Palaeontological and Archaeological Resources in Abu Dhabi Emirate
H.H. Sheikh
Khalifa bin Zayed Al Nahyan
President of the United Arab Emirates
H. H. Sheikh
Hamdan bin Zayed Al Nahyan
Deputy Prime Minister
تم إطلاق مبادرة أبوظبي العالمية للبيانات البيئية في الثاني من سبتمبر 2004 خلال مؤتمر القمة العالمي لتنمية المدن في مدينة جوهانسبيرغ جنوب إفريقيا من قبل دولة الإمارات العربية المتحدة. كمبادرة شاركت فيها من الصنف الثاني، تلقت أداء مبكرة لتنفيذ الأحكام المتعلقة بالبيئة والزراعة حيث اقتضى أقل من جدول أعمال القرن 21 وصُد الأهداف الإقليمية للألفية.

ويتغطى المبادرة التنموية بإمارة أبوظبي جزءًا من المشروع التنموي الوطني الخاص بدولة الإمارات العربية المتحدة. وقد كان النموذج من البداية يطبق شروط المشروع على مستوى إمارة أبوظبي وأن يتم اتخاذ نموذج عملياً لتنفيذ المشروع على المستوى الوطني والإقليمي. وتتمثل الرؤية الأساسية للمبادرة التنموية بإمارة أبوظبي في أن يكون نموذج المياه المحلي يسهل نموه من قبل كافة الجهات المعنية في الإمارة التي تسعى إلى تطوير وتنفيذ البيانات البيئية المكانية التي سيدعمها اتخاذ قرارات مستدامة وسياسة صناعة القرار.

أوقات العمل القطاعية

خلال السنوات القليلة الماضية، قامت مختلف القطاعات العالمية بشؤون البيئة بإمارة أبوظبي بجمع المعلومات البيئية المتوفرة لديها بشكل مختلف في إمارة أبوظبي. وبدأت الإمارات العربية المتحدة والعُليا في تطوير المشاريع التجارية، والزراعة والبيئة، وضبط اعتماد التكنولوجيا الأول من حالة البيئة، أن يتم تجميع المعلومات والتحصيصها على كل قطاع، بحيث تكون في البداية في صورة أوقات عمل للقطاعات البيئية والاجتماعية-الاقتصادية.

العناصر الأساسية للبيئة

- شروط ونقاط الشروط الصناعية
  - التحليل البيئي والдерبي
  - الفروع والشركات
- الاستجبات
  - السياسات
  - الإدارة
  - التعليم
  - التطوير
- الضغوط
  - عدد السكان
  - الزراعة
  - الصناعة
  - الإقتصاد
  - السياحة
  - الرحلات
- الشروط
بحث ورش العمل:

وقد قام مشتركون أوراق العمل العلمية والاجتماعية والميدانية بتبادل جدول
المحتوى ومرافعة الورقة من خلال بوابة مبادرات أبوظبي للبيانات
الإحصائية. وبعد الانتهاء من إعداد مساعدة الملاحظات التنفيذية، أعد
المشاركين قائمته المشاركين الذين أصبحوا مساهمين أو مشاركون

بتقنية أوراق العمل.

وقد استمر في إعداد الملاحظات الأولى لكل ورقة عمل لكل قطاع، ثم
إرسالها للشركاء والمؤسسات المشاركة للاجتهام. وبعد إدخال
الملاحظات وإجراء التعديلات تم عقد اجتماع ختامي حضره كافة
الاستراحات لوضع المسوغة النهائية، وقد قام هيئة البيئة -

أبوظبي بنشر أوراق العمل بعد مراجعتها.

للمزيد من المعلومات
والحصول على نسخ الكترونية

المزيد من المعلومات والحصول على نسخ الكترونية، سوء و أو
ملاحظات ومناقشات لكل ورقة عمل قطاع، سير عمل تقرير حالة البيئة
أو مشروع مبادرة أبوظبي العالمية للبيانات البيئية زوروا

www.aiedi/default.aspx

ويحث هيئة البيئة - أبوظبي
على إضافة على رابط بوابة مبادرة أبوظبي للبيانات البيئية على

www.aegdi.ac

العنوان التالي:

巴基斯坦 - ظاهرة العمل التنفيذية لتطوير بيئة البيئة.

وقد قطعت ورش العمل الموضوعات النهائية:

- وضع قائمة بالأعمال التي ستتناوبها كل ورقة عمل:
- وضع جدول شامل للملاحظات لكل ورقة:
- تحديد أدوات وطرق تحليل البيانات الموجودة أو الضرورية:
- لإعداد ورقة العمل لكل قطاع:
- تحديد أولى التدريبات والتدريبات التدريبية أو الضرورية:
- لإعداد ورقة العمل لكل قطاع:
- تحديد النماذج الضرورية لتنمية الكوارد البشرية لإعداد

أعمال العمل العلمية:

وأشرف على ورش العمل (ماعد ورقة قطاعات التعليم والتوعية البيئية)

السيد مارك سورينيس، مستشار قسم التدريس في معهد
ريدلاندز. كما قام مستشار معهد ريدلاندز بمشاركته في المناظر،
ومراجعة جدول الملاحظات، ونهاية، الورقات والتحديات التي
عرضت خلال ورش العمل.

كما تابع فريق عمل المبادرة مسار إعداد أوراق العمل العلمية. وبعد
كل ورشة عمل أجريت في إعداد مهمة ورشة ورشة مستشار معهد ريدلاندز
والمشاركون على أوراق العمل العلمية لمناقشة النتائج. إضافة إلى
ذلك، تم تحديث بوابة المبادرة.
وتهدف أوراق عمل القنوات البينية والاقتصادية-الاجتماعية إلى
تجميع أفضل المعلومات المتوفرة فيما يخص المناصرة الأساسية لليبيا
وعرض "النسر" لأبرز القنوات البينية في إدارة أبوظبي. وتماء
المستقبل من أوراق العمل الاقتصادية في إعداد تقرير عن حالة البيئة
والهياكل والجهات المتخصصة في مجالات الحفاظ على
المعلومات إلى أوراق العمل الاقتصادية من هيئة البيئة - أبوظبي.
والمؤسسات والجهات الأخرى.

ولقد تم وضع أوراق العمل الاقتصادية بهدف تجميع كافة المعلومات
المسؤولة، وتأتي القنوات البينية الأولى، وزيادة وعي الجمهور
بما يتعلق بالقضايا البيئية والمجالات التاريخية المدرجة لإدارة أبوظبي.
ولقد تم تثبيت مجموعة من المناصرة الأساسية لليبيا لإعداد تعش
"ورقة عمل طويلة".

خلاصة فترة التحريض، والتفقيض، للتقييم ميادينة أبوظبي العالمية للبيئات البينية
خلال العمل مع معهد ريدلزنز الابتدائي، تم تركز جزء من العمل
على وضع وتسهيل إعداد المناصرة كنماذج أوراق عمل طقاسية للبيئة. وتم
ترويج "النسر" لказать أبرز القنوات الاقتصادية" من قبل موظف، ومدارك
الآداب والبيئة. ضمن دور كل مشرف تسهيل إعداد ورق عمل
للطعام من خلال تثبيت الشارك بوصول العمل، وتشريب المساهمين في
إعداد وكتابة أوراق العمل، ووضع السنة الأولية، وتسهيل العمل قضايا
عن الإشراف على الحدود الزمنية لإعداد ورق عمل. وبالاعتماد على
توجهات جمعية البيئة، والجهات الأخرى المهنية، تم الاستفادة على إعداد
ورقة عمل طقاسية عن تقسيم الفصول والليبيا.

والإسهام في إعداد أوراق العمل من معهد ريدلزنز، وعثر من أربعة
أشخاص لتسهيل الإعداد في ثلاث سنوات، بدأ في شهر مارس 2005، وقام الفريق بالمساعدة في تطور أوراق العمل الاقتصادية وضع
برنامج "التقسيم الأول" في إعداد مشروع التموضع لإدارة أبوظبي.
وكيفية تنفيذ التدريب في تنفيذ المشروع.

وللبدء في إعداد أوراق العمل الاقتصادية، والبحث عن تنفيذ ورش
العمل، تم تنظيم سلسلة من ورش العمل شارك فيها 50 مشارك من
شركاء الهيئة. كما تم تشكيك مجموعة عمل على مستوى الهيئة لرسم
الأدوار وتحديد المسؤوليات.

ولقد تم تنظيم ورش العمل في المجمع التراثي بأبوظبي في الفترة بين
28 مارس 2005.

بدأت سلسلة ورش العمل تنفيذ ورشة عمل لوضع خطة العمل للمشروع.
ويعتبر هذه الورشة التي نظمت لمدة يوم واحد إلى استعراض المعلومات
المتعلقة بتقييم حالة البيئة التي تتوفر حالياً عن كل نظام من
القنوات المختلفة، وتحديداً شكل وتحديداً كل ورق عمل طقاسية.
What is AGEDI?

AGEDI Abu Dhabi is a subcomponent of AGEDI geared solely to the Emirate of Abu Dhabi. AGEDI Abu Dhabi serves as a pilot and ultimately as the basic model for replication within the nation and region.

The vision of AGEDI Abu Dhabi, the local level implementation pilot, is a “replicable, networked, adaptive and working model for the development and use of high quality spatial environmental data by all users within the Emirate of Abu Dhabi that will support sustainable decision and policy-making”.

Sector Papers

Over the years different organization sectors compiled a variety of information in many forms that describe what is known about Abu Dhabi, the UAE and the Arabian Gulf. The development of the first State of the Environment (SOE) Assessment for the Emirate of Abu Dhabi will require all environmental and socioeconomic...
ic data/ information compiled and summarized.

Environmental and Socioeconomic sector papers served that purpose and compiled the best available knowledge relevant to the state of the environment assessment and issues pertaining to the Emirate of Abu Dhabi’s environment. These sector papers will populate the SOE as well as highlight gaps in information and data. Inputs to these sector papers come from EAD and stakeholders, resource specialists, as well as local universities and other sources of knowledge.

Sector papers were created to capture all necessary information, highlight the most important issues, and make various audiences aware of the unique historical and current environmental setting of Abu Dhabi.

A range of environmental assets were identified to create a series of 9 Environmental Sector papers.

As part of the AGEDI inception period and the consulting work with Redlands Institute (RI), part of the focus was put on the facilitation and implementation of 8 Environmental Sector Papers. “Sector Paper Leads” were nominated by heads of EAD centers whose role included both leading and facilitating the implementation of the sector paper by nominating participants for the workshop, identifying contributors and authors, finalizing documents, facilitating the process and overseeing timelines. Upon the recommendation of our partners and contributors, an additional sector paper topic, Education and Awareness, was approved.

To support the implementation effort, RI mobilized a team of four people to work with EAD staff over the three week inception period commencing in May 2005, to assist in the definition of the sector papers and a program management infrastructure to be used to structure the overall AGEDI-Abu Dhabi effort and to monitor and assess progress over the project period

To kick off the sector paper activities a series of workshops were held, which included over 50 partners attendance. Additionally, in preparation to the workshops, internal groups and one on one meetings were held to clarify roles, responsibilities and the scope for leads. All workshops were held at the Abu Dhabi Cultural Foundation from May 28th to June 12th, 2005.

The workshop series commenced with a sector Framing Workshop. This one-day workshop was held to further refine the basic purpose, form and general range of content to be included in each of the sector papers. All EAD staff and external participants were invited to attend.

Basic topics defined included:
- Review of the purpose, process and intended results of the Sector Paper process, including relationship of the sector papers to the State of the Environment reporting and Atlas development efforts to be undertaken later;
- Confirmation and/or refinement of sector definitions;
- Development of an initial table of contents template;
- Refinement of list and description of outputs;

The specific paper workshops further refined the sector paper template. The workshops occurred as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Workshop</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 20 - Sun</td>
<td>Sector Paper Framing Workshop</td>
</tr>
<tr>
<td></td>
<td>Sector Paper Individual Workshops</td>
</tr>
<tr>
<td>May 30 - Mon</td>
<td>Waste Management and Pollution</td>
</tr>
<tr>
<td>May 31 - Tues</td>
<td>Environmental Policy and Regulation</td>
</tr>
<tr>
<td>June 1 - Wed</td>
<td>Terrestrial Habitat and Land Resources</td>
</tr>
<tr>
<td>June 6 - Mon</td>
<td>Water Resources</td>
</tr>
<tr>
<td>June 7 - Tues</td>
<td>Physical Geography - Abu Dhabi</td>
</tr>
<tr>
<td>June 11 - Sat</td>
<td>Marine and Coastal Environment</td>
</tr>
<tr>
<td>June 12 - Sun</td>
<td>Historical, Archaeological and Cultural Heritage</td>
</tr>
<tr>
<td>June 13 - Mon</td>
<td>Population, Development and Economy</td>
</tr>
<tr>
<td>September 4</td>
<td>Environmental Education and Awareness</td>
</tr>
</tbody>
</table>

...
The workshops covered the following:

- Development of a comprehensive “hit-list” of sector topics to be included;
- Development of a comprehensive table of contents for each paper;
- Initial analysis on what data analysis tools or methods exist or are needed to support sector paper development;
- Initial analysis on what applications tools or methods exist or are needed to support sector paper development;
- Initial analysis on what special projects or methods exist or are needed to support sector paper development;
- Initial analysis on what capacity building or communications needs exist or are needed to support sector paper development;

All the workshops (except education and awareness) were facilitated by Mark Sorensen as senior consultant of RI. Additional RI consultants kept track of discussions, table of contents, mind maps, data/application needs.

The AGEDI team each took track of topics including data and applications, QA/QC, special projects, communications and outreach, and capacity building opportunities using a normalized format.

The AGEDI team, RI consultants and the lead met after each workshop to discuss findings and clarify any points. Additionally, the AGEDI portal, http://agedi/default.aspx, was updated after the workshop with proceedings and documents.

The leads of each paper and partners, exchanged the prepared table of contents for peer review using the AGEDI portal. Upon producing a final draft for the outline, the leads prepared a list of participants that would become contributors and/or authors.

Once the first draft of each sector paper was complete, it was sent for peer review by the papers partners/ key stakeholders and collaborators. Once feedback and comments were incorporated a final meeting was held with the paper’s main contributors to finalize the draft.

The finalized version of each paper was published by the Environment Agency – Abu Dhabi after it had been reviewed.

For More Information and Online Versions

For more information, on-line version, pictures and/or discussion forum on each sector paper, the SOE process or the AGEDI project please visit the Environment Agency–Abu Dhabi website www.ead.ae and click on the AGEDI link or visit the portal directly at www.uat.agedi.ae
وتقع معظم المواقع الهامة التي تعود للعصر الحجري (12500-2000 قبل الميلاد) على جزيرة الصر بين ياس والدللي المادي الوحيد على وجود مجتمعات مسيحية قبل العصر الإسلامي في جنوب شبه الجزيرة العربية. وهي تشكل شيئاً من اكتشافاً في حضريات على الجزيرة في أوائل التسعينات إلى منتصف التسعينات، وقد نبنت داخل مجمع مسوري ضخم ديراً.

ومن العصر الإسلامي تم الكشف على أثار لمجموعة فريدة من الحكمن (بعضاً من قد تم ترميمها من قبل إدارة الآثار والسياحة) بالإضافة إلى بساتين التخوم وفهاء الاقلاع. ويعتبر وجود المباني التي تعود للقرن التاريخية القريبة نادرة الوجود على الساحل وجزر أبوظبي. ومن المواقع الرئيسية مسجد المريخي ومسجد الدولة، وموقع المريخي مسجد المهندس. كما تم العثور على أسوار من الحجر لمساجد القباء ومرور وبشند، لذا يمتاز عدد من حضريات الساحلية والتي تمثل جزءاً من المجموعة المعمارية.

تراكم الحضري والتاريخي الذي تلتقي منه جبال حجر لعدة أمتار على المواقع التي تعود لحضارية وادي عميدنة التقليد، وفي العثور إلا على آثار لمستوطنة عابرة تعود لأوائل العصر البرونزي، ولها ما تم التعرف بشكل صعب على أجزاء الاستيطان في ساحل جزيرة أبوظبي. هذه المنطقة خلال تلك الحقبة الزمنية.

وتشير بعض المصطلحات "العصر الحديث" (2500-300 قبل الميلاد) تسمية خاصة، فسكان الإمارات ذهبوا على استخدام النحاس بدلاً من التحول إلى معاينة جديدة، لأنه من المفترض أن يكون النحاس متوفرًا في الجبال.

وقد تم العثور على أدة متتالية من هذه الفترة على الشريط الساحلي والجزء من أبوظبي، والتي يبدو أنه لها ما من مستوطنات مؤقتة أو محطات مؤقتة ارتبطت بطرق التجارة البحرية، وبها تم الاستيطان فيها بشكل مستمر، ومن أكبر المستوطنات المعروفة من المواقع التي تقع في المناطق الداخلية مثل الرملية بالقرب من مدينة العين.
التراث التاريخي والأثري

ملخص تنفيذي

يتناول هذا الورقة التفتيش الفئة الأساسية للتراث التاريخي والأثري، والتراث الزماني والقضايا الرئيسية المتعلقة بإدارة هذا الوارد في إمارة أبوظبي. وتشمل القضايا الرئيسية التي تجريها هذه الورقة التسليطات والبني التحتية، والجهود المبذولة لتحقيق التوازن بين التنمية وبرامج الحماية والإدارة، وأهمية التعليم والتوعية.

ويتم هذا العمل بناءً على مجموعة أزمنة أعمال التوثيق التي تم إعدادها للتعبير عن العناصر الأساسية للبيئة وتحقيق أهم وأبرز القضايا البيئية في إمارة أبوظبي وذلك في إطار إعداد تقرير حالة البيئة الأول لإمارة أبوظبي الذي يعتبر أحد الأنشطة الرئيسية لقيادة أبوظبي العالمية للبيئات البيئية.

النتائج

قد تم العثور على مجموعة متنوعة من المواقع التاريخية والأثرية في إمارة أبوظبي. ويفترض هذا النص التنفيذي مجموعة من أهم النتائج والمواقع والمجاليات ذات الصلة:

من أحدث المواقع الأثرية التي تم اكتشافها موقع ضخم أثري تعود للعصر الطبيعي، أي منذ ما بين 144 - 86 ميلية سنة. وقد هذا الموقع بأصالة يمثل ورقة من الوعي بين المنطقة الإبداعية في إمارة أبوظبي. كما تم العثور على سلسلة من الأحافير تعود للعصر البيولوجي للتأخير، أي قبل حوالي 67 - 68 ميلية سنة. وذلك على طول الساحل داخل المنطقة العربية في إمارة أبوظبي مما يشير إلى أن المنطقة العربية في إمارة أبوظبي كانت منطقة تمثل سهول سافانا غنية بالأشجار والأظهر البيئية الحركة والتي تأوي العديد من الحيوانات الكبيرة مثل شرق أوروبا اليوم.

