

TRIBULUS

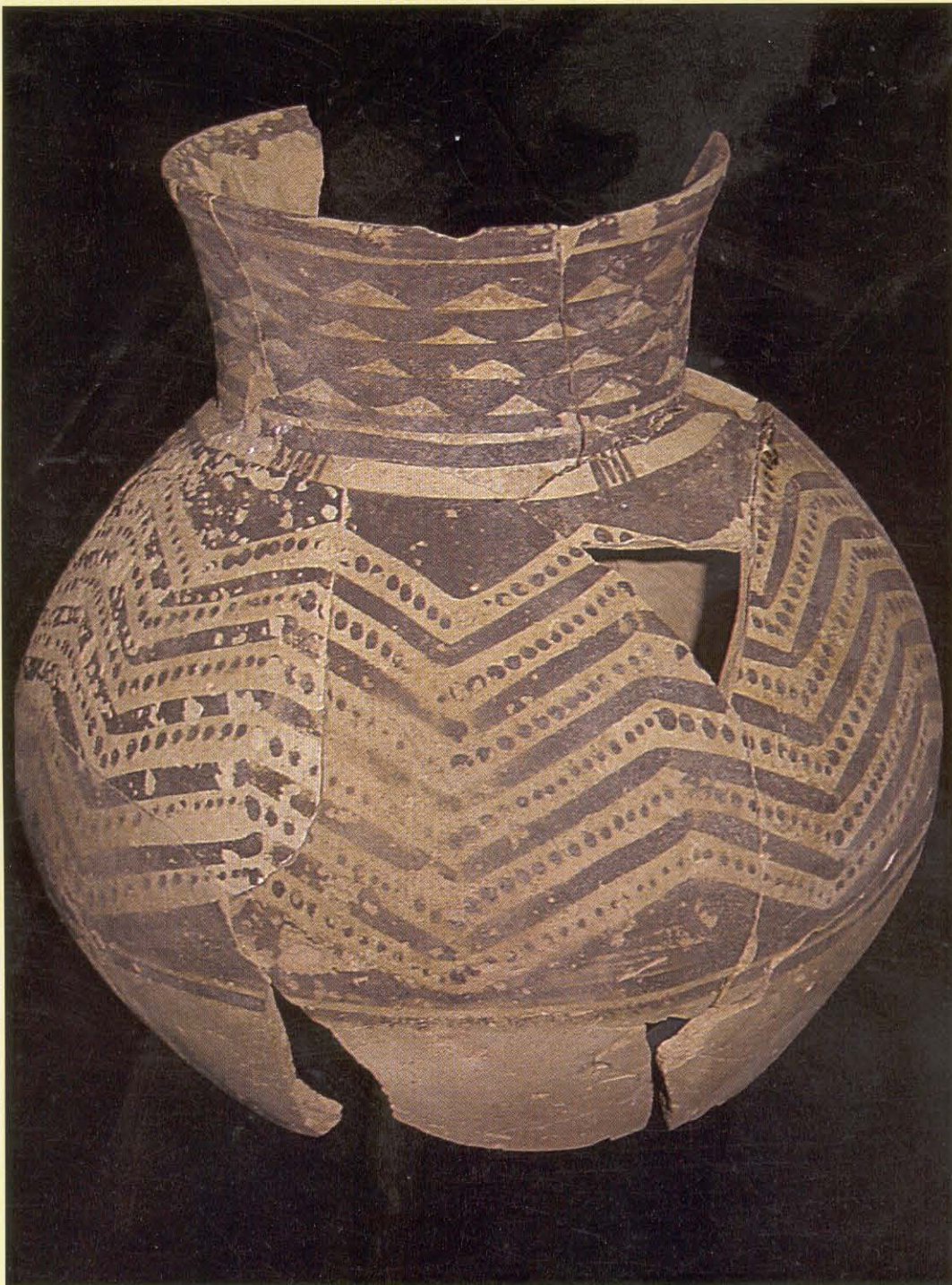


ENH G
ALAIN
LIBRARY

Journal of the Emirates Natural History Group

Vol. 14.1

Spring/Summer 2004



TRIBULUS

NOTES FOR CONTRIBUTORS

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

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

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

Correspondence and enquiries should be sent to:

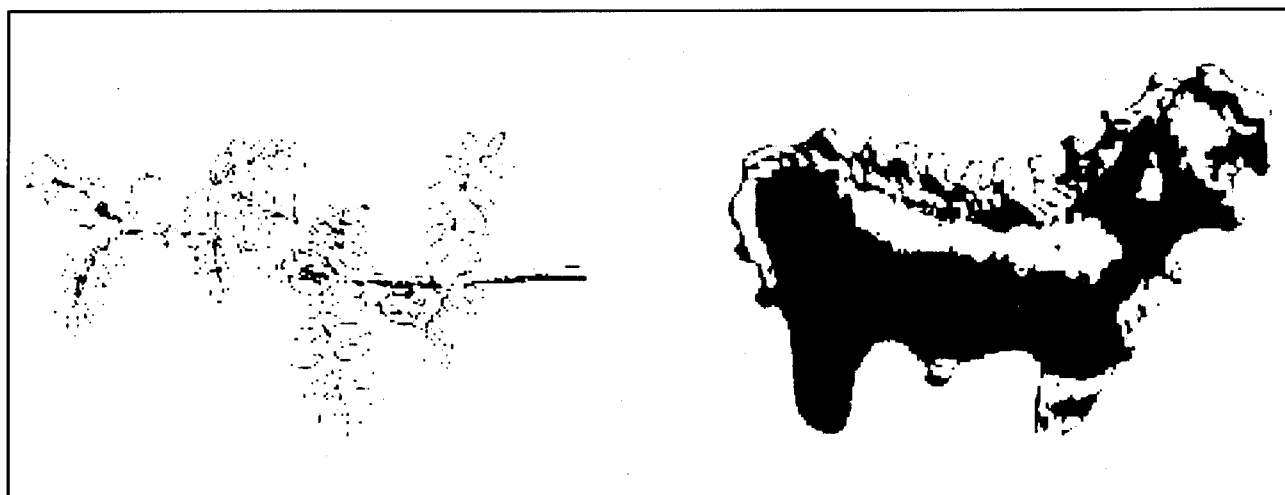
The Editor,
TRIBULUS,
P.O. Box 45553, Abu Dhabi - U.A.E.
or by e-mail to: hellyer@emirates.net.ae

Editorial Board:

H.E. Sheikh Nahayan bin Mubarak Al Nahayan, Patron,
Peter Hellyer, Managing Editor,
Simon Aspinall, Deputy Editor,
Dr. Michael Gillett
Professor Drew Gardner
Dr. Mark Beech

Advisory Panel:

Professor Jens Eriksen (Life Sciences)
Professor Graham Evans (Earth Sciences)
Professor Dan Potts (Archaeology)
Michael Gallagher (Fauna)
Dr. Geoffrey R.D. King (Archaeology)



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

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

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

International Standard Serial Number (ISSN): 1019 - 6919.

TRIBULUS

Vol. 14.1 Spring/Summer 2004

Contents

Editorial.....	2
Bayt al-Muraykhî: a later Islamic pearl merchant's house at Dalmâ, Abu Dhabi Emirate.....	3
by Geoffrey King	
World War Two plane crashes in the UAE.....	9
by Peter Hellyer and Laurence Garey	
The brain of the camel, <i>Camelus dromedarius</i> : a study of a possible pain-inhibiting pathway.....	12
by Laurence Garey and Eric Mensah-Brown	
Tail Signalling in the Semaphore Gecko <i>Pristurus celerrimus</i>	18
by Gary R. Feulner	
Notes.....	22
Obituary - Peter Whybrow.....	24
by Peter Hellyer	
Reviews.....	25
Publications and Research.....	27

Cover Illustrations:

Front: An early 5th Millennium BC pot from Site MR-11, Marawah

Photograph by Mark Beech / ADIAS

Back: A dhub *Uromastix aegyptia microlepis* on Marawah (see page 23)

Photograph by Mark Beech

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

TRIBULUS is published for circulation to members of the Group, and is also available on subscription on subscription inside and outside the UAE. Subscription in the UAE & the Arabian Gulf states: Dh 50 per year. Overseas details on request.

The Group is a non-governmental member of IUCN, the World Conservation Union.

**Published by the Emirates Natural History Group,
P.O. Box 45553, Abu Dhabi, United Arab Emirates**

Designed by Wafa M. Morda'a & Genedine dela Fuente

Printed by Dar Al Fajr Press, Printing, Publishing and Advertising, P.O. Box 505, Abu Dhabi, UAE

EDITORIAL

Over the course of the last few months, several of the members of the Editorial Board of *Tribulus* have been engaged in planning or providing advice on a number of small displays and exhibitions being planned in Abu Dhabi. These exhibitions, being mounted by a variety of government-related organisations, will include material that depicts aspects of the country's palaeontological, archaeological, historical and cultural heritage, although, sadly, the country's flora and fauna will not be included, except insofar as it relates to other aspects.

While we have been pleased to be associated with these planned displays – and are satisfied that each of them, in its own way, will be of value – we regret to note that, as yet, there is little sign that Abu Dhabi, the UAE capital city, is much nearer to having its own large-scale National Museum. Each of the other six emirates have museums, some more than one, as does Abu Dhabi Emirate's Eastern Region capital of Al Ain. The capital, meanwhile, makes do with the Petroleum Exhibition (itself shortly to receive a major update and upgrade – and about time too!) and very little else.

The need for a National Museum in Abu Dhabi is widely recognised in Government – and has been for many years. Such an institution, in our view, should not only include displays of palaeontology, geology, archaeology, history and the whole range of natural history. It should also be conceived in such a way that it becomes – as it could be – a major centre for scientific research into this aspect of the UAE, drawing on the many and varied resources that are available, including, of course, those of Abu Dhabi's Environmental Research and Wildlife Development Agency, ERWDA, the Emirates University, Zayed University, the Petroleum Institute, the Abu Dhabi Islands Archaeological Survey, ADIAS, and others.

We welcome the planning of the small displays – but look forward to seeing this issue being addressed with some urgency.

To the contents of this issue.

As readers will note, *Tribulus* this time ventures into previously untouched territory in terms of its content, with

two papers that are some way removed from the conventional range.

One is a short paper by Peter Hellyer and Laurence Garey on World War Two plane crashes in the Emirates – a topic that, as far as we are aware, has never been addressed elsewhere. With the end of that war now nearly sixty years ago, the subject does, we believe, meet our objective of including UAE history amongst our range of topics. The impact of the War on the UAE has received little attention and this paper represents a first dip of the toe in the water. Somewhat surprisingly, some of the crashes appear to be recorded nowhere else except the British archives of the period, not even in the archives of the armed forces of the relevant countries, so we are breaking new ground.

The second paper, by Laurence Garey and Eric Mensah-Brown, both of the Emirates University Department of Anatomy, reports on a study of an aspect of the brain of the camel – an important piece of research into one of the most important animals to be found in the Emirates. The results of the research apply well beyond the borders of the UAE, of course, and we hope that they will be noted in an area of science which *Tribulus* does not normally reach. We would welcome more papers on such topics, provided that the research is carried out in the Emirates.

Other papers fit better with convention. Geoffrey King reports on what is the best-preserved Late Islamic domestic building anywhere on the coast and islands of Abu Dhabi – the Bayt al -Muraykhî on Dalma, now restored and the home of a small museum.

Gary Feulner, another frequent contributor, on a wide range of topics, turns this time to signalling by one of the UAE's semaphore geckoes, an aspect of behaviour that has never been described in detail before for this species.

An Obituary of Peter Whybrow, a former contributor, profiles the work of one of the founders of UAE palaeontology, while the Reviews and Publications section rounds up the issue with a couple of reviews of recently-published books and a lengthy record of recent papers.

Corporate Members of the ENHG

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

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

Bayt al-Muraykhî: a later Islamic pearl merchant's house at Dalmâ, Abu Dhabi Emirate

by Geoffrey King

Architectural drawings by David Connolly

Introduction

The Bayt al-Muraykhî is a pearl merchant's house on the western side of the town centre of Dalmâ, at the southern tip of the island of the same name (*Plate 1*). Dalmâ island is located 40 kms off the coast of the United Arab Emirates, and is the most populous of the islands of the Western Region of Abu Dhabi Emirate. In its design, the Bayt al-Muraykhî is unique among the extant traditional buildings of the Gulf, combining secure ground-floor rooms with thick walls and an elegant upper floor room where business was conducted by a local pearl trader in the 20th Century. The house was built by Muhammad b. Jâsim al-Muraykhî who also founded a mosque which bears his name and which stands just to the east of the Bayt al-Muraykhî pearl-house (1).

When first recorded by the Abu Dhabi Islands Archaeological Survey (ADIAS) (2), the Bayt al-Muraykhî stood in a garden on a traffic island. In 1992, it was impossible to photograph the house from a distance as it was surrounded by tall trees. It stood close to the old shoreline, although this shoreline had been completely masked by landfill as the island had been enlarged in modern times. The lower rooms of the house had served as a local natural history museum until the late 1980s but this museum had fallen into disuse by 1992. The building

had seriously deteriorated when ADIAS first visited it and the floor in the eastern part of the upper room was collapsing.

Following the initial recording of the Bayt al-Muraykhî and the neighbouring mosques in 1992, ADIAS drew the attention of the Abu Dhabi authorities to their importance and Dr ʿAbd al-Sattâr ʿAzzawî of Sharjah Directorate of Antiquities was commissioned by the Public Works Department of Abu Dhabi Emirate to carry out restorations on behalf of the local *baladîya*, consolidating and stabilising the buildings and restoring them with sensitivity and accuracy (3). It is thanks to the prompt action of the Abu Dhabi authorities and the work of Dr ʿAzzawî and his team that Dalmâ's traditional Islamic buildings now survive. Since the completion of the restorations, the Bayt al-Muraykhî has become a local museum once more, the display including Islamic pottery excavated during the restoration of the Bayt al-Muraykhî and the al-Muraykhî mosque (4).

With its location in the midst of the southern Gulf pearl beds (5), Dalmâ was an important centre of the pearl trade in the early 20th Century, as it probably had been for a long period before that, for the town has the best sweet water wells in the whole region and a good anchorage. Indeed, artesian water supplies were so

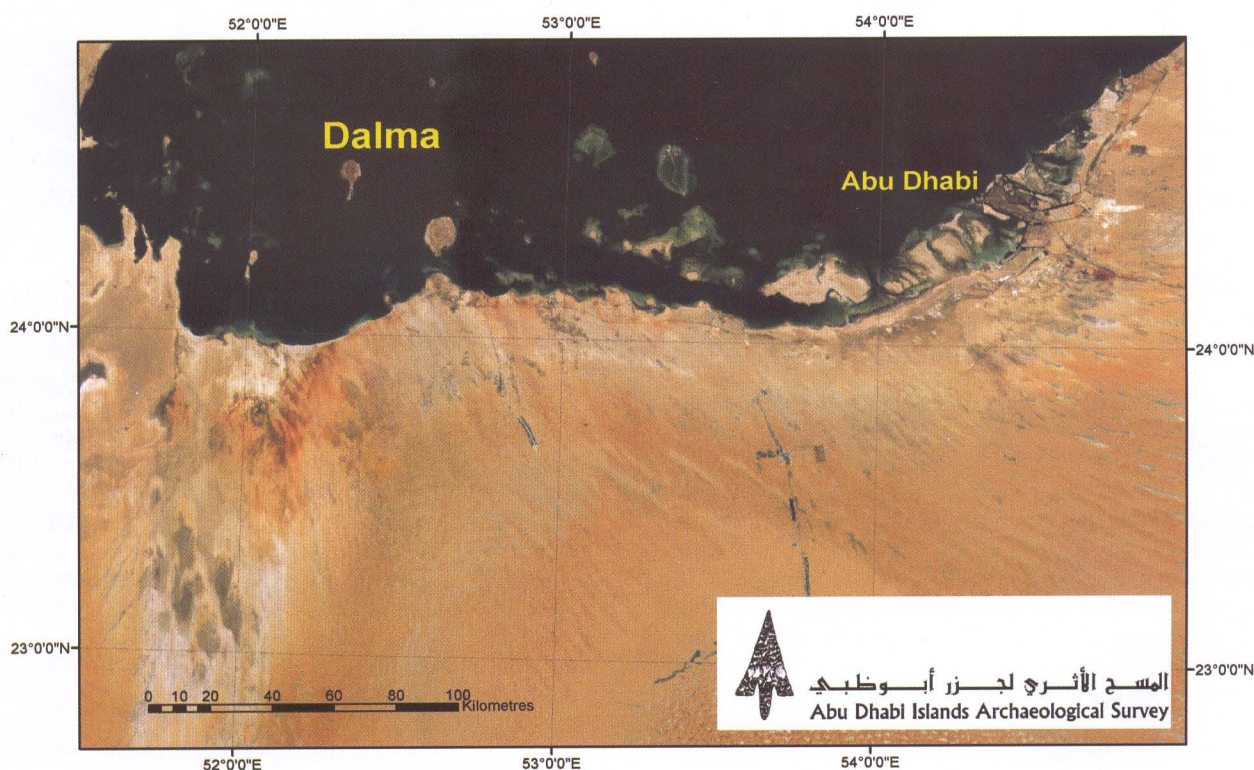


Plate 1: Map, Western Region, Abu Dhabi

reliable that Dalmâ was in a position to export water to other places along the coast, including the island of Abu Dhabi. According to J.G. Lorimer writing in 1908, the Abu Dhabi government derived a revenue of 5000 Maria Theresa silver dollars per annum from taxing the Dalmâ pearl trade (6). Given this taxation revenue, the income to the merchants must have been high in relative terms and local anecdotal evidence repeatedly emphasizes that pearling was the mainstay of the economy in the pre-oil period.

