Record of skeletal remains of dinosaur from early Middle Jurassic of Kuar Bet, Kutch, Gujarat*

In Western India, with its best exposed and accessible succession, Kutch forms the classic area for the study of Jurassic geology. There is a long list of investigations in this area, beginning with Sykes, which has contributed to the field of stratigraphy and fossil biota.

The Mesozoic rocks ranging in age from Aalenian (Middle Jurassic, 178.0 Ma) to Albion (Early Cretaceous, 98.9 Ma) are exposed mainly in six regions of Kutch district, viz. Kutch Mainland, Wagad Highlands, Patcham, Khadri and Bela ‘Islands’ and Chorar Hill. The ‘Island’ belt and Chorar Hill are isolated from the ‘Mainland’ by a vast stretch of Rann (Figure 1a).

The westernmost island belt of Patcham comprises two main islands: the Patcham and Kuar Bet, separated by a small section of Rann (Figure 1a). A thick sequence of conglomerate, sandstone and shale exposed in Kaladongar (black hills) range of Patcham Island constitutes the oldest stratigraphic unit of Kutch – the Kaladongar Formation, and is referable to Aalenian-Early Bajocian age (earliest Middle Jurassic). On the basis of the lithologic attributes, the formation has been subdivided into three informal members: (i) lowest – Dinghi Hill Member, (ii) the middle – Kaladongar Sandstone Member, and (iii) upper – Babia Cliff Sandstone Member. The rocks exposed in the smaller northern island of Kuar Bet are lithologically similar to Dinghi Hill Member, although exact correlation is not possible for want of marker beds.

During the course of geological field studies in Kuar Bet Island in February 1999, we came across a site rich in fossil bones and petrified wood (Figure 1b). This ‘fossil site’ is located approximately 1 km NNE of India Bridge on the Island.

The oldest beds of Dinghi Hill Member (Kaladongar Formation), exposed at the site are brown, fine-grained, well-indurated sandstones with occasional ripple marks. The beds are very gently dipping and are over lain by brownish, well-indurated limestone with abundant bivalves and corals. The succession is capped by grey, coarse-grained, poorly sorted and fractured sandstone containing large pebbles of quartz. A rich suite of well-preserved fossil skeletal remains of dinosaur and petrified tree trunks and branches have been recovered from the lowest sandstone beds, occupying the low grounds and are covered by the successive limestone beds. Although the occurrence of the petrified tree trunks is

The table below gives the stratigraphic column of Kutch Mainland and Patcham Island.

<table>
<thead>
<tr>
<th>Age</th>
<th>Kutch Mainland</th>
<th>Patcham Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Cretaceous</td>
<td>Bluj Formation (Dominantly sandstone with minor shale)</td>
<td></td>
</tr>
<tr>
<td>Kimmerridgian – Oxfordian</td>
<td>Jhumar Formation (Alternating beds of sandstone and shale)</td>
<td>Gotaonag Formation (Dominantly limestone with minor sandstone and shale)</td>
</tr>
<tr>
<td>Middle-Upper Jurassic</td>
<td>Jamur Formation (Grey, gypseous, laminated shales with alternating beds of limestone and occasional sandstone inter beds, with Dhoosa Oolite at the top)</td>
<td>Kaladongar Formation* (Conglomerate, calcareous sandstone and shale)</td>
</tr>
<tr>
<td>Aalenian – Bathonian</td>
<td>Jiurio Formation (Limestone and shale with bands of ‘golden oolite’ in the lower part)</td>
<td></td>
</tr>
</tbody>
</table>

*Fossils from this formation.

*The views expressed in the paper are those of the authors only and not necessarily of the organization they represent. All the illustrated materials are systematically catalogued and kept in the repository of the Regional Geology Laboratory, Oil & Natural Gas Corporation Limited, Panvel, Navi Mumbai. Considering the importance of the fossil site, the in situ material has not been disturbed and arranged to be properly fenced to prevent the site from any damage.

ACKNOWLEDGEMENTS. We thank UGC New Delhi for financial support. P.M. is grateful to CSIR for award of Senior Research Fellowship.

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Figure 1a. Location map showing generalized geology of the area and the fossil site.