كما تم العثور على مشغولات أثرية تعود للعصر الحجري القديم في منطقة أخرى من دول الإمارات العربية المتحدة، وفي الشارقة (وكلتا هذه المواقع أخرى بمنطقة الجزيرة العربية)، لكن لم يتم العثور عليها في إمارة أبوظبي.

ومن المواقع الأثرية المعروفة في إمارة أبوظبي موقعيين تم العثور عليها مؤخراً في جزيرة مرج بحدود تاريكيهما لأكثر من 7500 عام. كما تم العثور على أثر

ولقد تم العثور على دلائل الاستمرار تعود للعصر البرونزي، حوالي 3000 - 2600 قبل الميلاد، وتم العثور على مرفقات عديدة من خلال توفر هذه الورقة "متحف أم النار". وقد تم الكشف عن مستوحات سكينة ومياه جماعية تضم 50 موضعًا من قبل عمال مقربين من الصراع والصراع ودولة الإمارات.

ولقد تم بناء أم النار متحلة تصدير النجا إلى منطقة بلاد الرافدين. وأثار تلك الحضارة معرفة اليوم بين ماكينات كبيرة من دولة الإمارات ونظام سلطة مان.

ويقع أكبر مجتمع أثري في العصر البرونزي في دولة الإمارات في منطقة الهولالي إلى الشمال من منطقة العين. ويشمل هذا الموقع المناظر الحيوانية في هذه الفترة، بما يربط ذلك إلى التغيير الناجل. وتم وضع تلك المواقع إلى حدائق الأثر في الهولالي، والتي تم تشيدها لإبراز آثار المنطقة وتحقيق رياضها من قبل العامة.

ولقد تم العثور على دلائل الاستمرار تعود للعصر البرونزي، حوالي 3000 - 2600 قبل الميلاد، وتم العثور على مرفقات عديدة من خلال توفر هذه الورقة "متحف أم النار". وقد تم الكشف عن مستوحات سكينة ومياه جماعية تضم 50 موضعًا من قبل عمال مقربين من الصراع والصراع ودولة الإمارات.

ولقد تم بناء أم النار متحلة تصدير النجا إلى منطقة بلاد الرافدين. وأثار تلك الحضارة معرفة اليوم بين ماكينات كبيرة من دولة الإمارات ونظام سلطة مان.

ويقع أكبر مجتمع أثري في العصر البرونزي في دولة الإمارات في منطقة الهولالي إلى الشمال من منطقة العين. ويشمل هذا الموقع المناظر الحيوانية في هذه الفترة، بما يربط ذلك إلى التغيير الناجل. وتم وضع تلك المواقع إلى حدائق الأثر في الهولالي، والتي تم تشيدها لإبراز آثار المنطقة وتحقيق رياضها من قبل العامة.
EXECUTIVE SUMMARY

Project Description

The sector paper presented here provides a synthesis of knowledge concerning the palaeontology and archaeology of Abu Dhabi. Descriptions of the key components, main chronological periods represented and key management issues are provided. The report also details the cultural, scientific, educational and economic value of palaeontology and archaeology to Abu Dhabi emirate. Major issues which are discussed include legislation and infrastructure, the struggle for a balance between development vs. protection and management, and the importance of education and awareness.

This work forms part of a suite of sector papers which are intended to contribute to the State of the Environment Report as part of the activities of the Abu Dhabi Global Environment Data Initiative (AGEDI).

Findings

A wide variety of palaeontological and archaeological sites exist within Abu Dhabi emirate. This Executive Summary highlights a selection of the most significant findings and sites/areas of relevance:

The earliest palaeontological sites contain Cretaceous fossils, dating to 144-66.4 mya, found in the vicinity of Al Ain, in Abu Dhabi’s Eastern Region. The Late Miocene period fossils, dating to between 6-8 mya, discovered along the coast and interior of Abu Dhabi’s Western Region provide evidence of a lush savanna-type vegetation interspersed with large rivers and channels, the region being populated by a range of animals more familiar with the conditions of an environment like modern day East Africa.

Archaeological artifacts of probable Palaeolithic date have been identified from Jebel Barakah in Abu Dhabi’s Western Region, as well as from elsewhere in the United Arab Emirates, in Sharjah.

The two earliest archaeological settlement sites so far known from the Emirate date to about 7,500 years ago and come from Marawah island (sites MR1 and MR11). Traces of these early inhabitants of Abu Dhabi can be found on the coast and islands such as Dalma, as well as within the desert interior in areas like Umm az-Zamul. Ubaid pottery is known from both Dalma, Marawah and a third island, Al-Aryam, demonstrating a clear sign of contacts with southern Mesopotamia at that time, or at least with traders in the central Gulf, who were themselves in contact with Ubaid cultural groups.

Little evidence of fourth millennium occupation has been found on the coast and islands of Abu Dhabi. The Hafit period (3200-2600 BC) is named after the well-built stone tombs present in their hundreds on the slopes of Jebel Hafit near Al Ain, and the Hajar Mountains of neighbouring Oman. Some time in the late Fourth Millennium BC, knowledge of a major technological innovation arrived in the region. This was how to mine and smelt the copper ores found in the Hajar Mountains, and this marked the beginning of the local Bronze Age.

The island of Umm an-Nar (now also known as Sas al-Nakhl) gives its name to the chronological period known as Umm an-Nar (2600-2000 BC). A large settlement and a contemporary cemetery with 50 collective graves was investigated by Danish, Iraqi and Emirati archaeologists. The port of Umm an-Nar acted as a terminal for copper exports to Mesopotamia. Evidence of Umm an-Nar civilisation has subsequently been discovered throughout the UAE and northern Oman.

The largest Bronze Age complex in the United Arab Emirates is located at Hili, just to the north of Al Ain. This includes important settlements as well as three tombs inside the park and several others outside. Some sites of this complex have been incorporated into the Hili Archaeological Park, designed to highlight the archaeological sites and make them more accessible to the public.

Evidence of occupation during the middle Bronze Age, around 4,000 years ago, has been found on several of Abu Dhabi’s islands. There is little evidence of occupation of the deserts during this period, perhaps due to climatic change, and less rainfall, and some of the islands in the Western Region may have been used as temporary way-stations or trading settlements by sailors from Bahrain (ancient Dilmun), on their way to Hormuz. The lack of visible sites may however also be due to outwash from the Hajar Mountains depositing several metres of gravel and soil over Wadi Suq sites in the Al Ain area. Only ephemeral settlement traces from the Late Bronze Age have been identified on the coast and islands of Abu Dhabi, and the pattern of occupation in this region during this period is, at yet, poorly understood.
The term "Iron Age" (1250-300 BC) is technically a misnomer, as the inhabitants of the UAE continued to use copper rather than switching to the new metal, presumably because of the ready availability of copper in the mountains. Only sparse evidence from this period has been found on the coastline and islands of Abu Dhabi, many appearing to be temporary campsites or way-stations relating to maritime trade, and perhaps occupied on only a seasonal basis. More substantial settlements are known from sites in the interior such as Rumeilah, near Al Ain.

Some of the most important sites from the Sasanian period (300-632 AD) are located on Sir Bani Yas island, where the pre-Islamic Christian monastery and associated settlement buildings discovered during excavations in the early to mid 1990s provide the only physical evidence yet known in southeastern Arabia of the presence of Christian communities before Islam.

Important Islamic period remains found in the Al Ain area include a number of forts (some of which are restored by the Department of Antiquities and Tourism) and associated date palm oasis gardens and falaj systems. Buildings from the recent historical period are rare on the coastline and islands of Abu Dhabi. Key sites include the Bayt al-Muraykhi (a pearl trader’s house) and the al-Dawsari, al-Muraykhi and al-Muhannadi mosques, all on Dalma island. The stone walled mosques on Liffiya, Marawah and Bu Sharah, as well as a number of stone outline mosques on coastal islands also form an important architectural group.

**Major Issues**

The major issue relating to the palaeontological and archaeological resources of Abu Dhabi emirate is the lack of policy and regulation of legislation to enforce protection of sites. This is especially critical with the modern pace of development and landscape transformations underway. Data gathering and sharing of knowledge concerning the palaeontology and archaeology of Abu Dhabi emirate should be co-ordinated and the data distributed in a correct manner. There is a need for monitoring and organised management of palaeontological and archaeological resources.

There is a lack of UAE nationals trained in archaeology and palaeontology. Future mentoring or in-house training of UAE nationals, perhaps formalised as partnerships with existing university archaeology departments, should be urgently considered. There is a problem of lack of awareness of best practices in heritage management, and a need for training in appropriate practices carried out following internationally recognised standards.

Unlike a number of other professions, there is no formal professional association of archaeologists within Abu Dhabi emirate, or indeed within the Emirates as a whole. The establishment of such a body in the future may introduce a more professional approach and help to develop best practices.

Increased awareness of heritage issues is vital for educating the general public about the importance of archaeological and palaeontological sites in Abu Dhabi emirate.

This report was largely written in advance of the creation of the new Abu Dhabi Authority for Culture and Heritage (ADACH). Many of the issues highlighted are now beginning to be addressed by the new authority.
Table of Contents

EXECUTIVE SUMMARY 1

1. INTRODUCTION 9
   1.1. Geological Overview 11
   1.2. Ecological Overview 11
   1.3. Historical Development of Research in Palaeontology and Archaeology in Abu Dhabi emirate 11

2. COMPONENTS 14
   2.1. Palaeontology 14
      2.1.1. Cretaceous (144-66.4 mya) 14
      2.1.2. Palaeocene (66.4-56 mya) 15
      2.1.3. Eocene (56-34 mya) 15
      2.1.4. Oligocene (34-23 mya) 15
      2.1.5. Miocene (23-5.3 mya) 16
      2.1.6. Pliocene (5.3-1.8 mya) 16
      2.1.7. Pleistocene (1.8 mya - 9600 BC) 16
   2.2. Archaeology 16
      2.2.1. Holocene (9600 BC - present) 16
      2.2.2. Late Stone Age (5700-3800 BC) 17
         2.2.2.1. Marawah 17
         2.2.2.2. Dalma 17
         2.2.2.3. Umm az-Zamul 18
         2.2.2.4. Other sites 19
      2.2.3. Hafit (3200-2600 BC) 19
         2.2.3.1. Hafit tombs 19
      2.2.4. Umm an-Nar (2600-2000 BC) 21
         2.2.4.1. Archaeology of Umm an-Nar Island 21
         2.2.4.2. Hili Archaeological Park 22
         2.2.4.3. Bida Bint Saud 23
      2.2.5. Wadi Suq (2000-1600 BC) 24
      2.2.6. Late Bronze Age (1600-1250 BC) 24
      2.2.7. Iron Age (1250-300 BC) 25
      2.2.8. Late Pre-Islamic (300 BC - 300 AD) 25
      2.2.9. Sasanian (300-632 AD) 25
      2.2.10. Early, Middle, and Late Islamic (750 AD - 19th century) 26
      2.2.11. Recent Islamic (19th-20th century) 26
3. RELEVANCE OF PALAEONTOLOGY/ARCHAEOLOGY 28

3.1. Cultural Value 28

3.1.1. Understanding behaviour and patterns of previous civilizations 28
3.1.2. Understanding ancient land use patterns 28
3.1.3. Identifying past and present belief systems that have not been discussed in great detail (worship of fire and other pre-Islamic beliefs) 28

3.2. Scientific Value 29

3.3. Educational Value 29

3.3.1. Building understanding of common history and national identity 29
3.3.2. Current gap in educational material and educators relating to history, archaeology and palaeontology 29
3.3.3. Gaps in Arabic language educational materials 30
3.3.4. Showing the importance/significance of UAE history to the outside world 30

3.4. Economic Value 30

3.4.1. Tourism 30
3.4.2. Sale of reproductions of antiquities 30
3.4.3. Media value (books, documentaries, et cetera) that can be framed around archaeology/palaeontology 31

4. MAJOR ISSUES 32

4.1. Legislation and Infrastructure 32

4.1.1. Lack of implementation of current laws 32
4.1.2. Lack of legislation forbidding theft and sale of antiquities/fossils 32
4.1.3. Lack of participation in international conventions for preservation of archaeological and palaeontological resources 32
4.1.4. Authority for management of archaeological and palaeontological resources 32
4.1.5. Lack of coordination between different Emirates 32

4.2. Development vs Protection 32

4.2.1. Threats from development/construction activities (i.e. bulldozers) 32
4.2.2. Lack of formally protected areas, e.g. No designated World Heritage Sites in UAE 32

4.3. Education and Awareness 33

4.3.1. Lack of awareness of importance and protocols related to antiquities/fossils 33
4.3.2. Lack of UAE Nationals entering the professional field 33
4.3.3. Lack of museums and exhibits in Abu Dhabi Emirate 33

4.4. Antiquities trade 33

4.4.1. Sale of antiquities 33
4.4.2. Smuggling via the UAE 33
5. MANAGEMENT AND CONSERVATION 34

5.1. Institutional Arrangements 34

5.1.1. ADIAS MOU with the Environment Agency - Abu Dhabi (EAD) 34
5.1.2. ADIAS partnership with Dept. of Antiquities in the Eastern Region 34
5.1.3. Informal relationships (e.g. ADIAS and Zayed Centre for Heritage & History) 34
5.1.4. Abu Dhabi Authority for Culture and Heritage (ADACH) 34

5.2. Governmental bodies 34

5.2.1. Department of Antiquities and Tourism, Al Ain 34
5.2.2. Cultural Heritage Unit, Abu Dhabi Tourism Authority, Abu Dhabi 34
5.2.3. Abu Dhabi Islands Archaeological Survey (ADIAS) 34
5.2.4. Cultural Foundation, Abu Dhabi 35
5.2.5. Centre for Documentation and Research 35
5.2.6. Zayed Centre for Heritage and History 35
5.2.7. Abu Dhabi Authority for Culture and Heritage (ADACH) 35

5.3. Non-Governmental Organisations (NGOs) 36

5.3.1. Emirates Natural History Group 36

5.4. Conservation 36

5.4.1. Policy, Legislation, Regulation 36
5.4.2. Research and Monitoring 37
5.4.3. Protected Areas 37
5.4.4. Enforcement 37
5.4.5. Awareness and Capacity Building 37

6. OUTLOOK 38

6.1. Summary of the state of current knowledge 38

6.1.1. Palaeontology 38
6.1.2. Archaeology 38

6.2. What are the issues? 41

6.2.1. Legislation 41
6.2.2. Monitoring and Management 41
6.2.3. Training 41
6.2.4. Education and Awareness 41

6.2. Gap Analysis 42

6.2.1. Data and Knowledge 42
6.2.2. Policy and Regulation (at all levels- institutions, local & federal) 42
6.2.3. Awareness and best practices 42
6.2.4. Lack of Professional Association 42
6.2.5. Monitoring and Management 42
6.2.6. Education and Awareness 42
6.3. Way Forward

6.3.1. Development of appropriate legislation 42
6.3.2. Increase national and international awareness of UAE heritage 42
6.3.3. Designate key sites as potential World Heritage Sites 43
6.3.4. Increase transparency and access to data 43
6.3.5. Resolve issues surrounding data ownership and access 43
6.3.6. Develop Archaeological Association at the Federal Level 43
6.3.7. Identify executive authority for increasing efficiency of existing coordination/collaboration efforts 43
6.3.8. Improve training and qualifications 43

ACKNOWLEDGEMENTS 44
LIST OF AUTHORS AND CONTRIBUTORS 45
ARCHAEOLOGY 46
LIST OF FIGURES 47
REFERENCES 49
APPENDICES

Appendix 1 - Glossary of Terms and Abbreviations 59
Appendix 2 - Relevant Websites and Metadata 57
1 INTRODUCTION

A wide variety of palaeontological and archaeological sites exists within Abu Dhabi emirate. Palaeontological sites range from Cretaceous fossils found in the vicinity of Al Ain, in Abu Dhabi's Eastern Region, to Late Miocene fossils discovered along the coast and interior of the Western Region and Pleistocene marine fossils found on the island of Marawah. The earliest archaeological settlement sites so far known from the Emirate date to about 7,500 years ago, during the early Holocene period. Traces of these early inhabitants of Abu Dhabi can be found on the coast and islands, as well as the desert interior.

Earlier archaeological artifacts, of probable Palaeolithic date, have been identified from Jebel Barakah in Abu Dhabi's Western Region as well as elsewhere in the United Arab Emirates, in Sharjah.

The sector paper presented here provides a synthesis of the knowledge concerning the palaeontology and archaeology of Abu Dhabi. Descriptions of the key components, main chronological periods represented and key management issues are provided. The report also details the cultural, scientific, educational and economic value of palaeontology and archaeology to Abu Dhabi emirate. Major issues which are discussed include legislation and infrastructure, the struggle for a balance between development vs. protection, the importance of education and awareness, and the issue of the trade in antiquities.

This work forms part of a suite of sector papers which are intended to contribute to the State of the Environment Report as part of the activities of the Abu Dhabi Global Environment Data Initiative (AGEDI).
FIGURE 2: Geology of the United Arab Emirates.
1.1 Geological Overview

The geological history of the Emirates and adjacent areas of Arabia over the past 600 million years or so seems to have been mostly one of relative stability (Glennie 2002). Following tropical shallow-marine conditions of sedimentation in the late Precambrian, the area was largely terrestrial during much of the succeeding Palaeozoic time span (Figure 2). Deep erosion preceded the Permian separation of a micro-continent from the eastern margin of Arabia; the following marine transgression was associated with the successive creation of Neo-Tethys 1 and 2. Throughout most of the Mesozoic era, the Emirates was the site of shallow-marine sedimentation except in the two branches of Neo-Tethys, where deep-marine deposition took place. This situation was brought to an end by closure of Neo-Tethys 1 and 2, and the obduction of deep-oceanic sediments and a slice of newly formed back-arc oceanic crust onto the Arabian continental margin to form an island arc. The succeeding shallow-marine limestone deposition was terminated in the east when the Oman Mountains began to be uplifted into a high range some 30 Ma BP, but stable conditions of sedimentation continued over the bulk of the Emirates until major glaciations began to induce lower global sea levels perhaps some two to five million years ago and created the present land surface. Near-polar glaciations have controlled sea level in the Arabian Gulf for at least the last 500,000 years, thereby also controlling the supply of dune sand from the north or the cutting off of that supply, with the resulting widespread deflation and creation of sabkhas.

1.2 Ecological Overview

The majority of archaeological sites in Abu Dhabi emirate are located in the relatively fertile plains to the west of the Hajar Mountains, in the Al Ain area, in coastal areas and on offshore islands, see the web page, “ADIAS Guide to Archaeology in Abu Dhabi and the United Arab Emirates”, http://www.adias-uae.com/archaeology.html. This is because such locations provided strategic advantages in terms of natural resources, as well as access and communication routes. It was far easier in ancient times to travel along the coast by boat than it was to traverse large sand dunes and sabkha, while the plains in the Al Ain area not only provided relatively easy going, but were also better supplied than the deserts of the interior with fresh water supplies that could be tapped with relative ease.

