File Name: 1186.pdf **UNESCO Region:**

SITE NAME: **Wadi Al-Hitan (Whale Valley)**

DATE OF INSCRIPTION: 15th July 2005

STATE PARTY: EGYPT

CRITERIA: N (i)

DECISION OF THE WORLD HERITAGE COMMITTEE:
Excerpt from the Decisions of the 29th Session of the World Heritage Committee

Criterion (i): Wadi Al-Hitan is the most important site in the world to demonstrate one of the iconic changes that make up the record of life on Earth: the evolution of the whales. It portrays vividly their form and mode of life during their transition from land animals to a marine existence. It exceeds the values of other comparable sites in terms of the number, concentration and quality of its fossils, and their accessibility and setting in an attractive and protected landscape. It accords with key principles of the IUCN study on fossil World Heritage Sites, and represents significant values that are currently absent from the World Heritage List.

BRIEF DESCRIPTIONS

Wadi Al-Hitan, Whale Valley, in the Western Desert of Egypt, contains invaluable fossil remains of the earliest, and now extinct, suborder of whales, the archaeoceti. These fossils represent one of the major stories of evolution: the emergence of the whale as an ocean-going mammal from a previous life as a land-based animal. This is the most important site in the world for the demonstration of this stage of evolution. It portrays vividly the form and life of these whales during their transition. The number, concentration and quality of such fossils here is unique, as is their accessibility and setting in an attractive and protected landscape. The fossils of Al-Hitan show the youngest archaeocetes, in the last stages of losing their hind limbs. They already display the typical streamlined body form of modern whales, whilst retaining certain primitive aspects of skull and tooth structure. Other fossil material in the site makes it possible to reconstruct the surrounding environmental and ecological conditions of the time.

1.b State, Province or Region: Faiyum Governorate

1.d Exact location: N30 11 00.0 E29 20 00.0

Arab Republic of EGYPT
Ministry of Higher Education
Egyptian National UNESCO Commission
Egyptian National MAB Committee

NOMINATION FILE

For the Inscription of

WADI AL-HITAN

(WHALE VALLEY),

THE WESTERN DESERT

OF EGYPT

On the Natural World Heritage List

Cairo, Jan. 2004

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1. Identification of Property

a. Country **Arab Republic of EGYPT**

b. State, Province or Region
The Western Desert of Egypt, Faiyum Governorate

c. Name of Property **WADI AL-HITAN (WHALE VALLEY)**

d. Exact location on map and indication of geographical coordinates to the nearest second

Note on the Geographic situation of Whale Valley (Egypt)
The proposed site is defined in the Nomination File by four sets of coordinates, labelled Points 1-4.

Point	Long. E ° ' "	Lat. N ° ' "
1	30 11 00	29 20 00
2	30 11 00	29 13 00
3	30 01 00	29 13 00
4	30 01 00	29 20 00

e. Maps and/or plans showing boundary of area proposed for inscription and of any buffer zone

Fig. 1 – Map produced of satellite image of Wadi Al-Hitan (Whale Valley), Wadi El-Rayan Protected Area, Faiyum Governorate, proposed World Heritage Site showing approved boundaries of core area (red rectangle) and buffer zone (yellow rectangle). The boundaries of the Wadi Al-Rayan Protected Area (WRPA) are shown by a green line. Original scale 1:100,000, annexed to Nomination File. Scale of A4 reduction: ~ 1:579,000. Map prepared by EGSMA (Egyptian Geological Survey and Minerals Authority).

2 – Egyptian Survey, Geographical Map Section. Topographic map. Qaret Gahannam, sheet 72/48, 1945. Scale 1:100,000, annexed to Nomination File.

Fig. 3a –Satellite image: Whale Valley within a 15x15 km area in WRPA. Scale; 1:600,000, showing some of the threatened sites and a 15x15 km area where whale fossils are concentrated (courtesy of Mr. J. Dolson). This area *is not* the proposed area for the World Heritage Site.

Fig. 3b – Enlarged part of previous map, scale 1:120,000, showing the well developed desert road from park entrance past Gebel Gahannam, position of some whale skeletons, and approximate location of whale and sirenian (sea cows) skeletons (courtesy Mr. J. Dolson).

Fig. 4 – Location map of Wadi Al-Hitan in relation to Cairo (courtesy Mr. J. Dolson).

Fig. 5 – Map of WRPA. The fossil whale area shown is approximately 35 km west of the entrance to the park, but the road winds for about 45 km (courtesy Egyptian-Italian Environmental Programme, EIEP).

Fig. 6 – Map of 38 whale skeletons and location of heavily mangrove rooted ancient shoreline within the core area. Numbers for location are eastings and northings in meters (after Dolson *et al*. 2002).

f. Areas (ha) and perimeters (km) of property proposed for inscription and proposed buffer zone

Core Area: 200.15 km^2 (20,015 ha)
Buffer Zone: 58.85 km^2 (5,885 ha)

2. Justification for Inscription

Note 1:

This Nomination File for the inscription of Egypt's Wadi Al-Hitan (Whale Valley) on the Natural World Heritage List is to be considered as an Egyptian initiative to implement the Decisions of the 25th Session of the World Heritage Committee, Helsinki, Finland, December 2001, Concerning Desert Landscapes (see p. 61), the Recommendations of the World Heritage meeting on desert landscapes, in Kharga Oasis, Egypt, of 2001 and the UNESCO Ghardaia meeting in Algeria of 19-21 April 2003, on the role of desert landscapes in promoting ecotourism and the alleviation of poverty.

Note 2:

Very recently, Egypt announced that the official name of Fayoum should be spelt as "Faiyum" and Wadi el-Rayyan as "Wadi El-Rayan". We nevertheless follow in this text the spelling "Fayoum", for purposes of concordance with older literature, but retain the use of the spelling "Rayan". Moreover, the Arabic words Gabal, Gebel, Jabal, and Jebel (= mountain) are used according to how they are written on maps.

Note 3:

The naming of Wadi Al-Hitan passed through three phases. It was first named Zeuglodon Valley by its discoverer Beadnell (1905), after the whale genus *Zeuglodon* was found there. Because *Zeuglodon* was later renamed *Basilosaurus*, the name Zeuglodon Valley had to be abandoned, but it is still used in some non-scientific writings, just as nostalgia. When Philip Gingerich came in the late 1980's he called it Whale Valley. A few years later the Arabic translation of that name, Wadi Al-Hitan, was officially adopted by the Egyptian Government as well as by foreign researcher workers.

a. Statement of significance

The main area of significance in accordance with the principles of the World Heritage Convention, for the inscription of Egypt's Whale Valley is that the fossil species give us a lot of useful information about how the environments of these sites looked like millions of years ago, and hence give us an indication of an important part of the history of the earth, the Age of Whales, and how life evolved on Earth, following water courses of ancient rivers, and wetlands of the ancient coastlines. With more intensive studies, if the sites are protected, we can perhaps find answers to the riddle of how mammals went into the sea.

Continuity is important for tracing evolutionary lineages through geological time. Modern Odontoceti and Mysticeti can be traced backward in time to Eocene Archaeoceti, and before them to mesonychian Condylarthra. Within this shared continuum, the origin of Archaeoceti and the origin of Cetacea is marked by the first indication of a derived evolutionary transition-in-grade from terrestrial to aquatic life characteristic of later cetaceans. Archaeocetes are known from many fossil localities in Eocene marginal marine and shallow marine strata on six continents. These range in age from Priabonian (late Eocene; ca. 36 Ma) through late Ypresian (late early Eocene; ca. 49.5 Ma), a 13.5 my. time range, and they are widely distributed in North America (18 sites), Europe (5 sites), Asia (8 sites), Africa (8 sites), Australia (New Zealand; 2 sites), and Antarctica (1 site). Forty-two sites can be considered statistically-independent records.

The large number of whales of various species at Wadi Al-Hitan does not only reveal stages in their anatomical evolution, but also indicates that they had already become masters of the seas and had developed their habits and their social behaviour and had explored the world's oceans so well as to where were the best calving grounds, and what was the best season to migrate there, followed by their whale predators. It must have been a ritual that had lasted for several million years.

b. Possible comparative analysis (including state of conservation of similar sites)
It is not possible of course to give a comprehensive comparison of the Wadi Al-Hitan Site with all other fossil sites in the world, so only glimpses of the most important will be treated here.

b.1 – Comparison inbetween Egyptian Sites
The other site in Egypt giving a similar multi-epoch sequence is Gebel Qatrani (Bown *et al.* 1982). A Nomination File for its inscription on the World Heritage List in Danger is to be submitted shortly. It will be submitted separately for inscription on the World Heritage List in Danger because it is exposed to more serious threats than the four Oases under discussion, and for another obvious reason, that it is not an oasis, and hence cannot be included in the Northern Oases Serial Nomination.

b. 2 - The comparative formation of Egypt's Whale Valley:
Sampsell (2003) gave a concise history of the formation of Egypt's Whale Valley. A new hypothesis that answers questions about both timing and mechanism has been proposed on the basis of data obtained by space satellites. Radar has detected the remains of all drainage channels (the so-called Radar Rivers) that are now buried by sand sediments to such an extent that they are invisible to observers on the ground. Using this knowledge, Issawy and McCauley (1992) proposed that the Depressions were formed in conjunction with two ancient drainage systems that operated during the Tertiary Period over a period from 40 to 6 million years ago. These drainage systems not only formed the Depressions, they also removed hundreds of meters of the rock layers that formerly covered huge areas of the southern Western Desert.

It is recalled that Egypt was submerged by the Tethys Sea intermittently throughout the Palaeozoic, Mesozoic, and Early Tertiary Periods. During phases of submergence, many layers of sedimentary rocks were formed one atop another; from oldest to youngest these layers included the Nubia sandstone, the Cretaceous limestones and shales, and the Eocene limestones. The land of Egypt was eventually lifted above sea level, but the rise was gradual, so that the north part of the country remained submerged and continued to accumulate sediments longer than the southern part. The uplift began in the southwestern corner of Egypt – the site of Gebel Uweinat and the Gilf Kebir Plateau – tilting the rock layers toward the north and producing cracks and joints in the surface rocks.

By the beginning of the Oligocene Epoch, or about 37 million years ago, the sea had receded northward to the latitude of Siwa and Fayoum, exposing a vast plateau of limestone over the southern part of the country. A humid climate produced intense precipitation and rapid weathering of the exposed rocks. Rainwater also seeped into the jointed limestone, forming underground channels and caverns. Runoff from the highlands of the Uweinat/Gilf area flowed north along the down-dipping strata. This gave rise to a river system that Issawy and McCauley called the Gilf River, which reached the receding Tethys Sea near Siwa (Figs. 7-10).

The remains of the earlier river system of the Gilf River, has almost been obliterated: its channel was filled with sediment deposited by ephemeral streams during the Pliocene and Pleistocene Epochs' Pluvials and with wind-blown sand. The presence of the Radar Rivers has been confirmed by investigation on the ground.

Wadi Al-Hitan (Whale Valley) is unusual in having such a large concentration of fossil whales (406 fossil skeletons) in a relatively small area. They are accompanied by sirenian fossil skeletons as well. This concentration may be due to excellent exposure of fossil-bearing strata, and it is possible that other whale fossils lie under those exposed. It is not exactly known whether these whales died here during a storm or they died annually after giving birth to young. Or was it mass suicide?

The whales lie at different stratigraphic levels. In Fig. 6 (from Dolson *et al.* 2002) is clearly shown the estuarine nature of the area. It is certain that these were popular calving grounds in shallow estuaries south of the deep water Mediterranean sea. Modern whales seek out estuaries like the Baha bay in Mexico for calving, due to abundant food and sheltered waters. There will be tens of thousands of skeletons back in those cliffs and the ones found are only the surface exposures. The remains represent millions of years of occupation of the estuaries. That is why there are so many skeletons!

b. 3 – Comparison with similar sites outside Egypt

b.3.a –Comparison with sites <u>inscribed</u> on the World Heritage List

i – Monte San Giorgio, Switzerland
This is the most recent fossil site inscribed on the World Heritage List (World Heritage Center 2003). It is described as a Mid-Triassic succession resting uncomformably on older Permian volcanic rocks and overlain by Upper Triassic and Lower Jurassic rocks. It records life in a tropical lagoon environment, sheltered and partially separated from the open sea by an offshore reef. This is an environment similar to those of the Egyptian Oases at the time of deposition of the fossil animals found in. Comparison of the Monte San Giorgio fossil site in Switzerland with the Egyptian Whale Valley can give us a useful comparative analysis of the different successive stages in the history of the Tethys Sea and the evolution of the marine and estuarine biota, in its northern shores (MSG) and southern African shores at Wadi Al-Hitan (Whale Valley).

ii – Messel Pit Fossil Site, Germany
It is an ancient lake bed lying on deposits of 270 to 290 million years old, spanning the Cenozoic Era, the Tertiary Epoch, and the Eocene Period, above Old Red sandstone. The Eocene Lake Messel appears to have had a tropical to subtropical climate. Fossils include crocodiles, marsupials, pangolins, anteaters, hedgehogs, early horses, odd-toed ungulates, bats, and a rodent. It therefore no similarity to Wadi Al-Hitan, as its fauna is mostly terrestrial.

iii – Grand Canyon National Park, USA
Exposed horizontal geological strata in the Canyon span some 2,000 million years of geological history, providing evidence of the 4 major geological Eras, from the Late Precambrian to the Cenozoic. The first fossil evidence appears in the Late Precambrian Limestone with remains of early plant forms. Subsequent strata dating

from the Palaeozoic Era catalogue the sequence of local history, with both marine and terrestrial fossils demonstrating the periods in the distant past when the whole region was alternately submerged and raised. Here are however few fossil remains of Mesozoic reptiles (in the nearby Navajo Indian reservation) or mammals from the Cenozoic. The Canyon is 447 km long. Despite its great size, the Grand Canyon is poor in reptilian and mammalian faunas, and especially has no whales.

b.3.b. Comparison with sites <u>not inscribed</u> on the World Heritage List.

i – Gebel Qatrani, Fayoum, Egypt

Gebel Qatrani is rich in fossils that include some whales, but their numbers and species are much limited. It is more important, however, for a super-rich assemblage of fossils of 27 other mammalian Orders.

ii -*.Basilosaurus* fossils in Alabama.

http://www.archives.state.al.us/emblems/st_fosil.html

There are several fossil sites in North America. Notable among them is the *Basilosaurus* site in Alabama. In 1834 a skeleton of a basilosaur (king of the lizards) was found on a plantation in southwestern Alabama. Staff of the Philadelphia Academy of Natural Sciences studied the skeleton and said it was not a lizard, but a carnivore whale. Because of this they renamed it *Zeuglodon* (Genus *Basilosaurus*). They estimated it to be over forty-five million years old (Eocene period). Zeuglodons averaged from fifty-five to seventy feet long and had tails up to forty feet long. Fossil remains of this gigantic whale were first found in Clarke County in about 1833; bones were later discovered in Choctaw and Washington Counties. Fossil remains of the *Basilosaurus cetoides* may not be removed from the state without prior written approval of the Governor. The ancient whale fossil is most abundant in Alabama and many *Zeuglodon* skeletons have been found here. One was found in 1982 near Washington County and is now displayed at the McWane Center in Birmingham. Another was found in Alabama and sent to the Smithsonian Institution in Washington, DC. These are the two most comprehensive *Basilosaurus cetoides* skeletons ever found. In 1984 the legislature made the zeuglodon the state fossil by Act no. 84-66. It can be seen that the *Basilosaurus* fossils of Alabama are sparse and scattered, no way to compare with the 406 skeletons all in one place, of different species, and telling many stories, as those of Wadi Al-Hitan.

c. Authenticity/Integrity

The Wadi Al-Hitan (Whale Valley), lies within the Wadi El-Rayan Nature Protectorate declared by Prime Minister's Decree number 2954/1997, and is managed under the regulations of Law 102/1983, on Nature Protectorates (Nature Reserves). The Nature Conservation Sector (NCS) of the Egyptian Environmental Affairs Agency (EEAA), is responsible for the management, protection and conservation of the entire site.

