

NEW REMAINS OF *MICROSTONYX* (SUIDAE, ARTIODACTYLS) FROM THE MIOCENE OF PAKISTAN

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ABSTRACT

The remains of *Microstonyx* are discovered during the fossil excavation from the Potwar plateau, northern Pakistan. The detailed comparison with the *Dicoryphochoerus titanoides* and *Hippopotamodon sivalense*, the specimens are assigned to *Microstonyx major*. The genus *Microstonyx* is characterized by elongated I² and I³, gigantic suids but smaller than *Hippopotamodon*. The new molars of the rare species *M. major* reported here are recovered from Ava and Kund localities of the Siwalik Group.

Key words: Suidae, Chinji, Siwaliks, Paleontology, Taxonomy

INTRODUCTION

Microstonyx Pilgrim 1926 is a typical suid found in the Miocene of Europe and Asia (Pearson 1928; Erdbrink 1969; Made *et al.*, 2013) including the Subcontinent (Made and Hussain 1989). *Microstonyx* is a large suid having a massive skull, with wide and flat dorsal surface. The dental morphology of well-known and dominant species of the genus, *Microstonyx mior*, is very similar to *Hippopotamodon sivalense*. It is differentiated from *Hippopotamodon* in having an elongated snout, small canine, and shallow mandible. I³ is largely elongated, having posterior lingual cingula, inflated zygomatic arches. Posterior edge of the orbit is well behind the third upper molar, long diastema between canine and P². Canine is always reduced regardless the sex of an individual. P₁ is generally absent.

Lydekker (1877) named the genus and species *Hippopotamodon sivalense* for material from the Siwaliks (Pakistan). It is described mostly because of its large size. The cheek teeth are highly complicated with additional accessory conule like those of *Hippopotamodon* which was wrongly marked as *Sus titan* by Lydekker (1884), *Potamochoerus titan* by Stehlin (1899), *Dicoryphochoerus titan* by Pilgrim (1926), Colbert (1935), Schmidt-Kittler (1971) and Thenius (1972). The legitimacy of *Dicoryphochoerus chisholmi* and *Dicoryphochoerus instabilis* is unverifiable because of lacking material (Colbert 1935). The genus *Dicoryphochoerus titan* was initially incorporated in genus *Sus* by Lydekker (1884). In 1926, Pilgrim shifted the genus *Sus* to the genus *Dicoryphochoerus*. The genus *Dicoryphochoerus titanoides* is generally a small size variant of the species *Dicoryphochoerus titan* (Pilgrim 1926). As indicated by Colbert (1935), this species is

related to *Dicoryphochoerus chisholmi*. The species *Dicoryphochoerus vagus* is in synonymy with species *Sus hysudricus* (Colbert 1935). Pickford (1988) put together the whole material of genus *Dicoryphochoerus* under one species *Hippopotamodon sivalense*. He gave an account on genus and species *Hippopotamodon sivalense* in detail giving a long list of its synonymy including the species *Hippopotamodon sivalense*, *Dicoryphochoerus titanoides* and *Dicoryphochoerus robustus* which are by viewed as *Microstonyx major*. Made and Hussain (1989) raised the question of whether *Microstonyx* should be included in *Hippopotamodon* but did not resolve the question. Fortelius *et al.* (1996) included *Dicoryphochoerus meteani* in *M. antiquus* and transferred that species to *Hippopotamodon*, but not the other 2 European species (Made *et al.* 2013).

Microstonyx is known by two species in Europe i.e. *Microstonyx antiquus* Kaup 1833 (Holotype from Eppelsheim) and *Microstonyx major* Gervais, 1848/1852 (Holotype from Cucuron). The third species i.e. *Microstonyx erymanthius* founded by Roth and Wagner (1854) from Pikermi, gave the status of a subspecies of *Microstonyx major* by Made *et al.* (1992). Thenius (1972) suggested that *M. antiquus* and *M. major* were contemporaneous but lived in different habitats. Ginsburg (1980) noted that *Microstonyx antiquus* found in MN 9-10 and *Microstonyx major* in MN 11-12. Made and Moya-sola (1989) proposed that the species *Microstonyx major* comprises two subspecies i.e. *Microstonyx major major* and *Microstonyx major erymanthius*. According to Made *et al.* (1992) the later is more progressive than the former. Upto now the genus *Microstonyx* has been recorded from large number localities in Europe and Asia (Made and Hussain, 1989). Most of European material is known from Spain and France. It has been extensively

studied by Golpe-Posse (1972, 1979, 1980), Made and Moya-sola (1989) and Made *et al.* (1992). One evidence of *Microstonyx major* has been recorded from the SE European populations and late Miocene of Turkey (Kostopoulos *et al.*, 2001; Liu *et al.*, 2005).

