

TURONIAN TERRESTRIAL COMMUNITIES OF INDIA

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ABSTRACT

The paper deals with the reconstruction of Cretaceous terrestrial community structure based on faunal assemblages from Central and South India. Two major communities—a stream community comprising of molluscs, fish and turtles and a mega-terrestrial community comprising of carnivorous and large herbivorous dinosaurs inhabited a low coastal plain, east of the Narbada engulflment and west of the Bay of Bengal. In Jabalpur the occurrence of a horizon of homogeneous clay sediments bearing a prolific number of gastropods in the Mottled Nodular Bed (Lameta Formation) represents a period of lake development in the mainly fluvial sediments of Mottled Nodular Bed. The study of plants and other palynological evidences suggests that the flora comprises of luxuriant, warm-humid sub-tropical vegetation with temperate conditions towards the end of the Turonian. The decline of the dinosaurs in India is attributed to the sudden lowering of temperature in the Turonian.

INTRODUCTION

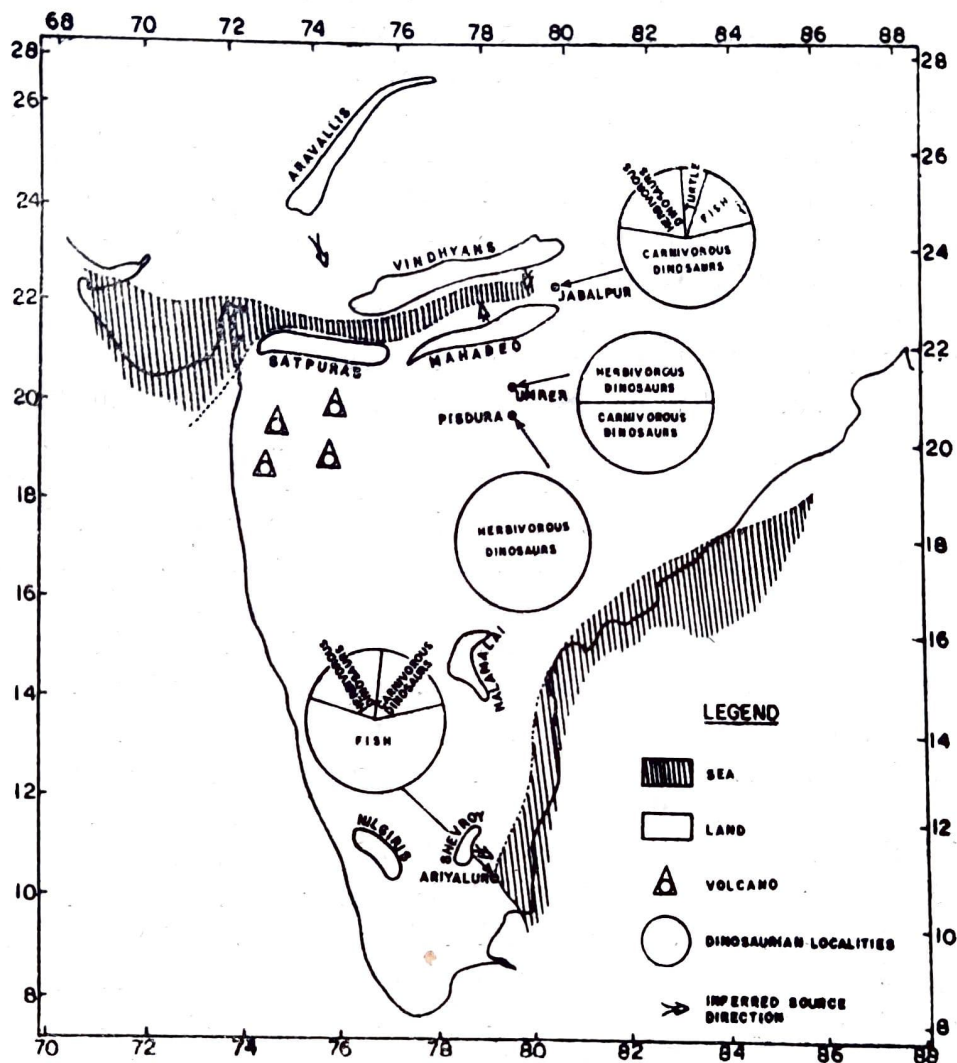
Present day terrestrial communities are represented by animal and plant population occupying a certain ecological niche in nature. Thus modern communities can be designated as arboreal, stream, shoreline etc. For instance, arboreal communities are those consisting of animals occupying specific ecological niche in forested areas such as lizards, monkeys and birds. Members of a particular community are always interacting with adjacent communities such as the forest floor community and stream bank community. A community is dependent upon contemporary environment, plants and ultimately climate. The reconstruction of palaeo-communities is particularly instructive as it serves to synthesize available data making it a useful unit to decipher climatic changes, migration, extinction and palaeoenvironment.

The paper deals with the reconstruction of Cretaceous terrestrial community structure. Lower vertebrates from the Cretaceous (Turonian) beds are known from four localities in Central India and two localities from Southern India. The vertebrates comprise 14 genera of dinosaurs, an unidentified chelonian and 3 genera of fishes. The pioneering work was carried out by MATLEY AND VON HUENE (1933) and more recently by PRASAD (1968). The latter author has compared the dinosaurian fauna of the Lameta and equivalent beds.