Wadi El-Rayan until 1970 was a dry depression not raising any interest except for a few Coptic hermits in the early centuries of Christianity in Egypt. It was abandoned for a long time until some other hermits came to settle in one of the caves of the area in the mid 20th century. Geologists were interested in it since the early 20th century to study it as part of the general survey of Egypt. This revival attracted some ecologists to study the area. Irrigation engineers were interested in it as a potential area in which to either use the Depression as a reservoir, similar to what had been the case for Lake

Qaroun in Ancient Egyptian times, or alternatively as an outlet for the agricultural drainage water of Fayoum. The second option prevailed and finally a canal was dug in the early 1970's to connect it to the Fayoum agricultural lands to drain one third of the drainage water of Fayoum into the Wadi El-Rayan Depression. Thus the Wadi El-Rayan Lakes came into existence as a man-made wetland. In the 1980's, a group of Egyptian scientists started studying the ecology of this new brackish man-made lake, and pointed out its importance as an exceptional feature of desert ecology, so that it was finally declared a Nature Reserve in 1997. Since then it became a very popular picnicking attraction for Cairenes, aided by TV shows, especially on the weekend Fridays. Very few of these visitors venture into Wadi Al-Hitan area. A visitor center has been established however in Wadi El-Rayan just on the shores of the Lake, in order to sensitize these visitors to the unique wealth of their country.

On the other hand, Gingerich (*cf*. Gingerich and Uhen 1996) came also in the 1980's to study the fossil whales nearby. His discoveries attracted more geologists and hence they advised the EEAA to annex the Whale Valley to the Wadi El-Rayan Protected Area in order to ensure its protection, which was done in good time. Nevertheless, this spot also became an important tourist attraction, but for those who can come to it with 4-wheel drive cars. These are either foreign visitors, or well-to-do Egyptians. In spite of this limitation, the number of visitors is nevertheless too high for such an extremely fragile area, where the fossil skeletons are exposed on the surface of the ground and the fossil mangrove remains crumble at the mere touch of fingers.

The Buffer Zone

Wadi Al-Hitan (Whale Valley), proposed as a Natural Heritage Site with boundaries shown as a red line on the map (Fig. 1), is surrounded by an effective buffer zone (boundaries shown as a yellow line on the map), that is the distance between the inner boundaries of the proposed World Heritage Site. The outer boundaries of the Nature Reserve are shown by a green line.

Figures 2-6 give more clarification of the features of Wadi Al-Hitan and show its geographic relations to adjacent areas.

The rules of the Management Plan apply to the entire area, but there are more restrictive rules for the proposed Wadi Al-Hitan World Heritage Site, such as restriction of visits except by prior permission and in the company of a Park Ranger, in a Park 4x4 vehicle, and along a prescribed trail (shown in Fig. 3).

d. Criteria under which inscription is proposed (and justification for inscription under these criteria)

Criterion N(1)

To apply Criterion N(1), the sites must "Be outstanding examples representing major stages of the earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features".

The Whale Valley site corroborates a Nomination on the World Heritage List by the application of. **criterion N(1)** as it:

- Represents a major stage of the evolution of whales, a major phenomenon in the history of mammalian evolution from land to sea, matched nowhere else in

the world, showing the stage by stage trophy of hind limbs, as well as their change of function from walking to mating.

- With at least 4 species discovered so far and there are certainly possibilities for more species to be discovered. We have: *Basilosaurus isis, Dorudon atrox*, known earlier as *Zeuglodon isis, Prozeuglodon atrox*, and an. additional whale recently described from Wadi Hitan is *Ancalecetus simonsi* (Gingerich and Uhen, 1996, Abed and Attia, 2001, El-Bedewey and Dahroug, 2001). Wadi Al-Hitan is unusual in having such a large concentration of fossil whales in a relatively small area. These are some more details about these species:

1 - *Basilosaurus isis* (Beadnell): formerly *Zeuglodon isis*; it was found and named by Beadnell then published in Andrews, 1904 (p.214).
2 - *Prozeuglodon atrox* Andrews: This species was named by Andrews, based on a type skull and a lower jaw collected by Beadnell.
3 - *Dorudon osiris* (Dames), formerly *Zeuglodon osiris*, is the largest species of *Dorudon* in Egypt.
4 - *Ancalecetus simonsi* Gingerich,1996.

- The site has the largest number of fossil Eocene whales anywhere in the world (exceptionally high diversity both in number of species and in number of individuals).
- Besides whales, the site has fossil sirenians and other vertebrate fossils, as well as fossil mangrove and apparently palm trees, showing the biotic assemblage of Eocene times.
- The Whale Valley also exhibits significant ancient geomorphic and physiographic features (Figs. 4, 11 and 12), indicative of past geographical, geological and ecological features, *e.g.*, estuarine habitats and coastal lagoons.

The fossil whale site represents a major stage in the evolution of life on earth as well as depicting the palaeogeography and palaeogeomorphology of the southern shorelines of the ancient Tethys Sea and its estuaries and coastal lagoonal lakes. The fossil animals (sirenians) and plants (mangrove) associated with the 406 whale skeletons indicate the climate and vegetation at the time the whales stranded on the shore. Research on the site for identification of microfossils can reveal still more accurate data about palaeoclimate. This large number of skeletons also indicates the communal habits and behaviour of whales at their early stages of evolution. It appears that the estuary was a meeting point for female whales to give birth to their young, because a large number of the skeletons is of baby whales. The site may have been an ideal choice for annual whale migration and birthing.

This is not a mass burial site from one point in geological time. Some of the local skeletons in pairs of 3-6 may represent this, but the site is that of an estuary with repeated annual calvings. Mass extinctions don't make sense when the details of the various levels that the whales are found at.the site are examined. There are possibly as many as five species of fossil archaeocoete whales present in Wadi Al-Hitan, but only two are well known. One of them is the very large *Basilosaurus isis*, with well developed five-fingered flippers on the forelimbs and surprisingly the presence of hind legs, feet, and toes, not known previously in any archaeocoete. (The name *Basilosaurus* was given to it because it was first thought to be a dinosaur). The other species is *Dorudon atrox*, a small whale with a more compact dolphin-like body. Besdies whales, three species of early sirenians, one partial skeleton of the primitive proboscidian *Moeritherium*, early mammals, lower vertebrate remains, three kinds of sawfish, bony fishes, several kinds of turtles (including a sea turtle), sea snakes, and

crocodiles, are also present. The fossils of *Basilosaurus* and *Dorudon* of Wadi Al-Hitan are found in the Eocene deposits of the Gulf of Mexico and the Atlantic coast of North America, showing that they were widely distributed. In Wadi Al-Hitan, several *Dorudon* juveniles have bite marks across their skulls, indicating they were bitten by a predator, probably the much larger *Basilosaurus*. This proves that the whale skeletons at Wadi Al-Hitan have more secrets to reveal than elsewhere in the world.

Fossil sea cows in Wadi Al-Hitan are very similar to modern ones, further evidence that the site was part of a shallow protected embayment. Abundant mangrove and several crystal kogs of beached shipworm-bored wood reinforce the embayment theory.

3. Description of Property

Situated in a remote desert region in the western section of Wadi El-Rayan Nature Protectorate, south of Fayoum Oasis, is the area of fossil whales. About forty to thirty-seven million years ago, Wadi El-Rayan was under a great ocean, and this site was a beach and a lagoon with mangrove vegetation. Due to geological upheavals, the ocean retreated leaving the remains of marine animals trapped in the sediments. Fossilized skeletons of primitive early species of whales, sharks, mollusca, and remnants of other marine life can be found there. Not less than 406 visible whale skeletons, the last ones to have functioning feet, lie exposed on the surface. The present-day limited numbers of flora and fauna species in Wadi Al-Hitan or in the larger area of Wadi El-Rayan, are not of special significance, except in showing how plants and animals can survive under extreme ecological conditions (extremophiles).

a. Natural History

a.1 Geology

Geological history of the area

The paper of Issawi and McCauley (1992), suggested that Egypt had been drained by a succession of at least three different river systems since the Tethys regression in the late Eocene (Figs. 7-10) and that a single master stream (the "Protonile") did not exist during the Tertiary. These newly described drainage systems flowed from the Red Sea highlands in the east to the western desert depressions in the west, and competed with one another for survival and the rivers with the overall gradient advantages replaced, over time, the earlier less efficient systems. Competition took place in response to tectonic uplifts, sea level changes and climate variations. The present landscape of Egypt was produced by the combined geomorphic effects of these old drainage systems. The modern Nile in Egypt, that is, a north-flowing river connected to the Ethiopian highlands, dates only from the very late Pleistocene, 250,000 years ago, and is made up locally of parts of the prior rivers and it is neither an antecedent nor a superimposed stream, and it is not the descendant of the imaginary "Protonile."

McCauley *et al.* (nd) conclude that the fifteen year period of SIR investigations in Northeast Africa has led to a much improved understanding of the geomorphic evolution of the Western Desert of Egypt and the relatively minor role of the Nile in this history. The non-redundant SIR-C coverage of Egypt shows convincingly that collected runoff in rivers, streams, and local lakes, was the principal agent of erosion that produced the major elements of the Egyptian landscape. The present-day eolian sand sheets and dunes of various types are only a thin blanket dating mostly to the Late Pleistocene and Holocene Epochs. Although southwestern Egypt lies within the most arid part of the Earth, and has a powerful and persistent wind regime, the radar shows the eolian landscape to be superficial.

Geomorphology

This Wadi is characterized by its magnificent and peculiar geomorphological features due to the severe action of wind erosion on the sedimentary rocks of different resistances. Isolated hills, hillocks of peculiar shape sculptured by the wind action, earth pillars and the curious huge globular masses possessing internal concentric bandings, enveloped by larger ones, so-called *battikh* (water melon). One of the

geomorphological landmarks in the Valley is Al-Akhawat Al-Talata (three sisters), which is a hill with its top divided into 3 little summits.

Stratigraphy

The sequence of rocks in Wadi Al-Hitan indicates that the oldest rocks are related to Gahannam Formation of Eocene age (Bartonian or Priabonian, about 40 to 41 million years ago, consisting of white marly limestone and gypseous clay. Like the lower part of the Birket Qaroun Formation (Upper Eocene), it is of particular interest in yielding many skeletons of the marine archaeocetes, shark teeth, chelonians, and crocodilians. The youngest formation in Wadi Al-Hitan is the Qasr El-Sagha Formation of Late Eocene age (Upper Priabonian, about 39 million years ago), with *Carolia placunoides* at its base. This Formation is exposed in some top parts in the Valley, and due to its richness in marine invertebrate fauna, it indicates a shallow marine environment.

Note: The following account is excerpted from Dolson *et al*. (2002).

Geological Setting and Prior Work

Jurassic rifting and Syrian Arc inversion were the dominant tectonic events shaping the current geometry of the Fayoum Basin. The basin is in excess of 6000 meters deep and is flanked to the northwest by a prominent Syrian Arc inversion structure known as the Kattaniya Horst. The Bahariya Oasis, formed by another large Syrian Arc structure, bounds the basin to the southwest.

The Greater Fayoum Basin holds a rich heritage of palaeontological, archaeological and geological exposures. The Qasr El Sagha (or Temple of the Crocodile), Wadi Rayan and Wadi Al-Hitan (Whale Valley) sites are the primary points of interest in the area.

The location, within a 1½-hour drive from Cairo's 16 million inhabitants (Fig. 4), makes this an area of high potential for eco-tourism and scientific discovery. However, the growing awareness of the scenic, recreational and scientific value, coupled with roads created for seismic and oil well drilling exploration, has now placed this fragile area in jeopardy of becoming damaged by uncontrolled visitation.

This description touches upon major facets of the area's natural science with a focus on:

1) learnings from petroleum exploration in the offshore Nile Delta
2) the palaeo-ecology of the Eocene and Oligocene vertebrate palaeontological sites
3) human history
4) the potential for eco-tourism and need for strong conservation measures (under tourism)

Egypt's tectonic history

Egypt's tectonic history can be summarized in eight major events (Dolson *et al.*, 2001).

1. Palaeozoic craton
2. Jurassic-Early Cretaceous rifting
3. Cretaceous passive margin
4. Syrian Arc inversion (84 MA-50 MA) and foreland transgression
5. Oligo-Miocene Gulf of Suez rifting
6. Late Miocene Red Sea breakup
7. Messinian salinity crisis
8. Plio-Pleistocene delta progradation

Outcrop exposures

1) (a) The Middle Eocene Gahannam and Lower Qasr El Sagha Formations at Whale Valley: shallow water lagoonal and shoreline facies capped by marine shales, extensive vertebrate graveyard of whales and sea cows, (b) exposures of large scale basinal thickening northward into the Fayoum Basin.

2) a. Temple Member of the Qasr El Sagha Formation: (a) Coarsening upward parasequences of tidal flat and beach horizons interbedded with lagoonal and marine shales, (b) Giant foreset beds of a palaeo-estuary in the Dir Abu Lifa member of the Qasr El Sagha Formation.

The area is currently under the protection of the Egyptian Environmental Affairs Agency (EEAA).

The Fayoum Basin was formed initially along the Tethyan margin in Jurassic time. Its current shape is from subsidence that terminated in late Eocene time. The basin is largely below sea level.

Natural breaks in the levee of the Nile River have caused repeated flooding of the basin. Ancient Lake Moeris was much more extensive than the current Lake Qaroun. Egypt's climate 8500-4000 years ago was significantly wetter, and this large natural lake with its abundant wildlife and surrounding fertile soils, attracted very early human occupation. The basin has seen continuous human habitation from Neolithic time to present.

In Pharaonic times, Egyptians built an extensive network of canals, locks and irrigation systems, designed to maintain the level of Lake Moeris. During Roman occupation, the level of the Lake was dropped to make room for more irrigable land and the present Lake Qaroun is only a fraction of its former size.

The most definitive work on the Eocene and the palaeo-ecology of the *Basilosaurus* and Sirenia (sea cows or manatees) is that of Gingerich (1992).

Web page hotlinks to geological information on the Fayoum Basin

Topic	Web hotlink
Granger 1907 expedition	http://www.nh.ultranet.com/~granger/FaiyumInstall4.html http://www.nh.ultranet.com/~granger/
Zeuglodon palaeontology, (*Basilosaurus*)	http://www.unmuseum.org/zeuglodo.htm http://www.archives.state.al.us/emblems/st_fosil.html http://www.strangemag.com/nessie.home.html http://www.zoomwhales.com/subjects/whales/classification/Whalefossils.shtml
Syrian Arc Event	http://www.geosociety.org/pubs/geology/0799geo.htm#S14
IUCN (World Conservation Union)	http://wcpa.iucn.org/region/mideast/mideast.html
AAPG activities	http://www.aapg/org

Egyptian Environmental Affairs Agency (EEAA)	http://www.eeaa.gov.eg/

What do the vertebrate fossils found in Wadi Al-Hitan tell us about the environment where they lived?

The fact that both *Basilosaurus* and *Dorudon* are found in Eocene deposits of the Gulf and Atlantic coasts of North America shows that they were widely distributed, fully marine, and probably highly mobile. Their teeth are sharp (Figs. 13 and 16), indicating that they were predators. The larger *Basilosaurus* is represented by about 97 partial skeletons in Wadi Al-Hitan, of which only one is a juvenile (1%). *Dorudon atrox* is represented by about 82 partial skeletons, of which 63 have been classified as adult and twenty-six (41%) as juvenile. The fact that so many juvenile *Dorudon* are found in Wadi Al-Hitan reinforces the idea that it represents a protected embayment or inland sea rather than open ocean. It also suggests that Wadi Al-Hitan was probably a favoured calving ground for *Dorudon*. Whales today seek warm, sheltered embayments and lagoons to give birth. Thus *Basilosaurus* and *Dorudon* are present in approximately equal numbers in Wadi Al-Hitan, but they have very different population structures. Several juvenile specimens of *Dorudon* have bite marks across their skulls indicating that they died when bitten by a predator. The predator could have been a large shark, but these are relatively rare. It seems more likely that *Basilosaurus* was the predator preying on young *Dorudo*n. Wadi Al-Hitan is unusual in having such a large concentration of fossil whales in a relatively small area.

There are several possible explanations for this. First, the area was sheltered and seemingly favourable for *Dorudon* calving. This would encourage these whales to return generation after generation. The presence of calving *Dorudon* females might have attracted larger predators like *Basilosaurus*, further increasing the diversity of whales. Second, if the proto-Nile or other large river system debouched into the embayment, this may have provided nutrients supporting a large biomass including fish, which would have attracted whales. The presence of sea cows might have attracted whale predators (though the whales greatly outnumbered such potential prey). In all, the rich concentration of fossils may be due to excellent exposure of fossil-bearing strata.

