PLEISTOCENE VERTEBRATE FOSSILS FROM TAMIL NADU, INDIA

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ABSTRACT

In contrast to the abundance of Pleistocene fossils found in other parts of Peninsular India, records of such fossils from Tamil Nadu have generally been scanty. This is partly due to the fact that Pleistocene formations, which range in thickness from 2 to 4m only and generally overlie the Cretaceous rocks, are exposed at various places in the form of detached outcrops. Consequently large areas have remained unexplored because of lack of interest in such outcrops.

However, in the past several years, a few records of Pleistocene fossils have become available from several sites. Important among these are the records of *Hypselephas hysudricus* from Ayyanidipu; *Stegodon insignis*, *Bos* cf. *namadicus* and *Cervus* cf. *unicolor* from Sayamalai (both sites in Tirunelveli Dist.); *Bos* sp. and *Equus namadicus* from Ariyalur; *Bos* sp., *Equus* sp. and a new species of *Bubalus*, *B. maruvattoorensis* from Maruvatoor (both sites in Tiruchirapalli Dist.). In the present paper descriptions of a partial skull of *Rhinoceros unicornis* collected at Sathankulum in Tirunelveli Dist. are given. These additional materials considerably add to our knowledge of paleogeographic distribution and migration patterns of these animals in Tamil Nadu during the Pleistocene period. An attempt is made to put the various faunal discoveries in Tamil Nadu in their proper perspective in relation to the whole of Peninsular India.

INTRODUCTION AND PREVIOUS WORK

When we talk of paleontology in South India the Cretaceous beds of Trichinopoly come to our mind first. These are most extensively developed in Tamil Nadu and have yielded a large number of invertebrate fossils (ammonites, lamellibranchs, gastropods, cephalopods, echinoids etc.) particularly from Trichinopoly Dist. which is one of the classic regions of Indian geology. However, the discovery of vertebrate fossils in Tamil Nadu as a whole has been very sporadic. Perhaps the first record of vertebrate fossils was that of dinosaur remains discovered by Blanford (1865) in the Ariyalur Group of the Cretaceous rocks of Trichinopoly Dist. during the 1875-60 geological survey. The place of discovery was near Kallamedu, about 10km from Ariyalur. These dinosaurian bones were described by Lydekker (1877) as *Megalosaurus* sp. and later as sauropodous fossils by Matley (1929) in his subsequent field survey around Kallamedu. Some of the smaller bones in his collection of fossils were possibly stegosaurian. The fact that dinosaur fossils are rare in India and that they occur in marine beds only in Trichinopoly Dist.

(containing cephalopods) helped the geological horizon to be fixed with some amount of precision. The rocks in general consist of sands and soft friable sandstones with pebbly bands among which are beds of clayey sand and clay (often gypseous), calcareous grits and shales and seams of highly fossiliferous limestone. These strata lie on Pre-Cambrian gneisses and granites and are overlain in part by the Cuddalore Sandstone. Some fragmentary remains of dinosaurs, Chelonia and fish were also found from Utatur and its neighbourhood during a visit to the area by Matley (1929).

The Pleistocene deposits in Tamil Nadu and fossils therein are few. The deposits occur as small outliers of 2 to 4m thickness, which are either not mapped or have been denuded. Nevertheless, a few Pleistocene fossil records have been made from various areas which are important in their own way. Among these are reports of mammalian species, *Bos* (or *Buffelus*) and *Equus* collected in a nala bed around Kallamedu by Matley (1929) in the course of his search for dinosaurian bones in the Ariyalur area. According to G.E. Pilgrim (personal communication to C.A. Matley) they may have been derived from the Cuddalore Sandstone which is considered of Pliocene age. Possibly Cuddalore Sandstone once overlaid this area. The mammalian horizon is reportedly at the base of the sandstone. One of the notable discoveries of Pleistocene fossils is the one reported by Tripathi (1964) who discovered a few fossils *Bos* cf. *namadicus* (GSI Type No. 17900), *Stegodon insignis* (GSI Type Nos. 17898 and 17899), *Cervus* cf. *unicolor* (GSI Type No. 17903) and *Lissemys punctata* (GSI Type No. 17902) from a few well sections near Sayamalai (9° 04' 45"N; 77° 40' 30"E) in Tirunelveli Dist. Here the tuffaceous kankar bands and the compact sandstones containing the vertebrate fossils are barely 6 to 8m thick and overlie the Archaeans directly. According to Tripathi (1964) the entire faunal evidence when weighed together comes in favour of assigning a Middle Pleistocene age to the compact sandstones of Sayamalai roughly equivalent to the Older Alluvial deposits of the Ganga, Yamuna, Narmada, Godavari and Krishna rivers although the possibility of their being slightly younger than Middle Pleistocene may not be ruled out. Another locality, Palankottai (9° 08'N : 77° 41'E), about 7km NE of Sayamalai also yielded partially mineralised animal remains of *Bos* and *Equus* which, however, may not geologically represent a great antiquity.

Subsequently, Prasad and Daniel (1968) described a partial skull of *Hypselephas hysudricus* (SRV No. 1/30 – GSI, Hyderabad) from Ayyanidipu (8° 45'N; 78° 07'E), 6.5km west, on the Tuticorin-Palayamcottah road, Tirunelveli Dist. According to the authors a small patch of Late Tertiary sediments of probable Plio-Pleistocene age occurs in a series of detached outcrops in the coastal belt of Tirunelveli-Tuticorin. The occurrence of *Hypselephas hysudricus* in this part of the region is the first record of the species in Tamil Nadu and is of considerable interest as it throws new light on the distribution of fossil elephants in India during the Pleistocene times. Fossils of this species are now extensively found in almost all the Quaternary deposits of India ranging from the Siwaliks of NW India to the Peninsular river valleys (Badam, 1984).

Mamgain and Sastry (1967) reported the first occurrence of *Bos* sp. in the Late Pleistocene deposits (overlying the Cretaceous rocks) near Ariyalur in the Tiruchirapalli Dist. of Tamil Nadu. The locality is near milestone 5/1 on the Ariyalur – Udaiyarapalaiyam road, about 1km NE of Kattuppirangiyam (11° 06' 43"N; 79° 08' 30"E). These fossils were found embedded in a thin layer of lateritic clays on the weathered surface of the siliceous buff limestone. Similar fossils were also found 2km SW of Kallankurichchi (11° 09'N; 79° 07'E). According to these authors the beds yielding these fossils seem to have been deposited in small isolated ponds during the Late Pleistocene period. The remnants of these sediments now occur as thin disconnected patches on the weathered surface of the Upper Cretaceous formations.

A well preserved tooth of *Equus* (T/65 AMU), possibly *Equus namadicus*, was described by Khan (1971) from Pleistocene deposits around Ariyalur. Khan reports some isolated patches of Middle Pleistocene deposits in the area.

