

to my mind, not due so much to the lack of change in the teeth as to the rapidity of change in the skull, and the whole family derives from late Miocene palæomerycines, an antiquity decidedly less than most mammalian families.

According to Pilgrim¹ the Giraffidæ afford "one of our most complete proofs for the Pontian age of the Dhok Pathan." But his argument will not stand analysis.

"There we find side by side with *Giraffa punjabiensis*, paralleled by *Giraffa attica* at Pikermi, the large genus *Helladotherium* allied to the Pikermi species *H. duvernoyi* and the almost equally large *Vishnutherium*.

"The palæotragine group, including the genera *Palæotragus*, *Samotherium* and *Alcicephalus*, has not so far been recognized in India.

"On the other hand, allied forms possessing a complex horn development occur in the genus *Hydaspietherium* in the Dhok Pathan zone, and as *Bramatherium* in the slightly older Perim Island beds.

"As we should expect if the strata below the Dhok Pathan zone were older than Pikermi age, we find ancestral giraffine types even in the lower beds of the Middle Siwaliks in the shape of a small helladotherine perhaps referable to the genus *Giraffokeryx* in the Nagri beds, and a small species of *Giraffa* in beds of similar age at Hari Talyangar. . . . In the Chinji zone, the primitive character of the giraffine type is evident in the genus *Giraffokeryx*, which is on the line of *Helladotherium*, and in *Propalæomeryx*. . . ."

All in all, I cannot see anything more primitive in the Chinji Giraffidæ than Pikermi can show, and I see no reason for hunting a separate

G. attica is in fact distinctly smaller and more brachydont than *punjabiensis*. What Pilgrim called '*Helladotherium grande*' is in fact Lydekker's *Hydaspietherium megacephalum*. *Helladotherium duvernoyi* is much more primitive; compares with "*Vishnutherium*," but then "*Vishnutherium*" occurs in both the middle and lower Siwalik.

Giraffokeryx is a member of it, and is considered by Bohlin to be a species of *Palæotragus*. One species of *Giraffokeryx*, however, if not both, carries four horns, and is generically distinct from *Palæotragus*, although clearly related.

As we should expect if the Dhok Pathan and Perim Island beds are later than Pikermi, Samos or Northern China.

But all this ignores the comparison between *Giraffokeryx* and the Pikermi *Palæotragus*, the presence of larger giraffid remains associated with *Giraffokeryx*, and comparable to *Vishnutherium* and *Helladotherium*. The small species of *Giraffa* at Hari Talyangar may compare with "*Orasius eximia*" of Pikermi. *Giraffokeryx* is not on the line of *Helladotherium*, as it is a four-horned type. As for the "*Propalæomeryx*," it is based upon an upper molar wrongly identified by Pilgrim as m¹ and two isolated lower molars wrongly referred to it.

¹1913, Correl. Siwal., Rec. Geol. Sur. Ind., XLIII.

evolution center for the giraffes in Africa when the Holarctic Miocene palæomerycines afford a perfectly good ancestral group.

X. BRITISH MUSEUM NOTES ON SIWALIK CAMELIDÆ

The only representation of Camelidæ in the Siwaliks is the genus *Camelus*, with two species nearly allied to each other and to the modern camel, but with one point in their dentition that suggests American affinity, namely retention of a slight antero-external fold at the anterior end of the lower molars.

Camelus sivalensis Falconer and Cautley, 1836

Camelus sivalensis FALCONER AND CAUTLEY, 1836, *Asiat. Res.*, XIX, p. 115; reprinted in FALCONER, 1868, *Pal. Mem.*, I, p. 227; LYDEKKER, 1885, *Rec. Geol. Sur. Ind.*, XVIII, p. 78; 1886, *B. M. Cat. Foss. Mam.*, II, p. 141 (type designated).

TYPE.—B. M. No. 39597, hinder part of cranium, m²⁻³ r. and l., figured in *Faun. Ant. Sival.*, Pl. LXXXVI, Fig. 1. Upper Siwalik beds, Moginand.

Distinguished from modern camels by larger size, and somewhat different proportions of jaw. Lydekker also notes rugosity of enamel, slight antero-external fold at anterior extremity of lower molars, inner face of molars flat, without any fold between the lobes, and long shallow jaw.

