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Keywords: West Africa, Pliocene
Biochronology, Palaeoecology

Chadian Australopithecines: Biochronology and Environmental Context

Five palaeontological and geological field missions carried out in the Djourab Desert (Northern Chad) by the French-Chadian Paleoanthropological Mission (MPFT) have resulted in the discovery of about one hundred continental Mio-Plio-Pleistocene vertebrates sites. Until now three areas have been intensively collected: Koro Toro (KT), Kollé (KL) and Kossom Bougoudi (KB). All the fossils come from poorly consolidated sub-horizontal sandstone levels that outcrop sporadically amid dunes and sand. Two hominid localities have already been discovered (Brunet *et al.*, 1995 and 1997). One of them has yielded the first australopithecine known from west of the Rift Valley, *Australopithecus bahrelghazali* Brunet *et al.*, 1996: a new species characterized by several unique features including a shortened face. In spite of biases associated with preliminary collections and some distinct provincialism, the faunas indicate a biochronological age of between 3 and 3.5 Ma for the two hominid sites, between 4 and 5 Ma for Kollé and older than 5 Ma for Kossom Bougoudi. These faunas are representative of mosaic landscapes including fresh water, wooded savannah and grassland. The diverse faunas indicate a closed environment for KB, a more open environment for KL and still more open for KT. Chadian faunas dated between 3 and 6 Ma are critical to an understanding of the evolution of early hominids and their environments. Already the Chadian australopithecines show us that the hominid story is pan-African at least until 3.5 Ma.

Introduction

Five paleontological collection trips carried out in the Djourab desert (northern Chad: 15-18°N, 16°-20°E) by the French-Chadian Paleoanthropological Mission (French acronym: MPFT) have resulted in the discovery of about one hundred continental Mio-Plio-Pleistocene vertebrate sites. Two hominid localities in the Koro Toro region (KT 12 and KT 13) have already been discussed (Brunet *et al.*, 1995, 1997). One of them (KT 12) has yielded the first australopithecine known from west of the Rift Valley: *Australopithecus bahrelghazali* Brunet *et al.*, 1996.

These discoveries have taken the MPFT to older sedimentary levels. Faunas from two new sites have been described ; the Kollé (KL) sites about 30 km NNE of the hominid sites (Brunet *et al.*, 1998) and the Kossom Bougoudi (KB) sites about 30 km West of Kollé (Brunet & MPFT, submitted). This entire region, called 'Pays Bas' ('low country'), is very flat and outcrop of the sedimentary deposits is patchy because they are overlain by dunes and windblown sand of variable thickness. Despite this, few rare and very small outcrops (no more than 1,5 m high) indicate repetitive successions of sandstones and pelitic clays with or without interstratified diatomites.

Biochronology and Biogeography

Almost all the fossils come from these poorly consolidated sandstone levels that outcrop

Table 1 : Chadian Suinae

Taxa	Localities			
	KB	KL	KT 12	KT 13
<i>Kolpochoerus afarensis</i>			+	+
<i>Notochoerus euilus</i>				+
<i>Nyanzachoerus jaegeri</i>	+			
<i>Nyanzachoerus kanamensis</i>	+	+		

sporadically amid the dunes and sand.

Thus far, almost four thousand fossil specimens have been collected and about one hundred taxa have been determined (flora 1; insects 3; fishes 13; reptiles 8; birds 6; mammals 67). Among the mammals, two groups are particularly significant from a biochronological point of view: Suidae and Proboscidea (Tables 1, 2).

We have recovered *Stegodon kaisensis* 'warwire' (also known from Uganda), from the Warwire Zone, which is dated to 3–3.5 Mya (Tassy, 1994); *Loxodonta exoptata*, as known from Laetoli and Hadar (Beden, 1985); and the *Kolpochoerus afarensis*–*Notochoerus euilus* association known also from Hadar (Cooke, 1985). Their presence in the faunas of the hominid sites KT 12–13 point to a biochronological age between 3 and 3.5 My (Brunet *et al.*, 1995, 1997).

In the Kollé fauna the Proboscidea (*Loxodonta* n. sp., *Stegodon kaisensis* 'warwire', *Anancus kenyensis* 'petrochii') and the suid association *Nyanzachoerus kanamensis*–*N. jaegeri* suggest an age between 4 and 5 My (Brunet *et al.*, 1998). In the KB fauna the more primitive Proboscidea *Anancus kenyensis* 'kenyensis', *Stegodon kaisensis* 'nkondo', and the sole primitive tetraconodontine *Nyanzachoerus kanamensis* indicate an age older than Kollé around the Mio-Pliocene boundary (Brunet & MPFT, submitted).

