

## Some Miocene and Upper Siwalik Vertebrates from Ceylon

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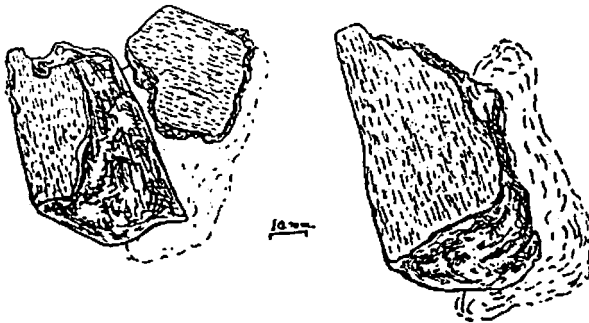
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(With Two Plates and Four Text Figures)

The present paper is a brief account of some vertebrate fossils from Ceylon, namely, (A) bone fragments discovered in Miocene sandstone of marine origin, and (B) teeth from deposits of Upper Siwalik age, from the inland Province of Sabaragamuva 51 kilometres (32 miles) from the sea.

(A) *Miocene fossils*. These were discovered in sandstone, which casts of such marine bivalves as *Tellina*, *Chlamys*, *Ostrea* and *Placuna*, as well as the detached teeth of nine genera of marine fishes comprising *Selachii* and *Pisces*<sup>1</sup>, proved to be of marine deposition. These rocks



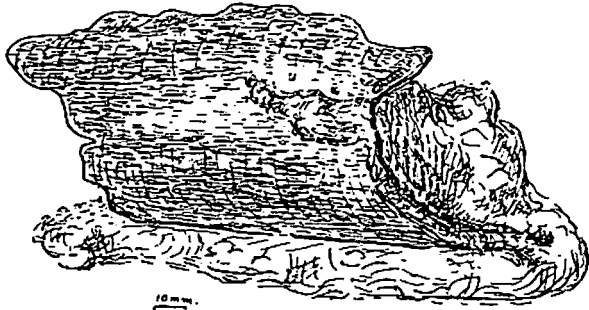
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Fig. 1. ?Marginals with matrix attached

<sup>1</sup> These fish fossils will be described in a subsequent issue of this journal.

were exposed between tide levels at Arua kallu, also known as Muringé Malé, on the east shore of Dutch Bay in the North-Western Province of Ceylon. The bones which occupied an area of about six square metres were more or less completely mineralized, and so firmly embedded in sandstone that a hammer and chisel were necessary to extract specimens. The majority were flat, while a few were cylindrical and were, apparently, parts of limb bones of considerable size. A conspicuous feature was the absence of vertebrae, and no parts could be recognized as belonging to the skull.

Under the circumstances, it seemed at first impossible to arrive at any conclusion as to the animal's identity, but further consideration suggested that the flat pieces of bone belonged to the carapace of a large marine thecophoran turtle. Supporting this view are pieces of what appear to be two marginal bones (fig. 1). The absence of vertebrae also supports the view that the animal was a thecophoran, for in such turtles the dorsal vertebrae are more or less reduced and adherent to the carapace, and if the dead animal lay prone it is likely that they would be embedded in sandstone.



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Fig. 2. Fragment of a long bone, with matrix attached  $\times 3$

There were two fragments of long bones. Each was 125 mm. long and the thickness of bone was 12 mm. The diameter of the better preserved piece was about 40 mm. (fig. 2). The thickness of the various pieces of bony plates was from 13 to 14 mm. The specimens will be deposited in the Colombo Museum.

(B) *Upper Siwalik fossils.* The stratigraphy of the fossil deposits of Upper Siwalik age in Ceylon has been discussed elsewhere and the

name 'Ratnapura' proposed for their horizon (Deraniyagala 1936, p. 316). Consequently this aspect will not be dealt with in the present paper, which is essentially a description of the teeth of extinct members of the Elephantidae, Rhinocerotidae and Hippopotamidae from Ceylon.