Although the fauna has been known for over half a century, picture of the community has yet to be constructed on the basis of available data from known fossil localities. Current investigation suggests the presence of two major communities, stream community and megaterrestrial community. The former comprises molluscs, fish and turtles. The latter community is a forest community of carnivorous dinosaurs and their herbivorous prey.

During the Turonian, the dinosaur provinces of India stretched from Jabalpur in the north to Ariyalur in the south. The dinosaur inhabited a low coastal plain east of Narbada engulflment and west of the Bay of Bengal. It is likely, as suggested by PRASAD

(1968) that volcanic activity had been initiated at that time. The major topographical features were the Aravalli mountains in Western India, Vindhyan Range in Central India and the granitic complexes in South India. The source of sedimentation has been recently investigated by CHANDA (1963) for the Jabalpur area and he comes to the conclusion that deposits represent eroded metamorphics. These could have been obtained from rivers flowing in a general southerly direction from the Aravalli Ranges. In South India, the river must have flowed east some 60-70 kms to fall into the sea. It was in this low coastal plain region between mountains of moderate relief on one side and an arm of the sea that the Turonian dinosaurs flourished. Of the dinosaurs, *Titanosaurus* an aquatic sauropod is the most common not only in the frequency of occurrence but also in widespread distribution, being found in four of the five localities. Other genera of dinosaur occur in almost equal frequency (Text-fig. 1).



Text-fig. 1. Palaeogeography and Terrestrial Communities in the Turonian.

Of interest, is the dominance of carnivorous dinosaurs in the Jabalpur fauna. There are 10 genera of carnosaurs to 4 genera of herbivorous dinosaurs. In recent as well as fossil population, there are larger number of herbivores to carnivores. This implies that the fossils recovered from the Bara Simla Hill in Jabalpur are not representative of the contemporary population.

The occurrence of a thin gastropod band (MEHROTRA, 1972) in Lameta Formation of Jabalpur District throws new light on the palaeoecology of these beds. A collection of about 70 shells of *Vivipara normalis* (HISLOP, 1860), a fresh water gastropod was made by

the authors in about 5 kilograms of matrix from a thin band in the Mottled Nodular Bed at Chui Hill, about 0.25 kilometers from the Dinosaur Bone Bed of Bara Simla Hill, Jabalpur. Other molluscs found in the Lametas are *Melania*, *Paludina* (FERMOR, 1913) and *Physa prinsepia* (ANNANDALE, 1919).

Most of the shells are thin varying in height from 7 mm to 20 mm with a maximum diameter of 10 mm. The number of whorl varies from 4 to 5. The whorls of the spire increase in size gradually. The body whorl is 2-3 times higher than the spire. Apex is sub-acute with a spiral angle ranging from 55° — 60° with a mean of 58° . Whorls are convex and smooth, sutures are widely separated. Aperture in most of the specimens is incomplete but a few well preserved forms indicate that it is entire and oval becoming highly angular posteriorly.

The presence of such a large number of gastropods in a band of distinctive lithology draws attention to the sedimentation and stratigraphic history of the Lameta Formation at Jabalpur. Although early workers advocated a fresh water origin for the Lametas, recently CHANDA (1963) suggested that the formation is the part of a "stable shelf association". In our opinion, however, the present study strongly suggests that though stable shelf conditions may have prevailed during the initial stages of Lameta sedimentation and perhaps also at the end, the main bulk of the Lametas were formed by fluvial sediments with intercalated lacustrine deposits.

This is borne out by the presence of terrestrial vertebrates and fresh water molluscs. The Mottled Nodular Bed is here reinterpreted to have been formed by the fluvial process in the following manner: Clay masses that formed part of the stream bank were eroded by the contemporary river as stream velocity increased. As these clay masses rolled downstream in the swiftly flowing water they acquired sphericity. Later on with the decrease in stream velocity these clay balls (Nodules) were redeposited in the steam bed. The initial high velocity of stream is indicated by the irregular shape and relatively smaller size of the nodules. This observation receives further confirmation from a study by BELL (1940) who computed the dimensions of clay balls and found them inversely proportional to the stream velocity i.e. smaller the clay balls, higher the velocity.

Any discussion on the Cretaceous is not complete without a discussion of contemporary plants. Plants have been described by SUKH DEV (1959); SINGH, *et al.* (1964); and BANERJEE AND MISRA (1968). The latter authors have recorded the presence of Palmae, Nymphaeaceae etc. which comprise 10% of the floral assemblage from the Cretaceous beds of South India (Karikal). Their study indicates that during Post-Albian times angiosperms dominated over Wealden forms like *Callialasporoties* and *Classopolis*, although Pteridophytic and Gymnospermous elements still dominated the tropical to sub-tropical vegetation. BOWEN (1961) on the basis of average mean temperature from the Belemnoides from South India showed that during Aptian-Albian there was a considerable rise of temperature reaching a maximum of 24° C. After that there was a gradual decline during Turonian. The diversity of climate resulted in gradual extinction of forest type vegetation which in turn affected entire plant and animal communities.

The decline of dinosaurs in south-west North America had been related to climatological changes with an accompanying modifications in the vegetation. As Cretaceous dinosaurs in India are known only from the Turonian, it is not possible to speculate on their extinction in the sub-continent. However, there is marked change in floras from the Turonian to the close of the Cretaceous which could have effectively caused the extinction of the herbivorous dinosaur population which in turn would affect the carnivores.

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