Depositional history of the early part of the Jurassic succession on the Rajasthan Shelf, western India*

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Received November 20, 2005; revised March 6, 2006

Abstract Part of the lowermost deposits of the Triassic to Early-mid Jurassic (up to Bajocian) sedimentary succession spread across the Rajasthan shelf on the western part of the Indian craton is found in the Jaisalmer Basin east of Jaisalmer with the best exposed sections along the Jodhpur-Jaisalmer Highway. Based on lithostratigraphic characteristics, the succession is divided into four: Odania and Thaiat members, Lathi Formation; and Hamira and Joyan members, Jaisalmer Formation. Six facies are defined from microfacies, sedimentary structures, biotic components and depositional environments: (1) ferruginous, pebbly, cross-bedded sandstone—high-energy, fluvial; (2) cross-bedded, poorly sorted, fossil wood-bearing sandstone—high-energy, terrestrial, with high influx of sediment and warm and humid climate; (3) cross-bedded to rarely bioturbated, alternating silt to fine-grained sandstone—fluctuating sedimentation rates and energy—nearshore, mesohaline embayment to lagoonal; (4) partly bioturbated, storm-dominated, mixed siliciclastic-carbonate facies—fully marine; (5) low angle cross-laminated, silt to fine-grained sandstone—nearshore shallow water, above fair weather wave base; and (6) thick rudstones with mega-ripples and reworked coral heads-storm deposits representing the peak of first major marine transgression across the basin.

Keywords: Jaisalmer Basin, sediments, basal Jurassic-Bajocian, microfacies, depositional environment.

The Rajasthan Shelf on the western part of the Indian craton forms the easternmost part of a large tectonic unit, the "Indo-Arabian geological province"[1—4]. Tectonically, the shelf, situated to the west of the Aravalli Range, has been divided into four elements; the Bikaner-Nagaur Basin, the Pokharan-Nachna High, the Jaisalmer Basin, and the Barmer-Sanchor Basin[5] (Fig. 1).

1 Geological setting

The sedimentary sequences of the shelf can be divided broadly into two geological cycles: Early Palaeozoic sediments followed by the Late Carboniferous to Pleistocene. The structural controls on sedimentation during the two cycles were more or less the same. A recent seismic survey and core data suggest that Permo-Carboniferous to Triassic and early Jurassic continental sediments are widespread on the Rajasthan Shelf and occur in all three basins. Similarly, Paleogene sediments are present in all three. The term Jaisalmer Basin has been hitherto restricted to the area west of the Bikaner-Nagaur Basin and the Pokharan-Nachna High, and north of the Barmer-Sanchor basins as well as to known Jurassic-Quaternary sediments exposed in the area around Jaisalmer. This definition is no longer tenable because of the possible continuity of the sedimentary strata beyond the present tectonic limit of the basin. Thus, "Jaisalmer Basin" should be used more in a geographical sense. Lithostratigraphically, the lower part of the Jurassic sequence exposed east of Jaisalmer city (the Golden City of Rajasthan) has been grouped into two, Lathi and Jaisalmer formations, in ascending order, ranging from Triassic to Early Jurassic/Bajocian to Oxfordian[5,6] (Fig. 1, Table 1).

Here we concentrate on this lowermost part of the sedimentary succession. Although widespread in the Rajasthan shelf, a complete section is exposed only between kilometers 20 to 6 along the Jodhpur-Jaisalmer Highway (National Highway No. 15) east of Jaisalmer.

2 Early Jurassic succession east of Jaisalmer

Lithostratigraphically, the early part of the Jur-

* Supported by the Department of Science and Technology, New Delhi (Project no. SR/S4/ES-41/2003), Chinese Academy of Sciences (Grant Nos. GJHZ 0522, KZCX2-SW-129). This is a contribution to UNESCO-IUGS IGCP 506 Project.