Diving at the pearl fisheries took place in summer but in the colder weather of winter, people would wade out to the shallow beds off-shore to collect pearl-oysters. At the end of the summer pearling season, there would be a temporary market at Dalmâ at which accounts would be settled between the merchants and the boats' crews. So many Indian traders would come to the Dalmâ market that it was nicknamed "Bombay" by the local people (7). It is in this context of a prosperous community engaged in the Abu Dhabi pearl trade early in the 20th Century that the elegant Bayt al-Muraykhî pearl house must be seen,

Islamic buildings as a group, since they are all similar in style to each other. The conclusion that these buildings were constructed in the early decades of the 20th Century is supported by information given to ADIAS by the people of Dalmâ.

The limited excavations that were made while the foundations of the Dalmâ buildings were being stabilised during the restorations revealed the wall-traces of earlier unrelated buildings to the north and east of Bayt al-Muraykhî and at the al-Muraykhî mosque. Judging by the unstratified ceramics recovered, the underlying structures were later Islamic, though pre-dating the house. This pottery, which today is on display in the Bayt al-Muraykhî and at the al-Muraykhî mosque museums, has yet to be studied (9).

The design of the building

a) The exterior

The Bayt al-Muraykhî is constructed of beach stone which was revealed during the restorations when the old

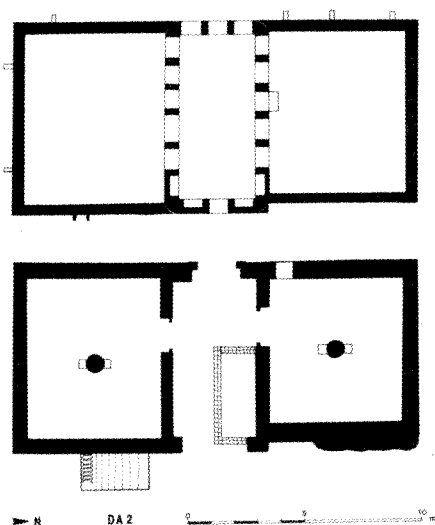


Plate 2: Ground-plan, Bayt al-Muraykhî, Dalmâ, drawn by David Connolly for ADIAS.

combining a lower storey vault for keeping pearls safe and a fine chamber above in which business would be conducted.

The date of Bayt al-Muraykhî

According to the local people, the Bayt al-Muraykhî and the nearby mosques were constructed by al-Huwâla Arab craftsmen from the Iranian shore and islands on the opposite side of the Gulf. The house and the neighbouring mosques belong to the same Islamic building tradition of the Gulf and they appear to all be of the same general date. The only one of the four traditional-style Islamic buildings at Dalmâ to have a foundation inscription is the al-Dawsarî mosque, which dates it to Shawwâl, 1349/March, 1931 (8) while a graffito inscription that was incised in plaster in the portico of the Sa'id b. 'Alî al-Muhammadî mosque has the date of 1377/1946. In the absence of other firm dating information, these inscriptions in the al-Dawsarî and al-Muhammadî mosques must be taken as providing a general *terminus ante quem* for the Dalmâ traditional

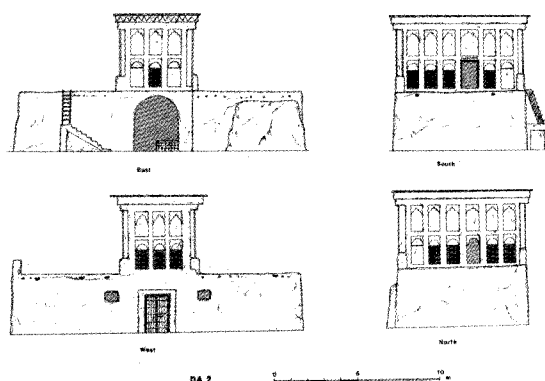


Plate 3: Elevation, Bayt al-Muraykhî, Dalmâ, drawn by David Connolly for ADIAS

covering of plaster was stripped off and replaced. There were terraces on either side of the upper room, forming the roofing of the ground-floor chambers below. The only access to this upper storey in 1992 was a wooden ladder fixed above a platform on the east side of the building, leading to the south terrace. It has now (2004) been replaced by a built staircase by which one ascends to the upper floor.

The secure ground-floor rooms of Bayt al-Muraykhî lack windows. There is a single entrance on the east side of the building leading into a central passage that gives access to the secure ground-floor rooms on either side (Plates 2,3). There is another external doorway at the west end of the passage. The old eastern door is now displayed in the Bayt al-Muraykhî museum but it was still in situ in 1992 (Plate 8).

The ground-floor measures externally 17.55 m. x 8.14 m. The south room internally measures 5.87 m. x 6.75 m. and the north room measures 6.02 m. x 6.28 m. The central east-west passage between them is 3.26 m. in width.

Close to the Bayt al-Muraykhî to the north is a date

press, a *madbasa* (Plate 5) which was excavated during the restorations but there was no trace of it visible on the surface in 1992 when the Bayt al-Muraykhî was first recorded. A modern superstructure was subsequently built over the *madbasa* to protect it.

The upper storey of Bayt al-Muraykhî includes two terraces, one to the north and one to the south of the central room built over the ground-floor central passage (Plates 6,7). The terraces form the roofing of the ground floor rooms.

The southern terrace measures 6.75 m. x 7.66 m. and the northern terrace measures 6.52 m. x 7.85 m. These terraces are surrounded by a low wall forming a balustrade, 40 cm. wide. Both terraces were pitched to the west in 1992, so that rainwater could flow off through four square wooden channels projecting ca 30 cm. from the building on that side. At the NW corner of the northern roof terrace was a vertical post, 36 cm. x 39 cm. and just under 1 m. high, of no obvious purpose.

Between the terraces, the upper floor chamber is set on an east-west axis, directly above the ground floor passage. It measures 7.02 m. x 3.28 m. and is built in the usual pier and panel system of construction found throughout the Gulf region. It has windows, a series of *bâd girr* (mid-wall wind catchers) (10) and blind arches arranged in two registers, in the manner customary in traditional buildings in the region. The chamber was made as cool as possible in the harsh summer environment of the Gulf by the numerous windows and the clustering of *bâd girr* at the east end. In cooler or windy weather, the wooden window shutters could be closed and the ventilator slots of the *bâd girr* could be shut off.

At the SW and SE corners of the upper storey

room are two curved quarter pilasters on squared plinths. There are corresponding pilasters at the NE and NW corners.

The single entrance leading into the upper chamber from the south terrace is offset to the east, rather than centrally located. It was preceded in 1992 by a 10 cm. high doorstep of beach rock, 40 cm. in width. The entrance is vaulted by a round arch, matching the narrower rounded blind arches over the windows of the upper room.

The southern door flaps had vanished by 1992 but the door-frame remained, measuring 1.90 m. x 1.20 m. There were still some hinges in place and rust stains where other hinges had vanished. The wooden lintel of the frame had a damaged Qur'anic inscription of which the following was legible: "*Sayafi-ka-hum.....wa.....al-sami' al-'alîm*" (11) : "But [Allâh] will suffice you against them, and [He] is the All-Hearing, the All-Knowing".

In the lower register of the south wall there are three identical rectangular windows at the western end. They are each surmounted by a blind rounded arch set back 2-3 cm. within a rectangular panel. These windows are subdivided by horizontal wooden cross pieces and there are eight vertical iron bars in each window, spaced 6 cm. apart. East of the entrance is another single window, identical to the three to the west while in the final panel to the east is a 'mid-wall wind catcher, a *bâd girr*. The windows once had wooden shutters but all were missing in 1992: today, they have been replaced.

In the upper register is a rank of rectangular recesses containing blind broken arches with lobes. The arches are again set back 2-3 cm. from their rectangular frames. The crowns of the arches are alternately either ogees or rounded. The blind arch with an ogee over the



Plate 4: General view, Bayt al-Muraykhî, Dalmâ, from the west.



Plate 5: *Madbasa*, Bayt al-Muraykhî.

entrance is wider than the other blind arches.

The wall is terminated by eaves which are set forward slightly from the plane of the rest of the wall on all four sides of the building. They are plain at this uppermost level except at the east end, where there is a dog's tooth relief motif.

The exterior surface of the north side of the chamber follows the same design as the south wall, with the corners again marked by pilasters on rectangular bases. The lower register on the north side consists of rectangular windows measuring 1.21 m. x 0.76 m., all set back 7 cm. from the surrounding frames. They were originally closed by metal grilles and have round-headed blind arches in the register above. The design of the north wall differs from the south wall only in the location of the doorway leading to the north terrace, which is set centrally, in contrast to the south door which, as we have seen, is off-set from the centre. The north entrance is of the same width as the flanking windows, in contrast to the main door on the south side which is wider.

The exterior faces of the east and west walls of the upper storey are treated in a similar manner to the south and north walls. At the east end there is a mid-wall *bâd girr* ventilator on either side of a central window while at the west end of the building, there are three windows in the lower register and no *bâd girr*. The upper register at the west end consists of blind broken arches crowned with ogees flanking a broken lobed arch over the central window.

b) The interior

The interior articulation of the walls corresponds to the exterior with respect to the treatment of the windows, the *bâd girr* mid-wall ventilators and the disposition of the blind panels in the upper register (Plate 6). The lower windows and the *bâd girr* are set back from the plane of the wall by 1-1.5 cm. on the interior.

The uppermost part of the wall below the cavetto is terminated by a dog's tooth moulding in relief

in the same manner as on the exterior of the east wall surface. This dog-tooth decoration below the cavetto runs around all of the uppermost part of the room. A triangular panel is cut off each of the four corners of the ceiling above the cavetto. The triangular panels are decorated although nowhere was the motif clear in 1992 and in some cases, the decoration had been virtually obliterated by renewal of the plaster. Similar decorative plaster triangles are found in the al-Muraykhî mosque and in the Bayt Jâsim b. 'Abd al-Wahhâb at Dârin on the Eastern Saudi island of Târût (12).

At the east end of the interior are three ranks of recesses. In the lower rank in the centre is the rectangular window arrangement noted already in the account of the exterior, each surmounted by a round lunette. To either side are the mid-wall wind-catchers, each also surmounted by blind, round-headed arches. On the next level, above the blind arches, are rectangular blind panels. That in the centre has a blind broken lobed arch and there is a blind arch with an ogee on either side. The design of the interior surface of the west wall is identical to that of the east wall, except that the mid-wall *bâd girr* are replaced by windows, as we have seen already.

Discussion

The Bayt al-Muraykhî pearl house is the only commercial structure of this character to have been recorded anywhere in the Gulf. It combines the need for security for valuable merchandise - the lower storey has

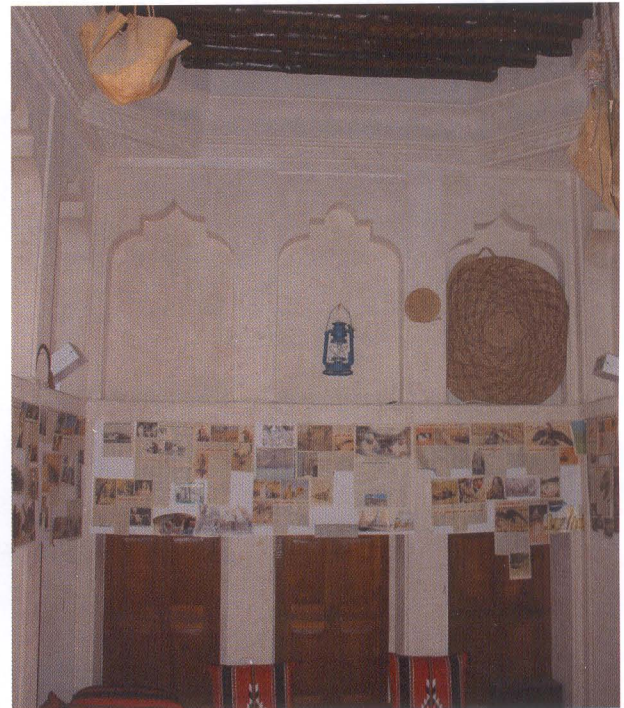


Plate 6: Bayt al-Muraykhî, Dalmâ. Interior of the upper storey room

the solidity of a bank vault - with the provision of a fine room on the upper floor where the pearl-merchant, Muhammad b. Jâsim al-Muraykhî, could conduct business in as cool an environment as the pre-modern Gulf could provide.

The airy upper room with its open windows and its *bâd girr* ventilators is designed for a pre-electricity, pre-air conditioning age, to take advantage of the slightest

breeze in the oppressive humidity and heat of a Gulf summer. Such cooling devices were essential given the nature of the climate and these systems are probably of great antiquity.

While parallels for the combination of strong rooms and the upper floor chamber do not seem to survive elsewhere, the upper floor chamber in itself has numerous extant parallels. In essence this is the standard pavilion-like chamber ubiquitous in the Gulf in the pre-modern period. The pier and panel construction method lends itself to the insertion of the *bâd girr* mid-wall wind-catchers and windows to admit the slightest breeze, while simultaneously excluding sunlight, essential in the oppressive humidity and heat of a Gulf summer.

Parallels for the upper chamber in terms of general appearance, design and ventilation systems and in the treatment of decoration are found in Qatar, Bahrain, Târût and al-Jubayl, the latter both in Eastern Saudi Arabia (13). A house at Wakra in Qatar is close in design, in decoration, and in its *bâd girs* to the Bayt al-Muraykhî (14). A free-standing chamber in the Bayt ʿAbd al-Wahhâb at Darîn on Tarût island off the Saudi coast is also very similar (15). The Bayt al-Muʿayyad house at Samahîj, Bahrain (now lost) also comprised a series of individual chambers of this type, in effect modules that together comprised a complex courtyard house.

The broken lobed arches in Bayt al-Muraykhî correspond to those in the Wakra house and in the Bayt ʿAbd al-Wahhâb in Tarût. They are also similar to those in the old ʿUtayba mosque in Abu Dhabi city, the predecessor of the present Shaykh Khalîfa b. Zayed

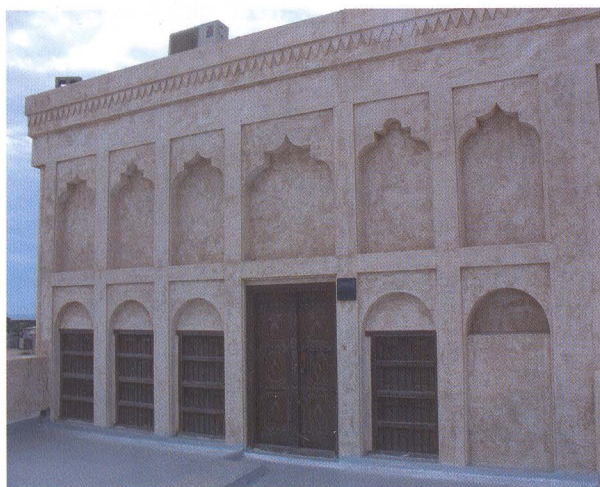


Plate 7: Bayt al-Muraykhî, Dalmâ. South side of the upper storey

mosque (16), and such arches were clearly a standard form throughout the Gulf region in the 19th and early 20th C. The blind plaster grilles and blind panels and arches in the Bayt al-Muraykhî are also ubiquitous throughout the area, as are the rectangular windows with pierced grilles.

As to the roof construction in the Bayt al-Muraykhî

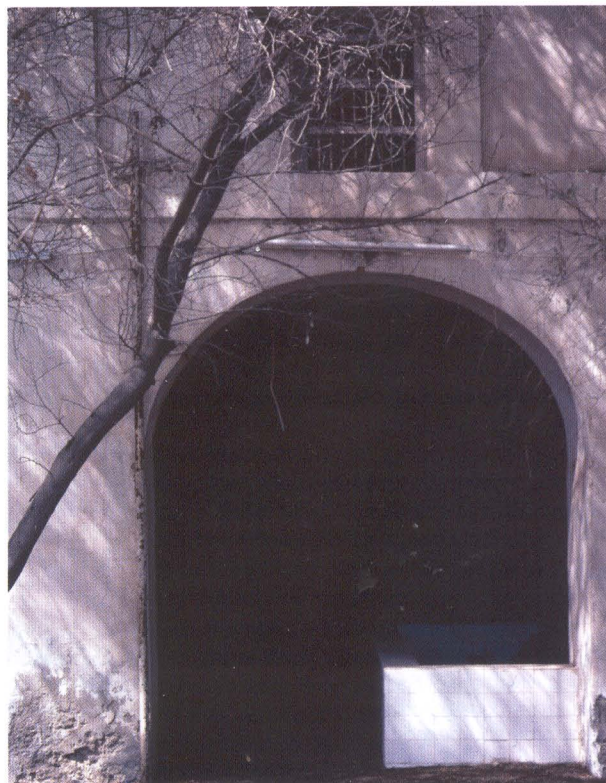


Plate 8: The eastern door to Bayt al-Muraykhî in 1992

which is now entirely restored, it is of a standard design and is of a width encountered everywhere throughout the Gulf and the rest of the Arabian littoral. The determining factor is the average length of the imported mangrove poles (ca 3 m.) which were used in roofing (17). Allowing 20-30 cm. for the ends of the poles to rest on the walls of the given structure, the use of these poles tends to give rooms and mosque aisles a uniform width of about 2.70 m. - 2.80 m. throughout the Arabian coastal area wherever mangrove is used for roof construction.

