

TRIBULUS

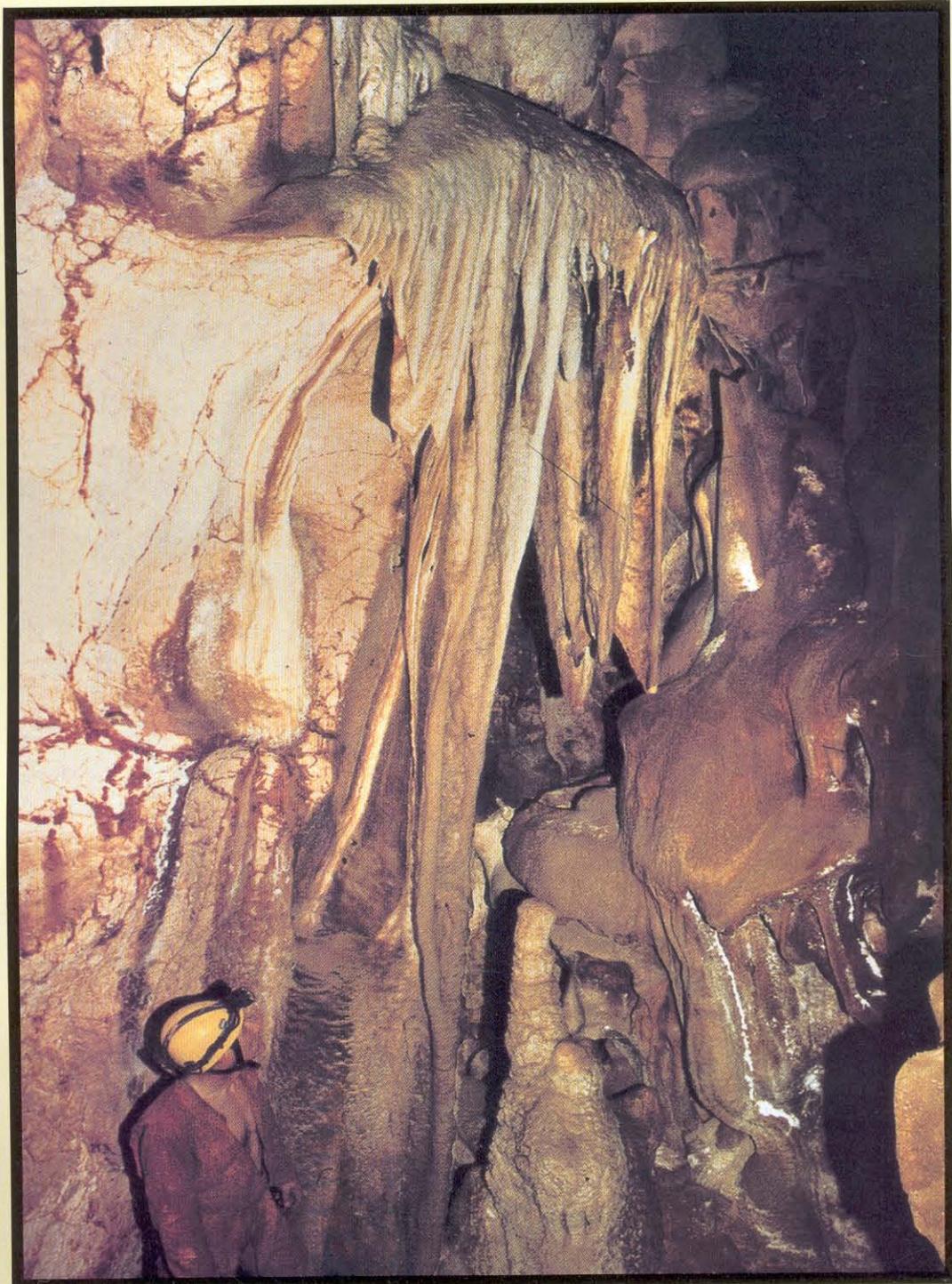


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TRIBULUS

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.

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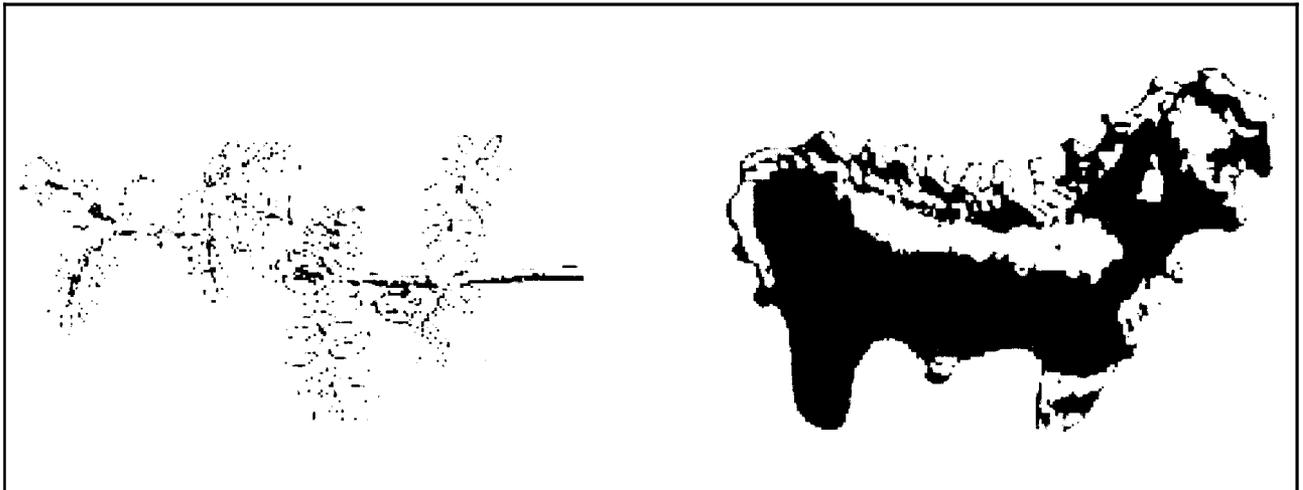
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The plant motif above is of the genus *Tribulus*, of which there are six species in the UAE. They all have pinnate leaves, yellow flowers with free petals and distinctive five-segmented fruits. They are found throughout the country, except in coastal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

The animal motif above is of a tiny golden bull, excavated from the early Second Millenium 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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Front: Studying a cave in Jebel Hafit (seep. 5).

.....**Picture by Tony Waltham**

Back: Cattle Egret *Bubulcus ibis* on the island of Sir Bani Yas

.....**Picture by David Robinson**

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 4, without whom publication in this format would be impossible. We also acknowledge the support and encouragement of our patron, H.E. Sheikh Nahayan bin Mubarak Al Nahayan, UAE Minister of Higher Education and Scientific Research.

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EDITORIAL

Over the course of the last few months, the UAE has attracted international criticism in terms of its performance on environmental issues. The latest World Environmental Sustainability Index, for example, placed the UAE at the bottom of the countries assessed. Another judgement on the country's performance, perhaps more important, was the decision by the secretariat of the Convention on International Trade in Endangered Species of Flora and Fauna, CITES, to recommend immediate suspension of trade with the UAE in wildlife and wildlife products because of the smuggling of illegally-caught Central Asian caviar into the country.

Both decisions were embarrassing, not least because of the Government's formal commitment to environmental conservation and protection. And, it should be acknowledged, that the CITES decision was not that much of a surprise, either. As previous Editorials have noted, there is often a wide gap between legislation on the statute book and enforcement of the terms of that legislation.

What is of particular significance, however, is the way in which Government and other bodies moved rapidly to respond in a clear, responsible and well-organised manner. As far as the Environmental Sustainability Index is concerned, the first task undertaken, by several bodies, including the Environmental Research and Wildlife Development Agency, ERWDA, was to analyse the components of the Index, to determine why the UAE had such a low score – and what could be done about it. One Index component, for example, is the number of Non-Governmental Organisations that are members of the World Conservation Union, IUCN. In the case of the UAE, there are only two - and we are delighted that the ENHG is one of them! Another component of the Index is based on carbon emissions. It was found that the figures used for the UAE were out of date, and did not take into account the achievements made by the ADNOC group in cutting gas flaring. The lack of availability for the Index compilers of up-to-date figures was found to be a problem in other sectors, too. Consultations were then undertaken with the compilers of the Index and relevant international organisations to discuss how the gaps identified could be addressed before the next Index is put together.

The Index itself does not, of course, compare like with like. Finland, at the top of the list, with its low temperatures, plenty of forest cover and fresh water, with a population growing relatively slowly, and without a major oil and gas industry, can't really be compared to the UAE. Nor can countries like Chad, which may be fairly similar in terms of

their geography, but are not developing at the speed of the stresses that such development brings.

The UAE's response to the Index, however, was positive, not defensive, not just in terms of the points mentioned above, but with the announcement of a Sustainability Initiative that the UAE will now put forward at the Rio + 10 conference in South Africa later this year. That suggests a mature and confident approach in dealing with criticism and those responsible are to be congratulated.

Another example of such an approach is the response to the suspension from CITES. This had a direct effect on the country, because it meant that trade in all wildlife was affected. Thus, legally-bred captive falcons or falcon hybrids could not be sent to the UAE, and falconers could not travel with their birds.

One of the problems with CITES in the UAE has always been the failure to equip the local designated authority, the Ministry of Agriculture and Fisheries, with sufficient resources, contributing to the failure to implement regulations effectively. Now, however, the Federal Environmental Agency has been made the authority, with local agencies, like ERWDA, being given powers to act on its behalf. In consultation with CITES, ERWDA has designed a whole raft of measures designed to ensure better implementation. A special register of captive falcons used for hunting has been established, along with a falcon 'passport' scheme, which will be administered by ERWDA. New legislation is being drawn up, and old legislation is being revised to strengthen the regulatory and monitoring mechanisms. As a result, the CITES suspension has already been partially lifted, with a full lifting possible by the end of the year if implementation of all the new procedures takes place successfully.

Such a rapid degree of progress could not have occurred without a firm resolve from the highest level of Government to acknowledge not only that a problem existed, but that the necessary action must be taken swiftly to resolve it.

Perhaps both issues, or problems, have been blessings in disguise. They have shown that issues like poor information gathering, ineffectual implementation of legislation and so on, are not simply matters that can be ignored, but have the capacity to cause real inconvenience and embarrassment to the country. That has, however, been limited by the wisdom and determination of our own senior environmental policy-makers.

To turn briefly to the contents of this issue of *Tribulus*. Our lead contribution is the first in the journal to deal with the presence of caves in the UAE, and we are delighted to welcome these new contributors. Other topics, and contributors, are more familiar, but there is, we believe, the usual wide range of material to keep readers happy!

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:

Al Fahim Group; Al Sayegh Richards Butler; British Petroleum (BP); Denton, Wilde, Sapté; Emirates Holdings; GAMCO; Hyder Consulting Middle East; Jashanmal National Company; Metco; Mohammed Bin Masood & Sons; Nama Development Enterprises; National Bank of Abu Dhabi; Omeir Travel Agency; Penspen International Limited; Ready Mix Abu Dhabi Ltd; Beach Rotana Hotel; Simmons & Simmons; Tabreed; Trowers & Hamlin; Union National Bank; WESCO.

Magharet Qasir Hafit, a significant cave in the United Arab Emirates

by Tim Fogg, Pam Fogg and Tony Waltham

Abstract

The limestone ridge of Jebel Hafit, overlooking Al Ain, contains caves that include Magharet Qasir Hafit with 450 m of shafts, passages and chambers reaching to a depth of 96 m. Stalagmite from the cave has been dated to 337,000 years ago, but the passages are much older, and originate from either a wetter past environment or a phase of hydrothermal activity. The subterranean fauna includes the remains of various bat species and living bristletails that are unpigmented and may be unique to these caves.

The karst of Jebel Hafit

The mountain that contains the cave is an isolated limestone ridge in the interior of the United Arab Emirates. At its northern tip stands the oasis city of Al Ain, and its southern end is over the border into Oman. The single ridge is only 12 km long, but it rises to a height of 1240 m, making it the highest ground in the Emirate of Abu Dhabi. It stands 900 m above the dunefields of the surrounding desert, and is a most impressive landmark. Jebel Hafit is a steep and slightly overfolded anticline of Eocene limestones, stripped of its cover rocks and only slightly eroded by wadi incision. At the summit of the mountain, the sequence of strong, massive and nodular limestones is hundreds of metres thick. In cave exposures, the buff limestone is laced with thin veins of calcite and red clay, which frame the nodular structures; the red clay is weathered away in surface outcrops, where the rounded nodular forms become more conspicuous. Concentric banding within the nodules is seen in some cave walls. Some beds are spectacularly fossiliferous, with echinoids, foraminifera, gastropods and sharks' teeth; bedding is not conspicuous.

Miocene folding created the Jebel Hafit anticline, with its axis aligned nearly north-south and plunging to the north. The western limb dips at about 40 degrees, but the eastern limb steepens to just beyond the vertical and is broken by a reverse fault.

The climate of the Emirates is barely conducive to limestone dissolution, and karst landforms appear to be very restricted. The wadis are dry. There are no signs of active underground drainage, though immature fissure systems in the heavily fractured limestone do appear to absorb the sporadic rainfall input. There is no impermeable cap to gather any meagre surface flows. Microkarren are etched into most surfaces on bare, undisturbed rock; the presence of these to the exclusion of any larger karren forms is the almost ubiquitous sign of minimal dissolution in desert environments.

The cave of Magharet Qasir Hafit

The cave entrance was exposed in a shallow trench that was cut into the limestone to take the foundations for a new building on the summit ridge of Jebel Hafit. A narrow vertical fissure had been blocked and covered by natural limestone debris: clearance to foundation level

revealed an elliptical shaft just large enough to descend. All the accessible cave was subsequently explored by Olivia Pozzan, Bill Algaier, Brian Goggin and a few other expatriates; they found more than 450 m of passages, reaching to a depth of 96 m. Exploration was a slow process as the main route on was not always obvious, and some narrow inclined rifts do not make for rapid progress underground (Plate 1).

The cave was surveyed at the request of the land owner by Tony Waltham and Tim Fogg in December 1997 (Plate 2); it provides no threat to the stability of the buildings above it. On a subsequent visit by Tim and Pam Fogg and Simon Aspinall, (Director of the Environmental Studies Unit of the Abu Dhabi Islands Archaeological Survey, ADIAS), the cave biology was examined, and stalagmite was collected for dating.

The narrow entrance rift drops 9 m into Top Passage, the higher of two level phreatic tunnels, both of which are choked just short of their exits onto the hillside to the south. Northwards, the Rift Below narrows, but Top Passage descends to the spacious, rounded Main Shaft, which drops 22 m into a rift passage. A traverse from the foot of Main Shaft is followed by an inclined fissure descent to Coral Passage, a second inclined fissure aligned to the southwest, which offers uncomfortable progress as it is narrow with coralloid calcite on its walls. Further fissure traverses and a long climb descend to a wider chamber with the stalactite curtains of the Calcite Waterfall at its far end.

