

New Suid Remains of Genus *Potamochoerus* from the Siwaliks of Pakistan

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Abstract

The recent findings and subsequent documentation of dental remains belonging to *Potamochoerus* (Mammalia, Suidae) have emerged from the Middle Miocene Siwalik beds in the vicinity of Hasnot, situated within the province of Punjab, Pakistan. The fossils in question were discovered in the Jhelum district. The material consists of an isolated tooth, the left third maxillary molar. The genus *Potamochoerus* was comprised of small-sized suids. The material currently under discussion, specifically an upper third molar located on the left side, provides significant insights into the essential dental traits of this particular genus. This particular substance can potentially augment the existing understanding of the species documented in the vicinity of the Salt Range of the Siwaliks in Pakistan.

Keywords: Artiodactyla, Miocene, Molar dentition, Morphology, Suidae

INTRODUCTION

Suids, classified as artiodactyl mammals, exhibit a significant presence inside the Siwalik region of Northern Punjab, as well as several other areas situated amidst these mountainous terrains. Beginning in the nineteenth century and continuing onward, numerous scholars, including Falconer (1868), Lydekker (1883), Stehlin (1899), Pilgrim (1926), Colbert (1935), and Pickford (1988), excavated diverse locations on the hills of the subcontinent, where they found a large number of fossils. Amongst many others, Ahmad (1995), Made (1996 & 1998), Ghaffar and Akhtar (2012), and Batool et al. (2015) are among the most well-known Palaeontological researchers that have conducted studies in this region. A few millennia ago, the family Suidae was among the most ubiquitous families in the Siwaliks of the Indo-Pakistani region and was represented by a significant number of genera. It was due to the family's ability to produce many offspring (Pickford and Obada, 2016; Spassov et al., 2018; Mörs et al., 2019).

However, even though many species from that time had a significant number of fossil records discovered repeatedly, others had exhibited significantly fewer fossils that represented them. As a result, the discovery of any additional examples of these ancient species is of utmost significance for understanding the part they played and where they stood during the evolution of this particular group. An example of this would be the recent discovery of *Potamochoerus* fossil molar remains from Hasnot, which is significant for establishing stratigraphic linkages with European and African materials. The Siwaliks of Pakistan have a world-famous reputation for housing vertebrate fossil sites like Hasnot (Lat. 32.824167 & Long. 73.131111) of district Jhelum (Figure 1) and many others. On the Potwar Plateau in the northern region of Pakistan, the town of Hasnot may be found around 54 kilometers to the west of the city of Jhelum.



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The five component formations, i.e., Soan, Dhok Pathan, Nagri, Chinji, and Kamliyal, are apparent in the region around Hasnot (Ghaffar and Akhtar, 2012). So, a field survey was planned in order to get some fresh material that would be helpful in describing the vertebrate fauna previously recorded in the locality. This article will emphasize the freshly recovered material and establish its relationship with the previously described material from the rich fossiliferous locality of Hasnot.

The current exploration work targeted the Nagri formation of the area. The Siwalik beds were divided into three levels, i.e., the Lower Siwaliks (Kamliyal and Chinji Formations), the Middle Siwaliks (Nagri and Dhok Pathan Formations), and the Upper Siwaliks (Pinjor, Boulder Conglomerates and Tatrot Formations), by Pilgrim (1913). The targeted Nagri Formation (8-10 million years of age) belonged to the Middle Siwaliks (approximately 1800 meters thick), and it is Miocene in age (Pilgrim, 1910, 1910a, 1913; Jacobs, 1978). Jacobs (1978) also correlates the Siwalik's Nagri Formation with the Valesian Formation of Europe. The Nagri Formation is composed of red clay with included nodules. The Nagri outcrops exhibit cyclic alternation of sandstone with subordinate clay and conglomerates. The sandstone is grey, greenish-grey, light grey, and medium to coarse-grained. In some places, this sandstone is bluish-grey, calcareous, and poorly cemented. Subordinate clay is sandy, silty, brown, chocolate brown, reddish grey, or pale orange in appearance, while the Conglomerates consist of pebbles of igneous rocks and Eocene limestone.