Bayt al-Muraykhî and the neighbouring mosques in Dalmâ are among the few surviving examples of the traditional Islamic architecture of the Gulf region, lost elsewhere in Abu Dhabi Emirate. The house, by the accident of its survival, is a unique instance in the UAE of a building specifically designed for dealing in pearls, a trade conducted in the relative comfort of the upper chamber. Below, the heavy walls of the windowless lower rooms protected the pearls, the valuable stock that was the basis of the past prosperity of Dalmâ and Abu Dhabi Emirate.

Notes

1. Apart from the al-Muraykhî mosque, there are two other old mosques nearby in Dalmâ, the al-Muhannadî mosque and the al-Dawsarî mosque. These mosques are the subject of a forthcoming study in *Tribulus* by the present author.

2. G.R.D. King, Abu Dhabi Islands Archaeological Survey (ADIAS 1): An Archaeological Survey of Sir Banî Yâs, Dalmâ and Marawah, (21st March to 21st April, 1992 (Trident Press, London, 1998), p. 52. The Bayt al-Muraykhî pearl house was given the site coding of DA 2 during the ADIAS survey of 1992. The recording of the measurements and initial description of Bayt al-Muraykhî were carried out by D. Connolly and F. Baker, members of the 1992 ADIAS team. Their description of the building was revised and refined by Dr Cristina Tonghini and the present writer in 1993 and this forms the basis of the present paper.

3. 'Abd al-Sattâr 'Azzawî, *Murshid al-mubânî al-turâthîya fi jazîra Dalmâ*, Abu Dhabi (1418/1996).

4. Mr Fâtiḥ Mohammed Abdullah, who worked on the restoration with Dr 'Azzawî, has been responsible for organizing the museums and curating them since the restorations were completed. He is the present custodian of the museum displays in the Bayt al-Muraykhî pearl house and al-Muraykhî mosque. Visitors requiring access can contact him on mobile (050) 5164389 – Fax: (02) 8781110 – email: fathy516@hotmail.com.

5. The National Atlas of the United Arab Emirates, United Arab Emirates University, Al Ain (1993), pl. 22.

6. J.G. Lorimer, Gazetteer of the 'Persian Gulf', Calcutta (1908), IIA, p. 409.

7. ADIAS team members were told this by residents of Dalmâ during the 1992 season of fieldwork.

8. This inscription incised in plaster is now in the Bayt al-Muraykhî museum.

9. Among the later Islamic pottery and Far Eastern imports displayed in the Dalmâ museums are alkaline blue glazed sherds which are of Sasanian/early Islamic date. Their presence should be considered in terms of the fact that sherds of the same type and period have been found along with later Islamic sherds to the NE of the al-Muraykhî mosque, in an Islamic graveyard (Site DA 7).

10. A distinction must be drawn between the wind-tower type of *bâd gîrr* which is encountered in the Gulf countries and in southern Iran and the mid-wall ventilator type seen in the Bayt al-Muraykhî and elsewhere in the region (see G. King, *The Traditional Architecture of Saudi Arabia*, I.B.Tauris, London (1998), p. 206-7). The term *bâd gîrr* is used to describe both the wind-tower and the mid-wall ventilator types.

11. Qur'ân II, sûrat al-Baqara, 137.

12. G.R.D. King, "Islamic Architecture in Eastern Arabia", *Proceedings of the 10th Seminar for Arabian Studies* 8 (1978), p. 28, Pl. 11.

13. G.R.D. King, "Bayt al-Mu'ayyad. A late nineteenth-century house of al-Bahrayn", *Arabian Studies* IV (1978), pp. 27-45.

14. G. King, *The Traditional Architecture of Saudi Arabia*, pp. 200-207; Muhammad J. al-Khulayfî, *Al-'Imârat al-Taqlîdiyya fi Qatar*, Doha (1990), p. 129, Pl. 52.

15. G.R.D. King, "Islamic Architecture in Eastern Arabia", *Proceedings of the 10th Seminar for Arabian Studies* 8 (1978), pp. 15-28.

16. P. Hellyer, *From Under Desert Sands*, ADCO's 40 years of Oil Exports 1963-2003, ADCO, Abu Dhabi (2003), p. 17.

17. The Gulf mangrove is insufficiently straight to be used and poles are imported from beyond Arabia.

Dr. Geoffrey R.D. King
Department of Art and Archaeology
School of Oriental and African Studies,
University of London
Thornhaugh Street,
LONDON, WC1H 0XG
e-mail: gk3@soas.ac.uk



Plate 9: Bayt al-Muraykhî, Dalmâ. Exterior of the upper storey room: view from the NE.

World War Two plane crashes in the UAE

by Peter Hellyer and Laurence Garey

Introduction

The effect of World War Two on the United Arab Emirates – then the Trucial States – has received little attention. One key source of information is the archives of the British Residency in the Gulf. Other sources, largely untapped, include the military records of Britain and the USA, both of whom had personnel stationed in Sharjah.

The War coincided with a period of severe drought, and the rising cost of foodstuffs caused by wartime restrictions had a major impact on the country's residents, while the pearling trade, already in decline, was also severely affected.

During recent preliminary research on some of these issues, data has been collected relating to air crashes in the Emirates during and immediately after the War. This is presented here for the record, and in the hope that it may stimulate further research.

B.O.A.C. HP42 'Hannibal' – March 1940

Considerable mystery surrounds an early wartime crash, which may have been in what was to become the UAE. Whilst on a flight with a crew of four and four passengers from Jiwani (now in Pakistan) to Sharjah on 1st March 1940, a Handley Page HP42 four-engined biplane, belonging to the newly-formed British Overseas Airways Corporation, BOAC, (the new name adopted by the former Imperial Airways the previous year), registered G-AAGX and named Hannibal, disappeared. No crash site, wreckage or bodies were ever identified, despite a large-scale search by the Royal Air Force (RAF) and Royal Navy. Some of the details are as follows.

Hannibal was flying flight CW197 ("Calcutta Westbound"). It left Karachi on 1st March 1940 at about 0600 local time and flew to Jiwani, then took off again for Sharjah. It reported by radio over Jask (on the Iranian coast) at about midday local time, and estimated its arrival at Sharjah at about 1330 local time.

The British Political Officer for the Trucial Coast, based in Sharjah, reported that: "The last radio message received from her was when she was about 40 miles out to sea, and the only distinguishable letters were ... 'OS' ... This, however, was not considered by B.O.A.C. staff to have been a distress signal. A search followed in which RAF planes from Karachi and Basra co-operated with sloops, and which continued for nearly a week. No trace of wreckage has been found or has since (by 21st March) been reported by any of the sheikhs." (1) He also reported "On March 4th, I flew to Kalba by RAF plane in connection with the missing landplane, and went from there to Fujairah for the same purpose." (2). (Both locations are on the UAE East Coast).

At the time of the radio message, it was unclear whether Hannibal was still over the sea or already flying over the mountains between the East Coast and Sharjah. Conflicting records, from official and unofficial sources, add to the mystery. Where did Hannibal crash? In the sea off Dibba, or even between Sharjah and the mountains to the East? When did it crash? Retrospective calculations made by aviation historians suggest that the actual crash

date was 2nd March 1940, and it has been speculated that it could have been as late as the 4th. However, the Political Officer's report clearly states that it went missing on 1st March.

Hannibal was carrying high-ranking government and military chiefs, and theories, apart from a simple crash – perhaps offshore – range from sabotage to hijacking. The flight's original passengers were off-loaded to another flight, and the accident passengers substituted at Karachi, which is strange. There is even the suggestion that a load of gold was aboard. Amazingly, this incident is still classified as secret in the UK, and various amateur aviation archaeologists claim to have received warnings not to investigate too deeply. An interesting website on this disappearance can be found at: http://rrhobby.ca/flight_cw197.htm

Curiously, the published British monthly records from the Gulf for the period make no further mention of the incident after the initial reports in March.

RAF crash near Dhadnah, 1943

In mid-February 1943 (the precise date is not clear), a Wellington bomber of the Royal Air Force en route from Sharjah to Gwadar, on Pakistan's Makran coast, made a forced landing on the coast of Fujairah. The initial report said the crash had been near 'Bidyah' (Bidiya), although subsequently it became clear that the incident took place near Dhadnah, further north along the coast.

One of the crew was killed in the landing, and it was initially reported that "Local Arabs are reported to have been friendly and reasonably helpful." (3)

A subsequent report provided further information, adding that "Arabs from the neighbouring village of Dhadnah were soon on the scene and at once engaged themselves in the quiet pilfering of articles of clothing and such other contents of burst suitcases as were scattered in the wake of the wrecked aircraft."

It went on to quote a Colonel de Watteville of the Royal Engineers, a passenger on the aircraft, as saying in regard to the 'pilfering' that "the Arabs, though not hostile, were quite uncontrollable."

It took three days for the survivors to be evacuated by sea. Prior to that, the Sheikh of Fujairah, Sheikh Mohammed bin Hamad al-Sharqi, "arrived at Dhadnah and arranged for a guard to be placed on the machine until the salvage of all valuable equipment had been completed," this presumably also being taken off by sea.

The British records noted that "The Sheikh will be suitably rewarded for his assistance," (4), although there is no subsequent reference in the archives (up to the end of 1946, at least), to the handing over of any reward.

The precise identity of this aircraft remains a mystery. No record other than that cited above has yet been traced, although it seems likely that this Wellington was one of the later, more powerful versions (e.g. the Mark X) that were widely used by the RAF Coastal Command in the Middle East in the War.

Apparently the crash site was nearer to Rul Dhadnah than to Dhadnah village itself, and the dead crew member may have been buried at the site (5). With the help of the local authorities, investigations are now under way to see whether the crash site, and the grave

can be identified. If the grave does, indeed, exist and can be located, it would be the first known Commonwealth War Grave on record in the United Arab Emirates.

Anti-Locust Planes – Sir Bani Yas, 1944

On 22nd April 1944, two 'Anson' aircraft belonging to the Anti-Locust Mission crash-landed at 'Yas Island' (Sir Bani Yas), en route from Sharjah to Bahrain. There was an emergency airstrip and fuel tank on Sir Bani Yas, established between the World Wars to serve the Britain to India route of Imperial Airways, the forerunner of British Airways, although it is not clear from the records whether the Ansons crash-landed at the strip, or elsewhere on the island.

The records noted that: "There was a good deal of excitement as the crews of the planes were disturbed at what they thought was the hostile attitude of the local inhabitants. In point of fact the local inhabitants were not hostile but frightened and on overcoming their fear made the usual Bedouin demands for money and firearms. Letters addressed to the local inhabitants by the Political Agent was (*sic*) dropped late in the afternoon of the 23rd and although the crews of the 'Ansons' are stated to have said that they had no effect the fact remains that no further alarmist signals were received and the airmen were provided with a bag of flour and a bag of peas by the "hostile natives." Unfortunately on the 24th a serious mishap occurred with a petrol fire and one man was very seriously burnt. A B.O.A.C. flying boat landed at Yas Island and the injured were evacuated to Bahrain. As a result of the efforts of an engineering party which went down by sea to Yas island, the aircraft were flown off and arrived in Bahrain on the 26th" (6).

By this stage of the War, there were serious food shortages in the Emirates and it is interesting to note that the Sir Bani Yas residents provided food to the stranded Anson crews.

The Anti-Locust Mission, joined by Wilfred Thesiger after the War, was already active in the peninsula at this time. Its records may be another source of information on the UAE during the period.

Flying Fortress (B17) - Jebel Dhanna, 1944

On 2nd May 1944, a B17 bomber (Flying Fortress), "force-landed ... on the mainland opposite Yas Island."

The British records note that the aircraft was on a photo-reconnaissance flight. An approach has now been made to the US authorities to see whether any of the photographs can be traced – it would certainly be interesting to see them.

Clearly the pilot had some warning of trouble, for the archive report adds that "Four members of the crew descended by parachute and were found the next morning some 49 miles to the east of the aircraft. Two of them were slightly injured while the two members of the crew who remained with the aircraft escaped without any injuries."

The records add that "It is understood that the 'Flying Fortress' is a total loss as it was landed on a part of the beach below high water mark and is therefore submerged twice in every twenty four hours."

The location, presumably close to Jebel Dhanna, has not yet been identified, but perhaps some older local

inhabitants may be able to point out the spot, even if all remains of the plane itself have since been removed or have disintegrated.

An evacuation of crew members was also not without incident, the records stating: "On the 23rd a Royal Air Force machine landing near the 'Flying Fortress' to rescue the two members of the crew was slightly damaged but will probably be able to be flown off after repairs have been carried out," (7).

Since there is no further mention in the records of the 'Flying Fortress' or of the RAF plane, presumably the latter did, in fact, manage to take off. There is also no mention as to whether the RAF plane came from Sharjah, Bahrain or elsewhere, or of the origins of the Flying Fortress.

We have so far been unable to trace any record of this crash in US military sources, e.g. see

<http://home.att.net/~jbaugher/usafserials.html>

The fact that the information comes from British records and that the RAF was involved in the rescue may suggest that the plane might have been an RAF Flying Fortress. The B17 was used by the RAF in relatively small numbers, especially by Coastal Command, operating weather reconnaissance flights. These were, however, usually in the North Atlantic.

US C46 (Curtiss Commando), near Dubai, 1945

In July 1945, an American C46 crashed south-east of Dubai, with the loss of all three crew members.

The plane had taken off from Karachi, bound for Abadan, Iran, on 26th of July. It was last heard of east of Sharjah, but no distress signals were sent (8). Aircraft from Sharjah carried out a sea and land search but failed to find any sign of the plane (9).

It was not until 29th July that the Political Agent in Bahrain and those in Muscat and Kuwait, as well as the Residency Agent in Sharjah, were informed. On the same day, however, the plane was found. Two reports, by the Political Agent in Bahrain and by the Sharjah Residency Agent, provide further information.

The Political Agent's Intelligence Summary noted: "the wreckage of this plane was discovered 13 1/2 miles south east of Dubai, and reported to the Royal Air Force. Rescue parties were rushed to the spot and the bodies of three of the crew removed to Abadan by air for burial. The wreckage has been examined with a view to discovering the cause of the crash but its results are not yet known here" (10).

The Residency Agent, benefiting from his proximity and from access to information from the RAF base at Sharjah, was able to provide more information: "On the 29th July two bedouins of Beni Yas tribe found the wreckage of the aircraft lying at a place called Naqa Bishr, 13 1/2 miles south-east of Dubai, and reported to the R.A.F. authorities through the Shaikh of Dubai... The aircraft had on board 1000 lbs of freight and mail. It was so badly damaged that nothing could be salvaged out of it" (11).

Once again, our efforts to find other records on this crash have proved fruitless. US records mention no C46 accident on the date given.

<http://home.att.net/~jbaugher/usafserials.html>

It would be interesting to know whether the crash site can still be located. Perhaps Dubai-based readers could investigate.

RAF Wellington, Abu Musa, 1946

The final report of a crash-landing comes from shortly after the war. It occurred in March 1946, when an RAF plane 'belly-landed' on Abu Musa.

The initial report in the Bahrain Intelligence Summary noted: "On the 18th March (1946), an R.A.F. Wellington flew over the s.s. 'Afghanistan' anchored off the island of Abu Musa to drop a message on board. Unfortunately in doing so the pilot misjudged his height and struck the top of one of the ship's masts, carrying it away, and damaging the tail and rudder of his aircraft. After jettisoning its petrol, the 'plane made a belly-landing on the island. The crew were uninjured and were taken to Sharjah the same day by launch.

The engines were undamaged, but the 'plane has been 'written off' and offered, with the dismantled engines, to the Shaikh of Sharjah."

We have been able to identify this aircraft as a Wellington Mark XIII of 294 Squadron, Coastal Command, RAF, serial number ME937, one of the last Wellingtons built of the over 11,000 total production. This squadron was based at Basrah from 1 June 1945 until it was disbanded on 8 April 1946 (12). In his book on the RAF station on Masirah Island, Oman, Colin Richardson describes the detachment of a Wellington of 294 Squadron from August 1945 until 1946. He describes it as very old and unserviceable most of the time. Indeed, one of the senior maintenance crew was killed falling off a lorry! (13). It is possible that this was the aircraft that crashed on Abu Musa.

