

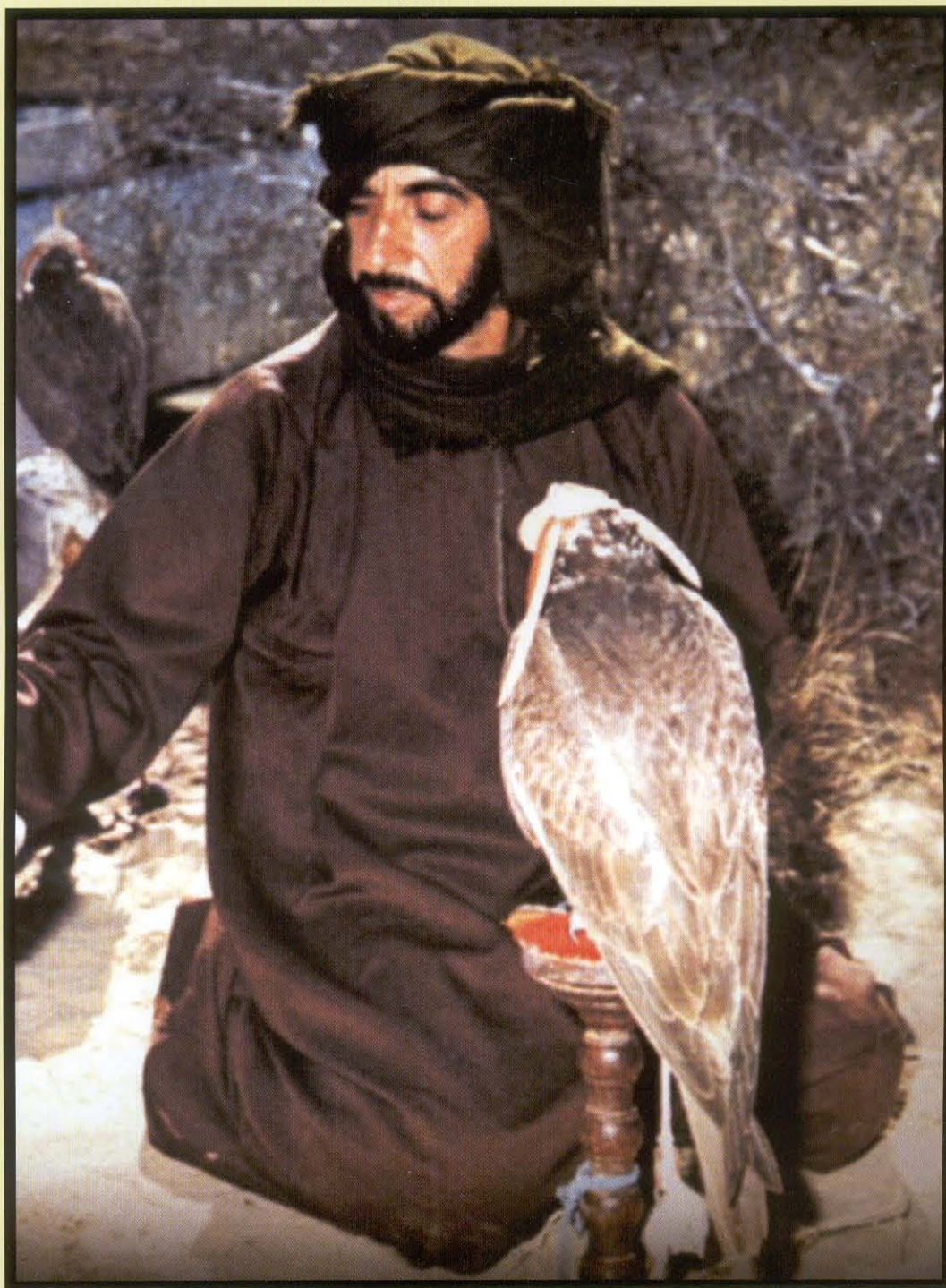
TRIBULUS



Journal of the Emirates Natural History Group

Vol. 14.2

Autumn/Winter 2004



TRIBULUS

NOTES FOR CONTRIBUTORS

TRIBULUS is the Journal of the Emirates Natural History Group and was launched in 1991. The Group was founded in 1976, and over the next fourteen years, 42 issues of a duplicated Bulletin were published.

TRIBULUS is published twice a year. The aim of the publication is to create and maintain in standard form a collection of recordings, articles and analysis on topics of regional natural history, heritage, geology, palaeontology and archaeology, with the emphasis on the United Arab Emirates and adjacent areas. Papers, short notes and other contributions are welcomed from anyone but should not have been published elsewhere. Guidelines are set out below. The information carried is as accurate as can be determined, in consultation with the Journal's Advisory Panel and referees, but opinions expressed are those of the authors alone.

All manuscripts received are reviewed by the Editorial Board and appropriate Advisory Panel members and, where appropriate, are also submitted to blind peer review.

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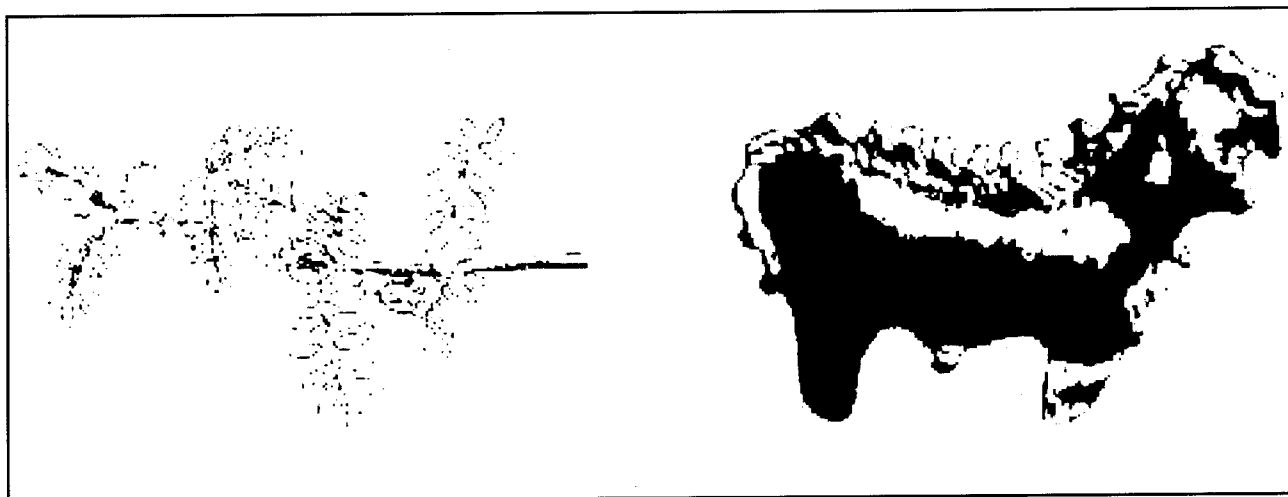
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The plant motif above is of the genus *Tribulus*, of which there are six species in the UAE. They all have pinnate leaves, yellow flowers with free petals and distinctive five-segmented fruits. They are found throughout the country, except in coastal sabkha.

The animal motif above is of a tiny golden bull, excavated from the early Second Millennium grave at Qattarah, Al Ain. The original is on display in Al Ain Museum, and measures above 5 cm by 4 cm.

Manuscripts should be submitted in electronic form, with a printed copy, typed on one side only, and double-spaced. A short abstract should precede the article, with the address(es) of the author(s) at the end. Photographs may be submitted and should be clearly captioned. Line drawings and maps, if not submitted in electronic form, should be in black ink on strong white or translucent paper. References should give the author's name, with the year of publication in brackets, and with the list of articles, showing title and publisher, in date order. Scientific names should follow customary nomenclature in Latin, while the English and, if appropriate, available local Arabic names should also be supplied.

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TRIBULUS

Vol. 14.2 Autumn/Winter 2004

Contents

Editorial.....	2
Zayed: Caring Environmentalist.....	3
<i>by Peter Hellyer and Simon Aspinall</i>	
Intertidal Archaeology on Marawah Island: New Evidence for Ancient Boat Mooring Sites.....	8
<i>by Mark Beech and Nasser Al Shaiba</i>	
Landslide Dams of Ru'us al-Jibal.....	12
<i>by Gary R. Feulner</i>	
The Traditional Mosques of Dalma, Abu Dhabi Emirate.....	23
<i>by G.R.D. King</i>	
A new species of viper described from the UAE and northern Oman.....	32
<i>by Drew Gardner</i>	
Obituary - Edward Wiltshire.....	32
Notes.....	33
Review, Publications and Research.....	34

Cover Illustrations:

Front: HH Sheikh Zayed bin Sultan Al Nahyan with a favourite falcon (*Emirates News Agency, WAM*)

Back: Fish trap on Yasat al-Sufla (*Simon Aspinall*)

The Editorial Board of TRIBULUS and the Committee of the Emirates Natural History Group acknowledge, with thanks, the support of the Group's Corporate members, a full list of whom can be found on Page 2, and without whom publication would be impossible. We also acknowledge the support and encouragement of our Patron, H.E. Sheikh Nahayan bin Mubarak Al Nahayan, UAE Minister of Education.

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EDITORIAL

This issue of *Tribulus* coincides with the passing of the UAE's first President, His Highness Sheikh Zayed bin Sultan Al Nahyan, who died on 2nd November 2004. A review of some of his direct, personal contributions to conservation and investigation of the country's environment and heritage is the first paper in the issue. It is appropriate, we believe, to pay tribute in this way to a man who was undoubtedly one of the leading Arab statesmen of the second half of the twentieth century, as well as being very much the founder of a consciousness about environmental and heritage issues in the country. The Editorial Board offer their condolences to his son and successor, HH Sheikh Khalifa bin Zayed Al Nahyan, to the Al Nahyan family and to the government and people of the United Arab Emirates.

The best way to acknowledge his work is to continue it, and we shall endeavour to continue to promote knowledge of the environment and heritage of the country he held so dear.

The second paper, by Mark Beech and Nasser Al Shaiba, represents the first detailed study of a type of archaeological site that is known to exist throughout the Gulf, but has been little reported – that of inter-tidal man-made structures. This paper reports on the discovery of several sites of this type on the island of Marawah, further evidence of the importance of this island to the UAE's archaeology. As is the case with many papers in *Tribulus*, this one may well represent only the tip of the iceberg – if its publication prompts the reporting of further sites of this type, we shall be well pleased.

The third paper is by one of our most regular contributors, Gary Feulner, who turns his attention on this occasion to the presence of 'landslide dams' in the Ru'us al Jibal. Only someone such as Gary, who has probably climbed more of the mountains in the UAE and Musandam than any other expatriate resident, could have put together a paper like this. It is easy to assume at first glance that the mountains have remained relatively unchanged for thousands of years, apart from the impact of erosion and the depletion of their natural vegetation as a result of climatic change and over-grazing. Here, as in his earlier paper on wadis that fork downstream, Gary shows that the geology is not immutable, or only changing very very slowly, but can be subject to sudden change. With the reports in the last couple of years or so of seismic tremors in the mountains, his paper is a timely reminder.

The fourth, and last of the main papers, is a lengthy study by Dr. Geoffrey King of a group of three Late

Islamic mosques on the island of Dalma. First recorded by the Abu Dhabi Islands Archaeological Survey, ADIAS, in 1992, these are the only group of their type still known to survive in eastern Arabia, and are a unique component of Abu Dhabi's architectural history. In recent years, they have been restored, and Dr. King's paper provides a detailed record of their state prior to restoration.

Our Notes section is shorter than usual this issue, because of the need to provide space for the four main papers (and even so, this issue is much longer than the now-conventional 28 pages). The single Note, by Drew Gardner, draws attention to the identification of a new species of viper, endemic to the UAE and Northern Oman, the Oman saw-scaled viper *Echis omanensis*, this now having been distinguished from Burton's saw-scaled viper *Echis coloratus*, formerly thought to be present here. The new species has been described on the basis of museum specimens – further confirmation, as if we needed any, that there is a real value to the maintaining of, and the proper curation of, museum reference collections of specimens. This is an area in which, sadly, the UAE is still lacking, although there are a growing number of specimens of various orders (insects and fishes, in particular) in private hands. We look forward, hopefully, but a bit cautiously, to the long-term establishment of some proper reference collections in the UAE in the years to come. It is right, and appropriate, that specimens of UAE flora and fauna can be found in major international scientific institutions, where they can be consulted by overseas scientists, but it is also essential that such collections are established in the UAE itself.

There is one Obituary – of a man, Edward Wiltshire, whose name is unlikely to be familiar to most readers of this Journal, even though he co-authored a paper on large moths in 1998. In a life of 94 years, he spent over 80 years of his time, when not engaged in a successful professional career in diplomacy, studying the insects of Arabia and elsewhere, an example to all those who believe that 'amateurs' can play a role in the promotion of scientific studies of natural history.

Finally, in our Review, Publications and Research section, mention is made of the PhD recently obtained by Chris Drew of the Environmental Research and Wildlife Development Agency, ERWDA, for his study of the Cape hare *Lepus capensis* in the deserts of Abu Dhabi. It is good to see some solid scientific results coming out of ERWDA's multi-faceted work. There are now quite a large number of archaeologists with doctorates on UAE topics, and we look forward to seeing more doctorates on natural history topics as well in the years to come.

Corporate Members of the ENHG

Production of *Tribulus*, and many of the other activities of the Emirates Natural History Group, including the grant programme of the Group's Conservation Fund, would not be possible without the generous support of the Group's Corporate Members, many of whom have provided consistent assistance over many years. The Editorial Board and the Group Committee acknowledge, with thanks, the invaluable support of the following companies and bodies, currently Corporate members of the Group, and all past Corporate sponsors:

Abu Dhabi Company for Onshore Oil Operations, ADCO; Al Fahim Group; Al Nasser Holdings; BP; Environmental Research and Wildlife Development Agency, ERWDA; Kanoo Group; Al Masood; Intercontinental Hotels; Jashanmal National Company; METCO; Motivate Publishing; Nama Development; National Bank of Abu Dhabi; Omeir Travel Agency; Richards Butler; Rotana Beach Hotel; URS Dames and Moore.

Zayed: Caring Environmentalist

by Peter Hellyer and Simon Aspinall



Abstract

HH Sheikh Zayed bin Sultan Al Nahyan, Ruler of Abu Dhabi and President of the United Arab Emirates, died on 2nd November 2004. Amidst his many achievements, he was an active protagonist for the conservation of wildlife and the environment and intensely keen to ensure the preservation of the heritage and history of his people. He was involved in promotion of these topics for well over half a century, commencing long before they became fashionable.

This paper focuses on his contribution as an individual, as well as a leader, to the conservation of the country's wildlife and heritage.

Introduction

The death on 2nd November 2004 of HH Sheikh Zayed bin Sultan Al Nahyan marked the end of an era in the United Arab Emirates. Sheikh Zayed had been President of the UAE since it was established in 1971, and had been involved in government since 1946, first as Ruler's Representative in the Eastern Region of Abu Dhabi, based in Al Ain, then, from 1966, as Ruler of Abu Dhabi emirate. His achievements in other spheres are outwith the scope of this paper, which will focus on his

lifelong and deep personal interest in the country's environment and heritage.

It has been noted by the Patron of the Emirates Natural History Group, Sheikh Nahayan bin Mubarak Al Nahayan, UAE Minister of Education, that Sheikh Zayed was an environmentalist long before it became fashionable to be one. His own recollections bear that out.

In a fragment of biography published a quarter of a century ago, Sheikh Zayed recalled the moment in his youth when he recognised the fact that the over-exploitation of natural resources could, and would, lead to the extinction of species.

"One day I set out on a hunting expedition in open country. My game was a large herd of gazelles spread over a wide area. I followed them and began shooting. Three hours later, I stopped to count my bag, and found I had shot fourteen gazelle."

I pondered over this a long time. I realised that hunting with a gun was no more than an outright attack on animals, and a cause of their rapid extinction. I changed my mind, and decided to restrict myself to falconry only" (1).

Sheikh Zayed was born into a world where the inter-relationship of Man and Nature was a crucial part of life itself. The time-honoured traditions of Bedu

nomadism and of the skills they involved of living off a harsh and demanding land were still the key to survival for many of the people of Abu Dhabi. Knowledge of where to find good pasture after rain, of how to find the scant water resources in the depth of the desert and of what plants and animals could provide medicines to cure ailments or food to supplement an always restricted diet was not merely useful. It was essential.

As a child, Sheikh Zayed loved riding and hunting while his lifelong fascination with the sport of falconry had already begun by the time he was eight years old (2).

Sheikh Zayed's knowledge of the environment around him led him to recognise the dangers posed by a non-sustainable exploitation of resources. He drew that insight from his knowledge of the traditional heritage of the people of the Emirates – whether dwellers in the deserts and mountains, or coastal-based fishermen and pearl-divers.

At the same time, however, Sheikh Zayed had a curiosity about scientific investigation that went well beyond a simple recognition of the need for conservation. He was interested both in ensuring the conservation of wildlife, and in learning about it.

One of the least-studied parts of the wildlife of the UAE is the bats, order chiroptera, whose nocturnal habits mean that the presence of the various species is often overlooked. Eight species of bats are now known to be present in the Emirates, and further studies may identify more.