The study is based on two isolated upper molars from the localities of Ava and Kund (Fig. 1), belonging to middle Chinji and Nagri formations, district Chakwal, Punjab, Pakistan.

MATERIALS AND METHODS

The material comes from the Lower and Middle Siwalik subgroups of Pakistan. The teeth were partially filled with cement and mud. These sediments were

removed with the help of light hammer, chisels and fine needles. During the preparation the broken parts were assembled by using elfy. The photographs were taken with Pentax digital camera by using accessory lenses. A Vernier caliper is used for the measurements. Each specimen shows both the collection years as well as the specimen number of that year e.g. PUPC 85/71. The lower figure shows the collection year and the upper figure indicates the serial number of the respective year. The following acronyms are used: PUPC, Punjab University, paleontological collection stored in Zoology Department Lahore, Pakistan; IM², upper left second molar; rM³, right third upper molar; MN, European land mammal zone.

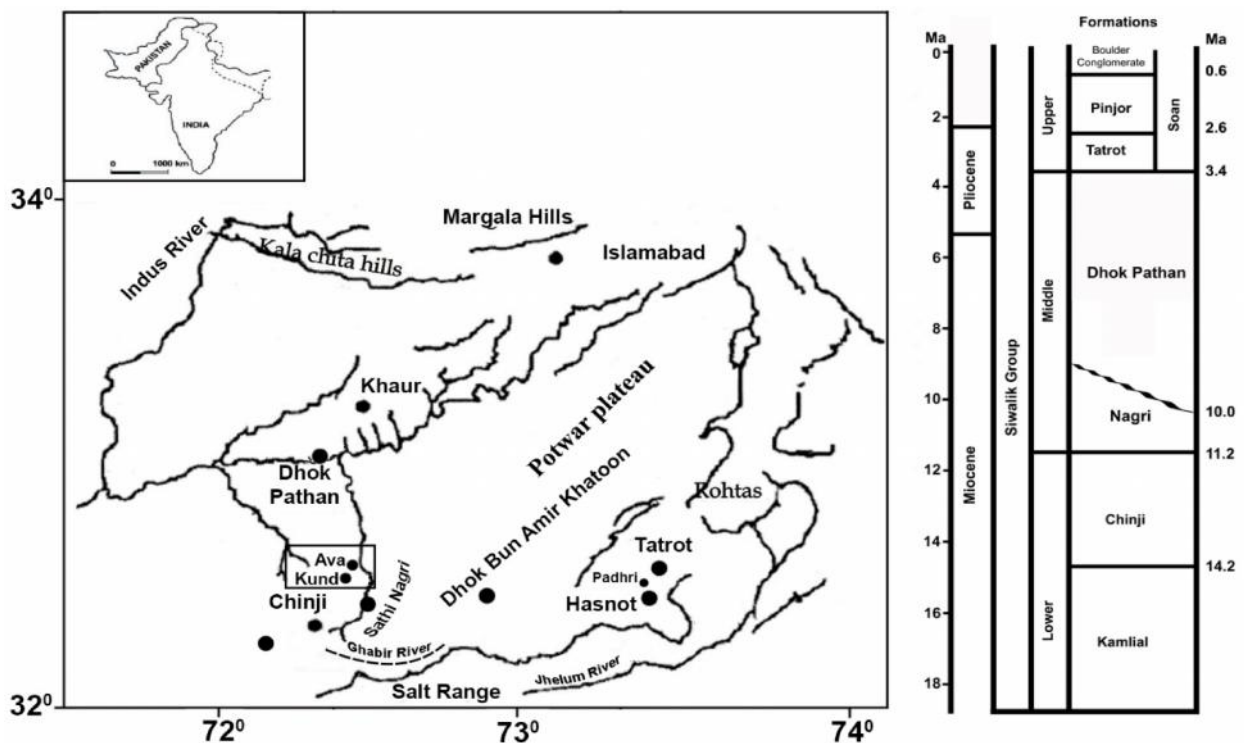


Fig.1. Location map of Potwar Plateau in Pakistan; the studied localities are encircled.

SYSTEMATIC PALEONTOLOGY

Order ARTIODACTYLA Owen 1848

Family SUIDAE Gray 1821

Subfamily SUINAE Lydekker 1877

Genus *Microstonyx* Pilgrim 1926

Microstonyx major Gervais 1848 (Fig. 1; Table 1- 3)

Synonymy: *Sus major* Gervais 1848: Pl. XII Fig. 2;

Microstonyx major Kazanci *et al.* 1999: 507;

Dicoryphochoerus titanoides Pilgrim 1926;

Dicoryphochoerus robustus Pilgrim 1926: 42-473, Pl. XIV, Figs. 9-11.

Diagnosis: Smaller than *Microstonyx antiquus*. P¹ present but P₁ absent (probably lost in early life). Canine much reduced.

