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1

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Editoriale	4
Avant-propos	5
<i>Jean Vercoutter</i> Le Sahara et l'Égypte pharaonique	9
<i>William Y. Adams</i> The Nile Trade in Post Pharaonic Times	21
<i>Achilles Gautier</i> The Final Demise of <i>Bos ibericus</i> ?	37
<i>François Soleilhavoup</i> Découvertes archéologiques exceptionnelles au sud de l'Ahaggar	49
<i>Joris Peters</i> The palaeoenvironment of the Gilf Kebir-Jebel Uweinat area during the first half of the Holocene: The latest evidence	73
<i>Louis Chaix</i> Le monde animal à Kerma (Soudan)	77
<i>Daniel Stiles</i> Desertification in Prehistory: the Sahara	85
Note brevi <i>Brief notes</i> Notes brèves	93
<i>Peter Rowley-Conwy</i> Early radiocarbon accelerator dates for camels from Qasr Ibrim, Egyptian Nubia	93
<i>Mark Milburn</i> On the identity of Tuareg and Moors	93
Documenti rupestri <i>Documents of rock art</i> Documents rupestres	95
<i>Jürgen Kunz</i> Un site à peintures pariétales de l'Oued Tirehart-Tassili n'Ajjer	95
<i>Aldo e Donatella Boccazzi</i> Alcuni graffiti della parete occidentale del Gilf Kebir	96
<i>Alfred Muzzolini</i> Figurations rupestres de chars avec attelage, de part et d'autre du Ténéré (Arkana et Oued Taguei, Niger). L'extension des "Libyco-berbères" au Djado	99
Note della redazione <i>Editor's notes</i> Notes de la rédaction	101
Paolo Graziosi	101
Congresso Internazionale "El Estrecho de Gibraltar"	101
Documenti preistorici <i>Prehistoric documents</i> Documents préhistoriques	102
Un bétyle de la région de Tabelbalet	102
Une ronde-bosse de la région de l'erg Tihodaïne	102
Rivista delle riviste <i>Review of reviews</i> Revue des revues	103
Libri ricevuti <i>Books received</i> Livres reçus	106
Recensioni <i>Reviews</i> Compte-rendus	107

The palaeoenvironment of the Gilf Kebir-Jebel Uweinat area during the first half of the Holocene: The latest evidence

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Riassunto

Fino a una decina di anni fa, gli studiosi ipotizzavano che nella regione Gilf Kebir - Uweinat prevalessero durante la prima metà dell'Olocene condizioni ambientali di savana di tipo saheliano. Recenti studi di paleobotanica, sedimentologia e archeozoologia evidenziano condizioni di clima arido tra il 9500 e il 6000 BP, con una precipitazione inferiore ai 100 mm/anno, e una moderata aridità durante il sesto millennio, con una probabile precipitazione annua tra i 100 e i 150 mm.

Summary

Until a decade ago, scientists postulated that Sahelian-savanna living conditions prevailed in the Gilf Kebir-Jebel Uweinat region during the first half of the Holocene. Recent palaeobotanical, sedimentological and archaeozoological studies point to arid climatic conditions between 9500 to 6000 BP with a rainfall below 100 mm/year, and to a moderate aridity during the sixth millennium, very likely with a yearly precipitation of some 100 to 150 mm.

Résumé

Jusqu'il y a une dizaine d'années, les chercheurs postulaient que l'environnement qui prévalait dans la région du Gilf Kebir-Uweinat pendant la première moitié de l'Holocène était celui d'une savane sahélienne. Mais de récentes recherches paléobotaniques, sédimentologiques et archéozoologiques mettent en évidence des conditions climatiques arides entre 9500 et 6000 BP, avec des précipitations inférieures à 100 mm/an, suivies d'une période d'aridité modérée pendant le 6ème millénaire BP, accompagnée de précipitations d'environ 100 à 150 mm/an.

The Gilf Kebir, a massif sandstone mesa rising 200 to 300 m above the surrounding plains, is situated in southwestern Egypt in the heart of the Libyan desert (Fig. 1). This plateau is intersected by numerous wadis, the largest being the Wadi Ard el Akhdar and the Wadi el Bakht. Today, it is considered one of the most arid regions of the world with an estimated precipitation of less than 5mm/year (Kröpelin, 1987). Vegetation is almost absent except for some woody species such as *Acacia*, *Balanites* and *Mearua*, though most of the trees are apparently dead (Neumann, 1987). Nevertheless, after the extremely rare precipitations, a very scattered vegetation of not more than fifteen species of ephemeral grasses and shrubs may appear in certain parts of the Gilf area (Neumann, *ibid.*).