In the floor of this chamber, Rift Pitch is a broken, awkward, oblique descent of 26 m in a narrow fissure. From the group of rift chambers at its foot, a traverse to the southwest leads to climbs up terraced flowstone and a short descent into the Crystal Ballroom. Though only 15 m long and 4 m wide, this is the finest chamber in the cave, with its walls liberally decorated with flowstone, stalagmites, stalactites, crystals and coralloid coatings. A long sloping climb up flowstone reaches the Red Room, smaller than the Ballroom, but with its upper alcoves cut into ancient flowstone with spectacular red and white vertical banding. From a ledge in the far end of the Red Room, a narrow tube descends into fissures which double back beneath themselves into a vertical labyrinth of small rifts and tubes, mostly within a single fissure; all narrow in, or are choked with, sediment.

Magharet Qasir Hafit contains a significant variety of calcite deposits. There are some fine stalactites and curtains, and flowstone forms steep sloping floors in the lower chambers of the cave. Notably common in the cave is coralloid calcite (Plate 3); some of it formed in pools of water, but some appears to have been deposited by thin films of surface water in open passages. Aragonite occurs in some small crystalline forms, and as a few layered flowstones in both the shallow and deeper parts of the cave. Thick banded flowstone is abundant in the large rift chambers; it is exposed most clearly in the Red Room, and has been dated to about 337,000 years old. Eroded remnants of similar material occur in other chambers, and it also forms the roof in some of the high fissures.

Origin and development of the cave

Nearly all the passages in Magharet Qasir Hafit have been formed along the major conjugate joints and faults; these provided the open pathways for the initial flow of groundwater through the limestone, and only a few sections of passage have developed away from them. Rounded walls and domed roofs throughout the cave indicate that almost its entire development was under phreatic conditions (Plate 4). There is, however, scope for debate over the precise environment and age of this phreatic development.

In a conventional concept of cave genesis, karstic dissolution is by meteoric groundwater (that originates from rainfall and discharges to sweetwater springs). Phreatic enlargement of Magharet Qasir Hafit was within the most active zone of dissolution, immediately below the contemporary water table (Waltham & Fogg, 1998). That water table was close to local base level and any surrounding plain, comparable to the situation where foot caves are now forming around the base of Jebel Hafit. Since then, local base level has declined by either or both tectonic uplift and surface lowering of the adjacent plain, and the total relative movement has been 800 m (the elevation of the cave entrance above the surface level of the surrounding plains). The largest and most mature passages are in the horizontal galleries near the entrance, and in the lower chambers of the Crystal Ballroom and the Red Room. This pattern may indicate that cave development was largely in two phases, the first when the water table stood at about the 1050 m level, and the second when it had been lowered to about the 1000 m level. Subsequently the cave was completely drained; bygone phases of percolation water were responsible for most of the calcite deposition, but the cave is now almost completely dry.

An alternative genesis is that the cave may have been corroded out of the limestone by deeply circulating hydrothermal solutions (Waltham & Jeannin, 1998). This is suggested by the distinctive bulbous morphology of the Top Passage in particular (Plate 5), and also by even better examples of these bulbous shapes in Kahf Hamam, a cave beside the road part way up Jebel Hafit (Jeannin, 1992). The concept of cave formation by hot waters rising from below is relatively new, following recognition of the process in the famous caves of Carlsbad and Lechuguilla, in New Mexico, USA. Subsequently a few caves elsewhere have been re-examined and it has been claimed that they too could be of hydrothermal (hot water) origin. One of their characteristics is an abundance of irregular bulbous passages. It is also significant that hydrothermal caves are more likely to occur in the mountains around basins that contain oilfields, and some of the spring waters emerging from the foot of Jebel Hafit have anomalously high temperatures that may indicate geothermal warming.

Evolution of the karst

Magharet Qasir Hafit was not formed at the top of a mountain. If it was formed by normal, meteoric groundwater, the process was very slow and took place below the regional base level. It therefore predates 800 m of erosional lowering of the surrounding plains. In desert environments, the mean rate of surface lowering may be estimated at about 50 mm per 1000 years (from

various sites in comparable environments where some datable feature, such as an igneous rock, can be related to surface paleomorphology). Derived values for lowland and foothill deserts range between 15 and 80 mm per 1000 years; a value of 50 mm makes some allowance for more rapid erosion during wetter climates in the past, but is only a best estimate. If surface lowering were the sole factor responsible for base level decline, the fall of 800 m would have taken about 16 million years. Erosion rates would have been much higher in an uplifting mountain terrain, and could match tectonic uplift rates in the order of 1 m per 1000 years, and the relative elevation of Jebel Hafit could have been achieved in about 1 million years. In either case, the time interval represents a minimum age for the cave, in the range 1-16 million years.

It is possible that hydrothermal solutions could rise inside an anticlinal mountain to elevations above the regional base level, at least for the shorter time necessary to create a cave by strong acid dissolution. Any elevation of the locus of dissolution reduces the amount of subsequent lowering of the surrounding planes to leave the cave in its present mountain-top site. This could then sensibly account for the cave being a little younger than the 1-16 million years deduced for a cave of non-hydrothermal origin. The age of the stalagmite in the Red Room, 337,000 years, merely shows that the cave was already drained by that time. Magharet Qasir Hafit is clearly a very old cave. It appears to be some millions of years old, but conclusive evidence for a more accurate age is difficult to recognise.

One sample of the thick, banded flowstone in the Red Room of Magharet Qasir Hafit (Plate 6) has been dated to 337 ka (in a probability range of 290-426 ka). A second sample from the Red Room has been dated to 100 ka (+/-7 ka), and appears to represent a second phase of deposition, though there is a possibility that it is the same old material modified by weathering. The flowstone is very similar to that which is abundant in the larger cave systems further east in Oman (Waltham *et al*, 1985). The age of the older material in the Red Room falls within one of the bands of dates determined for flowstones from Kahf Hoti (Burns *et al*, 2001). The range of dates of the Omani material suggests that the main periods of Pleistocene groundwater flow, and stalagmite deposition, were during warmer interglacial phases when the monsoon belt was shifted north of its present location. The Red Room material supports this concept, which is contrary to the notion (widely held before stalagmite dates were available) that the wetter climates of Arabia coincided with the glacial advances at higher latitudes.

The stalagmite analyses confirm only the date of the major phase of calcite deposition within the drained cave, and do not relate to the much greater age of the cave enlargement. This could well date back to the Neogene, to coincide with a phase of stream entrenchment in the wetter climates that are inferred from hippopotamus fossils in their sediments. Any further consideration of the cave's age remains speculative. A late climatic oscillation has been timed at about 7000 to 8000 years ago, when the local Neolithic cultures flourished in a wetter environment. This may have been the last time that percolation water have invaded the cave, to deposit the coralloid calcite in standing pools and also some of the fresher dripstone. Deposition of this younger calcite in the ancient passages of Magharet Qasir Hafit, was probably contemporary with erosion just below the water table, to form the foot caves around the base of Jebel

Hafit (Waltham & Fogg, 1998).
There is much still to learn about karst and cave
development in south-eastern Arabia. Magharet Qasir
Hafit appears to match the pattern that has already been

recognised elsewhere in the Arabian peninsula - of very
ancient cave development followed by flowstone
deposition and then almost complete abandonment.
(text continues on P. 13)

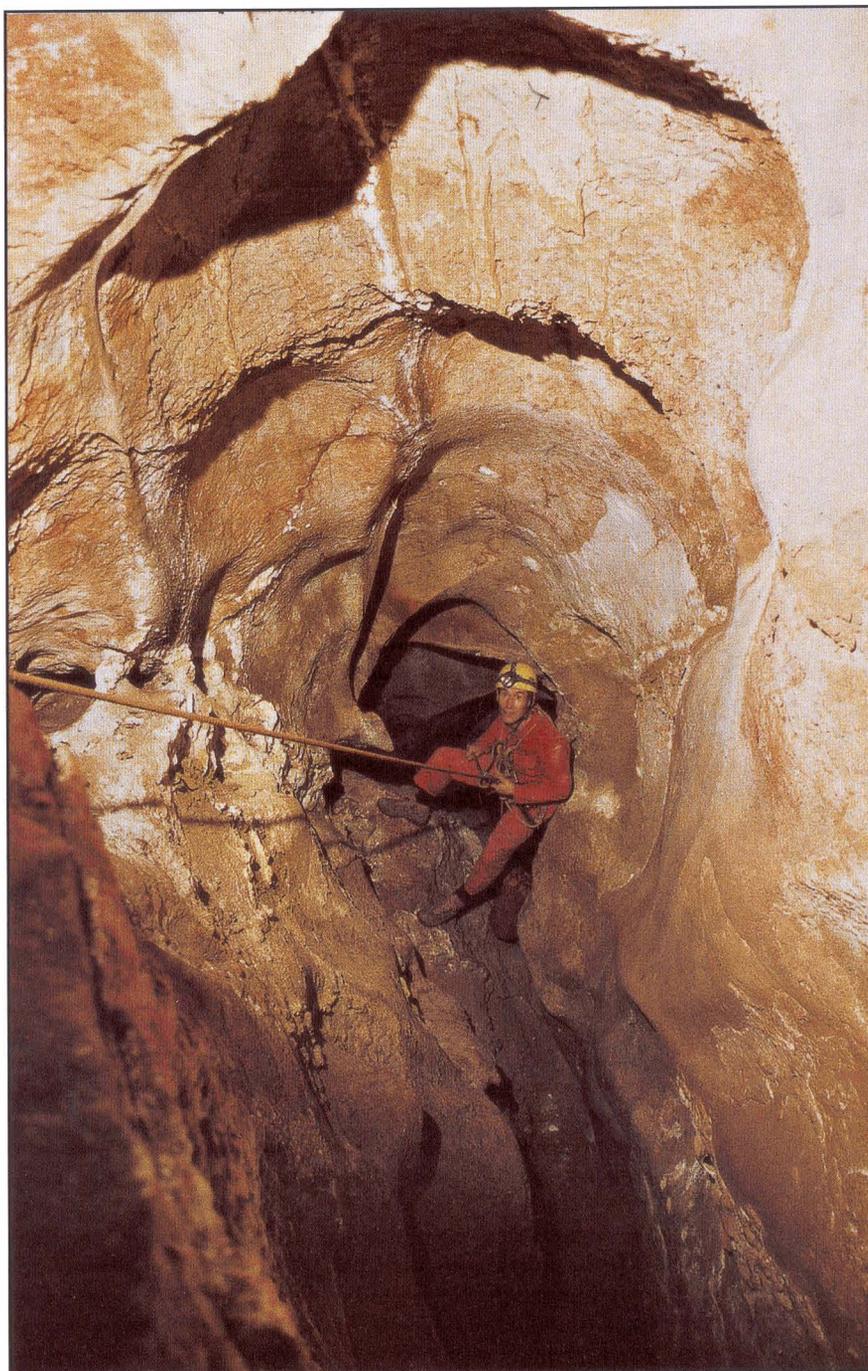


Plate 1. Looking down the rope pitch in the rounded phreatic rift below the Ledge

