Discovery of *Prolibytherium magnieri* Arambourg, 1961 (Artiodactyla, Climacoceratidae) in Egypt

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ABSTRACT
While searching for fossils from Wadi Moghara in the collections of the Egyptian Geological Museum, the authors came across some undescribed remains of Prolibytherium magnieri Arambourg, 1961. A brain case with attached frontal appendages (CGM 82975) has some matrix adhering to the bone which indicates that it is most probably from Wadi Moghara, although there is no documentary evidence as to its discovery locus. Some mandible fragments and postcranial elements which can be assigned to Prolibytherium Arambourg, 1961 on the basis of their size were collected from Wadi Moghara by R. Fourtau and others prior to 1920, but have remained undescribed. The fossils are sufficiently interesting to warrant description.

KEY WORDS
Artiodactyla,
Ruminantia,
Climacoceratidae,
early Miocene,
Egypt,
biochronology.

RÉSUMÉ

Découverte de Prolibytherium magnieri *Arambourg, 1961 (Artiodactyla, Climacoceratidae) en Égypte.*

En recherchant des fossiles du Wadi Moghara dans les collections de l'Egyptian Geological Museum, les auteurs ont découvert des restes inédits de *Prolibytherium magnieri* Arambourg, 1961. Une boîte crânienne portant les appendices frontaux (CGM 82975) porte encore un peu de gangue qui montre qu'elle provient très probablement du Wadi Moghara, bien que rien ne permette de préciser le site de sa découverte. Quelques fragments de mandibule et des éléments post-crâniens que leur taille permet de rapporter à *Prolibytherium* Arambourg, 1961 ont été collectés au Wadi Moghara par R. Fourteau et d'autres chercheurs avant 1920, mais sont restés inédits. Ces intéressants fossiles méritent d'être décrits.

MOTS CLÉS
Artiodactyla,
Ruminantia,
Climacoceratidae,
Miocène inférieur,
Égypte,
biochronologie.

INTRODUCTION

Fourtau (1918 [1920]) published a monograph on the fossil vertebrates from Wadi Moghara, Qattara Depression, Egypt. The deposits which yielded the material were correlated to the early Miocene by Fourtau, who considered that they were broadly Burdigalian on the basis of the presence in the Moghara stratigraphic succession of a marine bed with *Turitella*, the whole sequence being capped by a richly fossiliferous marine limestone of Vindobonian age. He particularly mentioned that the Moghara succession equates with the site of Eggenburg in Austria (MN3) and the Sables de l'Orléanais in France (MN3 to MN5).

Fourtau's monograph is remarkable for the rich anthracotherian fauna that he described and is notable for the lack of other artiodactyls in the sample. Examination of the old collections housed in the Egyptian Geological Museum (formerly called the Cairo Geological Museum, CGM) reveals that many of the fossils collected by Fourtau were not included in his monograph, presumably because he could not identify them precisely enough. Among these are sanitheres and climacoceratids, including a brain case with frontal appendages of *Prolibytherium*. Recent expeditions to Wadi Moghara (Miller & Simons 1996; Miller 1996) record the presence of suids, sanitheres, tragulids and giraffoids at the site, in addition to four species of anthracothere (Pickford 1991). Miller & Simons reported that *Prolibytherium magnieri* occurs at Wadi Moghara, but they did not describe any of the material and wrote that "assignation of specimens to *P. magnieri* is questionable (Miller 1996)". The newly recognised material removes any doubt about the presence of *Prolibytherium* in Egypt, and it provides evidence that part of the Wadi Moghara sequence equates chronologically with part of the Gebel Zelten succession.

