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# Bajocian (Mid Jurassic) Age of the Lower Jaisalmer Formation of Rajasthan, western India

by Dhirendra Kumar Pandey and Franz T. Fürsich*

with 2 figures and 1 table

**Abstract.** The occurrence of the coral *Isastrea bernardiana* (D'Orbigny 1850), hitherto known only from the Bajocian of Europe, near the so far undated base of the Jaisalmer Formation of Rajasthan, western India, suggests a Bajocian age for the lower part of the formation. As the base of the Jaisalmer Formation also represents the earliest marine record in the area, the time of transgression of the Jurassic sea across the Indus shelf can be dated accordingly as Bajocian.

**Kurzfassung.** Abgerollte Korallenstöcke von *Isastrea bernardiana* (D'Orbigny 1850) treten in einer 1 m mächtigen Schuttkalklage in der Nähe der Basis der marinen Jaisalmer Formation in Rajasthan, westliches Indien, auf. Die bislang undatierte Basis der Jaisalmer Formation überlagert die nicht-marinen Schichten der Lathi Formation und dokumentiert den Beginn der Jura-Transgression in Rajasthan. *Isastrea bernardiana* war bislang nur aus dem Bajoc Europas bekannt; ihr Auftreten in Rajasthan liefert deshalb einen Hinweis auf ein Bajoc-Alter der Basis der Jaisalmer Formation und damit der Transgression des Jura-Meeres über den Indus-Schelf.

## Introduction

The western part of Peninsular India was transgressed by a shallow epicontinental sea in the Jurassic. Marine sediments of Jurassic age occur in the Kachchh Basin which is the result of graben formation in connection with the breakup of eastern Gondwanaland (Biswas 1987) and on the so-called Indus shelf in what is now Rajasthan. The Jaisalmer Basin, part of the Indus shelf, was crossed by a northwest-southeast trending ridge, the Jaisalmer arch, that subdivided the shelf into two subbasins. Based on ammonite evidence marine sedimentation commenced in the Kachchh Basin as early as the Late Bajocian (Singh et al. 1982). The age of the earliest marine sediments in the Jaisalmer Basin, in contrast, is far from clear. Unfossiliferous sandstones and sandstone with tree remains and wood fragments (Lathi Formation; Table 1) are followed by poorly fossiliferous sandstones and shelly limestones of the lower and middle part of the Jaisalmer Formation. The middle part of the formation sensu Garg & Singh (1983)

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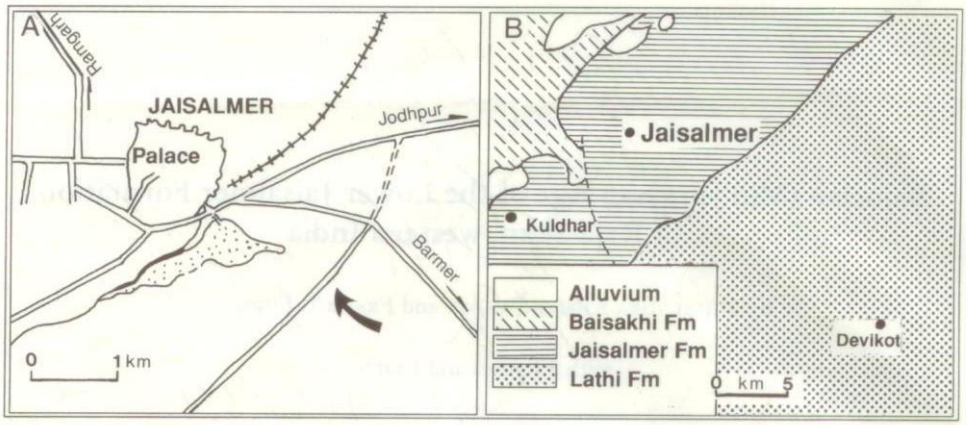