This first West African biochronological sequence is very important, first because it overlaps a critical period in the earliest hominid story, and secondly because its oldest fauna (KB) comes from near the Mio-Pliocene boundary. Sites of this age and of early Pliocene age are not numerous in Africa: Sahabi and Langebaanweg in North and South Africa respectively, and Middle Awash, Lukeino, Manonga Valley and Lothagam in East Africa.

The singularity of the Chadian faunas is evidenced by the presence of about ten per cent of new species, and by the fact that some known taxa, like *Stegodon*, are very common as in Uganda, although rare in Ethiopia and absent in Kenya (Tassy, 1994). This reflects marked provincialism.

It is clear that the Mio-Pliocene Chadian faunas will henceforth be critically important for a proper understanding of the environments of the first hominids in Africa.

Palaeoenvironment

All the fossiliferous levels belong to repetitive sedimentary sequences of sandstones, clays, and diatomites, representing a succession of fluvial and lacustrine environments in a relatively humid period. Moreover, in all the localities, the non-hominid fauna includes aquatic taxa such as siluriform and perciform (*Lates niloticus*) fish, and water-dependent taxa such as turtles (*Trionyx*), crocodiles (*Tomistoma* or *Euthecodon*), snakes (*Python* aff. *sebae*), water monitor lizards (*Varanus* cf. *niloticus*), aquatic birds (e.g. Anatidae), and several species of Hippopotamidae among the mammals. These taxa all indicate long-term stable freshwater environments.

On the other hand suids, *Giraffa*, Bovini and proboscideans suggest a wooded savannah environment, while equids, *Sivatherium* and Reduncini (*Kobus*) suggest an open environment like

Table 2 : Chadian Proboscidea

Taxa	Localities			
	KB	KL	KT 12	KT 13
<i>Loxodonta exoptata</i>			+	+aff.
cf. <i>Loxodonta</i> nov. sp. (primitive form)		+		
<i>Primelephas</i> aff. <i>gomphotheroides</i>	+			
<i>Stegotetabelodon</i> sp.		+		
Elephantidae stegomorph indet.		+		
<i>Stegodon kaisensis</i> 'warwire'		+		+
<i>Stegodon kaisensis</i> 'nkondo'	+			
<i>Anancus kenyensis</i> 'petrochii'		+		
<i>Anancus kenyensis</i> 'kenyensis'	+			

grassland. But in the mosaic of these environments, there are several important differences which show a progressively humid trend from KT to KL to KB. For example, the fish and aquatic bird diversity in KB is greater than in the other sites. The same applies to the frequency of occurrence of aquatic reptiles and Hippopotamidae. Among crocodiles, *Euthecodon* cf. *nitriae*, basically an ichthyophage, is very well represented from KB and KL, but is unknown from KT. Among rhinocerotids, the grazer *Ceratotherium praecox* from KT and KL is unknown from KB, which yielded the folivorous *Diceros*. The diverse faunas indicate a closed environment for KB, a more open environment for KL and a still more open one for the KT hominid sites.

These observations are confirmed by biogeochemical analysis of the tooth enamel of the herbivores (Bocherens *et al.*, 1996). To date about 75 fragments of tooth enamel from 15 species have been treated. The ^{13}C means are higher in KT ($-0,1 \pm 1,9$) and decrease from KL ($-2,0 \pm 2,1$) to KB ($-2,9 \pm 3,2$) (Bocherens *et al.*, submitted).

This independent approach confirms the opening up of the environment in the period from the Mio-Pliocene boundary (KB), through KL (5–4 Mya), to KT around 3.5–3.0 Mya.

All these preliminary results indicate that the Chadian faunas between 6 and 3 Mya are critically important to our understanding of the environmental evolution of early hominids. Already Chadian australopithecines show that the hominid story is pan-African at least until 3.5 Mya.

Acknowledgments

We thank the Chad authorities (Ministère de l'Education Nationale de l'Enseignement Supérieur et de la Recherche). We extend gratitude for their support to the French Ministères de l'Enseignement Supérieur, de la Recherche et de la Technologie (CNRS and Université de Poitiers) and Affaires Etrangères (Coopération: MCAC N'Djaména), to the Région Poitou-Charente, Département de la Vienne, Groupe Elf, and the Association pour le Prix scientifique Philip Morris, and also to the Armée française and all the soldiers of MAM and to Epervier, which, by their logistical support, have contributed with the members of MPFT to successful field programs. We are most grateful to Ghislaine Florent for administrative guidance of MPFT and to Sabine Riffaut for draughting the drawings.

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