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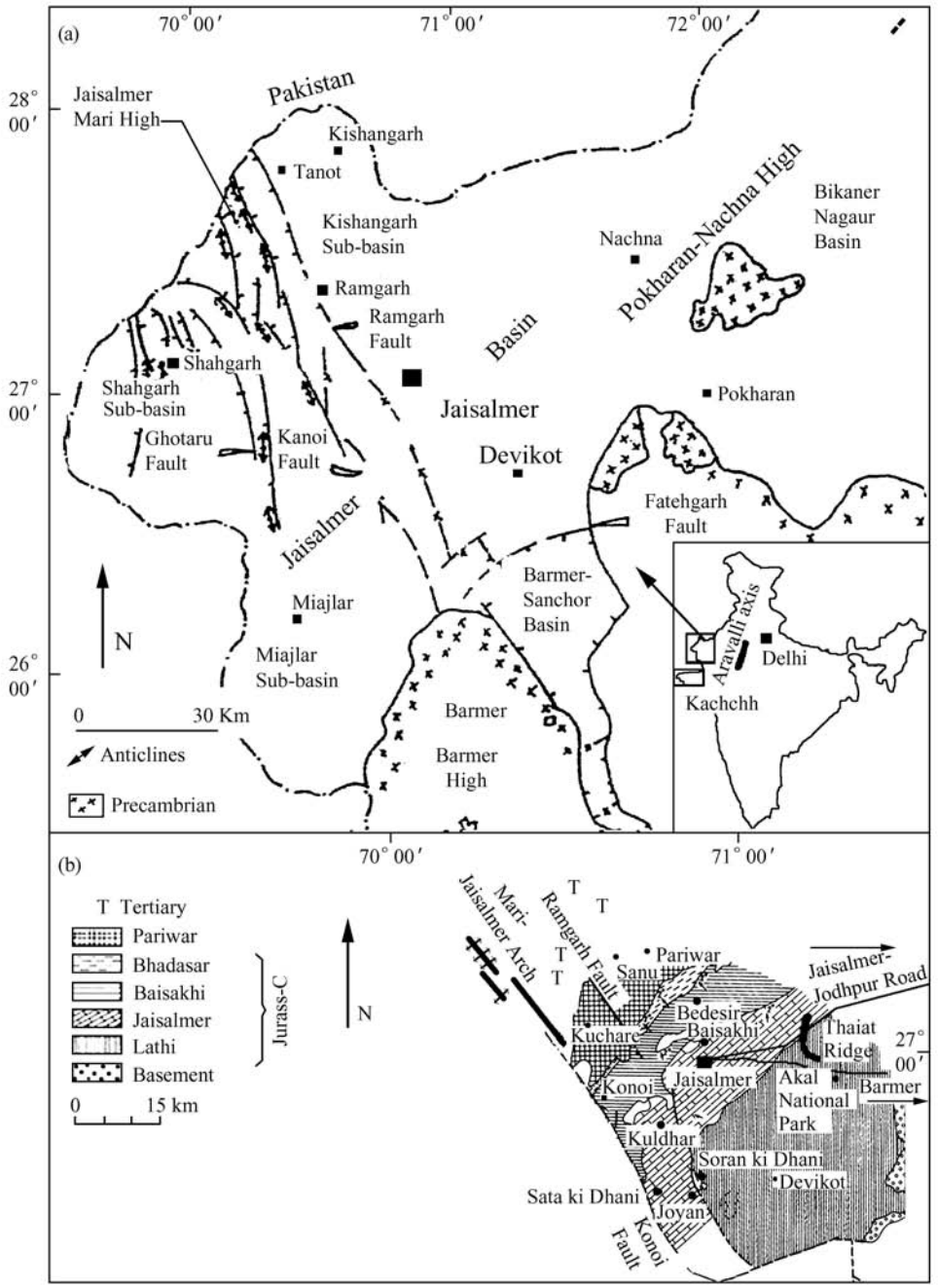

Fig. 1. Location map and structural elements of western Rajasthan (a) (modified after Pandey and Dave[5]) and geological map of Jurassic formations of western Rajasthan (b) (modified from Das Gupta[6]).

assic succession has been grouped into the Odania and Thaiat members of the Lathi Formation, and the Hamira and Joyan members of the Jaisalmer Formation (Table 1). The name Lathi Formation representing the earliest Jurassic sediments was given by Oldham[15] after the village of Lathi (71°32′E : 27°03′N) on the Pokaran to Jaisalmer Road. The Jaisalmer Formation represents predominantly carbonate sediments overlying the continental siliciclastic sediments of the Lathi Formation. The original name of this formation, "Jaisalmer Limestone", used by Oldham[15] and Blanford[16], was subsequently redefined as the Jaisalmer Formation by Swaminath et al.[17]. It has been divided lithostratigraphically into the Hamira, Joyan, Fort, Badabag, Kuldhar, and Jajiya members, in ascending order[6,13]1). In the

1) Narayanan K., Subrahmanyam M. and Srinivasan S. Geology of Jaisalmer. Unpublished report, O.N.G.C., Dehradun, 1961.

studied section, the youngest member of the Lathi Formation (Thaiat Member) is directly overlain by the Hamira Member of the Jaisalmer Formation (Table 1).

Table 1. Stratigraphic succession of the early part of the Jurassic sequence exposed east of and around Jaisalmer city[6,7]

Event	Lithology	Fm	Member	Age	Index/Guide Fossils[7-14]
Regression	Sandstones	Bhadasar	Mokal Member	Tithonian	*Virgatosphinctes*
			Kolar Dungar Member		
First marine transgression	Shales	Baisakhi	Lanela	Late Kimmeridgian	*Katroliceras*
			Ludharva	Early to Middle Kimmeridgian	*Torquatisphinctes*
			Rupsi		
	Sandstones & limestones	Jaisalmer	Jajiya	Callovian-Oxfordian	*Dhosaites*, *Mayaites*, *Epimayaites*, *Subkossmatia*, *Reineckeia*, *Macrocephalites*, etc, ostracods & foraminifers.
			Kuldhar		
			Badabag	Bathonian	*Clydoniceras* sp[a]
			Fort		Ostracod, foraminifera & bivalve assemblages
			Joyan	Bajocian	*Isastraea bernardiana*
			Hamira	?	
Continental deposits	Conglomerate & sandstone	Lathi	Thaiat	Triassic/Lower Jurassic	gymnosperm wood fossils[b]
			Odania		
Older Formations					

a) Dr. Surendra Prasad (pers. comm. to DKP) of the Geological Survey of India collected one specimen of the Bathonian ammonite *Clydoniceras* from the basal beds of the Badabag Member, Jaisalmer Formation.

b) Mathur. U. B. and Srivastava. S. Report on visit to Akal Fossil Wood Park and Neighbouring Area, Jaisalmer. Unpublished report of Geological Survey of India, 1995, Western Region, Jaipur: 1—7.

2.1 Odania Member

This member is typically exposed in the Lathi-Odania (71°43′E: 26°58′N) section and starts with pebbly sandstone (seen N and SE of Odania). The lithic units are low to high angle cross-bedded, well cemented, poorly sorted ferruginous sandstone with pebbles, to poorly cemented and poorly sorted, medium- to coarse-grained, mica-bearing, cross-bedded, calcareous to ferruginous sandstone. Wood fragments and tree trunks are commonly found in this member, for example at the Akal National Park, 17 km E of Jaisalmer on the Jaisalmer-Barmer road.