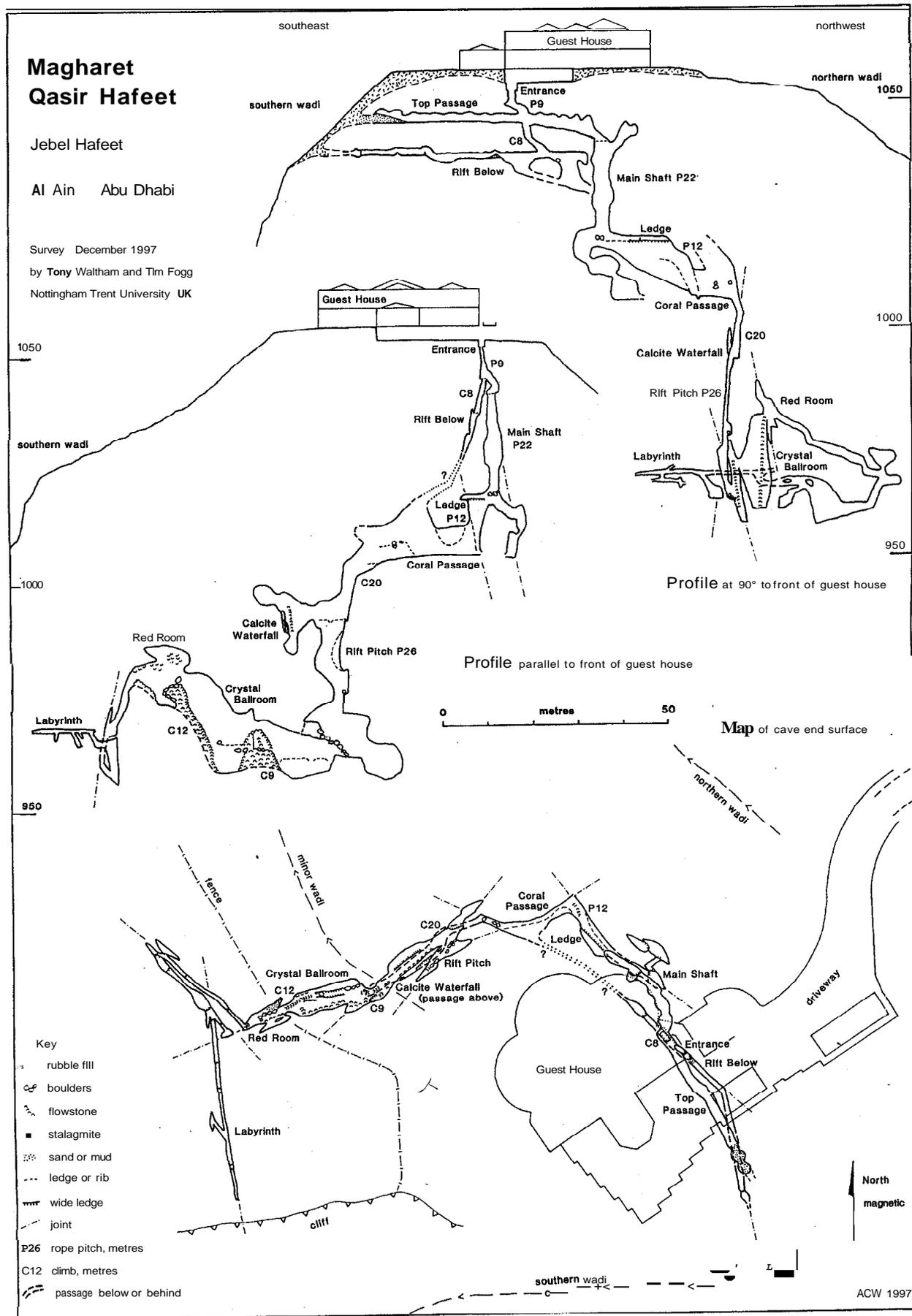


Plate 2. The survey of Magharet Qasir Hafit

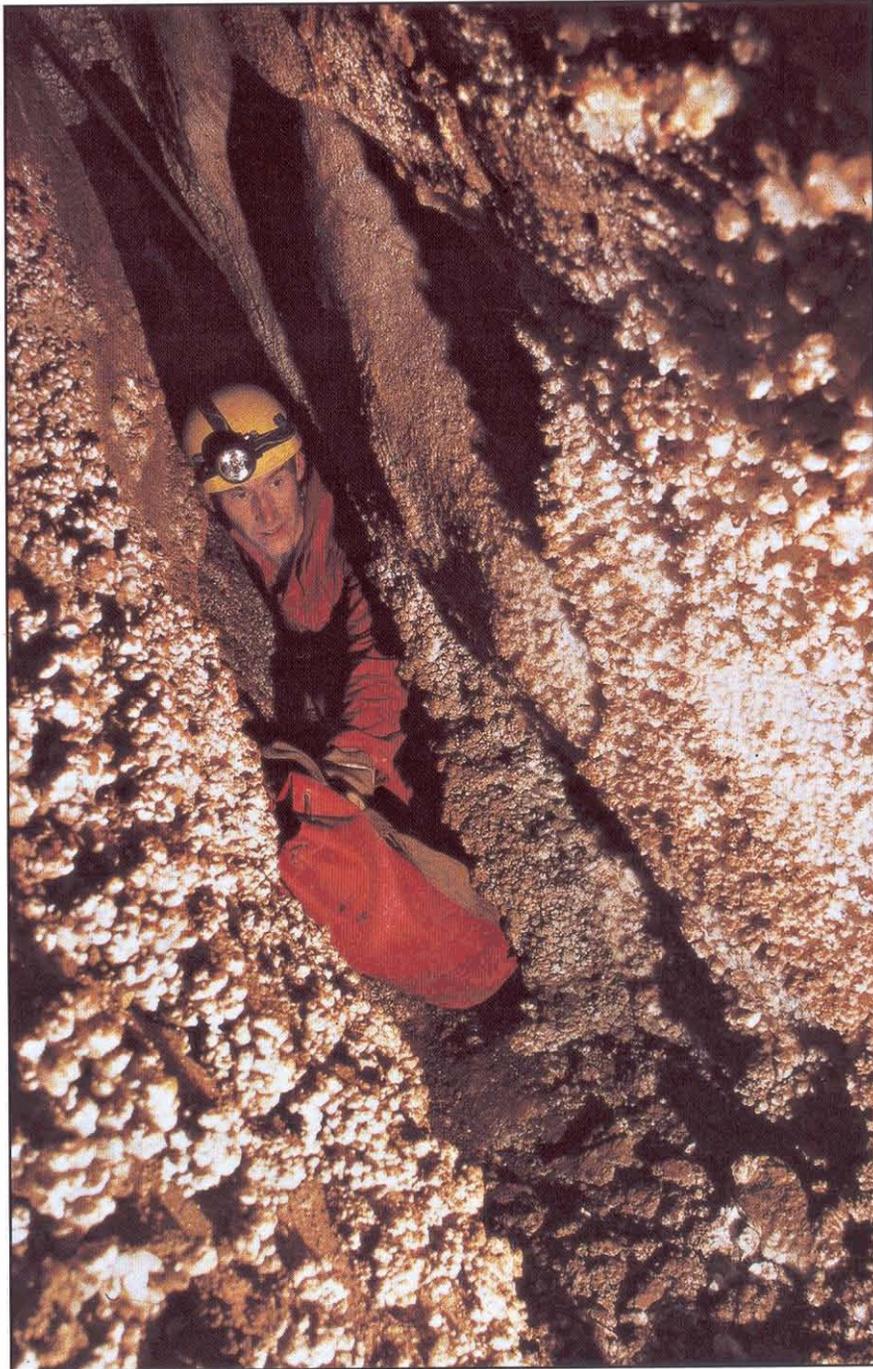


Plate 3. Coralloid calcite on the walls of Coral Passage

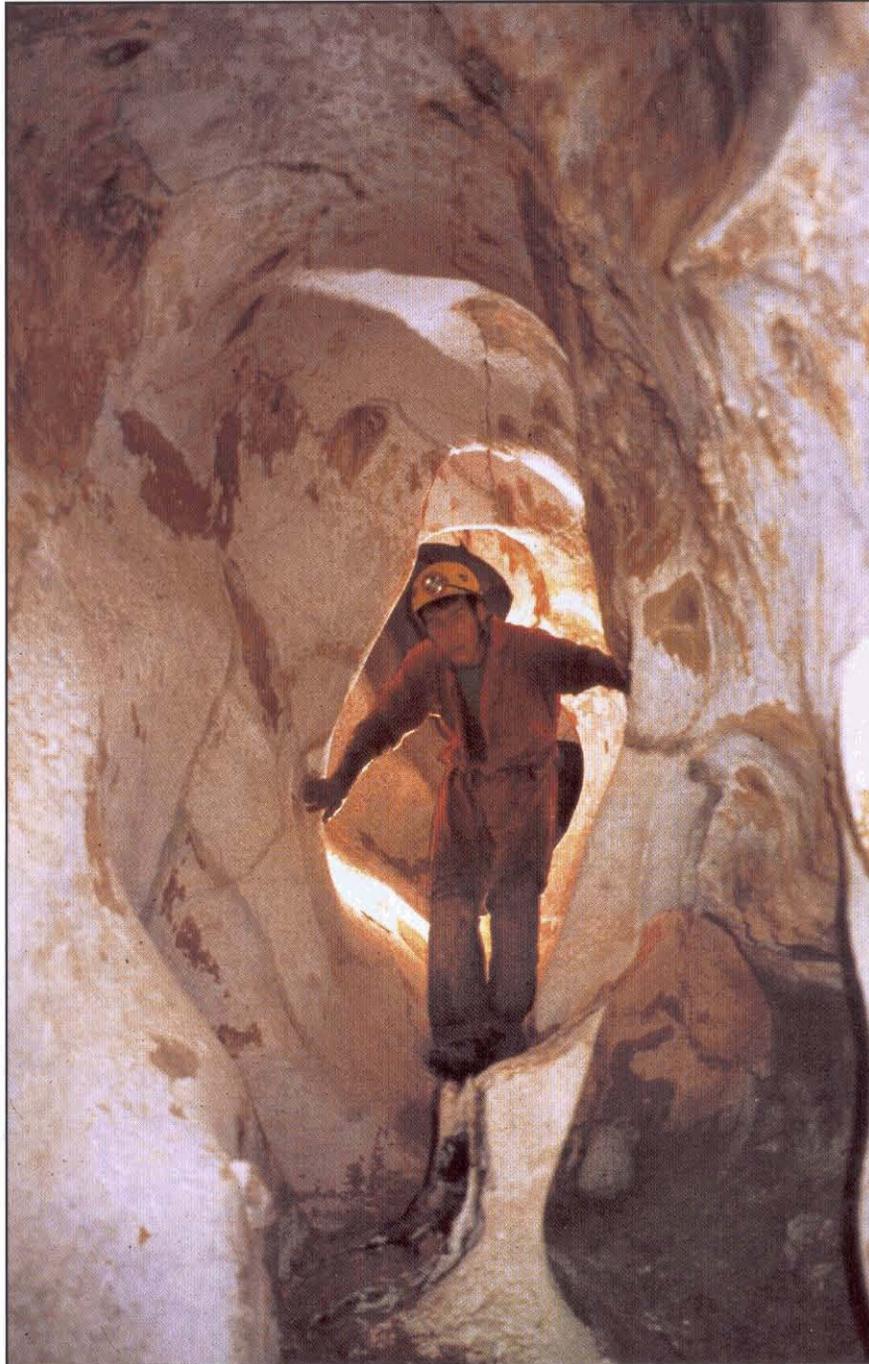


Plate 4. A typical phreatic passage in the Labyrinth



Plate 5. The rounded phreatic roof domes in Top Passage

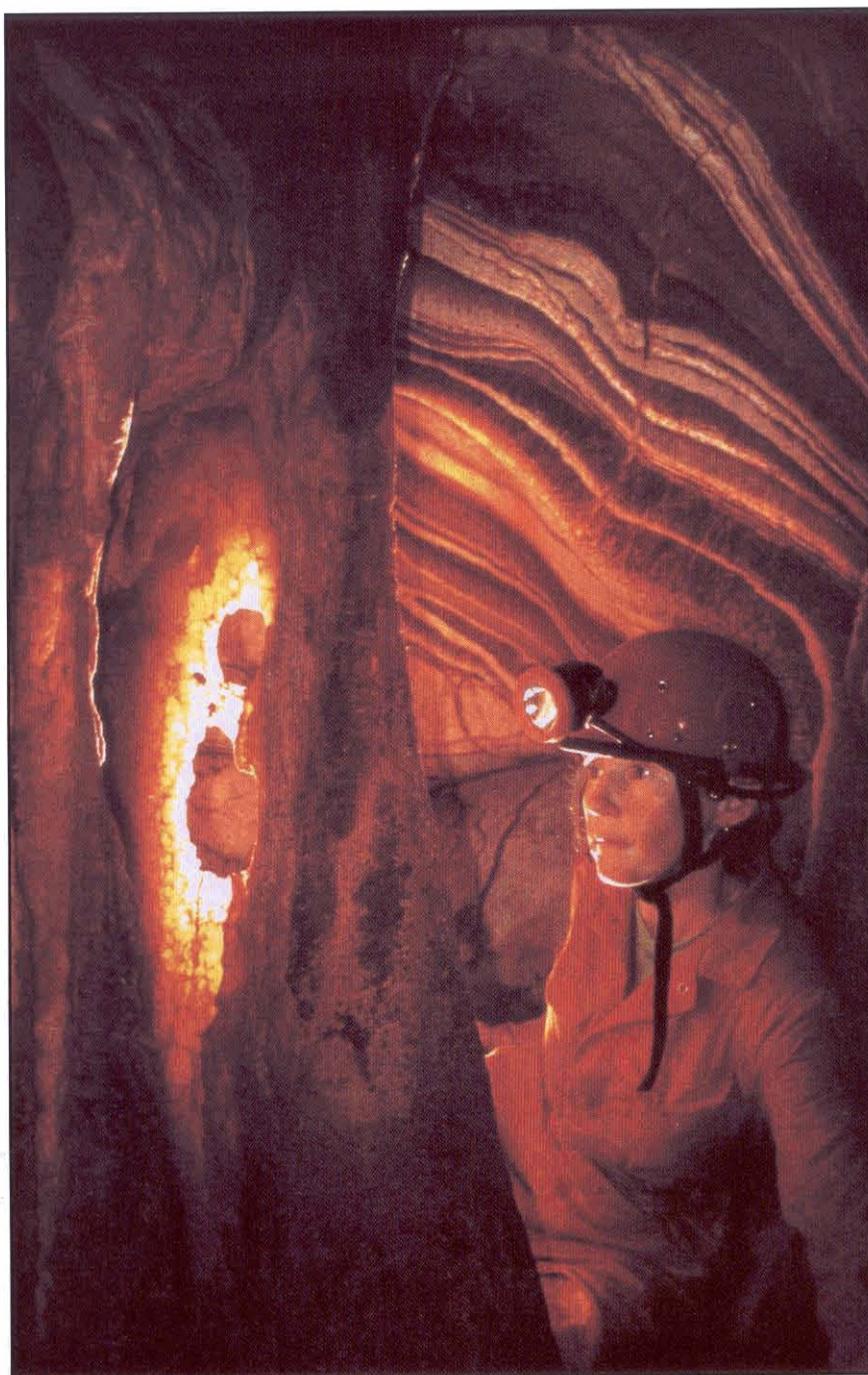


Plate 6. The banded flowstone deposited 337,000 years ago in the Red Room

Fauna within the cave

During the 1997 exploration and survey of the cave, various faunal observations were noted, the most significant being the presence of living insects in the farthest and deepest section of the cave. A basic sampling programme was undertaken on a later visit, in 2000.

Populations of the living insects were again located in 2000, and individuals were collected from the Labyrinth passages. They were also found in the Red Room. The insects have elongated flattened bodies (10-15 mm long) with three tail-like appendages at the posterior end of the abdomen. They are entirely white and have been identified as bristletails, order *Thysanura*, which are primitive wingless insects. Cave endemic species are known from other countries. The specimens from Magharet Qasir Hafit appear to be adapted to the cave environment, as they have long antennae and lack any pigmentation. Specialists in *Thysanura* are few and it seems likely that it will be extremely difficult to identify these bristletails. Very little work has been carried out worldwide on the order. Although there are about 370 species recorded world wide, it is estimated that only 60% of the North American fauna is documented despite decades of intensive entomological research.

One specimen of another cave-adapted species was collected for identification from a stalagmite in the Red Room. This is a white insect, 2-3 mm long, that resembles an isopod. Although the single specimen was preserved in 70% alcohol and glycerine, no detailed identification has been possible.

The Rift Below passage, the end of Coral Passage and the Labyrinth passages were among a number of sites throughout the cave where evidence of ant activity was found. Both live and dead ants were seen, along with soil tubes that may have been constructed by the ants on the cave walls. Spiders' webs were established in the roof domes of Top Passage, and spiders 5 mm long have been observed on them. The webs were found in December 1997 and in 2000, and it is likely that the spiders entered the cave after the entrance shaft was opened; they exist on small insects which enter the cave, possibly aided by the inward draught during the night.

Small fragments of vegetable material, including grass stems and roots, were seen in the cave in both 1997 and 2000. A plant root system has grown over a rock wall at the far end of Coral Passage, and may be an important source of nourishment at the base of the cave food chain. Bristletails are known generally to feed on vegetation. Furthermore, the high humidity (nearly 100%) and the relatively constant temperature of the cave air (close to 32 degrees C) appear to offer suitable conditions for the support of basic forms of life throughout the passages.

Clusters of small bones were found at various sites in the Crystal Ballroom and Red Room. These fossil micro-vertebrate remains and mammalian bones have been examined, and belong to bats and possibly a small fox. Preliminary study of the bat remains showed clearly that at least two and possibly three species of bat are present. These include a species of sheath-tailed bat (possibly *Taphozous perforatus*, the Egyptian tomb bat), horseshoe bat (*Rhinolophidae*) and some as yet unidentified species. The presence of the bats and fox in these deep chambers may represent single events when the animals entered the cave via small fissures and were unable to relocate the exit before they perished.

Alternatively, the bats may be the residue of a more permanent roost within the cave at some time in the past when a fissure or fissures were open to the surface. No bats were found living in Magharet Qasir Hafit, though Kahf Hamam and the Hafit foot caves contain active roosts of free-tailed bats (Plate 7).

The bat remains add to the knowledge of the fossil mammalian fauna of the United Arab Emirates. The living troglobites may be species unique to the ancient cave passages in Jebel Hafit, as the mountain and its caves have constituted an environmentally isolated niche for many millennia. Further studies that can conclusively identify and perhaps date the faunal remains would be worthwhile.

The modern cave environment

There are signs of only minimal water entry during the rare storm events; tiny amounts of water observed on some of the formations may be condensation from the micro-environment created by the observers themselves. The present water table in the limestone is at a level close to that of the gravel plains both east and west of Jebel Hafit; this is about 700 m below the deepest parts of Magharet Qasir Hafit. Fissures within the limestone appear to be able to carry any occasional drainage from the mountain down to the flooded zone of the aquifer, but no known cave passages reach to the greater depths.

Air circulation in the cave is not good. Below the 975 m level, the air is static and stale. This suggests that the rock fissures, which must exist through to the southern wadi, are sealed by calcite or mud deposition. Above the 975 m level, the air is fresher. Air blows out of the entrance in the late afternoons, but there is usually no significant air movement in the mornings. The air appears to be circulated and exchanged by natural cave breathing. In the heat of the day the ground warming causes thermal expansion of the cave air, creating the outward draught through the entrance in the afternoon. Ground cooling through the night probably creates an inward draught in the early hours of the morning; this then stops as the new day warms up, before the reverse draught is started in the afternoon.