None of these characters run very constant or make a very clean-cut distinction in *C. sivalensis* from modern *C. bactrianus*. All the material is in the light-colored, moderately soft matrix in which many of the best preserved and most modernized species of the Siwaliks are fossilized—most of the *Equus* material, *Canis curvivalatus*, *Meganthereon falconeri*, nearly all the bovid skulls, etc.

Camelus antiquus

Camelus antiquus FALCONER AND CAUTLEY, 1836, *Asiat. Res.*, XIX; reprinted in FALCONER, 1868, *Palæont. Memoirs*, I, p. 231 (no adequate description); LYDEKKER, 1885, *Rec. Geol. Sur. Ind.*, XVIII, p. 78.

TYPE.—A lower jaw,¹ B. M. No. 16165, from uppermost Siwalik beds, Moginund.

Lydekker notes as the characters of the species, in addition to smaller size mentioned by Falconer, the shorter and deeper jaw, smooth enamel, presence of a small antero-external fold on lower molars, and a ridge or displacement on inner wall of molars between the two lobes.

¹The specified characters given by Lydekker in the type description are taken from the lower jaw. I therefore designate this specimen as type, although in listing the specimens of the species in the type description he places an upper jaw, No. 15347, first, as he does in the *B. M. Catalogue of Fossil Mammals*, II, p. 146. Reference to the listing of other species catalogued by Lydekker in this volume and elsewhere will show that it was not his custom to place the type specimen at the head of the list. Osborn adopts the plan of selecting always as type the first mentioned specimen in a series of co-types. But there is no such ruling or recommendation by any authoritative body that I know of, and it seems better to follow the recommendation of the International Zoological Congress and select the type from among the original specimens "following the intent of the author" as shown in the wording of the type description.

These are not very constant characters in *Camelus*, and it is doubtful whether the two species are wholly distinct either from each other or from the modern species.

The genus *Camelus* is recorded from Pleistocene of Alaska? (probably late, but quite indeterminable), from beds of uncertain age in Russia, *C. knoblochi*, which may be the modern species and certainly is of quite modern type, from the Pleistocene of the Volga-Ufers, Russia.

C. alutensis, ?Pleistocene, Rumania, is not *Camelus*, but one of the sub-genera of "*Pliachaenia*."

C. americanus Wortman, Pleistocene, Nebraska, is not *Camelus* but belongs to an unnamed genus, congeneric with "*Lama*" *stevensi*. There is no proven record of the occurrence of *Camelus* in America, although it is quite likely that the toe-bones referred by Gidley and Hay to the genus may really represent it or a closely related type.

C. thomasi Pomel, from Algeria, prehistoric, but probably not old.

The genus is limited to the Boulder Conglomerate zone in the Siwaliks, and largely, if not wholly, to the upper beds. Its occurrence has no great weight for modernity of this formation as a whole. I have seen no specimens with the hard, black, rolled preservation of a large part of the Boulder Conglomerate fauna.

XI. BRITISH MUSEUM NOTES ON SIWALIK HIPPOPOTAMIDÆ

Hippopotamidæ make their first appearance (auct. Pilgrim) in the Dhok Pathan. In the Tatrot beds they come in more abundantly; but the chief part of the material comes from the Boulder Conglomerate zone, at top of Upper Siwaliks.

Their derivation has been supposed to be from the anthracotheres, through *Merycopotamus*. This is quite certainly wrong. They are derived from the Suidæ. The older Indian species are not much different from the modern hippopotamus except in retaining three sub-equal incisors. The smaller Pleistocene species, however, are very suggestively like mid-Tertiary Suidæ in construction of molars and premolars. This is especially true of *Hypopotamus minutus* from Cyprus and Crete collected by Miss Bate, which strongly reminds one of such primitive Suidæ as *Desmathyus*, etc., out of the Upper Rosebud and Lower Sheep Creek of the western United States.

So far as I know the Dhok Pathan hippopotamus is in no degree primitive, but compares closely with the Plio-Pleistocene species from elsewhere—Val d'Arno, Great Barrington, etc. I have not seen any specimens from Dhok Pathan, nor any of the "abundant" remains reported by Pilgrim from the Tatrot beds. Presumably they are in the Indian Museum.