It is known that each of the above family contains a number of extinct genera and species, the latter usually within close proximity to one another, while their living representatives display an equally, if not greater, restriction in specific and subspecific range of distribution, *e.g.*, the elephants form two genera, *Loxodonta* of Africa existing as fifteen subspecies, and *Elephas* of south-eastern Asia forming three. One of these latter is confined to Ceylon. The Rhinoceroses form two living genera in Africa and two more in Asia, while the Hippopotamus survives in Africa as two species and several subspecies.

Fossils of Siwalik age are known from the Siwalik area in India, the Irrawady delta in Burma and from Java and Africa. As there are nearly fifteen degrees of latitude separating Ceylon from the nearest Siwalik area, *viz.*, the Indian one which has the Narbadda river as its southern boundary, it is probable that the Ceylon animals now tentatively placed with their nearest Indian relatives, will, when better known, prove to be either distinct species or subspecies. The specimens here described, which will be deposited in the British Museum, were obtained from two localities in the Province of Sabaragamuva, *viz.*, an estate belonging to Mrs. A. H. E. Molamure at Kuruvita and from Potgul kanda.

### Order PROBOSCIDEA

#### **Palaeoloxodon** Matsumoto

*Palaeoloxodon* Matsumoto, 1924. J. Geol. Soc. Tokyo, XXXI, N 371, p. 257

Extinct elephants with a strong transverse frontal ridge and with hypsodont teeth, from the upper Pliocene and Pleistocene of Asia, Southern Europe and Northern Africa.

#### **Palaeoloxodon namadicus** (Falconer et Cautley) (Plates V, VI)

*Elephas namadicus* Falconer et Cautley, 1846. *Fauna Antiqua Sivalensis*, pt. 2, pl. XIII

The probability that some of the fossil proboscidean molars discovered in Ceylon by the author might belong to *Palaeoloxodon namadicus* (Falconer et Cautley), was suggested by Dr. A. Tindell Hopwood of the

British Museum (Deraniyagala 1936). Subsequent acquisition of a number of more or less complete molars shows that this view is correct. Further investigation might reveal that two species of *Palaeoloxodon* lived in Ceylon, a large one which is probably a subspecies of *P. namadicus* (Falconer et Cautley) and a smaller species possibly from another level.

The specimen figured in Plate VI, figs. 1, 2 is an upper front molar which has lost its last two or three enamel folds. Seven folds are intact and probably the entire tooth originally possessed nine or ten in all. Each rises above the cement to a considerable height, (Pl. VI, fig. 2) and is feebly expanded at the mid longitudinal axis of the crown, the enamel is crenulate upon both surfaces (Pl. VI, fig. 1).

This specimen is from the Kuruvita estate and was reported to have been obtained about eight metres below the surface. Its dimensions are as follows:—length of crown 112 mm.; width of crown 65 mm.; diagonal length from crown tip to root 140 mm.; projection of third and fourth enamel folds above cement 11 mm.

#### *Palaeoloxodon* sp. (Plate V, fig. 2)

In 1934 part of an elephant molar from Potgulkanda was sent to Dr. A. Tindell Hopwood, for his opinion. His comment was "extinct but species not determinable". The subsequent acquisition of four more or less similar specimens from the same, as well as other, localities suggests that these teeth belonged to a smaller species than the preceding one. The enamel folds do not rise above the cement of the crown, are more coarsely crenulate, especially on the external aspect, and are closer together than in the larger form; viewed anteriorly, the outline of each enamel fold is subovate. The specimens were obtained from depths of ten to twelve metres.

The dimensions of three from Potgulkanda were as follows: greatest length 80 mm.; width 65 mm.; depth 120 mm.; width of crown 66 mm.; thickness of each enamel fold 11 mm.; thickness of each interspace 5 mm.

The tooth comprised five enamel folds and a talon. The last fold was entire whereas the others had come into use. Each enamel fold displayed only four cusps which were most worn towards the middle of the tooth. The enamel of each fold was crenulate on both surfaces and cement filled the interspaces completely.

The other specimens consisted of two pieces, each comprising three enamel folds which had not yet come into use. The depth was 110 mm., the width 50 mm. Both probably belonged to the same animal.

A specimen from Kuruvita (Pl. VI, figs. 1-2) comprising three unworn enamel folds was 115 mm. deep, 63 mm. wide. The lateral thickness of an enamel fold was 11 mm. These folds were somewhat thicker than the cement interspaces.