MATERIALS AND METHODS

The tooth described was gathered in the Nagri Formation (characterized by sandstone with subordinate clay and conglomerates) in Punjab, Pakistan, in the general region of the Hasnot hamlet. It was found partially exposed and hence recovered carefully with the help of paleontological tools, including a light hammer, chisels, sharp needles, brushes, etc. It is stored in the palaeontological collections of the Department of Zoology at Government College (now known as GC University) in Lahore, Pakistan. The measurements were obtained using a Vernier caliper that had been calibrated in millimeters (mm), and the recorded data were expressed in this unit of measurement (Table 1). The morphometric features of the specimen under investigation are examined. The specimen in question is assigned a serial catalog number. The numbers associated with the specimen represent the serial number and the year the

specimen was collected (the denominator and the numerator, respectively). For example, Government College Palaeontological Collection Number 380/2001 (where "Government College Palaeontological Collection Number" is abbreviated as "G.C.P.C. No."). The terminology used to describe the parts of the dental crown and the measurement methods are based on Pickford (1988). Different specimens present in the palaeontological collection of the University of the Punjab, Lahore, were also examined along with the literature review of the previously described specimens like the "Transactions of the American Philosophical Society by Colbert (1935)".

Abbreviations used:

The following abbreviations are used in the manuscript:

G.C.P.C.	Government College Palaeontological Collection.
P.U.P.C.	Punjab University Palaeontological Collection.
Ind. Mus.	Indian Museum, Calcutta.
Amer. Mus.	American Museum of Natural History.

RESULTS

The following results are drawn after the detailed study of the recovered specimen:

Systematic Account

Order	Artiodactyla Owen, 1848
Family	Suidae Gray, 1821
Genus	<i>Potamochoerus</i> Gray, 1854
Species	<i>P. palaeindicus</i> Pilgrim (1926)

Specimen under study

G.C.P.C. No. 380/2001, an individual third molar located on the left side of the maxilla. It was obtained from Hasnot, a region situated in District Jhelum, Punjab, Pakistan.

Description

The morphological description of the material under study is given as follows:

Upper Dentition. Third Molar (Figure 2)

The specimen, identified as G.C.P.C. No. 380/2001, is an isolated upper third molar on the left side. The tooth is well preserved posteriorly while its anterior end is damaged, and its two anterior cones, i.e., protocone and paracone, are missing. Its general contour suggests that it is a third molar. It is just triangular due to the posterior elongation of the post-talon.