Horizon: Lower Vallesian to Middle Turolian of Europe (Made *et al.*, 1992); Nagri Formation of the Siwalik Group (Made and Hussain, 1989).

Geographic distribution: The species is known from Europe (Made and Moya-Sola, 1989; Made, 1988; Made *et al.*, 1992), Russia (Maimov, 1951), Turkey (Ozansoy, 1965), Iran (Campbell *et al.*, 1980), China (Erdbrink, 1969; Pearson, 1928) and Nagri, district Chakwal, Punjab, Pakistan (Made and Hussain, 1989).

Specimens and localities: PUPC 85/71, IM² from middle Nagri Formation, Ava, district Chakwal, Punjab, Pakistan. PUPC 84/87, rM³ from middle Chinji Formation, Kund (Chinji), district Chakwal, Punjab, Pakistan.

Description

IM²: The tooth is excellently preserved and slightly worn (Fig. 2). Only the anterior pair of cusps and the median conule have been worn. The tooth is somewhat longer than broader (Table 1). The anterior and posterior cingula are strong; the posterior cingulum is relatively weak and the labial cingulum is indicated by a low vertical ridge labially. The principal suid grooves are quite prominent in all the four cusps. Apart from the principal groove, accessory grooves are present in all the cusps. The metacone is triangular shape, it is provided with three suid grooves which is divided into three lobes, each of the three lobes is further bifurcated by a very shallow groove; these grooves have disappeared in the paracone because of the wear. However, its tripartite division is still very clear. The hypocone shows two accessory grooves anteriorly and one posteriorly. The protocone is similar to the hypocone. The anterior and posterior accessory conules are almost of equal size and are somewhat smaller than the median accessory conule. All the three conules are fairly raised. The transverse valley is quite open and is not blocked by the median accessory conule. The protocone and hypocone are low in vertical height, provided with the anterior, posterior and median grooves. The paracone and metacone are vertically higher than the lingual cusps, provided with the prominent suid grooves.

rM³: The last upper molar is damaged posteriorly (Fig. 2). The anterior cingulum is strong, there is a cingular tubercle anterolingually which is even larger than the anterior and median accessory conules. The cingulum is represented by a cingular tubercle lingually, blocking the entrance of the transverse valley. The cingulum is also present labially in the middle of transverse valley. The proto- and paracones are rounded, having a pyramidal tubercle. Apart from the principal suid grooves, one accessory groove may be seen at the anterior face of each of the four principal cusps. The protocone bears an accessory groove posteriorly. The anterior and median accessory conules are equally large and high. The former is anteroposteriorly compressed. They are provided with three suid grooves which form a definite lobe labiolingually. The hypocone and metacone are damaged posteriorly along with post talon. The cingulum is quite thick crenulated all around the crown surface.

Comparison: The teeth are large sized representing suid morphology. The large Siwalik suids include *Tetraconodon*, *Sivachoerus*, *Hippopotamodon* and *Microstonyx*. *Tetraconodon* and *Sivachoerus* have qualities expanded P3-4. The cheek teeth of *Hippopotamodon* are expansive to a great degree. The studied material is neither gigantic to put in the genus *Hippopotamodon* nor too small to be referred to the other Siwalik suid genera. Morphometrically, the specimens are pretty match with the transitional Siwalik genus *Microstonyx* (Made and Hussain, 1989). Metrically, the molars are within the variation limit of the species *Microstonyx major* (Table I). A careful study of morphological features of the specimens and their measurements (Table 2-3) indicates their affinity to the species *Microstonyx major*.

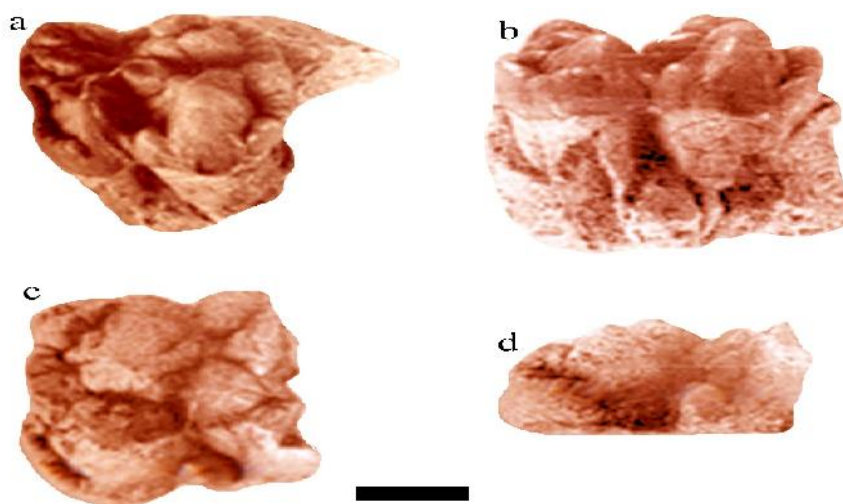


Fig. 2. *Microstonyx major*: Crown (a) and lingual (b) views of IM² (PUPC 85/71) from Ava, district Chakwal, Punjab, Pakistan. Crown (c) and lingual (d) views of a posteriorly damaged rM³ (PUPC 84/87) from Kund (Chinji), district Chakwal, Punjab, Pakistan. Scale bar 10 mm.

