

ICHNOFOSSILS FROM BHUJ FORMATION (CRETACEOUS) AS PALAEOENVIRONMENTAL PARAMETER

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THE sole objective of the present note is to place on record the occurrence of ichnofossils from the late Mesozoic Bhuj sequence exposed in and around Bhuj (23° 15' 16" : 69° 40' 13") in the district of Kutch, Gujarat. Ichnofossils (*Lebensspuren*, trace fossils) are being increasingly used as one of the parameters in the paleoenvironmental reconstructions¹⁻³. A preliminary study of ichnofossils recognises the following three ichnogenera: *Skolithos* Haldemann, *Planolites* Nicholson and *Thalassinoides* Ehrenberg.

The late Mesozoic (Cretaceous) sediments of Kutch district of Gujarat which overlie the marine Jurassic sediments (Katrol/Jhuran) and underlie the Ukra beds, have been referred to as the Bhuj Formation in literature. The Bhuj sequence is variable in thickness from 360-760 m and extends from Bachau in the east, through Bhuj, to Lakhpat in the west for about 200 km. Width of the Bhuj outcrop is maximum in the vicinity of Bhuj town. In places the Bhuj Formation is overlain directly by the Deccan Trap. The sedimentary sequence comprises repetitive fining upward cycles comprising gritty to very coarse and coarse sandstone, medium to fine sandstone, interbedded fine sandstone, siltstone and clay, and mudstones in ascending order. Gritty to very coarse and medium sandstones occur as thick bodies (2-20 m), lenticular and channel shaped and display large and small scale cross-bedding depending upon grain size. These sandstone bodies are white to pale brown and occasionally ferruginous. Medium to fine sandstone occur as laterally persistent sheetlike bodies, interbedded with siltstone and clay. Both symmetrical and asymmetrical ripple marks occur on upper surface of medium to fine sandstones. The associated clay and mudstone beds are massive or show well developed parallel laminations. The ichnofossils as reported here are commonly associated with ferruginous sandstone and interbedded fine sandstone, siltstone, clay and mudstones, and occur through out the sequence repetitively all along the basin.

Description of ichnofossils is arranged in alphabetic order:—

1. Ichnogenus: *Planolites* Nicholson, 1873
Planolites sp. (figure A-I)

Unornamented, horizontal, non-branching, straight to slightly curved burrows occurring in sandstone and associated silt and clay exposures in the vicinity of Bhuj (23° 15' 16" : 69° 40' 13") are referred to ichnogenus *Planolites* Nicholson. These burrows are slightly irregular on the outer surface and are subcircular in cross-section (1-2 cm). Our specimens may belong to *Planolites montanus* described from the Jurassic of Kutch⁴, Bagh beds of Narmada valley⁵ and Cretaceous of Trichinopoly⁶, however, the specific evaluation will be made on the availability of the comparative material.

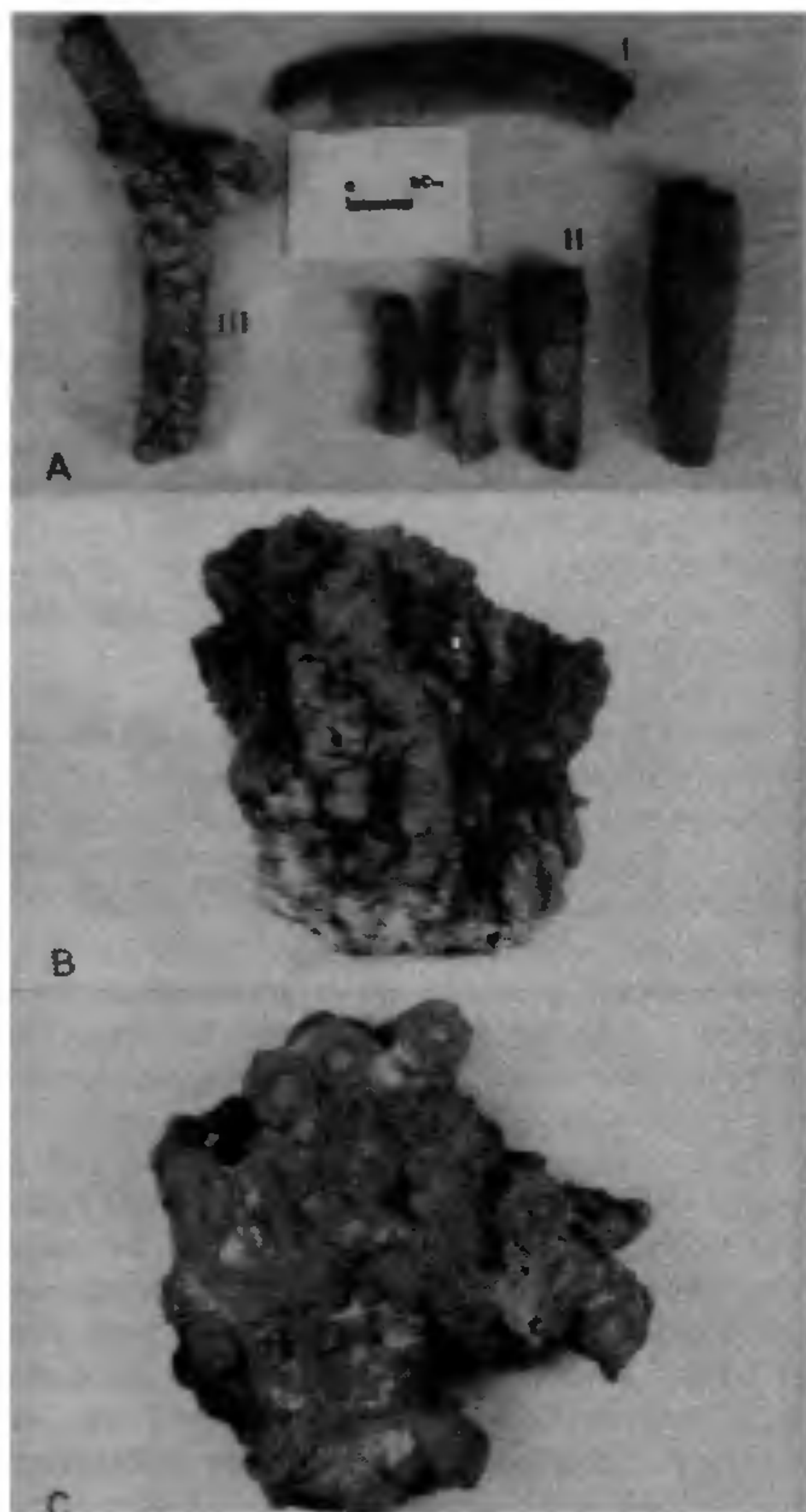
2. Ichnogenus: *Skolithos* Haldemann, 1840, *Skolithos* sp. (figure A-II, B & C)

