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### REVIEW PAPER

### TITLE

## A MORPHOMETRIC ANALYSIS OF NEW SUID REMAINS OF GENUS *PROPOTAMOCHOERUS* FROM THE SIWALIK BEDS OF DISTRICT JHELUM, PUNJAB, PAKISTAN

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# **A MORPHOMETRIC ANALYSIS OF NEW SUID REMAINS OF GENUS *PROPOTAMOCHOERUS* FROM THE SIWALIK BEDS OF DISTRICT JHELUM, PUNJAB, PAKISTAN**

## **ABSTRACT**

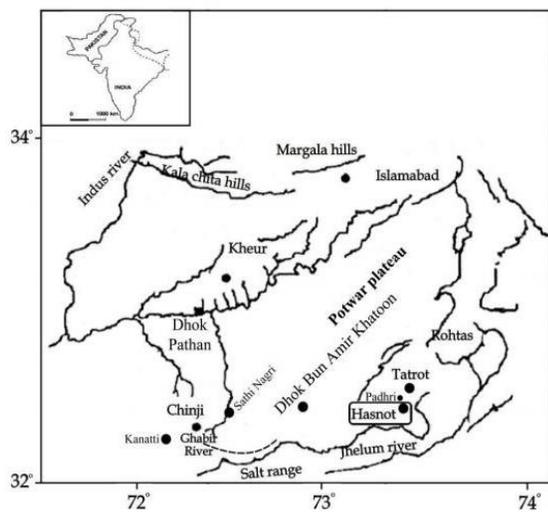
Dental remains of Propotamochoerus (Mammalia, Suidae) have been recently discovered and documented in the Middle Siwalik beds near Hasnot, a region in the Punjab province of Pakistan. The Jhelum district serves as the location where the fossils in question were found. A single tooth was extracted from the individual's left second maxillary molar, and this tooth is the component that is being discussed. The suids that belonged to the genus Propotamochoerus ranged in size from very small to quite enormous. An upper second molar on the left side is the focus of the investigation that is now being carried out because it provides insightful information regarding the essential dental traits of this particular genus. A detailed morphometric analysis of the tooth shows its relevant placement in the given genus. This particular tooth that was unearthed has the potential to contribute to the existing body of knowledge concerning the species that have been documented from the Siwaliks of Pakistan.

**Keywords:** Siwaliks, Artiodactyla, *Suidae*, *Propotamochoerus*, Molar dentition

## **1. INTRODUCTION**

Suids are a group of mammals that are classified under the order Artiodactyla. They are found in large numbers in the Siwalik mountains of Punjab, as well as in a number of other places that are situated in the middle of these hilly terrains (Figure 1). Beginning with the very first year of the nineteenth century and continuing onward, a large number of researchers, such as Falconer (1868), Lydekker (1883), Stehlin (1899), Pilgrim (1926), Colbert (1935), and Pickford (1988), explored various locations on these hills. As a result of their explorations, they discovered a significant number of fossils. Ahmad (1995), Made (1996 & 1998), Ghaffar and Akhtar (2012), and Batool et al. (2015) are only a few of the renowned scholars who have performed their research and field excursions in this region. Several thousand years ago, the Suidae family was widely distributed in the Siwaliks mountain

range in the region, and there were a substantial number of taxa. The favorable conditions in that habitat are likely to be responsible for the successful reproduction of the family as well as the enormous number of offspring that they have produced. (Mors et al., 2019; Spassov et al., 2018; Pickford and Obada, 2016).



**Figure 1.** An abundance of fossil-rich sites in the study's focal area may be seen on the map (Barry et al., 2002).

However, although some extinct species from that period had a significant number of fossil records that were discovered several times, others had a minimal number of representative fossils (Dar et al., 2019). Discovering fresh specimens of these elusive creatures is crucial for understanding their role and position in the evolutionary development of this specific group. Five component formations may be seen in the

region surrounding Hasnot. These formations are known as Soan, Dhok Pathan, Nagri, Chinji, and Kamlial (Ghaffar and Akhtar, 2012). Numerous vertebrate fossil sites have been preserved thanks to the Siwaliks of Pakistan, which are generally recognized for their crucial contribution to the preservation of these sites. One of these sites is the well-known Hasnot site, which is located in the Jhelum region (Figure 1). Therefore, it was planned to conduct a field survey in order to identify any dead relics of prior life that may have been present in the region that was being investigated, to describe the physical characteristics of those remains, and finally classify the material that was gathered up to precise genus or species levels.