A new species of *Bubalus, B. maruvattoorensis*, questionably placed in the Late Pleistocene, was described by Ghosh *et al.* (1972) from around Maruvattoor (11° 05'N; 79° 05'E) about 15km SSW of Ariyalur, on the basis of a large and stout distal part of a humerus. This material was collected on the dry bank of a small branch of Marudiyar river. The area as a whole belongs to the Cretaceous Period and has yielded a number of fossil invertebrates. Although the age of the present species cannot be determined with certainty, it is assumed to have been transported from some adjoining Late Pleistocene deposits overlying the Cretaceous beds. Judging from the measurements it appears that the new species represents a much larger form than the fossil *Bubalus palaeindicus* (Narmada and Godavari valleys) and the present day *Bubalus bubalis*. It is, however, smaller than *Bubalus platyceros* (Upper Siwaliks) which is known to be much larger than the other known buffaloes. Further, the new buffalo is much shorter than *Bos acutifrons* (Upper Siwaliks) and slightly less so than *Bos namadicus* of the Narmada and Deccan river valleys.

Teeth of *Equus* sp. and *Bos* sp. were collected from the alluvial beds on the bank of Marudiyar river near Maruvattoor, Tiruchirapalli Dist. (Saha, 1976). These remains might have been transported by streamlets flowing over the adjoining Late Pleistocene deposits overlying the Cretaceous rocks.

PRESENT MATERIAL

The faunal material discussed in the present communication includes a partial skull of *Rhinoceros unicornis* (collected at Sathankulum in Tirunelveli Dist.) and bovid teeth and horncores (collected from Elur in Coimbatore Dist. by one of us (SCJ) in the course of his hydrogeological investigations in the above mentioned districts.) In view of the scarcity of Quaternary fossils in Tamil Nadu as a whole, the present discovery assumes great significance. The object of the present

communication is to update our knowledge of Quaternary vertebrate fossils of Tamil Nadu and put the various discoveries in their proper perspective.

Rhinoceros unicornis

The present is the first record of fossil *Rhinoceros* from the southern tip of India. The specimens were found in a 2m thick semi-consolidated sandy deposit in a well cutting at Sathankulum (8° 27'N; 77° 55'E) in Tiruneveli Dist. of Tamil Nadu (Fig. 1) which is about 21m above mean sea level and about 30m south of the southern bank of the Karamanyar river. A brief note on the present material was published by Jayakaran (1980) putting the discovery on record. A detailed account of the find is given in the present communication.

Geologically, the formations are fluvial in origin. The thickness of the fossiliferous horizon does not exceed 2m and the sedimentary constituents are semi-consolidated sandy materials which overlie a layer of calcareous sandstone and appear localised. The fossiliferous horizon is overlain by a 5m thick tuffaceous calcareous formation. The calcareous sandstone is underlain by smoothly eroded Pre-Cambrians with a depth of about 8.5m below the ground level. The fossil yielding deposits are characterised by current bedding, suggestive of turbulent conditions during the time of deposition of these sediments.

Paleontological material recovered from the site includes a partial skull of *Rhinoceros unicornis* (anterior portion including the nasal prominence), fragments of teeth and ribs and a few unidentifiable postcranial fragments.

Systematics

Order: Perissodactyla Owen, 1847
Family: Rhinocerotidae Owen, 1845
Genus: *Rhinoceros* Linn., 1758
Species: *R. unicornis* Linn., 1758

Material: A partial skull representing the nasal region and part of the frontal up to the posterior aspect, and fragments of teeth.

Locality: A well cutting at Sathankulum, Tirunelveli Dist., 30m south of the southern bank of Karamanyar River.

Horizon: Late Pleistocene to Holocene.

The specimen under consideration is a partial skull of *Rhinoceros unicornis* being represented by the nasal region and part of the frontal up to the posterior aspect (Plate 1 a & b). The frontal region is tapering, giving rise to a saddle in the

cranial profile, which is, however, not very deep. The texture and surface of the skull does not show heavy petrification. However, various skull bones are ossified. The diploic cavities are filled with fine clayey material. Anteriorly the skull has undergone some lateral distortion resulting in a slight bend laterally in the nasal portion. It is characterized by a canoe-shaped overhanging premaxilla.

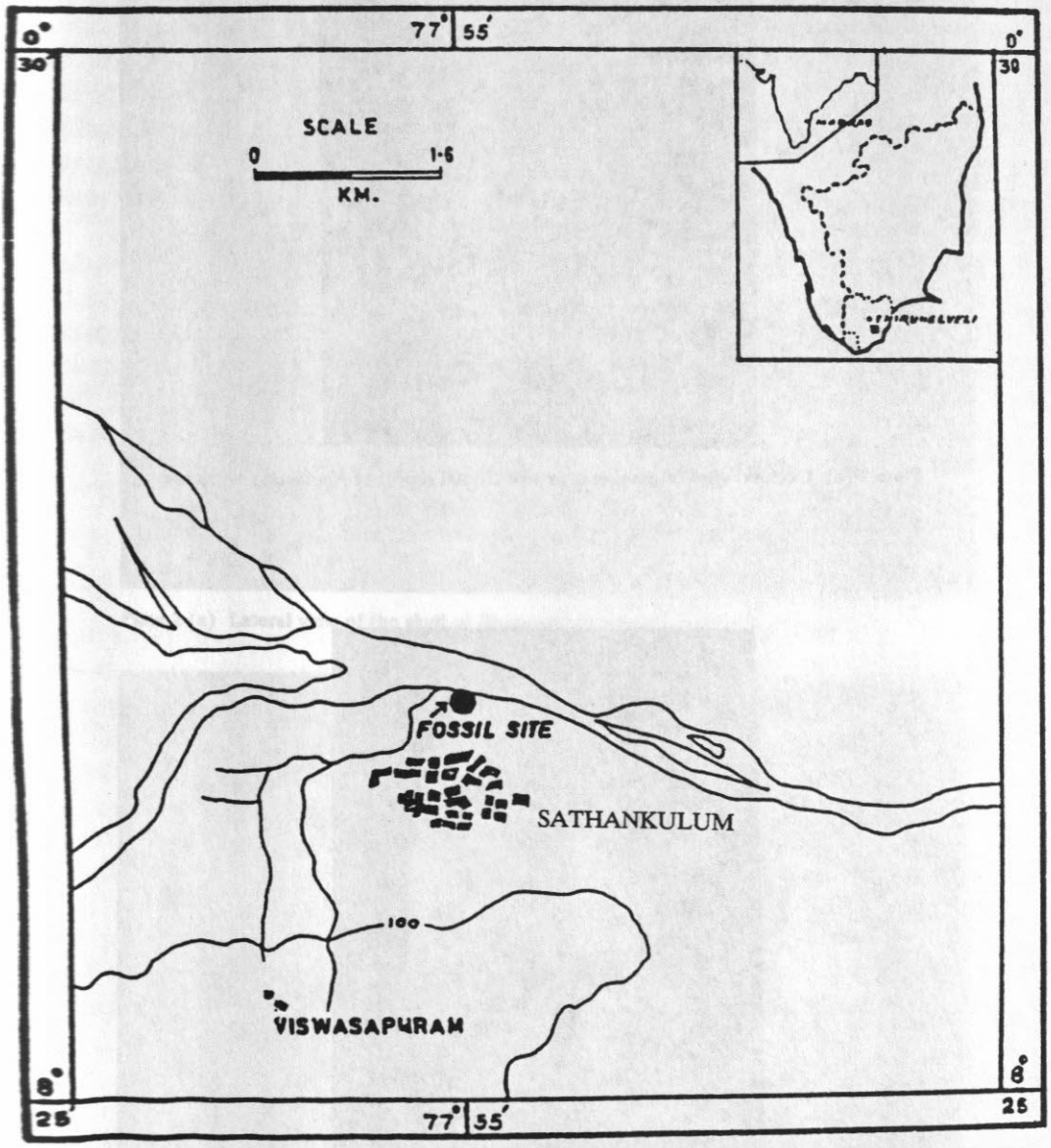


Fig. 1. Locality map of fossil sites in the Sathankulum, Tirunalveli, Tamil Nadu.

