

Late Miocene rhizomyid rodent-bearing faunule from the Siwalik of Palampur, Himachal Pradesh, India

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Brachyrhizomys (Rhizomyidae, Rodentia) and associated vertebrates from the Middle Siwalik of the Neogal Khad, Palampur are described and assigned an age of 8.1 Ma on the basis of rhizomyid biochronology developed in the Siwalik Group of Pakistan. Relatively wide palaeogeographical distribution of the Late Miocene Siwalik rhizomyid taxa indicates isolation of the Siwalik faunal province after 7 Ma.

RHIZOMYID rodents have been very well demonstrated as high quality geochronological constraints in the Siwalik Group of the Indian subcontinent^{1,2}. Small isolated outcrops yielding meagre rhizomyid rodent assemblages can also be dated and taken into account while synthesizing the geological evolution of the area. This note records an occurrence of a faunule having rhizomyid rodent elements from an isolated exposure (32°8'35"–76°32'5") on the left bank of Neogal Khad, facing Government Primary School Thala, in Palampur area (Figure 1). The various components of the faunule recovered from Palampur area are as follows:

Reptilia

Crocodylia - *Crocodylus* sp.

Mammalia

Rodentia - *Brachyrhizomys micrus*

Order indet. - Gen. et sp. indet. form 1
Gen. et sp. indet. form 2

The presence of *Brachyrhizomys*, a short ranging rhizomyid, in Neogal Khad faunule is important as it establishes the presence of the Late Miocene Siwalik sediments almost at the tectonic contact of the Siwalik with Chandpur metasediments. Further, it secures a place for Palampur Siwalik in the Neogene microvertebrate locality map of the Himalaya.

On the right bank of Neogal Khad, high dips varying between 55° and 65° in N 10° E direction with approximately E–W trending strike, conforming the regional aspect, are noticed between a rope bridge near Bandla and Kandi village. Thick cliff-forming micaceous medium-grained sandstone having floral

concentration along the bedding planes with alternating mudstone horizons in 1:1 ratio are exposed here. On the corresponding left bank huge glacial boulders and Recent assorted detritus form a thick cover concealing the stratified horizons below. However, a few detached exposures, including the above specified faunule yielding one, were observed peeping through this cover, and are lithologically dissimilar with the horizons which are in much high relief on the right bank.

Faunule yielding isolated exposure on the left bank of the Khad is 8.7 m thick (Figure 1) with its base unexposed and top obscured by loose material. A pale brownish to grey intraformational conglomerate horizon of 0.6 m thickness is sandwiched within the light grey fine-grained sandstone. It yields mostly fragmentary vertebrates.