I cannot see any very strong reason for according full generic rank to *Hexaprotodon*. Except for the incisors, it is in no way different from the

modern species. On the other hand, *Hypopotamus minutus*, the pigmy hippopotamus of Crete, Cyprus and Malta, appears to demand generic separation as lacking the accessory cusps (the valley cusps of the trefoil), much less expanded jaw, two small equal incisors, and various skull characters. *Chæropsis*, the pigmy hippopotamus of Liberia, better deserves generic rank than *Hexaprotodon*; but whether it is generically separable from *Hypopotamus* is not so clear. The following key covers the known genera.

- I. Accessory cusps of molars strong, forming a well-developed trefoil pattern in wear. Muzzle much expanded. Size large or gigantic, aquatic-amphibious.
 - A. Three subequal incisors on each side of jaw. (Subgeneric) . . . *Hexaprotodon*.
 - B. Two subequal incisors on each side of jaw. (Invalid) *Tetraprotodon*.
 - C. One large and one small incisor on each side. *Hippopotamus*.
- II. Accessory cusps of molars weak, forming a pattern essentially of transverse crests. Muzzle moderately expanded. Size medium to large, terrestrial-amphibious.
 - A. Two subequal incisors on each side of jaw. *Hypopotamus*; *Chæropsis*.

HIPPOPOTAMUS

TYPE.—*Hippopotamus amphibius*.

To this genus belong the following fossil species:

H. major.¹ Cf. fine specimens from Great Barrington.

H. penitlandi.² Typical from caverns in Sicily, Grotta di Mascagnone, Cazine.

H. minor.³ Typical from Malta. Not the same as Cuvier's *H. minutus* = *Hypopotamus minutus*, q. v.

H. madagascariensis. Although notably smaller, this species agrees in generic characters with *H. amphibius*. It may be more closely comparable with *H. penitlandi* and *H. minor*.

H. palæindicus ("Tetraprotodon") Falconer and Cautley, 1847.

TYPE.—A lower jaw, present locality of preservation unknown, figured by Falconer and Cautley in Pl. LVII, Fig. 5.

HORIZON AND LOCALITY.—Pleistocene, Nardaba (Nerbudda) River.

HEXAPROTODON Falconer

The only character that I can find to separate this genus is the one specified by the describer, the presence of six subequal incisors in a transverse row, three on each side of the jaw. The molars appear entirely of the modern type. Lydekker notes "the long mandibular symphysis, the three pairs of incisors in each jaw, the small prominence of the orbits, and the elongated astragalus" as species characters indicating a more primitive stage. I cannot verify any except the incisors; the other features appear to vary individually too much to be reliable.

¹Owen, 1843, Rep. Brit. Ass., p. 223. Cf. Cuvier, 1824, Oss. Foss., V, p. 527.

²H. v. Meyer, 1832, Palæologica. But ? = Cuvier's *H. medius*, 1824, Oss. Foss., V, p. 527.

³Falconer, 1849, Jour. Acad. Nat. Sci. Phila., (II) 1, p. 237.

Hexaprotodon sivalense Falconer and Cautley, 1839

Hippopotamus (Hexaprotodon) sivalensis FALCONER AND CAUTLEY, 1839, *Asiat. Res.*, XIX, p. 38; 1868, *Pal. Mem.*, I, p. 130; LYDEKKER, 1884, *Pal. Ind.*, (X) III, p. 37; PILGRIM, 1913, *Rec. Geol. Sur. Ind.*, XLIII, p. 324.

Hexaprotodon sivalense FALCONER AND CAUTLEY, in Owen, *Odontography*, p. 566, Pl. CXLIII.

TYPE.—No. M2269, British Museum, a complete skull with well-worn teeth.

Hexaprotodon namadicus Falconer and Cautley

Hippopotamus (Hexaprotodon) namadicus FALCONER AND CAUTLEY, *Faun. Ant. Sival.*, Pls. LVII, LVIII (name and figure); LYDEKKER, 1884, *Pal. Ind.*, (X) III, p. 43.

TYPE.—Not specified. Nos. 36838, 36839 and 36840 are co-types.

HORIZON.—Narbada (Nerbudda) River beds.