Jebel Uweinat is a relatively small tabular mountain mass which lies over 70 kilometres to the southwest of the Gilf Kebir plateau. Its height ranges from 600 to over 1900 meters above sea level, which makes it high enough to attract a little extra local rainfall and to maintain a poor vegetation (Bagnold, 1941; Leonard, 1971). The present day fauna of the Gilf Kebir - Jebel Uweinat area is not well known, but the animals recorded from it are well adapted to very arid living conditions: dorcas gazelle, slender-horned gazelle, Barbary sheep, Rüppell's sand fox, fennec, striped weasel, jerboa and two gerbil species (Peters, 1987).

The Gilf Kebir - Jebel Uweinat area remained unexplored until the middle of the 1920's, when pioneers such as Hassanein Bey (1924a, 1924b) and Newbold (1924) managed to visit this part of the Libyan Desert. Afterwards, the region became the target of many explorers and scientists, not in the least because of the fact that ancient human occupation in the area was illustrated by numerous rock paintings (Winkler, 1939; Rhotert, 1952; Van Noten, 1978). These suggested that the animal world, known to the prehistoric inhabitants of the Gilf Kebir - Jebel Uweinat region included giraffe, Barbary sheep, scimitar-horned oryx, antelopes, lion and ostrich. Furthermore, the numerous scenes depicting people with

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herds of cattle implied that they were typical pastoralists. On the basis of the ecological requirements of the animals figured in rock art, and the needs of present-day African pastoralist tribes living in arid environments, such as the Peul, Jies and Turkana, McHugh (1974) assumed that the Gilf Kebir - Jebel Uweinat area must have received a yearly precipitation of some 200 to 600 mm at the time of its occupation by prehistoric man.

Until a decade ago, only a few small scale excavations had been carried out in Wadi el Bakht at the eastern side of the Gilf plateau (Bagnold et al., 1939; Wendorf et al., 1976; McHugh, 1982) and in Karkur Talh, located at the northern side of Jebel Uweinat (Bagnold et al., *ibid.*; de Heinzelin et al., 1969). From 1980 onwards, archaeological sites in Wadi Ard el Akhdar, Wadi Bakht and elsewhere in the Gilf were systematically investigated by a multidisciplinary research group, led by R. Kuper (1981) of the University of Cologne. The results of this research group are not published in full yet, but two very interesting papers dealing with the palaeoclimate of the area during the early to mid-Holocene appeared last year (Kröpelin, 1987; Neumann, 1987). This coincided with the publication of our study of the faunal remains, collected by the Bagnold-Mond expedition in 1938 (Peters, 1987).

K. Neumann (1987) analysed samples of charred wood remains from prehistoric sites in Wadi Ard el Akhdar and Wadi el Bakht. The woody species recorded include plant of the genera *Acacia*, *Ziziphus*, *Maerua*, *Tamarix* and *Balanites*, all of which belong to the modern Sahara flora. *Tamarix* wood remains occur in all samples and suggest an arid climate with precipitations not exceeding 100 mm/year around 7700 BP and between 5700 and 4000 BP. Most likely, the drier phases of this period witnessed a comparatively sparse tree cover, whereas, during the moister phases, the vegetation may have consisted of dense stands of tamarisks in the lower parts of the wadis. Such concentrations of tamarisks occur today under an average rainfall of 50 to 100 mm/year. The second dominant species in the samples, *Ziziphus lotus*, is a low, spiny bush. It is known today from the northwestern Sahara, where it survives with a mean annual rainfall of 30-40 mm. The Gilf samples also contain *Acacia* wood, but its occurrence is rather low. Nevertheless, the isolated presence of *Acacia albida*, dated at 6150 ± 180 BP, indicates slightly moister climatic conditions at that time, because a minimum requirement of this species is a yearly precipitation of 100 to 150 mm. Summing up then, the floral evidence points to arid climatic conditions with annual precipitations not exceeding 100 mm between ca. 8000 and 4000 BP, and with a slightly moister period of unknown duration in between.

