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Genetic sequence stratigraphy on the basis of ichnology for the Middle Jurassic basin margin succession of Chorar Island (eastern Kachchh Basin, western India)

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Abstract

Synrift basin margin successions are greatly influenced by eustatic sea level changes, tectonics and accommodation space filled in by sediments. The Middle Jurassic (Bajocian–Callovian) of Chorar Island (western India) comprises a ~109-m-thick synrift basin margin succession of clastic, non-clastic and mixed siliciclastic-carbonate rocks which are here analysed and categorised into nine lithofacies. The succession is bioturbated to varying intensities; 16 identified ichnogenera can be assigned to environmentally related groups of five trace fossil assemblages, which include *Gyrochorte*, *Hillichnus*, *Rhizocorallium*, *Skolithos* and *Thalassinoides*. These ichnoassemblages document the *Skolithos* and *Cruziana* Ichnofacies which marks a change in energy conditions, sedimentation dispersal patterns and bathymetry in a shallow-marine environment. The Bajocian–Callovian succession is further analysed on the basis of sedimentological and ichnological data that show two genetic sequences consisting of Transgressive Systems Tract and Highstand Systems Tract bounded by Maximum Flooding Surface. The synrift basin margin succession of the Middle Jurassic of Chorar Island shows cyclicity in deposition; the Bajocian–Bathonian succession represents progradational to retrogradational coastlines, while the Callovian succession documents an aggrading progradational coastline.

Key words: Synrift basin, Bajocian–Callovian, lithofacies, ichnofacies, base level

1. Introduction

The accommodation history of rift basins is strongly linked to their mechanical subsidence regime with episodic pulses of extension that create space for sediment accumulation at very fast rates (Martins-Neto & Catuneanu, 2009). A sequence-stratigraphical model for rift basin defines the dominant stratigraphical patterns that are commonly encountered in tectonic settings and provides a framework for understanding the process-response relationship between controls on accommodation and the resultant stratigraphical architecture of rift basins (Martins-Neto & Catuneanu, 2009).

The Kachchh Basin in western India is a peri-continental embayment in an east-west-trending graben between the Nagar Parkar-Allah bund and North Kathiawar faults, which is filled by synrift sedimentary rocks within two major cycles: a transgression with the opening of the rift and a regression with rift failure during the Late Cretaceous (Biswas, 1999). The Jurassic strata formed in a shallow-marine, inner-shelf environment during transgression (Biswas, 1999), where normal faults controlled the creation of accommodation space for syntectonic deposition in a rift basin (Biswas, 1983, 2005).

The basin margin successions have been studied by various workers for their lithostratigraphy

(Biswas, 1971, 1977, 2016; Fürsich et al., 2001) and structure and tectonics (Biswas, 1983, 2005). Several workers have also studied the palaeoenvironment of these successions using different approaches such as palaeontology (Guha, 1977; Khosla et al., 2003), ichnology (Howard & Singh, 1985; Shringarpure, 1986; Kulkarni & Ghare, 1991; Fürsich, 1998; Patel et al., 2008, 2009, 2014; Joseph et al., 2012a; Darngawn et al., 2018) and sedimentology (Patel et al., 2010; Joseph et al., 2012b). Attempts have also been made to analyse the succession on the basis of sequence stratigraphy (Patel et al., 2010, 2013; Patel & Joseph, 2012).

The Mesozoic succession of the Kachchh Basin consists mainly of rift-filled deposits exposed in isolated patches and ranging in age from Aalenian to Albian (Biswas, 2016). Chorar Island is an isolated subbasin along the strike of the Island Belt Fault, comprising Bajocian to Callovian deposits. The present paper is focused mainly on an analysis of sedimentological and ichnological data for the synrift succession of Chorar Island (eastern Kachchh Basin), in order to deduce the genetic cycles and also discuss the implications of global eustatic sea level during the Bajocian to Callovian stages. The sedimentological and ichnological data will throw light on the dominant process and the process response of Middle Jurassic strata with respect to global sea level within the subbasin.

2. Geological setting

Chorar Island lies in the easternmost part of the island belt zone of the Kachchh Basin between latitude N 23°41'06" to N 23°57'00" and longitude E 71°00'55" to E71°18'36", in the Patan District of Gujarat (Fig. 1) along the strike of the Island Belt fault. The east-west-trending Island Belt Fault (IBF) forms a series of horsts and grabens in the northern part of the Kachchh Basin, consisting of four major uplifts in the form of the Patcham, Khadir, Bela and Chorar islands (Biswas, 2005). This uplift exposes the basin margin synrift succession of Middle Jurassic age recorded here. The succession in Chorar Island is characterised by distinct and unique facies associations that have recently been described with detailed data on stratigraphy and sedimentology by Patel et al. (2018) and on ichnology by Darngawn et al. (2018).

Chorar Island, on the eastern flank of the basin, contains strata that range in age from the Bajocian to Callovian and comprises the Khadir and Gadhada formations. A shale-dominated sequence of the Hadibhadang Shale Member is exposed at the base of the succession and is overlain by a mixed siliciclastic-carbonate-dominated Hadibhadang Sandstone Member of the Khadir Formation. The top of the Hadibhadang Sandstone Member is characterised by coralline limestone which is equivalent to the Raimalro Limestone Member of the Goradongar Formation (Biswas, 2016) and the Patcham Formation of Fürsich et al. (2013). The whole succession is capped by the Ratanpur Sandstone Member of the Gadhada Formation (Biswas, 2016; Patel et al., 2018) which consists of thickly bedded, ferruginous sandstone, with cross-bedded white sandstone and thinly bedded mudstone and shales.