Radon concentrations of 7368 and 9420 Bq/cu.m. have been measured in the lower chambers of the cave. These radon levels are high, but match what would be expected in a poorly ventilated cave within a massif that has geothermally warmed water circulating through its base. The stale air in the cave's lower chambers is probably slightly depleted in oxygen and enriched in carbon dioxide. Neither these levels of gas anomalies, nor the elevated radon levels, provides any hazard or danger to visitors to the cave.

It should be noted that there is no access for visitors to Magharet Qasir Hafit; its entrance is through a manhole in the basement of a private house on private ground.

Acknowledgements

This paper is based on reports prepared for the owner of the land in which lies Magharet Qasir Hafit. His financial and logistical support is gratefully acknowledged, as his permission to publish this paper. We also thank Olivia Pozzan, Simon Aspinall and Bill Algaier for their enthusiastic and energetic assistance in the cave; Peter Hellyer of the Abu Dhabi Islands Archaeological Survey for logistical assistance and support; Mark Beech of

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Plate 7. A free-tailed bat in nearby Kahf Hamam

The Ru'us al-Jibal mountains of Ras al-Khaimah- considerations for and against establishing a protected area.

by Robert E. Llewellyn-Smith

Abstract

The Ru'us al-Jibal mountains in Ra's al-Khaimah have been proposed by wildlife experts for protected area status, mainly on account of their endangered montane wildlife, particularly the Arabian leopard *Panthera pardus nimr*. Following a brief description of the area, this paper reports the main reasons for reserving a portion as a protected area. However, factors which may limit justification and successful operation are also included. By way of conclusion, protection is proposed and a specific approach suggested.

Introduction

It has been recommended that various sites in the UAE, which represent the full range of ecosystems present, form a network of protected natural areas (Aspinall 1995, Aspinall 1996). One site proposed by Aspinall (1996) and Stuart (1996) is the western Ru'us al-Jibal mountains, predominantly in the Emirate of Ra's al-Khaimah, bordering Oman. The principal justification given is the conservation of endangered montane wildlife including the Arabian leopard *Panthera pardus nimr*. An IUCN protected area management Category II as National Park and Transfrontier Reserve has been suggested where the area is managed primarily for ecosystem conservation and recreation.

In January 1999, the Arabian Leopard Trust (ALT) recruited the author to examine the feasibility of establishing a protected area in the Ru'us al-Jibal. A protected area is defined as 'an area of land and/or sea dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means' (IUCN, 1994).

A brief description of the area's geography, human population, fauna, flora, visitor interest and current land use is provided as background, followed by reasons for and against establishing a protected area.

Description of the area

Geography

The Ru'us al-Jibal is a rugged limestone mountain range, deeply dissected by wadis with Jebel Hejaylah, at 1565m, being the highest mountain in the UAE portion. The mountains extending into Oman form the Musandam Peninsula.

Rainfall is usually localised and sporadic, with some years receiving little or none, but the mountain range can receive up to 140mm average annual precipitation (Boer 1997). Little surface water exists except for a few isolated permanent seepages, and some deeply eroded limestone pockets which can contain water throughout the year.

Excluding areas of settlement in the wadis and mountain fringes, potentially there exists a 350 sq. km area of UAE

territory suitable for protection. This includes an approximate 100 sq. km area of montane habitat in the adjoining Fujairah Emirate.

Human population

The UAE portion of the Ru'us al-Jibal is the traditional tribal territory of the Shihuh, Bani Shumayli and Habus tribes of Ra's al-Khaimah and the Naqbiyin and Sharqiyin tribes of Fujairah (Figs. 1 & 2). All these tribes have largely retreated off the mountains, living in modern houses along their base or along the coast.

Traditional life, prior to the formation of the UAE in 1971, centred on seasonal nomadism with the cultivation of wheat and barley during autumn and winter on mountain terraces and date palm gardens on the coastal plains during the summer. Interesting structures which characterise the high villages (fariges), explained by Costa (1991) and Lancaster (1997/18; 1998/9), are distinctive stone houses known as bayt al-qufl (Fig. 3), stone granaries (yanz), mill houses, walled fields, irrigation spill ways, diversion channels and cisterns.

Traditional resource conservation centred mainly on the protection of trees which provided many valuable functions such as shade, beams for roofing, fodder, tool handles, and revenue from the sale of firewood, medicines, edible fruit and honey. Even today all trees are reportedly owned and living trees are never cut down. The local mountain tribes remain very proud of their traditional heritage which is reflected in the reconstruction of stone houses and displays of tools and weaponry in their respective Arts and Social Centres. In the mountains, land ownership and tribal territory is respected between tribal groups with strangers regarded suspiciously. A recent trend of stone house refurbishment reflects a continuing cultural identity and proof of ownership, although in some villages it is now hard to find an original bayt al-qufl.

Fauna

Various mammal species still survive in the Ru'us al-Jibal although at low density and many in small numbers. The first preliminary wildlife survey in the UAE portion of the Ru'us al-Jibal (Stuart, 1996) confirmed the presence of Arabian leopard *Panthera pardus nimr*, caracal *Caracal caracal schmitzi*, red fox *Vulpes vulpes*, Blanford's fox *Vulpes cana*, Egyptian spiny mouse *Acomys cahirinus* and Brandt's hedgehog *Paraechinus hypomelas*.

To further investigate wildlife status, the author conducted a photo-trapping exercise from October 1999 to April 2000. Two wildlife infrared cameras (Trailmaster Inc., USA), with bait, were placed periodically at seven different sites, either near to water, goat carcasses or where signs of caracal or leopard had been found. Ideally, additional cameras would have given more comprehensive data but limited resources prevented this. The exercise yielded pictures of Blanford's fox, red fox and numerous pictures of goats. These pictures of

Blanford's fox were the first photographic evidence of their presence in the area (Llewellyn-Smith, 2000). No pictures were obtained of caracal or leopard. This provides some support to claims that these predators exist in very low numbers.

Of over 400 bird species recorded in the UAE, thirty six bird species were recorded in the Ru'us al Jibal mountains in the winter of 1995/6 (Stuart, 1996). Hume's Wheatear *Oenanthe alboniger*, Chukar *Alectoris chukar* and Sand Partridge *Ammoperdix heyi* are most commonly seen, and the mountains are suspected to be the UAE's only breeding site for the Common Cuckoo *Cuculus canorus*.

Flora

From a distance the mountains look barren, but closer inspection reveals a great variety of species with various plants traditionally known for their medicinal properties. Low-growing woody perennials are dominant and highly adapted to the extreme conditions of limited rainfall and high temperatures. Various ephemeral species appear after rain in the cooler months. Vegetation above 1,000m is dominated by *Euphorbia larica*, *Dodonaea viscosa* and *Prunus arabica*. Below 1,000m slopes have a thin covering of grass and a sparse shrubland of *Acacia tortilis*, with *Moringa peregrina* on steep slopes. The tree species *Ficus salicifolia*, *Zizyphus spina-christi* and *A. tortilis* occur along drainage lines (Western, 1989).

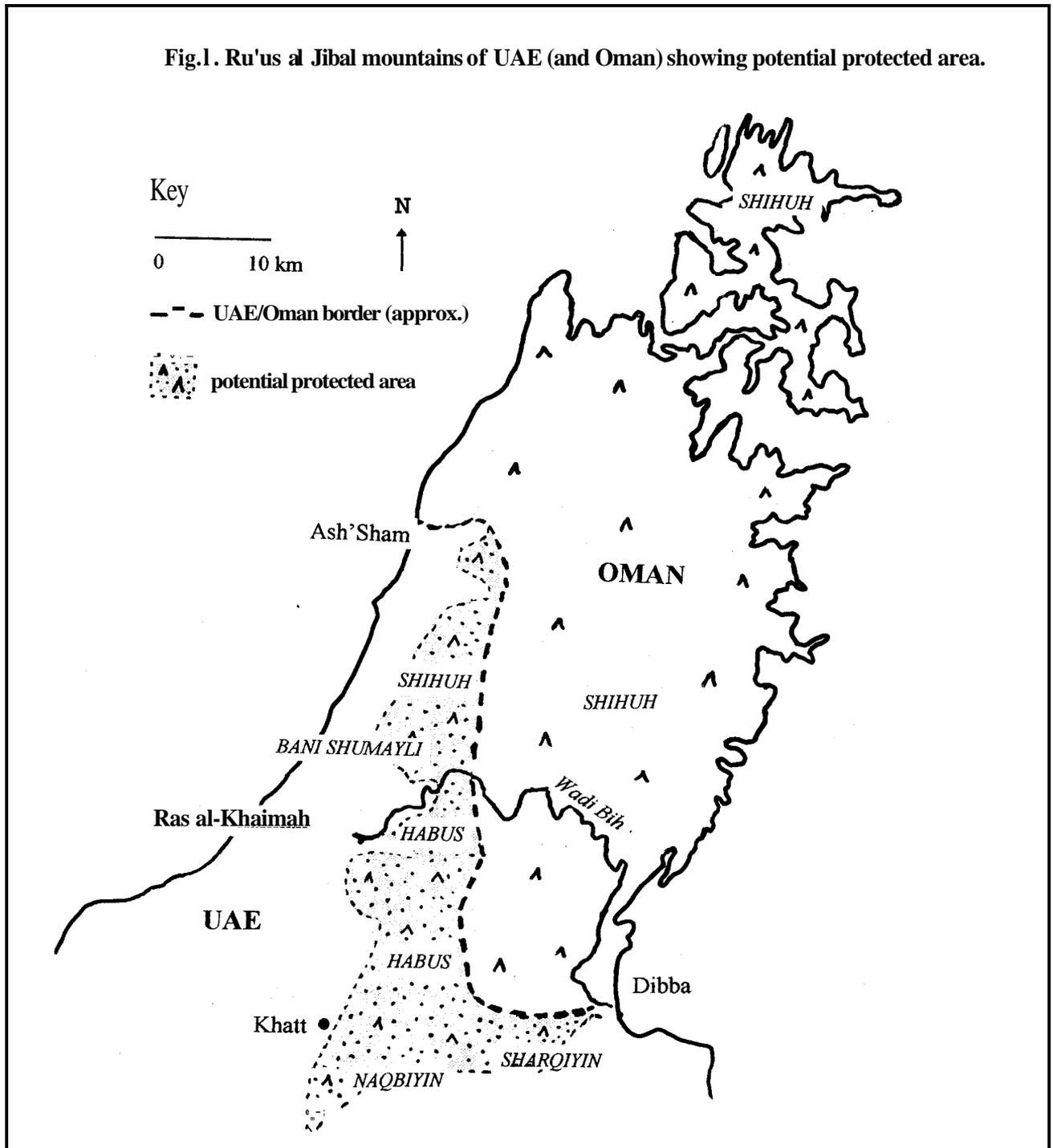


Fig. 1: The Ru'us al Jibal Mountains of UAE and Oman showing potential area for protection

Visitor interest

The majority of visitors to the Ru'us al-Jibal come on day visits to drive and picnic along the impressive Wadi Bih from Ra's al-Khaimah to Dibba. Various tour operators include this drive in their programme. A very small number of people, mainly expatriates, go trekking, bird watching, camping and rock climbing.

Current land use

The high mountain terraces, some perhaps as old as the Bronze Age (3rd Mill. BC), are no longer cultivated. Many local landowners own large goat herds which are either fed and watered daily or left to roam and inspected periodically. Some locals employ immigrant shepherds to live up in the mountains to look after their flocks. Some farming still occurs on terraces in the lower wadis. Along the mountain fringe quarries linked to the cement industry operate at Khor Khuwair and near Rams.

Given this background, what justification is there for establishing a protected area, perhaps as a National Park? If justifiable, is it feasible? In an attempt to answer this, various criteria adapted from McKinnon *et al.* (1996) have been used to assess principal reasons for and against protected area status.

Reasons for creating a protected area

1. Rarity

One of the most important functions of a protected area is to conserve endangered species of fauna and flora. The Arabian leopard still occurs in very low numbers and is described as 'critically endangered' in the Red List of

Mammals of the UAE (Hornby, 1996). Caracal are described as 'vulnerable'. However, it is thought that leopard are predominantly resident in Oman territory, moving in and out of UAE territory on a sporadic basis. Stuart and Stuart (1995) believe that no more than 20 adult leopards remain in the whole area. Evidence collected by the author suggests numbers in single figures are more likely. Sadly, shooting and trapping of caracal and leopard still occurs, with incidents reported even during the study period.

2. Uniqueness and heritage value

The Ru'us al-Jibal is the UAE's largest area of limestone montane habitat and the only area containing high altitude agricultural terracing and *fariges*. This modified landscape augments biological values and adds significant character to the area. Reinforcing the area's historical value are possessions such as water storage jars, cooking utensils and farming tools left behind in the stone houses, either because their owners have died or have moved away. This leaves the visitor in no doubt as to the huge changes brought about by economic development. The area can be considered a 'cultural resource' as mentioned earlier in the IUCN protected area definition.

3. Size

A potential protected area of 350 sq. km. is large enough to represent a montane ecosystem. However, the majority of the mountain range lies in Oman, and so the usefulness of the proposed site as a protected area would be increased if the adjoining portion in Oman could be protected, making a transfrontier reserve.



Fig. 2: A view of the Ru'us al Jibal mountains
(Picture by R. Llewellyn-Smith / Arabian Leopard Trust)

4. Socio-economic benefits

Various plant species are known for their traditional medicinal properties and may become a more significant resource in the future. Protection of the plant resource, as *in situ* gene banks, will be of increasing importance as remaining natural habitats become scarce.

The rugged scenery, dramatic sheer-sided wadis and sites of archaeological interest (tombs and settlements along the mountain fringe) will be increasingly valuable assets as the UAE expands its tourism base.

5. Provision of educational facilities

The UAE has a relatively low habitat diversity. A protected area such as this would provide an important educational and research role for school and universities, serving as an outdoor classroom to stimulate learning in the area's history, archaeology, geography, geology, biology and socio-economics.

Factors limiting justification and protected area success

1. Restricted opportunities for conservation

Local people have a deep-seated hatred for predators such as leopard and caracal. Even though loss of goats is no longer such an economic hardship, winning support for predator protection is difficult. In addition, an attempt to create a protected area may be viewed as a government imposed project on local people whose mountain territory is traditionally regarded as independent from government jurisdiction. These factors may lead to limited conservation success.

2. Human effect reducing richness and diversity of animal and plant species

Persecution by man has removed, or largely removed, several large mammal species in the UAE portion of the Ru'us al Jibal such as mountain gazelle *Gazella gazella*, Arabian tahr *Hemitragus jayakari* and Arabian wolf *Canis lupus*. The leopard and caracal population has also been drastically reduced.

The small numbers of remaining predators and their largely nocturnal behaviour means that visitors are most unlikely to see these animals. Without visible wildlife, it is harder to convince authorities, visitors, and landowners of the need for their protection. Re-introducing wildlife species, such as gazelle, may be possible but requires detailed feasibility studies. Adding to the leopard population with captive-bred animals is at present biologically, socially and geographically impractical.