## 2. MATERIALS AND METHODS

An individual tooth, which is the subject of this debate, was recovered from the Nagri Formation, which is located in the Punjab, specifically near the village of Hasnot. This specimen is housed within the paleontological collection of the Government College's Department of Zoology in Lahore City, Punjab, Pakistan. The measures of the tooth that was recovered were obtained using a Vernier caliper, and they were stated in millimeters (mm). These measurements are then shown in Table 1. An examination is performed on the morphological

characteristics of the tooth that is being described, in addition to its physical measures. Specifically, the specimen in question has been assigned a serial catalogue number that is completely unique. The serial number (numerator) and the year of collection of the specimen (denominator) were assigned to the tooth. For example, G.C.P.C. No. 374/2001 (where "G.C.P.C. No." is the abbreviation of "Government College Palaeontological Collection Number"). Pickford's work from 1988 is the source of both the terminology that is used to denote the components of the dental crown and the methodologies that are used to measure them.

### 3. RESULTS

After conducting an in-depth analysis of the specimen that was recovered from the study site at Hasnot, which is located in the district of Jhelum in Punjab, Pakistan, the following findings have been derived.

#### *Palaeontological Account*

Order	Artiodactyla, Owen, 1848
Family	Suidae, Gray, 1821
Genus	<i>Propotamochoerus</i> , Pilgrim, 1926
Species	<i>P. hysudricus</i> (Stehlin)

#### *Specimen under study*

An upper second molar, positioned on the left maxilla, designated as G.C.P.C. No. 374/2001, was collected from Hasnot, located in the district of Jhelum, Punjab, Pakistan.

### 4. Description

The following is a morphological description of the tooth that is being investigated:

#### *Second Molar - Upper Dentition (Figure 2)*

An isolated second maxillary molar is the specimen that is being utilized for this inquiry. The region of Hasnot, which is located inside the Jhelum District of Punjab in Pakistan, was the location where it was found. An observable pressure mark on both the front and back sides of the tooth is present, which means that the tooth is classified as the second molar. The specimen has been kept exceptionally well and has an overall contour that is almost uniformly square. The enamel layer of the tooth is thick, has a textured surface with little ridges, and has a shiny appearance all around. The brachyodont type is indicated by the height-to-width index of the fossil. The tooth clearly shows its narrow-crowned nature through its morphology. The tooth displays a strong and complex cingulum with several tubercles in both its front and back regions.

All suid grooves that are characteristic of the specimen can be seen, and the protocone of the specimen exhibits a considerable amount of wear and tear. This appearance of the fossil demonstrates an anterior cingular ridge, which serves to provide support for the protocone. There is a dentinal islet that is occupied by a thin covering of cement that is located at the extreme point of the protocone. The anterior accessory conule and the protocone are attached through a narrow channel. Both the anterior accessory conule of the tooth and the anterior cingulum are connected continuously. The severe wear causes the anterior accessory conule to become practically flat with the anterior cingulum because of the condition. Additionally, it is linked to the hypocone in the posterior region. Among both the protocone and paracone, the paracone is a bit higher vertically. From the labial side, it is weathered to the maximum. It is weathered moderately from the top surface of its crown, and only the two characteristic grooves (i.e., anterior and median) are visible.

The hypocone conspicuously shows its suid grooves. The hypocone is physically linked with the median and the posterior accessory conule from its anterior and posterior sides, respectively. Furthermore, a supplementary posterior accessory conule of the tooth is also

there. It is possible to observe a connection between the structure in question and the posterior cingulum. The metacone of the tooth is also damaged from its labial face to some extent. All three characteristic suid grooves are clearly visible, forming the three respective lobes. The two cones, i.e., hypo and protocone, are lower vertically than the meta and the paracone.



2A



2B



2C

**Figure 2.** The Crown (2A), Lingual (2B), and Labial (2C) views of G.C.P.C. No. 374/2001.

Within the current tooth, a median accessory conule may be seen located in the middle of the tooth. This median accessory conule moderately undergoes abrasive damage and becomes a little flat laterally and transversely. This conule is connected from its anterior side with the proto and paracone while posteriorly with the hypo and metacone of the tooth. A prominent transverse depression of considerable depth and width is clearly visible in the central area of the tooth. This valley is quite open in terms of its lingual and labial aspects. A robust basal pillar is located on the inner side of the entrance of this valley. A broken basal pillar may be seen in the labial region, midway between the paracone and the metacone. The longitudinal valley exhibits undulating topography and has a shallow depth due to the obstruction caused by the existence of an accessory conule. The specimen under consideration has a small post-talon at its posterior extreme, which is supported by thick cingular ridges and a strong multi-tuberculated cingulum. The posterior auxiliary conule, located at the foundation of the conule, also contributes to this support.