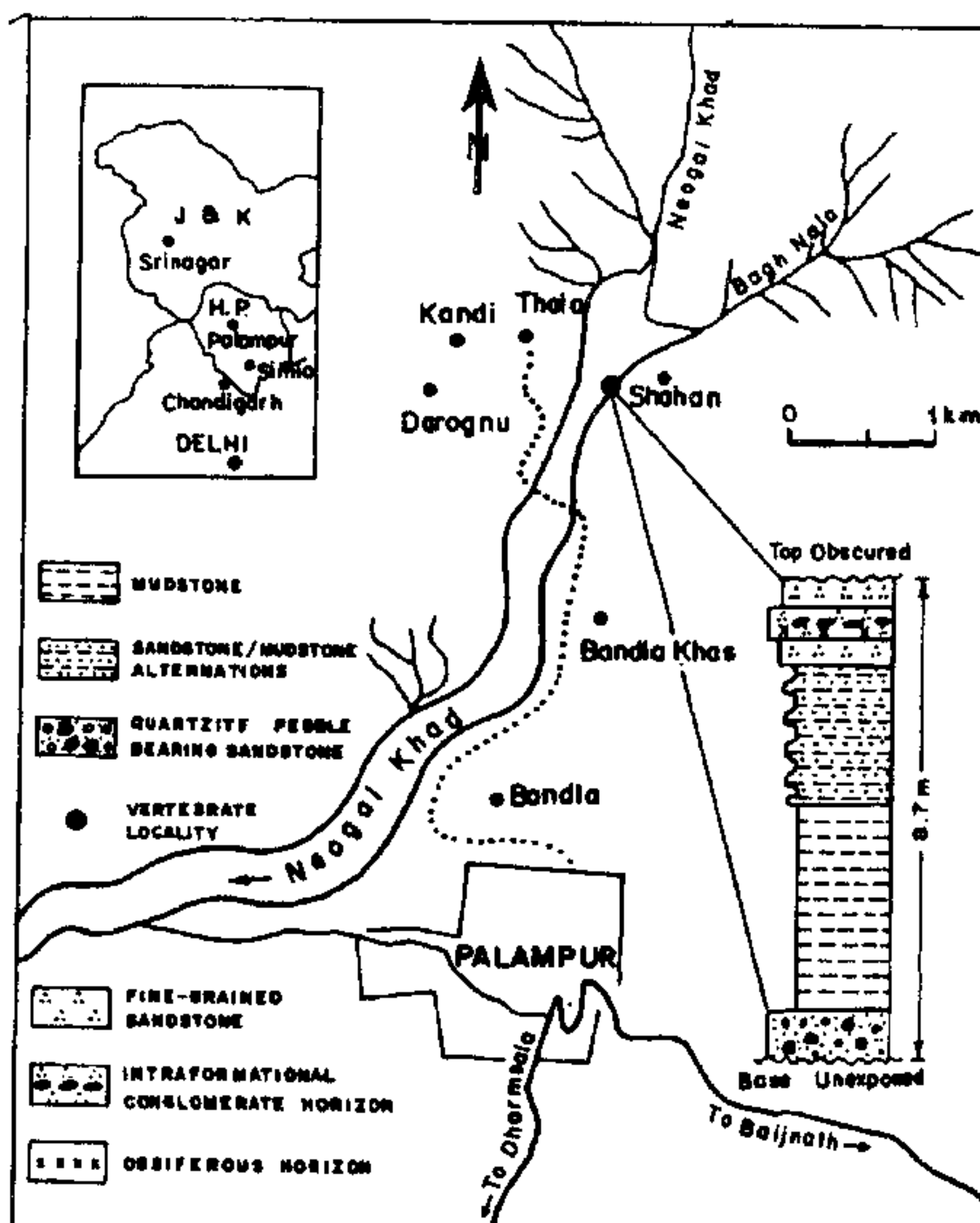


Figure 1. Vertebrate locality map, litholog of the exposure, and position of Palampur in inset.

Faunal description

Family: Rhizomyidae Miller & Gidley, 1918
 Subfamily: Rhizomyinae Miller & Gidley, 1918
 Genus: *Brachyrhizomys* Teilhard de Chardin, 1942
 Type species: *Brachyrhizomys shansius* Teilhard de Chardin, 1942

Brachyrhizomys micrus Flynn, 1982 (Figures 2–6)

Holotype, horizon and locality: YGSP 5494, left dentary with broken I/1, M/1–3, lower Dhok Pathan Formation, locality Y314, Potwar Plateau, Pakistan.

Material: An isolated LM/3 (WIMF/A 643) and an incisor fragment (WIMF/A 651).

Horizon and locality: Detached Middle Siwalik (Late Miocene) near Bandla Water Works, on the left bank of Neogal Khad, Palampur (Figure 1).

Repository: Museum, Wadia Institute of Himalayan Geology, Dehradun, India. Specimens bear WIMF/A numbers given in the text.

Description

LM/3 (WIMF/A 643). The molar is slightly worn. Occlusal outline is rectangular with subrounded and sloping posterior margin. Characteristically, the low-crowned LM/3 is unilaterally or differentially hypsodont with anterolingual corner in relatively higher relief. Deep and wide labial reentrant reaches lingual margin as the mure is weak because of an early wear. Stria is shallow and terminates well above the enamel base on an uneven enamel platform. Anterolophid and metalophid form an anterolingual shallow enamel lake with a narrow passage to adjacent arcuate enamel lake posteriorly bordered by mesolophid. Mesolophid originates from middle of the posterior arm of the protoconid. Arcuate enamel

lake with restricted lingual opening is followed posteriorly by relatively deeper transverse enamel lake between mesolophid and hypolophid. Additional enamel bead at the lingual end of mesolophid further restricts the narrow lingual opening of this lake. Stout posterolophid is isolated from other crown features because of continuous and deep reentrant. The molar has a broken, stout, lingual root towards the posterior side and an incomplete compressed transverse root supporting the anterior end.