S. Kröpelin (1987) investigated the sediments of early to mid-Holocene playas in valleys of the Gilf Kebir plateau. From his observations, it becomes clear that the playa-formation in the Gilf area is due only to surficial run-off, although favourable local circumstances have added considerably to their formation. Among these, Kröpelin mentions the combination of W-E trending valleys with trade winds blowing roughly N-S and a source of sand in the north (in this case the Great Sand Sea). The blockage of Wadi el Bakht and Wadi Ard el Akhdar, creating the conditions necessary for playa formation, most likely occurred, or at least begun, before ca. 9400 BP. At that time, the climate seems to have been more arid than today, since actual dunes are not able to cause total blockage of the valleys of Wadi el Bakht and Wadi el Akhdar. However, different non-climatic boundary conditions may have prevailed, causing for example an increased supply of sand.

The blockage of the wadis was followed by a period of uneven, discontinuous sedimentation. This points to an arid climate, lasting roughly from 9000 to 6000 BP. Between 6000 and 5000 BP, continuous sedimentation of pelitic layers suggests a moderate aridity, with an estimated annual rainfall of 100 mm. Not long after c. 5000 BP the deposition of playa sediments stopped in Wadi el Bakht and in Wadi Ard el Akhdar, suggesting that the dunes blocking both wadis were breached during this period. Most likely, this was due to an unprecedented, exceptionally high water pressure or level, pointing to a climatic optimum with comparatively high precipitation or a unique millennial rainfall event. Afterwards, no more playa sediments were deposited and therefore, no evidence of the subsequent increase in aridity could be observed. Our work dealt with the faunal remains, recovered from archaeological sites in the major wadis of the

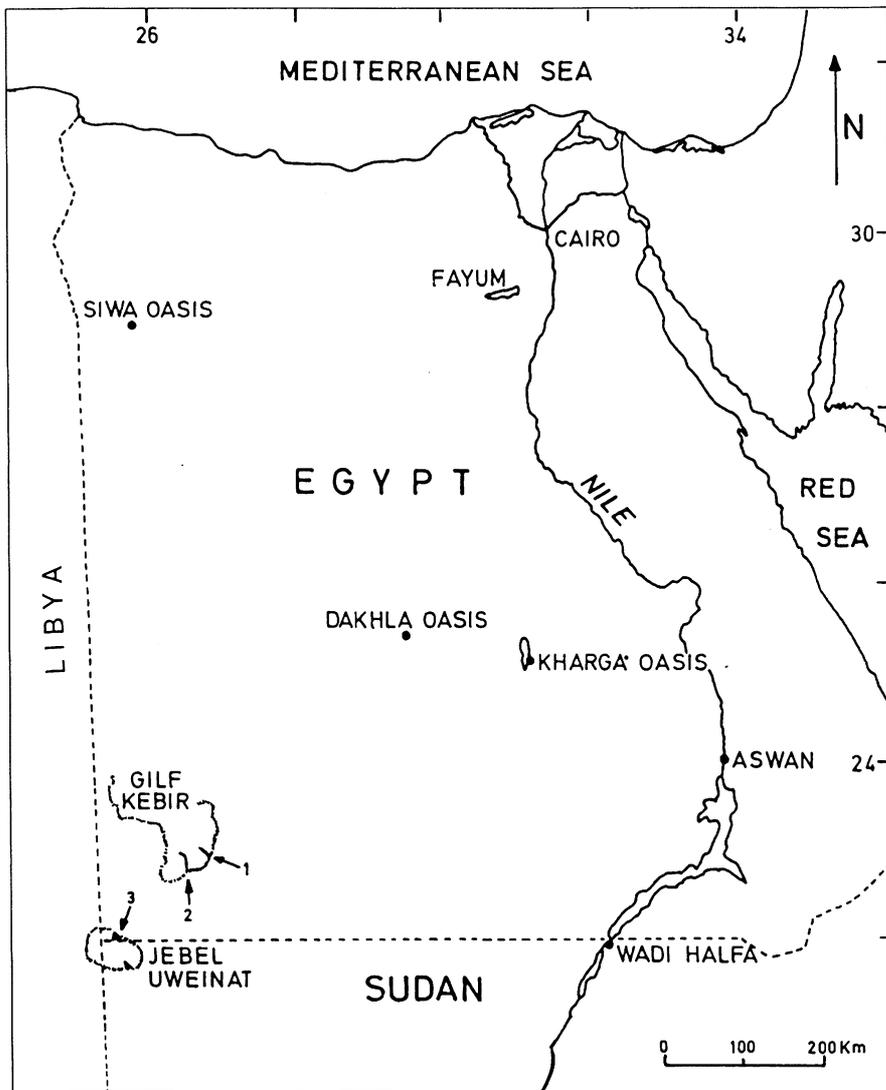


Fig. 1. Location of the sites discussed in the text. (1) Wadi el Bahkt; (2) Wadi (Ard) el Akhdar; (3) Karkur Talh.

