



Cricetid rodents from the Lower Siwalik Subgroup of Jammu, India: Biochronological significance

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Received 19 August 2014; received in revised form 13 November 2014; accepted 11 December 2014

Available online 22 December 2014

Abstract

We describe the cricetid rodents represented by *Megacricetodon daamsi*, *Megacricetodon sivalensis*, and *Myocricetodon sivalensis*, recovered from two localities, Dehari and Jhajjar Kotli, lying in the upper part of the Lower Siwalik Subgroup of Jammu Province. The cricetid fauna is similar to that reported from the Pakistan Siwaliks. Based on the species identifications and the stratigraphic range of the cricetid taxa in the Siwalik succession of Pakistan, the age of the Dehari locality is correlated to between 13.8 and 13.2 Ma, whereas an age of 13.8–12.5 Ma would be assigned to the Jhajjar Kotli rodent yielding level. The occurrence of similar rodent taxa at the two investigated sites points to the homotaxial nature of the fossiliferous beds.

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Keywords: Cricetid; Lower Siwalik; Jammu; India; Biochronology

1. Introduction

The last and the southernmost phase of the uplift of the Himalayan Range exposed the sediments deposited in front of it during the Middle Miocene (18.3 Ma) to Late Pleistocene (0.22 Ma), referred to as the Siwalik Group in the Indian stratigraphy. Today extending between the River Indus in the west and the Brahmaputra gorge in the east, the sediments of the Siwalik Group were deposited by a large river system analogous to present day rivers draining the Himalayas (Willis, 1993; Willis and Behrensmeyer, 1995).

Of all the Siwalik sections, those from the Potwar Plateau, Pakistan are the best studied from the palaeontological point of view and are the most precisely dated so far. In this area, precise palaeomagnetic control has led to the establishment

of a high resolution biostratigraphic and biochronological framework, which has become useful for intraregional correlation and dating of other Siwalik fossil sites where no radiometric dates or magnetostratigraphic zones are available (Barry et al., 1982, 1985, 2002; Flynn and Jacobs, 1982; Johnson et al., 1982, 1985; Barry and Flynn, 1990; Flynn et al., 1995). Many age diagnostic cricetid and rhizomyid rodent taxa have been documented from the Siwalik outcrops of the Potwar Plateau (Flynn, 1982a,b, 1986; Lindsay, 1988; Flynn et al., 1995; Lindsay and Downs, 1998; Barry et al., 2002).

Cricetid rodents from the Siwalik deposits were first documented by Jacobs in 1978 from the Potwar Plateau. Thereafter, focused research by the American and Pakistani researchers led to the recovery of a diversified fauna belonging to six subfamilies: Eucricetodontinae, Eumyarioninae, Democricetodontinae, Megacricetodontinae, Myocricetodontinae, and Dendromurinae from a number of geographic areas in Pakistan. The Eumyarioninae taxon was later transferred to the rhizomyine, *Prokanisamys*. The lithostratigraphic units that yielded cricetid rodents from Pakistan include the Muree Formation (de Bruijn et al., 1981) and the Chinji Formation (Wessels et al., 1982) near Banda Daud Shah, the Chinji Formation near Daud Khel (Hussain et al., 1977,

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1979; Munthe, 1980) from the Trans-Indus area, the Manchar Formation of eastern Sindh near the Manchar lake (de Bruijn and Hussain, 1984; Wessels et al., 1987; Wessels, 1996), the Chitarwata and Vihowa Formations in Zinda Pir Dome in west central Pakistan (Downing et al., 1993; Lindsay, 1996), and the Lower and Middle Siwalik deposits of the Potwar Plateau in northern Punjab (Jacobs, 1978; Cheema et al., 1983; Lindsay, 1988; Jacobs et al., 1989; Barry et al., 1991; Lindsay and Downs, 1998).

In contrast, despite several decades of palaeontological research on the Siwalik Group of India, one significant report on the cricetid rodents has been made from the Lower Siwalik deposits of Jammu earlier by Parmar (2007). Recently, Sehgal and Patnaik (2012) described a right upper second molar belonging to *Megacricetodon* cf. *sivalensis* from the Lower Siwalik rocks exposed at Tarmin near Ramnagar town, Jammu and Kashmir. Based on this fossil find along with the recovery of a muroid rodent *Antemus chinjiensis* and an earlier report of a murid rodent, *Kanisamys* cf. *potwarensis* (Parmar and Prasad, 2006) from the Ramnagar area, Sehgal and Patnaik (2012) constrained the age of the Ramnagar deposits between 13.8 and 13.2 Ma on the basis of the FADs (First Appearance Datum) and LADs (Last Appearance Datum) of *Kanisamys potwarensis*, *Megacricetodon sivalensis*, and *Antemus chinjiensis* established in Potwar Plateau, Pakistan. The Lower Siwalik rodent yielding site at Dehari in Ramnagar area had been earlier dated between 13 and 14 Ma based on the presence of *Kanisamys* cf. *potwarensis* by Parmar and Prasad (2006). We here add another rodent, *Megacricetodon daamsi* to the list of rodents recovered from the Dehari locality. We also present here a cricetid fauna comprising *Megacricetodon daamsi*, *Megacricetodon sivalensis*, and *Myocricetodon sivalensis* from another Lower Siwalik locality, Jhajjar Kotli, exposed 35 km NW of the first locality Dehari within the Jammu Province, Jammu and Kashmir State, India.