3. Livestock and overgrazing

An altitudinal transition from 200m to 1,565m within the proposed site includes some vegetation change and plant diversity. Grazing by goats, and, to a lesser extent feral donkeys, provides the main threat. Although no study has been conducted, it is likely that overgrazing has led to a decline in plant diversity and distribution and an over-abundance of species unpalatable to grazing animals. Complete goat removal, suggested by Stuart (1996), may be difficult because of local opposition, and would remove a food source for predators.

4. Restricted opportunities for recreation

Wildlife viewing is limited as larger mammals are virtually impossible to see and bird populations are not as diverse

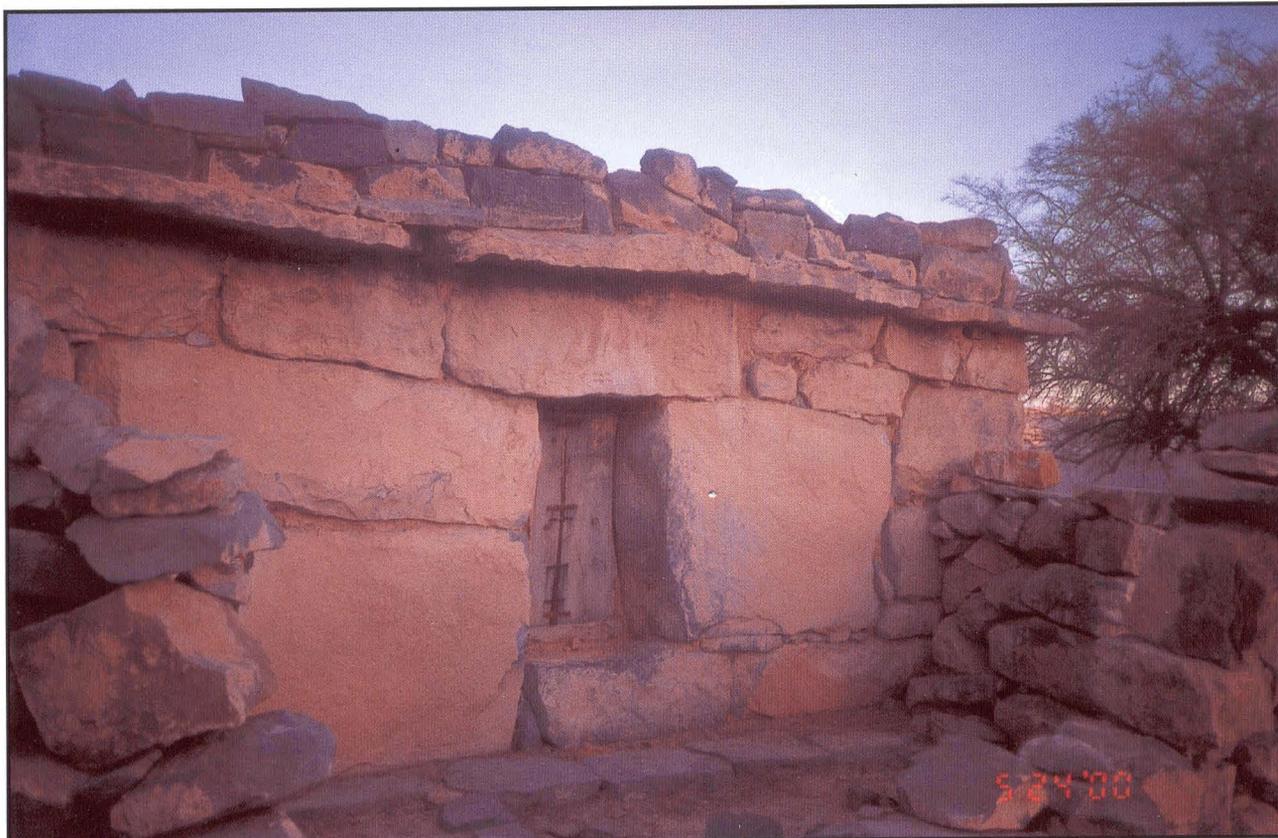


Fig. 3: A traditional *bayt al-qufl*
(Picture by R. Llewellyn-Smith / Arabian Leopard Trust)

as in coastal areas. Trekking can be arduous as the traditional mountain paths are usually ill-defined, often on exposed mountain ledges with strenuous and dangerous climbs and descents. However, trekking tours could be organised in the cool winter months, with refurbished mountain huts offering accommodation with revenue channeled back to benefit local communities.

The current visitor use, where most only drive through Wadi Bih, exerts little pressure on the environment, reducing the need for protection. Those expatriates who enjoy outdoor activities are generally respectful of their natural surrounds.

5. Rugged terrain is protection in itself

The rugged and inaccessible terrain should serve as some deterrent to building development and adverse visitor impact.

6. Social change

The abandonment of the high altitude seasonal villages with decreased human activity has probably proved beneficial to wildlife through reduced hunting and trapping activity.

Conclusion

Protection approach

In addition to the factors limiting justification for a protected area, actually establishing such an area is often a complicated, lengthy and costly affair. Ra's al-Khaimah also lacks a conservation authority. Without such an authority, protection of the Ru'us al-Jibal is unlikely.

A first step could be to establish a conservation office in Ra's al-Khaimah. This could come under the Government's Environmental Protection and Industrial Development Commission (EPIDC), created in 1999, whose initial remit was to tackle pollution caused by the cement and quarry industries.

Working in partnership with local tribal communities, this office would recognise, monitor and promote the importance of the mountains and build understanding and support for conservation in all sectors of the community. This office would also plan conservation measures for other important wildlife habitats along the coast and inland. Habitats such as the Jazirat al-Hamra wetland, the mangrove wetland at Rams, and sand dunes and *ghaf* woodland inland of Jazirat al Hamra are under increasing pressure from development. They face drastic alteration and reduction of biodiversity in the next few years.

Progress would come through building strong partnerships with local communities and other stakeholders. Some examples are Ra's al-Khaimah's Tourism Department, National Museum, the various tribal Arts and Social Centres, the World Wide Fund For Nature (WWF) UAE office, and the Federal Environmental Agency. Long term funding for conservation work will be essential and could be sought through federal and local government means and corporate sponsorship.

A valuable start has been made by the ALT by involving local tribesmen in wildlife surveys. A conservation office could build on this by recruiting a team of local rangers. Their duties could involve reporting wildlife sightings,

helping with research and habitat restoration projects, monitoring visitor use, discouraging hunting and assisting with education and public awareness programmes. The office could investigate possibilities for wildlife re-introduction~livestock compensation, ecotourism, and collaboration with other UAE research institutions.

The author feels that protection of the Ru'us al-Jibal's biodiversity and cultural heritage is very important. Developing conservation will be challenging but the process of addressing these issues will provide excellent lessons and may lead to some surprising results. Working from a cultural or historical perspective to develop conservation, rather than basing conservation on its potential for revenue generation may offer greater success, given local peoples' pride in their traditional mountain heritage. However, designating the area a National Park and managing it accordingly may not be beneficial nor immediately feasible. The nature of protection should be decided by the conservation office working with local communities and other stakeholders.

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Seagrasses of Abu Dhabi, U.A.E.

by Ronald C. Phillips, Ronald A. Loughland & Ashraf Youssef

Abstract

Field survey of seagrasses was undertaken by the authors in the waters of Abu Dhabi Emirate in both 1997 and 1998 and then more intensively in October-November 1999 and September 2000. This work included inspection from a helicopter and from a boat, using snorkeling and scuba diving. Three species of seagrasses were found: *Halodule uninervis*, *Halophila ovalis* and *Halophila stipulacea*. Overall, a total of 5,500 sq. km of seagrass cover was found in the Gulf inshore and offshore in Abu Dhabi Emirate. These plants are judged to constitute a nursery and habitat of inestimable value. Many dugong *Dugong dugon* and turtles, mostly green turtles *Chelonia mydas*, were observed within and grazing on these plants during the work.

A review of recent bibliography is provided.

Introduction

Seagrasses represent an extremely valuable coastal resource. They are rooted in relatively unconsolidated substrates, thereby stabilising and consolidating them (Fonseca 1996; Fonseca & Fisher 1986; Fonseca *et al.* 1998; Ginsburg & Lowenstam 1958; Schubel 1973; Scoffin 1970). Plants are dense and produce a dense leaf mass which extends vertically into the water column. These dense leaves act as a baffle, which absorbs energy from waves, currents and tides (Basson *et al.* 1977; Fonseca *et al.* 1998), which then results in particle deposition and the reduction of substrate erosion and turbidity.

The very high growth rate and primary production of seagrasses lead to a very high biodiversity of plants and animals within the meadows (Fonseca *et al.* 1998). Seagrass meadows become areas of species refuge from predation. They form nurseries for many complex food chains (Baelde 1990; Basson *et al.* 1977; Bell & Pollard 1989; Bell & Hicks 1991; Bostrom & Mattila 1999; Heck & Orth 1980; Heck *et al.* 1989, 1995; Kikuchi 1980; Kikuchi & Peres 1977; Klumpp *et al.* 1989; Ogden 1980; Orth & Heck 1980; Orth *et al.* 1984; Virnstein *et al.* 1983). Basson *et al.* (1977) stated that the seagrass beds of the Arabian Gulf coastline of Saudi Arabia were richer in both numbers and variety of organisms than any other ecosystem occupying the same range of depth, except for coral reefs.

In the Arabian Gulf (hereafter referred to as the Gulf), Basson *et al.* (1977) and Preen (1989) documented that seagrass beds attract large numbers of dugongs, green turtles, shrimp, fish, pearl oysters and scallops. Dugongs and the turtles feed directly on the living plants, while the other species either find refuge in the seagrasses, or are part of the seagrass based food web.

A limited number of papers and reports have been published on the seagrasses of the Gulf (Basson *et al.* 1977; Carpenter *et al.* 1997; Coles & McCain 1990; De Clerck & Coppejans 1996; Durako *et al.* 1993; IUCN/UNEP 1985; Jones 1985; Kenworthy *et al.* 1993; Madany *et al.* 1987; McCain 1984; Price 1982, 1990; Price & Coles 1992; Price *et al.* 1983, 1987; Richmond

1996; Sheppard & Price 1991; Sheppard *et al.* 1992; Vine 1986; Vousden 1988; Vousden & Price 1985).

The Gulf is relatively shallow with vast areas with depths suitable for seagrass growth (Price & Coles 1992; Sheppard *et al.* 1992; Basson *et al.* 1977). However, the Gulf is considered to be a stressful habitat for seagrasses. The region is extremely arid and hot for many months of the year. These climatic conditions lead to warmer and more saline waters than most seagrasses can tolerate. Price & Coles (1992) reported that inshore waters of the Gulf vary seasonally in temperature from 10 degrees C. to 39 degrees C. and offshore from 18 degrees C. to 33 degrees C. Water salinities may vary from 38 parts per thousand (ppt) to 70 ppt. It is probable that these ranges have selected against all but the most tolerant of the available tropical seagrass species. Only three species have been found in the Gulf: *Halodule uninervis* (Forsk.) Aschers., *Halophila ovalis* (R.Br.) Hook., and *Halophila stipulacea* (Forsk.) Aschers.

This paper reports the results of studies begun in the inshore and offshore seagrass beds of the Gulf offshore of Abu Dhabi Emirate, United Arab Emirates (UAE) in 1997, continuing to 2000. The goal of this work was to determine the distribution and extent of the seagrasses in this area.

Methods

Field work was conducted in November 1997, March through May 1998, October-November 1999 and September 2000. The work in 1997 and 1998 was somewhat limited in scope with only four field trips conducted.

In October-November 1999, the work began with an extensive helicopter-borne survey of the entire inshore and offshore area from Abu Dhabi. Using British Admiralty maps of the area, we pre-selected six flight lines. These flight lines covered most of the area where the water was less than 20 m deep. The lines extended from the inshore coast to the offshore islands of Zirku and Arzanah. In 1998, a trip was made offshore to Qarnein. Subsequent site-intensive work in this period and in September 2000 was based on observations made from this aerial survey.

Following the aerial survey in October 1999, numerous snorkel- and scuba-dives were made from a Coast Guard vessel (ca. 20m long) and from a series of smaller shallow-draught boats supplied by the Coast Guard and the Emirates Heritage Club. An extensive amount of diving was also conducted throughout the entire waters of Abu Dhabi Emirate in September 2000.

On October 31 and November 1-2, 1999, five seagrass samples were taken for density analysis. At four sites, four replicates, each 361 sq. cm, were taken (quadrat inside dimensions of 19 cm x 19 cm). At the fifth site, five replicates were made. The number of leafy shoots in each replicate were counted, averaged, and scaled to a per sq. m. basis (Table 1).

An extensive exploration was made by snorkel-diving on the shallow flats and in deeper water from the west end

of Marawah to the east end of Jananah to Ra's Muqayshit on Jazirat Abu al-Abyadh, northward to the 10 m contour, and westward within the 6-7 m contour to the west end of Marawah and eastward along Marawah. Snorkel-dives were also made southward and within the 6-9 m depths of the Khawr al-Bazm.

Results

Based on the field observations, *Halodule uninervis* was the most abundant species of seagrass observed in the Gulf off Abu Dhabi. There was a vast coverage of this species inshore around most, if not all, islands from Abu Dhabi Island to Ra's Hanjurah to the east. In this area, there were vast shallow flats down to 5 m deep which were continuously covered with *Halodule*. Occasionally, *Halophila stipulacea* and *H. ovalis* were mixed in. *Halodule* was extremely dense and luxuriant with long leaves (measured to be up to 15 cm.). In other parts of the tropics, the longer *Halodule* leaves were found only in the deeper waters, but in this area, the shorter leaves (4-6 cm. long) may be found in the deeper waters (5 m) as well as in the shallower waters (1.5 m to 2.5 m deep), and vice versa. In this area, the leaves of *Halodule* and *H. ovalis* were heavily grazed. There was little to no grazing observed of the leaves of *H. stipulacea*.

On the shallow flats west of Marawah and surrounding Jananah, *Halodule* formed a vast continuous carpet with *H. stipulacea* and *H. ovalis* occasionally mixed in. In the deeper waters off the shoals and north of Marawah and Jananah, occasionally only *H. ovalis* was found in 9 m to 11 m deep. More often, *Halodule* was mixed in with *H. ovalis* at 6 m to 15 m deep. Twice, *H. stipulacea* was found at 2.5 m and 7 m to 9 m deep.

In depths of 2.5 m to 7 m, for the most part, *Halodule* formed large continuous meadows. Occasionally, sites were observed at these depths without seagrasses. Even though *Halodule* was observed at 15 m, *H. ovalis* tended to become more predominant than *Halodule* in depths greater than 11 m. The results of the density analyses made in 1999 are listed in Table 1.

Inshore, immediately west of Jebel Dhanna, there were occasional solid vast carpets of *H. stipulacea* with a sparse cover of *Halodule* (6 m deep). At other locations, vast continuous meadows of *Halodule* were found with either *H. stipulacea* or *H. ovalis* mixed in (2-6 m deep). In this area from Jebel Dhanna to Jebel Gharain, seagrass occurrence was patchy. Where found, the seagrasses were dense and luxuriant in large carpets, but they were not in the vast continuous growths as those found west of Abu Dhabi. Offshore in this area, the seagrass occurrence became more frequent and abundant, perhaps reflecting the distance from the inshore oil processing facilities between Jebel Dhanna and Ruwais. The divers who explored the inshore bottom in this area found a great deal of sludge-oil pollution over the seabed. Offshore, there was a vast extensive *Halodule* meadow east of the hotel at Jebel Dhanna extending to the islands of Marawah and Jananah.

