

LOWER EOCENE SIRENIA, *ISHATHERIUM SUBATHUENSIS*, GEN. ET SP. NOV. FROM THE TYPE AREA, SUBATHU FORMATION, SUBATHU, SIMLA HIMALAYAS, H.P.

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ABSTRACT

This paper describes a new Sirenia, *Ishatherium subathuensis* gen. and sp. nov. from the middle marine Subathu Formation of the type area, Subathu, Simla hills. The Subathu dugongid has many primitive features and is considered as ancestral to all later sirenians. Post cranial skeletal material shows considerable similarity to that of *Moeritherium* (Proboscidea). The ossiferous horizon is a shallow water, massive shelly limestone which has been demonstrated to be of Ypresian (Lower Eocene) age on the basis of foraminiferal biostratigraphy.

INTRODUCTION

There is a clear evidence that the type section of the Subathu Formation as well as its lateral extensions in the Dharampur area yield vertebrates in several horizons in the middle marine and upper transitional part of the sequence (Sahni, in press). Further collection and preparation of previously collected vertebrates has resulted in the recovery of an almost complete lower molar, a partial incisor, several rather long limb bones, fragmentary girdle elements and some conical fish teeth. These finds not only constitute the oldest Tertiary record of mammals in the Indian subcontinent but also shed considerable light on the origin of sirenians and the timing of the sirenian—*Moeritherium* divergence.

Prior to recent studies undertaken by the present authors, there was no detailed account of vertebrates from the Subathu-Dharampur area in the Simla Himalayas. One of the few reports to mention the occurrence of fragmentary vertebrates was that of Bhatia and Mathur (1965) from passage beds between the Subathus and Dagshais in the Dharampur area. The present collection has been recovered from the bridge path leading from the Kuthar nala section to the steep escarpments comprising the southern slope of the hill on which the military cantonment of Subathu is situated, representing the type section of the Subathu Formation. Well preserved bone is also found dispersed throughout the marine sequences in calcareous shales, coquinoïd limestone and massive pelletal limestone.

In contrast to the Middle Eocene localities of Attock district, Pakistan (Dehm and Spielberg 1958, Gingerich 1977); India (Pilgrim 1940, Ranga Rao 1973, Sahni and Khare 1972, 73, Khan 1973) and Honan in China (Chow

1965) which yield a predominantly terrestrial mammalian fauna, the finds from the Subathu-Dharampur area represent predominantly marine Lower Eocene mammals including cetaceans and sirenians. The only questionably marine mammal in the dominantly terrestrial Lutetian fauna of Pakistan and India is *Ichthyolestes* which is probably an archaeocete cetacean. In many respects, the marine Subathu sequence of Himachal Pradesh is

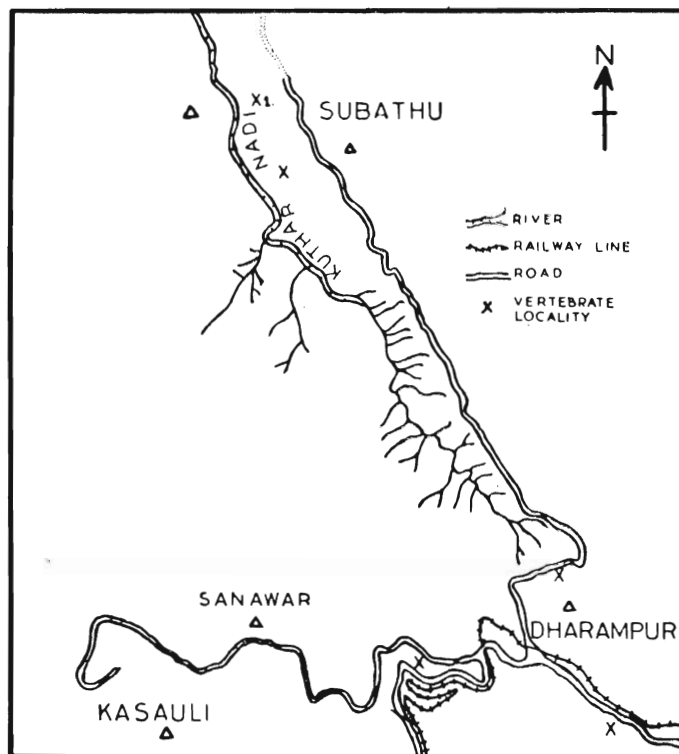


Fig. 1. Sketch map showing Lower Eocene vertebrate localities.