3. Sedimentology and ichnology

The Middle Jurassic succession (Fig. 5) of Chorar Island is exposed in discontinuous and isolated patches and comprises a ~109-m-thick succession of the Khadir Formation (Hadibhadang Shale and Hadibhadang Sandstone members) and the Gadha-

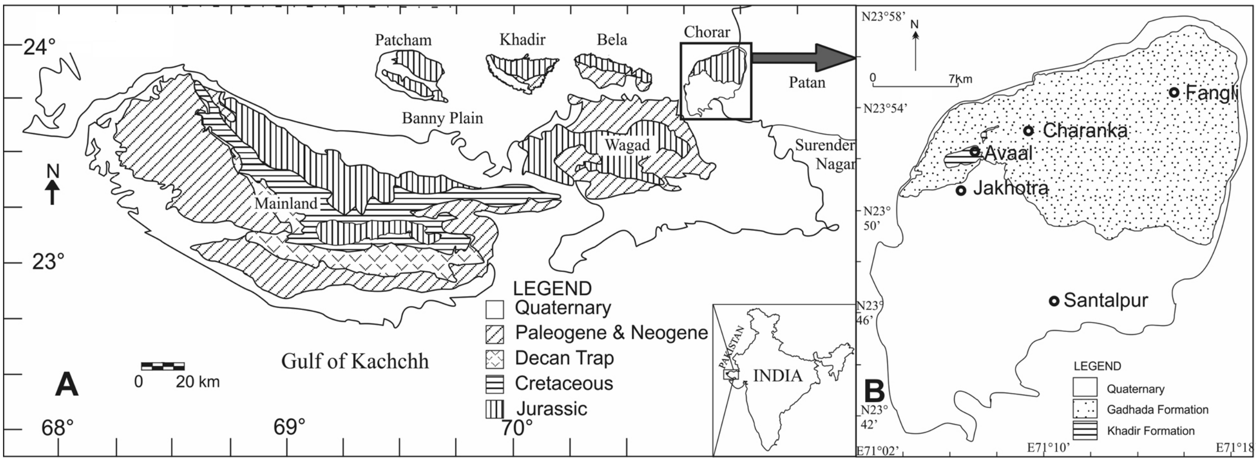

Fig. 1. Location and geological map of Chorar Island

da Formation (Ratanpur Sandstone Member). Our sedimentological analysis has demonstrated nine lithofacies, viz., a ferruginous sandstone, a cross-bedded white sandstone, an allochemic sandstone, mudstone, a coralline limestone, a sandy allochemic limestone, a micritic sandstone, a sandy micrite and a shale facies (Patel et al., 2018). The ferruginous sandstone, cross-bedded white sandstone and micritic sandstone facies are moderately bioturbated, while the sandy allochemic limestone facies is relatively more bioturbated and yields sixteen identifiable ichnogenera (*Arenicolites*, *Asterosoma*, *Curvolithus*, *Didymaulichnus*, *Diplocraterion*, *Gyrochorte*, *Halopoa*, *Hillichnus*, *Lockeia*, *Megagrapton*, *Palaeophycus*, *Planolites*, *Protovirgularia*, *Rhizocorallium*, *Skolithos* and *Thalassinoides*) (Darngawn et al., 2018), which document a moderate diversity in behaviours (i.e., dwelling, feeding and crawling). The characteristic set of an environmentally related group of trace fossils also revealed five ichnoassemblages representing the *Skolithos* (*Skolithos* assemblage) and *Cruziana* (*Gyrochorte*, *Hillichnus*, *Rhizocorallium* and *Thalassinoides* assemblages) ichnofacies. Each ichnoassemblage is characterised by a particular suite of trace fossils that reflect unique hydrodynamic conditions, substrate consistency and bathymetry (Joseph et al., 2012a) during deposition.

The micritic sandstone (siliciclastic: 65–70 per cent, Rx: 5–10 per cent, Micrite: 20 per cent) attains a thickness of +13.3 m, is grey to brownish in colour and characterised by cross-bedding and ripple marks, as has been observed in the Hadibhadang Sandstone and Hadibhadang Shale members. The Micritic Sandstone of the Hadibhadang Sandstone Member yields *Halopoa* (Fig. 2A), *Palaeophycus* (Fig. 2B), *Rhizocorallium*, *Thalassinoides* (Fig. 2C) that form the *Thalassinoides* ichnoassemblage.

The sandy allochemic limestone, 1–2 m thick, is a bright yellow-coloured mixed siliciclastic-carbonate rock, as observed in the Hadibhadang Sandstone

