RAPID COMMUNICATION

EARLY EOCENE (YPRESIAN) CONTINENTAL VERTEBRATE ASSEMBLAGE FROM INDIA, WITH DESCRIPTION OF A NEW ANTHRACOBUNID (MAMMALIA, TETHYThERIA)

K. D. ROSE1, T. SMITH2, R. S. RANA3, A. SAHNI4, H. SINGH5, P. MISSIAEN5, and A. FOLIE2

1Center for Functional Anatomy and Evolution, Johns Hopkins University School of Medicine, Baltimore, Maryland 21205, kdrose@jhmi.edu;
2Department of Paleontology, Royal Belgian Institute of Natural Sciences, B-1000 Brussels, Belgium, Thierry.Smith@naturalsciences.be, Annelise.Folie@naturalsciences.be;
3Department of Geology, H.N.B. Garhwal University, Srinagar 246175, Uttarakhand, India, rs_rana_hnbgu@yahoo.com;
4Centre of Advanced Study in Geology, Panjab University, Chandigarh-160014, India, ash.sahni@gmail.com;
5Research Unit of Paleontology, University of Ghent, B-9000 Ghent, Belgium, Pieter.Missiaen@ugent.be

Considerable discussion and controversy have focused on the timing of the collision of India with Asia. Although some geologic and paleontologic evidence suggests initial contact between these two land masses as early as the Cretaceous/Tertiary boundary (e.g., Jaeger et al., 1989; Klooijwijk et al., 1992; Rage and Jaeger, 1995), most current evidence indicates that the Indian Plate began colliding with Asia in the late Paleocene, or at the Paleocene-Eocene boundary, and culminated about 49 Ma ago, when India became sutured to Asia (Gaetani and Garzanti, 1991; Beck et al., 1995, 1998; Butler, 1995; Rowley, 1996; Briggs, 2003; Clyde et al., 2003). Little is known of the mammalian fauna that inhabited India before and around the time of the collision, but the significance of India as a potential center of origin for various modern groups that appeared abruptly at the beginning of the Eocene (Krause and Maas, 1990) has sparked interest in its early Cenozoic faunas. Euprimates, perissodactyls, and artiodactyls are among taxa that first appeared across the holarctic continents during the Initial Eocene Thermal Maximum, and whose geographic origins remain obscure. It has been suggested that the climatic and biotic changes that coincided with the Paleocene-Eocene boundary could be related to the India-Asia collision (Beck et al., 1998).

We report here the discovery of an early Eocene (Ypresian) vertebrate assemblage from Gujarat, India, including continental mammals from the first early Paleogene site that is well south of the Indus-Tsangpo Suture Zone. Among the mammals are primates, bats, artiodactyls, a rodent, and a new anthracobunid tethythere, described below. Descriptions of other new taxa are in preparation. The mammals appear to have holarctic (primarily Eurasian) affinities.

The fossils were found in the lower Eocene Cambay Shale (Samant and Tapaswi, 2001) at the Vastan Lignite Mine, about 40 km northeast of Surat, Gujarat, India. In the Cambay Basin, Paleogene beds are exposed in narrow bands along the western and eastern coasts of the Gulf of Cambay (= Khammad). The Paleocene-lower Eocene Oolite Formation, deposited over the Deccan Traps, comprises the oldest sediments in the basin. The Cambay Shale overlies the Oolite Formation. It ranges from 75 m to 1500 m thick and consists of variegated clay and shale with lignite seams (Chandra and Chaudhary, 1969). The Cambay Shale is overlain by upper Eocene calcareous and bentonitic clay, which in turn is overlain by upper Eocene nummulitic limestone and marl (Ameravati Formation) or Holocene alluvium.

Vastan Mine is one of several lignite deposits along the west side of India explored by our collaborative team since 2001. Our earlier work in the vicinity of Barmer, Rajasthan, yielded lower vertebrates, including sharks, teleosts, a crocodilian, and a snake (Rana, Kumar, et al., 2005; Rana et al., in press). Exploration farther south by Rana and Singh produced shark and teleost teeth (Rana et al., 2004) and a small number of mammal teeth from Vastan Mine (Fig. 1; Rana, Singh, et al., 2005). These discoveries prompted renewed efforts to find mammals at Vastan Mine in November 2004, resulting in the assemblage reported here. The fossils come from two thin lenses (about 5 m wide by 0.3 m thick) of dark, organic-rich, clayey silt at the contact between a marine shelly layer, containing shark and fish remains, and a continental clay layer. About a ton of sediment has been screen-washed and has yielded 23 jaws and >140 isolated teeth of continental mammals so far, a few of which are shown in Figure 2. About 13 species representing seven placental orders have been identified, as well as a diversity of lower vertebrates (Table 1). The fossils are catalogued in the collection of the Department of Geology, H. N. B. Garhwal University, Uttarakhand, India (GU/RSR/VAS = Garhwal University/R.S. Rana/ Vastan). Additional terrestrial mammals were recently discovered at Vastan Mine and were briefly described by Bajpai et al. (2005; see Discussion).

Associated with the fossil vertebrates at Vastan Mine is a large, early Eocene foraminifera, Nummulites burdigalensis, which is an indicator of Shallow Benthic Zone 10–11, of middle to late Ypresian age (Serra-Kiel et al., 1998; Govindan, 2003; Rana, Singh, et al., 2005). Association of N. burdigalensis with Assilina daviesi at the Akli lignite mine, near Barmer, suggests correlation with planktonic foraminiferal zones P7-P8 and corroborates a middle to late Ypresian age, approximately 50–52 Ma.

Aside from the Vastan assemblage, the oldest Cenozoic continental mammals previously reported from India come from the upper part of the Subathu Formation near Kalakot (Jammu and Kashmir) and Subathu (Himachal Pradesh), and are of early Lutetian age (early middle Eocene) (e.g., Sahni and Khare, 1973; Kumar, 1991, 2000; Sahni and Jolly, 1993). Continental mammals from the Kuldana Formation of northern Pakistan, sometimes considered of Ypresian age, have recently been shown to be Lutetian (Gingerich, 2003). The only continental mammals from this region that are of comparable age to those reported here come from the Ghazi Formation near Quetta, Pakistan (Gingerich et al., 1997, 2001; Ginsburg et al., 1999), and the Mami...