Hexaprotodon iravaticus Falconer and Cautley

Hippopotamus (Hexaprotodon) iravaticus FALCONER AND CAUTLEY, 1847, *Fauna Antiqua Sivalensis*, Pl. LVII (name and figure); LYDEKKER, 1884, *Pal. Ind.*, (X) III, p. 42; (*Hexaprotodon*) FALCONER, 1849, *Jour. Acad. Nat. Sci. Phila.*, (II) I, p. 237; 1868, *Palæont. Mem.*, I, p. 142.

TYPE.—B. M. No. 14771, symphysis of mandible from Irawaddian of Burma.

This species is decidedly smaller than *H. sivalensis*, probably comparable with the material reported by Pilgrim from the Middle Siwaliks or the Tatrot zone.

HYOPOTAMUS Kaup, 1844

Hyopotamus KAUP, 1844. Not *Hyopotamus* Owen, 1848, which is a genus of anthracotheres.

TYPE.—*Hippopotamus minutus* Cuvier, 1824.

Hyopotamus minutus Cuvier, 1824

CUVIER, 1824, *Ossemens Fossiles*, Éd. Nouv., I, pp. 322–331 (figures); II, p. 382 (locality stated); V, p. 527 (scientific name); FORSYTH MAJOR, 1902, *Proc. Zoöl. Soc. London*, p. 107.

Major gives a note regarding the locality of Cuvier's *H. minutus*, suggesting that it came from Cyprus. Cuvier's statement of the record and history of the blocks of breccia from which his type specimens were extracted is very specific and definite, and I do not see how it can be set aside.

TYPE LOCALITY.—Between Dax and Tartas, Dept. Landes, France.

The admirable material collected and described by Miss Bate, now in the British Museum, gives a very good idea of the skull and skeleton characters of this interesting animal. If, as seems probable, it is closely related to the Liberian pigmy hippopotamus, and generically the same,

the distribution will stand as from the Pleistocene of the Mediterranean region and surviving today in West Africa; a distribution that finds many analogies among mammals and lower animals.

XII. BRITISH MUSEUM NOTES ON SIWALIK RODENTS

Mus

Mus, sp. indesc., innom.

(?FALCONER), 1835, Jour. Asiat. Soc., IV, p. 706; 1836, V, p. 296; FALCONER, 1868, Pal. Mem., I, p. 23.

'Murine rodent,' LYDEKKER, 1884, Pal. Ind., (X) III, p. 105.

No descriptions or figures of the above are known to me, nor any specimens except the one mentioned by Lydekker, which is from the Narbada beds.

RHIZOMYS

?SYNONYM.—*Typhlodon* FALCONER, 1868, Pal. Mem., I, p. 23 (nomen nudum); LYDEKKER, 1878, Rec. Geol. Sur. Ind., XI, p. 101.

Rhizomys sivalensis Lydekker

Rhizomys sivalensis LYDEKKER, 1878, Rec. Geol. Sur. Ind., XII, p. 41, and Fig. 3 of Pl. opp. p. 50; 1884, Pal. Ind., (X) III, p. 106, Figs. 1-3.

TYPE.—(Co-types) Ind. Mus. No. D97, 97A, two detached rami (of jaw; different individuals). Lectotype is D97 figured by Lydekker in 1879.

HORIZON AND LOCALITY.—Middle Siwaliks, Jabi, Punjab.

Lydekker in 1884 refers to this species and figures a third jaw from the Middle Siwaliks of the Punjab, and provisionally refers to the species two jaws "of slightly larger size than the largest Punjab specimen" from the "typical Siwaliks" (Upper Siwalik).

DISTINCTIVE CHARACTERS.—"In all the recent species the molars are relatively wider than in the fossil." Smaller jaw than *sumatrensis*, teeth of same length but less width. Smaller incisors and slenderer jaw and more elongate molars than *pruinusos*. Larger than the Chinese and Indian species (*badius*, *sinensis*, *erythrognys*).

All this would seem to agree rather well with our Yen-ching-kao *Rhizomys*, save for smaller size. The referred specimens from the Upper Siwalik are distinguished by larger size, and may agree more nearly.

Nesokia sp.