Taphozous nudiventris, a species of sheath-tailed bat found in the Emirates, has amongst its described sub-species one, from the Al Ain area, that carries the scientific name of *zayidi*. The tale of how it came by its name provides an interesting insight into Sheikh Zayed's fascination with the process of scientific research.

The arrival in the mid-1930s of the first oil exploration teams, with their vehicles, had made it possible for areas of the desert and hinterland to be visited with relative ease. Sheikh Zayed himself had accompanied some of those teams, assigned by his eldest brother, then Ruler, Sheikh Shakhbut bin Sultan to ensure that they were able to travel freely wherever they wished. With the country beginning to open up, the first real studies of the country's flora and fauna began in the 1950s, often with logistic support provided by the holder of the onshore oil concession, the Iraq Petroleum Company, whose local subsidiary was Petroleum Development (Trucial Coast), later the Abu Dhabi Petroleum Company, ADPC, whose participants are still shareholders in the Abu Dhabi Company for Onshore Oil Operations, ADCO.

One of those early researchers was Dr. David Harrison, a specialist in Arabian mammals, who made several visits to the UAE. In 1954, Harrison visited the Al Ain area, and was invited to have dinner with Sheikh Zayed, then Ruler's Representative in Abu Dhabi's Eastern Region.

During the evening, Sheikh Zayed and Harrison were sitting out of doors, with Sheikh Zayed asking his visitor about his work that he was doing, and giving Harrison the benefit of his own knowledge of the country's wildlife. As they spoke, Harrison noted that a number of bats were flying around above them and mentioned that it would be of considerable use if he could obtain a specimen, to identify it, and to see if it was of a species, or a sub-species, not yet known to science.

Recalling their discussion over 45 years later, Harrison said that Sheikh Zayed promptly offered to get him one, called for a rifle, and, in a remarkable display of marksmanship, shot him a bat. It proved to be of a sub-species not previously known, and, in acknowledgement of Sheikh Zayed's role in procuring the specimen, Harrison gave the bat the Latin name of *Taphozous nudiventris zayidi*, and the popular name of Zayed's sheath-tailed bat (3). (Subsequently, *T.n. zayidi* has been shown to be intermediate with *T.n. nudiventris* and must be considered doubtfully valid)

In later years, Sheikh Zayed continued to display that personal interest in other ways. In the early 1960s, for example, aware that the Arabian oryx was on the verge of extinction in Oman, he arranged, just in time, for the capture of two breeding pairs for the nucleus of a captive-breeding programme.

Today, 40 years later, there are well over 2,000 Arabian oryx in captivity in the UAE, many on his own private nature reserve island of Sir Bani Yas, (along with hundreds of other endangered species like the Arabian gazelle and the scimitar-horned oryx) and a programme of exchange has been initiated with other collections worldwide in order to ensure the preservation of the different genetic strains of the species.

The recent establishment of an International Arabian Oryx Secretariat puts a final touch to the programme of the preservation of the species, and the choice of Abu Dhabi as the base of that Secretariat was a fitting recognition of the role played by Sheikh Zayed in those days, nearly four decades ago, when the survival of the species was in question.

In the late 1960s, when he became Ruler of Abu Dhabi, Sheikh Zayed created the Association for Animal Welfare, a group of rangers who patrolled – and still patrol – the deserts to ensure that there was no uncontrolled hunting. The gazelle and hare populations were immediate beneficiaries.

He continued also his own personal and active interest in falconry and conservation, not just as a participant, but as the source of numerous initiatives that have come, over the years, to have a far-reaching effect.

One was the 1st World Conference on Falconry and Conservation, held in Abu Dhabi at the end of 1976.

This, for the first time, brought falconers from North America, Europe and the Far East together with falconers from Arabia, the stronghold of the sport. It not only allowed the falconers to meet each other but also acted as a launch pad for a strategy devised by Sheikh Zayed to bring falconers into the mainstream of emerging conservation efforts.

It was at this time that captive-bred falcons from Europe first began to appear in Arabia, launching a trend that today sees most UAE falconers choosing captive-bred birds by preference.

At that conference, the promulgation of an Abu Dhabi Emiri decree was announced by Deputy Prime Minister Sheikh Sultan bin Zayed Al Nahyan which indicated that the President's interest in matters of conservation went far beyond falcons and their prey. The decree started the process of conserving the country's marine life by banning the use of explosives for fishing, a practice which had only recently begun to take place, and which was in complete contradiction with the traditional practices of sustainable harvesting of the food resources.

A few years later, on Sheikh Zayed's instructions,

the country's first Hunting Law was promulgated, providing protection to virtually all of the UAE's wildlife, with the exception of Socotra cormorants *Phalacrocorax nigrogularis*, excluded after heavy (and ill-informed) lobbying from fishermen who were concerned about the potential impact of the species on fish stocks (4).

The issuing of legislation and the establishing of new governmental structures, such as the National Avian Research Centre, in the early 1990s, followed by the Environmental Research and Wildlife Development Agency, ERWDA, later in the decade, is, of course, a function of Government, even if the personal views of leaders can prompt such decisions. Sheikh Zayed also showed in his own private actions, however, that his personal commitment to conservation was deep-rooted, an essential component of the way he looked upon the world around him.

One example is the way in which he has encouraged research into the ecology of falcons and the health of captive birds.

Sheikh Zayed was also amongst the first to discern the threats to wild populations and set in motion a variety of captive-breeding programmes for species related to falconry.

On his directives, for example, a Houbara Breeding Programme was launched at Al Ain Zoo in 1977, with the first successes in 1982. In 1989, the National Avian Research Centre, NARC, now part of ERWDA, began a breeding programme for the Asian houbara which, after a slow start, produced over 200 birds in 2004. The long-term objective, determined by Sheikh Zayed himself, is to produce substantial numbers of birds, most to be released to supplement wild stocks.

Like most responsible Arab falconers, Sheikh Zayed has long followed a practice of releasing many of his birds at the end of the hunting season. Just as the shooting of too many gazelles can endanger the survival of the animal in the wild, so can the capture of too many wild-bred falcons have a damaging effect on their species. The Zayed Falcon Release Programme, launched in 1995, and devoted to the release of wild-caught birds at the end of the falconry season, had, by 2004, seen nearly 1000 sakers and peregrines released in Pakistan and Central Asia during the peak of the spring migration. Satellite-tracking of some of the released birds indicate that some, at least, have re-integrated successfully with the wild populations.

Sheikh Zayed also moved both to ensure that wild-caught falcons lived longer in captivity, by establishing his own falcon hospital at Al Khazna, in 1985, which, by 1991, was treating nearly 3,000 birds a year. He followed this up by beginning to use captive-bred hybrids from 1993.

According to the former director of the Al Khazna hospital, Dr. Ken Riddle, "These hybrids were a phenomenal success and convinced H.H. Sheikh Zayed to concentrate his efforts on captive-raised hybrids from then on" (5).

Today, many of the initiatives on the environment and wildlife conservation made by Sheikh Zayed are enshrined in legislation, both Federal laws and Emiri decrees. In many other countries, the legislation is there, but the commitment is lacking and, as a result, conservation ranks fairly low down on the political agenda. That is, however, not the case in the UAE, where the President's personal interest ensured that conservation was, and remains, a high priority.

That personal interest was well displayed in his quick response to the identification of threats to two important sites for the UAE's bird life.

In the late 1980s, for example, increasing ease of access to the mangroves just to the east of Abu Dhabi island led to growing human disturbance. Members of the Emirates Natural History Group, who had already identified the area as being important for birds, drew this to the attention of the Group's Patron, Sheikh Nahayan bin Mubarak Al Nahayan, who then informed Sheikh Zayed. There was an immediate response. The police were ordered to patrol the area, while Sheikh Nahayan was instructed to visit the mangroves as soon as possible and to report back to Sheikh Zayed on whether Asian honeybees were building combs there. A muddy Friday morning outing by Sheikh Nahayan and one of the writers, PH, not only found honeybees (and breeding Western reef heron *Egretta gularis*), but produced a set of photographs of honeycombs that were duly shown to Sheikh Zayed the same evening.

In 1990, another message reached Sheikh Zayed, via the same route, from another ENHG member, the then Dutch Ambassador in the UAE, Willem Dolleman, a keen birdwatcher, who was concerned about the shooting that he had witnessed at an area then known as the Al Ghar Lakes, 40 km, outside Abu Dhabi on the truck road to Al Ain. The lakes, created by a damming of outflow from a neighbouring sewage plant, had emerged as a major site for wintering waterfowl, including several species of duck.

Once again, Sheikh Zayed responded, and police patrols were instituted. Later, in 1998, when greater flamingos *Phoenicopterus ruber* attempted, unsuccessfully, to breed at the site, following an approach by SA to the Deputy Chairman of ERWDA, Sheikh Hamdan bin Zayed Al Nahyan, who briefed the President, Sheikh Zayed ordered its formal protection of the site, which he requested be re-named the Al Wathba Lakes (6).

Today, managed by ERWDA, they are one of the most important wetland sites for birds anywhere in south-eastern Arabia and flamingos have now successfully raised their young here.

While he displayed an interest in conservation from an early age, Sheikh Zayed also showed a deep and abiding personal interest in the history and heritage of his country. He, of course, recognised the need for change, and worked to bring the benefits of modern development to the people of Abu Dhabi and the UAE as a whole. At the same time, however, he was always eager to advocate the necessity of preserving the fundamental traits of UAE society that have permitted its people to live in an environment where the harshness of nature itself has always made simple survival a challenge.

In one often-quoted statement, Sheikh Zayed said: "*History is a continuous chain of events. The present is only an extension of the past. 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 new generation should have a proper appreciation of the role played by their forefathers*" (7).

Sheikh Zayed learned of the ways of the people of the Emirates in his youth. As a boy, then as a young man, he imbibed the traditions and listened to the oral history of the tribesmen, the stories (half fact, half legend) which spoke of their origins and of the conflicts of the past.

Little of that is recorded in a sense that historians

would accept. There are few books that record the events, little in the way of the remains of monumental buildings to offer mute evidence of past civilisations and conflicts. Yet those tales and traditions heard in his youth must have sparked a desire in Sheikh Zayed's mind to know more of the past, for it is evident that he long had a curiosity to know more, and to contribute to the removal of the veil of ignorance that has concealed the heritage of the people of the Emirates.

Back in 1959, the arrival of a group of Danes to examine what appeared to constitute little more than piles of stones on a little island near Abu Dhabi must have seemed somewhat odd to Sheikh Zayed and his fellow citizens. Most Europeans who visited Abu Dhabi were British, and, with the exception of a few itinerant scientists like Dr. David Harrison, they were generally connected either with the oil industry or the British Government. This group, however, came from an unfamiliar country, Denmark, that had no traditional ties with the Gulf, and the Danes who arrived were clearly neither government men nor oil company employees.

The group was, of course, the first team of archaeologists ever to visit the Emirates, and the island was that of Umm al-Nar, where the team was beginning the process of uncovering the evidence of a previously unknown civilisation.

One of the leaders of the team was Geoffrey Bibby, (himself, as it happens, both British and a former employee of the Iraq Petroleum Company, the parent of Abu Dhabi's onshore oil concessionaire), who recorded later in his book 'Looking for Dilmun' how Sheikh Zayed displayed his interest in what they were doing.

Sheikh Zayed came out frequently to visit the team at Umm al-Nar, and asked hosts of questions about what they were doing, and the meaning of what they were finding in the massive collective tombs, more than four thousand years old. And, in the discussions, he tempted the archaeologists with stories of other mounds for them to examine.

"If you want to see mounds like these in their hundreds," he said, "you should come to Al Ain" (8).

The archaeologists took him up on his invitation, and visited Al Ain a few weeks later.

"Zayed's boast of hundreds of mounds was not idle," Bibby wrote. "Around us on the ridge stood quite that number, and as our eyes accustomed themselves to the landscape, we could see mounds on every crag and crest and spur, all the way to Mount Hafit itself" (9).

Fascinated by the discoveries of the archaeologists, and by the light they were shedding on the history of the Emirates, Sheikh Zayed urged Bibby and his colleagues to come and work at Al Ain, putting at their disposal some of the sparse resources then available to him. And, in a demonstration of his genuine interest in their work, he continued to suggest to them new areas in which they might look. One such suggestion, in 1962, was that they should examine a scattered heap of large stones in a desert area near the village of Hili. Bibby described the appearance of the site as *"a miniature Stonehenge, a rough circle of large stone slabs, most of them fallen but one still standing on edge."* (10)

The 'miniature Stonehenge' was, of course, the collapsed Hili Tomb, another site of major importance for the history and heritage of the Emirates. During its excavation and subsequent restoration, Sheikh Zayed displayed a deep personal interest and he was a

frequent visitor to observe the progress being made.

Subsequently, of course, the UAE has become one of the most active countries in Arabia in terms of archaeological investigations, with substantial investment being made by Government to facilitate the uncovering of the country's past.

Sheikh Zayed continued to maintain his personal interest in the topic of the country's heritage, extending not only to archaeology, but further back, too, to the study of palaeontology, the fossil record of millions of years ago.

During a visit to Jebel Dhanna in the early 1990s, Sheikh Zayed heard that a group of scientists were also staying in the Dhafra Beach Hotel, looking at fossiliferous outcrops in the region. He promptly asked to see them, and asked to be briefed upon their work. Being told that one of their discoveries was that a huge river had flowed through the area around five or six million years ago, he told them that there was an ancient tradition of a river running into the sea through what are now the great salt flats of the Sabkhat Matti.

That tradition clearly could not have come down from millions of years ago, long before Man appeared on earth, but geologists have now shown that freshwater was still discharging through the Sabkhat Matti into the sea seven or eight thousand years ago. Is the tradition, perhaps, a hazy memory of that more recent past, by which time the UAE's first inhabitants had arrived?

Similar interest was shown by Sheikh Zayed in the work of the Abu Dhabi Islands Archaeological Survey, ADIAS. Indeed, ADIAS owes its very existence to him. Back in 1991, ENHG Patron Sheikh Nahayan bin Mubarak Al Nahayan informed Sheikh Zayed that a group of British archaeologists had expressed an interest in carrying out surveys on some of Abu Dhabi's islands. Approval was promptly given, with a request that they should start work on Sir Bani Yas and Dalma.

When the team of archaeologists paid their first visit to Sir Bani Yas, in early 1992, Sheikh Zayed was on the island. Spotting them at work beginning their survey of the island, he invited them over for dinner to discuss their finds, providing them, at the same time, with useful anecdotal information on types of pottery used in the UAE in his youth.

And when, at the end of that first season of work, Sheikh Nahayan presented Sheikh Zayed with a summary report of their finds, the President promptly ordered the establishment of the Abu Dhabi Islands Archaeological Survey and provided it with regular funds so that the work could continue on a more structured basis.

In subsequent seasons of work, ADIAS identified on Sir Bani Yas the remains of a pre-Islamic Christian monastery, the first evidence that Christianity had reached the Emirates before the revelation of Islam. The archaeologists were, not surprisingly, slightly nervous as to how this discovery might be received. They need not have worried. Upon being informed, Sheikh Zayed responded by instructing that the work should continue, noting that this aspect of the country's heritage was also part of the history of its people.

Later, he continued to display an interest in a wide range of ADIAS discoveries, including most recently, the Late Stone Age village on Marawah, the oldest archaeological site yet identified in the United Arab Emirates (11), and the major Miocene fossil site near Ruwais, with its remains of four-tusked elephants and

other important finds (12).

In terms of the heritage of the UAE, it is clear that Sheikh Zayed was motivated by a genuine scientific curiosity to know more about the past. His curiosity was driven by a belief that today's Emiratis need to know of the ways of their ancestors, their lifestyle, how they survived, what resources they were able to call upon - in essence what were the circumstances that made them who they were.

Sheikh Zayed's statement about the need to understand the past in order to be able to cope with the challenges of the present and future has been cited above. Through understanding the ways of the past, he believed, the people of today are better able to recognise the significance of the changes of the modern world and, at the same time, to put them in context.

Similarly, in terms of environment and wildlife, through understanding and conserving it, he believed that Man today has a duty to maintain an evolving balance with Nature, to preserve it not merely for today's generation, but for the generations to come.

Sheikh Zayed was neither a scientist nor a historian, but in his curiosity about his own country and its history, and in his encouragement of research, he was a worthy successor to those great Arab Rulers of the past who created the cultural environment out of which came the great intellectual achievements of early Muslim Arab civilisation.

Acknowledgement

We are grateful to Mohammed Al Bowardi, Director of the Environmental Research and Wildlife Development Agency, ERWDA, for information on Abu Dhabi's "Association for Animal Welfare" and on the breeding programmes inspired by H.H. Sheikh Zayed.

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Intertidal Archaeology on Marawah island: New Evidence for Ancient Boat Mooring Sites

by Mark Beech and Nasser Al Shaiba

Introduction

This paper presents details of a new category of archaeological site which occurs in the intertidal zone on the island of Marawah. Three examples of these sites were recently discovered by Nasser Al-Shaiba during his duties on Marawah for the Marine Environment Research Centre (MERC), part of the Environmental Research and Wildlife Development Agency (ERWDA) in Abu Dhabi. Subsequently two further visits were paid to the sites by both authors to record their location and to take measurements and photographs of them.