Sirenians (or sea cows), living today, inhabit sheltered estuaries and feed on seagrass meadows growing in shallow coastal waters (maximum 30 m water depth). Fossil sea cows known from Wadi Al-Hitan are so similar to modern Sirenians in skeletal form, with tusked skulls, compact bodies, forelimb flippers, dense expanded ribs neutralizing their buoyancy, reduced hind limbs, and fluked tails, that we can safely infer that they lived like their modern relatives do. This is further evidence that Wadi Al-Hitan was part of a shallow protected embayment. The only land mammal found in Wadi Al-Hitan is one partial skeleton of the amphibious early proboscidean *Moeritheriu*m. This may indicate that the shoreline was nearby, but the *Moeritherium* may also have been caught and transported some distance from shore by *Basilosaurus* or another predator.

Abundant mangrove and several crystal logs of beached shipworm-bored wood reinforce evidence from vertebrates that the fossils in Wadi Al-Hitan accumulated during a time of relatively low sea stand in a shallow embayment or inland sea.

How did the Wadi Al-Hitan whales die?

The presence of a large number of whales dying in the same area is reminiscent of the beachings or strandings of whole groups or pods of extant whale species on modern beaches. There is no question that multiple skeletons are found on single bedding planes, and multiple skeletons are found on steep vertical escarpments. However, the skeletons are almost always found separated from each other spatially and stratigraphically, and, with one or two possible exceptions, whales are not found in the close single-species associations expected of strandings.

One final observation in Wadi Al-Hitan is interesting. Adult skeletons of *Dorudon atrox* are fossilized in circles (Figs. 13 and 14), as if they were attempting to stretch backwards and bite their tails. This is undoubtedly due to desiccation of the powerful back and tail muscles in salt water, which caused the skeleton to curl backwards into a circle before it was buried and fossilized. However, when an adult *Basilosaurus isis* skeleton is found it is always straighter and never curled back in the same way. This indicates that the two were differently muscled, which is not surprising, given their greatly differing body lengths and vertebral proportions.

Of interest here, the orientation of *Basilosaurus* skeletons has the potential to tell us something about the environment of accumulation. In the course of studying *Basilosaurus*, the bearing of the head relative to the rest of the body was recorded for 14 individuals scattered across the whole of Wadi Al-Hitan.

The rose diagram of orientation of the skeletons of fossil whales is clearly bimodal (Fig. 15), with four of the 14 skeletons oriented with their heads in the North octant and four oriented with their heads in the South octant. The remaining six skeletons fall in four of the remaining octants, and two octants are empty. The probability of eight of 14 skeletons being oriented in opposing octants is only about 0.04, and this is thus not likely to have happened by chance alone. Orientation could reflect alignment with prevailing sea floor currents, but then we would not expect equal numbers of heads in the opposing octants. Alternatively, orientation might reflect alignment with the ancient shoreline determined by the ebb and flow of tidal currents.

Some skeletons have been partially reconstructed, but many vertebrae and other bones have been stolen over the years, leaving only partial skeletons at each site. Many complete skeletons remain to be excavated, preserved and reconstructed.

Whale Feet

(Excerpted from Philip Gingerich home page, see below)

Many scientists believe that whales were once land bound animals because of the hoofed fossils that have been discovered. The oldest whale fossil discovered to date, dates back forty million years. However, it is believed that whales have been around for sixty million years. It is reported that "No fossil has yet been found, however, that links the land-living ancestors and the early cetaceans, and the reasons for a mammal's return to the sea are also not known." But, Dr. Holly Smith, a seasoned fossil hunter affiliated with the University of Michigan, would not agree with this claim. Holly and her husband, Dr. Philip Gingerich, discovered the remains of a whale with hind legs in Egypt's Zeuglodon Valley (now Wadi Al-Hitan), in 1989. Not only did they discover hind legs, they also found an ankle bone and what appear to be toe joints.

Once whales moved to the sea, their bodies began to adapt to its new environment. It is believed that the whales front limbs evolved into flippers and their back legs "were

lost." Whale flippers have a bone structure "reminiscent of jointed limbs and digits. The modern whale has two "numbs of bone" where the ancient whales had hind limbs". It is reported that today only 1 whale out of 100,000 has a slightly protruding stub of a hind limb."

Theoretically, there are many reasons why the ancient whales took to the seas. They might have needed more space or more food, both of which were found in the sea. The adaptation to the sea's environment took place gradually through natural selection.

Smith and Gingerich believe the evolutionist theory that the land bound whales were forced into the sea by predators. Then they adapted to the sea environment through natural selection. The whale fossil that Smith and Gingerich found is the species *Basilosaurus isis*. This species "lived 10 million years after the transition from land to sea had occurred." Dr. Gingerich was surprised that they still had "functioning hind legs."

Evolutionists point to this whale discovery as evidence of evolutionary transitions. Creationists are still not convinced by the evolutionists arguments and theories.

http://www.dc.peachnet.edu/~pgore/students/f95/shuff/whales.htm

Basilosaurus therefore may represent the whales having the last hind limbs visible enough to be recognized as "legs". But they were not used for walking. It is believed they were used instead for mating, like the appendages of male sharks or the claspers of the aquatic oligochaete worm *Alma nilotica. Basilosaurus* also represents the stage in whale evolution in which they became fishlike, with a streamlined fusiform body, a long and powerful tail, forelimbs turned into flippers, and a terminal tail fin.

Whales and hippos are close kin

http://www.geocities.com/egenews/sep1/

As long ago as 1950, scientists using immunological methods on material from living animals came to the surprising conclusion that whales are most closely related to artiodactyls. In the early 1990s in Egypt, University of Michigan palaeontology Prof. Philip Gingerich found *Basilosaurus*, a 42-million-year-old fossil whale with leg, foot and toe bones, but its ankle bones were too rudimentary and its feet were useless for walking. In the last few years, 15 or 20 DNA studies have come out supporting the connection of artiodactyls to whales. Gingerich's team found in Pakistan fossil whales with sheep-like ankle bones in the very same skeletons, which was some 5 million years older than the whales Gingerich found in Egypt. Artiodactyls have ankle bones unlike those of any other living or extinct animals, so comparing fossil whale feet with those of artiodactyls provides the crucial clues to their relationship. Whales seem to have evolved from early ancestors of sheep, deer and hippopotami and may be hippos are the closest living relatives of whales. Thus Basilosaurus of Egypt with its toe bones represents one more step in the evolution of whales into fully aquatic animals, thereby completing the chain that led from sheep to modern day true whales.

a.1.2 Palaeontology
a.1.2.a Fossil Flora

The Fossil Mangrove

In present day mangroves, trees grow singly on slightly raised ground in nearshore swamps. El-Saadawi (*in litt*. 2003) says that although fossil whales at Wadi Al-Hitan were known to science since 1904, the exposed fossil mangrove bed of the Wadi (Figs.17 and 18), more conspicuous than the whales, was not identified until 80 years ago (*cf.* Gingerich 1992). This mangrove bed lies in the "Camp White Layer" at the top of the Gahannam Formation (Late Middle Eocene), Bartonian, and/or Priabonian). The bed shows, according to the geological literature, a succession of vertical pneumatophores (respiratory roots) dissected by wind erosion and capped by an extensive hard limestone resistant to erosion. So far, no palaeobotanical work has been done on this fossil mangrove.

Fossil Palms

A very long tree trunk lies in Wadi Al-Hitan covered by what has been explained as worm borings (Fig. 19). During the recent visit of the Scientific Team to Wadi Al-Hitan on 19 Dec. 2002, Prof. W. El-Saadawi collected a fossil plant specimen at the main mangrove site (29° 16´ 15˝ N and 30° 01´ 26˝ E) which closely resembles an old dichotomized rhizome of *Nypa fruticans* (Palmae), illustrated by Tomlinson (1994), but is 10 times smaller in size. *N. fruticans* does not occur in Egypt now, but is found in South and Southeast Asia and northern Australia. Its present occurrence in these tropical countries indicates that the climate of this part of Egypt at Late Eocene times was similar, *i.e.*, tropical and humid.

It is worth mentioning that fossil fruits of *Nypa* and remains of other plant genera known to have species that grow in association with mangroves, have been reported from nearby sites in the Egyptian deserts. Therefore, an at length palaeobotanical study of this mangrove site and its plant remains is worthwhile. Plant species whose logs (or other remains) are abundant in the nearby deserts might be identified in the Wadi Al-Hitan mangrove site; particularly that it is known that these logs do not occur in growth position, but lying on the ground. Sedimentologic evidence indicates that most of them were transported a short distance, probably from such mangrove sites, prior to burial.

The detailed palaeobotanical study is hoped also to throw more light on two points referred to in the geological literature:

1) The 1.5 m tall isolated block of the Camp White Layer which is lying in Wadi Al-Hitan at 29° 16´ 15˝ N and 30° 01´ 25˝ E, quite near the above mentioned main mangrove formation, and having the same structure. Is it a broken block (as mentioned in the literature)? Or is it an unbroken one?
2) The 18 m long, entirely worm-bored petrified tree (as described in the literature), located at 29° 16´ 18˝ N and 30° 01´ 30˝ E, along a palaeo-shoreline in Wadi Al-Hitan. Is it, in fact, an entirely worm-bored tree in which borings have been filled with celestine (as mentioned in the literature)? Or is it a fossil palm with adventitious roots that decayed and their piths filled with another mineral? More sound proof is really needed in favour of or against this idea.

a.1.2.b Fossil Animals

Characteristic Animal Fossils

Description:
The Faiyum Province is one of the most attractive and very interesting areas, not only in Egypt, but in the whole world, owing to its valuable vertebrate fossils that date back to more than 40 million years ago, its variety of rocks of different geologic ages, some of which are of peculiar features, and also the presence of Lake Qaroun, with its historical value.

One of the most interesting sites in Faiyum is Wadi Al-Hitan (Whale Valley), located about 12 km WSW of the prominent hill Garet Gahannam (Hell's Cliff), in Wadi El-Rayan Protected Area (WRPA). It is known also as Zeuglodon Valley, but this name is now obsolete. This is the type locality known among palaeontologists for the Eocene whale *Prozeuglodon atrox*, described by Andrews in 1906. It is also the type locality of *Basilosaurus isis* (Fig. 20), described by Beadnell in the same year.

This Valley contains about 406 huge skeletons of prehistoric whales that lived in this region in the Middle Eocene Age about 40 million years ago. Many of these skeletons are almost complete and well preserved; some on the surface and others covered with sand. They are grouped in families which may one to think about a mass suicide like in modern whales. However, these Eocene whales are taxonomically different from modern ones and are placed in a separate sub-order, the Archaeoceti. Their bodies were very long, up to 21 m and apparently thinner than modern whales, suggesting a sea-serpent form, probably of low swimming efficiency. The skull is very long and the nostril was some way back. Teeth are very interesting in that they were of the normal mammalian number (44), and show some signs of the heterodont arrangement. The molars have sharp crenate edges, as is other fish-eaters. The animals were obviously carnivorous.

Beside the whales in Wadi Al-Hitan (*Prozeuglodon atrox*, *Basilosaurus isis*, *Dorudon osiris*, and *Ancalecetus simonsi*), there are also sharks (witnessed by fossil shark teeth), crocodilians, and chelonian remains.

Macro-invertebrate fossils are of significance in this area. The sedimentary rocks in the area are very rich in bivalves, like *Pycnodonte*, *Lucina*, *Tellina*, *Cardita*, and many other genera. *Turritella* and *Mesalia* are among the most prominent gastropods, while *Nautilus* represents the cephalopods. A peculiar hydrozoan called *Qerunia cornuta* and fossil crabs of the genus *Lobocarcinus* are also found. Plenty of the coin-like *Nummulites* are found scattered on the ground, and embedded inside the rock.

Moreover, the relics of an Eocene mangrove forest, dating back to about 40 million years ago, is found fossilized in some sedimentary strata in Wadi Al-Hitan, which can really be considered as an open display case in the desert.

The following is a detailed description of the outstanding fossil species in the area of Wadi Al-Hitan.

Notes on <u>Whale</u> Fossils in Wadi Al-Hitan
Class: Mammalia
Infraclass: Eutheria

Order: Cetacea Brisson 1763
Suborder: Archaeoceti Flower 1883
Family: Basilosauridae Cope 1868
Subfamily: Dorudontinae Miller 1924

Genus: *Dorudon osiris*
Synonym: *Zeuglodon osiris* Dames 1894
D. osiris is the largest species of *Dorudon* from Egypt. All are from Qasr El-Sagha Formation of Late Eocene age. It is one of three species of *Dorudon* recognized by Kellog (1936) from that Formation.

Genus: *Ancalecetus simonsi* Gingrich 1996
This is an advanced archeocete described from the Birket Qaroun Formation (earliest Priabonian, Late Eocene) of Wadi Al-Hitan. It is similar to *D. atros* in many ways but differs conspicuously in having fused elbows, other distinctive features of forelimb structure, and a more curved malleus within the middle ear. It appears to have a viable, if not a highly specialized evolutionary experiment, one that may have contributed nothing to subsequent evolution of cetaceans, but one nevertheless broadening our understanding of the morphological diversity of archeocetes.

Basilosaurids

Basilosaurids are the youngest group of archaeocete whales. By the late Eocene, all other groups of archaeocetes became extinct and only basilosaurids remained. Based on this observation and the sharing of many derived morphological features with early mysticetes and early odontocetes, basilosaurids are thought to have given rise to modern cetaceans. Basilosaurids all share the loss of the third upper molar, the presence of accessory denticles on their cheek teeth, a high number of lumbar vertebrae, highly reduced hind limbs that do not have a bony connection to the vertebral column, and dorsoventrally flattened tail vertebrae indicating the presence of a tail fluke.

The earliest basilosaurids are from the late middle Eocene of Pakistan. By the late Eocene, basilosaurids are virtually globally distributed with specimens known from New Zealand, Senegal, Europe, Jordan and common from Egypt and the southeastern United States.

Basilosaurids are divided into two groups, Basilosaurinae and Dorudontinae. Basilosaurines include the genera *Basilosaurus* and *Basilosterus*. Dorudontines include *Dorudon*, *Pontogeneus*, *Zygorhiza*, *Saghacetus*, *Ancalecetus*, and a new species yet to be named. Basilosaurines all have elongate posterior thoracic, lumbar, and anterior caudal vertebrae, a feature that dorudontines lack.

Basilosaurids have many anatomical features that indicate they were fully aquatic. Their hind limbs are extremely reduced and lack a bony attachment to the vertebral column. Their fore limbs are formed into flippers, with limited mobility at the wrist and elbow. They also have broad, fan-shaped scapulae like those of modern cetaceans. Basilosaurids have short necks, although all seven cervical vertebrae remain free and unfused, unlike many modern cetaceans where some of the cervical vertebrae are fused. Also, basilosaurids have their posterior caudal vertebrae dorsoventrally flattened. This feature is only found in modern mammals that have a tail fluke (cetaceans and sirenians) and the pattern of shape change along the vertebral columns

of dorudontines is very similar to the pattern seen in modern cetaceans. http://www.cdp1802.org/~muhen/CetRes.html

The evolution of whales

Fossil representatives of these modern groups go back to the Oligocene epoch. Early members of these groups are more primitive than the modern representatives (odontocetes with primitive-looking teeth, mysticetes with teeth), but they are part of these modern groups. Prior to the Oligocene, during the Eocene epoch, there were no odontocetes or mysticetes, only Archaeocetes (ancient whales). Archaeocetes retain many features of more primitive mammals in their skulls, teeth, vertebral columns, and limbs relative to their modern descendants. Research has focused on archaeocetes from the middle and late Eocene, protocetid and Basilosaurids.

Notes on <u>Invertebrate</u> Fossils of Wadi Al-Hitan

Thousands of *Nummulites fraasi* and *N. beaumonti* are scattered on the Wadi ground beside many exposures of macro-invertebrate fossils, which characterize the three Formations found there: Gahannam, Birket Qaroun, and Qasr El Sagha. The macro-invertebrate fauna is usually found in three major rock types: shales, compact white limestone, and sandy hard brown limestone.