similar to the Middle Eocene Lutetian sequence of Kutch (Sahni and Mishra 1975, Mishra 1976, Ph.D. Thesis) which has also yielded ninasires and cetaceans.

The age of the marine, dominantly calcareous sequence of the type section of the Subathu Formation has been worked out by several authors including Singh (1952) and Mathur (1965) on the basis of foraminiferal biostratigraphy both in relation to the European standard geological time scale (Ypresian) and to standard Lower Eocene reference section for the Indian subcontinent (Laki) of Sind and Baluchistan area. The ossiferous horizon is probably equivalent to Mathur's (1965) zone III C which is of definite Ypresian age. Zone III is characterized by very shallow-water deposits with the ostracode *Neocyprideis* and the alga *Chara*.

The present collection comprising of sirenian teeth constitutes one of the oldest global records of sirenians. Previously, apart from *Prorastomus* described from the undifferentiated Eocenes of Jamaica by Owen (1855), all other occurrences post-date the lower Eocene as given below :

Middle Eocene of Egypt :

(1) *Eotheroides* Palmer, 1899 (= *Eotherium* Owen 1875, *Eosiren* Andrews-1902, *Archaeosiren* Abel 1913).

(2) *Protosiren* Abel, 1904 (also reported in India).

Upper Eocene of Italy :

Prototherium De Zigno, 1887 (= *Mesosiren* Abel 1906, *Paraliosiren*-Abel 1906)

The Lower Eocene has been emphasized by several workers (Andrews 1906, pp. 119 Matsumoto 1923, Simpson 1932) as a crucial period not only for the origin of the sirenia but also for the differentiation of sirenians and proboscideans from a common ancestral stock. The sirenia-moeritheriid stock is thought to have originated from a large generalized condylarthra of essentially coastal habitat. *Ishatherium* probably represents the ancestral sirenian-moeritheriid stock of animals equally adapted to life in coastal marshes as well as near-shore conditions. This is also suggested by the post-cranial skeletal elements in the present collection. Eocene record of primitive sirenians in Egypt, Kutch and in the Subathu Range is of extremely shallow-water conditions. The occurrences at Kutch are from a *Corbula*-rich chocolate coloured limestone representing the Babia stage (Middle Eocene) whereas the occurrences from the Subathu-Dharampur area are from high energy strand-line environments. Oyster-Banks were common all along the strand-lines of the Sindhu sea (Sahni and Kumar, 1974) representing the northern coast line of the Indian subcontinent during Eocene times.

SYSTEMATIC DESCRIPTION

Order Sirenia
Family Dugongidae

Ishatherium gen. nov.

Etymology : "Ish" Sanskrit=divine, therium=mammal.

Type species : *Ishatherium subathuensis*

Diagnosis : Moderately large molars, metaconid conical situated slightly posterior to the protoconid, separated from the protoconid by a shallow valley and not by a relatively higher lophid as in *Eotheroides*, *Prototherium*, *Moeritherium* etc. Anterior cingulum well developed prominent and high. Width of trigonid relatively less than that of the talonid. Entoconid high ; conical well separated from a rather massive hypoconid but joined to the later cusp by a high slightly sinuous ridge. Posterior slope of the talonid cusps rather prolonged and shelf-like.

Ishatherium subathuensis sp. nov.

(Figs. 2 a, b, c)

Etymology : "subathuensis" refers to the town of Subathu.

Holotype : LM₂ (V. P. L. 1)

Referred Material : Upper incisor and a few fragmentary limb and girdle bones.