The island of Marawah lies around 100 kilometres to the west of the city of Abu Dhabi, and is located just to the north of the Khor al Bazm (*Figure 1*). To the west is the island of Liffiyah, to the south-east the island of Junaina, and to the east the island of Abu Al Abyadh. It is around 15 km north of the main coastline and about eight km north west of Junaina. Marawah is around 13 kilometres from east-west and is a maximum of 5.5 kilometres north-south. The structure of the island is formed from relict Pleistocene limestone platforms linked by Holocene (recent) sand and beach deposits and intervening patches of *sabkha* (salt flats) (Evans *et al* 2002). ADIAS carried out a preliminary survey of the archaeological sites on the island in 1992 (King 1998). This identified a total of 13 major sites ranging in date from the Late Stone Age to Late Islamic period. More recent surveys during the late 1990's and since 2000 have added more sites to this total.

Intertidal Archaeology

Very few archaeological sites are known in the intertidal zone along the coastline of Abu Dhabi. The rapid pace of development of the coastal zone, accompanied by such activities as dredging, reclamation, landfill and new construction, means that sites where they do exist are often under threat. Many sites may have been lost as the original course of the coastline has been dramatically altered, especially during the past ten years or so.

The aim of this paper is to highlight this important new category of archaeological site in the hope that it will encourage the reporting of further examples. Such sites should be protected as they form an important link with the past heritage of the UAE when the pearl trade formed the basis of the pre-oil economy. The coastal communities of the UAE have always had a close connection with the sea and it would be a pity if all traces of these structures were to disappear. Fortunately those discussed here are located within the Marawah Marine Protected Area (MMPA), which is being managed by the Environmental Research and Wildlife Development Agency (ERWDA) in Abu Dhabi, with the objective of preserving the natural diversity and quality of the coastal marine environment for the benefit of the people of Abu Dhabi Emirate and the UAE. Although these new sites discussed here should be safe for the foreseeable future, this sadly may not be the case for similar sites elsewhere.

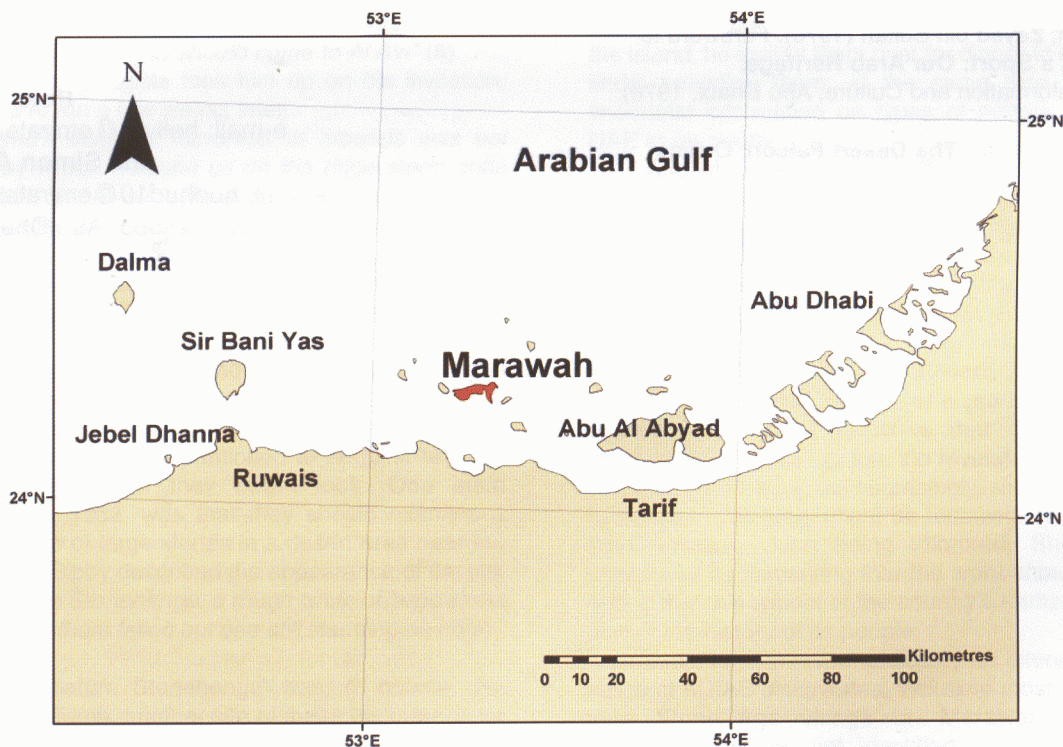


Figure 1. Location of Marawah island in Abu Dhabi emirate, UAE.

Intertidal Fish Traps

Among sites so far recorded in the intertidal zone of the United Arab Emirates are fish traps. These fall into several types.

The best known type are "*haddrah*" or "*al hadhra*". In Bahrain these are constructed over the course of one or two weeks by specialised fishermen called "*rassam*" (Al-Baharna 1986: 18). Such traps in Bahrain are often shaped like an arrowhead, the trap being perpendicular to the shoreline with the pointed end facing out to sea. However, in the UAE a variety of shapes are known, including mainly circular, pentagonal, square, "question mark"-shaped, or "banjo"-shaped traps. Such traps were made traditionally by driving a row of palm fronds and wooden stakes into the mud-sand bottom supported by stones at their base. A frond fence was then placed between these stakes out towards the outer circular/pentagonal enclosure, which in turn surrounded an inner chamber. With the receding of the tide, fish were thus channelled by the wings of the trap into first an outer, then an inner chamber. In the UAE these traps are traditionally used, especially during the summer months, to catch the blackspot snapper (*Lutjanus fulvivlamma*). Other typical kinds of fish caught using "*haddrah*" include needlefish (Belonidae), jacks (Carangidae), seabream (Sparidae), mullets (Mugilidae), barracuda (Sphyraenidae) and rabbitfish (Siganidae). Other bottom species may also be occasionally caught. The modern versions of the "*haddrah*" are usually made with steel or iron poles and wire mesh or nylon netting.

Other variants of tidal barrier traps also exist in the UAE. One is a wide fence of nets linked by wooden posts called "*sikar*" or "*sakkar*". This may be stretched across narrow estuaries or gaps in lagoons. This is particularly

used in the capture of mojarras (Gerreidae) and goldstriped seabream (*Rhabdosargus sarba*). Sometimes a second fence called "*dafaf*" is added behind the "*sakkar*", and this may catch fish like seabream (*Acanthopagrus spp.*) and flathead mullets (*Mugil cephalus*).

As traditional "*haddrah*" were made entirely of organic materials, there is little chance of identifying them in the archaeological record. However, the stone footings supporting the fence-like structure perpendicular to the shoreline leading out towards the main enclosure may still survive.

During April 1995 one of the authors (MB), along with Prof. Ernie Haerincx from the University of Ghent and Liz Popescu (née Shepherd) from the Abu Dhabi Islands Archaeological Survey (ADIAS) team, visited the island of Dalma as part of the ADIAS survey programme. Whilst travelling around the west coast of the island, less than a kilometre south of the municipal waste dump, a series of stone-built fish traps were observed. However, these do not appear to be simply stone footings for where palm frond *haddrahs* originally stood. They have quite solid stone walls constructed from the local beach rock, known locally as "*farush*". As these are located in the present intertidal zone, it is presumed that they are Late Islamic in date. Subsequent enquiries on the island regarding the antiquity of the traps produced no data. A whole series of walls appeared to project out from the shore, some were perpendicular to the shoreline, whilst others formed diagonal or arc-like shapes suggesting that the whole of the local bay was enclosed. Just below the line of the high tide was a large stone circular enclosure about 8m in diameter which had an opening on its seaward side (Beech 2003: 294, Figs.1-2).

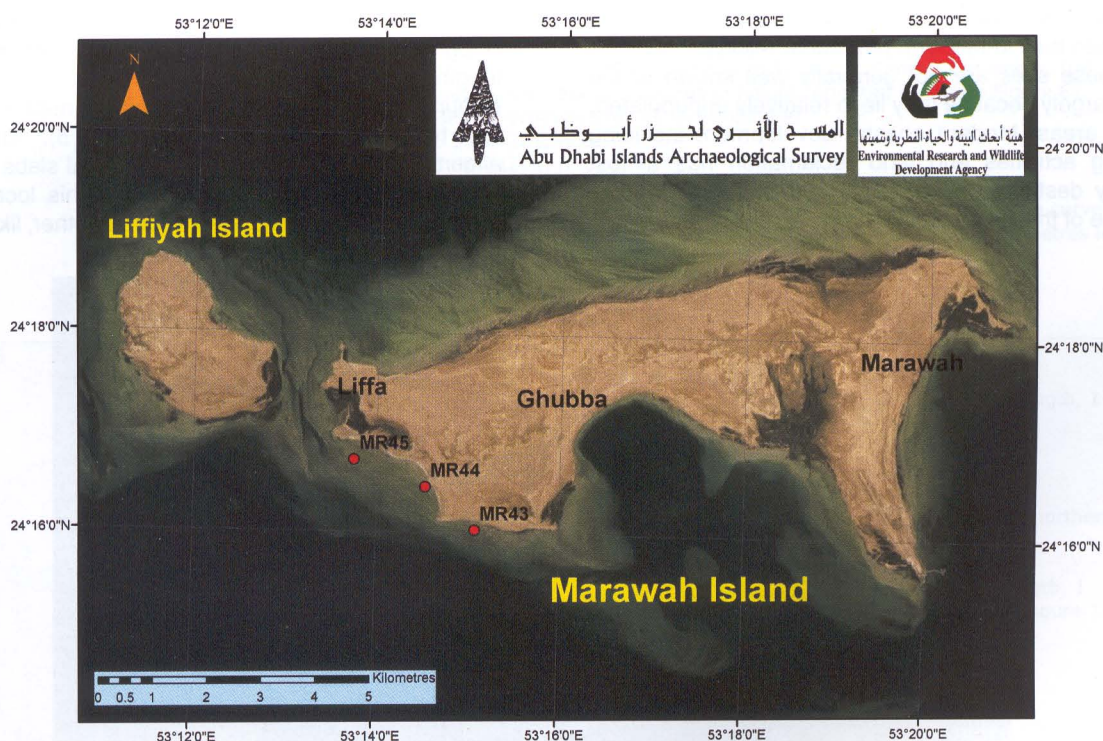


Figure 2. Location of the ancient boat mooring sites (MR43, MR44 and MR45)



Figure 3: General view south-east across site MR43. Tanya Atkinson and Karen Cooper from the ADIAS team are in the distance.

In April 2000 the first author (MB) briefly visited the island of Ghagha in western Abu Dhabi. Here he observed that a small bay on the north-west coast of the island was enclosed by a stone wall projecting in an arc to enclose the whole of the inlet. This appears to be a fish trap of the “*sika*” type but is made out of a wall of beach rocks.

Other fish traps made of stone have also been observed on other islands such as Qarnein and Yasat in the Western Region of Abu Dhabi (Simon Aspinall *pers. comm.*, back cover of this issue). The Qarnein example is located approximately 30 metres offshore, being in the angle of the bay formed by the westward turn of the coastline. It is constructed of a rough line of rocks which have been built in the form of a curve (Hellyer 1998).

These sites are not generally well known in the region largely because they lie in relatively unpopulated, remote areas. Modern coastal development including dredging activities and land reclamation has almost certainly destroyed many sites of this type along the coastline of the Emirates and it has been suggested that

surviving examples of these ancient fish traps should be preserved for posterity (Hellyer and Beech, 2001).

Stone Mooring Sites

In the spring of 2003 the second author (NAS) observed a series of three stone structures located in the intertidal zone on the south-west coast of Marawah island (*Figure 2*). Subsequent visits were made to the site by both authors in June and December 2003. The three structures are described in detail in Table 1. GPS co-ordinates are given in decimal degrees Latitude and Longitude, with WGS84 as the datum.

Site MR43 consisted of two parallel rows of stones (*Figure 3*). Part A to the north was 13.45 metres in length, whilst Part B was only 7.7 metres in length (*Figure 4*). There was a gap of about 8 metres between the two stone alignments (*Figure 5*). The stone alignments were constructed using local slabs of beach rock which had been carried out to this location and carefully placed leaning against one another, like toppled dominoes (*Figure 6*).



Figure 4: View of site MR43, Part B, with Nasser Al Shaiba.

Site MR44 consisted of two rows of stones located 6.6 metres apart (*Figure 7*). Part A was an almost straight row of stones, 8.7 metres in length, oriented N-S (*Figure 8*). Part B was a concave arc of stones, perpendicular to Part A, 12.5 metres in length, oriented NE-SW (*Figures 9-10*). These features formed a similar configuration to MR43 (cf. *Figures 5 and 11*).

Site MR45 consisted of three associated stone features (*Figure 12*). Part A was an almost straight row of 60 stones, 7.2 metres in length, oriented NW-SE. Part B was a curved arc of about 110 stones, 15.2 metres in length, oriented NE-SW (*Figure 13*). Part C was a cluster of stones ca. 2.3 metres in diameter.

These sites are all interpreted by the authors as representing ancient boat mooring sites. So why are these newly discovered stone features not fish traps? Several points seem to suggest that they are not some sort of "haddrah" or "sika". First, they are unlike the Dalma fish traps which generally join up from the present shoreline, and run perpendicular to or obliquely from the shoreline for considerable distances (often 25+ metres).

These Marawah sites stand separately some distance from the modern shoreline, between 120-250 metres out from the modern day high tide mark. The juxtaposition of the main paired walls does not resemble the usual barrier traps, and does not seem functionally to make sense as a fish trap. All three sites have a common feature in that the longer walls are generally oriented NE-SW and are located to the NW side of the complex. This suggests that the walls may have been deliberately constructed at this angle to provide shelter from the prevailing wind direction from the NW. The walls of these structures are quite solidly built and are constructed differently from the fish traps seen on Dalma. Whereas on Dalma misshaped pieces of beachrock were placed on top of one another to form an irregular wall, the examples on Marawah are constructed with large slabs of beach rock laid against one another like leaning dominos (*Figure 6*). Some of these are quite massive suggesting that the aim was to construct a substantial feature immovable by waves and tides.

SITE CODE	E	N	DESCRIPTION
MR43	53.25132	24.26724	Two rows of stones (See Figures 3-6): Part A = an almost straight row of 33 stones, 7.7 metres in length, 1.1 metres wide, and 0.7 metres in height, oriented NE-SW. GPS co-ordinates for its two ends are: E 53.25132, N 24.26716 E 53.25133, N 24.26722 Part B = a curved arc of 70 stones, 13.45 metres in length, 1 metre wide and 0.7 metres in height, oriented NNE-SSW (See Figures 4 and 6). GPS co-ordinates for its two ends are: E 53.25124, N 24.26725 E 53.25133, N 24.26731
MR44	53.24221	24.27437	Two rows of stones located 6.6 metres apart (See Figures 7-11): Part A = An almost straight row of stones, 8.7 metres in length, 0.9 metres wide and 0.6 metres in height, oriented N-S (See Figure 8). GPS co-ordinates for its two ends are: E 53.24221, N 24.27429 E 53.24221, N 24.27437 Part B = Perpendicular to the above row of stones is a concave curved arc of stones, 12.5 metres in length, 0.65 metres wide, and 0.8 metres in height, oriented NE-SW (See Figure 9-10). GPS co-ordinates for its two ends are: E 53.24213, N 24.27439 E 53.24225, N 24.27445
MR45	53.22923	24.27875	Three associated stone features (See Figure 12-13): Part A = an almost straight row of 60 stones, 7.2 metres in length, 1 metre wide and 0.55 metres in height, oriented NW-SE. GPS co-ordinates for its two ends are: E 53.22926, N 24.27870 E 53.22923, N 24.27875 What looks like an old abandoned steel buoy is located at the northern end of this row of stones. Part B = a curved arc of about 110 stones, 15.2 metres in length, 1 metre wide and 0.75 metres in height, oriented NE-SW (See Figure 12). GPS co-ordinates for its two ends are: E 53.22916, N 24.27878 E 53.22924, N 24.27892 Part C = a cluster of stones ca. 2.3 metres in diameter with a height of 0.7 metres. GPS co-ordinates: E 53.22932, N 24.27882

Table 1: Sites MR43, MR44 and MR45 on Marawah

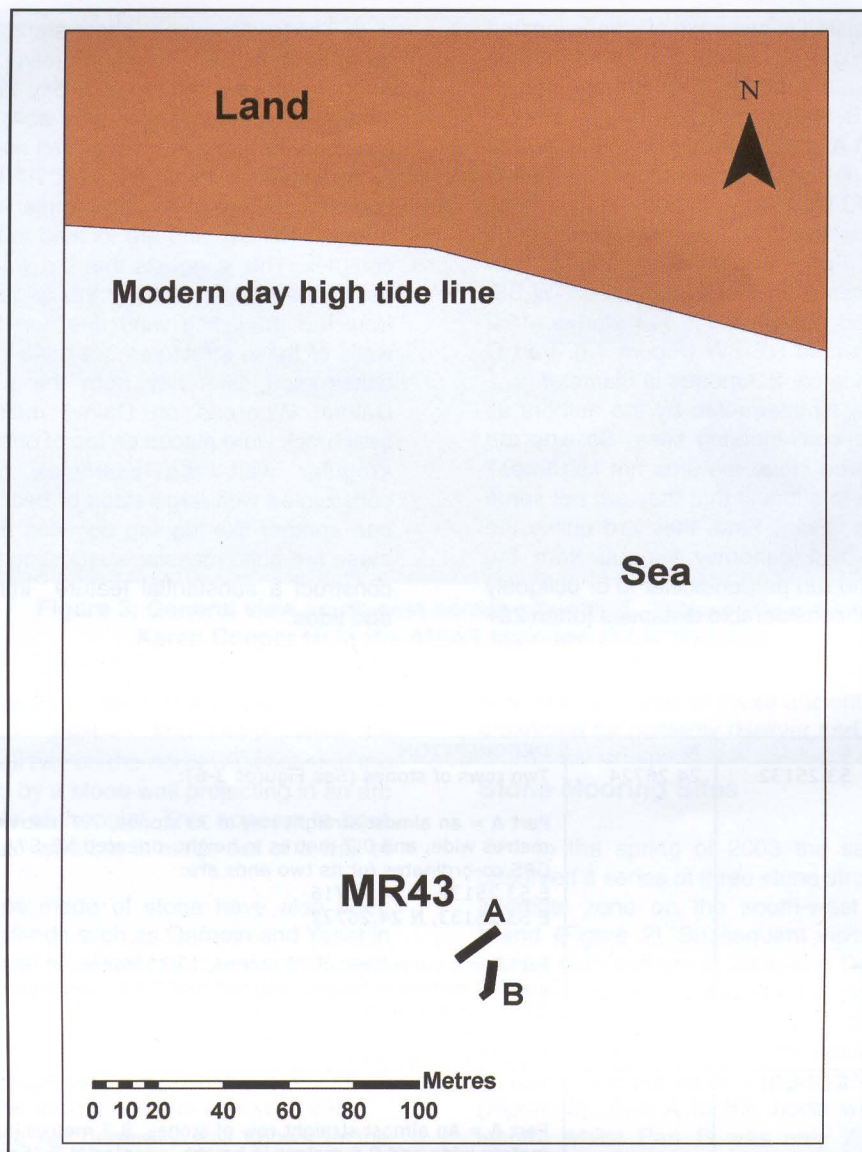


Figure 5: Plan of site MR43.



