeological history of the area from about the 5th until almost the 20th century AD, taking into consideration the location, type and amount of settlement in different periods and to some degree the nature and scale of the economy.

THE NORTHERN EMIRATES IN THE ISLAMIC PERIOD

It is a preliminary outline of exactly such an 'archaeological history' that is the aim of the present paper. Given the constraints of space it is necessarily brief. The value of writing this now is that it serves as a measure of how much progress has been achieved archaeologically over the past fifty years and at the same time sets out some ideas and interpretations for others to accept or to challenge.

The following chronological periods will be used as the framework in an attempt to simplify developments into a comprehensible overview.

Period A	5th–7th century
Period B	8th century
Period C	9th–early 11th century
Period D	11th–mid 14th century
Period E	Mid 14th–late 16th
Period F	Late 16th–early 20th century

From a geographical perspective, the focus of this paper will be the Northern Emirates, encompassing

roughly the area north of a line between Dubai and Fujairah in the south to the border of the Omani Musandam in the north. This apparently arbitrary definition can be justified by the fact that this area does appear to have had its own distinct historical dynamic and cohesion through much of the past 1500 years. Having said that, frequent reference will be made to sites and areas beyond this where necessary or convenient. There will also be a perceptible bias towards northern Ra's al-Khaimah – especially the Sir and Jiri plains – partly because this is the area in which the present author has conducted much of his own research and partly because it contains a wealth of important archaeological remains of the Islamic period. At the same time, an attempt will be made, where possible, to set the main developments within their regional perspective – which will refer to the Gulf, eastern Arabia and southern Iraq. The locations of sites mentioned in the text are shown in Figs. 1 and 2.

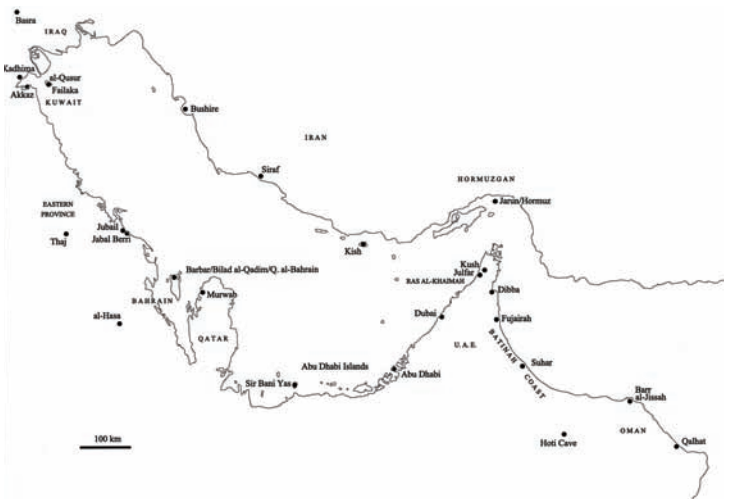

Fig. 1. Map showing the location of sites around the Gulf mentioned in the text.

During the 700 years or so between the end of the Iron Age and about 400 AD,[1] the archaeology of the Northern Emirates is dominated by the large, quasi-urban sites of Mleiha and ed-Dur. Some occupation is reported from Tell Abraq, although this is apparently quite limited in extent (Potts 1991: 105–119) and hints of occupation have been revealed at a few other sites, such as Khatt and Asimah (de Cardi et al. 1994: 53–4; Vogt 1994: 147–150). In addition there are a number of burials, some apparently in reused tombs of much older construction, for many of which no associated settlement has yet come to light. Examples of these are: Fashgha; Wa'ab and Naslah in the Wadi al-Qawr; Dibba; Sharm; Khatt and others (de Cardi 1996; Jasim 2006; Petrie 2000; Phillips c. 2004).

Relatively speaking, this period appears to have been a time of prosperity and high population levels across much of Arabia, certainly eastern Arabia. This is reflected in the large urban or quasi-urban sites such as Thaj, Qala'at al-Bahrain and Failaka, as well as the number of coins, burials and rural sites that have been found. The paucity of evidence from the Sir and Jiri plains during this period is therefore notable and it is very likely that a large site or sites existed in this area but has not yet come to light. Some years ago, during the construction of a cemetery wall at Shimal by the Municipality of Ra's al-Khaimah, a number of sherds of this period were revealed at a depth of about one meter and these may have been part of a large site.[2] It is also possible that there was occupation at Kush earlier than the 5th century. Natural soil has not been reached by the excavations in the heart of the tell and a few fragments of glass and pottery sherds of this period have been found in later levels at the site.

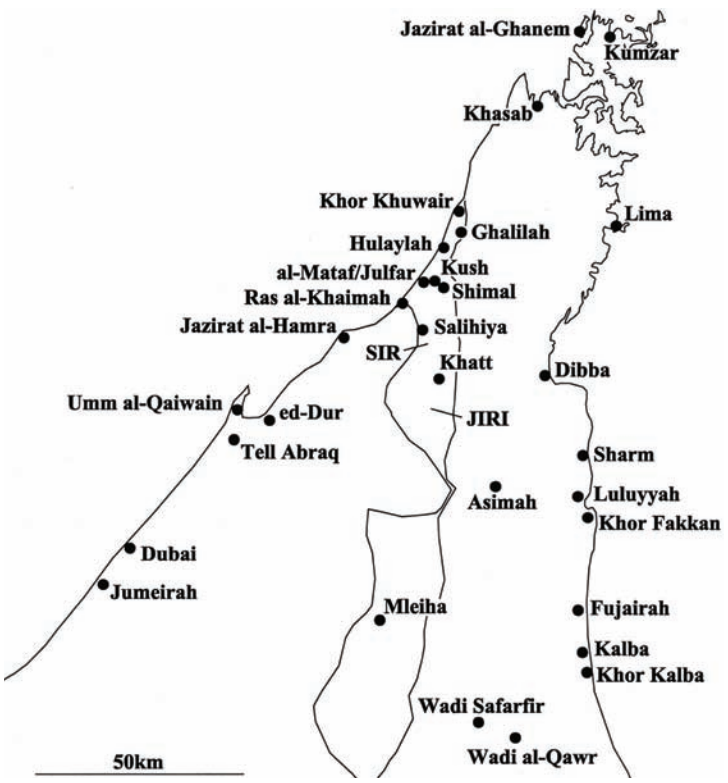

Fig. 2. Map showing sites in the Northern Emirates mentioned in the text.

Cuny and Mouton have recently published a useful review of the evidence for the 2nd to 4th centuries AD, arguing that there was a more significant presence at Mleiha up to the early 3rd century than was originally stated – although it was much less extensive than earlier periods – and reiterating the fact that ed-Dur was a very much smaller site by the 4th century than it had been in the 1st/2nd centuries (Cuny and Mouton 2008).

PERIOD A (5TH – 7TH CENTURY) – A LOW EBB

By the middle of the 4th century, both Mleiha and ed-Dur had been abandoned and it seems that occupation later than this time was extremely rare across much of Arabia, certainly across eastern Arabia (Cuny and Mouton 2008: 110, Kennet 2005, 2007; Shiettecatte 2008).[3]

In fact, the only sites in the Northern Emirates where there is reliable evidence for occupation at this time are Kush, Khatt Area 3, and Jazirat al-Ghanem (Cuny and Mouton 2008: 122). The locations of Kush and Khatt are similar in that both sites are surrounded by fertile agricultural land. Kush is the larger of the two sites, although there may still be more evidence to come to light at Khatt. Jazirat al-Ghanem is a completely different type of site, being located on a small barren island in the north-west of the Musandam which lacked agricultural potential or water in the early 20th century and probably did so 1500 years earlier (Lorimer 1908: 577). The function of this site is uncertain, although it might have been some form of military outpost (de Cardi 1972).

Little is known about the nature of occupation at Khatt because nothing more than a small sounding has been excavated but the larger-scale excavations at Kush have begun to yield information on this period. The impression given is of a small site with a rather parochial feel to it. A rectangular mudbrick tower, probably built in the 7th century, may have been the work of a petty local ruler. It is certainly a structure of limited proportions, the like of which is not otherwise known from the Hellenistic, Parthian or early Sasanian periods in the region. Although it is defensive in nature, it is a much less ambitious undertaking than the forts of Mleiha and ed-Dur. The palaeobotanical evidence from the site indicates mixed production of foodstuffs, perhaps suggesting some degree of self-sufficiency rather than integration into a wider exchange or supply network. The pottery assemblage, by contrast, indicates contact with South Asia, Iran and Iraq (Kennet 2008).

Apart from these three sites and some limited traces of occupation close to Suhar (Costa and Wilkinson 1987: 107, 133–9, 184–5), there is, in fact, very little convincing archaeological evidence for substantial settlement in the whole of the Oman Peninsula beyond about the 4th century AD, with the possible exception of the site of Barr al-Jissah close to Muscat that was excavated by Geoffrey King between 2001 and 2003. King believes there to be evidence of Sasanian-period military occupation at this site (King, pers. comm.) but as no evidence has been published, it is impossible to be certain of its dating or function.

Of the three sites known to have been occupied during this period, two are located on the Sir and Jiri plains. This might be pure coincidence or it might reflect the interests of those archaeologists who have conducted field work in this area. But another possibility, hinted at in the introduction to this paper, is that at times of economic or environmental stress settlement on the Sir and Jiri plains showed a greater degree of resilience than settlement elsewhere in the Oman Peninsula. This may also have been the case during the Wadi Suq and Late Bronze Age, when this area appears to have supported a much greater density of activity than most others.

It is likely, but not certain, that Khatt and Jazirat al-Ghanem were themselves abandoned before the 7th century. Only at Kush can it be stated with reasonable certainty that occupation continued beyond the 7th century and that the site was occupied during the Islamisation of the area.

It is not clear why there was so little settlement or activity in eastern Arabia at this time or why levels had declined since the Hellenistic/Parthian periods. The answer might be related to changing rainfall and monsoonal patterns – recent work on speleotherm data from Hoti Cave in northern Oman by Fleitmann has indicated a relatively brief period of intense desiccation, possibly in the early to mid 6th century AD. But this seems to have been a very brief event and does not comfortably explain what appears to have been a slow, sustained decline over a period of three or four centuries.[4] Interestingly, although low levels of activity and population appear to have prevailed over most of eastern Arabia during this period, there is little doubt that Iraq was at the long-term historical peak of its agricultural development (Adams 1965: 69–83; 1981: 200–214). The situation in southern Iran is less clear; evidence from the Williamson survey suggests there was some, but not very much, Sasanian activity along the coast south of Bushire, whereas in and around Bushire and to the north, this was a period of relatively high levels of activity (Priestman and Kennet n.d.).

PERIOD B (8TH CENTURY) – THE BEGINNINGS OF REVIVAL

Until very recently, the 8th century was almost completely invisible to archaeologists because the pottery types that

were in use at this time were unknown and it was therefore impossible to distinguish 8th century occupation from 5th, 6th or 7th century occupation. Many of the key forms and wares were thought to date to the Sasanian period, and for that reason many sites of the 8th century had been misdated to that time. To some extent the stratigraphic excavations at Kush have helped to resolve this question, but it is also the scholarship of St. John Simpson that is to be credited with correctly dating of stucco at the early Christian churches in the region to the 8th century (Simpson n.d.). Now that the pottery of this period is known and recognised, it can be expected that more sites will come to light in the future as more fieldwork continues.

In the Northern Emirates, new activity is marked at the site of Hulaylah where an extensive but short-lived settlement grew up at the southern tip of the island (Sasaki 1995: 6–8; Sasaki and Sasaki 1996, 1998). At the same time, occupation continued at Kush, although apparently on quite a small scale. Unpublished, occasional finds of Honeycomb and Indian Red Polished Ware from the Sir and Jiri plains indicate that there was some rural activity in these areas at the same time.

At the broader regional level, the increase in settlement and activity is reflected in the appearance of new occupation at sites such as Kadhima and Suhar, and Christian sites such as: Akkaz and al-Qusur in Kuwait and Thaj; Jubail; Hinnah and Jabal Berri in eastern Saudi Arabia; Muharraq in Bahrain and Sir Bani Yas in Abu Dhabi amongst others (al-Darwish 2005; Kennet 2007: 97–100; Gachet 1998; Bernard et al. 1991; Langfeldt 1994; Potts 1994; Kervran et al. 2005: 248; Carter 2008). Most of the early Christian sites appear to be new foundations as they have not yielded earlier material. It is also notable that, with the possible exception of Muharraq, there is apparently no coincidence between the early Christian toponyms that are known from historical sources of the 4th and 5th century and those that are known archaeologically for the 8th century.[5] This might suggest a total break in occupation at most or all sites during or after the 4th/5th century and a re-foundation of new sites in the later 7th or 8th century. New foundations of Christian sites might be reflected in what Beaucamp and Robin have called the *éclat du christianisme* in eastern Arabia in the later 7th century, by which they refer to an apparent intensification of a range of activities including the building of new churches and monasteries (Beaucamp and Robin 1983: 186). What is not yet clear is whether or not similarly renewed levels of activity occurred beyond the very specific cultural and political context of the early Christian communities. Amongst the new sites, only Hulaylah, Kadhima and Suhar have so far revealed no archaeological or historical connection to Christianity, and this might simply be because it has not been found. It is not therefore known whether the apparent growth of the church at this time was in some way a causal factor behind the revival in settlement and activity in the region, or whether the church was itself riding a tide of increased population and economic activity that was due to other causes.

PERIOD C (9TH – EARLY 11TH CENTURY) – MARKED CHANGES, CONTRASTING PATTERNS

The 9th century is easy to recognise archaeologically as it is marked by the introduction of a completely new style of glazed ceramics that were manufactured in southern Iraq but were traded widely over the whole of the Indian Ocean, including the Gulf and eastern Arabia. These ceramics are known collectively as the 'Samarra horizon' because they came into use at around the same time as Samarra became the capital of Abbasid Iraq in the early 9th century. The new styles were inspired by Chinese ceramics and reflect increasing contact between China and the Middle East.

In addition to new styles of ceramics, the 9th century also appears to have witnessed some important developments in settlement history. Firstly, many of the 8th century sites described above appear to have been abandoned, for example Hulaylah and Sir Bani Yas, whilst some continued to be occupied, for example Kush. Secondly, a number of sites came into existence in a variety of new locations.

For example at Khatt, Samarra-horizon pottery has been found in the large, low-lying area to the south-west of the date-palm groves (de Cardi et al. 1994: 59–61), likewise copper-smelting sites in places such as Wadi Safarfir have yielded the same (Western n.d.) and this is mirrored in similar developments further south (Costa and Wilkinson 1987: 93–131).

A number of small but important new sites are to be found on many low-lying shell middens and mounds on the western coast. These sites lack evidence for stone buildings, suggesting that the occupants lived in palm-frond huts, but they have nonetheless yielded significant amounts of imported Samarra-horizon pottery.

Examples are known from Jazirat al-Hamra in Ra's al-Khaimah (Vogt 1988), at the northern end of Hulaylah and in Area 46 at Sharaisha immediately behind al-Mataf/Julfar (Kennet 1994: Fig. 6; 2001: 104) as well as from Umm al-Qaiwain (Anon n.d.). It is likely that others exist but have not been reported.

The excavations by Professor Sasaki in Area A at Hulaylah give us an insight into what occupation at one of these sites was actually like. In Area A, Sasaki reported a single layer of occupation on the side of a large sand dune, consisting of hearths, shell scatters and fishbone scatters associated with coarse wares, beads, glazed wares and glass but entirely lacking in structures (Sasaki 1995: 3–5, 8–14). What is really striking about this site is the large amount of imported Samarra-horizon glaze wares which made up 34.8 percent of the Abbasid pottery assemblage by weight (Sasaki 1995: Tables 1 and 3). The sharp contrast between the ephemeral nature of the occupation and the subsistence economy on the one hand and the extremely high proportion of imported Iraqi glazed pottery on the other is very striking. Sasaki interpreted this as being evidence for a military camp (Sasaki 1995: 18–20), but this seems unlikely due to the number of similar sites along the coast. Instead, these sites seem to be related to a broader change in settlement and economy at this time.

In many ways this new pattern of apparently seasonal occupation on coastal shell middens with high-value imported pottery from Iraq is strangely reminiscent of the Ubaid sites that are known along the coast of eastern Arabia from 7,000 years earlier. The 9th century sites seem likely to represent seasonal occupation by nomadic or semi-nomadic groups who were nonetheless engaged in trade with merchants from Iraq. It is not clear what they might have been trading in return for the imported pottery, but the increase in activity that is reported at some copper smelting sites in the interior suggests that copper ore may have been one of the commodities. These sites appear, therefore, to represent an important new development in the history of the area, even if it is still difficult to situate the occupants, whoever they were, within a detailed understanding of the social and economic structures of the time.

The largest and most important site of this period is Jumeirah, which is a site of over nine hectares now located in the southern suburbs of the city of Dubai about 600 metres from the shore. This is a site that was wrongly dated to the Sasanian period when it was first excavated in the 1970s (Baramki 1975). Inspection of the pottery by the present author and recent excavation between 1993 and 2001 have indicated that occupation can be dated to between the 9th/10th and the 11th or possibly even the 12th century with no trace of Sasanian occupation at all (Qandil 2003).[6] Occupation at Jumeirah consisted of a number of very substantial stone buildings amongst which appear to be a fort or *caravanserai* and at least one palace (Fig. 3; Potts 1990: Fig 24). The nine or so excavated buildings are widely spaced with apparently open areas of up to 120 metres between some of them, although it is possible that they were surrounded by less substantial occupation in palm-frond huts. The function of Jumeirah is not clear, but its size and the high quality of the buildings suggest that it was a site of some social and political significance, perhaps the seat of a governor or local ruler.

A very significant development of this period, although strictly just outside the Northern Emirates area, was the emergence of the first true town in the history of the Oman Peninsula – Suhar on the Batinah coast. By the 10th century, Suhar had developed into a major trading emporium that extended over an area of more than 73 hectares and had a considerable agricultural hinterland (Williamson 1973a: 14–18; Costa and Wilkinson 1987: 79–92). Recent re-interpretation of the excavated evidence from this site suggests that the town had its roots in the 8th century (Kennet 2007: 97–100).

Until more evidence comes to light, it is impossible to propose a coherent picture of how the coastal sites, the inland, copper-smelting, sites, Suhar and Jumeirah might have been related to each other. Nonetheless, the notable increase in the number of sites at this time is remarkable. It might be that this growth was a continuation of the increased activity that had begun in the 8th century but the impression is certainly of a population and economy that were beginning to flourish again for the first time since about the 1st century AD.

However, these new developments seem to have been quite patchy. In the coastal areas of Abu Dhabi, no settlements of this period have come to light at all, despite the extensive survey work carried out by the Abu Dhabi Islands Archaeological Survey (e.g. Carter 2000; pers. comm).

At a regional level, an increase in settlement is reported from almost all areas around the Gulf where archaeological survey or excavation has been conducted, such as Bahrain, the al-Hasa oasis and the eastern Province of Saudi Arabia (e.g. Larsen 1983: App. II, Fig. 13.271–277; Whitcomb 1978: Pl. 76; Potts et al. 1978: 13–14, n. 30) whilst excavations at Murwab in Qatar have demonstrated the growth of new settlement there (Guérin and Na'imi 2009). Only in Kuwait is there, so far, a complete lack of evidence for this period.[7]

The amount of occupation in most parts of the Iranian coast increased slightly or stayed about the

Fig. 3. Jumeirah in Dubai. At least nine different excavated buildings can be seen, including what looks like a large fort or caravanserai (c. 34 x 36 m) just west of the centre and a large rectangular courtyard building in the centre of the east side (15 x 25 m?). None of the buildings appears to correspond in layout or proportions to the four published by Potts (1990: Fig. 24) which came from a handout obtained at the Dubai Museum in 1984. Photograph: Google Earth.

same according to the survey information collected by Andrew Williamson (Priestman and Kennet n.d.), whilst Siraf developed into a major international trading emporium of even greater size and wealth than Suhar (Whitehouse 1979).

With the flourishing of Basra, the main port of Abbasid Iraq, Siraf in Iran and Suhar in Oman, this period clearly represents a significant regional boom in trade, settlement and urbanisation. Indeed, the Abbasid commercial boom is a phenomenon that can be recognised well beyond the Gulf into the western Indian Ocean. An indication of this is the fact that Samarra-horizon pottery has been found all over the western Indian Ocean, for example at Shanga in East Africa, Sanjan in India and Anuradhapura in Sri Lanka amongst others (Horton 1996: 277–279; Nanji 2007: 62–93; Coningham 2006: 91–99).

It is remarkable that an economic boom had the potential, at this early period, to affect such a large part of the Indian Ocean. This would suggest high levels of mercantile and economic inter-connectedness, but the pattern is not ubiquitous. Settlement levels in the Iraqi countryside, the heart of the Abbasid empire, had already begun to decline by this period suggesting that

whilst trade may have been booming, agricultural output may have been dropping, at least in some places (Adams 1965: 97–102; 1981: 214–228).

During the 10th and early 11th century, it seems that the sites in the Northern Emirates that came into existence in the 9th century mostly continued to be occupied. It is possible that some were abandoned or contracted – and this may have been the case at Kush – but this is not yet certain due to the lack of chronological resolution.

PERIOD D (11TH – MID 14TH CENTURY) – ANOTHER LOW EBB

The early 11th century represents another marked break in the settlement history of the region. This period can be recognised archaeologically by a type of pottery known as Hatched *Sgraffiato*, that was probably manufactured in Iran but was widely exported. During the excavations at Siraf, this ware was dubbed 'the type fossil of decline' and it is true that its introduction seems to mark the decline in size and activity levels at both Siraf and Suhar, the two most important regional trading emporia of the 9th to 10th centuries (Whitehouse 1983: 330; Williamson 1973a: 19, Fig. 3b). During the 12th and 13th centuries Hatched *Sgraffiato* was succeeded by other types of Iranian *sgraffiatos* as the most commonly traded table ware across the region; these are also easily recognisable and allow occupation of this time to be reliably identified.

Hatched *Sgraffiato* is rare in the Northern Emirates because, as at Siraf and Suhar, its introduction appears to have heralded something of a decline. None of the shell-midden sites of the 9th and 10th centuries on the western coast continued in existence beyond this time and neither did activity at the copper-smelting sites in the interior, although Jumeirah and Kush both continued to be occupied and may have actually flourished. 'Sheba's palace', a fort/palace complex situated on a rocky ridge overlooking the Shimal plain in Ra's al-Khaimah, was probably first occupied at this time (Franke-Vogt 1996) and it is possible that there was also a large-tell site on the Sir plain at the place called Salihiyah where de Cardi mentions a mound from which she collected early medieval pottery in 1968 (de Cardi and Doe 1971: 251) but the site has since been destroyed leaving no trace.