Palaeontological sites from the Late Miocene period are confined to the Baynunah Formation, which outcrops throughout the coastal regions of Abu Dhabi, from Rumaitha in the east to Umm al-Ishtan in the West, while fossils from other, earlier periods (as yet poorly studied) are known from Jebel Hafit and smaller exposed rocky hills near Al Ain.

1.3 Historical Development of Research in Palaeontology and Archaeology in Abu Dhabi Emirate

The early phases of work on the palaeontology of the Emirate of Abu Dhabi, led by teams from the British Natural History Museum and Yale University laid important groundwork for the study of the Late Miocene fossil vertebrate fauna of the Western Region of Abu Dhabi (Whybrow and Hill 1999). Much of the work, carried out in association with the Department of Antiquities and Tourism in the Eastern Region of Abu Dhabi, was sponsored by the Abu Dhabi Company for Onshore Oil Operations (ADCO) and the Abu Dhabi National Oil Company (ADNOC). The Emirates University was also involved in some of the early work. The Late Miocene vertebrate fossils primarily came from fluvial sediments (sands and gravels). Many of the animals recovered confirm this riverine origin such as freshwater mussels, crocodiles, turtles, fish and hippopotami.

Mammals are amongst the best-represented group of vertebrates in the Baynunah Formation. The elephant family are primarily represented by Stegotetrabelodon syrticus, although a type of Mastodon and a Deinothere were also present. The odd-toed ungulates included two Hipparion species, three-toed horses, precursors of modern true horses. Horse remains of rhinoceroses are present. The largest group of mammals belong to the even-toed ungulates. These include the pigs, hippopotami, cattle, antelopes, gazelle and giraffe. This combination of ruminants suggests that the Late Miocene was very much like the modern day savannah grasslands of East Africa.

A single canine of a male monkey from Jebel Dhanna is the only evidence of Old World monkeys yet found in the Arabian Peninsula. A number of small mammals, rodents and invertebrates were found during the sieving of sediment samples from Shuwaihat in 1995. The biogeographic affinities of the taxa represented reflect a mixture of African and Asian fauna. Finally, carnivore fossils include rare specimens of sabre-toothed cat, hyaenas, and an ancestral member of the weasel and badger family.

In accordance with an agreement between ADNOC and the then Environmental Research and Wildlife Development Agency, ERWDA (now known as the Environment Agency - Abu Dhabi, EAD), the fossil collections made during work in the early 1990s returned to Abu Dhabi, where they are curated and stored. These fossils are now in the custody of the Abu Dhabi Authority for Culture and Heritage (ADACH). Further palaeontological fieldwork has continued, since then confirming that the Late Miocene fossil vertebrate fauna of the Western Region of Abu Dhabi is of international importance.
In 2001, extensive trackways with large footprints of Proboscideans (elephant family) were identified at Mleisa (Figure 3), a white stone plain south of the Baynunah forest (Higgs et al. 2003; Higgs 2005; Higgs et al. 2005). A second Proboscidean trackway site was also later identified in the vicinity in 2003. In 2002 and 2003, work in the Ruwais area, by ADIAS, in association with TAKREER, identified further important fossil localities, recovering numerous fossils, the most spectacular of which was an almost complete upper tusk from the primitive elephant *Stegotetrabelodon syrticus* (Figure 4).

The Ruwais tusk measured 2.54 metres in length from its base to its tip. This tusk along with other important *Stegotetrabelodon* fossils, collected in the early 1990s, were subsequently put on display in the exhibition "Abu Dhabi 8 Million Years Ago" in June 2005 (Beech and Hellyer 2005). This exhibition is currently located in the foyer of the Environment Agency building in Abu Dhabi. To coincide with the launch of the exhibition a book and DVD were also released (Beech and Hellyer 2005; ADIAS 2005).

Further *Stegotetrabelodon syrticus* fossils were identified at Umm al-Ishtan, south-west of Ruwais, in late 2005 and early 2006. A third Proboscidean trackway was also identified early in 2006 close to Bida Al-Mutawa.

Discussions are currently under way (early 2006) between the Abu Dhabi Authority for Culture and Heritage, ADACH, and Yale University on a possible resumption of fieldwork by Yale.

Archaeology in the Emirate of Abu Dhabi commenced in 1959, with a visit by a team of archaeologists from Denmark who were then working in Bahrain, to examine reported stone burial mounds on the island of Umm al-
Nar (now known as Sa’s al-Nakhl), adjacent to Abu Dhabi. These proved to be of Bronze Age date (c. 2500 - 2,000 BC) but of a previously-undiscovered civilisation that had trading connections with the Dilmun civilisation in Bahrain and the Harappan civilisation in the Indus Valley (Hellyer 1998).

This was followed by further work by the Danish team, both at Umm al-Nar and in the Al Ain area, inland, including the neighbouring mountain of Jebel Hafit, where dozens of early Bronze Age burial cairns (dating to around 3,000 BC) were identified, and at Hili, one of the villages in the Al Ain / Buraimi Oasis.

On the instructions of Sheikh Zayed bin Sultan Al Nahyan, who became Ruler of Abu Dhabi in 1966 (and, subsequently, President of the United Arab Emirates in 1971), a Department of Archaeology and Tourism was established in the Diwan of the Ruler’s Representative in the Eastern Region of Abu Dhabi, this Department subsequently carrying out excavations and surveys in the Al Ain area and at Umm al-Nar and other locations on the coast and islands of Abu Dhabi.

The Danish archaeological mission ceased its work in Abu Dhabi in the mid-1960s, but further work was subsequently undertaken in association with the Department of Antiquities and Tourism, by teams from Iraq, in the early 1970s, and then by the French Archaeological Mission in the Emirates, which commenced work in the late 1970s, and continues, in the Al Ain area, in early 2006.

In 1992, following a short survey by a team of British-based archaeologists of the islands of Sir Bani Yas, Dalma and Marawah, the Abu Dhabi Islands Archaeological Survey, ADIAS, was established on the instructions of President Sheikh Zayed. Operating under the patronage of Sheikh Mohammed bin Zayed Al Nahyan, then Chief of Staff of the UAE Armed Forces, ADIAS was initially charged with responsibility for surveying for, recording and, where appropriate, excavating archaeological sites on the coast and islands of Abu Dhabi. Its geographical scope of responsibilities was later expanded to include the bulk of the Western Region, while it was also given responsibility for palaeontology in these areas (Hellyer 1998).

Major sites of importance identified by ADIAS have included several of Late Stone Age (Neolithic date), including the oldest village thus far discovered in the UAE, on Marawah island, and the UAE’s only known pre-Islamic Christian monastery, on Sir Bani Yas.

The Department of Antiquities and Tourism became part of the new Abu Dhabi Authority for Culture and Heritage (ADACH) in early 2006, which has also assumed responsibilities formerly assigned to ADIAS for excavations in the Western Region.
2 COMPONENTS

2.1 Palaeontology

The earliest known fossils found in Abu Dhabi emirate date to the Cretaceous period. No surface geological deposits bearing fossils of Jurassic date (206 to 144 million years ago) or earlier date are known from the area.

2.1.1 Cretaceous (144-66.4 mya)

The term Cretaceous refers to the period c. 144 to 66.4 million years ago. It is normally divided into an Early (144 to 97.5 million years ago) and Late (97.5 to 66.4 million years ago) Epoch. With a span of some 77 million years it is the longest eon in the earth’s history.

At the beginning of the Cretaceous period the Earth’s landmasses consisted of two mega-continents, known as Laurasia and Gondwana, a northern and southern landmass separated by an equatorial waterway known as Tethys. By the end of the Cretaceous, most of the today’s continents had emerged, albeit not in final form. Sea-levels were high throughout the Cretaceous - sometimes as little as 18 per cent of the Earth’s surface was free of water (vs. 28 per cent nowadays) - and temperature variation between the two poles and the Equator was minimal.

The Cretaceous period was especially significant for the Emirates and its neighbours, since more than 50 per cent of the world’s oil reserves were formed at this time, and of these, some 75 per cent are located in and around the Arabian Gulf. Other important metals, such as gold, silver, copper, zinc, lead, manganese, tungsten, tin and iron also became concentrated in ore bodies during the Cretaceous period.

Dinosaurs continued to dominate Earth during the Cretaceous period. These included Tyrannosaurus rex, the Iguanodon, Triceratops and the flying reptiles known as pterosaurs. The Cretaceous period also witnessed the appearance and evolution of many modern mammal types, including placental mammals (e.g. primates, pigs, cows, cats, dogs, rodents) and marsupials (e.g. opossums, kangaroos, koalas). Flora was much as it had been during the Jurassic, and included ferns, conifers, cycads and ginkgoes. Marine algae, particularly the coccolithophores, were so numerous and accumulated in such vast quantities that vast quantities of chalk were formed, and it is from this chalk (Latin creta) that the period took its name in 1822.

In the Hajar Mountains the uplift, caused by colliding continents during the Cretaceous, produced a chain of islands formed of ophiolite (the Semail ophiolite), now an unfossiliferous, reddish-black rock exposed on some jebels in the eastern mountains and especially well-exposed in Wadi Ham, Fujairah Emirate. A broad shallow and warm sea lapped against the Hajar islands and its limestones are now called the Simsima Formation. Knowledge of the palaeontology and stratigraphy of these carbonate sediments is of particular interest to the Abu Dhabi Company for Onshore Oil Operations, ADCO, for they comprise the primary oil-bearing rocks in the Shah field, south of Liwa. The best exposures of the Simsima Formation are found at Jebel Huwayyah - known as Fossil Valley, Jebel Rawdah, Jebel Buhays and Qarn Murra, none of which are in the Emirate of Abu Dhabi.

Around the ophiolite islands, coarse beach conglomerates and beach sands were deposited. In exposed environments with high wave activity, the pounding of the waves eroded the beach rocks to form large beds of boulders which had little in the way of marine life. In more protected bays, reefs and thickets of corals and rudist bivalves lived close to the shore while sandy bays had their own fauna of burrowing bivalves and marine snails.

Much of this ancient marine fauna of crabs, sea-urchins, bivalve shells, corals and sea worms would be easily recognisable today (Figure 5). However, there are also fossils from some groups of animals that have completely disappeared, having become extinct at the end of the Cretaceous period. These include the ammonites, free-swimming relatives of bivalves and sea-snails that possessed a spirally-coiled chambered shell. Another group of marine animals that no longer exists today are the rudists, a highly specialised kind of bivalve with a large, horn-shaped lower valve that rested on or in the sediment. A rudist found by Natural History Museum palaeontologists from Jebel Rawdah has been given the scientific name of Glabrobournonia arabica.

Corals were common in these waters, sometimes forming dense bush-like thickets or patch reefs and sometimes occurring as button-like individuals (some rudists resemble these corals) scattered across the ocean floor. On the edges of the shoals, massive brain corals are to be found. Probably the most unusual of all the corals is the fan-shaped and solitary Diploctenium, which attached itself to the sea floor by a thin stalk. Rather delicate for potential preservation as a fossil, it is only found in rocks deposited in the more sheltered environments.
Of the 45 sea-urchins now known from the Simsima Formation, 14 species are new to science and some of them have been named after places where they were found or, in one instance, after a person who has helped the Natural History Museum team - *Codiopsis lehmannae*. Specimens named after places in the Emirates are *Prionocidaris emiratus*, *Heterodiadema buhaysensis*, *Gonioptys arabicus*, *Circopeltis emiratus*, and *Petalabrissus rawdahensis*.

2.1.2 Palaeocene (66.4-56 mya)

At the beginning of the Paleocene epoch, the world had very few larger sized terrestrial animals. This unique situation was the starting point for the great evolutionary success of the mammals. Only ten million years later, at the end of the Paleocene, they had occupied a large part of the vacant ecological niches. By this time, the landscape was teeming with small insectivorous and rodent-like mammals, medium-sized mammals were searching the forests for any kind of food they could cope with, the first large (but not yet gigantic) mammals were browsing on the abundant vegetation and carnivorous mammals were stalking their prey.

Despite this impressive diversification, most Paleocene mammals still have a primitive level of anatomy in comparison to mammals of today. Often they show only the first beginning of specializations that characterise their descendants from later epochs, such as optimisation of the teeth for a special kind of food or adaptations of the limbs to fast running. The Paleocene mammalian fauna is therefore often called archaic. The beginning of the following epoch, the Eocene, brought about an important modernisation of this fauna. Several groups of mammals with more modern appearance spread over the northern hemisphere at this time, whereas the decline of the archaic forms started.

The Paleocene is a crucial time in the history of mammals. Unfortunately, mammal fossils from this epoch are either scarce or entirely unknown in many parts of the world.

2.1.3 - Eocene (56-34 mya)

Mammalian evolution was a hallmark of the Tertiary, as over 20 orders became established by the early Eocene. These included the earliest artiodactyls (e.g. camels and deer), perissodactyls (e.g. horses, rhinoceroses and tapirs), rabbits and rodents. No Eocene fossils have been reported from the Emirate of Abu Dhabi.

2.1.4 - Oligocene (34-23 mya)

The cooling conditions increase in intensity into the Oligocene when glaciation began in Antarctica. Oligocene rocks are present in the vicinity of Al Ain, and fossil mussels have been recovered from Jebel Huwayyah (Fossil Valley), just across the border with Oman (Hellyer 1996).

About 23 million years ago, a land bridge, possibly located between Qatar and the coastal Fars region of Iran was formed. Land animals from both Africa and Asia had the opportunity for intercontinental dispersal via Arabia and it is probable that these changes to Middle East geography also changed the flow of river systems in northwestern Africa and in Mesopotamia allowing animals in freshwater habitats, such as fish, turtles, crocodiles and aquatic mammals, to disperse into new ecosystems. The remains of these animals can be found in the Western Region of the Emirate of Abu Dhabi (see below).
2.1.5 Miocene (23-5.3 mya)

Sites with Late Miocene fossil faunas are distributed from Jebel Barakah and Umm al-Ishtan in the far west to Rumaitha in the east (Figure 6). Palaeomagnetic dating, as well as biochronostratigraphic dating, suggests that these fossil sites all date to around 6 to 8 million years ago.

The importance of these sites to the cultural and scientific heritage of the United Arab Emirates lies in the fact that they are the only locations in Arabia where the remains of fossil animals and plants from the Late Miocene period have been recovered that are of international significance. The Baynunah Formation crops out in an area of about 1800 sq km. The fossils identified so far only come from a 560 sq km area, and that has not been yet surveyed in detail. More work is required.

The Baynunah Formation is preceded, in geological age, by the Shuweihat Formation, which is several million years earlier, but still in the Late Miocene period. No fossil material has yet been recovered from the Shuwaihat Formation.

2.1.6 Pliocene (5.3-1.8 mya)

Very little known about this time period in Abu Dhabi emirate and further geological study is required.

2.1.7 Pleistocene (1.8 mya - 9600 BC)

Further study on the geology of this time period in the Emirate of Abu Dhabi is required, although fossil mangrove pneumatophora present in some coastal areas and on offshore islands have been ascribed to this period, as have fossil corals identified on the island of Marawah (Evans, Kirkham and Carter 2002).

Flint material attributed to the Palaeolithic or Old Stone Age period recorded by Sally McBrearty from the Western Region of Abu Dhabi and has been definitively identified in the Emirate of Abu Dhabi, the presence of palaeolithic material elsewhere in the UAE has been reported from Sharjah (Hans-Peter Uerpmann, pers.comm.).

2.2. Archaeology

2.2.1 Holocene (9600 BC - present)

The Holocene refers to the period from 9600 BC to the present. The majority of archaeological finds in Abu Dhabi, within the UAE, and indeed within the Gulf region as a whole, date to this time period. Archaeologists working in the United Arab Emirates have adopted the following chronological divisions which describe different time periods. These are generally accepted categories.
based on shifts in cultural and economic patterns. Some periods are named after particular "type sites". These are archaeological sites whose local geographic name has been adopted as the name for that particular time period. The chronology adopted here is generally applicable to the United Arab Emirates, Oman and the southern Arabian Gulf region.

2.2.2 Late Stone Age (5700-3800 BC)

The earliest evidence we have for human settlement in the United Arab Emirates, (with the exception of probable Palaeolithic material identified in Abu Dhabi and Sharjah) is from Marawah Island. Two sites, MR1 and MR11, both have the earliest radiocarbon dates known from any site in the UAE.

2.2.2.1 Marawah

The site of MR1 is located on a rocky coastal promontory on the western coast of Marawah and was first discovered during the initial archaeological survey of the island in 1992 (King 1998). The site consists of a limestone plateau on which are several mounds, wall lines and structural traces. A large quantity of flint projectile points (Figure 7), knives and scrapers were collected from the surface of this site (Hellyer 1993). Radiocarbon dates indicate that the site was occupied during the 6th-5th millennium BC (ADIAS Radiocarbon Archive 2005).

Site MR11 is located in the south-western corner of the island at the north-western tip of a triangular-shaped limestone plateau about 2 kms south-west of the modern village of Ghubba. It was also first discovered in 1992. Excavations at site MR11 in 2003, directed by Dr Mark Beech for ADIAS, have revealed at least three stone-built multi-roomed structures within a settlement area covering 200 by 150 metres (Beech et al. 2005). At the end of one of these rooms was a stone platform on which the skeleton of a man had been interred once the building was no longer utilised for its original presumed domestic function. Radiocarbon dates suggest that the site was initially occupied about 7700 years ago, with traces of settlement activities continuing there for around 1000 years. In the same room as the skeleton an almost complete beautifully decorated 'Ubaid pottery jar was discovered (Figure 8). This type of pottery was imported from southern Mesopotamia, modern day Iraq, providing the first evidence of overseas trade by the people of the UAE.

2.2.2.2 Dalma

Another important Neolithic settlement was discovered by ADIAS in 1992 on Dalma Island (Flavin and Shepherd 1994). Excavations in 1998 at the site of DA11, located within the former compound of the Dalma branch of the Abu Dhabi Women's Association in Dalma town, have revealed two building structures along with extensive midden deposits (Beech and Elders 1999; Beech et al. 2000).

These were not sophisticated stone-built houses like those at MR11 on Marawah Island, but consisted of simple circular
arrangements of post holes indicating the location of circular structures, one of which was almost 7 metres in diameter. These would have provided the foundations for wooden posts and probably palm-frond walling. Around these structures were considerable midden deposits and ashy material from cooking hearths.

Radiocarbon dates suggest that the settlement was occupied between around 7400 to 6500 years ago. Dalma provides some of the earliest evidence for the exploitation of the date palm in the Middle East. Two carbonised date stones were successfully radiocarbon dated using the AMS method (Beech and Shepherd 2001; Beech 2003).

The inhabitants of DA11, like the community on Marawah, kept domestic sheep/goat, and consumed dugong, marine turtle, fish and shellfish (Beech 2004). Some pottery sherds from 'Ubaid vessels imported from southern Mesopotamia were also noted at this site (Figure 9). More frequently found at the site, as at MR11, were fragments of locally-manufactured gypsum plaster vessels, some painted with decoration emulating the designs of the imported 'Ubaid pottery. These demonstrate a remarkable regional tradition which has so far only been identified within the lower Gulf on Marawah and Dalma islands.

