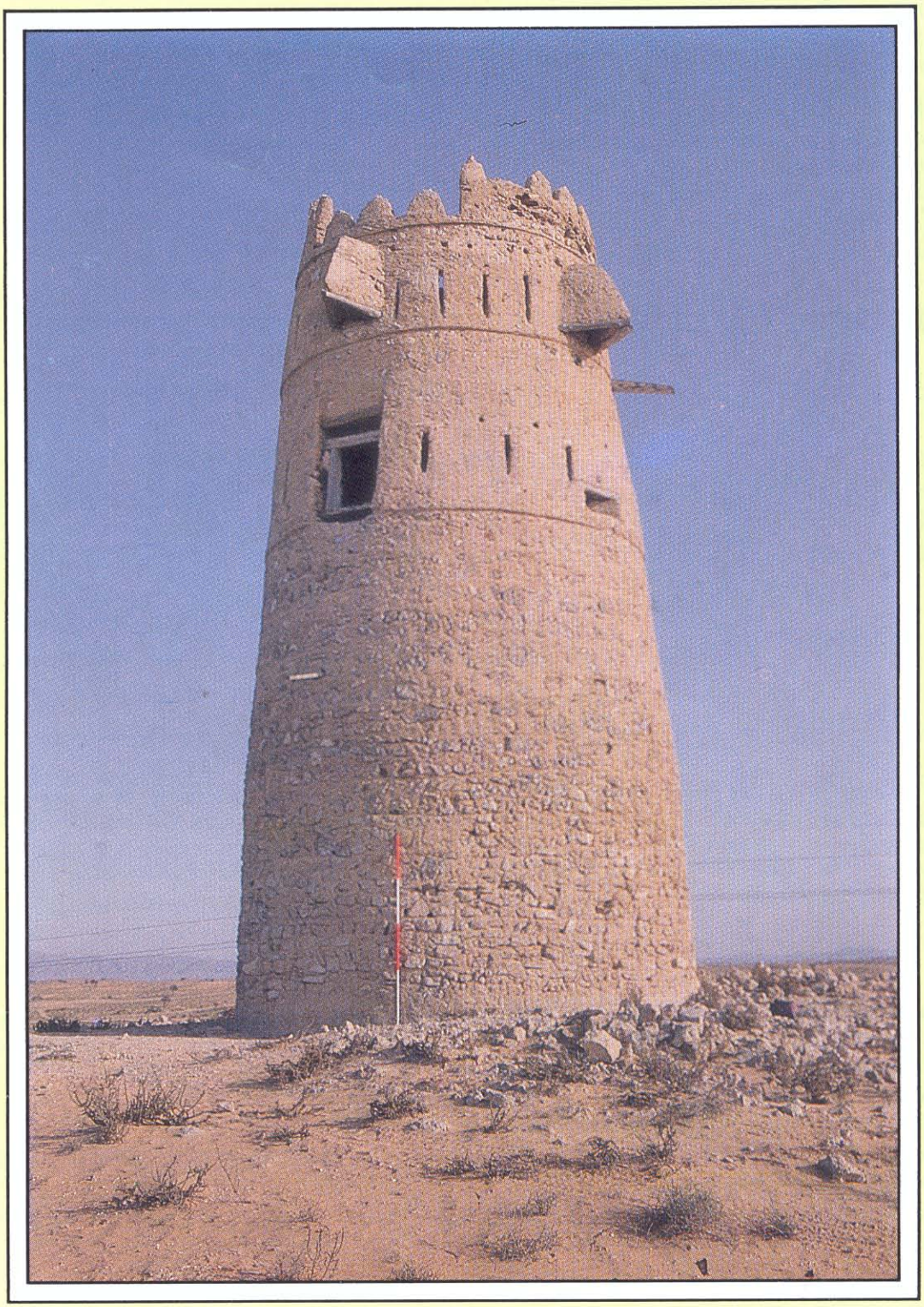
TRIBULUS

Bulletin of the Emirates Natural History Group

Vol. 2.2 OCTOBER 1992



NOTES FOR CONTRIBUTORS

TRIBULUS is the new name given to the Bulletin of the Emirates Natural History Group. The group was founded in 1976, and over the next fourteen years, 42 issues of the Bulletin were published. The revised format of TRIBULUS permits the inclusion of black and white and colour photographs, not previously possible.

TRIBULUS is published twice a year, in April and October. The aim of the publication, as for the Bulletin, is to create and maintain in standard form a collection of recordings, articles and analysis on topics of regional history and natural history, with the emphasis focussing on the United Arab Emirates and adjacent areas. Articles are welcomed from Group members and others, and guidelines are set out below. The information carried is as accurate as the Editorial Committee can determine, but opinions expressed are those of the authors alone.

Correspondence and enquires should be sent to:

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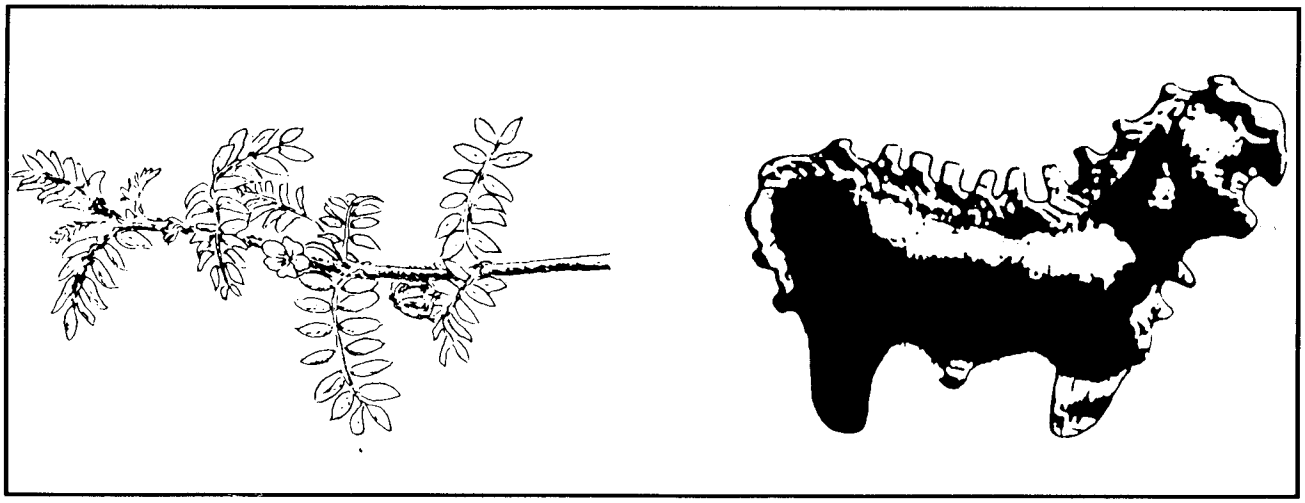

The plant motif above is of the genus Tribulus, of which there are six species in the UAE. They all have pinnate leaves, yellow flowers with free petals and distinctive five-segmented fruits. They are found throughout the country, except in coastal sabkha.

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

Manuscripts should be typed, on one side only, and double-spaced, and may be submitted in either English or Arabic. A short abstract should precede the article, with the address(es) of the author(s) at the end. For Arabic contributions, a short summary in English, of not more than 200 words, should also be supplied.

Photographs may be submitted and should be either glossy black-and-white prints or colour slides, which should be clearly captioned. Line drawings and maps 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 Arabic names should also be supplied.

TRIBULUS

Vol. 2.2 October 1992

Contents

Colour photographs, on Pages 25 - 28, are included with support by a grant from ***Union National Bank.***

Cover Illustrations:

English : A pepper-pot tower at Jazirat Al Hamra, Ras al Khaimah. (See page 29) (Derek Kennet)

Arabic : A Spotted Eagle, photographed at Rughailat, Fujairah. (P. Hellyer)

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 45, without whom publication in this format would be impossible.

We also acknowledge the support and encouragement of our Patron, H.E. Sheikh Nahyan bin Mubarak al Nahyan, the U.A.E. Minister of Higher Education and Scientific Research.

TRIBULUS is published for circulation to members of the ENHG, and is also available for subscribers overseas or through the Ornithological Society of the Middle East. Details on request. Overseas Distribution via Federal Express.

Published by the Emirates Natural History Group, P.O. Box 2380, Abu Dhabi, United Arab Emirates.

Printed for the ENHG by ***Emirates News***, (Al Ittihad Press and Printing Corporation), P.O. Box 791, Abu Dhabi, U.A.E.

International Standard Serial No. (ISSN) 1019 - 6919.

Editorial

"In the age of the dinosaur, the earth lost a single species every thousand years. Today, we lose one every single day. At this alarming rate, by the year 2000, one out of every five species existing now will have disappeared from the face of the earth." This quotation from the National Geographic Magazine formed part of advertisements by Union National Bank in September. Over the figure of a leaping hump-backed dolphin the advertisement goes on to state that this marine mammal is likely to disappear from the Gulf within our generation. The blame is put firmly onto two causes — water pollution, and litter pollution (specifically those blue plastic bags used for supermarket purchases). The message of the advert is unequivocal — "The destruction of each species bring us close to the extinction of our own."

Ten years, even five years ago, such an advertisement would not have been placed in the Gulf press. During the Group's dolphin surveys of the early 1980's nobody in the E.N.H.G. or elsewhere was concerned about the possible extinction of a dolphin species. How times have changed. A mere ten years later we are bombarded daily with doom and gloom on the environmental front. From all over the world come press and TV reports of massive pollution, rainforest destruction and the probable consequences of global warming. Nobody these days can claim ignorance about what is happening on a greater or lesser scale to the earth's ecosystem. Perhaps we all now have an occasional twinge of guilt about leaving litter in the desert, about using leaded fuel, about bashing around over fragile soils in a 4-wheel drive.

As members of a natural history group, I would like to think that such environmental issues are not constantly pushed into the backs of our minds under the combined weight of daily concerns and inertia. After all, why join the E.N.H.G. in the first place unless we have some feeling for our local environment, for wildlife, for open spaces, all as part of a wider recognition of our own part in a global ecosystem. Which leads us to the question of what we can begin to do about the situation.

The UAE is a small country, and those of us who have been here for some years have witnessed huge changes in the landscape. Such a rapid expansion of building activities has of course taken its toll in derelict desert areas where the topsoil has gone, in the amount of rubble left lying around, and in the detrimental effects of litter in every town, village and roadside hamlet. Desert habitats which were relatively remote in 1980 are now moulded into forested areas and farms, settlements and industrial sites. How many of us have been a 'worral' recently, let alone a true Sand Cat in its natural habitat?

Yet perhaps all is not lost. No longer do people shoot gazelle on sight. Last March the Sharjah Municipality banned the catching and selling of turtles, thus following the lead of Abu Dhabi and Fujairah. Surveys following the Gulf War suggest that the marine oil pollution was not as bad as was once feared; dugong continue to exist between Bahrain and Abu Dhabi. Hares and foxes seem to be on the increase.

We all have to live with change and the inexorable spread of human populations across lands previously left alone. What is different in the late twentieth century is the rapid increase in the rate and scale of change to the land surface of our world. What is needed now is an assessment of what elements of the so-called natural world we wish to preserve, if any. None of us I am sure wants to see once wild animals only in a zoo. We all now have vague notions of the 'rights' of wild species to some sort of future in their own habitats. And this is where the E.N.H.G. can contribute in its own small way, by acting as a pressure group in proposing areas and habitats within the UAE, such as the Eastern Lagoon and Ghar Lake, which should be protected for their intrinsic value to future generations. The surveys and recording activities of the Group do help to provide the basic data needed for rational evaluation. Since its inception in 1976 the Group has always recognised this as being our prime function, but it needs commitment from both Recorders and ordinary members. A realisation that we as humans are an integral part of our environment can only enhance our own enjoyment of that environment, provided we do not help to destroy it beyond the chances of recovery. We are learning all the time but it is important not to let events overtake us. Recent surveys of Abu Dhabi islands have revealed significant archaeological sites. New bird records mean that our information on UAE breeding species, for example, is constantly being updated. The June 1992 Newsletter reported the discovery in Fujairah of three new species of seashell previously unknown to science. What further opportunities await the budding amateur? But they will only occur if we want them to happen. For all the destruction a new road might bring, it does permit access to previously inaccessible areas, and Group members are in an advantageous position to benefit. Doom and gloom is for those who sit on their backsides, not for those who take advantage of the physical changes that do occur around us.

A glance at the Contents of this issue of **TRIBULUS** shows just how varied recent recordings and findings can be. In our lead article, this time on archaeology, Dr. Remy Boucharlat reports on archaeological research in Sharjah Emirate. Birds always figure prominently in our publications and this issue is no exception. Erik Hirschfeld and Colin Richardson review the distribution of Harriers in Arabia, while John Stewart-Smith, the Group's founding member and first Chairman in 1976, reports on the breeding activities of Socotra Cormorants in the UAE. Ulrich Wernery gives an account of the biology of camels, while geology is covered in Dr. K.W. Glennie's article on plate tectonics in Oman. Local architecture is represented by Derek Kennet's article on the different tower styles in Ras al Khaimah. A little further abroad, Michael Jennings reports on the wildlife of Eastern Yemen, with other items too.

So, take your pick. There must be something of interest for even the most lukewarm member. And that may yet spark off a commitment from somebody.

ROB WESTERN

Archaeological Research in the Emirate of Sharjah

by Dr. Remy Boucharlat

The following account summarises the findings of a Seminar at the Sharjah Cultural Centre on February 27th, 1992.

● هذا المقال يلخص نتائج الأبحاث الأثرية في امارة الشارقة.

Background

The joint Sharjah-France archaeological expedition has been working in Sharjah Emirate since 1985. So far, six seasons of field research have been completed, focusing on both the coastal area around Hamriyah and the inland plain between Dhaid and Al Madam.

The French team has consisted of up to ten archaeologists, led by Dr. Remy Boucharlat, with representatives of the Universities of Paris and Lyons, and the National Centre for Scientific Research. On the Sharjah side very keen interest has been expressed by Dr. Sheikh Sultan bin Mohammed al Qassimi, Ruler of Sharjah, while the Department of Culture, Sharjah, and the Directorate of Archaeology and Museums, led by Nassir H. Al Abboudi, has given every help possible. Special thanks should go to the Survey Department of Sharjah Municipality.

After a short reconnaissance in the spring of 1984, the scientific programme has developed year by year. This programme has emphasised the twin aims of pure archaeological research on the one hand with the need for preserving and conserving the Emirate's heritage sites on the other. During the course of research, questions concerning the whole of Sharjah's geographical, geophysical and historical background have had to be faced, and answers attempted. Hence the team has included specialist geographers, geologists and mineralogists (at least two every season); zoologists, including a shell expert, and palaeobotanists; prehistorians, architects and draughtsmen as well as archaeologists specialised in particular periods.

Programme

It was recognised early on that some rescue archaeology would be required in areas ready for development, particularly in Sharjah town itself and the airport area. In addition it would be necessary to divert manpower and resources to chance finds in the Emirate as they occurred. It was also decided that a Museum would be developed on scientific lines with the co-operation of the French team.

For the main research two main areas were selected. First, the coastal area near Hamriyah, a 20 km. long strip bordered by Ajman Emirate in the south and Umm al Qaiwain Emirate in the north. Second, the piedmont plain between Dhaid and Al Madam, about 40 km. long by 20 km. wide. For the rest of the Emirate, fieldwork was limited to brief surveys and visits to the Sharjah territories along the East Coast, some inland valleys and the dune field region.

Summary of Work to date

1985 – first part of the geographical and archaeological survey of Hamriyah (all periods); soundings on prehistoric and Iron Age sites.
– first survey of Dhaid and Al Madam plain.
– tests of electromagnetic survey of Mileiha to define underground structures before excavating.
– rescue excavations at Shargan, near Al Qassimi Hospital in Sharjah town (modern period).

1986 – second part of the Hamriyah survey.
– rescue excavations at Yarmuk and Al Madam plain, especially the central part (Jebel Faiyah and section of the piedmont).
– first season of excavations at Mileiha, on two grave sites.

1988 – end of the coastal survey; series of drillings for the late Quaternary Period.
– end of the Jebel Faiyah survey; soundings on a rock shelter.
– second season of survey and excavations at Mileiha (graves and settlement).
– study of the results of excavations at Thuqaibah (Al Madam).

1989 – third season at Mileiha, focussing on stratigraphy and the settlement area; a precise site map was drawn.
– rapid geographical and archaeological survey of the East Coast territories.
– rescue excavations at Muwaileh, near Sharjah Airport (Iron Age and Late Islamic occupations).

1990 – fourth season at Mileiha, focussing on craftwork areas: bone and softstone working, copper and iron metallurgy.
– mineralogy and archaeology of metal resources of the Mileiha site (with the hypothesis of iron ore mining in Jebel Faiyah). The excavations reveal the earliest evidence in the UAE of a developed iron metallurgy.
– excavations at Jebel Buhays, 20 km. south of Mileiha, of a series of Iron Age stone graves.

1992 – fifth season at Mileiha, concentrating on one spot along the main road, where a large wall and a unique coin were found accidentally in March 1990
– a further survey of Al Madam plain.

Preliminary results are published in the annual interim reports produced by the Sharjah Department of Culture. The first three were published in 1989 and 1990; the fourth and fifth will be ready shortly. The 1990 and 1992 reports will be in one volume. All the results will be gathered in two final reports, one dealing with the various surveys, and the other with the Mileiha excavations.

The results

The objective was not to collect beautiful objects, but to

reconstruct human occupancy over the millennia, and this report complements other important findings in neighbouring Emirates. The chronological sequence of the past 7,000 years in Sharjah is still incomplete, but the following indicates the present level of knowledge:

- the recent geology and corresponding palaeo-environment (Late Pleistocene and Holocene, or the past 40 mill.) have been well studied both in Hamriyah and in the piedmont area.
- there is a good understanding of the 4th and 5th millennia along the coast, less so inland.
- Bronze Age (3rd - 2nd mill. BC) remains are very few in the two surveyed areas. This period is well documented at nearby Ajman and Tell Abraq.
- The Iron Age (roughly 1st mill. BC) is better known. The main problem here is a lack of sites of comparable importance to Mileiha.
- information is scarce on the early to middle Islamic period, despite a comparison offered by sites such as Julfar in Ras al Khaimah and Jumeirah in Dubai.
- the modern period from the 17th century is apparently well-represented along the coast, but the team has not had a specialist in this period.

Geomorphology and Palaeo-environment

This is now better understood from the surveys of the coastal and piedmont regions and the area between, now covered by sand dunes. The present topography was formed by three generations of terraces or glacis, the oldest more than 100,000 years Before Present, BP, the second around 30,000 - 20,000 BP and the third corresponding to the last humid period, 9,000 - 6,000 BP. This was the last time when wadis ran directly to the sea to the north and north-west. These deposits of sands, gravels and pebbles were observed in sections in quarries near Sharjah Airport and in a series of drillings along the Hamriyah coast beneath the ancient lagoons. Some 4,000 years ago sand dunes began to cover their present day areas.

18,000 years ago the Gulf was empty; sea level then rose gradually to a point one metre above today's margin 6,000 years ago. Around 5,000 BC sea level dipped and then rose 1.5 metres maximum, a point reached during the late 3rd millenium BC Although these sea level changes appear minor, they greatly affected the local seashore topography and limits of the lagoons. The biotope appears to have changed. While oyster and murex shells were collected during every period, the terebralia, the long conical shell, began to disappear; common before the 2nd millenium BC, it was rare 2000 years ago and now has gone completely from the coast.

Hamriyah Area

The Hamriyah survey made no attempt to be a complete one covering the whole of the coast in great detail. The aim was to survey occupation and presence sites and build up a distribution map. The landmark of such occupation is given by shell concentrations (a better term than shell mounds, which, in Sharjah at any rate, do not exist in the raised forms evident in Ras al Khaimah). It is clear that there was occupation along the coast throughout the 7,000 years under survey, though it should be seen in terms of temporary or seasonal camps rather than permanent occupation. Besides shell concentrations, there is evidence of consolidated sandstone block walls (Iron Age) or loose sandstone walls (Islamic period).

One shell site just to the east of the main coastal highway was sampled to test for different layers, in order to check for different occupation periods. Along with different shell species collected, there were various radiocarbon dates, giving evidence of two separate dates separated by about 1,000 years.

A major drawback is the complete lack of evidence for the Paleolithic, not only in Sharjah but also throughout the rest of the region. Since the source flint is available in the mountains, in the piedmont and even carried along by ancient wadis, some evidence was expected. The team had experts specialising in the Paleolithic, but without success.

The better-documented 5th and 4th millenium BC are dated on the basis of several radiocarbon datings and comparison. The population at that time lived in groups along the shore, fishing and collecting shells and perhaps hunting, using flint tools and weapons.

Many 1st millenium BC occupation sites were found, most of them rather far from present-day lagoon coastlines. This suggests a higher sea level in the past and different lagoon topography around Hamriyah. Again, no building or grave site of this period was discovered. For the following centuries, corresponding to the major occupation site at Ad Door, Umm al Qaiwain, only one site is recorded with the distinctive glazed pottery of that period. From that date until the recent Islamic period there is a large gap in sites. Apart from Sharjah town, only camp sites are recorded, some so small that they may have been mere overnight stops.

East Coast

The brief surveys and visits to Sharjah's East Coast territories add very little more to previous knowledge by Beatrice de Cardi and others. Sites are mostly graves, either cairn burials or subterranean tombs. The former are on hill ridges or outcrops, mostly empty and because of their positions not immediately threatened by modern development. The latter includes a good example at Kalba on the border with Fujeirah Emirate, and is in need of protection as it is close to built-up areas.

The Inland Plain between Dhaid and Al Madam

This region has now been surveyed extensively by geomorphologists, prehistorians and archaeologists. A geological map of the past 100,000 years or so has been built up by the study of artificial sections, wadi beds and occasionally taking unexpected opportunities, such as the redigging of a 2000 year old well at Mileiha that was more than 8 metres deep.

Prehistoric times are evidenced by flint finds, rarely completely worked. Several knapping areas were discovered, both in the piedmont and on the slopes of Jebel Faiyah, as well as further out in the plain, especially the Al Madam - Fili area. The colour and quality of the flint can be distinguished from site to site but it is surprising that the actual tools found on the plain (as at Mileiha) and also on the coastal sites are rarely made from these known flint types. Since these knapping sites are on the surface, they contain few if any distinctive tools and cannot be dated with any accuracy. However, they are tentatively placed in the 5th and 4th millenium BC by comparison with other dated sites in the general region.

The Bronze Age

The piedmont and plain are surprisingly poor for this period on evidence so far found. It is tempting to date some of the stone structures to the Bronze Age but not in the absence of artefacts. The only exception is a small group of apparently circular graves at the southern end of Jebel Rumailah, about 10 km. south of Mileiha. Two pots and a chlorite vessel found there some years ago are now the only testament to this period in the Sharjah Museum.

The Iron Age

The southern part of the plain is better documented than the Dhaid-Mileiha area, thanks to excavations carried out by the Sharjah Dept. of Culture at Thuqaibah in 1988, team excavations at Jebel Buhays in 1990 and broader surface surveys. At Mileiha fragments of Iron Age soft stone vessels were found at the lowest and highest levels, along with one bronze arrowhead.

Near the Fili road junction, along Jebel Buhays, a group of graves and a rectangular stone structure were found in the 1970's, but in a poor state of preservation. The graves had been robbed and the skeletons disturbed but typical slipped bowls have now been excavated, along with fragments of chlorite vessels and bronze arrowheads.

The evidence for occupation at Al Madam during this period was confirmed by the discovery of the Thuqaibah site at the south-east corner of the cultivated area. A well-preserved mudbrick house has been explored, with missing roof but partial staircase. A plan of this building compares with those of the Iron Age site at Rumeilah in Al Ain. A number of copper slag pieces were found, indicating the existence of a metal industry.

The most important Iron Age discovery was at Umm Safat, covering a total area of some 1.5 km. square, though partly destroyed by succeeding and modern cultivation. It may have been organised like Hili with houses in isolation and in small groups.

It is interesting to note the presence of at least three falaj, two oriented to the Thuqaibah area and one to Umm Safat. However, this may be coincidence in terms of occupying the best places for agriculture, in modern times as well as in the distant past. It is clear that Al Madam was extensively occupied during the Iron Age, whereas Mileiha was not.

The Late 1st Millennium and the 1st Century AD

So far Mileiha is the only known site in the UAE with occupation evidence for the last two centuries BC. One or two graves in Asimah and Wa'ab (Ras al Khaimah) may also date from this period.

Mileiha, a settlement area of at least 1.5 km. square, was occupied from the late 3rd Century BC until the 1st Century AD and is partly contemporary with Ad Door in Umm al Qaiwain. Domestic houses and craft sites are bounded by a succession of cemeteries to the south and east.

The culture of Mileiha is quite different to that characterising the preceding Iron Age. There is a change in architecture and in funerary rites, iron weapons are common throughout the period (not in the Iron Age), there was knowledge of south Arabic and Aramaic writing, and coinage was in use. Greek amphoras were imported, along with glazed and other ceramics from the east. It would appear that the people of Mileiha do not represent a continuity of the Iron Age population and may be an Arab group of nomadic origin, related to central and northern Arabian communities; there are similarities between the funerary architecture of Mileiha and monuments at Qaryat al Fau, in Saudi Arabia, and Petra, in Southern Jordan, for instance.

During the last period of occupation at the site, contemporary with Ad Door, very large structures were built. Excavations of a fortified building in the centre of the site have yielded two coin moulds. This evidence of minting emphasises the importance of Mileiha in its time, but the site was apparently abandoned in the late 1st Century AD while Ad Door continued to be occupied for another three centuries.

An Update on the 1992 excavations

Following the results of the last season of work, in 1990, the 1992 season was divided into two parts:

a) a field survey of the Madam Plain to complete the reconnaissance begun in 1985;

b) a rescue excavation alongside the main road which is in the centre of the Mileiha site, prior to civil works to double the width of the highway.

The Al Madam Survey

The main survey area was around the modern villages of Thuqaibah and Umm Safat. The area today is densely covered by farms and small-holdings. Previous surveys had covered the east of Jebel Rumeilah and west of the Fili - Al-Madam road. Altogether 32 pottery sites were recorded, and a sample taken from each. Most of the material can be dated to the Iron Age or recent Islamic.

Some stone graves, probably Iron Age, were found on small gravelled hillocks on the plain south of the Fili road. The settlement at Thuqaibah, where a mudbrick house had been previously excavated, was further explored and its limits (800 x 400 metres) established. A few spots of Iron Age pottery were found there, especially near Tawi al Hosn. The main discovery, however, was a settlement of scattered and grouped houses at Umm Safat, covering an area of some 1.5 km square.

The numerous remains represent large scale human occupation in the Al Madam area during the Iron Age, contrasting with no occupation at Mileiha. Some parts of the Umm Safat settlement are still outside the modern farms and should be enclosed and protected.