SYSTEMATICS

Order ARTIODACTYLA Owen, 1848
Suborder RUMINANTIA Scopoli, 1777
Superfamily GIRAFFOIDEA Simpson, 1931
Family CLIMACOCERATIDAE Hamilton, 1978
(= CLIMACOCERIDAE Hamilton, 1978)
Genus *Prolibytherium* Arambourg, 1961

Prolibytherium magnieri Arambourg, 1961

MATERIAL EXAMINED. — Frontal appendages with part of braincase (CGM 82975) (Fig. 1); edentulous left mandible with roots of m1 to m3 (CGM 82976); distal left humerus (CGM 30794); distal radius (CGM 16016); vertebra (CGM 30792).

DESCRIPTION

The most diagnostic specimen is the pair of frontal appendages attached to the brain case (Fig. 1). The morphology of the frontal

appendages, their thickness, their growth lines, their continuity over the brain case and their extension distal to the nuchal bone are all features unique to *Prolibytherium magnieri*. In ventral view, the dorsal portion of the neurocranium is preserved and shows the impressions of the brain on its inner surface. The brain case is small and has thin lateral walls as in material from Gebel Zelten (Arambourg 1961; Hamilton 1973, 1978a, b). The brain case measures 57.5 mm from side to side, and the overhang of the frontal appendages beyond the nuchals is 31.5 mm.

The edentulous mandible, and postcranial bones are of a size range compatible with *Prolibytherium*, although in the absence of associated elements there must remain some doubt about the identification of the specimens. The distal humerus is typically ruminant in morphology. The mediolateral diameter of the distal articular facet is 41 mm. A specimen assigned to this species by Hamilton (1973) measured 35 mm across the epicondyles. The distal radius and vertebra are also typically ruminant in morphology and their size indicates that they may represent *Prolibytherium*.

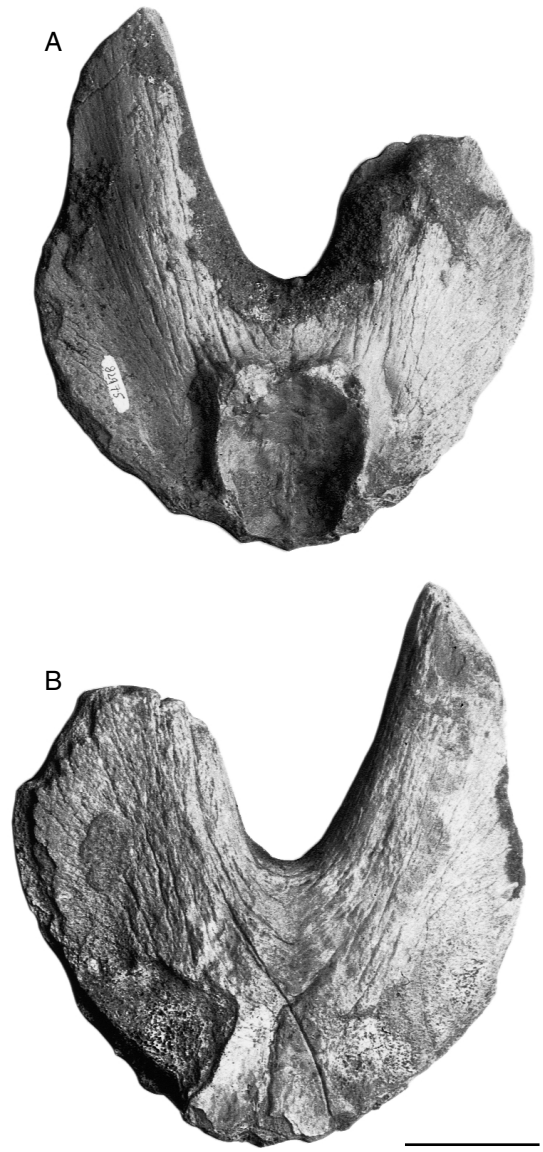

FIG. 1. — Partial brain case and frontal appendages of *Prolibytherium magnieri* Arambourg, 1961 (CGM 82975) probably from Wadi Moghara (early middle Miocene = MN4), Egypt; **A**, ventral view; **B**, dorsal view. Scale bar: 5 cm.