Plate 1 (a) Occlusal view of nasal and part of frontal aspect of *Rhinoceros unicornis*.

Plate 1 (b) Palatal view of the skull of *Rhinoceros unicornis*.

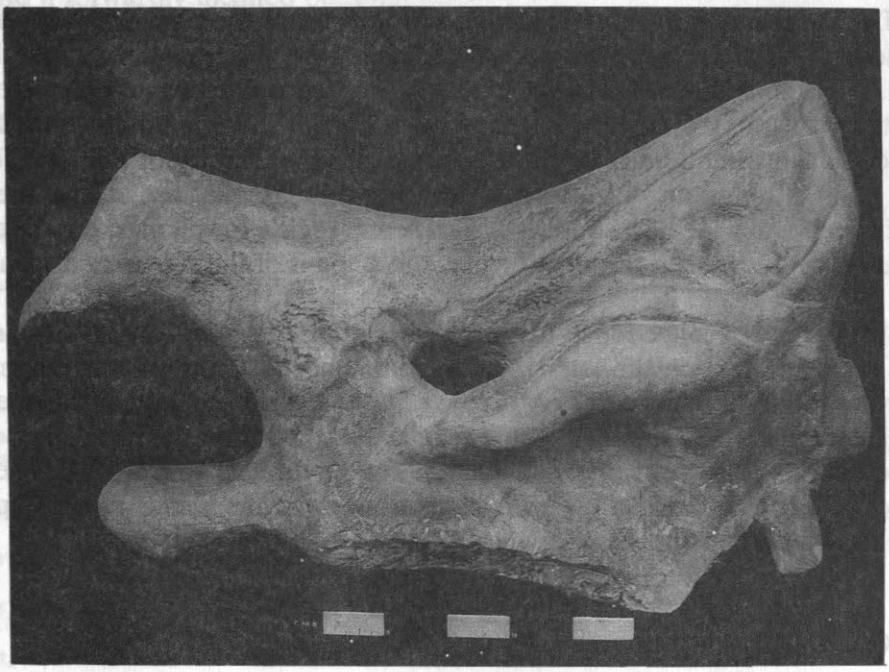


Plate 2 (a) Lateral view of the skull of *Rhinoceros unicornis* (after reconstruction).

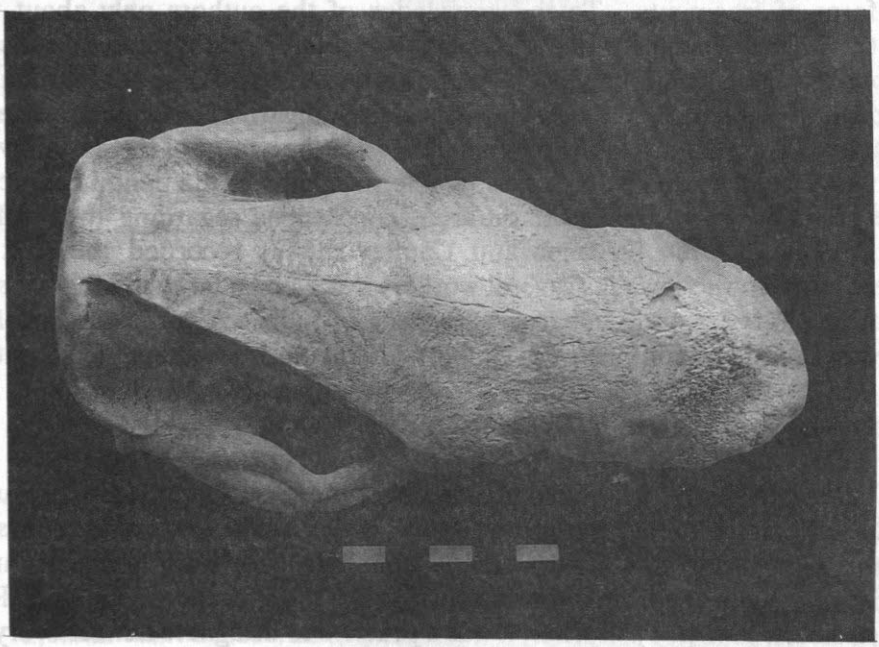


Plate 2 (b) Occlusal view of the skull of *Rhinoceros unicornis* (after reconstruction).

On reconstruction the skull appears to be large, low and elongated with a sharp and high occipital crest on the occiput which is inclined forwards. Posteriorly, the skull is elevated (Plate 2 a & b).

The nasal boss is prominent having a protuberance for a horn base resembling the *unicornis* variety. Dorsally the nasal boss is rugose, the bones of the nasal being arched. The massive nasal region with the rugose nasal boss of this specimen suggests that it carried a well developed nasal horn. There is no evidence for the presence of the frontal horn in the present specimen. The tip of the anterior end of the nasal is long and downturned. The nasal is laterally broad and the nasal cavity is deep and wide. The anterior nasal septal region is well marked. The naso-maxillary complex is seen terminating into the summit of the roughened nasal boss.

At the time of collection of the skull, parts of maxillary bones had three molars on the right and two on the left, which were damaged. Only isolated fragmented cusps were found in a few cases. Moreover, in the course of study of the specimen the fragmented parts of the teeth got gradually detached from the maxillary portion. As a result reconstruction of the teeth was rather difficult and would have been erroneous. Broadly the teeth were hypsodont, showed medisinus or ectoloph and the crista was perhaps not developed.

Remarks

Fossil rhinoceroses in Indian geological formations have generally been found in the form of fragments. To the knowledge of the authors only about twenty complete or nearly complete skulls of various genera of rhinoceroses are displayed in various museums in India, most of them in the India Museum, Calcutta and the Geological Museum of the Panjab University, Chandigarh. Consequently they have been studied in a relatively incomplete manner. Further, most of the earlier workers seem to have been misled by the considerable variability in the dental characters of rhinoceroses and have arrived at different conclusions regarding their affinities (Badam, 1979). After Falconer and Cautley (1847) recorded the first fossil rhinoceroses from the Siwaliks several workers described a large number of species from various Tertiary and Quaternary deposits of India. A complete list of fossil rhinoceroses initially compiled by Colbert (1935) and subsequently updated by Badam (1979) is given in Table 1. Distribution of *Rhinoceros* in Indian archaeological sites is given in Table 2.

There seems to be a lot of confusion about the term *Rhinoceros* when used in a formal sense and it would be appropriate to indicate here the limits of this term. The genus *Rhinoceros* has been used by paleontologists to "include a great number of species ranging in age from the Miocene through the Pleistocene and into Recent times" (Colbert, 1942 p. 1). Earlier, it was a practice to designate almost every fossil rhinoceros of post-Oligocene age as *Rhinoceros*. The differentiation of rhinoceroses

into various genera started in the mid-Miocene when the genus *Rhinoceros* became restricted to the individuals with nasal bones expanded into a nasal boss for bearing a nasal horn, with incisors present and cheek teeth sub-hypsodont and with short skull and a forwardly inclined occipital plane.