2.2.2.3 Umm az-Zamul

In the southeast region of the Emirate of Abu Dhabi near Umm az-Zamul, not far from the border between the Emirates, Oman and Saudi Arabia a number of Neolithic sites have been recently discovered. In several locations of this region which extends within the territory of the U.A.E., namely to the west of the road linking Al Qua’a with Umm az-Zamul, Late Stone Age people were active practicing their daily life. At that time (around seven thousand years ago), the climate in this part of Arabia was different from that of today, with more rainfall and more vegetation.

During three short seasons carried out by the Abu Dhabi Islands Archaeological Survey (ADIAS), in collaboration with the Department of Antiquities and Tourism in Abu Dhabi’s Eastern region (the latter now absorbed by the Abu Dhabi Authority for Culture and Heritage), it became clear that the area is of importance from the archaeological point of view. Large collections of flint tools and artefacts have been discovered. These are currently being studied by Dr Heiko Kallweit. Arrowheads of different types are the most recognisable tools among the collections (Figure 10) which also include flakes and limestone mortars (Kallweit, Beech...
and Al-Tikriti 2004). Similar artefacts are known from other regions of the U.A.E but this is the first time to have been located in such inhospitable environment and in large quantities. (Beech, Kallweit, Cuttler and Al-Tikriti 2006).

Archaeological investigations carried out so far indicate that this region which is a desert today was different when communities were roaming the area during the Neolithic time. Preliminary evidence also indicates that some of these sites may have been originally located on the shores of land-locked lakes that may have existed in the region when the climate was wet (Beech, Kallweit, Zander and Al-Tikriti, in prep.). Exposed limestone terraces that perhaps were submerged by water do exist in the plains which extend scores of kilometres to the west of the Al Hajar Mountains. These plains are mainly covered with sand dunes which get higher further to the west towards the Liwa Oases. Taking in consideration the formation of the sand dunes and the exposed sites located between these dunes, one can assume that other similar sites may have been covered.

2.2.2.4 Other sites

Other smaller, but important Neolithic sites, have been discovered at a number of other coastal sites including Abu Dhabi International Airport (Beech, Cooper and Kallweit 2003; Beech, Kallweit and Hellyer 2004; Kallweit 2004), and on the islands of Abu al-Abyadh (Hellyer and Hull 2002) and Ghaghah (King and Tonghini 1999). Sites have also been discovered within the desert interior. In 1992 a geological survey team discovered a prehistoric surface site situated 5km to the south of Bida Al-Mutawa in Abu Dhabi Emirate. Lying on a paleodune, which is partially overlain by the first dunes of Rub Al Khali along the southeastern border of gravel desert, the site apparently covers an area of more than 10 ha (Crombé 2000). Neolithic flint sites are also known in the Liwa area (Kallweit 1999) and elsewhere in the deserts of the Western Region of Abu Dhabi (Kallweit 2003; Kallweit and Hellyer 2003).

Numerous Neolithic flint sites are also reported to have been found in the vicinity of Al Ain, although these have not yet been published in any detail.

2.2.3 - Hafit (3200-2600 BC)

Little evidence of fourth millennium occupation has been found on the coast and islands of Abu Dhabi. The Hafit period is named after the well-built stone tombs present in their hundreds on the slopes of Jebel Hafit near Al Ain, and the Hajar Mountains of neighbouring Oman. The main evidence for this period in Abu Dhabi has so far been found well inland, although a few possible Hafit-type pottery sherds were identified close to Abu Dhabi Airport (de Cardi 1997).

It is striking that a completely different picture emerges if one considers coastal settlements on the coastline of Oman. Here there is abundant evidence for coastal occupation during the fourth millennium BC with extensive coastal shell middens from Ras al-Hamra to Ras al-Hadd and beyond (Uerpmann and Uerpmann 2003). This has led some authors to describe the archaeology of this period in the Gulf as the "Dark Millennium" (Uerpmann 2003). It is likely that a climatic deterioration caused dramatic changes of subsistence and settlement patterns in the Gulf around 4000 BC.

Some time in the late Fourth Millennium BC, knowledge of a major technological innovation arrived in the region. This was how to mine and smelt the copper ores found in the Hajar Mountains, and this marked the beginning of the local Bronze Age.

2.2.3.1 Hafit Tombs

Jebel Hafit dominates the Al Ain and Buraimi oases. The mountain is 4000 feet above sea level and is considered, owing to its bare rocks and exposed geology, a special geological feature in the Eastern Region of the Emirate of Abu Dhabi. A few marine fossils going back to 70 million years ago when the Jebel (Arabic for "mountain") was uplifted from the ocean can be found on the summit or slopes.
Approximately 5000 years ago, Man chose the northern escarpment and eastern slopes of this mountain as cemeteries for the dead. More than 500 graves have been found in these two areas. While most of the graves located on the northern side have been regrettably destroyed, the second group - located on the eastern side - is now protected by the Department of Antiquities and Tourism (Figure 12).

Hafit graves, also called Mezyad graves (after the name of the village located near the second group), are well-known to archaeologists, as they represent an early period in the history of the UAE. Scores of these graves were excavated more than four decades ago and proved to be similar in many ways to each other. Unlike the tombs of the Umm an-Nar period, which followed, each tomb here has a single round or oval chamber built of rough local stones. One, two or three ring-walls encircle the chamber and rise to the height of 3-4 metres above the ground. As they rise the walls gradually slope inwards until they eventually meet and forms what looks like a dome. A narrow entrance, usually facing towards the sun, pierces the walls. Does this have something to do with Shamash, the Sun God worshipped, with many others, by the Mesopotamians? This remains an unanswered question. A small number of these graves have been either partially or fully restored by the Department of Antiquities and Tourism. Finds are rare, because most of the graves were, unfortunately, plundered in the past and in recent times. However, imported pottery from Mesopotamia has been discovered in the tombs (Figure 11); this pottery dates the earliest use of the tombs. These are small painted vessels of a type known as Jemdet Nasr (late 4th millennium BC; Jemdet Nasr is an archaeological site located near Babylon in Iraq and famous for its polychrome pottery).

Although most of the pottery and also some types of beads found in the Hafit graves are of Mesopotamian origin, the architecture of the graves is local and not known in Mesopotamia. Discovery of Mesopotamian objects in these graves does indicate, however, a trade relationship between the upper and lower Gulf during the Hafit period. Indeed, as noted above, contact between the two regions goes back to the 'Ubaid period of the 5th and 6th millennium BC. Some of the Hafit graves yielded bronze objects and vessels made of soapstone, as well as beads of much later date which indicate that these graves continued in use and/or were re-used in later periods, mainly during the Iron Age. The phenomenon of Iron Age people re-using old graves is well-known in the United Arab Emirates and Oman; it is therefore not always possible to date the skeletal remains.
2.2.4 Umm an-Nar (2600-2000 BC)

The most important Bronze Age site located in the coastal region is on the island of Umm al-Nar (Sas al-Nakhl), situated just to the east of Abu Dhabi island (Figure 13). A Danish team began excavations here in 1959 which identified over 50 large stone-built collective graves and a settlement which date to around 2700 BC to 2000 BC (Frifelt 1991, 1995). The port of Umm al-Nar acted as a terminal for copper exports to Mesopotamia. Evidence of the Umm al-Nar civilisation has subsequently been discovered throughout the UAE and northern Oman. Since the mid 1970s, Umm an-Nar has been the site of the UAE’s first oil refinery and a chlorine plant, while there is also a major water desalination and power generation complex on the island. The archaeological sites, however, are carefully protected and preserved.

2.2.4.1 Archaeology of Umm an Nar Island (by Dr Walid Yasin Al-Tikriti)

The island of Umm an-Nar was the first archaeological site discovered and excavated in the United Arab Emirates (see above).

The Island is very important from an archaeological point of view as it houses quite a large settlement and a contemporary cemetery dating to around 2600-2300 BC. The first excavations were conducted in 1959 by a team from Denmark. Evidence from the stone-built houses, excavated not only by the Danes but also by teams from Iraq and the UAE, demonstrates that the island was involved with trade, fishing and copper industry. Inhabitants of the island had contact across land and sea with remote places such as Mesopotamia and the Indus valley. They traded in several commodities, among them copper, shark oil and onions, in exchange for wheat, barley, bitumen and textiles.

The Umm an-Nar cemetery, the largest from this period ever discovered in the Gulf region, consists of 50 tombs. The most impressive are those of circular shape built of dressed stones. They range from 6 to 12 metres in diameter and must originally have stood several metres high. In some cases the circular walls were found decorated with carvings representing animals or human figures. The tombs are divided into several chambers, each intended to contain a number of dead. Access to these chambers was through small trapezoidal-shaped entrances. Each tomb had two entrances aligned in a north-south direction. Though most burials were distributed in antiquity, the available evidence indicates that scores of people were buried over a number of years. The graves were furnished with objects that the dead might need in their after-life. Local and imported pottery vessels were discovered, as were jewellery and various kinds of beads. A number of the tombs were restored, using the original stones, by a team from Iraq in the early 1970s.

The archaeological sites once occupied a large part of the original area of the island. In recent times this has been enlarged by dredging the seabed. The island now has an oil refinery together with military and industrial installations. Most of the latter were built on recently-reclaimed land, while the archaeological site itself is now protected by a brick wall.
ancient houses excavated many years ago have recently been
restored by the Department of Antiquities in Al Ain, and a
plan to excavate and restore more of the monuments of the
island is now being carried forward. Unfortunately, owing to
the nature of the new installations, the island is currently
closed to the public.

Today the name Umm an Nar represents not only the site and
the island but also the ancient culture, while Umm an Nar
itself remains one of the major sites representing the ancient
history of the UAE during the second half of the third mil-
lennium BC. The term "Umm an-Nar Culture" is used by
archaeologists worldwide to refer to the culture that once
thrived not only on this particular island but also in many
other regions in the Arabian Gulf and the whole of Southeast
Arabia at that time.

During the second half of the 3rd millennium BC (2500 -
2000 BC) the inhabitants of South-east Arabia lived in sun-
dried mud-brick houses and buried their dead in stone-built
collective graves. The site designated as Hili 1, located next to
the Grand Tomb, was once a high tower, standing several
meters above the ground. This building, excavated by a Danish
team in the 1960s, was found to have a thick circular wall
embracing several rooms which were served by a well located
in the centre of the structure. Only the foundations of this
building remain but better-preserved minor structures abut-
ting the circular wall on the outside were found. The site was
surrounded by a moat which may occasionally have filled with
rainwater.

The remains of a similar building, designated as Hili 10, were
discovered near the main entrance of the park. It was excavat-
ed in the early 1990s by the Department of Antiquities and
Tourism and found also to have a central well. As at Hili 1, the
building was of mud-brick construction; it has been restored
recently using the same materials. Its three-metre-wide circu-
lar wall suggests that the building was once a stronghold, per-
haps controlling trade routes to the region. A third building,
similar to the others, located outside the south eastern corner
of the park wall, was excavated by a French team (Figure 14).
It seems to have had the same or an even more important role.

Collective tombs from Umm an Nar period dating to the sec-
ond half of the 3rd millennium BC are known today at many
sites in the UAE, but most importantly at both Hili and the
Island of Umm an Nar. At Hili, there are three tombs inside
the park and several others outside. Hili Grand Tomb, located
in the middle of the park, is over 4000 years old (Figure 15).
The largest monument in the UAE, it is around 12 metres in diameter and must originally have stood at least four metres high. It is divided into four interior chambers, each intended to house a number of dead. Though the tomb was found badly damaged when excavated, evidence from other collective graves from the same period in the region indicates that hundreds of people would have been buried here over a long period of time. The two entrances of the grave are well-decorated with carvings. The northern entrance was cut into a large stone and decorated with three different scenes: above, a man riding an animal with another man walking behind, on the right two embracing figures and, below the opening, two facing animals perhaps devouring a young gazelle or oryx. The decoration on the south-facing entrance consists of a pair of oryx with two standing figures in between. Both entrances were originally blocked with loose stones that could easily be removed to enable reuse of the tomb. The tomb is believed to have been in use for two to three hundred years, more than four thousand years ago.

Not far from the grand tomb another above-ground circular tomb was found, very much disturbed. Its original layout was reconstructed and found to have six chambers formed by a cross wall dividing the tomb in half, each half further divided by two smaller, parallel walls, perpendicular to the main cross-wall. Most of the original stones were missing, and the tomb has now been restored with new stones cut into the original shapes. Because it was empty when excavated, archaeologists believe that the skeletal remains originally buried here may have been transferred to the adjacent pit-grave (Tomb N), which contained many disarticulated human bones. The recent excavations of the central section of the tomb have shown that some of the skeletal remains, including small bones, were in articulation, indicating that some of the dead were buried directly in the pit-grave (Figure 16). Tomb N is exceptional in that it also contained many objects such as pottery, stone vessels and ornaments, all dating to the very end of the third millennium BC. During at least its latest phase of use, the dead appear to have been buried directly in Tomb N, that is, only the earlier skeletons had been redeposited here. Tomb N contained perhaps as many as six hundred individuals, buried over a period of 100 to 200 years. Males, females and children of all ages were found. Most adults died while in their twenties or thirties, although it is not clear that some lived into old age; most had lost at least some of their teeth by the time of death.

2.2.4. Bida Bint Saud

Some 3000 years ago, man inhabited the area of Bida Bint Saud (Figure 17), located to the north of Hili, 25 kilometres from the Al Ain National Museum. The area is dominated by an outcrop of stratified rock, rising to about 40 m above the surrounding landscape.
Cemeteries were discovered here in 1970 and since then a number of graves have been located and excavated along the eastern side of the outcrop and on the summit. The first excavations were by a Danish team, followed by teams from the Department of Antiquities and Tourism in Al Ain.

The graves located along the eastern side of Bronze Age date similar to those of Hafit. According to the small number of pottery vessels, these are dated to the late fourth and early third millennia BC. Though mostly disturbed, these resemble solid heaps of stones. Excavations showed that each heap concealed a hollow chamber surrounded by a ring wall, pierced by a narrow passage leading inside. The roofs were corbelled in such a way that the ring wall inclined inwards the higher it rose. Originally these graves would have resembled domed structures.

Another group of graves belonging to the Iron Age is located on the top of the outcrop. They are of various shapes and dates, though mostly circular in shape. Like the first group, they are built above ground from local rough stones. These are collective graves divided into a number of chambers each with several burials. The discovered skeletons were in poor condition and only fragmented bones were found. Though these graves had been plundered in the past, the excavations yielded a number of discoveries including pottery and stone vessels, dagger blades, bronze arrowheads and different types of beads. Other small finds were also found. These artifacts belong to the first and second millennium BC and are on display in the Al Ain museum. Following some destruction in the mid-1980's, the excavated graves were rebuilt according to their original plans.

A few hundred metres to the west of the outcrop, a local team from the Department of Antiquities and Tourism in Al Ain excavated a public building, the first of its kind discovered in the region. The building, which was covered by blown sand, is built of mud bricks similar to those of many other structures of the same date already known in the region. The plan and function, however, are new. The building is mainly occupied by a large hall. The roof is missing but originally seems to have supported by twelve columns, the plinth of which are still visible. Storage rooms have been added to the outside of the building and many storage jars were found inside them. The building may have served as a place to control the distribution of water in the region some three thousand years ago. Because of the fragile condition of the construction materials, the structure had to be back-filled with sand. It will be re-exposed only when a restoration plan is implemented. About 150 metres to the south of the building, a falaj (underground water tunnel) was discovered and partly excavated. Several shaft holes belonging to this falaj, an underground shari’a (access for water) with steps leading to it, and a large open cistern were excavated. A second falaj has also been discovered in the same region. The existence of both falajes indicates that the area of Bida Bint Saud played a major role in the history of the Eastern Region of Abu Dhabi. The discoveries also provide evidence that the falaj system was indigenous to the region, being introduced during the Iron Age some 3000 years ago.

2.2.5 Wadi Suq (2000-1600 BC)

Evidence of occupation during the middle Bronze Age, around 4,000 years ago, has been found on several of Abu Dhabi’s islands, including Ghaghah, Sir Bani Yas, Marawah, Rufayq, Umm an-Nar and Balghelam. There is little evidence of occupation of the deserts during this period, perhaps due to climatic change, and less rainfall, and some of the islands in the Western Region may have been used as temporary way-stations or trading settlements by sailors from Bahrain (ancient Dilmun), on their way to Hormuz (Carter 2003).

Occupation in the Wadi Suq period is also attested from Al Ain, in particular from a long collective grave excavated in the 1970s in the Qattara oasis.

In contrast to the northern UAE, however, there is relatively little evidence of occupation during this period. This may be related, in part, to the fact that outwash from the Hajar Mountains may have deposited several metres of gravel and soil over other Wadi Suq sites in the Al Ain area.

2.2.6 Late Bronze Age (1600-1250 BC)

Only ephemeral settlement traces from the Late Bronze Age have been identified on the coast and islands of Abu Dhabi, and the pattern of occupation in this region during this period is, at yet, poorly understood.
Insofar as the inland areas around Al Ain are concerned, once again sites may have been covered by outwash from the mountains. Given the relative abundance in the Al Ain area of sites from the Jebel Hafit and Umm al-Nar periods, which preceded the Wadi Suq and Late Bronze Age periods, and from the Iron Age, which followed, it is considered likely that the area continued to be occupied, even if few sites have yet been identified.

A falling in the water table has, however, been identified during this period, and this may have affected patterns of settlement.

2.2.7 Iron Age (1250-300 BC)

The term "Iron Age" is technically a misnomer, as the inhabitants of the UAE continued to use copper rather than switching to the new metal, presumably because of the ready availability of copper in the mountains. Only sparse evidence from this period has been found on the coastline and islands of Abu Dhabi, many appearing to be temporary campsites or way-stations relating to maritime trade, and perhaps occupied on only a seasonal basis. They often consist primarily of hearths (Hellyer and Beech 2001b), although some burial cairns have also been identified on or near to the coast, as at Bitashar and Jebel Dhanna.

Many of the major Iron Age sites so far discovered in the UAE, including Rumeilah and Hili, both in Al Ain, and at Muweilah and Al-Thuqabah in Sharjah and Khatt in Ra’s al-Khaimah, lie inland near the Hajar Mountains and supplies of subterranean water. This period coincides with the first use of ‘falaj’ underground water systems. The well-preserved sites in the Al Ain area, including villages, as at Rumeilah (Figure 18), cemeteries, as at Bida Bint Saud, and a fortress, at the northern tip of Jebel Hafit, are indicative of extensive settlement, while other Iron Age sites recently discovered by interested amateurs in the sands north-east of Al Ain, as at Jabeel, suggest that the area suitable for settlement was then larger than it was at later periods.