It is notable that occupation at sites on the eastern coast of the Northern Emirates appears not have declined in the same way that those on the western coast did. It seems likely that levels of settlement and activity continued or even increased along the coast from Fujairah to the Batinah (e.g. Whitcomb 1975: 126–8). An excavated example of one of these sites is Luluyyah Fort in Sharjah territory where there is evidence of occupation from the 12th until the 14th century (Sasaki and Sasaki 2001).

At the regional level, there is very little evidence for occupation over the whole of eastern Arabia. Only three sites are known from Bahrain; Qala'at al-Bahrain, Bilad al-Qadim and Barbar (Insoll 2005; Fredslund-Andersen and Kennet 2003; Frifelt 2001), but the distinctive plain *sgraffiato* pottery of this period is generally so rare in Bahrain that Larsen did not even realise it existed when he carried out his survey and review of settlement on the island in 1975–6 (Larsen 1983: 276–7, 279–285). No evidence of activity has so far come to light from the al-Hasa oasis, the eastern Province survey or Kuwait (Whitcomb 1978: 102; Potts et al. 1978: 14).

In the Gulf, this period is considered by some historians as a time of economic decline. The absence of navigational texts that were written during these centuries has been pointed out, whilst the general scarcity of coins minted in the region has also been noted (Sauvaget 1948; Aubin 1959: 299–300; Lowick 1974: 320–2; contra Aubin 1963: 169–70). The decline is generally attributed to a re-directing of Indian Ocean trade away from Iraq towards Egypt as Iraq encountered economic and political crisis and Egypt became the dominant power of the medieval Islamic world. This would have meant that Indian Ocean trade heading towards the Near East and Mediterranean would have flowed through the Red Sea rather than the Gulf, which lost its position as a seaway of international importance.

The archaeological evidence presents a slightly contradictory picture. It is certainly true that Iraq was in a period of deep decline: the countryside of southern Mesopotamian has been shown by field survey to have been very sparsely occupied and, whilst life continued in the cities, it was probably on a greatly reduced scale (Adams 1965: 106–111; 1981: 225–228). But the evidence from coastal Iran argues against the idea that the entire Gulf was in economic free fall at this time. Evidence from the Williamson survey shows high levels of occupation on many parts of the coast, especially in the south towards Hormuzgan province and around the island of Kish, which is known to have been a flourishing emporium at this time (Priestman and Kennet n.d.).

The pottery assemblage from Kush and the material from the Williamson Collection all indicate a significant increase in the amount of Chinese ceramics that were imported into the region at this time (Kennet 2004: 72–75). If the ceramic evidence is accepted as a reliable indicator, this might point to an increase in the amount of maritime trade with China more generally, for

example in spices, silk and other products. But using the pottery evidence in this way might not be wise because it is known that the Chinese Yuan dynasty (1271–1368 AD) deliberately encouraged the manufacture and trade in ceramics as a way of improving their trade balance (Guy 1990: 24). The changing levels of Chinese ceramics might therefore simply reflect political changes in China, rather than broader levels of trade.

On balance, it seems likely that most of eastern Arabia and Iraq were in a period of marked decline during this period, whilst Iran and the Batinah coast continued to flourish, but there is clearly still more that needs to be learned before a definitive interpretation is written. The apparent diversity of regional and sub-regional patterns is interesting and suggests a complex pattern of economic strategy and interaction.

PERIOD E (MID 14TH – LATE 16TH) – THE HORMUZI ECONOMIC BOOM

During the 14th century, the Northern Emirates underwent a profound economic revolution that transformed all aspects of life in the area. At this time we see the re-emergence of urbanism – at al-Mataf/Julfar – for the first time in the Oman Penunsula since the demise of Suhar about 300 years earlier. This period also witnessed the monetisation of the economy, probably for the first time in its history, certainly for the first time since the Hellenistic/Parthian period,[8] a massive increase in settlement on the Sir and Jiri plains leading to the densest levels of activity in their entire history, and a range of other changes that all reflect the intensification and extensification of the economy accompanied by a notable increase in population levels.

Our understanding of the development of al-Mataf/Julfar comes from the numerous excavation campaigns that have been carried out at the site since it was first explored by Professor Taha in 1973/4. These have been summarised in a recent paper by the present author (Kennet 2003) and illustrate the very rapid development of this large town from what appears to have been a modest settlement of fishermen-traders living in palm-frond huts on a sand bar. Excavations by Professor Sasaki have exposed part of the dense street plan that appears to have covered much of the 14 ha core of the site, whilst the 1988–1992 excavations by Geoffrey King have revealed how the main mosque at the site increased in size through its various phases of rebuilding, most probably in order to be able to accommodate an increasing urban population.[9]

These developments reflect much wider changes in the area. Of these, probably the most important is the introduction of low-denomination, fiduciary coinage that appears to have circulated very widely after the 14th century. The evidence for this is the high number of coins that have been retrieved by all excavations at al-Mataf. For example, Lowick reports that 335 bronze and six silver coins were retrieved from Professor Taha's 1973/4 excavations and John Hansman's 1977 excavations at the site (Lowick 1985: 97). Compare this to the total of two coins (one silver and one gold) that were recovered from the 5th to 13th century excavated sequence at Kush. This fact makes it clear that something of a monetary revolution had occurred during the early development of al-Mataf/Julfar, that probably reflects a transition from an agricultural economy that was largely based on local self-sufficiency to one that was based on cash cropping and trade.

Over 80 percent of the identified bronze coins from al-Mataf/Julfar were minted on Jarun Island, the location of the wealthy Indian Ocean emporium of Hormuz across the straits of the same name. It seems likely that it was the demand for agricultural produce that was created by the existence of a large, urban and wealthy mercantile community living on a barren, salt-dome of an island with no agricultural resources of its own that stimulated the economic development of al-Mataf/Julfar and its hinterland. Indeed, archaeological survey on the plains in the immediate hinterland of al-Mataf/Julfar has shown how levels of activity underwent a rapid increase at exactly this time (Kennet 2002), and this may reflect increased agricultural exploitation to satisfy the market demand from Hormuz and al-Mataf/Julfar.

These economic changes are also reflected in three other ways that can be detected archaeologically. Firstly, in the development of a large-scale Julfar ware pottery manufacturing industry that exported its products across the Gulf and beyond (Kennet 2004: 53–56). Secondly the exploitation for the first time of marginal agricultural areas such as the mountain villages of the Musandam Peninsula where high prices may have stimulated production (Kennet n.d.). And thirdly the increasing proportion of Chinese ceramics in the al-Mataf/Julfar pottery assemblage, again, possibly (but not certainly) reflecting an increasing involvement with long-distance Indian Ocean trade by the mercantile communities in al-Mataf/Julfar and Hormuz (Kennet 2004: 72–75).

The Hormuzi mercantile economic boom not only affected the Northern Emirates; its repercussions were felt all around the lower Gulf from Bahrain to Qalhat and

along the Iranian coast as well, as Andrew Williamson first recognised when he conducted survey in Iran in the 1970s (Williamson 1973b: 57, map 3). Dramatic increases in the amount of rural settlement have been demonstrated in Bahrain, al-Hasa, the Eastern Province of Saudi Arabia, southern Iran and the Omani interior at this time (Larsen 1983: 85–88, Fig. 14; Whitcomb 1978: 102–104; Potts et al. 1978: 14–15; Priestman and Kennet n.d.; al-Jahwari 2008: 356–360), while the development of Qalhat in Oman into a large urban emporium seems to have followed a similar pattern to al-Mataf/Julfar (Vosmer 2004).

By contrast, the Iraqi countryside was at its lowest ebb during this time and similarly low densities of rural settlement are also to be found along the northern part of the Iranian coast (Adams 1965: 111; Priestman and Kennet n.d.). It may be that these areas were simply outside the economic reach of Hormuz.

PERIOD F (LATE 16TH – EARLY 20TH CENTURY) – TO THE PRESENT DAY

According to the archaeological evidence, after 1550–1575 AD al-Mataf/Julfar was abandoned (Kennet 2003: 116–118).[10] At about this time, it seems that Ra's al-Khaimah town became the main urban centre and key focal point for maritime trade in the immediate area. The reason for this change is not clear, but it may possibly have resulted from a reconfiguration of local political structures.

It seems that it was around this time that the modern pattern of coastal settlement of the UAE first came into existence. This is indicated by the fact that of the seventeen main coastal settlements listed by Lorimer in 1908, at least twelve (seventy percent) are already known from European sources of the 16th century (Table 1). In fact, many of these settlements may have originally been founded a century or so earlier but, unfortunately, the Arabic navigational texts of the late 15th/early 16th century do not give a full list of toponyms along this stretch of coast (Tibbetts 1974: 95–100).

There is very little archaeological evidence that can help to clarify the early development of these new coastal settlements. One of the few insights is provided by Hansman's 1977/78 soundings in Ra's al-Khaimah town, which have shown that occupation had already begun by the middle of the 15th century (Hansman 1985: 16–20). Certainly, to the knowledge of the present author, no traces of occupation dating back earlier than the 15th century have so far been reported from most of these locations.

Modern Name	Lorimer 1908: Page	Population in early 20th C.	16th C. Toponym
Sharjah	1761	15000	Sarba
Dubai	454	10000	Dibei
Abu Dhabi	410	6000	Cherizan
Umm al-Qaiwain	1474	5000	Ras Emegovien
Ras al-Khaimah	1007	5000	Rasaelchime
Kumzar	1040	3000	Conzar
Jazirat al-Hamra	622	2500	
Rams	1573	2000	
Kalba/Ghallah	576	1500	Chelb
Khasab	1030	1500	Casab
Dibba	453	1000	Debe
Ajman	52	750	Agiman
Khor Fakkan	516	750	Chorf
Khor Kalba	970	750	
Fujairah	555	750	
Lima	1609	750	Lima
Ghalilah	1005	250	
Khor Khuwair	1005	150	Sircorcor

Table 1. The main coastal settlements in Abu Dhabi, the Northern Emirates and Musandam as listed by Lorimer (1908) with his estimated populations (based on number of houses multiplied by five). Probable 16th century toponyms are also given (after Slot 1993: 37–39).

The key point, therefore, is that there appears to have been a complete and dramatic reconfiguration of settlement patterns over the whole area during the 15th and 16th centuries. Since that time until the present day these coastal settlements have remained a fundamental part of the political, social and economic configuration of the area. This pattern is in sharp contrast to the preceding periods and seems to indicate that the effects of the economic changes that occurred from the 14th/15th century onwards did not disappear after the decline of Hormuz but that they were in fact an important landmark in the developmental history of the area, with permanent and far-reaching consequences.

Many, if not all, of these once small coastal settlements are now very large and very obviously urban. An important question, therefore, is when they first urbanised and properly became towns and why. In some cases, especially in the Northern Emirates, this may have occurred as early as the 16th century. However, Carter has argued that, around Abu Dhabi at least, the key transition took place during the 18th century in response to the economic importance of pearling (Carter 2005: 149–153, 169–178).

As far as rural occupation is concerned, it has been shown that levels of activity remained very high on the Sir and Jiri plains (Kennet 2002) and indeed this appears to have been the case in all areas in eastern Arabia that have been properly surveyed, such as Fujairah (King and Maren-Griesebach 1999: 11; Ziolkowski 2003: 8) the

coast of Abu Dhabi (Garfi 1996: 11; King and Hellyer 2003: 274; Carter 2005: 169–178), the interior of Abu Dhabi (Hellyer 2002: 6–10), the Omani interior (al-Jahwari 2008: 356–360), Bahrain (Larsen 1983: 88–90, Fig. 14) and eastern Saudi Arabia (Whitcomb 1978: 102–104; Potts et al. 1978: 14–15) as well as many parts of the Iranian coast (Priestman and Kennet n.d.).[11]

In addition, there are types of evidence available for this period that are not available for earlier periods, most notably standing buildings such as defensive towers, forts, mosques and houses that have been quite extensively studied in this area, although many of these are isolated studies and a broader interpretive framework is still lacking (e.g. Czastka 1997; Dostal 1983; Hawker 2001, 2006; Kennet 1995; King 2004a–b; Longden and Garfi 2000; 2001; Velde 2001; Ziolkowski 1999; Ziolkowski and al-Sharqi 2005, 2006, 2009). The preservation of standing buildings from the past few hundred years is quite normal, but the picture might have been affected by the fact that, according to historical sources, it was only after the arrival of the Portuguese that stone and mortar, as opposed to mudbrick, construction was first used in this area (Kennet 1995: 6).

CONCLUDING REMARKS

In this short paper, an attempt has been made, based almost entirely on the archaeological evidence that has been accumulated since 1968, to sketch an outline of the development of the Northern Emirates over a period of about 1500 years and to place it within a broader regional context where possible. This has served to illustrate how much information has been accumulated over the past forty years and how much it can now – and might in the future – be able to tell us about the *longue durée* development of the area. Allowing the archaeological evidence to dictate its own narrative, independent of historical sources, has a number of important advantages. Firstly, the archaeological narrative can be allowed to speak on its own terms, dealing with the issues and questions with which archaeological evidence is capable of dealing, such as long-term settlement trends, trade, and economic strategy, rather than doing an often bad job of illustrating an historical, source-based narrative. Secondly, the archaeological narrative can be used to support or contradict the historical, source-based narrative without the risk of circularity of argument. Thirdly, this approach permits developments in the Islamic period to be compared with, and fitted into, a longer narrative stretching back into the prehistoric period for which no historical sources are available. Making comparisons across such broad swathes of time can highlight repeating patterns or strategies that would otherwise be invisible but that can be very useful in allowing us to understand how the area has been exploited and inhabited. Examples in this paper might be the repeated importance of the Sir and Jiri plains in times of economic or environmental stress in the Wadi Suq and then later in the Sasanian period, or in the comparisons between coastal shell-midden settlement in the Ubaid and the Abbasid periods that have been made.

The outline is patchy in many places and is still a long way from being complete or even satisfactory – there is certainly still a lot more work to be done. A great deal of further, carefully targeted research is needed to address questions and illuminate periods that are still poorly understood.

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1 Mouton's PIR A–D (Mouton 2008: 22–35).
2 The precise location is 25° 49' 54.14" / 56° 01' 14.47".
3 This interpretation is based on the present author's reassessment of the dating of many sites across Eastern Arabia that, until recently, were believed to be dated to the Sasanian period (Kennet 2007). Recent publications suggest that the revised dating has broadly been accepted by other scholars (Carter 2008; Cuny and Mouton 2008: 119–20; Yule 2008: 76–84).
4 Paper presented by Dominik Fleitmann at the conference L'Orient à la veille de l'Islam: évolution du peuplement (4e–8e s.). Organised by Christian Robin (CNRS, Paris) and Jérémie Schiettecatte (CNRS, Paris). Paris, Collège de France, 7–18 November 2008.
5 Compare Carter 2008: Figs 1 and 2.
6 Thanks are due to Dr H. Qandil of the Dubai Museum for his kindness in showing these ceramics to the present author.
7 The dating and site counts of some of the older surveys have been re-interpreted in light of recent evidence (Kennet 2001: Chapter 8).
8 It is not clear to what extent the economy of this area was monetised during the Hellenistic/Parthian period.
9 These excavations are still unpublished, see Kennet 2004: 111–114 for a summary.
10 This probably explains why Julfar was not mentioned by Gasparo Balbi in 1580.
11 The dating and site counts of some of the older surveys have been re-interpreted in light of recent evidence (Kennet 2001: Chapter 8).

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Fifty Years of Emirates Archaeology

COASTAL SETTLEMENT IN SOUTH-EAST ARABIA DURING THE ISLAMIC PERIOD

Andrew Petersen (Lampeter)

INTRODUCTION

The aim of this paper is to consider some general features of coastal settlement in the Gulf region during the period from the 7th to the 20th century. In particular, attention will be paid to the relationship between these settlements and the marine environment.

The relationship between humans and the environment during the Islamic period is often overlooked in favour of other factors. There are a number of reasons for this situation which may be summarised as: 1) the primacy of historical documentation; 2) an assumption that there has been little change in the natural environment in the 1400 years since the advent of Islam; and 3) because Islam as a structuring principle has a fixed and distant relationship with the environment. The importance attached to historical documents – many of which make little or no reference to the natural environment – has meant that other factors such as dynastic rivalries and social or cultural issues have been seen as the main driving force of historical development during this period. By and large, archaeologists of the period have tended to follow the agenda set by historians focusing on issues such as trading patterns, urban development and dynastic and cultural allegiances, all of which can be revealed through the material record.

In contrast with the fast-changing human world, the environment is often regarded as a static backdrop in which any significant change only happens over cycles of thousands or tens of thousands of years. In any case the environment is seen to be intrinsically more important for pre- and proto-historic periods when people apparently had a more direct relationship with their immediate surroundings. The relationship between Islam and the environment is an issue that has only recently begun to attract significant theoretical attention. However, recent archaeological and anthropological work indicates a complex and very close relationship between Islamic societies and their environments.

Before looking at some specific issues in relation to coastal settlements during this period, it is important to consider a few general points that help to establish the historical context (Fig. 1). The first of these is the relationship between the northern and southern sides of the Gulf which has always been a major factor in the location, growth and development of settlements.

Whilst the Iranian coast always had a larger population, resident in a number of fishing and trading settlements, the connection with the interior was hampered by high mountains and the easiest connections were always maritime routes. Settlements on the Arabian side of the Gulf were usually smaller and fewer in number and connections with the interior were also difficult and were generally tribal in nature. Ethnically, there was considerable overlap between the two areas. Thus, there were Arabic speakers on the Iranian coast and Farsi-speaking people in the permanent settlements of the Arabian coast. At certain periods connections with Iran were particularly strong, e.g. under the Sasanians, the Buwayhids and the Safavids. However, there were also periods when Arab tribal leaders gained control of the Iranian side of the Gulf as was the case when the Imam of Muscat seized control of several Persian towns.

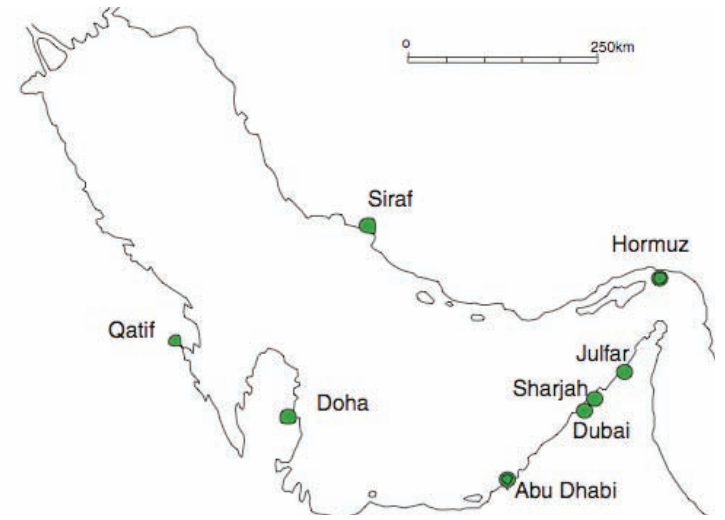

Fig. 1. Map of the Arabian Gulf showing principal historic settlements from the Islamic period.

The second major historical factor to consider is the arrival of the Europeans in the Gulf from the beginning of the 16th century. In 1507, the Portuguese under Alfonso Albuquerque seized control of Hormuz and began a period of European domination of the Gulf that lasted with some qualifications until the 20th century. By the 17th century, Portuguese power was challenged and eventually replaced by English, Dutch and French interests. However, the inhabitants of the Gulf were not passive bystanders to these power struggles and it is increasingly being demonstrated that local interests were using the European powers to achieve their own objectives. The importance of these developments from the point of view of coastal settlement is that there was increased competition for the control of resources and of trade.

THE ARABIAN GULF

The Arabian Peninsula is surrounded on three sides by seas of remarkably different character. The Red Sea, that lies along the west coast of Arabia, is remarkably deep (3 km in some places) and narrow (average width 280 km). It is bordered on both sides by high mountains that

generally slope away from the sea so that sediment-rich run-off from the scarce rains does not find its way into the sea water. The result is that the Red Sea has extremely clear water suited to the development of coral-based marine life. The southern coast of Arabia is bordered by the Arabian Sea which forms the north-western portion of the Indian Ocean. The open nature of this coast, together with the depth of the sea (3–4000 metres in places), gives it a mixture of cold and warm water that supports a diverse ecological mixture particularly during the summer monsoon (*kharif*).

By contrast, the Arabian Gulf is an enclosed sea, approximately 1000 km long and 200–300 km wide. The two sides of the Gulf show geomorphological differences. The Iranian side comprises an unstable fold belt and the Arabian side has the form of a stable foreland. The Gulf is divided into two geo-climatic zones by the Qatar peninsula, the northern half of which is characterised by winds and currents that drive water south-eastwards along both the Iranian and Arabian coastlines (Fig. 2). The southern half of the Gulf is governed by an inflow and outflow of water from the Indian Ocean through the straits of Hormuz. Water entering the Gulf circulates in an anti-clockwise direction, first along the northern coast and then the southern coast, gradually slowing and depositing sediment in the southern part. The water entering the Gulf through the Straits of Hormuz is generally surface water, whilst the heavier, saline sediment-laden waters flow out along the seabed. The Gulf is generally shallow with an average depth of 35 m (max. of 100 m at Musandam) and a sandy bed (Green and Keech 1986: 92) (Figs. 3–4). High temperatures cause fast evaporation resulting in low oxygen levels and high salinity inhibiting marine life. In some enclosed bays the high evaporation rates (up to seventy percent) make the water exceptionally saline, causing gypsum and salt to be precipitated on the shoreline. There are also marked seasonal differences in surface water temperature from 40˚ C. in summer to 10˚ C. in winter that further reduces the range of species able to survive (Baldwin 2003: 42–46).

A recent study of foraminifera in the Gulf showed variation in the biodiversity of different parts of the Gulf with the northern part near the Shatt al-Arab exhibiting the greatest range of species, followed by the shallow shelf on the Iranian side of the southern Gulf. Both areas were supplied with nutrients and fresh water (the former from the Tigris and Euphrates, and the latter from the Iranian highlands) that proved favourable for the development of marine life. However, the southern part of the Gulf adjacent to the Arabian peninsula (Arabian Shallow Shelf or Homocline) has markedly fewer species and contains only ten percent of the forminifera assemblage recorded for the Gulf as a whole. This particularly poor marine environment is a result of both 'intense carbonate sedimentation' and 'a poor supply of terrigenous clastics related to input of fresh water from the hinterland' (Cherif et al. 1997: 276).

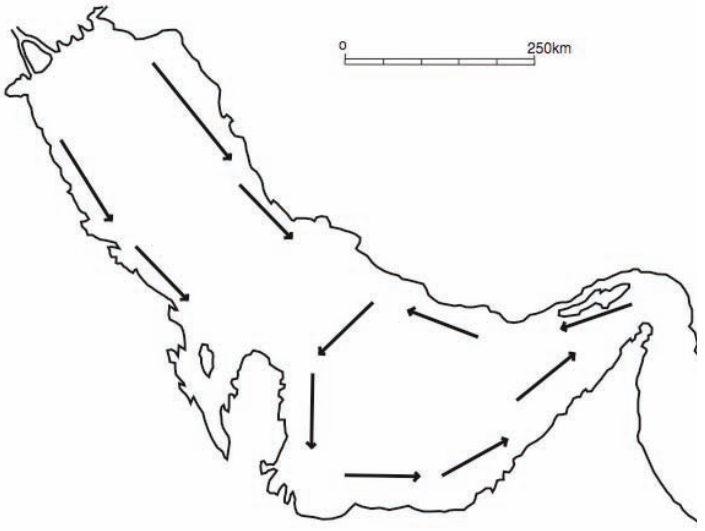

Fig. 2. Map of the Arabian Gulf showing the direction of currents.