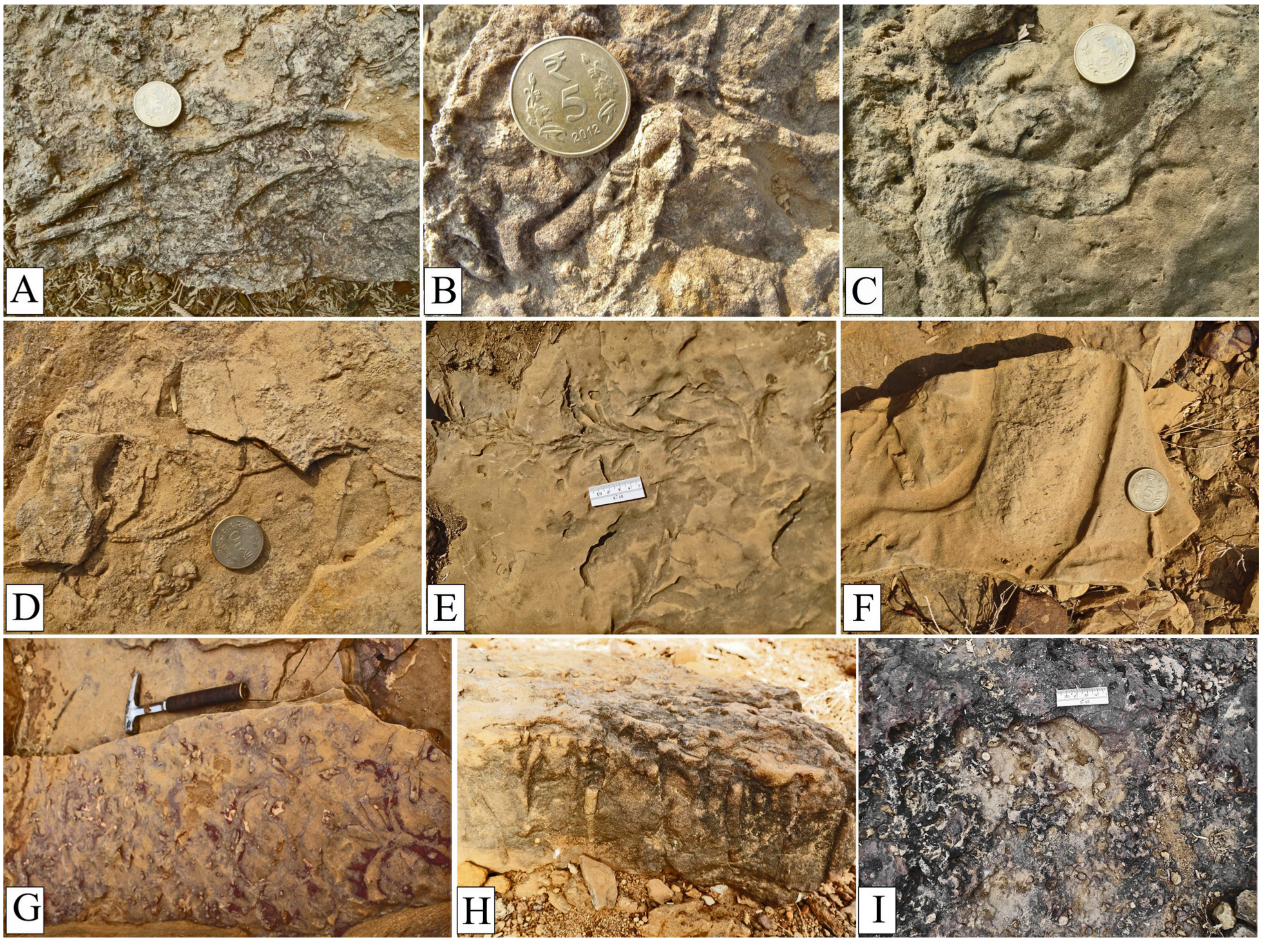

Fig. 2. A – *Halopoa*; **B –** *Palaeophycus*; **C –** *Thalassinoides* of the micritic sandstone facies of the Hadibhadang Sandstone Member (top view); **D –** *Gyrochorte*; **E –** *Hillichnus* (scale bar equals 50 mm); **F –** *Rhizocorallium*; **G –** *Thalassinoides* at sediment-sediment interface in the sandy allochemic limestone facies of the Hadibhadang Sandstone Member (top view); **H –** *Skolithos* in the cross-bedded white sandstone facies (side view); **I –** *Skolithos* in the ferruginous sandstone facies of the Ratanpur Sandstone Member (top view; scale bar equals 50 mm)

Member of the Khadir Formation. The carbonate component (allochems: 35–40 per cent, micrite: 15–20 per cent) exceeds the siliciclastic (35–40 per cent) component. This unit is highly fossiliferous and yields bivalves (*Trigonia*, *Corbula* and *Gervinella*), algae, echinoid spines, foraminifera and brachiopods and is also bioturbated in nature. This facies recurs in time and is preferentially bioturbated by a variable number and types of organisms that produced *Arenicolites*, *Asterosoma*, *Didymaulichnus*, *Gyrochorte* (Fig. 2D), *Halopoa*, *Hillichnus* (Fig. 2E), *Lockeia*, *Megagrapton*, *Palaeophycus*, *Planolites*, *Protovirgularia*, *Rhizocorallium* (Fig. 2F) and *Thalassinoides* (Fig. 2G). The distinct occurrence of trace fossils in different bands allows the distinction of four assemblages, namely: *Hillichnus*, *Rhizocorallium*, *Gyrochorte* and *Thalassinoides*. The *Hillichnus* assemblage consists mainly of *Hillichnus* and *Protovirgularia*; the predominance of *Hillichnus*, illustrating a complex deposit-feeding behaviour produced by tellinoid bivalves (Bromley et al., 2003) and crawling structures such as *Protovirgularia* made by bivalves (Carmona et al., 2010). The *Rhizocorallium* assemblage comprises mainly *Arenicolites*, *Asterosoma*, *Didymaulichnus*, *Lockeia* and *Rhizocorallium*, documenting a predominance of deposit feeders such as polychaetes (Chamberlain, 1977), worms (Pemberton, 2001), gastropods (Hakes, 1985), bivalves (Seilacher, 1953) and crustaceans (Seilacher, 2007), respectively; these indicate well-oxygenated, nutrient-rich soft substrates. The *Gyrochorte* assemblage encompasses mainly dwelling structures of the *Arenicolites* and *Palaeophycus* (Osgood, 1970) and feeding structures such as *Gyrochorte*, *Megagrapton* and *Planolites*, made by worm-like producers (de Gibert & Benner, 2002; Knaust, 2013) at the sediment-sediment and sediment-water interface in oxygenated sediments. The *Thalassinoides* assemblage consists of *Rhizocorallium*, *Halopoa* and *Palaeophycus*, with *T. horizontalis* and *T. paradoxicus*; *Thalassinoides* is frequently related to oxygenated settings (Savrda & Bottjer, 1986) and is produced by decapod crustaceans (Myrow, 1995). The predominance of deposit feeders indicates that the sandy allochemic limestone was a well-oxygenated and nutrient-rich substrate (Bromley & Frey, 1974; Kern & Warme, 1974).