The mode of preservation of fossils varied widely in these types of rocks. In most cases, the specimens occur as molds obscuring their internal structure, but retaining, in most cases, their external features. In the limestone basal beds of Qasr El Sagha Formation, *Carolia* and oysters together, with few other genera, retain their original material and structure. In some other cases, in the upper beds of Gahannam Formation and the lower beds of Birket Qaroun Formation, the shells are replaced by celestite (strontium sulphate). *Carolia* characterizes the basal beds of Qasr El Sagha Formation. It is found in some exposures in the southern parts of Wadi Al-Hitan, where the basal parts of this Formation are exposed. These shells are found crowded and may even form a complete bed.

<u>Bivalves</u>

Suborder: Ostreinae
Superfamily: Ostreacea
Family: Gryphaeidae
Subfamily: Pycnodonteinae Stenzel 1959
Genus: ***Pycnodonte*** F. de Waldheim 1835
***P. gigantica* Soldner 1766**

This large shell (Fig. 1 a and b, Plate I) indicates a shallow water environment since such oysters live nowadays in shallow depths and near the shore. They are found in the basal beds of Qasr El Sagha Formation and also in the upper beds of Birket Qaroun Formation.

Family: Osteidae
Subfamily: Ostreinae
Genus: ***Ostrea*** L. 1758
***O. elegans* Desch. var. *exogyroides* M-Eymar**

This species (Fig. 2 a and b, Plate I) is found in the same beds as the previous species. It has a characteristic shape and ornamentation.

Subfamily: Lophinae

Genus: ***Nicaisolopha*** Vyalov 1936
***N. clot-beyi* (Bellardi 1854)**
Members of this characteristic upper Eocene small oyster (Fig. 5, Plate I) are found in the same beds as the previous two species.

Order: Veneroidea
Superfamily: Lucinacea
Family: Lucinidae
Genus: ***Lucina***
***L. fajumensis* (Oppenheim 1903)**
This species (Fig. 4, Plate I) was identified by Oppenheim from the Faiyum Province. It dates back to the late middle Eocene age and was found in both Gehannam and Birket Qaroun Formations.

Superfamily: Carditacea
Family: Carditidae
Genus: ***Cardita***
***C. viquesneli* Oppenheim 1903**
This species (Fig. 3, Plate I) is characterized by numerous tripartite radial ribs. It is found abundantly It is found in the same beds as *Pycnodonte gigantica* and *Ostrea elegans*.

Genus: ***Vulsella*** Lamarck
***V. crispata* Fischer**
This species (Fig. 12, Plate I) is found at many localities where oysters are less prominent. The vulsellas are the commonest variety in their group. They were collected from Gehannam and Birket Qaroun Formations in a good state of preservation.

Genus ***Carolia*** Cantraine 1838
Carolia placunoides Cantraine (Fig 13 a and b, Plate I)

Gastropoda

Order: Mesogastropoda Thiele 1925
Family: Turritellidae Woodward 1851
Genus: ***Turritella*** Lamarck 1799
Subgenus: ***Torquesia*** Douville 1929
T. (T.) carinifera Deshayes 1824
This upper Eocene species (Fig. 7, Plate I) is abundantly found in both Birket Qaroun and Qasr El Sagha Formations.

Species: ***T. (T.) pharaonica*** Cossmann 1901
Specimens of this upper Eocene turritellid (Fig. 6, Plate I) are mostly found in the same beds containing the previous *T. carinifera*.

Genus: ***Mesalia*** Gray 1824
M. fasciata Lamarck
This species is characterized by its wide spire angle, wide whorls with numerous spiral ribs, of which the anterior second one is the most prominent. It is frequently found in Birket Qaroun Formation.

Family: Aporrhaidae
Genus: ***Drepanocheilus*** Meek 1864
D. wagihi Abbass 1963
This species (Fig. 10, Plate I) is found in Birket Qaroun Formation. It is characterized by its fusiform shape, convex whorls, undulating sutures, axial ridges, and short anterior canal.

Cephalopoda
Order: Nautiloidea
Genus: ***Nautilus***
N. mokattamensis Oppenheim 1903
Specimens of this species (Fig. 11, Plate I) are rare remains of cephalopods in Egyptian Eocene rocks. They are found well preserved in Birket Qaroun Formation. They are indicative of normal marine salinity.

a.1.3 Biodiversity

(See Appendix for Lists of Species)

Extant plants and animals in the core area of the proposed Whale Valley Site arevery sparse. Perhaps not more than a handful of plant species represented by very few individuals exist in it, and a slightly higher number of invertebrates and vertebrates. The larger area of WRPA, on the other hand, with its more than 30 years old brackish man-made lake, attracts a relatively large number of species. All the species that are found in WRPA, or are likely to be found, being known from the wider area of the Fayoum Governorate, are listed in the Appendix.

b. History and development

History of discovery
Situated in a remote desert region in the western section of Wadi El-Rayan Nature Protectorate, south of Fayoum Oasis, is the area of fossil whales. About forty to thirty-seven million years ago, Wadi El-Rayan was under a great ocean, and this site was a beach and a lagoon with mangrove vegetation. Due to geological upheavals, the ocean retreated leaving the remains of marine animals trapped in the sediments. Fossilized skeletons of primitive early species of whales, sharks, mollusca, and remnants of other marine life can be found there. Not less than 406 full whale skeletons, the last ones to have functioning feet, lie exposed on the surface. The present-day limited numbers of flora and fauna species in Wadi Al-Hitan or in the larger area of Wadi El-Rayan, are not of special significance, except in showing how plants and animals can survive under extreme ecological conditions (extremophiles).

The Fayoum region, is from where fossilized remains were first described by A. B. Orlebar in 1845. But the first fossil vertebrate discovery made in Fayoum at Gebel Qatrani area, was of whales by the, Schweinfurth, from the German-speaking part of Switzerland, in 1879. His find was published in 1882. In 1898, geologist Hugh J. L Beadnell of the Egyptian Survey was sent to Fayoum and soon found more fossil vertebrates. Working on camel back and foot, the early maps of Beadnell actually contained navigation units in “camel hours” but were surprisingly accurate for their day. British Museum of Natural History palaeontologist Charles W. Andrews joined Beadnell in 1901 to help make the first extensive fossil collection from Fayoum. Andrews was appointed the first Keeper of the Egyptian Geological Museum. The

collection dug from the Fayoum in 1898 was sent to the British Museum in London for identification in 1899 and returned for display. The famous fossil collection of the Fayoum vertebrates was the first to be displayed in the new museum. The two geologists published their impressive results shortly thereafter and aroused world attention. Their collections continued to grow and become more varied with the increased number of field expedition and the different areas covered by field work.

A German team, led by Stuttgart's Eberhard Fraas and Richard Markgraf who had moved to the Fayoum, followed the British in 1905. A later American expedition was comprised of two parties consisting of the work party with Walter Granger as leader, assisted by George Olsen plus a group of Egyptian workers hired in Egypt; and the escort party of the Department of Vertebrate Palaeontology curator Henry F. Osborn. The Fayoum fossil site was reached in February 1907. Granger stayed until the end of May. Granger went on to discover the first dinosaur eggs in the world in the Gobi Desert in the 1920s. http://www.touregypt.net/featurestories/grangerfayoumintro.html

The area remained unexplored further for more than 70 years. Then the American Gingerich and his crew came first in 1983 and worked hard till they found tiny hind limbs belonging to a 60-foot-long sea snake-like *Basilosaurus* and the first evidence of cetacean feet. Earlier finds of *Basilosaurus*, a fully aquatic animal that slithered through the seas between some 40 million and 37 million years ago, preserved only a partial femur, which its early discoverers interpreted as vestigial. But the well-formed legs and feet revealed by this latter discovery hinted at functionality. Although at less than half a meter in length the diminutive limbs probably would not have assisted *Basilosaurus* in swimming and certainly would not have enabled it to walk on land, they may well have helped guide the beast’s serpentine body during the difficult activity of aquatic mating. Whatever their purpose, if any, the little legs had big implications. Gingerich immediately thought that this was 10 million years after the *Pakicetus* he earlier discovered in Pakistan. If these things still had feet and toes, there would be 10 million years of history to look at.

History of protection

In the 1960s the Fayoum Province expanded rice cultivation and also other semi-aquatic plants like ornamental *Cyperus*. This resulted in the use of increased quantities of irrigation water, and consequently huge quantities of drainage water went in Lake Qaroun, the only outlet for drainage water of the entire Province at that time. The Lake level rose alarmingly, overflowing onto prime agricultural land, its water became saltier, and its fish stocks much deteriorated, and eventually collapsed. The Government thought of allowing another outlet into the Wadi Rayan Depression, which was a dry desert at that time. A canal was dug to drain one third of the drainage water of Fayoum into that Depression, which was terminated in 1972. Thus a brackish water lake was created in the middle of the dry desert, the Wadi Al-Rayan Lakes. In the 1980s, a team of Egyptian researchers started studying the new aquatic ecosystem created in this dry desert. They recommended declaring it a nature reserve representing a unique case of a man-made brackish water lake, complementing the famous Lake Nasser fresh water lake, and allowing significant comparisons between the two as regards the evolution and development of such ecosystems. Law 102/1983 came to the rescue, and the WRPA was eventually declared.

Declaration of this Protected Area attracted visitors and facilitated excursions into its surrounding areas of interest. While increasing the numbers of visitors to the lakes area was welcome, their pressure on the Wadi Al-Hitan was seen as serious threat to

the fragile fossils. It was agreed therefore that the nearby Wadi Al-Hitan should be within WRPA, and this was done, and that it needs special maegement measures within the management plan of WRPA.

c. Form and dates of most recent records of property:
(Information kindly provided by the Central Administration for Nature Conservation Sector (NCS) of the EEAA, State Ministry for Environmental Affairs.)

The Egyptian Environmental Affairs Agency (EEAA) is the agency representing the Government of Egypt in what regards environmental matters. In general, the lands of the protected areas within Egypt are governmental property, where each Protected Area Management Unit (PAMU) takes the legal reaction against any environmental or illegal land reclamation or violation.

The core area and buffer zone of Wadi Al-Hitan (Whale Valley) are completely inside the border limits of Wadi Rayan Protected Area (Fayoum Governorate), which is declared by the Prime Minister's Decree no. 943/1989, and later was enlarged to include W. Hitan by Prime Minister's Decree no. 2954/1997, to become about 1759 km2

d. Present state of conservation
The conservation of the Wadi Rayan is going on according to management plan as the protected area starts years ago with the support of Italian Government, but still some corrective measures has to be taken to prevent unmonitored visitors, because of unlimited four wheels drive cars entrance of the Wadi Rayan in general, and particularly Wadi Al-Hitan, the main corrective action is to recruit and train some community guards from the local people, for monitoring and tourists support.

e. Policies and programmes related to the presentation and promotion of the property
Tourist attractions in the greater Fayoum area are varied: the Lake provides tremendous recreational opportunities, bird watching, fishing, boating, etc. The countryside provides unusual sightseeing with the water wheels driven by the mere downward flow of water (without need for animal power, like elsewhere in Egypt). The spring at Ain Siliyyeen is also another unusual spot for national tourism, with its flour mill running by water energy alone. Fayoum is the theme of several guidebooks, in French and in English. The books are sold in selected bookstores in Cairo and can currently be obtained in Fayoum. Wadi Al-Hitan Administration provides interested persons with any material on the area. The Egyptian-Italian Cooperation has produced several wonderful publications in large numbers, ranging from attractive guidance and information brochures to serious scientific books, such as "*Wadi Rayan: Gateway to the Western Desert*."

General information on Wadi Al-Hitan is available in very attractive brochures, the website (http://www.elrayan.org), the Atlas and the Video of WRPA. They are all exhibited at the WRPA Visitor Center on the western side of the lake. In addition, a number of representative fossils are also exhibited in the Visitor Center, together with large explanatory maps and wall charts. And in order to attract visitors coming for recreation into the Visitor Center with a lecture room, a skeleton of a fossil whale has been transported from Wadi Al-Hitan and proudly displayed in front of the Center. Most hotels in Fayoum and the Tourism Authority have brochures, atlases or video

copies. The entrance gate of WRPA started to distribute brochures to visitors. The video and atlas are available in the Visitor Center at WRPA.

The Tourism Authority of the Governorate recently produced an information brochure in Arabic on the Governorate that contains a short paragraph on the Waterfalls area of Wadi Rayan. Also, a professional video on Fayoum Governorate has been produced, but has not been distributed yet. Much presentable English information material is available on Fayoum in general, and also on the geological, palaeontological and cultural heritage in particular. The website of the Fayoum Governorate (http://www.Fayoum.8k.com/fayeng.htm) contains information on tourism in general and on certain cultural sites in particular.

Chances and opportunities for information management and the tourism market

- ✓ Make better use of existing material: Develop an information distribution plan for e WRPA (even if limited) the Governorate information material and train park staff and Tourism Authority staff on basic information management, communication and presentation strategies on the implementation plan
- ✓ Train Governorate key employees from different departments on tourism management and marketing and facilitate the development of an integrated marketing strategy that involves also private sector stakeholders.
- ✓ Develop ecotourism attraction inventories in a systematic and categorized way, identifying focal, complementary and support attractions. These inventories should be the basis for promotional and marketing efforts.
- ✓ Hire specialists that identify important visitor target groups and develop custom target brochures and other information material who should professionalize the existing Governorate website and link it up with other existing websites on Fayoum.
- ✓ Develop and distribute best practices and information material for visitors, hotel owners, and tour operators.
- ✓ Train and assign a market researcher that provides key stakeholders with information on existing markets, on tourism related fairs and with general relevant information on the visited sites and on Fayoum.
- ✓ Institutionalize and participate in relevant tourism fairs.
- ✓ Take the interest and operational process of the private sector into account when developing and implementing a market strategy.
- ✓ Marketing should emphasize environmentally sound and socioculturally equitable behaviour on the part of the tourists and the tourism industry in general.

4. Management

General context

The Wadi Al-Hitan or "Valley of Whales", located within the Wadi el Rayan Protected Area (WRPA), is considered a palaeontological site of international importance due to the presence of unique fossils of some of the earliest forms of whale discovered to date (Gingerich, 1992; Abed & Attia, 2001). Large numbers of skeletons of *Zeuglodon* (also known as *Basilosaurus*), dating from the Upper Eocene appear to be closely grouped on bedding planes, in what was perhaps a death assemblage of "beached" whales that may have died together along a paleo-shoreline (Dolson, 2001).

We are grateful for the NCS, EEAA, for providing us with the detailed Management Plan as well as the Monitoring Report (both attached) from which we extracted the information below.

The Wadi Rayan Protected Area (WRPA) covering a total area of 1,759 km^2 was instituted in 1989 by Prime Ministerial decree N. 943 (Fig. 1). The WRPA enjoys the highest number of visitors of any protected area in Egypt outside the South Sinai. Some 150,000 people visit it each year, the vast majority being Egyptians. Demand for the WRPA as a recreational destination is likely to continue to rise, given the crowded conditions prevailing in many urban areas in Lower Egypt. Greater Cairo, with an estimated population of 16 million, is one of the world's largest cities and is situated less than 100 kilometres away. Expected sustained economic growth throughout the region will increasingly give city-dwellers the means to satisfy their rising requirement for recreation in open and clean spaces.

In 1998 the Egyptian and Italian Governments, respectively through the Environmental Affairs Agency (EEAA) and the General Directorate for Development Cooperation, have initiated a conservation and development project to support the Wadi el Rayan Protected Area. The World Conservation Union (IUCN) participates in an advisory capacity by providing technical support in accordance with internationally recognised guidelines and strategies related to the sustainable management of protected areas.