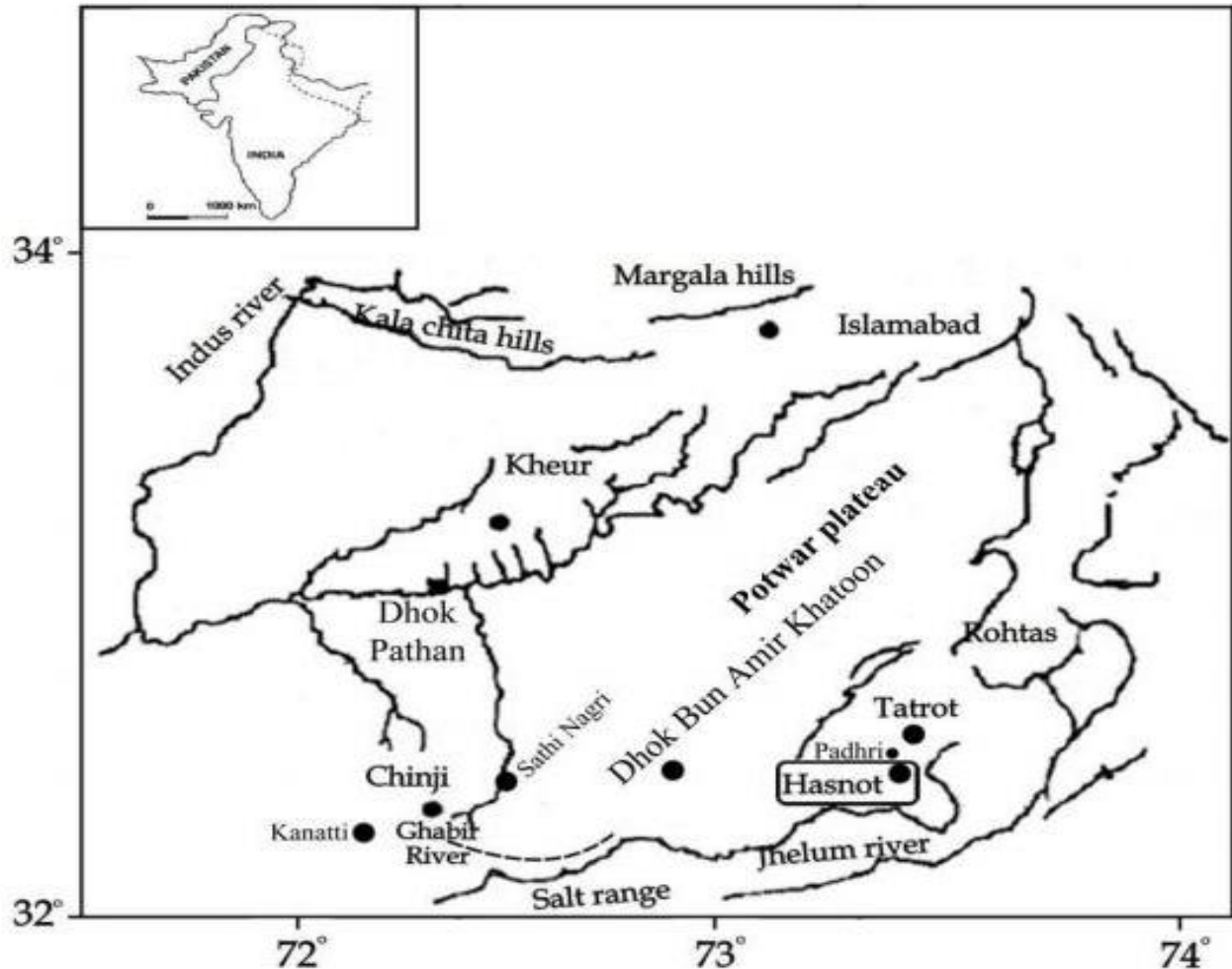


Figure 1. The studied area is highlighted by a map showing different fossil-bearing localities of the Potwar Plateau in Punjab and northern Pakistan (Barry et al., 2002).

The tooth exhibits initial wear on the lingual aspect. The enamel layer of the present specimen is thick, smooth, and rough. It is perhaps due to the process of weathering. The specimen is a narrow-crowned tooth. A thin layer of cement encompasses the tooth. The cingulum can be readily detected at the lingual and labial aspects of the transverse valley of the tooth. The cingulum is multituberculated. The height-to-width index of the tooth suggests that it is a bunodont and brachyodont type of tooth.

The hypocone of the tooth is lower in vertical height than that of the metacone. It is much worn as compared to the metacone. The characteristic suid grooves, i.e., anterior, posterior, and median suid grooves, are incipiently visible. The longitudinal valley is continuous between the hypocone and metacone of the tooth from the median accessory conule up to the structure of the posterior accessory conule. It is supported by a narrow channel. The transverse valley has significant depth and

undulating morphology, being both lingually and labially open in the vicinity of the posterior accessory conule.

The median accessory conule, which is worn and becomes flattened anteroposteriorly, is contiguous with the hypocone of the tooth. The summit of the median accessory conule is filled with cement. The metacone, which is present at the labial side, is conical in its present shape. The anterior, posterior, and median suid grooves are prominent, and they form separate anterior, posterior, and median lobes of the metacone, respectively.

The posterior accessory conule is much worn out at the summit. It is low in vertical height, having a lateral groove that is contiguous with the post-talon cingulum, dentine is exposed, and a dentinal islet is formed. It is flattened transversely due to weathering. Three suid grooves are present, which are connected with the cingular ridges.

Table 1. Measurements (in mm) of the left upper third molar, G.C.P.C. No. 380/2001, of <i>Potamochoerus palaeindicus</i> .	
Preserved anteroposterior crown length	33.4
Reconstructed anteroposterior crown length	47
Preserved transverse crown width	24
Reconstructed transverse crown width	25
Preserved crown height	16.5
Reconstructed crown height	17.3
Height/Width index	69.2
Width/Length Index	53.2
Enamel Thickness	2

A transverse valley is seen between the cusps and the post-talon. The longitudinal valley is linear and narrow, which is blocked by the median and posterior accessory conules in its present appearance. The post-talon is very simple, supported by multituberculated labial and lingual cingulum. It is moderately worn-out anteriorly and connected with the posterior accessory conule by a transverse narrow channel. Post-talon is conical in shape, robust, and corrugated. A thin layer of cement covers it.

DISCUSSION

The specimen under discussion is an isolated upper-third molar having an elongated and transversely narrow crown. The tubercles of the tooth are low in vertical height and rounded. Such crown structure is observed in the members of the suborder Suiformes of the order Artiodactyla (Simpson, 1945). Among Suiformes, two groups are made based on their type of dentition. These are the bunodont pigs and lophodont pigs. The latter includes Listriodonts (Zittel, 1925). The former group, i.e., bunodont pigs, comprises many primitive and advanced forms. The specimen's low-rounded structure suggests its classification within the Suidae family, as identified by Grey (1821).