Table 1. Distribution of fossil Rhinoceroses from Indian geological formations (Updated from Colbert, 1935 and Badam, 1979)

Species	Author	Locality	Horizon
Gaindatherium browni	Colbert, 1934	Lower Siwaliks	Chinji
Aceratherium blanfordi	Lydekker, 1884	Lower and Middle Siwaliks	Chinji, Nagri, Dhokpathan
Chilotherium blanfordi (1)	(Lydekker), 1884	Lower and Middle Siwaliks (Bugti beds of Baluchistan)	Kamlial, Chinji, Nagri, Dhokpathan
Rhinoceros perimensis (2)	Falconer and Cautley, 1847	Middle Siwaliks	Chinji, Nagri, Dhokpathan
Aceratherium lydekkeri	Pilgrim, 1910	Middle Siwaliks	Dhokpathan
Chilotherium intermedium (3)	(Lydekker), 1884 Lower,	Middle & Upper Siwaliks	Chinji, Nagri, Dhokpathan, Pinjor
Rhinoceros sivalensis	Falconer and Cautley, 1847	Upper Siwaliks	Pinjor
Rhinoceros palaeindicus	Falconer and Cautley, 1847	Upper Siwaliks	Pinjor
Rhinoceros platyrhinus (4)	Falconer and Cautley, 1847	Upper Siwaliks	Pinjor
Rhinoceros deccanensis	Foote, 1876	Krishna Valley (near Gokak, Dist. Belgaum on Ghataprabha river)	Late Pleistocene
Rhinoceros karnuliensis	Lydekker, 1886	Kurnool Caves, Andhra Pradesh	Late Pleistocene
Rhinoceros unicornis	Linneaus, 1758	Narmada, Tamil Nadu, (Pleistocene), East Bengai, Assam, Burma, Malaya, Sumatra, Java (for recent specimens)	Late Pleistocene, Recent

NOTES

A 1. Its synonyms are *Teleoceros blanfordi mihi* Pilgrim, 1910 from Lower and Middle Siwaliks (precise locality not known), and *Aceratherium blanfordi* Lydekker, 1884 Lower and Middle Siwaliks (Chinji, Nagri and Dhokpathan).

2. Its synonyms are *Aceratherium perimense* (Falconer and Cautley), 1847 (the Type specimen from Perim Island, Gujarat) from Lower and Middle Siwaliks (Chinji, Nagri and Dhokpathan), *Rhinoceros planidens* Lydekker, 1880 *from Middle Siwaliks (Dhokpathan) and *Rhinoceros iravadicus* Lydekker, 1876 (Irrawaddy beds of Burma) Middle Siwaliks (Dhokpathan).

* There seems to be some discrepancy with regard to the year in which the species was established by Lydekker. Whereas Colbert, 1935, page 33, mentions 1876 as the year, on page 177 of the same publication the date is mentioned as 1880.

3. Its synonym is *Rhinoceros sivalensis intermedius* Lydekker, 1884 from Lower and Middle Siwaliks (Chinji, Nagri and Dhokpathan).

4. *Coelodonta platyrhinus* (Falconer and Cautley), 1847 from Upper Siwaliks (Pinjor) is considered its synonym.

B *Rhinoceros planidens and Rhinoceros iravadicus*. Colbert, 1935, page 200 treats the species as *Aceratherium planidens* and *Aceratherium iravadicus* respectively. However in his table, page 33, 1935, he retains the generic name *Rhinoceros* for both the species.

C Khan (1971) established a new genus *Panjabitherium platyrhinum* on the basis of skull no. A/559 collected from the Pinjor Stage of Upper Siwaliks and housed in the Geological Museaum of Panjab University, Chandigarh. However, a close scrutiny of the specimen indicates that there is no reason to treat it as different from *Rhinoceros*.

Table 2. Distribution of Rhinoceros in archaeological sites in India

Culture	Site	Date
Mesolithic	Langhnaj	2,000 B.C.
	Kanewal	
	Sarai Nahar Rai	8,400 + 113 B.C.
		995 + 124 B.C.
Neolithic	Payampalli	1,700 - 1,400 B.C.
	Chirand*	
Harappan	Harappa	2,500 - 1,500 B.C.
	Amri III	3,660 - 3,020 B.C.
	Lothal	2,005 - 1,900 B.C.
	Kalibangan II	2,062 - 1,902 B.C.
	Oriyo Timbo	2,980 - 2,525 B.C.
Chalcolithic	Inamgaon	1,600 - 700 B.C.
	Khanpur	

* It is not clear whether *R. unicornis* is recorded from Neolithic levels or from Chalcolithic.

The genus *Rhinoceros* includes 4 well defined species, two of which are of recent age and two extinct (there may be other fossil species but these are of doubtful validity). These are as follows:

1) *Rhinoceros unicornis* Linn., 1758 (Type of the genus)
Synonyms: *R. indicus, R. asiaticus, R. stenocephalus*
Range: Pleistocene – Recent of India.

2) *Rhinoceros sondaicus* Desmarest, 1822
Synonyms: *R. javanicus, R. inermis, R. nasalis, R. floweri*
Range: Pleistocene of Borneo, Recent of the Sunderbans, Bengal, Assam, Burma, Malaya, Sumatra and Java.

3) *Rhinoceros sivalensis* Falconer and Cautley, 1847
Synonym: *Rhinoceros palaeindicus*
Range: Pleistocene of Upper Siwaliks of NW India.
Note: The senior author does not consider *R. sivalensis* and *R. palaeindicus* as synonyms (Badam, 1979).

4) *Rhinoceros sinensis* Owen, 1870
Synonyms: *Rhinoceros plicidens, Rhinoceros simplicidens*
Range: Pleistocene of SW China.

A discussion of all the fossils listed in Table 1 and immediately above is beyond the scope of the present paper. However, comments on fossils related directly or indirectly to the present find in terms of morphological features, geological range and geographical distribution are only offered here.

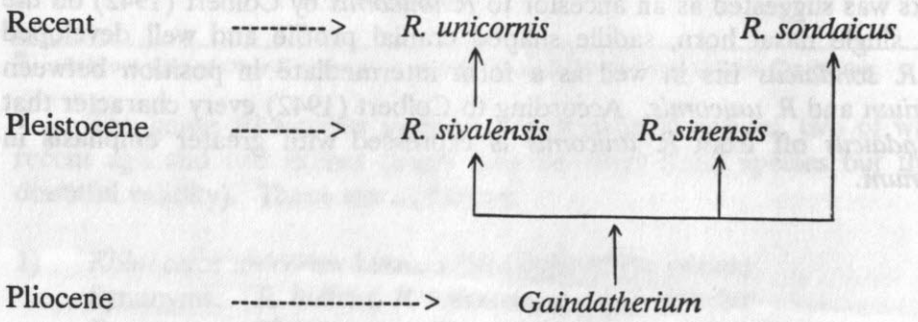
Pilgrim (1905) was the first to list *Rhinoceros unicornis*, the present Indian species of rhinoceros, in his collection of fossils from Quaternary formations of the Narmada Alluvium. The range of the species was mentioned as Pleistocene and Recent by Colbert (1942) while discussing the affinities of fossil and living rhinoceroses. He has drawn up a very useful comparison between the two modern species, *R. unicornis* and *R. sondaicus* (also extending into the Pleistocene) on the basis of the works of Flower (1876) and Osborn (1898) and the specimens housed in the American Museum of Natural History. He calls the comparison as "harmonic" specialization of *R. unicornis* over *R. sondaicus*, in overall characters of skulls, jaws and dentition. These are summarized in Table 3 along with the characters of *R. sivalensis* to demonstrate the degree of relationship of one form with the other.