2. Stratigraphic setting

The Siwalik belt of Jammu lies between the Indo-Pakistan border (actual line of control) in the northwest and the Ravi River in the southeast (Fig. 1A) between the latitudes of 34°05' and 32°20' N and longitudes 73°30' and 75°55' E. The rocks of the Siwalik Group in Jammu Province are exposed in Suruin–Mastgarh anticline, Udampur syncline, and a separate trough around Kishanpur. Detailed geological mapping by the Geological Survey of India (GSI) revealed the presence of 7000 m thick, nearly complete sequence of Siwalik rocks in the southern limb of Suruin–Mastgarh anticline in the Mansar–Uttarbani section, Jammu District (Gupta and Verma, 1988). Gupta and Verma (1988) classified the Siwalik deposits of Jammu into five formations viz. Mansar (Lower Siwalik), Dewal and Mohargarh (Middle Siwalik), and Uttarbani and Dughor (Upper Siwalik). Gupta (1997) further classified the Mansar Formation into lower Dodenal Member consisting of a dominantly arenaceous facies and upper Ramnagar Member representing clay, claystone, siltstone, and sandstone alternations. Exposures of the Ramnagar Member are well developed in the

Ramnagar area that lies 38 km northeast of Jammu within the southern limb of Udampur Syncline. Basu (2004) provided a stratigraphic framework for the upper 350 m fossiliferous Lower Siwalik sequence of Ramnagar area (equivalent to the Ramnagar Member of Gupta, 1997). He designated the sandstones occurring in the Ramnagar area with persistent physical character and considerable lateral extent as *reference sandstones* A–J and marked the stratigraphic levels of the fossil yielding localities from 1 to 29 with respect to the *reference sandstones* A–J (Basu, 2004, Figs. 2 and 3). One of the cricetid rodents described in the present work, represented by a right upper molar M^1 and assigned to *Megacricetodon daamsi*, comes from a site close to the fossil locality 9 (Basu, 2004) that lies a little above the reference sandstone I of Basu (2004). The fossiliferous bed is gritty brownish-grey sandstone (Fig. 1B) and is located about 8 km southwest of Ramnagar and about 0.5 km northeast of Dehari village (Fig. 1B), District Udampur, Jammu and Kashmir State, India. From this site, Parmar and Prasad (2006) reported a right dentary fragment of *Kanisamys* cf. *potwarensis*. The second cricetid fossil site too comes from the Ramnagar Member of the Mansar Formation (Lower Siwalik Subgroup), exposed about 33 km North of Jammu on National Highway No.1A, and about 100 m before the Jhajjar bridge, near Jhajjar Kotli village, District Jammu, Jammu and Kashmir State, India (Fig. 1D). According to the existing geological maps and field guides (Shah et al., 1988; Nanda and Kumar, 1998; Bhat et al., 1999, 2003), the rock strata exposed here fall in the southern limb of Suruin–Mastgarh anticline and form the upper part of the Lower Siwalik Subgroup (Nanda and Kumar, 1998). The rodent yielding section (Fig. 1E) consists of alternations of greenish grey fine-grained sandstone, red siltstones and brownish red to red coloured mudstones. A rodent fauna comprising a left lower molar (M_2) of *Megacricetodon daamsi*, a left lower molar (M_1) of *Megacricetodon sivalensis*, and a right upper molar (M^2) of *Myocricetodon sivalensis* is recovered from a red-coloured mudstone bed sandwiched between the siltstone units.

3. Materials and methods

About 200 kg of sample from Dehari site and about 100 kg of sample from Jhajjar Kotli site were collected for processing. The Lower Siwalik rock samples collected from these two sites were macerated employing oil-water immersion method in the laboratory at University of Jammu. The residue left after screen washing was sorted under CENSICO stereoscopic zoom binocular microscope DZ-240 for the recovery of rodents. The specimens described in the paper are housed in vertebrate palaeontology laboratory of University of Jammu, Jammu, Jammu and Kashmir State, India, and bear the acronym VPL/JU/SM/(Vertebrate Palaeontology Laboratory/Jammu University/Siwalik Mammals). Photomicrographs were taken and line drawings were made using Nikon Stereoscopic Microscope SMZ 1500 attached with a drawing tube. The cricetid systematic and dental terminology of Lindsay (1988) and Lindsay and Downs (1998) are followed in this paper. Wessels (1996) did not recognize the genus *Megacricetodon*

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