The allochemic sandstone facies (Ratanpur Sandstone Member) is light brown to dirty yellow in colour, with bed thicknesses of 0.5 m, comprising of 60 per cent siliciclastic and 40 per cent of carbonate material (allochems, 30 per cent and micrite 10 per cent).

The Mudstone facies (Dunham, 1962) is also recognised in the Ratanpur Sandstone Member and is characterised by greyish to brown-coloured, with thin intercalations of shales. It shows less than 5 per cent of allochems (micritised bioclasts).

The Coralline limestone facies of the Hadibhadang Sandstone Member of the Khadir Formation is grey to dirty yellow in colour and attains a maximum thickness of about 2 m. It yields bivalves and large corals which are diagenetically modified and form large calcite crystals, having lost their internal structures. Siliciclastic components constitute about 5–10 per cent of quartz grains which are fine grained, angular and poorly sorted, indicating negligible clastic influx.

The Sandy micrite facies (siliciclastic: 30–40 per cent, allochems: 10–20 per cent, micrite: 30–40 per cent) is observed in the Hadibhadang Sandstone Member of the Khadir Formation, characterised by blackish coloured, cross-bedded and planar, laminated intercalated with shales. The shale is characterised by a grey colour and is gypseous, occurring as intercalations in the Ratanpur Sandstone, Hadibhadang Sandstone and Hadibhadang Shale members.

The cross-bedded white sandstone and ferruginous sandstone facies are observed in the Ratanpur Sandstone Member of the Gadhada Formation. The former facies is friable, off-white to yellowish in colour and characterised by cross-bedding, pinching towards the western side of the dome. It shows an increase in calcareous matrix and hence represents a micritic sandstone facies. The cross-bedded white sandstone facies is also bioturbated in nature and yield trace fossil genera such as *Skolithos*, *Planolites* and *Thalassinoides*, representing the *Skolithos* assemblage. The ferruginous sandstone facies is dark red to brownish in colour, characterised by different types of ripple marks and cross bedding and containing body fossils of bivalves and gastropods, as well as fossilwood. It is moderately bioturbated and yields ichnogenera such as *Arenicolites*, *Diplocraterion*, *Palaeophycus* and *Skolithos* (Fig. 2H), representing the *Skolithos* assemblage. This assemblage is dominated by vertical dwelling burrows of opportunistic suspension feeders which were made in unconsolidated, poorly sorted, shifting-substrate sediments in high-energy settings (Seilacher, 1967; Pemberton & MacEachern, 1995).

The Sandy allochemic limestone and micritic sandstone facies of the Hadibhadang Sandstone Member of the Khadir Formation are dominated by cylindrical, branched to unbranched, large-sized, horizontal endichnial/hypichnial structures such as *Asterosoma*, *Curvolithus*, *Didymaulichnus*, *Gyrochorte*, *Halopoa*, *Lockeia*, *Planolites*, *Palaeophycus*, *Protovirgularia*, *Rhizocorallium* and *Thalassinoides*. The T-shaped or curved Y-shaped, branched *Thalassinoides* is considered a typical member of the *Cruziana* Ichnofacies (Seilacher, 1967), colonising under reduced energy conditions in shallow-marine environments. The *Cruziana* Ichnofacies indicates low to moderate energy conditions and unconsolidated, poorly sorted, soft substrates and plenty of organic detritus in shallow-water marine settings (Pemberton et al., 2001). The ferruginous sandstone facies and cross-bedded white sandstone facies contain ichnogenera such as *Arenicolites*, *Diplocraterion*, *Planolites* and *Skolithos* (Fig. 2I); these are typical members of the *Skolithos* Ichnofacies. The fine- to coarse-grained clastic sedimentary rocks, the presence of cross-bedding and the predominant occurrence of vertical burrows indicates unconsolidated, poorly sorted, moderate to high wave and current energy conditions and shifting substrates that were exploited by opportunistic animals in middle shoreface environments (Pemberton et al., 2001).

4. Sequence stratigraphy

A model-dependent workflow has been considered in order to assess the relatively conformable succession of Chorar Island. The genetic sequence-stratigraphical model (Galloway, 1989) is considered with maximum flooding surfaces (MFS) as sequence boundaries. This model is independent of subaerial unconformity and recognises the importance of separating forced regressive, normal regressive (lowstand and highstand) and transgressive deposits as distinct genetic units (Catuneanu et al., 2009). The Chorar Island succession lacks Lowstand Systems Tract (LST) and shows retrogradation with flooding surface in Transgressive Systems Tract (TST), overlain by a progradational Highstand Systems Tract (HST), suggesting a typical rift sequence rather than sequence developed in a tectonically stable basin (Martins-Neto & Catuneanu, 2009).