Figure 1b–e. b, Close up of fossil tree trunks; c, d. Vertebrae and limb elements of the fossil dinosaur from the sandstone bed; e. Transverse section of the fossil bone showing cell structure (negative print, bar = 1 cm).
known from the Dingi Hill Member in Patcham Island3, there is no report till date on the occurrence of fossil bones of dinosaurs from the Jurassic of Kutch.

The purpose of the present communication is to record and also report the occurrence of a rich vertebrate fossil assemblage from the Middle Jurassic of Kutch. The 'material' comprises several vertebrates and limb elements (Figure 1 c, d). More than twelve vertebrates and many other bone pieces are found. Some of them are still embedded in the sandstone and some are scattered over the outcrops, covering an area of about 200 m². The length and the diameter of these bones range from 10 to 15 cm and 9 to 10 cm, respectively. A few pieces of bones have been collected from the area and their longitudinal and transverse sections reveal a definite cell structure made up of calcium carbonate (Figure 1 e).

The presence of a large number of well-preserved bones and tree trunks from the Middle Jurassic rocks of Kuar Bet and their close comparison with published literature strongly suggest the presence of a dinosaur skeleton at this site. Although there are records of the presence of dinosaur eggs from the intertrappean beds of Late Cretaceous age from the nearby Anjar area, there is no record of skeleton or part of skeleton of dinosaurs from Kutch – especially from Jurassic strata. Thus, this communication records the first occurrence of oldest fossil dinosaur from the earliest Middle Jurassic of Kutch. A systematic excavation of the site is required by professionals to reconstruct the full skeleton of what could possibly be a Middle Jurassic dinosaur – the oldest record of these giant reptiles from Kutch.


ACKNOWLEDGEMENTS. We are grateful to Shri S. K. Patra, Gr. Gen. Manager (Exploration) and Shri D. R. Ghosh, Gen. Manager (Geology), ONGC for support to carry out the field studies. The logistic support given by the authorities from Indian Army especially Ashok Daggal and V. R. K. Nair of Border Security Force at Bhuj is sincerely acknowledged. We also thank Shri R. V. Paranjkar, ONGC for taking excellent photographs in the field.

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Record of a nesting burrow from the Badhaura Formation (Permian), Rajasthan

Fossiliferous sedimentary rocks found to occur in association with the Bap Boulder Bed in the Jodhpur district, Rajasthan were designated as the Badhaura Formation1. The fossil fauna recovered from these rocks, dominated by brachiopods and bivalves, indicates a Permian age and a marine origin2-4. Although the body fossils were studied to some extent, trace fossils from the Badhaura Formation did not receive any attention. There is only a passing reference to the presence of 'abundant worm burrows in the basal sandstones' of the Badhaura Formation5.

We report here a fossil nesting burrow, a brood structure, from the Badhaura Formation. Seen in negative semirelief, it is preserved within the buff-coloured, calcareous sandstone, exposed at a spot (27°21'36"N : 72°16'45"E), 3 km south of Bhimji ka Gaon (Figure 1).

The biogenic structure is a vertical, unbranched, long-necked, flask-shaped burrow consisting of a shaft with a pear-shaped, bulb-like structure at its base. The upper portion of the shaft is broken off. Preserved height of the shaft is 58 mm. The shaft measures 6 mm in width which is uniform throughout its length. The bulb measures 32 mm at its maximum width and is 53 mm in height. Therefore, total height of this nesting burrow must have been more than 111 mm. A well-defined outline of the burrow is suggestive of the presence of a lining which, however, is not preserved. The inner surface of the bulb exhibits fine scratch marks. Two petaloid, pad-like structures are seen inside the cavity of the bulb at its base (Figures 2 and 3). Also seen are parts of two vertical, cylindrical burrows penetrating the bulb, evidently emplaced subsequent to the formation of this nesting burrow. Obviously these are not integral parts of the nesting burrow.

Following the architecture of the trace fossil, the entire burrow can be reconstructed (Figure 4). It would then reveal the presence of at least two or three more of the petaloid pads, hinting that they were four to live in all. They probably served as cushions to support and protect the eggs.

Two ichnofossils recorded from younger sediments are closely comparable to the present form, one of them has been attributed to insects5, while the other to callianassids6. The callianassid brood structure from the Pleistocene of North Carolina7 differs from the present specimen in having a number of tubes.

Figure 1. Locality map. Fossil locality is indicated by an asterisk.