



## DISCOVERY OF *THALASSINOIDES* BURROWS IN THE EDIACARAN JODHPUR SANDSTONE (=POKARAN SANDSTONE), MARWAR SUPERGROUP, POKARAN AREA, WESTERN RAJASTHAN

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### ABSTRACT

The paper records well-preserved *Thalassinoides* burrows in the Precambrian (Ediacaran) Jodhpur Sandstone (=Pokaran Sandstone) exposed near Pokaran township, Jaisalmer district. The burrows confirm the presence of soft-bodied benthic animals which could develop a mode of suspension feeding and burrowing in the Late Neoproterozoic era.

**Keywords:** *Thalassinoides*, burrows, Marwar Supergroup, Jodhpur Sandstone, benthic animals, Ediacaran age

### INTRODUCTION

Trace fossil *Thalassinoides* representing a branching burrow system is common in the Mesozoic and younger strata but poorly represented in the Palaeozoic (Myrow, 1995). Its presence in the Precambrian is still not confirmed. The paper records the presence of *Thalassinoides* burrows in the Jodhpur Sandstone (=Pokaran Sandstone) which has been assigned Ediacaran age on the basis of the stratigraphic position, body fossils and microbial mat structures. From the Artiya Kalan area, district Jodhpur, Raghav *et al.* (2005) have described two trace fossils *Skolithos* and *Planolites* from the lower part of the Jodhpur Sandstone. The *Thalassinoides* burrows confirm the presence of benthic community during the deposition of the Ediacaran Jodhpur Sandstone which must have been made by the soft-bodied primitive crustaceans.

### GEOLOGICAL SETTING

The Jodhpur Sandstone is an important lithostratigraphic unit of the Marwar Supergroup which occupies a large area in the western part of Rajasthan. The Pokaran Sandstone is the local name of the Jodhpur Sandstone in the Pokaran area. The Marwar Supergroup is developed west of the Aravalli mountain chain in a desert setting forming small hillocks (Fig. 1). It is represented by sandstone, conglomerate, siltstone, limestone and dolostone and shale. The rocks are unmetamorphosed and undeformed. The rocks are horizontal in most of the areas or show very low dips. The Marwar Supergroup unconformably overlies the Malani Igneous Suite which has been dated as  $771 \pm 5$  Ma (Gregory *et al.*, 2009) by U-Pb method. The Marwar Supergroup has been subdivided into the Jodhpur Group, the Bilara Group and the Nagaur Group. Each group has been further subdivided into different formations (Table 1). The Jodhpur Group has been subdivided into the Pokaran Boulder Bed, the Sonia Sandstone and the Girbhakar Sandstone (Pareek, 1981, 1984) but Chauhan *et al.* (2004) has merged the Sonia Sandstone and the Girbhakar Sandstone under the Jodhpur Sandstone. The Pokaran Boulder Bed is 4m thick and is developed only in the western part of the basin around Pokaran where it unconformably overlies the Malani Igneous Suite. In rest of the area, the Jodhpur Sandstone directly

overlies the Malani Igneous Suite (Pareek, 1981, 1984; Chauhan *et al.*, 2004). The Jodhpur Sandstone has yielded the Ediacaran fossils (*Hiemalora*, *Aspidella*, *Arumberia banksi*, *Rameshia rampurensis* and *Marsonia artyansis*) and has been assigned the Ediacaran age (Raghav *et al.*, 2005 and Kumar and Pandey, 2009). Since it overlies the Malani Igneous Suite, it appears to be younger than 771 Ma. As it lies about 500 m below the Nagaur Sandstone of the Nagaur Group which has yielded an assemblage of trace fossils dominated by *Cruziana* and *Rusophycus* of the Lower Cambrian age (Kumar and Pandey, 2008, 2010), it has to be older than Lower Cambrian. Thus, the Jodhpur Sandstone can be assigned the Ediacaran age on the basis of the stratigraphic position and fossil assemblage.

The Jodhpur Sandstone has been locally referred to as the Pokaran Sandstone in the Pokaran area (Chauhan *et al.*, 2001). It overlies the Pokaran Boulder Bed. It is represented by fine to medium-grained, reddish brown sandstone and red to maroon shaly sandstone showing well developed large-scale cross bedding (Pl. I, fig.B). Both planar and trough cross beddings with southwesterly current direction have been noted. The sandstone shows sharp contact with the underlying conglomerate.