SYSTEMATIC POSITION OF *PROLIBYTHERIUM*

Hamilton (1973) placed *Prolibytherium* in the Sivatheriidae Hamilton, 1973 (Giraffoidea) but the same author (Hamilton 1978b) later excluded the genus from the Giraffoidea because the lower canine was unknown. The cheek dentition of *Prolibytherium* is poorly known, because most of the described specimens are heavily worn or broken (Hamilton 1973), but the little that can be discerned from the remains indicates that they are closer in overall morphology to those of Climacoceratidae (*Climacoceras* [MacInnes, 1936] and *Orangemeryx* [Morales, Soria & Pickford, 1999]) than to Giraffidae. As far as is known, *Orangemeryx* does not possess a bilobed lower canine, and it is thus not a giraffoid in the sense of Hamilton (1978b). *Climacoceras gentryi* Hamilton, 1978 is reported to possess a bilobed canine (Hamilton 1978b), but the association of the tooth with the mandible may not be a primary one (Morales *et al.* 1999) and further evidence is required to settle the matter. Skull M 15543 in the NHM, London, the holotype of *Nyanzameryx pickfordi* Thomas, 1984, was placed in the Climacoceratidae by Thomas (1984). However, as it has been pointed out by

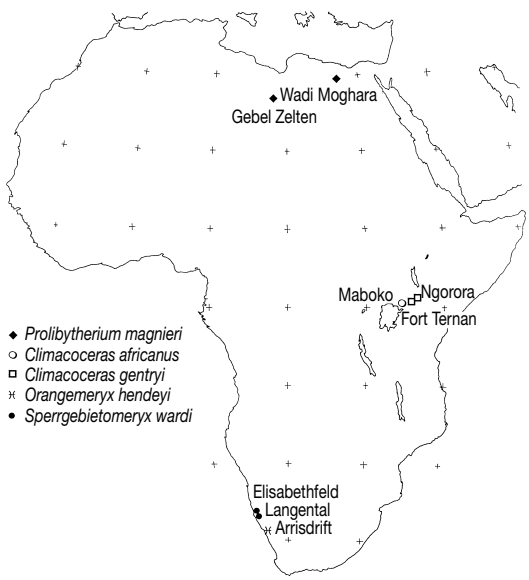

FIG. 2. — Geographic distribution of Climacoceratidae.

McCrossin *et al.* (1998), it could well belong instead to a primitive bovid, because the left frontal apophysis, in spite of the reconstruction, reveals a transition between the pedicle and the part that would have been covered by the horn, a defining feature of Bovidae.

Prolibytherium possesses several features of the skull (Hamilton 1978b) that are reminiscent of *Prodremotherium* Filhol, 1877, as do the genera *Sperrgebietomeryx* (Morales, Soria & Pickford, 1999) and *Orangemeryx* (Morales *et al.* 1999) from southern Africa (Fig. 2). The skull of *Climacoceras* is still poorly known but, apart from the frontal appendages, it appears to be close to that of *Orangemeryx*. All in all, the available evidence suggests a closer relationship between *Prolibytherium* and *Climacoceras* than between the former genus and any of the Giraffidae. For this reason, we consider it likely that *Prolibytherium* is a Climacoceratidae and that the genera *Sperrgebietomeryx* and *Orangemeryx* belong to the same family. Counter to this suggestion is the observation that the neck vertebrae of *Prolibytherium* appear not to be elongated (Hamilton 1973) as much as they are in *Orangemeryx* and *Sperrgebietomeryx* (Morales *et al.* 1999). Only more complete material will permit a clear determination of the systematic position of *Prolibytherium*, but out of the various families of African early Miocene ruminants, its affinities seem to be closest to Climacoceratidae.