It may not be out of place to mention here that *Gaindatherium browni* from the Siwaliks was suggested as an ancestor to *R. unicornis* by Colbert (1942) on the basis of a single nasal horn, saddle shaped cranial profile and well developed incisors. *R. sondaicus* fits in well as a form intermediate in position between *Gaindatherium* and *R. unicornis*. According to Colbert (1942) every character that sets *R. sondaicus* off from *R. unicornis* is expressed with greater emphasis in *Gaindatherium*.

Table 3. Characteristic features in skulls and teeth of *R. sivalensis, R. unicornis and R. sondaicus* (After Badam, 1979).

R. sivalensis	R. unicornis	R. sondaicus
1. Large	Large and robust	Smaller and lighter
2. Nasals expanded into large rounded horn boss	Nasals expanded into large rounded horn boss	Nasals less expanded, horn boss pointed
3. Deep saddle in the cranial profile	Deep saddle in the cranial profile	Shallow saddle in the cranial profile
4. Occiput forwardly inclined	Occiput high and narrow	Occiput low and broad
5. Skull considerably deep	Skull deep	Skull comparatively shallow
6. Ectoloph of cheek teeth flat	Ectoloph of cheek teeth flat	Ectoloph of cheek teeth sinuous
7. Parastyle buttress present	Parastyle buttress suppressed	Parastyle buttress prominent
8. Well developed crochet and indistinct crista	Well developed crochet and crista	Crochet present but crista generally absent
9. Teeth hypsodont	Teeth sub-hypsodont	Teeth less hypsodont
10. Premaxillaries broad	Premaxillaries broad	Premaxillaries narrow

Amongst the two fossil forms, *R. sivalensis* and *R. sinensis*, from India and China, respectively, *R. sinensis* is as big as *R. unicornis* but it shows a combination of characters that distinguish *R. sondaicus* and *R. unicornis*. It had a small horn carried on a pointed horn boss as in *R. sondaicus*. Also in the characters of teeth *R. sinensis* is a form of intermediate position between the two living forms. *R. sivalensis* is more close to *R. unicornis* (large horn boss, deep saddle in the cranial profile, forwardly inclined occiput, depth of the skull etc.) and has close approach to modern Indian form. The following tree indicates the origin of the two living species (after Colbert, 1942).



Amongst the other records of fossil rhinoceroses from Peninsular India is an upper jaw described as a new species, *R. deccanensis* from the ossiferous deposits near Gokak in Dist. Belgaum on the Ghataprabha river of the Krishna Valley (Foote, 1876). The place of discovery was a section exposed on the bank of a stream near the village Chikdauli, 5km east of Gokak. Lydekker (1886) described *R. karnuliensis* from the Late Pleistocene deposits of Kurnool Caves which he considered as distinct from the extant *R. unicornis*. He thinks that *R. karnuliensis* and even *R. deccanensis* have no representatives at present in India. The Kurnool species appears to have characters connecting it on one hand with *R. etruscus* (European) and *R. deccanensis*, and on the other with *R. bicornis* (African).

Deraniyagala (1958) thinks that *R. sinhaleyus* and *R. kagavena* which have been reported from the Pleistocene of Ratnapur beds in Sri Lanka are related to the Upper Siwalik species of India. However, Jayakaran (1980) suggests that extinct vertebrates in Sri Lanka had a parallel evolutionary tendency as that displayed by the Indian stock. The similarity of the present find from Tamil Nadu to those of Sri Lanka is therefore to be expected.

MEASUREMENTS (IN MM) OF THE PARTIAL SKULL OF *RHINOCEROS UNICORNIS*

Since the present specimen is broken, no comparative measurements with other species of rhinoceros can be taken. However, measurements of the preserved specimen are as follows:

1.	Maximum length from nasal boss to posterior end of frontal	350
2.	Length between premaxilla and nasal boss	225
3.	Length from premaxilla to the end of frontal	575
4.	Width of the skull near zygomatic	460
5.	Width of the skull near nasal boss	350
6.	Width of the skull near the premaxilla	220

Bos sp.

Fossils of *Bos* sp. have, for the first time, been recorded from a Pleistocene deposit in Coimbatore Dist. The fossils were collected from a well cutting located at about 380m above MSL, 5km NW of Elur village (10° 49'N : 77° O'E), NW of Kinathu – Kadavu on Coimbatore-Pollachi Highway (Fig. 2).