The Islamic sites discovered are not old and probably developed around some large wells still visible inside today's farms, beside the traditional south-north crossing of the plain via Tawi Ayow (near the road to Hatta), Tawi Thuqaibah (south-east of the modern village) and Tawi al Hosn, where the ruins of an ancient mudbrick square tower are still visible.

Two spots of a very few pottery sherds can tentatively be dated to the 3rd or 2nd Millenium BC but further dating analysis is needed.

The Mileiha Excavations

The main aim of the 1992 season was to determine the kind of building that housed the coin mould, and to delineate the total area of the structure and any associated works.

A trench was opened at the site of the mould, and a

series of smaller diggings attempted to define the size of the area.

In the main area, roughly 400 m^2, the team came across a long north-south wall, some 1.8 metres thick abutting a square tower to the south. East of the wall was a building with two rooms and a corridor. The main wall is preserved to 1.5 metres high, but associated finds were scanty — an iron three-winged arrowhead of a new type to Mileiha, some pottery sherds and a very broken coin mould. This latter represents the reverse half of a coin mould which produced a coin quite different from the obverse half previously discovered. While the first mould was well preserved and apparently never used, this second one was in poor condition, blackened by the heat of the castings.

The series of minor trenches confirmed the continuation of the north-south outer wall of the building up to the north-west square tower which was found at the very limit of the cultivated area. Lastly, three soundings were carried out east of the main road in the hope of finding the eastern wall of what appeared to be a four-sided building. A square fort of some 2000 m^2 is expected, but not confirmed from results in the 1992 season.

The excavated area revealed a fortified building in the central part of the site measuring 47 m along each side (52 m including the corner towers). According to artefacts recovered, the site was occupied in the 1st Century AD. The two coin moulds clearly imply some sort of official function for the building. These moulds are the first evidence of a mint in the UAE area, and suggest that Mileiha may have been a site of pre-eminence at that time. Certainly in the last few centuries before Christ the conditions of agriculture and possible iron ore in local hills made Mileiha a prime spot for settlement. The site is also right on a favourable trans-plain route.

There is no evidence from the 1992 or previous seasons' work to suggest why Mileiha was abandoned in the late 1st or early 2nd Century. It is proposed that future work should concentrate on a complete exploration of the fort, which unfortunately straddles the main Dhaid - Al Madam road. It is for Sharjah Municipality to decide on the possibility of a fuller excavation but the joint team has plenty of work for coming seasons, which can only enhance our overall picture of this part of Arabia during a period which is not particularly rich in archaeological discoveries.

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Distribution of Harriers (*Circus pygargus/macrourus*) in Arabia and their identification in Subadult, Juvenile and female plumages

by Erik Hirschfeld & Colin Richardson

Introduction

On 19 July 1991 CR found three subadult Harriers in a fodder field at Al Habab (25°03'N 55°33'E) (ABBA Square VB 27), near Dubai where they remained until 12 September. EH and Rob Morris visited the site on 2 August 1991 verifying the initial identification as **Montagu's Harriers** *C. pygargus*. As Montagu's Harrier is a scarce bird in the United Arab Emirates and central parts of the southern Gulf coast, and the separation of it from the more common **Pallid Harrier** *C. macrourus*, especially in subadult plumages, is quite difficult, this paper attempts to describe their occurrence pattern in Arabia and give hints on identification of the more difficult plumages.

Distribution and Migration

Montagu's Harrier breeds in a belt from Western Europe east over Asia to the Altai mountains. The main wintering areas lie in India (presumably for eastern populations) and eastern Africa, with fewer overwintering in southern Arabia. Despite its wide range most migratory birds seem to pass though the Straits of Gibraltar, eastern and southern Turkey and Iraq with surprisingly few recorded at migration points in the eastern Mediterranean Sea. The similar Pallid Harrier has an overlapping, but totally smaller, breeding range starting from the steppes north of the Black Sea continuing east (roughly) to the Altai. The wintering areas are virtually identical to Montagu's, with the

● هذا المقال يوضح طرق التمييز بين نوعين من طيور الصيد في دولة الامارات.

exception of scattered, regular winter occurrences in the Middle East (Cramp et al 1980).

Pallid Harrier is a common migrant and sometimes winter guest in the Arabian peninsula while Montagu's is surprisingly rare. In the Eastern Province of Saudi Arabia it is considered a regular migrant in April, September and October and in the Riyadh region a rare migrant in March and August to mid October, while it is unrecorded in south-west Saudi Arabia. It is a regular autumn migrant in the Yemen. In Oman it is considered an uncommon passage migrant and winter visitor September to May. There were seven acceptable records from the UAE before the summer of 1991; from January (1), March (2), April (3) and November (1). None have been recorded in Qatar and there are only two accepted records from Bahrain (April 1990 and January 1992). Another Bahraini record from November 1991 is under consideration. (Bundy et al 1989, Stagg 1985, Stagg 1987, Brooks et al 1987, Oman Bird List ed. 3, Richardson & Richardson 1991, Warr 1986 and Hirschfeld in prep.)

Harriers are, unlike most raptors, considered to be able to cross stretches of water on migration. The paucity of Montagu's Harrier records from Bahrain and Qatar (and

indeed the eastern Mediterranean) suggest however that Montagu's might differ from Pallid in that respect. For example only two (or possibly three) out of c. 40 carefully-checked Pallids recorded by EH in Bahrain 1989-91 were identified as Montagu's.

Harriers are also notoriously difficult to identify and there is a good possibility that birds in untypical or immature plumages might go undetected among Pallids but that alone cannot account for the scarcity of records from the south-central Gulf coast.

Identification

The following is not intended to be comprehensive. Instead we have concentrated on some important characteristics, easy-to-see for an unexperienced Harrier-watcher.

Adult males are quite straight - forward and will not be discussed in detail here as they are well covered in the literature already. Juvenile birds, together with females known as "ring-tails,." and subadult males, however, can cause problems.

Differences from Hen Harrier

The first step is to make sure one is not watching a Hen Harrier. Hen Harrier is generally a larger bird than both Montagu's and Pallid with — above all — broad wings and a broad tail. The "fingers" (primary feathers on the stretched wing) number five on Hen but only four on Pallid and Montagu's. This is a very important difference but be careful with birds that show less or growing primaries due to moult (carefully checked, the observer should see in that case that there is a gap between the fingers or that the point of the wing looks "unnatural"). Furthermore the difference in length of the different fingers is larger for Pallid and Montagu's, making their wings look more slender and pointed. The best way to come to terms with this character is to get used to observing it on all harriers one sees. Hen Harrier's flight is also more straight and not so "bouncing" as Pallid and Montagu's, a character easy to see for a trained observer. Forget differences in the white rump patches (mentioned in some field guides). It is very difficult to see and the feature varies much.

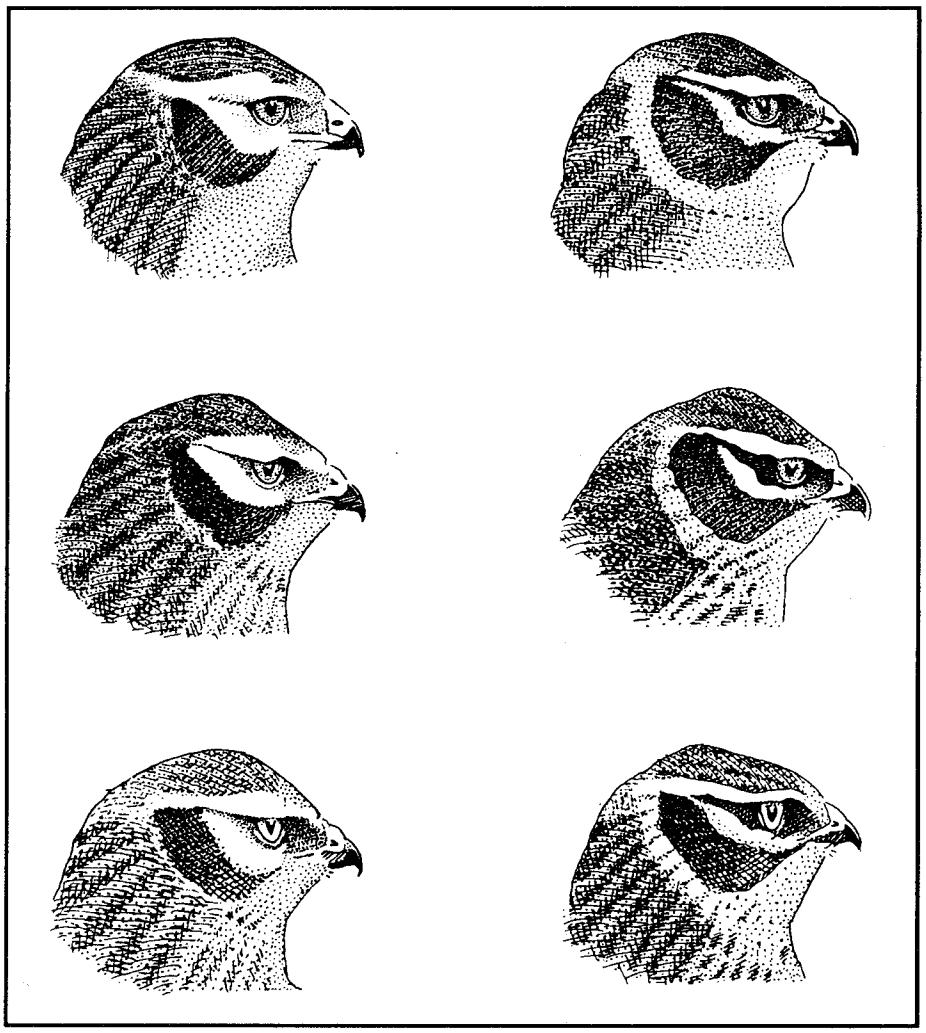
We have now excluded Hen Harrier and can go further.

Aging

The next step is to age the bird correctly. Adult males are always mainly blue-grey (with various extent of black on the wing depending on species) in their plumage while females are browner, with a white rump and a barred tail. Subadult males in spring and early summer show a few blue feathers (which increase in amount as summer progresses) and can be mistaken for females. Carefully check breast and flight feathers on a female-looking bird for traces of blue.

Females

Females differ from juveniles in lacking uniform rusty or yellowish colour on the underside of the body, being considerably streaked instead, having banded secondaries underneath (much darker and very difficult to spot banding on juveniles) and having a less-contrasting facial pattern.



Heads of (from top) juvenile, young female and adult female of Montagu's Harri (left) and Pallid Harrier (right). Drawn after Forsman (1984) by Bill Morton.

The best character between the two species is undoubtedly on the upperside of the secondaries (the inner, stiff feathers trailing the wing). On Pallid they are evenly coloured (exceptionally with **indistinct** dark bands running parallel with the trailing edge) while on Montagu's they are crossed by three, thick, contrasting dark bands. The facial pattern also differs (see Figure 1). Pallid has less white above the eye, the dark line through the eye runs uninterrupted to the dark ear-coverts and there is a distinct collar behind the ear-coverts. (Montagu's with more white above the eye, faint collar and a shorter eye-stripe). The undertail covers and "trousers" (feathers down the legs) are generally more coarsely and indistinctly streaked on

Pallid (Alstrom et al 1991).

Second-year males

As already mentioned these birds can show a mixture of female- and male-type characters. Especially when perched they might look like normal females, but when flying they can show much blue-grey. Forget about facial patterns and the shape of the dark on the primaries (the latter is useful only on fully-moulted, adult males). Concentrate instead on the underside. If the blue-grey from the head extends far down the breast and is abruptly demarcated it surely is a Montagu's, but if the sides of the head are paler blue-grey or whitish gradually becoming white, it is a Pallid. Montagu's furthermore show strong, **reddish** spots on the inner part of the underwing coverts and similarly-coloured streaks along the white belly, always lacking in Pallid. Montagu's seem to moult their body feathers much earlier than Pallid and can thus exhibit extensive blue-grey already in April. Birds observed by EH at Ras al Khaimah and Bahrain had in fact quite a lot of blue feathers on their throats and upper breasts already at the end of January. On the upperwing, the secondaries of Montagu's show a broad black band at the base of the secondaries provided the individual has started to moult to its adult, bluish secondaries, while they are plain blue-grey on a Pallid in the same condition. This band is clearly visible from CR's photo (See centre pages) of one of the Al Habab individuals. Note that it is interrupted on the growing, outer secondary on the right wing (since the base is concealed by the coverts) and not present on the inner, juvenile (brown) secondaries. The underside of the adult secondaries show two basal dark bands on the inner parts, running parallel with the wing. On a Pallid they are unpatterned pale. Individuals in wing moult could be difficult, but concentrate on the **adult** secondaries when assessing the character.

Juveniles

As mentioned before juveniles are mainly unstreaked below, often showing a warm rusty or yellowy tone to the body. The secondaries are wholly dark, without the bands of the females. The facial patterns are more distinct and basically the same characters as for adult females are valid. However, there seems to be variation in juvenile Montagu's, so they apparently can show less white on the face than adult females but the frequency of this is still poorly understood. The sides of the throat are usually distinctly streaked light and dark on Montagu's while they are plain-looking, often very dark on Pallid. Some Montagu's also have unstreaked undersides to the primaries; they are more plain looking, while Pallid always has visible banding there.

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Plate Tectonics & the Oman Mountains

by Dr. K.W. Glennie

1. Plate Tectonics

With the advent of television documentary films, most educated people these days have heard of the geological concept of **Plate Tectonics** (see also Glossary), but few, apart from geoscientists, have any real idea of what is involved.

In its simplest form, the Earth's crust consists of broad, relatively thin, **plates**. The biggest plates comprise a continent (**continental crust**, which can extend beneath the shallow seas of continental shelves such as the Arabian Gulf or the North Sea) together with adjacent crust of oceanic type (Fig. 1). The plates vary in thickness between about 4 and 10 km for the more dense oceanic crust and 20-70 km for the lighter continental crust. The thicker continental crust tends to be more rigid than oceanic crust, and both types 'float' on the deeper, denser and more plastic **Mantle**. (Fig. 2).

During the course of geological time, each plate can be seen to have moved relative to the poles, and to have changed in both shape and size. Although unproven, it now seems likely that the plates move in response to convection currents within the mantle, the required heat possibly being generated by the radio-active decay of uranium-rich minerals within the core of the Earth (Fig. 2).

Within rifts along the axes of **mid-oceanic ridges**, convection-driven hot molten rock rises from the mantle to the sea bed, where it solidifies as **dykes** covered by lava. Melting begins 70 to 50 km below the ocean floor, forming a linear **magma** chamber at 20 to 30 km depth. Each of these ridges forms the boundary between two plates. At the same time, because the flanks of the ridges move apart, more dykes are accommodated within the rift. By this means, new **oceanic crust** is generated at an average horizontal rate of about 5 cm per year, separating its flanking continents at the same rate (i.e. in geological time, 50 km per million years). As the hot, new oceanic crust moves away from the mid-oceanic ridge, it cools, shrinks, becomes more dense, and its surface thus subsides to a greater depth below sea level.

In some cases, equivalent convection cells develop beneath continents, eventually splitting them in two to create a **microcontinent**. Such an event in what is now the Red Sea caused the separation of Africa and Arabia (Fig. 2) about 10 million years before present (10 Ma BP). Within East Africa, two attempts to split the continent resulted in the African Rift System, complete separation possibly being prevented by opposing crustal spreading in the Atlantic and Indian Oceans.

As can be seen on Figure 1, the crests of the mid-ocean ridges are cut and offset by what are known as **transform faults**, which accommodate relative plate rotations. There is an opposing sense of spreading between the ridges on either side of these faults, but the distance between ridge-crest rifts remains constant with time.

There is no evidence, however, that the diameter of the world is increasing because of these processes. The width of newly created crust in the oceans is balanced by the loss of older oceanic crust, which sinks at an angle beneath the edge of the opposing plate (**subduction zones**) to be reincorporated within the mantle (Fig. 2). In the best known type of subduction zone (Andean type; Fig. 3a), oceanic crust is carried down at a moderate angle beneath the edge of a continent.

● بعض الخنافس تم العثور عليها بالقرب من منطقة مهده في سلطنة عمان وتشكل هذه الحشرة خطورة كبيرة على المزارع في دولة الامارات العربية المتحدة.

As oceanic crust sinks down the subduction zone, its cover of ocean-floor sediments may be scraped off and accreted (stuck) to the under surface of the opposing plate. By this means, thick **accretionary wedges** of sedimentary rocks may accumulate like newspapers coming off a conveyor belt, the first rocks to be accreted being at the top of the pile (Fig. 3a). The Hawasina of the Oman Mountains and the Makran accretionary wedge of SE Iran (see sections 2 and 3, below) originated in this way.

The frictional heat associated with down-going slabs of oceanic crust within an Andean-type subduction zone can cause melting and the creation of a linear magma chamber in the overlying rocks of the continental crust. About 20 million years after subduction begins, a string of volcanoes becomes active on the continent around 100 km or more behind the oceanic trench (Fig. 3A).

In some circumstances, subduction can lead to the generation of new oceanic crust behind the subduction trench. This **back-arc** extension process is co-existent with adjacent crustal shortening by subduction. If old and fairly cold oceanic crust descends steeply in a subduction zone, its increasing length, and therefore weight, leads to an increased rate of subduction. This may be accelerated by retreat of the trench line oceanward with respect to the overriding plate, the heavy subducting plate causing 'roll-back' of the axis of subduction (Fig. 3B). This leads to a change in the back-arc area from crustal compression to crustal tension. Pressure reduction allows hot mantle rocks to melt and rise up through the tension gashes to the sea floor. In this way a new convection-driven magmatic cell comes into operation. Such a linear cell results in the generation of new oceanic crust along a back-arc axis of spreading. Thermal systems of this type probably take at least 10 million years to become effective following the initiation of subduction.

The resulting axis of **back-arc spreading** acts in a fashion similar to that of mid-ocean ridges, but is limited to relatively short linear distances of hundreds rather than thousands of kilometres. The new oceanic crust differs slightly from crust of mid-oceanic origin because of differences in the size of the convection cell. In the Oman Mountains, the **Semail Ophiolite** (which forms a tectonic sheet overlying the **Hawasina** accretionary

wedge) probably originated in the above fashion rather than in a ridge of mid-ocean type. Unlike crust generated at a mid-ocean ridge, which is invariably much older than the time of subduction, crust of back-arc type is of the same general age as the subduction process.

2. Rock Units of the Oman Mountains

Although these can be subdivided into ever smaller units, only six need concern us here. From bottom to top they are:

A. Basement: the oldest sedimentary rock units were deposited more than 300 million years ago. They form the exposed core of the mountains in Oman (Jebel Akhdar and Saih Hatat), but are seen within the Emirates in only one displaced block, Jebel Qamar.

B. The Hajar Supergroup (Table 1): includes all the rocks, mostly of shallow-marine origin, deposited over the ancient continental crust of Eastern Arabia between the late Permian and mid Cretaceous (-270-95 Ma ago); they include rocks similar to the oil and gas-bearing reservoirs of the Emirates.

C. Aruma Group: Late Cretaceous (Turonian to Maastrichtian) sediments that overlie the Hajar Supergroup unconformably and straddle the time of **obduction** (see D, below) of both the Hawasina and Semail nappes (i.e about 90 and 70 Ma BP).

D. The Hawasina: deposition of these flysch-rich rocks took place during the same time span as that of the Hajar Supergroup: this happened mostly in deep water over a continental slope and ocean floor that lay to the northeast of the Arabian continent. Following the initiation of subduction around 110 Ma, the Hawasina started to form a very complex accretionary wedge when its underlying oceanic crust began to be carried own an oceanward-dipping trench about 96 Ma ago (age of youngest known Hawasina). Subduction ceased about 70 Ma BP when the much thicker and more buoyant continental crust of the eastern margin of Arabia could not be consumed down the trench. By that time, the Hawasina imbricate wedge overlay the Hajar Super Group and was itself overlain by the Semail Nappe. The above process, by which ocean-floor sediments and oceanic crust become emplaced above rocks of continental type, is known as **obduction**.

E. Semail Nappe: the world's largest slab of exposed former oceanic crust. Originally thought to be of mid-ocean type, it is now considered to have been generated by back-arc processes. Its rocks range from **mantle peridotites** at the base, through **gabbro** to a sheet of dykes, which were the feeders to basaltic **pillow laves** at the top. The pillow lavas acquired their characteristic shapes because they were erupted on the ocean floor and grew like balloons until their surfaces were chilled sufficiently by the water to solidify; the pillow lavas are associated with sediment and fossils of the same age. The combination of mantle and oceanic-crust rocks obducted into a continental environment is known as an **ophiolite**. The Semail ophiolites have been described by Gary Feulner in an earlier edition of the E.N.H.G. Bulletin.

F. Maastrichtian to Early Tertiary; mostly shallow-marine limestones that overlie all other units.

3. Brief History of the Greater Oman Mountains Area

The above sequence of rocks can be reconstructed palinspastically (put back into their original spatial relationships) to give a fairly clear developmental history of oceanic sedimentation and relative plate movement. They show that around 270 million years ago (Table 1), a microcontinent, Anatolia plus a sliver in Iran known as the Sanandaj-Sirjan Zone (Fig. 4), began to separate from Afro-Arabia with the creation of intervening new oceanic crust (Figs 5, 6, 7). This arm of the much bigger and longer-lived ocean Tethys, has been referred to as South or Neo-Tethys, or, adjacent to Oman, as the Hawasina Ocean; it extended around Arabia to the area of Cyprus in the eastern Mediterranean. The Hawasina sedimentary sequences was to be deposited in Neo-Tethys during the next 180 million years until it was obducted as an accretionary wedge over the continental margin of Arabia.

The northern part of Neo-Tethys, between the Zagros areas and the Sanandaj-Sirjan Zone, probably continued to widen for only about 70 million years, possibly achieving a width of some 350 km (now represented by what is known as the **Crush Zone** following collision between these two areas of continental crust).

Spreading in the Crush Zone sector of Neo-Tethys ceased about 200 Ma ago when a new axis of ocean-floor spreading developed between the Sanandaj-Sirjan Zone and Central Iran, extending around the southern end of the Lut Block. (If a microcontinent ever intervened between Lut and the Oman portion of the Arabian continental margin, it was probably very narrow and has since been destroyed by subduction; the two areas of oceanic crust were probably offset by the transform fault that extends from the Dibba area of northern Oman Fig. 6B). This new arm of Tethys which can be called the Zanjan-Taftan Ocean (Fig. 5B, 6B, 7A), was to continue spreading until some unknown later date, possibly when subduction of its crust began about 70 Ma BP.

From the origin of Neo-Tethys, the northeastern continental edge of Afro-Arabia was a passive margin (i.e. it had no associated Andean-type subduction trench). Afro-Arabia and South America, which were then part of the same mega-continent, moved to the southwest, away from the axis of spreading, at about 2 1/2 cm per year for the next 160 Ma, no matter whether that axis lay in Neo-Tethys or in the Zanjan-Taftan sector of Tethys.

The Arabian shallow-marine shelf edge was the source of most of the carbonate sediment that was transported to the deep ocean floor of Neo-Tethys by sporadic high-velocity turbidity currents (flysch). The intervening periods acquired nothing more than a gentle rain of the finest particles held in suspension, much of which dissolved at water depths of 2000m or more to produce **cherts**. This style of sedimentation was controlled by variations in global sea level until about 110 Ma, when the South Atlantic Ocean began to open under the influence of a new axis of spreading; Africa and South America began to separate, and Afro Arabia started to move back over the area previously occupied by the oceanic crust of Neo-Tethys (Fig. 6C, 7).

The immediate result must have been strong crustal compression in the area of Neo-Tethys; two spreading ridges, South Atlantic and Zanjan-Taftan, were actively generating new oceanic crust on either side. The oceanic crust of Neo-Tethys presumably ruptured at its

weakest point, which in the Crush Zone sector may have been just west of the narrow Sanandaj-Sirjan microcontinent. This is suggested by the occurrence of early Cretaceous subaerial volcanism, perhaps induced by northeastward subduction, close to the southern end of that continental sliver. In the Oman sector, subduction could have been initiated anywhere in an ocean up to 4000 km wide, possibly SW of an extension of the Sanandaj-Sirjan Zone, now lost, that had been offset across the Dibba transform fault (Fig. 6C).

Wherever it began, the crust was probably old and cold (maybe Jurassic or Triassic — see Table 1 — and thus possibly around 100 Ma at that time), for subduction led to back-arc extension with its generation of new oceanic crust. Subduction also involved accretion of the Hawasina nappes beneath a cover of back-arc oceanic crust that was to become the future Semail Ophiolite. In Neo-Tethys, subduction ceased about 85 Ma BP when the thick and buoyant continental crust of the Arabian margin could no longer be consumed down the subduction zone.

Ocean-floor spreading continued to be active, however, both in the South Atlantic and the Zanjan-Taftan sector of Tethys. Horizontal compressive stresses soon built up to the point where another subduction zone had to be created. This new subduction zone developed in the Zanjan-Taftan sector of Tethys where it is best exposed in the Inner Makran around the southern edge of the Lut Block; it was possibly already active around 78 million years ago during the Campanian (Fig. 5D, 6C, 7B).

The palinspastic reconstruction of the rock sequences of the Inner Makran provide the basis for working out the geological history of the area. Shortly after subduction ceased in the Oman area (-85 Ma BP), stresses induced the Inner Makran trench beneath oceanic crust of latest Jurassic age (-140 Ma – Table 1), now seen south and southwest of Jaz Murian (Fig. 7B). A thick accretionary wedge of oceanic sediments has been building up ever since and now extends to south of the Makran coast. An older sequence of fragmented oceanic crust and its sedimentary cover, known in the Crush Zone as the Coloured Melange, is similar to, and a time-equivalent of, the Hawasina. It had an unconformable cover of Maastrichtian sediments at the time of subduction. Initially, the sedimentary sequence included kilometre-size slabs and blocks (wildflysch) that slid into the trench from shallower waters. These were incorporated into the wedge as tectonic slices. A NW-SE trending zone of volcanic rocks along the Zanjan-Taftan Zone marks the orientation and approximate location of the deeper parts of the subduction zone, but it also masks the site of closure of that sector of the Tethys ocean.

The initiation of subduction in the Inner Makran relieved the compressive forces that had kept the northeastern edge of Arabia wedged down the Semail subduction trench. Its relatively light continental crust relaxed and rose **isostatically** (like a cork in water), causing the Semail Nappe to shear from its contiguous oceanic crust, probably along the axis of spreading. This uplift was sufficient to cause the obducted Hawasina and Semail to slide further onto the Arabian margin, and locally brought the Semail above sea level, where its erosion resulted in conglomerate deposition within the Emirates (Juweiza Formation of the Aruma Group). Isostatic uplift of the area of emplaced nappes continued on a minor scale throughout the earlier Tertiary, causing further erosion (Paleocene conglomerates), gravity sliding and the compressional deformation of Lower Tertiary strata; indeed, some units of Hawasina and Semail rocks now locally overlie Lower Tertiary limestones.