4.1. Genetic sequence stratigraphy

The Middle Jurassic synrift succession of Chorar Island shows a major base level rise with a minor fall at the end of the Bajocian. It comprises one major sequence of approximately 6 myr, of 2nd order hierarchy, which is further subdivided into two cycles of 3rd order genetic sequence of 3 myr each (Vail et al., 1991; Catuneanu, 2006) separated by Flooding Surface (FS) at the end of the Bathonian. It comprises TST-I and HST-II, where LST-I is absent due to a lack of exposure in Chorar Island. However, LST has been observed in the neighbouring Khadir Island along the strike of the Island Belt Fault where the succession is characterised by polymictic conglomerate deposits of an alluvial fan environment (Biswas, 1993).

4.1.1. Trangressive Systems Tract (TST) – I

The TST-I, observed in the Hadibhadang Shale and Hadibhadang Sandstone members of the Khadir Formation, is represented by a thick intercalated sequence of shale with mixed siliciclastic-carbonate sedimentary rocks. The succession shows a gradual base level rise with a minor fluctuation at the end of Bajocian, represented by a ~23-m-thick argillaceous shale (Fig.3A) succession interrupted by cross-bedded micritic sandstone (Fig. 3B) in the Hadibhadang Shale Member. A further rise in the base level during the Bathonian resulted in deposition of a ~31-m-thick intercalated sequence of mixed siliciclastic-carbonate sediments which include sandy allochemic limestone, micritic sandstone and sandy micrite with shales and coralline limestone at the top of the Hadibhadang Sandstone Member.

The thick argillaceous shales overlain by micritic sandstone represent a gradual increase in the base level, interrupted by a short-term decrease in local accommodation space with a change in hydrodynamic conditions which allowed deposition of coarse-grained micritic sandstone towards the end of the Bajocian. Haq et al. (1988) and Ruban (2015) also depicted the worldwide gradual transgression during the Bajocian, with short-term changes as regression. The intercalated sequence of mixed siliciclastic-carbonate sediments indicates an increase in carbonate content. The carbonate precipitation and secretion by *in-situ* organisms (coral) during the Bathonian marks an increase in accommodation space which is also reflected in bioturbation patterns.

The sandy allochemic limestone facies, which overlies the micritic sandstone facies, is intensely bioturbated by *Hillichnus* (Fig. 3C). This facies recurs with time and is preferentially bioturbated within the systems tract with diverse trace fossil types of *Rhizocorallium*, *Gyrochorte* and *Thalassinoides* assemblages of the *Cruziana* Ichnofacies (Seilacher, 1967). The presence of *Hillichnus* in sandy allochemic sandstone indicates a shallow-marine environment (Ekdale & Ekdale, 2018), while the *Rhizocorallium* assemblage represents a shoreface to deeper marine environment (Worsley & Mørk, 2001). The *Gyrochorte* assemblage of rippled sandy allochemic limestone facies (Fig. 3D) represents the *Cruziana* Ichnofacies (Seilacher, 1967). It is also developed in the rippled, mixed carbonate-siliciclastic grainstones of a shallow, storm-dominated shelf (Picard & Uygur, 1982; Lord, 1985), suggesting further upward-deepening shoreface environments.

The *Thalassinoides* assemblage recurs and is observed in micritic sandstone and sandy allochemic limestone facies, documenting intense bioturbation at the sediment-sediment interface. This sandy allochemic limestone is thickly bedded and consists mainly of *Thalassinoides horizontalis* and *T. paradoxicus.* Intense bioturbation and the appreciable amount of siliciclastic-bioclastic material suggest that deposition took place in a lower shoreface environment (Joseph & Patel, 2015). Moreover, *Thalassinoides* burrows are frequently related to oxygenated settings and soft, yet fairly cohesive, substrates indicate a lower shoreface environment (Bromley & Frey, 1974; Kern & Warme, 1974).