Inshore and west of Jebel Dhanna to Ra's as Sila, there were no seagrasses. Depths of 4 m to 10 m were explored. Only patches of corals, coralline algae and the brown alga *Cystoseira* were found on the bottom. Occasionally, only an anoxic muddy bottom was observed.

North along the escarpment of the Sila'a peninsula, at Ra's Sarab, seagrasses became evident and were

extremely abundant along the entire northern shore at Mushayrib and then south into the Dawhat al Nakhlah and in the Dawhat al Khuwaysat. *Halodule* was the predominant seagrass growing in depths of 2 m to 9 m. *Halodule* formed large vast continuous meadows. Occasionally *H. stipulacea* was abundant in the understory. *H. ovalis* was occasionally found in small sand patches within the *Halodule* meadows. There were no seagrasses in 1.5 m of water or shallower. At the south end of both these inlets, water currents were sluggish, and the water was extremely warm. We conclude that seagrasses are present and luxuriant in this area, since the waters are sheltered from the occasionally strong *shamal* winds by the Qatar Peninsula.

In May 1998, large beds of *Halodule* were found surrounding the island of Qarnein. These plants were found from 0.5 m deep to well over 1.5 m deep. On 25 October 1999, small patches of *H. ovalis* were observed at a depth of 12 m east of the island of Arzanah. A vast continuous solid carpet of *H. ovalis* was found at a depth of 15 m southeast of Arzanah on October 26, 1999.

These sites represented the only sites with seagrasses so far offshore. There were seagrasses found all around Bu Tinah. However, an estimated 99% of all the seagrasses in the Gulf inshore and offshore of Abu Dhabi were found just north of Marawah and Jananah and inshore.

Abu Dhabi's Environmental Research & Wildlife Development Agency, ERWDA, has estimated the areal extent of seagrass beds using imagery and ground-truthing, the latter conducted both by CER and its own researchers. ERWDA has also undertaken some preliminary mapping of nearshore seagrass habitats as part of an oil-spill contingency Atlas (Atkinson *et al.* 2000).

Discussion

Basson *et al.* (1977) stated that the seagrasses of the Arabian Gulf performed all the vital functions documented for seagrasses everywhere in the world, e.g., the dense leaves formed a baffle which absorbed wave energy, reduced water currents over the sediment, and reduced current erosion, as well as forming nurseries for many complex food chains. Basson *et al.* (1977) also documented that the seagrass beds of the Saudi Arabian coast in the Gulf were richer in numbers and variety of organisms than any other biotope occupying the same range of depth, except for coral reefs.

The study reported herein reports a vast acreage of the Gulf off Abu Dhabi Emirate covered by all three species of seagrasses. These seagrasses form a habitat and nursery as described from elsewhere in the Gulf and in the world. Both dugong and sea turtles were observed over the seagrasses. At one location, we observed a sea turtle grazing on the seagrasses on the seabed. In many areas, we have observed evidence of fish, dugong and turtle grazing, i.e. leaves grazed short and bites taken from the sides of the leaf blades by herbivorous fishes. Future research should be conducted on density, biomass and primary production studies of these seagrasses. A survey should be made as to the epiphytes and macroalgae and their primary production. These latter plants have also been shown in many areas to contribute to the nursery function of the seagrass

ecosystem. Many species of fish were also observed in the seagrass beds, as well as scallops in most areas. There appear to be no extensive lists yet published of animals at the various levels of the seagrass food chains for this area. Thus, there is no documentation for trophodynamics in the seagrass beds in the Gulf off Abu Dhabi Emirate.

Seagrass research in the Gulf may well represent one of the greatest opportunities in marine botanical research in the world today.

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Table 1. SEAGRASS DENSITY

Species	Location	Density (shoots1 per sq. m.)
Halodule uninervis	West of dock – Mubarraz Island (1.75 m deep)	6,510 to 7,811 (4 replicates)
	Hail Shoals (1.5 m deep)	8,393 to 21,590 (5 replicates)
	Bu Tina Island (5 m deep)	582 to 2,342 (4 replicates)
	North of Jananah Island (5 m deep)	3,462 to 5,762 (4 replicates)
	North of Marawah Island (6.5 m deep)	1,745 to 2,853 (4 replicates)
Halophila ovalis	Hail Shoals (1.5 m deep)	260 to 332 (4 replicates)
	North of Marawah Island (6.5 m deep)	166 to 1,108 (4 replicates)

NOTES AND QUERIES

Association between Desert Wheatear & Desert Warbler by Simon Aspinall

A number of species of bird co-exist commensally or symbiotically with another related or unrelated species, respectively whereby one or both apparently benefit from the relationship. Stonechat *Saxicola torquata* and Dartford warbler *Sylvia undata*, both passerines, do so on European heathland throughout the year (Cramp & Brooks 1992; SBR 1998) and also occasionally in non-heathland habitats in winter (*pers. obs.*), while two waders, European golden plover *Pluvialis apricaria* and dunlin *Calidris alpina*, form an alliance on their moorland nesting grounds (Ratcliffe 1976), the latter often being referred to as the "Plover's page". The relative vulnerability to attack by ground predators, particularly from red fox *Vulpes vulpes*, stoat *Mustela erminea* and adder *Vipera berus*, and avian predators, such as corvids and raptors, in such open habitats, must necessitate vigilance at all times. The supposition is that this is improved by mutual interspecific association.

Certain affinities exist with the situation observed in desert areas, specifically between desert wheatear *Oenanthe deserti* and desert warbler *Sylvia nana* in the non-breeding season (hereafter referred to as wheatear and warbler respectively). During a faunal survey of the desert of Abu Dhabi, United Arab Emirates, UAE, the strength of this association was examined.

Desert wheatear and desert warbler are passage migrant and winter visitors to the UAE. The former species inhabits a variety of open habitats, while the latter is restricted, except to some degree on migration, to sparsely vegetated (mostly *Chenopod* and *Zygophyllum* dominated) flat or undulating sand and gravel deserts.

All wheatear and warbler sightings and any association with each other was recorded in the mid-winter (December-January) of 1996/97. It is unlikely that any individual bird or "couple" was recorded on more than one occasion, each of the survey areas being no closer than twenty-five kilometres from any other such area.

Twenty-eight out of 114 warblers seen (25%) were consorting with wheatears, while 86 (75%) were seen foraging alone. Four of these were noted with paired wheatears. Conversely, 24 out of 140 single wheatears (17%) had a warbler alongside, whereas 116 (83%) were alone (Table 1).

Since it is the warbler that mirrors the movements of the wheatear, always following slightly behind, it appears it must be the former that seeks out the company of the latter. Also, while the warblers could usually be seen to be foraging, the wheatear generally remained on guard. The presence of an observer may, of course, have been

responsible for the wheatear's behaviour at the time, but this is considered unlikely as a 'perching up' habit is typical of desert wheatear observed at any range.

As with the example of the plover and dunlin, the purpose of the association is possibly symbiotic, or at least beneficial to the warbler without being detrimental to the wheatear. The wheatear appears to act as a 'lookout' sentinel for the warbler, which would then need to devote less time to vigilance activity. It is probable that the warbler's metabolism and diet necessitates more continuous feeding and foraging than is required by the wheatear. It is also possible that a wheatear landing on a desert shrub may result in invertebrates escaping into the interior of the bush or dropping to the ground, and this 'flushing' might usefully aid foraging efficiency in the warbler which arrives after a marginal (and perhaps purposeful) delay.

It is altogether more difficult, however, to see how the wheatear might benefit from the relationship, unlike, for example, in the association between plover and dunlin. A close similarity does, however, seem to exist with the example of stonechat and Dartford warbler, which it should be noticed, perhaps not by coincidence, are also a close taxonomic match with desert wheatear and desert warbler.

Sex ratio of wintering desert wheatears

An uneven sex ratio in desert wheatears is well known to observers in the region. In this study, 69.5% (100/144) of all wheatears observed were males, compared with 30.5% females (44/144). Various possible explanations can be given for this: **i.** the ratio is real **ii.** it is an artifact due to males being more readily detected **iii.** it is a result of males and females having different wintering areas or **iv.** is due to the sexes favouring differing micro-habitats. A combination of **ii** & **iii** seems the most plausible, since a sex ratio imbalance of almost 2.3:1 is hardly conceivable, while neither is there any evidence of the sex ratio being reversed in any other habitat locally. A second survey of wheatears in January 1999 found a ratio of 2.4:1 males to females (114/147) which is confirmation of the observed skew, for whatever reason or reasons.

Male wheatears are territorial in winter, advertising by singing a feeble sub-song from exposed perches, and as a consequence are certainly easier to detect than females.

Table 1. Occurrence of Desert Wheatears with and without Desert Warblers

Sex of Wheatear	Paired with warbler	Without warbler
Male (n=96)	18	78
Female (n=40)	6	34
Unsexed (n=4)	0	4
Paired (n=4)	4	0
TOTAL (n=144)	28	116

Selection of male or female wheatears by warblers

Eighteen out of 24 warblers (75%) seen with single wheatears were consorting with male wheatears, whereas only 6 (25%) were with females (the four warblers associating with male and female 'pairs' of wheatears being excluded). Correcting for the imbalance in sex ratio among all wheatears observed, 'expected' values would be 17 and 7 respectively. Clearly, therefore, the occurrence of warblers with wheatears is irrespective of the sex of the latter, being in proportion to the observed ratio - territorial males are not being actively sought out. The sexes are identical in desert warbler and only singing birds were sexed, but from these nothing was to be deduced.

Strength of the relationship

In most instances of pairing, the wheatear was sighted before the warbler, if any, was seen or heard, although occasionally singing warblers were heard and wheatear then seen before, again, the warbler was observed. The wheatear was thus often "used to find the warbler (unavoidably so, unless earplugs were to be worn). The desert warbler is not always readily detected, being typically silent and usually scampering about mouse-like on the ground or concealed in cover. Despite the obvious bias introduced by first finding your wheatear and then looking for the warbler, the figure derived during this short survey probably reflects a minimum co-occurrence, since although more warblers were foraging without wheatears nearby, there is the chance that some actually associating with wheatears were missed.

A previous census of wintering desert bird populations

estimated some 15,000 wheatears and 12,000 warblers in an area of 180,000 ha. in western Abu Dhabi (Evans 1994). The current study found the same ratio (5:4), such that there is easily sufficient wheatears for each warbler to be able to find one to accompany, yet only 25% of warblers were paired up in this way. It must be noted, however, that a number of associations, including perhaps short-lived diurnal ones, could easily have been missed. A plausible explanation for why some birds 'paired-up' but not others cannot be proffered here. Many observers have noted the regular association between desert warbler and desert wheatear, including during migratory stopovers, i.e. while on passage, although it is the warbler alone that appears to benefit from the association.

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Review of the False Horned Viper (Dumeril, Bibron & Dumeril, 1854) from the UAE & northern Oman, including a first record for Jebel Hafit.

by Peter L. Cunningham

Abstract.

False Horned Viper *Pseudocerastes persicus* sightings have been reported sporadically at higher elevations throughout the mountains of eastern UAE and Oman. During an ascent of the western flank of Jebel Hafit, a 1200-metre inselberg straddling the United Arab Emirates and Sultanate of Oman border, during December 2001, an individual of *P. persicus* was located basking at an elevation of approximately 900m at 14h15. This is the first confirmed record for Jebel Hafit. This paper reviews the distribution (confirmed and unconfirmed sightings) of *P. persicus* from the UAE and adjacent border areas.

Introduction

The False Horned Viper, *Pseudocerastes persicus* (Dumeril, Bibron & Dumeril, 1854) is thought to be a relict species from a cooler, moister era (Gallagher 1993). The subspecies *Pseudocerastes persicus persicus* is recognised from the Arabian Peninsula (Leviton et al. 1992). Its natural range outside Arabia includes mountainous parts of Afghanistan, Iran, Iraq and Pakistan (Gasperetti 1988, Leviton et al. 1992, Jongbloed 2000). Its distribution in Arabia is limited to the Musandam Peninsula and Hajar Mountains, which dominate the East Coast area of the United Arab Emirates and northern Oman (Gardner 1999, Jongbloed 2000).

This viper species is rarely encountered as it typically favours rugged, rocky terrain at higher elevations – areas not often visited by humans. Very little is known about the ecology of this species. The venom is neurotoxic.

Sighting

A False Horned Viper, approximately 30cm in length was observed basking at 14.15 on 31 December 2001 on the western flank of Jebel Hafit, a limestone inselberg south of Al Ain, at an elevation of approximately 900m (24°03'33"N, 55°47'12"E). The general terrain was broken and extremely rocky. Vegetation was dominated by moribund tufts of *Cymbopogon* sp. grass. The ambient temperature at the time of the sighting was 29°C. Although active, the snake showed little aggression, other than hissing, and struck out twice while being manoeuvred for photographs.

Its build was relatively short and thickset with a triangular head. Distinctive "horns" of thickened scales were located above the eyes, which had dark brown eye-stripes. The overall colouration was light brown with darker brown dorsal blotches and a black-tipped tail of which the function is not entirely clear. According to Branch (1998), 25% of *Peringuey's Adder* *Bitis peringueyi* – an endemic Adder species from Namibia in Southern Africa – have black tipped tails which "it waves to attract desert and sand lizards." As very little is known of the behaviour of *P.p. persicus*, the black-tipped tail

could possibly serve a similar function.

Previous reptile surveys of Abu Dhabi Emirate, including Jebel Hafit (Leviton & Anderson 1967, Baha El Din 1996, Khan 1998), did not locate and/or identify this species as occurring in the area. However, an anecdotal reference (unconfirmed and not published) to a "snake with horns" does exist from Jebel Hafit from the early 1980s (Jongbloed pers. comm.). Hornby (1996) classifies the False Horned Viper as "rare" in the UAE. Although this sighting occurred on the Oman side of the border it is suggested that the snakes also occur on the UAE side as no physical boundaries exist to prevent this.

Very few confirmed records of the False Horned Viper have been documented for the UAE. Previous sightings include three definite UAE locations (Feulner 1999) and one location "too close to the [undefined] border to call" (Feulner pers. comm.) -- all from the relatively high mountains of the Ru'us al-Jibal area, east of Ra's al-Khaimah. Two other sightings from the Ru'us al-Jibal were within Oman (Jebel Qiwi and the plateau north of Rawdhah Bowl) (Feulner 2001 & pers. comm.). These are summarised in Table 1. Of these six sightings, all since 1996, Feulner (pers. comm.) states the following: "Four [of the False Horned Vipers] were 'sunning' on rocks, one was found on the ground on a plateau, in shade between low rocks, and the last was found on an upper ridge near the summit of Jebel Qiwi (the photo shows low rocks and vegetation). All but one were above 1000m. In no case did the animals behave aggressively. In two instances sunning snakes were actually touched inadvertently without reacting immediately."