The WRPA has been defined as a Managed Resource Protected Area or Type VI area according to current IUCN/WCPA categories, although its closeness to Cairo and its unusually high potential as a recreational and educational area are more in line with Type II or V areas. The approach adopted by the project has therefore conformed to the management objectives of Type VI areas by focusing on the conservation of biodiversity and sustainable economic production, but has also taken into account the specificity of the WRPA by contributing to its development as a prime recreational and educational area.

a. Ownership

All desert land in Egypt is Government property. Hence declaring a Nature Reserve in a desert area does not need depossessing its owners. However, Bedouin tribes have traditional rights in land use that the Government acknowledges but does legally recognize. The Government recognizes right of land to Bedouins in two cases only: a home built of stone, and/or land cultivated with tree crops. In Wadi Al-Hitan there are absolutely no Bedouin inhabitants and no agriculture. There were therefore no problems of land ownership here. The Wadi el-Rayan was declared a Protected Area

according to Law 102 of 1983, which provides the framework for Protected Areas in Egypt. The entire area proposed to UNESCO has been declared protected by Prime Ministerial Decree #943. According to Law 102 of 1983, which provides the framework for Protected Areas in Egypt, the Egyptian Environmental Affairs Agency (EEAA) is the legal owner of the area.

b. Legal status

As mentioned above, WRPA has been declared protected and falls under the direct jurisdiction of EEAA. Law 102 of 1983 provides the legal framework for this protection. As of 1991, the policy of EEAA towards protected areas are as follows: "to construct an efficient network of natural parks, protected areas, and the wisely thought of multiple use management areas, by developing the recently declared sites and selecting new locations; integration of protectorates programme with the social and economic development, to attain sustainable development, conservation of biological resources, its monitoring, surveying, survival and development, to maintain sound management, and administration of protected areas projects and enforcing Law No. 102/1983. As mentioned above, the site has been declared protected and is falling under the direct jurisdiction of EEAA.

c. Protective measures and means of implementing them

WRPA is directly managed by the Nature Conservation Sector (NCS) of the Egyptian Environmental Affairs Agency (EEAA). The NCS is directly responsible for the management of the areas.

Any visitor wishing to go to Wadi Al-Hitan has to obtain prior permission from WRPA Administration, and has to be accompanied by a Park Ranger travelling with the visitor(s) in a Park 4x4 vehicle. The track to the fossil site is marked and the fossils themselves are surrounded by a fence to prevent trampling (Figs. 21 and 22).

It is important to note that other authorities have a certain management authority with regards to their specific areas of competencies. The Supreme Council of Antiquities (SCA) would have to give prior permission if somebody would like to make archaeological excavations within the areas of any of the suggested sites. The permit given by the SCA in any case is to be followed by and conditioned by another permission that is necessary from the EEAA management authority if the arachaeological site is within a Nature Reserve.

The Antiquities Law 117/1983

Law number 117/1983 for the Protection of Antiquities, Article 22, stipulates that no permit for buildings on an archaeological site can be given. Similarly, canals, graveyards, roads, or farming cannot be allowed, nor planting of trees, their uprooting, removal of debris, of soil, of fertilizers, or any change of features can be allowed. This rule applies also to a buffer zone of 3 km wide of land around the site, or any other distance decided by the Supreme Council of Antiquities, that would ensure the protection of archaeological remains in the site or nearby.

The Environment Law 4/1994

The rules and regulations of Law 102/1983 on Nature Protectorates (Nature Reserves) are applied to the entire area of the WRPA, White Desert, and Siwa Nature Protectorates.

According to *Article 2* of this Law:
"It is prohibited to carry on actions or take measures that would result in destruction or deterioration of the natural environment, or harm to terrestrial or marine life, or to the area's natural beauty. It is also prohibited to raise buildings, build roads, move vehicles, or carry on any agricultural, industrial, or commercial activities within the area of the Protectorate, except by license from the competent administrative authority, according to conditions, rules, and measures that are to be issued by Decree from the Prime Minister".

Article 3 of the same Law stipulates, for the buffer zone:
"It is not allowed to practice any activities or business in the areas surrounding the Protectorate, that are to be delineated by the competent Minister, at the proposal of the Environmental Affairs Agency, if these activities are to affect the environment of the Protectorate, or its natural phenomena, except by license from the competent administrative authority."

These rules and regulations are realized through the vigilant care of the Egyptian Government (the Nature Conservation Sector of the State Ministry of the Environment for the Nature Protectorate the Ministry of Culture for Antiquities, wherever applicable), and their various policing bodies, principally the Security Corps and the Tourist Police, or the Water Surfaces and Environment Police, as the case may be. There are various security systems, starting with the Park Rangers and ending with the District Attorneys and Criminal Courts. The relatively great distances of the regions in question and the consequent difficulty in access have contributed to a large extent in this sense, at least up to now. If tourism is to increase to higher volumes, this is luckily more than compensated for by a correspondingly increased care and vigilance on the part of the Egyptian Government.

Prime Minister's Decrees
Regulations set by the Prime Minister's Decrees for the declaration of specific nature reserves in Egypt, are based on the stipulations spelt out in that Law, and reiterate them, with some modifications according to the nature and requirements of each newly declared Nature Reserve. We can give the regulations for WRPA as follows:

Prime Minster's Decree number 943/1989 makes the specific following arrangement for the WRPA and Lake Qaroun Protected Area (both in Fayoum Governorate, except for a small portion of the latter, in Giza Governorate), as such:

Article 2: "A branch of the EEAA is to be established in Fayoum Governorate, to be administered by an Executive Council under the Chairmanship of the Governor of Fayoum, with membership representing the Ministries of Agriculture (Agency for Wildlife Protection and Zoos), Defence, Tourism, Housing, Interior, and Culture, and Cairo University, the EEAA at the Cabinet of Ministers, the Academy of Scientific Research and Technology (National Oceanography and Fisheries Institute), and the Desert Research Center … … This Branch is charged with executing the competences spelt out in Law 102/1983".

Article 3: "Are prohibited any actions or activities or measures that would destroy or spoil or degrade the natural environment or harm wild animal or plant life, or affect its aesthetic standard, within the two Protectorates. The following is especially prohibited:

- Hunting, transporting, killing, or disturbing terrestrial or aquatic organisms, or doing activities that can destroy them, limit their growth, affect their hereditary characteristics, or destroy their habitats,
- Destroying or transporting plants within the two Protectorates,
- Destruction or spoiling of geological formations or geographical features or areas that are considered habitats for animal or plant species or for their reproduction,
- Introducing alien species to the areas of the Protectorates,
- Polluting soil, water, or air in the areas of the Protectorates,
- Discharge of harmful liquids, chemical substances, oils, or any garbage of any kind ito areas of the Protectorates, or in adjacent areas, if they may flow into these areas,
- Throwing away food wrappings and food remains or other refuse.

Also prohibited is the erection of buildings, paving roads, moving vehicles, or any agricultural, industrial, or commercial activities in the areas of the Protectorates, without obtaining a permit from thr the EEAA Branch at the Governorate, according to the conditions, rules, and procedures that are promulgated by a decision from the Prime Minister.

Article 4: The Governor of Fayoum is to supervise suitable measures for the guarding of the areas of the two Protectorates.

Article 5: The Executive Council is to assume direct responsibility that aims at developing and upgrading the areas of the two Protectorates. It has especially to:

- Prepare studies and programmes necessary for the upgrading and development of the two Protectorates,
- Monitoring of environmental phenomena and organizing censuses of terrestrial and aquatic organisms within the areas of the two Protectorates, and keeping records for each species,
- Management and coordination of activities related to the two Protectorates,
- Informing and educating the public about the objectives and aims of establishing nature reserves.

WRPA Administration has already appointed “Community Guards” from among the neighbouring tribe members. They will be moving on camel back to better monitor the landscape.

It is important to note that other authorities have a certain management authority with regards to their specific areas of competencies. For example, the Governorate of Fayoum, being the administrative body in charge of management at Governorate level, would have to agree on building an outpost in the Valley of the Whales; equally, the Supreme Council of Antiquities would have to give permission if somebody would like to make archaeological excavations within the areas of any of the suggested sites. Their authority though in any case is subordinated to EEAA’s management authority and conditioned by it.

The area is direclty managed by the Nature Conservation Sector of the Egyptian Evnironmental Affairs Agency (EEAA). Other agencies have a management authority with regards to their competencies. The Governorate of Fayoum, for example, is responsible for supervising the guarding the two Protectorates, according to Article 4

above. would have to agree on building for example an outpost in the Valley of Whales; the Supreme Council of Antiquities would have to give a permission if a team would like to make archaeological excavations etc.

A provisional and non-exhaustive set of key management guidelines aiming at the development and conservation of the Wadi Al-Hitan site are outlined here:

Infrastructure and logistics

Permanent outpost. In order to counter the extremely hot and windy conditions prevailing in Wadi Al-Hitan, while mitigating the visual impact of the outpost, a simple design based on the long-standing experience of the Wadi El Rayan Coptic monastery is adopted. Sighted in a strategic location overlooking the open-air display, the outpost could be formed by three caves dug in the rocky escarpment and a small office/utility building oriented to act as a windshield. A rough sketch-plan for such an outpost was given in IUCN (1999) and more detailed plans have since been developed by the PAMU. Several possible sites for such an outpost have been identified but prior to making a final selection, the logistical implications of potential sites should be field-tested through the establishment of a temporary tented camp (Figs. 29 and 30) in Wadi Al-Hitan.

Transport. (i) N.1 Double cabin Toyota Hilux for liaison between PAMU headquarters and the Wadi Al-Hitan outpost; (ii) N.2 off-road motorbikes (e.g. Honda 250cc, trial bikes) for patrolling of Wadi Al-Hitan site and surroundings; (iii) N.6 camels for transport and logistics between Wadi Al-Hitan and Uta.

Communication. (i) 1 VHF base unit with relay station; (ii) 1 VHF mobile unit for vehicle; (iii) 4 walkie-talkie units. (iv) 2 GSM mobile phones.

Current activities at WRPA

- Further strengthening of the Field Unit
    - Evaluation, selection and Recruitment of trained staff by EEAA.
    - Preliminary proposal for staffing structure
    - Logistics and equipment
    - Follow up of priority issues (e.g. rallies)
    - Start up of administrative procedures for operations
    - Introductory meetings with local authorities and stakeholders by the PA manager.
- Preparatory activities
    - Planning, evaluation of priority actions, initial survey of declared boundaries (with the support of IUCN Senior Advisor)
    - Visitor management: visitor survey.
    - Public awareness: continuation of the program of Public Awareness in schools.
    - Production of information brochure
- Constraints:
- Prolonged unavailability of the vehicle assigned to the Unit
- Occasional difficulties in obtaining permission from military offices for access to desert areas.

Recommended actions for the coming months:

- Mobilize resources (funds for recurrent expenditures, ensure availability of vehicle)
- Ensure support to the field unit at the end of the extension

e. Level at which management is exercised (e.g., on property, regionally) and name and address of responsible person for contact purposes

Management is exercised in WRPA, White Desert, and Siwa, through the Nature Conservation Sector of the EEAA. Coordination with local government authorities (City Council and Governorate), and the local population is always ensured. In Bahariya Oasis, Environment Law #4/1994 controlling the Egyptian environment in general terms, applies, with the direct supervision of the EEAA.

The Institutional Framework

The majority of Reserves in Egypt suffer from some institutional problems due to interference in competences between the EEAA, represented by the administration of the Resreve, and other governmental or non-governmental administrations or organizations, such as the Governorates or Ministries, that have something to do inside the Reserve, such as the Ministry of Agriculture, or tribal organizations, that use the land or the resources of the Reserve or exploit it. Such interferences are a hindrance to the proper administration of the Reserve. They result in a serious loss of time and energy spent to solve them.

In order to avoid these conflicts, these organizations must, from the very beginning, not be separated from decision making. They must participate in solving the problems faced by its administration, and in political and social support (and probably financial) of these solutions. They can help in finding suitable alternatives for the economic activities that may be affected by these decisions. It is therefore suggested that a Governing Board for the Reserve should be established, comprising delegates of these stakeholder organizations. This Board should meet periodically and regularly under the joint supervision of the Ministry of the Environment and the Governorate.

Wadi Rayan is a protected area managed in cooperation with the Italian Government experts with experience in the management of the Protectorate for the last three years, Name of the Manager: Eng. Hossam Kamel:Tel:084- 830535

f. Agreed plans related to property (e.g., regional, local plan, conservation plan, tourism development plan)

In 1998 the Egyptian and Italian Governments, respectively through the Environmental Affairs Agency (EEAA) and the General Directorate for Development Cooperation (DGCD), have initiated a conservation and development project to support the Wadi el Rayan Protected Area. The World Conservation Union (IUCN) participates in an advisory capacity by providing technical support in accordance with internationally recognised guidelines and strategies related to the sustainable management of protected areas (Figs. 23-25).

The Wadi El-Rayan Protected Area is currently planning to construct an outpost in the Valley of Whales to ensure a permanent presence of park staff in the site.

The second phase of the Italian-Egyptian Environment Program for Wadi Rayan is also planning to provide technical management support and financial support for the

outpost construction and management. The support will be delivered direlcty by the program and by IUCN, the World Conservation Union

The WRPA Management Plan (attached) has been prepared in accordance with the management planning system for the protected areas of Egypt. Using the 1994 IUCN protected area management categories; WRPA has now been classified in a two-category system. A first category II part, managed mainly for ecosystem protection and integrity, environmental education, and ecotourism, and a second category IV part, managed mainly for the sustainable use of natural ecosystems, environmental education, and recreation.

The main management issues of WRPA are the variety of agencies and authorities that operate inside WRPA, including the Ministry of Agriculture and Land Reclamation, the Ministry of Petroleum, the Ministry of Water Resources and Irrigation, the Ministry of Tourism, the Ministry of Defence, and the Ministry of the Interior. It is also a major site of economic development and a popular site of recreational attraction for local and foreign visitors. The current rate of water extraction and evaporation from the lakes (created in the 1970's), exceeds the inflow, and this places the future of the lakes system in jeopardy.

The main external management constraints are the weak collaboration among te Egyptian authorities involved in WRPA, the continuous expansion in both volume and variety of human activities inside WRPA, and the overuse of some resources of the protected area (e.g., the water of the lakes). Inadequate funding for running expenses, training, communication tools, etc., and the lack of permanent operating staff inside the protected area, are the main internal constraints.

Zoning into homogeneous use areas is an essential tool for the management of a protected area, allowing differential management, considering the different characteristics of each zone. WRPA has zones permitting zero impact, low impact, moderate impact, and high impact.

The natural resources of WRPA are under threat from the economic and human activities within it, but sound management practices, law enforcement (in collaboration with stakeholders), and monitoring, can ensure the sustainable use of its natural resources.

This management plan covers the period 2002-2006. It includes collaborative management, improving control over water use in the lakes, adaptive management, and focussing at the level of management zones.

The Governor of Fayoum described the management plan of WRPA as an essential tool for achieving the required level of coordination among the various public agencies active in the Protected Area.

All key stakeholders are being continuously informed and involved from the start of this management plan. The management t plan has been forwarded to the appropriate collaborating authorities for endorsement. The development of public awareness programmes in WRPA is a main and important component of its management plan.

The management strategy is being achieved through using the following management tools: environmental regulations and law enforcement, communication,

documentation, monitoring and research, GIS and remote sensing, and EIA (environmental impact assessment).

The critical resources needed for the management of WRPA are infrastructure and equipment, financing, and staffing.

The WRPA project was funded by the Egyptian-Italian Environment Programme in the First Phase (March 1998-February 2001) and implemented by EEAA with international technical assistance from the World Conservation Union (IUCN). The transition phase started in June 2001 and stopped in December 2003, again with technical assistance from IUCN. The Second Phase is expected to begin early 2004, as one of the components of a broader support programme to the EEAA, the Nature Conservation Sector (NCS). It is funded by the Directorate-General for Co-operation Development (DGCD) of the Italian Foreign Ministry.

g. Sources and levels of finance

Sources of finance:

EEAA except for Wadi Rayan protected area for the last three years was cooperation with Italian Government. The White Desert PA is fully financed by the Egyptian Government, while the Siwa PA is co-financed by the Government of Egypt and the Italian Government. The Egyptian Government finances, among other things, the establishment of the infrastructure and the salaries and wages of employees.

Level of finance:

The outpost plans of the Protected Area are sponsored by EEAA. The Egyptian-Italian Enviornment Program is sponsored by the Italian Government.

Business plan. A business plan for the Wadi Al-Hitan site covering a period of 3-5 years, will be developed and implemented. Detailed budgetary requirements will be defined in terms of investments and operating costs and potential sources of revenue quantified based on a system of fees and other income generating and fund raising activities based on the leveraging of funds from government agencies, donor-sponsored projects and the private sector.

Marketing. A finely-targeted outreach programme will be designed to build the image of Wadi Al-Hitan as a unique conservation area and highlighting its significance as a palaeontological site. Effective tools based on the press, electronic and web-based media will be designed to disseminate information to a wide national and international constituency.