Apart from the above adjustments, the northeastern margin of Arabia was to remain quiescent for the next 40 million years. All the activity during that time span appears to have taken place in the Inner Makran, where a thick wedge of sediments accumulated above the subduction trench.

A lack of marine sediments of Oligocene age in the Inner Makran suggests that the area had then been lifted to above sea level. This, coupled with a whole range of other evidence, indicates that a large part of the Middle East was again subjected to lateral compression. For instance, movement of the Naiband Fault between central Iran and Lut caused clockwise rotation of fault blocks at the southeastern end of the Sanandaj-Sirjan Zone, and coincided with SW thrusting of the Musandam Peninsula over Tertiary sediments; it also coincided with the at least 3000 m uplift of the Oman mountain range, which for the previous 40 Ma had remained at or below sea level. Both these events were the outcome of horizontal crustal compression in response to relative movements of the Arabian plate and adjacent microcontinents towards the southwestern edge of Asia (Fig. 6D).

Only during the past 5 Ma has the Zagros area been deformed into a mountain range by continent-continent collision. This was the outcome of two confining pressures. The one was caused by Africa continuing to move away from the axis of the Atlantic Ocean, with the added effects of the axis of spreading initiated in the Red Sea/Gulf of Arabia some 10 million years ago; the other confining pressure resulted from the relatively immovable mass of the Eurasian plate. The resulting compressive movements are the cause of devastating earthquakes along the Zagros Crush Zone. In contrast, the earthquake-free Oman Mountains are flanked by oceanic crust, which is now being subducted beneath the Makran coast along the northern edge of the Gulf of Oman (Fig. 1, 7).

4. Suggestions for further reading

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5. Figures and Tables

1. Simplified map of the Earth's plates, showing distribution of axes of oceanic spreading, transform faults, ocean/continent (solid triangles) and continent/continent (open triangles) subduction zones.

2. Schematic equatorial section of the Earth showing plate boundaries at spreading ridges and subduction trenches, with suggestion of convection currents within the mantle. Crustal thickness considerably exaggerated.

3. Sketches illustrating A. Andean-type subduction with back-arc compression and sub-aerial volcanism, and B. Back-arc extension and the generation of new oceanic crust because of tension induced by the rolling-back of the subduction axis by the weight of cold, rapidly sinking, old oceanic plate.

4. Belts of important microcontinents (Anatolia, Sanandaj-Sirjan; Central Iran/Lut, Helmand; Pontids, Lesser Caucasus, Elburz, Central Afghanistan) and intervening relics of Tethyan oceanic crust (Crush Zone, Zanjan-Taftan, Sabzevar) that separate the Arabian and Eurasian platforms.

5. A sequence of maps that illustrate the time-related plate-tectonic movements of Afro-Arabia relative to Tethys and the rest of the world.

6. Cartoons illustrating the plate-tectonic development of Arabia and the various sectors of Tethys with time. A Anatolia CI Central Iran, H Helmand, M Musandam Peninsula, O Oman Mnts. Note that during the Mid Cretaceous (Fig. 6C), a back-arc spreading ridge developed behind the subduction trench in the Crush Zone — Oman sector of Tethys.

7. Cross-sectional cartoons illustrating the generation of new oceanic crust, plate movements and associated subduction/obduction throughout the evolution of the greater Oman area. A. Zagros-Central Iran sector of Tethys. B. Oman-Makran sector of Tethys.

6. Glossary of Geological terms

accretionary wedge: a wedge of sedimentary rocks that were scraped off the surface of a down-going plate during subduction. B.P.: Refers to years before present.

back-arc compression: the process whereby subduction of an oceanic plate beneath a continental margin leads to overthrusts and folding in the continental back-arc area overlying the subduction zone.

back-arc spreading (extension): the process of creating new oceanic crust in the back-arc area behind a subduction trench.

chert: beds of finely crystalline deep-water silica.

continental crust: the lighter (less dense) of the two main types of the Earth's crust, which forms most land masses.

dyke: tension cracks within the crust that were filled with molten magma, but now solid.

flysch: product of tectonically-induced turbidity currents.

gabbro: rock representative of the lower part of the crust.

isostatic: continental crust 'floats' on a denser, plastic substratum and, like a boat, tries to adjust isostatically to changes in its load caused by tectonic pressures, erosion, or sedimentation.

Ma: millions of years

magma: molten rock when still within the Earth's crust or Mantle.

Mantle: the part of the Earth, nearly 3000 km thick, that underlies crust of both continental and oceanic type.

microcontinent: a sub-continent or continental sliver calved from a continental plate by processes of crustal spreading.

mid-ocean ridge: a (mostly) submarine ridge that transects oceanic area and is a locus of generation of new oceanic crust.

nappe: a large sheet-like rock unit that has been tectonically emplaced over a dominantly subhorizontal or low-angle floor.

obduction: the process by which former oceanic crust or wedge of oceanic sediments comes to lie upon crust of continental type.

oceanic crust: the type of crust that characteristically underlies the Earth's oceans; it is denser than continental crust.

ophiolite: obducted oceanic crust now separated from previously adjacent crust of oceanic type.

peridotite: rock typical of the upper mantle; well exposed in the lower parts of the Semail Nappe in the Oman Mountains.

pillow lava: the pillow-like masses of rock that are formed when magma is extruded below water and rapidly chilled.

plate: one of the major areas of the Earth's crust, normally comprising continental and contiguous oceanic crust.

plate tectonics: the processes by which the Earth's crustal plates are formed and interact with each other.

roll-back: the process by which the weight of old, cold, subducting oceanic crust causes the axis of subduction to move oceanward, away from the subduction trench.

subduction: the process at a plate margin of crustal consumption down a subduction zone.

subduction zone: a linear zone down which crust of mostly oceanic type passes into the mantle beneath the edge of another plate, commonly but not exclusively of continental type.

transform fault: fault that separates two areas on the same axis of spreading oceanic crust; there is an opposing sense of spreading between ridges, but the distance between ridge crests remains constant.

turbidity current: high-velocity currents of turbid sediment and water that occasionally flow across the floor of some ocean basins.

Ma	AGE	ARABIAN CONTINENTAL MARGIN	NEO-TETHYS	INNER MAKRAN
2	PLIO PLEISTOCENE	**FOLDING OF ZAGROS MOUNTAINS**		Subduction to N along Makran coast
30	OLIGOCENE	**UPLIFT OF OMAN MOUNTAINS**	Deep-marine sedimentation only in Gulf of Oman	Right-lateral crustal compression
45	EOCENE	Shallow-marine deposition		Flysch deposition
60	PALEOCENE	Shallow-marine deposition		Wildflysch deposition
70	MAASTRICHT	Aruma **SEMAIL/HAWASINA**	**Closure of Crush Zone sector?**	**Active subduction S of Lut Block**
80	CAMPANIAN	deposition **OBDUCTED**		
95	CENOMANIAN	Youngest HAJAR SUPERGROUP	**Youngest HAWASINA**	
100	ALBIAN		**Start of Semail spreading**	
110	APTIAN		**Start of Hawasina subduction?**	
140	PORTLANDIAN			**Dated oceanic crust**
200	LIASSIC		**End of spreading in Crush Zone**	**Start of Zanjan-Taftan spreading**
250	TRIASSIC		Neo-Tethys actively spreading	
270	PERMIAN	Shallow-arine carbonates of HAJAR SUPERGROUP	**Initiation of Neo-Tethys & Oldest Hawasina sediments**	

Table 1. Outline history of the Greater Oman Area: ages are only approximate. The age of the Jurassic period is from 210 to 140 Ma, and the Cretaceous from 140 to 65 Ma.

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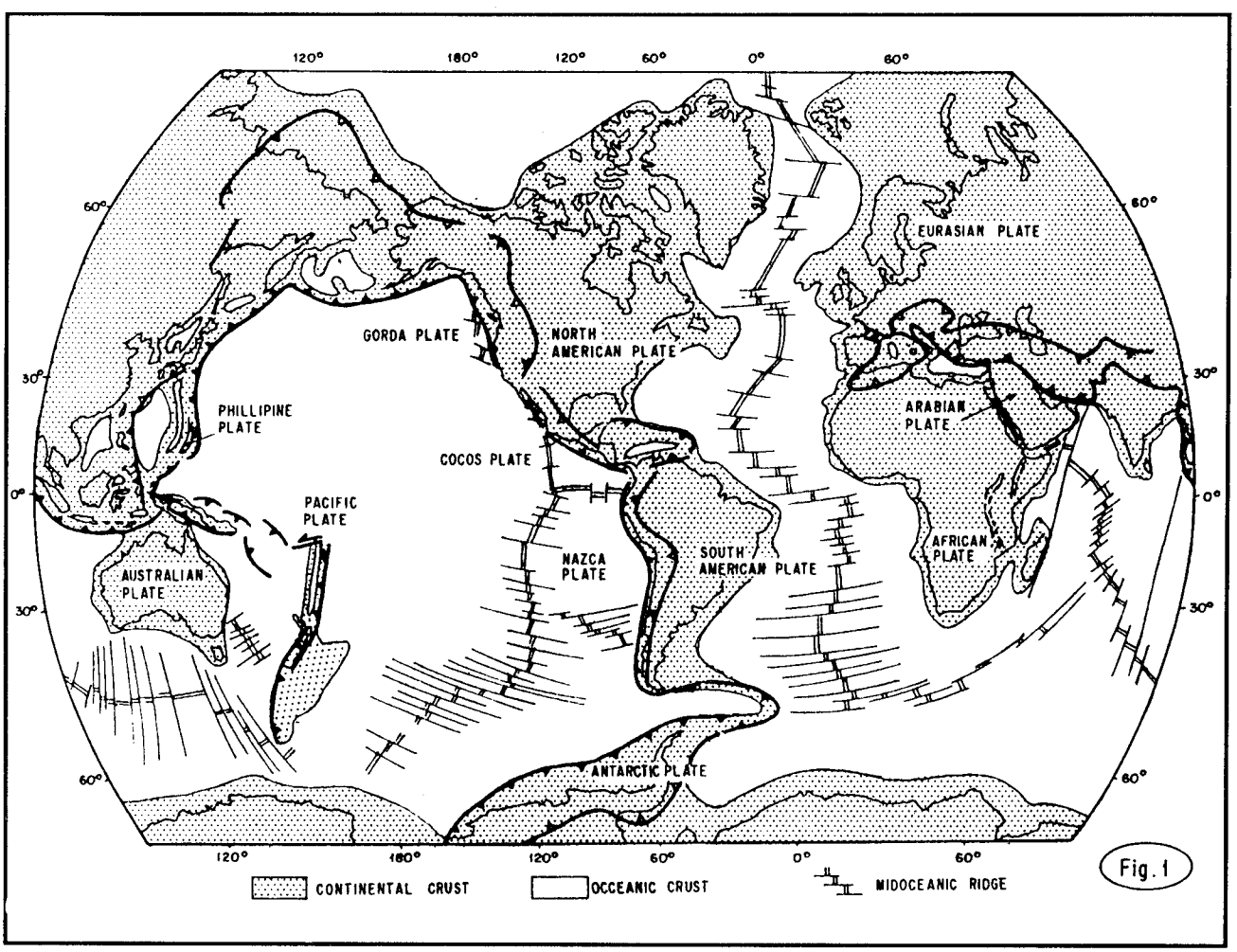
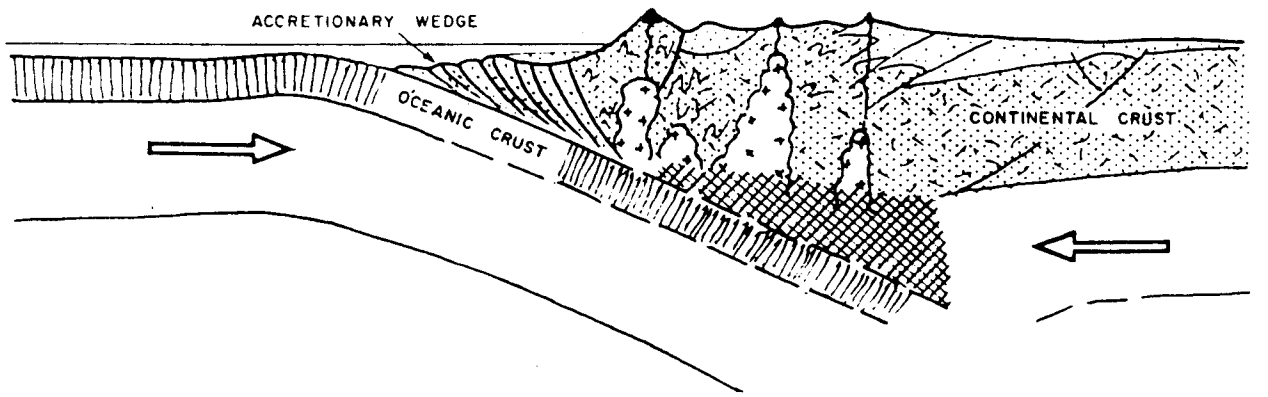
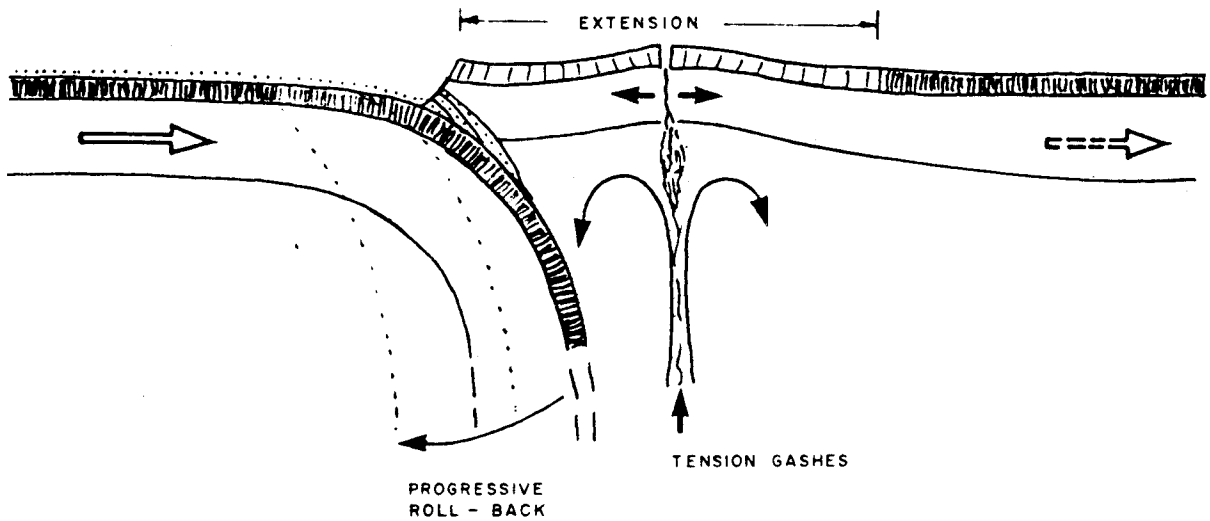




(A) BACK-ARC COMPRESSION

(ANDEAN-TYPE SUBDUCTION)



(B) BACK-ARC EXTENSION

(SEMAIL-TYPE GENERATION OF OCEANIC CRUST)

OCEAN-OCEAN TYPE SUBDUCTION

Fig. 3

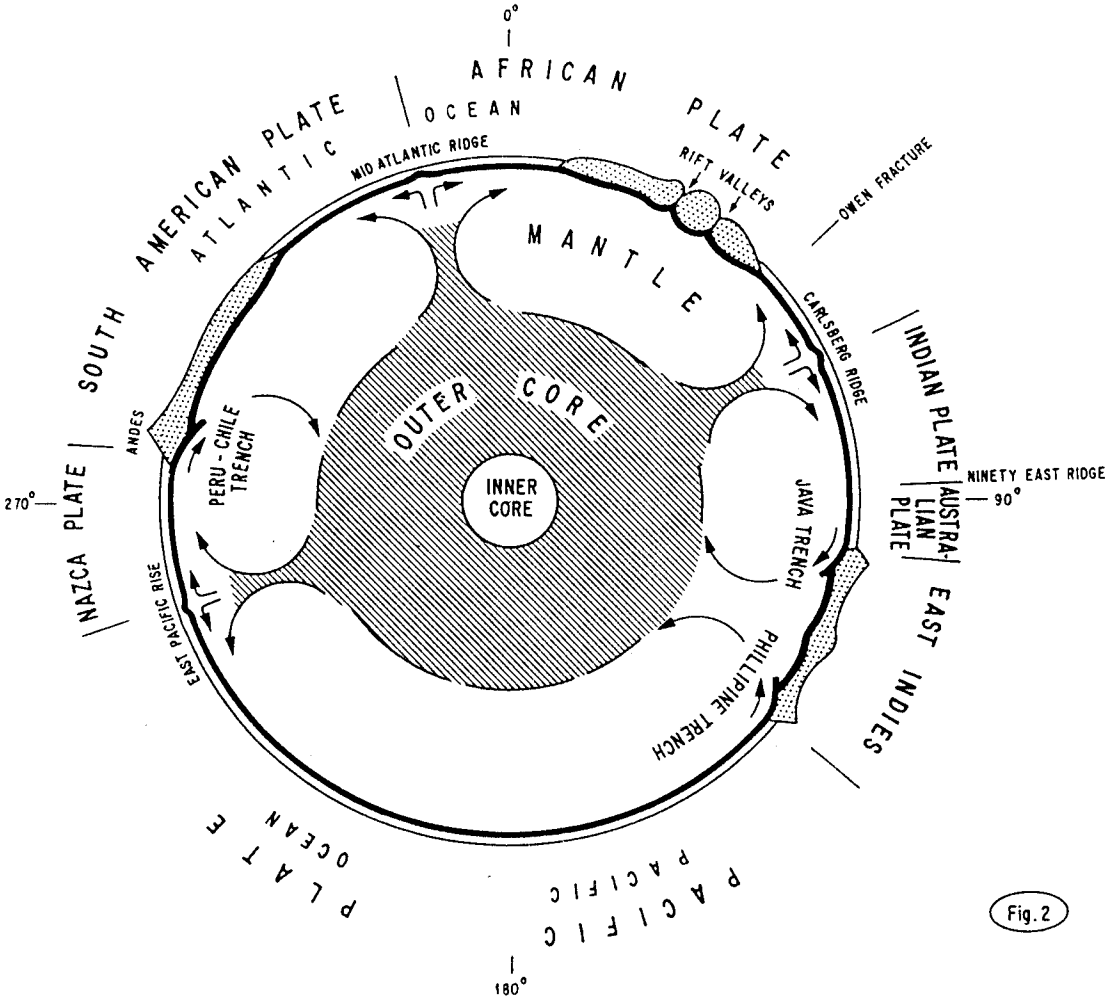

0°
AFRICAN PLATE
OCEAN
ATLANTIC
SOUTH AMERICAN PLATE
MID ATLANTIC RIDGE
RIFT VALLEYS
OWEN FRACTURE
MANTLE
CARLSBERG RIDGE
INDIAN PLATE
OUTER CORE
INNER CORE
ANDES
PERU-CHILE TRENCH
JAVA TRENCH
NINETY EAST RIDGE
90°
270°
NAZCA PLATE
EAST PACIFIC RISE
PHILLIPINE TRENCH
AUSTRALIAN PLATE
EAST INDIES
PLATE
OCEAN
PACIFIC
PACIFIC
180°