Sightings of other viper species at high elevations are scarce, but include two Carpet Viper *Echis coloratus* sightings in Oman at 1950m (Jebel Shams – Wadi Bir Rumayn) and 950m (Bimah – Wadi Bani Auf) (Gardner pers. comm.) and a Saw-scaled Viper *Echis carinatus* at approximately 750-800m on the north east slope of Jebel Hagab in the Ru'us al-Jibal (Feulner pers. comm.). Gardner (pers. comm.) suggests that the distribution of *Echis coloratus* overlaps with that of *Pseudocerastes persicus* in the Hajar Mountains while *Echis carinatus* possibly do not, due to different preferred habitats.

The first False Horned Viper from Oman was recorded during a flora and fauna survey in 1975 (Arnold & Gallagher 1977). By 1988 Gasperetti (1988) had recorded only 5 confirmed sightings (all from Oman) while more recently Gardner (pers. comm.) acknowledges 11 confirmed sightings of this species throughout Oman.

The closest suspected False Horned Viper sightings to Jebel Hafit are from Jebel 1442 (southeast of Jebel Hatta and Rayy) (Feulner pers. comm.) and Jebel Ghaweel (northeast of Al Ain and 50km from Jebel Hafit) (Zakhour pers. comm.), both at high elevations, but neither identification was confirmed.

Conclusion

Although not totally unexpected, the Jebel Hafit sighting

is interesting as this inselberg is separated from the rest of the Hajar Mountain Range by more than 20km of flat gravel terrain at an elevation of c.350 metres. This is consistent with the hypothesis that the distribution of *P.p. persicus* was more widespread in the past, and is now limited to higher mountains throughout its Arabian range. Gardner (pers. comm.) believes that they probably occur right along the mountain chain from Ru'us al-Jibal to Jebel Qahwan, at least at higher elevations, but high peaks in the Hajar Mountains are seldom explored due to the difficult terrain. How this species competes with the Carpet Viper *Echis coloratus* and Sawscaled Viper *Echis carinatus*, other viper species known to occur in the mountains of the UAE and Oman, at least at lower elevations, remains to be investigated.

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Location	Date	Elevation (m)
Jebel 1442 (unconfirmed) (Oman)	Oct 1991	-1100
Plateau north of Rawdhah Bowl (Oman)	Mar 1996	1100+
Jebel Rahabah (UAE)**	Feb 1999	1100+
Ridge above W. Khamid (UAE)	Mar 1999	1200+
Jebel Yabana*	1997-98	1300
Jebel Hagab* (UAE)	-1998	-800
Jebel Qiwi* (Oman)	Nov 2001	1700
Jebel Ghaweel # (unconfirmed) (Oman)	?	?
Jebel Hafit (Oman) (this paper)	Dec 2001	900

Table 1. Reported sightings of False Horned Viper from the UAE and adjacent areas in neighbouring Oman.

* Source: Feulner (pers. comm.) and author
 Sightings by Barbara Couldrey

** Sighting by Steve James

Sighting by Ghassan Zakhour

False Horned Viper sightings by Arnold & Gallagher (1977), Gasperetti (1988) and Gardner (pers. comm.) from Oman have been excluded from Table 1 as only borderline areas are included.

An Inland record of *Chalcides ocellatus* from the UAE

The Ocellated Skink, *Chalcides ocellatus* (Forskål 1775) has a wide natural distribution which includes most of north and east Africa, the Sinai Peninsula, Turkey, Greece, the Mediterranean islands and lowland southwest Asia as far east as western Pakistan (Arnold 1980, Arnold 1986, Baha El Din 1996, Geniez et al. 2000, Jongbloed 2000, Leviton et al. 1992, Schatti & Gasperetti 1994). In the Arabian Peninsula it is recorded from coastal areas in Oman, Qatar, western Saudi Arabia, Yemen and eastern United Arab Emirates (Arnold 1980, Arnold 1996, Baha El Din 1996, El-Sherif & Al-Thani 2000, Leviton et al. 1992). According to Baha El Din (1996) a specimen was seen on Abu al-Abyadh island (west of Abu Dhabi) in 1991/1992. The same author also states that "they are known from gardens in Abu Dhabi City and particularly in the northern Emirates". Generally the UAE distribution of this skink is said to be in coastal areas, often in gardens and palm plantations (Arnold 1984). It is quite common on the UAE East Coast, in Fujairah, (Hornby 1996, Jongbloed 2000). The distribution in neighbouring Oman is mainly coastal, from Khasab, in the Musandam Peninsula, and Sohar, on the Batinah Coast, southwards to Muscat and Dhofar (Arnold 1980, Gardner pers.comm.).

New observations

Ocellated Skinks are newly recorded from at least two locations - both suburban gardens - in Al Ain (see: Cunningham 2000). This is an inland range extension of approximately 140km. According to Leviton et al. (1992) the furthest inland localities are for Israel, Syria and Jordan although no specifics are provided. Although most populations are from coastal areas, they have been recorded from as high as 2200m in Asir (Western Saudi Arabia) (Arnold 1986), Manah (SE of Nizwa) and Al Ruwair in Oman (Gardner pers.comm.) and inland mountains in Western Sahara (Geniez et al. 2000). Sightings, during daylight hours only, were made in suburban gardens in Al Ain between 1998 and 2001. Most activity, including young, were observed annually between June and September. Observations were usually restricted to late afternoon, although a few individual sightings were around midday. No active individuals were seen during the cooler, winter months, although two individuals were found in a lethargic state

under a rock during December 2000, suggesting at least partial hibernation at this time. This skink is secretive and its habit of burrowing under leaf litter possibly results in it being infrequently encountered and recorded. Urban gardens could have resulted in an extension in this species habitat and "accidental" introductions to suitable inland oases are also possible.

Acknowledgements

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The mangrove crab *Scylla serrata* in the UAE

In a note in **Tribulus** Vol. 712 (Autumn/Winter 2001), visiting scientists Peter Hogarth and Mark Beech reported the first modern record of the Indo-Pacific mangrove crab *Scylla serrata* in the UAE and the southeastern Arabian Gulf, based on a specimen caught for food in the mangroves in Khor Ra's al-Khaimah. The authors left open the possibility that this large predatory crab might also be found on the East Coast of the UAE. Their note emphasises the utility of making a brief record of what information is already known to locally-based naturalists about *S. serrata*.

In fact, *S. serrata* is present in modest numbers not only in Khor Ra's al-Khaimah, but also at Khor Kalba on the East Coast, where it continues to be hunted for food on a small scale, despite official discouragement. A Kalba fisherman, a UAE national, once showed me how to find them in the surface mud at low tide (they do not necessarily retreat to their burrows) and catch them by hand. The fisherman acknowledged that hunting is now illegal at Khor Kalba and said that he had to stay out of sight of the buildings from where the khor is officially watched, but he explained that he was hunting the crabs to eat, not to sell, just as he always had, and he saw nothing wrong with that.

S. serrata and its burrows, in use or abandoned, can be seen in various places at Khor Kalba. Burrow sites are not limited to the mangrove forest, but have also been found on isolated areas of open flats within the intertidal zone. On the seaward side of the forest, collapsed and abandoned burrows represent a minor hazard on the open bank at places where the tidal channels reach furthest inland. In a few instances I have been able to see the crabs within their burrows and I once saw a crab take refuge within the hollow base of the trunk of an old mangrove tree. Multiple burrows can sometimes be found in close proximity.

S. serrata claws are occasionally seen as flotsam at Khor Kalba, and permit at least generic identification. They are the size of small Maine lobster claws. Dr. Reza Khan, who first alerted me to the *S. serrata* burrows at Khor Kalba, cautions that in life these claws can sever a finger, so the crab must be handled with care.

Hogarth and Beech speculated that Ra's al-Khaimah might have been the source of *S. serrata* remains found at the Iron Age archaeological site of Rafaq, in Wadi Qawr, although they noted that an East Coast origin was more likely. Khor Kalba or a historical precursor, seems possible. In fact, Rafaq is no more than 25 km from Khor

Kalba - an easy day's walk across the Batinah coastal plain and into the broad Wadi Qawr, itself a traditional caravan route. In contrast, Ra's al-Khaimah is more than 125 km from Rafaq by a plains and wadi route. The hill fort at Rafaq also contains many remains of the large mud snail *Terebralia palustris*, which is still abundant at Khor Kalba today.

Hogarth and Beech have also speculated that the apparent decline in the numbers of *S. serrata* at Ra's al-Khaimah may be due to the diminution of its mangrove habitat. This could well be so, but it is worth noting that the association of *S. serrata* with mangroves may be somewhat secondary, as is the case for most species found in mangrove forests. Observations at Khor Kalba suggest that *S. serrata* does not restrict itself to areas of mangrove cover and it may in fact depend on the muddy substrate more than the mangrove forest. Nevertheless, for a species subject to human predation, the inaccessibility of forest areas may be important for protection in localities where the human population density is relatively high.

At Ra's al-Khaimah, in any case, the predation continues. Dr. Richard Hornby, who was unable to confirm *S. serrata* in his 1997 survey of the UAE coastal region, was subsequently shown one by an Asian crab hunter at Khor Ra's al-Khaimah, who complained that they were getting harder to find. And *S. serrata* still finds its way from time to time to the table of Hogarth and Beech's hosts in Ra's al-Khaimah, where I personally observed a specimen destined for the pot in mid-January 2002.

Hogarth and Beech see a ray of hope for the survival of *S. serrata* in the Arabian Gulf in the form of increased public awareness of the importance of mangrove habitats and in programmes such as mangrove afforestation undertaken in Abu Dhabi, although it is not certain that *S. serrata* has ever been present in significant numbers in the relatively saline coastal waters of most of Abu Dhabi Emirate itself. Sadly, this ray of hope seems so far to have been eclipsed in Ra's al-Khaimah, where the mangroves in Khor Ra's al-Khaimah, having recently given way in part for a shopping mall, are at this moment being further filled for construction of a golf course.

(Picture of *S. serrata* by Mark Beech)

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Two New Butterfly Sightings from the Musandam Region

Gillett (1995) updated the list by Brown (1992) of butterflies occurring in the UAE and Musandam, and expanded it to cover adjacent Omani territory along the west flank of the Hajar Mountains from Hatta southwards to the Al-Ain/Buraimi area. Gillett (1997, 1999) subsequently reported a number of additional species, so that more than 50 species of butterflies have been recorded to date from the UAE and neighbouring areas of Oman.

Sightings of two additional species are reported here, both from the Ru'us al-Jibal, i.e., the mountains of the Musandam region. These are the Small Copper *Lycaena phlaeas* and the Small Cabbage White *Artogeia rapae*. Both are primarily Palaearctic species common in Europe and also found in Iran and elsewhere in Arabia, but not previously reported from either the UAE or Oman. In each case, identification was made from comparison with colour plates in Larsen (1984). Identification was facilitated by good views with binoculars at close range (c.3m), the observer's familiarity with the butterfly fauna of the Ru'us al-Jibal and the UAE in general, and the absence of confusingly similar species regionally.

Several individuals of the Small Copper were observed on 5 November 1999, hilltopping in early afternoon at c.1500m elevation on a mesa-like summit about 6 km E of Jebel Harim, in the NE Ru'us al-Jibal. From time to time they alighted on the barren ground with wings opened flat, the forewings characteristically angled slightly rearward. Also present was a single Swallowtail butterfly *Papilio machaon*, a notorious hilltopper in the UAE. The presence of the Small Copper at that particular time and place is unexplained. Its preferred foodplant is said to be *Rumex*, but *Rumex* species (and other Polygonaceae) are not common in the Ru'us al-Jibal, especially at higher elevations. Moreover, the Ru'us al-Jibal is believed to have gone for almost two years without rain at the time, and although more than 25 plant species were recorded in the vicinity of the mesa, none were observed in flower.

According to Larsen, the Small Copper is thought to have originated in temperate Eurasia, where it is widespread, but today it ranges throughout the entire northern temperate zone, being found in North America and even in Greenland (Sbordoni & Forestiero 1985). Distinct subspecies are recognised in many areas, including East Africa and the mountains of SW Arabia. In the latter, *L. p. shima* is common above 2,500m. Intriguingly, Larsen categorises the Small Copper among a small group of Arabian butterflies that show affinities with the

Himalayas and Baluchistan, and that appear to have reached SW Arabia and even Africa, but that have since become extinct in the intervening Hajar Mountains. Larsen does not suggest that any of these butterflies might yet be found in the Hajar Mountains, but in view of the many other faunal and floral affinities between Baluchistan, Iran and the Hajar Mountains, such a possibility should not be entirely surprising.

A single specimen of the Small Cabbage White was observed on 10 May 2002, at about 150m elevation in a rocky tributary of Wadi Haqil, north of Ra's al-Khaimah. It was flushed in the early morning from one low shrub to another (*Tephrosia apollinea*), where it perched with wings folded. The observed specimen was apparently the Iranian species, *A. r. iranica*, which has pale yellow underwings, but in flight it appeared white in colour. Also present in the immediate vicinity were Caper White butterflies *Anaphaeis aurota*, which afforded a comparison of size and general aspect. Larsen wrote of the Small Cabbage White that it is unable to survive the heat of the Arabian summer, but that migrant specimens regularly reach central and eastern Arabia from Iran and Jordan, to breed on cruciferous plants including cultivated cabbages and radishes. Larsen specifically remarked that the Small Cabbage White may sometimes reach Oman, but that it had never actually been recorded there.

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Gerbils feeding on camel-dung

In late December 2002 during a visit to the Bab oilfield (23 45N 53 30E) near Habshan, western Abu Dhabi, the observer noted clear evidence of a gerbil having deliberately and dexterously dismantled several individual camel droppings, presumably in search of something edible. Since the habitat being sparsely vegetated mobile dunes, the species concerned was almost certainly Cheesman's gerbil *Gerbillus cheesmani*. The accompanying plate shows the result of the gerbil's nighttime foraging activity

The persistent drought experienced over much of the Abu Dhabi desert in recent years appears to have reduced the populations of many species of animal to a low ebb, while the flora of certain areas and of specific habitats has died back, sometimes completely so. The knock-on effect appears to have had an impact on many species of animal at all trophic levels. Several different observers have suggested, for example, the vegetarian spiny-tailed lizard or dhub, *Uromastix aegyptius microlepis*, which is unable to relocate far, to be quite literally starving to death in drought-stricken parts of the country.

In the case of the gerbil fossicking through the fibrous, albeit fresh camel droppings, it seems probable that the animal was looking for undigested or part-digested seeds, or just possibly shoots. The droppings were, or seemed to be, less than twelve hours old and it is improbable that any live or dead animal matter (such as a larva or even a parasite) otherwise suitable for a

rodent's diet would yet have been present.

The camel itself could have, and probably had, moved a number of kilometres from the area where it was browsing to where the material deposited within the territory of the gerbil. This is a useful free home-delivery service for the gerbil. Whether the latter's behaviour may have been induced by the ongoing drought is uncertain. However, a second instance of exactly the same behaviour, of a gerbil breaking apart camel dung (only in this instance, while the gerbil tracks were fresh, the dung was not), was noted in Bu Hasa (23 30N 53 15E), 50km south-west of Bab, in late May 2002. Such apparent opportunism may not actually be related to a drought-induced food shortage. Instead, this method of foraging may be commonplace in the desert - where it really must pay to be as catholic as possible in what is utilised as a source of food, since rains, and the fresh flora they engender, are few and far between.