2.2.8 Late Pre-Islamic (300 BC - 300 AD)

Important evidence of occupation of many of Abu Dhabi’s islands during the few centuries just prior to the coming of Islam has been identified. Among islands where sites from this period have been found are Abu al-Abyadh, Abu Dhabi, Balghelam, Dalma, Marawah, Qarnein, Sir Bani Yas, Yasat al-Ulya and Yasat Sufla, while slight traces of occupation, in the form of the occasional potsherds, have also been identified on the coast, as at Ra’s Bilyaryar, north-east of Abu Dhabi.

Inland, there are again some indications from the Al Ain area, although, once again, much evidence may be buried beneath the existing city.

2.2.9 Sasanian (300-632 AD)

One of the most important sites from this period is on Sir Bani Yas island, where the pre-Islamic Christian monastery found by ADIAS is the only physical evidence yet known in south-eastern Arabia of the presence of Christian communities before Islam (Figure 19). Excavations between 1993-96
uncovered a church constructed within a walled monastic complex (Elders 2001, 2003; Hellyer 2001; King 1997, 2001). A number of associated courtyard villas were also excavated from the surrounding area of the monastery. These all appear to have been occupied during the sixth and seventh centuries AD, being abandoned shortly after the arrival of Islam, perhaps because its inhabitants became Muslims or moved away. There is textual and archaeological evidence of the presence of the Nestorian Church in the north-east Arabian peninsula, Mesopotamia and Iran during this period, although Sir Bani Yas is the furthest east site so far identified. A number of other Nestorian churches have been identified in the Gulf, notably at Failaka in Kuwait and Jubail in Saudi Arabia, but Sir Bani Yas is the first to be clearly identified with a related monastic settlement.

2.2.10 Early, Middle and Late Islamic (750 AD - 19th century)

Study of the Islamic Period is hampered by the lack of local written records for Abu Dhabi. Arab travelers like Ibn Battuta, Al-Idrisi and Yaqut passed through or dealt with the region but they made little reference to the UAE, apart from mentioning the major trading ports of Julfar (Ra’s al-Khaimah) and Dibba. The climate of the region became increasingly arid, perhaps prompting inhabitants to turn to a semi-nomadic lifestyle that subsequently lasted for much of the period until the coming of oil in the 1960s, except in the relatively well-watered areas around Al Ain. Some earlier settlements on offshore islands, such as Yasat al-Ulya and Ghaghah, as well as on Sir Bani Yas, appear to have been abandoned by around the beginning of the Islamic period.

For the bulk of the interior, no settlement, or, indeed, occupation is attested for the whole of the period from the end of the Late Stone Age until the Late Islamic period, although it continued in the Al Ain area. There are significant remains of the Islamic period in the region of Al Ain, including the many forts for which the town is famous. A targeted study of the Islamic period remains of Al Ain together with detailed historical investigation is likely to yield significant results.

One interesting site - as yet not studied in details, at Manṭiqa al-Sirra, in the Western Late Islamic period. (Hellyer 1998). This is the only central desert site of its type yet identified, and further work is required to determine both its function and also, if possible, the reasons for its abandonment, although a slight harshening of the climate or reduction of the already sparse rainfall may have been responsible.

2.2.11 Recent Islamic (19th-20th century)

Sites have been found throughout the Emirate of Abu Dhabi dating to the Later Islamic period, although they are, not surprisingly, less common in the desert areas. The nature of the sites varies from evidence of burning and pottery scatters suggesting the presence of occasional campsites to areas of more extensive fireplaces, stone structures including outline mosques, water catchment systems, shell middens and pottery scatters which probably represent at least frequent seasonal occupation. The number of sites from this period testifies to the importance of the pearling industry in the pre-oil era. Pearling may have reached a peak in the late 18th and 19th Centuries. Among key sites is a shell midden (piles of opened and abandoned pearl oyster shells) on the island of Abu al-Abyadh (Hellyer and Hull 2002). It was once over three kilometres long, containing many millions of shells. The presence of Chinese porcelain and other imported pottery on some island sites demonstrates that, besides being involved in fishing and pearling, the people also took part in regional trade and in other economic activities.

One important coastal site dating to the Later Islamic Period is the complex of sulphur mines at Jebel Dhanna (King 2003). With support from ADCO, ADIAS has identified and studied a complex of sulphur mines with around 150 individual mine shafts (Figure 20). These probably date to the 18th Century AD, and are the only sulphur mines known in Eastern Arabia. The sulphur was probably largely exported, for the manufacture of gunpowder.
Buildings from the recent historical period are rare on the coastline and islands of Abu Dhabi. Key sites include the Bayt al-Muraykhi (a pearl trader’s house) and the al-Dawsari, al-Muraykhi and al-Muhannadi mosques, all on Dalma island (King 2004a, b). The stone walled mosques on Liffiya, Marawah and Bu Sharah, as well as number of stone outline mosques on coastal islands also form an important architectural group (King, forthcoming).

In the Liwa oases, permanent settlement appears to have commenced by the 16th or 17th Century AD, and certainly by the 19th Century AD mud-brick forts had been built.

In the Al Ain area, the continued availability of water, through falaj systems, made permanent occupation, associated with agriculture, feasible. A number of the built architectural monuments in Al Ain, such as the forts, (now restored by the Department of Antiquities and Tourism) date to the 19th or early 20th Centuries, while the falaj systems may be of a much earlier date, albeit frequently repaired.

Recent settlement on the island of Abu Dhabi dates from the mid-18th Century, and a number of buildings were constructed in the 19th and early 20th Centuries, including forts, mosques and domestic dwellings, although few survive. A key impetus for the 19th Century building may have been increased prosperity resulting from the pearling trade.
3 RELEVANCE OF PALAEONTOLOGY/ARCHAEOLOGY

3.1 Cultural Value

H.H. Sheikh Zayed bin Sultan Al Nahyan, the late President of the UAE, was particularly keen in making the younger generation familiar with their cultural heritage so that it is never forgotten. He stated that a “nation without heritage is a nation without a beginning or an end”.

3.1.1 Understanding behaviour and patterns of previous civilizations

In pursuit of that understanding of the past that was encouraged by Sheikh Zayed, archaeology, and the associated study of surviving buildings, and of the information these can yield about behavioural patterns of the past, including those of pre-Islamic civilisations, is essential. Further promotion of study of that type, using a multi-disciplinary approach, is required, and is likely to be a key part of the future strategy of the new Abu Dhabi Authority for Culture and Heritage (ADACH).

3.1.2 Understanding ancient land use patterns

One of the aspects of the multi-disciplinary approach is a study of past patterns of land use. In the desert areas, these will be primarily related to the grazing of livestock, with the most productive areas varying according to the amount of rainfall. Recent observations suggest not only that the amount of rainfall can differ significantly on a year-to-year basis, but also that they vary significantly from area to area, within a broad pattern of there being, generally, more rainfall in the east of Abu Dhabi Emirate, in the Al Ain area, this gradually declining as one goes west and south, with the lowest rainfall being recorded in the broader areas of these districts.

This prompted, of course, traditional seasonal movements, albeit allowing for opportunistic movements to areas where there had been better rain, and where, as a result, better grazing was available.

An understanding of past patterns of land-use is difficult to obtain, but some conclusions can be drawn from a combination of current patterns, an examination of rainfall patterns, and information, where available, of past climatic change, particularly insofar as this is related to rainfall.

Thus in the south-east of Abu Dhabi, today largely arid, existing land-forms in the area north of Umm al-Zamul, combined with observations following rainfall in early 2005, suggest that there may have been permanent or semi-permanent bodies of fresh water at times of the higher rainfall during the Neolithic Climatic Optimum.

In the Eastern Region, around Al Ain, a different pattern applies, both with regards to the availability of fresh water and to land-use. Besides the fact that this area, at least today, generally has more rainfall, there is also an easier access to subterranean water supplies flowing out from the adjacent Hajar Mountains - these being those supplies which are tapped by the falaj water channel systems. These appear to have been introduced around 3,000 years ago, following a period of increasing aridity (proven through excavations of Bronze Age wells in the area). Land-use also changed after the Iron Age in the Al Ain area, as shown by the fact that Iron Age settlements, with falajes, have been identified in areas, such as Bida Bint Saud and Jabeel, which are now covered by mobile dunes.

Changing land-use on the coast and islands can also be detected through archaeological studies - these often suggesting that a decline in the availability of freshwater, whether through rainfall or through wells - has resulted in the abandonment of formerly-present permanent settlements, as on Ghaghah, Yasat-al-Uly and Al-Utsa’iyyah.

3.1.3 Identifying past and present belief systems that have not been discussed in great detail (worship of fire and other pre-Islamic beliefs)

The discovery of the pre-Islamic Christian monastery on Sir Bani Yas confirms the presence of Christianity in the Emirate of Abu Dhabi prior to the coming of Islam. This is believed to have faded away over the course of the next couple of hundreds years or so, based upon textual evidence of the last-known Nestorian bishop from the UAE and Oman area (known to the church as Bait Mazunaye) to have attended Nestorian synods.

Since that time, the religion of the indigenous inhabitants of the Emirate of Abu Dhabi has been Islam, with the dominant sect being Sunni and with a small minority of Shi’a Muslims, primarily, since the 19th Century at least, being of immigrant origin, mainly from the southern Iranian coast.

Pre-Islamic beliefs have not been examined in detail, although a belief in the existence of an after-life can be deduced from the presence of well-built tombs during some periods (in particular the Jebel Hafit and Umm al-Nar periods) and by the presence of grave goods in burials.

No evidence is known for the presence of Zoroastrianism, which may have been present during the late pre-Islamic “Sasanian” period, when the area was in close contact with the Iran-based Sasanian Empire.
3.2 Scientific Value

Over the course of the decades since archaeological and palaeontological investigations first formally commenced in the Emirate of Abu Dhabi (and the UAE) in 1959, a substantial amount of fieldwork has been undertaken, particularly since the early 1990s. This and an extensive programme of publication and of paper presentation at conferences have meant that today there is a large and widely-diversified body of knowledge about Abu Dhabi’s archaeology and palaeontology. A similar pattern of extensive activity also applies to the rest of the United Arab Emirates, this dating to the early 1980s when, for a variety of reasons, foreign archaeological teams that had previously focused their attention on Iran, Iraq and Saudi Arabia, began to work in the UAE.

Although this process is now being reversed, at least insofar as Iran is concerned, one result has been that the contributions of the last twenty years to knowledge of UAE archaeology outweigh those of the period from 1959 to the early 1980s. The dissemination of such knowledge outside the academic community still, however, has considerable scope for improvement.

3.3. Educational Value

History is taught in all schools in the UAE but little mention is made of the archaeology and palaeontology of the UAE. Indeed the curriculum in use in Government schools and in many private schools is focused more on the history of the wider Arab world than on that of the United Arab Emirates itself. Moreover, many private schools follow a foreign curriculum.

At the level of higher education, the UAE University, based in Al Ain, currently offers a degree major in History and Archaeology. In the near future the university will introduce a ‘Thematic Application’ in Cultural Resource Management, which is a series of six courses aimed at training people to work in heritage, archaeology and museums. In addition, the University is developing an MA in Practical Archaeology which includes a significant period of practice based education.

Studies of geology, also at the UAE University, are related primarily to the long-term needs of the UAE’s oil and gas industry and, therefore, pay little attention to palaeontology.

Thus, at present, the potential educational value of the rapidly-expanding body of knowledge of the UAE’s archaeology and palaeontology is not being realised.

3.3.1 Building understanding of common history and national identity

‘A people that knows not its past is not equipped to tackle the challenges of the present or of the future’

(Former UAE President Sheikh Zayed bin Sultan Al Nahyan)

If the inhabitants of the United Arab Emirates are to be able to apply the dictum of Sheikh Zayed, cited above, so that they learn of their current national identity through an understanding of their shared past, then a focus on archaeology and history is required at all levels of the educational curriculum, and well as in more general public education. This can only be achieved through a well-defined and concerted, government-led approach to this challenge, although some preliminary steps can be made, at a limited level, through the activities of existing government institutions dealing with archaeology and history, such as ADIAS, the Department of Antiquities and Tourism and the new Abu Dhabi Authority for Culture and Heritage (ADACH), and through the activities of voluntary non-governmental organisations.

3.3.2 Current gap in educational material and educators relating to history, archaeology and palaeontology

There is very little material, in either Arabic or English that deals with archaeology and palaeontology of the Emirate of Abu Dhabi, or of the wider UAE, that is suitable for use in schools, or by educators, although there is a growing body of academic material.

Archaeology, palaeontology and broader aspects of the country’s history are among topics that are due to be discussed during current (early 2006) planning for the devising of a new national curriculum.

FIGURE 21. The Proceedings of the First International Conference on the Archaeology of the UAE were published in Arabic and English, as well as in the form of a DVD (Photograph: Trident Press)
3.3.3 Gap in Arabic language educational materials

There is very little material in Arabic on the archaeology and palaeontology of the United Arab Emirates, with the only general overview being provided by the book 'Hidden Riches' (Hellyer 1998). However, in the last few years, a number of more specialised books have been produced, although they are not widely available. The Abu Dhabi Authority for Culture and Heritage (ADACH) is planning a programme of publication in Arabic, both of academic works and of material designed for the general reader.

3.3.4 Showing the importance/significance of UAE history to the outside world

The annual yearbooks of the UAE's External Information Department, formerly part of the Ministry of Information and Culture and, since February 2006, of the Ministry of Presidential Affairs, provide an annual round-up of recent archaeological and palaeontological studies that is available outside the UAE, both in printed and electronic format. The website www.uaeinteract.com, managed by the Department, also contains extensive material on archaeology and palaeontology, while both ADIAS and the Department of Antiquities and Tourism have their own websites. During the course of 2006, that of the latter will be integrated into the website of the new Abu Dhabi Authority for Culture and Heritage. Exhibitions of archaeological artifacts from the Emirates and other displays are rarely arranged outside the country - such events have the capacity to contribute in a significant way to a great understanding of UAE history abroad.

Moreover, while, as noted above, there is a growing body of published work dealing with the archaeology, palaeontology and history of the country, much of it is academic in format, and, thus not best-suited to the general reader. Many such publications, moreover, are found only with considerable difficulty abroad, as a result of the apparent inability to identify distributors interested in handling material on the Emirates.

With these constraints, a focus on developing greater use of the electronic media may prove to be a productive way to move forward on this issue.

3.4 Economic Value

Little study has yet been undertaken on the economic value that can be derived from archaeological, palaeontological and fossil sites and related institutions, such as museums. Indeed, although there is a small museum in Al Ain, Abu Dhabi city, the capital of the Emirate and of the UAE as a whole, currently has no museum, of any kind.

The existing Al Ain Museum and the Hili Archaeological Park, also in Al Ain, do, however, attract a considerable number of visitors, while the popularity among visiting tour groups of displays of ethnographic material (such as in 'Heritage Villages') indicates that there is a potential demand to be satisfied.

The Abu Dhabi Authority for Culture and Heritage is expected to examine the potential for stimulating greater visitor interest, both among UAE residents and among visitors overseas, with a view to creating more awareness of Abu Dhabi's heritage and to generating revenues. In this process, it will be working with the Abu Dhabi Tourism Authority, with whom it shares a Chairman.

3.4.1 Tourism

"Eco-tourism" is now beginning to grow in the Emirates, partly as a result of a specially-designed resort in Dubai, and of the emergence of specialist tour-operators. Thus far, it has not developed significantly in the Emirate of Abu Dhabi. The Environment Agency - Abu Dhabi, EAD, is, however, discussing plans for promoting "eco-tourism" in Abu Dhabi, with particular reference to the island of Marawah and the Marawah Marine Protected Area of which it is a part. ADIAS has been involved in discussions with EAD on this concept, because of the presence of important archaeological sites on the island. Moreover, the Abu Dhabi Tourism Authority has identified "eco-tourism" as one area in which it may be possible to stimulate an increase in visitor numbers. Close collaboration between EAD, the Tourism Authority and the Culture and Heritage Authority on the development of a strategy for promoting both "eco-tourism" and tourism related to heritage would be appropriate.

3.4.2 Sale of reproduction of antiquities

At present (mid-2006), there is no federal legislation in the United Arab Emirates relating to the sale of reproductions of antiques, or, indeed, of the sale of genuine antiques. Draft legislation on antiquities and archaeology has been prepared, but has not yet been adopted, while there may also be future legislation applicable to the Emirate of Abu Dhabi, through the Culture and Heritage Authority.
Provided that such legislation is in place, and provided that there is a suitable inspection procedure to ensure that items on sale are, indeed, reproductions, then a market may emerge for the sale of reproductions of antiques and artifacts.

3.4.3 Media value (books, documentaries, etc) that can be framed around archaeology/palaeontology

As noted above, and in the bibliography, there is an increasing amount of media material on the archaeology, palaeontology and history of the Emirate of Abu Dhabi and the UAE as a whole, while further material is being prepared, both aimed at an Academic audience and at the general reader.

As public awareness of this material increases, through better display and distribution, a great volume of sales can be anticipated.
4. MAJOR ISSUES

4.1 Legislation and Infrastructure

4.1.1 Lack of implementation of current laws

No legislation on protection of archaeological sites currently exists in the Emirate of Abu Dhabi, and there is no UAE federal legislation, although local decrees exist in some emirates.

4.1.2 Lack of legislation forbidding theft and sale of antiquities/fossils

No legislation currently exists in the Emirate of Abu Dhabi, and there is no UAE federal legislation, although local decrees exist in some emirates.

4.1.3 Lack of participation in international conventions for preservation of archaeological and palaeontological resources

The United Arab Emirates federal government is responsible for signing international conventions on behalf of the member emirates of the federation. No such conventions or agreements relating to archaeology and palaeontology have been signed, including the UNESCO World Heritage Convention, although the issue of adhesion is currently (mid 2006) being discussed.

4.1.4 Authority for management of archaeological resources

Since late 2005, the authority for the management of archaeological (and palaeontological) resources in the Emirate of Abu Dhabi is the Abu Dhabi Authority for Culture and Heritage. This body is currently (mid-2006) in the process of absorbing the Department of Antiquities and Tourism in the Eastern Region of Abu Dhabi and taking over some of the responsibilities formerly assigned to the Abu Dhabi Islands Archaeological Survey, ADIAS.

4.1.5 Lack of coordination between different Emirates

Although responsibility for archaeology at a federal UAE level was formerly assigned to the former Ministry of Information and Culture and is now, since February 2006, the responsibility of the new Ministry of Culture, Youth and Community Development, activities related to archaeology at a federal level have been primarily confined to the selection of individuals from within the Ministries and from local Departments of archaeology and antiquities to attend international conferences, mainly on a pan-Arab level.

There are separate Departments in each emirate, but there is no formal structure promoting collaboration between them.

Such collaboration as does currently exist is mainly at a personal, rather than an institutional level, although the degree of exchange of information has been enhanced by the introduction, in 2003, of an annual symposium on recent archaeological and palaeontological work in the country. This is organised by the Zayed Center for Heritage and History. One volume of proceedings, under the title of "Emirates Heritage" has been published (Hellyer and Ziolkowski 2005).