Fig. 2

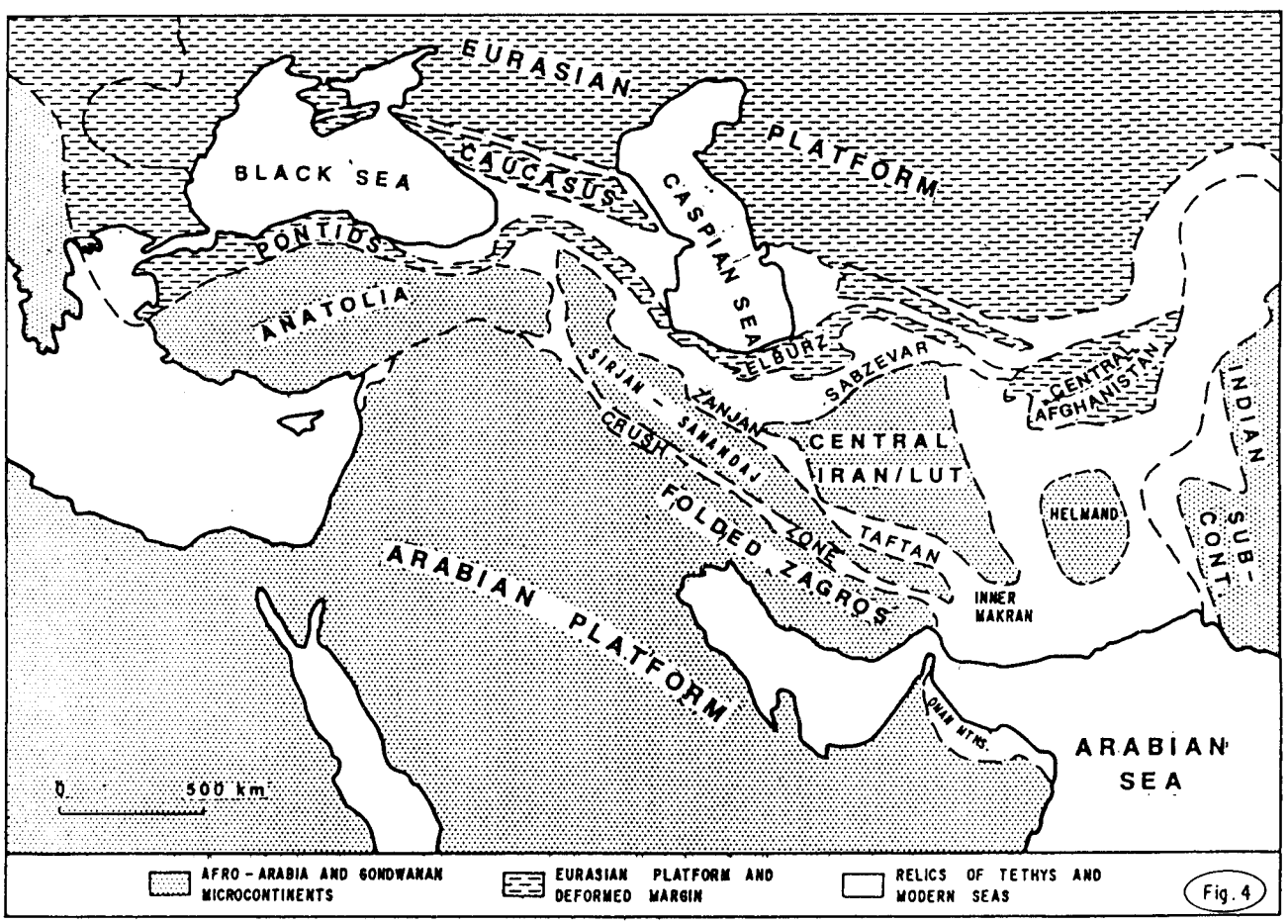
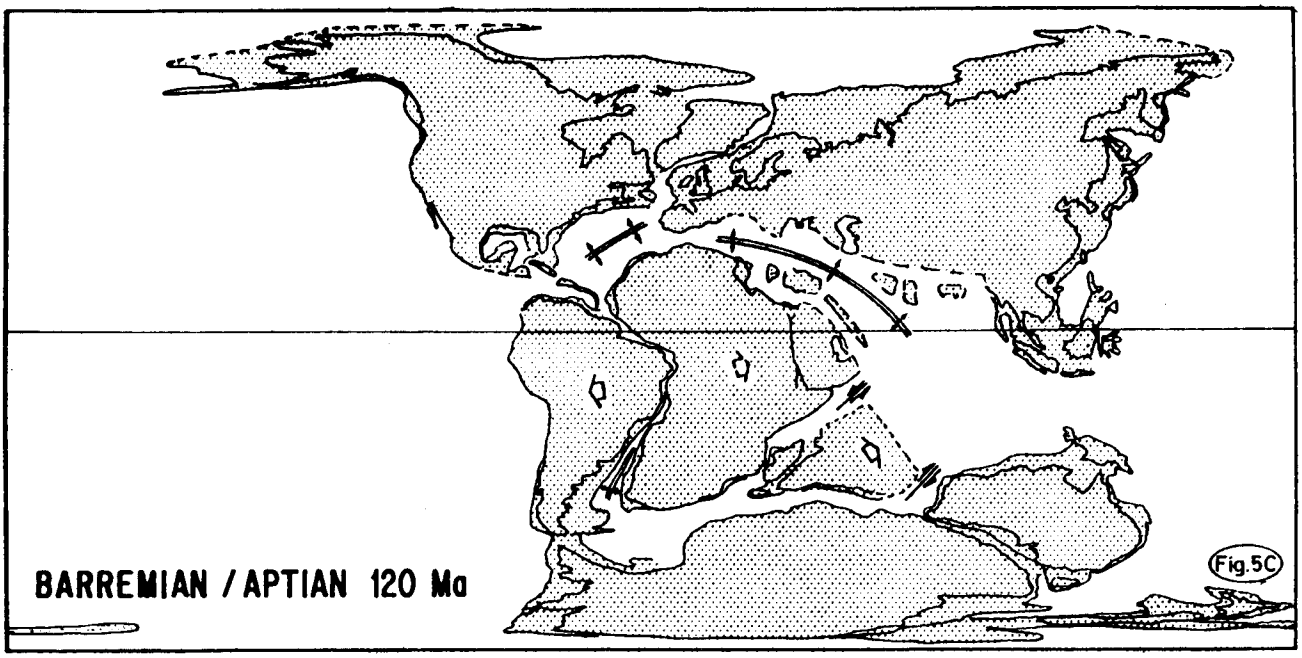
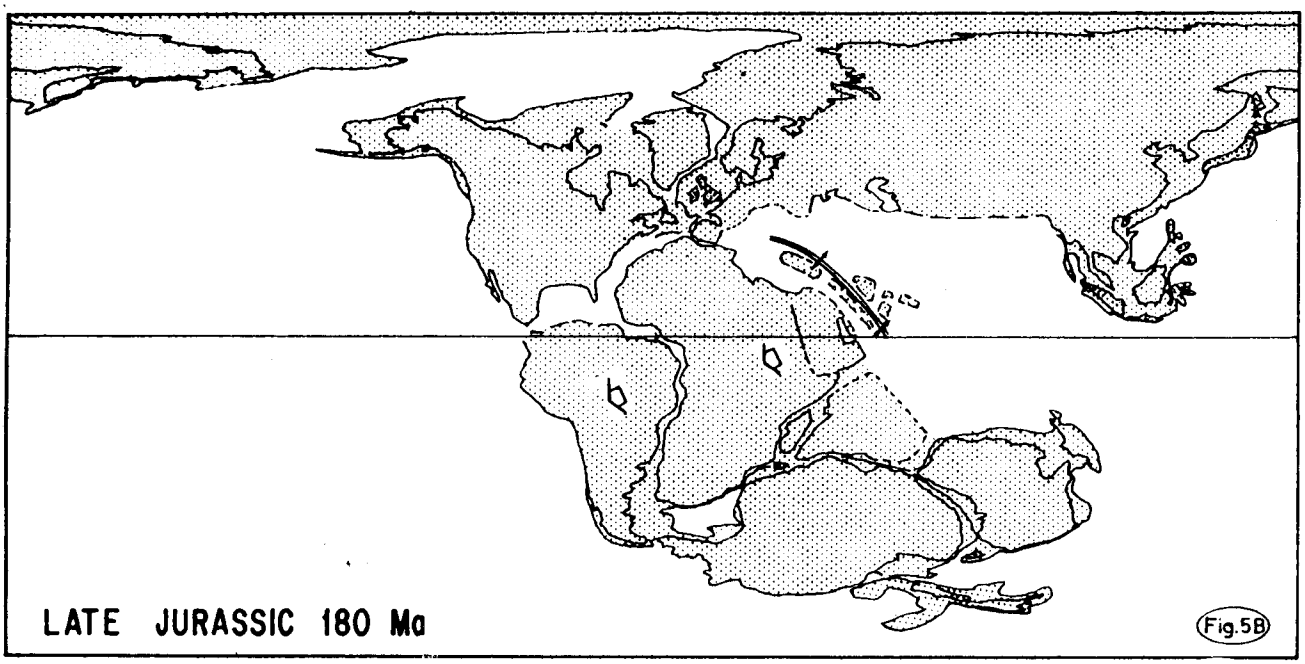
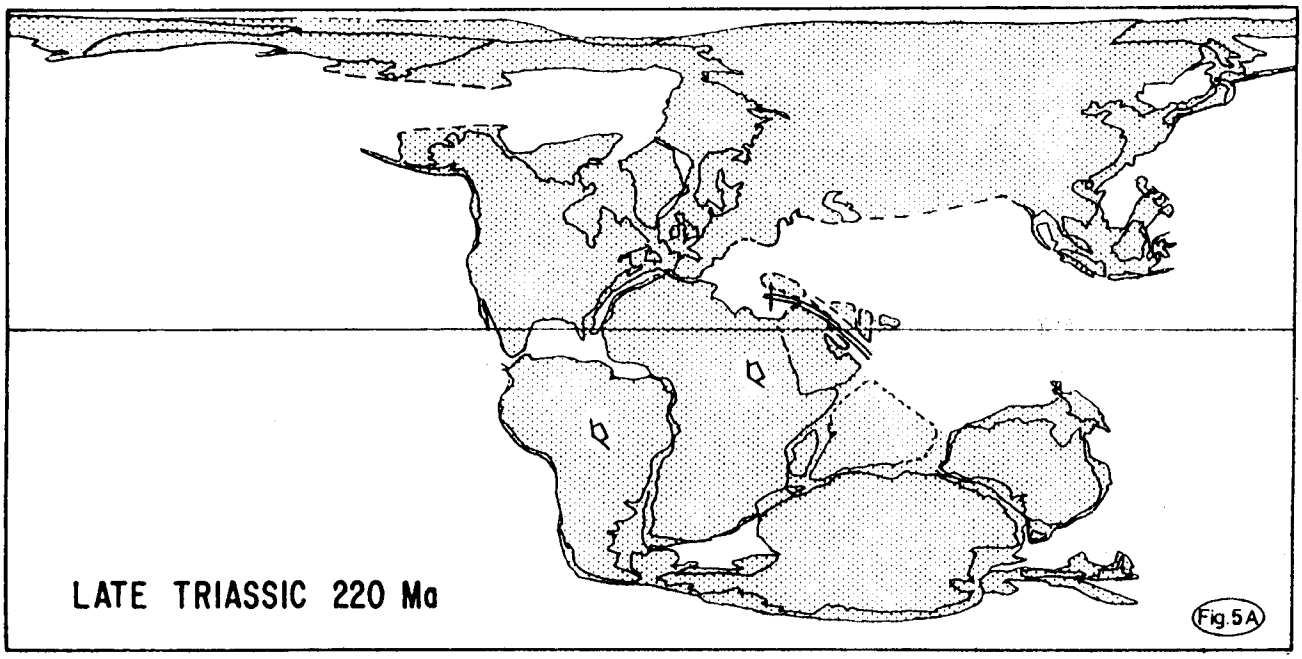
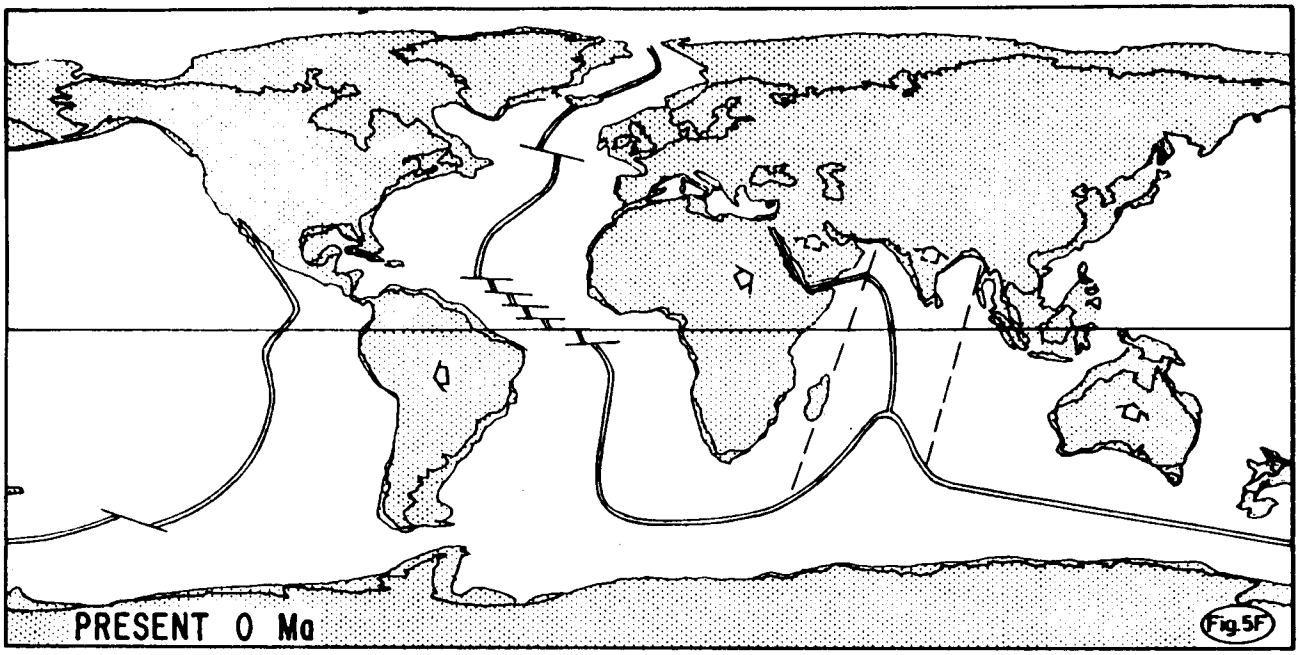

EURASIAN PLATFORM
BLACK SEA
CAUCASUS
CASPIAN SEA
PONTIDS
ANATOLIA
ELBURZ
SABZEVAR
CENTRAL AFGHANISTAN
INDIAN SUB-CONT.
SIRJAN - SANANDAJ CRUSH ZONE
ZANJAN
CENTRAL IRAN/LUT
HELMAND
FOLDED ZAGROS
TAFTAN
INNER MAKRAN
ARABIAN PLATFORM
QUAM MTNS.
ARABIAN SEA
0
500 km
AFRO-ARABIA AND GONDWANAN MICROCONTINENTS
EURASIAN PLATFORM AND DEFORMED MARGIN
RELICS OF TETHYS AND MODERN SEAS

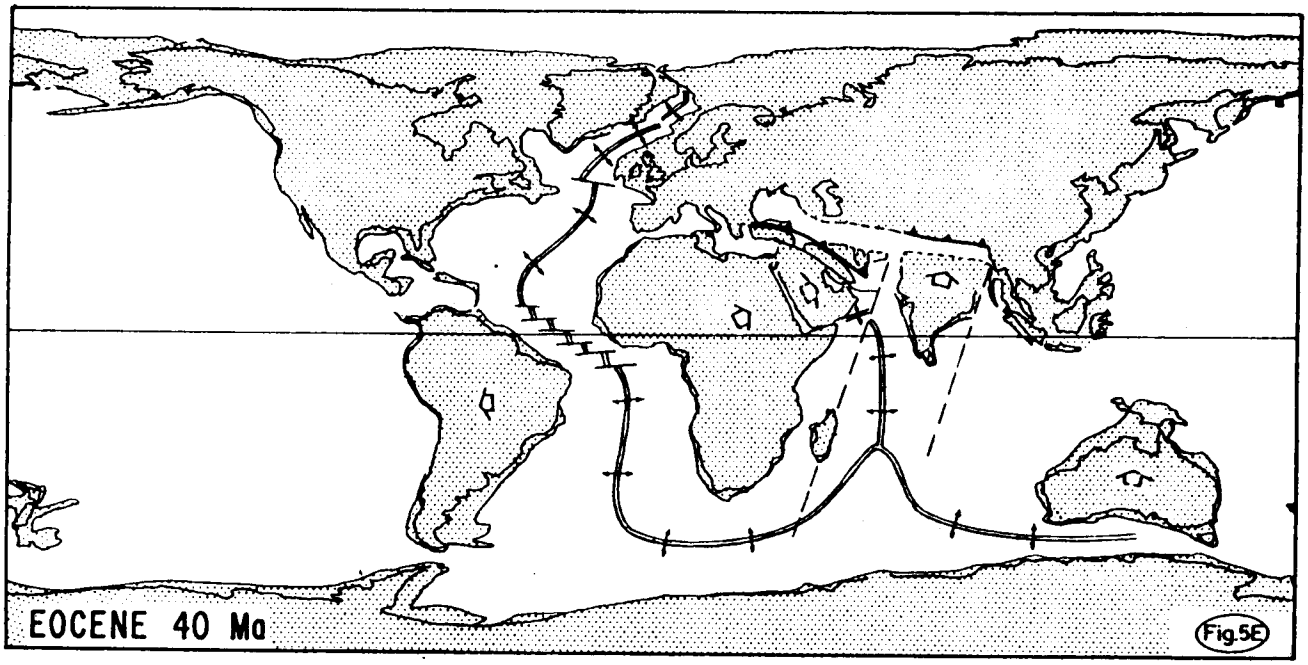
Fig. 4

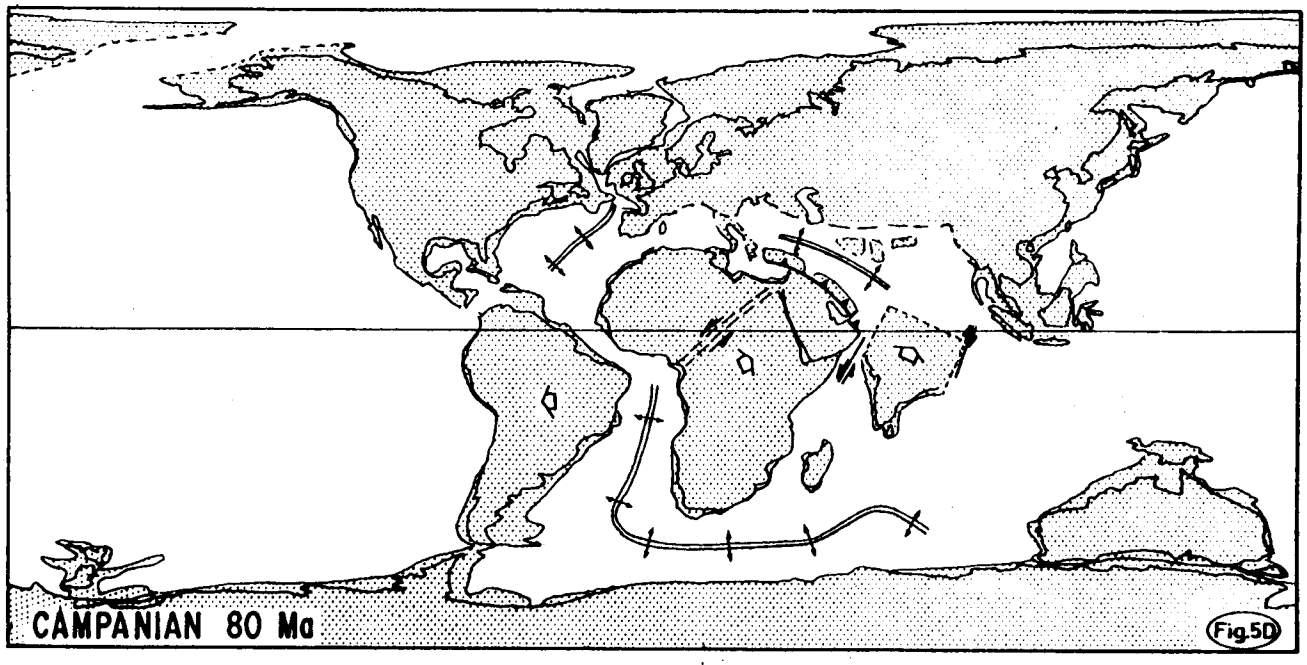

BARREMIAN / APTIAN 120 Ma
Fig.5C

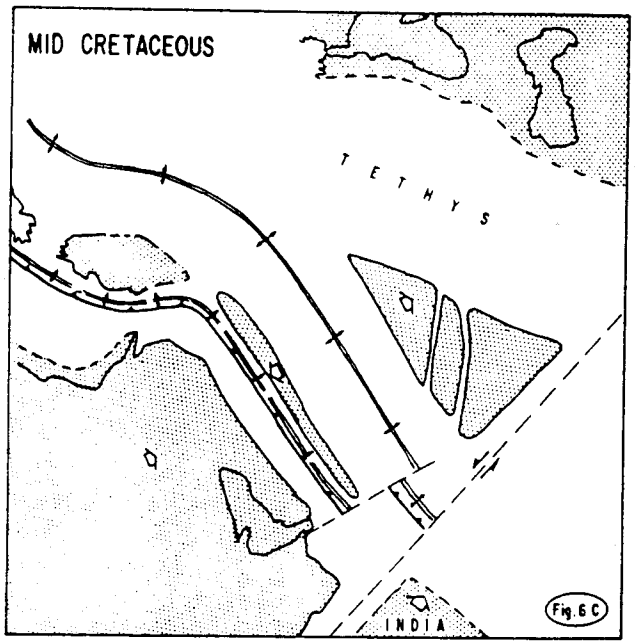

LATE JURASSIC 180 Ma
Fig.5B

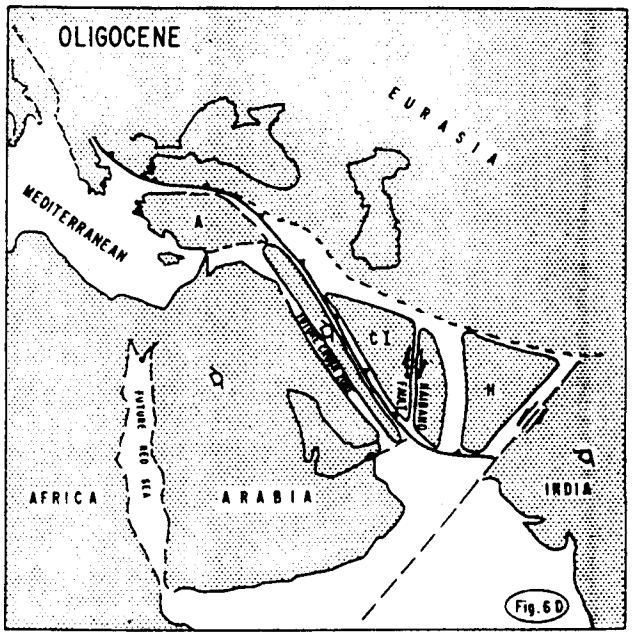

LATE TRIASSIC 220 Ma
Fig.5A

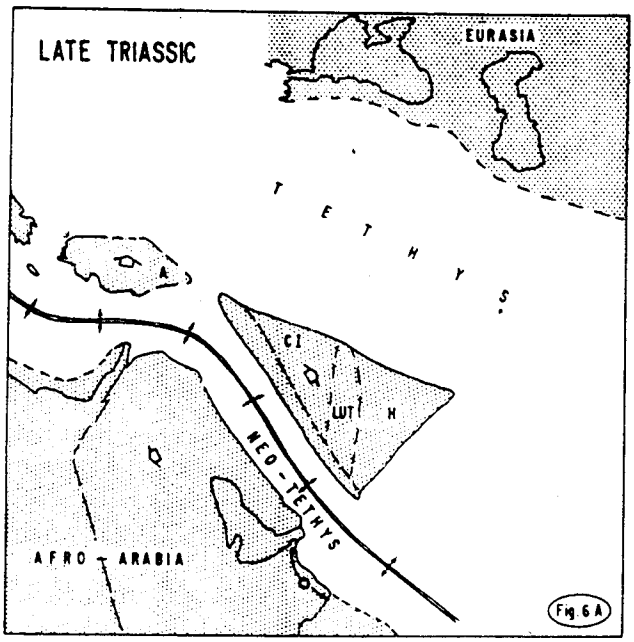

PRESENT 0 Ma
Fig.5F

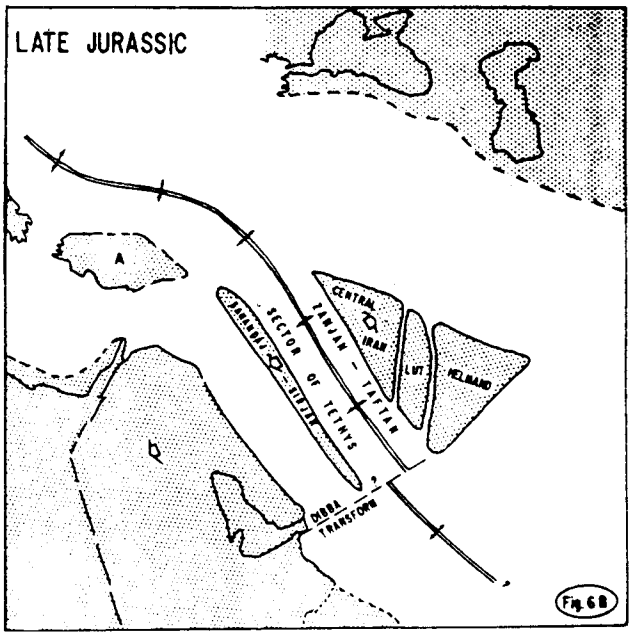

EOCENE 40 Ma
Fig.5E

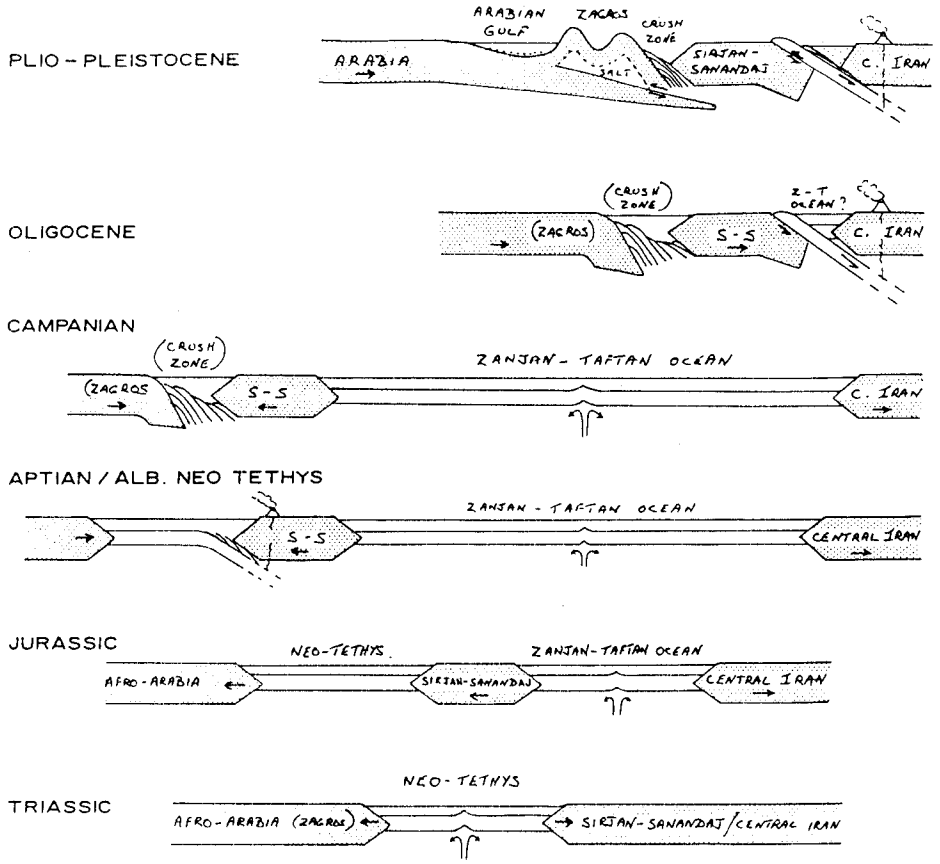

CAMPANIAN 80 Ma
Fig.5D


MID CRETACEOUS
TETHYS
INDIA
Fig. 6 C


OLIGOCENE
EURASIA
MEDITERRANEAN
A
CI
H
AFRICA
ARABIA
INDIA
Fig. 6 D

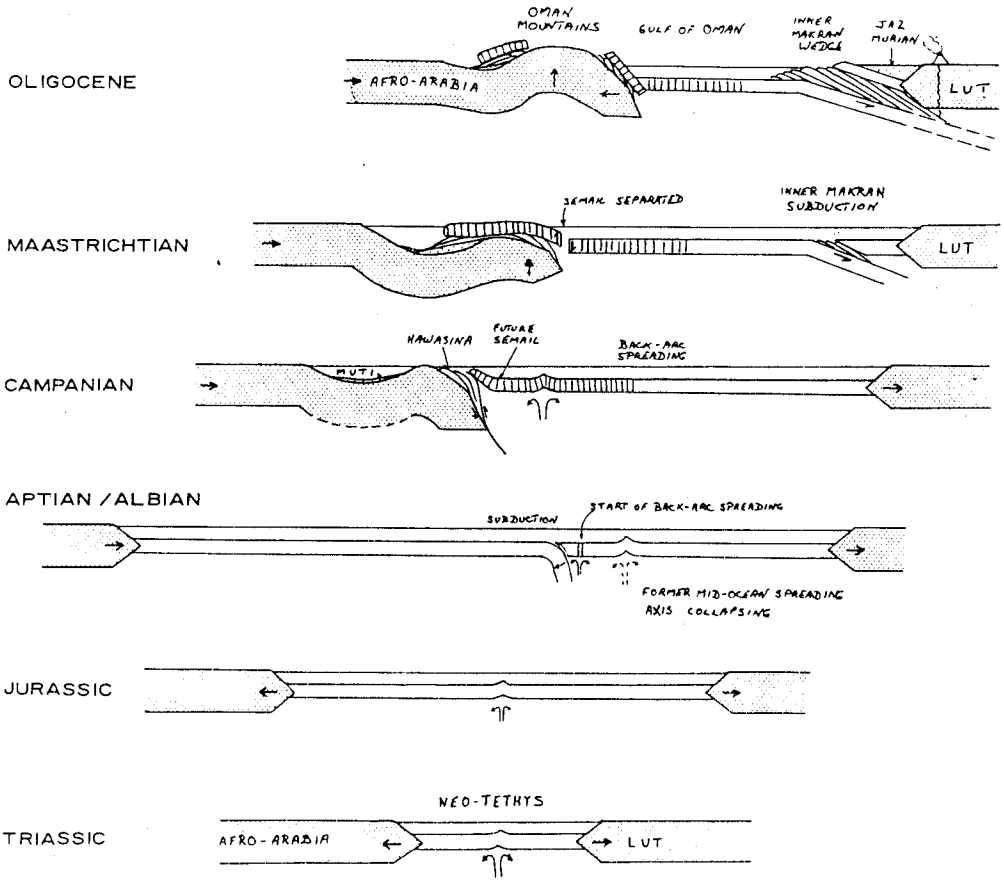

LATE TRIASSIC
EURASIA
TETHYS
A
CI
WT
H
NEO-TETHYS
AFRO - ARABIA
Fig. 6 A


LATE JURASSIC
A
CENTRAL IRAN
SECTOR OF TETHYS
TABAS - TAFTAN
LUT
HELMAND
DIBBA TRANSFORM
Fig. 6 B



ZAGROS - CENTRAL IRAN SECTOR OF TETHYS

Fig 7 A



OMAN - MAKRAN SECTOR OF TETHYS

Fig 7 B

Socotra Cormorants breeding in the UAE

by John Stewart-Smith

(Editors' note: The first Chairman of the Emirates Natural History Group, founded in 1977, was a pilot, photographer and bird-watcher, John Stewart-Smith. During his reconnaissance work for the UAE Air Force, he photographed and recorded the first scientifically-examined colonies of Socotra Cormorants in the Emirates, on the islands of South Farayat and Zirku, in late 1972. The latter colony has now been displaced by an oil terminal, while South Farayat has not been visited by birdwatchers for some years. Another large colony is known, however, from the island of Sinaiya, in Umm al Qaiwain.

The article that follows is published partly because of its scientific interest — few bird recordings exist from the Emirates twenty years ago — and partly as a tribute to the author's efforts in establishing the Group.)

● طائر الغاق السوقطري يعتبر من أندر الطيور البحرية في العالم.. النائب الأول لرئيس جمعية الامارات للتاريخ الطبيعي كتب مقالاً عن مستوطنة لهذا النوع من الطيور تم اكتشافها في جزيرة فراية عام ١٩٧٢.

In October 1972 a photographic reconnaissance "Hunter" jet fighter of the Abu Dhabi Defence Force brought back pictures of what looked like cormorants apparently breeding on several small islets in the southern Arabian Gulf. Further photographic reconnaissance sorties, flown by the author, confirmed that the birds were cormorants and were indeed nesting.

Some of the pictures taken were went to the International Wildfowl Research Bureau at Slimbridge in England where they were examined by Erik Carp and Professor GVT Matthews. The pictures were also examined by Doctor W.R.P. Bourne of the International Council for Bird Preservation.