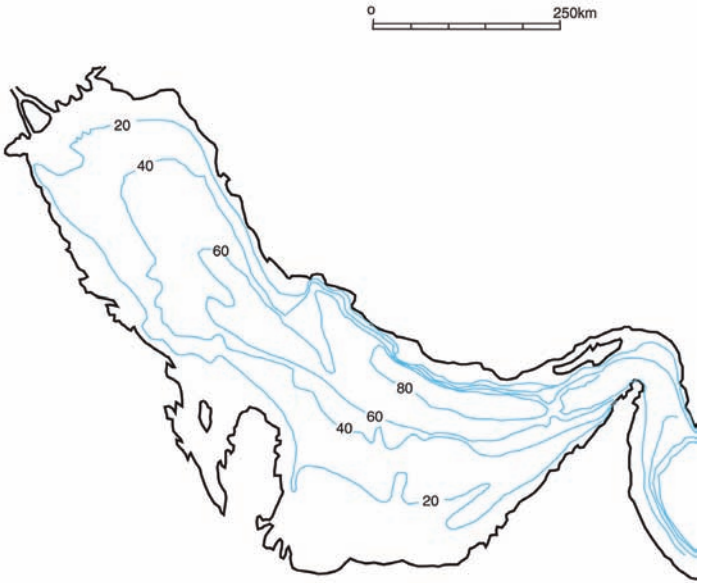

Fig. 3. Map of the Arabian Gulf showing depth in metres.

HISTORIC SETTLEMENTS

There is remarkably little information about coastal settlements in the area between Qatar and Musandam from the early Islamic (631–1000 AD) and medieval (1000–1500 AD) periods (Fig. 1). Eastern Arabia, in particular, is under represented in the works of Arabic geographers. Thus al-Maqdisi admits to limited knowledge about the area. Nevertheless, it is notable that al-Maqdisi's

Fig. 4. Shallow water at Ruwais, Qatar, with traditional Arabic vessel (boom) and dead marine coral in foreground.

description of cities in the Arabian peninsula includes Sohar as the largest city after Mecca, surpassing both of the Yemeni capitals, Zabid and San'a (Wheatley 2001: 83). The only place on the southern side of the Gulf coast that is frequently mentioned by early authors is Julfar (for a discussion of the early sources see King 2008: 83–9). For example, Ahmad Ibn Majid (c.1432–1500) provides a rather vague description of the coastal settlements here despite the fact that he originated from Julfar (Ra's al-Khaimah) (Tibbets 1971: 447).

The earliest detailed description of the southern coast of the Gulf is by the Venetian Gasparo Balbi c. 1580. Ostensibly this is a list of places where pearls were harvested along the coast, although in fact it seems to be an Italian translation of an Arab navigational text. Twenty-eight locations are mentioned between Bahrain and Musandam, the majority of which are presumed to be temporary or seasonal settlements. However, the list does include the earliest mention of a number of important places including Sir Bani Yas (Sirbeniast), [Jebel] Dhanna (Aldane) Abu Dhabi (Cherizan – believed to be the same as today's Khor Qirqishan, adjacent to Abu Dhabi island), Dubai (Dibei), Sharjah (Sarab), Ajman (Agiman), Umm al-Qaiwain (Emegovein), Ra's al-Ajer (Rasagaiar), Diahn (Daoin), Ra's al-Khaimah (Rasaelchime), Khor al-Khuwair (Sircorcor) and Khasab (Casab) (Slot 1993: 36–39).

From the 1600s onwards, there are increasing references to many of these locations although it is not really until the mid-19th century that place names on this part of the coast are mentioned with any consistency. The reasons for this situation are various and will be discussed below but, for the present, it should be pointed out that the shallow waters and scarcity of fresh water meant that European navigators entering the Gulf preferred to travel up the Iranian coast aided by the surface currents. In this connection, it is worth noting that the Qatar peninsula does not appear as such on maps before the 19th century, implying that ships followed the edge of the Arabian coastal shelf rather than risk following the actual coastline itself (Fig. 4).

If we turn from the documentary evidence to the archaeological remains a similar, though slightly different, picture emerges. The most notable difference is that Dubai, or rather Jumeirah, is represented by a large, early Islamic settlement complete with two large enclosures and a mosque. Other sites of early Islamic date for which there is archaeological information include Kush (the predecessor of Julfar and modern Ra's al-Khaimah) and a number of sites in Qatar, the most notable of which is Murwab. In addition to these large sites there are occasional finds indicating some degree of coastal settlement. Robert Carter studied some medieval (9th–13th century) ceramics found on Abu Dhabi island and Kennet identified early Islamic occupation at Jazirat al-Huwayla north of Ra's al-Khaimah (Carter 2000).

Fig. 5. Ruwais coastal mosque, Qatar. Most coastal settlements had a mosque by the shore for fishermen and travellers. The mosque provided a means of identification and also aided in navigation.

MORPHOLOGY OF COASTAL SETTLEMENTS

In 1980 Paolo Costa suggested some general characteristics of traditional settlement in Eastern Arabia (Costa 1983: 247–268). Although Costa only discussed settlements within the Sultanate of Oman, the methodology and some of the observations provide a useful way of looking at historical settlements on the Arabian Gulf coast of the UAE. Two types of coastal settlement were identified: (a) 'built up areas distributed along the shore and intimately connected with an inland strip of cultivation'; and (b) 'isolated centres clustered at the mouth of *wadis*' (Costa 1983: 247).

One of the most notable features of coastal settlement identified is that all were built around either a *wadi* or an inlet or creek (*khor*) (see Fig. 6). In other words, all ports were built around some natural coastal feature that provided both an anchorage and a focal point for passing navigation. Costa noted that all of the coastal towns demonstrate 'a remarkable adaptation of the town to the physical characteristics of the coast' (Costa 1983: 265).

Fig. 6. Ruined coral building on the Sharjah waterfront. Preliminary examination identified at least three types of coral in this building.

Within the Arabian Gulf, this adaptation to the shape of the coast meant that, in many cases, the immediate hinterland would have been insufficient to support the local population. Often, a coastal town had a direct link with a town or settlement in the interior that would be able to supply many of the essentials that it lacked. At its simplest, this involved an exchange of dates and camels from the interior in return for fish and traded commodities.

Although water supply was obviously an issue at all sites, it does not appear to have been the determining factor in establishing a settlement. Obviously large amounts of water were required for agriculture. This could be delivered either via a *falaj* system or by means of occasional winter rains. However, drinking water was available at most locations, given the necessary investment in digging wells and cisterns. Julfar was an exception as it had a large and productive agricultural hinterland. It has been suggested that the agricultural productivity of Julfar was part of the reason for its growth during the 14th century when it supplied the island of Hormuz that had virtually no natural resources.

Other aspects of settlement morphology suggested by Costa include a division into distinct areas or quarters which may either represent different tribes or different ethnic groups. These separate parts of a town may reflect similar divisions in inland towns with which a particular coastal town was paired. In some cases, such as the al-Ain/Buraimi oasis, there may have been different quarters with links to different coastal settlements. The different quarters may have had a similar architectural form, although they sometimes reflected their tribal, ethnic or other affiliations.

For example, Costa noted that part of Khasab was occupied by *'arish* (palm frond) houses built on high pillars that belonged to Shihuh tribesmen (Costa 1983: 258). These buildings were very different from the stone houses with wind towers (*badghirs*) inhabited by the Persian-speaking merchants.

Another example of the identity of different groups expressed though architecture may be the old houses of the al-Hajira quarter of Sohar in Oman. Here residents consciously selected ancient bricks to build their houses in preference to stone, mudbrick or *'arish* (Kerveran et al. 1983: 307). Such distinctions are also common in Swahili architecture in East Africa where stone houses represent a claimed descent from Gulf Arabs or Persians.

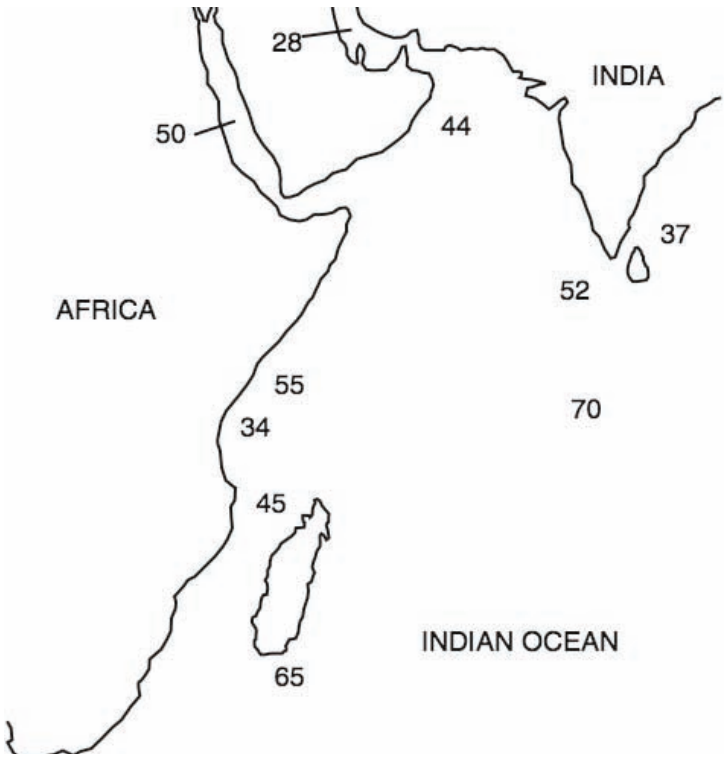

Fig. 7. Map of the Indian Ocean showing distribution of coral genera. Presumed point of origin is the East African coast with a gradual diffusion northwards with the Arabian Gulf as one of the last areas to be colonised (after Green and Keech 1986).

One material of particular interest, employed in coastal buildings throughout the Gulf from Kuwait to Oman, is coral. Coral was also used as a building material elsewhere on the Arabian and Indian Ocean littoral with famous examples of coral stone architecture known at Kilwa (Tanzania), Lamu (Kenya) and Suakin (Sudan). The coral employed in buildings is of two types: fossil coral that can be found in terrestrial environments

and coral that is harvested live from the seabed. Within the UAE, coral stone was employed in buildings in most of the coastal settlements including Sharjah, Dubai and Abu Dhabi (Fig. 6).

Whilst the use of coral in coastal settlements may not seem surprising, the fact that most of the coral used was live, undersea coral suggests specialised recovery techniques. More significantly, it appears that coral did not grow in the Arabian Gulf before the 1700s (Green and Keech 1986: 87) and that even now it is restricted to a few species (*Siderastrea savignyana*, *Acropora clathara*, *Acropra downingi*, *Porites lutea*, *Porites harrisoni*, *Favia spp* and *Platygyra spp*). Examination of coral buildings at the coastal site of Ra's al-Hadd in Oman has revealed a number of coral species that are not native to the area and would almost certainly have been imported from elsewhere in the Indian Ocean (Fig. 7).

So far there has been no systematic examination of corals used in buildings within the UAE, although preliminary investigations indicate that at least some of the species were brought from elsewhere (pers. comm. Abd al-sattar al-Awaisi Sharjah, November 2006). As an organic material, corals also have the potential to be dated with radiocarbon, although correction for the marine reservoir effect is required.

FISHING SETTLEMENTS

All coastal settlements would have had some reliance on fishing at a subsistence level and most would have traded dried fish with the interior. One consequence of the biogeography of this area as discussed above is that the amount of nutrients available to support life in the southern Gulf were more available near the mouth of the Gulf (i.e. the Northern Emirates) than in the southern and western areas towards the Qatar peninsula. This disparity is reflected in the varieties of fish remains recovered at archaeological sites in the UAE. Beech has shown a marked increase in the numbers of fish species found at sites in the northern UAE as compared with those found at sites in the south. In particular, pelagic fish such as tuna and kingfish were caught in the northern region (Beech 2004: 216).

Although boats were used for fishing throughout the area (Fig. 8) under consideration, it is likely that in shallow waters fish traps, in-shore nets and hand lines were used. So far no fish traps have been investigated archaeologically although there is an assumption, based on the associated settlements, that most surviving remains were built post-1000 AD and probably more recently (i.e. the last 300 years). Where boats were used it is unlikely that they went beyond one hour's travelling time from their home port (al-Jazeera News 2009), both due to the limitations of storage and because of the need to return to the home base (for a discussion of traditional fishing techniques, see Beech 2004, 44ff).

Fig. 8. Traditional Arabic fishing vessel (sambuk) in Ruwais harbour loaded with fish traps (gargour).

It is probable that most fishing was carried out on a subsistence basis. However, there are cases (Beech et al. 2009) in which surpluses were exported as dried fish to the interior. Large fish could be cured by gutting and placing them on some form of rack whereas small fish could simply be laid out on a mat in the sun. Dried fish could be used in a number of ways, either for human and animal (fodder for cattle) consumption or for use as fertiliser in intensively cultivated areas such as oases.

In addition to fish, a number of other marine animals would have been harvested for food including turtles, cetaceans (whales and dolphins) and dugong. Turtles were certainly eaten during the medieval period at Julfar and Jazirat al-Hulaylah although they may also have been caught for their carapaces (Beech 1998). Certainly at a late Islamic site on Balghelam island, the large number of turtle bones present as well as marks on the bones suggest that they were being killed specifically for the carapaces which were a prized commodity (Beech 2004: 140–43). Whales were hunted for their oil which was used to cover the holes in sewn ships. Specialised factories were established for the processing of whale oil, e.g. at the 10th-century port of Siraf in the north of the Arabian Gulf (Whitehouse 1974: 18) Dolphin teeth were also prized and used as trade items in the Straits of Hormuz (Baldwin 2003). Dugong were caught at a number of sites and in recent times may have been eaten as a delicacy though in the past they were probably more

numerous (Heard-Bey 2004: 175 see also 455 n.19. For an example of consumption see Beech 2004 140–3).

Although it is likely that some fishing sites were temporary, specialised sites where fish were cured or processed in some way, it is likely that the majority of permanent or semi-permanent fishing settlements had some other economic rationale.

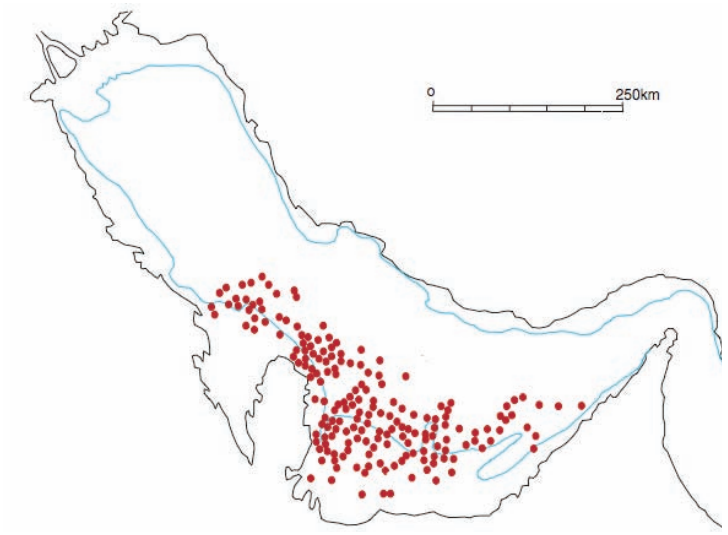

Fig. 9. Map of the Arabian Gulf with pearl banks and contour line indicating 20 m depth.

PEARLING SETTLEMENTS

The harvesting and trade of pearls is generally considered to be the primary coastal activity in the southern Gulf. Certainly the Great Pearl Bank that lies north of the coast of Qatar and extends south and east into the waters of Abu Dhabi emirate was one of the largest pearl producing areas in the world (Fig. 9). The pearl-fishing industry of the Gulf has certainly aroused the interests of Europeans from Balbi in the 16th century to Lorimer in the early 20th century who stated ' ... all sources of profit here are subsidiary to pearl diving, and if the pearl banks were to fail this coast would shortly be de-populated' (Lorimer 1908–15/2: 1440).

More recently, Carter has suggested that the present pattern of human settlement in the southern Gulf is largely a result of the exploitation of pearls. Thus he states, '… pearling played a formative role in the development of the region's political and financial structures, and in the foundation of the major towns themselves, determining their location, their growth and the very reason for their existence' (Carter 2009: 1).

Much has been written about the pearl industry and there is no need to discuss details of either the harvesting or trade in pearls within the present context. However, there are a few considerations which are particularly pertinent to the discussion of coastal settlement. The first concerns the settlements on the Abu Dhabi islands that appear to date from the very late Islamic period (i.e. the 19th and early 20th centuries) though there is also widespread evidence from ceramics of earlier occupation). Although it is evident from Balbi's account that many of the islands were used as temporary camps for pearling expeditions as early as the 16th century (Slot 1993: 36–39), they do not appear to have been used for permanent settlement until the 19th and 20th centuries (however, large numbers of wells at Dalma indicate some form of permanent occupation before, even if the architectural remains are only recent). Archaeological survey work and excavations indicate that Dalma and Ghagha islands had permanent occupation with stone architecture from the very late Islamic period (Hawker, Hull and Rouhani 2005).

The second point relates to the natural productivity of the pearl banks and its relationship to settlement location. Pearl oysters have been found throughout the Arabian Gulf from Kuwait to Hormuz at depths of from 1 to 15 m. The locations of named oyster beds (*hayrs*) within the Gulf were mapped by Lorimer and more recently by Khalifa bin Muhammad bin Rashid al-'Aseeri (Ahmed 1987: 56).

There has been an assumption that the location of the oyster beds has remained static and that any changes in settlement are a result of different trading patterns rather than movement of the pearl banks themselves. However, a number of writers from the 18th century onwards indicate that pearl banks in particular areas had been over-fished. In 1770 it was noted that the pearl banks of the eastern Gulf in the area around Hormuz had been exhausted (Hughes Thomas 1985: 25). In addition to over-fishing, it seems likely that changes in sea level and other climatic changes may also have had an impact on the location and productivity of pearl banks.

Thus, whilst most authors (e.g. Floor 2007 and Carter 2005) would argue that the rise in the number of settlements on the Arabian side of the Gulf was a result of the failure of the Safavid state to create stable conditions along the Persian coast, it is also possible that changes in the distribution and location of pearl banks may have been a significant factor.

TRADE AND PIRACY

Although pearls appear to have been the driving force for much of the Gulf trade prior to the 20th century, they were not the only commodity. As Heard-Bey has pointed out, unlike precious metals, pearls have no intrinsic value

and are only worth what people are prepared to pay for them (Heared-Bey 2004: 182). In fact, it appears that pearls functioned as a catalyst for the introduction of monetised economies which allowed the development of specialised goods and services from the 18th century onwards.

Prior to the 18th century, there appears to have been very few coastal trading settlements on the Arabian side of the Gulf between Qatar and Musandam with the majority of ports located on the Iranian coast (for a discussion of the Persian trading settlements, see Ricks 1970, Whitehouse 1983 and Floor 2008). The only early Islamic sites of any size on the Arabian coast of the Gulf were Julfar and Jumeirah. The location of early Islamic Julfar mentioned in historical texts is unknown, although Kennet has identified it with the nearby Sasanian and early Islamic site of Kush (Kennet 1997). Jumeirah, to the south of Dubai, is only known from archaeological excavations that have revealed several large stone buildings together with pottery indicating an extensive trade network. Significantly, the settlement was located on either side of a small creek that subsequently silted up.

Maritime trade within the Gulf was of two types: international long-distance trade and local trade either across the Gulf (e.g. Iran to Arabia) or along its length (e.g. Ra's al-Khaimah to Abu Dhabi). The local trade of the Gulf was primarily controlled by Arabs on both the Persian and Arabian coasts whilst from the 16th century international trade was increasingly controlled by Europeans.

In general, the coastal settlements within the area of what is now the UAE were engaged in local trade or trans-shipment rather than long-distance trade. This is largely explained by the nature of the coast with shallow waters that were unfavourable to the larger ocean-going ships. This point has also been made by Sweet who wrote, 'the indigenous craft of the Gulf later called dhows were generally small, shallow in draft, swift sailors and carriers of cargo to and from the many small ports which large ships could not reach whether European or the larger deep sea *dhows* of Muscat and the Indian merchants' (Sweet 1964: 265).

Knowledge of the coastline and suitable craft meant that the Arabs were able to dominate the trade in this area of the Gulf up until the eighteenth century. However, increased European control of shipping meant that they were gradually excluded from this trade and increasingly turned to piracy as a means of earning a living (for a discussion of this question see Risso 2001).

The area which became known as the Pirate Coast was centered on a series of twenty-five settlements established on the coast between Rams and Dubai (Hawker 2006). Geographically, this area is characterised by a narrowing coastal plain and proximity to the Straits of Hormuz. Although not all of these ports were engaged in long-distance trade, together they formed a network of interconnected maritime communities. The southernmost of these settlements was Dubai that was mentioned as a trading centre as early as the 16th century (Slot 1993: 36–39). However, the present town appears to date from the late 18th century (Fig. 10) when it was founded as a dependency of Abu Dhabi (Lorimer 1908: 772). The town was built on the west side of a creek that extended more than 5 kms inland, providing one of the best anchorages on the coast. The early town was divided into three quarters and was protected by a fort and a town wall, part of which is still visible (Boussa 2006: 126). Although some pearl fishing may have been carried out, it is evident that Dubai was predominantly a trading town with resident Indian and Persian communities as well as Arabs. The key to Dubai's trade was the sizeable creek that provided anchorage for large, deep-water vessels.

To the north of Dubai is the settlement of Sharjah that appears to be considerably older as it is listed as a town in a Dutch account of 1756 and is one of only two towns in the present day UAE marked on Niebuhr's map of 1765 (Floor 2007: 36). Sharjah is also located on a deep water creek (*khor*), though in this case significantly shorter than the one at Dubai. The best-known and most extensively studied of these settlements is Ra's al-Khaimah and its predecessor Julfar (King 2008, Kennet 1997 and 2003). The location of the main settlement has shifted several times, probably in response to changing coastal morphology, although it has always been oriented around one of the creeks that provides access to the sea.

A study of the settlement patterns of some of the other coastal settlements in the Northern Emirates is currently under way by Ronald Hawker. Preliminary results indicate that layout and design were influenced by a complex series of factors including tribal affiliation, seasonality and status. Of particular importance is the relationship to the sea. Thus, Khor Kalba, on the UAE's east coast, was located on a creek (*khor*) which could be navigated at high tide whilst Jazirat al-Hamra was located on a coastal island (Hawker 2006).