Conservation Fund. A permanent fund will be established and endowed in order to support the long-.term and sustainable management of the Wadi Al-Hitan site. A stable institutional mechanism such as a Wadi Al-Hitan Management Board will provide an umbrella for all key stakeholders and ensure the necessary conditions of pluralism, credibility and transparency, which are crucial prerequisites for the effective management of such a Conservation Fund.

Schedule of the Implementation for WRPA

ACTIVITIES	2002		2003				2004				2005	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Human resources												
Deployment of Range Manager												
Recruitment of Community Guards												
Training of staff												
Infrastructure & logistics												
Site-selection and design of outpost												
Construction of outpost												
Procurement of equipment												
Visitor facilities and services												
Rehabilitation of Main Gate outpost												
Demarcation of new access track												
New ticketing system												
Establishment of open-air museum												
Camping sites												
Guided trekking tours												
Camel-tours												
Bedouin-style ecolodge												
Financial sustainability												
Design of business and marketing plans												
Outreach and promotion activities												
Design of Conservation Fund												
Endowment of Conservation Fund												

Budget for the Implementation Plan of WRPA

Code	Budget Items	Units	Qty	Unit cost	Total (Note 1)	
					L.E.	US $
1.	**TECHNICAL ASSISTANCE**					
1.1	Design of infrastructure	m/m	3	5.000	15.000	3.529
1.2	Ecotourism facilities and services	m/m	3	5.000	15.000	3.529
1.3	Business and marketing plans	m/m	4	5.000	20.000	4.706
1.4	Outreach and promotion	m/m	5	5.000	25.000	5.882
1.5	Unallocated	m/m	4	5.000	20.000	4.706
	TOTAL TA				**95.000**	**22.353**
2.	**OPERATIONS & MAINTENANCE**					
2.1	**Expenditure**					
2.1.1	Outposts Operating Expenses	m	36	1.000	36.000	8.471
2.1.2	Museum Operating Expenses	m	36	500	18.000	4.235
2.1.3	Vehicle operating expenses	lump	1	90.000	90.000	21.176
2.2	**Personnel**					
2.2.1	Allowances existing PAMU staff	lump	1	20.000	20.000	4.706
2.2.2	Community Guards	m/m	216	600	129.600	30.494
2.2.3	Local travel	lump	1	10.000	10.000	2.353
	TOT. OPER. & MAINT.				**293.600**	**69.082**
3.	**EQUIPMENT & SUPPLIES**					
3.1	Rehabilitation Main Gate Outpost	lump	1	150.000	150.000	35.294
3.3	Fossil Area Outpost	lump	1	400.000	400.000	94.118
3.4	Tracks and signposts	lump	1	200.000	200.000	47.059
3.5	Open-air museum	lump	1	1.000.000	1.000.000	235.294
3.6	Ecotourism facilities	lump	1	150.000	150.000	35.294
3.7	N.1 Vehicle	lump	1	100.000	100.000	23.529
3.8	Communication equipment	lump	1	100.000	100.000	23.529
3.9	Field equipment	lump	1	50.000	50.000	11.765
	TOT. EQUIP. & SUPPLIES				**2.150.000**	**505.882**
4.	**ACTIVITIES**					
4.1	Training of staff	lump	1	75.000	75.000	17.647
4.2	Pilot ecotourism services	lump	1	100.000	100.000	23.529
4.3	Outreach and promotion	lump	1	300.000	300.000	70.588
4.4	Establishment of Conservation Fund	lump	1	100.000	100.000	23.529
	TOTAL ACTIVITIES				**575.000**	**135.294**
TOTAL PROJECT					3.113.600	732.612
INITIAL ENDOWMENT OF CONSERVATION FUND					1.500.000	352.941
GRAND TOTAL					**4.613.600**	**1.085.553**

h. Sources of expertise and training in conservation and management techniques

In general, for the last fifteen years the Government of Egypt in cooperation with the European Union work together to establish and develop the Gulf of Aqaba Nature Reserves and the St. Catherine Protectorate, the US/AID cooperates to establish the Red Sea Protectorates, the Italian Government cooperates to establish the Wadi El-Rayan Protectorate and some others. International expertise supports the training programmes, and the work and management plans for these areas. Expertise is transferred to the senior staff. EEAA supports the training of staff locally and abroad. Non-governmental organizations cooperate to train the EEAA staff and to assist them in various environmental matters.

The European Union established the NCS training center at Sharm El-Sheikh where nowadays the basic training of the newly recruited staff takes place.

Park Rangers have received a fair amount of conservation management training. Priority was given to technical biodiversity subjects. One Ranger, a trained palaeontologist, has received on-the-job training in conservation by a number of national and international palaeontologists. No training has yet been provided with regards to site management and visitor management.

WRPA is directly managed by one authority; each protected area having a local headquarter, headed by an Area Management (Manager) that reports directly to the Director of the Nature Conservation Sector of EEAA.

The responsible person for contact purposes is:
Dr. Mostafa Foda
Director, Nature Conservation Sector (NCS)
Egyptian Environmental Affairs Agency
Tel: + 20 (2) 5248 792 / 527 1391
Email: foudamos@link.net

Rangers of the Protected Areas received a fair amount of conservation management training. Priority was given to technical biodiversity subjects. Some Rangers acquired additional qualifications (3-month training periods in Kruger National Park in South Africa, or, for example, a Masters Degree from the UK). In general, the Rangers and Managers of the Protected Area do have a good technical background.

Lacking is management training for mid-management staff (Protected Area Manager) and general training in visitor management and tourism planning – in particular in view of the high visitor pressure existing in the sites.

i. Visitor facilities and statistics

Visitor facilities

A Visitor center at the water falls of Wadi Rayan lakes (Fig. 26) with an external exhibit of one of whale backbones. Brochures and information about the history of W. Hitan is available as well the track to the area being marked for about 44 km from the asphalt road. Notification to local authorities and the Protectorate prior to the visit of the area of W. Hitan is obligatory, just to follow up the safety of visitors, due to the rough road. Community Guard recruitment is in process.

A Visitor Center (Fig. 26) has ben opened a few months ago. It has a fossil museum, large wall charts, a lecture hall for groups, and a fossil whale skeleton at its doorstep, brought from Wadi Al-Hitan. It is expected that even if some visitors are unable to visit Wadi Al-Hitan itself, they can get a glimpse of what it is about at the Visitor Center.

Statistics

Visitor statistics are obtained from the sale of tickets at the official entrance gate. It is estimated that 150,000 visitors come to WRPA annually, but only not more than perhaps one thousand people visit Wadi Al-Hitan, as it needs 4x4 vehicles and the road is not paved, passing through a treacherous sandy area between the lakes and Gebel Gahannam. Visitor facilities exist in the sites. There is still to be established a

monitoring system in place and protected area staff is not permanently present in the sites.

Access. The official access to the Wadi Al-Hitan site is through the Main Gate outpost of the WRPA, which will be rehabilitated and enlarged in order to accommodate ticket collectors as well as other PAMU staff. The existing track, which has been demarcated from the main road to Wadi Al-Hitan, will be modified so as to start from the Main Gate outpost. A guiding/security service is offered to legal visitors.

Ticketing. A new ticketing system will be established which differentiates between nationals and foreigners and with a specific additional fee levied for visiting the open-air museum in Wadi Al-Hitan.

Open-air museum. The open-air museum is established over a 1-2 km radius core area of the Wadi Al-Hitan fossil site. It will feature state of the art interpretation facilities and displays on the unique geology and palaeontology of the site and several professionally prepared skeletons. Vehicular access will be strictly reduced.

Camping. Two camping sites with basic facilities will be established and maintained. Camping may be allowed away from allocated areas but a special permit will need to be arranged with the PAMU.

Ecotourism services. Services will be provided by licensing private sector initiatives in the following areas: (i) guided trekking tours; (ii) camel rides either in Wadi Al-Hitan or along the ancient caravan trails approaching the Fayoum depression through Uta and Kasr Qaroun (iv) a Bedouin-style eco-lodge offering the "deep desert experience" (a preliminary proposal for such a facility has already been developed by the PAMU as part of an overall study for the development of ecotourism in the WRPA).

j. Site management and statement of objectives (copy to be annexed)

The conservation and development of the Wadi Al-Hitan site requires special and urgent attention. Against a backdrop of rapidly increasing visitor numbers, the key management issue is to strike the right balance between facilitating access for visitors, the need for extra surveillance and the logistical implications of maintaining a significant presence in this highly sensitive and remote section of the protected area.

Based on the proposed overall objectives and future activities of the WRPA project, the specific management objectives for the Wadi Al-Hitan site may be summarised as follows:

- Firmly establish a permanent presence of the WRPA Protected Area Management Unit (PAMU) in the Wadi Al-Hitan site.
- Ensure the participation of local stakeholders in the sound and collaborative management of the site.
- Promote Wadi Al-Hitan as a leading site for non-intrusive eco-tourism and environmental education.
- Ensure that the conservation and development of the Wadi Al-Hitan site is financially sustainable.

The management plan is annexed to this Nomination File. Its Executive Summary runs as follows:

"Wadi El-Rayan Protected Area has been declared by prime-ministerial decree No. 943 in 1989 according to law No. 102/1983 of the protected areas in Egypt, and is directed by the Nature Conservation Sector (NCS) of the Egyptian Environmental Affairs Agency (EEAA). The overall management goal of the protected area is the protection of the natural resources in accordance with the declaration decree of the protected area.

Using the 1994 IUCN protected area management categories, WRPA has now been classified in a two-category system. A category II part managed mainly for ecosystem protection and integrity, environmental education and ecotourism, and a category VI part managed mainly for the sustainable use of natural ecosystems, environmental education and recreation.

WRPA is a desert area situated in the Fayoum Governorate of the Western Desert of Egypt. In the nineteen seventies two lakes were created in the lower portion of Wadi El-Rayan sub-depression to channel out excess agricultural drainage water. The creation of a large body of water in this hyper-arid area had a striking ecological impact and new species of plants, mammals, birds and invertebrates moved to Wadi El-Rayan area.

The main management issues of WRPA are the variety of agencies and authorities that operate inside WRPA, including the Ministry of Agriculture and Land Reclamation, Ministry of Petroleum, Ministry of Irrigation, Ministry of Tourism, Ministry of Defence and Ministry of Interior. It is also a major site of economic development and a popular site of attraction for local and foreign visitors. The current rate of water extraction and evaporation from the Wadi El-Rayan lake system, exceeds the inflow, and this places the future of the lake system in jeopardy.

The main external management constraints are the weak collaboration among the Egyptian authorities involved with WRPA, the continuous expansion in both volume and variety of the human activities inside WRPA, and the overuse of some resources of the protected area (e.g. the water of the lakes). Inadequate funding for running expenses, training, communication tools, etc., and the lack of permanent operating staff inside the protected area are the main internal constraints.

Zoning is the division of the protected area into zones of homogenous use and is an essential tool for the management of a protected area, which allows differential management considering the different zones characteristics. WRPA has zones permitting zero impact, low impact, moderate impact and high impact.

Development of clear strategies for the management of WRPA is one of the desired outputs of this management plan covering the period 2002-2006 and the strategies include collaborative management, improving control over water use in the lake system, adaptive management, and focusing at the management zone level.

The Governor of El-Fayoum expressed his appreciation to WRPA for initiating the management planning process at WRPA and described the Management Plan as an essential tool to achieve the required level of coordination between the various public agencies active in the Protected Area.

All key stakeholders are being informed and involved from the start of this management plan continuously. The management plan will be forwarded to the appropriate collaborating authorities for endorsement.

The natural resources of the protected area are under threat from the economic and human activities within WRPA but sound management practices, law enforcement (in collaboration with stakeholders) and monitoring can ensure the sustainable use of the natural resources.

The public use inside the area has been identified to include eco-tourism activities, human economic activities and human settlement.

The development of the public awareness program in WRPA is a main and important component of the management plan of the protected area.

The management strategy is being achieved through using the following management tools; environmental regulations and law enforcement, communication, documenting, monitoring and research, GIS and remote sensing, and EIA.

The critical resources needed for the management of WRPA are infrastructure and equipment, financing and staffing and are described in the plan.

The WRPA project was funded by the Italian-Egyptian Environmental Program in the first phase (March 1998 - February 2001) and implemented by EEAA with international technical assistance from the World Conservation Union (IUCN). The transition phase of the WRPA project started in June 2001 and ceased in December 2002. As one of the components of a broader support programme to the Egyptian Environmental Affairs Agency (EEAA), Nature Conservation Sector (NCS), funded by the Directorate General Co-operation Development (DGCD) of the Italian Foreign Ministry, the total proposed budget of the second phase of WRPA project is 6,024,000 L.E. until December 2005 shared with the NCS/EEAA."

An attempt at signage by a dedicated group was made in 2002 to put in signs of the Wadi Al-Hitan area fossil whale area (Fig. 27).

Advice to Visitors

To help preserve the beauty of the Wadi Rayan Protected Area, as in all other Egyptian protected areas, visitors are advised to follow these rules:

• Not to disturb or damage animals and plants.
• When driving, follow the marked tracks.
• To avoiding driving on vegetated areas.
• Not to collect, move or damage fossils, rocks or geological features.
• Not to leave any garbage.
• To avoid loud noise and the use of sound systems.
• Not to damage or pollute water sources.
• To respect the customs and sensitivity of the local community.

And for their safety, they are reminded that:

• A permit from military authorities is required for access to many areas, so they must make sure you have it before starting off.
• In order to visit the Protected Area, 4WD vehicles are necessary; travelling in convoys of at least 2 vehicles is recommended.
• If they are not experienced, some areas may be dangerous; the services of a guide are recommended for visiting the desert.
• Travelling time in the desert may be deceivingly long; they should make sure they are properly equipped and take with them enough food and water.
• Before leaving they should let someone know where they are going and when they are expected back.

Useful Contacts

Nature Conservation Sector, **EEAA, Cairo.** Tel. +20 (2) 5248792 / 5271391.

k. Staffing Levels (professional, technical, maintenance)

	Professional	Technical	Maintenance	Total
Number	**15**	**10**	**14**	**39**

5. Factors affecting the property

a. Development pressures (e.g. encroachment, adaptation, agriculture, mining)
So far no kind of development pressure on the nominated site herein, but for safety purposes, the Egyptian National UNESCO Committee recommend to the Governor of Fayoum to keep urban and agricultural development away enough from the fossil locations, while the Egyptian Urban Planning Authority requests from EEAA all conditions and limits proposed for urban planning and development of Protectorates. Local authorities consider a protectorate within their limits a treasure, as new income generation for the local people that should be kept from any kind of encroachment.

b. Environmental pressures (e.g. Climate change)
Climate in Egypt
The bioclimatic provinces in Egypt are defined with some modification according to the system applied in UNESCO map of the world distribution of arid regions (UNESCO, 1979) . This system is based on the aridity index P/ETP where ETP (potential evapotranspiration) is calculated according to Penman's formula. Two classes are recognized: hyper arid (P/ETP< 0.03), and arid (P/ETP =0.03-020). These classes are, in turn, subdivided according to the mean temperature of the coldest month and that of the hottest month of the year. Consideration is also given to the time of the rainy period relative to the temperature region.

Accordingly, four climatic provinces are distinguished in Egypt:

(1) The hyper arid provinces include all the area between Lat. 22 and 30 N, except the coastal mountains along the Gulf of Suez.
   a) Hyper arid with a mild winter and a hot summer (mean temperature of the hottest month 20 – 30 C 0, this include Jebel Uweinat.
   b) Hyper arid with a cool winter (mean temperature of the coldest month 0 – 10 C), and a hot summer, represented around the high land of the southern Sinai.

   The rain in these provinces is less than 30 mm/yr and is occasional and unpredictable. (2) The arid province includes the northern section with winter rainfall, it extends along the Mediterranean coast and the Gulf of Suez. This section is distinguished into two provinces by the UNESCO/FAO map of 1963: the coastal belt province under the maritime influence of the Mediterranean, with a shorter dry period (attenuated), and the more inland with a longer dry period (accentuated), and an annual rainfall from 20 – 100 mm. Both provinces are characterized by a mild winter and a hot summer.