A specimen from Karmarangapitiya also comprised three unworn enamel folds and a talon. The specimen was 115 mm. deep, 61 mm. wide and the lateral thickness of each enamel fold was 10 or 11 mm. The enamel folds displayed remarkably well the coarse crenulation previously mentioned.

### Order PERISSODACTYLA

#### *Rhinoceros* Linné (Plate VI, figs. 3-4)

*Rhinoceros* Linné, 1758. Syst. Natural X

Rhinoceroses with a single nasal horn, cutting teeth in both jaws, manus with three digits. Pliocene to recent, restricted to Asia.

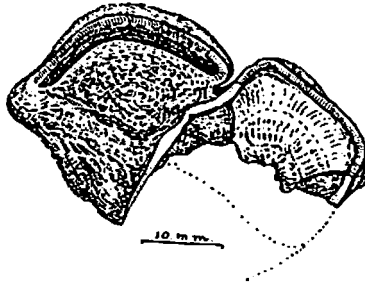
In Asia the family Rhinocerotidae comprises a number of extinct as well as living genera. Some of these vary in the number of digits, and nasal horns, while one lacks the latter. The family is known in Ceylon from two lower molars found within a period of three months of each other, and close to molars of a species of hippopotamus. This association suggests that the rhinoceros might possibly have belonged to the short limbed teleocerine group which are thought to have frequented the neighbourhood of slow flowing rivers. However for the present the Ceylon animal is tentatively assigned to *Rhinoceros sivalensis* Falconer et Cautley.

#### *Rhinoceros sivalensis* Falconer et Cautley

*Rhinoceros sivalensis* Falconer et Cautley, 1847. Fauna Antiqua Sivalensis

The teeth are two lower molars of the usual lophodont type. The one here described (Plate VI, fig. 3) is a last lower left molar fractured on the lingual surface of the anterior pillar. The posterior pillar is more or less intact and its crown shows a narrow, crescentic metaloph close to its labial margin which is a ridge marked with fine crenulations resembling the 'milling' upon the rim of a coin (Plate VI, fig. 4). The dimensions of the tooth are as follows: length across crown 44 mm.;

length across crown of anterior pillar 20 mm.; height of anterior pillar 41 mm.; length across crown of posterior pillar 30 mm.; height of posterior pillar 36 mm., length of metaloph 26 mm.



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Fig. 3. Crown of molar of *Rhinoceros sivalensis*  $\times \frac{3}{2}$

### Order ARTIODACTYLA

#### Hexaprotodon Falconer et Cautley

*Hippopotamus (Hexaprotodon) sivalensis* Falconer et Cautley, 1836. Asiatic Researches XIX

Extinct hippopotami with six incisors in each jaw; from the Pliocene and Pleistocene of Asia and Africa.

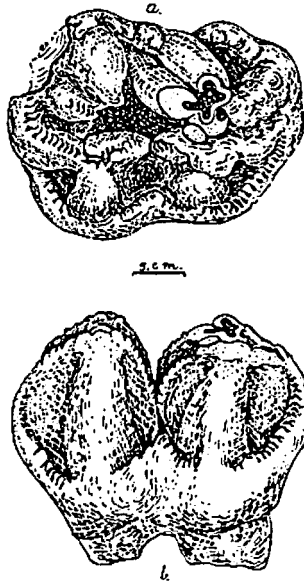
This generic name was originally applied by the authors in a sub-generic sense to the hippopotami of the Upper Siwalik beds. Modern investigation has shown that the name is entitled to generic rank. This genus is considered more primitive than *Hippopotamus*. The Asiatic representatives of the family Hippopotamidae are extinct and all appear referable to *Hexaprotodon*. The Ceylon form, known from four molars and part of an incisor obtained on different occasions, from the same locality, is tentatively assigned to *Hexaprotodon sivalensis* Falconer et Cautley.

#### *Hexaprotodon sivalensis* Falconer et Cautley (Plate V, fig. 3)

*Hippopotamus (Hexaprotodon) sivalensis* Falconer et Cautley, 1836. Asiatic Researches XIX

The description and figure of the first molar discovered, which is now in the British Museum, appears elsewhere (Deraniyagala 1936). Other teeth were discovered subsequently on the same estate at a depth of about ten metres. The specimen now described is a lower left molar found as four fragments, and when these were assembled, one cusp was still missing and only one was in wear.