CONCLUSION

A number of issues become apparent from this brief review of Islamic period coastal settlements. The first is that the sea is always a dynamic environment where fluctuations in sea level, water temperature, salinity and tidal currents have profound effects not only on the natural ecology of

the Gulf but also on the humans who live close by. Whilst there is often a combination of economic, political and social factors that influence the location and fortunes of settlements changes to the maritime ecology will also have significance. As we have seen, the pearl banks were vulnerable to over-exploitation and may also have been modified by changes in undersea currents, water levels and sediment composition. Similarly, coral appears to be a fairly recent arrival in the Arabian Gulf with a restricted range of species that again are extremely vulnerable to fluctuations in visibility, temperatures and salinity.

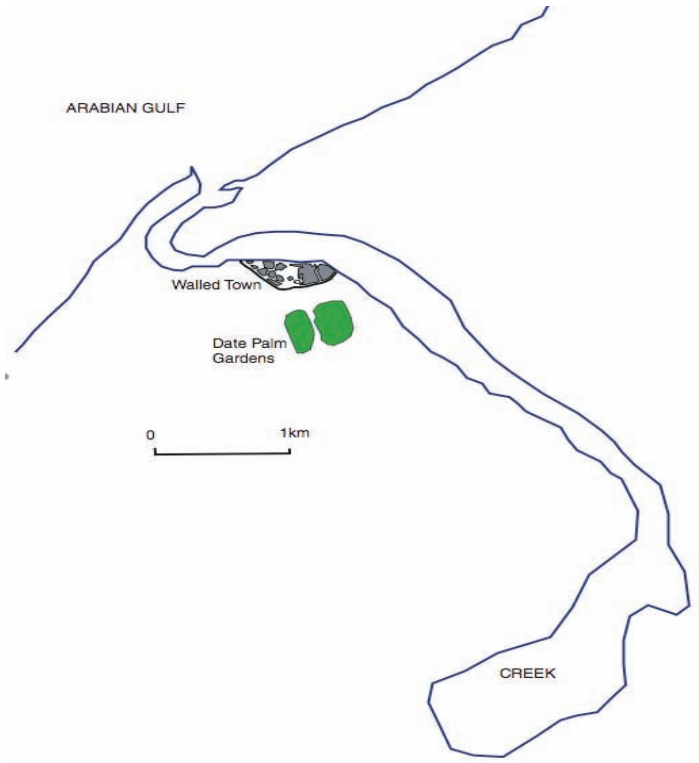

Fig. 10. Dubai Creek based on aerial photographs and an 18th-century plan by Niebuhr. Note the length of the creek and the position of the palm gardens.

Secondly, more research is required into the archaeology of the modern coastal towns. The documentary history for this region is problematic and, as we have seen with Jumeirah, major settlements are not mentioned in historical sources. It therefore seems likely that many of the coastal towns that are presumed to have a recent history may in fact be considerably older. In any case, further archaeological investigation will enhance our understanding of the coastal towns before they are swamped by modern developments.

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Fifty Years of Emirates Archaeology

THE GEOGRAPHICAL HISTORY OF JULFAR

Christian Velde (Ra's al-Khaimah)

JULFAR: THE GEOGRAPHICAL SETTING

The following paper will take a closer look at the landscape around the modern town of Ra's al-Khaimah in which the medieval trading town of Julfar evolved (Fig. 1). In the past, it has been associated primarily with the archaeological area of al-Mataf – discovered by Beatrice de Cardi in 1968 (de Cardi and Doe 1971: 249) during her first survey in Ra's al-Khaimah – and, according to local tradition, identified as Julfar.

Following Iraqi excavations (Taha 1975), Hansman (1985) was the first to identify al-Mataf as the core of an urban settlement. Later work on this area was started by Vogt (1991) and followed by an international excavation (Hardy-Guilbert 1991; Jansen 1991; King 1990, 1991, 1992; Sasaki and Sasaki 1992; Sasaki 1993, 1994). Kennet (2001, 2002, 2003) provides the best synopsis and analysis of Julfar's archaeology.

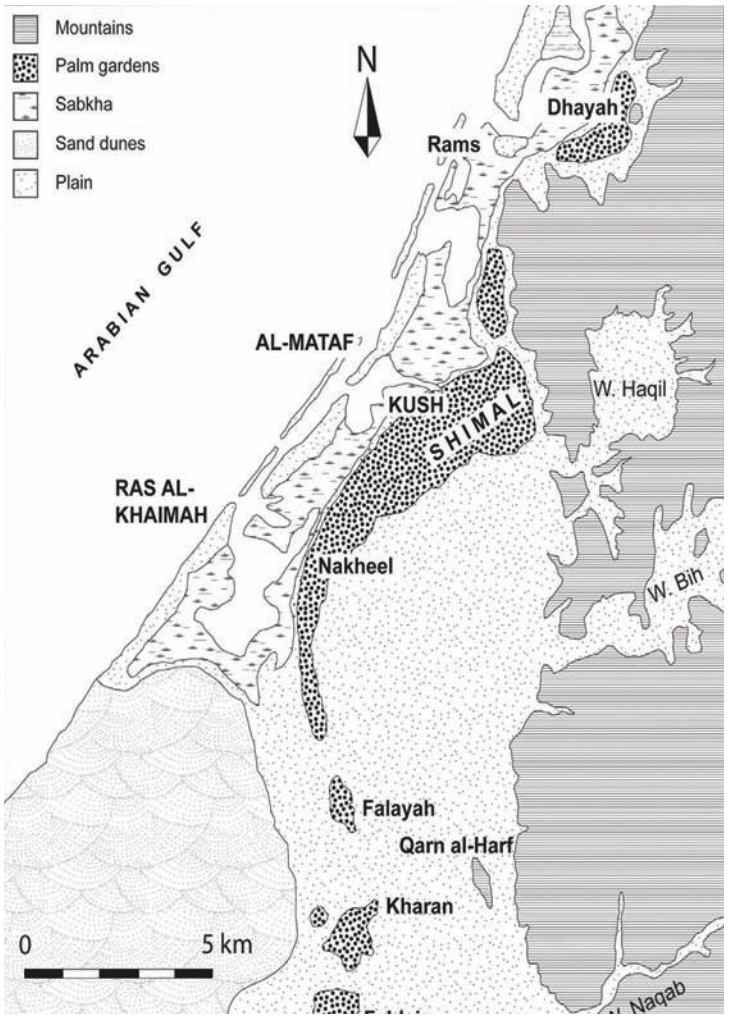

Fig. 1. Map of northern Ra's al-Khaimah and of the locations mentioned.

Julfar is, however, also associated with the archaeological site of Kush, that was discovered by Beatrice de Cardi in 1977 (de Cardi 1985: 179). Between 1994 and 2000 excavations by D. Kennet (Kennet 1997) led to the present identification of Kush with early Julfar. However, Julfar can also be associated with the town of Ra's al-Khaimah and the palm gardens of Shimal.

Besides discussing the geographical dimensions of Julfar, the paper will also take past geomorphological changes into account. These have altered the settled landscape and help to explain why several different archaeological sites are known as 'Julfar'.

Julfar is part of the Musandam peninsula, close to the Strait of Hormuz. The area discussed in this paper is situated exactly where alluvial plains separate the limestone mountains of the Ru'us al-Jibal from the coast. The alluvial plain at Julfar consists mainly of the huge outwash fan of Wadi al-Bih, that collects one third of the rainwater from the towering mountains above it. The water table at the lower edge of this fan was exploitable through wells, thus enabling a substantial area of palm gardens to develop along a narrow strip on the western side of Wadi al-Bih. However, due to a unique geographical feature, only the northern side of its outwash fan is covered by a huge concentration of palm gardens. A second, large outwash fan from the Wadi Haqil fuses in this area with the Wadi al-Bih fan and generates a higher rate of sedimentation and exploitable water. Together, these *wadi* fans form one of the largest arable regions in the UAE.

The coastline was formerly characterised by two large lagoons, fed by the water in these gravel fans and protected from encroachment by the sea by elongated sandbars. These lagoons were always important as a rich food source for the coastal population and acted as a natural shelter for ships. The south-western lagoon still exists today, forming the modern creek of Ra's al-Khaimah town, while the north-eastern lagoon has become a large *sabkha* (salt flat) with dense, modern settlement. From the Neolithic to the beginning of the Islamic period this lagoon, situated directly opposite the palm gardens, was the main focus of settled life and trade. It also played an important role in the rise and decline of Julfar.

The plain runs southwards along the mountains and is bordered to the west by large dune fields, that reach the south-western lagoon and form the easternmost end of the Rub al-Khali desert. In order to fully understand settlement patterns in this landscape, as well as the development of Julfar, we shall first take a brief look at the most important form of settled life in the pre-modern UAE – the palm garden oasis.

THE PATTERN OF OASIS SETTLEMENT

Water is one of the most problematic factors in the settlement history of the UAE. Looking back, we see that settlements only existed in areas with access to water. Large, concentrated settlements were rare, as the water necessary to sustain them was generally lacking.

The easiest access to groundwater was to be found along the large outwash fans of the mountains. At the lower edge of a *wadi* fan, the water table could be tapped using wells 5–6 m deep. In these areas, palm gardens occupied every piece of arable land and each garden had its own well, serving at the same time as the living space for one family. Most settled life was therefore scattered within the fertile palm gardens. Thus the landscape of the UAE produced a type of dispersed settlement, characterised by palm gardens interspersed with houses which were distributed over extended areas along the edges of large gravel fans. In contrast to more concentrated settlements, that left obvious traces, the oasis type of settlement is very difficult to evaluate and comprehend archaeologically.[1]

Life in dispersed settlements inside palm gardens was the typical settlement pattern in the UAE and Oman until the mid 20th century, especially along the limestone mountains in the north. Only small concentrations of buildings, with a Friday mosque and fortifications forming the central focus point,[2] were situated inside areas of palm gardens. On occasion, such settlements grew into towns, like Bahla in Oman, where a large fort, a Friday mosque and a number of houses form the focal point and administrative centre for a huge palm oasis. Most people continued to live in the palm oasis of Bahla, which was entirely surrounded by a wall.

The pattern of scattered houses with a small focal point as the centre characterised all palm oases, except where a falaj system allowed a separation of gardens and a larger concentration of houses.[3] The largest concentration of palm gardens in the Julfar area is situated at the northern end of Wadi al-Bih, near the outlet of Wadi Haqil. These gardens, most of which belong to the modern area of Shimal, form a coherent unit covering more than 15 km^2, making it the most important area of settlement in northern Ra's al-Khaimah until recent times.

This large palm-garden area, with its dispersed settlement pattern, formed the core of what people would have known as Julfar in the past, while Kush and al-Mataf, with their more concentrated settlements, were the administrative centres of this oasis. Although Kush and al-Mataf would have been the visible representation of Julfar to the outside world and, thanks to the concentration of archaeological remains in each, are easier for us to grasp today, neither was ever more than a part of Julfar. To better understand this important palm-garden area, we shall take a short look back through its history since the Bronze Age.

SHIMAL: THE OASIS SETTLEMENT OF JULFAR

The pattern of 'settlements inside palm gardens' is not a modern development, but was already in place during the Bronze Age (Velde 2009). A comparison between the well-preserved cemeteries of the Middle Bronze Age and pre-modern palm garden areas has shown an obvious correlation in size and location. During prehistoric times, the picture is very clear: the largest part of the population lived in the palm gardens and the size of the gardens restricted the size of the population.

The palm-garden area of Shimal, which is the core of later Julfar, was the largest Middle Bronze Age settlement in the UAE as can be deduced from its more than one hundred tombs (Velde 2009:66). Unfortunately, if a larger mound such as those of Kalba or Tell Abraq existed as the focal point of such an important Bronze Age settlement (Velde 2009:71–73), it has disappeared archaeologically. It may have been destroyed due to the constant reuse of land for agriculture. However, if such a focal point did exist, we may assume that it was not in the centre of the oasis, but rather near to the north-eastern lagoon, that runs along the palm gardens of Shimal. Excavations at Kush have yielded a number of prehistoric sherds (pers. comm. Kennet) indicating that its buildings were made of recycled material from an earlier mound. Such a site could have been the focal point of Shimal during the Bronze and Iron Ages. Thus, the palm gardens were the population centre, while a small cluster of concentrated buildings served as the administrative centre or might have been part of a port.

The large north-eastern lagoon, now disappeared, was a vital part of this oasis settlement. The geomorphology of the lagoon, especially for the period during which al-Mataf was settled, was studied during the British excavations there (Brunsden et al. 1997). It served as a crucial food source, while acting at the same time as a 'gate to the world'. The lagoon and palm gardens in combination were the backbone of the enormous oasis settlement during the Bronze Age. This survived for the next two millennia[4] and still dominated the settlement hierarchy when Kush was founded.

EARLY JULFAR KUSH: HARBOUR AND OASIS SETTLEMENT

The mound of Kush is situated directly at the interface of the outwash fan of Wadi al-Bih and the *sabkha* which once was part of the north-eastern lagoon. This interface is still visible as a 'step' in the landscape, around 50 m away from Kush. The mound was excavated between 1994 and 2001 (Kennet 2004: 13ff) and revealed a long history of settlement from the Sasanian period until the 13th century AD (Figs. 2–3).

Fig. 2. Julfar – 3rd to 11th century AD.

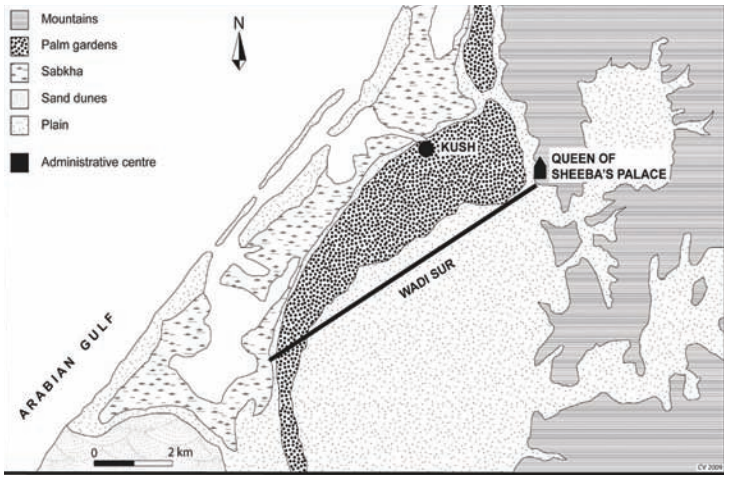

Fig. 3. Julfar – 11th to 13th century AD.

From its very beginning Kush must have been a new focal point of the oasis settlement, acting as an administrative and commercial centre, as well as a port. Several rooms of a large building were excavated in the earliest phases, and we may assume that additional major buildings were concentrated in this area. From the beginning of the Islamic era onwards, the area was known as Julfar (King 1994) and we can conjecture that Kush was an important part of it. During the 8th century a large tower, surrounded by a moat, was erected which might have guarded the harbour as part of Julfar's defence system. Excavations revealed that Kush was settled, with some interruptions, until the end of the 13th century AD.

While Kush was certainly the administrative centre, port and commercial centre of Julfar, it would be wrong to regard this rather small mound[5] as Julfar itself. The 'oasis settlement' still topped the settlement hierarchy with a large expanse of palm gardens, where the majority of people lived. After the 10th century, the population started growing, settlements covered more and more of the available space and we see an increase in archaeological material from the 11th century onwards (Kennet 2002: 158–160). In the past, this oasis settlement has been described as Julfar's hinterland, but we now know that it would be more appropriate to describe it as the real Julfar. The recently identified town wall, Wadi Sur, (Velde et al. 2008) is the clearest indication yet of what the inhabitants themselves considered to be Julfar.

TOWN WALL AND QUEEN OF SHEBA'S PALACE

Unfortunately, we do not know when the town wall was built, as no finds were made during its excavation. However, some sherds were found in a German excavation near the northern end of Wadi Sur (Franke-Vogt 1996: 166). Although these date to the 14th/15th century, it is possible that the wall itself was built much earlier, possibly before the 12th century.

This town wall of Julfar, Wadi Sur, (Fig. 4) was an impressive fortification, exploiting the geographical situation to protect both the oasis settlement and the administrative centre. Julfar's palm gardens form a narrow triangle, situated just at the point where the coastline is separated from the mountains. The town wall's engineers used the natural, defensive character of the lagoons and the sea to the west, and the steep, high mountains of the Ru'us al-Jibal to the east. Only the plain formed by the outwash fan of Wadi al-Bih remained to be secured and was, therefore, protected by a town wall. It was built in a straight line, running for about 7 km from the mountains to the lagoon of Ra's al-Khaimah.

A 3.5 m-wide and 2.5 m-deep ditch was cut into the concreted gravel of the outwash fan. Behind it stood a rampart topped with a mudbrick wall, both together forming a 4–5 m high defensive structure. Semi-circular towers were attached to it at intervals of 150 m (Fig. 4). This town wall is among the most impressive defensive

structures in the Oman Peninsula and despite erosion and stone robbery, the wall still constitutes a remarkable landmark today.

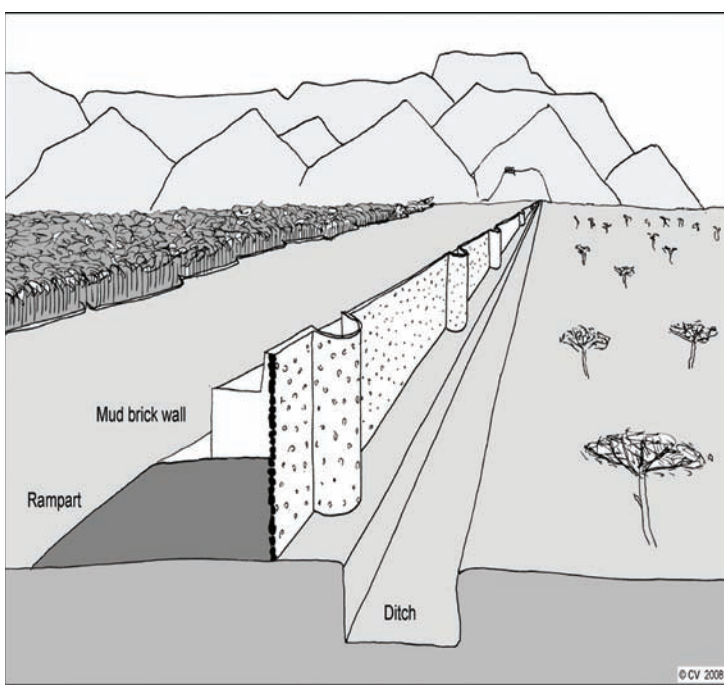

Fig. 4. Schematic section of the town wall of Julfar.

Another important structure, the so-called 'Queen of Sheba's Palace', was built in this period and must be seen in connection with the town wall of Julfar (Fig. 3). It was erected on a plateau on the outer range of the mountains behind Shimal and the oasis settlement. Its structure has been thoroughly recorded, with additional excavations revealing pottery dating to the 10th–13th century (Franke-Vogt 1996: 165). We assume that this medieval palace was built during this time, as there were no indications of an older structure, despite its name.

The palace consists of a long, rectangular building on top of the plateau, with towers at each side overlooking the oasis settlement of Julfar. A wall surrounds the rest of the plateau and secures a ravine, that serves as the only proper access to it. The town wall of Julfar starts directly at the foot of this plateau, that suggests that it, too, was constructed in the 11th century, when the plateau was fortified, the palace was built and Julfar was becoming an increasingly important trading hub (Fig. 3).

The town wall encloses an area of c. 16–17 km^2, including the oasis settlement and the palace where the ruler of Julfar must have stayed, this area lying between the mountains and the sea. While the enclosed palm gardens and oasis settlement must be seen as the area that was identified locally as Julfar, Kush served as its administrative and commercial centre and might have been originally the visible representation of Julfar to the outside world.[6]

MATURE JULFAR AL-MATAF: RISE OF A COASTAL TOWN AND SHIFTING OF THE ADMINISTRATIVE CENTRE

At the end of the 13th century or the beginning of the 14th century, Kush was abandoned (Kennet 2004: 15) and the former administrative centre of the oasis settlement fell into disuse. At the same time a new and dense settlement arose on the sand bars, that protected the north-eastern lagoon, in an area which is currently called 'al-Mataf' (Fig. 5). Excavations there have recorded only *'arish* structures in the lowest levels, but soon mudbrick buildings and a mosque appeared and, by the end of the 14th century, a densely settled area with large houses, narrow alleys, a fort and a mosque had arisen (Kennet 2002).

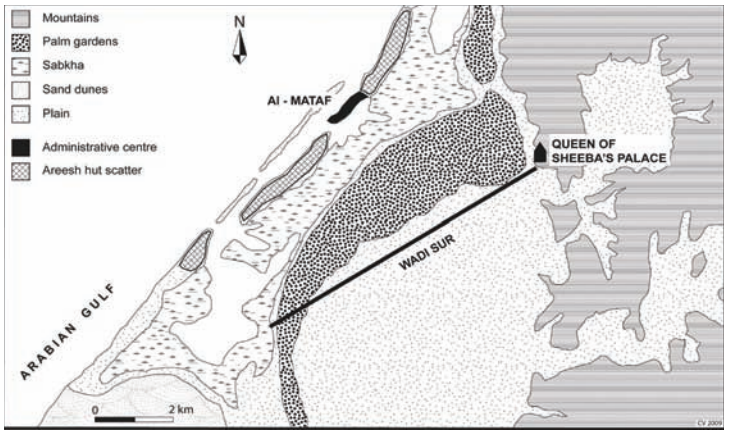

Fig. 5. Julfar – 13th to 16th century AD.

Why did this new administrative centre develop on the other side of the lagoon, far from the oasis settlement? The reason for this shift must be seen in the development of the lagoon itself. Although it was an important element of the oasis settlement of Shimal for thousands of years, the lagoon had suffered from high rates of siltation. The combined sediments flushed out during the rains from Wadi al-Bih and Wadi Haqil might have already started to silt up the lagoon when Kush was still inhabited. A 12th-century report that Julfar was built on a river (De Cardi and Doe 1971: 230), might suggest that the lagoon was already partly silted-up, with only a small channel left to connect the sea with the harbour of Kush. Covered originally with mangroves on both sides, it would have easily given the impression of a river to travellers from

outside. We may assume that this channel ceased to exist during the 13th century, finally cutting off the palm oasis and the administrative centre of Kush from their lifeline. Therefore, Julfar's commercial centre had to be moved to a new location suitable for shipping, the al-Mataf sand bank, situated at the entrance to the surviving lagoon.

AL-MATAF

The new commercial centre was built during a period of unprecedented economic prosperity. Julfar became part of the kingdom of Hormuz, which controlled the lower Gulf and part of the Indian Ocean (Aubin 1953; Fiorani Piacentini 1975, 2000; Williamson 1973). This sudden boom prompted the administrative and commercial centre of the oasis to grow disproportionately.