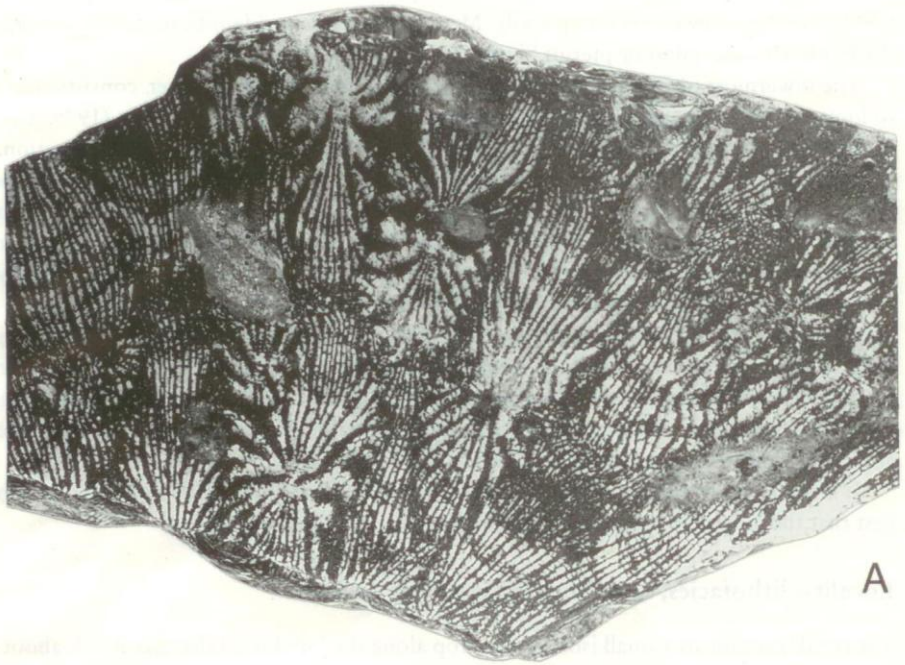

Fig. 1. **A:** Sketch map of *Isastrea bernardiana* locality (arrowed). **B:** Geological sketch map of the Jaisalmer area (after DAS GUPTA 1975).

(Kuldhar Oolite Member) is richly fossiliferous. Its ammonites indicate a Late Bathonian/Early Callovian to Oxfordian age (DAS GUPTA 1975; JAI KRISHNA 1987; CARIOU & JAI KRISHNA 1988) depending on the definition of the Bathonian-Callovian boundary. Fossils in the lower part of the formation (Amarsagar Limestone Member of GARG & SINGH 1983; Jaisalmer Member of JAI KRISHNA 1983, 1987) occur concentrated in thin shell beds within the upper part of the Amarsagar Limestone Member. They are often poorly preserved and belong exclusively to groups such as bivalves and gastropods that do not yield precise ages. These groups undoubtedly show that this part of the Jaisalmer Formation is of marine origin. KACHHARA & JODHAWAT (1981) reported several species of neomiodontid bivalves such as *Eomiodon baroni* NEWTON and *E. indicus* COX from the calcareous units, species which occur also in the Jurassic of the Attock District (now Pakistan), Kachchh, and Madagascar and which have been tentatively assigned a Bajocian or Bathonian age (e.g. NEWTON 1895; COX 1935). KACHHARA & JODHAWAT (1981) therefore placed these beds in the Bathonian. Evidence of benthic foraminifera similarly points to a Middle to Upper Bathonian age of the calcareous part of the Amarsagar Limestone Member (GARG & SINGH 1983).

DAS GUPTA (1975) proposed a different lithostratigraphic scheme, subdividing the Jaisalmer Formation into five members (Table 1). The problem with DAS GUPTA's scheme is, that his members are poorly defined and no lithologs are given.