Incisor (WIMF/A 651). Enamel covering on the incisor fragment is confined only to the anterior side leaving two-thirds of the dentine exposed. The incisor is medially flattened to a little extent with an oval cross-section. It is moderately curved and is being tentatively assigned to *B. micrus*.

Dimensions

	LM/3	Incisor
Length (mm)	3.7	2.9
Width (mm)	3.0	1.4
Crown height* (mm)	1.4	

*1.7 mm at anterolingual corner.

Comparisons

WIMF/A 643, the LM/3 resembles morphologically and dimensionally the corresponding molars of *Protachyoryctes*, described by Flynn². It, however, exhibits a few characters, viz. low crown, deep labial reentrant and short posterior enamel lake on the basis of which it cannot be assigned to any tachyoryctine taxon including *Protachyoryctes tatroti*. Though hypsodonty is certainly not a pronounced feature of *P. tatroti*, relatively short labial reentrant and large posterior enamel lake in their last lower molars clearly differentiate *P. tatroti* from WIMF/A 643.

Last molars of *Brachyrhizomys nagrii* also exhibit all the above mentioned features of the LM/3. Additional common features are: (i) termination of stria well above enamel base on labial side and, (ii) weak mure in early wear stage of the molar². However in spite of all the above mentioned characters slightly narrowing and sloping posterior of the LM/3 (WIMF/A 643) differentiates it from M/3s of *B. nagrii* which narrow abruptly on the posterior side³. Another species *B. punjabiensis* is relatively smaller, and its upper variation limits do not envelop the LM/3s dimensions. *Brachyrhizomys* cf. *B. pilgrimi*, *B. blacki*, *B. tatracharax* and *B. choristos* are much larger to be assigned to the present LM/3. Slightly narrowing and sloping posterior margin of the lower last molars of *B. micrus* and nearly identical size favour the attribu-