Excavations in al-Mataf have revealed dense living quarters with large courtyard houses, a big fort and central mosque nearby. The size of the densely-populated quarters in al-Mataf is ten times larger than those of Kush (Kennet 2003: 121), even if we assume that Kush originally included areas on the fringe of the mound. A defensive wall surrounded the entire area, with its remains found on all three landward sides of the sand bank. In addition to this core, the sand dunes were settled along the creek for at least 1.5 km on both sides of al-Mataf. There, a more open but still dense covering of *'arish* buildings must have spread along the narrow strip of dunes (Fig. 5). D. Kennet points out that al-Mataf's size and density of housing, together with the building of a fort and defence wall, justify calling it 'urbanised' and a 'town' (Kennet 2003: 121ff).

The economic boom and growing urbanisation elsewhere in the Gulf have been described as the driving forces behind the growth of this new town of al-Mataf (Kennet 2002). There was, however, another force which helps to explain its sudden rise and the huge difference in size between Kush and Julfar. As long as the administrative and commercial centre was situated at the edge of the oasis with the then existing lagoon serving as the harbour of Kush, people had no reason to concentrate their housing in one place. The ancient concept of 'dispersed living' was not yet affected, as many people could still live in their gardens with access to the harbour and coastline. Merchants and craftsmen had no need to concentrate their houses around Kush itself. Rather, the majority could still live inside the oasis, only a short distance away from access to commerce and the elements of administrative control.

However, when the commercial/administrative centre moved to the sand banks of al-Mataf, nearly 2 km from the edge of the oasis and further separated by a swampy *sabkha*, life in the oasis settlement changed as well. For the first time in several thousand years, people moved out of their palm gardens, away from direct access to food and water. Merchants, ship builders, craftsmen, fishermen and many other specialists, who had always lived in or at the edge of the oasis now moved to the distant sandbanks, away from their oasis homes. Due to this, families and daily life had to be separated, with many families having both their gardens at Shimal and a house in or around al-Mataf.[7]

Shifting the administrative centre far outside the oasis settlement initiated an unprecedented concentration of housing, surpassing anything previously known. This, in combination with a general development of urbanisation in the Gulf during the 14th/15th century, as well as the sudden economic boom of the Kingdom of Hormuz, explains the development of al-Mataf into a town.

Despite these changes and the division of Julfar's population, the oasis remained an important part of the town. During the 14th and 15th century the exploitation of land reached its maximum limit. The density of the palm gardens developed at an unprecedented rate with evident signs of economic stress. In the northern end of the oasis and other areas like Dhayah, fields were now also created inside the upper *wadi* gravel fans. We can assume water wells were dug there as well, but to reach the water table these had to be much deeper than the usual 5–6 m.[8] These fields were created in areas which had not been used before and have also not been used since.

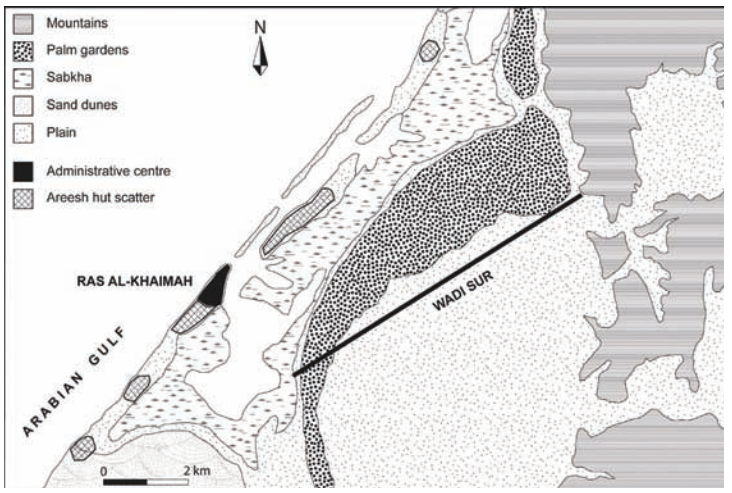

Fig. 6. Julfar – 16th to 18th century AD.

Thus, the oasis settlement of Julfar extended over more than 15 km^2 and could have incorporated at least 10,000–15,000 inhabitants (Fiorani Piacentini and Velde 2009: 328). Defended by its unique town wall, 7 km long, this was the most important part of Julfar, despite its new administrative centre, far away on the sandbanks, developing into a densely built-up town. This importance

and the traditional local focus on the oasis explains why Julfar was retained as a general name for both the oasis and the emerging town on the sand bank. In time, the coastal town with administrative and commercial centre and the oasis settlement might have grown more and more into two distinct entities. During the next step of development and another shift of the centre, however, the breakdown of the old oasis settlement began, ending with the disappearance of the name Julfar.

LATE JULFAR RA'S AL-KHAIMAH: MOVE TOWARDS A NEW CREEK AND THE DISAPPEARANCE OF JULFAR

Excavations testify to an appreciable decline in al-Mataf during the 16th century and by the end of that century no large buildings seem to have existed (Kennet 2001: 72–74; 2004: 21). After 250 years, al-Mataf had ceased to exist as the centre of the oasis and as a town. The driving force behind this development must have been the continuous siltation of the lagoon, that finally ended its use as a natural harbour. However, the end of al-Mataf as a town and administrative and commercial centre did not spell the end of the name Julfar and there is clear evidence that the town itself had not been the source of the name used for the wider area.

As a result of the siltation of the natural harbour, the commercial and administrative centre of Julfar shifted again, away from the north-eastern creek that had served as the natural harbour of the oasis settlement during the previous three millennia. Now it moved to the south-western lagoon that is today the modern creek of Ra's al-Khaimah. Because it was situated far from the centre of the oasis settlement, this area had never been part of any larger settlement during the previous three millennia. The peninsula, which naturally protects this creek, had been settled since the 15th century, most probably with a light scatter of *'arish* huts (Hansman 1985:16–18). These formed the south-western end of the *'arish* settlement on both sides of al-Mataf. During the 16th century, the settlement of Ra's al-Khaimah (translatable as 'peninsula of the *khaimah*-type *'arish* houses') slowly took over the functions of al-Mataf. First mentioned at the beginning of the 16th century (Hansman 1985:17), Ra's al-Khaimah developed into a town and became the new centre of Julfar by the end of the 16th century[9] (Fig. 6). The economic and social changes in local society, brought about by the development of al-Mataf, also strengthened the urban fabric at the new location of Ra's al-Khaimah even after the economic boom of the Hormuz Period (Kennet 2003: 122).

Through this inevitable move, the administrative and commercial centre of Julfar was shifted far away from the original settlement core, the palm oasis of Shimal. This geographical distance accelerated the development of two distinct entities and enhanced the local perception of two separate units. A first glimpse of this process can be found in Italian records (King 2006) and maps (pers. comm. Fiorani Piacentini). By the end of the 16th century, while talking about harbours along the coast, Italian sources mention Ra's al-Khaimah for the first time and no longer refer to Julfar. If the assumption is right, that Julfar was the name associated with the oasis settlement, then it would be natural that it was no longer mentioned in conjunction with harbours. Furthermore, as a result of these changes, the new town of Ra's al-Khaimah was not seen as the administrative centre of the oasis settlement.

Despite these changes, the large oasis settlement known as Julfar continued to exist as the separation of oasis settlement and town into two distinct entities took time. There is evidence, for example, that the town wall of Julfar was intact until the middle of the 18th century and it was at this time that both Julfar and Ra's al-Khaimah are mentioned in the written records (King 2008: 97).

THE HIDDEN VILLAGES

The existence of Julfar's town wall in the 17th century can be demonstrated by the existence of some concealed villages (Velde n. d.) hidden in the hills of northern Ra's al-Khaimah (Fig. 7). These are full-fledged villages with an average of forty large, well-built stone houses each.[10] All show extensive evidence of levelling and terracing, indicating the expenditure of a huge amount of labour. Furthermore, the majority of these hidden villages have no fields, that further distinguishes them from the usual mountain settlements of northern Ra's al-Khaimah, surveyed several years ago (Kennet 2001: 26). Instead, all of them were either built in easily defendable positions, equipped with small-scale fortifications or with separate refuge forts. All of the hidden villages are within walking distance of the palm gardens and could be reached in twenty minutes to an hour on foot. They reflect growing insecurity after the collapse of the Kingdom of Hormuz which forced villagers to retreat into safe, sheltered areas, away from the coast and gardens.

The position of the hidden villages corresponds well with the palm gardens and settlement concentrations in the north. Two are known in the Dhayah area, two more near the village of Rams, which existed already in the 17th century (de Cardi and Doe 1971: 234), one was built at the edge of Wadi Haqil and another one in a *wadi* south of Wadi al-Bih. However, the distribution of these hidden villages shows an interesting gap. The area of Julfar, including its massive palm gardens, that cover at least 15 km^2 and had the largest concentration of population, has no corresponding mountain villages. The lack of any hidden villages in the Shimal area is the clearest indication that the town wall of Julfar was still in use in the 17th century and provided adequate security for the inhabitants of this large oasis settlement.

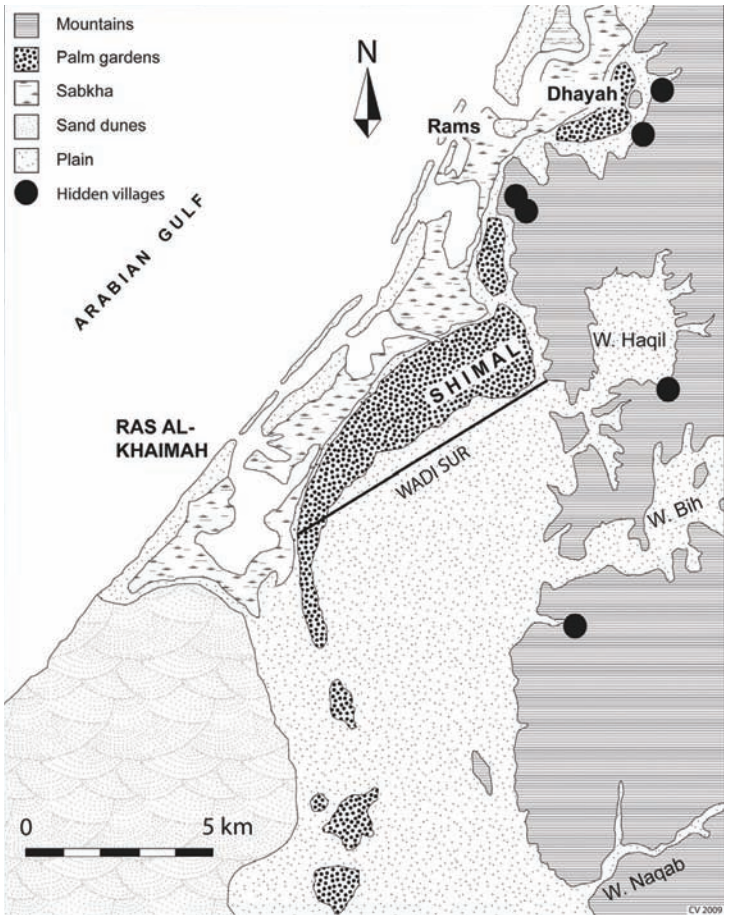

Fig. 7. The hidden villages of northern Ra's al-Khaimah.

THE RISE OF RA'S AL-KHAIMAH

The long distance to the new administrative and commercial centre of Ra's al-Khaimah put a strain on the old core of the oasis settlement. With the silting-up of the creek, the large palm garden of Shimal, in existence since the Bronze Age, lost its importance.

Families owning a second home in the gardens of Shimal would have started to relocate closer to Ra's al-Khaimah and into the belt of palm gardens there, which are known today as Nakheel. After protecting Julfar during earlier centuries, the town wall fell into disuse as a result of a declining population in the palm gardens around Shimal who could no longer maintain it. We cannot date the collapse of the town wall precisely, but several facts suggest that it might have happened in the mid-18th century:

- after the middle of the 18th century, two refuge forts ('Sur') were built inside the palm gardens of Shimal (Fig. 8).
- the plateau of Sheba's palace, where the ruler of Julfar used to reside, was transformed into a refuge fortification.
- a large number of small stone houses, still visible today, were built directly against the old town wall, using one side of it as a wall of the house. Both their small size and building style indicate that they were built during the 18th and 19th centuries.

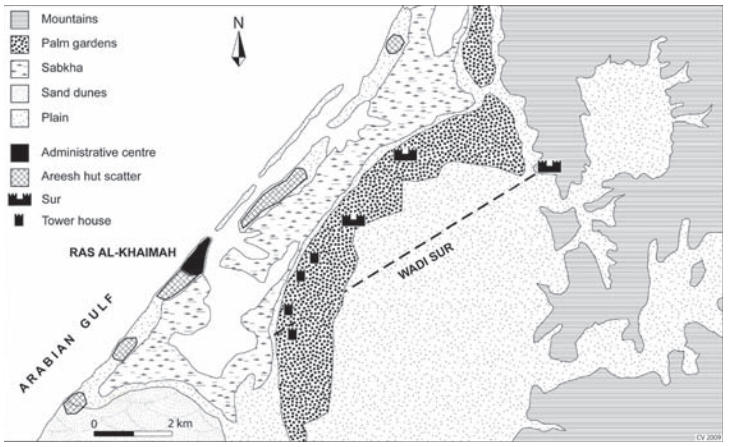

Fig. 8. Ra's al-Khaimah after the 18th century AD.

It is around this date that Julfar ceased to be mentioned in written sources (King 2006, 2008: 98). With the collapse of the town wall, the large palm oasis in the Shimal area, which had played such an important role since the Bronze Age, ceased to be a dominant factor in northern Ra's al-Khaimah. Instead, the former administrative centre of the oasis settlement, which had first moved to a new town on the sand bars of al-Mataf, and then to the south-western lagoon away from the old palm gardens, evolved into a distinct entity of increasing importance, size and population. This shift of population towards Ra's al-Khaimah and the collapse of the oasis settlement explain the final disappearance of the name Julfar. It is interesting to note that, with the shift to Ra's al-Khaimah, a new territorial name, 'al-Sirr', appeared. King (2006: 251–252) collected some records of this name which was used as a synonym for northern Ra's al-Khaimah and may have supplanted

the name Julfar for the remains of the oasis settlement in the Shimal area.

Eventually a new, smaller oasis settlement developed inside the palm gardens of Nakheel. Their increasing importance and the new, overall focus on this area is attested by large stone towers and houses (Fig. 8) built by the ruling families during the 18th and 19th centuries (Kennet 1995). These tower houses are concentrated around the gardens of Nakheel and constitute visible testimony of the importance of these new palm gardens. Nevertheless, despite the new concentration of gardens and population at Nakheel, this oasis settlement never dominated the settlement hierarchy as the oasis settlement of Julfar had done. Instead it was always secondary to the town of Ra's al-Khaimah and can rightfully be regarded as its 'hinterland'.

1 The problem of estimating dispersed settlements and the lack of concentrated and archaeologically visible settlements can be seen in the discussion in Kennet 2002: 160–161.
2 A small fortification called 'Sur' can at the same time act as the living place of an important local family or sheikh. A good example, in combination with a mosque, is Falayah in Ra's al-Khaimah. See Velde 2003.
3 The best examples of *falaj* settlements in the UAE are the original villages of Al Ain.
4 The survey of the gardens shows that occupation density differed in various periods (Kennet 2002).
5 Compared to the average size of archaeological mounds in the Near East.
6 Likewise being the most visible archaeological representation.
7 This was the typical way of life in the town of Ra's al-Khaimah until the mid 20th century.
8 The deeper a well, the longer it takes to pull up water, which means that less water can be supplied in the same amount of time. This process fast reaches a point where a well is no longer viable.
9 Further excavations in the old town of Ra's al-Khaimah will document this development.
10 The houses are approximately one third larger than the average stone house found in later settlements along the foothills of the Ru'us al-Jabal.

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Fifty Years of Emirates Archaeology

TRADE CERAMICS FROM EAST ASIA TO THE ARABIAN PENINSULA

Hanae Sasaki (Kanazawa)
Tatsuo Sasaki (Kanazawa)

THE ERA OF THE GREAT VOYAGES IN ASIA

Asia entered the era of the Great Voyages in the 8th century AD. This was the time when two empires, the Abbasid dynasty that ruled the Mediterranean and Arabian Gulf in the west and the Tang dynasty of China in the east, prospered in West and East Asia. Making use of the Indian Ocean monsoon winds, these two great empires transported large quantities of goods over long distances by sea, exchanging information via the movements of people.

Beginning in the 8th century, the East African coast, Iran and India, South-east Asia, and the south-eastern parts of China, Korea and Japan shared goods from remote sources and raised their standards of living and the quality of their cultures during the Era of Great Voyages. Port towns were established on the coasts of these regions, some of which prospered like city-states or port polities. Chinese Longquan green ware was one of the representative trade goods from the 13th to 15th century on the Asian seas (Sasaki 1994a).

After the second half of the 15th century, European ships reached the Atlantic coast of Africa, and in the 16th century they reached Asia via the Cape of Good Hope, seeking the rich agricultural products and handicrafts available there. After the arrival at Calicut in 1498 of the Portuguese, fighting broke out with Asian merchants that continued through the first half of the 16th century until a fortress was built in Macao in 1557 AD. As trade goods like Indian spices were typically profitable items in earlier times, they were now also sold to Europe directly by European ships, not via indirect trade by Islamic merchants as had been the case.

Many scholars call the period from the second half of the 15th century to the middle of the 17th century, when European ships made their presence known in Asian seas, the Era of the Great Voyages. However, this is incorrect. The Era of the Great Voyage in Asian seas had begun in the 8th century, before European ships entered the Indian Ocean and destroyed its rules and the order of the sea.

A CERAMIC ROAD AROUND THE WORLD

In the 16th century, the American continent was pillaged by Portugal and Spain, and the Atlantic route became active. The sea routes around the world were connected, forming one circular route and worldwide trading began in the first half of the 16th century. Later, England, France, Holland and other countries joined in, and the sea road was utilised as an active trade route.

With the appearance of European ships, the Era of the Great Voyage in Asia underwent a significant change. In the 16th century, Portugal attacked major port cities in Asia and built trade forts with thick ramparts and cannons along the trade route. These forts were intended to aid Portugal in monopolising the trade that had previously been the source of prosperity for various port towns in Asia. Although Portugal's destructive and warlike invasion of the Asian seas gave her temporary prosperity and control, this power did not last long, however, since the local people counter-attacked. Countries and companies from various parts of Europe, such as Spain, Holland, France and England, also sent large trading vessels armed with cannon to the Asian seas and were actively involved in seaborne trade. As for the sailing routes of such ships, the major one passed through the Indian Ocean and circled around the southernmost end of Africa.

Spain took the lead in dominating the sailing route of the Atlantic Ocean and the Pacific Ocean by developing trade routes centering on Mexico. Spain conquered the Philippines in 1571 AD, and shipped large amounts of Chinese ceramics and a small quantity of Japanese ceramics in galleons from Manila to the American continents. The ceramics road followed the ocean routes across the world. Although the products transported by ship were highly varied, the typical archaeological remains found at the sites involved today are ceramics.

CHINESE AND SOUTH-EAST ASIAN TRADE CERAMICS FOUND IN THE ARABIAN PENINSULA

A large amount of trade ceramics has been excavated all over the world, capturing the spotlight as concrete evidence of the ocean trade. Fragments of many Chinese and South-east Asian ceramic vessels that were traded in the Era of the Great Voyages in Asia have also been excavated at archaeological sites in the Arabian Peninsula (Sasaki and Sasaki 2002c; Sasaki 2005a). If one marks such sites on a map, one finds that the coastal areas are thick with marks. Although the collections of Topkapi Sarayi and Ardabil are very famous and well-

known to everyone, our understanding of less famous archaeological sites is less advanced (Sasaki 1993b).

Chinese green ware, blue-and-white ware, brown-glazed ware and white porcelain; Vietnamese white ware, painted ware, blue-and-white ware and ash-glazed ware; Thai green ware, brown-glazed ware and painted ware; Myanmar green-and-white wares; and Indian and Pakistani earthenwares have been excavated together with Iraqi, Iranian, Omani, and Yemeni wares. Central Asian and European wares have also been found, but only in particular periods.

The most abundant wares through the ages have been locally made cooking pots and vases/jars. Combination and production areas of excavated ceramics have been varied according to the periods (Sasaki 1989a, 2007b–c). The types, forms, and usages of trade ceramics, as well as their associations with local ceramics, reflect the lifestyles of the residents of this region in the past (Sasaki 1993a). Here we shall discuss several archaeological sites at which we have made excavations and at which East and South-east Asian trade wares have been found.

JAZIRAT AL-HULAYLA

Jazirat al-Hulayla is a 9 km-long sand island along the Arabian Gulf near the Straits of Hormuz (Sasaki 1995b, 1996a, b, 1998a; Sasaki and Sasaki 1998, 1999, 2000b, 2001b, 2006d, 2007c). Dated to the 9th–10th centuries, Area A yielded Mesopotamian white-glazed bowls and blue/green glazed ware. Area C is a 15th–17th-century dwelling site that contained many imported wares, including Chinese blue-and-white, and green ware, Myanmar white and green wares, and Iranian green and white wares. Area D, dated to the 5th to 8th century, had only Mesopotamian green/blue-glazed ware.

LULUIYAH

Luluiyah is the ruins of a small fort (Fig. 1) on the coast of the Gulf of Oman, just north of Khor Fakkan, to the south of the Straits of Hormuz (Sasaki and Sasaki 2000a, 2001a, 2002a–b; Sasaki 2005b). Yemeni yellow-glazed ware with brown painting and Iranian blue-glazed ware predominate. Excavated Islamic ware and Chinese green wares (Fig. 2) dated from the late 13th and early 14th centuries and included Longquan green ware, white ware and brown-glazed ware (Fig. 3). Blue-and-white and South-east Asian wares were absent. This site illustrates the variety of East and South-east Asian ceramics that were traded in the late 13th century.

Fig. 1. Luluiyah Fort.

Fig. 2. Chinese green ware from Luluiyah Fort.

Fig. 3. Chinese brown-glazed jars from Luluiyah Fort.

JULFAR

Julfar is a ruined seaport town situated at the lower end of the Arabian Gulf, on the north-eastern part of the Oman Peninsula (Sasaki 1991, 1993c–d, 1994a–c, 1998b; Sasaki and Sasaki 1992, 1998, 2005b, 2006). Julfar had a political and commercial relationship with

Hormuz, one of the largest port towns in the Gulf during the 14th and 15th centuries. At Julfar, we excavated the residential area and identified seven cultural levels. Among the finds were sherds of Longquan green ware. Most of the imported ceramics dated to the mid-14th through mid-15th centuries. These included Chinese, Vietnamese, Thai, Myanmar, Central Asian and Iranian wares together with a large amount of local earthenware produced at the foot of the mountains near Julfar.