The *Thalassinoides* burrows are recorded in the calcareous sandstone adjacent to an important land mark near Pokaran township, locally known as *Teen Chattariyan* (Pl. I, fig. A). The horizon is only one meter thick and is marked by colour mottling, a visual sign of bioturbation. The burrows are marked by relatively light-coloured sandstone, while the host rock is reddish brown. The exposure is seen on a small mound near a nala cutting whose GPS value is N26°56.250'; E 71°54.101'. The lithocolumn of the burrow-bearing horizon is given in Fig.2. The samples of the *Thalassinoides* burrows are deposited in the Museum of the Department of Geology, University of Lucknow, Lucknow.

### THALASSINOIDES BURROWS

The *Thalassinoides* (Häntzschel, 1975) burrows are represented by the cylindrical tubes forming 3-D branching system consisting of horizontal networks connected to surface by more or less vertical shafts (Pl. I, figs. C, D & E). The

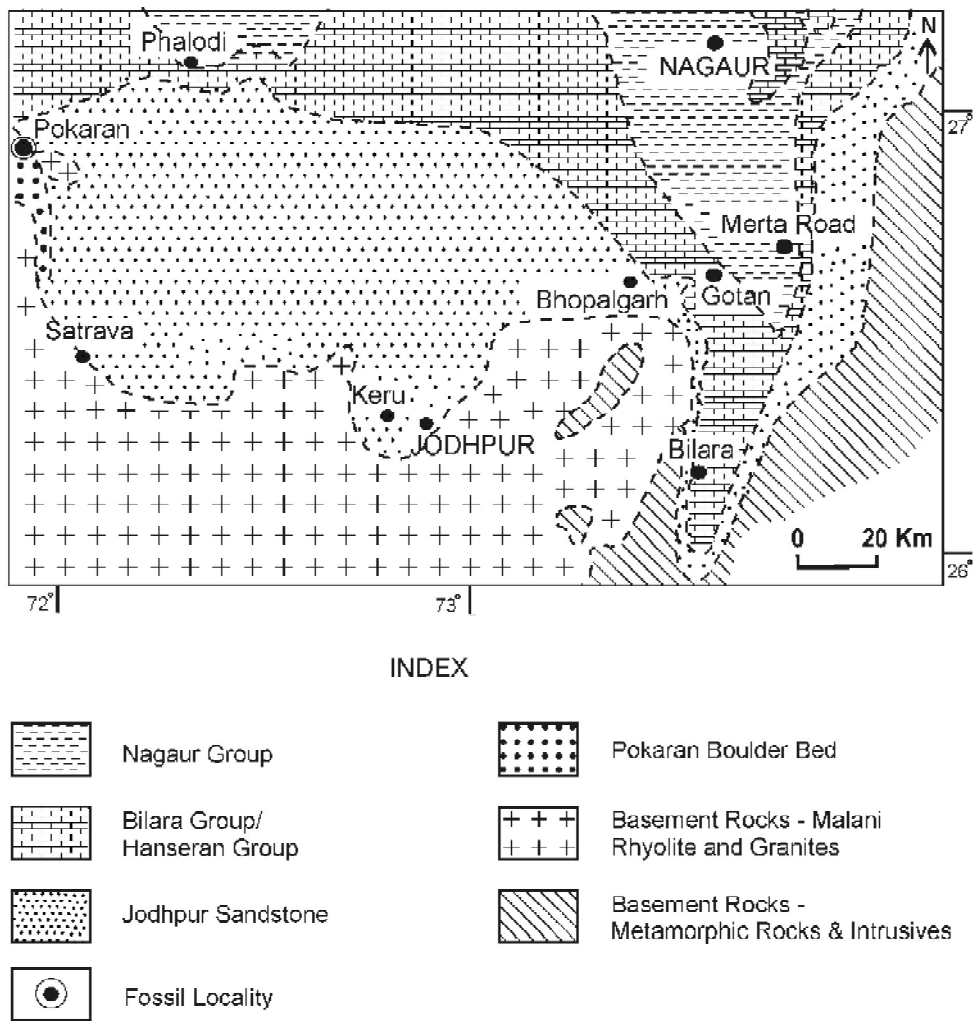
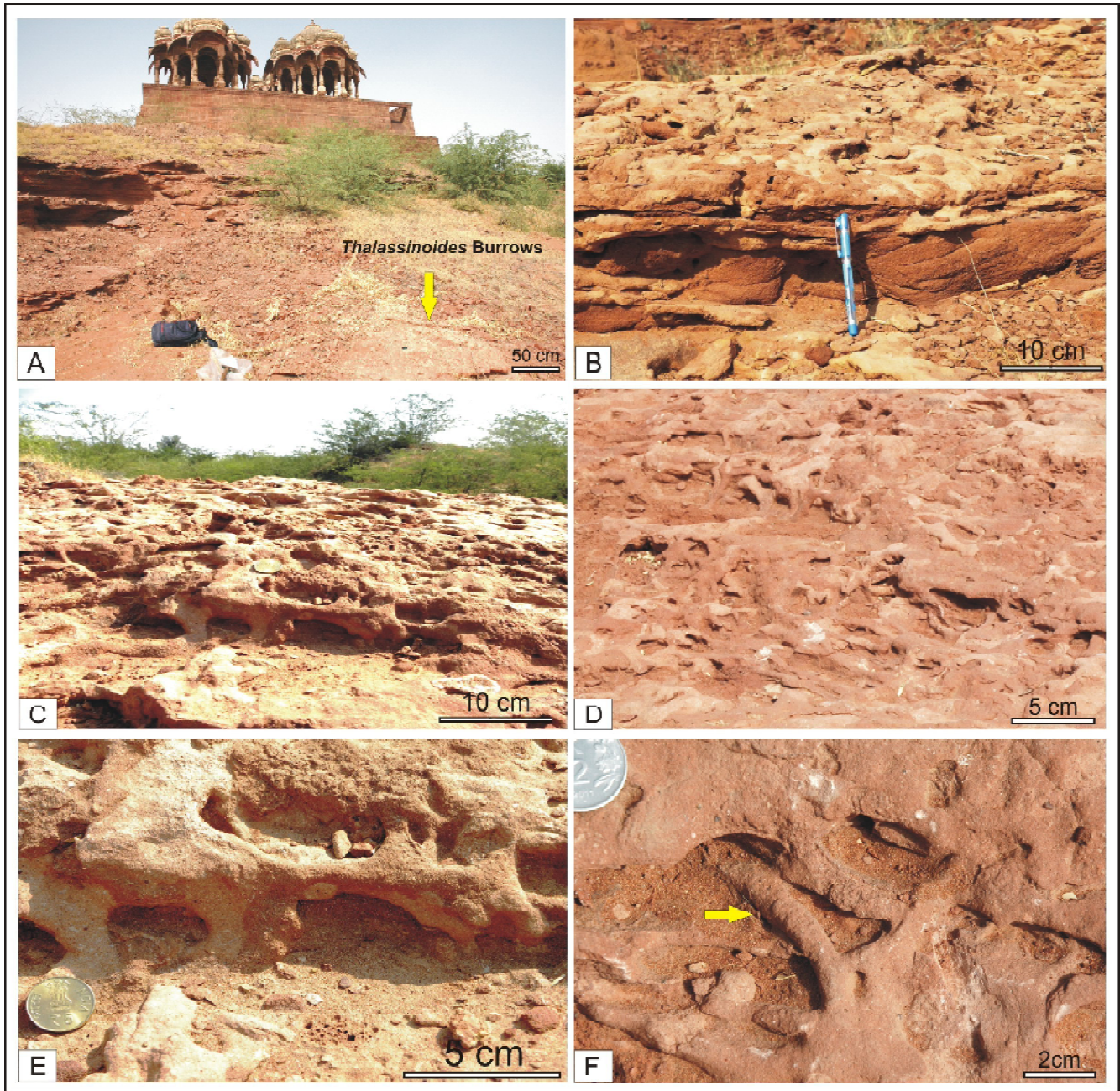


Fig. 1. Geological map of the Pokaran area, western Rajasthan (after Pareek, 1984).