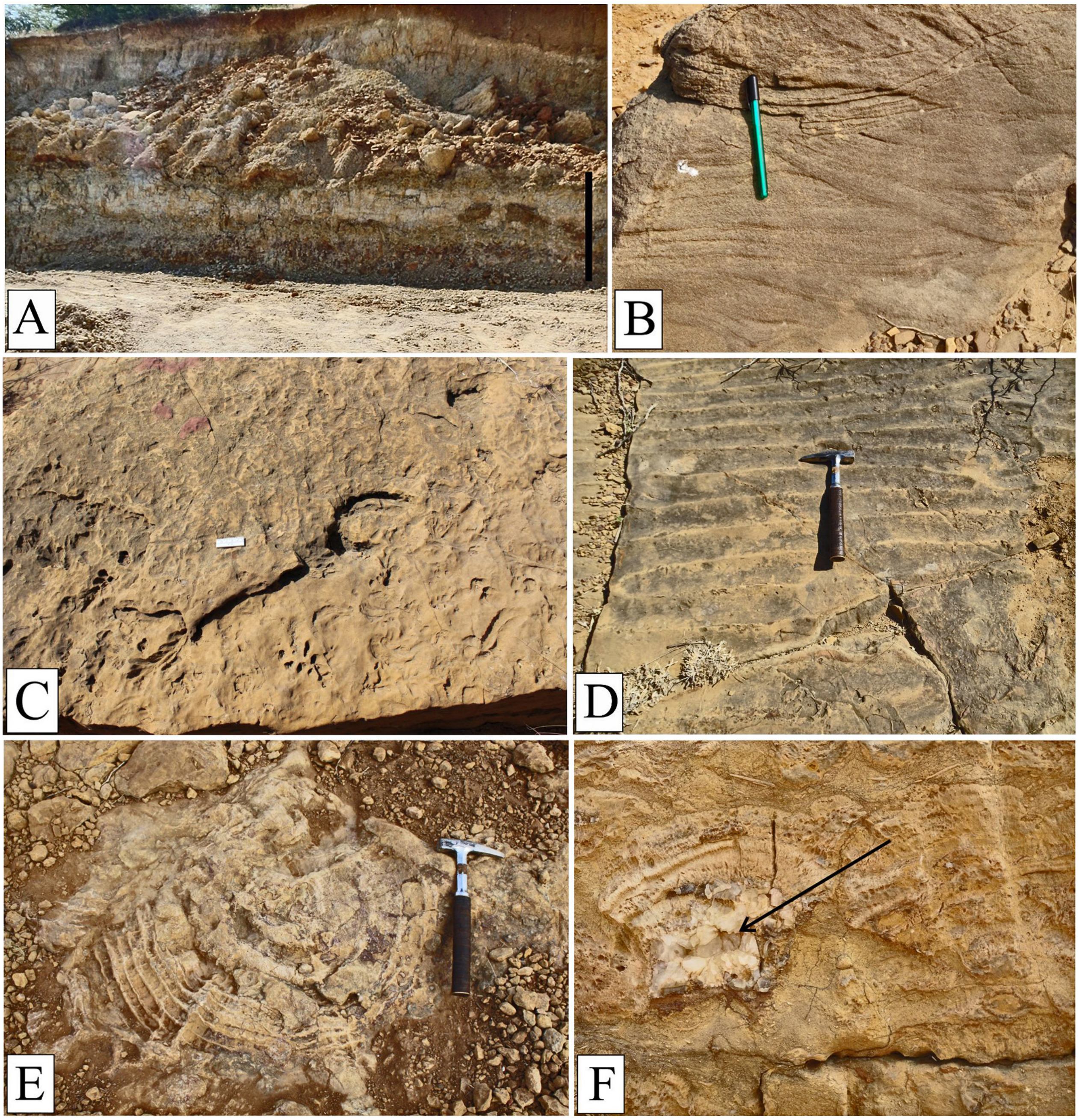

Fig. 3. A – Argillaceous shale, the oldest rock unit exposed in the core of the Chorar dome (scale bar equals 5 feet); **B –** Planar-trough, cross-bedded micritic sandstone facies marking a change in sediment influx towards the upper part of the Hadibhadang Shale Member; **C –** *Hillichnus*- bearing sandy allochemic limestone developed at the base of the Hadibhadang Sandstone Member, marking the onset of TST-II; **D –** Ripples in sandy allochemic limestone; **E –** Top view of large, well-preserved, *in-situ* coral on the bedding surface of coralline limestone at the close of TST-II; **F –** Vertical view of an *in-situ* coral skeleton with recrystallised large calcite crystals (arrow)

The sandy allochemic limestone of TST-I contains a variable amount of micrite and allochems with horizontal biogenic structures. These pieces of evidence indicate fluctuations of energy conditions and bathymetry in a shoreface environment, suggesting an increase in accommodation space forming aggradational deposits in a synrift basin margin succession.

The thickly bedded sandy allochemic limestone is overlain by the coralline limestone facies (2.7 m) that marks the top of TST-I. This facies is characterised by corals of large diameters (Fig. 3E, F) which