Two main breeding areas were seen on the early photographs. The first site was the island of **Arzanah** (ABBA Square SB 26), at position 24° 48' North, 52° 32.5' East, where the birds were scattered along the top edges of the dried-out wadis at positions up to 500 metres from the shore and up to 50 metres above sea level. The second colony was on a tiny islet called **South Farayat** (ABBA Square RB 25), 24° 23' North, 51° 42.5' East, which is not shown on most charts. This islet is 10 kms east of Ra's al Hazrah and 10 kms 337 degrees from Ra's Mushayrib. The islet is about 150 metres long by up to 40 metres wide, with the longer axis on 330 degrees magnetic. These nesting sites were inaccessible, being on small islets situated some 180 kms from Abu Dhabi town and airfield, where the author lived at that time.

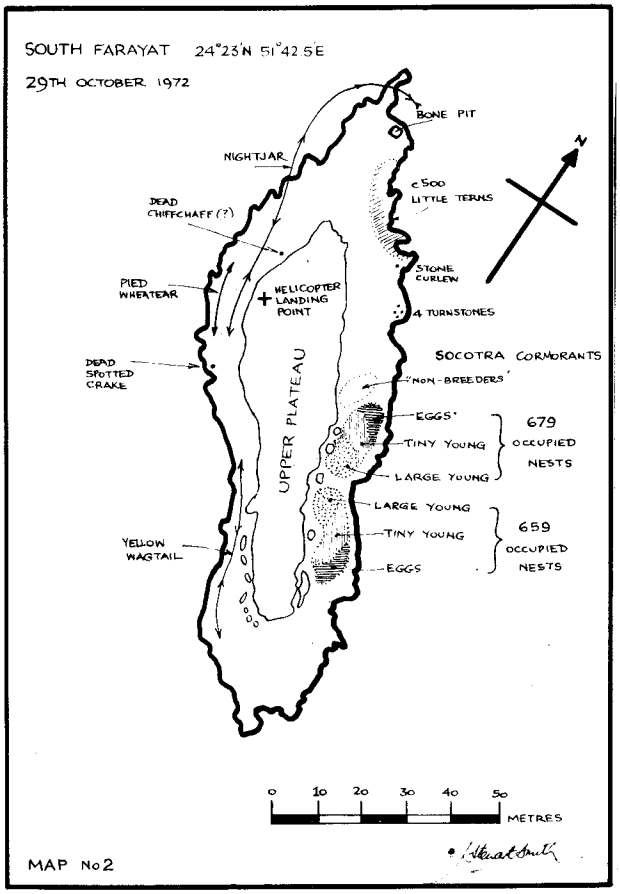
Careful examination of the pictures taken by the author on the second sortie showed 1338 occupied nests at South Farayat and revealed several interesting features of the nesting colony. The birds had congregated into two almost equal sized adjacent groups on the eastern side of the island. The nests were spaced very regularly, appeared to be constructed of sand mounds about 10-15 cms high, and all the birds sat facing North. Examination of stereoscopic pairs of photographs showed the nesting site to be on almost level sand about 3 metres above sea level. There was no obvious reason for the birds to have chosen that particular area of the islet. It is supposed that the nest spacing is regulated by the length of the neck of each sitting bird, as in some other species. Close scrutiny of hundreds of pictures showed no white patches on the birds and indicated that they were not **Greater Cormorant** *Phalacrocorax carbo*, although that species has been observed by the author in this area. A subsequent letter from IWRB Slimbridge expressed the opinion that, on the evidence of the photographs taken on the first sortie, the birds were probably **Socotra Cormorants** *Phalacrocorax nigrogularis.*

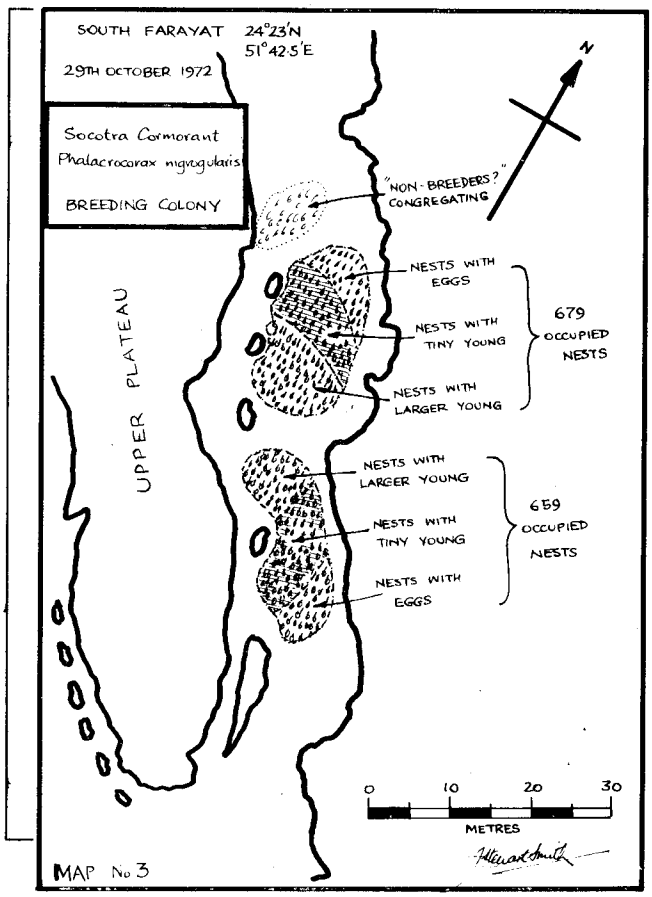
On 29th October 1972 the author flew to South Farayah islet in a helicopter and landed on the northwestern edge of the central plateau, about 7 metres above sea level. Although this position was only some 40 metres from the colony it was out of sight of the nesting cormorants. A careful low-level approach caused minimum disturbance to the birds.

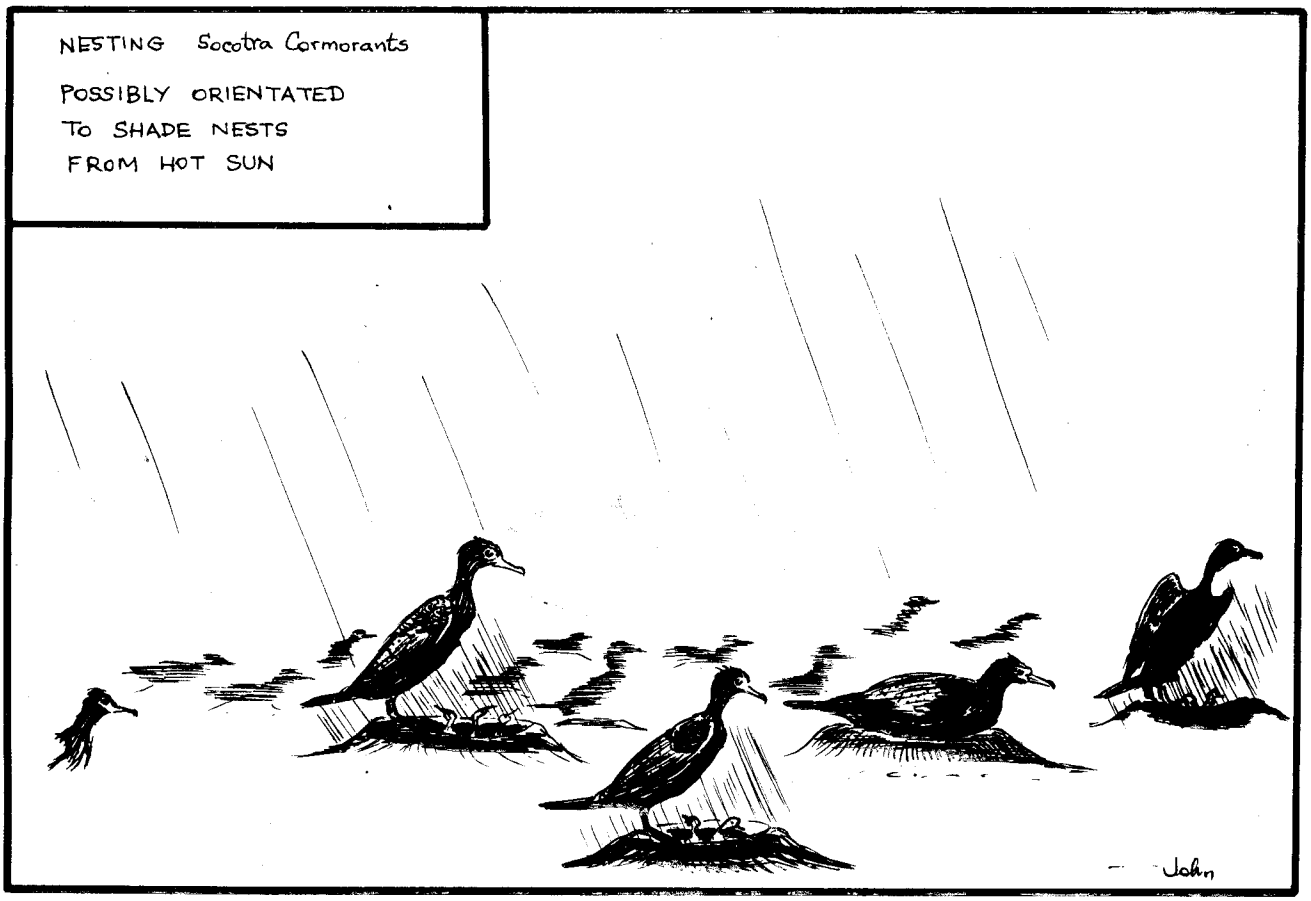
While the cormorants were settling down the author climbed onto the lower plateau and erected a parachute sun shelter and inflated a rubber dinghy. The idea of the rubber dinghy was to allow a quiet and close sea-borne approach to the colony under cover of the 3 metre high coastline. A large shark swimming nearby caused that idea to be abandoned.

Two **Red-breasted Mergansers** *Mergus serrator* were disturbed at the northern end of the island. They flew off the sea towards the west before photographs could be taken. A **Nightjar**, probably *Caprimulgus europaeus*, moved between the shade below the western edge of the upper plateau and the coast, within 10 metres of the author. The only other birds seen on the west side of the islet were a **Pied Wheatear** *Oenanthe pleschanka* with very worn plumage, a **Yellow Wagtail** *Motacilla flava*, a dead and "mummified" **Chiffchaff** *Phylloscopus collybita(?)*, and the remains of a **Spotted Crake** *Porzana porzana* which had been eaten recently by a bird of prey. The bird of prey was not seen.

Numerous colour photographs were taken of the breeding cormorants. The birds proved to be **Socotra Cormorant** *Phalacrocorax nigrogularis* as suggested by Professor Matthews and Mr. Carp. The cormorants were very tolerant of a careful approach to the colony. The layout of the colony is shown in Sketch Map No. 3, the surrounds of the island in Sketch Map No. 2 and the


SOUTH FARAYAT 24°23'N 51°42.5'E
29TH OCTOBER 1972
BONE PIT
NIGHTJAR
DEAD CHIFFCHAFF (?)
c500 LITTLE TERNS
PIED WHEATEAR
HELICOPTER LANDING POINT
STONE CURLEW
4 TURNSTONES
SOCOTRA CORMORANTS
DEAD SPOTTED CRAKE
UPPER PLATEAU
"NON-BREEDERS"
EGGS
TINY YOUNG
LARGE YOUNG
679 OCCUPIED NESTS
LARGE YOUNG
TINY YOUNG
EGGS
659 OCCUPIED NESTS
YELLOW WAGTAIL
0 10 20 30 40 50
METRES
MAP No2


SOUTH FARAYAT 24°23'N 51°42.5'E
29TH OCTOBER 1972
Socotra Cormorant
Phalacrocorax nigrogularis
BREEDING COLONY
"NON-BREEDERS?" CONGREGATING
UPPER PLATEAU
NESTS WITH EGGS
NESTS WITH TINY YOUNG
NESTS WITH LARGER YOUNG
679 OCCUPIED NESTS
NESTS WITH LARGER YOUNG
NESTS WITH TINY YOUNG
NESTS WITH EGGS
659 OCCUPIED NESTS
0 10 20 30
METRES
MAP No 3


NESTING Socotra Cormorants
POSSIBLY ORIENTATED
TO SHADE NESTS
FROM HOT SUN
John

location of the island is shown in Sketch Map No. 1.

The nests at the southern end of the southern group of birds contained eggs. Twenty eggs were measured, and these averaged 61mm by 38mm. Their colour was dull chalky white and the shell texture was slightly rough. One hundred nests were checked for numbers of eggs and the average was 3.03, within limits of 2 and 5. The one nest with five eggs is suspect because it was closer than average to another nest which contained only two eggs. Of the hundred nests checked, 84 contained 3 eggs, 8 contained 4 eggs, 7 contained 2 eggs and 1 contained 5 eggs.

Moving northwards through the southern group of nests it was seen that the eggs in the centre of the group had hatched within the previous few hours and tiny altricial young were in the nests. The young birds were almost all pink-skinned, but a few had dark patches like freckles on the bare skin. At the northern end of the southern group the more developed young birds had left their nests and scrambled into a tight mass of white bodies. These birds were moving around in a compact group and were rejected by the adult birds which were still sitting on their nests. Adults regurgitated compacted balls of small fish 2-3 cms long in the area where these young birds were congregating, but actual feeding was not observed. The hatching sequence of the northern group of birds was a mirror image of the southern group, with the larger young towards the south of the group, recently hatched birds in the centre of the group, and eggs at the northern edge of the colony. This indicates that either the colony "grew" outwards from the centre or that birds nesting towards the centre of the colony laid their eggs earlier than those nesting towards the ends of the colony.

A group of c. 150 adult cormorants gathered at the northern edge of the colony and remained there throughout the time of observation. During the second airborne reconnaissance sorties it was noted that about 50 nests at the northern edge of the colony were occupied by two adult birds at the same time. These "extra" birds may have come from the adjacent congregation of what may have been non-breeding adults or may have been breeding birds loitering while "off duty." This habit of "double sitting" on the nest was not observed during the ground visit.

The north-eastern corner of the islet was occupied by c.500 **Saunders' Little Terns** *Sterna saundersi* but no signs of breeding by this species were observed on Farayat. Among the Little Terns was one **Stone Curlew** *Burhinus oedicnemus* and four **Turnstones** *Arenaria interpres.*

There was a natural, steep-sided hole about 60 cms square and 50 cms deep near the northern tip of the islet. This contained many old bird bones, but no complete skeletons. The bottom of the hole was heavily encrusted with salt from evaporated sea water. A large cormorant chick was rescued alive from a nearby smaller hole in the rock. It is presumed that the bones in the larger hole were the remains of young cormorants which had become trapped during previous breeding periods — assuming that these birds breed seasonally.

It is suggested that the reason all the adults face the same direction while on the nest is so that their shadows provide protection from the sun for the eggs and the nestlings. The orientation adopted by the adults was not related to the surface wind direction. They sat facing north-westwards on the morning the landing was made on the island, while the wind was fresh from the south-east. The surface wind was from the east during one photographic reconnaissance sortie and from the north-west during the second sortie, but the adults still sat with their backs to the sun. Proof of exact orientation in relation to the sun was not gathered because the possible significance of the alignment of the sitting birds did not occur to the author until the day after his visit to the island. By an unfortunate coincidence, all the airborne photographs were taken at about the same time of day, so the orientation may have some other explanation which has not yet occurred to the author.

So as to avoid further disturbance to the nesting birds no more airborne photographs were taken until seven days after the landing on the island. The last photographic sortie was flown on 5th November 1972, by which time hatching appeared to be complete and the adults were apparently feeding the young off the nests. The young were congregated at the centre of the colony. All the nest mounds were empty, which indicates that the hatchlings leave the nest within seven days of hatching.

Two unexplained points were observed during the ground visit to the islet. There were few (c. 50) dead chicks in the colony and these were concentrated at the western edge of the area, just outside the nesting site. This would indicate a high breeding success, or removal of the bodies by an unknown agency. Despite the number of chicks which had hatched by the time the author visited this particular colony (c. 2500), there were very few empty egg shells on the island, other than those which hatched during the period of the visit. The shallow water close to the island did not provide any evidence of the adults having carried the shells into the adjacent water, yet the nesting area contained no old shell fragments. Is it possible that Socotra Cormorants eat the shells of hatched eggs as an additional source of calcium?

Acknowledgements

Captain Dan Carter and Jihad Irsheid assisted by taking aerial reconnaissance pictures while on routine training sorties. Dan Carter found the colony on South Farayat. Erik Carp and Professor Matthews of the International Wildfowl Research Bureau assisted with recognition of the species of cormorant. The Chief of Staff of the Abu Dhabi Defence Force, Sheikh Faisal bin Sultan al Qassimi, permitted and encouraged the author to use many of the ADDF facilities, including aircraft, to conduct many surveys of the natural wildlife of the Arabian Gulf and the United Arab Emirates. I thank them all for their interest and assistance.

John Stewart-Smith,
24, Carneton Close, Crantock,
Cornwall TR8 5RY England.

* * *

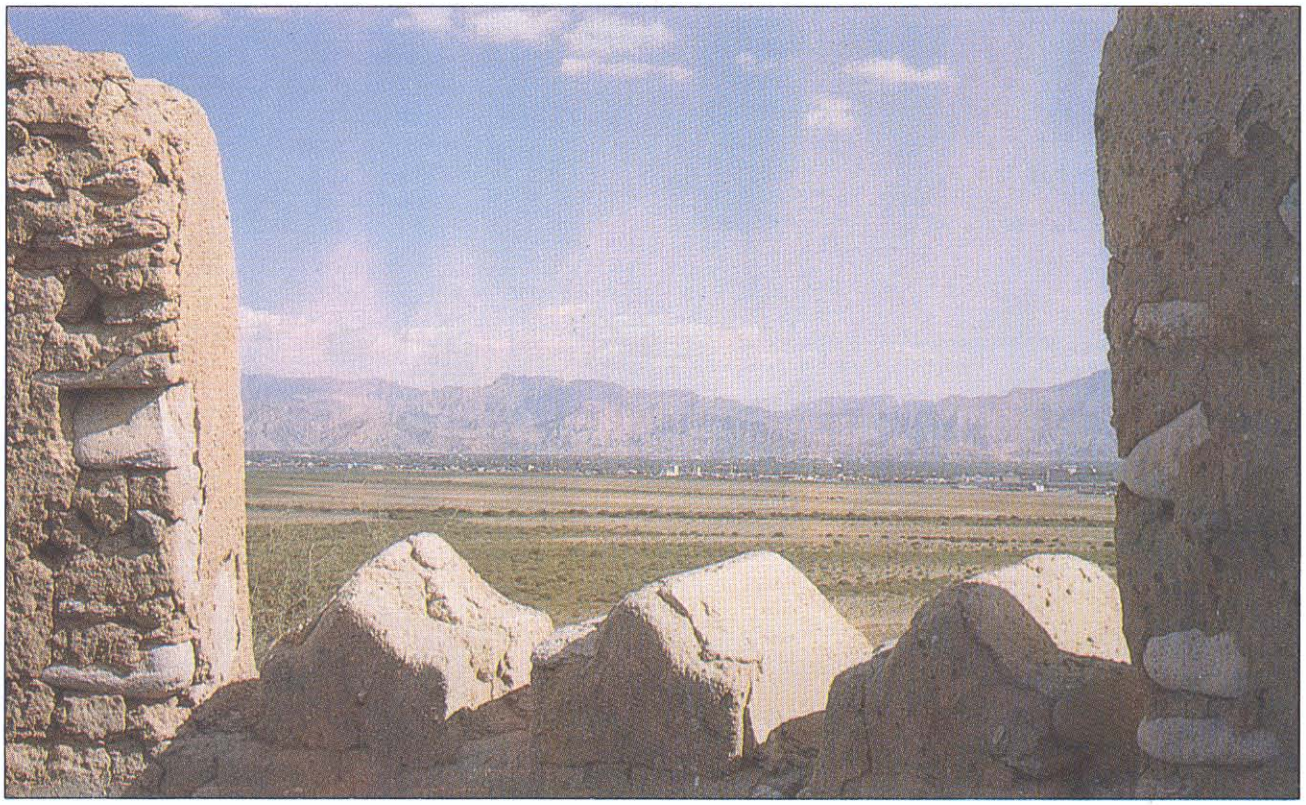
THE TOWERS OF RAS AL KHAIMAH

**The house-tower at Falayya, Ras al Khaimah, built of cobbles and mortar.
One of the best surviving examples of a Type 1 Tower.**

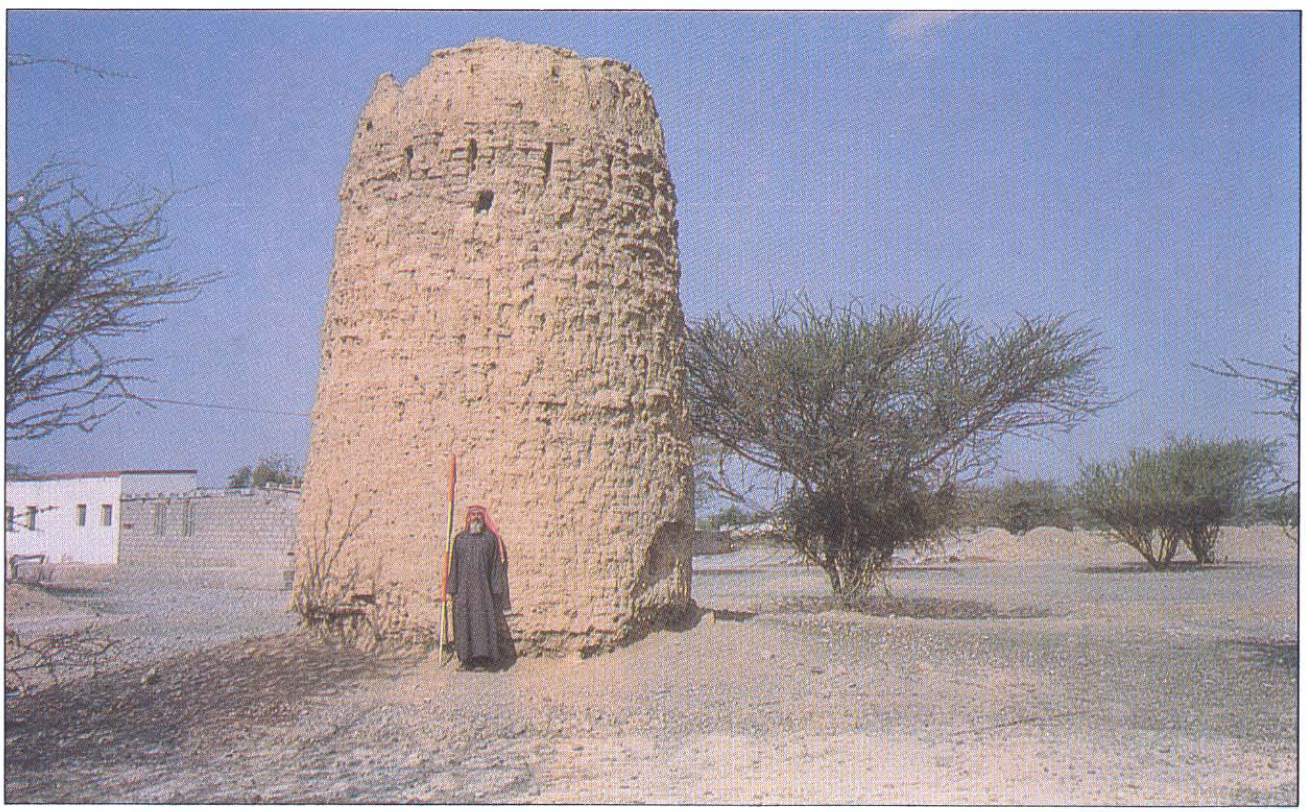
A mud-brick house-tower amid palm groves at Dhayah.

Pictures by Derek Kennet

THE TOWERS OF RAS AL KHAIMAH



A view over the crenellations of the tower at Khuzam, a Type 2 tower positioned for maximum visibility.

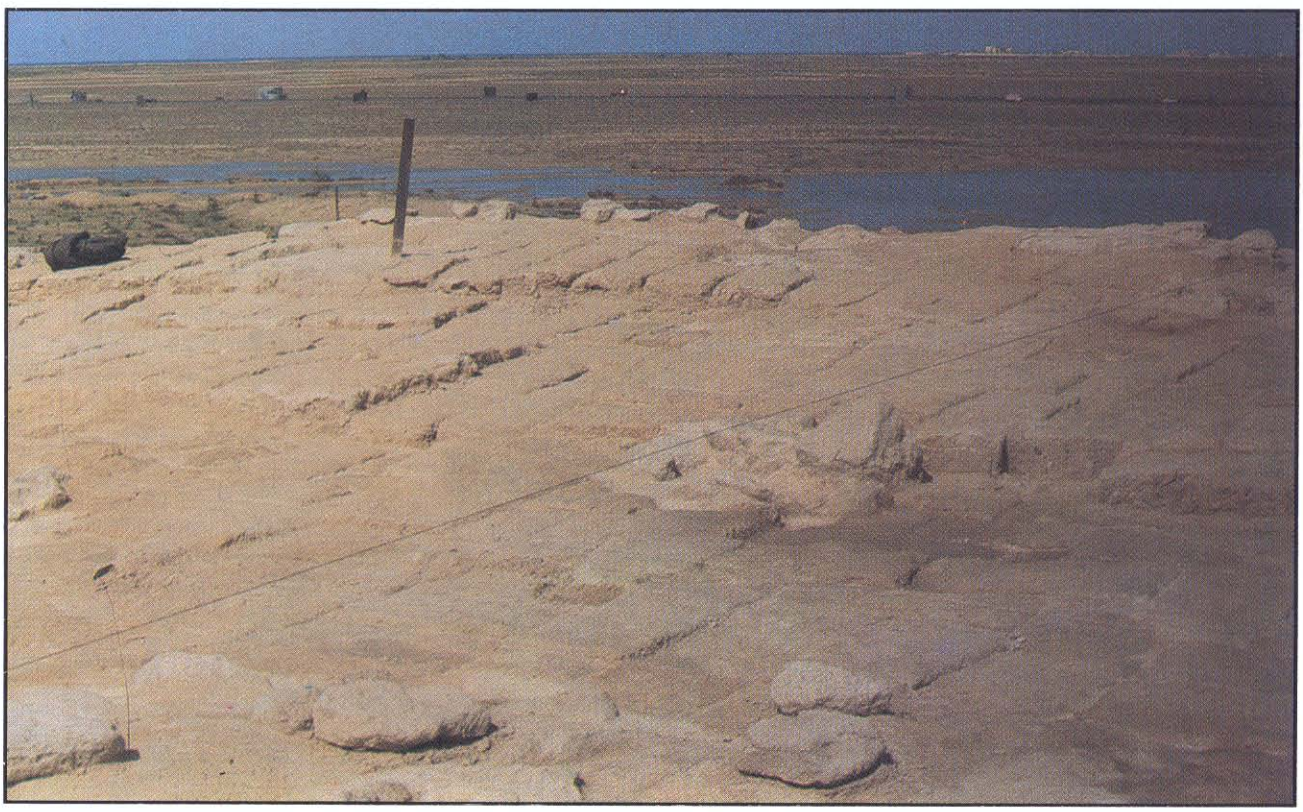


A mud-brick Type 3 tower at Dhayah, probably built by the villagers in order to protect their community.