2.2 Thaiat Member

Succeeding the Odania Member, the sediments of the Thaiat Member are best exposed on the scarp to the W and NW of Thaiat village (71°04′E: 26°56′N). The section consists of a sequence of white to gray, poorly cemented, fine-grained, often-calcareous sandstone, variegated sandy siltstone and a red siltstone bed at the top, persistently seen along the contact with the overlying Jaisalmer Formation[6]. The upper part is also exposed along the Thaiat ridge, which crosses the Jodhpur-Jaisalmer Highway about 16 km E of Jaisalmer, and along the basal part of an outlier, which is a southward extension of the Thaiat ridge (best approached from the Jaisalmer-Barmer road, 3 km N of the 13 km-milestone E of Jaisalmer). The outlier is truncated by a NW-trending fault.

2.3 Hamira Member

The member, defined by Das Gupta[6], and named after the village Hamira (71°05′E: 27°00′N), is characterized by yellow arenaceous limestone with fragmentary bivalves. It succeeds the Thaiat Member, exposed along the upper part of the Thaiat ridge. According to him[6], the Hamira Member, a basal member of the Jaisalmer Formation, has "intertonguing" relationship with the underlying Lathi Formation.

2.4 Joyan Member

Narayanan et al.[1] defined this member, which consists of mixed siliciclastic and carbonate sediments with a maximum thickness between Sata-ki-Dhani and Soran-ki-Dhani, WSW and NE of Joyan village (71°53′45″E: 26°48′45″N)[13]2). The part of the member is also exposed along the left side of the Jodhpur-Jaisalmer road, between 15 km E of

1) Narayanan K., Subrahmanyam M. and Srinivasan S. Geology of Jaisalmer. Unpublished report, O. N. G. C., Dehradun, 1961.

2) Jodhawat R. L. A study of Bivalvia from the Jurassic Beds of Jaisalmer, Rajasthan. Ph. D, thesis of University of Rajasthan, 1984.

Jaisalmer and Jaisalmer city. Here the deposits are predominantly poorly-to well cemented, low angle cross-bedded, occasionally bioturbated, ferruginous to calcareous silt to medium-grained sandstones overlain by an approximately 70 cm-thick rudstone with a megarippled surface and reworked coral heads of *Isastraea bernardiana* (d 'Orbigny). The biotic components are shell pavement, nuculids, *Trigonia*, corals, *Rhizocorallium jenense*, etc.

Kachhara and Jodhawat[11], based on the bivalve fossil assemblage, mentioned that in all probability the Joyan Member is Bajocian. The occurrence of the characteristic Bajocian coral *I. bernardiana* in the topmost bed of the member also refines the upper limit of the Joyan Member as Late Bajocian[7].

3 Depositional history

Based on the fine silty arkosic nature of the sandstones and the plant remains, a stable continental environment of deposition has been deciphered by earlier workers for the lower part of Lathi Formation, whereas based on the transitional relationship with the overlying marine Jaisalmer Formation, a littoral environment of deposition has been suggested for the upper part of the Lathi Formation[6].

Microfacies, sedimentary structures and biotic components of the sedimentary units in this early part of the Jurassic succession on the Rajasthan shelf exposed east of Jaisalmer are broadly distinguished into six facies, the depositional environment of which are as follows.

3.1 Facies 1—Ferruginous, pebbly, cross-bedded sandstone

The beds of this facies are exposed in patches about 9 km SW of Pokharan, best approached from the Pokharan-Jaisalmer Road from a left hand cut about 1 km from Pokharan. This is the oldest unit, which consists of an about 40 cm-thick, yellowish-ochre to different shades of brown, low angle cross-bedded, well cemented, well sorted, medium-grained ferruginous sandstone and a brown, high angle cross-bedded, well cemented, poorly sorted, ferruginous sandstone with pebbles of quartzite and chert up to 11.5 cm in diameter (Fig. 2(a), (b)); the angular to subangular quartz grains are densely packed.

Low and high angle cross-bedding suggests a high-energy depositional environment. The well-sorted sandy components also suggest a high-energy condition and probably long transportation. However, the arkosic nature of the sediments of this facies mentioned by earlier workers[6] suggests immature sediments, not transported long distance. The outcrop pattern, sedimentary structures and mineral composition of the facies suggest for fluvial depositional environment near to the hinterland.