Table 1. Measurements of M² and M³ in European and Pakistani material of the species *Microstonyx major*.

	Pakistani material						European material					
	PUPC collection			B. 354			(mean deduced by Made <i>et al.</i> (1992))					
	According to Pickford (1988).			According to Made & Hussain (1989).								
	L	W	W/L index	L	W	W/L index	L	W	W/L index	L	W	W/L index
M ²	29.5	26.0	88.0	29.0	25.5	88.0	29.0	25.2	87.0	30.5	26.5	87.0
M ³	46.0 ^e	30.6	67.0 ^e	46.5	31.0	67.0	45.6	30.5	67.0	44.5	29.0	65.0

Table 2. Comparative measurements of P₃-M₂ in Ind. Mus. B. 714 and the mean value(M) of the dimensions for P₃-M₂ in the species *Microstonyx major* deduced by Made *et al.* (1992).

*According to Pickford (1988) the anteroposterior length is 24.5 and width is 15.6. The latter dimension is the same as measured from the figure illustrated by Pilgrim (1926, pl.XIV, fig. 10) the former when measured came to be 21.5 instead of 24.5.

	P ₃		P ₄		M ₁		M ₂	
	B.714	M	B.714	M	B.714	M	B.714	M
L	22.0	19.9	21.5*	21.5	25.0	23.0	31.5	29.3
W	12.0	10.6	15.6	15.7	16.8	16.4	21.8	20.6

Table 3. Transverse width of P₃-M₂ (Ind. Mus. B.714) of *Dicoryphochoerus robustus* Pilgrim (= *Microstonyx major* Gervais) and the range of transverse width of P₃ - M₂ of *Hippopotamodon sivalense* deduced by Made *et al.* (1992).

B.714	P ₃		P ₄		M ₁		M ₂	
	<i>H. sivalense</i>		B.714	<i>H.sivalense</i>	B.714	<i>H.sivalense</i>	B.714	<i>H.sivalense</i>
12.0	13.4-15.6	15.6	18.6- 21.3	16.8	17.5-20.5	21.8	22.9-26.3	

DISCUSSION

Microstonyx is a common faunal element in the Miocene faunas of SE Europe Greece, Yugoslavia, Bulgaria, Turkey, Spain and France (Thenius, 1972; Ginsburg, 1988; Made and Moya-Sola, 1989; Made *et al.*, 1992, 1997; Pickford, 1993; Fortelius *et al.*, 1996; Hunermann, 1999). In the Subcontinent the genus *Microstonyx* was erected by Pilgrim (1926) from the Siwaliks. The dimensions of the holotypes are almost close to *Sus titan*, *Sus praecox* and *Dicoryphochoerus robustus* (Made and Hussein, 1989). Nevertheless, the Subcontinental large suids can be divided into two groups: *Hippopotamodon*-like suids and *Microstonyx*-like suids. The very large species includes *Hippopotamodon sivalense* and a smaller species can be named *Microstonyx major*. Both groups have almost same morphology but differ in dimensions.

Microstonyx is characterized in having long upper second and third incisors. The feature suggests that *Microstonyx* was an able rooter, extracting the food from the soil (Made *et al.*, 2013). The species appears to be very flexible on ecological changes, providing population

of smaller size in more arid condition and a large form of *M. major* is probably northern in origins, where savanna wood land like environment predominate (De Bonis *et al.* 1992). At the beginning of the Turolian (MN11), the increase of aridity the predominance of open landscapes allowed a smaller form of Asiatic origin towards the west of Greece where it survive until the middle of Turolian (MN12). During the middle of Turolians period, the large forms seem to disappear temporarily from the study area. During the late Turolian (MN13), the species appears to be geographical restricted to the areas of more humid condition where the increase of the forested environment allowed *Microstonyx major* to be progressive. The ecological adaptations are associated with the increase of the size of a species.

Conclusions: *Microstonyx major*, a rare suid species is reported from the outcrops of localities Ava and Kund in the Pakistani Siwaliks. This is the second report of this species from the Siwaliks after Made and Hussain (1989). *M. major* shows close morphological resemblance with the other Siwaliks species *Hippopotamodon sivalense* and further research could ascertain a possible synonymy.

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