Figure 6: Close-up of part of the structure at site MR43, Part B.

Figure 7. General view of site MR44 looking SW.



Figure 8. View of site MR44, Part A.

Figure 9. View of site MR44, Part B.



It seems likely that these structures may have been some sort of mooring sites for small traditional boats. The second author was informed by Ahmed Hathbour Al-Rumaithi, whose family are from the nearby village of Ghubbah, that these stone structures had been once used by the island community. They had been apparently utilised as mooring jetties by the pearling boats as they sought shelter on the island. Their location on the southern side of the island would have certainly provided excellent shelter from the fierce north-westerly ("shamal") winds.

Stone Jetties on Abu al-Abyadh

Similar man-made jetties have been identified by ADIAS on the island of Abu Al-Abyadh. These were described as follows:

"At least four probable man-made jetties have been located, two at Site ABY 30, and at Sites ABY 41 and ABY 42, with a further possible structure at ABY 18. All of these are at least 10m long, and so would have been well suited to the mooring of traditional boats such as "houre", "baggarah" and large fishing vessels" (Hellyer & Hull 2002: 31-32).

Site ABY 18 (E 53.87556, N 24.26262) comprised a sparse scatter of pearl oyster (*Pinctada radiata*) shells, an extensive scatter of Late Islamic pottery, a hearth and an adjacent rock-built jetty (Hellyer & Hull 2002: 33).

Site ABY 30 (West end = E 53.73931, N 24.23588; East end = E 53.74094, N 24.23551) consists of two lengths of arranged, locally derived stones, around 80 metres apart and each extending from natural outcrops on the shoreline out into the sea for c.20 m. They are each c.1.0m wide, around 3-5 courses high and c.1.0 m in elevation (Hellyer & Hull 2002: 35).

Site ABY 41 (E 53.70345, N 24.21661) is a small jetty observed offshore just to the west of Khor Abu Al Abyadh. It is not visible at high tide. It is a slightly curvilinear arrangement of local stone blocks (typically 0.5m across), forming a feature c.40m long x c.1m wide. This feature extends from a rock outcrop and runs in an approximately east-west direction, and thus parallel to the shoreline (curving slightly towards it), at a distance of around 25m from it (Hellyer & Hull 2002: 36).

Ali Mattar al-Rumaithi, a UAE national who spent much of his childhood on the island, remembers such types of sites being used as jetties for small local craft (Hellyer & Hull 2002: 35).



Figure 10. View of site MR44, Part B, with Nasser Al Shaiba and Simon Aspinall.

Conclusions

The newly discovered ancient mooring jetties on Marawah will now be protected within the Marawah Marine Protected Area and represent excellent examples of such sites, intimately connected with the maritime heritage of the UAE.

Several of those noted above are not visible at high tide such as the fish traps on Dalma and stone jetties on Abu Al Abyadh, and further surveys of the archaeology of the intertidal zone should be undertaken. This is particularly relevant to the shallow waters of the Abu Dhabi coastline. Many sites may have been overlooked during previous surveys if coastal areas are not surveyed at low tides then sites can be missed. Those on Dalma and Abu al-Abyadh were missed during the initial surveys carried out on the islands.

Dating of these sites is difficult. However, they presumably date to a period when sea levels had reached roughly their present level, i.e. to the later Islamic period, or to the last couple of hundred years or so. Archaeological sites on the coast of Marawah in the vicinity of the sites on this island have pottery from this period (King 1998).

The authors would be grateful for information concerning any further sightings of man-made stone structures in the intertidal zone. These should be reported to the Abu Dhabi Islands Archaeological

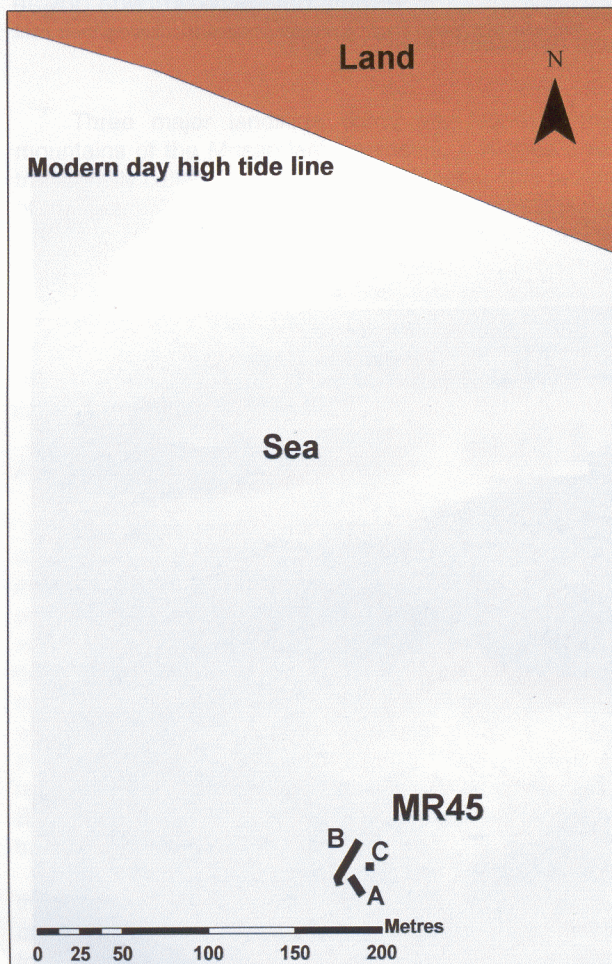


Figure 12. Plan of site MR45.

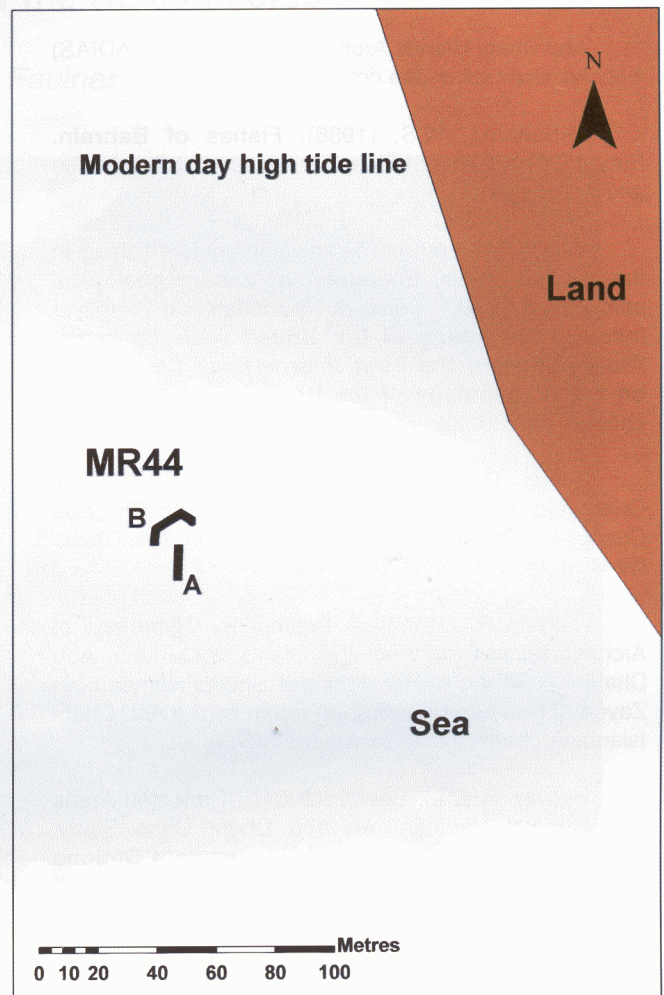


Figure 11. Plan of site MR44.

Survey (ADIAS), P.O. Box 45553, Abu Dhabi, United Arab Emirates – tel: +971 (0)2 6934515 – fax: +971 (0)2 6810008 – email: adiaz@erwda.gov.ae – website: www.adiaz-uae.com. Reports should preferably include photographic evidence and the GPS co-ordinates in the following format, Eastings and Northings in decimal degrees, with WGS84 as the datum setting.

All information submitted will be incorporated into the Archaeological Sites Database managed by ADIAS. This forms a component of the Abu Dhabi Environmental Database being developed by the Environmental Research and Wildlife Development Agency (ERWDA) in Abu Dhabi.

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Figure 13. View of site MR45, Part B.

Landslide Dams of the Ru'us al-Jibal

by Gary R. Feulner



Fig. 1: The Al-Yabbanah landslide dam as seen from Wadi Bih.

Three major landslide dams are found in the mountains of the Musandam Peninsula, a rugged area traditionally called the *Ru'us al-Jibal* (literally, "the heads of the mountains"). In each case a substantial landslide – amounting to the collapse of a steep rocky hillside – has blocked a large wadi, stopping or impeding the flow of water, with the result that subsequent intermittent floodwaters have accumulated behind the dams and deposited silt, forming, over time, a large, flat and relatively fertile plain that in two cases has been used for cultivation into the modern era.

Al-Yabbanah

The most readily accessible of these landslide dams is at Al Yabbanah, alongside Wadi Bih. Just before the United Arab Emirates border checkpoint in Wadi Bih, where (at the time of this writing) the paved road ends and vehicle number plates are often recorded at the gate, if you look left, above and behind the buildings of a small settlement at the base of the mountain slopes, you will see what appears to be a horizontal wall of large, angular boulders, resembling, (for those observers raised in cooler climes), a glacial moraine (Fig. 1). Behind this wall the steep-sided trough of a large tributary wadi obviously continues.

Closer inspection reveals that the "wall" is in fact the downstream edge of a broad, almost circular mound, ca. 300m in diameter (Fig. 2). This shape is testimony to its probable origin in a single, locally catastrophic, event, the distribution of the debris portraying a sort of bell curve representing the distribution of momentum of the collapse, probably of a relatively steep, cliff-like

slope. The accumulation of debris by more continuous, gradual, downslope processes, or by the collapse of a gentler slope, would have produced instead a characteristic fan shape.

The surface of the dam consists of angular blocks with interstitial angular gravel and negligible soil development (Fig. 3). The largest block is estimated to have dimensions of 15m x 15m x 8m. The top of the dam, at an elevation of 300m (as determined by GPS), rises 20m above the flats behind it, but sediment has accumulated behind the dam to such an extent that there is today an elevation change of approximately 40 metres from the upstream side to the downstream side of the dam.

The shape of the dam has been modified, but perhaps not greatly, by the flow of water over one or both of the low points at the banks (at the NW and SE margins of the dam). The main watercourse follows the north bank of the wadi and today breaches the dam at its NW end, where it first channels the accumulated silt and then descends more steeply through boulders and coarse rubble. The other low point, at the SE end of the dam, is somewhat higher and probably no longer serves as an overflow, but silt still collects in the area behind it.

The silt plain behind the dam extends for a maximum of 500m upstream. It has not been cultivated during the last decade, but there is evidence for the cultivation of at least a few small, stone-walled plots in the past. One impediment to cultivation appears to be the active tongue of coarse gravel that impinges on the south edge of the flats from a steep wadi to the south (Fig. 2).



Fig. 2: The Al-Yabbanah landslide dam as seen from the slopes to the NW (the area of origin).



Fig. 3: View to the NW across the top of the Al-Yabbanah landslide dam, showing the area of origin.

The origin of the landslide was the collapse of a 400m cliff to the NW of the current dam, where several long, steep tongues of scree are now present (Figs. 1 and 3). Field evidence supports the inference that the original cliff face was probably a relatively steep rampart. To the west of the most prominent scree slope is a zone of angular rubble, and above it, at ca. 550m elevation, is a 300m long shelf on which is perched a ridge of large, angular boulders similar to those of the landslide dam itself. Above this is another scree slope. Thus it appears that the slide involved the collapse of bedrock from an elevation at least as high as 650m, into the wadi at less than 250m.

As is the case throughout the Ru'us al-Jibal, the bedrock at Al-Yabbanah consists primarily of well-bedded, shallow water carbonate sediments (limestone and dolomite). The bedding planes are sub-horizontal, dipping gently to the SE, but a system of steeper (ca. 40°) fracture planes is evident in the rocks to the north

and west of the landslide dam, also dipping SE and cutting across the bedding (Fig. 1). It may be on one or more such fracture planes that the landslide detached.

A high angle geological fault trending N-S has been mapped to within 1-2km both north and south of Al-Yabbanah (Le Metour *et al.* 1992) and may continue through the landslide area. The landslide is very near the UAE-Oman border and was unfortunately not mapped as part of the same exercise, which was done under Omani auspices and did not include uncontested UAE territory; no similarly detailed geologic maps are generally available for the UAE. An alternative possibility is that high angle faulting extends to the Al-Yabbanah area from Wadi Shah, to the NNW. A fault relationship could not be confirmed by field investigation at the landslide site alone, although bedding orientation is somewhat disturbed in the rocks immediately to the south of the landslide dam.

As-Sayh

The most often visited of the major landslide dams, but seldom recognised as such, is at As-Sayh (the current road sign says "As-Saye"), a fertile, silty plain at ca.1150m in the mountains south of Khasab, Oman (Fig. 4). The graded road from Khasab to Jebel Harim (and beyond to Wadi Bih and Rawdhah Bowl) passes through the flats at As-Sayh, which has dimensions of approximately 1500m x 350m. Most visitors are surprised to encounter this singular feature but never ask themselves about its origin.

Where the ascent road enters As-Sayh (at the north end), it crosses over a debris dam, giving the visitor an initial view of the plain from a slightly elevated perspective and creating the impression that As-Sayh is an internal basin, fed by wadis from the south, east and west. It is, however, this debris dam itself that has blocked the course of the former exit wadi, which once flowed steeply downhill from As-Sayh and north to Khasab, falling 900 m in its first 7km. The road from Khasab follows this route and the attentive observer will have noticed, just before arrival at As-Sayh, that the wadi along which the graded road ascends appears to end abruptly in a wall of coarse debris (Fig. 5), unlike the bedrock through which it has climbed to that point. The debris dam is surmounted by several short switchbacks ending in the view of As-Sayh.

The landslide at As-Sayh stretches some 700m from head to toe. (Fig. 6). It fell from a ridge to the west, along moderately east-dipping bedding planes in the massive limestone sediments, and it blocked the wadi at a relatively narrow point. This was evidently a single event but it appears to have been more of a slide than a fall, since the overall form is that of a tongue and numerous larger blocks can be seen at the uphill end, having not travelled downhill with the rest. The original landscape probably resembled the same ridge as it exists today further to the north (to the right of the landslide in Fig. 6). Geological mapping reveals that an extensive high angle fault passes through As-Sayh from north to south (KSEPL 1974, Le Metour et al. 1992). As discussed below, it is reasonable to suppose that this fault played a role in localising the landslide.

It is possible, if not probable, that floodwaters that accumulate at As-Sayh dissipate in part via subterranean drainage, in addition to evaporation. Subterranean channelling would be the rule, not the exception, in carbonate terrain like that of the Ru'us al-Jibal. In this case, however, two factors may impede subterranean drainage. First, the dried silt from previous floods at As-Sayh will tend to form an impermeable seal preventing underground seepage by subsequent floodwaters. This has been the experience at man-made dams in the area. Second, it has been reckoned from a preliminary speleological survey that most subterranean fissures in the Ru'us al-Jibal, many of which might otherwise constitute potential cave passages, are today blocked with silt (Borreguero & Jeannin 1990). This is attributed to the relatively low rainfall regime in the area for the past 5,000 years or more.