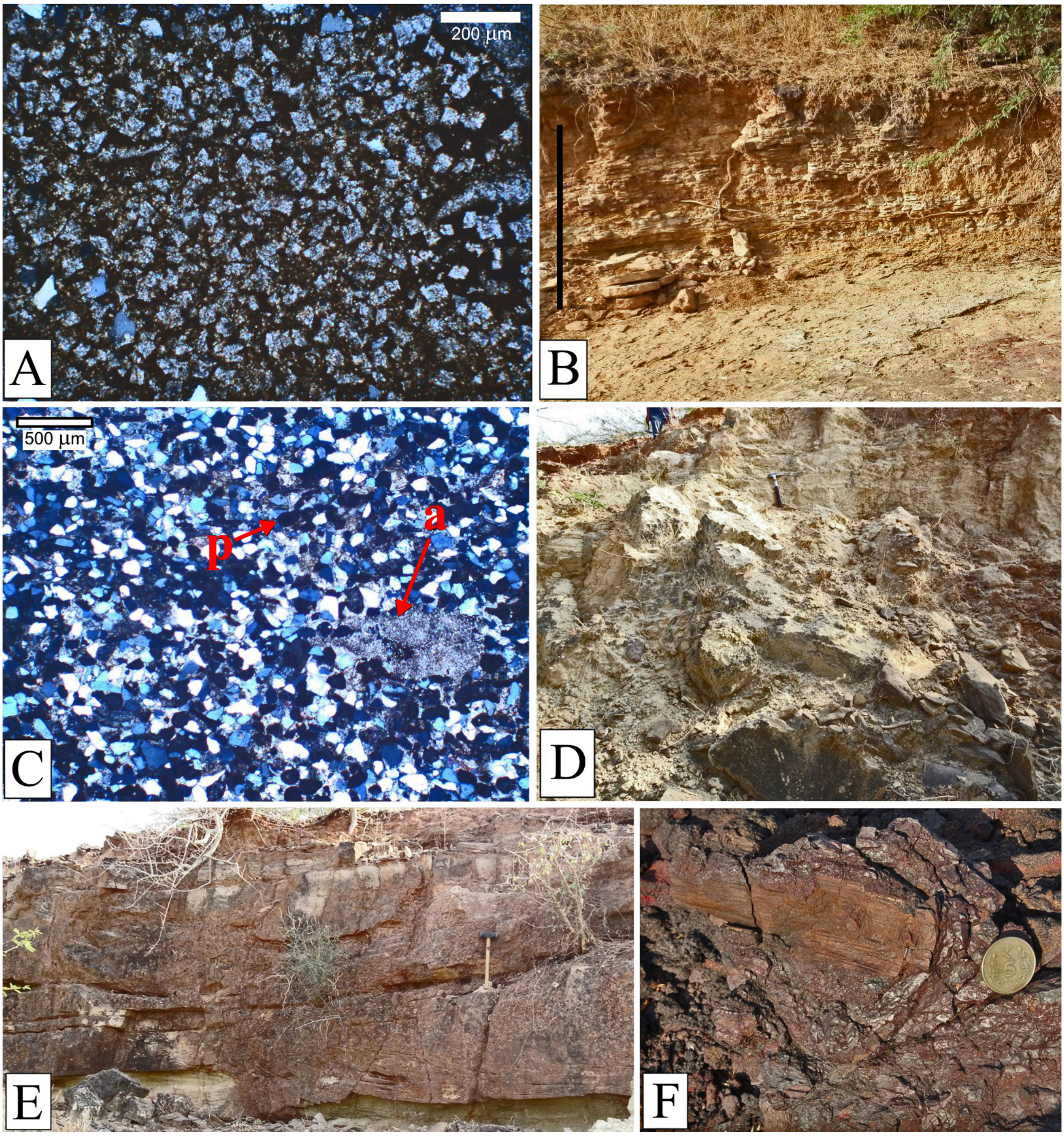

Fig. 4. A – Photomicrograph showing dolomite crystals in the coralline limestone facies at the top of the Hadibhadang Sandstone Member; **B –** Thinly bedded mudstone marking the flooding surface and onset of RST-II in the Ratanpur Sandstone Member (scale bar equals 150 cm); **C –** Photomicrograph of allochemic sandstone consisting predominantly of quartz along with allochems such as pellets (p) and algae (a), indicating a change in clastic influx; **D –** Aggrading, thickly bedded, cross-bedded white sandstone; **E –** Ferruginous sandstone facies containing fossilwood (**F**) of the Ratanpur Sandstone Member, marking the fall of base level

are sparitised and dolomitised (Fig. 4 A) with allochems including algae and shell fragments. The absence of primary sedimentary structures and well-developed corals with a negligible amount of clastic sediments suggest offshore environment. The coralline limestone that is overlain by thinly bedded mudstone facies (Fig. 4 B), intercalated with shales, representing calm and oxygenated offshore conditions, suggest a maximum sea level rise during the late Bathonian, marking the Flooding Surface (FS) that also coincides (Fig. 5) with the global sea level rise (Haq et al., 1988; Haq & Al-Qahtani, 2005). Thus, the TST-I represents aggradational deposits in a middle shoreface to offshore environment.

4.1.2. Highstand Systems Tract (HST)-II

HST-II is represented by a 55-m-thick succession of the Ratanpur Sandstone Member of the Gadhada Formation, of Callovian age. It comprises mudstone facies intercalated with argillaceous shale which is overlain by the allochemic sandstone facies, which in turn is overlain by the cross-bedded white sandstone and ferruginous sandstone facies of lower and middle shoreface environments, respectively.

The mudstone facies (Fig. 4B) is characterised by thinly bedded lime/carbonate mud, intercalated with shales, which indicate calm conditions of lower shoreface-offshore environments. The basal fine-grained succession that overlies the flooding surface indicates the onset of a progradational coast-