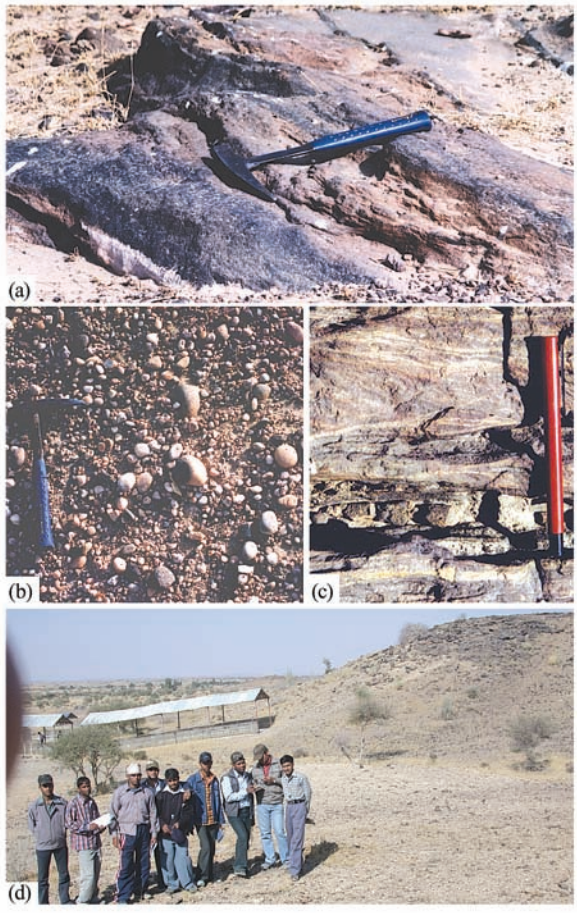

Fig. 2. (a) An approximately 40 cm-thick, well cemented, low angle large-scale cross-bedded, ferruginous, well-sorted medium-grained sandstone with pebbles of quartzite (basal part of Odania Member, Lathi Formation) exposed about 9 km SW of Pokharan, E of Jaisalmer. (b) Present-day Lag deposit of rounded, up to 11.5 cm quartzite pebbles of the basal Odania Member distributed about 9 km SW of Pokharan, E of Jaisalmer. (c) A thick, well-cemented, medium-to coarse-grained ferruginous sandstone showing low angle cross-bedding at Akal National Park, about 17.5 km from Jaisalmer: upper part of the Odania Member, Lathi Formation. (d) Panoramic view of Akal National Park. The tin roof on the left protects one fossil tree trunk, about 13.4 m long and 0.4 m in diameter.

3.2 Facies 2—Cross-bedded, poorly sorted, fossil-wood bearing sandstone

The facies is a low to high angle cross-bedded, moderately cemented, medium-to coarse-grained, mi-

ca-bearing ferruginous, calcareous sandstone with subangular to subrounded grains widely exposed in Akal National Park (see above). The estimated thickness of the sandstone facies is more than 10 m. Several pieces of gymnosperm fossil wood, up to 13.4 m long with a diameter of 0.4 m, have been found in this facies (Fig. 2(c), (d)). Often, calcium carbonate is concentrated as thin film over the surface of the beds.

Like the previous one, this facies also exhibits low and high angle cross-bedding and suggests a high-energy depositional environment. Poor sorting and mixing of mica flakes surely indicate very high influx of sediment, with no time for sorting. Absence of body fossils and the unknown origin for its ferruginous and calcareous nature open a Pandora 's Box regarding this facies. The occurrence of large pieces of fossil wood supports the nearness of land where gigantic gymnosperm trees existed. The carbonate concentrations in the form of a thin film or concretions suggest mobilization of carbonate during diagenesis. Based on the cross-beddings, poor sorting, a common occurrence of wood fossils and the absence of any other guiding evidence for the marine condition it can be safely suggested for now that this facies represents a high energy fluvial depositional condition with high influx rate of sediments.

3.3 Facies 3—Cross-bedded, rarely bioturbated, alternating silt and fine-grained sandstone

The facies is best exposed along the base of an outlier, exposed 3 km N from the 13 km stone from Jaisalmer on the Jaisalmer-Barmer National Highway (NH15) (bed Nos. 1—13, Figs. 3 and 4(a)). It is also exposed along the Thaiat ridge section at 16 km E of Jaisalmer on the Jaisalmer-Jodhpur Road (Figs. 4(c); 5(a), (b); 6—9), and along the base of three scarps, 6, 11 and 15 km, respectively, E of Jaisalmer on the right hand side of the Jaisalmer-Jodhpur Road (NH15).

The facies is about 11 m thick unit of alternating siltstones and fine-grained sandstones. A yellowish, reddish-brown colour predominates (Figs. 4(c); 5(a), (b)). Except for bed No. 7 (outlier section), which is a wedge-shaped, high angle cross-bedded fine-grained calcareous sandstone bed, all the units are either thinly laminated or bedded, low angle cross-bedded or bioturbated (Fig. 5(a)). Bed No. 2 (Thaiat section) shows convolute bedding (Fig. 5 (b)). Individual beds can be easily recognized on the basis of a sharp base and top. The beds are generally poorly cemented. Only bed Nos. 2 and 5 in the outlier section and bed Nos. 5 and 6 in the Thaiat ridge section are fossiliferous. The dominant body fossils in order of abundance are nerineid gastropods, fossil woods (up to 60 cm long), *Trigonia*, fossil bones, and other articulated bivalve shells, oysters, etc. Trace fossils in this facies are *Thalassinoides*, *Gyrochorte* and burrow tubes.

Predominance of ferruginous siliciclastic sediments, wedge- and lensoid-shaped bodies, occurrence of mono-specific shallow infaunal nerineid gastropods in association with fossil wood fragments, fossil bones and the very low biodiversity suggest nearshore, shallow, mesohaline embayment to lagoonal conditions. The low angle cross-bedding, bioturbation and alternation of silt and fine-grained sandy sediments and sharp bases to the units suggest a fluctuating rate of sedimentation and rapid change in water energy between low and moderate, with water depth oscillating rapidly between above and below the fair-weather wave base. The wedge-shaped, high angle cross-bedded fine-grained sandstone suggest for a high energy, fluvial channel depositional environment for a short interval.