A wry note of humour was inserted by the Political Agent, who commented: "There is quite a brisk trade springing up on the Trucial Coast of beating out trays from 'pranged' aircraft (14).

It would be interesting to know whether any of these trays can still be traced.

The S.S. Afghanistan was off Abu Musa to load red oxide, (haematite), a mineral then being mined on the island, as it also had been, at one time, on Abu Dhabi's Western island of Dalma.

A report of the same incident in the Trucial Coast News Report notes that the crew of the plane were evacuated to Sharjah by the launch of the Political Officer, Trucial Coast – this post having been created after the end of the War to replace the former Residency Agent (15).

Further information would be gratefully received on these or on other incidents related to the Second World War in the Emirates.

References

1. 'Trucial Coast Report for period March 1st – 21st', in Political Diaries of the 'Persian' Gulf, Vol. 14, 1940-41, Archive Editions, London, 1990. p. 79.

2. Trucial Coast Report for period March 1st – 21st, (*op. cit.*) p. 79

3. 'Intelligence Summary of the Political Agency, Bahrain, (henceforth 'Bahrain Summary') for the period 16th to 28th February 1943. No. 4 of 1943', in: Political Diaries (*op. cit.*) 1990. Vol. 15, p. 421.

4. 'Bahrain Summary' for the period 1st to 15th March 1943'. No., 5 of 1943.' In Political Diaries, (*op. cit.*), Vol. 15, pp. 443-444.

5. *Pers. comm.* Ruler's Office, Fujairah, 4th March 2004

6. 'Bahrain Summary' for the period 16th to 30th April 1944'. No. 8 of 1944'. In: Political Diaries, (*op. cit.*), Vol. 16, pp. 87-88.

7. 'Bahrain Summary' for the period 16th to 31st May 1944. No. 10 of 1944'. In: Political Diaries, (*op. cit.*), Vol. 16, p.112.

8. 'Bahrain Summary' for the period 15th to 31st July 1945. No. 14 of 1945'. In: Political Diaries, (*op. cit.*), Vol. 16, p. 454

9. 'Trucial Coast News Report No. 14 for the period ending the 31st of July 1945'. In: Political Diaries, (*op. cit.*), Vol. 16, p. 461.

10. 'Bahrain Summary' for the period 15th to 31st July 1945. No. 14 of 1945'. In: Political Diaries, (*op. cit.*), Vol. 16, p. 454

11. 'Trucial Coast News Report No. 14 for the period ending the 31st of July 1945'. In: Political Diaries, (*op. cit.*), Vol. 16, p. 461.

12. R. McNeill, *pers. comm.* April 2004.

13. Richardson, C (2003) **Masirah, Tales from a Desert Island**. Lancaster: Scotforth Books. pp. 148-149

14. 'Bahrain Summary' No. 6 for period from 18th to 31st March 1946'. In: Political Diaries, (*op. cit.*), Vol. 17, p. 64.

15. 'Trucial Coast News Report No 6 for the period ending the 31st March 1946'. In: Political Diaries (*op. cit.*), Vol. 17, p. 73.

Peter Hellyer,
P.O.Box 45553,
Abu Dhabi, U.A.E.
e-mail: hellyer@emirates.net.ae

Laurence Garey,
Route Suisse 43,
CH-1166 Perroy,
Switzerland
e-mail: l.garey@freesurf.ch

The brain of the camel, *Camelus dromedarius*: a study of a possible pain-inhibiting pathway

by Laurence Garey and Eric Mensah-Brown

Abstract

Using specimens obtained in Al Ain, United Arab Emirates, an examination was made of the superior colliculus on the dorsal surface of the midbrain portion of the brainstem of the camel *Camelus dromedarius*, using modern immunohistochemical techniques for total neuronal population as well as for certain neuropeptides. It was found that, unlike in most mammals, the superior colliculus is much larger than the inferior. The superior colliculus is concerned with visual reflexes and the coordination of head, neck and eye motricity, certainly of importance to this animal with large eyes, head and neck, and apparent good vision (Harman *et al.*, 2001). Its basic neuronal architecture and lamination is similar to that in other mammals. However, we describe for the first time an unusually large content of neurons in the superior colliculus with strong immunopositivity for met-enkephalin, a known "endogenous opioid". We propose that this system is associated with the pain inhibiting pathway that has been described from the periaqueductal grey matter, juxtaposing the deep layers of the superior colliculus, to the lower brainstem and spinal cord. Such pain inhibition could be important in relation to the camel's life in the harsh environment of its native deserts, often living in very high temperatures with no shade and a diet consisting largely of thorny branches.

Introduction

The mammalian brain consists essentially of the cerebral hemispheres, covered by the cerebral cortex, the cerebellum related largely to motor integration and learning, and the brainstem which links the hemispheres

to the spinal cord. Whereas the hemispheres and cortex are the prime location for sensory integration and the initiation of motor behaviour, together with higher cognitive function, the brainstem (medulla, pons and midbrain) contains neural centres that support reflex activity. The colliculi (superior and inferior) form laminated eminences on the dorsal surface, or tectum, of the midbrain. The superior colliculi are related to visual reflexes (Meikle and Sprague, 1964), whereas the inferior colliculi form part of the auditory pathway (Moore and Goldberg, 1966).

Many studies have established the architecture of the inferior (see Garey and Webster, 1989) and superior colliculus in species from rodents to man (Altman and Carpenter, 1961; Garey and Powell, 1968; Garey *et al.*, 1968; Leuba and Saini 1996). However a perusal of the literature reveals a paucity of information on large mammals, such as the camel.

The camel, *Camelus dromedarius*, is held in local folklore in the United Arab Emirates and elsewhere in Arabia to possess exceptional visual capabilities, and this is supported by scientific evidence (Harman *et al.*, 2001). This quality may have aided its adaptation to the desert (Plate 1). The cranial cavity of the camel is small compared with the whole skull (Plate 2). On macroscopic examination, the camel brain is also relatively small, up to about 500g (Plate 3). We were surprised to find that its superior colliculus was several times the volume of the inferior colliculus (Plate 3), whereas as in most species (including man) the two are approximately the same size (Plate 4). This difference could be significant because dolphins (Order Cetacea), closely related to the order Artiodactyla, to which camels belong (<http://www.ezresult.com/article/Ungulate>; Luo, 2000), are known to have an elaborate auditory system



Plate 1. The camel in typical desert surroundings. There is little protection from the sun at any time of the day.

and possess an inferior colliculus that is much larger than the superior colliculus (*Plate 5*).

The superficial layers of the superior colliculus receive nerve fibres (axons) from the retina of the eye (*Plate 6*) and from the visual cortex, the highest processing area for visual information coming from the retina. Portions of the visual cortex and superior colliculus receiving input from particular regions of the retina are interconnected, and related cortical and retinal projections coincide in the superior colliculus (Garey, 1965; Garey and Powell, 1968; Garey *et al.*, 1968).

The superior colliculus is involved in processing sensory information from other modalities than just visual, including feedback from the auditory,

somatosensory and motor regions of the cerebral cortex to its deeper layers (Garey *et al.*, 1968). This is consistent with the superior colliculus being an important integrative centre for the control of orientation of head and eye (Wurz and Albano, 1980).

The superior colliculus is composed of layers of alternating grey matter (largely composed of neuronal cell bodies) and white matter (containing mainly nerve fibres) (*Plate 7*). From the surface, the following layers can be recognised: stratum zonale, superficial grey, stratum opticum (in which the retinal fibres enter the superior colliculus – see *Plate 6*), then intermediate grey and white, followed by deep grey and white.

The cellular architecture of the superior colliculus

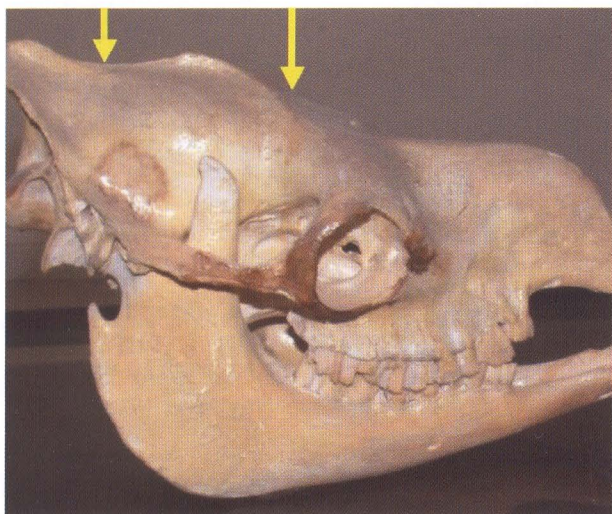


Plate 2. The skull of the camel has rather little space for the brain (between the arrows).

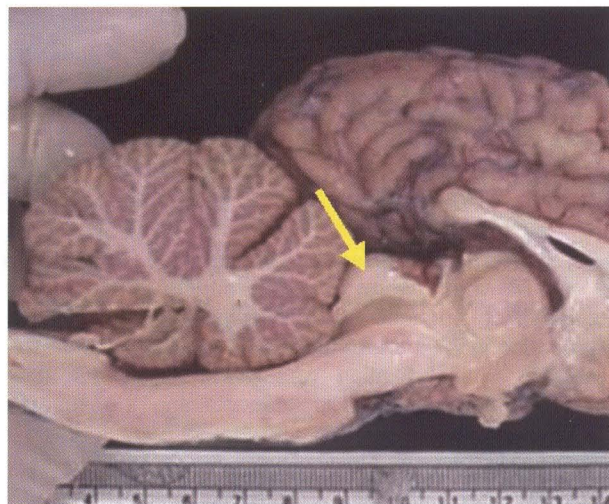


Plate 3. The camel brain is like most ungulate brains and only weighs about 500g in spite of the large body mass. The very large superior colliculus (arrow) is obvious.

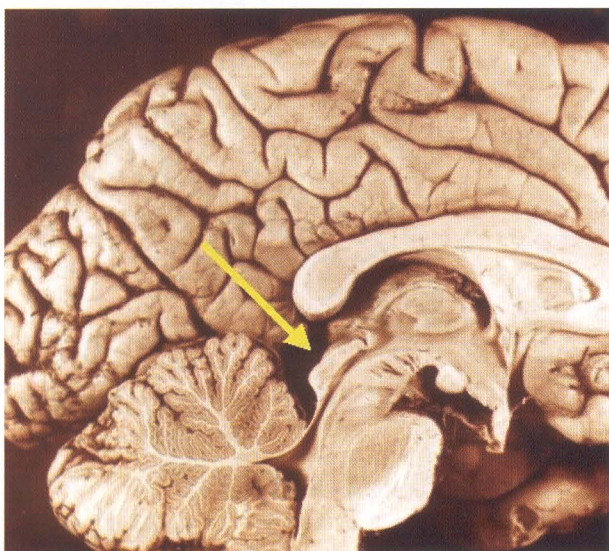


Plate 4. Medial view of the human brain. Note that the colliculi (arrowed) are about the same size.

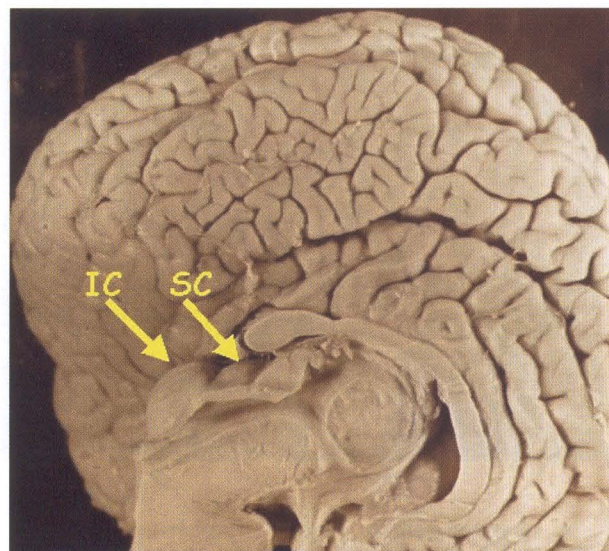


Plate 5. In the dolphin, the inferior colliculus (IC) is much larger than the superior (SC). This may be related to the important auditory functions of this animal (i.e. sonar).

has been established using simple methods such as Nissl staining. This well-established method of staining neuronal cytoplasm has the disadvantage that it is unable to distinguish neurons from the numerous supporting glial cells present throughout the central nervous system, making the demarcation between neuronal layers difficult and imprecise. More recently, neurons have been demonstrated using an antibody to a neuronal marker that does not stain glia, neuronal specific nuclear protein (NeuN) (Mullen *et al.*, 1992).

The aim of our study was to determine to what extent the very large superior colliculus of the camel might have a different neuronal architecture or distribution of neurotransmitters that are responsible for passage of neural information between nerve cells. Our first objective was therefore to examine the neuronal lamination as well as the number and sizes of neurons in the superior colliculus using NeuN and Nissl staining. Secondly, we examined the distribution of certain peptides, related to neurotransmitters (Mensah-Brown and Garey, 2004).

Material and methods

The brains of 12 adult male camels aged between 2 and 4 years were obtained during 2004 from a commercial abattoir in Al Ain and were fixed by immersion in 4% paraformaldehyde within 15 minutes of slaughter. Initial fixation was overnight at 4C, then transferred to buffer. Blocks containing the superior

colliculus were removed from the midbrain and fixed for a further 24 hours. They were then sectioned at a thickness of 40-50 μ m, before being stained with toluidine blue (Nissl method) or by standard immunohistochemical protocols for NeuN or neuropeptides.

Results

Using Neu-N immunohistochemistry it was shown that the neuronal architecture of the superior colliculus of the camel is similar to that of other mammals. Measurement of neuronal cell body sizes after Nissl staining demonstrated no significant mean differences between the layers. However, although small neurons predominate in all layers, the deep layers contain numbers of larger neurons. Neuronal cell bodies immunoreactive to some neuropeptides were limited to the superficial layers (*Plate 8*), whereas others were restricted to deeper layers, and yet others were only in the grey matter deep to the superior colliculus, the so-called periaqueductal grey (PAG).

Of the peptides we studied, the most interesting were the enkephalins (or endorphins). These "intrinsic opioids" are postulated to be important in the regulation of pain (Basbaum and Fields, 1984). In particular, met-enkephalin (M-enk) neurons showed striking differences from what has been described before. Most were small, and discernible predominantly in the superficial layers, but some larger M-enk neurons were observed, especially in the intermediate grey layer (*Plates 9,10*).



Plate 6. An autoradiograph of the superior colliculi of a monkey in which a radioactive marker had been injected in the retina. The marker (glowing brightly in this "dark field" micrograph) has been transported along the axons from the retina to the superficial laminae of the colliculus (stratum opticum and superficial grey).

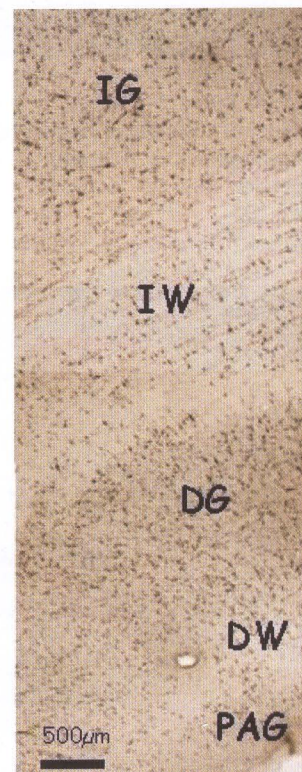


Plate 7. Low power micrograph of the intermediate grey (IG) and white (IW), and deep grey (DG) and white (DW) laminae of the superior colliculus, plus the periaqueductal grey (PAG).

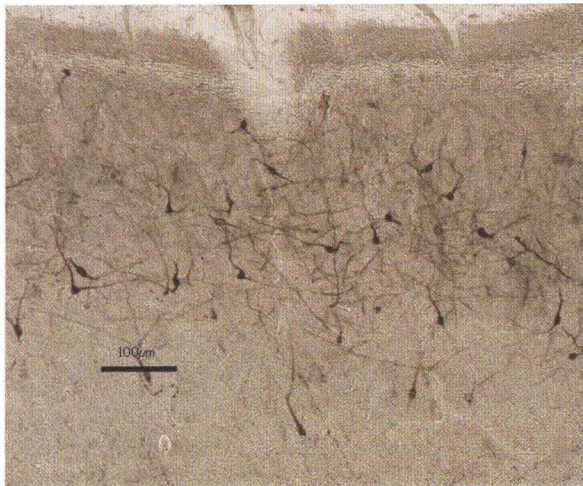


Plate 8. Specific neuropeptides are found mainly in restricted layers, in this case substance P neurons in the superficial grey.