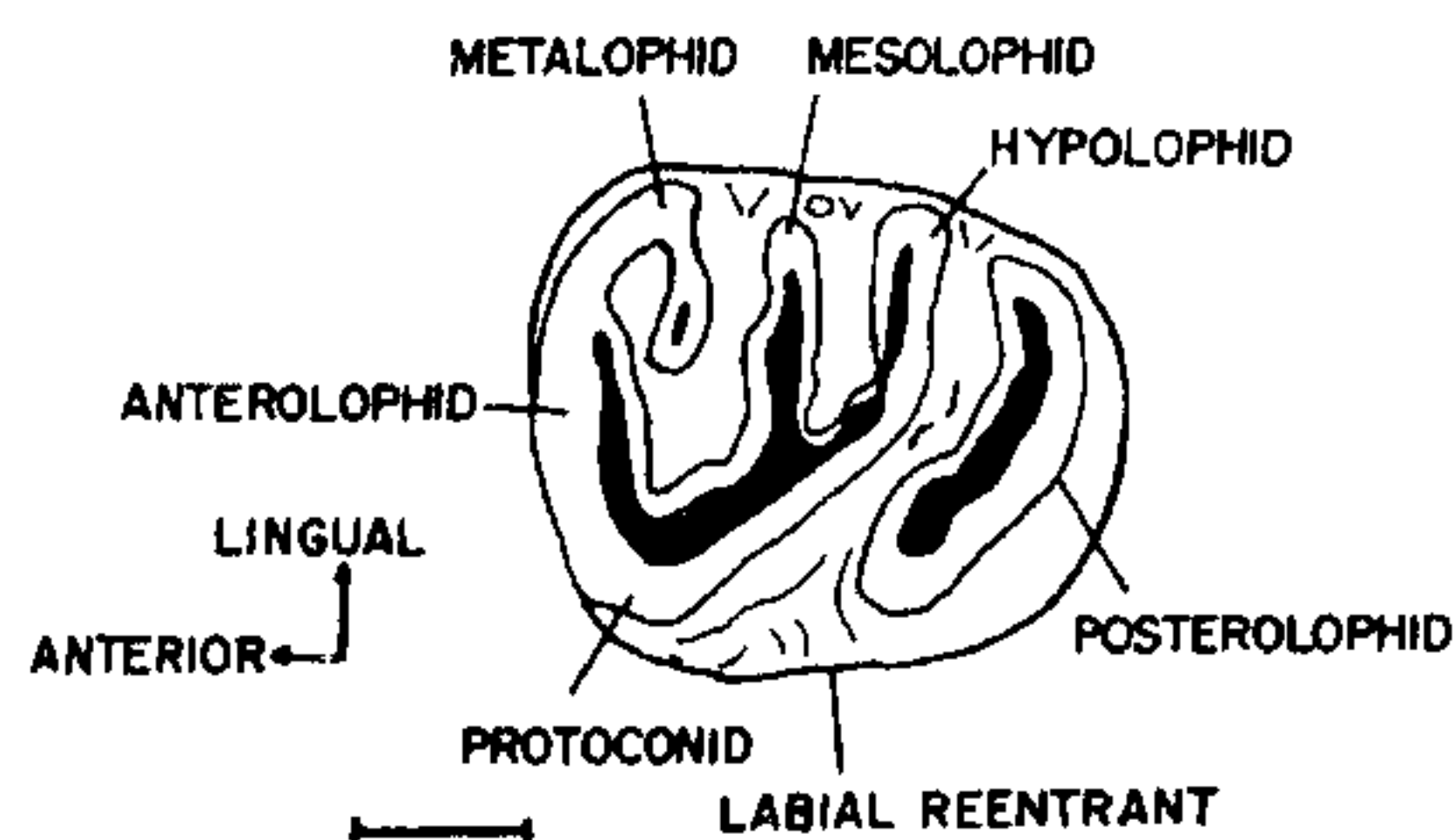
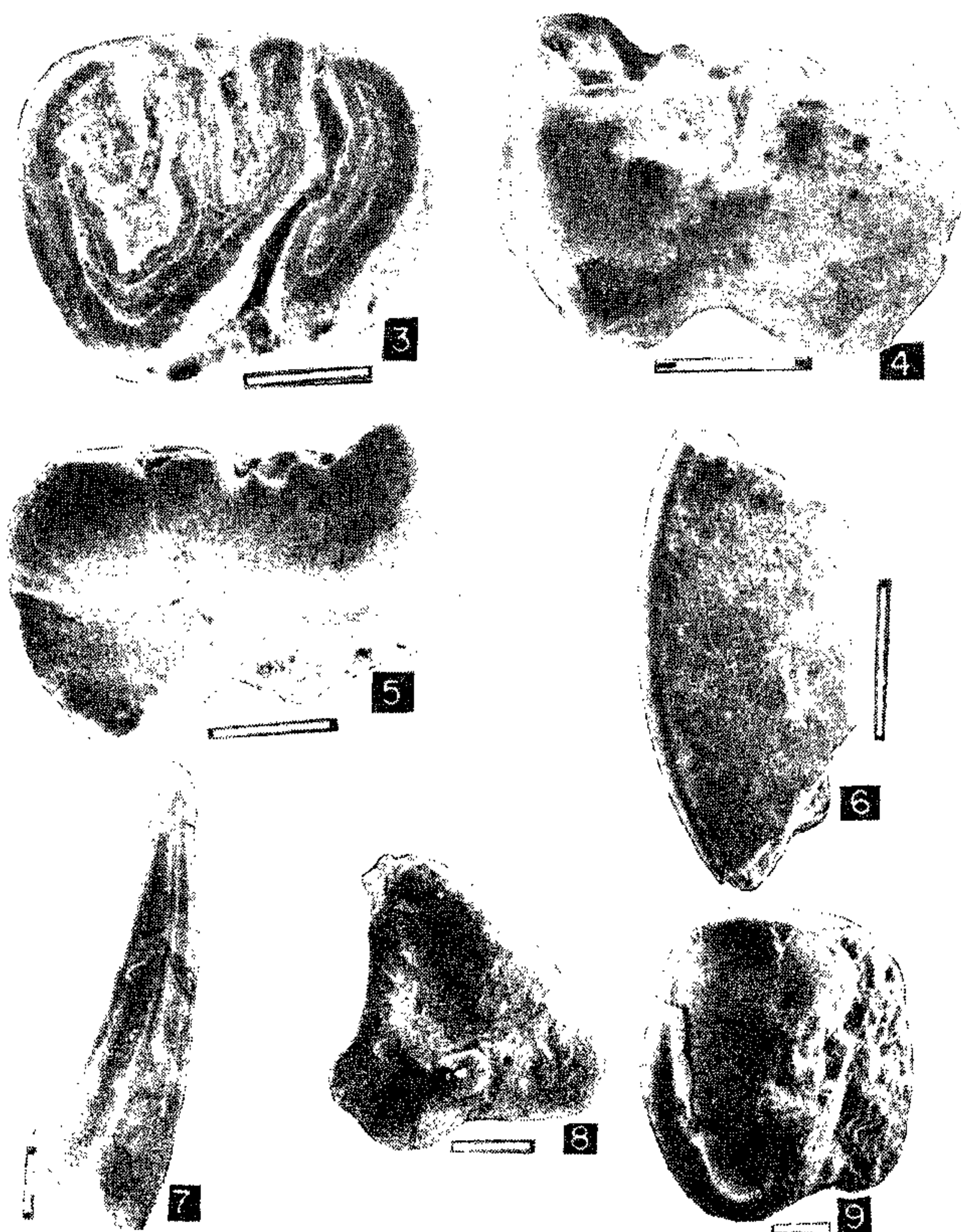