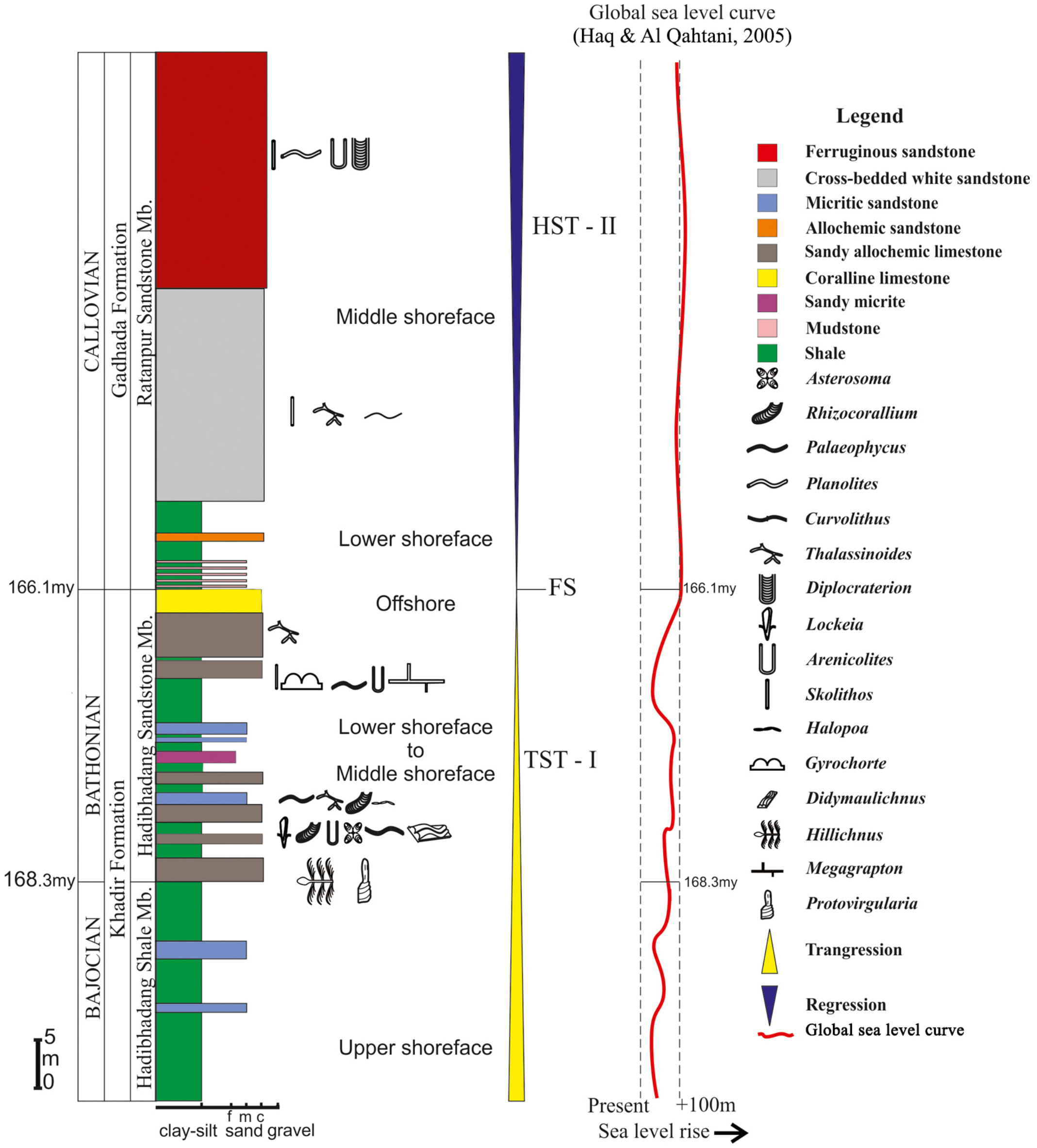

Fig. 5. Composite litholog of the Middle Jurassic succession of Chorar Island, showing representative facies and associated ichnofossil genera within each genetic cycle and corresponding to global sea level curve

line (Martins-Neto & Catuneanu, 2009), overlain by allochemic sandstone. This allochemic sandstone contains ~60 per cent of siliciclastic component with abundant pellets (Fig. 4C), suggesting an increase in clastic sediment supply in a tidally influenced shoreface zone and a reduction of accommodation space during the early Callovian and marking the beginning of HST-II (Fig. 5).

The allochemic sandstone facies is overlain by thick, friable, poorly sorted and bioturbated, cross-bedded white sandstone facies (Fig. 4D), which in turn is overlain by the cross-bedded ferruginous sandstone (Fig. 4E) facies that yields body fossils such as bivalves, gastropods, as well as driftwood (Fig. 4F) which are bioturbated at varying intensities. The predominance of vertical burrows (*Arenicolites*, *Diplocraterion* and *Skolithos*) in the *Skolithos* assemblage belonging to the *Skolithos* Ichnofacies (Seilacher, 1967) and indicating moderate to high-energy conditions in the middle shoreface (Pemberton et al., 2001).

The deposits of HST-II show a shallowing-upward sequence of lower- and middle shoreface environments, indicating a sea level drop during the Callovian. The intercalated sequence of mudstone and allochemic sandstone facies marks the onset of progradation, while the thick, cross-bedded, white and ferruginous sandstone facies and the associated trace fossils mark a drop in base-level during the Callovian. The HST-II represents a major progradation of the shoreline in the Chorar Island area during the Callovian, which does not coincide with the global sea level curve (Haq et al., 1988; Haq & Al-Qahtani, 2005). The development of a HST due to sediment supply that outpaced the accommodation space in a rift environment has been observed in the Gainsborough Trough (UK) in upper Namurian strata (Church & Gawthorpe, 1997). Hence, HST-II indicates a continuous creation of accommodation space within a synrift basin margin compensated by sediment supply outpacing the accommodation space and resulting in an aggrading thick clastic sequence (Fig. 5).

5. Conclusions

Our sedimentological and ichnological analysis of Chorar Island, the easternmost part of the Kachchh Basin which characteristically comprises shallow-marine synrift sediments of Middle Jurassic age, allows the following conclusions to be drawn.

Chorar Island (Kachchh Basin) comprises a ~109-m-thick Bajocian–Callovian succession that is characterised by bioturbated clastic, non-clastic and mixed siliciclastic-carbonate sedimentary rocks of shoreface-offshore environments. Sixteen ichnogenera document five ichnoassemblages that are represented by the *Skolithos* (*Skolithos* assemblage) and *Cruziana* (*Gyrochorte*, *Hillichnus*, *Rhizocorallium* and *Thalassinoides* assemblages) ichnofacies. Sedimentological and ichnological evidence has revealed two genetic cycles: TST-I and HST-II, separated by Flooding Surface (FS).

The Middle Jurassic synrift basin margin succession of Chorar Island displays two Genetic Cycles; TST-I marks a sea level rise during the Bajocian-Bathonian that matches the short-term global eustatic sea level curve, while HST-II (Callovian) represents a deviation from the global sea level curve due to abundant sediment supply that outpaced accommodation space.

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