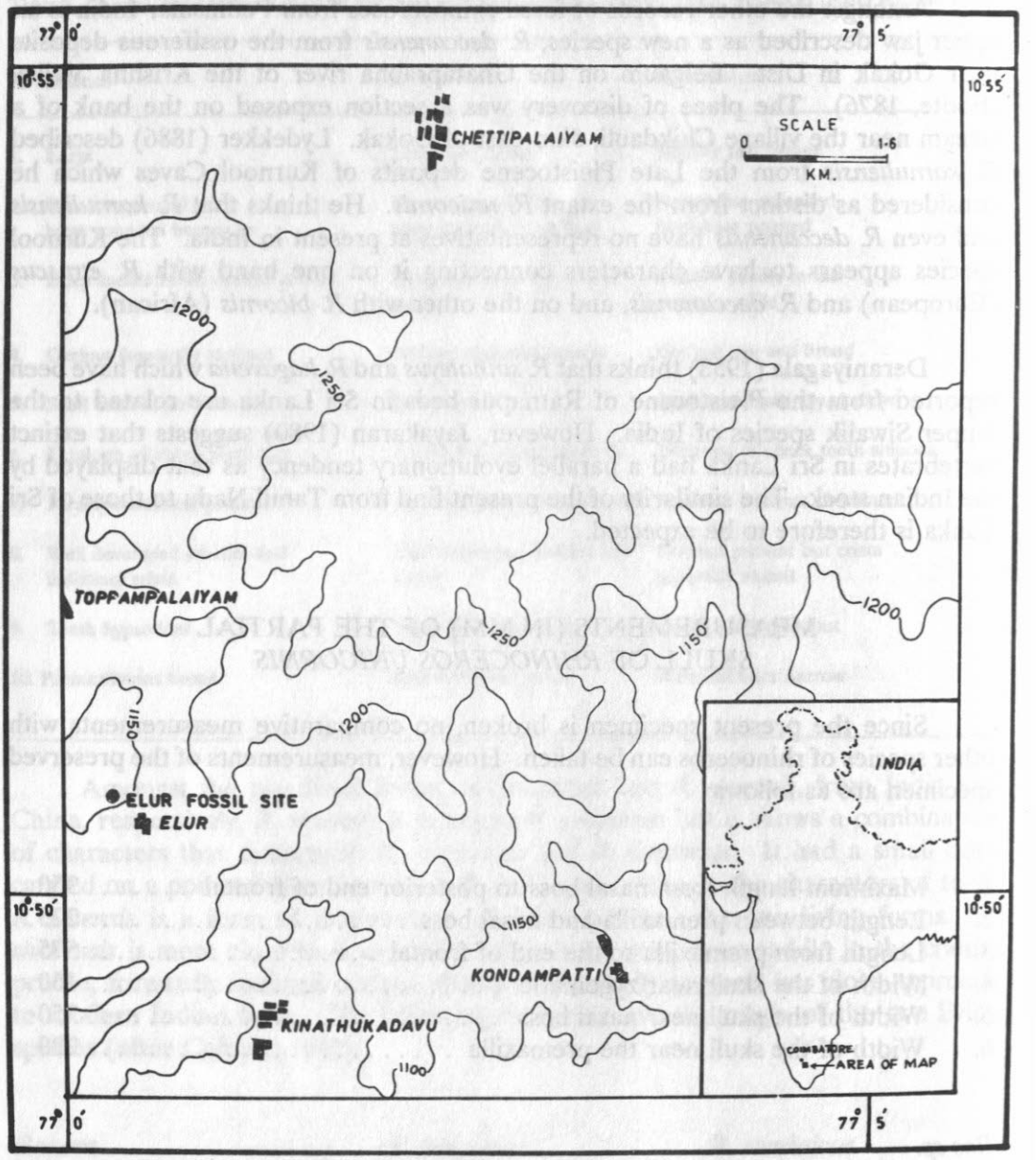


Fig. 2. Quaternary fossil sites of Bos sp. from Elur, Coimbatore District, Tamil Nadu.

The fossils were found embedded in an alluvial formation at a depth of 2.2m below the modern bed level, overlain by 1.75m thick reddish clayey soil. The fossil-bearing horizon, about 2.6m thick, extends down to 4.3m below modern bed level and overlies the gneisses unconformably. The fossils were observed in the middle of the bed, which shows current bedding deposited in a depression close to the stream. Numerous fresh water molluscan shells, at least of two genera, were also found associated with the fossils under study.

Systematics

Order: Artiodactyla Owen, 1847
Family: Bovidae Gray, 1821
Genus: *Bos* Linn., 1758
Bos sp.

Material: A mandibular fragment, isolated RP_2, RP_3, RM_1 & RM_2 and fragment of a horn core.

Locality: A well cutting, 5km NW of Elur village in Coimbatore Dist. on the Coimbatore – Pollachi Highway.

Horizon: Late Pleistocene to Holocene.

The teeth in general are well preserved and hypsodont. However, parts of roots are broken. In the case of premolars, the enamel folds surrounding the single cusps are prominent, so are the median ribs.

The crown of the M_1 is considerably worn, the wearing of the anterior cusp being oblique to the crown surface. Pre - and post-fossettes are crescent shaped and the tooth is somewhat rugose. In this case only the anterior root is broken. In M_2 there is slight wear on the crown. The fossettes are deep and their enamel is thick. Buccal cusps are oval while the lingual appear somewhat V-shaped. The median cavity in both molars is deep (plate 3/a).

All the teeth were precariously attached to the right mandible, which is quite deep, and got easily detached upon handling. The angle of the mandible exposes connective tissues. A horizontal crack is present throughout the length of the jaw at about mid portion which continues gradually up towards the anterior side. Posteriorly there is a deep vertical crack near the position of molars which could break the ramus subsequently (Plate 3/b). This situation indicates exposure to sub — aerial agencies and other physical forces (dry climate, trampling etc.).

The mandibular foramen is intact. The internal surface of the body of the mandible on its ventral margin, a little anteriorly to the mandibular foramen, shows a pronounced sulcus. The ventral lamina which delineates the sulcus is raised in the middle and forms a slight tubercle. This gives the sulcus a curved shape.

The fragment of the horncore has round, oval shape which is characteristic of *Bos* sp. The surface is rough and pitted and hornsheath is absent. This is attached to part of a frontal bone with large corunal process. The portion of the temporal fossa is rough and part of frontal sinus is present (Plate 4/a).

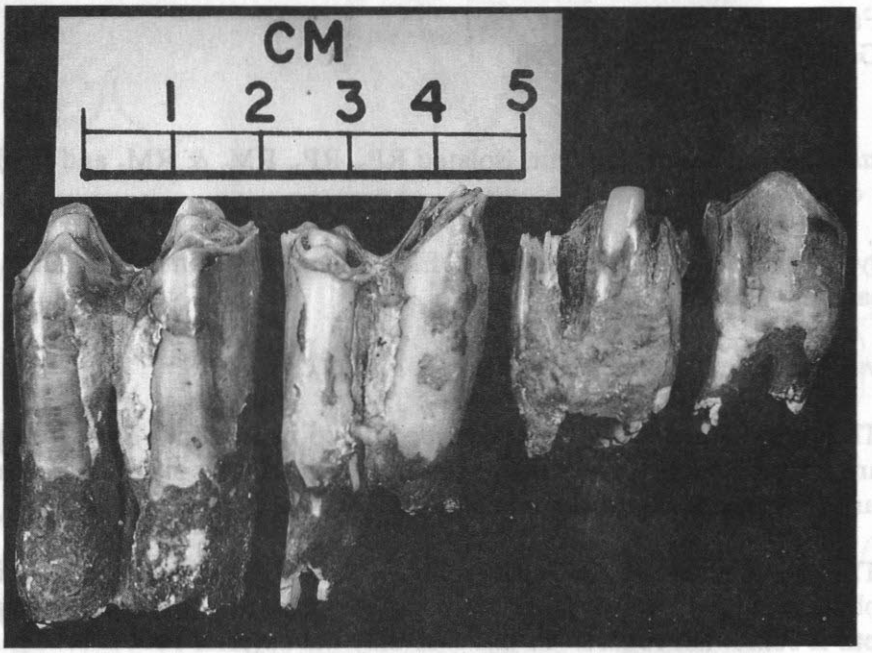


Plate 3 (a) Lingual view of right P_3 & P_4, and buccal view of right M_1 & M_2 of *Bos* sp.

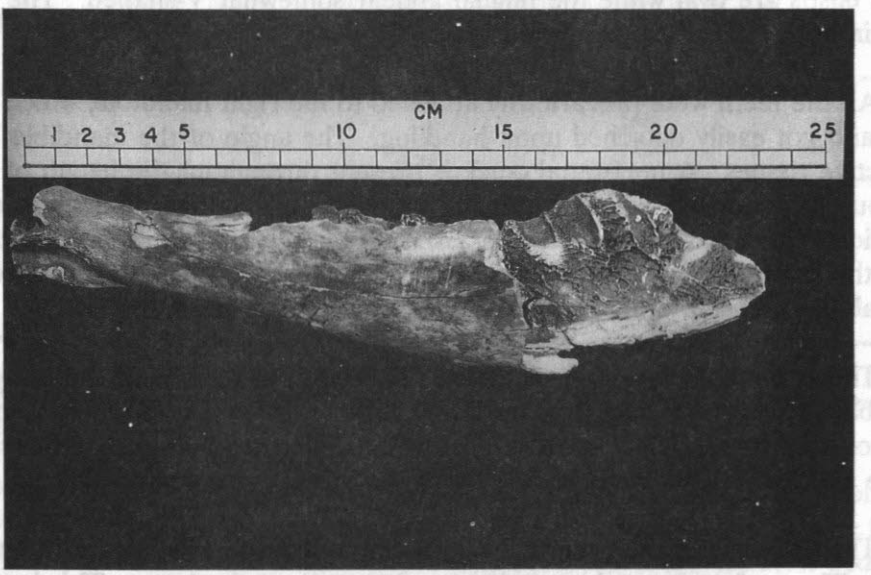


Plate 3 (b) Lingual view of right mandible of *Bos* sp.