3.4 Facies 4—Partly bioturbated, storm-dominated, mixed siliciclastic-carbonates

This facies (bed Nos. 14—25, about 6.60 m thick) overlies directly facies 3 in all four localities but gradually diminishes in thickness towards the west and southwest (bed Nos. 14—25, Figs. 3; 4(a); 7—9). The facies begins with an intra-formational conglomerate, then fallow, in ascending order, well-cemented, fine- to coarse-grained, ferruginous conglomeratic sandstone, silty wacke- to packstone with an interbed of coarse-grained to gravely gritstone (10 cm thick), about 25 cm below the top of the unit. The pebbles in this bed consist of siltstone showing cracks filled with ferruginous material. The upper and lower surfaces of the bed are sharp and uneven. The overlying beds consist of bioturbated to low angle cross-laminated, hummocky cross-bedded silty calcareous mudstone to sandy packstone with silty calcareous mudstone interbeds, with sharp and uneven bases (Fig. 10(b) storm and inter-storm intercalations). The facies is richly fossiliferous in the lower part. The biotic components are *Trigonia*, *Orthotrigonia* (shallow infaunal suspension feeders), oysters (epifaunal cem-

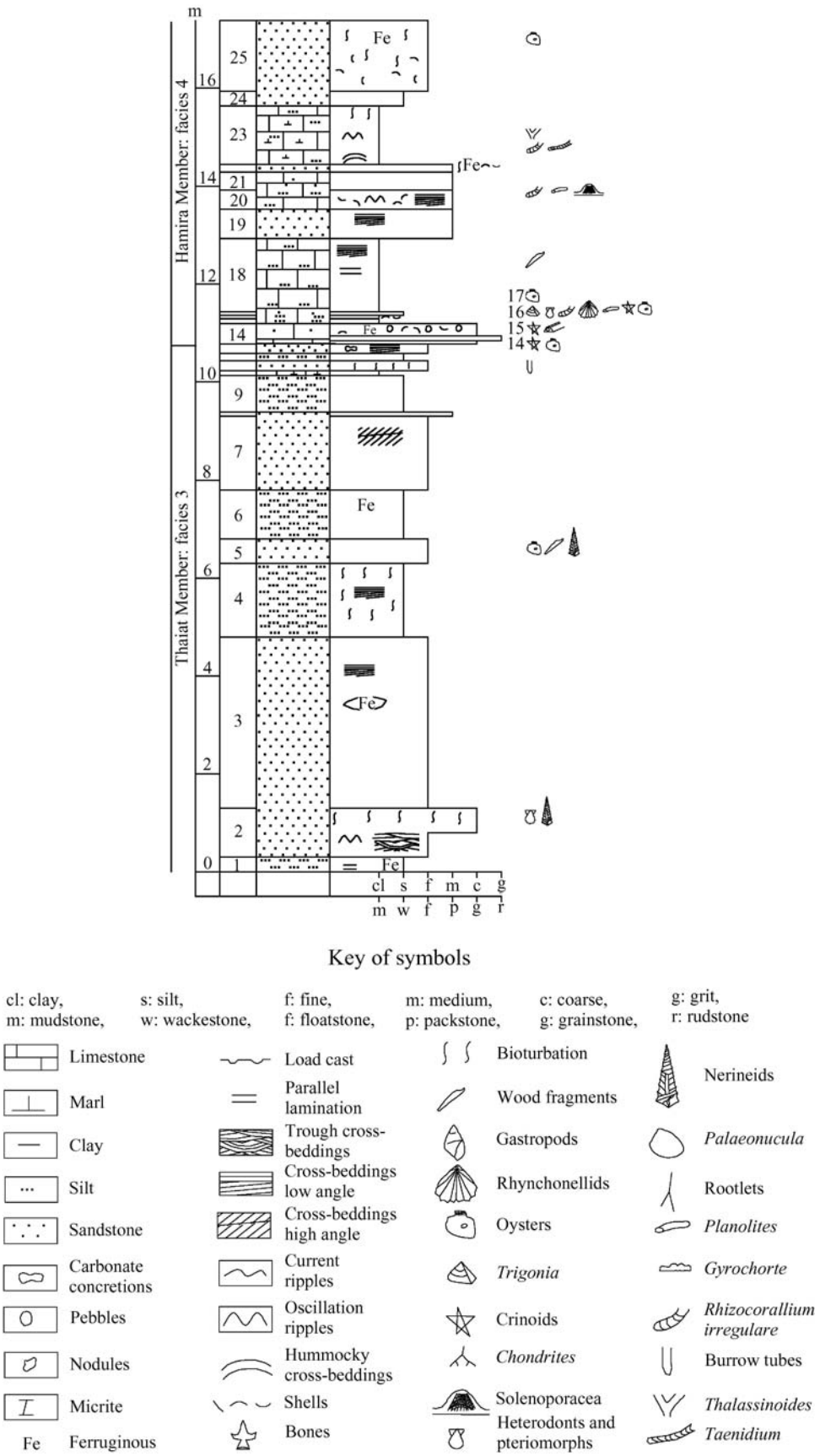

Fig. 3. Lithological section of Thaiat Member (facies 3) and Hamira Member (facies 4) at outlier on Thaiat Ridge, 3 km north from 13 km milestone from Jaisalmer on the Jaisalmer-Barmer National Highway (NH15).

