1985

A frotarsius chatrathi, first tarsiiform primate (? Tarsiidae) from Africa

Elwyn L. Simons
Duke University

Thomas M. Bown
US Geological Survey

Afrotarsius chatrathi, first tarsiiform primate (? Tarsiidae) from Africa

Elwyn L. Simons

Duke University Primate Center, Durham, North Carolina 27705, USA

Thomas M. Bown

US Geological Survey, Denver, Colorado 80225, USA

Tarsiiform primates have long been regarded as a Laurasian group, with an extensive fossil record in the Eocene of North America and Europe[1–4] and two important but less well-known records from Asia[5,6]. The only living genus is *Tarsius* (Tarsiidae), whereas all of the fossil tarsier-like primates are usually placed in the extinct family Omomyidae[3]. We now report the discovery of *Afrotarsius chatrathi* from early Oligocene rocks of Fayum Province, Egypt. This is the first known tarsiiform primate from Africa. Compared with fossil primates, the molar tooth morphology of this diminutive prosimian is most similar to that of the European Eocene microchoerine *Pseudoloris*; however, the closest similarity is to the

molars of *Tarsius*. Because the phylogenetic relationships among living *Tarsius* and the omomyids remain unclear[7,8] and because of the fragmentary nature of the only known specimen of this new primate, allocation of *Afrotarsius* to either Omomyidae or Tarsiidae is necessarily provisional. As we believe that its molar teeth are more like those of *Tarsius* than of any omomyids (including *Pseudoloris*), we tentatively assign the new genus to the extant family Tarsiidae as its only known fossil representative. Recovery of a *Tarsius*-like primate from Africa suggests that it or its ancestors might have been immigrants from Europe, may have been derived from an unknown Asian stock related to the ancestry of *Tarsius*, or may have originated in Africa.

Order Primates
Suborder Prosimii
Infraorder Tarsiiformes
Family Tarsiidae?

Afrotarsius, gen. nov.

Type species: *Afrotarsius chatrathi*, sp. nov.

Diagnosis: Differs from *Tarsius* in having a more posteriorly placed entoconid and thereby relatively longer distance between the M_{1-2} entoconid and metaconid; in having a relatively larger and slightly more labial M_2 paraconid; in lacking a distinct entoconid and in having a smaller, less posteriorly extended posterior cusp on M_3; and in having M_3 with a shorter talonid and a relatively smaller crown with respect to M_2. The specimen differs from all anaptomorphine and omomyine omomyids in the combination of labiolingually broad and shelf-like molar paraconids separated from metaconids and protoconids by a deep notch, and from all omomyids in having a raised, wall-like ridge between the entoconid and metaconid (both features as in *Tarsius*). It differs from all omomyids (except possibly *Hemiacodon* and *Macrotarsius*) in having M_1 metaconid lingually opposite to protoconid, not placed more posteriorly, and in having a smooth posterior wall on the M_1 trigonid. It differs from all omomyids and *Tarsius* in having an indistinct talonid notch on molars and in having $M_1 > M_2 > M_3$.

Afrotarsius chatrathi, sp. nov.

Etymology: For Prithijit S. Chatrath, collector of the type and only known specimen.

Holotype: CGM (Cairo Geological Museum, Ma'adi, Cairo) 42830, fragment of right mandibular ramus with M_{1-3}, lower parts of crowns of P_3 and P_4 (Figs 1, 2).

Locality: Fossil vertebrate quarry M, 249-m level of Jebel Qatrani Formation (Oligocene), Fayum Province, Egypt. Older than 31.0 ± 1.0 Myr[9].

Diagnosis: Only known species; same as for genus. Measurements (mm) are: P_4–M_3 (in series trigonids overlap talonids), 8.70; P_4 length, 1.90; P_4 width, 1.60; M_1 length, 2.45; M_1 trigonid width, 2.00; M_1 talonid width, 2.10; M_2 length, 2.30; M_3 length, 2.20; M_3 trigonid width, 1.80; M_3 talonid width, 2.65; depth of horizontal ramus beneath anterior root of M_2 (lingual side), 3.25.

Description: CGM 42830 is a right lower jaw fragment preserving parts of P_3–M_3 (Figs 1, 2). The top of the crown of P_3 and most of P_4 are missing, as is much of the labial margin of M_2. In addition, the protoconid of M_1 and the metaconids of M_1 and M_3 are broken. Anterior to P_3, part of the distal border of an alveolus is preserved. The lower jaw is slender and shallow and maintains a fairly even depth of 3.25 mm beneath M_{1-3}, shallowing to about 2.90 mm beneath P_3. A tiny mental foramen is present about 1.20 mm above the inferior border of the jaw and slightly anterior to the anterior root of P_4.

P_{3-4} are two-rooted teeth, P_3 being the smaller. Both teeth seem to have been essentially unicuspid. A small cristid connects the base of the P_4 protoconid with the tiny hypoconulid on the posterior margin of the tooth. A well-developed labial cingulid becomes confluent posteriorly with this raised distal heel.