BIOCHRONOLOGY OF WADI MOGHARA

Fourtau (1918 [1920]) correlated Wadi Moghara with the European Burdigalian, in particular the site of Eggenburg (MN3) and the Sables de l'Orléanais (MN3 to MN5). Pickford (1991a) placed it in Faunal Set PII, slightly younger than Rusinga and older than Gebel Zelten and considered that it correlated with MN3 of Europe (Fig. 3). Miller & Simons (1996) reached a similar conclusion that "Moghara and Zelten overlap in time at about 17 My., but that Moghara is slightly older than Zelten".

Fourtau (1918 [1920]) mentioned that the fossiliferous zone extends from Wadi Faregh in the East to 30 km West of Wadi Moghara a distance of some 130 km. Miller & Simons (1996) reported that the fossils they studied came from approximately 40 fossiliferous localities spanning a maximum distance of 55 km. Miller & Simons (1996) did not provide details of the stratigraphic interval covered by the fossil samples but Fourtau (1918 [1920]) measured a stratigraphic section of the Moghara area over 200 metres thick, but did not indicate from which beds the fossil vertebrates were derived. It is likely therefore that at Wadi Moghara, as at Gebel Zelten, a significant span of geological time is represented in the fossil samples (Pickford 1991b).

Prolibytherium magnieri described here is so similar to the type and other material from Gebel Zelten (Arambourg 1961; Hamilton 1973), that there can be little doubt that the same time interval occurs in both places. Furthermore, study of the proboscideans from Gebel Zelten housed in the Natural History Museum, London, reveals that the Gebel Zelten succession spans a considerable period of time, and that it probably even

has late Oligocene strata at its base, and late middle Miocene strata near the top. The main fossil levels at Gebel Zelten contain anthracotheres, proboscideans, sanitheres and ruminants that are so close to those of Wadi Moghara that there can remain little doubt that much of the two successions was laid down at the same time. Miller & Simons (1996) discounted the presence of *Brachyodus* at Gebel Zelten because only one metapodial had been recorded from the site (Pickford 1991b). In the NHM collections, however, there are several more undescribed specimens (two distal tibia, a proximal tibia, three tali, a calcaneum, two complete metapodials), and recent work at the site has yielded much material (Dolores Soria pers. comm.). The *Brachyodus* from Gebel Zelten is similar in size to *Brachyodus depereti* (Fourteau, 1918), and is larger than *Brachyodus mogharensis* Pickford, 1991 and *Afromeryx africanus* (Andrews, 1899), both of which occur at Wadi Moghara. A suid talus from Wadi Moghara is the same size (pers. obs.) as those of *Libycochoerus massai* Arambourg, 1961 from Gebel Zelten (Van der Made 1996), suggesting that this species occurs at Wadi Moghara, even though no dental remains have been found to confirm its presence there. The overall picture that emerges is that parts of the Gebel Zelten and Wadi Moghara sequences span the same period of time (Fig. 3). In both areas, it is clear that the old collections consist of mixed assemblages from various levels, but the bulk of the samples come from a relatively restricted period which best equates with MN4 in Europe.

AGE Ma	Northern Africa	Tropical Africa	Southern Africa
11			
12			
13		Ngorora B Fort Ternan	
14			
15		Nachola, Nyakach Maboko, Muruyur	
16			
17	Gebel Zelten Wadi Moghara		Arrisdrift
18			
19			Langental
20			
21			Elisabethfeld
22			

Fig. 3. — Ages of localities which have yielded Climacoceratidae.

CONCLUSION

A pair of frontal appendages and part of the brain case of a large ruminant housed in the Egyptian Geological Museum belong to *Prolibytherium magnieri*. The specimen probably came from Wadi Moghara, although there is no documentary evidence of its discovery locus. The presence of this climacoceratid in Egypt provides evidence for biostratigraphic correlation between Egypt and Libya where the type material of the species comes from. It is concluded that part of the Wadi Moghara succession correlates with part of the sequence at Gebel Zelten. The fossil is probably basal middle Miocene in age (MN4).

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