**Table 1.** The tooth's (G.C.P.C. No. 374/2001) measurements (in mm).

Conserved length of the crown	20.5
Reconstructed length of the crown	21
Preserved width of the crown	14.7
Reconstructed width of the crown	15.7
Preserved height of the crown	10
Reconstructed height of the crown	11
Height-to-Width index	69.8
Width-to-Length index	75
Thickness of the enamel	1.3

## 5. DISCUSSION

The second maxillary molar is the specimen that is being discussed here. It was collected from the borders of the Hasnot hamlet, which is located in the Jhelum district of Punjab, Pakistan. The tooth that is being discussed has the look of a quadrangular shape and a rounded posterior part. Additionally, it features tubercles that are rounded and low, which are characteristics of pigs (Romer, 1974; Colbert, 1980). In addition, there is no crowding on the crown of the molar teeth,

which means that there are no issues (Pilgrim, 1926).

When compared to their breadth, the molar teeth belonging to the genus *Propotamochoerus* are significantly longer than their width. The anterior and posterior cingulum of the teeth are strong and well-developed. However, these features are absent on the sides of the teeth, except for a small basal pillar that is noticeably smaller in size. This pillar is located at the points where the transverse valley enters the tooth, both on the inner (lingual) and outer (labial) sides. This is particularly true for the second molar. The anterior auxiliary conules are diminutive, while the posterior accessory conule is larger than the anterior one. However, the middle accessory conule is the largest. The primary cones of the tooth are separated from the accessory conule that is located in the middle of the tooth. Supplementary furrows are visible on the tooth tubercles. As these are the typical characteristics of the genus *Propotamochoerus*, the specimen being studied can be classified as belonging to the genus *Propotamochoerus*.

The genus *Propotamochoerus* is thought to have made its initial appearance in these highlands, which are typically referred to as the Siwalik Mountains. One of the

characteristics that sets it apart from other bunodont pigs is the presence of simple molars that have rounded tubercles. Four species of the *Propotamochoerus* genus were found in the Siwaliks, specifically *P. salinus*, *P. uliginosus*, *P. ingens*, and *P. hysudricus*. Among the four species under consideration, *P. salinus* is characterized by its diminutive suids, which possess molars exhibiting a rugose enamel and a diminutive heel on its final tooth (Pilgrim, 1926). *Propotamochoerus hysudricus*, on the other hand, is a big suid species that is distinguished by its highly complicated molar structure (Stehlin, 1899).

Pilgrim (1926) identified the species *Propotamochoerus hysudricus* through the analysis of a mandibular ramus specimen (Geological Survey of India or G.S.I. No. B 30), which had been previously named and depicted as *Sus hysudricus* by Lydekker (1884). Stehlin (1899) subsequently categorized it into the taxonomic genus *Propotamochoerus*. The specimen that serves as the type is a mandibular ramus bear P<sub>3</sub>-M<sub>3</sub>. The premolars are characterized by elongation and have a significant thickness in the transverse perspective. The genus has elongated M<sup>1</sup>. Both *Propotamochoerus salinus* and *Propotamochoerus uliginosus* share similarities; nonetheless, there are

apparent differences between the two species, primarily in terms of dental traits. Colbert (1935) asserts that the species bears a striking resemblance to *Propotamochoerus salinus* and *Propotamochoerus ingens*, the latter of which is a huge member of the *Propotamochoerus* genus. From Colbert's standpoint, there is a similarity between the species *Propotamochoerus salinus* and *Propotamochoerus hysudricus*, with the sole distinguishing factor being their respective dimensions. According to him, *P. salinus* is most likely a variant of the species *P. hysudricus* (Colbert, 1935). He based this opinion on his observations.

The skull measurements of *Propotamochoerus hysudricus* and contemporary African *Propotamochoerus* specimens share substantial similarities in terms of size and appearance. These similarities are important. The difference between the two species is characterized by changes in the location and dimensions of the orbit. *Propotamochoerus hysudricus* has a more centered and somewhat smaller orbit than either of the other species (Pilgrim, 1926). It has been observed that the first maxillary premolar is present in *P. hysudricus*, which is a characteristic that is not prevalent in the *Potamochoerus* genus (Colbert, 1935). Consequently, it is evident

that *Propotamochoerus* is a species of large pig that is distinguished by its intricate molars, which are characterized by having enamel that is smooth in addition to vertical ridges and grooves (Colbert, 1935).

## 6. CONCLUSIONS

The specimen being analyzed has an approximately average-thick enamel, an uncomplicated crown structure, and round tubercles. These are all typical characteristics of the species *Propotamochoerus hysudricus*, so we may refer to the specimen under study as *Propotamochoerus hysudricus*.