A number of species of bird are also known to pick their way through trampled, broken-up camel droppings on camel racetracks in the UAE, among them crested lark *Galerida cristata*, bimaculated lark *Melanocorypha bimaculata*, laughing dove *Streptopelia senegalensis*, collared dove *S. decaocto* and escapee pheasants *Phasianus colchicus*. All are granivorous, or both granivorous and insectivorous.

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News Roundup

UAE cracks down on illegal wildlife trade

A UAE delegation from ERWDA, the FEA and Ministry of Agriculture and Fisheries visited the Geneva HQ of the Convention of International Trade in Endangered Species, CITES, in January 2002, to brief the General Secretariat on measures being taken in the UAE to comply with the terms of the convention. A wildlife trade ban with the UAE had been imposed by the Secretariat in November 2001.

Under the ban, import, export or re-export of any CITES listed species was not allowed to or from UAE, with the Secretariat requesting its 155 member countries not to trade in endangered species with the UAE.

The relevant bodies in the UAE subsequently worked with CITES to improve the efficiency of enforcement and reorganised the CITES legal framework in the country, and in March 2002 the trade suspension was partially lifted. Complete removal of the ban will come in three phases, assuming there are demonstrable improvements to enforcement and compliance. The first phase relates solely to trade for non-commercial purposes.

The Federal Environment Agency, FEA, is now the CITES Management Authority in the UAE, a position previously held by the Ministry of Agriculture and Fisheries, and will be responsible for issuing permits in Abu Dhabi Emirate. In other emirates the latter will be issued by the Ministry of Agriculture and Fisheries. The FEA has called upon the UAE municipalities to inspect pet shops stocking endangered species and wildlife products listed by CITES.

CITES enforcement officers are also now being recruited by the FEA, with a capacity building and training programme being organised and run by ERWDA and World Wide Fund for Nature (WWF) office in UAE.

The Washington-based Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES, entered into force in 1975. CITES regulates international trade in over 30,000 species, of which approximately 25,000 are plants. The UAE became a signatory in 1990.

(Source: Emirates News Agency, WAM, 6 March 2002)

Falcon Release Programme

The eighth annual release of falcons under the Sheikh Zayed Falcon Release Programme took place in April 2002, with a total of 75 peregrines *Falco peregrinus* and 27 sakers *Falco cherrug* being set free in the Chitral district of the North West Frontier Province of Pakistan.

Six of the falcons were fitted with satellite transmitters, three being sakers and three peregrines. All three sakers remained alive after a fortnight, one staying close to the release site, another having moved into Tajikistan and the third having reached China. Of the peregrines, one bird moved to around 100 km south of the release point, another 30 km to the north, with the third tag apparently failing.

The release programme is co-ordinated by the Environmental Research and Wildlife Development Agency, ERWDA, in collaboration with the Falcon

Hospital at Al Khazna, Abu Dhabi; the World Wide Fund for Nature-Pakistan) and the Falcon Foundation International, also in Pakistan. A total of 686 falcons have been released since commencement of the programme in 1995.

(Source: ERWDA)

Tighter rules on fishing

Controls on fishing in the waters of the Emirate of Abu Dhabi have been strengthened with the introduction of a licensing procedure for sports and leisure marine anglers. The move, announced by the Environmental Research and Wildlife Development Agency, ERWDA, in late April, came into effect on 4th May, and requires anglers over the age of 18 to pay an annual fee of Dh120, or a weekly fee of Dh30 for a fishing permit.

The new rule, issued under the provisions of Federal Law No. 23 for 1999, covering protection of marine resources, extends control over all fishing activities in the Emirate. Professional fishermen in Abu Dhabi are already required to obtain a licence from ERWDA. A total of 639 such licences were issued during 2001.

(Source: ERWDA)

UNESCO team visits, studies Khor Kalba

In May 2002 the regional programme specialist from UNESCO's Doha office visited the UAE to pursue a range of potential collaborative environmental activities around the country. Of particular significance, and considered of the highest priority, was that concerning the proposed designation of Khor Kalba on the UAE's East Coast as a Biosphere Reserve. This site is internationally renowned for its flora and fauna, but remains without official protection. During the visit, a meeting to discuss this possibility was held between UNESCO and the Environment and Protected Areas Authority, EPAA, the Sharjah government body having jurisdiction over this site. A team assembled by UNESCO also carried out a preliminary environmental and archaeological assessment of Kalba and its catchment area, as part of the process which it is hoped will lead to its eventual recognition as the UAE's first biosphere reserve.

Tribulus Editorial Board

Two new members have joined the *Tribulus* Editorial Board.

Professor Drew Gardner, Professor of Biology at Zayed University, and formerly with Sultan Qabus University in Oman, is, above all, a specialist in the reptiles of south-eastern Arabia.

Dr. Mark Beech, a Visiting Fellow at the University of York, is environmental archaeologist for the Abu Dhabi Islands Archaeological Survey, with particular expertise not only in archaeology, but also in the fish of the Gulf.

compiled by Simon Aspinall

Review of ADIAS Archaeological Season for 2001-2002

(The following is a short round-up of work undertaken by the Abu Dhabi Islands Archaeological Survey, ADIAS, during the 2001-2002 autumn-to-spring season, including work outside Abu Dhabi. Work by other UAE departments and foreign teams is not covered).

In Fujairah, excavations were undertaken by ADIAS on the edge of the coastal plain at Qidfa in late December and January. The work followed the carrying out of a survey of the line of a new water pipeline from Qidfa to Al Ain for the UAE Offsets Programme. The work, immediately adjacent to the site of a new desalination plant on the coast at Qidfa, confirmed that the date palm gardens at Qidfa had formerly covered a more extensive area than they do today. Evidence of occupation included the remains of water distribution channels, field walls and stone surrounds for palm groves, as well as two Muslim cemeteries. Ceramics were of Late Islamic date.

During the survey, the ADIAS team also identified a number of previously unrecorded sites elsewhere in Fujairah and Ra's al-Khaimah, including probable pre-Islamic burial cairns in Wadi Saqamqam, abandoned settlements at Qirath and Qurrayah and a copper smelting complex near Muna'i, in Ra's al-Khaimah.

Winter work by ADIAS in Abu Dhabi focused mainly on compilation of a database of the results of the last ten years of work, with over 1000 individual sites and sub-sites now recorded. Further fieldwork was undertaken on the island of Futaisi, adjacent to Abu Dhabi, where a preliminary archaeological survey has now been completed. Apart from three large hearths of possible pre-Islamic date, all other sites, including water catchment systems, a graveyard and pottery scatters, can be securely dated to the Late Islamic period.

In association with the Abu Dhabi Company for Onshore Oil Operations, ADCO, a fourth phase of work was undertaken at the Jebel Dhanna sulphur mine complex. ADCO support also facilitated the carrying out of further survey work in some of the oilfield areas, including Asab, Sahil and Bab, with several previously unrecorded sites being added to the gazetteer of sites for these field areas.

Further fieldwork carried out by ADIAS at an archaeological site at the Abu Dhabi Airport Golf Club, coupled with a detailed study of the flint tools recovered

during earlier work at the site confirmed the importance of the site during the Late Stone Age period, around 5,500 to 4,000 BC.

The Airport site was first discovered on a range of low hills inside the perimeter of the Golf Club in 1995. That work showed that the site had been occupied during the Late Stone Age, the early to middle Bronze Age, around 3,000 BC to 2,000 BC, and in the Late pre-Islamic period, around the beginning of the Christian era.

A review of the stone tools and animal remains from the site was undertaken by the ADIAS flint tools expert, Dr. Heiko Kallweit, from Germany's University of Freiburg, with the assistance of Dr. Mark Beech, ADIAS environmental archaeologist. This was coupled with further visits to the site, to search for new material uncovered as a result of recent rains. As a result, the site was proved to extend further than had been originally recognised, and new flint material was collected.

During the site visits, a tiny crescent-shaped fragment of worked flint, known as a microlith, was collected. This provides useful insight into the way of life of the UAE's Late Stone Age inhabitants. Two further examples were also identified during the detailed review of material collected during the earlier phase of fieldwork. The microliths are "teeth" of flint that would have been set into a wooden handle for use as an early sickle or knife for cutting grasses. Further fieldwork at the Airport site is planned next winter.

In association with the Environmental Research and Wildlife Development Agency, ERWDA, ADIAS now has responsibility for palaeontology on the coast and islands of the Western Region of Abu Dhabi. This relates, in particular, to the fossil material from Late Miocene outcrops, stretching from near Rumaitha, in the east, to Jebel Barakah, in the west. Further fieldwork has been undertaken in the Ruwais area, with previously unrecorded fossil sites being identified.

One result of this new responsibility is that ADIAS has now taken over the database put together by the London Natural History Museum, following its work, along with Yale University, in the Western Region in the late 1980s and early 1990s. Details of that database have now been added to the ADIAS website - www.adias-uae.com

Peter Hellyer

Reviews, Publications and Research

Wild about Mammals

by Marijcke Jongbloed, Robert Llewellyn-Smith & Moaz Sawaf. Published 2002. Arabian Leopard Trust. A5, 72 pp., spiral bound

Having heard that a new book on mammals of UAE was in press, I was pleased to be asked to review it. This was particularly so because ERWDA is currently carrying out a terrestrial baseline survey of the fauna and flora of Abu Dhabi, and field differentiation of some of the mammals, gerbils and jirds in particular, can be quite difficult, especially for less experienced staff.

Spiral bound and running to 72 pages including covers, this book is marketed as a field guide to the terrestrial

mammals of the UAE. How then does the book fare? There are few books on mammals of the Arabian peninsula, let alone the UAE, and this new publication seems to be a synthesis of information from the three main ones - Kingdon, Harrison and Bates, and Osborne. Some thirty-one species are covered, with one side of a double page spread being devoted to photographs and the other devoted to text containing information about the animal depicted.

The text really does not allow the reader to differentiate between some species and there are some factual errors (and spelling mistakes). That said, two difficult species to distinguish, Sundevall's and Libyan Jirds, have been dealt with well. It might be noted here that there are two other species of jird that may occur in UAE, namely

Arabian jird *Meriones arimalius* and king jird *M. rex*, although neither has been described. This, to my mind, is a missed opportunity, even if it would not have been the primary purpose of such a guide. Discoveries are still there to be made in the UAE, but these are certainly aided by improved literature coming along.

Distribution maps of Arabian mammals generally tend to be based on few records and often reflect the distribution of observers rather than the distribution of mammals themselves, I get the impression that this is largely the case with this book. Reading the sections on distribution it would appear that at least some recent information is missing. For example, the Egyptian spiny mouse *Acomys cahirinus* (recently re-named *Acomys dimidiatus*) from Jebel Hafit, where it is actually rather common, is an oversight.

Most of the photographs are acceptable, although clearly not professional, and that of a house mouse shows it to be a rust-coloured animal with, apparently, a terminal tail tuft. Perhaps it's just a shadow, but the house mouse and Wagner's gerbil look uncomfortably similar and I remain unconvinced of its correct identity.

The idea of showing photographs of tracks is a good one, however it could have been done better. Most have no scale and those that do use an indeterminate-sized camera lens cap. A ruler or something of known size, such as a dirham coin or a car key, would have been much better. Unless the substrate is perfect for preserving tracks (and sand usually isn't), a better approach might have been to have used drawings. Key features, such as the number of claws visible in a hare's foot print, or retractable and extended claws in cats and Rüppell's foxes, could then have been highlighted.

This is a useful little book that can be taken out into the field at a very reasonable price. It should not, however, be considered as an authority on any species or its distribution. For the time being, the serious naturalist will have to continue to refer in the main to Harrison & Bates, even though the price of this work may remain something of a drawback.

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Traditional Buildings in Al Ain

by Philip Iddison. Published 2002 by Hyder Consulting Middle East as a contribution to the 2nd Al Ain Flower Show and Festival. 24 pp., A5, with 17 colour illustrations, 1 map, English text with Arabic summary.

An excellent little introduction to some of the main traditional buildings surviving in Al Ain, covering materials used, and the types of buildings, including mosques, houses, forts, Sheikh Zayed's palace, *falaj* watchtowers and other structures, along with a bit of history and information on architectural techniques. It doesn't pretend to be a piece of academic study, merely a simple introductory guidebook, and that is a task it performs very well, with the map making it easy to find the buildings. Highly recommended - and Hyder Consulting deserve credit for having sponsored its publication.

PH

Journals received

Bulletin of The Society for Arabian Studies, No.7 (2002). ISSN: 1361-9144. 64 pp. c/o The British Academy, 10 Carlton House Terrace, London SW1Y 5AH. UK pounds 5.00.

The annual Bulletin of the Society for Arabian Studies contains the usual round-up of activities related to the peninsula, including much on the UAE.

The main paper is a preliminary report, by Dr. Robert Carter, on the Umm al-Nar period tomb UNAR-2 at Shimal: *Unar 2 and its ceramics: a unique Umm an-Nar period collective grave from Ra's al-Khaimah* (pp. 5-14). A Research Note by Chris Mosseri-Marlio (p.14) is entitled: *Copper poisoning in sheep - a possible limiting factor in Bronze Age animal husbandry at Kalba?*

Books

The following books have also been received. Mention of them here does not preclude a review in future.

Aspinall, S. (comp.). [2002]. **Birds of Fujairah and the UAE East Coast**. 32 pp, A5, with 20 colour illustrations. English and Arabic text. Published by *Twitchers' Guide*, PO Box 45553, Abu Dhabi, U.A.E.

Barth, Hans-Joerg & Boer, Benno (eds). [2002]. **Sabkha Ecosystems. Volume 1: The Arabian Peninsula and Adjacent Countries**. ISBN 1-4020-0504-0. Kluwer Academic Publishers, Dordrecht. 354 pp. Many chapters on the UAE; authors including Anthony Kirkham, Graham Evans, Benno Boer, Ronald Loughland, Peter Cunningham, Mark Beech, Ronald Phillips, Simon Aspinall, Peter Hellyer & Amrita de Soyza.

Hellyer, P [2001]. **Early Days in Abu Dhabi: The Origins of ADCO, 1936-1971**. ISBN 1-86063-128-2. Published for ADCO, by Motivate Publishing. 178 pp.

Published Papers

Apart from those contained in **Sabkha Ecosystems. Volume 1**, to be reviewed in a future issue, the editors are aware of the following recently published papers. Authors are encouraged to supply details of other publications for listing in future issues of **Tribulus**.

Beech, M. & E. Shepherd [2001]. *Archaeobotanical evidence for early date consumption on Dalma Island, United Arab Emirates*. **Antiquity 75**: 83-9.

Evans, G. A. Kirkham & R.A. Carter [2002]. *Quaternary development of the United Arab Emirates coast: new evidence from Marawah Island, Abu Dhabi*. **GeoArabia Vol. 7**, 603-620.

Hellyer, P. [2001]. *Christianity in the pre-Islamic UAE and south-eastern Arabia*. **Journal of Social Affairs (Sociological Association of the UAE), Vol 18**, no., 72, pp. 79-100.

Research

Michele Ziolkowski has received her PhD from the Department of Near Eastern Archaeology, University of Sydney, for a thesis on the archaeology of the coastal areas of Fujairah.

The title is: **The Historical Archaeology of the Coast of Fujairah, United Arab Emirates: from the Eve of Islam to the Early Twentieth Century**.



تريبيلوس

مجلة جمعية الامارات للتاريخ الطبيعي

ربيع / صيف ٢٠٠٢ م

المجلد ١،١٢