The excavated area shows a clear stratigraphic sequence from the lower to the upper layers. The Longquan green wares of the late 14th century were found in the lowest layer. Further up were Longquan and Myanmar green wares belonging to the early 15th century. These were topped by Chinese blue-and-white and Myanmar green ware, with a small amount of Longquan green ware, from the early 15th century. Chinese green ware became the second most common imported ceramic at the site. These findings show us that the export of South-east Asian ceramics to Western Asia began in the first half of the 14th century. Sherds excavated at Julfar shed light on patterns of export during the second half of the 14th and the first half of the 15th century.

The uppermost layer, Level 1, produced ceramics dating from the mid-15th century, while the lowermost habitation layer, Level 7, dated to the mid-14th century. Level 6, representing the second half of the 14th century, was divided into three main layers: A, B and C. Houses 8, 9, 10 and 11, a date press, and two streets were found in Layer A. House 11 and a date press were found in Layer 6B, and House 15 was found in Layer 6C. Large quantities of finds excavated from these houses were used to study the change in traded ceramics from the lower to the upper levels. Chinese blue-and-white ware (2,821 g), Chinese green ware (18,039 g), Myanmar green ware (3,749 g), Thai brown ware (10,401 g), Iranian green-glazed ware (19,871 g), Iranian white-glazed ware (85,696 g), and a lot of Iranian and Arabian earthenware (3,031,357 g) were regularly observed within every layer and location.

In the lower levels, Chinese white ware, Myanmar green ware, Thai brown ware and Vietnamese white ware were seen along with Chinese green ware and blue-and-white, Iranian ware, and local earthenware. Small quantities of Vietnamese iron painted-ware appeared in the middle levels. Vietnamese blue-and-white ware appeared occasionally in the upper levels. Thai brown jars from the Mae-Nam-Noi and Si-Satchanalai kilns increased considerably in Level 1. The provenance and ratios of types and shapes of South-east Asian ceramics changed noticeably from the lower to the upper levels. The types, shapes, weight, and ratios of South-east Asian ceramics from every level are shown in the tables.

These carefully excavated ceramics provide us with good evidence for long-distance trade, ratios and combinations for the purpose of reconstructing the exportation of South-east Asian ceramics throughout the Indian Ocean region during the second half of the 14th and the first half of the 15th century.

Fig. 4. The Khor Fakkan town site.

Fig. 5. Chinese blue-and-white ware from the Khor Fakkan town site.

KHOR FAKKAN

The site at Khor Fakkan is the ruins of the old seaport (Fig. 4), south of the Strait of Hormuz on the Gulf of Oman (Sasaki and Sasaki 2003a, 2006a, 2008). The excavated wares from Layer 3 belonged to the 15th and the early 16th century. Chinese green ware and blue-and-white (Fig. 5), and Myanmar green ware and white ware (Fig. 6) were found together with a large amount of Iranian green ware, many incised earthenware vases, Omani brown-glazed ware and local earthenware.

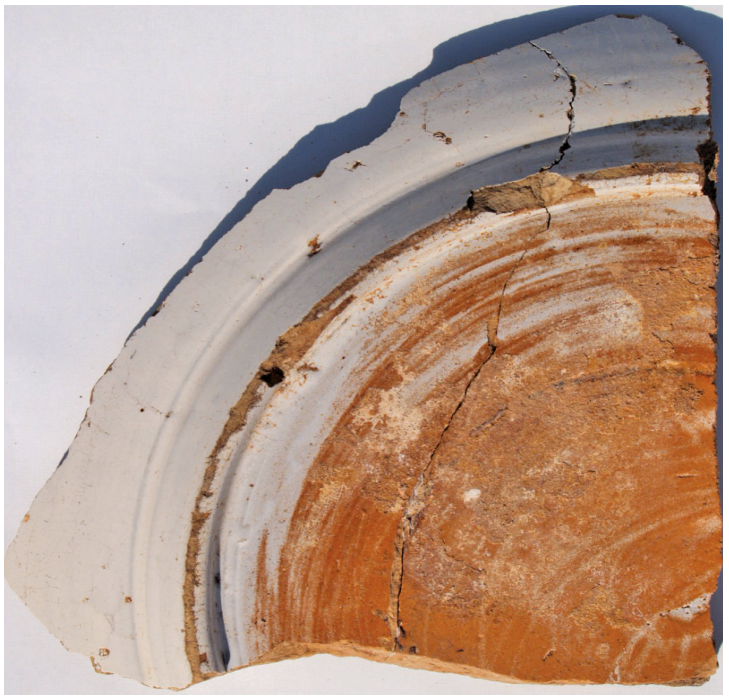

Fig. 6. Myanmar white ware from the Khor Fakkan town site.

KHOR KALBA

The site at Khor Kalba is the remains of the old seaport, to the south of Khor Fakkan, and also on the Gulf of Oman (Sasaki and Sasaki 2003b, 2004). Chinese blue-and-white, Iranian blue-glazed painted ware, Omani brown-glazed ware, Iranian incised earthenware, and local earthenware of the 18th and 19th century were excavated here. The same types were found at Masafi (Sasaki and Sasaki 2006c, 2007a; Sasaki 2007b), Fujairah (Sasaki and Sasaki 2005a) and Dibba (Sasaki and Sasaki 2006b, 2007b, 2009; Sasaki 2009).

MURAY AND BEDUWA SHWAIBA

Muray (Fig. 7) and Beduwa Shwaiba were nomadic camps in the desert between Abu Dhabi and Al Ain (Sasaki 2009). European glazed ware (Fig. 8), Chinese blue-and-white (Fig. 9), Iranian and Omani glazed wares and local earthenwares were found together with many fish bones on the surfaces of sand dunes. Most of the ceramics dated to between the 18th and 20th century. Nomadic people in the desert used European painted ware and Chinese Fujain blue-and-white, just like those who lived on the coast of the Arabian Gulf and the Gulf of Oman.

Fig. 7. Muray No.1 site in the desert.

Fig. 8. European enamel ware from Muray No.1 site.

Fig. 9. Chinese blue-and-white from Muray No.1 site.

CERAMICS FROM SAMARRA FOR COMPARISON WITH THE FINDS FROM THE ARABIAN PENINSULA

The capital city of the Abbasid dynasty from 836 to 892 AD, Samarra was the first excavated site in Western Asia at which imported Tang dynasty ceramics from China were identified (Sasaki 1995a). Located near the centre of the Mesopotamian plain, Samarra was initially excavated from 1911 to 1914 by German archaeologists. The identification of Chinese ceramics there came as a surprise, since no one at that time expected to find that East Asian goods had been traded as far west as Samarra at such an early date. It was equally surprising to discover that local potters at Samarra had begun to produce imitations of imported Chinese ware soon after it first arrived in Mesopotamia, copying glazed colours as well as shapes (Sarre 1925). Communications through maritime trade seem to have facilitated the exchange of pottery production skills in spite of the distance involved. [Many scholars may still think that there was a pottery production centre at Samarra. I presume the major pottery production was Basra, in southern Mesopotamia. See Mason and Keall 1991.]

Chinese green, white, splashed, and Changsha wares were found at Samarra, together with a large quantity of Islamic pottery. In the excavation report, we can find only six pieces of green ware, together with Yue-type and Longquan wares of the 13th century (Sarre 1925: Pl. 23.11–12) which, however, were reported as 9th century finds. Four pieces are Yue-type. One piece is a bi-base of the 9th century, one is a ring-base of the 9th–10th centuries, and two are from the 10th century.

Although the German archaeologists misdated some of these finds, the Samarra report was important for our understanding of the early phases of ceramic trade between East and West. Regrettably, the report gives no indication of the ratio of Zhejiang green wares to total ceramic finds. [I examined all the pieces from Samarra that are stored in the British Museum, the Victoria and Albert Museum, the Royal Ontario Museum, and the Museum of Anthropology of the University of Michigan, and found that green ware was quite rare and likely dates to the 10th century. Although there is green ware from Samarra in Berlin and Baghdad, the ratio of Zhejiang green wares to total ceramic finds is still unclear.] The Islamic and Chinese wares excavated at Samarra are often cited as dating references for other comparable sites and objects, because scholars (Sarre 1925, Koechlin 1928, Hobson 1932, Lane 1947) assumed that Samarra was occupied only for a very short period (i.e. 836–892 A.D.) during which it served as the capital of the Abbasid Caliphate, and these criteria are still widely accepted. Scholars like Whitehouse have pointed out the problem with this assumption. In reality, Samarra was a flourishing city both before and after it was the Abbasid capital (Miles 1954, Whitehouse 1979, Sasaki 1991). [One of the aims of Whitehouse's excavations at Siraf was to re-examine the chronology based on the Samarran pottery types. I am also researching the finds of so-called Samarra type from Samarra and A'Ali. See Sasaki 1990, 1991; Sasaki et al. 1993.] The finds from Samarra were classified, drawings were made and the finds were dated (Sasaki 1995a). The finds reflect significant trade in Chinese ceramics during the 9th century, but no South-east Asian wares were found.

FUSTAT

Fustat is the site of a large city located in what is today a suburb of Cairo. Excavations there began in 1912 and have been conducted intermittently ever since by archaeologists from Egypt, the United States, Japan (Sasaki 1992) and other countries.

In the 9th century Zhejiang green ware, or Yue ware, at Fustat is extremely limited, increasing in the 10th century when the amount of Chinese white porcelain present rose sharply. The latter continued to increase until the 11th century. The scarcity of imported Chinese ceramics in the late 12th century is probably a result of the European Crusaders' invasion in 1168 AD, after which Fustat was temporarily abandoned. From the mid-13th to the early 14th centuries, large numbers of Zhejiang green ware bowls were in use at Fustat. As was the case all across Asia, normal and large bowls of Longquan ware were common, suggesting that these types were mass produced in China and traded extensively in the Red Sea area during the 13th and 14th centuries.

Japanese excavations in 1980 revealed that only 1.3 percent of all glazed sherds in the upper layer were of Chinese origin (Sasaki 1983, 1989b). [This figure is low compared with the percentage of Chinese ceramics at Japanese medieval castle sites, probably because of the great distance of Fustat from China. See Sasaki 1981]. A sherd count of Scanlon's 1968 excavation at Fustat showed that only 0.67 percent of the sherds recorded were Chinese (Scanlon 1971). Most of the finds found there in the upper layer dated to the late 12th to mid-

14th centuries. The rest of the glazed ceramics, i.e. almost 95 percent, were made in Egypt. Ninety-five percent of all excavated sherds by weight were unglazed earthenware produced in Egypt. Over 60 percent of all Chinese ceramics were Zhejiang or Longquan green wares. Finds in the upper layer included ceramics from the Tang, Sung and Yuan dynasties. If we consider only the ceramics of the Southern Sung and Yuan dynasties, the ratio of Zhejiang green ware is even higher. In the upper layer, Myanmar green ware was also found.

REMARKS ON TRADE CERAMICS FOUND IN THE ARABIAN PENINSULA PROBLEMS

The historical significance of the trade ceramics excavated at the sites mentioned above will be discussed in relation to the following points: types, forms, usage, value, frequency, and ratio of each kind of trade ware to the total ceramic assemblage at each site. Needless to say, the importation of foreign wares influenced local potters and the lifestyles of the local people. Sea trade facilitated important cultural exchange, a point on which I want to focus when considering the use of excavated ceramic sherds from the Arabian Peninsula in archaeological explanation.

CHANGING WARES THROUGH TIME

Historians have long stated that maritime trade involving East Asia began in the Indian Ocean after the early 1st millennium AD. Archaeologists tend to emphasise the first appearance of long-distance, trade wares in the 9th and 10th centuries. Although these ceramics show that large-volume maritime commerce existed then, ceramics tell us nothing about maritime trade before the 8th century. Ceramics were not the only commodity being traded, however.

Maritime trade with the Arabian Peninsula may be divided into three stages. The first stage, before the 8th century, involved no trade wares from East Asia. The second stage, from the 9th through the 15th centuries, saw a high volume of Chinese ceramics transported by Arabian, Iranian and Indian merchants. The third stage, after the 16th century, is the period when European merchants came into the region and the system of commerce changed markedly. Ceramics at this time continued to be traded and a great number of written documents from the third stage are available for study.

It is possible to subdivide the second stage chronologically on the basis of the ceramic evidence. Zhejiang and Guangdong green wares, Hobei and Henan white wares, Henan green splashed ware and Changsha painted ware were the main wares traded from the East in the 9th and 10th centuries. In the 11th and 12th centuries Guangdong, Fujian and Jiangxi white wares were the principal wares traded. Zhejiang green ware became the most common ware traded in the 13th and 14th centuries. Coarse green ware became abundant in the 15th century, along with Chinese blue-and-white, Myanmar, Vietnamese and Thai wares. Thus, the provenance and types of traded wares changed through time. South-east Asian ceramics appeared in the middle of the 14th century, and became popular in the 15th and 16th centuries (Sasaki H. and Sasaki T. 2002; Sasaki and Sasaki 2003c; Sasaki 2007a).

Excavated sites in the Arabian Peninsula display an absence of Chinese ceramics from Jingdezhen in the 16th and 17th centuries. Elsewhere, however, these were found, in large quantities. During the 18th and 19th centuries, cheap ceramics from Fujian province in China spread all over the world (except Japan), including the Arabian Peninsula where they have even been found in the desert.

TYPES OF TRADE WARES

The types of Chinese wares commonly used in East and South-east Asia were not necessarily popular in Western Asia. For example, black-glazed bowls, popular for drinking tea in East Asia and found in every city and castle site in Japan from the 14th through 16th centuries, are completely absent at the sites discussed here. As for Cizhou and Jun wares, produced in the northern part of China and in common use there, only a few pieces have been unearthed in Western Asia. The most common kind of Myanmar wares of the 15th and 16th century are large dishes of green ware, iron-painted ware and small vessels of Thai origin that are also found in Western Asia. Myanmar green ware is not popular in the eastern part of South-east Asia, and a very limited amount has been found in Japan, but it was very popular in the western part of the Indian Ocean region. Thai wares were popular in South-east Asia, but only selected types in limited quantities were exported to the West.

Yue ware did not play a dominant role in the Chinese ceramic industry, while Guangdong wares were the most numerous, comprising over 50 percent of the total Chinese ceramics at Laem Pho and Ko Kho Khao in the Malay Peninsula during the 9th and 10th centuries (Ho 1994). However, such was not the case in Western Asia at that time, when Guangdong wares were most numerous at Siraf in Iran. The amount of Guangdong ware bowls seems very low even there, however, and was dominated by fragments of large jars and basins. Amongst the excavated Guangdong ware sherds from Siraf in the British Museum and the Royal Ontario Museum, large bowls with lumpy white spur marks on the inside predominate, while medium-sized bowls of bi-base and ring-base are also seen. Fewer Guangdong bowls have been found in the Arabian Gulf.

Changsha bowls with polychrome underglaze painting are known from many sites in Western Asia during the 9th and 10th centuries, together with some *appliqué*-decorated or brown-spotted ewers. Monochrome green Changsha ware is rare on West Asian sites, although this kind of ware is very common at Laem Pho and Ko Kho Khao in the Malay Peninsula (Ho 1994). Some monochrome green Changsha ware appears at Banbhore in Pakistan as well (Sasaki 1987), but very little Changsha ware was found at Fustat. These observations suggest that the kinds of ceramics transported to the West in the 9th and 10th centuries depended on local tastes and the chance of what could be obtained at any given time. From the 13th to 15th centuries Longquan green ware was the main export ware to the West, along with some Guangdong and Fujian wares.

Thus, exported Chinese ceramics came mainly from southern China where they were mass-produced near the southern port cities for shipment to the West. However, Only in the latter half of the 8th and in the 9th and 10th centuries did white porcelain from northern China spread over the Indian Ocean region, along with Yue ware from the south. Ceramic importers in Western Asia may have submitted special orders to Chinese producers. Certain wares, such as blue-and-white of the 14th and 15th centuries, were geared to West Asian tastes.

FORMS AND USAGE OF TRADE CERAMICS

Most of the excavated Chinese ceramics at the above-mentioned sites are bowls, suggesting that such vessels were used as tableware in Western Asia, just as in East Asia. The percentage of dishes of various sizes differs from site to site. In addition to large dishes and large and small bowls for food, people in Western Asia also used tea cups. Although small dishes were very popular in Japan, very few have been found in the Arabian Peninsula, no doubt a reflection of differing dietary habits there. The percentage of large-sized bowls probably reflects the custom of communal meals and the habit of using metalwork. Although many large Chinese dishes, mainly of Longquan green ware can be seen in the Topkapi Sarayi museum in Istanbul, such dishes are relatively scarce in archaeological contexts. Compared with many city and town sites in the Arabian Peninsula, the usage of a great number of large dishes in Istanbul is exceptional.

Chinese vessels in other shapes have been excavated at sites in Western Asia, but these are rare. They include small Longquan green ware jars, which seem to have been used as containers for cosmetics and other items. Perfume seems to have been kept at home in small glass containers made in Western Asia. Small Chinese vessels were probably not used for perfume.

People customarily drank water from earthenware bottles, bowls or brass cups. Earthenware containers can cool water by evaporation. In the later Islamic period, copper trays plated with tin were used to collect the water that seeped from earthenware bottles. In the cool season, Chinese ceramic bottles, which are non-porous, were used instead of earthenware. Thus, the people of Western Asia made use of bottles produced from local earthenware and Chinese ceramics, taking the season into account as appropriate. However, on the whole, not too many Chinese green ware vases or bottles have been discovered in the West.

Great quantities of locally produced earthenware vessels have been found at many sites in Western Asia. These are mostly thick and unglazed, and include serving bowls, containers for preserving food and so forth. At nearly all sites in Western Asia, imported wares account for only a small percentage of the excavated ceramics, although some port towns might be exceptions to this general rule. Because of the rarity of Chinese ceramics, it is not surprising that they were copied locally in various parts of Western Asia. Some Islamic wares imitate the shapes, glaze colours, decorative techniques and design motifs of East Asian ceramics. Blue/green-glazed ware, similar in appearance to Longquan green ware, was popular in the West.

MARKETS

Excavations in Western Asia indicate that imported wares of various types and shapes had their own markets that differed in extent, varying from a single, small area to the entire world. Although the archaeological evidence

is unclear, it seems that some wares were used according to local tastes or customs, while some were used only by a certain class. The fact that Arabic-like characters were added to some East Asian vessels before firing suggests the possibility that these represent special orders made for the Western Asiatic market.

VALUE OF TRADE CERAMICS

Sherds excavated at the sites discussed above often have repair holes (Fig. 10), through which copper wire or iron clamps were passed and fastened tightly around the broken pieces so that the damaged vessel could be reused. Such drill-holes appear on sherds of large, Chinese ash-glazed jars of the 9th or 10th century found at Jumeirah on the coast of Dubai (Sasaki 1989a) and at Mantai in Sri Lanka. [Dr. M. Prickett was kind enough to show me excavated sherds from Mantai in Colombo. For Mantai, see Carswell and Prickett 1984]. Islamic sherds from A'Ali (Sasaki 1990) and Jumeirah have repair holes as well. After the 11th century, white porcelain from northern China was repaired in the same way by passing copper wires through small drilled holes. At Fustat, no fewer than 10 percent of all Chinese white porcelain show drilled repair holes (Sasaki 1992). Pieces of 13th and 14th century green ware from southern China, mainly from Zhejiang province, were mended with iron clamps fitted in drilled holes.

About four per cent of these green wares have repair holes. Many green ware sherds with drill-holes have also been found at Hormuz and Minab in Iran in 13th and 14th century contexts (Sasaki 1986). In the 15th and 16th centuries, Chinese blue-and-white porcelain dishes in Western Asia were also mended in the same way. The frequency of repair-holes usually indicates how valuable an imported ceramic vessel was in Western Asia. Wear traces such as knife scratches often appear inside large dishes of green ware.

Such scratches never appear inside dishes from archaeological sites in Japan.

Fig. 10. Ceramics with mending holes from the Khor Fakkan town site, including the lid of a local earthenware cooking pot, the mouth of a local cooking pot, Iranian earthenware vases, Iranian white-glazed bowls, Iranian green-glazed bowls, an Omani brown-glazed bowl, Myanmar green ash-glazed dish and a Chinese green ware bowl.

THE REASON FOR THE CERAMIC TRADE

It is not quite clear why so many ceramic vessels were imported from China and Myanmar when Western Asia had its own ceramics. [The main trading periods of Chinese and Myanmar wares were different, as evidenced at Julfar (Sasaki 2006)]. Chinese ceramics were harder, and may well have been considered superior to local products. Clays for ceramics that were available in Western Asia were not suitable for high-temperature firing or the production of hard white paste wares. Durability as well as changes in taste and fashion may have determined the quality, quantities and types of imported wares. These, in turn, affected the work of local potters, especially those who made imitations. The pattern of the ceramic trade may have also been affected by the frequency of sea voyages, by the way in which the merchants who controlled the seaborne trade were organised, by the stability or instability of political powers along the trade routes, and by government policies on the production side.

Ceramics were not the most important kind of trade goods in the past. They were simply objects for daily use, but ceramics only became a major trade good in the 9th century. However, they have survived in large quantities, and are thus dominant in the archaeological record and in historical reconstructions. We need to examine further medieval trade between East and West by combining research on ceramics with research on other kinds of excavated trade materials in order to better understand the relationship between East and West.

TRADE CERAMICS AND THE LIFESTYLE OF THE RESIDENTS

When ceramics were shipped in large quantities from remote areas by sea, the impact was felt differently in each culture that received these wares. For example, it was common for areas far from China to copy Chinese vessel forms and designs. Japanese ceramics were heavily and frequently influenced by Chinese ceramics. At the same time, Japanese ceramics also influenced Chinese and European ceramic styles. European ceramics were greatly influenced by West Asian ceramics, just as they were influenced by Chinese and Japanese vessel forms and designs. Similar patterns have been documented in the Americas as well, where, for example the ceramics of the Pueblo in Mexico made use of the Chinese flower design. Studies of the influence of Chinese ceramics on local production demonstrate the well-known example of the copied design of a confederate rose pattern, or Crack ware. Plates and bowls of this type were made at the Jingdezhen and Zhangzhou kilns in China and the Arita kilns in Japan, and were displayed in the Baroque palaces of Europe. The same design was copied by the Delft potters in Holland and elsewhere, and such European copies were exported and eventually discovered at archaeological sites in UAE.

Production and circulation, the copying of designs and vessel form and differences in usage based on dissimilar ways of living are major themes in the study of the ceramic road along the ocean route. Studies of wrecks containing actual trade materials are in progress in various areas. Three comparative studies, that concern ceramic production centres, and the distribution of wrecks and consumer towns and villages, underpin our research into maritime ceramic trade.

The maritime trade route or 'ceramic road' has been studied extensively in Asia, especially in Japan, Korea, Taiwan and China. Furthermore, the study of the ceramic road from Asia to Europe has developed into a research theme all over the world. Analyses of production centres, chronology, and the use of trade goods alone and in combination with local wares at ancient and medieval sites are in progress in various areas. Comparative studies are being undertaken examining the imitation of the vessel forms and designs of trade goods in order to better understand the nature of regional cultures and lifestyles. The study of ceramics found at archaeological sites in the UAE is part of this global research effort.