Gifl and in Karkur Talh at Jebel Uweinat (Peters, 1987). We re-identified the faunal remains collected by the Bagnold-Mond expedition in 1938 and evaluated critically the faunal lists, given by other authors of bone samples from the same or related archaeological deposits. Among the animal remains, the presence of the following species could be established with certainty: Ostrich, striped hyaena, rock hyrax, giraffe, addax, dorcas gazelle, dama, Barbary sheep, cattle and goat. Faunal material collected by Kuper's team in the Gifl area furthermore produced remains of scimitar-horned oryx (W. Van Neer, pers. comm.).

As to the ecological requirements of the species mentioned, most of the wild animals feed on grasses as well as on foliage of trees and shrubs. Giraffes, however, are predominantly browsers, utilising a wide range of food plants. Cattle, on the other hand, are typical grazers and need good quality pasture, whereas goats are much less particular about their food requirements. All wild mammals are almost completely independent of water, obtaining their moisture requirements from their food plants. However, the two domestic species, and especially cattle, definitely need surface water to survive in arid climates.

What does the faunal spectrum learn us about the palaeoenvironment? If we accept on the basis of the best archaeological evidence that our picture of the fauna is representative for the main settlement phase in the area, that is between ca. 6000 and 5000 BP (Kuper, 1981), then the spectrum obtained suggests arid living conditions in the Gifl Kebir-Jebel Uweinat region. Consequently, we can imagine a floral pattern in the area consisting of seasonal grassy plains, most likely with a disjunct ground cover, but no doubt with concentrations of trees and shrubs at more favourable places such as wadis. Precise estimates of the annual

precipitations cannot be based on wild mammals such as dorcas gazelle, dama, addax or oryx because these animals undertake large scale migrations if food becomes rare. On the other hand, livestock is not of much use either for palaeoclimatological reconstructions. Indeed, present-day pastoralists living in arid regions are forced to undertake large scale migrations to provide their flocks with the necessary amounts of pasture and water. The inhabitants of the Gilf Kebir - Jebel Uweinat region were most likely there on a temporary basis, their presence depending on the availability of good grazing and surface water.

The only faunal element that can be used to say something about the palaeoclimate appears to be the giraffe. These animals do not migrate over considerable distances, although they are great wanderers because their food is generally well dispersed (Kingdon, 1979: 329). As a consequence, their home ranges can be very extensive especially during the rains when the animals start wandering (650 km²; Kingdon, *ibid.*) During the dry season the animals remain in a relatively small area (in Tsavo National Park 160 km²; Leuthold, 1977: 44). We therefore consider the Gilf Kebir remains of giraffe to be derived from a local population. Such a population no doubt also existed at Jebel Uweinat, as the rock art indicates. The food requirements of giraffe suggest a minimum annual precipitation of ca. 200 mm in the plains around the two mountain masses. However, both the Gilf Kebir and especially Jebel Uweinat may have received more rain because of their altitude. Since it is known that in mountain systems the deeper parts of the relief act as water collectors, it can be expected that the wadis of Gilf Kebir and Jebel Uweinat received decidedly more moisture than the surrounding plains. Because this may have resulted in more favourable conditions for plant growth and animal life, it is not inconceivable that our estimate of 200 mm/year for the plains may be too high.

Summing up then, the earlier views of Sahelian-savanna living conditions in the Gilf Kebir - Jebel Uweinat area during the first half of the Holocene are contradicted by recent palaeobotanical, sedimentological and archaeozoological studies. These suggest for the period between ca. 9500 to 6000 BP arid climatic conditions with an annual rainfall below 100 mm. In the sixth millennium BP, the area witnessed a more moderate aridity, very likely with a yearly precipitation of some 100 to 150 mm.

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