**Table 1. Stratigraphic succession of the Marwar Supergroup (modified after Pareek (1981, 1984; Chauhan *et al.*, 2004).**

	Supergroup	Group	Formation
↑ Late Neoproterozoic to Early Cambrian ↓	↑ MARWAR SUPERGROUP ↓	Nagaur Group (75-500 m)	Tunklian Sandstone Nagaur Sandstone
		Bilara Group (100-300 m)	Pondlo Dolomite Gotan Limestone Dhanapa Dolomite
		Jodhpur Group (125-240)	Jodhpur Sandstone Pokaran Boulder Bed
		~~~~~ Unconformity ~~~~~	
		Basement	Malani Igneous Suite/Aravalli Rock



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### EXPLANATION OF PLATE I

A-F. Field photographs of *Thalassinoides* burrows in the Pokaran area, district Jaisalmer, Rajasthan. A, Photograph shows the fossil-bearing horizon near *Teen Chattariyan* (local name of the place), Pokaran-Jaisalmer highway. B, The Pokaran Sandstone showing cross-bedding in the lower part and *Thalassinoides* burrows in the upper part. C, Photograph shows “Y” and “T” shaped branching patterns in the burrows. D, Photograph shows *Thalassinoides* burrows. E, Photograph shows horizontal tunnels and vertical shafts. F, Photograph shows the transverse scratch marks on the wall of *Thalassinoides* burrow, as shown by the arrow.

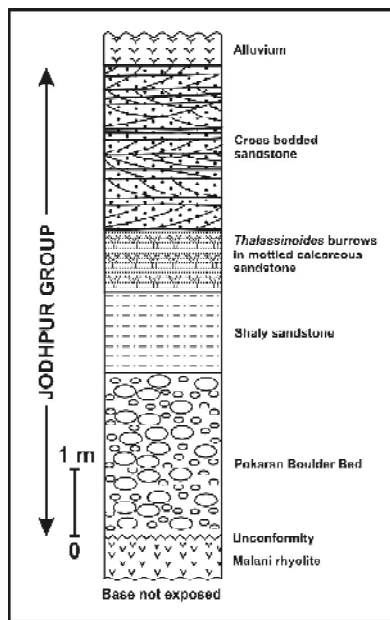


Fig. 2. Lithocolumn of the *Thalassinoides*-bearing horizon, Pokaran area, western Rajasthan. The lithology of the area is represented by Pokaran Boulder Bed overlain by the shaly sandstone and medium to fine-grained cross-bedded sandstone. The *Thalassinoides*-bearing horizon is represented by calcareous sandstone.

burrows are up to 15 cm in length and 7 mm to 20 mm in diameter. The cross-section is circular to elliptical. Branching is well marked and both “Y” and “T” shaped bifurcation recorded (Pl. I, figs. C, D & E); swells at the point of branching are also noted. Burrows chiefly consist of horizontal tunnels that bifurcate at an angle of 60° to 90°. Burrows are horizontal with respect to the bedding plane. In some of the outer surfaces of the burrows, transverse markings are well preserved (Pl. I, fig.F). The texture and colour of the sediments constituting the burrows and the host rock differ. The burrows are light coloured and their relative grain size is less in comparison to the grain size of the host rock which shows darker brownish colour.

## DISCUSSION

In the modern environment, a number of marine organisms most importantly decapods crustaceans, produce *Thalassinoides* burrows. The decapod crustaceans have been known only since Devonian (Myrow, 1995). Thus, their presence in the Ediacaran period is completely ruled out, but these burrows confirm the presence of possibly similar soft-bodied animals which produced burrows for living and were suspension feeders. Only one pocket could be located where such burrows have been produced and at this place the lithology is represented by the calcareous sandstone whose

mean grain size is 0.25 mm (N=100). It shows well-preserved bioturbation. It appears that the calcareous nature of rock helped in the preservation of the burrow system. The presence of *Thalassinoides* burrow in the Jodhpur Sandstone suggests that the soft-bodied animals representing primitive crustaceans with stiffer legs had already evolved to act individually for burrowing and also developed a dwelling habit at the beginning of the deposition of the Jodhpur Sandstone (=Pokaran Sandstone) at ca. 600 Ma. The detailed work is under progress.

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