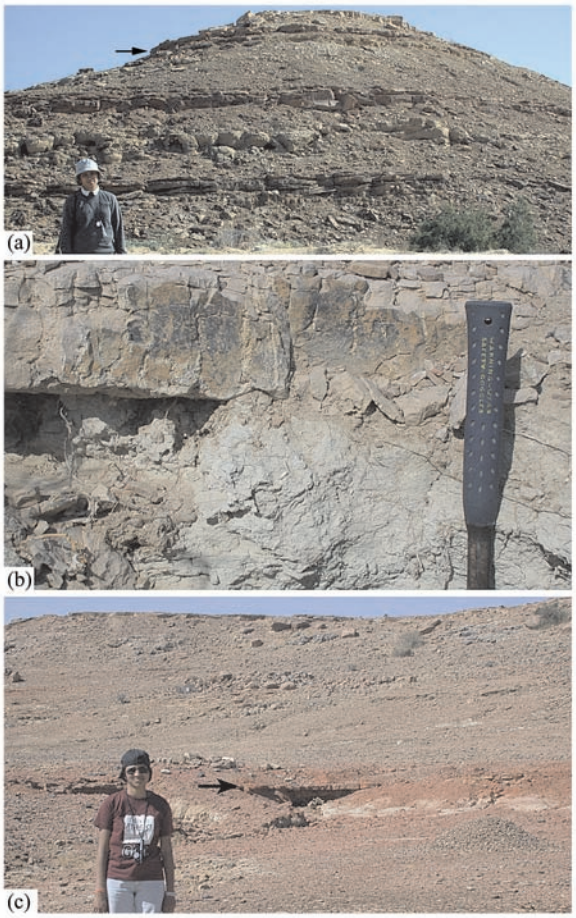

Fig. 4. (a) Panoramic view of the outlier section on Thaiat Ridge (see Fig. 3). The arrow marks the boundary between the Thaiat Member, Lathi Formation (below), with facies 3; and the Hamira Member, Jaisalmer Formation (above) with facies 4. (b) Close-up of rootlets in grainstone in facies 4, Hamira Member, Jaisalmer Formation, exposed along the base of a scarp 6 km E of Jaisalmer on the Jaisalmer-Jodhpur Road (NH15). (c) Thaiat ridge section showing succession of cross-bedded, alternating silt and fine-grained sandstone (facies 3), Thaiat Member, Lathi Formation, exposed along the base of a scarp at 16 km E of Jaisalmer on Jaisalmer-Jodhpur Road (NH15). Note the red siltstone near the base of the sequence (arrowed).

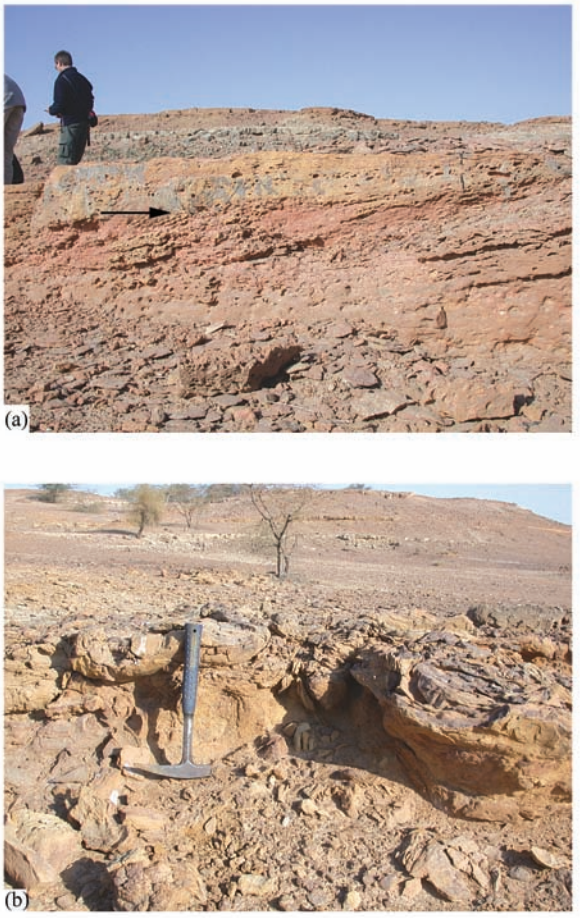

Fig. 5. (a) Close-up of Thaiat Ridge section showing facies 3, Thaiat Member, Lathi Formation, exposed 16 km E of Jaisalmer on the Jaisalmer-Jodhpur Road (NH15). Note the sharp base of the overlying bed of silt to fine-grained sandstone with small pits (arrowed); these are holes spaces left by silicified wood fragments and horizontal and inclined cylindrical burrow. (b) Convolute bedding in bed No. 2 of the Thaiat Ridge section, at 16 km E of Jaisalmer on the Jaisalmer-Jodhpur Road (NH15) near the base of facies 3, Thaiat Member, Lathi Formation.

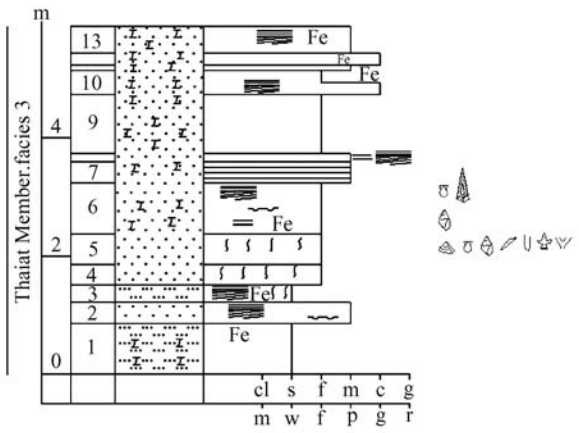

Fig. 6. Section at Thaiat scarp, 16 km E of Jaisalmer, exposed along a ridge crossing the Jaisalmer-Jodhpur Road (NH15); for key of symbols see Fig. 3.