4.2 Development vs Protection

4.2.1 Threats from development/construction activities (i.e. bulldozers)

Threats from development, both on the coast and islands and inland, are extensive, and are comparable to those posed to ecology and natural habitats (see elsewhere in this report). A review of the threat to archaeological and fossil sites from coastal development can be found in Beech and Hellyer (in press).

4.2.2 Lack of formally protected areas, e.g. No designated world heritage sites in UAE

Informal protection has been accorded to some sites in the Emirate of Abu Dhabi, such as the Hili Archaeological Park and those on the island of Umm al-Nar.

Archaeological sites on islands within the Marawah Marine Protected Area are protected within the framework of the local Abu Dhabi legislation on protection of the environment of the area.

As noted above, the federal Government of the United Arab Emirates has not signed the World Heritage Convention or other relevant conventions, and, as a result no sites in Abu Dhabi, or indeed elsewhere in the UAE, are afforded protection under international conventions, although several sites, including Jebel Hafit and Marawah, have been suggested as possible future candidates for nomination for inclusion on the list of World Heritage Sites.
4.3 Education and Awareness

4.3.1 Lack of awareness of importance and protocol related to antiquities/fossils

As noted above, there is a lack of public awareness about the archaeological and palaeontological heritage of the Emirate of Abu Dhabi and the United Arab Emirates.

One corollary of this is that there is little awareness, either, of the necessity of ensuring that items related to this heritage are protected.

Enhancing of this awareness can come about only through campaigns aimed both at the educational sector and at the general public, both in Arabic and in other languages spoken by the UAE's expatriate residents.

4.3.2 Lack of UAE Nationals entering the professional field

As noted above, the national schools curriculum devotes little or no attention to topics related to the archaeology, palaeontology and history of the UAE, while there is little tertiary education available. Archaeology and Palaeontology are not a priority in the current educational system and there are no economic incentives for entering this field.

Moreover, there has, in the past, been only a relatively few number of employment opportunities related to these fields, while employment in other sectors, such as the finance industry or the oil and gas industry, is perceived as having a higher status. As a result, there are few UAE citizens with any relevant qualifications, while expatriate residents with relevant qualifications generally find that there are no employment opportunities.

With the establishment of the Abu Dhabi Authority for Culture and Heritage, which is planning to establish several museums as well as to increase the amount of archaeological

and palaeontological fieldwork being undertaken, more employment opportunities can be expected to emerge in future.

4.3.3 Lack of museums and exhibits within Abu Dhabi

As noted above, there is no museum in the city of Abu Dhabi, although there is a small museum in Al Ain, which is in need of refurbishment and re-organisation. This issue is being addressed by the Abu Dhabi Authority for Culture and Heritage, and may involve collaboration with the Environment Agency - Abu Dhabi.

4.4 Antiquities trade

4.4.1 Sale of antiquities

As noted above, there is no legislation in Abu Dhabi, or at a federal UAE level relating to the sale of antiquities, although federal legislation has been drafted.

4.4.2 Smuggling via the UAE

The existence of a trade in antiquities smuggled into the UAE from other countries is well-attested, although, with the exception of the Emirate of Sharjah, there is no relevant legislation to permit action to be taken against it.

On occasion, ADIAS and the Department of Antiquities and Tourism have been asked to assist the Abu Dhabi Police with the identification of artifacts, although in the case which involved ADIAS, at least, police interest was related to whether or not a salesman was misrepresenting the age of the items, rather than to whether or not they had been illegally exported from their country of origin to the United Arab Emirates.
5. MANAGEMENT AND CONSERVATION

5.1 Institutional Arrangements

5.1.1 ADIAS MOU with the Environment Agency - Abu Dhabi (EAD)

In 2000 a Memorandum of Understanding (MOU) was signed between the Abu Dhabi Islands Archaeological Survey (ADIAS) and the Environment Agency Abu Dhabi (EAD), at that time known as the Environmental Research and Wildlife Development Agency (ERWDA). This MOU was to develop the ADIAS Sites Database, a geo-referenced database of archaeological and palaeontological sites for the Western Region of Abu Dhabi (Beech and Hellyer 2000). The application was developed in Microsoft SQL and is hosted on the EAD server. It forms part of the Abu Dhabi Environmental Database (EDB).

The ADIAS Sites Database records the following information: site code, previous or old site codes, Latitude and Longitude co-ordinates (recorded in decimal degrees, with the datum as WGS84), size and extent of the site in metres, details of surveys carried out, brief description of archaeological finds, classification of site type, classification of age of site, grade of importance of the site (local, regional, national or international).

Geo-referenced data is exported from the application in CSV(DOS) format which can then be inputted into a GIS system. ADIAS currently uses the same platform as EAD, with ESRI ArcInfo/ArcMap 8.2 being used to produce maps and undertake analyses of the data.

Consideration is being given to the signing of a new MOU between EAD and the Abu Dhabi Authority for Cultural Heritage, ADACH.

5.1.2 ADIAS partnership with the Department of Antiquities and Tourism in the Eastern Region

Three seasons of joint fieldwork have been carried out by ADIAS and the Department at sites in the south-east of Abu Dhabi, although without any formal agreements.

With ADIAS ceasing to be involved in excavations, and with the Department now being absorbed into the Culture and Heritage Authority, the need for such a partnership will come to an end.

5.1.3 Informal relationships (e.g. ADIAS and Zayed Centre for Heritage & History)

Together with the Abu Dhabi Islands Archaeological Survey (ADIAS), and the Ministry of Information and Culture, the Zayed Centre for Heritage and History organised the First International Conference on Emirates Archaeology, which was held in Abu Dhabi from 17-19 May 2001. The Centre and ADIAS have subsequently organised four annual symposia on recent archaeological and palaeontological work in the Emirates between 2003-2006. These symposia were held in late March to early April and were attended by participants from local departments throughout the country as well as by foreign-based archaeologists working in the country.

5.1.4 Abu Dhabi Authority for Culture and Heritage (ADACH)

For details of this newly-established body, see below. It is now the governmental authority in the Emirate of Abu Dhabi responsible for archaeology.

5.2 Governmental bodies

5.2.1 Department of Antiquities and Tourism, Al Ain

Al Ain Museum is the oldest in the UAE and was opened in 1971. The Department of Antiquities and Tourism, under the Diwan of the Eastern Region, has been in charge of this museum since it was established.

The Department of Antiquities and Tourism is being merged into the new Abu Dhabi Authority for Culture and Heritage Authority (ADACH).

5.2.2 Cultural Heritage Unit, Abu Dhabi Tourism Authority, Abu Dhabi

The Cultural Heritage Unit (CHU), formerly part of the Al Ain Tourism and Economic Development Authority, was subsequently transferred to the Abu Dhabi Tourism Authority and is now part of the Abu Dhabi Authority for Culture and Heritage (ADACH).

5.2.3 Abu Dhabi Islands Archaeological Survey (ADIAS)

The Abu Dhabi Islands Archaeological Survey (ADIAS) was established in 1992 on the instruction of the late President His Highness Sheikh Zayed bin Sultan Al Nahyan. In the years
that have followed, ADIAS identified over a thousand sites or
groups of sites on the coast and islands of Abu Dhabi.

Many of its responsibilities will now be taken over by the new
Abu Dhabi Authority for Culture and Heritage (ADACH).

5.2.4 Cultural Foundation, Abu Dhabi

The Cultural Foundation in Abu Dhabi is made up of two
major institutions, the Arts and Culture Establishment and the
National Library. The National Library contains a large collec-
tion of books known as the Gulf and Arabian Peninsula
Library, a significant collection of manuscripts and an online
database.

The Cultural Foundation has become part of the new Abu
Dhabi Authority for Culture and Heritage (ADACH).

5.2.5 Centre for Documentation and Research

The Centre for Documentation and Research (CDR) was
established in 1968 for the purpose of documenting the histo-
ry of the UAE and Gulf region. Originally part of the Cultural
Foundation in Abu Dhabi, it is now part of the Ministry of
Presidential Affairs. Among its collections of documents is
archival material obtained from a number of foreign sources
including: American; British; Dutch; French; German;
Japanese; Ottoman; Persian; and Portuguese. The Portuguese,
Dutch, British and French holdings constitute a particularly
strong resource.

5.2.6 Zayed Centre for Heritage and History

Established in March 1999 by the late President H.H. Sheikh
Zayed bin Sultan al Nahyan, the Zayed Centre for Heritage
and History in Al Ain is an official, cultural and research institu-
tion founded to foster study and research related to tradition
and history.

Together with the Abu Dhabi Islands Archaeological Survey
(ADIAS), and the Ministry of Information and Culture, the
Centre organised the First International Conference on
Emirates Archaeology, 17-19 May 2001. The Centre and
ADIAS have subsequently organised four annual symposia, in
2003, 2004, 2005 and 2006, on recent archaeological and
palaeontological work in the UAE, these being attended by
participants from local departments throughout the country
and by foreign-based archaeologists working in the country.
The Zayed Centre holds weekly lectures relating to the histo-
ry, heritage and culture of the United Arab Emirates and the
Gulf region. It also publishes books on the history and heri-
tage of the Gulf and has an extensive collection of books,
tapes, DVDs and manuscripts.

5.2.7 Abu Dhabi Authority for Culture and Heritage (ADACH)

On the 14th October 2005 President HH Sheikh Khalifa bin
Zayed Al Nahyan, acting in his capacity as Ruler of Abu
Dhabi, issued a law to establish the Abu Dhabi Authority for
Culture and Heritage.

According to the terms of the Law, the Authority: "will over-
see intellectual and artistic activities in the Emirate of Abu
Dhabi and will also be responsible for maintaining, protecting,
managing and promoting the cultural heritage of the Emirate
through the following means:

• the evolving of cultural policies, plans and programmes
  and ensuring that such policies are implemented.
• undertaking projects designed to develop, promote and
  protect the cultural heritage of the Emirate and to make
  appropriate recommendations to the relevant authorities.
• organising and developing activities dealing with the
  heritage of the country as well as organising
  conferences, cultural shows, plastic arts exhibitions and
  other activities related to the activities of the National
  Library.
• organising study programmes and seminars and other
  intellectual, scientific and professional meetings in
  addition to the publication of research and studies in the
  field of culture and heritage.
• conserving historical, archaeological, heritage sites and
  buildings, as well as preparing an inventory of cultural
  property and artifacts.
• carrying out of archaeological excavations, conserving
  archaeological artefacts and relics and issuing licences for
  excavations.
• supervising the work and activities of archaeological
  excavation teams and establishing a department to man
  age, develop and supervise museums and other buildings
  where cultural artefacts are housed.
• recommending laws and regulations to protect, promote
  and preserve cultural heritage.
• providing support for training and educational activities
  in the Authority's field of specialization.
• developing human and cultural resources in the fields of
  documentation, management, archiving and
  preservation of cultural heritage.
• outlining general plans for the activities of museums, in
  addition to planning for exhibitions on heritage, ensuring
  that such plans are carried out in association with the
  authorities and institutions concerned.
• checking for violations of and damage to the cultural
  heritage and antiquities of the emirate and taking the
  necessary legal action in association with the relevant
  authorities.
providing support and assistance to bodies working in the field of the preservation, management and promotion of cultural heritage.
• exercising control over heritage and cultural property, whether public or private
• managing the National Library in such a way as to enrich and promote intellectual, artistic and scientific activities in Abu Dhabi through the provision of references, journals and periodicals in Arabic and other languages in various fields of knowledge.
• recording national history through the collection of documents, the registering of the heritage of the emirate and through the publication of works in this field.

The Authority has absorbed the following organizations: the Cultural Foundation, the Department of Antiquities and Tourism in Abu Dhabi’s Eastern Region and the Cultural Heritage section of the Abu Dhabi Tourism Authority.

5.3 Non-Governmental Organisations (NGOs)

5.3.1 Emirates Natural History Group

The Emirates Natural History Group (ENHG) was founded in 1977 as a non-profit organisation for individuals with an interest in the natural history of the United Arab Emirates. There are three chapters of the ENHG in the UAE and these are located in Abu Dhabi, Al Ain and Dubai. Bi-monthly lectures are held, as well as regular fieldtrips during weekends. The subject matter of these lectures and fieldtrips is not merely confined to natural history and there is a great interest in archaeology and paleontology amongst the members of this group. The ENHG has a bi-annual journal called Tribulus, which publishes a wide range of articles on natural history, paleontology and archaeology.

Members of the Abu Dhabi ENHG chapter have participated as volunteers on surveys and excavations carried out by the Abu Dhabi Islands Archaeological Survey (ADIAS) at Abu Dhabi international airport (winter 2002-3), as well as more recently at Umm az-Zamul, while the chapter has also provided financial support to several ADIAS projects, as well as to other archaeological work elsewhere in the Emirates.

In 2004 the ENHG published a book, "Jebel Hafit: A Natural History" (Aspinall and Hellyer 2004), which includes a chapter on archaeology by Drs Rob Carter and Walid Yasin Al-Tikriti.

The Al Ain Chapter of the ENHG was established in 1980 and has a programme of lectures and fieldtrips similar to those of the Abu Dhabi Chapter. Its location has made it easy for interested members to undertake detailed recording of a number of archaeological sites in the Al Ain region. These have included surveys of wadis around the Al Ain region and across the border into Oman. They have made important discoveries such as an important Iron Age site at Jabeeb near Al Ain and the copper mining slag sites at Wadi Khutwa. Information collected has been shared with the Department of Antiquities and Tourism in Al Ain, which also receives all archaeological material collected for review and assessment.

Of special interest to the group is the history of copper smelting in the region over the past 5000 or more years. The group has made an effort to record smelting sites and revisit sites recorded in the past (i.e. Wadi Safafir). The search for copper mine sites continues. Likewise, the group has a special interest in the archaeology at Jabeeb where ancient falaj, smelting hearths and occupation sites have been recorded. These sites are under threat from development and the group has worked in close cooperation with the Al Ain Museum to identify sites and recommend their protection and preservation. Other sites of special interest include the graves and settlements of Jebel Qatara and the Jebel Hafit period tombs of Jebel Aqbar (both in the neighbouring Sultanate of Oman).

The group has also provided financial support for archaeological projects in Abu Dhabi and in other Emirates. This has included awarding grants to support DNA research on human remains found at archaeological sites in the UAE and for a number of topics related to natural history.

5.4 Conservation

5.4.1 Policy, Legislation and Regulation

There is no comprehensive archaeology/antiquities law for the UAE. A draft federal law has been prepared, but is not yet adopted.
In October 2005 the President HH Sheikh Khalifa bin Zayed Al Nahyan, acting in his capacity as Ruler of Abu Dhabi, issued a law to establish the Abu Dhabi Authority for Culture and Heritage (see above). This body will be responsible for drafting appropriate legislation for the Emirate of Abu Dhabi.

5.4.2 Research and Monitoring

There is no organised patrolling and monitoring of archaeological sites in the Western Region of Abu Dhabi Emirate, although guards employed by the Department of Antiquities and Tourism in Al Ain are stationed at the Umm al-Nar Bronze Age site.

In collaboration with ADIAs, the Abu Dhabi Company for Onshore Oil Operations, ADCO, has erected warning notices at several sites in its concession area and the responsibility for ensuring that these are safeguarded has been assigned to ADCO Environmental Engineers.

Employees of the Department of Antiquities and Tourism regularly examine sites in the Al Ain area.

5.4.3 Protected Areas

There is no formal protection of archaeological and palaeontological sites that is supported by legislation. However, as noted above, some archaeological and palaeontological sites in the operational area of the oil company, ADCO, are protected under the company’s own internal policy.

Sites in the Marawah Marine Protected Area are covered by the legislation relating to that area, which is administered by the Environment Agency - Abu Dhabi, EAD; identification of these sites being currently the responsibility of ADIAs. This responsibility will be transferred to the Culture and Heritage Agency.

In the Eastern Region (and at Umm al-Nar), the Department of Antiquities and Tourism ha built protective walls around some key sites, such as those in the Hili Archaeological Park and the Iron Age village at Rumailah.

The Late Miocene fossil trackway at Mleisa, identified by ADIAs, has been fenced by the local office of the Municipality, to prevent vehicular access.

5.4.4 Enforcement

Little enforcement activity has been carried out, in the absence of legislation and, as far as is known, there have been no court cases involving damage to archaeological sites in the Emirate of Abu Dhabi.

This issue will be addressed by the newly-established Culture and Heritage Authority.

5.4.5 Awareness and Capacity Building

Issues related to the need for an increase in awareness and capacity building have been dealt with above, but include the preparation of more media material, in relevant languages, that is aimed at the general public, revisions to the national curriculum, including the preparation of textbooks and other teaching material, and a building of relationships between those bodies concerned with archaeology and palaeontology and other governmental and non-governmental organisations and the corporate sector.
6 Outlook

6.1 Summary of the state of knowledge

6.1.1 Palaeontology

A wide variety of palaeontological sites exist within Abu Dhabi emirate.

Cretaceous fossils (dating to between 144 to 66.4 million years ago) consist of marine fossils such as sea urchins, shells and corals. These are principally found in the area of Jebel Hafit in the Eastern Region.

Late Miocene fossils (dating to around 6-8 million years ago) are located within the Baynunah formation along the coast and interior of Abu Dhabi emirate between Rumaitha in the east to Jebel Barakah in the west. Recent work at Umm al-Ishtan and close to Bida al-Mutawa demonstrates that the Baynunah formation in actual fact extends further west and south than originally determined by earlier palaeontological research. Fossils have been discovered from a large number of sites. Animals represented include freshwater molluscs, freshwater catfish, freshwater turtles and terrestrial tortoises, crocodiles and birds (including ostrich, egret and darter). Largest amongst the fossil mammalian remains are bones from proboscideans/elephants (mainly from the four-tusked Stegotetrabelodon syrticus, together with a type of Mastodon and Deinothere). The odd-toed ungulates include two species of primitive three-toed horse (Hipparion) and a rhinoceros. Even-toed ungulates include pigs, hippopotami, cattle, antelopes, gazelle and giraffe. Carnivore fossils included sabre-toothed cat, hyaena and wolverine. Other animals represented include an Old World monkey, a new gerbil species named Abudhabia baynunensis, a cane rat, a jerboa, an Old World rat and an undetermined shrew.

Together these fossils demonstrate that Abu Dhabi was a land of fertile plains within which broad rivers flowed through savannah grasslands, the plains being dotted with acacia trees, somewhat akin to modern day East Africa.

In addition to the fossil bearing sites, a series of trackway sites have also been recently identified at Mleisa, Niqa and Bida al-Mutawa. These trackways have hundreds of footprints made by some type of proboscidean, as well as other animals, in the case of the Niqa site. Further study of these sites is required but initial investigations suggest that they too may date to the Late Miocene period.

Pleistocene marine fossils have been identified in the form of fossil mangrove pneumatophora, present in some coastal areas and on offshore islands. Fossil corals have also been identified on the island of Marawah. Some of these relate to periods of higher sea-levels in the past.