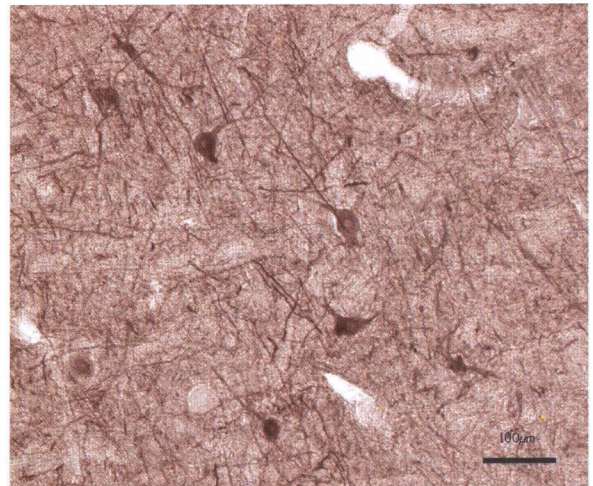


Plate 9. Large M-enk neurons in the intermediate grey.

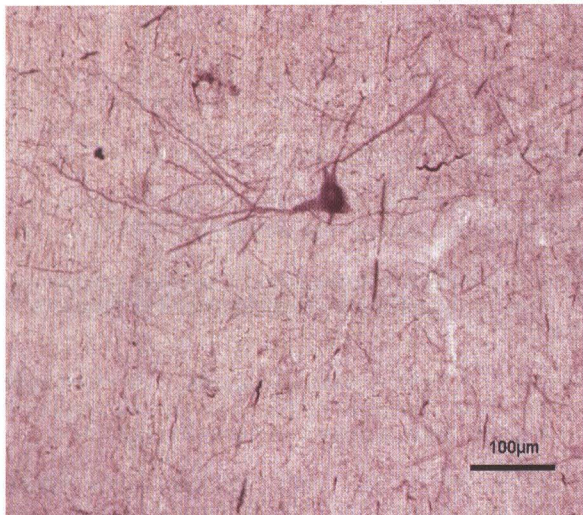


Plate 10. Large M-enk neurons in the intermediate grey.

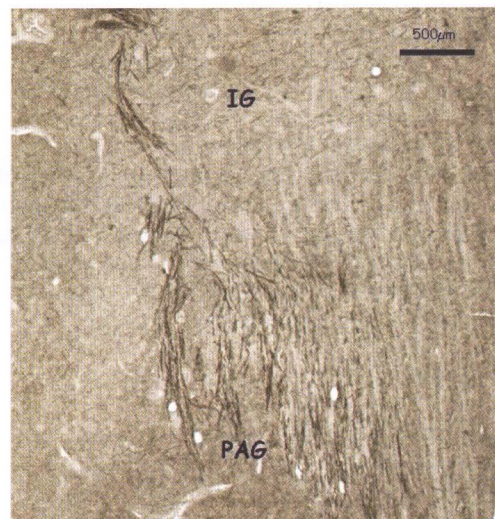


Plate 11. Bridging M-enk axons between the intermediate grey and PAG.

Projections of other peptidergic neurons appeared to be limited to the layers in which the cell bodies were found, but bridging M-enk fibres (axons) were observed between the superficial, intermediate and deep layers, while some extended into the PAG (*Plate 11*).

Discussion

The superior colliculus of the camel is remarkable for its large size compared with the inferior colliculus. Part of this may be due to a well-developed visual system, and also due to the necessity for the camel to coordinate eye and head and movements accentuated by its long, muscular neck. However, our discovery of numerous large M-enk neurons in the superior colliculus suggests a specialisation of this part of the brain compared with other mammals studied so far.

Several investigations have demonstrated the presence of enkephalins in the superior colliculus (eg: Mize, 1989; Berson *et al.*, 1991) mainly as a minor population of small neurons located almost exclusively in the superficial layers with a few patches of positive fibres in deeper layers. Enkephalins may modulate transmission of signals from the retina (Mize, 1989; Berson *et al.*, 1991), and thus may affect eye movements and other visual reflexes controlled by the superior colliculus. This is consistent with our observation of small enkephalin-positive neurons in the superficial, visual layers. However, in the camel a large population of enkephalin neurons is found in the deep layers. Enkephalins are important in pain suppression in central neural pathways (Basbaum and Fields, 1984): they are essentially endogenous opiates of the nervous system, exerting their influence through opioid receptors on neurons. They may explain the well-known phenomenon of initial inhibition of pain sensation that can last for several hours after acute trauma. A pain inhibitory pathway (*Plate 12*) has been described from the PAG to the medulla in the lower brainstem, and thence to the spinal cord (Liebeskind *et al.*, 1973; Basbaum *et al.*, 1977) and we propose that the M-enk projections that we describe here may represent the first part of that pathway in the camel.

It would be of great interest to compare our findings in the dromedary with a similar study in the Bactrian camel *Camelus bactrianus*, which lives in Central Asian environments which, although often cooler, have greater extremes of climate and weather. To our knowledge, no such comparison has been attempted so far.

Conclusion

The very large size of the superior colliculus of the camel dromedary brain suggests it may have a special function in this animal. The presence of numerous large M-enk neurons throughout the superior colliculus with fibres projecting to the PAG suggests that the pain inhibiting opioid pathway, known to be present generally in mammals, may be especially well developed in the camel, perhaps helping to suit it for the extremes of temperature and discomfort one might expect it to endure in the desert.

Acknowledgements

This work was supported by grants from the UAE University (whose Chancellor, UAE Minister of Higher Education and Scientific Research, Sheikh Nahayan bin aMubarak Al Nahyan, is thanked for his support and interest) and from the Emirates Natural History Group, Al Ain. We wish to thank Ulrich Wernery (of the Central Veterinary Research Laboratory, Dubai) and Joerg Kinne (also of the Central Veterinary Research Laboratory, Dubai) for help with initial pilot experiments, and Ebrahim Al Shamsi and Omar Al Falasi for assistance with some quantitative studies. Our special thanks are due to the late Alyaa Ali Hussain Talib without whose devotion these observations would never have been made.

Bibliography

- Altman, J. and M.B. Carpenter (1961). 'Fiber projections of the superior colliculus in the cat.' **Journal of Comparative Neurology** **116**: 157-177.
- Basbaum, A.I., N. Marley, J. O'Keefe and C.H. Clanton (1977). 'Reversal of morphine and stimulus produced analgesia by subtotal spinal cord lesions' **Pain** **3**: 43-56.
- Basbaum A.I. and H.L. Fields (1984). 'Endogenous pain control systems: brainstem spinal pathways and endorphin circuitry.' **Annual Reviews of Neuroscience** **7**: 309-338.
- Bear, M.F., B.W. Connors and M.A. Paradiso (2001). **Neuroscience. Exploring the Brain**. Second edition. Baltimore: Lippincott, Williams and Wilkins.
- Berson, D.M., A.M. Graybiel, W.D. Bowen and L.A. Thompson (1991). 'Evidence for intrinsic expression of enkephalin-like immunoreactivity and opioid binding sites in cat superior colliculus.' **Neuroscience** **43**: 513-529.
- Garey, L.J. (1965). 'Interrelationships of the visual cortex and superior colliculus in the cat.' **Nature**, **207**: 1410-1411.
- Garey, L.J., E.G. Jones and T.P.S. Powell (1968). 'Interrelationships of striate and extrastriate cortex with the primary relay sites of the visual pathway.' **Journal of Neurology, Neurosurgery and Psychiatry** **31**: 135-157.
- Garey, L.J. and T.P.S. Powell (1968). 'The projection of the retina in the cat.' **Journal of Anatomy** **102**: 189-222.
- Garey, L.J. and W.R. Webster (1989). 'Functional morphology in the inferior colliculus of the marmoset.' **Hearing Research** **38**: 67-80.
- Harman, A., J. Dann, A. Ahmat, T. Macuda, K. Johnston and B. Timney (2001). 'The retinal ganglion cell layer and visual acuity of the camel.' **Brain, Behavior and Evolution** **58**: 15-27.
- Leuba, G. and K. Saini (1996). 'Calcium-binding proteins immunoreactivity in the human subcortical and cortical visual structures.' **Visual Neuroscience** **13**: 1997-1009.
- Liebeskind, J.C., G. Guilbaud, J.M. Besson and J.L. Oliveras (1973). 'Analgesia from electrical stimulation of the periaqueductal gray matter in the cat: behavioral observations and inhibitory effects on spinal cord interneurons.' **Brain Research** **50**: 441-446.
- Luo, Z. (2000) 'Evolution: in search of the whales' sisters.' **Nature** **404**: 235-239.

Meikle, T.H. and J.M. Spague (1964). 'The neural organization of the visual pathways in the cat.' **International Reviews of Neurobiology** 6: 149-189.

Mensah-Brown, E.P.K. and L.J. Garey (2004) 'The lamination of the superior colliculus of the camel, *Camelus dromedarius*: a neuron-specific nuclear protein and neuropeptidergic immunohistochemical study..' **Journal of Anatomy** (in press).

Mize, R.R. (1989) 'Enkephalin-like immunoreactivity in the cat superior colliculus: distribution, ultrastructure, and colocalization with GABA.' **Journal of Comparative Neurology**. 285:133-155.

Moore, R.Y. and J.M. Goldberg (1966), 'Projections of the inferior colliculus in the monkey.' **Experimental Neurology** 14: 429-438.

Mullen R.J., C.R. Buck and A.M. Smith (1992). 'NeuN, a neuronal specific nuclear protein in vertebrates.' **Development** 116: 201-211.

Wurtz, R.H. and J.E. Albano (1980) 'Visual-motor function of the primate superior colliculus.' **Annual Reviews of Neuroscience** 3: 189-226.

Laurence Garey and Eric Mensah-Brown,
Department of Anatomy,
Faculty of Medicine and Health Sciences,
UAE University,
PO Box 17666,
Al Ain, United Arab Emirates
e-mail: l.garey@uaeu.ac.ae

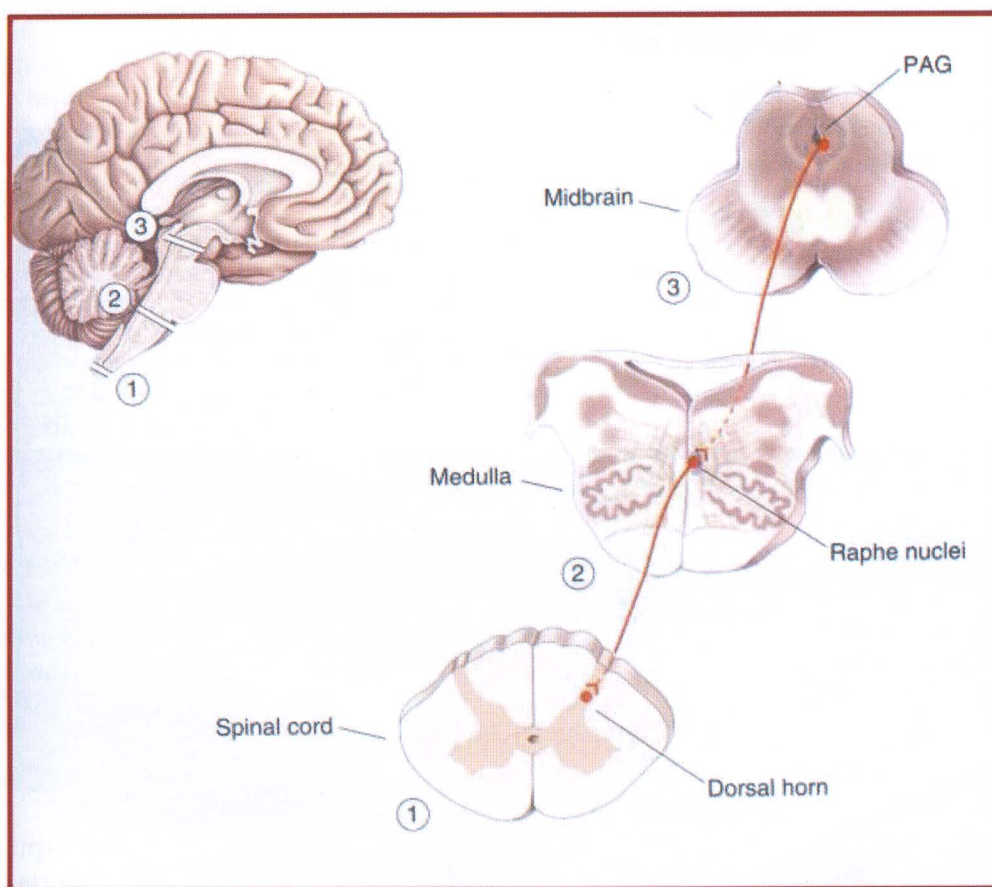


Plate 12. Schema of the pain inhibitory pathway (from Bear *et al.*, 2001)

Tail signalling in the Semaphore Gecko *Pristurus celerrimus*

by Gary R. Feulner

Abstract

Pristurus celerrimus Arnold, 1977 is a basal member of the group of so-called semaphore geckos, known for their tail signalling. *P. celerrimus* is endemic to the mountains of the United Arab Emirates and northern Oman, where it is common in the Musandam region. Its signalling behaviour has seldom been observed and never studied. In February 2004, a single individual was observed to engage in repeated signalling directed at a conspecific close by.

The signal consisted of two phases, always performed in sequence. In the first phase, the legs were extended, the body raised with hind parts highest, and the tail extended straight in line with the body. In the second phase the body was prostrated and the tail raised several times to a 45 degree angle and slowly lowered.

The first phase resembles the "threat display" that has been described and interpreted for the more widespread *P. rupestris*. The second phase does not closely resemble any of the reported signalling movements of *P. rupestris*, but, by reference to the signal repertoire of *P. rupestris*, the observed sequence is tentatively interpreted to represent a combination of threat and territorial signalling by a male to a female. This interpretation implies the possibility of a relatively elaborate inventory of tail signals even at an early stage of the *Pristurus* lineage.

Introduction

Geckos of the genus *Pristurus* comprise some 21 species distributed within the Arabian region, the Socotra Island group and north-east Africa, including five species found in the United Arab Emirates and the Sultanate of Oman (Arnold 1993, Uetz 2004). They are unusual among geckos in being diurnal rather than nocturnal (Ross 1990, Gardner 2004). Correlated with this, they do not communicate by voice, as do most geckos, but rather they communicate visually by signalling, primarily using their tails. For this reason they have been given the common name "semaphore geckos."

Ross (1990) studied tail signalling in *P. rupestris*, the most widespread species and the one most common in Arabia, and speculated that studies of signalling in other species of semaphore geckos might shed light on the evolution of this trait within the genus as a whole. Arnold (1993) expanded and elaborated on that line of reasoning by correlating the history of the evolution of individual species within the genus *Pristurus* (as inferred from anatomical study) with trend-oriented changes in more than a dozen ecological, physiological and behavioural characteristics, including the nature of the tail movements used in intraspecific communication by tail signalling. Gardner (1994) added supporting evidence for the apparent progressive evolution of increasingly complex tail signalling within the genus, in the form of observations of signalling in the arboreal *P. gallagheri* of the Jebel Akhdar of northern Oman.

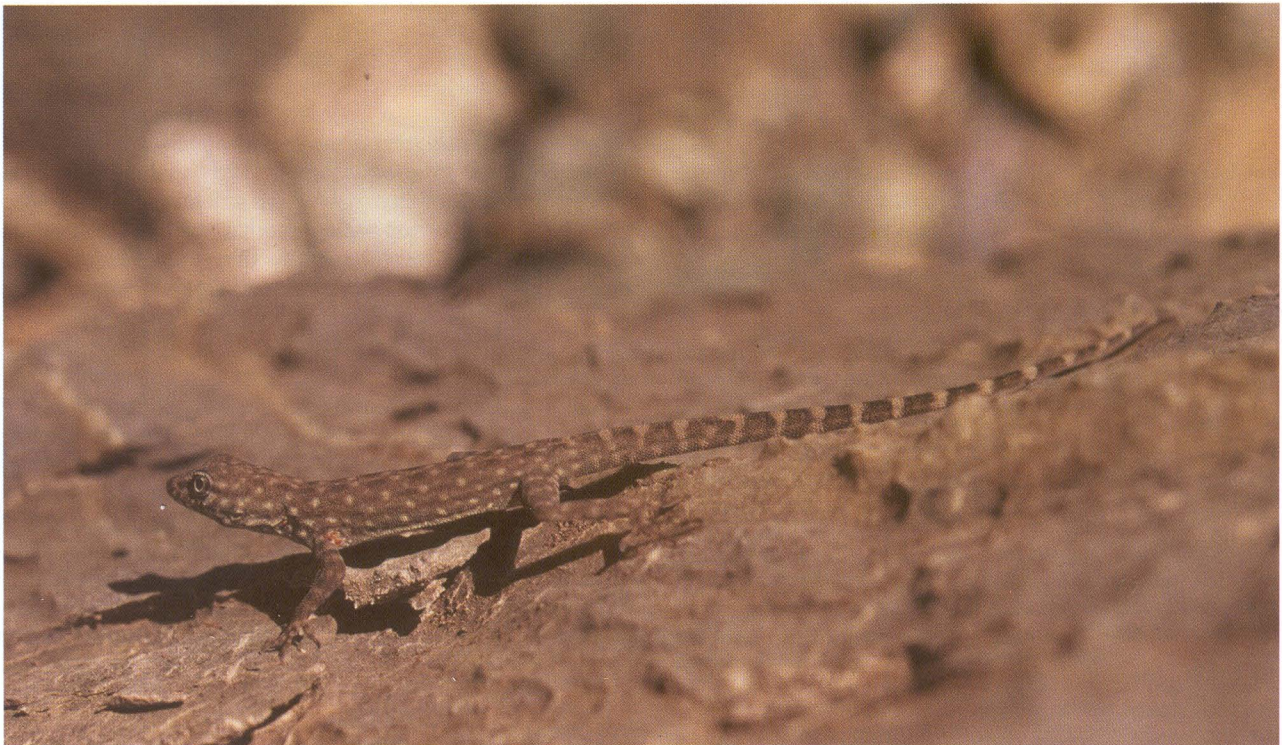


Fig. 1: A typical *P. celerrimus*, showing the conspicuously banded tail.