The Joyan Member contains oyster fragments and other poorly preserved bivalves such as *Isognomon, Inoceramus* and *Modiolus* (KACHHARA & JODHAWAT (1981), taxa which are not age diagnostic. (The report of *Rhaetavicula* sp. from these beds by KACHHARA & JODHAWAT

Fig. 2. *Isastrea bernardiana* (D'ORBIGNY 1850) from the base of the Jaisalmer Formation 4 km southeast of Jaisalmer, along the Jaisalmer-Ghadisar road, Rajasthan. **A:** Polished longitudinal section, x2, RUC 1992I 141. **B:** Part of upper surface of corallum, x2, RUC 1992I 22.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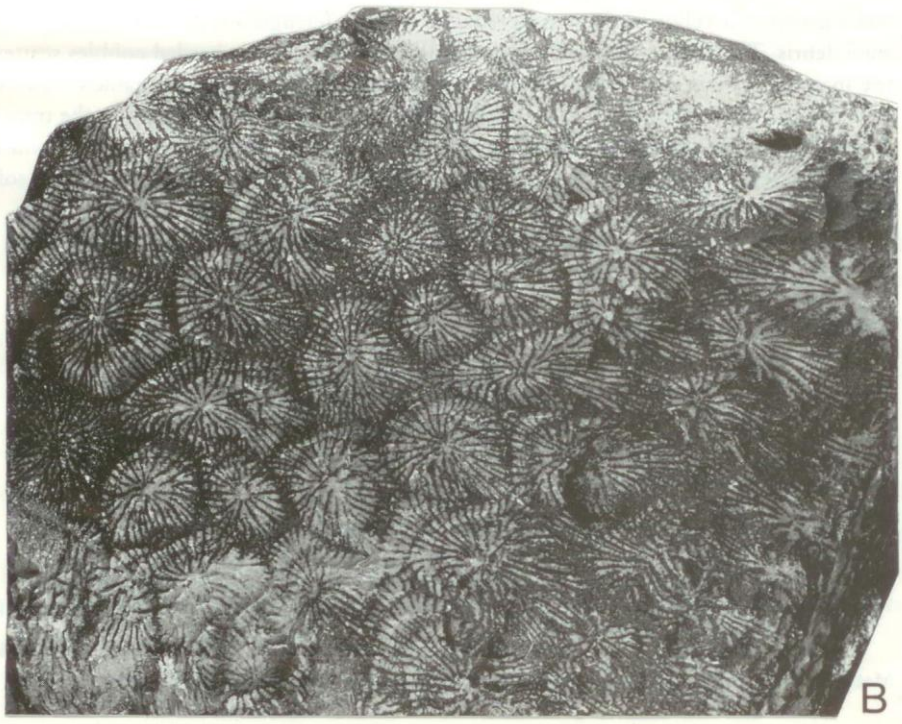
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(1981) has to be viewed very sceptically. Most likely it is a misidentification of some other radially ribbed bakevelliid or pteriid bivalve.)

The lowermost of DAS GUPTA's (1975) members, the Hamira Member, consists, according to him, of an arenaceous limestone containing bivalve fragments. DAS GUPTA (1975) mentioned that the Hamira Member is intertonguing with the underlying Lathi Formation. The member apparently was not taken into consideration when GARG & SINGH proposed their lithostratigraphic scheme. Personal observations at the Thayat section in 1989 and 1990 showed a sequence consisting of fine-grained sandstones with thin layers of shell fragments, thin layers of coquinoid fine-sandy micrite, reddish silts and siltstone with pavements of poorly preserved bivalves and gastropods and ripple-laminated fine-grained sandstones with the trace fossils *Gyrochorte, Rhizocorallium*, and *Thalassinoides.* The trace fossils indicate marine conditions; the bivalves, many of them *Eomiodon*, brackish conditions. As this unit is overlying the wood-bearing, cross-bedded coarse-grained sandstones of the typical Lathi Formation, it apparently represents the gradual transgression of the Jurassic sea across the fluvial and coastal plain sediments of the Lathi Formation.

It is from this basal unit of the Jaisalmer Formation that corals were recovered which suggest that the lower part of the member most likely is of Bajocian age.