6.1.2 Archaeology

Archaeological stone artifacts, of probable Palaeolithic date, have been identified at Jebel Barakah in Abu Dhabi’s Western Region.

The earliest archaeological settlement sites so far known within Abu Dhabi date to the early Holocene period, about 7,500 years ago. This period is known as the Late Stone Age, Neolithic or Ubaid period, and dates from around 7,500 years ago up until just over 5,000 years ago (5500-3200 BC). Traces of these early inhabitants of Abu Dhabi can be found on the coast and islands, as well as the desert interior. Key sites include sites MR1 and MR11 on Marawah Island and site DA11 on Dalma Island. Ubaid pottery is known from these sites, a clear sign of contacts with southern Mesopotamia at that time, or at least with traders in the central Gulf, who were themselves in contact with Ubaid cultural groups.

Key Neolithic sites located in the desert interior can be found in the Umm az-Zamul region. These are aceramic but have substantial lithic assemblages focused in particular locations. As known elsewhere in the Rub al-Khali, these may relate to settlement activities adjacent to ancient lakes which the Neolithic pastoral nomads exploited on a regular basis.

Little evidence of fourth millennium occupation has been found on the coast and islands of Abu Dhabi. The Hafit period (3200-2600 BC) is named after the well-built stone tombs present in their hundreds on the slopes of Jebel Hafit near Al Ain, and the Hajar Mountains of neighbouring Oman. Pottery found within these tombs includes small painted vessels of a type known as Jemdet Nasr. This is an archaeological site located near Babylon in southern Iraq, famous for its polychrome pottery, produced in the late 4th millennium BC. The main evidence for this period in Abu Dhabi has so far been found well inland, although a few possible Hafit-type pottery sherds have been identified close to Abu Dhabi Airport. It is striking that a completely different picture emerges if one considers coastal settlements on the coastline of Oman. Here there is abundant evidence for coastal occupation during the fourth millennium BC with extensive coastal shell middens from Ra’s al-Hamra to Ra’s al-Hadd and beyond. The archae-
ology of this period in the Gulf has been referred to by some authors as the "Dark Millennium". It seems that a marked climatic deterioration caused dramatic changes of subsistence and settlement patterns in the Gulf around 4000 BC.

Some time in the late Fourth Millennium BC, however, knowledge of a major technological innovation arrived in the region, that of how to mine and smelt the copper ores found in the Hajjar mountains. This marked the beginning of the local Bronze Age.

The most important Bronze Age site located in the coastal region of Abu Dhabi is on the island of Umm al-Nar (also known as Sas al-Nakhl), situated just to the east of Abu Dhabi Island. This type site gives its name to the chronological period known as Umm al-Nar (2600-2000 BC). The port of Umm al-Nar acted as a terminal for copper exports to Mesopotamia. Evidence of the Umm al-Nar civilisation has subsequently been discovered throughout the UAE and northern Oman.

Within the interior, the most important group of archaeological sites dating to the Bronze Age is found in Hili, just to the north of the centre of Al Ain. During the second half of the 3rd millennium BC (2500 - 2000 BC) the inhabitants of this area lived in sun-dried mud-brick houses and buried their dead in stone-built collective graves (although stone-built houses from the period are known from Umm al-Nar). The site designated as Hili 1, located next to the Grand Tomb, was once a high tower, standing several meters above the ground. This building had a thick circular wall embracing several rooms which were served by a well located in the centre of the structure. It was surrounded by a moat. A similar building, known as Hili 10, with a central well was also discovered near the main entrance of the park. A third building, known as Hili 8, located outside the south eastern corner of the park wall, was excavated by a French team. It seems to have had the same or an even more important role.

Collective tombs from the Umm an Nar period dating to the second half of the 3rd millennium BC are known today at many sites in the UAE, but most importantly at both Hili and the Island of Umm al-Nar. At Hili, there are three tombs inside the park and several others outside. Hili Grand Tomb, located in the middle of the park, is over 4000 years old and was probably in use for two or three hundred years. Evidence from collective graves from the same period in the region indicates that hundreds of people would have been buried here over a long period of time. A particularly interesting discovery at the Hili site was the existence of a pit-grave, known as Tomb N, adjacent to one of the smaller above ground circular tombs. This was found to contain many objects such as pottery, stone vessels and ornaments, all dating to the very end of the third millennium BC. Tomb N contained perhaps as many as six hundred individuals, buried over a period of 100 to 200 years.

Another important site located in the eastern region of Abu Dhabi emirate is Bida Bint Saud. This is situated to the north of Hili, some 25km from the city of Al Ain. The high rocky plateau rises some 40m above the surrounding area. A number of Haftit, Umm al-Nar and Iron Age graves have been also excavated here. A large public mud-brick building has been excavated here dating to around three thousand years ago. It is thought that this may have served as a place to control the distribution of water since about 150m south of this building a falaj (underground water tunnel) was discovered and partly excavated. A second falaj has also been discovered in the same region. The existence of both falajes indicates that the area of Bida Bint Saud played a major role in the history of the Eastern Region of Abu Dhabi. The discoveries also provide important evidence that the falaj system was indigenous to the region, being introduced during the Iron Age some 3000 years ago.

Evidence of occupation during the middle Bronze Age, known as the Wadi Suq period (2000-1600 BC), around 4,000 years ago, has been found on several of Abu Dhabi's islands, including Ghaghah, Sir Bani Yas, Marawah, Rufaiq and Balghelam. There is little evidence of occupation of the deserts during this period, perhaps due to climatic change, and less rainfall, and some of the islands in the Western Region may have been used as temporary way-stations or trading settlements by sailors from Bahrain (ancient Dilmun), on their way to Hormuz. Occupation in the Wadi Suq period is also attested from Al Ain, in particular from a long collective grave excavated in the 1970s in the Qattara oasis. There is, however, relatively little evidence of occupation during this period. This may be related, in part, to the fact that outwash from the Hajar Mountains may have deposited several metres of gravel and soil over other Wadi Suq sites in the Al Ain area.

Only ephemeral settlement traces from the Late Bronze Age (1600-1250 BC) have been identified on the coast and islands of Abu Dhabi, and the pattern of occupation in this region during this period is, at yet, poorly understood. Insofar as the inland areas around Al Ain are concerned, once again sites may have been covered by outwash from the mountains. Given the relative abundance in the Al Ain area of sites from...
the Jebel Hafit and Umm al-Nar periods, which preceded the Wadi Suq and Late Bronze Age periods, and from the Iron Age, which followed, it is considered likely that the area continued to be occupied, even if few sites have yet been identified. A falling in the water table has, however, been identified during this period, and this may have affected patterns of settlement.

The term "Iron Age" is technically a misnomer, as the inhabitants of the UAE continued to use copper rather than switching to the new metal, presumably because of the ready availability of copper in the mountains. Only sparse evidence from the Iron Age (1250-300 BC) has been found on the coastline and islands of Abu Dhabi, many appearing to be temporary campsites or way-stations relating to maritime trade, and perhaps occupied on only a seasonal basis. Many of the major Iron Age sites so far discovered in the UAE, including Rumeilah and Hili, both in Al Ain, and at Muweilah and Al-Thuqaiyah in Sharjah and Khatt in Ra’s al-Khaimah, lie inland near the Hajar Mountains and supplies of subterranean water. This period coincides with the first use of 'falaj' underground water systems. The well-preserved sites in the Al Ain area, including villages, as at Rumeilah, cemeteries, as mentioned earlier at Bida Bint Saud, and a fortress, at the northern tip of Jebel Hafit, are indicative of extensive settlement, while other Iron Age sites recently discovered by interested amateurs in the sands north-east of Al Ain, as at Jabeel, suggest that the area suitable for settlement was then larger than it was at later periods.

Important evidence of occupation during the Late Pre-Islamic period (300 BC - 300 AD) of many of Abu Dhabi's islands during the few centuries just prior to the coming of Islam has been identified. Among islands where sites from this period have been found are Abu al-Abyadh, Abu Dhabi, Balghelam, Dalma, Marawah, Qarnein, Sir Bani Yas, Yasat al-Ulya and Yasat Sufla. Inland, there are again some indications from the Al Ain area, although, once again, much evidence may be buried beneath the existing city.

One of the most important sites from the Sasanian period (300-632 AD) is located on Sir Bani Yas island, where the pre-Islamic Christian monastery discovered during excavations in the early to mid 1990s is the only physical evidence yet known in south-eastern Arabia of the presence of Christian communities before Islam. Excavations which took place between 1993-96 uncovered a church constructed within a walled monastic complex. A number of associated courtyard villas were also excavated from the surrounding area of the monastery. These all appear to have been occupied during the sixth and seventh centuries AD, being abandoned shortly after the arrival of Islam, perhaps because its inhabitants became Muslims or moved away. There is textual and archaeological evidence of the presence of the Nestorian Church in the north-east Arabian Peninsula, Mesopotamia and Iran during this period, although Sir Bani Yas is the furthest east site so far identified. A number of other Nestorian churches have been identified in the Gulf, notably at Failaka in Kuwait and Jubail in Saudi Arabia, but Sir Bani Yas is the first to be clearly identified with a related monastic settlement.

Study of the Islamic Period (750 AD to 19th century) is hampered by the lack of local written records for Abu Dhabi. Arab travelers like Ibn Battuta, Al-Idrisi and Yaqut passed through or dealt with the region but they made little reference to the UAE, apart from mentioning the major trading ports of Julfar (Ra’s al-Khaimah) and Dibba. The climate of the region became increasingly arid, perhaps prompting inhabitants to turn to a semi-nomadic lifestyle that subsequently lasted for much of the period until the coming of oil in the 1960s, except in the relatively well-watered areas around Al Ain. Some earlier settlements on offshore islands, such as Yasat al-Ulya and Ghaghah, as well as on Sir Bani Yas, appear to have been abandoned by around the beginning of the Islamic period. For the bulk of the interior, no settlement, or, indeed, occupation is attested for the whole of the period from the end of the Late Stone Age until the Late Islamic period, although it continued in the Al Ain area. There are significant remains of the Islamic period in the region of Al Ain including the many forts for which the town is famous.

One interesting site, not yet studied in detail, is located at Mantiqa al-Sirra, in the Western Region, to the east of Medinat Zayed. This is a large fortified settlement with apparent abandoned wells nearby, and with pottery suggesting an occupation date in the Late Islamic period. Further work is required to determine both its function and the reasons for its abandonment, although a slight harshening of the climate or reduction of the already sparse rainfall may have been responsible.

Sites have been found throughout the Emirate of Abu Dhabi dating to the Recent Islamic period (19th-20th century), although they are, not surprisingly, less common in the desert areas. The nature of the sites varies from evidence of burning and pottery scatters suggesting the presence of occasional campsites to areas of more extensive fireplaces, stone struc-
tures including outline mosques, water catchment systems, shell middens and pottery scatters which probably represent at least frequent seasonal occupation. The number of sites from this period testifies to the importance of the pearling industry in the pre-oil era. Pearling may have reached a peak in the late 18th and 19th Centuries. Among key sites is a shell midden (piles of opened and abandoned pearl oyster shells) on the island of Abu al-Abyadh which was once over three kilometres long, containing many millions of shells. The presence of Chinese porcelain and other imported pottery on some island sites demonstrates that, besides being involved in fishing and pearling, the people also took part in regional trade and in other economic activities.

An important coastal site dating to the Later Islamic Period are the sulphur mines discovered at Jebel Dhanna. This complex of sulphur mines with around 150 individual mine shafts probably date to the 18th Century AD, and are the only sulphur mines known in Eastern Arabia. The sulphur was probably largely exported, for the manufacture of gunpowder.

Buildings from the recent historical period are rare on the coastline and islands of Abu Dhabi. Key sites include the Bayt al-Muraykhi (pearl trader's house) and al-Dawsari, al-Muraykhi and al-Muhannadi mosques in Dalma town on Dalma Island. The stone walled mosques on Liffiya, Marawah and Bu Sharah, as well as number of stone outline mosques on coastal islands also form an important architectural group. In the Liwa Oases, permanent settlement appears to have commenced by the 16th or 17th Century AD, and certainly by the 19th Century AD mud-brick forts had been built. In the Al Ain area, the continued availability of water, through falaj systems, made permanent occupation, associated with agriculture, feasible. A number of the built architectural monuments in Al Ain, such as the forts, (now restored by the Department of Antiquities and Tourism) date to the 19th or early 20th Centuries, while the falaj systems may be of a much earlier date, albeit frequently repaired.

Recent settlement on the island of Abu Dhabi dates from the mid-18th Century, and a number of buildings were constructed in the 19th and early 20th Centuries, including forts, mosques and domestic dwellings, although few survive. A key impetus for the 19th Century building may have been increased prosperity resulting from the pearling trade. It is a pity that so few traces of recent historical architecture genuinely survive. Those buildings which do remain, such as the important group of buildings on Dalma, provide an important link to life in Abu Dhabi during the pre-oil era.

6.2. - What are the issues?

A number of issues are currently important to discuss in relation to palaeontology and archaeology in Abu Dhabi.

6.2.1. Legislation

The major issue relating to the palaeontological and archaeological resources of Abu Dhabi emirate is the lack of legislation to enforce protection of sites. This is especially critical with the modern pace of development and landscape transformations currently under way.

6.2.2. Monitoring and Management

No system is currently established for the patrolling and monitoring of existing known sites, or to systematically monitor new areas being developed. Although Environmental Impact Assessments (EIAs) should be carried out according to the Federal Environment Laws No. 23 and 24 (1999), there is no current enforcement of the provision that the archaeological/palaeontological component is fulfilled.

6.2.3. Training

There is a lack of UAE nationals trained in archaeology and palaeontology. This is discussed in further detail below. Future mentoring or in-house training of UAE nationals, perhaps formalised as partnerships with existing university archaeology departments, should be urgently considered.

6.2.4. Education and Awareness

The newly-established Abu Dhabi Authority for Culture and Heritage (ADACH) will provide a more unified approach to management of archaeological and palaeontological resources in Abu Dhabi emirate. This authority will have an Education and Awareness Department which will provide information concerning the heritage of the emirate. This can only be done, however, by a co-ordinated strategy working together with the relevant education authority. The preparation of suitable material for incorporation into school curriculums will be vital here.
6.2 Gap Analysis

The Gap Analysis presented here is based on a general consensus of opinions gathered at the AGEDI archaeology and palaeontology workshop to which all stakeholders were invited.

6.2.1 Data and Knowledge

It was generally agreed that an important point was to co-ordinate data gathering and sharing so that knowledge concerning the palaeontology and archaeology of Abu Dhabi emirate was widely available to all interested parties.

6.2.2 Policy and Regulation (at all levels- institutions, local and federal)

There was consensus that the lack of policy and regulation was hindering progress in the management of archaeology and palaeontology in Abu Dhabi emirate. It should be noted that the AGEDI workshop was held prior to the establishment of the new Abu Dhabi Authority for Culture and Heritage (ADACH).

6.2.3 Awareness and best practices

The problem of lack of awareness of best practices in heritage management, and the need for training in appropriate practices carried out following internationally recognised standards was iterated.

6.2.4 Lack of Professional Association

Unlike a number of other professions, there is no formal professional association of archaeologists within Abu Dhabi emirate, or indeed within the Emirates as a whole. The establishment of such a body in the future may introduce a more professional approach and help to develop best practices.

6.2.5 Monitoring and Management

A need for monitoring and organised management of archaeological and palaeontological resources was expressed. It was suggested by a number of attendees that this would be best achieved by having archaeologists posted in, and/or responsible for, different regions throughout Abu Dhabi emirate to patrol and monitor existing known sites, as well as to check new areas being developed.

6.2.6 Education and Awareness

The topic of education and awareness came up frequently during discussions at the workshop. Increased awareness of heritage issues was stressed as vital to educate the general public about the importance of archaeological and palaeontological sites in Abu Dhabi emirate.

6.3 Way Forward

6.3.1 Development of appropriate legislation

In October 2005 the President HH Sheikh Khalifa bin Zayed Al Nahyan, acting in his capacity as Ruler of Abu Dhabi, issued a law to establish the Abu Dhabi Authority for Culture and Heritage (see above). This body will be responsible for drafting appropriate legislation for the Emirate of Abu Dhabi. Hopefully, this will act as a spur to encourage the draft federal archaeology/antiquities law to be adopted.

6.3.2 Increase national and international awareness of UAE heritage

Increased awareness of heritage issues at both a national and international level is important. As discussed above, there is cultural, scientific, educational and economic value to both archaeological and palaeontological resources. At present these resources are undervalued. Efforts should be made to promote awareness of these resources by holding exhibitions, publication, including the preparation of suitable educational material, as well as through the use of multimedia formats, e.g. CD, DVD, internet and television, as well as the holding of conferences and workshops.

It is important that archaeologists working in the UAE participate in all regional and international conferences and meetings relating to archaeology in the Middle East. Archaeology and Palaeontology does not respect national boundaries. Many types of sites and cultural periods are common across the region, and there are a number of transboundary issues, such as Haifit and Umm Al-Nar tombs/periods which both occur in the United Arab Emirates and the Sultanate of Oman. Participation in regional meetings such as those organised by the GCC Union of Archaeologists, and international meetings such as the Seminar for Arabian Studies, held annually at the British Museum in London, and the International Congress on Archaeology of the Ancient Near East, ICAANE, help to maintain contacts between colleagues in neighbouring countries, as well as to keep colleagues up to date with the latest research developments within the region.
6.3.3 Designate key sites as potential World Heritage Sites

The designation of key sites as potential World Heritage Sites is an important step towards wider recognition of the importance of the heritage of the UAE. There have already been discussions held with representatives from UNESCO concerning the possible listing of Jebel Hafit and Marawah Island. Further steps will depend on the appropriate federal legislation being in place to enable progress to be made in negotiations with UNESCO.

6.3.4 Increase transparency and access to data

The establishment of an Abu Dhabi wide geo-referenced database of all palaeontological, archaeological and cultural heritage sites is critical for the future management and development of the palaeontological and archaeological resources of Abu Dhabi emirate. This database can then be integrated within a GIS-based system as a valuable tool for development and planning.

Increased transparency and access to data are of the utmost importance. Access to archaeological data via an online Geospatial portal would increase awareness and knowledge of such sites to a wider audience. A current attempt to remedy this is being provided by the Abu Dhabi Global Environmental Data Initiative (AGEDI).

6.3.5 Resolve issues surrounding data ownership and access

Some issues relating to data ownership and access exist and need to be resolved. Many of the archaeological surveys in Abu Dhabi carried out by ADIAS were undertaken at the request of various high-ranking individuals or were located inside oil concession areas, being commissioned by the Abu Dhabi Company for Onshore Oil Operations, ADCO, or were commissioned by other companies. It is important that all data emanating from this work be included in the Abu Dhabi database of archaeological and palaeontological sites, while maintaining the appropriate degree of confidentiality.