In area and length of the molar crowns, $M_1 > M_2 > M_3$. The molars are simple tribosphenic teeth, each with a large, shelf-like paraconid separated from the metaconid and protoconid by a deep, curved, posteriorly convex sulcus. On M_{1-2} the paraconids are lingual to the midline mesiodistal axis of the crown and project mesially, giving the trigonid an almost equilateral triangular shape in occlusal view. On M_3 the paraconid is more lingual in position and is slightly closer to the metaconid than on M_1 or M_2. The M_{1-2} talonids are broad, deeply basined, bounded by hypoconids and entoconids of approximately equal size, and closed posteriorly by small but distinct hypoconulids. The entoconids are located on the distal border of the talonids, with the result that the talonid basins are long mediodistally. The high wall connecting the entoconids with the bases of the metaconids has an even crest, causing the talonid notch to be indistinct.

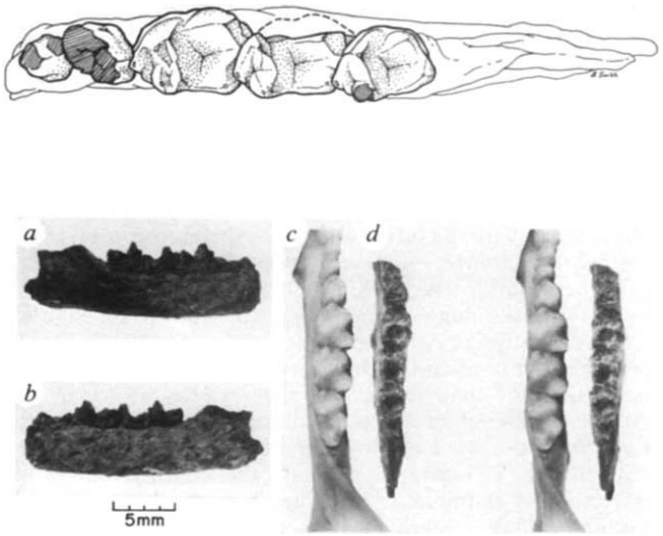

Fig. 2 Labial (*a*), lingual (*b*) and occlusal (*d*) aspects of CGM 42830, holotype of *Afrotarsius chatrathi*, and occlusal aspect (*c*) of FMNH 57281, *Tarsius syrichta*; *c* and *d* are stereo photographs.

M_3 has a somewhat narrower talonid than M_2, caused by the sharp posterolabial inflection of the entocristid, and possesses only two talonid cusps, a large hypoconid at the posterolabial margin of the crown, and a second cusp (hypoconulid or entoconid) at the centre of the posterior margin of the crown. A high oblique wall connects the hypoconulid with the base of the metaconid. As on M_{1-2}, there is no distinct talonid notch. The M_3 post-hypocristid reaches distally into a sharp notch at the base of the hypoconulid.

The M_{1-3} hypoflexids are shallow, the cristids obliquae reaching the bases of the trigonids slightly lingual to the protoconid. M_1 and M_3 have strong labial cingulids that cross the hypoflexid and merge with strong precingulids and weaker post-cingulids (this part of the crown is missing on M_2).

Afrotarsius chatrathi shows a mosaic of dental similarities to the late Eocene microchoerine *Pseudoloris* and to living South-East Asian *Tarsius*. Traditionally, *Tarsius* has been considered to be a living remnant of some early lineage of omomyid primates, which were diverse and abundant during the Eocene in North America and Europe. More recently, several authors have suggested that *Tarsius* has a closer phyletic relationship with living and fossil higher primates than with omomyids[10-12]. Nonetheless, the morphology of the teeth of *Afrotarsius* is clearly closest to that of living *Tarsius* and, among fossil forms, the Omomyidae. We therefore believe, in the absence of other evidence, that the affinities of *Afrotarsius* lie with these animals.

Development of a linguolabially broad and shelf-like molar paraconid separated from the other cusps of the trigonid by a deep valley is a feature shared among *Tarsius*, *Afrotarsius* and *Pseudoloris*, although the more lingual placement of a relatively large paraconid in *Afrotarsius* is more reminiscent of the condition in *Tarsius* than of that in *Pseudoloris*. Also shared is the distinctive posterolabial inflection of the M_3 entocristid, an

unusual feature that seems to link *Afrotarsius* and *Tarsius* to the exclusion of other primate species. The presence of a tall, wall-like entocristid with an indistinct talonid notch, the direct opposition of the M_1 metaconid and protoconid, and the development of tall hypoconids (not relatively short as in *Pseudoloris*) are additional features linking *Afrotarsius* more closely to *Tarsius* than to *Pseudoloris*. Thus, the combination of these and the other diagnostic features demonstrate that *Afrotarsius* is closer in its dental morphology to *Tarsius* than to the Omomyidae, but within that family, *Afrotarsius* most closely resembles *Pseudoloris*.