Diagnosis : As for genus.

Description : Upper incisor : There is a fragmentary much enlarged incisor which was found over 200 meters from the molar tooth locality and probably belongs to the same species, though this cannot be presently confirmed. The portion preserved measures about 8 cms. The incisor narrows anteriorly without any sharp flexure. Enamel surrounds the dentine at the proximal as well as distal extremity of the tooth. The proximal cross-section is oval

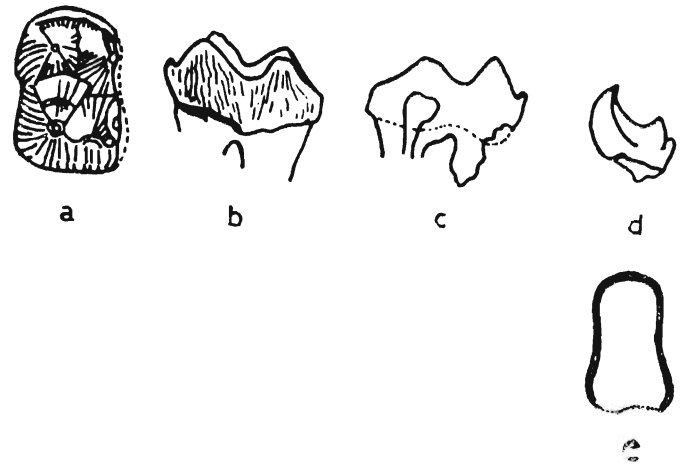


Fig. 2. a. *Ishatherium subathuensis* holotype occlusal view $\times 1.5$
b. labial view $\times 1.5$
c. lingual view $\times 1.5$
d. *Ancistrodon* sp. pharyngeal tooth $\times 2.5$
e. Transverse section through proximal portion of incisor nat. size.

in outline and elongated in the dorso-ventral plane (Fig. 2, e). Microstructural studies on thin sections of the incisor enamel show cylindrical prisms in longitudinal sections, with circular outlines on etched enamel surface.

LM₂ : The molar was found in a very hard, slightly recrystallized limestone which made extraction of the tooth a difficult task and resulted in the development of some fracture planes along the anterior part of the crown. However, the tooth is generally well preserved lacking only a small lingual section. The tooth in occlusal view is rectangular in outline with the trigonid region being slightly narrower than the talonid. On the labial side there is a slight central concavity between the protoconid and hypoconid as in some other Eocene sirenians, e.g. *Eotheroides*, *Prototherium*. A prominent cingulum is confined to the anterior border of the molar. The cingulum is not as broad as in *Protosiren* and *Eotheroides* but is high, closely appressed to the protoconid-metaconid cusps and raised to about one-fourth the height of the protoconid. The metaconid is a high conical cusp well separated from the more robust and massive protoconid by a shallow valley. There is no indication of a high anterior lophid as is found in *Eotheroides* and *Prototherium*. Wear facets are developed posteriorly on the protoconid. A conical entoconid is situated apparently close to the lingual border and is relatively higher than the massive and bunodont hypoconid. The posterior two talonid cusps are linked by a relatively high posterior lophid which has a prominent sinuous course. The posterior margin of the tooth is rather prolonged, sloping gently and evenly from the talonid cusp. The length of the tooth measures 1.95 cms.

First Dorsal Vertebra: (Fig. 3 a, b) The vertebra found in the Subathu limestones at Dharampur has been assigned to sirenian though it has considerable morphological affinity with the corresponding vertebra of *Moeritherium*. The vertebra belongs to the thoracic region. Its short and stout transverse process together with a massive posteriorly directed neural spine suggests that it is an anterior dorsal vertebra and most probably the anterior most. The anterior and posterior outlines of the centrum face are oval and transversely elongated respectively. The centrum contains a demifacet for the capitular head of the rib on the upper angle of its anterior face and a slightly deeper broad and sharply defined demifacet on the upper angle of the posterior face. The transverse processes are short in the form of metapophyses terminating in a tubercular facet which is a shallow concave facet facing downwards and forwards. There is a shelf-like projection of bone on the anterior edge of the transverse processes containing on its upper surface a broad and flat anterior zygapophysis. The posterior zygapophyses are poorly developed. The neural spine is very massive, sloping strongly backwards. A natural horizontal fracture plane at the apex of the spine shows a

triangular outline. The neural arch is broad and triangular in outline.