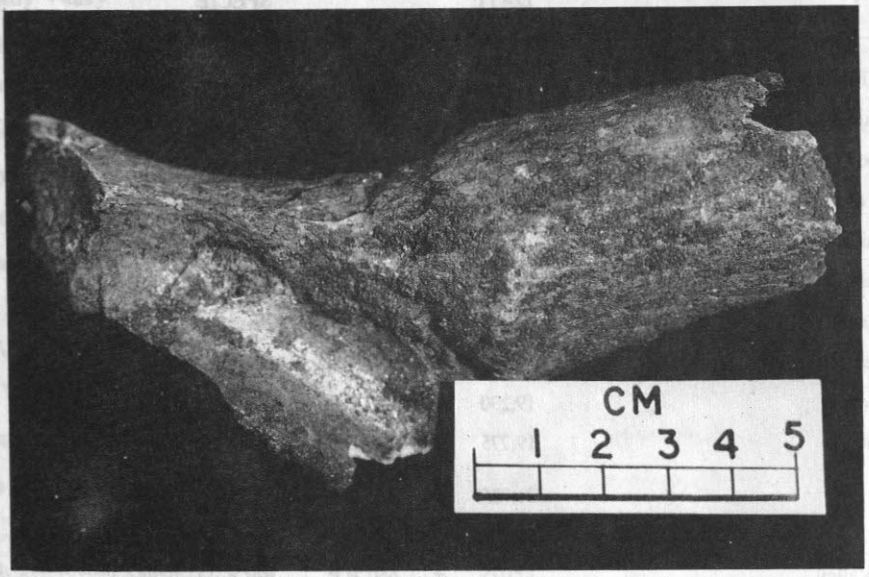


Plate 4 (a) Right horn core fragment of *Bos* sp.

Remarks:

Bos is one of the most profusely found and studied genera in the Pleistocene deposits of India. In fact its importance as an Index Fossil for the beginning of Quaternary in India is so well known that it hardly needs any emphasis.

The first appearance of the genus is from the Lower Pleistocene of Siwaliks of NW India and the Karewas of Kashmir (*Bos acutifrons*). It is profusely reported from various sites in the Indo-Gangetic belt and Peninsular India, ranging in age from Middle to Late Pleistocene (*Bos namadicus*), in association with or in close proximity to Stone Age tools. It is also known from early Holocene deposits of Mehrgarh, dated at 6000 B.C. (Meadow, 1981). *Bos namadicus* had a direct phylogenetic relationship with cattle, *Bos indicus is* found profusely in archaeological excavations right from the Mesolithic to the Iron Age in percentages at each site ranging from 60 to 70% of the total faunal collection (Badam 1984). An up to date list of the *Bos* sp. found in Pleistocene deposits of India is given in Table 4.

Discovery of *Bos* sp. from neighboring areas in Tamil Nadu also in Andhra Pradesh and Karnataka indicates that this genus had a wide geographical distribution even in Peninsular India. As the genus is well known in geological and archaeological contexts, it is not necessary to enter into a discussion here on its phylogeny and distribution.

Table 4. Distribution of *Bos* sp. in pleistocene deposits of India (modified after Badam, *et. al.* 1988-89).

LOCALITY	DATE	SPECIE
Ariyalur (Tamil Nadu)		*Bos* sp., *Bos namadicus*
Kattuppirangiyam (Tamil Nadu)		*Bos* sp.
Maruvattoor (Tamil Nadu)		*Bos* sp.
Sayamalai (Tamil Nadu)		*Bos namadicus*
Elur (Tamil nadu)		*Bos namadicus*
Palankottai (Tamil Nadu)		*Bos* sp.
Kurnool Caves (AP)	17,390 ± 10 B.P.	*Bos* sp.
Belan valley (UP)	19,160 ± 330 B.P.	*Bos* sp.
Ghod Valley	19,290 ± 360 B.P.	*Bos namadicus*
(Maharashtra)	19,775 ± 630 B.P. 585	
	21,725 ± 630 B.P. 585	
Godavari Valley	17,075 ± 660 B.P.	*Bos namadicus*
(Maharashtra)	19,025 ± 660 B.P. 19,000 yrs B.P.	
	26,635 ± 425 B.P. 32,000 yrs B.P.	
Pravara Valley (Maharashtra)	24,670 ± 710 B.P.	*Bos namadicus*
Son Valley (MP)	26,850 ± 820 B.P. 750	*Bos* sp.
Manjra Valley	26,820 ± 750 B.P.	*Bos namadicus*
(Maharashtra, Karnataka & AP)	34,470 ± 2,070 B.P.	
Mula Valley	30,030 ± 5,715 B.P.	*Bos namadicus*
(Maharashtra)	3,340 31,000 yrs B.P. 39,000 yrs B.P.	
Narmada Valley (MP)	31,750 ± 1,820 B.P. 1,625	*Bos namadicus*
Krishna Valley (Maharashtra, Karnataka)	37,640 ± 9,200 B.P. 4,250 38,480 ± 8,940 B.P. 4,125	*Bos namadicus*
Nittur (Karnataka)		*Bos namadicus*
Mahanadi Valley (MP)		*Bos namadicus*
Paimar Valley (Bihar)		*Bos* sp.
Gandeswary Valley		*Bos namadicus*

Mahanadi Valley (MP)		*Bos namadicus*
Paimar Valley (Bihar)		*Bos* sp.
Gandeswary Valley (W. Bengal)		*Bos namadicus*
Purna Valley (Maharashtra)		*Bos* sp.
Dhond (Maharashtra)		*Bos* sp.
Hangargundi (Karnataka)		*Bos namadicus*
Servaipet (A.P.)		*Bos namadicus*
Bori (Mahrashtra)		*Bos namadicus*
Krishna Valley (Karnataka)		*Bos namadicus*
Hunsgi Valley (Karnataka)		*Bos namadicus*
Pravara Valley (Maharashtra)		*Bos namadicus*
Tungabhadra Valley (Karnataka)		*Bos namadicus*
Karewas (Kashmir)	2.47/1.87 - 0.7 Ma	*Bos acutifrons*
Siwaliks (Jammu, Punjab, Haryana, Himachal Pradesh)	2.47/1.87 - 0.7 Ma	*Bos acutifrons*

The paleoecology of Tamil Nadu is to be treated as part of the whole of Peninsular India. The overall paleoecological evidence indicates the presence of well-forested patches with swamps, surrounded by tall grasses which is one of the prominent supplementary diets of *Rhinoceros* and *Bos*. The existence of savannah grassland interspersed with aquatic surrounding is ideal to maintain a balance of cattle population. Rhinoceroses which have totally disappeared from South India today must have inhabited this area when the low hills were forested with swamps in short canyons surrounded by grass.