B. M. No. 16529A. Upper Siwaliks, locality unrecorded.

A fragment of the lower jaw with m_1 r. and roots or alveoli of m_{2-3} is the only representative of this genus. It does not appear to be described. About size of *N. kok* from Karnul cavern, Madras.

HYSTRICIDÆ

Hystrix sivalensis Lydekker

Hystrix sivalensis LYDEKKER, 1878, Rec. Geol. Sur. Ind., XI, p. 98; 1884, Pal. Ind., (X) III, p. 109, Fig. 4.

TYPE.—Ind. Mus. No. D96, from Middle Siwaliks of Hasnot, Punjab, a lower jaw with M_{1-2} r., root of p_4 and alveolus of m_3 .

Distinguished as with separate roots on p_4 . This is suggestively like dp_4 , but Lydekker remarks "the large size of the alveolus of this tooth and the well-worn condition of the true molars show that the former could not have been a milk molar."

Without seeing the type it is difficult to be certain, but the referred skull and jaws (from Upper Siwaliks) shows a milk molar in place and little worn, m_1 present, almost unworn, and the posterior teeth not yet up. If this dentition were worn down so as to bring it to stage of the type, dp_4 would show roots if broken off, m_1 would have enamel inflection about as in type, and m_2 would presumably be up and well worn, m_3 perhaps emerged, perhaps not. The dp_4 ? is considerably smaller, but so is m_1 ; the species is really a much smaller one than Lydekker's type. I cannot understand his saying that in the lower part the dimensions of m_1 are the same as in the type. If his figure of the type is correct, they most certainly are not ($7.3 \times$

7.3 , as against 9.3×9.3 of his figure). He states that the roots are distinctly visible in m_1 of the type at a distance of a quarter of an inch below the external enamel fold, and that in the young specimen the external enamel fold extends as near down to the root as in the latter specimen (the type jaw). But in the young animal m_1 is not calcified down to the root; it is impossible to say how far it would be below the external enamel fold, but certainly *more* than a quarter of an inch. All in all, one would be inclined to refer the Upper Siwalik young skull and jaw to *H. hirsutirostris* (*leucurus*) or some other hypsodont species of that size. The skull has attained practically full growth in this stage. On the other hand, *H. sivalensis* proper is nearly comparable with *H. primigenia* of Pikermi, although not so brachyodont.

It is a little more worn than *H. primigenia* jaw M9037 from Pikermi, and *H. karnulensis* (M3448) jaw from Karnul caves near Madras; both

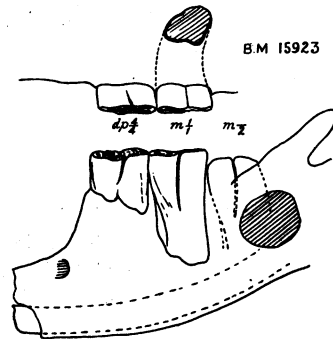


Fig. 55.—*Hystrix* cf. *leucurus*. Upper and lower dentition from an immature skull, No. 15923 British Museum. Upper Siwalik beds. Referred by Lydekker to *H. sivalensis*.

of which have dp_4 only moderately worn. The spreading roots of dp_4 are well shown in left ramus of M3448; in M9037 the point of the permanent p_4 has been exposed beneath in the jaw. Size of molars about the same as in *H. sivalensis* type, but width less because they are at an earlier stage of wear. The Pikermi species is *much* more brachydont than the modern or the Pleistocene *karnulensis*, and judging from Lydekker's figure and description his species is intermediate, perhaps somewhat, but not much, nearer to *primigenia*.

The figured skull and jaw (Fig. 55) belong to a distinct species which may be *H. leucurus* or an ancestral species. Certainly much smaller than *H. crassidens* of Karnul caves or *H. refossa* of Perrier or the *Hystrix* of Val d'Arno (probably *H. refossa*).

LAGOMORPHA

Caprolagus sivalensis Major

Caprolagus sivalensis MAJOR, 1899, Trans. Linn. Soc., VII, Pl. xxxvii, Fig. 18.

The only lagomorph remains consist of a fragment of jaw, probably from Upper Siwalik beds, attributed by Major to *Caprolagus*.

TYPE.—B. M. No. 16529 from Upper Siwaliks.

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