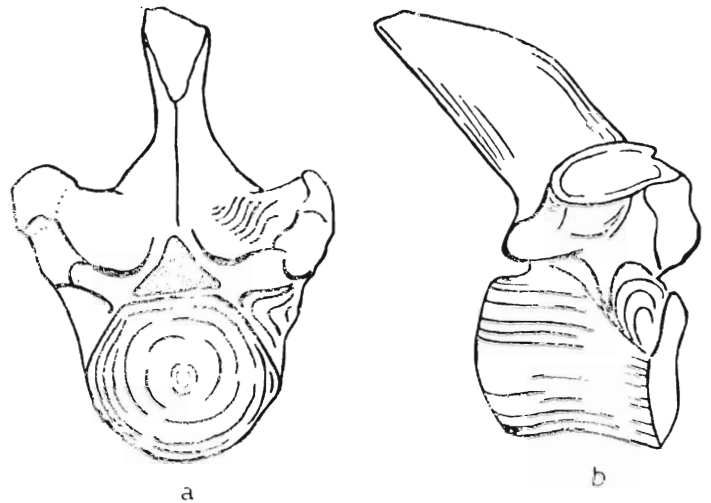


Fig. 3. a. Anterior view of first dorsal vertebra, $\times 1/2$.
b. lateral view $\times 1/2$.

The dimensions of the vertebra are as below :

Length of centrum (anterior to posterior face of centrum)	..	..	..	3.7 cms.
Width of anterior face of centrum	..	..	..	4.1 cms.
Width of posterior face of centrum	..	..	..	5.3 cms.
Height of the anterior face of centrum	..	..	..	3.3 cms.
Height of the posterior face of centrum	..	..	..	2.9 cms.
Width between outer ends of transverse processes	..	..	..	7.7 cms.
Width of neural canal	..	..	..	2.6 cms.

Fish Teeth : (Fig. 2 d). Fishes associated with the sirenian material include several well preserved pharyngeal teeth of a scleroderm *Ancistrodon* described from the Lower Mokattam (Lower Lutetian) of the Fayum Basin of Egypt. Such teeth have been previously related to genera such as *Ostracion* which are still common in the Indian ocean. The teeth have a definite, nearly translucent "enameloid" covering and are cuspidate. The terminal cusp is the highest curved and pointed. Subsidiary cusps may vary between one or two.

Turtles : Turtles are represented by approximately up to one centimeter thick carapace and plastron fragments. In longitudinal section, there appear to be three well-marked layers the top and bottom represented by compact and relatively dense bone while the middle layer is of a more porous nature. The external ornamentation is smooth as in many marine turtles.

SUMMARY AND CONCLUSION

- (1) The Subathu Formation in the type area as well as in the neighbourhood of the town of Dharampur has several bone bearing beds. The middle

Subathu Formation is marine and yields marine mammals of Lower Eocene (Ypresian) age.

- (2) *Ishatherium subathuensis* gen. et sp. nov. represents a very primitive sirenian close to the ancestral sirenian—moeritheriid stock.
- (3) Associated fragmentary limbs and girdle remains indicate that the Subathu Sirenia was equally adapted to the life in coastal, near-shore conditions as well as on land.
- (4) Unlike the bone of later sirenians which exhibit pachyostosis, the skeletal elements of the Subathu Sirenia show no such modification.
- (5) The ossiferous limestones occur in the middle Subathu Formation and probably represents zone III of Mathur (1965). This zone is of shallow water origin and is found to contain *Chara* sp. cf. *C. vasiformis* and the ostracode *Neocyprideis*.

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