Soil samples collected from the fossil–bearing horizons at Elur (where *Bos* sp. was collected) were observed to be poor in pollen content. The pollen analysis indicates the presence of a few floral species represented by grass 48.1%, Caryophyllacea 29.24%, Chenomaranths 6.6%, Compositae 6.5%, the rest being 1.1%. A rich pollen content in the soil would indicate the presence of an open vegetation in the form of grasslands with scanty trees and a dry climate during the period of deposition. However, the climate at Sathankulum was more moist during the Pleistocene period. Slight variations in paleoecological situations in the same geological setting in neighbouring areas of Tamil Nadu cannot therefore be ruled out. Further field explorations and fossil collecting in the area might prove promising for a more precise paleoecological interpretation of the areas under consideration.

Finally, there are numerous Pleistocene sedimentary patches overlying the older rocks and crystallines which are generally overlooked in a crystalline terrain like the Coimbatore Dist. A correlation of these deposits will be of interest in studying the distribution of the fauna.

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Epilogue

The present paper is the outcome of a joint collaborative research programme on the Quaternary of Tamil Nadu. Several new fossils and fossil sites have been discovered in Tamil Nadu since the writing of the paper. Some of the important fossils are those of *Bos* sp. (Plate 4/b) and *Elephas* sp. (Plate 5/a) from Trichinopoly and *Bos.* sp. (Plate 5/b) from Madurai. The other sites that have come to light are Marichetti–Pati and Vannathangarai, both in Coimbtore Dist. These will be studied in due course.

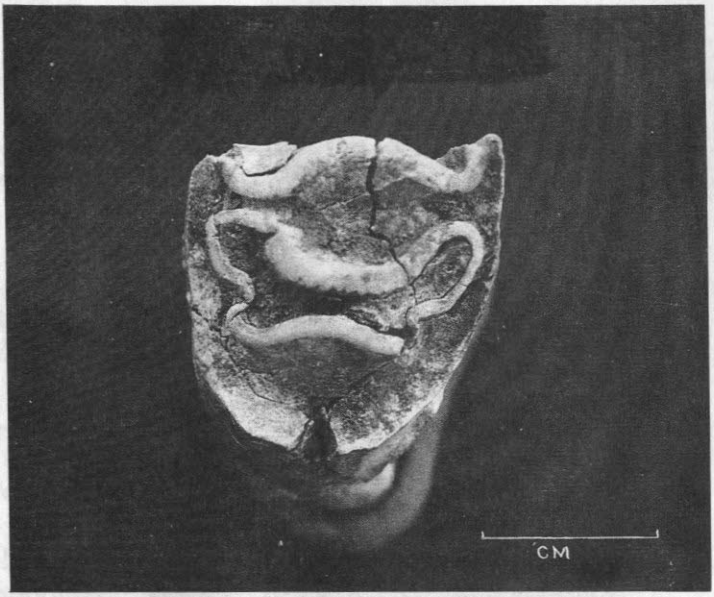
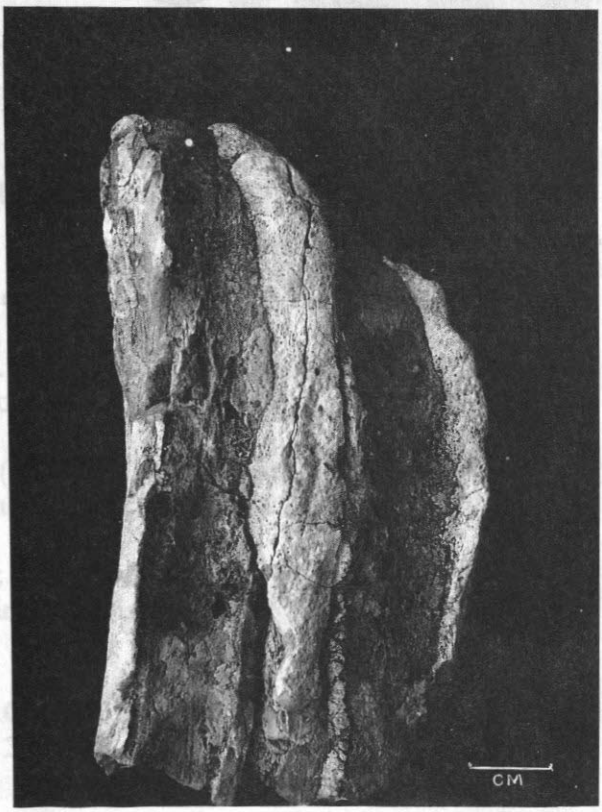


Plate 4 (b) Left upper P^3 of *Bos* sp. form Trichinopoly, Tamil Nadu.



5 (a) Tooth fragment of *Elephas* sp. from Trichinopoly, Tamil Nadu.

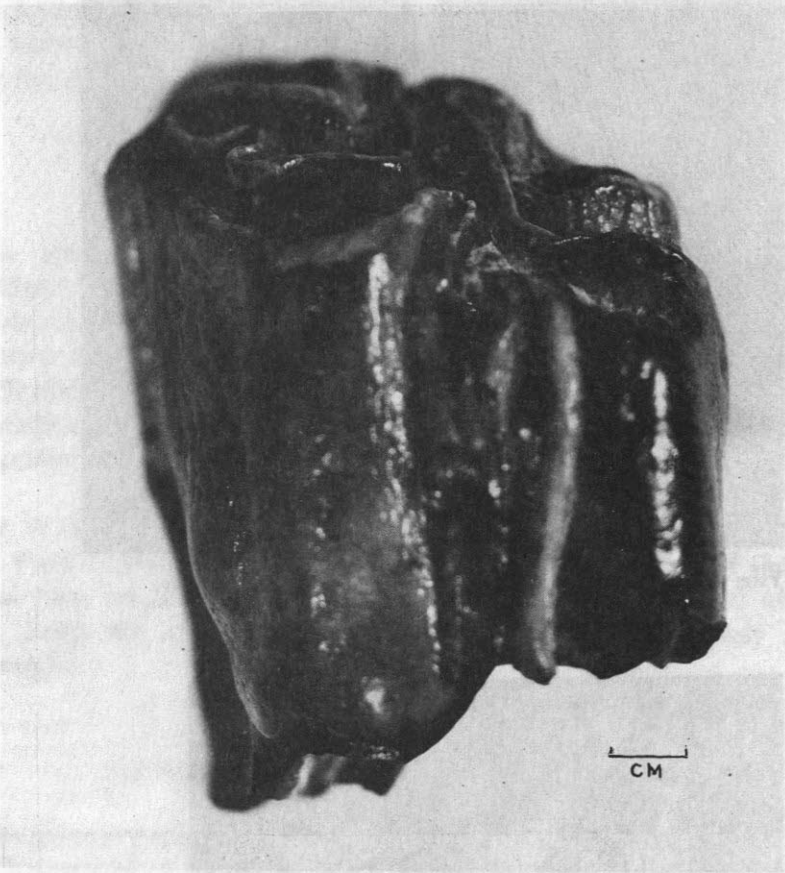


Plate 5 (b) An upper molar of *Bos* sp. from Madurai, Tamil Nadu.

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