Fig. 4: The plain at As-Sayh, seen from the SSW.



Fig. 5: The wadi along which the graded road ascends to As-Sayh ends in a wall of debris that is the base of the landslide.

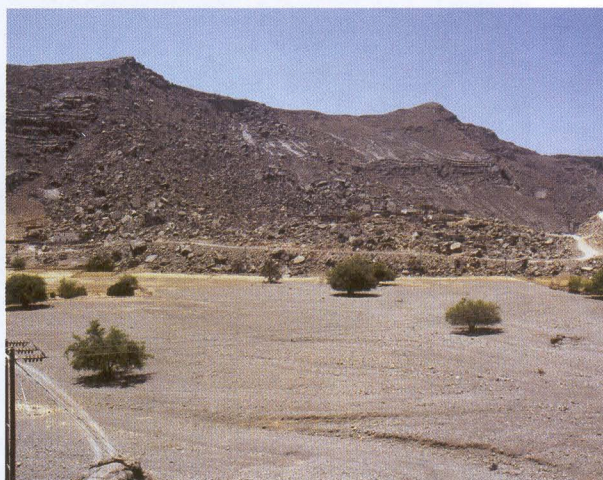


Fig. 6: The landslide dam at As-Sayh, from the SE. Note the houses built among the lower landslide blocks. From the low point at the right, the main road and wadi descend to the right rear.

"Palm Paradise"

The most picturesque of the three landslide dams is located at 750m in the Lahsah area in an upper tributary of Wadi Shah, itself a tributary of Wadi Bih (Fig. 7). The silted plain behind the dam measures approximately 200 metres square and supports an estimated 150-200 cultivated palms, at least one cultivated fig, and scattered, naturally occurring *Ziziphus spina-christi* and *Acacia tortilis* trees. All this is set between steep wadi walls, shielding it from view even from many elevated vantage points within the surrounding mountains, creating the impression of a veritable Shangri La. Reliable information about local nomenclature is not readily available, although it has been called "Palm Paradise" by English-speaking visitors.

The silt plain is variably barren or vegetated. Ground cover in March 1999 was primarily grass and scattered shrubs, but a visit after rains in January 2001 revealed dense, tall (30cm) growth of the wild mallow *Malva parviflora*. There is evidence of ground cultivation on the plain in the past, in the remains of shallow underground irrigation channels, traces of ridges and furrows, and the presence of the land snail *Xeropicta mesopotamica*, which in the UAE is normally associated with traditional agriculture. However, it appears that ground cultivation in the immediate vicinity is currently concentrated at a hillside site nearby (shown in Fig. 8) that has been refurbished with the help of expatriate labour.

The wadi at Palm Paradise flows from NNE to SSW, and the landslide represents the collapse of the original north bank of the wadi along a length of approximately half a kilometre. The silted plain has formed at the upstream end of the landslide, behind (i.e., to the east of) a NW-SE ridge of angular boulders and rubble, supported in part by a bedrock ledge and having its crest an estimated 10 metres above the plain (Fig. 7).

Just west of the ridge, a tributary entering from the north has cut a trough, emphasising the dam-like character of this barrier. But in fact the landslide is much larger: downstream it consists of a mantle of large, angular carbonate blocks that spill from the "fresh" faces of sub-vertical cliffs at ca. 850m to the wadi bed at ca. 600m (Figs. 8 and 9).

At Palm Paradise, as at Al-Yabbanah, the landslide dam is lowest at the two banks of the wadi. However, unlike Al-Yabbanah, the dam at Palm Paradise does not appear to have been breached by floodwaters. The main channel follows the south bank of the wadi, as is evident from the distribution of debris after minor flooding, but even the lowest point at the SE end of the dam remains some 2-3m above the level of the plain. There is, however, a sunken terrace level in the silt at the SE end of the dam, as well as evidence of subsidence, and it seems likely that shallow subterranean drainage occurs in this area.

A number of smaller landslides are present nearby, in upper Wadi Shah, where they are associated with detachment along steeply dipping bedding planes (Fig. 8). The Palm Paradise landslide is evidently of a different sort and may owe more to karst phenomena, i.e. the extensive subterranean erosion that typically occurs in carbonate rocks in the presence of water. In support of this hypothesis, an excellent example of stalactite curtains, formed in a subterranean environment, can be seen at the base of the cliff face at the head of the landslide (Fig. 10), as first pointed out by Geoff Cosson of the Dubai Natural History Group. These deposits have the potential to permit radioisotope dating of their time of formation (which would represent a wet interval in the climatic history of the area) and thereby establish a maximum age for the landslide. However, consistent with evidence from the Jebel Akhdar of Oman, it would be expected that the growth of stalactites might have ceased more than 6,000 years ago (Uerpman & Uerpman 2003).



Fig. 7: Palm Paradise seen from the NW, showing the landslide dam. Ground cover in this March 1999 photo is mostly grass.



Fig. 8: The landslide and escarpment at Palm Paradise seen from the ENE. The silt plain with palms, shown in Fig. 7, is below and to the left of centre, partly obscured, and the plain is barren in this February 2002 photo. Other landslides along steeply dipping bedding planes in Wadi Shah can be seen at the left rear. At the right are higher fields recently refurbished for cultivation.

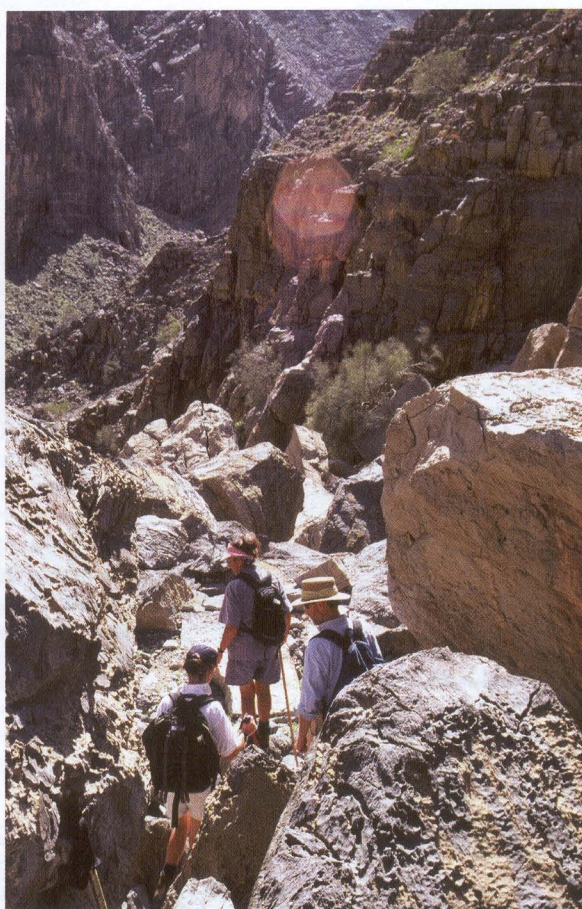


Fig. 9: Negotiating the Bedu trail along the lower edge of the landslide at Palm Paradise.



Fig. 10: Stalactite curtains at the base of the vertical cliffs above the Palm Paradise landslide.

Discussion

The age of the three landslides is unknown and could possibly differ by an order of magnitude. The nature of the phenomena and the sedimentary deposits at issue do not lend themselves to conventional absolute dating techniques. Most likely the dams do not pre-date the last glacial maximum, which reached its peak ca. 18,000 years ago, and therefore they are probably measured in thousands of years. As-Sayh is probably the oldest, judging from the size of the silt plain that has developed behind it.

In principle, the age of the dams could be estimated from the thickness of the sediment accumulated behind them, based upon the average annual rate of sedimentation, but in practice the latter parameter is itself unknown and highly speculative. Even seemingly very low rates of sedimentation, however, would be consistent with a post-glacial origin. For example, an average sedimentation rate of only 1mm per year would yield a full metre of silt every thousand years.

As to the causes of the landslides, it is reasonable to suspect that they may be related to the tectonism responsible for the geologically rapid uplift and warping of the Ru'us al-Jibal, and that they may have been triggered by minor earthquakes. But if tectonism *per se* was a sufficient explanation, more than three such examples might be expected.

Different rock units are involved in each of the three landslide dams - Permo-Triassic at Al-Yabbanah, Triassic-Jurassic at Palm Paradise, and Jurassic at As-Sayh - but in each case the landslides are situated on or immediately adjacent to one of the many high angle, N-S or NNE-SSW trending faults that characterise the Ru'us al-Jibal (KSEPL 1974, Le Metour *et al.* 1992). In each case, too, the relevant fault is sufficiently large that its trace has been mapped for more than 10km horizontally. As-Sayh sits astride such a fault and Al-Yabbanah appears to do the same. Palm Paradise is situated at or very near to what has been mapped as a lower angle thrust fault (Le Metour *et al.* 1992) and is only a kilometre from the high angle fault that defines upper Wadi Shah (KSEPL 1974).

It seems fair to conclude from this that faulting within the rock units of the Ru'us al-Jibal has been a significant factor in creating zones of weakness susceptible to landslides. Major faults have probably also served to focus the effects of tectonic forces. In addition, movement on specific zones of weakness may have been facilitated by intermittent saturation and/or dissolution in a wetter climate (e.g. the Climatic Optimum of 6,000 to 10,000 years ago), as seems indicated in the case of Palm Paradise.

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The Traditional Mosques of Dalma, Abu Dhabi Emirate

by G.R.D. King

Ground-plans and elevational drawings by David Connolly

Dalmâ island is situated 40 kms off the mainland of the Western Region of Abu Dhabi¹. It is by far the most heavily populated of Abu Dhabi's islands, with its people originating from among the mainland tribes of Abu Dhabi and *huwâla* Arabs from the Iranian coast. Its principal town, also called Dalmâ, is at the southern tip of the island, an area where there has been settlement since the Late Stone Age, thanks to the presence of plentiful sweet water reached by shallow wells. During a survey of Dalmâ by the Abu Dhabi Islands Archaeological Survey (ADIAS) in 1992, three mosques, the Muhammad b. Jâsim al-Muraykhî mosque, the al-

Dawsarî mosque and the Sa'îd 'Alî al-Muhammadî mosque, and a commercial building, the Bayt al-Muraykhî pearl-house, were recorded. They are all in the old town centre and they are all built in traditional regional style².

An inscription in one of these buildings, the al-Dawsarî mosque, gives a foundation date of *Shawwâl*, 1349/March, 1931. There was also a *graffito* in the Sa'îd 'Alî al-Muhammadî mosque (formerly known as the Sa'îd 'Alî al-Qubaysî mosque) dated to 1377/1946, which gives a *terminus ante quem* for this building.

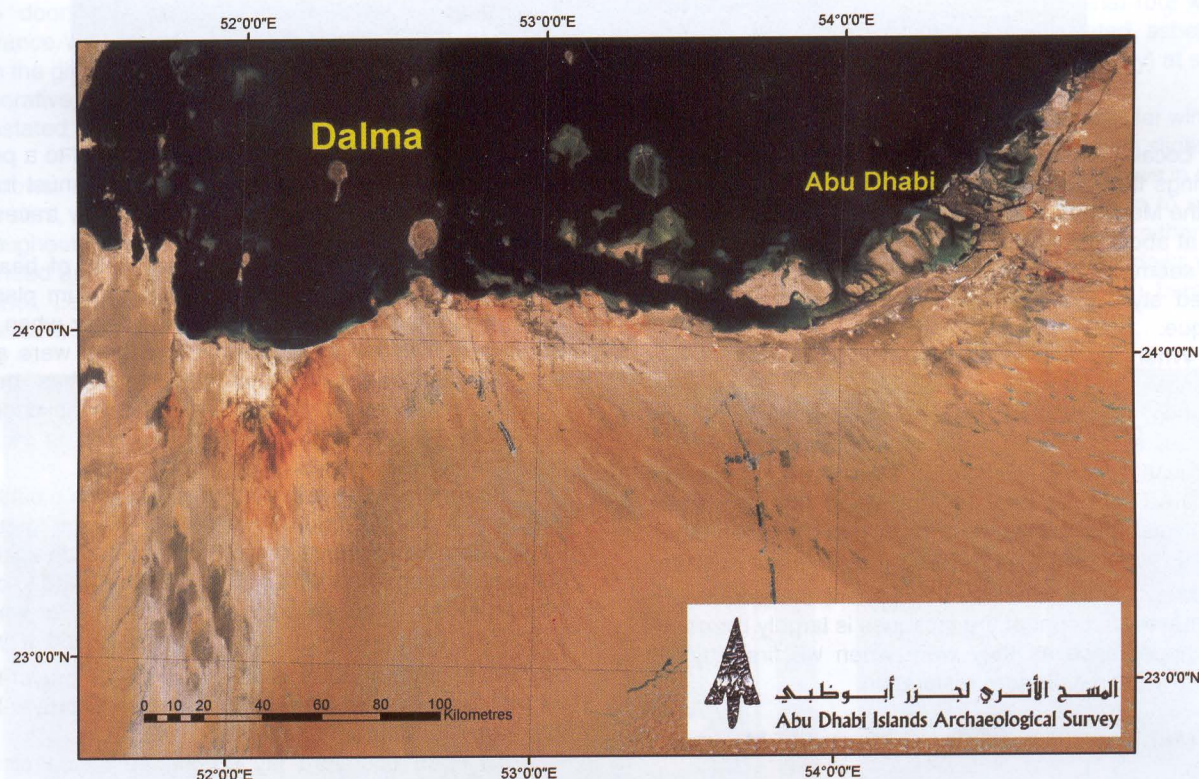


Plate 1. Map, Dalmâ and the Western Region of Abu Dhabi.

¹The Abu Dhabi Islands Archaeological Survey (ADIAS) first carried out fieldwork at Dalmâ from 31st March to 11th April, 1992. Drawings and ground-plans of the mosques discussed here were produced by Mr David Connolly assisted by Ms Fiona Baker. The preliminary record of the buildings was also made by Mr Connolly and Ms Baker and revised by the present writer with Dr Cristina Tonghini, University of Venice, in subsequent visits to Dalmâ in 1993 and 1996. A further visit with Dr Mark Beech of ADIAS was made in April, 2004 to see the current state of the buildings. The results of the first season of fieldwork on the islands are recorded in G.R.D. King, *Abu Dhabi Islands Archaeological Survey (ADIAS 1): An Archaeological Survey of Sir Banî Yâs, Dalmâ and Marawah, (21st March to 21st April, 1992)*, Trident Press, London (1998), pp. 51-55 (translated into Arabic as *Al-Masah al-Atharî li-Juzar Abû Dhabî*, Trident Press, London (2001), pp. 51-55). For the Bayt al-Muraykhî, see G.R.D. King, with architectural drawings by David Connolly, "Bayt al-Muraykhî: a later Islamic pearl merchant's house at Dalmâ, Abu Dhabi Emirate", *Tribulus, Journal of the Emirates Natural History Group* 14.1 (Spring, Summer, 2004), pp. 3-8.

²A short report on these buildings had been made over a decade earlier by Prof. S. Cleuziou. See G. Harter, S. Cleuziou, J.P. Laffont, J. Nockin and R. Toussaint, *Emirat d'Abu Dhabi. Propositions pour Dalmâ*, (Sept.-Oct., 1979), pp. 10-15. This report included ground-plans and photographs of this group of buildings, but it had had only limited circulation and I express my thanks to Dr C. Hardy-Guilbert for providing ADIAS with a copy.



Plate 2. Al-Muraykhî mosque, exterior.

Local people thought that the other traditional buildings that lacked inscriptions (the Bayt al-Muraykhî and the Muhammad b. Jâsim al-Muraykhî mosque) were built at about the same time as the al-Dawsarî mosque. This seems to be a reasonable assumption given their shared stylistic similarities with the dated al-Dawsarî mosque.

When we first studied them in April 1992, these buildings were all dilapidated and their future was uncertain; indeed, a suggestion had been made that the mosques and the pearl merchant's house should all be demolished and rebuilt entirely. Fortunately, as a result of an ADIAS report submitted in 1992 to the Abu Dhabi authorities, instructions were given for their restoration and this was undertaken in 1993-4 by Dr 'Abd al-Sattâr al-'Azzawî of the Sharjah Department of Antiquities³. The present account of the mosques is largely based on their appearance as they were when we first studied them in 1992, i.e., before restoration.

The Muhammad b. Jâsim al-Muraykhî Mosque

The Muhammad b. Jâsim al-Muraykhî mosque was no longer in use when we first examined it in 1992. Today, it has been restored and it serves as a museum⁴. It is situated west of the site of the old *sûq* of Dalmâ which had been demolished some years before 1992⁵. The National Bank of Abu Dhabi to the north of the mosque now stands where part of the *sûq* used to be. Land filling had led to considerable change to the area around the mosque by the time of our 1992 visit, but we

were informed that the sea had once reached to a point about 50 m. to the south of the mosque. It must have come in close to the north as well, judging by traces of the old shoreline in that area.

The al-Muraykhî mosque was built of beach-stone and coral and it was covered in gypsum plaster which was painted pale green on the exterior when we first saw it. The interior was white and there were also some cement repairs. Now the plaster has been replaced by the restoration team. Some of the original decorative plaster from around the *mihrâb* is in the present Bayt al-Muraykhî museum display.