P. celerrimus Arnold, 1977 (Fig. 1) is one of a number of lizards endemic to the mountains of the eastern UAE and northern Oman (Gardner 1999). Its range lies entirely within the more extensive range of *P. rupestris* and the two are similar in both appearance and ecology. Within the mountain habitat, both are climbers on rocks and boulders, and both hunt by perching to watch for and ambush arthropod prey, particularly ants (Arnold 1993). *P. celerrimus* differs from *P. rupestris* in being somewhat larger (having a maximum snout to vent length of ca. 40mm versus ca. 30mm for *P. rupestris*) and being found generally on larger rocks and higher from the ground (Arnold 1977, Arnold & Gallagher 1977, Bischoff 1989). *P. celerrimus* is also said to change perches more frequently than *P. rupestris* (Arnold & Gallagher 1977, Arnold 1993).

P. celerrimus is considered the most morphologically primitive member of the genus *Pristurus* (Arnold 1980, 1993). This, coupled with its sympatry and ecological similarity with the somewhat more evolved *P. rupestris*, makes it a particularly attractive candidate for comparison of its signalling behaviour as invited by Ross (1990). Field observations of signalling behaviour by *P. celerrimus* appear to be uncommon, however, and the few published accounts have been general in nature.

Arnold and Gallagher (1977) reported of *P. celerrimus* that: "These lizards seem to communicate by 'semaphoring' with the often strongly barred tail which is held straight and rigid and flicked upwards to fall more slowly, the movement being repeated a number of times. This behaviour occurs in even quite young animals" Arnold (1993) essentially repeats the same description. Leptien (1993) says (in translation): "A characteristic of these geckos is that they lift the rigidly straightened tail at a slant and move it up and down." Bischoff (1989) is alone in attributing lateral tail signalling to *P. celerrimus*. He says (in translation): "Within the species both sexes communicate by lifting the straightened tail at a slant and waving it slowly from side to side."

Gardner, who studied reptiles in the field in Oman for more than a decade, recalls no observations of signalling by *P. celerrimus*, although it should be noted that *P. celerrimus* is uncommon in most of the mountains of northern Oman, including the Jebel Akhdar (Gardner *pers. comm.*). To the north, by contrast, in the UAE and especially in the mountains of the Ru'us al-Jibal, which comprise the north-easternmost UAE and the enclave of the Musandam province of Oman, *P. celerrimus* is the most common diurnal gecko at higher elevations. Nevertheless, it was only in February 2004, after more than a decade of regular natural history observations in the mountains of the UAE and Oman, that the author first observed signalling by *P. celerrimus*.

Description of the Observed Signalling Behaviour

The location was in the Ru'us al-Jibal of Ra's al-Khaimah, in an upper tributary of Wadi Shah, itself a tributary of Wadi Bih. The observation site was among massive angular carbonate boulders near the downhill margin of a kilometre-wide landslide, through which runs an imaginatively conceived and executed Bedu trail. At the observation point the trail crosses atop a large boulder (ca. 2m x 2m x 3m) with an irregular but sub-

vertical downstream face, on which the signalling gecko was observed from above. Immediately to the left, looking downstream, was a much smaller boulder with a more gently angled face. Downstream to the right and left were large boulders with sub-vertical faces perpendicular to the observation face, forming a sort of gecko amphitheatre.

The subject gecko was observed briefly at first, motionless but wary, and was photographed when it seemed tolerant of close observation (Fig. 2). Although not vividly marked and with an almost completely regrown tail, it could immediately be identified as *P. celerrimus* (versus *P. rupestris*) by its larger size. Its sex could not be determined immediately in the field, but on behavioural and other evidence (discussed below) it is believed to be a male. Only when the camera was being stowed did the gecko commence signalling, whereupon the observers witnessed some two dozen or more displays.

Signalling was provoked, it transpired, by the presence of a second, paler individual in the immediate vicinity, although the observers did not immediately notice this second individual. At its closest approach the second gecko perched low on the smaller rock to the left of the main observation face and the signalling gecko moved to within ca. 30cm of the interloper.

The signalling gecko changed position regularly, moving on the original rock face, or to or from one of the immediately adjacent rock faces, usually from ca. 10cm to 30cm, but in a few instances simply changing its body aspect. In approximately half of the instances observed, the gecko signalled immediately after attaining its new position. In fewer than half the instances, it signalled more than once from the same position. Signalling frequency may have been skewed somewhat by the presence of the observers and by the attempt to photograph the phenomenon. The gecko seemed relatively undisturbed by photography from a distance of a metre or more, but did not signal when approached to 30cm or less.

The signal itself consisted of two phases. These were repeated in sequence in every instance observed. In the first phase (Fig. 3) the gecko extended its legs and raised its body, which was held rigid with the back very slightly arched. The hind legs were stretched stiff and held relatively close to the body, whereas the front legs were more splayed, so that the rear of the body was elevated in relation to the front. In this position the tail was extended stiffly to the rear, in line with the body – thus angled up and back. In side view, the throat sac was inflated and the belly was slightly distended, making visible the conspicuous greenish-yellow ventral colour (a feature not otherwise noted in the literature). This position was held for an estimated 2-3 seconds.

In the second phase (Fig. 4), which followed immediately, the body was prostrated, with the legs flattened against the ground, and the tail was then raised and slowly lowered, from three to six times, for little more than about a second each, each time to a diminishing angle, beginning at an estimated 45 degrees. After the third or fourth repetition, any additional repetitions were mere twitches of the tail that would not have attracted attention on their own.

The underside of the tail was relatively pale but with a distinct darker centreline near the base (Fig. 5),



Fig. 2: The individual observed to signal, showing its regenerated tail.



Fig. 3: First phase of the observed signal.



Fig. 4: Second phase of the observed signal



Fig. 5: Posterior view of the raised tail in phase two of the signal, showing darker basal centreline

consistent with the identification of the individual as a male (Arnold 1977 [see especially Arnold's Plate 3], Bischoff 1989, Leptien 1993). As noted, the observed individual bore a replaced tail and the colouration of a normal tail might have been more vivid or distinctive.

The second individual appeared alert but was unmoving throughout several displays at close range (Figs. 3 and 4). It was also much paler. Other similarly pale individuals with original tails were present within 100 metres or so of the observation site, as well as individuals with the characteristic vivid tail stripes, suggesting a somewhat heterogeneous local population. In *P. celerrimus*, as in other *Pristurus* species (including *P. rupestris*), overall colour is somewhat variable, with populations tending to match the prevailing substrate (e.g. pale or dark gray carbonate, or red-brown weathering peridotite or gabbro). However, Arnold (1993) reported a general tendency among *Pristurus* species for an individual's colour to become paler with increasing body temperature. It is not known to what extent colouration might also be sex-related in *P. celerrimus*, although Arnold (1977) found that among the type specimens females were often more boldly patterned dorsally.

In the instance under discussion, the second individual moved off during the latter part of the observed signalling, disappearing from sight around the large boulder to the left, at a time when the first gecko was still signalling but had withdrawn to a distance of about a metre. Signalling continued, interrupted once by the author's renewed attempt at close-up photography, and the gecko moved to and signalled again from the face of the boulder to the right.

Discussion

Ross (1990) studied an isolated population of *P. rupestris* living among archaeological ruins on Tarut Island along the Arabian Gulf coast of Saudi Arabia. He recognised a repertoire of six basic signals, to which he was able to assign apparent meanings. Four of these involved curling the tail over the hindquarters, rotating it, wagging it from side to side, and/or passing sinusoidal waves along it. These he characterised as indicating variously awareness or submission, territoriality, aggression and non-aggression or appeasement. The other two signals involved body posture and forward lunges, and were considered a "threat display" and a "mini-threat display," usually performed in close proximity to another individual and sometimes involving reciprocal behaviour.

The first phase of the observed *P. celerrimus* signal bears a considerable resemblance to Ross' "threat display" in *P. rupestris* (see Ross' Plate 3) although in the latter the legs appear to remain somewhat more flexed, the tail is said to be raised vertically and the display ends in a forward lunge. The second phase observed in *P. celerrimus* does not resemble any of the *P. rupestris* signals described by Ross.

Ross' "threat display" in *P. rupestris* is predominantly a male signal, and he reports that when it is performed at another male, it may result in retreat by the second individual or in a counter-display followed by retreat or a short, fast skirmish. Ross adds, however, that the threat display may also be directed at a female, and

that in this case it is usually followed by a territorial display and no fighting.

This latter situation – a threat display by a male towards a female (first phase), followed by a territorial display (second phase) – offers perhaps the best explanation of the observed signalling in *P. celerrimus*. In particular, it would account for the absence of a retreat or counter-display by the second (female) individual, and it would explain the second phase (the raising and lowering of the tail) as being the territorial signal of *P. celerrimus*. Ross finds that the territorial signal is the most common signal in *P. rupestris* (47.7% of all signals observed). If the same is true for *P. celerrimus*, this would explain the prevalence of tail raising and lowering in *P. celerrimus* as reported by previous authors.

It should be emphasised that the territorial display of *P. rupestris* is nevertheless quite different from the second phase of the display observed in *P. celerrimus*. The former consists of curling the tail over the hindquarters an average of three times, followed by wagging the tail stiffly from side to side about three times (Ross 1990). The author has observed such a sequence of tail signalling in lone *P. rupestris* in the Buraimi area of northern Oman.

Leptien (1993) generalised that the characteristic signalling by *P. celerrimus* "obviously serves as a communication between the sexes, for this behaviour can be observed in both males and females." But the implication of a sexual purpose is a *non sequitur* and, in light of Ross (1990) and the observations reported here, may well be incorrect.

Arnold (1993) contrasted the straight-tailed signalling of *P. celerrimus*, which he called "tail flagging", with signalling by the more evolved *Pristurus* species (such as *P. rupestris*) in which the tail is frequently curled. He found that this behavioural distinction is reflected in the anatomy of the tail – sufficiently so to give him the confidence to predict the tail signalling behaviour of *Pristurus* species for which no field observations were yet reported. Arnold considered that the range of signals used "appears to have become greater . . . and sexual differences have become marked." He speculated that the evolution of more elaborate tail signalling (e.g. from lifting or flicking the tail up and down, to curling it) might be an adaptation to an increasingly passive, sit-and-wait hunting style in more evolved *Pristurus* species, which reduced the incidence of intermittent contact between widely distributed individuals.

The interpretation proposed here for the signalling sequence observed in *P. celerrimus* implies considerable similarity between *P. rupestris* and *P. celerrimus* in terms of the contexts in which signalling occurs, although somewhat less similarity in the nature of the specific signals themselves. If this is so, then while certain mechanical aspects of the signals used by *P. celerrimus* may be "primitive" (e.g. tail flagging versus tail curling), *P. celerrimus* might nevertheless employ a more elaborate repertoire of tail signals than has so far been recognised.

Acknowledgements

Thanks are due to Peter L. Cunningham for first encouraging the author's attention to the *Pristurus* geckos, to Andrew S. Gardner and Michael D. Gallagher for sharing the benefit of their long field experience in

Oman and the UAE, as well as commenting on a draft of this paper, and to Marijke Jongbloed and Rolf Schuster for translation of pertinent German language references.

References

- Arnold, E.N. 1977. 'Little Known Geckoes (Reptilia: Gekkonidae) from Arabia with descriptions of two new species from the Sultanate of Oman'. In **The Oman Flora and Fauna Survey 1975**, Journal of Oman Studies Special Report, Ministry of Information and Culture, Sultanate of Oman, pp 81-110.
- Arnold, E.N. 1980. 'The reptiles and amphibians of Dhofar, Southern Arabia'. In **The Scientific Results of the Oman Flora and Fauna Survey 1977 (Dhofar)**, Journal of Oman Studies, Special Report No. 2, Office of the Government Adviser for Conservation of the Environment, pp 273-332.
- Arnold, E.N. 1993. 'Historical Changes in the ecology and behaviour of semaphore geckos (*Pristurus*, Gekkonidae) and their relatives', **Journal of Zoology** (London) **229**: 353-84.
- Arnold, E.N. and Gallagher, M.D. 1977. 'Reptiles and Amphibians from the Mountains of Northern Oman with special reference to the Jebel Akhdar region'. In **The Oman Flora and Fauna Survey 1975**, Journal of Oman Studies Special Report, Ministry of Information and Culture, Sultanate of Oman, pp 59-80.
- Bischoff, W. 1989. '*Pristurus celerrimus* Arnold 1977', **Sauria** (West Berlin) **11**(3): 23-24.
- Gardner, A.S. 1994. '*Pristurus gallagheri*, an arboreal semaphore gecko from Oman, with notes on its tail flagging behaviour', **Dactylus** **2**(4) 126-129 and manuscript.
- Gardner, A.S. 1999. 'The Reptiles and Amphibians of Oman: Herpetological History and Current Status', Chapter 4: 65-88. In: M. Fisher, S.A. Ghazanfar & A. Spalton (Eds.), **The Natural History of Oman – A Festschrift for Michael Gallagher**, Backhuys Publishers, Leiden.
- Gardner, A.S. 2004. 'Geckos', **ENHG Focus**, Feb 2004, pp 2-4.
- Gardner, A.S., Zayed University, Abu Dhabi, *personal communication*, February 2004.
- Leptien, R. 1993. 'Ein wenig bekannten Taggecko aus den Vereinten Arabischen Emiraten, *Pristurus cellerimus* [sic] Arnold, 1977', **Sauria** (Berlin) **15**(1): 23-25.
- Ross, W. 1990. 'Notes on the Behaviour of *Pristurus rupestris* (Reptilia: Gekkonidae) with Special Reference to Tail Signalling', **Fauna of Saudi Arabia** **11**: 300-305.
- Uetz, P. (ed.) 2004. The EMBL Database (European Molecular Biology Laboratory, Heidelberg), <http://www.reptile-database.org>, at 3 June 2004.

Gary R. Feulner
P.O. Box 31045
Dubai, United Arab Emirates
e-mail: grfeulner@shuaacapital.com

Notes

CITES meeting on falcons and falconry held in Abu Dhabi

A consultative meeting, hosted by the CITES* Management Authorities and Scientific Authority of the United Arab Emirates, (the Federal Environmental Agency and the Environmental Research and Wildlife Development Agency, ERWDA), was held in Abu Dhabi from 16 to 19 May 2004. The meeting was attended by representatives of the following Parties, non-Party and observer organisations: Canada, Czech Republic, Egypt, Germany, Hungary, Jordan, Kazakhstan, Kuwait, Mongolia, Pakistan, Qatar, Russian Federation, Saudi Arabia, Tunisia, the UAE, the United Kingdom, Turkmenistan, Birdlife International, Greifvogelzuchtverband and the International Association for Falconry.

The meeting focused on falcons and falconry. Some of the more salient matters outlined in the resulting recommendations are given here in an abridged version of the final statement released after the meeting. The latter is available on request from ERWDA. The UAE raised an important issue on the permissible age and sex structure of birds harvested from the wild, although the absence of certain parties and insufficient remaining time meant, regrettably, that it could only be "noted".

Establishment and management of catch and export quotas

".....Concern was also expressed that, in some countries, insufficient information is available regarding the population sizes of falcons, and that it was, therefore, difficult to make the findings required under Articles III

and IV of CITES relating to the survival of the species in the wild.

Delegates encouraged range States of Saker *Falco cherrug* affected by the current Review of Significant Trade of this species to cooperate with the Animals Committee and the CITES Secretariat in providing information about the scientific basis upon which they determine the level of export of falcons that can be authorized. They also expressed their belief that this was an important process to help safeguard wild populations of *Falco cherrug*."

Enforcement matters

"Delegates noted that illicit trade in falcons was of great concern and that it threatens the survival of wild populations of some species, in particular [Saker] *Falco cherrug*.

Delegates believed that there is a need to raise awareness among falconers of the provisions of the Convention, the seriously low levels of [Saker] *Falco cherrug* populations and the significant impact of illicit trade on wild populations of birds, in order to encourage compliance with CITES. They also believed there was a need for awareness-raising and training for law enforcement officials who are involved in implementing the Convention, enforcing national legislation and combating illegal capture of falcons from the wild. Delegates noted the important role that the Gulf Cooperation Council could play in facilitating a harmonised approach to the regulation of trade in falcons by Gulf States.