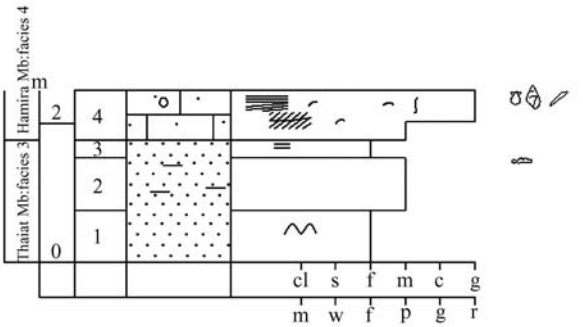

Fig. 7. Section at 15 km E of Jaisalmer, along the right hand side of the Jaisalmer-Jodhpur Road (NH15); for key of symbols see Fig. 3.

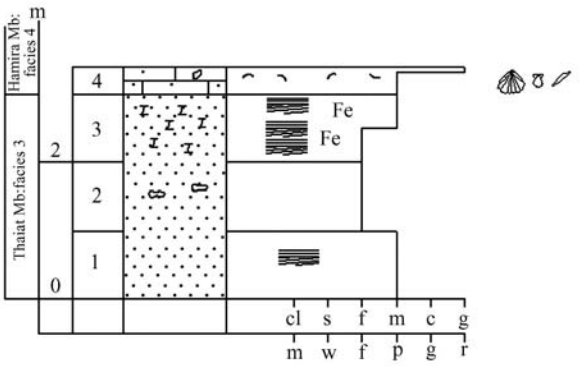

Fig. 8. Section at 11 km E of Jaisalmer, along the right hand side of the Jaisalmer-Jodhpur Road (NH15); for key of symbols see Fig. 3.

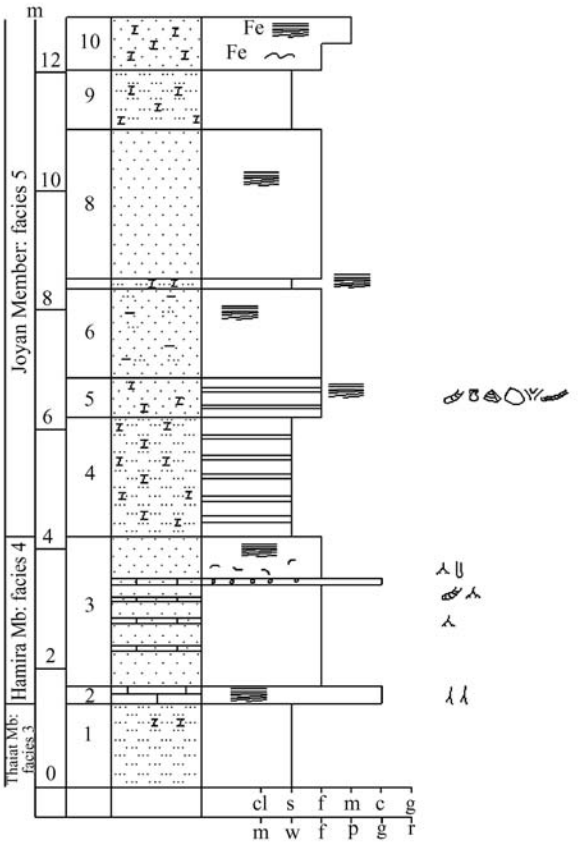

Fig. 9. Section at 6 km E of Jaisalmer, along the right hand side of the Jaisalmer-Jodhpur Road (NH15); for key of symbols see Fig. 3.

ented suspension feeders), crinozoan arms with pinnules, crinoid ossicles, *Grammatodon*, *Pseudolima* and rhynchonellids (epi- and endobyssate suspension feeders). Also rich are the ichnospecies, *Rhizocorallium irregulare*, *Taenidium* (Fig. 10 (a)) and *Planolites*.

The basal bed of the facies is an impersistent intra-formational conglomerate, which records subaerial

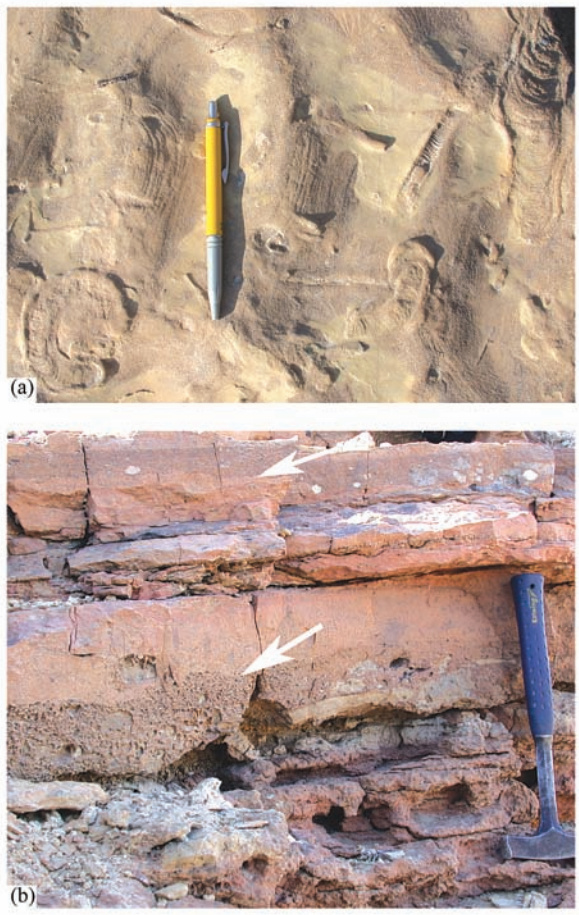

Fig. 10. (a) Close-up of the upper surface of bed No. 23, with intersecting oscillation ripples, straight to spiral *Rhizocorallium irregulare* and *Taenidium*, facies 4, Hamira Member, Jaisalmer Formation, upper part of the outlier section, 3 km N from the 13 km milestone from Jaisalmer on the Jaisalmer-Barmer National Highway (NH15). (b) Close up view of the storm and inter-storm intercalations, facies 4, Hamira Member, Jaisalmer Formation, upper part of the outlier section (locality is the same as that in Fig. 10 (a)). Note the erosional surfaces (arrowed).