Pictures by Derek Kennet

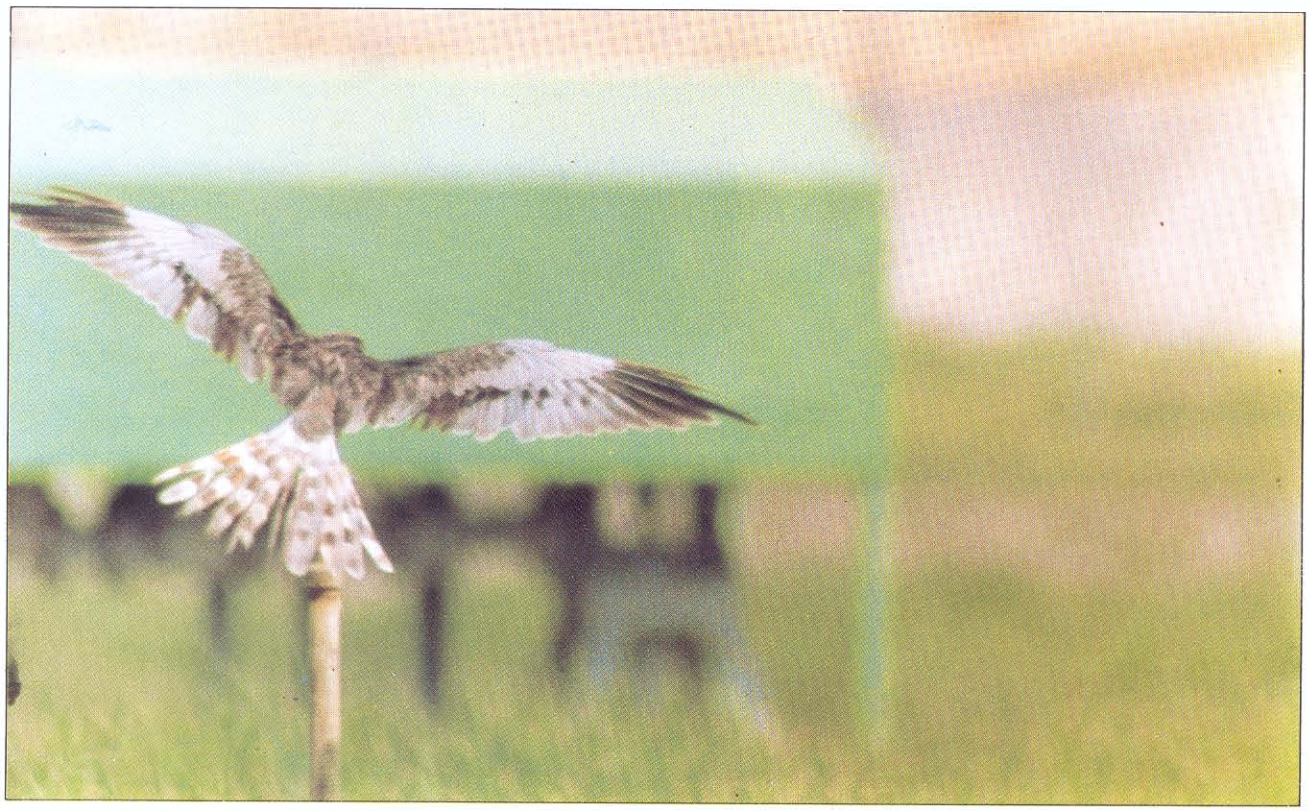
Sassanian decorated plaster work, discovered on the island of Sir Bani Yas during March 1992.

(Mohammed Latif)



The Iron Age platform on the top of Tell Abraq. (see page 41)

(P. Hellyer)



Second-year male Montagu's Harrier (*Circus pygargus*) at Al Hababb in August 1991. (See page 8)

(Colin Richardson)

An immature Night Heron (*Nycticorax nycticorax*) in Abu Dhabi.
The species was first recorded breeding in the UAE in Dubai in August 1992.

(P. Hellyer)

The Towers of Ras al Khaimah

by Derek Kennet

There can be few parts of the world which have changed so drastically over the last fifty years as the countries of the Arabian Gulf. The discovery of oil, and all its consequences, have brought huge improvements and benefits to the local people making possible a lifestyle which would otherwise be unthinkable in one of the harshest climates on the surface of the planet.

There is a general misconception, among both citizens and expatriates and alike, that before the discovery of oil the peoples of the Gulf lived in abject poverty and had no civilisation to speak of. The fact is that for over 5,000 years there is evidence for a continued and sophisticated civilisation which has uniquely adapted itself to the restrictions of the local climate. In the days before oil the value of basic commodities was much higher. A source of fresh water and the availability of fertile agricultural land could mean the difference between life and death. In this respect the Emirate of Ras al Khaimah, because of its geographical situation on a relatively well-watered plain, was one of the most desirable areas on the Gulf littoral.

Competition for local resources amongst tribes would have been intense and it is because of this competition that landowners and Sheikhs were forced to defend their own property and access to water. One of the ways of defending land and home was to build a defensive tower and it is these towers which are one of the most visible and well-known monuments of past times in the United Arab Emirates. The towers are particularly common in Ras al Khaimah — so far more than 75 examples are known — because the settled population of this Emirate was so much denser than elsewhere.

A recent study of the Ras al Khaimah towers, commissioned by Sheikh Sultan bin Saqr al Qassimi, Deputy Ruler and Director of Antiquities of Ras al Khaimah, has revealed new information and interpretations of the towers and their functions. During the winter of 1991/2 the towers were carefully drawn, photographed and recorded.

A close examination suggested that the towers can be divided into the following three types:

1. The first and most common, is the ***muraba*** or square tower (in practice they are always rectangular). The characteristics of such towers are that they are built on agricultural land — usually in the midst of date palms. They are generally three-storied — rarely higher — and the top storey is open and surrounded only by a parapet wall. The tower has an entrance on the ground floor — a very important characteristic — and is nearly always attached to a domestic complex surrounded by a courtyard wall. These towers resemble the traditional houses and in fact they are no more than defended houses. The entrance on the ground floor was to allow normal daily use, although there were ways of securing a strong door in times of attack, and an inner staircase gave access to a first floor surrounded by large windows. At this level there would have also be a series of loop holes in the walls to enable rifles to be fired as well as a series of slits — which look like arrow slits — to enable firing towards the base of the wall. The top floor would be surrounded by a parapet wall, often crenellated like a medieval European castle, with another series of loop holes.

   These towers combine two functions — that of a domestic building with that of a mini-fortress, something like the moated farmhouses of later medieval England. The idea was that a farmer/landowner living in the midst of his crops would be able to defend himself and his family in time of a possible raid. Such raids may have come from the bedouin or mountain tribes and are frequent occurrences in the history of the UAE. The plan and design of these towers followed a traditional pattern based on the house. The towers are built from mud-brick or stone and mortar, mud-brick being perhaps the preferred method in the older towers. Good examples to visit are at Falayya or Hail and all along the Jiri Plain between Goob and Sayh al Fahleen. There are at least fifteen examples. The age of the towers is not yet known but it is believed that the tradition of building such towers goes back more than two hundred years — possibly much more.

2. The second type of tower is much the most famous and visible tower — and is also much more widespread across the UAE, occurring also in the Emirates of Dubai and Abu Dhabi. These are the 'pepper-pot towers', the large round towers which get gradually thinner towards the top and whose loop holes and hooded firing points resemble the eyes and nose and give these towers a character all of their own.

   These towers are much higher than the first type and can be as much as 13m (40ft) tall. There are often four or five storeys — the top one always open and surrounded by a parapet wall. One feature which is remarkably different to the first type of tower is the fact that the door is always located up on the first floor 5m (15ft) above ground level. Access was via a rope or ladder which could be quickly withdrawn in time of attack. The ground floor was a large dark cellar reserved for storing supplies of water, ammunition and food in time of siege.

   Living space inside the tower was severely limited and cramped and the defensive features took predominance over features such as windows. The towers are covered with loop holes and firing slots. The hooded firing points which project out from the walls of the tower allowed the defenders to fire at attackers who were attempting to undermine the base of the walls. Such firing points are known from

● دراسة توضح أنماط مختلفة من المنازل المحصنة والقلاع في امارة رأس الخيمة.

a few areas in Bahrain, Saudi Arabia and Oman but may have originally come from India.

The location of these towers is also markedly different to the location of the first type. The positions chosen are usually either in or on the edge of a town — often a coastal town such as Rams or Jazirat al-Hamra — or on a high ridge with good visibility.

The function of these towers was entirely different to that of the first type. These towers have no attachment to agricultural land and no domestic functions. They were built to be manned by a small number (maybe three or four) of professional soldiers or 'askars' in the employ of the Sheikh. The towers were built on order by the Sheikh's Government and form a centrally organised defensive network across the country. Each tower is positioned so that it is visible from the last, allowing lookouts to signal by mirror or by fire at any sign of attack either from the land or from the sea. The central point of this defensive system would have been the fort in Ras al Khaimah. Here a small group of askars were kept ready to move out if attack was signalled by the towers.

The value of such towers in defence are well illustrated in this report from Lorimer which refers to 1840.

"....Sheikh Sultan-bin-Saqr, who was by no means satisfied with the blow which his son and ally had dealt the Sheikh of Umm al Qaiwain, made a well-organised effort to reduce that port. While he himself with 700 Bedouins invested the place by land, a fleet of 3 Baghlahs and 60 Baqarahs, commanded by Saqr bin Sultan and the Sheikh of Dibai and carrying 1,500 men, proceeded to blockade it by sea; but a tower, situated at the entrance, prevented the boats from entering the backwater or creek, without possession of which the blockade could not be made effective. An entrenchment covering this tower was taken by a landing party of the Qawasim, but they were beaten back from the tower itself with the loss of 8 men killed and 40 wounded ...." Lorimer (1915: 716).

Such towers are to be found at Rams, Bu Shaqq, Jazirat al Hamra, Khuzam and Khatt. One which has now been destroyed used to stand at the archaeological site of Julfar. They are nearly all built to a similar pattern and probably followed the design of a military architect. They are solidly built, using rock and mortar with walls more than a metre thick at ground level.

These towers represent the earliest national defensive system and appear to have been built some time late in the last century. At Al Araibi and Hudaybah older towers of type 1 have been strengthened and enlarged so that they form a part of the network. Typical late features such as hooded firing points and cannon ports have been added.

3. The third type of tower is a smaller circular tower, built usually of mud brick. They have similarities with both of the two previous types of towers. They have doors only on the first floor and are generally circular with limited space inside and no windows. Such a design indicates that this type of tower was also clearly built for military use with no domestic arrangements. Type 3 towers stand on and around agricultural land such as the Dhayah plain and Khatt. The origin, date and precise function of these towers is not really understood but it is believed that they represent a mini-defensive system around individual villages organised by the local Sheikh or tribe. In this way the Sheikh of Dhayah made sure that he had lookout towers surrounding the date-palm groves of his village, the central point of defence of which would have been the famous fort on the hill. At Khatt the local tribes had the precious water source to defend and here five or six towers stand within a couple of kilometres of the springs.

This is a brief outline of the organisation of the towers of Ras al Khaimah. There are, of course, some towers which do not fit into the typology described here, as indeed is always the case with typologies.

The construction of the towers made clever use of the locally available materials: palm trunks cut in half length ways; palm frond matting; beach rock and mud brick are all used extensively — although many towers incorporate mangrove poles which were imported from India or East Africa.

The Bin Majid Folklore Club of Maarid have published recently a book on the towers of Ras al Khaimah which includes a description and photograph of most of the towers.

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A Potential pest of Agriculture in the Al Ain Region

Epicauta erythrocephala (Pallas, 1776), (Coleoptera: Meloidae)

by Michael P.T. Gillett

Many different species of oil or blister beetles belonging to the family Meloidae are to be found during spring and early summer in the Al Ain region and in neighbouring areas of the Sultanate of Oman. Most are brightly coloured, diurnal and highly poisonous insects and may be of potential medical importance. A few species, belonging to the genus ***Epicauta,*** *are known from around the world as serious pests of agriculture. In this report I describe the occurrence of one such species,* ***Epicauta erythrocephala,*** *from the Mahdah area of Oman. This is a species already recorded as a serious defoliator of market garden crops in the Near East and known to be subject to sudden population explosions. Given the pace of development of agriculture in the region of Al Ain, it is likely that this insect could, at some future date, become a significant pest in plantations of such crops as tomatoes, cucumbers, melons and beans.*

تم اكتشاف نوع من الخنافس بمنطقة «مهدا» بالقرب من العين وهي نوع من الحشرات الضارة بالزراعة حسب تجارب الدول الأخرى.
الورقة التالية توصف اماكن تواجد هذه الحشرة والأضرار التي تلحقها بالزراعة.

Introduction

Oil or blister beetles of the family Meloidae are characteristic insects of arid and semi-arid regions around the world. They occur in association with grasshoppers and locusts and to a lesser extent with solitary bees and sphecoid wasps. The family is well represented in the Al Ain region of the United Arab Emirates and in neighbouring parts of the Sultanate of Oman (Buraimi and Mahdah). Very many species belonging to the genera *Mylabris, Cerocoma, Nemognatha* and *Croscherichia*, amongst others, abound on flowers and other vegetation from March through until early June. They occur both in sandy and in rocky places and many species are brightly coloured — often yellow or red with black spots or wavy bands on their elytra (wingcases). Several East Arabian species have been illustrated (Walker & Pittaway, 1987). Some local oil beetles have cryptic colouration, either green or brown/back, and are less easily observed by the casual naturalist. Meloid beetles are all, to a greater or lesser degree, poisonous and their bright colours are clear warnings of this fact to potential predators. The poison which they contain, cantharidin, has been used in Europe from the times of Ancient Greece until well into the present century to treat or mistreat a wide variety of ailments in both human and veterinary medicine (Klausnitzer, 1983). Cantharidin was one of the components of the "aqua tofana" poison used by the powerful Medici family in Renaissance Tuscany. Cantharidin has also long been used as an aphrodisiac, sometimes with fatal results! Classically the drug was obtained from "May-worms" (*Meloe* species) and from the "Spanish Fly" (*Lytta vescitoria*), but in more recent times, *Mylabris* species, similar to the ones found in the Al Ain region, have been used as they were found to contain very high amounts of the substance (Linssen, 1959). Oil beetles, however, arouse interests, other than the medical, pseudomedical, forensic and the erotic. The larvae of these beetles are parasites in the nests of various species of Hymenoptera and in the oothecae (egg pods) of Orthoptera. They undergo a curiously complex development known as hypermetamorphosis and this makes them interesting subjects for biological studies. Economically, oil beetles are also of interest because some species are very destructive pests of cultivated plants. However, it is difficult to assess the status of these insects in relation to agriculture. Often the same species may have beneficial effects as a larva (by destroying locust eggs) and deleterious effects as an adult (by eating the foliage and flowers of crops). Most serious pest species seem to belong to the genus *Epicauta*. I have recently identified one such species, *Epicauta erythrocephala*, in the Mahdah area of Oman and this forms the subject of the present report.

Recording of *E. erythrocephala*

On 17 April 1992 I made a morning visit to the Mahdah area for a natural history foray and parked my car just off the right-hand-side of the Buraimi-Mahdah road at 18 km. I spent several hours walking in this area and had noted the presence of many colourful oil beetles of the genera already listed above, as well as some interesting beetles representing other families. On walking back across the gravel plain to my vehicle, I glanced down and saw between 15 and 20 specimens of a quite different oil beetle on a single plant of *Diplotoxis harra* (Cruciferae). On being disturbed, the beetles scurried away in all directions, but did not take to flight. I was able to capture several specimens and to take them back to Al Ain for examination. The species was identified as *Epicauta erythrocephala*, and representative specimens, along with other material, will eventually be donated to the Natural History Museum of the U.A.E. University in Al Ain.

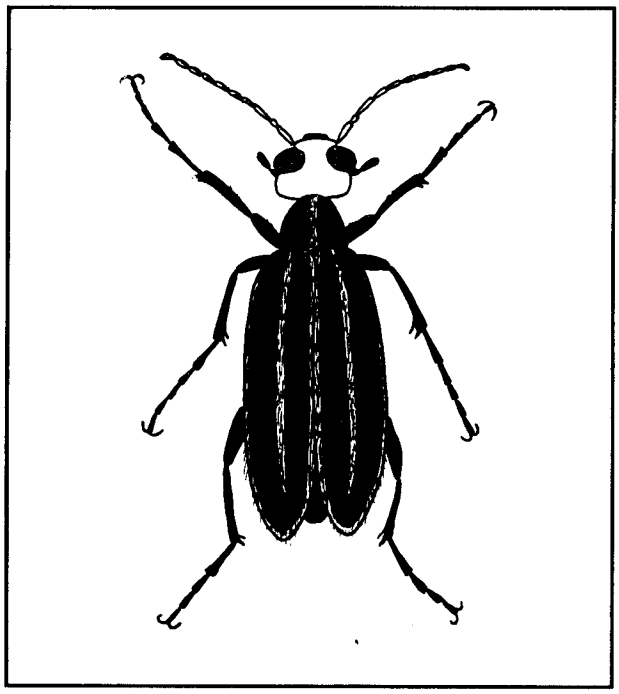
Description of *E. erythrocephala*

The specimens of *E. erythrocephala* that were obtained vary from 9 - 14 mm total length, but the colouration of individuals of either sex is quite uniform. The broad rectangular head and antennae are bright orange-red and the mouthparts, eyes, long legs, pronotum, underside and elytra are sooty-black. The elytral markings include a border of greyish-white pubescence along both the lateral and the sutural edges and a median longitudinal strip (faint in some specimens) of the same colour, which fails to reach the apex of each elytron. A longitudinal stripe of this colour is also present on the pronotum. Sparse short greyish-white hairs cover the underside and the femora and tibia of the legs. I include a habitus drawing (Figure 1), so that the beetle may be identified should it be encountered again.

Economic importance of *Epicauta* species

My first thoughts were that *E. erythrocephala* was just another species of oil beetle amongst many in the region, and that its presence correlated well with the

co-occurrence of many species of short-horned grasshoppers. This oil beetle is known to be a parasite of large species of Orthoptera including *Calliptramus, Gomphocephalus* and *Locusta migratoria*. However, *Epicauta* species have been frequently recorded as very serious agricultural pests in many areas of the world. In Brazil, *E. atomaria* is a pest of cultivated Solanaceae (Carrera, 1980). In North America, the species *E. maculata, E. pennsylvanicus and E. albida* have, on occasions, devastated crops of beets, potatoes, beans, tomatoes and alfalfa (Swan and Papp, 1972). Jaques (1951) also mentions *E. murina* and *E. cinerea* as serious garden pests in the U.S.A., whilst *E. vittata* is known in that country as the "Old fashioned potato beetle," presumably to distinguish it from the well known and even more destructive, but unrelated, "Colorado potato beetle" (*Leptinotarsa decimlineata*; family: Chrysomelidae). More recent information about North American species of Epicauta is given by White (1983).



Habitus drawing of Epicauta erythrocephala from Mahdah, (Sultanate of Oman). Line length = 5 mm

An interesting account of *E. erythrocephala* is given by Bily (1990), together with information about the economic importance of this species in the Near East. Apparently, this beetle is able to respond to increases in the numbers of grasshoppers by explosively increasing its own population. Should this happen, then the gregarious nature of the beetles ensures that individual crop plants are overwhelmed. Such occurrences have happened in the Near East and whole plantations of mustard, tobacco, cucumbers, melons, squash, beans and alfalfa have been wiped out. As the development of agriculture progresses in the countryside around Al Ain, plantations of many of these same crops are becoming increasingly common. Therefore, *E. erythrocephala* may represent a serious threat to agriculture in this area at some time in the future, should the insect spread from the surrounding sands and gravel plains to the plantations. In effect, a period of unusually high grasshopper damage to crops could be quickly followed by a wave of damage caused by this beetle. Clearly, any further information about this species, particularly in regard to its associated grasshopper species and to its preferred indigenous host plants, could be of importance in establishing control measures.

The good news about this insect is, I suppose, that I have only found it on one occasion, but then I have only been living in Al Ain for one year. The bad news is that when the insect was found, it was present gregariously, in some numbers on a single plant, suggesting that a sizeable population was probably present in the area. Over the next few years, this beetle will certainly merit further study and I would be interested to receive information on sightings and, if possible, actual specimens with all pertinent data (date, exact locality, host plant, species of grasshoppers present with which the beetle may be associated, numbers of individual beetles seen etc.) I will try to collate any such data with my own, either for publication or for passing on in the form of a report to the relevant Government Ministries.

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Camels, world champions in water conservation

by Ulrich Wernery

Water is essential to life, and the camel often has to survive on very limited quantities. It is the only domesticated mammal which can survive for a long period in the heat of the desert without water, making it superior to any other animal in this respect and very valuable to the Bedouins.

The camel does not store water in its body either in its stomach or in the hump. The hump is mainly fat, and thus the metabolic water content is high. Complete oxidation of the fat in the hump would release a total of just over 20 kg of water. However, the cost in energy to make this water available would be enormous. Only in emaciated camels does the hump disappear.

Over thousands of years the camel has developed several mechanisms of restricting water loss when intake is reduced, making life in a very harsh climate possible. Many underdeveloped countries rely heavily on the camel for food and for labour, and in recent years we have seen the renaissance of an animal which is fascinating from the physiological point of view.

The ancestors of the camel lived in North America some 60 million years ago. They were no bigger than a hare. From North America they reached Asia and South America where they live on as the South American camelids: Llamas, Alpacas, Vicunas and Guanacos. Today the one-humped camel or dromedary (**Camelus dromedarius**) is distributed over North Africa, Arabia and the Near East. Some 20,000 dromedaries are said to live in Australia, brought from India and Afghanistan approximately 100 years ago. In some areas they are a threat to the Australian cattle farmers. The two-humped or Bactrian camel (**Camelus bactrianus**) is distributed over the Far East and North of the Himalayas. Small numbers of wild Bactrians roam through the Mongolian desert. They are endangered and the only genuine wild specimens of the camel family.

Water is lost from the body by evaporative cooling, in the urine and in the fa eces. The camel is able to achieve considerable savings of water from these sources. The structure and function of the camel's kidneys are of extreme importance in water conservation. The long loops of Henle in the medulla have the function both of concentrating urine and reducing its flow. A dehydrated camel urinates only drops and the concentration of the urine is indicated by white stripes on the hind legs (salt crystals). Concentration of urine not only serves to conserve water, but allows camels to drink water which is even more concentrated than sea water, and to eat very salty plants that would otherwise be poisonous.

Faecal water loss is also very small in camels. Camel droppings are small, hard and dry, due to a final reabsorption of water in the colon. Camels are again more efficient in their conservation mechanisms than other animals.

A fully watered camel does not need to save water. It withstands the extreme heat in the desert by sweating. This keeps its body temperature between 37 and 38°C, and this cools the camel down. As it becomes

● هذا البحث يوضح الأساليب التي تتبعها الجمال للمحافظة على الماء.

dehydrated the animal allows its body temperature to rise higher than that of other mammals, which helps prevent the loss of water by sweating. At the peak of the day, with outside temperatures between 45 and 50°C, the camel's body temperature can rise to 42°C, thereby lessening the need to sweat and conserving water. In other animals this high body temperature would be a threat to the brain and to the eyes. Not so in camels. Humans and most large animals exhale air that is saturated with water. Dehydrated camels, however, can exhale air that contains virtually no water vapour. Where does the water vapour go? The animal has a complex nasal structure which retains this water and in effect provides its brain with an air conditioning system. This heat exchange mechanism in the camel's nose defuses the threat; the retained water cools the blood to the brain (and to the retinas in the eyes), and ensures it is not damaged by overheating. It is believed that hormones are responsible for controlling these mechanisms. In several cases in which camels were given anaesthetics for an operation, the animals died because the anaesthetic switched off the mechanism that kept the brain cool.

In cool temperatures averaging less than 20°C camels can go for long periods without drinking, obtaining sufficient water from trees, bushes and grass to maintain a physiological balance. When day temperatures reach 40°C and temperatures at night do not fall below 25°C, a steady loss of water from the body occurs through evaporative cooling, urine and faeces. If this is not made up by drinking, loss of body weight results. Camels are able to tolerate this dehydration much better than other animals, enabling them to go on grazing normally for very longer periods. Camels also lose less water as a proportion of this initial weight. Some comparative total weight losses per day are: 6.1% in cattle, 4.5% in sheep and 2% in camels. At those rates of loss, losing in total 28-32% before death intervenes, cattle would die in four days without water, sheep in about seven and camels in fifteen or more.

When water becomes available camels rehydrate very rapidly. In a trial in Morocco camels, after being denied water for three weeks, were finally allowed to drink in their enclosure. The camels got through about 60 litres each minute. One animal drank 186 litres. Such rapid intake of water would normally place great strain on the regulatory systems of an animal, causing the blood corpuscles to swell or even to rupture. This does not appear to be important in camels, as the blood cells are capable of reverting to their original size and shape. In fact, camels have the most resilient red blood cells of a series of fifteen domestic and laboratory animals. Erythrocytes of the **Camelidae** are elliptical or oval and the osmotic fragility is much reduced in comparison with oth-

er artiodactylids. Camel red blood cells withstand lower ionic concentrations such as water loading, thus explaining the intake of huge amounts of fluid without any problems.

Until recently scientific knowledge of the camel has been fragmentary. Little research had been undertaken and there were very few publications relating to it. A changed attitude has been seen in the research community with the appearance of a number of bibliographies during the early part of the last decade. Up to 1980 around 3,000 papers had been written. Since then, approximately 900 additional scientific articles have been published on **Camelus dromedarius.** The growing awareness of the unique role the camel plays in the culture, heritage and agriculture of a desert country has made more people interested in one of the most peculiar desert mammals.

(The first World Camel Symposium was held in Dubai in February 1992, bringing together researchers from all over the world to pool information on the biology of the camel and on ways of improving its performance as a racing animal. — Eds.)