In his seminal work, Simpson (1945) classified the Suidae family into five distinct subfamilies, namely Suinae, Sanitheriinae, Tetraconodontinae, Listriodontinae, and Hyotheriinae. The dental characteristics of the sub-families Hyotheriinae and Sanitheriinae exhibit complexity, but the teeth of Listriodontinae are classified as lophodont (Cope, 1888; Meyer, 1865). In comparison, Tetraconodontinae are mostly the larger forms. The dental features of the present tooth suggest that it belongs to the family Suinae. According to Simpson (1945), six genera of the



Figure 2. G.C.P.C. No. 380/2001 is an individual third molar located on the left side of the maxilla, recovered from Hasnot, District Jhelum, Punjab, Pakistan.

subfamily are known from the Siwaliks, and these genera are differentiated based on differences in their premolars.

A comparison of the specimen under study with the known material of the genera of the bunodont pigs shows that it may be referred to the genus *Potamochoerus*. Following are the reasons for its inclusion in this genus. This is because the molar tooth is quite simple. Its tubercles are well-defined. The tubercles are far apart from each other. The suid grooves

are simple and weak. Due to the presence of a large, complex, and rounded talon, it becomes elongated posteriorly.

Table 2. Measurements of upper dentition of *Potamochoerus palaeindicus* and its comparison with the already recovered material.

Specimen No.	Position	Length (mm)	Width (mm)	W/L Index
G.C.P.C. No. 380/2001	M-3	47.0	25.0	53.2
P.U.P.C. No. 366/69*	M-3	40.0	19.5	48.75
Ind. Mus. B. 11**	M-3	47.8*	22.6	47.3
Ind. Mus. B. 691**	M-3	43.3*	20.0	46.3

* Taken from Ahmad (1995),
 ** Taken from illustrations made by Pilgrim (1926).

The Siwalik *Potamochoerus* is quite different from the European forms of the genus. In European forms such as *Potamochoerus provincialis*, the upper third premolar i.e., P³ is transversally narrower with an elongated, transversally narrow postero-lingual cusp (Stehlin, 1899-1900, pl.II, Fig.22). On the contrary, the Siwalik *Potamochoerus* is exceedingly similar to the African species i.e., *Potamochoerus majus* and *Potamochoerus koiropotamus*. A study of the illustrations of cheek teeth of the said African species made by Leakey (1958) indicates the following major differences between the African forms and the Siwalik form of the genus:

1. P₄ is relatively narrower in the African forms and broader in the Siwalik species.
2. M₃ of the African species is relatively more complex with the crowding of tubercles. The anterior cingulum and anterior accessory conulid are present and of considerable size. The lower third molar of the Siwalik species is relatively simple crowned, and the anterior accessory conulid is absent.

A comparison of the dental morphology of the African and the Siwalik species of the genus *Potamochoerus* indicates that the latter probably has an ancestral to the former. The genus *Potamochoerus* is comprised of two species found inside the Siwaliks (Colbert, 1935). These are *Potamochoerus palaeindicus* and *Potamochoerus theobaldi*. Both were described by Pilgrim (1926). Among these, the *Potamochoerus palaeindicus* is larger than the *Potamochoerus theobaldi*. The measurements of the present specimen are in accordance with the material described by Pilgrim (1926) and others (Table 2). Table 2 shows a comparison of various measurements of the present and previously discovered molar teeth of this species. The morphometric analysis of the tooth shows that its measurements are relatively closer to the species *Potamochoerus palaeindicus*, as it is also mentioned previously that this species is larger in size than the other contemporary species, i.e., *Potamochoerus theobaldi*. The presently described specimen is also studied in comparison with the (Amer. Mus. No. 19878, bearing left P³-M²) described by Colbert (1935).

CONCLUSION

Based on the details and the comparative data mentioned earlier, it has been ascertained that the specimen under examination pertains to the taxonomic classification of *Potamochoerus palaeindicus*. This particular species is predominantly recognized throughout the Pinjor Zone, which is a sub-division of Upper Siwaliks. In contrast, the present specimen is collected from the Nagri Formation of the Middle Siwaliks located around Hasnot, District Jhelum, Punjab, Pakistan. Thus, this genus seems to have survived since the Middle Siwaliks, as previously, it was largely reported from the Upper Siwaliks only.

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CONFLICT OF INTEREST

Not Applicable

ETHICAL INFORMATION

Not Applicable

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