6.3.6 Develop Archaeological Association at the Federal level

The development of a Federal Archaeological Association would encourage co-ordination and collaboration between the different departments in different emirates. Such an association should be open both to UAE nationals and to citizens of other countries. It might play a leading role in the adoption of Codes of Practice for archaeological and palaeontological work across the whole of the Emirates. Good practice should aim to follow international standards in terms of field methodologies adopted, electronic archiving of archaeological and palaeontological data and publication of results.

This organisation might also be an appropriate body to organise an annual conference to promote the exchange and sharing of information between the different emirates. Such a conference has been organized for the past four years by the Zayed Centre for Heritage and History, together with the Abu Dhabi Islands Archaeological Survey (ADIAS). This has been held for the past few years during late March/early April in Al Ain, towards the end of the main archaeology field season. By holding such a meeting at this time of year it permits visiting archaeologists from some of the international teams working in the Emirates to participate at the end of their field seasons.

6.3.7 Identify executive authority for increasing efficiency of existing co-ordination/collaboration efforts

The newly-established Abu Dhabi Authority for Culture and Heritage (ADACH) is expected to play a leading role in increasing efficiency in the management of archaeological and palaeontological resources in Abu Dhabi emirate. This new authority will help avoid duplication of effort and resources.

6.3.8 Improve training and qualifications

Archaeology is only currently taught at one university in the United Arab Emirates, the Emirates University in Al Ain. The scope of the existing archaeology degree course taught there should be widened to provide practical archaeological training for UAE nationals. This should involve such elements as instruction in surveying, excavation, mapping, use of GIS, documentation, as well as laboratory-based analytical studies. Ideally the students would have to undertake a placement during their degree course to gain practical work experience.

The University of the Sorbonne (Paris) has announced plans to establish a branch in Abu Dhabi in the 2006-2007 academic year. Undergraduate courses to be taught there will include archaeology. It is not yet clear if post-graduate opportunities will be provided.

Few UAE nationals have post-graduate training in archaeology or palaeontology. There is a need for scholarships to provide opportunities for UAE nationals to go abroad for post-graduate training, appropriate Masters Degree courses and PhD studies. Hopefully in the future there will be opportunities to undertake post-graduate studies in archaeology or palaeontology within the United Arab Emirates.
Acknowledgements

The two main authors (MB and PH) would like to thank the contributing authors for their input towards this report. Thanks go to the AGEDI team, including the consultants from the Redlands Institute, who assisted with the running of the Palaeontology and Archaeology AGEDI Sector Paper workshop. They also provided support and assistance during the process of preparing the report.

Dr Andrew Petersen, formerly of the Department of History and Archaeology, UAE University in Al Ain and Dr Hassan Naboodah of the Zayed Centre for Heritage and History and Department of History and Archaeology, UAE University, kindly provided useful feedback and comments on the report.

As we were completing the writing of this report the Abu Dhabi Authority for Culture and Heritage (ADACH) was established. This new organisation will now be the sole body responsible for the management of the palaeontology and archaeological resources of Abu Dhabi emirate. Many of the points addressed in this report will undoubtedly be tackled by ADACH in the near future.

Copyright © 2007 Environment Agency-Abu Dhabi
All Rights Reserved No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, or otherwise, without permission in writing from the publisher. Electrostatic, magnetic tape, mechanical, photocopying, recording, scanning or otherwise, without permission in writing from the publisher.

Photography Copyright © 2007 Environment Agency-Abu Dhabi, unless otherwise stated.

Produced by:
Abu Dhabi Islands Archaeological Survey (ADIAS),
P.O. Box 45553, Abu Dhabi.
Tel: (02) 4044288
Fax: (02) 4450458

For the:
Environment Agency-Abu Dhabi
P.O. Box: 45553, Abu Dhabi, UAE
Tel: +971-2-681 7171
Fax: +971-2-681 0008
Website: www.ead.ae
List of Authors and Contributors

The following people contributed towards the writing of the AGEDI Sector Paper for Palaeontological and Archaeological Resources in Abu Dhabi emirate:

<table>
<thead>
<tr>
<th>Sectors' Contributors</th>
<th>Name of Contributor</th>
<th>Organization</th>
<th>Areas of Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Palaeontology and Archaeology</strong></td>
<td>Dr Mark Beech * (Head of Division - Cultural Landscapes, ADACH)</td>
<td>Abu Dhabi Authority for Culture and Heritage (ADACH), P.O. Box 2380, Abu Dhabi. Tel: (02) 6215300 Fax: (02) 6212186 Mobile: (050) 7527407 Email: <a href="mailto:mark.beech@cultural.org.ae">mark.beech@cultural.org.ae</a></td>
<td>Main author: Archaeology/Palaeontology of Abu Dhabi</td>
</tr>
<tr>
<td></td>
<td>Peter Hellyer (ADIAS Executive Director)</td>
<td>Abu Dhabi Islands Archaeological Survey (ADIAS), P.O. Box 45553, Abu Dhabi. Tel: (02) 4044288 Fax: (02) 4439458 Mobile: (050) 6424357 Email: <a href="mailto:peter@extinfo.gov.ae">peter@extinfo.gov.ae</a> <a href="mailto:hellyer@emirates.net.ae">hellyer@emirates.net.ae</a></td>
<td>Main author: Archaeology/Palaeontology of Abu Dhabi</td>
</tr>
<tr>
<td></td>
<td>Dr. Drew Gardner (Chairman, Abu Dhabi branch of the Emirates Natural History Group)</td>
<td>Department of Natural and Quantitative Sciences, Zayed University, P.O. Box 4783, Abu Dhabi. Tel: (02) 4079799 Fax: (02) 4434847 Mobile: (050) 667830 Email: <a href="mailto:drew.gardner@zu.ac.ae">drew.gardner@zu.ac.ae</a> and <a href="mailto:asgardner@hotmail.co.uk">asgardner@hotmail.co.uk</a></td>
<td>Archaeology/Palaeontology of Abu Dhabi emirate, Role of NGO/volunteer organisations in archaeology and palaeontology in Abu Dhabi emirate</td>
</tr>
<tr>
<td></td>
<td>Brien Holmes (Chairman, Al Ain branch of the Emirates Natural History Group)</td>
<td>Chairman, Al Ain branch of the Emirates Natural History Group, Al Ain. Tel: (03) 781-0489 Mobile: (050) 5330579 Email: <a href="mailto:bockhobby@yahoo.com">bockhobby@yahoo.com</a></td>
<td>Archaeology/Palaeontology of Al Ain region, Role of NGO/volunteer organisations in archaeology and palaeontology in Abu Dhabi emirate</td>
</tr>
<tr>
<td></td>
<td>Dr. Walid Yasin Al Tikriti (Head of Division-Archaeology ADACH)</td>
<td>Abu Dhabi Authority for Culture and Heritage (ADACH), Al Ain Museum, P.O Box 15715, Al Ain. Tel: (03) 7641595 Fax: (03) 7658311 Mobile: (050) 4492108 Email: <a href="mailto:wyasin11@yahoo.com">wyasin11@yahoo.com</a></td>
<td>Umm an-Nar, Bronze age and Iron age periods, Archaeology of Falaj, Archaeology of Al Ain region</td>
</tr>
<tr>
<td></td>
<td>Dr. Andrew Petersen ** (Lecturer in Archaeology)</td>
<td>Department of Archaeology &amp; Anthropology, University of Wales, Lampeter, Ceredigion, Wales SA48 7ED, UK Email: <a href="mailto:apetersen@lamp.ac.uk">apetersen@lamp.ac.uk</a></td>
<td>Reviewed the report and provided feedback</td>
</tr>
<tr>
<td></td>
<td>Dr. Hassan M. Al-Naboodah (Director, Zayed Centre for Heritage and History)</td>
<td>Zayed Centre for Heritage and History, P.O. Box 23888, Al Ain, United Arab Emirates Tel (office): +971 (03) 7615166 Mobile: (050) 6422492 Fax : (03) 7615177. Email: <a href="mailto:naboodah@uau.ae">naboodah@uau.ae</a></td>
<td>Reviewed the report and provided feedback</td>
</tr>
</tbody>
</table>

** formerly Assistant Professor - Archaeology, Department of History & Archaeology, College of Humanities & Social Sciences, P.O. Box 17771, UAE University, Al Ain.
Archaeology

The Abu Dhabi Islands Archaeological Survey (ADIAS) maintains an online archive of all its projects at: http://www.adias-uae.com/archaeology.html

and all its publications at: http://www.adias-uae.com/publications.html

The Abu Dhabi Islands Archaeological Survey (ADIAS) maintains a Site Summary Database of palaeontological and archaeological sites in the Western Region of Abu Dhabi emirate. This is currently housed on the server of the Environment Agency - Abu Dhabi (EAD). In 2000 ADIAS signed a partnership agreement with EAD to collaborate on an archaeological database and related data. This database is in Microsoft SQL server format. Site location co-ordinates and details can be extracted from the database and incorporated into GIS-based mapping systems. This system will shortly be incorporated into the new Abu Dhabi Authority for Culture and Heritage (ADACH) database system, which plans to expand the dataset to include the whole of Abu Dhabi emirate.

The Department of Antiquities and Tourism has a website which provides information about the Al Ain Museum, excavations carried out by the Department and other projects. It can be accessed at:
http://www.aam.gov.ae/index_a.html (Arabic)
http://www.aam.gov.ae/ (English)

Information about the Abu Dhabi chapter of the Emirates Natural History Group is available at:
http://groups.yahoo.com/group/ADNHS/

Information about the Al Ain chapter of the Emirates Natural History Group is available at:
http://www.enh.org. This includes links to previous Bulletin articles on archaeology at:
http://www.enh.org/bulletin/arch.htm, as well as information about archaeological sites in the field visit and photo gallery sections of the website.

The Zayed Center for Heritage and History has a website at:
http://www.zayedcenter.org.ac/

The Centre for Documentation and Research in Abu Dhabi has a website at:
http://www.cdr.gov.ac/

The Cultural Foundation/Abu Dhabi Authority for Culture and Heritage (ADACH) has a website at:
http://www.cultural.org.ac/ (Arabic)
http://www.cultural.org.ac/e/ (English)
List of figures

FIGURE 1 Satellite image of the United Arab Emirates.
FIGURE 2 Geology of the United Arab Emirates.
FIGURE 3 Proboscidean footprints at the fossil trackway site at Mleisa (Photograph: ADIAS).
FIGURE 4 The 2.54 metre long tusk of *Stegotetrabelodon syrticus* found at Ruwais. This primitive elephant species had four tusks, two long upper tusks and two short parallel lower ones (Photograph: Dr Mark Beech).
FIGURE 6 Map showing the location of major Late Miocene fossil sites in the Western Region of Abu Dhabi (After: Whybrow and Hill 1999).
FIGURE 7 Selection of flint arrowheads from site MR1, Marawah (Photograph: Dr Mark Beech).
FIGURE 8 Site MR11, Marawah. Top left: View of one of the 7500 year old structures. Top right: male adult skeleton, the earliest known inhabitant of the UAE. Bottom left: almost complete Ubaid jar discovered in the 2004 excavations. Bottom right: pearl oyster buttons found during the 2004 excavations (Photographs: Dr Mark Beech).
FIGURE 9 Ubaid potsherds from site DA11, Dalma island (Photograph: ADIAS).
FIGURE 10 Flint artefacts from Umm az-Zamul (Photograph: Dr Mark Beech).
FIGURE 11 Jemdet Nasr pottery vessel found in a Hafit tomb, c. 3000 BC (Photograph: Dr Walid Yasin Al-Tikriti/Al Ain Museum).
FIGURE 12 Reconstructed Hafit tombs at Mezyad, Jebel Hafit (Photograph: Dr Mark Beech).
FIGURE 13 Left: Restored tomb on Umm al-Nar island (Photograph: Peter Hellyer). Right: View of the settlement area on Umm al-Nar island, taken during the Danish excavations (Photograph: Al Ain Museum).
FIGURE 14 Hili 8, the Bronze Age settlement in the city of Al Ain. Note the round tower and the well in the centre. (Photograph: French Archaeological Mission/Al Ain Museum).
FIGURE 15 View of the Great Tomb at Hili Archaeological Park (Photograph: Dr Mark Beech).
FIGURE 16 Excavation of the human skeletal remains in Tomb N (Photograph: Al Ain Museum).
FIGURE 17 Bida Bint Saud, a rocky outcrop about 25km north of Al Ain. Cemeteries from both the Iron Age and Early Bronze Age were found here (Photograph: Dr Mark Beech).
FIGURE 18  Aerial view of the Iron Age settlement at Rumeilah, Al Ain  
(Photograph: Dr Walid Yasin Al-Tikriti/Al Ain Museum).

FIGURE 19  The Nestorian church on Sir Bani Yas island. Top left: eastern wing of monastery. 
Bottom left: the church. Top + bottom right: decorated plaster panels. 
(Photographs: Dr Mark Beech).

FIGURE 20  The sulphur mines at Jebel Dhanna (Photograph: ADIAS).

FIGURE 21  The Proceedings of the First International Conference on the Archaeology of the United Arab Emirates were published in Arabic and English, as well as in the form of a DVD 
(Photograph: Trident Press).

FIGURE 22  Logo of the Emirates Natural History Group - Abu Dhabi.

FIGURE 23  Sign for the Marawah Marine Protected Area (Photograph: Dr Mark Beech).

FIGURE 24  ADCO warning sign for the Protected Area around site RM-7, a Late Miocene vertebrate fossil locality at Rumaitha (Photograph: Dr Mark Beech).
References


*Abu Dhabi Islands Archaeological Survey (ADIAS)* website: [http://www.adias-uae.com](http://www.adias-uae.com)


APPENDICES

Appendix 1 - Glossary of terms and abbreviations

Abbasid - period dating between 750 to 1100 AD.

Butchery site - collection of bones dispersed on the surface (often dugong, turtle, etc.). Some may show signs of cut marks.

Cairn - agglomeration of stones possibly concealing a burial chamber.

Camp Site - traces of an old camp/encampment. May have stones organised on ground surface where 'arish or tents previously stood. This category may comprise two or more of the following attributes: "Hearth", "Lithic Scatter" "Midden", "Pottery Scatter", "Shell Scatter".

Cistern - stone or plaster construction for collection of water.

Cleared Area - area where the surface stones and sediment have been deliberately cleared. This may in some cases be connected with "Water catchment" system.

Cretaceous - period dating between 144 to 66.4 mya.

Early, Middle, and Late Islamic - period dating between 750 AD to the 19th century.

Eocene - period dating between 56 to 34 mya.

Falaj - underground water canal system.

Field Terrace - field built on a man-made terrace, usually found in the mountains.

Fish trap - stone-built fish trap located in intertidal zone.

Fossil/Palaeontological - these sites may vary from agglomerations of Miocene, Plio-Pleistocene fossil bones, to traces of ancient footprints.

Hafit - period dating between 3200 to 2600 BC.

Hearth - cooking/processing area denoted by the presence of one or more of the following attributes: square, rectangular or sub-rectangular, or circular stone alignments, ash, charcoal, burnt shell/bone, etc.

Hellenistic/Parthian - period dating between 300 BC to AD 230.

Holocene - period dating between 9600 BC to present.

Human Burial - human skeletal burial, sometimes located within a "Cairn" or perhaps indicated by the presence of a gravestone.

Iron Age - period dating between 1250 to 300 BC.

Jemdat Nasr - period dating between the Late 4th to Early 3rd millennium BC.
Jetty - stone-built jetty located in intertidal zone/shallow waters.

Julfar - period dating between AD 14th to 17th centuries.

Late Bronze Age - period dating between 1600 to 1250 BC.

Late Islamic - period dating between 1600 to 1900 AD.

Late Pre-Islamic - period dating between 300 BC to 300 AD.

Late Stone Age / Ubaid - period dating between 5700 to 3800 BC.

Lithic Scatter - scatter of stone tools or waste stone flakes resulting from human modification.

Midden - a mound of humanly derived occupation debris, usually consisting largely of interwoven layers of ashy sand containing shell and bone.

Mid Islamic - period dating between 1100 to 1600 AD.

Mine - mineshafts, i.e. holes cut as shafts to allow access for mineral exploitation.

Miocene - period dating between 23 to 5.3 mya.

Modern - period dating between AD 1900 to the pre-oil era.

Mosque - mosques are usually identified by the presence of a mihrab and/or walls in an appropriate alignment/orientation.

Mound - a man-made mound which may obscure a "Burial" or "Cairn", or may represent concealed "Settlement" traces.

Natural - this category is assigned to sites which were previously believed to be palaeontological or archaeological sites but are now known, after further investigation, to be simply a natural phenomenon.

Oligocene - period dating between 56 to 34 mya.

Ostrich eggshell scatter - scatter of Miocene or Holocene ostrich eggshell.

Pliocene - period dating between 1.8 mya to 9600 BC.

Pleistocene - period dating between 1.8 million years to present.

Pliocene / Holocene - period dating between 1.8 million years to present.

Pottery scatter - scatter of pottery sherds on the ground surface.

Pre-Islamic - period dating between 300 BC to 600 AD.

Recent Islamic - period dating between 19th to 20th century.
Rock depression - shallow depressions cut into rock surfaces.
Sasanian - period dating between 300 to 632 AD.
Settlement - a larger site usually comprising two or more of the following attributes: "Hearth", "Midden", "Mounds", "Pottery Scatter", "Structure", and "Wall".
Shell scatter - scatter of shells on the ground surface. If the scatter is of a considerable size and density then it may be referred to as a Midden.
Structure - traces of stone walls forming part of a building.
Umm an Nar or Umm al-Nar - period dating between 2600 to 2000 BC.
Umayyad - period dating between 600 to 750 AD.
Wadi Suq - period dating between 2000 to 1600 BC.
Wall - remains of a wall, usually stone (but can also be from mudbrick or simply traces of a ditch cut for an 'arish type of structure).
Water catchment - small walls of either stone or sediment forming part of a damming system designed to retain water.
Well - Wells vary from simple holes in the ground to more complex shafts lined with stones.
Appendix 2 - Relevant Websites and Metadata

Palaeontology

Information about geology and fossils in Abu Dhabi emirate and the U.A.E. can be found online on the UAEinteract website at: http://uaeinteract.com/nature/geology/index.asp

Details concerning "Miocene Vertebrates from the Emirate of Abu Dhabi, United Arab Emirates: The Natural History Museum - Yale University Abu Dhabi Miocene Project" by Peter J. Whybrow and Andrew Hill, a project carried out in collaboration with the Abu Dhabi Company for Onshore Oil Operations (ADCO), the UAE Ministry for Higher Education and Scientific Research and the Natural History Museum, London, U.K. between 1999-2002 can be found online at: http://www.adias-uae.com/fossils/index.html

The more recent palaeontological work carried out by the Abu Dhabi Islands Archaeological Survey (ADIAS) can be found online at the following sites:

Ruwais - a new Late Miocene fossil site
http://www.adias-uae.com/ruwais.html

Mleisa - fossil Proboscidean trackways dating to the Late Miocene
http://www.adias-uae.com/mleisa.html

Details of the exhibition "Abu Dhabi 8 million years ago - Fossils from the Western Region"
http://www.adias-uae.com/fossils.html