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Wildlife and Conservation in Eastern Yemen

by Michael Jennings

From the creation of the Peoples Democratic Republic of Yemen (PDRY) in 1967, to the time of its union with the Yemen Arab Republic to form the Republic of Yemen in May 1990, it was generally very difficult for western naturalists to visit the country. This country has been known colloquially as 'South Yemen,' but this is a misnomer, because on average South Yemen was further north than North Yemen(YAR). Now that the two countries are joined I prefer to use the term 'eastern Yemen' to refer to the former South Yemen (PDRY). Although the country was barred to the West for so long a number of scientists from Eastern Europe did visit the region and have published their results. Notable among these was an important survey of the flora and fauna of Socotra Island in the early 1980s by a combined East German and Aden University team, led by Dr. Wranik. In recent years a trickle of western scientists have been able to visit the country. Among the first of these was the ornithologist Dr. John Ash, who visited Aden and nearby areas in 1984 under UNEP sponsorship to study the serious pest status of the introduced **Indian House Crow** *Corvus splendens* (Ash, 1984; Ash, 1988), That study resulted in a control programme, commencing in 1986, which, by May 1989 had eliminated 241,000 crows in the Aden Governorate area alone (Jennings, in press). The crow has been greatly reduced in numbers but is still a serious pest. Other more recent visitors have included Dr. Anthony Miller of the Royal Botanical Gardens, Edinburgh and Luigi Gaurino, UNFAO, who studied the botany of Socotra and the extreme eastern part of Yemen, as well as collecting plant specimens for the **Flora of Arabia** project.

I was fortunate to be able to visit eastern Yemen for three weeks in October and November 1989 for the purpose of a survey for the **Atlas of the Breeding Birds of Arabia** project. My subsidiary tasks included a follow-up study to the Ash report on the Indian House Crow and local crow control programmes, and to look into the possibility of the Ornithological Society of the Middle East mounting a full-scale ornithological survey of the country.

Thanks to the assistance of the then Ministry of Agricul-

● طوال الخمسة وعشرون عاماً الماضية قام العلماء بزيارات محدودة ونادرة لليمن الجنوبي سابقاً ولم تحظ تلك الدولة بدراسات وافية. هذا المقال يدور حول زيارة لدراسة تلك الدولة.

ture in Aden I was able to travel widely within the country, including the full length of the coast from Aden to the border with Oman, and in the interior, to Wadi Hadramaut, Wadi Hajar, Laudar and Ad Dali. Although primarily interested in the breeding bird fauna I collected as much information as I could on the environment generally and on conservation issues.

In comparison with many other parts of Arabia, where overgrazing, deforestation, erosion and pollution present serious problems, the environment of eastern Yemen was in a relatively healthy state. One reason for this might have been that no financial encouragement was paid to bedouin to increase the size of their flocks, nor any subsidy to pay for grain during periods when there was little grazing. This means that, unlike the situation in the more prosperous states of Arabia, the rangelands hold no more stock than they can naturally support. Where the bedouin are given subsidised grain, the higher population of animals means, inevitably, that overgrazing occurs. With fewer bedouin in the desert as a result, secondary effects such as the cutting down of trees for firewood is less pronounced. Native charcoal burning was noted in some areas but a much greater impact was being made by commercial lime kilns which required large quantities of wood. Fortunately, most of the wood being burnt appeared to be the introduced **Mesquite** *Prosopis juliflora.*

In the latter years of the PDRY administration the authorities banned the use of persistent pest control agents such as aldrin and dieldrin, mainly as a result of World Bank pressure. Agricultural specialists told me that this results in a problem with some crop pests as al-

ternative pesticides were not effective. Physical pollution by domestic rubbish was much less apparent in eastern Yemen than elsewhere in Arabia. This was because the country was relatively poor and underdeveloped; the variety and quantity of imported foods (and their wrappings), and consumer goods were at much lower levels. The coast was noticeably oil-free and largely clear of domestic refuse.

Large mammals, especially carnivores, are good indicators of the health of the environment. It is clear that status of predators in eastern Yemen is at least as good as any other parts of Arabia, although there is still considerable cause for concern. In a short specialised survey such as my own I could not hope to survey carnivores but reports and notes I collected are encouraging. **Wolf** *Canis lupus* and **Striped Hyaena** *Hyaena hyaena* were reported to be common, from the edge of the Empty Quarter to just outside Aden. **Caracal lynx** *Caracal caracal* has been recorded recently from over a wide area from near the Dhofar border in the east, to the border with the former North Yemen in the west. The **Honey Badger** or **Ratel** *Mellivora capensis* and **Red Fox** *Vulpes vulpes* also occur widely. The **Arabian Leopard** *Panthera pardus* survives and at least four individuals are known to have been shot in the last few years, indicating the species occurs quite widely. Much of eastern Yemen is remote and mountainous, very suited to the leopard. There have been no recent reports of the **Asiatic Jackal** *Canis aureus*, but I was informed of an intriguing, unconfirmed, reference to a possible **Cheetah** *Acinonyx jubatus* sighting in the mid 1980s. (One of the last verified cheetah records for Arabia came from eastern Yemen, 80km NW of Habarut, in March 1963, Harrison, 1972). Ungulates include the **Idmi (Mountain gazelle)** *Gazella gazella* and the **Rheem (Arabian gazelle)** *Gazella subgutturosa* which were reported in 1989 from several localities. I was able to establish the **Ibex** *Capra ibex* was still widespread in eastern Yemen, especially in the Wadi Hadramaut area, the eastern border near Oman and in the coastal mountains near Mukalla. However, everyone I questioned agreed that it was very much reduced in numbers over the last ten years. Like all large mammals in Arabia, the ibex is susceptible to hunting pressure and in a country where the bedouin often have sub-machine guns, key species like this are badly in need of protection through the establishment of effective observation laws and reserves.

Other interesting large mammals include **Porcupine** *Hystrix indica*, which is widespread, and **Hamadryas Baboon** *Papio hamadryas*, limited to the western mountains where, as elsewhere in south west Arabia, they are a serious crop pest.

The border area of eastern Yemen with Saudi Arabia and Oman was the last refuge of the southern population of the **Arabian Ostrich** *Struthio camelus syriacus*. The last were probably hunted in this area as late as 1920-30 (Jennings, 1986) although, even today, whole eggs can be found in sand dunes in the area (Walker, 1981; Gallagher, 1988). Important bird species in eastern Yemen, in terms of their rarity in Arabia, include the **Houbara Bustard** *Chlamydotis undulata*, which is likely to breed in some parts of the country, **Abdim's Stork** *Ciconia abdimii* and **Black-winged Kite** *Elanus caerulus*. All ten Arabian endemic landbird species occur in the border area with the former YAR. It may be possible that the houbara has a healthier population in Eastern Yemen than anywhere else in Arabia, both as a breeding bird and as a winter visitor, because organised no-expense-spared hunting parties, which have existed elsewhere in Arabia, have been absent from eastern Yemen. The **Arabian Bustard** *Ardeotis arabs* has not been seen in the country in recent years. Despite suggestions by Meinertzhagen (1954) the **Bald Ibis** *Geronticus eremita* was probably never a breeding bird in southern Arabia and has not been seen in eastern Yemen since his own record at Laudar in 1949. Vulture species are apparently on the decline in the area as elsewhere in Arabia (Jennings, 1988). Surprisingly I did not see a single **Griffon Vulture** *Gyps fulvus*, during my survey. The **Egyptian Vulture** was widespread, although apparently not so numerous as in former years. The **Lappet-faced Vulture**, which is now known to breed over a large area of central Arabia, probably also occurs over much of eastern Yemen. I saw one on the edge of the Empty Quarter in November 1989, only the second record for the former PDRY.

On the sandy coast near the border with Oman it was encouraging to see a large area completely covered by the nesting depressions of turtles (species not determined). I estimated that there were at least 500 turtle nesting depressions in this area, with no evidence of interference by the local inhabitants. The sea yields an abundant fish crop to local fishermen. There appeared to be no infrastructure to freeze, process and transport fish crops and fishing activities appeared mainly for sardines and whitebait for the local economy, to be used for fertilisers and animal fodder.

One part of the former PDRY where the flora and fauna are of special interest is Socotra Island. Here no less than five bird species are endemic, and all are poorly studied. These endemic birds are the **Socotra Grackle** *Onychognathus frater*, **Socotra Rock Bunting** *Emberiza socotrans*, **Socotra Sunbird** *Nectarinia balfouri*, **Socotra Warbler** *Incana incana* and **Socotra Cisticola** *Cisticola haesitata*. I was not able to visit Socotra myself but it will hopefully be included in the itinerary of the forthcoming OSME survey.

Plants which are of special interest include the endangered **Bankouale Palm** *Livistona carinensis* which is known to occur only in three widely scattered populations, in Djibouti, Somalia and Wadi Hajar in eastern Yemen. Until very recently, this palm tree was highly sought after by the local inhabitants in Wadi Hajar for roof timbers, because it is regarded as termite resistant. The stands of this palm in Wadi Hajar were very much under attack from builders until just before my visit in 1989, threatening to wipe out the total Arabian population of about 2,000 palms. When I visited the site there was no regeneration and suckers were burnt away to get at the main trunk. Fortunately the mamoor (village chief) following pleas and advice from visiting botanists, had agreed, early in 1989, to place a ban on the felling and burning of this palm, and these measures appeared to have been remarkably effective by the time of my own visit.

In 1989 environment and conservation-orientated legislation in the former PDRY was rudimentary and limited to two laws, one concerned the protection of plants, which includes control of tree felling, and another which bans hunting of birds and animals and the keeping of wild animals privately. These laws were largely ignored as there were only limited resources available for en-

forcement. Unfortunately, gun ownership is widespread and the traditional Arab love of *la chasse* is as strong as ever. However, the Government at the time did have plans for more gun control and there was an increasing and encouraging tendency for the bedouin to adopt a settled existence. On unification with North Yemen in May 1990, presumably the respective environment laws of the two countries would be rationalised but this will almost certainly be a low priority of the new Government, which has many other pressing issues to rationalise.

In late 1989 there were no protected areas in eastern Yemen other than some small fenced experimental areas to study plant regeneration for rangeland use. Perhaps the Bankouale palm grove of Wadi Hajar could be the first target for such a reserve, especially as the surrounding area is known to hold ibex, leopard, wolves and other larger mammals. In addition a Wildlife Research Unit had recently been set up at Al Kod, in the Abyan Governorate, as part of the Research and Extension Department of the then PDRY Ministry of Agriculture. This boded well for future wildlife work in eastern Yemen but the present situation is unknown. Nabeel Obadi, the wildlife officer who was in post in November 1989, had just published what is probably PDRYs first (and last) environment orientated book in Arabic — **The Birds of South Yemen** (Obadi, 1989).

Acknowledgements

I would like to express my sincere thanks to all those who made my visit to the former PDRY a success. Especially warm thanks go to Dr Abdulwahad O. Mukred, Director of the Research and Extension Department of the then Ministry of Agriculture, who provided much logistic assistance, and to Nabeel Obadi of the Wildlife Research Unit who provided much information. Thanks are also extended to the National Commission for Wildlife Conservation and Development, Riyadh, for sponsorship of the ABBA project and my air ticket to Aden and to the Ornithological Society of the Middle East for a cash grant towards my expenses.

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Group Meetings January– June 1992

January	6	:	Palaeontology, by Robin Cocks, Keeper of Palaeontology, The Natural History Museum, London.
"	20	:	Annual General Meeting plus film.
"	23/24	:	(At Jebel Dhanna) Weekend on Fossils of Abu Dhabi's Western Region, speaker Peter Whybrow, The Natural History Museum, London.
February	3	:	Dubai Zoo, Dr. Reza Khan.
"	5	:	(In Ras al Khaimah) Pre-Islamic Coinage in Arabia, by Professor Dan Potts, University of Sydney.
"	17	:	The Tell Abraq excavations in Umm al Qaiwain, by Professor Dan Potts.
March	2	:	Orientalism in Art, by Brian McDermot, Director, The Mathaf Gallery, London.
"	16	:	A History of Oil in the UAE, by David Heard
April	4-11	:	Group Trip to Oman.
"	20	:	Birds in the Emirates, by David Robinson.
May	4	:	A Historical Look at Yemen, by Dr. Frauke Heard-Bey.
"	18	:	Religion and Pre-Dynastic Egypt, by Dr. Farid Elyahky, University of Toronto.
June	1	:	Pictures of the Group Trip to Oman, by John Nowell and Connie Eide.
"	15	:	Saluki Dogs, by Dr. R.K. Shukla.

NOTES AND QUERIES

Islands Survey

For a four week period in March and April 1992, a team of British archaeologists, led by Dr. Geoffrey King of London University's School of Oriental and African Studies, carried out a preliminary archaeological survey of three of the main offshore islands in the Emirate of Abu Dhabi, Sir Bani Yas, Dalma and Merawah.

The survey, carried out in association with the Society for Arabian Studies in London, was undertaken on the instruction of UAE President Sheikh Zayed bin Sultan al Nahyan, and was co-ordinated by the Emirates Natural History Group at the request of the Group's Patron, Minister of Higher Education and Scientific Research Sheikh Nahyan bin Mubarak al Nahyan.

Important discoveries were made on each of the islands. On Sir Bani Yas, the main sites of interest were the remains of buildings, including a possible township, dating back to Sassanian times, just before the beginning of the Islamic era, along with other Partho-Sassanian or Sassanian — Islamic material. The remains of at least six courtyard houses were located, some with visible stone coursing and pieces of plaster, some of which were decorated.

The bulk of the sites were inside pens built to hold llamas, part of President Sheikh Zayed's collection of wild animals. The first archaeological evidence from the pens was located in May 1991 during a Group study trip to the Island.

A number of cairns of uncertain date, Islamic campsites and a possibly Neolithic flint knapping site were also noted.

On Dalma island, which lies well offshore, around thirty kilometres from Sir Bani Yas and 27.5 kilometres from the coast of the Qatar Peninsula, the most important discoveries were two sites dating to the Ubaid period, in the fourth or fifth millenium BC, identified by potsherds, and described by King in a report as "one of the most important discoveries of the survey."

The sites, enclosed but endangered, also included flints and beads, and, as far as is known, are the only Ubaid sites yet to have been found on offshore islands in the Emirates. Ubaid sherds, originating from Mesopotamia, have also been found in shell mounds and middens along the coast in Sharjah, Ajman, Umm al Qaiwain and Ras al Khaimah in the northern Emirates.

Much of Dalma has been affected by agricultural development and the building of houses, but the team identified and recommented for preservation a number of recent Islamic buildings of a unique design.

Merawah island, the property of Deputy Chief of Staff Major General Sheikh Mohammed bin Zayed al Nahyan, was found to contain a large Neolithic site, "a significant addition to our knowledge of early archaeology in the UAE," according to King.

The site includes cairns, stone rings, and a number of rectangular structures, as well as a "profusion of arrowheads, knives, scrapers and piercers," some of which were taken to London, with the permission of Sheikh Zayed, for comparison with lithic material from the Qatar peninsula.

A number of large shell middens were also located, many of which are recent Islamic, although others may be earlier, a late Islamic mosque and a number of cairns and graves, many of which are pre-Islamic.

On the neighbouring island of Liffiyyah, (Fiyyah), a brief examination also found evidence of three cairns and the site of a now abandoned village.

In his report, submitted to President Sheikh Zayed, Dr. King made a series of recommendations for preservation of the key sites. Those identified on each of the islands, the Sassanian on Sir Bani Yas, the Ubaid on Dalma and the Neolithic on Merawah, all have the potential to add significantly to the understanding of the country's history and pre-history, and are not parallelled elsewhere in the Emirates.

Sheikh Zayed has requested that the survey work continue in 1993, possibly associated with some excavation, and that the team should also examine other coastal and island areas, including the area between Jebel Shuweihat and Ras Khumays along the coast of the west of the Emirate of Abu Dhabi.

Air transport for the survey team was provided by the UAE Air Force, arranged by Sheikh Mohammed bin Zayed, while corporate support was provided by the following companies and institutions, many of them also Corporate members of the Emirates Natural History Group: Emirates Airlines, The British Council, the Al Fahim Group, Abu Dhabi Company for Onshore Oil Operations, Union National Bank, Abu Dhabi National Hotels Company, Wimpey (Abu Dhabi), Spinneys Abu Dhabi and the Higher Colleges of Technology. A small grant was also provided towards expenses by the Group.

PETER HELLYER
Archaeology Recorder

* * *

New Mammal Records from Abu Dhabi

As noted in the Mammal Recorder's report (see Page 43), the recently-established National Avian Research Centre, sponsored by the Crown Prince of Abu Dhabi, Sheikh Khalifa bin Zayed al Nahyan, organised two detailed surveys of desert areas of the Emirate of Abu Dhabi in the winter of 1992.

The surveys, carried out for the NARC by the Nature Conservation Bureau of Britain, took place between October and December 1991 and February and March 1992, and focussed on the **Houbara Bustard,** (*Chlamydotis undulata*).

During the surveys, mammalogists with the team collected information on the presence of mammals, through live sightings, road casualties, tracks, trapping and evidence such as burrows. The result was a substantial addition to knowledge of distribution of mammals in the non-urban areas of the Emirate of Abu Dhabi, which comprises the bulk of the territory of the United Arab Emirates.

As a matter of record, the key results are summarised below, by species:

Hedgehog (*Paraechinus sp.*) : Thinly scattered throughout.

Sind Serotine Bat (*Eptesicus nasutus*) : One identified, others present at Ruwais, presumed to be of same species (ABBA Square SB 25). First UAE records.

Bats (other species): Two sizes (species?) in Liwa (ABBA Squares TB/UA 23).

Arabian Red Fox (*Vulpes vulpes*) : Almost ubiquitous

Rüppell's Fox (*Vulpes rüppellii*): Widespread. Less common than the Red Fox, but recorded through sightings, tracks and burrows in the general areas of Bida Hamama (VA 25), Arjan (VA 24), Umm az-Zamul, (UB/VA 22), Habshan (TB 24), and Ghiyathi, (SA/SB 24).

The Emirates Natural History Group has no previous records of sightings of this fox species, although Gross (1987), refers to it as "a typical desert dweller," and mentions a skull found at Jebèl Ali (VA 26) in 1973 and specimens being obtained south of Liwa. The species is clearly much more widespread than has previously been noted.

Wild cat (*Felis sylvestris*): Records of cat tracks in remote areas may indicate wild stock.

Sand cat (*Felis margarita*): One road casualty near Ghiyathi, (SB 24), while tracks were thinly scattered in remote sandy areas. Previously reported by Bedouin from the UAE/Qatar border area, to the west of Ghiyathi, and from near Jebel Ali and possibly Falaj al Mu'alla, (VB 27). Secretive and endangered, this is the first recent record, although the species may well be fairly widely spread in undisturbed areas.

Arabian Gazelle (*Gazella gazella arabica = cora*): A total of 25 sightings, (apart from introduced animals on Abu al Abyadh island), and particularly near Sweihan (VA 25), described in N.A.R.C. report as "a well-known traditional site for wild gazelle," as well as a single sighting near Umm az-Zamul, (UB/VA 22).

Together with the Group's own recent records, (see Page 43), this suggests that the species remains widespread in both mountain and desert, although the possibility of introduced stock forming part of at least the desert population cannot be ruled out.

(No sightings were made of the **Dorcas Gazelle** (*Gazella dorcas*), or **Goitered Gazelle** or **Rheem**, (*Gazella subgutturosa*), apart from introduced animals on Abu al Abyadh, although the species have previously been reported on headlands west of Abu Dhabi).

Cape Hare (*Capus lepensis*): Widespread, but probably absent from some areas. Young seen in area of Square TB 24 on March 9 1991. The survey results confirm previous information.

Lesser Jerboa (*Jaculus jaculus*): Three seen and assumed widespread in sandy and gravel areas.

House Mouse (*Mus musculus*): One near Ghiyathi (SB 24), a range extension as far as ENHG records are concerned, but not unexpected.

Cheesman's Gerbil (*Gerbilus cheesmani*): A common nocturnal visitor to the camps of the survey team, with two individuals found freshly dead, as well as recordings in pellets of **Little Owl** (*Athene noctua*) near Al Ain, (VB 25). Described as "probably almost ubiquitous."

Gerbil species (*G. nanus or G. dasyorus* — Baluchistan Gerbil or Gallagher's Gerbil):

One near Ghiyathi (SB 24) and one near Al Ain (VB 25).

Libyan Jird (*Meriones libycus*): Found in rocky areas near Al Ain, (UB 25).

Sundevall's Jird (*Meriones crassus*): Described as "quite common in sandy areas surrounded by open plains, but not recorded in sand dunes." Colonial burrows. Recorded from Ghiyathi, (SA/SB 24), Habshan, TB 24) Arjan (VA 24), and in pellets of **Short-eared Owl**, (*Asio flammeus)*, in the Sweihan area, (VA 25).

Full details of the several hundred records are held by the National Avian Research Centre, and represent a very substantial addition to knowledge of the distribution of the mammal fauna of the United Arab Emirates, previously little studied and little understood.

The total number of records during the two short surveys exceed the previous total of records of non-marine mammals held by the ENHG, even though mammals were incidental to the main purpose of the surveys.

Despite this, however, recordings by Group members remain invaluable in determining detailed maps of the distribution of mammal species throughout the Emirates, since the N.A.R.C. surveys cover only part of the Emirate of Abu Dhabi.

The Group will continue its collaboration with the N.A.R.C., in pursuit of a better understanding of the natural history of the United Arab Emirates.

Acknowledgements:

I am grateful to Dr. Richard Hornby, General Manager of NARC and to Mohammed al Bawardi, Managing Director of the NARC and Manager of the Office of Sheikh Mohammed bin Zayed al Nahyan, for permission to quote from the survey findings.

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Interim reports to the Scientific Advisory Panel of the National Avian Research Centre, Abu Dhabi.

Peter Hellyer

* * *

Rock Varnish

*[**Editor's Note:** The author of this note has been a legal advisor in the UAE for a number of years, but also holds academic degrees in geology. The information presented here is based on an article entitled "Rock Varnish" which appeared in the November-December 1991 issue of **American Scientist** and was written by Professor Ronald I. Dorn of the University of Arizona at Tempe. Professor Dorn is one of the foremost scientific investigators of rock varnish.]*

In many areas of the mountains of the UAE south of the Musandam Peninsula, the elevated gravel plains adjacent to the main wadis have a very deep purple colour. This can be readily observed, for example, on the road from Dhaid to Masafi, Masafi to Dibba, or in Oman along the newly-popular Mahdah-Hatta road, wherever the original surfaces have not been disturbed.

The distinctive colour is attributable to the colour of the rocks which lie on the surface of these plains. Closer inspection reveals, however, that this colour is not a primary feature of these rocks but is limited to their upper surfaces. The sides and bottoms are invariably paler, and often the sides are orange in colour. The colour of the fresh rock, which can be ascertained by breaking a sample to expose the interior, may be quite different altogether.

The purplish surface veneer, which in some instances may become almost black, is called rock varnish. It has also been called desert varnish beçause it is generally best developed in arid or semi-arid climates. It is a phenomenon distinct from ordinary weathering processes, since it does not involve chemical changes in the original rock and it affects many different kinds of rock in a similar fashion (although within the UAE rock varnish is not well developed among the carbonate rocks of the Musandam Peninsula).

As recently as twenty years ago the origin of rock varnish remained almost a complete mystery. Since then, however, the mystery has gradually been solved through the efforts of a relatively small but dedicated number of scientific researchers.

Bacteria, it turns out, are responsible. These include primarily a number of species of bacteria which obtain part of their metabolic energy from the precipitation or "fixing" of inorganic manganese as manganese oxide. Manganese is found in trace quantities in many rocks and may be dissolved by moisture, but only biological processes are capable of precipitating manganese at normal pH ranges. The presence of manganese-fixing bacteria in rock varnish has been confirmed by electron microscopy.

The "varnish" itself typically consists of a layer less than half a millimeter thick consisting of approximately 60% clay minerals, 20-30% manganese and iron oxides, and 10% miscellaneous materials including other metallic oxides and pollen. The bacteria live on the surface of the rocks, and they appear to be most successful in conditions of only intermittent rain in a nutrient poor environment. The precipitation of manganese traps ambient dust as clay minerals, along with pollen and other airborne materials. The clay minerals may even serve as chemical catalysts to some extent. Where dust levels are high, the varnish tends to accrete in layers. Where dust levels are lower, the varnish has a more nodular structure.

The sides of individual rocks, as well as cracks in the rocks, seem to favour the normal chemical precipitation of iron oxides rather than manganese. This accounts for the orange colour often seen localised in these areas. These same sites are also generally found to be areas of elevated pH, which inhibits the growth of manganese-fixing bacteria.

The depth of colour of rock varnish is an indicator of the relative age of gravel surfaces, at least within a particular geographical area. The darker the varnish, the longer the surface has been exposed. This had long been suspected but has now been demonstrated empirically. Both clay minerals and carbonaceous material trapped in the varnish can be used for absolute dating by chemical and/or radiometric means.

These same methods can be applied to establish minimum ages for certain archaeological materials found at the surface. They have been used, for example, to date the famous prehistoric geoglyphs found at Nazca, Peru, which were "drawn" by removal of varnished rocks to expose underlying lighter coloured rocks and soil. Additionally, pollen and other carbonaceous material trapped in rock varnish can give an indication of earlier climate and climatic change in the area, both directly and by means of isotopic analysis.

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UAE invertebrates

This list of terrestrial invertebrates was compiled during the second half of April and the whole of May 1992. The sites visited were mainly limited to Al Ain zoo and the grounds of Ain Al Faydah Hotel. There was one trip into the hills of Oman a few kilometres from Buraimi. Due to the scarcity of literature to refer to there were quite a few animals that I could not positively identify. These were mainly grasshoppers, ant-lion flies and the smaller moths, and they have been excluded. The number of species of invertebrates in the UAE was a surprise to me because it is mainly a desert environment. Scorpions and Desert Beetles I expected, but there is also a large variety of Butterflies, Moths, Grasshoppers, in fact almost every order that one would expect to find in Europe. Presumably the extensive irrigation and planting has meant an increase in the numbers of species as well as individual animals.

I did not spend a great deal of time actively searching for invertebrates. The following list I just happened upon during my daily work or on an evening walk after dinner.

The most productive area seems to be around the lamp posts at Ain Al Faydah after dark. This I believe to be cause for concern. Huge amounts of insecticide are used at Ain Al Faydah and, I suspect, elsewhere in the UAE. Early one morning I observed a pick-up truck driving around the grounds with a great cloud of insecticide following it. The cloud was at least six metres high and so thick it completely blocked the view from the windows. My car was covered in a thick oily deposit. I had to wash the windscreen before I could drive away.

Pale Crag Martins were 'hawking' for insects shortly after. I must admit that I am ignorant of the insecticide used and I am aware of the fly and mosquito problem. However, the long term affect on the wild-life must be considered.

Thousands of insects are attracted to these lights each night and if they linger until morning, they will not make another visit.