## Locality, lithofacies, and lithostratigraphic position

The coral layer forms a small isolated outcrop along the Jaisalmer-Ghadisar Road, about 4 km from Jaisalmer (Fig. 1). The coral bed is about 100 cm in thickness, heavily fractured by joints, and consists of a yellowish brown to redbrown, hard, ferruginous bioclastic rudstone full of shell debris. The purple-coloured corals occur as reworked and abraded cobbles scattered in the matrix. The size of the coral heads varies considerably; maximum diameter was 40 cm. Many of the corals were bored by slender cylindrical tubes corresponding to the trace fossil *Trypanites;* on one specimen, remains of serpulid tubes were found. In the same specimen, solution cavities with geopetal fills were observed which suggest emergence and partial solution of the lithified coral, before reworking and renewed submergence took place.

All corals belong to a single species which is briefly described in the following.

## Systematic palaeontology

Class ANTHOZOA EHRENBERG 1834
Family ISASTRAEIDAE ALLOITEAU 1952
Genus *Isastrea* M. EDWARDS & HAIME 1851

**Type species:** *Astrea helianthoides* GOLDFUSS 1826.

*Isastrea bernardiana* (D'ORBIGNY 1850)

1850 *Prionastrea bernardiana* sp. nov.; D'ORBIGNY, p. 293.
1988 *Isastrea bernardiana* D'ORBIGNY; LATHUILIERE, p. 287, pl. 1–4, pl. 5, figs. 1–3, 7–8, pl. 6, figs. 1–3 (see for extensive synonymy).

**Material:** Four specimens (Rasjasthan University Collection 1992I 22, 1992I 141–143).

Table 1 Existing lithostratigraphic schemes of the Jurassic strata in the Jaisalmer Basin.

| AGE | LITHOSTRATIGRAPHIC UNITS Das Gupta 1975 | | Garg & Singh 1983 | | AGE |
|---|---|---|---|---|---|
| Tithonian | Bhadasar Formation | Mokal Mb.<br>Kolar Dungar Member | Bhadasar Formation | | Tithonian |
| | | | | Unconformity | |
| Kimmeridgian | Baisakhi Formation | Rupsi Mb.<br>Ludharwa Member<br>Baisakhi Member | Jaisalmer Formation | Rupsi Shale Member | lowermost Tithonian to uppermost Oxfordian |
| | | | | Baisakhi Member | Oxfordian |
| | | Unconformity | | Unconformity | |
| Callovo-Oxfordian | Jaisalmer Formation | Kuldhar Member<br>Badabag Mb.<br>Fort Mb.<br>Joyan Mb.<br>Hamira Mb. | | Kuldhar Oolite Member | Callovian (Lower-Middle) |
| | | | | Amarsagar Limestone Member | Bathonian (Middle-Upper) |
| | | | | Unconformity | |
| Lias to Bathonian | Lathi Formation | Thaiat Mb.<br>Odania Mb. | Lathi Formation | | Lower-Middle Jurassic (Part) |

**Dimensions:** (in mm).
Diameter of the corallum: c. 120
Height of the corallum: c. 35
Diameter of the corallites: D5.5/d5.5–D11.4/d6.5
Distance between corallite centres: 5.1–8.0
Number of septa: 39–54 in 3 to 4 cycles
Density of the septa per 2 mm: 5.

**Description:** Corallum massive, cerioid, calices superficial, small, subpolygonal, suboval, elongated or subcircular in outline; the ratio between maximum and minimum diameter varies from 1 to 1.7; the walls of the corallites are thin. The septa are thin, lamellar, free at the inner end and bear conspicuous carinae along the lateral sides. Endothecal tabular and vascular dissepiments are abundant; a columella is absent.

**Remarks:** LATHULIERE (1988) discussed and illustrated *Isastrea bernardiana* (D'ORBIGNY) in detail. As the dimensions and morphological features of the present specimens fall within the range of variation of *I. bernardiana*, they have been assigned to this species which is known so far only from the Bajocian of Europe.

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