Unfortunately, canines and incisors, which most clearly distinguish microchoerines and *Tarsius*, are unknown for *Afrotarsius*. Microchoerines, like other omomyids, tend to have a relatively large front tooth in the lower jaw. Of the two teeth immediately posterior to the front tooth, at least one is also relatively large. The anterior three teeth in the lower jaw of *Tarsius*, on the other hand, consist of a very large tooth flanked both anteriorly and posteriorly by much smaller teeth. The divergent structure and placement of the paraconid serve to distinguish the molars of representatives of the omomyid sub-families Omomyinae, Anaptomorphinae and Microchoerinae[1,13–15]. We believe that the paraconid condition in *Afrotarsius* is most similar to that of *Tarsius* and that in both it is different from that of omomyids. Because only one (if any) of the four basic types of paraconid development can be primitive for primates of modern aspect, we feel that the paraconid condition in *Afrotarsius* is probably the most useful morphological guide to its relative kinship to other primates.

Concerning the palaeobiogeography of Tarsiiformes, relatively little more can be adduced from the discovery of a tarsier-like primate in Egypt. Given the Oligocene palaeogeography of Africa, Europe or Asia are the obvious contenders for the geographical origin of *Afrotarsius* and/or its ancestors. Either solution implies the presence on one of these continents of an unknown stock of *Tarsius*-like Prosimii. Of these two possibilities, an Asian origin is perhaps the more likely, though supported only by circumstantial evidence: (1) there are no known suitable morphological candidates for the ancestry of *Afrotarsius* in the relatively well-sampled fossil record of the Euramerican Eocene Omomyidae; (2) the dentition of *Afrotarsius* is structurally most similar to that of living South-East Asian *Tarsius*; and (3) at least some floral[16] and faunal[17] elements of the Egyptian Oligocene might have been more closely linked to those of various parts of Eocene and present-day South-East Asia than they are to floras and faunas of the early Tertiary of Europe. If *Afrotarsius* or its ancestors immigrated to Africa from either Europe or Asia, this dispersal is most likely to have taken place during the late Eocene–early Oligocene Tethyan regression, an event that facilitated the entry of marsupials into Africa from Europe[18]. A last possibility is that *Afrotarsius* originated in Africa from an otherwise unknown (possibly omomyid) prosimian stock. By this viewpoint, *Tarsius*-like primates were deployed from Africa to Asia some time in the Tertiary. However, it is impossible at present to distinguish between these possibilities.

We thank J. G. Fleagle, R. F. Kay, D. W. Krause, P. D. Gingerich, and F. C. Whitmore for review of the manuscript, B. Issawi and M. Askalany for scientific and logistic assistance in Egypt, and A. H. Coleman for photography. J. G. Fleagle mounted Fig. 2. We gratefully acknowledge support through NSF grant BNS-82-09937 to E.L.S., and grant BNS-1961A to J. G. Fleagle.

Received 25 July; accepted 25 October 1984.

1. Simons, E. L. *Primate Evolution: an Introduction to Man's Place in Nature*, 1–322 (Macmillan, New York, 1972).
2. Hoffstetter, R. *J. hum. Evol.* **3**, 327–350 (1974).
3. Szalay, F. S. *Bull. Am. Mus. nat. Hist.* **156**, 157–450 (1976).
4. Gingerich, P. D. *J. hum. Evol.* **10**, 345–374 (1980).
5. Dashzeveg, D. & McKenna, M. C. *Acta palaeont. pol.* **22**, 119–137 (1977).
6. Russell, D. E. & Gingerich, P. D. *C. r. hebd. Séanc. Acad. Sci., Paris* **291**, 621–624 (1980).
7. Simons, E. L. *Bull. Br. Mus. (nat. Hist.) Geol.* **5**, 45–69 (1961).
8. Schmid, P. *Folia primatol* **40**, 1–10 (1983).
9. Fleagle, J. G., Bown, T. M., Obradovich, J. D. & Simons, E. L. *Proc. 10th Congr. int. Primatol. Soc.* (Cambridge University Press, in the press).
10. MacPhee, R. D. E. & Cartmill, M. in *Comparative Primate Biology* Vol. 1 (ed. Swindler, D.) (Liss, New York, in the press).
11. Cartmill, M. & Kay, R. F. *Recent Adv. Primat.* **3**, 205–213 (1978).
12. Cartmill, M. in *Evolutionary Biology of New World Monkeys and Continental Drift* (eds Ciochon, R. L. & Chiarelli, B.) 243–274 (Plenum, New York, 1980).
13. Gazin, C. L. *Smithson misc. Collns* **136**, 1–112 (1958).
14. Bown, T. M. *Folia primatol.* **25**, 62–72 (1976).
15. Bown, T. M. *Wyoming geol. Surv. Mem.* **2**, 1–151 (1979).
16. Bown, T. M. *et al. J. hum. Evol.* **11**, 603–632 (1982).
17. Savage, D. E. & Russell, D. E. *Mammalian Palaeofaunas of the World*, 1–432 (Addison-Wesley, London, 1983).
18. Bown, T. M. & Simons, E. L. *Nature* **308**, 447–449 (1984).