A noticeable feature of the teeth was the strong convolution of the cusps which differ in this respect from those figured by Falconer and Cautley in *Fauna Antiqua Sivalensis*. The dimensions of this tooth are as follows: crown length 57 mm.; crown width 44 mm.; depth 49 mm.



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Fig. 4. Molar of *Heraprotodon sivalensis*  $\times \frac{1}{10}$   
(a) Crown, (b) Lateral view.

#### SUMMARY

The genera of extinct vertebrates described in this paper are as follows:—

#### *Miocene*

- ? Class Reptilia
- ? Order Testudinata

#### *Lower Pleistocene*

*Ratnapura horizon* (Upper Siwalik age)

- Class Mammalia
- Order Proboscidea
- Family Elephantidae
- Genus *Palaeolozodon* Matsumoto

Order Perissodactyla  
 Family Rhinocerotidae  
 Genus *Rhinoceros* Linné

Order Artiodactyla  
 Family Hippopotamidae  
 Genus *Hexaprotodon* Falconer et Cautley.

The extinct vertebrates of Ceylon thus briefly described comprise a Miocene form which is probably a marine thecophoran turtle, at least one elephant as well as a rhinoceros and hippopotamus, of upper Siwalik age. The hippopotamus remains suggest that during upper Siwalik times there were numerous large, slow-flowing rivers with broad flood plains among the hills of Sabaragamuva. Sometime these rivers appear to have entered lakes, which they eventually silted completely before they themselves ceased to exist. Such deposits yield a considerable proportion of the more valuable gems, which were probably in large measure exposed as a result of subaerial decomposition of the matrix, and the rivers deposited these gems either immediately prior to or simultaneously with the bones of the animals mentioned. Fossiliferous beds, however, are sufficiently uncommon in Ceylon, for Wayland, a former Government Mineralogist to state (1916), that although the Mineralogical Department had been on the look-out for vertebrate fossils since its inception in 1903, none had been discovered, and it was consequently thought that the climatic conditions of Ceylon were not conducive to the preservation of bones.

#### REFERENCES TO LITERATURE

- DERANIYAGALA, P. E. P. 1936. Some Vertebrate fossils from Ceylon. *Geological Mag.*, LXXIII, pp. 316-318, figs. 3
- WAYLAND, E. J. 1916. *Equus zeylanicus*. *Spolia Zeylanica*, Vol. X, pp. 274-275

#### EXPLANATION OF PLATES

##### PLATE V.

Fig. 1. Separated enamel folds of a molar of *Palaeoloxodon namadicus* from Potgul kanda

Fig. 2. Molar of *Palaeoloxodon* ?from Potgull kanda

Fig. 3. Molar of *Hexaprotodon sivalensis* from Kuruvita specimen in British Museum

##### PLATE VI.

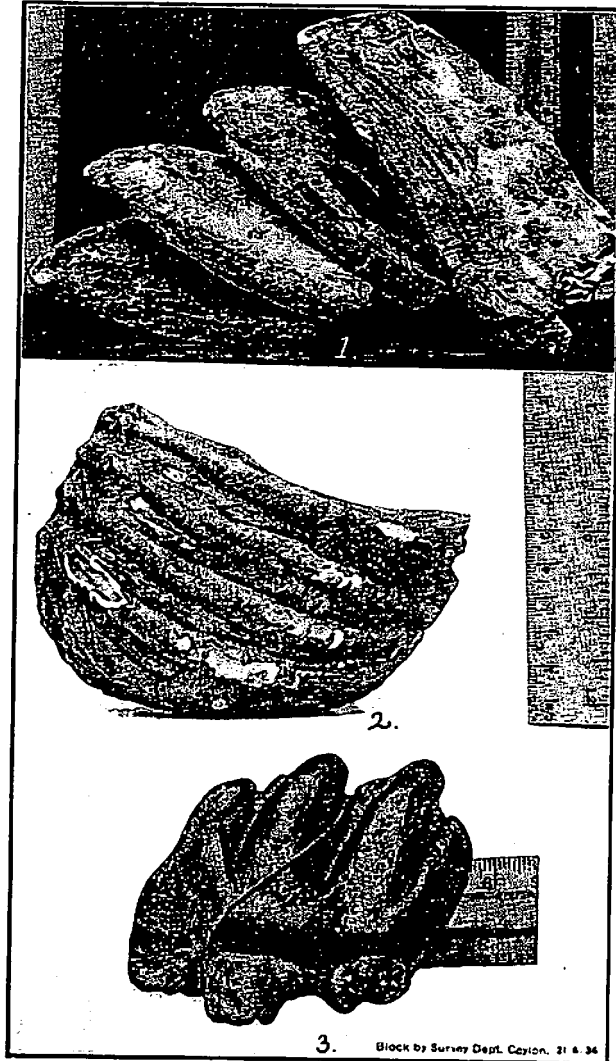
Fig. 1. Crown of upper front molar of *Palaeoloxodon namadicus* from Kuruvita