The predominant, vertical, cylindrical burrows of about .5-1.5 cm were collected from well washed quartz rich sandstones, exposed at Wada near Anjar (69° 55' ; 23° 7'), Bhuj, and about 3 km north of Gaduli (68° 59' ; 23° 40'). These pipe like sandy burrow tubes are assigned to ichnogenous *Skolithos* Haldemann. The vertical tubes oriented across bedding surface and are more or less circular in cross sections, occur in colonial form (figure B) or en mass, in dense cluster (figure C). Their outer surface show concentric lining or to be apparently smooth consisting of fine sand grains. The vertical tubes of *Skolithos* have been reported from widely different geological records. Chiplonkar and Ghare⁶ have recorded the presence of *Skolithos linearis* from the Cretaceous sediments of Trichinopoly. The Kutch specimens appear to be new species.

3. Ichnogenus: *Thalassinoides* Ehrenberg, 1944
Thalassinoides sp. (figure A-III)

Burrows of variable diameter (0.5-1.5 cm) oriented vertically, inclined or horizontally, and in 'Y'-shaped branches swollen at bifurcations, occur frequently around Wada near Anjar and Bhuj. These burrows consisting of coarse to fine sandy material and circular to subcircular in cross-section are ascribed to ichnogenus *Thalassinoides* Ehrenberg. This genus has a range from Triassic to Tertiary. These burrows from Bhuj Formation show some resemblance to *Thalassinoides saxonicus* (Cieinitz) described from Upper Cretaceous of Germany (Sax)⁷.

The present ichnofossil assemblage including *Skolithos*, *Planolites* and *Thalassinoides* belongs to the *Skolithos-Cruziana* ichnofacies^{8,9} which is characteristic of shallow water, littoral and intertidal environments. Seilacher¹⁰ attributed *Skolithos* to both shallow water non-marine and marginal marine enviro-



Figures A-C. A(i) *Planolites* Nicholson, 1873. (ii) *Skolithos* Haldemann, 1840, (iii) *Thalassinoides* Ehrenberg, 1944. B. Pipe like tubes of *Skolithos* sp. C. En mass occurring burrows of *Skolithos* sp.

onments. The *Cruziana* ichnofacies indicates a shallow sublittoral zone, below wave base, to slightly quieter off shore conditions of moderately low energy environments⁹. Chamberlain and Clark⁸ interpreted *Cruziana* ichnofacies as indicative of shallow marine environment.

Thus, the palaeoecological data on ichnogenera *Skolithos*, *Planolites* and *Thalassinoides* are indicative of littoral marginal marine environment for the deposition of Bhuj Formation. Coarse to medium, channel shaped sandstone bodies with oppositely oriented cross-bedding forests may correspond to sandy tidal channel facies, whereas associated fine sandstone,

clay and mudstone resemble interchannel tidal flats.

A detailed study of sedimentary facies, palaeoflow, textural parameters and systematics of ichnofauna is in progress and the results shall be communicated in due course.

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IN VIVO RECOVERY OF ACETYLCHOLINESTERASE ACTIVITY FROM METHYL PARATHION INDUCED INHIBITION IN THE FRESHWATER TELEOST, *CYPRINUS CARPIO*

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INHIBITION of Acetylcholinesterase (AChE) in fish by the organophosphate (OP) compounds is well