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### Conflict of interest

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### Ethical information

Not Applicable

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## REFERENCES

- Ahmad, Z. (1995). "Taxonomy and distribution of the Siwalik suids." Ph.D. Dissertation, University of the

- Punjab.
- Barry, J. C., Morgan, M. E., Flynn, L. J., Pilbeam, D., Anna, K., Raza, S. M., Khan, I. A., Badgley, C., Hicks, J., & Kelley, J. (2002). "Faunal and environmental change in the late Miocene Siwaliks of northern Pakistan." *Palaeobiology*, **28**:1–71.
- Batool, A., Khan, M. A., & Qureshi, N. A. (2015). "New fossils of Suidae (Mammalia, Artiodactyla) from the Hasnot late Miocene, northern Pakistan." *Journal of Animal and Plant Sciences*, **25**(2):578–590.
- Colbert, E. H. (1980). "Evolution of the vertebrates, history of the backboned animals through time." 3<sup>rd</sup> Edition, John Wiley and Sons, New York., p.1-510.
- Colbert, E. H. (1935). "Siwalik mammals in the American Museum of Natural History." *Trans. Amer. Phil. Soc.*, **26**:1–401.
- Dar, F. Y., Aftab, K., Babar, M. A., Khan, M. A., Abbas, S. G., Shahid, R. & Asim, M. (2019). New fossils of suidae (mammalia) from Dhok Pathan formation of Siwaliks, Punjab, Pakistan. *The Journal of Animal and Plant Sciences*. **29**(4):1198-1203.
- Falconer, H. (1868). "XXV Notes on fossil remains found in the valley of the Indus below Attock and at Jubbulpoor." In *Palaeontological memoirs and notes of the late Hugh Falconer, A.M., M.D. Fauna Antiqua Sivalensis*, **1**:414-417. London. Robert Hardwicke.
- Ghaffar, A., and Akhtar, M. (2012). "New fossil record of Hyaenictitherium pilgrimi (Carnivora: Hyaenidae) from Dhok Pathan Formation of Hasnot, Pakistan." *Swiss Journal of Palaeontology*, **131**(2):275–281. <https://doi.org/10.1007/s13358-012-0042-y>
- Gray J. E. (1821). "On the natural arrangement of vertebrate animals." *London Medical Repository*, **15**(1):296–310.
- Lydekker, R. (1884). "Indian Tertiary and post-Tertiary Vertebrata: Siwalik and Narbada bunodont Suina." *Memories of Geological Survey of India. Palaeont. Indica, Serial 10*, **3**(2):35–104.

- Lydekker, R. (1883). "Indian Tertiary and post-Tertiary Vertebrata: Siwalik selenodont Suina, etc.." *Memories of Geological Survey of India. Palaeont. Indica*, **5**(10):143–177.
- Made, J. van der. (1998). "Biometrical trends in the Tetraconodontinae, a subfamily of pigs." *Transactions of the Royal Society of Edinburgh: Earth Sciences*, **89**(3):199–225.  
<https://doi.org/10.1017/S0263593300007136>
- Made, J. van der. (1996). "Listriodontinae (Suidae, Mammalia), their evolution, systematics and distribution in time and space." *Contributions to Tertiary and Quarternary Geology*, **33**(1–4), 3–254.  
<https://natuurtijdschriften.nl/pub/521620>
- Mörs, T., Liu, L., and Hagström, J. (2019). "A Miocene tetraconodontine (Suidae, Mammalia) from Falkenberg (Halland, Sweden)". *GFF*, **141**(1):77–81.  
<https://doi.org/10.1080/11035897.2019.1566273>
- Pickford, M., and Obada, T. (2016). "Pliocene suids from Musaitu and Dermenji, Moldova: implications for understanding the origin of African Kolpochoerus Van Hoepen & Van Hoepen, 1932". *Geodiversitas*, **38**(1), 99–134.  
<https://doi.org/10.5252/g2016n1a5>
- Pickford, M. (1988). "Revision of the Miocene suidae of the Indian subcontinent". *Münchener Geowissenschaftliche Abhandlungen, Reihe A, Geologie Und Paläontologie*, **12**:1–91.
- Pilgrim, G. E. (1926). "The fossil suidae of India". *Memoirs of the Geological Survey of India, Palaeontologia Indica, New Series*, **8**(4):1–105, Pls. I-XX.
- Romer, A. S. (1974). "Vertebrate Palaeontology." Edition **3**:1–687.
- Spassov, N., Geraads, D., Hristova, L., Markov, G. N., Garevska, B., & Garevski, R. (2018). "The late Miocene mammal faunas of the Republic of Macedonia (FYROM)". *Palaeontographica Abteilung A*, **311**(1–6):1–85.  
<https://doi.org/10.1127/pala/2018/0073>

Stehlin, H. G. (1899). "Geschichte des  
Suiden Gebisses". *Abh. der Schw.  
Pal. Gesellsch*, **26**:13.