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Fifty Years of Emirates Archaeology

CONSIDERING THE 'TERRA INCOGNITA' AND THE IMPLICATIONS FOR THE CULTURAL RESOURCE MANAGEMENT OF THE ARABIAN GULF PALAEOLANDSCAPE

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INTRODUCTION

Over recent years a multitude of extensive marine geophysical data sets have been gathered in the Arabian Gulf, chiefly for the purposes of oil and gas exploration. Although such geophysical surveys are primarily targeted towards the mapping of deep subsurface rock formations, the top section of the data can be processed specifically to detail the currently unknown shallow palaeo-geomorphology of the Gulf, providing information that would be impossible to collect within archaeological budgets. Using such data to document palaeolandscapes is just one element of a marine mapping programme that can form the basis of a cohesive strategy for managing the archaeological resource in marine areas. Such strategies impact upon education, the accessibility of heritage information to the public, and ultimately the protection of this marine cultural landscape.

THE IMPORTANCE OF THE ARABIAN GULF MARINE PALAEOLANDSCAPE

The Upper Palaeolithic

Archaeologists have long recognised the potential of the Arabian Gulf as an area of occupation during the Palaeolithic. Lower sea levels during much of the last glacial period indicate that until about 9 kya (kya = thousand years ago) the Gulf would have been an open landscape suitable for exploitation by human groups. Anatomically Modern Humans (AMH) may have migrated into the Arabian Peninsula as early as late Marine Isotope Stage 6 (MIS 6) or early MIS 5. As sea levels dropped throughout MIS 4 the Gulf would have become gradually more available to AMH, eventually providing a landscape with permanent fresh water and a variety of other resources essential to Palaeolithic Groups. The absence of information about this late Pleistocene and early Holocene landscape forms a significant gap in our knowledge of human dispersal between approximately 120 kya and 9 kya.

The Gulf is a relatively recent sea. It covers some 251,000 km^2, measures 980 km in length and averages 250 km in width. Adjacent to the Iranian coast, close to Kish Island, the water reaches a maximum depth of 90 m, while the average depth is around 50 m. In contrast, much of the seabed between Abu Dhabi and Qatar is relatively flat and shallow, with the depth of water for the most part, being only 15 metres or less. As a consequence, for most of the last 70 kya the Gulf remained an open landscape unaffected by marine incursion until as late as 14 kya. For thousands of years, the Ur-Shatt River (a confluence of the Tigris-Euphrates Rivers) provided fresh water to the Gulf, as it flowed through the Strait of Hormuz into the Gulf of Oman. The presence of this river has been noted in earlier bathymetric studies of the lower regions of the Arabian Gulf (Sarnthein 1971).

At the northern end of the Gulf, the present-day Shatt-al-Arab forms a wide, deltaic region at the south-eastern extent of the Fertile Crescent. The topography is flat, allowing for slow-moving water and steady alluvial deposition forming marshland with an uninterrupted supply of fresh water from the Tigris, Euphrates and Karun Rivers to the north. Prior to drainage schemes (from the late 1970s onwards) this was a vast flood plain featuring huge permanent lakes, marshes, and the largest date-palm forest in the world (some eighteen to nineteen million date palms). The anatomising channels support rich natural resources including papyrus, rushes, reeds and a wide variety of aquatic species.

While some of the submerged topography of the northern Gulf is marginally more inclined than the present day Shatt-al-Arab, it is not dissimilar, suggesting that the Gulf basin may formerly have supported a similar environment to that of the Shatt-al-Arab. This could have included shallow fresh water lakes, swamps, and both fresh water and alluvial salt marsh. The basin would have been bordered to the north and east by the Zagros Mountains and to the south and west by an expanse of desert, that for the most part was uninhabitable.

While it is likely that early groups exploited the landscape as it became exposed due to a fall in eustatic sea level following MIS 5, we currently have no submerged landscapes that enable us to investigate these groups. The Levalloisian/Middle Palaeolithic technologies encountered in Jebel Barakah, Abu Dhabi (McBrearty 1993, Wahida et al. 2008), northern Qatar (Kapel 1967, Al-Naimi et al. 2010) and Fili, Sharjah (Scott-Jackson et al. 2008 and 2009) for example, are technologies common to both Neanderthals and AMH. Between 70 kya and 35 kya Neanderthal groups dominated the Tigris Valley to the north and the mountainous regions to the east of the Gulf (Finlayson 2007, Churchill et al. 2009), and it would not be unreasonable to suggest that Neanderthal groups in the Tigris and Euphrates Valley would have been inclined to compete for resources with AMH in the Arabian Gulf (Fig. 1).

This region is also important as it appears to mark the extent of Neanderthal dispersal and thus presumably

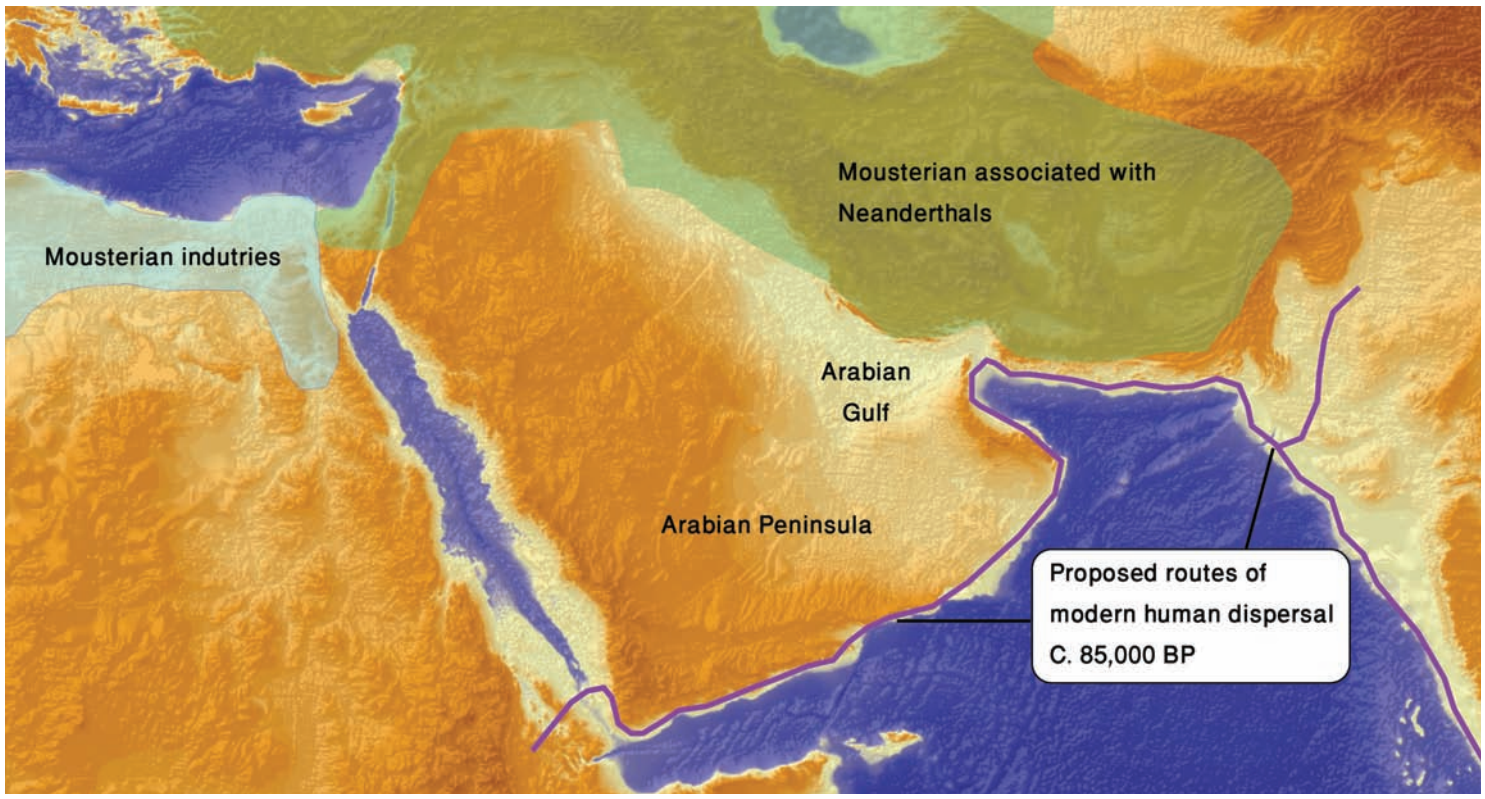

Fig. 1. The extent of Mousterian technologies associated with Neanderthals (after Finlayson 2007) and the proposed route of human dispersal (after Oppenheimer 2009) showing sea levels at approximately 100 m below current level.

(with the possible exception of the Levant) the location of early encounters between Neanderthals and AMH. Sites in the Emirates such as Jebel Faya, Sharjah (Uerpmann et al. 2009, Marks 2009), provisionally dated to MIS 5, suggest AMH had reached the Emirates by c. 127 kya. While the most obvious assumption for AMH migration would be a 'dry-land' route through the Sinai Peninsula into the Levant, this may not have been the case. There is evidence for an AMH dispersal into the southern Levant occurring at approximately 115 kya (Mercier et al. 1993), but this appears to have ceased with later Neanderthal re-occupation between 70 and 50 kya (Valladas et al. 1999). An alternative route for dispersal through the Yemen and Oman suggests AMH may have entered the Gulf during MIS 6 (Oppenheimer 2009). This coincides with a lowering of the sea levels making the Bab el Mandeb strait significantly easier to cross, a theory supported by DNA research (Templeton 2002).

Migration from Arabia continued around coastal areas to South-east Asia, but if, as suspected, the Gulf was a potential refugia with abundant natural resources for early groups (Rose 2010), why did this migration not continue northwards along the Ur-Shatt River and into the Fertile Crescent? Of course it is entirely possible that the Gulf basin did not provide adequate natural resources to support human groups, thus forming an environmental barrier (that with adequate environmental evidence can subjected to scrutiny). However, another plausible explanation relates to the dynamics between Neanderthal and AMH, namely that early AMH dispersals were affected by the presence of Neanderthal groups to the north. While Neanderthal groups in the Levant appear to have prevented earlier northwards dispersals of AMH, it is possible that a similar situation in the Gulf caused AMH to migrate eastwards rather than to the north. Lower sea levels, therefore, influenced contacts between Africa and Eurasia and affected the movements of human groups between the Arabian Peninsula, Iran and India, placing the submerged Gulf palaeolandscape firmly at a crossroads of early human dispersal.

Models of marine transgression and the end of the Palaeolithic

Our present understanding of the Upper Palaeolithic geomorphology of the Gulf is mostly derived from bathymetric data and hydrological charts. More recently this has been supplemented by ETOPO2 data from satellite altimetry, enabling the refinement of earlier bathymetric models. While satellite altimetry is a coarse dataset and, therefore, less suitable for fine-scale changes such as those in shallow regions like the Gulf, when combined with additional data sources, such as the GLOBE digital elevation model, it is possible to utilise ETOPO2 data to provide a reasonably accurate, though low-resolution topographic profile (Fig. 2).

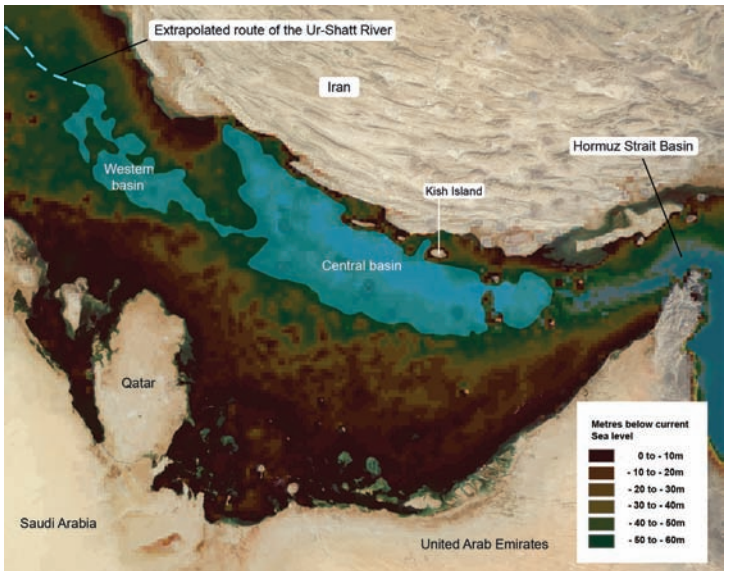

Fig. 2. The southern Arabian Gulf at C. 18,000 years ago derived from bathymetric data and satellite altimetry.

While sea levels rose steadily between about 18 kya and 14 kya, the Arabian Gulf – being relatively shallow – remained largely unaffected by marine transgression during this period, with rising sea levels affecting only the Biaban Shelf in the Gulf of Oman. Analysis of bathymetric and ETOPO2 data implies the presence of two palaeobasins in the Arabian Gulf that may have been provided with fresh water by the Ur-Shatt River. The westernmost basin (Fig. 2), located 80 km north of Qatar, is approximately 75 m below present mean sea level (PMSL) at its lowest point. The eastern end of this basin has a bar rising to a depth of approximately 60 m below PMSL that could potentially have dammed the river, forming a large freshwater palaeolake with a maximum depth of around 15 m.

Approximately 50 km further to the east there is evidence for a central basin, that at 90 m below PMSL is now the deepest part of the Arabian Gulf. At its eastern extent this central basin rises to approximately 69 m below PMSL implying that such a basin could have maintained a water depth approaching 20 m. If this was indeed the case, such a basin would have formed a fresh-water lake approaching an area of 20,000 km^2, comparable at its fullest extent to lakes such as Lake Malawi in Africa. While these palaeolakes are inferred from low-resolution ETOPO2 and bathymetric models, further study is required to conclusively prove their presence or absence. Water levels would have been entirely dependent on the topography of the river channel at the outflow of the palaeobasin. If conditions encouraged a narrowly defined channel with a rapid flow, it is likely that a deep channel was cut to the east of each basin resulting in a subsequent reduction in water level. Despite this, as a minimum, these areas were likely to have provided important resources, with wide areas of slow-moving anatomising channels and silt-rich marshlands, deltas and littoral vegetation.

At approximately 14 kya the Strait of Hormuz was subject to gradual marine incursion from the Gulf of Oman and became a narrow waterway (Lambeck 1996). By approximately 1,500 years later sea levels rose above -69 m below PMSL, flooding the central basin of the Arabian Gulf with saline water and very likely killing or displacing fresh water-dependent flora and fauna (Fig. 3).

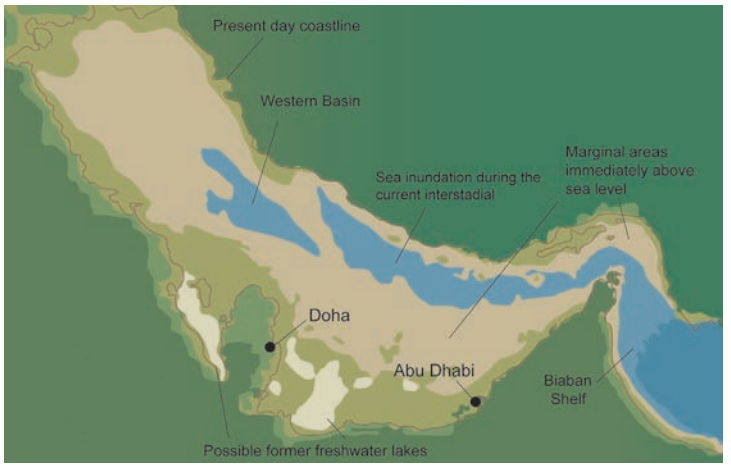

Fig. 3. Model of marine transgression at approximately 12,000 years ago (after Lambeck 1996).

Fig. 4. Model of marine transgression at approximately 10,000 years ago (after Lambeck 1996).

Models of marine transgression and the Early Holocene

Between 12,000 and 9,000 years ago much of the Gulf floor would still have remained exposed with broad *wadi* valleys and lakes present in the lower regions. (Fig. 4). Periods of still-stands were punctuated by periods of more rapid marine transgression, the rate of which was dictated by two critical factors; the first related to topography and the second to late glacial meltwater pulses. The topography between Abu Dhabi, Qatar

and Bahrain is almost flat, and in such shallow coastal gradients even relatively minor rises in sea level can affect marine transgression across large areas of land. The effects of North American late-Quaternary meltwater pulses into the North Atlantic (Lewis and Teller 2007) are much less certain.

Glacial run-off from the retreating ice sheets formed an immense, land-locked glacial lake in central North America. Known as Lake Agassiz, at its greatest this lake may have extended over as much as 440,000 km^2 (larger than any lake today). The final collapse of the Laurentide ice sheet of north-eastern North America at around 8,200 years ago (commonly termed the '8,200 year event') emptied the lake into the North Atlantic as a single meltwater pulse. Based on the analysis of stable Isotope records from the Greenland ice cores, the climatic effects of this event were sustained over a period of approximately 160 years (Thomas et al. 2007). The resulting effects may have caused sea levels to rise by as much as 7 m within a two-hundred year period. In areas with a very shallow coastal gradient, during some years the rate of coastal land lost could be as much as 1 km (Teller et al. 2000). It is not difficult to imagine that within a generation communities living on the exposed floor of the Gulf basin would have been forced to abandon homelands, moving progressively to the north and west due to constant encroachment from the sea.

The 8,200 year event also seems to have temporarily affected the North Atlantic thermohaline circulation, reducing northward heat transport in the Atlantic and resulting in a sudden decrease in global temperatures (Alley 2005). Changes in the climate of the North Atlantic appear to be closely linked to changes in the Asian monsoon, which in this instance caused temporary hyper-aridity across the Arabian Peninsula and dune mobilisation, as inferred from the OSL dating of dunes in the Rub' al-Khālī (Cuttler et al. 2007).

The melting glaciers and increased precipitation during the 2,000 years preceding the 8,200 year event had witnessed an ameliorating climate (the Arabian Holocene Sub-pluvial). Steppe conditions across the Arabian Peninsula, associated with vegetation more akin to savannah, coincided with a humidity maximum in the West African Sahara. This amelioration of the climate would have enabled coastal nomadic groups to move into the previously uninhabitable interior of the Arabian Peninsula, as implied by numerous flint sites dated to this period in the now hyper-arid Rub' al-Khali (Charpentier 2008). Studies on stable isotopes in groundwater from the Liwa aquifer, Abu Dhabi (Stokes 2003) along with speleotherm and micro-morphological analysis suggest that a temporary northward shift of the Inter Tropical Convergence Zone (ITCZ) caused a northwesterly shift of the Indian Ocean Monsoon towards the interior of the Arabian Peninsula, that resulted in increased summer monsoon-associated precipitation (Parker and Rose 2008).

While marine transgression displaced groups occupying the Gulf, an ameliorating climate from about 10,000 years ago would have enabled groups to exploit the interior of the Arabian Peninsula. However, the 8,200 year event resulting from the final collapse of the Laurentide ice sheet is likely to have both rapidly increased the rate of land lost to the sea, and temporarily caused the onset of hyper-aridity. Thus, while coastal groups were being displaced by marine transgression, groups within the interior would have been forced towards the coastal regions, and any attempt at small-scale agriculture would almost certainly have been brought to an abrupt end by the 8,200 year event. Critically, during key periods of early agricultural development such abrupt environmental changes are absent, suggesting a sustained period of climate stability a prerequisite for settlement and agricultural development (Burroughs 2005).

The 8,200 year event becomes more significant when regional flint assemblages are taken into consideration. Prior to this period technocomplexes are dominated by tanged, unifacial Fasad points and the blade technology associated with Qatar B sites, generally considered to have been produced between 11–8.5kya (Kapel 1967; Charpentier 1996). The technology of Fasad points then appears to have been replaced by pressure-flaked bifacial arrowheads and large bifacial-retouched, elongated points that are generally dated to a period after 8 kya. These are seen as part of a distinctly eastern and southern Arabian stone tool technology known as the "Arabian Bifacial Tradition" (ABT) (Uerpmann 1992; Potts 1993; Charpentier 2008). ABT sites are often found in association with Ubaid ceramics but never with the earlier Fasad points (Rose 2010).

The period after the 8,200 year event also sees a marked change in structures and architecture. Rectangular mudbrick houses form part of Ubaid settlements in Southern Mesopotamia, which also feature the first temples and the appearance of public architecture. Coastal settlements around the Gulf associated with ABT also see a development in architectural techniques. One settlement along the coast of Kuwait (H3, 7.5–7kya: Carter 2006 and Carter and Crawford 2009) includes a multi-roomed, stone-built complex. Another settlement on Marawah Island, Abu Dhabi, was an exceptionally well-built stone structure with walls surviving to over 0.7 m in height. Of particular interest is that the complex appeared to feature a corbelled stone roof. This

type of architecture has no obvious parallels with other sites of the period from south-east Arabia and has been described as unique. Dating to between 7.6–6.4kya the structure is one of the earliest in Arabia, with the main phase of occupation dating to 7.5 kya (Beech et al. 2008). Given such dramatic changes in architecture and stone tool technology, it is worth considering the possibility, that the ABT populations associated with these changes are the residue of an early Holocene population native to the region, forced out of the former Gulf basin by marine transgression around the time of the 8,200 year event.

Whatever the origins of the groups associated with the ABT, these settlements within coastal margins would have had greater access to food resources and improved opportunities for transport and maritime trade, while the island settlements also afforded natural protection. The pattern of early settlement within established coastal regions and on islands suggests that the identification of these zones in the now submerged Gulf is a fundamental prerequisite to further survey in order to ensure that research is targeted towards areas of high potential for former habitation (Fig. 5).