Delegates recalled, as stated in Decision 9.15 of the Conference of the (CITES) Parties, that there is no immunity from the provisions of CITES regardless of a person's diplomatic or social status. They believed that

the actions of some persons holding diplomatic, VIP or other high social status, who fail to comply with the requirements of the Convention and national legislation, risk undermining the efforts of CITES."

Captive breeding

"Delegates expressed their concern that, although some States regulate captive breeding of falcons strictly and carry out regular inspections, some captive-breeding operations are not adequately monitored and are used by unscrupulous traders to 'launder' falcons that have been taken from the wild. An additional concern was that falcons taken illegally from the wild or illegally imported are sometimes used as breeding stock. The benefits of using DNA profiling to confirm parent-offspring relationships was acknowledged.

Delegates noted that increasing the use of captive-bred falcons in falconry helps reduce the pressure on wild populations. They recognised that, when appropriately operated and regulated, and provided other conservation measures are also implemented, such breeding might be particularly beneficial for those countries where wild populations have seriously declined, especially if operations include a release element that meets existing IUCN reintroduction criteria. At the same time, they believed that it was important for local communities in range States to participate in and benefit from the conservation of wild falcon populations. The success achieved in using artificial nesting sites to encourage breeding in the wild was noted and, together with other in situ conservation measures, its potential for the future was also acknowledged."

General matters

"Delegates noted that Birdlife International, as the listing authority for birds on the IUCN Red List, in evaluating the status of the Saker falcon, had found that it now qualifies for threatened status with the category Endangered, owing to the high rate of overall decline in the recent past. Delegates noted that, as a result of the contacts made during the consultative meeting, attempts would be made to establish a European action plan for the conservation of *Falco cherrug*. Delegates requested that the summary record of their discussions be provided to the 51st meeting of the Standing Committee and also to the diplomatic missions in Geneva of Parties and non-Parties. [No specific mention was made regarding Asian populations of Saker Falcon].

The United Arab Emirates suggested that, when assessing quotas for a harvest of wild falcons, the quota should be balanced between the sexes and not include adult birds. However, owing to the late stage at which this point was raised and the absence of some Parties that establish quotas, and which had been present during previous discussions on quotas, the meeting agreed that this matter, although important, could only be noted."

*** CITES is the Convention on International Trade in Endangered Species of Flora and Fauna. UAE is party to the convention (see Tribulus 12.1:32 & 12.2:28)**

Abridged from a press release by ERWDA

A full account of the discussions and recommendations arising from this meeting can be found in the news-section of the CITES website: www.iucn.com (News and Highlights)

Dhub sightings requested

The 'dhub' or spiny-tailed agamid (lizard) is the largest of the UAE's land-dwelling reptiles, and will be familiar to many readers. Two species are present, the Egyptian spiny-tailed lizard *Uromastix aegyptia microlepis* in the Emirate of Abu Dhabi and a second, recently-recognised species, Leptien's spiny-tailed lizard *Uromastix leptieni*, in the Northern UAE (Wilms and Böhme 2000). The precise dividing line between the two has not yet been identified, but is probably somewhere in the deserts south-west of Dubai.

Both are vegetarians, living mainly on plants and are protected under the terms of the 1983 Federal Law on Hunting.

Because of the pace of development in recent years, which has destroyed some of the habitat in which they used to live, there is now some concern about the country's dhub population. Are there areas where dhubs were once present, but from which they have now disappeared? Are numbers declining, or are they stable? Is the species endangered, or potentially vulnerable?

The Environmental Research and Wildlife Development Agency, ERWDA, is now collecting data on dhub distribution throughout the Emirate of Abu Dhabi, to try to build up a better picture. Readers can contribute to this research by collecting data on dhubs and their distribution in field areas.

The following information is required:

- Date of sighting (of live animals, dead animals or of droppings – whether fresh or old)
- Location of sighting (with GPS location, noting the datum - WGS84, decimal degrees is preferred)
- Number of animals seen
- An estimate, if possible, of the number of active burrows (holes) in each colony.
- Details of any area where dhubs were once present, but have now disappeared
- The information can be sent either to the *Tribulus* Editors, who will pass it on to ERWDA, or direct to John Newby, Head of the Terrestrial Environment Research Centre, TERC, at ERWDA – e-mail jnewby@erwda.gov.ae, PO Box 45553, Abu Dhabi, United Arab Emirates.

Reference

Wilms, T. and Böhme, W. (2000). 'A new *Uromastix* species from south-eastern Arabia, with comments on the taxonomy of *Uromastix aegyptia* (FORSSKAL, 1775).' *Herpetozoa* 13 (3/4):133-148.

Peter Hellyer

Houbara Bust

An international smuggling ring involved in bringing endangered houbara bustards into the UAE from Iran has been broken in a sting operation involving officials from both Abu Dhabi and Sharjah. Some 273 houbara were seized and four persons arrested in the successful operation early in January.

In the carefully planned decoy operation, one hundred of the birds arrived at the pre-arranged rendezvous packed in crates in a Dubai-registered van, only to be met by police, while subsequent raids on two houses in Ajman resulted in the confiscation of another

173 birds, 16 of which were already dead. Abu Dhabi's Environmental Research & Wildlife Development Agency, ERWDA, took receipt of the birds and will attempt to rehabilitate them so that they can be released back into the wild.

If found guilty, the smugglers will receive custodial sentences of up to six months, each be fined 5,000-10,000 dirhams and be deported after serving their time in prison.

All species of houbara (the species in Central Asia

and in Arabia is Macqueen's Bustard *Chlamydotis macqueenii* are listed under CITES, the Convention on International Trade in Endangered Species of Wild Flora and Fauna, and international trade in the species is banned. The UAE is a party to the convention, and has been intensifying its efforts to crackdown on illicit trade in wildlife.

Source: Gulf News 6 January 2004

Obituary

Peter Whybrow

Peter Whybrow, one of the founders of studies of the fossils of the United Arab Emirates, died suddenly on February 13th 2004. He was 61.

He first came to south-eastern Arabia in 1979, to carry out fossil research in Qatar, on behalf of what was then the British Museum (Natural History), and later became The Natural History Museum. During that visit, he made a one-day trip across the border into the Emirates, visiting Jebel Barakah, an outcrop on the coast west of Jebel Dhanna. There he found fossil remains of crocodiles and recognised the importance of the rock outcrops in the Western Region. On another visit to Jebel Barakah, in 1981, working in collaboration with the Geology department of the Emirates University, he found more fossils, including teeth of primitive horses, which he dated to the Late Miocene period, from 5 to 11 million years ago. He returned again in 1984.

At the time, another scientist, Professor Andrew Hill, of Yale University, was also studying the fossils of the Western Region, and the two of them came together to plan a joint programme of research. In 1989 and 1990, they worked in association with the Department of Antiquities and Tourism in Al Ain and then, for a further five years, the Whybrow-Hill team carried out further studies with sponsorship from the Abu Dhabi Company for Onshore Oil Operations, ADCO.

The results of their work proved to be of international scientific importance. Over an area stretching from Mirfa to Jebel Barakah, covering over 100 kilometres of the UAE coastline, they found numerous fossil sites, with evidence of a wide range of animals, including early elephants, hippopotami, horses, gazelles, crocodiles, turtles and other species. These were eventually dated to around 6-8 million years ago.

Whybrow also co-ordinated studies of the fossils to be found in the mountains of the eastern UAE, and carried out surveys in Fujairah.

The results of their work, and that of other colleagues, in western Abu Dhabi were the focus of the First International Conference on the Fossil Vertebrates of Arabia, held at Jebel Dhanna in 1995, under the sponsorship of the Minister of Higher Education and Scientific Research, Sheikh Nahyan bin Mubarak Al Nahyan, and with the support of ADCO, this later giving rise to the major book 'Fossil Vertebrates of Arabia,' in 1999.

In the process of this research, Whybrow played a major role, not only in co-ordinating and taking part in fieldwork, but also in the associated publication

programme. It was Whybrow, for example, who named and dated the two major rock formations from the Late Miocene in Western Abu Dhabi, the Shuweihat Formation and the later Baynunah Formation, around 6-8 million years old, in which the fossils were found.

Largely as a result of Whybrow's work, Abu Dhabi became well-known internationally as one of the key areas in the world for fossils of the Miocene period.

Accustomed to visiting out-of-the-way places, and to doing things which, to others, might seem a little off-beat, or even suspect, Whybrow derived considerable amusement from events that made his research into the distant past relevant to today. He recounted with pleasure, for example, that, following Iraq's invasion of Kuwait in August 1990, he was asked by the British Ministry of Defence if he had any photographs of areas he had studied in the hinterland of Kuwait – the Ministry having managed, in a clear-out of old maps, to throw away all of its material on the Gulf state. The photographs, of geological sections of a wadi in north-west Kuwait, proved to be of considerable interest to the military planners. Whybrow himself spent part of the period immediately prior to the US-led counter-attack to expel the Iraqis carrying out field research in the Western Region of Abu Dhabi. There, equipped with an identity pass issued by GHQ that described him as a civilian fossil expert, he encountered on several occasions US troops carrying out exercises. The troops apparently found it a little difficult to believe that he was, as his pass said, simply looking for fossils, offering him both endless cups of tea and snappy salutes!

Whybrow spent most of his working life as a research scientist in the Palaeontology Department of the Natural History Museum in London, carrying out fieldwork not only in the UAE and Qatar, but also in Kuwait, Saudi Arabia, Yemen and Pakistan, as well as in the Sahel belt of Africa and in Europe. Some of his tales of fossil-hunting, as well as those of other palaeontologists, were included in a book 'Travels with The Fossil Hunters', published by the Museum in 2000.

He retired early in 2002, moving to Cornwall in south-west England, with his wife, Valerie, a former colleague at the Natural History Museum, and two young sons. Ill-health, sadly, prevented him from returning to the UAE, to take part in the continuing studies of Abu Dhabi's fossils being undertaken, with his encouragement, by the Abu Dhabi Islands Archaeological Survey.

Instead, he became a keen amateur gardener, and it was, appropriately, in his garden that he died of a heart attack, surrounded by the plants that he loved.

Peter Hellyer

Reviews

Whales and Dolphins of Arabia. By Robert Baldwin. Privately published. 2003. Hardback 116 pp. ISBN 0 9526605 0 2 (e-mail: wosoman@omantel.net.om)

This self-contained book is the successor to Robert Baldwin's 'Whales and Dolphins of the United Arab Emirates', published in 1995. The size and format is an immediate improvement on that earlier work and you might want to, and easily could, carry it with you for reference in the field, although it is not specifically intended as a field guide.

'Whales and Dolphins of Arabia' is divided into three sections, of unequal length: The World of Whales and Dolphins; Arabian Whales and Dolphins and Whales, Dolphins and People.

The first section is a general account and deals with evolution, social structure, behaviour, communication, reproduction and various other aspects of cetacean biology. It concludes with a brief summary of 'migration and the Arabian enigma', without elaborating a plausible hypothesis, relating to cold-water upwelling off Dhofar in summer, as to what is thought to be going on (until you find it in a single sentence six pages later).

The second section, predictably the longest, commences by describing the marine environment around Arabia (geography, bathymetry, temperature, salinity etc), and then goes on to deal in turn with each of the twenty-one species definitely known to occur in and around Arabia, three Baleen whales and 18 Odontocete (toothed) whales and dolphins. Each is afforded one or, for ten species, two full pages, with liberal use of high-quality photographs which should help your identifications, a range map and information on the species' appearance, regional distribution, status and general biology, such as the diet.

The final section 'Whales, Dolphins and People' talks about the effects of the commercial whaling industry (with some startling catch statistics from the Arabian Sea in the 1960s), fisheries and management, habitat loss and protection, pollution and threats, then on to whale watching and conservation and research aspects, including DNA studies.

For 16 of the 21 species described the status is given as 'insufficiently known' and, not surprisingly, there is a message regarding the need not only for continued research but also for urgent conservation action.

This book is an easy read, suitable for those of 8 to 88, or more, and the author should be credited with the foresight in largely avoiding scientific terms throughout. The diversity of species that live around Arabia (admittedly largely outside the Arabian Gulf) will come as a surprise to many, as will the ease with which you can still see many of them - with just a little bit of effort and a small slice of luck. I thoroughly recommend you buy this book, and then a boat or helicopter of your own.

**Simon Aspinall,
P.O.Box 45553,
Abu Dhabi, U.A.E.**

e-mail: hudhud10@emirates.net.ae

[Whale and dolphin sightings can be sent to the Editors of Tribulus for inclusion on the UAE national cetacean database - Editors]

Stone Age Sites and their Natural Environment – The Capital Area of Northern Oman Part III

By Hans-Peter Uerpmann & Margarethe Uerpmann, with a contribution by Stefan Schöler. 2003. Beihefte zum Tübinger Atlas des Vorderen Orients – Reihe A (Naturwissenschaften) Nr. 31/3. Publisher: Dr. Ludwig Reichert, Wiesbaden, Germany. 266 pages. 136 black and white figures. 46 tables.

This publication presents the results of archaeological work carried out by the authors in the Capital Area of Northern Oman between 1979 and 1988 under the sponsorship of the Department of Antiquities of the Ministry of National Heritage and Culture of the Sultanate of Oman. The volume is the third in a series of joint collaborative efforts made by members of the research team of the Tübingen Atlas Project, following earlier volumes on the geomorphology and palaeoenvironment (Hannss 1991) and climate (Hannss and Kürschner 1998) of the area.

This volume is dedicated to the detailed description of Stone Age sites and their findings and attempts to interpret the archaeological evidence and to develop a human paleoecology of this region. The main area covered in this study is the so-called Capital Area which includes the old towns of Muscat and Matrah and their newly urbanised surroundings from Madinat Qaboos in the west to Bandar Gissa in the east. The other sites dealt with in this volume are located in the Quriyat area, some 60km SE of Muscat.

Chapter 1 (pages 1-2) provides a Preface to the study. Chapter 2 (pages 3-26) gives an introduction to the sites of Ra's al-Hamra, Qurum, Wadi 'Udayy, the Saruq area, Bandar Gissa and Quriyat area. There is some discussion of the spatial distribution of sites, as well as the significance of the radiocarbon dating. Chapter 3 (pages 27-43) outlines the results of test excavations in Wadi Wutayya. It provides interesting information on the links between stratigraphy and rock art, suggesting that some of the oldest parts of the rock art in Wadi Wutayya may have originated during the Late Stone Age. The oldest fireplace in Wadi Wutayya was in use about 11,000 years ago, indicating that people existed in this area long before the arrival of Neolithic herders, who started to populate Arabia from the north-west more than a thousand years later. Wadi Wutayya is an important site as it provides a well-dated sequence through the whole of the Late Stone Age from the beginning of the Holocene to the beginning of the Bronze Age. Chapter 4 (pages 44-72) discusses the chipped stone industry and other finds from Wadi Wutayya, Wadi Udayy and Qurum regions and includes excellent illustrations of the lithics recovered. Chapter 5 (pages 73-93) presents the archaeological finds from the coastal sites at Ra's al-Hamra, Qurum and Saruq. Illustrations of the stone tools from Saruq are provided. Chapter 6 (pages 94-97) is a short note concerning work at Bandar Gissa. Shell-midden deposits under a rock-shelter site have been dated here to the first half of the 4th millennium BC. Chapter 7 (pages 98-142) discusses archaeological finds from the Quriyat area, covering the sites of Khor Milk 1 (KM1) and 2, and including the beautiful shell fish-hooks found at KM1. Chapter 8 (pages 143-162) is written by Stefan Schöler and provides a mineralogical and petrological examination of some of the objects found at Khor Milk. Beads were made from talc, calcite, chlorite and serpentinite, ear-

rings of serpentinite and clay-schist, and rasps from sandstone and apatite. Chapter 9 (pages 163-254) discusses the results of analysis of marine mollusca, fish, reptile, bird and mammalian remains from various sites. The richest assemblage discussed is that from Ra's Al-Hamra site 5 (RH5), which dates to between about 4000-3500 cal BC. Here the people regularly consumed shellfish (including *Terebralia palustris* and *Ostrea cuculata*), fish (especially tuna and jacks) and green turtles. Birds noted at RH5 include Great Cormorant, Purple Heron, Goliath Heron, a smaller unidentified heron and a large raptor, as well as several bones from sea-birds of the Gull and Tern families. Cetacean remains included bones from small and large dolphins, as well as from a Short-fin Pilot Whale. Hunted wild animals included hare, wolf, fox, caracal, wild ass, mountain gazelle and Arabian tahr. Domestic animals identified included cattle, sheep, goat and dog.

The final part of the book, chapter 10, provides an overview by the authors of the development of culture, subsistence and the environment in Northern Oman during the Late Stone Age. They conclude by mentioning the thousands of Hafit-type burial cairns scattered along mountain ridges of the Oman peninsula, and say that these provide evidence of a fairly dense population of nomadic herders, which have so far more or less escaped the interest of archaeologists. The authors go on to speculate that the large scatters of flint artifacts found in many parts of the interior, and exhibiting none of the characteristic implements of a known industry, may be the remains of these last nomadic Late Stone Age herders, who roamed the desert steppes during the final 4th and early 3rd millennium BC.