Temperature
The temperature regime in the desert of Egypt is governed mainly by the latitude location and maritime effect of the Mediterranean and the Red sea. The latitude effect is limited to the highlands: the Sinai Mountains, the Red Sea coastal chain and Jebel Uweinat at the western corner of the Sudan-Egypt border. Summer is generally hot (mean of the hottest month between 20°–30° C), or very hot (mean of the hottest month more than 30° C). Winter is either warm (mean of coldest month 20°-30°C) or mild (mean minimum of coldest month 10°-20°C) except on the highlands where the winter is cool with a mean minimum of the coldest month between 0°–10°C. The temperature along the Red Sea coast varies between a mean minimum of the coldest month of about 10°C towards the north and about 20°C towards the south and a mean

max of the hottest month of about 33°C towards the north and about 40°C towards the south. The range of variation becomes greater further inland (from about 4° to 38°C in the oasis of the Western Desert).

In continental locations temperature extremes of less than -4° C in the coldest month (e.g. Oases of the Western Desert of Egypt) have been recorded. The coldest month is between December and February, and the hottest month is between June and August in the hyper-arid provinces.

Relative Humidity

The relative humidity is affected mainly by the relative proximity of the Mediterranean and the Red Seas. The lowest records are those of inlands locations of the arid and hyper arid provinces and the highest are those of locations closer to the Mediterranean coast and in the Nile Delta within the arid province (e.g. mean min 60% and mean max of 72 % in Damanhur City). The Lowest records of the relative humidity are generally those of the late spring whereas the highest records are those of the late Autumn and early winter.

Rainfall

In general three rainfall belts may be characterized in the desert of Egypt:
(!) The Mediterranean coastal belt; (2) Middle Egypt, with Latitude 29N as its southern boundary; and (3) Upper Egypt. The first and second belts have a winter rainfall (Mediterranean regime), the rainy season extends from November to April, though mainly concentrated in December and January. These belts correspond roughly to the attenuated and accentuated arid provinces of northern Egypt, where the average annual rainfall ranges from 100=150 mm in the attenuated arid province, and from 20-100 mm in the accentuated arid province. It extends rather south along the Gulf of Suez to Lat. 26N due to the orographic influence of the Red Sea coastal mountains. The third belt is almost rainless; it corresponds roughly to the hyper arid province. Rain at the center of this belt is not an annual recurring incident; 10 mm may occur once every ten years. The rainfall increases gradually to the north until reaches about 20 mm at the borders with the arid province (at Giza).

Once of the major features of rainfall in arid and semiarid regions, other than being scanty, is its great temporal variability. Percentage variability (average deviation of annual precipitation from the mean, expressed as percentage of the mean) is greatest in the hyper arid province (e.g. Siwa oasis 83%) In the arid province the percentage variability is 65% at Giza, which is close to the hyper arid province.

Wind

Three high-pressure belts control wind circulation over Egypt: the Azores, the Indian subtropical, and the south Atlantic subtropical. Besides these, a permanent low-pressure belt, the doldrums, crosses the African continent in the vicinity of the equator. Seasonal high and low pressure systems also alternate over the continental mass, the red Sea, the Mediterranean, and the Arabian Peninsula.

Accordingly, two main flows may be distinguished: one originating in the north (the northerlies) and the other in the south (the southerlies) the tropical highs over the Indian and Atlantic oceans are the original sources of the southerlies.

In winter, the Sahara high pressure system dominates the circulation and the northerlies bring cool dry air from the North African continental source region, though occasionally the Arabian high brings warmer air to the eastern parts of the Sudan. Both of these types are occasionally interrupted by east west depressions along the Mediterranean and replaced by cold dry air from the Eurasian landmass. In spring and autumn, the Arabian high is more dominant in the east, and the effect of Mediterranean depression is relatively felt, as air from both the north African and the Arabian source is considerably warmer than in winter. In summer, the Sahara high is again dominant bringing hot dry air.

Occasionally, very hot dust-laden winds blow (Khamsin) which have numerous environmental consequences including a possible effect on climate, soil formation, ground-water quality and crop growth. They may create problems including substantial degrees of deflation and erosion, the spread of diseases through pathogen transport, the suffocation of cattle, disruption of transport and damage to property. Visibility during these storms is reduced substantially (below 1000 m). Dust deposition rate due to these storms in Egypt has been estimated as 371 t/km2 in individual falls. In the early seventies a normal rate of 131 t/km2 /yr was estimated in Cairo, which increased to 2236 t/km2 /yr (17-fold) in areas near quarries. The grains were of calcite, quartz, amorphous silica and very little montmorillonite.

The Wadi Al-Hitan site is exposed to both erosion and deposition. The whale skeletons found by Beadnell in the early 20th century are no longer there. They have been eroded. The skeletons discovered in the late 1980s are now either partially or, alternatively, buried under thick sand sheets.

Moisture regime

The evaporative power of the air in the hyper arid provinces of Egypt as measured by the Piche evaporimeter, varies in January from 3.6 mm/ day in Aswan to 7.9 mm/day in Dakhla oases. In the arid province, the mean min. evaporation rate during winter is, in general, within the same range as in the hyper arid provinces.

The annual potential evapotraspiration is, in general, lower in the arid province than in hyper arid provinces. The lowest is that of Giza (592 mm according to Penman's equation, and 1582 mm according to Turc's equation).

In general, common threats are: wind deflation, sand accumulation, weathering, morning dew condensation, and vehicle traffic (especially rallies).

c. Natural disasters and preparedness (earthquakes, floods, fires, etc)

Some rare flash floods do occur in the Western Desert of Egypt, at an average rate of perhaps once every decade. They usually follow wadi beds chiselled on the desert floor be earlier streams. As for earthquakes, the adjacent Gebel Qatrani north of Lake Qaroun was the epicenter of the well remembered 1992 earthquake which caused great havoc in Cairo, but had almost no effect on the desert landscape. Fire is not a problem in the desert with its sparse vegetation.

d. Visitor/tourism pressures

With the active PAMU in W. Rayan we state that there good controls on the visitors pressures as the driving the four wheels drive the visitors can enter the place of W. Hitan from different directions, within the recruitment of the community guards the control will be excellent, and as the other protectorate (Siwa, white desert just started

and because of there remote area and no that much visitors, NCs can state that very soon the visitors controls for these places will be excellent, But for the Bahariya Oasis the situation is critical because so far the area is uncontrolled, and the visitors can go any where with no limits, NCS will work with UNESCO to add the area to the White Desert protectorate but this issue will take some time.

e. Number of inhabitants within property

None in the Wadi Hitan site, but a few thousand in the Lakes area, especially on its eastern side, working as temporary or settled farmers and fishermen. About 150,000 visitors come to WRPA annually.

f. Other.

WRPA Administration has a well-equipped headquarters at the Lake area (Fig. 28). Park Rangers make their daily sorties to patrol and for monitoring purposes in all directions, and especially in the Wadi Al-Hitan area, to catch any illegal visitors and/or poachers (Figs. 29-30).

6. Monitoring

Understandably, the monitoring programme is not for Wadi Al-Hitan, but for the whole of WRPA. We present here a brief summary of the first monitoring report (El-Hennawy 2002, attached), kindly provided by the NCS, EEAA.

a. Key indicators for measuring state of conservation

The key indicators selected in the monitoring programme for WRPA as a whole, as given in the first monitoring report (El-Hennawy 2002), are:

- Climate, a meteorological station regularly records the usual climate data, and there is special attention to phenomena such as such as sandstorms, frost, high humidity, etc.
- Land use, to monitor encroachment for irrigation or habitation, as well as erosion, sand movement, etc.
- Human population (resident about 13,000 and temporary about 150,000), to monitor human resident population and visitor pressure
- Plant and animal biodiversity, to monitor status of biota, through number of species, plant cover, etc.
- Degree of pollution, to monitor possible effect on water quality, possible weathering of fossils, etc.
- Observance of WRPA regulations, to monitor visitor behaviour, waste production and removal, tracks, poaching, etc.

b. Administrative arrangements for monitoring property

The Director of WRPA and his staff are responsible for the monitoring activity in the field. They may be aided by external experts from the EEAA or from universities. Their job is:

1. Surveying and preparatory activities: patrolling and revision of proposed borders and areas to be included in the Protected Area (PA), biodiversity inventories.
2. Regular field visits to focal areas
3. Baseline activities on assessment and monitoring of resources
4. Preparatory studies: Traditional and current natural resource use. A Preliminary study for Collaborative Management in the PA
5. Overview of traditional land tenure and natural resource use within the PA
6. Identification of natural resource uses within the Protected Area (livestock herding, tourism, hunting, agriculture)
7. Evaluation of their economic value and threat assessment
8. Overview of traditional land tenure claims.
9. Preparatory studies: Traditional and current natural resource use. A Preliminary study for Collaborative Management in the PA.
10. Definition of an outline strategy to facilitate the successful establishment of Collaborative Management between the local stakeholders:
11. Preparatory process and establishment of start up team;
12. Technical studies (impact of herding practices, livestock carrying capacity, impact of safari tourism)
13. Implementation of Pilot Collaborative Management Agreements
14. Surveying and preparatory activities: Public Awareness and Tourism.
15. Public Awareness : program of schools visits
16. Ecotourism: survey of safari guides (questionnaire for people organizing desert tours).

c. Results of previous reporting exercise

Monitoring in the Wadi El Rayan Protected Area (WRPA) was carried for more than three years now (El-Hennawy 2002, attached). More advanced and organized presentations of monitoring activities were introduced by WRPA personnel, each in his field. The third year of the monitoring activities inside WRPA was organized and practiced mainly by WRPA staff after the ending over of the First Phase of the Egyptian-Italian Project, with less presence of the Italian side at the intermediate period (the time of the monitoring work). The report of the monitoring work includes the following: Introduction: The Basic Information, Specific Aims and Total Achievements.

Mapping:

Topographic, infrastructure and habitat and land-use maps were produced and their continuous update is presented. Three maps at the scale of 1:100,000 were produced, for topography, infrastructure, and habitat/land use.

Biodiversity monitoring:

Includes the different practices and methodologies applied and the interpretation of the results obtained in the third year of scientific monitoring programmes of WRPA. These programmes included the available aspects of the main elements of biodiversity, such as vegetation, birds, and mammals. With only 10 mm/year rainfall, the area id hyper-arid. Temperatures vary from mean 13° in winter to mean 29° in summer. The plant cover is made up of 3 categories: cultivated crops covering about 4000 acres, naturalized date palms, and the spontaneous vegetation. In the whale fossils area the main plant species are: *Cornulaca monacantha*, *Salsola imbricata* subsp. *gaetula*, *Tamarix nilotica*, and *Zygophyllum coccineum*, indicating high soil salinity. The distribution of the main plant species in the different habitats was mapped. Birds were monitored only in the Lakes area. On the other hand, mammals were monitored all over WRPA. The species were: *Canis aureus lupaster*, *Vulpes v. aegyptiaca*, *V. r. rueppeli*, *Fennecus zerda*, *Herpestes ichneumon*, *Felis sylvestris lybica*, and *Gazella d. dorcas*. All six species are rare or unobserved in the fossil area, except the fennec. *Gazella leptoceros* (reem), which was very rarely seen in the 1980s was not seen these days.

Resources and environmental monitoring:

This Includes the methodologies, results, and assessment of the natural resources within WRPA. Monitoring of geology and palaeontology, aquatic resources (water quality of the two Lakes, the Upper and the Lower), economic activities inside the Area, and their impacts on the environment of the Protected Area, and visitor monitoring. Photographs were made of 35 fossils every month. No damage was observed. A total of 25 fossil sites were examined for repair and 3 of them repaired. One fossil skeleton was transferred in front of the Visitor Center at the Lake shore, but this proved to be an experiment not to be repeated. As for the impact of economic activities, attention was especially paid to the oil well at the NE side of WRPA. Garbage is regularly collected and transferred to a garbage disposal site outside WRPA. Almost all activities are provided with septic tanks for sewage disposal. Regular visitor surveys are carried out. They show that Egyptian visitors constitute 99% of these. The age category with highest percentage is 21-25 years old.

The report on the third year of monitoring was carried out by the WRPA Rangers who became reliable sources of information and in collecting and presenting data, and are

able to evaluate and understand the proper way to keep the protected area well organized and managed.

7. Documentation

a. Photographs, Slides and, where available, film/video
See Atlas

b. Copies of property management plan and extracts of other plans relevant to the property.
See Attachments:

1. Atlas
2. Copy of the management plan for WRPA
3. Copy of the first monitoring report for WRPA

c. Bibliography

References given here and not mentioned in the text serve as additional explicatory material.

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d. Address where inventory, records, and archives are held.

1 - Main Depository:
Egyptian National Commission for UNESCO,
17 Kuwait Street (ex Ismail Aboul-Fotouh),
Dokki,
Cairo,
Egypt

2 - With copies at:
Nature Conservation Sector (NCS),
Egyptian Environmental Affairs Agency (EEAA),
State Ministry for Environmental Affairs (MSEA),
30 Misr-Helwan Agricultural Road,
Maadi,
Cairo,
Egypt

8. Signature on Behalf of the State Party

Name: Mrs. Mervat Omar

Position: Secretary-General,

Egyptian National Commission for UNESCO

Signature: ……..

Date: ……

ACKNOWLEDGEMENTS

Meeting with HE the State Minister for Environmental Affairs

HE Dr. Mamdouh Riad, State Minister for Environmental Affairs, kindly asked for a meeting with the Steering Committee charged with the preparation of the Nomination File for inscribing Egypt's Northern Oases on the Natural World Heritage List, in his office, on 8 September 2003 and encouraged us to go on with the work. He observed that the Whale Valley in Wadi El-Rayan Nature Reserve was under great threat of being very easily damaged due to frequent visitation by large numbers of tourists, reaching as much as 600 on one day. He gave us instructions and urged us to finalize the Nomination File as quickly as possible. We are glad to implement the first phase of this nomination by finalizing herewith the nomination file for the Wadi Al-Hitan (Whale Valley).

Thanks are due to H.E. Dr. Mamdouh Riad, Minister of State for Environmental Affairs, and H.E. Dr. Saad Nassar, Governor of Fayoum, for their valuable support and the facilities offered during the excursions made by the Working Team to the Whale Valley in December 2002.

Thanks are also due to the personnel of the Nature Conservation Sector (NCS) of the Egyptian Environmental Affairs Agency (EEAA), Ministry of State for Environmental Affairs (MSEA): Dr. Mostafa Fouda, Under-Secretary of State of the NCS, Mr. Mohammad Ibrahim, then Director of Nature Reserves, Eng. Atef Darwish, then Director of Nature Reserves and now Consultant at the NCS, Eng. Hossam Kamel, Director of Wadi El-Rayan Protected Area, and his collaborators, for kind help and facilities offered during our excursions, for providing the necessary maps and documents, and for actively participating in our meetings.

It is our pleasure to extend our deepest gratitude to the personnel of the Egyptian National UNESCO Commission: Mrs. Mervat Omar, Secretary-General, Mrs. Intisar Mashaly, Assistant-Secretary-General, Mrs. Mona Allam, Director of Science, Mrs. Gazebia Abdel-Rahman, Environmental Science Specialist, Mrs. Azza Abdel-Aziz, Hydrology Specialist, Mr. Samir Nagy, Logistics Specialist, Mr. Shahhat Abdel-Hady, Financier, and many others in the Commission who offered help without sparing any effort, to make this endeavour a success.

We are pleased and honoured to extend our deepest thanks and sincerest gratitude to our Cooperating Guests who gave us a most valuable helping hand in many aspects and phases of the work: Mr. John Dolson, Dr. Philip Gingerich, Dr. Marco Marchetti, Ms. Nina Prochazka, Mr. Richard Hoath (who kindly gave us a list of the birds), Mr. Rafik Ghabbour, and Miss Samiha Ghabbour.

A most crucial last minute help came from an anonymous world calibre expert in cartography, to whom we extend our deepest gratitude.