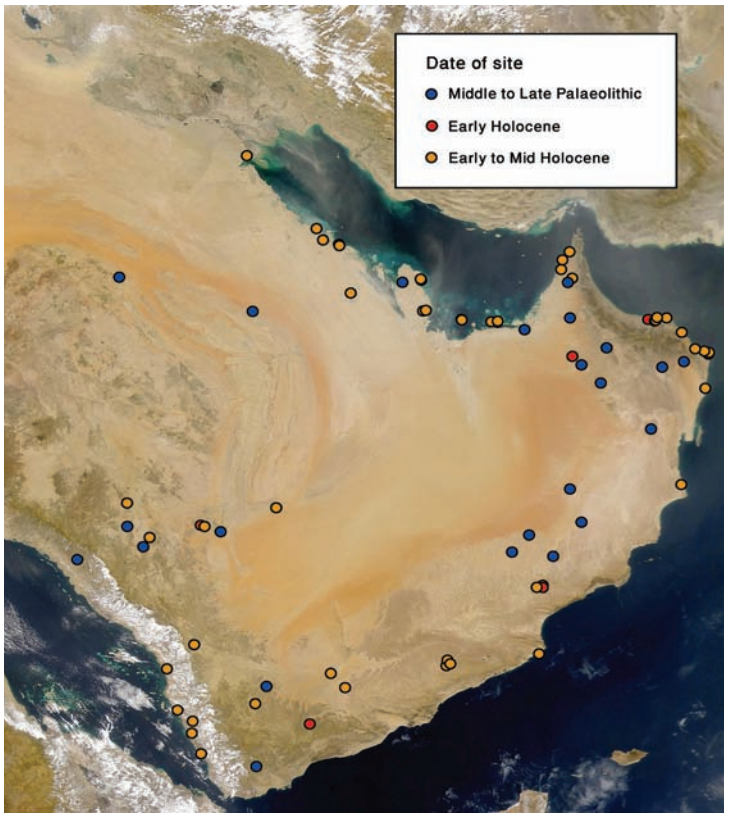

Fig. 5. Distribution of Palaeolithic and Late Stone Age sites across the Arabian Peninsula (after Rose 2004, Scott-Jackson et al. 2007 Drechsler 2009). Image reproduced with the kind permission of NASA.

Prior to 8,000 years ago (Fig. 6) land to the north-west of Abu Dhabi and around Qatar still remained relatively free from marine influence. Shallow lakes and swamps may have been present to the north-west of Abu Dhabi, although the extent to which these basins were filled with fresh water would have been dependent on local

Fig. 6. Model of marine transgression at approximately 8,000 years ago (after Lambeck 1996).

climatic conditions and the hinterland catchment area of the major *wadi* systems. An amelioration of the climate following the short-term effects of the 8,200 year event meant that the interior of the peninsula was once again able to support communities within the interior in areas that are now desert. Documented surface assemblages are typologically dated to around 7,500 to 6,000 years ago (Charpentier 2008).

Global sea level curves (Flemming et al. 1998, Bird 2007) show that after 8,000 years ago sea levels rose to within -3 m of PMSL. Sea level curves for other parts of the globe place high stands of +1 to +2 m PMSL somewhere between 7,400 and 7,000 years ago, before returning to PMSL sometime between 3,000 and 2,000 years ago. The early coastal Ubaid settlements H3 in Kuwait (Carter 2006) and MR11 on Marawah, Abu Dhabi (Beech et al. 2008) lie above the 2 m contour and are now away from the coast, implying occupation during periods of high sea levels towards the middle of the 8th millennium BP. While sea level curves from other parts of the globe provide an indication of broad trends, there is significant spatial variability across the Gulf due to the response of the Earth to glacial unloading of distant ice sheets, tectonic movement and the hydro-isostatic effects of meltwater loading on both the Gulf and adjacent areas (Lambeck 1996).

THE IMPLICATIONS OF REMOTELY SENSED DATA FOR CULTURAL RESOURCE MANAGEMENT

The suitability of current models

Marine prehistory often suffers from being 'out of sight' and therefore is often 'out of mind' to archaeologists in research terms. The absence of reliable archaeological data and archaeological prospection effectively renders the marine areas of the Gulf basin *terra incognita* to mainstream archaeology. To a certain extent, this situation reflects fairly complex logistical issues combined with the increased expense of performing extensive survey within an offshore marine environment rather than terrestrial survey. This lack of research to date is such that our archaeological understanding of the prehistoric landscape within the marine areas of the Gulf has advanced little in recent years, and, if the historic resource is to be effectively managed, the need for detailed survey is pressing. Commercial development and offshore dredging are now occurring at an increasing rate in the region and there is a requirement for archaeological information on a spatially extensive scale to aid both research and heritage management.

Whilst eustatic models based on bathymetry may provide outline representations of the former coastlines (e.g. Lambeck 1996, Kennett and Kennett 2006), the scales at which these coarse models operate make them unsuitable for the purposes of archaeological survey, interpretation or smaller-scale landscape analysis. Even when considering higher-resolution local models, the commonly utilised cell size (1.2 x 1.2 km, Shennan 2002: 513) is still too large for archaeological purposes. Although tectonic influences are considered to be relatively minor (Aqrawi 2001, Lambeck 1996), this, combined with the exclusion of important oceanographic and geological factors (such as burial and erosion) in such models, makes any resultant maps far from ideal and is likely to result in significant topographic features being overlooked.

Essentially, the information required for management of the resource is far more complex than bathymetric data sources such as ETOPO2 data can provide. Bathymetry, for example, can give us information relating to the topography of the present-day sea bed, not the former landscape surface. While bathymetry can be used to correlate topographic features to submerged landscape features – such as basins or possible islands – these data cannot be used to map parts of a landscape that no longer has a bathymetric expression. If we were to map the former fluvial systems or river deltas, for example, data regarding sedimentation and erosion would simply be absent. The issues associated with isostatic modelling and its use in archaeology and the need for mapping of the archaeological landscape based upon other methods is, therefore, essential if we are to adequately survey prehistoric features within the region.

New data to refine existing models

Within the marine areas of the Gulf many regional industries and ministries have commissioned extensive remotely sensed surveys, that can be used both for land management and for the mapping of structural traps and deep geological formations. Of particular interest to archaeological geophysicists is seismic reflection survey, that involves initiating a seismic energy source, usually a controlled acoustic signal, and collecting reflected data (Fig. 7). By measuring the time taken for a wave to travel into the earth and for the reflection to arrive at a receiver it is possible to estimate the depth of the feature generating the reflection.

When a seismic wave encounters an interface between different materials (with different impedances), some of the energy of the wave is reflected off the interface, while the remainder is transmitted through the interface and reflected from lower boundaries. From the reflected seismic waves, it is possible to estimate the changes in the composition and properties of the sediments. The archaeological potential of datasets that can detail sedimentary information, rather than simply topographic data, is fairly evident. Until recently, the potential of

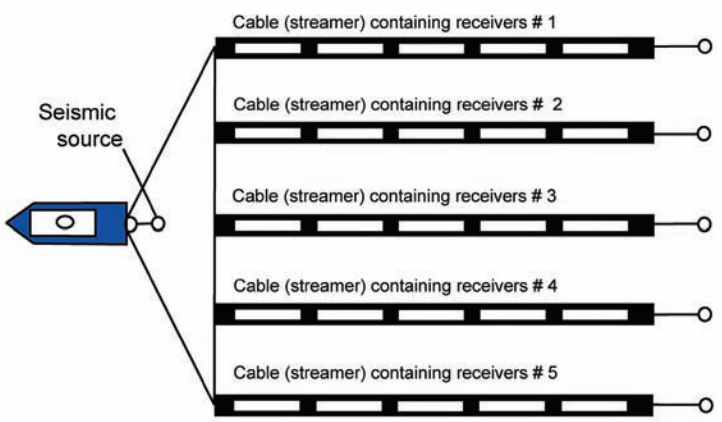

Fig. 7. Typical marine 3D seismic reflection acquisition, plan view.

these data was not explored in the Gulf. Some of the 3D seismic surveys cover extensive areas within the offshore environment and provide considerable detail. However, it is not just the extent of these surveys that is significant; the quality of data provides valuable information not usually provided through traditional archaeological prospection. Importantly, this has provided the opportunity for analysis on a large scale, and at a resolution enabling the interpretation and subsequent mapping of discrete features within the landscape.

EUROPEAN PALAEOLANDSCAPE STUDIES USING 3D SEISMIC DATA

The potential use for 3D seismic data for the purposes of archaeological prospection in marine areas was noted

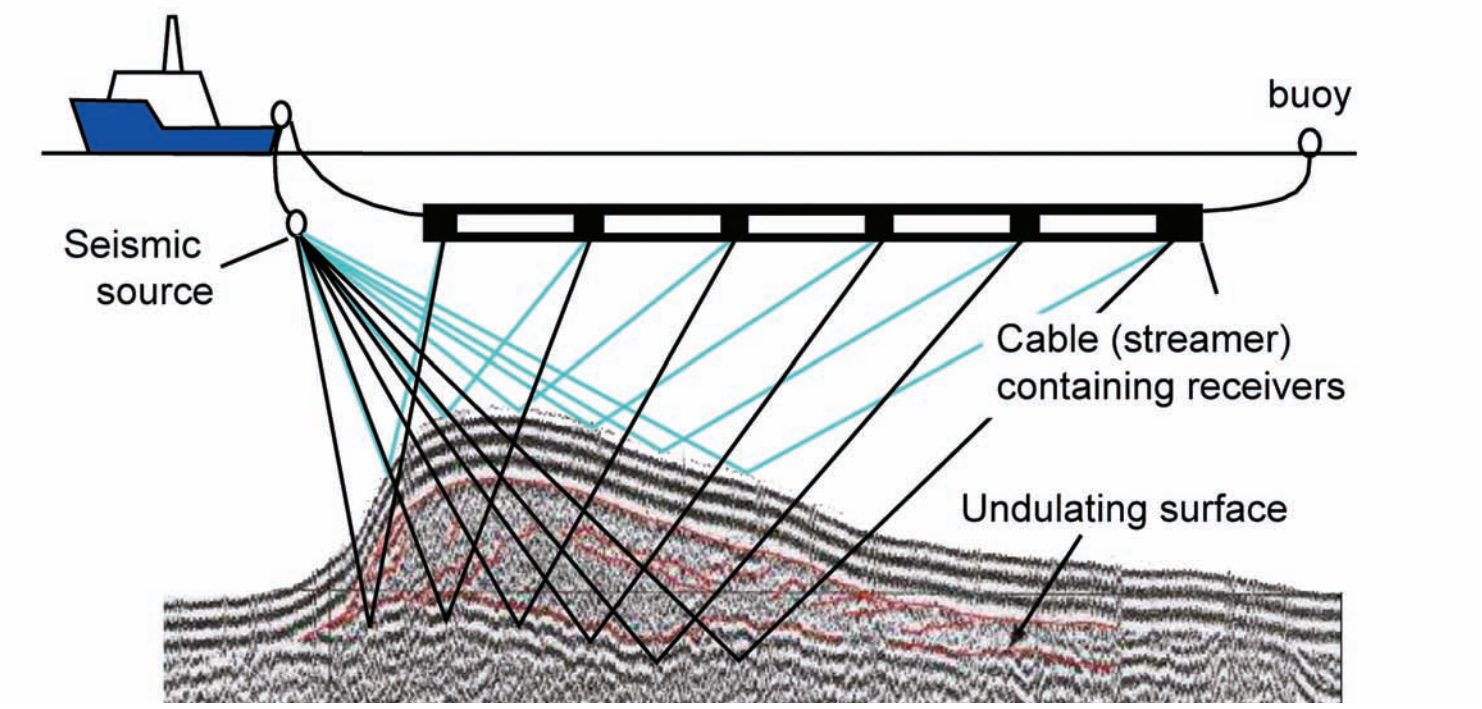

Fig. 8. Marine 3D seismic multiple reflection acquisition, vertical view with a seismic line below.

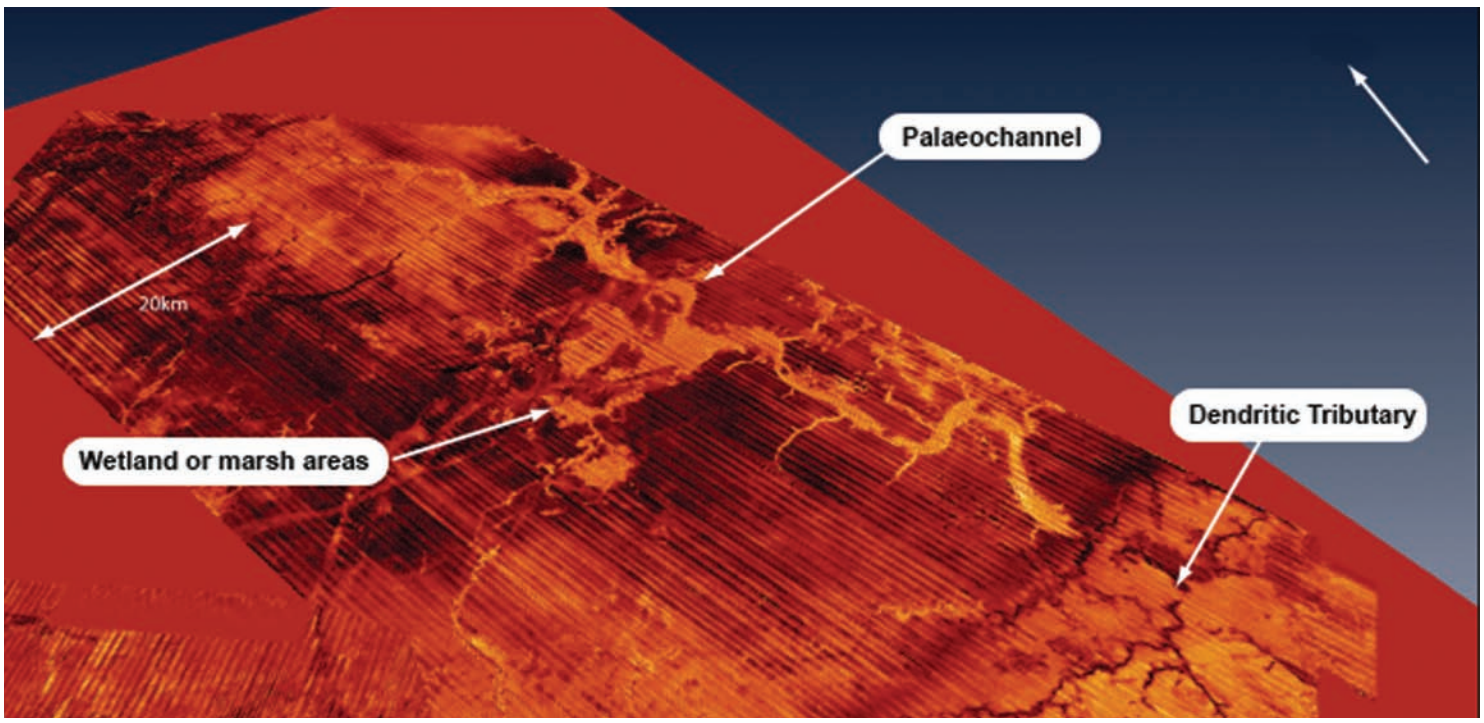

Fig. 9. A timeslice through the prehistoric landscape of the southern North Sea as derived from 3D seismic data (Gaffney et al. 2007).

more than twenty years ago (Kraft et al. 1983). However the techniques and technology to implement such studies have been unavailable until relatively recently. The application of extracted datasets for archaeological purposes on a large scale was pioneered by the University of Birmingham for the study of the palaeolandscape of the southern North Sea (Gaffney et al. 2007 and Gaffney et al. 2009). The project employed advanced visualisation and computer techniques, normally available to the petroleum industry, to image a 3D seismic dataset provided by PGS Ltd. This revealed a submerged Mesolithic landscape in unprecedented detail. Initially, the 3D seismic volumes were analysed by compiling the vertical lines (as in Fig. 8) into cubes to produce horizontal slices. The horizontal, or time, slices (Fig. 9), allowed for the observation of features in plan that were not evident within the vertical lines. However, one difficulty with the horizontal view was determining the relationship between features expressed on the timeslice. For example, abraded stream channels may relate to a whole sequence of events over many thousands of years and not to contemporary anastomosing channels as they would appear within a timeslice. By utilising the intrinsic three dimensionality of the seismic data, it was possible to resolve these issues through further analysis. To achieve this, voxel rendering of the features (Fig. 10) enabled a visualisation of the landscape in 3D which assisted the resolution of relationship and chronological issues between features within the landscape (Gaffney et al. 2007).

The resolution (12.5 x 12.5 m) of the resultant output is sufficient to perform detailed archaeological landscape analysis upon the data, revealing the presence of coastlines, estuaries and major fluvial features active in prehistory (Fig. 9). The utility of such finer resolution data to archaeological research and management when considered to that previously possible is apparent. These results add further value to existing data, significantly changing the way that heritage marine areas are perceived and interpreted; and make these submerged landscapes accessible to archaeologists for the first time. Mapping such palaeolandscapes maximises the effectiveness of future, targeted archaeological survey and provides a context into which resulting archaeological discoveries can be placed.

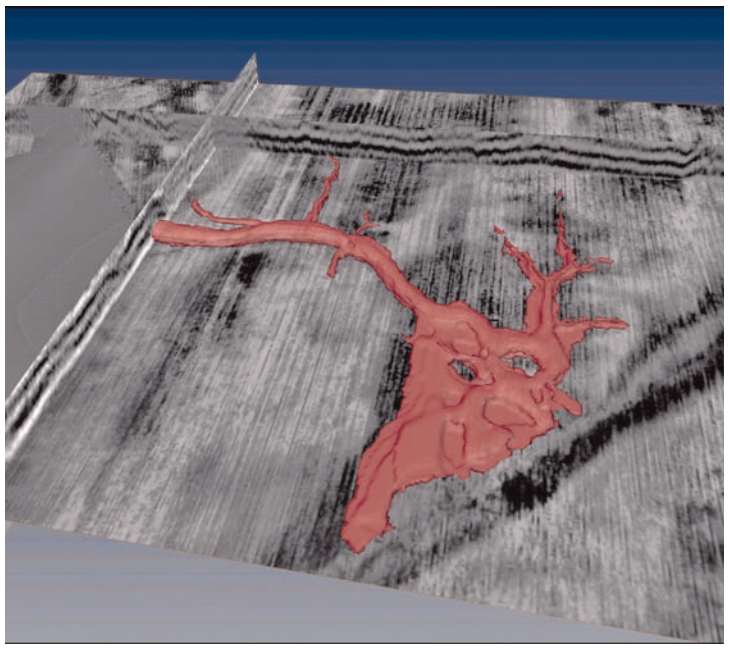

Fig. 10. A timeslice overlain by a voxel-rendered prehistoric palaeochannel, delta and submerged former river estuary from the southern North Sea (Gaffney et al. 2007).

THE GULF PALAEOLANDSCAPES MAPPING PROJECT

With agreement from regional companies, and based on the success of the analysis undertaken in the North Sea, a similar project is currently under way within the Gulf. Based in Qatar, the project is mapping the former late Pleistocene and early Holocene palaeolandscape, with plans for extending the project to other parts of the Southern Arabian Gulf. Whilst analysis of 3D seismic data may not necessarily provide direct information about discrete archaeological sites, this work will provide a platform for future research and ground-truthing. In the very near future, this will facilitate direct environmental management by identifying 'palaeoenvironmental sediment traps' within marine areas.

The purpose of this is to resolve some of the problems associated with the study of the late Palaeolithic and early Holocene within the arid environment of the Arabian Peninsula. The research aims to identify well-stratified, preserved organic deposits that are able to provide good environmental data and meaningful chronological sequences. Since marine sediments are waterlogged and generally anaerobic, the identification of marshlands, deltas and former palaeochannels within submerged areas is of major importance and identification and mapping of such deposits makes a future strategy of targeted core sampling possible and supports the testing of theories regarding the nature of the former prehistoric palaeolandscapes (as outlined at the start of this paper). Where organic remains and sediment traps are mapped, it will be possible to analyse a full sequence of environmental data, beetles, pollen, charred plant, diatoms etc. Furthermore, by radiocarbon dating this sequence, it will be possible to construct models of the regional environmental conditions and change through time.

The option to use optically stimulated luminescence dating (OSL) and radiocarbon dating on specifically targeted marine cores in order to refine regional sea level curves is attractive. Importantly, this will enable us to refine regional sea level curves since our current understanding of marine transgression within the Arabian Gulf is largely approximated from other sea level curves around the globe. Whilst raised beaches in Qatar and the United Arab Emirates are accessible for the refining of sea level curves, these only provide information about the sea level changes over the past 8,000 years. If we are to understand sedimentation relating to the entire sequence of marine transgression over the past 14,000 years then the mapping of sediments within the marine areas of the Arabian Gulf is a necessary first step.

Threat mapping and cultural resource management

Most of the threats to the Arabian Gulf palaeolandscape come from major infrastructure projects. The shallow water depths around coastal areas also make land reclamation a viable option for development, while access to new ports for larger vessels requires the dredging of deep-water channels. Currently no marine heritage assessments are being undertaken prior to large infrastructure works, and the impact of such projects on the heritage resource is simply unknown. Palaeolandscape mapping will provide information regarding areas with both high and low potential for the survival of archaeological and environmental deposits. Based on this, strategies can be developed to mitigate the impact of development.

It is likely that marine resources will be subject to increasing exploitation in future years, with an emphasis on the recovery of valuable mineral resources and possibly aggregates extraction. On land, such deposits would probably be afforded adequate mitigation. However, it would be unrealistic to consider that equal status will be afforded to marine areas. The inaccessibility of buried marine sediments does not encourage engagement or intervention (Gaffney et al. 2009). However, the fact that the Arabian Gulf is so shallow makes this region more accessible than many other areas with submerged landscapes. Archaeologists will therefore, it is hoped, be called upon to provide methodologies to assess the potential archaeological potential of these landscapes while facilitating regional development.

Issues of protection become more complicated when one considers that the Arabian Gulf is shared between the UAE, Oman, Qatar, Bahrain, Saudi Arabia, Kuwait, Iran and Iraq. However, it is hoped that the Convention on the Protection of the Underwater Cultural Heritage (ratified in January, 2009) will lend to the development of mutual standards since the identification of submerged cultural heritage and its protection is a shared concern. The convention is largely based on The United Nations Convention on the Law of the Sea (UNCLOS) which clarifies that all states have a duty to protect archaeological resources found at sea 'and shall cooperate for this purpose'. Stakeholder cooperation is fundamental, since palaeolandscapes and sediment traps are not defined by geographic boundaries or distinctions between economic and jurisdictional zones.

The study of remotely-sensed data from marine sources, therefore, will assist palaeolandscape assessment, and provide a platform for resource management and future research. The capacity to produce and utilise large spatial 3D data sets and their integration with existing data, however, also presents new challenges, that may require the development of bespoke systems or inventories that are sensitive to regional chronologies, local environments and existing data standards. The use of such inventories should therefore develop in tandem with 3D seismic palaeolandscape mapping, to inform and prioritise proactive management and protection (from designation to forward planning). Without management systems that accommodate remotely-sensed data and interpreted datasets, it is impossible to determine heritage significance for many critical historic periods or to provide an effective curation or conservation response. At the same time, the creation of such systems is a two-way process, requiring negotiation between international standards and local requirements.

The submerged landscape of the Gulf Basin and the impact of marine transgressions are, therefore, fundamental to understanding the dynamics of regional migrations and technocomplexes during the late Pleistocene and early Holocene. With access to large-scale commercial surveys, it is intended that the Gulf Palaeolandscapes Mapping Project will provide a better understanding of both the spatial distribution and character of areas formerly considered *terra incognita*, and thereby provide a platform for long-term cultural management, conservation, research and education. This study will not only radically improve our understanding of former Pleistocene and Holocene Gulf landscapes but should facilitate access to new palaeoenvironmental resources, while contributing to international debate and research on human migrations.

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