Species:	Location
CICADAS	
Arabian Cicada *Platypleura arabica*	AAF. PZ. DZ.
BEETLES	
Domino Beetle *Anthia duodecimguttata*	AAF. PZ.
Sulphurous Jewel Beetle *Julodis euphratica*	AAF. PZ.
Rhinoceros Beetle *Oryctes sp.* (Probably *elegans*)	DZ.
Oil Beetle (Meloidae)?	PZ.
Darkling Beetles *Pimelia sp.*	AAF. PZ. DZ.
Pitted Beetle *Adesmia cancellata*	AAF. PZ. DZ.
Elevated Stalker Beetle *Adesmia stoeckleini*	PZ.
Scarce Stalker Beetle *Ocnera hispida*	AAF.
Short legged Stalker Beetle *Thriptera crinita*	AAF.
BEES, ANTS & WASPS	
Carpenter Bee *Xylocopa spp.*	DZ.
Desert Giant Ant *Camponotus xerxes*	AAF.
Desert Runner Ant *Cataglyphis niger*	Everywhere
BUTTERFLIES & MOTHS	
Blue Pansy *Junonia orithya here*	Everywhere
Swallowtail *Papilio machaon muetingi*	DZ.
Citrus Swallowtail *Paiilio demoleus*	DZ.
Monarch Butterfly *Danaus chrysippus*	AAF. PZ. DZ. AW
Crimson Speckled Footman *Utetheisa pulchella*	PZ.
Death's Head Hawk *Moth Acherontia styx*	DZ.
(Ditto Larva captured by Sparrow)	DZ.
Silver Striped Hawkmoth *Hippotion celerio*	AAF.
Striped Hawkmoth *Hyles livornica*	AAF.
COCKROACHES & MANTISES	
American Cockroach *Periplaneta americana*	DZ.
Ground Mantis *Eremiaphila braveri*	PZ. DZ. O.
Praying Mantis *Mantis religiosa*	AAF.
Lappet Mantis *Empusa hedenborgi*	AAF.
Striped Mantis *Blepharopsis mendica*	AAF.
Various unidentified mantis species	AAF. DZ. O.
GRASSHOPPERS & CRICKETS	
Migratory Locust *Locusta migratoria*	AAF.
Gangling Grasshopper *Truxalis procera*	PZ.
Banded Cloak Grasshopper *Pseudosphingonotus savignyi*	AAF.
Yellow Streak Grasshopper *Heteractis sp.*	AAF.
Blue Shinned Grasshopper *Sphingonotus rubescens*	AAF.
Grass Pest *Aiolopus thallasinus*	AAF.
Hollow Grasshopper *Pyrgomorpha conica*	AAF.
Tropical Field Cricket *Gryllus bimaculatus*	AAF.
House Cricket *Acheta domestica*	AAF.
DRAGONFLIES	
Lesser Emperor *Anax parthenope*	AAF. DZ.
Purple Blushed Darter *Trithemis annulata*	AAF.
ARACHNIDS	
Camel Spider *Solifugida sp*	AAF.
Scorpion *Scorpiones sp?*	PZ.
Jumping Spider (several species)	DZ.

DZ. **Developed Zone of Al Ain Zoo**
PZ. **Paddock Zone of Al Ain Zoo**
AAF. **Ain Al Faydah Hotel & Park**
AW. **Al Wagan or between AAF. & Al Wagan**
O. **Oman**

Bob Wingate,
Head Keeper, Discovery Centre,
Whipsnade Zoo, Bedfordshire, UK.

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RECORDERS' REPORTS FOR JANUARY - JUNE 1992

Archaeology and Palaeontology

The first half of 1992 saw archaeological work in the United Arab Emirates returning to its normal pattern, with foreign teams absent during the Gulf War returning to continue their work. For the first time for a number of years, there was also some activity in the field by Group members.

In the Emirate of Abu Dhabi, the Department of Antiquities and Tourism, based in Al Ain, continued its work in the Hili area, some involving students from the Archaeology and History Department of the Emirates University, while some preliminary surveying was done of an Islamic site in the desert south west of Al Wathba. Because of the extent and important of the pre-Islamic sites involved, most of the Department's work has concentrated in recent years on the Al Ain area. Department officials, however, now plan to devote more of their resources to investigating the Islamic sites in the Emirate, including those in remote desert areas that may shed light on the pattern of settlement.

On the palaeontological side, the Department continued to give support to the survey being carried out in the Western Region by a team led by Peter Whybrow from the British Museum (Natural History), which has now completed the third of five seasons of work being sponsored by our Corporate member, the Abu Dhabi Company for Onshore Oil Operations, ADCO. (See **TRIBULUS Vol. 1.1.**, April 1991, Page 4) .

In January, an inter-Emirates natural history weekend saw around sixty members of the ENHG and its counterparts in Dubai and Al Ain gather at Jebel Dhanna for an evening lecture by Peter Whybrow, and a Friday morning visit to the palaeontological site at Jebel Barakah, west of Jebel Dhanna. During the visit, Group members were responsible for the discovery of the fossilised jaw of a deinothere, (an early elephant). An outline of the season's work was carried in **Vol. 2.1.** (April 1992), Page 20.

A member of the palaeontological team also studied evidence for lithic industries, (flints), along part of the coast. (See Page 22).

The Group was also active in the generating of sponsorship and support for the British Abu Dhabi Islands Survey, which took place in March and April at the request of President Sheikh Zayed bin Sultan al Nahyan. The survey, which visited the islands of Sir Bani Yas, Dalma and Merawah, received financial and other support from the Group, and from our Corporate sponsors ADCO, Abu Dhabi National Hotels Company, Al Fahim Group, The British Council, Higher Colleges of Technology, Spinneys Abu Dhabi, Union National Bank and Al Wimpey, as well as from our Patron, Higher Education Minister Sheikh Nahyan bin Mubarak al Nahyan and from the UAE Air Force, through Deputy Chief of Staff Major General Sheikh Mohammed bin Zayed al Nahyan.

The survey, led by Dr. Geoffrey King of London University's School of Oriental and African Studies, (also Director of the British team at Julfar), identified important sites on Sir Bani Yas (pre-Islamic/Sassanian), Dalma (Ubaid), and Merawah, (Neolithic). Work is under way on preparations for a second season in early 1993. (See Page 36).

Our member Carolyn Lehmann was an active member of the team. Other activity by Group members included the identification of a raised beach and shell concentrations on the island of Abu Dhabi which, according to Dr. King, may date to around 4,000 BC. A preliminary survey yielded no potsherds or flints that would permit dating, but the survey team, in association with Group members, plan to examine the site further in early 1993.

In the northern Emirates, the main activity, as usual, focussed on the Bronze Age site at Tell Abraq in Umm al Qaiwain, (see **Vol. 2.1**, April 1992, Page 15), the Parthian site at Ad Door, also in Umm al Qaiwain, (see **Vol. 1.1** April 1991, Page 18), the site of the Islamic port of Julfar in Ras al Khaimah, (see **Vol. 1.2**, October 1991, Page 19) and the Hellenistic site at Mileiha in Sharjah. Results of the recent French excavations in Sharjah are reported on Page 5.

A geomorphology survey was also carried out by a British team on behalf of the Government of Ras al Khaimah to determine the changing patterns of the coastline between Jazirat al Hamra and Sha'am, including the area of the Julfar site, which yielded valuable information, while a study was undertaken of traditional architecture, including fortified buildings in the same Emirate. (See Page 24).

Group members were pleased to welcome Professor Daniel Potts of Sydney University, to talk on the pre-Islamic coinage of Arabia during a weekend visit to Ras al Khaimah, and to welcome him again to Abu Dhabi in February to talk on the Tell Abraq site during his February excavation. The Group repaid his efforts by helping his team to obtain generous sponsorship for the Tell Abraq dig from General Motors.

Another speaker on archaeology was our member Farid Elyahky, on Pre-dynastic religion in Egypt. When not working at the Higher Colleges of Technology, Dr. Elyahky conducts excavations for the University of Toronto on pre-dynastic sites in Egypt, and the Group was pleased to welcome him as Assistant Archaeology Recorder.

Studies into the archaeology and palaeontology of the United Arab Emirates continue to expand, with the activities of foreign teams now including other more general studies like geomorphology and surface surveys of coastal areas and islands as well as investigation and excavation of specific sites. Although qualified scientists are now more and more actively engaged in the field, there remains an important role for Group members and other interested amateurs in identifying potential new sites throughout the country, and in providing support and assistant to archaeologists.

PETER HELLYER
Archaeology Recorder

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Birds

This is my first official recorder's report for **Tribulus**. Former ENHG Bird Recorder Bob Richardson had to step down in the spring in the wake of job uncertainties. Bob's contribution to bird recording has been significant since taking the post in September 1990. His work included the co-authoring of our official list of birds in the UAE in 1991 (**TRIBULUS Vol. 1. 2 pp 3-12**). Fortunately he is still in the Emirates, transferred to Dubai with the prospect of staying in this superb birdwatching area for several more months. I hope to continue his work in gathering data for Abu Dhabi emirate and so completing the picture for the whole country.

Bird recording continues apace as we consolidate our knowledge of breeding species, migrants and the status of rare or hitherto unknown species in the country. Of the latter, 9 **Black-bellied Sandgrouse** at Abu al Abyadh on 9 February, a **Black Bush Chat** at the Emirates Golf Club from 15 - 19 April and up to 4 **Dead Sea Sparrows** on Das Island from 21 January - 3 April were new for the country list. Black-bellied Sandgrouse have been recorded before and formerly were assumed to be escapees. However these birds arrived at a time when severe weather seems to have pushed many species, including Dead Sea Sparrows, into the Gulf region from their more northwesterly ranges.

Of the exciting vagrants to occur were single **Sacred Ibis** at the Emirates Golf Club on the 5 February and Ramtha tip from mid May, a **Merlin** (subspecies *pallida*) at Abu al Abyadh on 18 February, **Little Crakes** at the Emirates Golf Club 10-19 March and at Dubai's fish farm 19-21 April, 3 **Sociable Plovers** at Ras al Khaimah for several days from 24 January, 70 **Great Knot** at Umm al Qaiwain on 30 31 March, up to 13 **Pintail Snipe** at the Emirates Golf Club from 4 January - 26 April, **Small Skylarks** at Abu al Abyadh and Das Island from mid to late February and at Al Wathba in late March. A **Little Bunting** was on Das Island on 15 June.

Other important field activity during the period included a February survey by co-ordinator Mike Jennings for the Atlas of Breeding Birds of Arabia (ABBA). The expedition was aimed at Central Oman, but additional breeding evidence was obtained of **Chukar** and surprisingly, **Cuckoo** in the Musandam area of the Emirates. We would never have guessed that Cuckoo would breed in Arabia, but such reports are mounting of their calls being heard and birds occasionally seen, high on the plateau above Wadi Bih in Ras al Khaimah. Other observers have heard them calling in March in the area on several occasions since 1988.

The Emirates are proving to be surprising new breeding grounds for other species too. **Night Herons** produced at least 4 young from 2 nests at the fish farm in August 1992, a first breeding record for the UAE and only a second for Arabia. Similarly **Reed Warbler** seems to have had considerable successes at the same site, where young were seen and heard from June onwards. The recently formed reedbeds have obviously been the catalyst for all this activity.

Long-legged Buzzard chicks were found in a very accessible nest near the Liwa Oasis in early January, suggesting the earliest egglaying date yet known in Arabia. (see **TRIBULUS Vol. 2.1**)

COLIN RICHARDSON
Bird Recorder

(Colin Richardson is the author of "The Birds of the UAE")

* * *

Flora

After a hot and dry summer, it is easy to forget the relative lushness of spring in the Emirates, but 1992 was a particularly good year for annuals and it is to be hoped that a lot of seed has been produced for future seasons. Reports from all parts of the country speak of a spring vegetation rich in colour and growth. The Group's main records for the first half of the year have come from Gary Feulner, based in Dubai, who has sent in a number of reports and plant lists, as well as some interesting photographs. Most of his trips, in the company of Abu Dhabi-based Charles Laubach, have been in the more mountainous areas with odd forays into the deserts of the south and east of Abu Dhabi Emirate. Their plant records have already extended the range of some species shown in the maps in the Recorder's "Flora of the United Arab Emirates." Examples include **Prosopis cinerea**, the "ghaf" tree, found in clumps south of Mudaysis (Quaa) on the UAE/Oman border, and east of Asab, and **Caralluma cf. arabica** in Wadi Bada', a branch of Wadi Sahanna north of Fujairah. This last species was also recorded on the summit of Jebel Ghawil, just inside Oman to the north east of Al Hair (near Buraimi). What is most intriguing is that there are reports from Gary of yellow-flowered Caralluma species on J. Ghawil too (seen in 1989 or 1990). To date, only the typical wine-red-to-black flowered specimens have been recorded in the UAE. There are over thirty species of this plant in Yemen, a major centre of diversity, with numbers decreasing rapidly as one crosses Oman to our one species in the UAE. Gary's sighting may be of **Caralluma flava** or, less likely, **C. hexagona**, but since yellow-flowered versions are definitely in a small minority, this is a recording that needs to be followed up next spring.

Peter Hellyer contributed records of a trip to Wadi Hail, near Fujairah, on February 21st and again he notes range extensions. **Dodonaea angustifolia** is a noticeable shrub at higher elevations on Jebel Hafit and the Musandam hills but Peter now records it in Fujairah too. Incidentally Gary also lists **D. angustifolia** at low altitude in Wadi Mamdook (Wadi Farfar), though he comments that it might have been introduced because

there are orchards in the immediate area. This species is also a common hedging ornamental in Dubai and Abu Dhabi cities, so it does have an extensive altitude range from near sea level to at least 1500 metres. Peter also reports the presence of **Fagonia indica, Urospermum picroides** and **Anagallis arvensis** in Wadi Hail.

Loutfy Boulos at the University of Kuwait has been working on the family Chenopodiaceae for some time, and thanks to his research, we can make now some sense of what has hitherto been some confusing species, particularly Salsola and Suaeda. The common sabkha shrub "harrm" should henceforth be referred to as **Salsola imbricata** Forsskal. What we have been referring to as **S. baryosma** should in fact be regarded as a synonym only, and not a separate species. This plant is recogniseable by its bright red germinating shoots, and by its fishy odour when the mature leafs are squashed in the hands. Other synonyms include **S. foetida, Chenopodium baryosmon** and **Caroxylon imbricatum.**

Henceforth **Suaeda vermiculata** (Forsskal) should be used as the preferred name for our old **S. fruticosa** Forsskal, a name which should now disappear from new records. This is a shrubby plant that is found close to the high tide line and which used to be common around Abu Dhabi island before most of its habitats were destroyed. it is still noticeable along parts of the coastline north and south of the island.

Suaeda aegyptiaca (Hasselq) Zohary is more cosmopolitan and is one of the first colonisers of reclaimed land along dredged Gulf coastlines. The succulent, rounded leaves are yellowish to dark green and highly polished in appearance. This species is also very common in East Coast plantations, an indication of salinity build-up in the soil. Synonyms now include **S. hortensis, S. baccata, Chenopodium aegyptiacum** and **Schanginia aegyptiaca.**

R. A. WESTERN
Plant Recorder

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Mammals

As usual, there has been a relatively small number of mammal records submitted by Group members over the first six month of 1992, but, happily, there are a few of considerable significance including one new species for the Group. The most exciting was that of an **Arabian Leopard,** (*Panthera pardus nimr*), from the Manama area, (Abba Square WA 27). The animal, a four year old adult male, was driven out of the foothills of the Hajar Mountains on February 18th, and was captured, subsequently making its way to the private collection of Defence Minister Sheikh Mohammed bin Rashid al Maktoum. Contact has been made with the Oman collection at Seeb, with a view to future breeding of this highly endangered sub-species.

The only previous record in the Group files was from the mid-nineteen eighties, in the Wadi Bih in Ras al Khaimah, so the Manama record shows an extension of known range as well as the continued survival of the species. The Ruler of Fujairah, Sheikh Hamad bin Mohammed al Sharqi, in whose mountains the leopard had been living, has re-issued instructions to local inhabitants to report sightings or evidence of leopards, and not to harass or kill them.

Another interesting cluster of records was of the **Arabian Gazelle,** (*Gazella gazella cora*). Four were seen in the Wadi Hail, (WA27), on January 1st, where others had been seen several years ago, followed by one at Sih Shueib (VB26) on January 17th, and one on the gravel plain between Masafi and Tayyiba, (WA27), on February 6th. A senior official of the Fujairah Government reported in January that there were still a substantial number of this elusive species in the remoter parts of the Hajar Mountains, still subject to a limited amount of hunting, despite Emiri instructions to the contrary. Together with the record from Sih Shueib, near the coast, these records from the mountains indicate that the species may well remain fairly widespread.

There were also several desert records from the work of the National Avian Research Centre, (see Page 37). More records would be appreciated.

From the Wadi Naqab, near Khatt, (WA 28), comes a record of between 85 and 100 **Egyptian Fruit Bats,** (*Rousettus aegyptiacus arabicus*), on April 10th, seen, and heard chirping, in a large limestone cave.

There has also been another bat record (Order Chiroptera), from Abu Dhabi's Bateen Wood, (UA25), on February 14th, although unfortunately identification was impossible. Much more work needs to be done on bat species present in the UAE, but can only be carried out with proper trapping, something which, unfortunately, Group members are not equipped to handle.

Easier to detect, or to identify, are Hedgehogs, and several reports of sightings were made, one of a road casualty near Fili, (VB 26), and another of a live specimen in the Wadi Naqab (WA 28), on March 13th, where a third was seen on April 10th, The April specimen, closely examined as it cowered on the ground, was seven to eight inches long, black in colour with lighter flecks on its back. It did not roll up into a ball when examined. The road casualty at Fili was probably of the species **Ethiopian Hedgehog,** (*Paraechinus aethiopicus dorsalis*), which appears to be fairly widespread. The Wadi Naqab sightings appear to be of the other hedgehog species known to occur, **Brandt's Hedgehog** (*Paraechinus hypomelas niger*). These are the first record for the Group of this hedgehog, which may have been overlooked as its habitat seems to be mainly in more remote areas.

Other species reported during the first half of the year included, as usual, **Cape Hare** (*Capus lepensis omanensis*), from a Long-legged Buzzard's nest south of Liwa, TA22), (see **Tribulus Vol 2.1** Page 21), Harmiya, (TA25), and Saih al Salem, (VA 25), and **Arabian Red Fox** (*Vulpes vulpes arabica*), from Ras al Aysh, (TA 25),

Jebel Barakah, (SA 25), Bahrani island near Abu Dhabi, (UA 25), and Siji, (WA 27), some of the latter species being recorded either from road casualties or from holes in use. Distribution of both species appears to cover most of the country, including, for the Fox, the urban areas.

One record of a **Mouse**, (*Mus musculus gentilulus*), came from the promontory of Dhabbiyyah, (UA 25), on February 19th, while **Black Rats**, (*Rattus rattus rattus*), were seen on Abu Dhabi island. (UA 25). Both species are clearly much more widespread than records would indicate, but a few more records would help in plotting distribution.

Although it is a feral rather than a native animal, several records were received of donkeys, from the Wadi Hail and elsewhere, the species clearly having adapted happily to a free-ranging life.

Offshore, one interesting record was of a **Hump-back Dolphin**, (*Sousa chinensis*), in the Eastern Lagoon channel of Abu Dhabi, (UA 25), on March 6th, the first record for the lagoon. Another, perhaps the same animal, was seen again a few days later. Hump-back Dolphins were also seen, as usual, off Bahrani Island, (UA 25), while a sighting of less common **Bottle-nosed Dolphins** (*Tursiops truncatus*), was made near Mina Zayed, (UA 26), a few weeks earlier. The only report of a **Dugong**, (*Dugong dugon*), was of a skeleton about four and a half feet long at Dhabbiyyah, (UA 25), on February 19th.

The Group is still awaiting formal identification of the whales caught or washed up off the Abu Dhabi coast last year.

One problem with the Group's mammal records over the years has been the fact that we have had no specialists out in the field. Fortunately, as part of its survey work into the presence of the **Houbara Bustard,** (*Chlamydotis undulata*), in the Emirate of Abu Dhabi, the National Avian Research Centre has produced a number of extremely valuable records of local mammals (and reptiles too). They include the first record for the UAE of the **Sind Serotine Bat** (*Eptesicus nasutus*), mentioned in **TRIBULUS Vol. 2.1** (Page 29). Details can be found on Page 37.

My thanks to those who contributed records and information, including Sheikh Hamad bin Mohammed al Sharqi, W. Barnes, J.N.B Brown, L. Graham, G.R. Feulner, Dr. R. Khan, J. Nowell, D. Teasdale, M. Verhage, and the N.A.R.C. team.

PETER HELLYER

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Reptiles and amphibians

With the departure of the Group's long-time Reptile Recorder, Bish Brown, in May, (yet to be replaced), there has been not only a sudden slump in records during the first part of this year, but also a lack of some-one to identify and categorise them! Nevertheless, some interesting and useful records have been obtained. From his home in Britain, Bish also supplies a report for the first three months of the year.

The National Avian Research Centre's survey of the Emirate of Abu Dhabi, in October to December last year, and February and March this year, produced a total of around 750 sightings or tracks of reptiles, of more than thirty species. Preliminary plotting of the records by the NARC showed that the **Stone Gecko**, *Bunopus tuberculatus*, is the most widely distributed, being found almost everywhere.

Of particular interest is the discovery of three species new to the Emirates list.

Acanthodactylus hassi, a rare Arabian endemic only first described as recently as 1967, was found 10 kilometres south of Ruwais, (ABBA Square SB 24) and near Bida Zayed, (TB 24). It was previously known only from the Dhahran and Sakaka areas of Saudi Arabia, and Oman's Wahiba Sands.

Pristurus minimus, another Arabian endemic, was also found in five locations, in the east of the Emirate, the most easterly being near Ajban, (UB 26), representing a range extension of around 550 kilometres NNE from its nearest known other location in Central Oman.

Another species, *Acanthodactylus opheodurus*, was found on and near Jebel Hafit, (VB 25), again a first record.

A fourth species, *Stenodactylus khobarensis*, was found in one or two locations, the most significant being north east of Umm al Zamul, (UB 22), 150 kilometres from the coast, on a patch of inland sabhka. The species was previously thought to be restricted to coastal habitats.

These, and other records, have added very substantially to knowledge of the UAE's reptilian fauna, (and have also shown that there are plenty of discoveries yet to be made). Our thanks to the NARC for permission to report on their finds.

Group members out and about after the satisfactory rains earlier in the year reported the discovery of several hundred tadpoles and a number of toads, some still mating, in the Wadi Hail, (WA 27) on February 21st. They were presumed to be the **Arabian Toad**, *Bufo arabicus*, previously recorded in the nearby Wadi Diftah and elsewhere in the Hajar Mountains, like Wadi Aboule, Oman, (VB 25) on March 15th 1991. The species has also been found in Sharjah.

All Group records of toads refer to this species. There is, however, another species of toad that has been recorded locally, *Bufo dhufarensis*, found in the Al Ain Oasis, (VB 25), in 1944, and at Digdagga, (VB 28), and Masafi, (WA 27), in 1973. This species is described in THE FAUNA and FLORA OF SAUDI ARABIA as being "exclusively nocturnal ... even during the few 'wet' periods of the year."

The diurnal activity of the Wadi Hail toads suggests they were *Bufo arabicus*, but collection of more specimens, particularly at night, might provide more evidence of the local distribution of *Bufo dhufarensis*.

Thanks to the NARC team and others supplying records.

PETER HELLYER

Bish Brown adds:

There was a strong wind blowing sand on January 1st, so I headed to the mountains at Aboule, near Mahdah (VB 25). In warmer weather I would have expected to see a number of **Blue Rock Agamids** (*Agama sinaiti*) sunning themselves on the rocks lining the track. Inside Aboule Fort, hiding in dark corners, I found three **Fan-footed Geckoes** (*Ptyodactylus hasselquistii*). The only other lizard that day was a large **Jayakar's Lacertid** (*Lacerta jayakari*), hunting for flies among the rocks close to the water in the wadi.

Despite all the construction work in the Old Fort in Abu Dhabi, reptiles still thrive. At various times there were **Yellow-bellied House Geckoes** (*Hemidactylus flaviviridis*) hiding in the shadows waiting for the odd cockroach or an insect meal. In the gardens there were **Dwarf Rock Geckoes** (*Pristurus rupestris*) on the palm trees and I caught glimpses of an **Ocellated Skink** (*Chalcides ocellatus*) scurrying through the plants. In the past the skinks have been badly affected by pesticides sprayed around the gardens.

During the ENHG field trip on January 24th, a quick walk along the beach at Jebel Barakah (SA 24) revealed a live **Arabian Gulf Sea Snake** (*Hydrophis lapemoides*) stranded on the high water line. It was returned to the water several times, but found it difficult to prevent itself being washed up again, so probably didn't survive. There was a very mottled grey **Variable Orange-tailed Agamid** (*Agama flavimaculata*) making the most of the weak sun. It gets its orange tail and blue coloration during the breeding season. There were burrows and droppings of **Spiny-tailed Agamids** (*Uromastyx microlepis*) in the area, but there were no lizards (dhubs - Arabic) to be seen.

On February 1st, during a trip across the desert with Gary Feulner from the Liwa to the eastern boundary with Oman, we found a single specimen of **Banded Toadhead** (*Phrynocephalus maculatus*). It was hiding under the broken crust of open subkha, 3 kms from the Haliba track junction with the Qua'a, the new name for Medesis (28 kms) to Umm Zamul (59 kms south) (UB 23). How this animal survived was not obvious, as the nearest vegetation was many metres away. We saw no other lizards on the trip. It was previously found on the subkha east of Ghar Lake (UB 25).

A dead **Variable (Hissing) Sand Snake** (*Psammophis schokari*) was seen on the New Airport bypass (UB 25) on February 10th. On another sandy day later on 20th February, a number of **Stone Geckoes** (*Bunopus tuberculatus*) were found hiding under man-made debris in Fossil Valley (VB 25). Two others were seen at Site 1 (VA 25) on 20th March.

In the plantation of Gabat Bainounah, 10 kms south of Decca Green mast (SB 25) there was a colony of **Spiny-tailed Agamid**. The area has been somewhat isolated for many years and some of the specimens were rather larger than normally seen. The vegetation inside the fence was lush and ideal for a vegetarian like this lizard.

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Production of TRIBULUS, and much of the other activity of the Emirates Natural History Group, like our sponsorship of the Emirates Bird Report, would not be possible without the generous support of the Group's Corporate members. Indeed, the Group Committee would not have been able even to consider converting our duplicated Bulletin into a printed format without such support.

The Editorial Board and the Group Committee acknowledge, with thanks, the sponsorship of the following Companies and bodies, whose support has been invaluable.

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تريبـــلوس

جمعية الإمـــارات للتاريخ الطبيعي

العـــدد: (٢ر٢) اكتوبـر ١٩٩٢م