The entire mosque in 1992 was raised on a banked masonry platform about 1 m. above present ground level. This platform served to protect the mosque against damp rising from the saline soil and it also served to cast off rain-water. The mosque enclosure as a whole measured 14.2 m. x 17.12 m. externally and it was oriented to *qibla* at 265°. It had a flat roofed prayer-hall on the western side towards the *qibla*: this prayer-hall measured 12.90 m. x 7.30 m. internally.

An open courtyard lay on the east side of the prayer-hall, outlined by a low wall. In the NE corner of the courtyard was a slightly banked platform, measuring 1.02 m. x 0.87 m. at the base, built against the courtyard wall and to the exact height of the courtyard wall. It was explained to us as being a prayer-call platform and in its position it matched a similar prayer-call platform in Mosques II and III which the British team had excavated in 1991-1992 at Julfâr (Ra's al-Khaimah): these Julfâr mosques are dated to ca 14th/15th century⁶.

³An account of these buildings and their restoration has been published by Dr 'Abd al-Sattâr 'Azzawî. See Murshid al-mubânî al-turâthiyya fî jazîra Dalmâ, Abu Dhabi (1418/1996). See also King, Abu Dhabi Islands Archaeological Survey....., pp. 51- 52 and Al-Masah al-Atharî li-Juzar Abû Dhabî....., pp. 51- 52.

⁴A second, larger museum has also been established in the Bayt al-Muraykhî pearl-house nearby.

⁵In the course of the restorations by the Sharjah Department of Antiquities, structures were found beneath the al-Muraykhî mosque and close to the Bayt al-Muraykhî pearl house. These were accompanied by late Islamic ceramics of the Julfâr horizon, i.e., ca 14th/15th-19th C. AD. These ceramics are now on display in the al-Muraykhî mosque and in the Bayt al-Muraykhî museum.

⁶This prayer-call platform was not reinstated during the restoration.

There was no trace of a *hammâm* at the al-Muraykhî mosque in 1992 although foundations were found during the restorations and a new *hammâm* was subsequently constructed on the alignment of the old walls. The excavations during the restorations also exposed two circular stone-lined wells with water at about 3 m. depth. Earlier underlying structures with no relation to the mosque were also discovered: these were probably later Islamic in origin, judging by the pottery recovered⁷.

The al-Muraykhî mosque enclosure is entered by a single entrance set at the southern end of the east wall of the courtyard. It was approached by a rough earth ramp in 1992 but there may have been a step here originally. The floor of the courtyard was slightly lower than the level of the prayer-hall floor, and it was unpaved, although some traces of plaster were visible in the central area.

The prayer-hall has three rectangular entrances in the east wall, the central one aligned with the *mihrâb* in the centre of the *qibla* wall on the interior. The doors had all vanished by 1992. Above each entrance were square decorative blind grilles in plaster with the grille over the central entrance emphasised by a decorative circular motif and a star. These grilles were reinstated during the restorations.

Flanking the three doorways are rectangular windows, each with a wooden frame that in 1992 held iron bars, set vertically, a feature typical of old buildings throughout the Gulf region. Above each window is a blind rounded arch, corresponding to a similar recess on the interior. Local terminology for these windows is either *dârisha* or *daraysh*.

Internally, the prayer-hall is divided longitudinally by a row of four rectangular piers that create two aisles running parallel to the *qibla* wall. Surmounting the piers are stepped impost blocks forming simple capitals. Attached piers of similar design articulate the lateral walls of the prayer-hall which, along with the free-standing piers, serve to support the roofing system. The original roof had been replaced before 1992 but traces of some of the earlier wooden beams remained. The entire roof has now been reconstructed according to traditional methods by Dr 'Azzâwî's team.

The upper walls of the al-Muraykhî mosque interior above the piers terminated in a plaster *cavetto*, forming a continuous cornice running independently around the west (*qibla*) aisle of the mosque and around the rear (east) aisle. The corners of the two rectangular roofing units to east and west of the central colonnade were cut by a triangular decorative feature in plaster. This treatment of the corners is also found in the Bayt al-Muraykhî.

Above the cornice, the upper wall in 1992 carried traces of the wooden beams of the original roof which had been replaced by modern corrugated asbestos, work done by the Dalmâ *baladiya* (municipality) at some time before our first visit.

The mosque has a series of rectangular window units with blind round-headed arches set back slightly in their rectangular frames. There are four windows in each of the north and the south lateral walls, three to either side of the *mihrâb* in the west wall, and one at either end of the east wall, flanking the doors. All the windows were closed in 1992 in the lower part by six iron bars set vertically.



Plate 3. Al-Muraykhî mosque, interior.

⁷This pottery is now displayed in the al-Muraykhî mosque museum and compares to the generally later Islamic pottery in the Bayt al-Muraykhî museum.

The *mihrâb*, vaulted by a barrel vault, is set centrally in the western wall. It is rectangular in ground-plan and is set within a larger rectangular plaster frame with a blind arch framing the *mihrâb* arch proper. This decorative frame rises the full height of the *qibla* wall. This suggests some degree of Iranian influence insofar as the design echoes the flat decorative frames often encountered in *mihrâbs* in Iran which in turn stem from the Great Mosque of 9th C. Samârrâ' of the 'Abbâsid Caliph al-Mutawakkil.

On the exterior of the *mihrâb*, set at the outermost edge of the barrel vault was a narrow round column, about 1 m. high with a conical capping. It was the only mosque at Dalmâ with this feature and I have not encountered such a column elsewhere. Its presence was explained by local people as indicating that the mosque had *Shî'a* connections but if this is correct, it seems unusual even in *Shî'a* mosque architecture, to the best of my knowledge.

In the three inner faces of the *mihrâb* walls there are wind-catchers (*bâd girr*) set in rectangular recesses. These serve to ventilate the *mihrâb* interior and the forefront of the mosque. In the heat of a Gulf summer, these ventilating devices along with the openness of the mosque with its many windows were all sorely needed before the introduction of air-conditioning.

Al-Dawsarî Mosque

The al-Dawsarî mosque lies about 30 m. south of the National Bank of Abu Dhabi and to the north of the al-Muhammadî mosque⁸. The mosque was no longer in use in 1992 but prayer has resumed there since the completion of the restoration by Dr al-^cAzzâwî's team. It is constructed of beach-rock, coral and gypsum mortar. It was coated in white plaster and it had some repair in cement in 1992. This plaster has now been renewed.

The mosque measures overall 12.82 m. x 11.62 m. externally and it is oriented to 266° to *qibla*. It consists of a shallow rectangular courtyard on the east side and a prayer-hall preceded by a portico on the west (*qibla*) side. Built against the exterior of the courtyard on the south side is a *hammâm* room. There is a single entrance to the courtyard set slightly off-centre from the axis of the *mihrâb* in the prayer-hall. There is also access to the courtyard from the *hammâm* through the south wall of the courtyard.

The courtyard measures 4.00 m. x 11.00 m. and it merges with an open portico in front of the prayer-hall which lies on its west side. On the other three sides, the courtyard was defined by a somewhat irregular low stone balustrade. As the side walls of the courtyard did not align in 1992 with the lateral walls of the prayer-hall, we assumed that the courtyard was built later than the prayer-hall but by how much is unclear.

The portico is 3.80 m. deep and its lateral walls form one with the side walls of the prayer-hall. Attached columns terminate the eastern end of the portico side walls. In 1992, before the restoration, it appeared that the squared column on the south side incorporated an earlier circular column.

The roof of the portico formerly must have been supported by two columns similar to those attached to

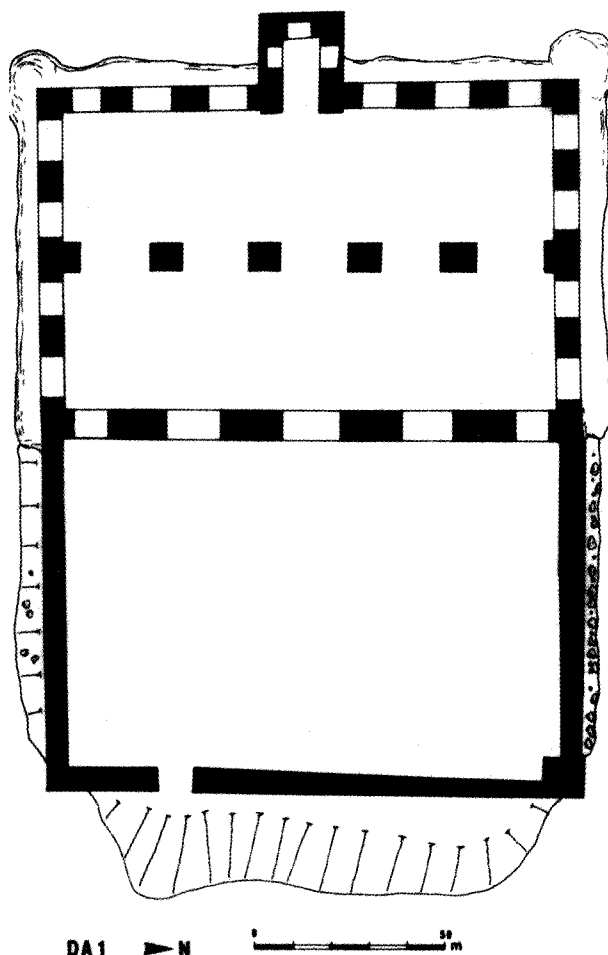


Plate 4. Al-Muraykhî mosque: ground-plan (by D. Connolly).

the lateral walls of the portico, but in 1992 these central columns had vanished and they had been replaced by squared wooden posts to support the portico roof. During the restorations, columns were reinstated.

The prayer-hall is shallow, measuring 10.2 m. x 3.57 m. In 1992, it had a flat roof constructed of mangrove poles and palm matting mesh (*basjil*), covered externally by gypsum plaster. It was in a very poor condition when we first saw it.

There are three doorways in the east wall of the prayer-hall leading from the courtyard and the portico. Of these, one is nearly on axis with the *mihrâb* in the centre of the western (*qibla*) wall; the other two are set on either side. There were wooden double doors in each entrance in 1992, each with a decorated cover-strip. The door designs differed from each other but any significant difference was masked as they were badly weathered. These doors are now in the Bayt al-Muraykhî museum.

There are two rectangular windows in each of the lateral walls of the prayer-hall, all closed by vertical iron bars. The window units repeat the design already seen in the portico, the only difference being that the round-headed arches above these windows are blind. Each window in 1992 had plain wooden shutters.

⁸In an earlier account of this mosque (King, *Abu Dhabi Islands Archaeological Survey...*, pp. 52-53; and *Al-masah al-atharî li-juzar Abû Dhabi*, p. 54), it was misnamed on the basis of information we received at Dalmâ in 1992. We have since been informed that the mosque is called the al-Dawsarî mosque.

The *mihrâb* in the centre of the *qibla* wall forms a large rectangular projection externally. It is roofed by a barrel vault, which slopes slightly down and away from the *qibla* wall. In the upper part of the south, north and west sides of the *mihrâb*, there are small openings to light and ventilate the interior. There is a niche for storing *Qur'âns* in the west side of the *mihrâb* with a moulded frame around it in plaster.

Inside the prayer-hall, surrounding the *mihrâb*, is set a rectangular recessed frame with moulded relief decoration. Within this panel is yet another set back panel, with a deeply cut geometric grille in plaster. The panel is similar to decorative plaster panels in plaster found at Târût in eastern Saudi Arabia and in the old Islamic architecture of Bahrain and Dubai. On either side of the *mihrâb* and below the decorative plaster panels were incised inscriptions in 1992. On the right was written:

"Bism Allâh al-rahmân al-rahîm"

Below was inscribed: *"Qad kamal al-binâ' bi-cawn al-khâliq al-samâ' fî shawwâl sanna 1349"*

"In the name of God the Merciful, the Compassionate. The building was completed with the help of the Creator of heaven in [the month of] Shawwâl of the year 1349 [March, 1931]".

The original inscription panel has now been removed to the Bayt al-Muraykhî pearl house museum.

Arranged on each side of the *mihrâb* in the *qibla* wall are four window units in groups of two. These windows are slightly different from those already described. There are rectangular window frames in the lower rank, each with seven vertical iron window bars. Above each window is a blind round-headed arch. Apart from these windows, there are a number of blind niches set in the interior wall surfaces: there are two in the inner face of the north wall, two in the south wall and two on either side of the *mihrâb* in the west wall.

On the exterior of the prayer-hall, at the point of junction of the *qibla* wall with the north and south side walls of the prayer-hall, there are attached quarter columns. Also on the exterior, at roof level on the *qibla* side in 1992 were four rectangular holes in various degrees of disintegration which once held wooden drainage spouts to carry rainwater off from the roof of the mosque.

Sa'îd b. ʿAlî al-Muhannadî mosque

In contrast to the al-Muraykhî mosque and the al-Dawsarî mosque, the Sa'îd b. ʿAlî al-Muhannadî mosque was still in use in April, 1992, with a large congregation regularly attending prayers there. Since the restorations, the mosque has remained in use for Friday prayers.

Before the restorations to the mosque, it had an inscription on a white marble plaque beside the door on the east side of the courtyard which named it as the Sa'îd b. ʿAlî al-Qubaysî mosque. Since the restorations, it has been termed the Sa'îd b. ʿAlî al-Muhannadî mosque.

It is the largest mosque of the Dalmâ group, measuring overall 21.80 m. x 17.57 m. It is oriented to *qibla* at 268° and it consists of a prayer-hall on the west side preceded by a portico with an open courtyard lying to the east. There is a *hammâm* at the south-east corner of the courtyard, built outside the enclosure. The mosque is constructed of beach rock and coral covered in gypsum plaster and it is now white-washed inside and out, as it was when we first studied it in 1992.

The courtyard measures internally 12.72 m. x 16.34 m. and it is surrounded by a low wall. In 1992, there was a single entrance on the north side with plain wooden double doors: these have been replaced, the original doors being displayed today in the Bayt al-Muraykhî museum. The courtyard was partly roofed with asbestos sheets in 1992, resting on modern timber and its floor was cemented. There was a wooden bier for funerals in the courtyard.



Plate 5. Al-Dawsarî mosque, exterior



Plate 6. Al-Dawsarî mosque, interior

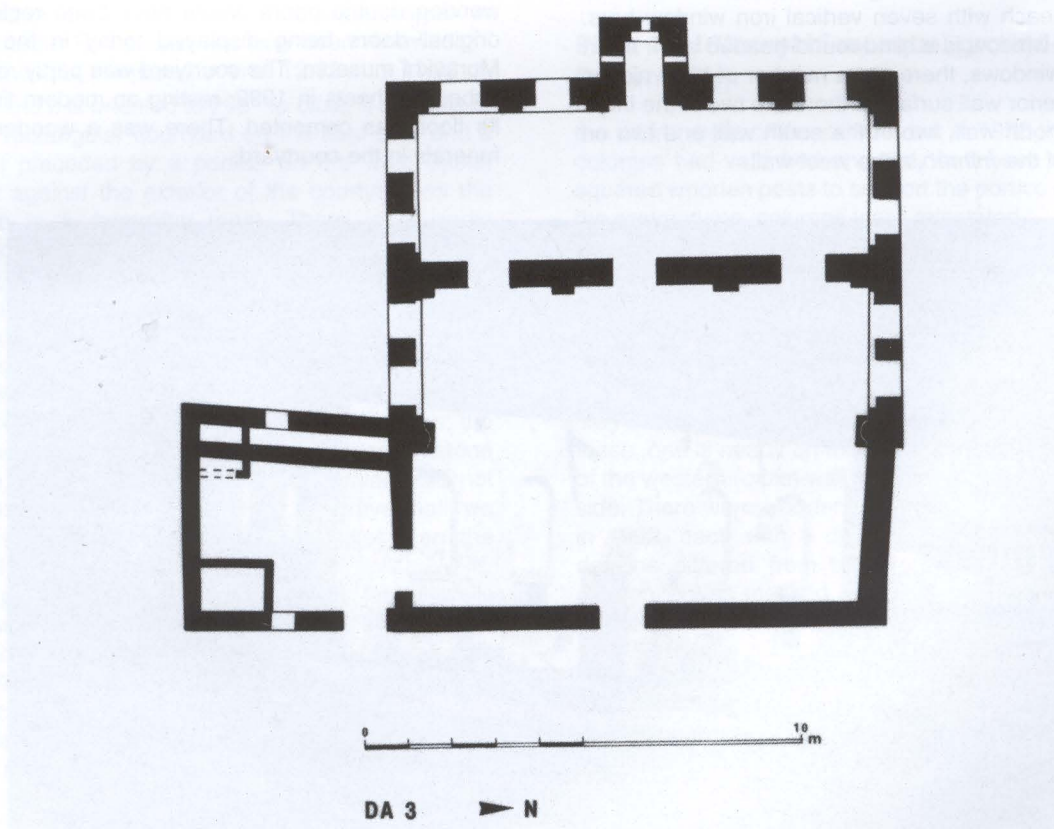


Plate 7. Al-Dawsarî mosque: ground-plan (by D. Connolly).