exposure (evidenced from cracks of the pebbles filled with ferruginous material) followed by at least three storm-induced inundations of the basin that partly winnowed cemented siltstones of the underlying facies and redeposited them together with marine biotic components. The sharp erosive base and top corroborates the action of erosion due to storm activity providing evidence of the early transgression after a period of subaerial exposure. The characteristic features of the overlying sediments, i.e., beds of bioturbated silty calcareous mudstone to sandy packstone and silty calcareous mudstone interbeds, with sharp erosional bases and storm-beds, suggest alternations of low energy conditions and storm events. In this facies the carbonate component is greater than the siliciclastic. Although the biotic components (fossils) are not as

common as one would expect, they suggest a fully marine environment. Possibly, the facies represents a mixed siliciclastic- carbonate protected ramp. The upsection of this facies and increasing siliciclastic input towards the west and southwest (bed Nos. 2—4, Fig. 9) suggest fine-grained offshore sandy shoals.

3.5 Facies 5—Low angle cross-laminated silt to fine-grained sandstone

The facies (about 6 m thick) is exposed along the cliff-section of a scarp about 6 km E of Jaisalmer on the right hand side of the Jaisalmer-Jodhpur Road (NH15). This facies (bed Nos. 6—10, Fig. 9) is comparable to the underlying facies (No. 3) in terms of the alternation of siltstone and fine-grained sandstone units, except for its homogeneous low angle cross- laminated/bedded character, which is in contrast to the partly bioturbated nature of facies 3. The individual beds in general are well-sorted siltstone or fine- to medium-grained sandstone with sharp bases. No fossils have been recovered.

Exclusive low angle cross-bedded, well-sorted siliciclastic sediments suggest a nearshore shallow water above the fair-weather wave base, possibly sheet sands on a siliciclastic ramp where, because of wave action or currents, the coastal sediments were redistributed. Except for the alternating change in grain size that suggests fluctuating water energy, no other distinctive features can be discerned.

3.6 Facies 6—Storm-dominated, thick rudstone with mega ripples and reworked coral heads

This is the youngest unit observed in the present study exposed as a bed all around to the east and south-east of Jaisalmer, best seen about 4 km E of Jaisalmer on the right hand side of the Jaisalmer-Jodhpur Road (NH15). Stratigraphically, this is the oldest occurrence of the facies in the Jaisalmer Basin, the facies consisting of an about 65—100 cm thick, yellowish to red-brown, well-cemented, hard, ferruginous biorudstone unit, when weathered exhibiting to bedding, and directly overlying the sandstone of facies 4. The individual units within the rudstone are: a lower part with fining-upward shells (11.5 cm) topped by a sharp, uneven erosional surface; a thin shell-bearing unit (1 cm) also with an erosional top; a uniform concave-upward shell-bearing unit (20 cm); a middle part with a thick shell concentration with irregular pattern (8 to 15 cm) and with iron concentration along the erosional surface, which secondarily impregnated fractures; and an upper part the top of which shows megaripples, and reworked abraded and bored coral heads (5 to 46 cm in diameter) as well as abraded cobbles. The shells are more or less arranged parallel to the bedding surfaces. As noted above, the characteristic Bajocian coral *Isastraea bernardiana* was found in this unit[7].

The characteristic features of the unit such as a rudstone microfacies, reworked coral heads, erosional surfaces, graded beddings, and mega-ripples, suggest for amalgamated storm deposits. The unit can be assigned to a high-energy sediment of a late transgressive system tract. The facies represents the peak of first major marine transgression across the Jaisalmer Basin.

4 Conclusions

The oldest sediments exposed east of Jaisalmer display a continental to marine succession that starts with the terrestrial conglomerate and sandstone of facies 1 and sandstone of facies 2 (Odania Member, Lathi Formation) and such as is commonly seen in any shelf basin with rise of sea-level. During this early Jurassic period the climate was warm and humid.

Deposition of facies 4 (Hamira Member, Jaisalmer Formation) indicates an increase in the intensity of the transgression. There was yet another phase of stillstand when the periodic wave and current action redistributed the sediments and then facies 5 was deposited. The last facies 6 with its storm-dominated rudstone is the topmost bed of the Joyan Member (Late Bajocian) of the Jaisalmer Formation, deposited at the peak of this first major marine transgression across the Jaisalmer Basin.

Of these six facies of the lower sedimentary succession exposed east of Jaisalmer, described here for the first time, only the upper four are the result of marine inundation and have been recorded only around east and south of Jaisalmer; they have not been recorded elsewhere on the Rajasthan Shelf. Consequently, the oldest sediments of the Jaisalmer Basin, i.e. the area west of the Bikaner-Nagaur Basin and the Pokharan-Nachna High, and north of the Barmer-Sanchor basins, belong to Thaiat Member of the Lathi Formation (facies 3), which overlie the Odania Member of the Lathi Formation (facies 2) of wide lateral extension on the Rajasthan Shelf.

Acknowledgements We thank Mr. Abhishek Shah and Miss Deepali Kashyap for field assistance. Administrative support from the Department of Geology, University of Rajasthan is gratefully acknowledged. The manuscript was finalised at NIGPAS, Nanjing, Chinese Academy of Sciences.

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