Fig. 2. Side view of molar of *Palaeoloxodon namadicus* Kuruvita

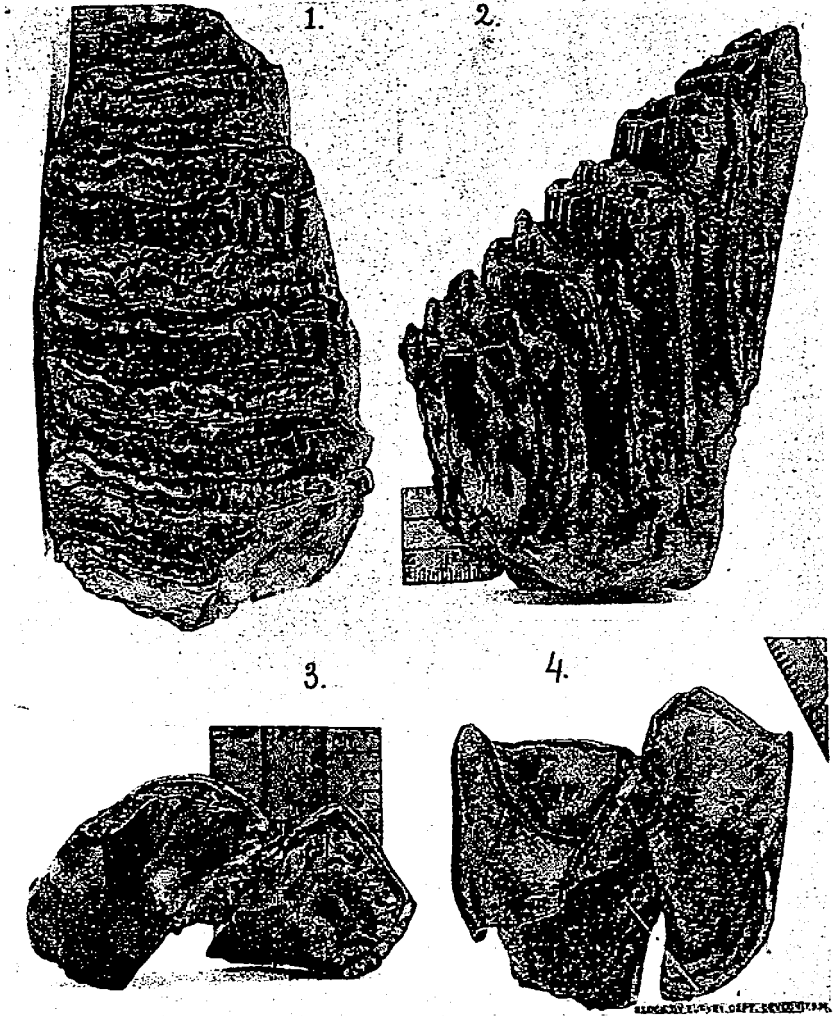
Fig. 3. Crown of last lower left molar of *Rhinoceros sivalensis* from Kuruvita

Fig. 4. Lingual surface of molar of *Rhinoceros sivalensis* from Kuruvita





*Vertebrate Fossils from Ceylon*



*Vertebrate Fossils from Ceylon*