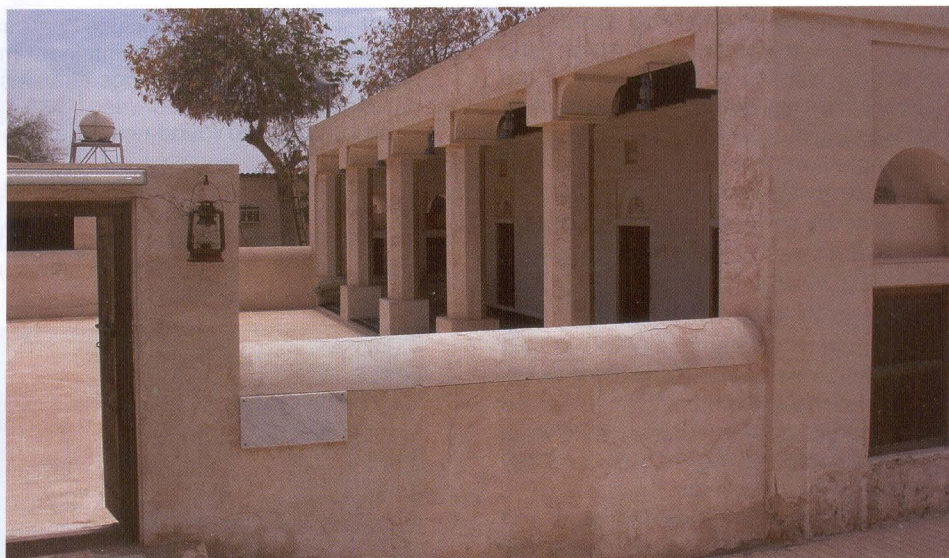


Plate 8. Sa'îd b. 'Alî al-Muhannadî mosque, exterior.

An open portico running along the west side of the courtyard and preceding the east facade of the prayer-hall forms a natural continuation of the court. Like the portico of the al-Dawsarî mosque, that of the al-Muhannadî mosque is defined by two lateral walls (i.e., to north and south). These bond to the lateral walls of the prayer-hall. At their east ends, both lateral walls terminate in an attached column. Four octagonal columns run along the *qibla* side of the courtyard, parallel to the prayer-hall's east wall and supporting the roof of the portico.

In each of the portico lateral walls there are two rectangular windows. In 1992, they had wooden shutters which were closed and boarded up. Surmounting each window is a stilted round-headed arch set in a rectangular frame. The portico walls terminate at the summit in a cornice and an undulating moulding of plaster in relief.

When ADIAS first recorded the mosque in 1992, on the short stretch of wall between the two windows at the north end of the portico were two lightly incised *graffiti* representing boats, carved into the smooth gypsum plaster of the mosque walls. The plaster

was falling away and much had been lost. The two drawings were already very fragile in 1992 and since then they have both been lost. The incised boat motifs are discussed below.

The prayer-hall of the al-Muhannadî mosque measures 16.30 m. x 7.15 m. Its only access is from the east side where there are five doorways. The entrances are all rectangular, measuring 1.08 m. in width. The central entrance had its original wooden double doors *in situ* in 1992: these were lightly carved with elongated oval motifs on each leaf, whereas the other doors lacked decoration. The interior of the prayer-hall is divided by a row of four round columns forming two aisles that run north-south, parallel to the *qibla* wall. Their design corresponds to the half-columns attached to the lateral walls of the portico.

The columns inside the prayer-hall rest on square bases and they are set 2.65 m. apart from each other. They carry squared impost blocks with a moulded *cavetto* giving a capital-like effect. These impost blocks still carried the original wooden joists in 1992.

The upper wall areas of the east and the west aisles of the prayer-hall each have their own independent systems of cornices and raised undulating moulding like those already described in the portico. This independent treatment of the cornices in each aisle also occurs in the al-Muraykhî mosque.

The roofing of the prayer-hall was extant in 1992 and it was of traditional Gulf type with mangrove poles laid across the joists. These poles had been imported from India and supported a wood lattice which in turn carried a thin mesh of palm matting. It has now been renewed in traditional style in the course of the restorations.

The *mihirâb* recess in the Sa'îd b. 'Alî al-Muhannadî mosque is of particular note. It is set in the centre of the *qibla* wall, on line with the central door to the prayer-hall from the courtyard. It is rectangular in ground-plan, forming a projection on the exterior of the *qibla* wall. It is roofed like the other Dalmâ mosques by a barrel vault. Internally, the niche is divided into two distinct elements, the *mihirâb* proper to the left (south) and a fixed *minbar* built into the right (north) side of the niche. As a result, the *mihirâb* is reduced to a width of a mere 0.77 m. with a thin wall dividing it from the *minbar*. An entrance from the *mihirâb* leads into the *minbar* within



Plate 9. Sa'îd b. 'Alî al-Muhannadî mosque, interior.

The *minbar* is fronted by a projecting rectangular screen whose upper ledge is stepped forward from the facade of the *qibla* wall. This ledge on the front of the *minbar* is decorated with an undulating relief decoration in plaster and with a *cavetto* below, both recalling the decoration already noted beneath the roofing of the prayer-hall. This *mihrâb-minbar* niche has a blocked air vent in the upper part of the west wall and mid-wall wind catchers (*bâd girr*) lower down in each of its three sides.

The incised drawings in the portico

Boat drawings have a long history in the Gulf and those found in 1992 incised into the plaster in the north wall of the portico of the al-Muhannadî mosque are a new addition to the *corpus* of such pictures. They were the first found in a mosque in the region. They are now lost along with the rest of the old plaster.

The boats in the two drawings identified and copied by Mr Connolly in 1992 were shown side-on to the viewer but the nature of the plaster breakage was such that in neither case was any single boat illustrated complete. In one case, half of a hull and a sail was visible, but the vertical break of the plaster had sliced away the other end of the boat and its sail; in the second case, two halves of separate hulls survived with two sails clearly visible, as well as rigging and perhaps a third sail. There were no human figures whatsoever. The pictures are dated 1377/1946 by a graffito on the second drawing.

There are number of similar boat representations elsewhere in the Gulf area. The earliest reported was found at Sirâf on the Iranian coast⁹. It was from an upper room of a palace, incised into the wall and it showed a three-masted boat.

D. Whitehouse, the excavator of Sirâf, suggested that it should be regarded as being of 11th C. AD date.

A group of boat drawings has been found incised in natural rock at Jabal al-Jussasiya on the north-east

coast of Qatar¹⁰. These include boats in profile like those which we found in the al-Muhannadî mosque. W. Facey argues that the boat drawings at al-Jussasiya should be dated to somewhere between 1600 and 1800, on the basis of ceramics found nearby although they could be older.

At al-Qidâ to the NW of Khasab in Musandam, Sultanate of Oman, there is also a boat drawing on boulders in the valley behind the town, but it is of indeterminate date. There are other instances of boat drawings in Dhofar, also in Oman.

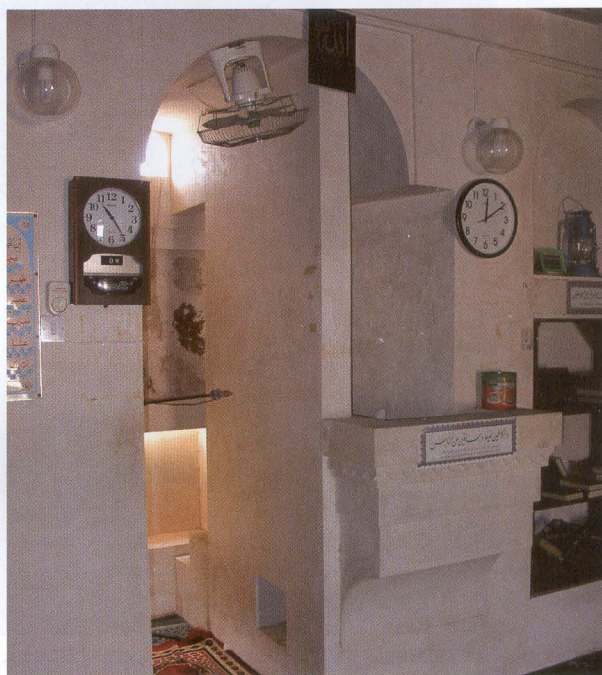


Plate 10. Sa'îd ʿAlî al-Muhannadî mosque: the *mihrâb*.

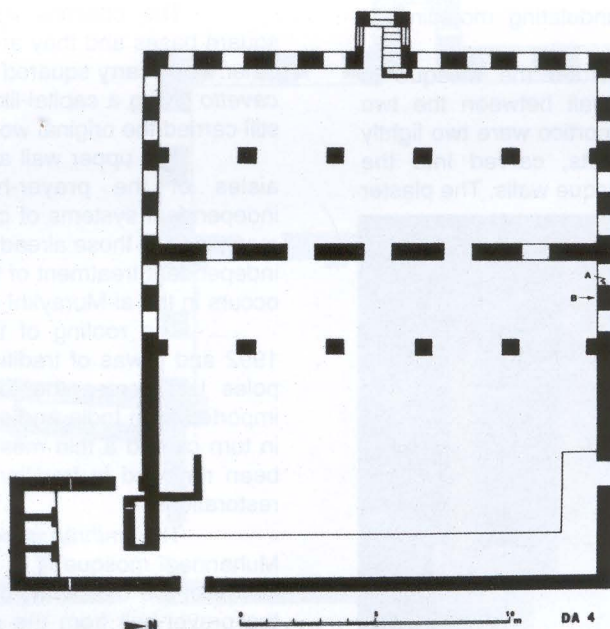


Plate 11. Sa'îd ʿAlî al-Muhannadî mosque: ground-plan (by D. Connolly).

⁹ D. Whitehouse, "Excavations at Siraf. Fifth Interim Report", *Iran* x (1972), p. 74 and fig. 7, p. 75. I am grateful to Dr C. Tonghini for drawing my attention to this parallel.

¹⁰ B. de Cardi, *Qatar Archaeological Report: Excavations 1973*, Oxford (1978), p. 190 and Pls xxxi-xxxii.

H. Kapel, "Rock carvings at Jebel Jusasiyah, Qatar", *Arrayan*, no. 8 (unseen).

W. Facey, "The boat carvings at Jabal al-Jussasiyah, northeast Qatar", *Proceedings of the Seminar for Arabian Studies* 17 (1987), pp. 199-222.

D.F. Hawkins, "Primitive rock carvings in Qatar", *Proceedings of the Seminar for Arabian Studies* 17 (1987), p. 54.

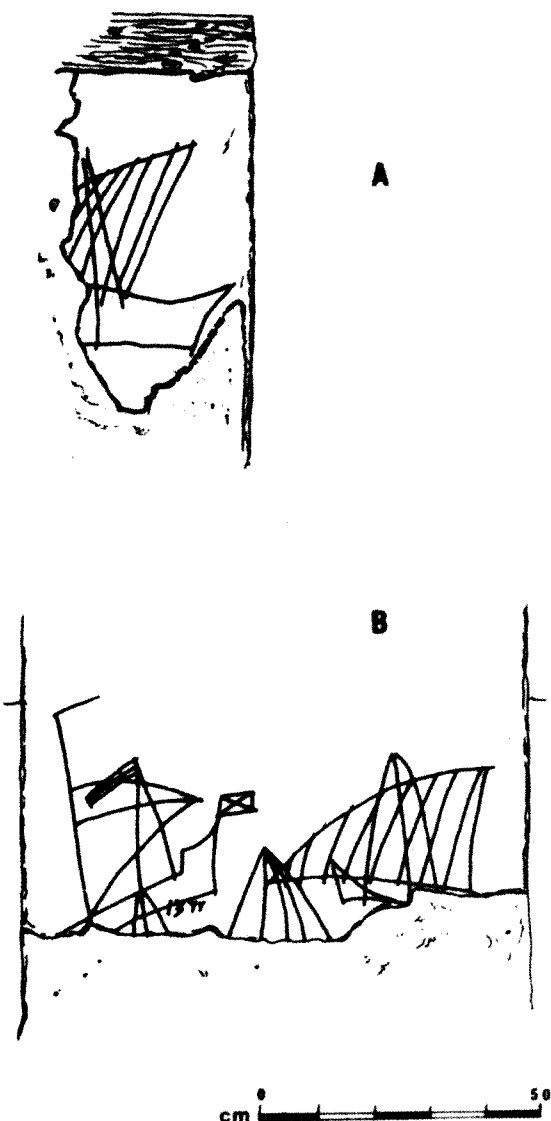


Plate 12. Boat drawings in the Sa'īd 'Alī al-Muhammadī mosque .

Summary

Throughout the Gulf countries, the ever-increasing pace of modernisation has been accompanied by the loss of the fragile architecture of earlier centuries, and this has been as much the case in Abu Dhabi as elsewhere in the region. Piety tends to ensure that mosques are among the first buildings to be modernized or rebuilt.

As a result, decreasing numbers of mosques and other old buildings survive in their original form in Arabia as a whole and it is rare now in the Gulf to find extant a group of traditional buildings like those concentrated in Dalmā, all related closely in date and style. This loss elsewhere underlines the importance of the accident of survival of the Dalmā mosques. The survival of a distinctive and related group of later Islamic buildings is fortunate and their restoration in 1993-4 is extremely welcome, for the mosques provide rare evidence of the architectural tradition of Abu Dhabi in the past and its relationship with the Islamic Gulf architectural tradition as whole.

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H. Kapel, "Rock carvings at Jebel Jusasiyah, Qatar", **Arayan**, no. 8 (unseen).

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G.R.D. King, **Abu Dhabi Islands Archaeological Survey (ADIAS 1): An Archaeological Survey of Sir Banī Yās, Dalmā and Marawah, (21st March to 21st April, 1992)**, Trident Press, London (1998); translated into Arabic as *Al-Masah al-Atharī li-Juzar Abū Dhabī*, Trident Press, London (2001).

G. R.D. King with drawings by D.Connolly, "Bayt al-Muraykhī: a later Islamic pearl merchant's house at Dalmā, Abu Dhabi Emirate", **Tribulus** 14.1 (Spring, Summer, 2004), pp. 3-8.

D. Whitehouse, "Excavations at Siraf. Fifth Interim Report", **Iran** x (1972), pp. 63-87.

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A new species of viper described from the UAE and northern Oman

by Drew Gardner

Recent studies by Gergely Babocsay on museum specimens from across the entire range of '*Echis coloratus*' vipers has revealed that the specimens from northern Oman and the UAE mountains are distinctive in their scalation, colour pattern and body proportions from all other populations. As such, they have now been described as belonging to a new species, the Oman saw-scaled viper *Echis omanensis* Babocsay 2004. This implies that Burton's saw-scaled viper *Echis coloratus* must be removed from the UAE species list and *Echis omanensis* needs to be added. *Echis omanensis* is a regional endemic species for Oman and the UAE.

The main differences between *Echis omanensis* and *Echis coloratus* involve the gular scales under the head being rounder and more numerous in the new species. The tail is longer, with more sub-caudal scales, and there are differences in some of the scales around the nostrils and in the pattern of dark grey blotches on the head, back and flanks.

Geographically, the separation of *Echis omanensis* from *Echis coloratus* is wide to the west and north of the UAE mountains, where the species are separated by the sands of the Rub al Khali.

The nature of the separation is less clear along the south Arabian margins between the northern Oman mountains and Yemen. Vipers of the *coloratus* complex are found on Jebel Madmar near Adam, the Huqf escarpment along the Jiddat al Harasis in central Oman and around Thumrait in Dhofar.

However, the area between the Hadramaut and

northern Oman mountains, some 1500 km, is represented by only two specimens in the analysis. These apparently cluster with *coloratus*, though the separation between BMNH1994.134 from the Jiddat al Harasis and *Echis omanensis* in gular scales morphology is certainly not clear from the photograph (Fig 3, pg 510 Babocsay 2004).

A comparison with the *Echis carinatus* viper complex can be made where *E-carinatus sochureki* is found on the Jiddat al Harasis while the closely related *E. pyramidum* is found in the Dhofar mountains to the south.

It is a pity that Babocsay did not contact local herpetologists in the UAE and Oman, as further specimens of what are now to be regarded as *Echis omanensis*, distribution data and colour photographs are available. A further minor gripe is that the UAE is not mentioned in the paper's title, despite the type locality for the new species being Wadi Siji, near Masafi, UAE.

Reference:

Babocsay, G. (2004). "A new species of saw-scaled viper of the *Echis coloratus* complex (Ophidia: Viperidae) from Oman, Eastern Arabia." **Systematics and Biodiversity** 1(4): 503-514.

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Obituary

Edward Wiltshire

The entomologist and diplomat Edward Wiltshire, a former contributor to *Tribulus*, died on 8th July 2004 at the age of 94, after over 80 years of studying insects.

Wiltshire spent more than 40 years in the British Consular service, mostly in the Middle East, including the Gulf, but also in South America and Europe. In his spare time he built up formidable expertise, and an international reputation, in entomology.

Born in Norfolk in 1910, he went to preparatory school in Sussex, and it was here that he first became hooked on entomology. He later studied at Jesus College, Cambridge, where he was an active member of the university Natural History Society's entomological section.

In 1932 he joined the British Consular Service, and was sent to Beirut. By 1935, he was publishing papers in the Entomologist's Record on finds in Lebanon and Syria. He was then posted to Iraq and then to Iran, in 1939, where he added three apparently new butterfly species to the genus *Melitaea* during his first three months in Shiraz.

He was then posted to Basra, beginning his investigation of the desert areas of the northern Gulf. In 1944, the Government of Iraq published the first edition

of his *Lepidoptera of Iraq*. Invalided home that year, he took the opportunity to transfer most of his collection of foreign Lepidoptera to the Zoological Museum at Tring, before being posted again to New York.