The present author cannot discuss this book without briefly passing some comments on the large samples of fish remains evaluated in this study. Fish bones represented 80% of the more than 60,000 faunal remains quantified from RH5. Numerically almost half of the identifiable bones belong to the Scombridae family (Tunas and Mackerels). The other major family represented were the jacks or Carangidae. Middle and smaller-sized fish only occurred in comparatively low numbers. This confirms the contrasting picture of fish resources modeled by the author within the Arabian Gulf and Gulf of Oman, more pelagic species being generally caught in the more open waters of the Indian Ocean (Beech 2004). The remains of these larger fish may have required fishing in deeper water which would have required some sort of boat. Such fish do, however, come close to shore on a seasonal basis when they target schooling sardines. It is possible that they may have, therefore, been also caught from the foot of the cliffs at the site. An interesting discovery within the graveyard of RH5 was a shark tooth found sticking in a human vertebra which indicates its use as a projectile point. This gives a whole new meaning to the danger of sharks out of water!

I have only a few minor criticisms, firstly that it is unfortunate that the faunal remains could not be studied evenly for all the studied sites dealt with in this book. Parts of the vertebrate assemblage were apparently not studied due to various logistical problems. This makes it very difficult to assess the quantitative relations between fish, turtle and mammal remains. At RH5 the authors conclude that green turtles between 60-90cm in carapace length were mostly exploited, and that these

were mostly immature. It is a pity that the complete turtle skulls and other bones from the graves at RH5 were not available for their study. Some of these appear to be quite large and may well be examples from large adult animals (Sandro Salvatori, pers.comm.). This might alter the interpretation of the assemblage being skewed towards immature individuals.

The analysis of the faunal material from the settlement area at RH5 has been treated as one unit, although the authors admit that "the animal bone complexes were only assigned to local features and could not be connected to the general chronology (p.165). Although separation of the fauna into sub-complexes would have led to an insufficient numerical basis for comparisons, it is a pity that more effort was not made to analyse the spatial distribution of environmental and archaeological data across the site. This might have produced more meaningful insights into domestic activities and waste disposal practices, e.g. differences between domestic and ritual activities may be hinted at by the discrepancy in the size of the green turtle remains in the cemetery and the settlement.

Sadly, the entire volume is produced in black and white and there are no colour pictures to illustrate the environments surrounding these sites and to illustrate some of the nicer archaeological finds. The inclusion of a summary in Arabic of the major conclusions from this study would also have been helpful. It might have been useful also to have had bi-lingual captions in Arabic and English for all the figures and tables. Such publications should be made available to a wider audience, and in particular to the local Arabic speaking peoples of the peninsula. Many modern day inhabitants of this region do not realise that the foundations of many of their present day coastal communities were laid in the Neolithic period, as long ago as 11,000 years ago, as we now know from Wadi Wutayya.

For those looking for a popular guide to Stone Age prehistoric sites in Oman, this is not it. There is still a need for someone to write an easy to read non-specialist guide to the early prehistoric coastal sites of the region. Putting aside these minor gripes, however, this book is a serious weighty academic contribution to our knowledge of the Neolithic period in South Eastern Arabia and will be an important source for years to come.

References

- Beech, M.J. 2004. 'Abu Dhabi Islands Archaeological Survey Monograph 1 - In the Land of the Ichthyophagi: Modelling fish exploitation in the Arabian Gulf and Gulf of Oman from the 5th millennium BC to the Late Islamic period.' British Archaeological Reports International Series S1217. ArchaeoPress, Oxford. ISBN 1841715778.
- Hannss, C. 1991. 'Grunzüge der Reliefentwicklung (Basic Relief Development). The Capital Area of Northern Oman Teil I.' Beihefte zum TAVO Reihe A Nr.31/1, Wiesbaden.
- Hannss, C. & H. Kurschner, 1998. 'The Capital Area of Northern Oman, Teil II. Beihefte zum TAVO Reihe A No. 31/2. Wiesbaden.

**Dr Mark Beech,
ADIAS**

**P.O. Box 45553, Abu Dhabi,
United Arab Emirates
email: beech@emirates.net.ae**

Publications and Research

Other Books Received

(Mention here does not preclude subsequent review)

Beech, M.J. (2004). **Abu Dhabi Islands Archaeological Survey Monograph 1 - In the Land of the Ichthyophagi: Modelling fish exploitation in the Arabian Gulf and Gulf of Oman from the 5th millennium BC to the Late Islamic period.** Abu Dhabi Islands Archaeological Survey Monograph 1. Published by British Archaeological Reports International Series S1217. Archaeopress, Oxford. ISBN 1841715778. xxi + 293 pages; 126 figures, maps, plans, drawings, photographs; 232 tables; 8 Appendices of data, remains and sites. Price £ 39.00 UK pounds. Order from: **www.archaeopress.com**

Mark Beech's PhD thesis, based upon his examination of fish remains from archaeological sites from Kuwait to Oman. Many of the sites included are in the UAE. As one would expect, this book is very much one for the specialist, but others with an interest in the way in which Gulf people have utilised marine resources since the Neolithic period will also find it valuable.

The Date Palm: From Traditional Resource to Green Wealth. (No editor identified). Emirates Centre for Strategic Studies and Research, ECSSR. PO Box 4567, Abu Dhabi, UAE. pubdis@ecssr.ac.ae ISBN 9948-00-5551-1 (hardback); 9948-00-550-3 (paperback). Price: h 70 (hdbck), Dh 50(pbck)

The proceedings of the International Date Palm Forum held in Abu Dhabi in 2002. Papers include three on archaeological aspects of the date palm (the earliest evidence in SE Arabia of people eating dates comes from Dalma, in western Abu Dhabi), followed by others on date production, diseases and pests, date palms in the UAE, case studies of date palm production in South Africa, India and the Sahel, and studies on storage and marketing. Locally-related papers are as follows:

Al Kaabi, H. and A. Zaid – Date Palm Tissue Culture in the UAE: Research Activities and Mass Propagation (Pages 65-77).

Al Shakir, S. – Date Post-Harvest Technology in the UAE (Pages 171-198).

Beech, M. - Archaeobotanical Evidence for Early Date Consumption in the Arabian Gulf (Pages 11-31).

Dakheel, A. – Date Palm and Biosaline Agriculture in the UAE (Pages 199-211).

Potts, D. – Date palms and date consumption in Eastern Arabia during the Bronze Age (Pages 33-50).

Tengberg, M. – Research into the Origins of Date Palm Domestication (Pages 51-62).

Zaid, A. – Date Palm Culture in the UAE: Present situation and Future Potential (Pages 151-169).

Journals and Magazines

The following papers have been noted.

Archaeology

Jousse, H. and Guérin, C. (2003). 'Dugongs (Sirenia, Dugongidae) from the Early Holocene of Umm al-Qaiwain (United Arab Emirates).' **Mammalia** 67:337-347.

King, G.R.D. (2004). 'Notes on the Coast of Musandam, Sultanate of Oman.' **Bulletin of the Society**

for Arabian Studies 9: 24-28.

Arabian Archaeology and Epigraphy (AAE) Vol. 15, Issue 1, May 2004- Print ISSN: 0905-7196. Online ISSN: 1600-0471.

Papers of local interest include:

Barker, D. (2004). Notes on four miscellaneous shell and organic objects from Sharm. **AAE** 15(1): 20-23.

Barker, D. (2004). Miniature shell and bone 'hilts' or 'pulleys' from Sharm. **AAE** 15(1): 115-119.

Blau, S. (2004). Out of anonymity—A central location for 'peripheral' places through people: the contributions made by Karen Frifelt and Beatrice de Cardi to an understanding of the archaeology of the United Arab Emirates. **AAE** 15(1): 11-19.

Charpentier, V., S. Méry and C. Phillips (2004). Des coquillages... outillages des Ichthyophages? Mise en évidence d'industries sur Veneridae, du Néolithique à l'âge du Fer (Yémen, Oman, E.A.U.). **AAE** 15(1): 1-10.

Daems, A. (2004). The terracotta figurines from ed-Dur (Umm al-Qaiwain, U.A.E.): the human representations. **AAE** 15(1): 92-104.

Magee, P. (2004). The impact of southeast Arabian intra-regional trade on settlement location and organization during the Iron Age II period. **AAE** 15(1): 22-42.

Zutterman, C. (2004). The softstone vessels from Qarn Bint Sa'ud, Abu Dhabi (U.A.E.). **AAE** 15(1): 105-114.

Geology and Palaeontology

Abdelghany, O. (2003). 'Late Campanian-Maastrichtian foraminifera from the Simsim Formation on the western side of the Northern Oman Mountains.' **Cretaceous Research** 24(4): 391-405.

Al Farraj, A. and A.M. Harvey. (2004). Late Quaternary interactions between aeolian and fluvial processes: a case study in the northern UAE. **Journal of Arid Environments** 56: 235-248.

Anan, H.S. (2003). 'Three new species of benthic foraminifera from the Middle-Upper Eocene of Jabal Hafit, Al Ain area, United Arab Emirates'. **Neues Jahrbuch für Geologie und Paläontologie-Monatshefte** 9:529-536

Angela, D. Buscalioni, A.D., A.S. Schulp, J.W.M. Jag, S.S. Hanna and A.F. Hartman. (2004) Late Cretaceous neosuchian crocodiles from the Sultanate of Oman. **Cretaceous Research** 25: 267-275.

Bray, H. E. and S. Stokes (2004). 'Temporal patterns of arid-humid transitions in the south-eastern Arabian Peninsula based on optical dating.' **Geomorphology** 59(1-4): 271-280.

Boukhary, M., Abdeen, M.M. and Alsharhan, A.S. (2003). 'Stratigraphical setting and structural evolution of Jebel Malaqet, northern Oman Mountains, United Arab Emirates'. **Neues Jahrbuch für Geologie und Paläontologie-Monatshefte** 8:477-497.

Fleitmann, D. S.J. Burns, U. Neff, A. Mangini and A. Matter. (2003). Changing moisture sources over the last 330,000 years in Northern Oman from fluid-inclusion evidence in speleothems. **Quaternary Research** 60: 223-232.

Fleitmann, D., S.J. Burns, U., Neff, M. Mudelsee, A. Mangini and A. Mattera. (2004). Palaeoclimatic interpretation of high-resolution oxygen isotope profiles

derived from annually laminated speleothems from Southern Oman. **Quaternary Science Reviews** 23: 935-945.

Murad, A. A. and R. V. Krishnamurthy (2004). "Factors controlling groundwater quality in Eastern United Arab Emirates: a chemical and isotopic approach." **Journal of Hydrology** 286(1-4): 227-235

Rizk, A.S. and Alsharhan, A.S. (2003). 'Water resources in the United Arab Emirates.' **Developments in Water Science** 50: 245-264.

Wood, W.W. and Imes, J.L. (2003). 'Dating of holocene ground-water recharge in western part of Abu Dhabi (United Arab Emirates): Constraints on global climate-change models.' **Developments in Water Science** 50: 379-385.

Natural History (general)

De Mora, S., S. W. Fowler, *et al.* "Distribution of heavy metals in marine bivalves, fish and coastal sediments in the Gulf and Gulf of Oman." **Marine Pollution Bulletin**, *In press*.

Feulner, G.R. and Green, S.A. (2003). 'Terrestrial molluscs of the United Arab Emirates'. **Mitteilungen der Deutschen Malakologischen Gesellschaft** (Communications of the German Malacological Society). 69/70:23-34.

(The first detailed review of the UAE's terrestrial molluscs, following up on the paper by the same authors on the UAE's freshwater snails, published in *Tribulus* Vol. 9.1 (pp. 5-9).)

Hoolihan, J. (2003). 'Sailfish movement in the Arabian Gulf: a summary of tagging efforts'. **Marine and Freshwater Research** 54: 509-513.

Hussain, M.I., Victor, R. and Khoja, T.M. (2003). 'Charophytes of the Sultanate of Oman, southern Arabia'. **Nova Hedwigia** 77: 429-444.

Phelan, P. and A. Sliwa "Range size and den use of Gordon's wildcats *Felis silvestris gordonii* in the Emirate of Sharjah, United Arab Emirates." **Journal of Arid Environments**, *In Press*.

Preen, A. (2004). "Distribution, abundance and conservation status of dugongs and dolphins in the southern and western Arabian Gulf." **Biological Conservation** 118(2): 205-218.

(Estimates of dolphin abundance in the Marawah area between 1986 and 1999 indicate a population decline of 71%.)

Roberts, D. (2004). 'Prolonged survival of eggs of the rock-pool mosquito, *Aedes vittatus*, in the extreme heat of the Arabian peninsula.' **Journal of Arid Environments** 57: 203-210.

Saito, H., Bellan, M.F., Al-Habshi, A., Aispiru, M. and Blasco, F. (2003). 'Mangrove research and coastal ecosystem studies with SPOT-4 HRVIR and TERRA ASTER in the Arabian Gulf'. **International Journal of Remote Sensing** 24: 4073-4092.

Wynne, M.J. and Freshwater, D.W. (2004). '*Gelidium omanense* sp nov (Gelidiaceae, Rhodophyta) from the Sultanate of Oman'. **Botanica Marina** 47: 64-72.

Ornithology

The Phoenix, issue 20, (28 pp.) published by Michael Jennings for contributors to the Atlas of Breeding Birds of Arabia, ABBA, appeared in January 2004. ISSN:

0268-487X. Address: M. Jennings, Warners Farm House, Warners Drove, Somersham, Cambridgeshire PE28 3WD, U.K.

One paper specifically on the UAE, viz.

Diskin, D.A. 'Breeding Records of Shikra in the UAE'. 10-11.

Also of interest is a review of breeding exotic species throughout Arabia, (pp. 2-4). Abu Dhabi and Dubai figure prominently!

Tourenq, C. Combreau, O. Pole, S.B. Lawrence, M. Sgeyev, V.S. Karpov, A.A. & Launay, F. (2004). 'Monitoring of Asian houbara bustard *Chlamydotis macqueenii* populations in Kazakhstan reveals dramatic decline.' **Oryx** 38 (1): 62-67.

Conferences

History of the UAE 28th-29th February 2004

Organised by the Zayed Centre for Heritage and History in Al Ain, this conference included the following papers in English:

Coins for Identity and Coins for trade (*Ernie Haerinck, University of Ghent*); The History and Archaeology of Pearling in the Arabian Gulf (*Robert Carter, Institute of Archaeology, University College, London*); Julfar: An Historical Outline (*Geoffrey King, SOAS, University of London*); Port Cities and Urbanisation in the Arabian Gulf, ca. 1820-1930 (*Nelida Fuccaro, SOAS*); Horses in the Gulf – Companions of the Past (*Frauke Heard-Bey*); Historical Sources concerning Fujairah and the East Coast from the Eve of Islam until the early 20th Century (*Michele Ziolkowski*); Western military records as a Source for the Social History of the UAE (*Fred Lawson, Mills College, California*).

Papers will be published in 2005.

Second Annual Symposium on 'Recent Archaeological Discoveries in the UAE' – 7th/8th April 2004

Organised by the Zayed Centre for Heritage and History, Al Ain.

Papers presented were as follows:

Neolithic Occupation in the south-eastern region of the UAE (*Dr. Heiko Kallweit, Univ. of Freiburg & ADIAS*), Dr. Mark Beech (*ADIAS*) & Dr. Walid Yasin al-Tikriti (*Dept. of Antiquities and Tourism, Al Ain*); New results from Excavations of a Neolithic Settlement on Marawah island, Abu Dhabi, UAE (*Dr. Mark Beech [ADIAS], Richard Cuttler [Univ. of Birmingham], Derek Moscrop [Univ. of Birmingham], Dr. Heiko Kallweit [Univ. of Freiburg & ADIAS] and John Martin [ADIAS]*); Neolithic Use of Space and Environment at Jebel al-Buhais (*Prof. Hans-Peter Uerpmann, Dr. Margrethe Uerpmann and Marc Haendel [all Univ. of Tübingen]*); Latest results from al-Sufouh-2, Dubai (*Claudia Gruber [Univ. of Munich]*); Stamp seals from Jebel Buhais (*Dr. Sabah Jasim [Sharjah Directorate of Antiquities]*); Wadi Sur – a large fortification in Ra's al-Khaimah (*Christian Velde [National Museum of Ra's al-Khaimah]*); Fujairah fort and its associated settlement (*Dr. Michele Ziolkowski and Abdullah bin Suhail al-Sharqi [both Fujairah]*); Mosques of the islands of Abu Dhabi (*Dr. Geoffrey King [SOAS and ADIAS]*) and A Survey of Traditional Houses in Ra's al-Khaimah (*Ahmed Hilal [National Museum of Ra's al-Khaimah]*).

Papers will be published in 2005.



تريبيلوس

مجلة جمعية الامارات للتاريخ الطبيعي

ربيع / صيف ٢٠٠٤ م

المجلد ١/١٤