THE SCIENTIFIC WORK GROUP

The Work Plan consisted of a meeting of the National MAB Committee in July 2002 to nominate the Steering Committee from within its own members. It was constituted of Prof. Samir Ghabbour (Cairo University), Chairman of the Committee, Prof. (Mrs.) Ferial El-Bedewy, geologist at the University of Mansoura, and Dr. (Mrs.) Boshra Salem, botanist at the University of Alexandria. The Steering Committee met in August 2002 and recruited the following experts as a Task Force to carry on the work needed for the preparation of the Nomination File

*1 – Prof. S. Ghabbour, Chairman of Egyptian National MAB Committee, Conservationist, Coordinator and Editor of the Nomination File.
*2 – Prof. Ferial El-Bedewy, geologist
*3 – Dr. Boshra Salem, botanist
*#4 – Dr. Mostafa Fouda, Under-Secretary of Sate for the Nature Conservation Sector (NCS), Egyptian Environmental Affairs Agency (EEAA), Ministry of State for Environmental Affairs
#5 – Mr. Mohammad Ibrahim, Director-General for Nature Reserves, EEAA, MSE
6 – Prof. Mohammad Abed, geologist, Univ. of Mansoura (invertebrate palaeontologist)
#7 – Eng. Atef Darwish, Consultant, Central Directorate for Nature Reserves, EEAA,
8 – Dr. Zenhom El-Alfy, Vice-Chairman, Geological Survey
9 – Mr. Yousry Attia, Director of Fossils Section, Geological Museum (vertebrate palaeontologist)
#10 – Eng. Tarek El-Qanawaty, Director of the White Desert (Farafra Oasis) Nature Reserve
#11 – Eng. Hossam Kamel, Director of Fayoum Nature Reserves
#12 – Mr. Ali Metrash, Director of the Siwa Nature Reserve
13 – Mr. Hesham El-Hennawy, Arachnid Specialist
14 – Prof. Wagieh El-Saadawy, Biodiversity Consultant (mosses and fossil plants), Univ. of Ain Shams
15 – Prof. Loutfy Boulos, Biodiversity Consultant (higher plants)
16 – Dr. Mohammad Abdel-Maksoud, Archaeologist, Supreme Council of Antiquities
17 – Prof. Wafai Z. A. Mikhail, zoologist, Cairo University (soil invertebrates)
18 – Dr. Mohammad Ismail, Palaeo-botanist, Univ. of Alexandria
19 – Eng. Mohammad Meheina, GIS specialist
20 – Mr. Joseph N. Soliman, Archaeologist, Supreme Council of Antiquities

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* = MAB Committee members:
# = from the NCS, EEAA

The Task Force also includes from the Egyptian National UNESCO Commission: Mrs. Intisar Mashaly, Assistant Secretary-General, Mrs. Mona Allam, Director of Science, Mrs. Gazebia Abdel-Rahman (who participated in the May 2002 Amman Workshop on the Harmonization of Tentative Lists of Arab Natural World Heritage Sites), Mrs. Azza Abdel-Aziz, Mrs. Amal Abdin, Mr. Samir Nagy, and Mr. Shahhat Abdel-Hady, who provided all the needed help in the preparation of the meetings, and notably, correspondence, travel and financial arrangements. We are grateful to them. It is a fact that without their support our work could never have been done.

Wadi al-Hitan Task Force Teams

1 – Geology Team:

- Prof. (Mrs.) Ferial El-Bedewy (U. of Mansoura)
- Prof. Mohammad Abed (U. of Mansoura)
- Mr. Yousry Attia (Geological Museum)
- Dr. M. Ibrahim Ismail (U. of Alexandria)

2 – Plant Life Team:

- Prof. Loutfy Boulos (Intern'l Consultant)
- Prof. Wagih El-Saadawy (U. of Ain Shams)

3 – Animal Life Team:

- Prof. Samir Ghabbour (Cairo U.)
- Prof. Wafai Mikhail (Cairo U.)
- Mr. Hisham El-Hennawy (Intern'l Consultant)

4 – Protectorates Administration and Informatics Team:

- Prof. Mostafa Fouda (NCS, EEAA)
- Mr. Mohammad Ibrahim (NCS, EEAA)
- Eng. Atef Darwish (NCS, EEAA)
- Eng. Hossam Kamel (WRPA)
- Eng. Tarek El-Qanawaty (White Desert PA)
- Mr. Aly Metrash (Siwa PA)

5 - Mapping Team:

- Dr. Z. El-Alfy (Deputy-Director, EGSMA)
- Dr. (Mrs.) Boshra B. Salem (U. of Alexandria)
- Mr. Mohammad Meheina (U. of Alexandria)

6 – Archaeology Team:

- Dr. Mohammad Abdel-Maksoud (SCA)
- Mr. Joseph N. Soliman (SCA)

7 – Assistants:

- Mr. Rafik Ghabbour (Cairo U.)
- Miss Samiha Ghabbour (EQI)

TESTIMONIES AND ENDORSEMENTS

0924/417

Cairo, 29 OCT 2003

L'Ambasciatore d'Italia

Dear Mrs. Omar,

As a continuation of the Egyptian-Italian Environmental Cooperation Program initiative in Wadi El Rayan Protected Area (WRPA), I'm pleased to confirm that the Italian Government will support the development of Wadi El Rayan project during its Phase II, which is due to start early 2004 and lasting for three years.

As per the Overall Work Plan, the project will focus its support to the Ministry of State for Environmental Affairs, and its Nature Conservation Sector, on the consolidation of the results achieved during the first phase, and on the promotion of the environmental education and communication (for which a Visitor Center is already in operation), with integration of cultural resources (like the ancient city of Medinet Madi) for the broader development of sustainable tourism in Fayoum governorate.

Particular attention will be given on strengthening the capacity of the Protected Area officials to manage and conserve the ecosystem, in accordance with internationally recognized guidelines and strategies related to the protection and sustainable management of natural resources, and the Management Plan already adopted in the Protected Area.

Extraordinary efforts will be devoted to Fossil Area of Wadi Hitan (Whale Valley), which is part of the Protected Area. Within the Zoning System of the WRPA Management Plan, differentiated by the different degrees of protection level, this zone is treated as Special Protection Zone. At present the zone is fully under investigation, and a special team will further study the area and prepare a visitor use and education plan leading to a Site Management Plan and to its realization, as soon as the Phase II will be launched providing the required support from international technical assistance and financial resources.

Mrs. Mervat M. Omar
Secretary General
Egyptian National Commission for UNESCO
17, Kuwait Street, Dokki, Cairo

Cc: Dr. Moustafa Fouda
Director Nature Conservation Sector
EEAA – Ministry of State for Environmental Affairs

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Letter from HE Mr. Antonio Badini, the Ambassador of Italy, addressed to Mrs. Mervat Omar, Sceretary-General of the Egyptian National Commission for UNESCO, explainib-ng future Egyptian-Italian cooperation programmes for he Wadi Al-Hitan area, WRPA (page 1).

Consistent budget allocation is earmarked for the "Wadi Hitan initiative", which will cover technical assistance, training, recruitment of community guards from surrounding villages, the establishment of permanent outpost in a strategic location overlooking the zone, means of transport such as camels, motorbikes and vehicles, VHF base unit with walkie-talkie units, etc.

In addition, we also hope to involve in the ear future in this joint endeavor other Italian partners, which have already shown keen interest and would bring the Italian parks experience, possibly facilitating the setting up of a system of exchange of acquisition for a better organization of the territorial management, and the creation of an integrated network of parks in the Mediterranean basin.

Believing in the world's significance of this unique Egyptian Site that is Wadi Hitan, the Italian Government is keen to participate to the efforts being exerted for its declaration as a World Natural Heritage site, and I would like to reaffirm our commitments for the success of this initiative.

Antonio Badini
Ambassador of Italy

Letter from HE Mr. Antonio Badini, the Ambassador of Italy, addressed to Mrs. Mervat Omar, Sceretary-General of the Egyptian National Commission for UNESCO, explainib-ng future Egyptian-Italian cooperation programmes for he Wadi Al-Hitan area, WRPA (page 2).

Endorsement by the Vertebrate Paleontological Society of America

SOCIETY OF VERTEBRATE PALEONTOLOGY
60 REVERE DRIVE, SUITE 500
NORTHBROOK, IL 60062 U.S.A.

August 11, 2001

John Dolson
Senior Geological Associate
BP-Egypt
14, Road 252 Digla
PO Box 2409
Cairo, EGYPT

Dear John,

We are delighted to hear that you have organized the support of so many companies in Cairo to help in the vital effort of preserving the prehistory of the Fayoum. For more than 100 years, this area has been famous both to the archeological and the paleontological communities as a world-class showcase of prehistory, a place where the geology is well exposed and the strata extraordinarily rich in important fossils, all overlain with the traces of ancient civilizations.

Your proposal, together with Dr. Aly Wally to coordinate a non-profit, multi-company organization to raise funds to preserve the site is most commendable, and the kind of initiative that we need to preserve these resources for future generations. As you know, there are sites in the United States where the natural setting of paleontological resources has been used to enhance the message, creating natural outdoor museums that are great tourist attractions. Dinosaur National Monument, the Big Badlands, and Dinosaur Ridge are several other examples that attract tens of thousands of visitors every year. Paleontological resources are unique and all too easily destroyed or removed. We strongly endorse the concept of creating local site-appropriate display facilities that not only teach the public about earth history, but which may become attractions, drawing and educating visitors who otherwise might pass by with little awareness of the marvels and significance of the land through which they travel.

The concept of 38 whales lying amidst the stony erg of the Sahara, surrounded by evidence of mangroves and ancient beaches is inspirational, and together with the other attractions of the Fayoum, clearly warrant every possible effort at interpretation and preservation. We heartily endorse your plans to this effect.

Sincerely yours,

Richard K. Stucky, Ph.D.
President, Society of Vertebrate Paleontology
Director of Museum Programs, Denver Museum of Nature and Science

TEL: 847/480-9095 • FAX: 847/480-9282 • E-MAIL: SVP@SHERWOOD-GROUP.COM

ENDORSEMENTS FROM INDIVIDUAL SCIENTISTS

"There are several reasons that the greater Whale Valley and northern part of Fayoum should be designated a World Heritage Site (or sites). First, Whale Valley itself has an absolutely unique richness of extraordinarily well-preseved early whale fossils. These were the first known to science to retain legs, feet, and toes, and there is much more material eroding at the surface in the site (and being carried away by tourists). Second, the northern part of Fayoum, north of Birket Qaroun, is the best known area in the world for fossils representing the beginning of 'higher Primate' evolution, the branch of the evolutionary tree to which we belong. In both cases these sites are part of our scientific heritage (and I use 'our' here representing all people of the earth). …… The region already generates a substantial tourist visitation, and thus needs the protection and respect that designation as a World Heritage Site would provide."

Philip D. Gingerich, Professor of Palaeontology, University of Michigan, USA

"The site of Whale Valley (Wadi El-Hitan) is as important and perhaps even more significant that that of the Dinosaur National Monument in Colorado".

J. Dolson, Exploration Advisor, BP.

" repeated, persistent fossil collecting in the same productive areas will continue to unveil new fossiol species and new information about paleoenvironments, biogeography and the evolution of all variety of plant and animal life."

E. Simons and D. T. Rasmussem (1990)

Support from External Experts

We were surprised, and also very happy, to receive on the first of December 2002 from Ms. M. Ugo at the UNESCO World Heritage Center and from Ms. P. Matero, at the UNESCO Cairo Office, messages indicating that they were contacted by a team of Egyptian, American, and Polish geologists, who had been working since several years in the Valley of Whales and are specialists of the area, and who would like to give their contribution to this Nomination File, helping through their information and studies on the site. We were very glad for this unexpected help. A leading expert of that team, Mr. John Dolson, Team Leader, American Association of Petroleum Geologists, Egypt and NE Africa, and Exploration Advisor, BP (now located in Sunbury-on-Thames, United Kingdom) effectively paid a visit to the Egyptian National UNESCO Committee and talked to us about the importance of the Whale Valley (406 fossil skeletons in a stretch 10 kms long, from 45 million years ago), in an ancient lagoonal environment with fossil mangroves, indicating a tropical type of climate at that remote time.

Mr. Dolson who was on the Board of Directors for the Friends of Dinosaur Ridge, in Colorado, USA, which he had helped create, kindly gave us copies of a report detailing these researches. Moreover, he pointed out to another very important site, north of Lake Qaroun and within the boundaries of the Lake Qaroun Nature Reserve, in the north of Fayoum Governorate. The site is the area between Gebel Qatrani and the Lake Qaroun. The Gebel Qatrani, he pointed out, is the meeting point of the 2 great Afro-Arabian Shield faults, the Rift Valley and the Syrian Arc. The area in question contains the oldest basalt quarries, dating from the Neolithic, the most ancient paved road (about 10 km long) in the world leading from the quarries to the shores of Lake Moeris (the ancient Lake Qaroun), dating from the Predynastic and the early Dynasties of the Old Kingdom (Harrell and Bown 1995), a Graeco-Roman old city (Dima) and a temple (Qasr El-Sagha), and a Coptic monastery of the 8^{th}-9^{th} centuries B.C. (Deir Abu Lifa), all in acceptably good condition but exposed to threats (due to encroaching development schemes and uncontrolled tourism, besides vandalism), and all along a distance of 10-15 kms, relating a history of more than 5000 years. Dr. Dolson obtained several hundred endorsements from all over the world in favour of inscribing the Gebel Qatrani area on the World Heritage List.

Dr. Dolson also kindly came to our meeting with H.E. the Governor of Fayoum, in company of his colleague Dr. Ahmad El-Barkouky, Professor at the Geology Dept., Cairo University, and made a special presentation on both sites, namely the Valley of Whales and Gebel Qatrani. Geologist Yousry Attia, Curator of Vertebrate Fossls at the Cairo Geological Museum, confirmed to H.E. the Governor all the information given by Dr. Dolson. He added that the area contains the (Miocene) fossils of 12 Orders out of the 28 Orders of Eutherian (placental) Mammals, from Insectivora to Primates. Dr. Wagieh El-Saadawy, Professor at the Botany Dept., University of Ain Shams, Cairo, on his part, emphasized the importance of the fossil forests (petrified wood) in the area. Prof. (Mrs.) Ferial El-Bedewy and Prof. Mohammad Abed (both at the Geology Dept., University of Mansoura), also confirmed the geological uniqueness and interest of the Gebel Qatrani site, which they had been studying for the last 20 years.

Dr. Dolson further pointed out the threats to the Gebel Qatrani site from vehicles and uncontrolled tourism. He said that out of the 8 ancient basalt quarries, four are now

completely obliterated because of modern quarrying on the very same sites. *He strongly warned against the imminent loss of the remaining four*. Dr. Zenhom El-Alfy (Deputy Director, EGSMA), added that in some mysterious way the Ancient Egyptians apparently surmised that the black clay brought by the Nile with each flood originated from the erosion of basalt, and so they revered that kind of rock. They quarried it for making sacred objects. If the stone slabs or blocks they extracted from the mountain were fissured, they used them as floor slabs for temples. If they were in one piece, they carved the small ones for making vessels while the larger ones were carved into sarcophagi.

We sent Dr. Dolson's speech to H.E. the Governor at this meeting, by e-mail to Dr. Francesco Bandarin (Director, WH Center) and Dr. Giovanni Boccardi (responsible for Arab States at the WHC).

H.E. the Governor of Fayoum told us of plans to have a natural history museum for the Governorate. One highly placed investor offered the land and H.E. the Deputy-Prime Minister and Minister of Agriculture, Dr. Youssef Waly, offered a substantial private fund as seed money for its construction. The envisaged site is at the western end of the cultivated land of the Governorate, near to the entrance to the Wadi El-Rayan Protected Area. Another *in situ* open-air museum for the whales was also decided, with due protection of their fossil skeletons.

We later received an e-mail from Mr. Maged Toson, a not-for-profit safari organizer, on the remarkable beauty of the site, which we also forwarded to Drs. Bandarin and Boccardi.

Decisions of the 25th Session of the World Heritage Committee,

Helsinki, Finland, December 2001

Concerning Desert Landscapes

IX.16 Commenting on the Secretariat's report on the Desert Landscape Meeting, organized in Egypt (September 2001), the Committee recalled the importance of this category of properties. It recommended that resources be allocated to further the process of identification of potential desert landscapes for possible inclusion on the World Heritage List, starting with those located across two or more countries. Committee members from the Arab region stated that this should be the focus rather than dispersing resources on less urgent initiatives, such as the proposed Thematic Study on Modern Heritage in the Arab States. In this respect, and taking into account that deserts are a common feature across several regions of the world, the Committee stressed the desirability of a more intense inter-regional co-operation in this field, such as in the Mediterranean Action Plan. The Delegate of Egypt suggested that the year 2003 be declared an *International Year of the Desert*.