Subsequent postings took him to Cairo, as Consul, in 1947; to Shiraz again in 1949; and to Port Said in 1952. For five years he was then once more in Baghdad, this time as Consul, before being posted to Rio de Janeiro in 1957. Next came Bahrain, as Political Agent, from 1959 to 1963, and then Geneva, as Consul-General, in 1963. During home leaves in England, Wiltshire paid frequent visits to consult with his friends in the entomology departments of the museums at Tring and South Kensington.

He returned to London in 1967 to become director of the Diplomatic Service Centre. In 1968-69 he worked for the Council for Nature, editing *Habitat*. In 1980, he was made an Honorary Associate of the British Museum (Natural History), a beneficiary of his collecting activities. In retirement, he and his wife lived at Cookham, in Berkshire.

Retirement, of course, gave him time to pursue his interests in entomology. Already author of the full *Lepidoptera of Iraq* in 1957 and of *A Revision of the Armadini* in 1979, he also produced numerous papers for journals. Among those was the '*Provisional Checklist of the Macroheterocera (Lepidoptera) of the UAE*', jointly produced with Albert Legrain and published in Vol. 8.2 of *Tribulus*, in 1998, when he was 88.

Other major papers on Lepidoptera of the peninsula included *The Lepidoptera of Bahrain*, in 1964, *The larger moths of Dhofar and their Zoogeographic composition*, in 1977 and *Insects of Saudi Arabia: Lepidoptera*, in Fauna of Saudi Arabia, in 1980.

Wiltshire was an outstanding example of a type of naturalist that is now, sadly, often treated with a certain amount of disdain by those who have doctoral degrees in arcane minutiae of natural history, but lack the field skills – or experience – of Wiltshire and his ilk. Self-taught, and without formal related qualifications, he pursued an active and successful career in another, completely different, field while making, over many decades, a major contribution to science, in particular to the Lepidoptera of Arabia and the Gulf region, though knowledge of many other parts of the world also benefited from his enthusiasm, dedication and professionalism.

For the 'amateur' enthusiasts of the Emirates Natural History Group, he provides a fine example to follow.

(Much of the information in this Obituary is taken from that published in the Daily Telegraph of London on 4th September 2004).

NOTES

(compiled by Simon Aspinall)

DEL sponsors WWF-ERWDA regional coral project

Dolphin Energy Limited has announced a US\$500,000 sponsorship agreement with the World Wildlife Fund for Nature (WWF) and the Abu Dhabi Environmental Research and Wildlife Development Agency (ERWDA) for research and protection of major Coral Habitats in Abu Dhabi and Qatar.

This three year WWF/ERWDA project will run from 2004 through 2006, in association with Qatar's Supreme Council for the Environment and Nature Reserves (SCENR). The results will include a study - 'Conservation of Coral Reef Habitats of the Arabian Gulf' - and the first comprehensive coral conservation plan for the region.

Following conclusion of the research, the WWF will publish a Gulf coral atlas and identification guide, plus supporting strategy documents.

(source: Emirates News Agency, WAM, 21 June 2004)

Amended decree on use of *Halaq* nets in Abu Dhabi

Abu Dhabi's Environmental Research and Wildlife Development Agency, ERWDA, issued an amended decree in September on the use of *Halaq* nets, used for the catching of large migratory species, including the Spanish mackerel (locally known as Kana'ad). The decree extends the period permitted for use of *Halaq*, from the beginning of October 2004 until the end of April 2005, an extension of one month at the end of the season.

Other amendments include the removal of any specification of the depth of the net and specifying that each net must be comprised of a single piece, of no more than 700 metres in length, and with a mesh size of not less than 7.5 centimetres, and without any anchoring device. The peak of the spawning season for *Kana'ad* is in May.

The decree noted that there will henceforth be an annual decree on *Halaq* usage, taking into account a review of stock status and spawning periods.

(Source: ERWDA).

Houbara agreement with Yemen

The Environmental Research and Wildlife Development Agency (ERWDA) of Abu Dhabi and the Ministry of Environment and Water Resources of the Republic of Yemen signed in October an agreement for the captive propagation and re-introduction of houbara bustard (*Chlamydotis macqueenii*) originating from Yemen.

The main objective is to preserve in captivity at ERWDA's National Avian Research Centre (NARC), in Sweihan, a stock of houbara originating from Yemen to prevent their extinction. In addition the agreement stipulates the collection of houbara eggs or chicks from Yemen within a period of 5 years from the signature of this agreement, where a specific captive breeding programme for these birds will be undertaken at NARC and 30% of this captive production will be introduced to the wild in Yemen.

Yemen has one of the rare remnant houbara populations of the Arabian Peninsula, but as houbara hunting is still taking place in Arabia it is anticipated that the current hunting and poaching pressure might lead to extinction, including of the resident houbara in the Republic of Yemen. (Source: ERWDA).

Sheikh Zayed Falcon Release Project completes ten years

The Sheikh Zayed bin Sultan Al Nahyan Falcon Release Project, initiated by the late UAE President, completed its tenth year of operations in May 2004, with the release of 27 Saker (*Falco cherrug*) and 49 Peregrine (*Falco peregrinus*) falcons in the Gilgit District of Pakistan's Northern Areas.

The release programme was organised under the aegis of the Environmental Research and Wildlife Development Agency, ERWDA, with support being provided by the Falcon Hospital at Al Khazna. Help in Pakistan was provided by the WorldWide Fund for Nature (Pakistan) and the Falcon Foundation International.

The released falcons included birds from Qatar and Kuwait for the first time.

Six of the falcons were equipped with satellite transmitters, to permit their movements to be tracked.

The first release programme took place in April 1995 in the Kharan District of Pakistan's western province of Baluchistan. Succeeding years have seen releases in the Gilgit District and the Chitral District of Pakistan's North-Western Frontier Province, in the Lake Issyk-kul area of Kyrgyzstan and, in 2003, in the Iranian province of Gorgan, near the Caspian Sea.

In all, a total of 857 falcons, all but two of them Sakers or Peregrines, have been released during the ten years of the programme, the other two being a lanner and a Barbary falcon.

4WDs a global threat

Off-road driving in the Middle East and the south-western United States is being blamed for destroying the deserts' fragile crust and allowing clouds of fine dust to be swept away. This, it is claimed, has contributed to a ten-fold increase in dust storms around the globe. Andrew Goudie, Professor of Geography at Oxford University, speaking at the 30th Congress of the International Geographical Union, described how what he calls "Toyotarisation" has led to a significant increase in dust in the atmosphere and warned of the environmental consequences. Herbicides, pesticides and soil being transported by such storms were all considered likely to affect human health, while rural agriculture in Africa was also expected to suffer in the same way as the Dust Bowl of the 1930s destroyed the prairies of the American west, forcing the population to migrate. (Source: The Times 20 August 2004)

Hares & hyraxes in Arabia

Data on the distribution and relative abundance of hares & hyraxes throughout Arabia is currently being compiled in a project being coordinated out of Sharjah. The genetics of both animals will also be being studied. If you wish to assist or learn more then please email John Burton at: jab@worldlandtrust.org
(Source: Sandgrouse 26 (2) 2004).

Review, Publications and Research

Fauna of Arabia Vol 20 2004 Editor-in-Chief Friedhelm Krupp

The *Fauna of Arabia* series and its precursor, *Fauna of (Saudi) Arabia*, which was founded in 1979, and under which name volumes 1-18 were published, is of unsurpassed quality. Volume 20, a special issue devoting itself to Yemen's Socotra Archipelago, is no exception to this rule. The text is in English throughout, with the titles and abstracts also in Arabic, and runs to a massive 548 pages, plus endpapers, and forewords which are repeated in Arabic.

Volume 20 is a collection of 22 papers, plus three scene-setting introductory contributions on conservation; geology and climatic history, and marine biotopes. In all, over forty different authors are involved, just a few of whom appear as co-authors in more than one paper such is the degree of specialism involved. Jumping between taxa is an impressive feat given the, to be completely frank, complete obscurity of many of the subjects to all but the wholly dedicated specialist. Some of the organisms involved can only be examined thoroughly using a scanning electron microscope, so this is hardly surprising. Colour or black and white photographs, including some taken with SEM, and black and white illustrations, all of the highest quality, accompany each account as necessary.

Most taxa are represented by just a single contribution: Reptiles, Birds, Corals, Rotifers and Chilopods (whatever there are – I read it, because it was a new species to science being described, though still couldn't say I'd recognize one even if it bit me), but Crustaceans get three, Arachnids another three and

Insects, most of all, with no fewer than eleven separate accounts. That vertebrates fare badly is not an issue because most are covered in *Fauna of the Socotra Archipelago (Fieldguide)* published only early this year.

Although this volume of FoA may seem to provide an eclectic and uneven mix among taxa, it might be contended that since only one Kingdom is represented it isn't imbalanced in the slightest. Insects certainly deserve the most attention, this much is sure, Mendes, for example, describes nine new species in his contribution on silverfish (or Zygentoma if you prefer), while Schwallier details seven new Tenebrionid beetles. Socotra is a veritable Aladdin's cave for zoologists (and botanists) and it is hard to imagine where else one might find so many species from so many different taxa new to science being described in a single volume. In this respect *Fauna of Arabia* is a fabulous resource, and a rare luxury to which the scientific world is able to avail itself, and right here on our doorstep too.

Volume 20 is not for the faint-hearted, it is scientific inquiry of the highest order and you are likely have to visit the library of a serious academic institute to find it. If nothing else, a quick perusal will improve your word power and make you appear exceptionally well-informed, and certainly a Scrabble champion, unless of course you come up against the likes of Kay Van Damme, Tony Van Harten, Wolfgang Wranik and their fellow contributors. (Warning: Van Harten is now a resident of the UAE).

Simon Aspinall

Books

(Mention here does not preclude subsequent review)

Kennet, D. 2004. **Sasanian and Islamic pottery from Ras al-Khaimah : classification, chronology and analysis of trade in the Western Indian Ocean.** Society for Arabian Studies Monographs No. 1. British Archaeological Reports International Series 1248.

Weeks, L.R. (2004). **Early Metallurgy of the 'Persian' Gulf: Technology, Trade, and the Bronze Age World.** Boston: Brill Academic Publishers, Inc. American School of Prehistoric Research Monograph Series, vol. 2. ISBN 0-391-04213-0. ISSN 1543-0529.

Journals and Magazines

The following papers have been noted.

Archaeology

Proceedings of the Seminar for Arabian Studies (PSAS) Vol. 34, 2004. Archaeopress, Oxford. ISSN 0308-8421. ISBN 0-9539923-5-7. Order from: www.archaeopress.com – email: bar@archaeopress.com

This new issue of PSAS contains the following UAE and Oman related papers:

Beech, M., H. Kallweit & P. Hellyer. (2004). 'New archaeological investigations at Abu Dhabi Airport, United Arab Emirates'. **PSAS 34:** 1-15.

Benoist, A., V. Bernard, A. Hamel, F. Saint-Genez, J. Schiettecatte & M. Skorupka. (2004). 'L'Age du Fer à

Bithnah (Emirat de Fujairah): campagnes 2001–2002'. **PSAS 34**: 17-34.

Al-Busaidi, Y.S. (2004). 'The protection and management of historic monuments in the Sultanate of Oman: the historic buildings of Oman'. **PSAS 34**: 35-44.

Cartwright, C. (2004). 'Reconstructing the use of coastal resources at Rams al-Hadd, Oman, in the third millennium BC'. **PSAS 34**: 45-51.

Charpentier, V. (2004). 'Trihedral points: a new facet to the "Arabian Bifacial Tradition" '. **PSAS 34**: 53-66.

Edgell, H.S. (2004). 'The myth of the "lost city of the Arabian sands" '. **PSAS 34**: 105-120.

Kallweit, H. (2004). 'Lithics from the Emirates: the Abu Dhabi Airport sites'. **PSAS 34**: 139-145.

Lancaster, W. & F. with a technical report by Martin Bridge. (2004). 'Tree cores from Ras al-Khaimah'. **PSAS 34**: 147-156.

Mershen, B. (2004). 'Pots and tombs in Ibra, Oman. Investigations into the archaeological surface record of Islamic cemeteries and the related burial customs and funerary rituals'. **PSAS 34**: 165-179.

Pedersen, R.K. (2004). 'Traditional Arabian watercraft and the ark of the Gilgamesh epic: interpretations and realizations'. **PSAS 34**: 231-238.

Schreiber, J. & J. Häser. (2004). 'Archaeological survey at Tiwi and its hinterland (Central Oman)'. **PSAS 34**: 319-329.

Vosmer, T. (2004). 'Qalhat, an ancient port of Oman: results of the first mission'. **PSAS 34**: 389-404.

Other papers:

Biagi, P. (2004). 'Surveys Along the Oman Coast: A Review of The Prehistoric Sites Discovered Between Dibab and Qalhat'. **Adumatu 10**.

Hoorn, C. & M. Cremaschi. (2004). 'Late Holocene palaeoenvironmental history of Khawr Rawri and Khawr Al Balid (Dhofar, Sultanate of Oman)'. **Palaeogeography, Palaeoclimatology, Palaeoecology 213 (1-2)**: 1-36.

Suwaileh, A.A. (2004). 'Dilmunite General Health through the Evidence of The Third Mill Mounds Field, Bahrain'. **Adumatu 10**.

Geology and Palaeontology

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Conferences

ADIPEC - 2004

The geological conference held as part of the biennial Abu Dhabi International Petroleum Exhibition and Conference, ADIPEC, in early October had its major focus on the evaporates of Abu Dhabi. Held with the title 'Abu Dhabi Evaporite Retrospective', it was sub-titled 'Professor Douglas Shearman's Outstanding Research' as a tribute to the British geologist who was one of the first to study Abu Dhabi's surface geology.

Papers included:

Contribution of Dr. Shearman to Evaporite Studies (Professor Graham Evans)

History of Carbonate/Evaporite Studies in Abu Dhabi (Dr. Christopher Kendall)

The Impact of sea level change on Ramp Margin Deposition – lessons from the Holocene Sabkhas of Abu Dhabi (Dr. Robert Park)

Dolomite Formation beneath Abu Dhabi Sabkhas (UAE) – then and now (Dr. Judith McKenzie and Chris Ogono)
Evolution of Holocene Coastal Sabkhat of the UAE (Dr. Warren Wood)

Depositional Environment and sea-Level History of the Abu Dhabi Sabkha in the Vicinity of Al-Qanatir Island, UAE (Dr. Christian Strohmenger)

Some engineering properties of the carbonate sediments of Abu Dhabi island, UAE (Dr. R.J. Epps)

Arabian Tales: a historical review of the Quaternary sediments of the Arabian Gulf and its geological impact (Professor Graham Evans)

Forty years on – Holocene Evolution of Arabian Coastal Sabkhas – with an Overview of coeval Historical Development in the Region (Dr. Ananda Gunatilaka)

Organic and carbon isotopic geochemistry of the lagoon-sabkha system of Abu Dhabi, UAE (Dr. Fabien Kemp)

Chloride and Sulphate Deposits, Abu Dhabi Coastal Regions (Dr. Tony Kirkham)

Cyano-bacterial Mats in Strandline Evaporite/Carbonate Deposits along the coast of Abu Dhabi, UAE (Dr. Christopher Kendall, Dr. Abdul Rahman Al-Sharhan and Ahmed Al Suwaidi)

Seminar for Arabian Studies - London, July 2004

The annual Arabian seminar in London included, as usual, several papers related to the UAE and Oman.

Papers will be published next year in the *Proceedings*, and will be listed here then.

Doctorate on Abu Dhabi hares

Chris Drew, of the Environmental Research and Wildlife Development Agency, ERWDA, received his doctorate in November 2004 from the University of Stirling, Scotland, for a thesis entitled: "Aspects of the ecology and management of the Cape hare (*Lepus capensis* Linnaeus 1758) in Abu Dhabi, United Arab Emirates.

Abstract:

The Cape hare (*Lepus capensis*), known throughout Arabia as the desert hare, is of cultural significance within the United Arab Emirates (UAE). Hares were hunted using saluki dogs or falcons and provided a valuable source of meat to the desert Bedouins. No studies had been carried out on their ecology or management and this study represents the first piece of work on the subject.

The study shows that hares are distributed throughout the Emirate of Abu Dhabi; although there are preferences for certain landforms. An assessment of dominant vegetation types within the landforms found to be preferred by hares suggested that they contain better resources for food and shelter over the others.

Desert hares are considerably smaller than other members of the species found in Asia and Africa. The mean weights of male and female adult hares are 973 g and 1083 g respectively. Ear length represents 26% of their entire body length and is higher than that recorded for any other species of leporid.

The home range of male and female desert hares is 57 ha and 28 ha respectively. Hares have no significant preference for daytime resting sites during winter, however in summer there is a significant preference for larger cover-providing shrubs.

For desert hares, having a surface dwelling habit, resting site selection is clearly an important factor in their ability to survive. A pilot study to develop a method that used implantable, temperature sensitive radio transmitters to estimate body temperature was carried out. The technique may be used for estimating the efficacy of artificial refugia as a habitat management technique.

In order to facilitate the conservation of desert hares within Protected Areas, it is recommended that disturbance to hares at certain times of the day is minimised, introduced predators be controlled, and vegetation be restored in order to provide shelter and forage.



تريبيلوس

مجلة جمعية الامارات للتاريخ الطبيعي

خريف / شتاء ٢٠٠٤ م

المجلد ٢٠١٤