Figure 2. Labelled sketch of the LM/3 (WIMF/A 643). Bar length 1 mm.



Figures 3-9. *Brachyrhizomys micrus*, 3-5, Isolated LM/3 (WIMF/A 643) occlusal (3), labial (4), lingual (5), views. 6, *Brachyrhizomys micrus* (WIMF/A 651) incisor, medial view. 7, *Crocodylus* sp. (WIMF/A 646) an isolated tooth. 8 & 9, Mammalian molar fragments (WIMF/A 650, 648) Gen et sp. indet. Bar length 1 mm.

tion of present LM/3 to *B. micrus*. WIMF/A 651, the incisor fragment has similar morphological features as the ones described by Flynn².

Other vertebrate remains

Many fragmentary micro- and macrovertebrate remains were found associated with the LM/3 of *B. micrus*. They include several fragmentary mammalian teeth and bones, and an isolated slightly curved tooth of *Crocodylus* sp. (WIMF/A 643, Figure 7). *Crocodylus* sp. being an end member of the food-web cycle, indicates the presence of sufficient biomass in the area.

WIMF/A 648, a mammalian molar fragment (Figure 9) of unknown affinity exhibits deep lake rimmed by an enamel ridge with dentine at lake base. WIMF/

A 650 is another molar fragment (Figure 8) having an enamel cusp with cingulum.

Age considerations

Brachyrhizomys evolved from *Kanisamys* at 9.5 Ma with *B. punjabiensis* (9.5 Ma to 9 Ma), the most primitive rhizomyine species, exhibiting close resemblance with *Kanisamys* stock². *B. nagrii* speciated from primitive *Brachyrhizomys* stock at 8.5 Ma with advanced characters typical of bamboo rat subfamily Rhizomyinae. *Brachyrhizomys* is known to range up to 7 Ma in Pakistani Siwalik sequence. There are reports of some *Brachyrhizomys* specimens from the Indian Siwalik from still younger horizons¹. These findings have been slightly elaborated by Gupta *et al.*⁴ making it clear that the LM/3 from the

Neogal Khad is more primitive; being considerably low-crowned and smaller in size it cannot be from a horizon younger to 7 Ma BP. *Brachyrhizomys micrus* is known from 8.1 Ma level in Pakistani sequence¹. As the present LM/3 is specifically similar to the M/3 in the Holotype (YGSP 5494) of *B. micrus* which is from 8.1 Ma BP level, it is also being assigned the same age.

Palaeobiogeographical observations

Most of the rhizomyid taxa are not good tools for long distance biostratigraphical correlations owing to their endemic nature. *Brachyrhizomys* is not an exception to this virtue. However, it is known from the Lower Manchar Formation⁵ in Sind, Pakistan, and at least from three localities in China yielding five species of which three are well known from the Siwalik Group of the Indian subcontinent⁶. *Kanisamys*, a relatively more primitive rhizomyid taxon, is rather widely distributed in the Late Miocene localities of southern Asia. This geographical distribution of rhizomyid taxa indicates the degree of intermingling

of rodents which was possible during the Late Miocene because of the absence of physical barriers, paving way for mixing of faunal elements. Subsequent tectonic events in the region brought physical barriers into being and consequently faunal communities started evolving in isolation in smaller subdivided faunal provinces.

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