

## SCRUTINY OF THE EARLIEST RECORDS OF BIOGENIC SEDIMENTARY STRUCTURES FROM THE PROTEROZOIC ROCK FORMATIONS OF THE INDIAN SHIELD

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**Earliest reports of seeming biogenic structures from the Proterozoic sediments of the Indian Shield include ridges on lower bedding planes of the Soniya Sandstone, indeterminate markings on the Sirbu Shale, and a spiral marking from the Rohtas Limestone. However, any suggestion of an affinity of the specimens both from the Soniya Sandstone and the Sirbu Shale with trilobites cannot be sustained. Field and laboratory studies by the present authors led to the conclusion that the thin ridges on the Soniya Sandstone slabs are casts of rill marks, while the thick swellings comparable to *Cruziana furcifera* are load casts. The indeterminate structures on the Sirbu Shale are mere crack-fillings. The spiral marking from the Rohtas Limestone likewise is not a trace fossil. Hofmann has shown it to be *Grypania spiralis*, a Proterozoic alga.**

### Introduction

The first discovery of a seeming organogenic structure from any Proterozoic sediment from the Indian Peninsular shield was by La Touché (1902) from near Osiyan, Jodhpur district, on sandstone, which he referred to as the 'Vindhyan of western Rajputana'. Vredenburg (1908) not only identified chordophyceous remains among the specimens collected by La Touché, but also reported indeterminate organic markings from the Sirbu Shale (Bhander Group, Vindhyan Supergroup) in the Raisen district. Later, Beer (1919) discovered a small spiral impression from the Rohtas Limestone, Rohtasgarh in Bihar. The present paper analyses these controversial structures in light of fresh material procured from Osiyan and Nilgarh. The specimens illustrated herein are housed in the Repository of Geology and Palaeontology Group of the Agharkar Research Institute, Pune, India.

### Specimen from Osiyan

La Touché (1902) noticed occurrence of certain ridges, on the lower surfaces of a fine grained sandstone near village Basni, about 4 km SE of Osiyan in the Jodhpur district of

Rajasthan. He conceded the possibility of an inorganic origin for them, but could not envisage the responsible agent. On one of the slabs, Vredenburg (1908) identified chordophyceous markings, produced by shrimps or other crustaceans – not by crawling – but swimming almost in contact with the sea floor to derive gentle support, without actually touching it. The structure consisted of a succession of swellings, each about 45 mm in length and 25 mm in width. According to Vredenburg, each swelling resembled in shape 'an inflated wine skin, a bagpipe, or a deflected urn'. Thicker end of each swelling gives rise to tentacle-like filaments, one of which constitutes the stalk for the next swelling. As swellings were better marked on one side, he inferred that the causative animal was crawling sideways. Later, this structure was formally designated as *Chordoichnus latouchei* by Mathur (1983), instituting new ichnogenus and new ichnospecies. Sharma et al. (1991), in a comprehensive review on Proterozoic metaphytes and metazoans, refrained from offering any comment stating that its origin and affinity were not known.

La Touché (1902) considered the thin ridges described by him as relief casts. However, his effort to locate corresponding concavities on upper bedding surfaces met with little success. He presumed that anticipated details had disappeared as underlying beds were probably of soft clayey material. However, field observations by the present authors revealed a total absence of argillaceous beds in vicinity of Basni. Reddish, medium to fine grained sandstone exposed there is a current bedded, ripple marked arenite. In fact, weathering of crests of megaripples at several places has given rise to nondescript shapes (Fig.1), more or less resembling the specimen illustrated by Vredenburg (1908) as a chordophyceous trace.

According to Vredenburg (1908), the Osiyan specimens are identical with those from the Silurian of Portugal (Delgado, 1885) that have a very close resemblance with *Cruziana furcifera* d'Orbigny. This implies an early Palaeozoic age, necessitating careful comparison of the Osiyan specimen with *Cruziana*. The diagnostic feature of *Cruziana* is an elongate, band-like furrow superimposed by



**Fig.1.** Weathering of crests of megaripples at Basni has given rise to nondescript shapes (Repository Registration No. MACS G-4366).  
(The bar scale represents 20 mm).

herringbone-shaped ridges. Additional lateral markings could be present depending upon the appendages of the causative organism (Häntzschel, 1975). Neither an elongate, band-like furrow nor any lateral markings are seen in the illustration given by Vredenburg (1908). On the other hand, its careful and unbiased examination clearly shows that the swellings are load-casts, exhibiting wrinkles produced after a plastic material has hardened at the lower surface of a bed under the weight of overlying sediments. As regards the thin ridges referred to by La Touché (1902), the present authors suggest here, that they are relief casts of rill marks or swash marks.

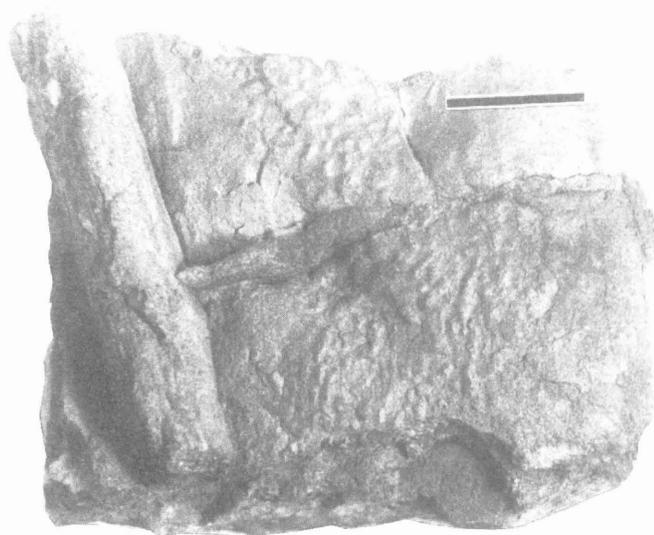
It may be mentioned here that the correct source of specimens under consideration should be cited as the Soniya Sandstone Member (Jodhpur Group, Marwar Supergroup) following the lithostratigraphic classification of the Proterozoic sediments of the Marwar Region proposed by Khan (in Barman, 1987). Usage of conventional terms like the 'Vindhya of Western Rajputana' or 'Trans-Aravalli Vindhya' should be avoided.

#### Specimens from Nilgarh

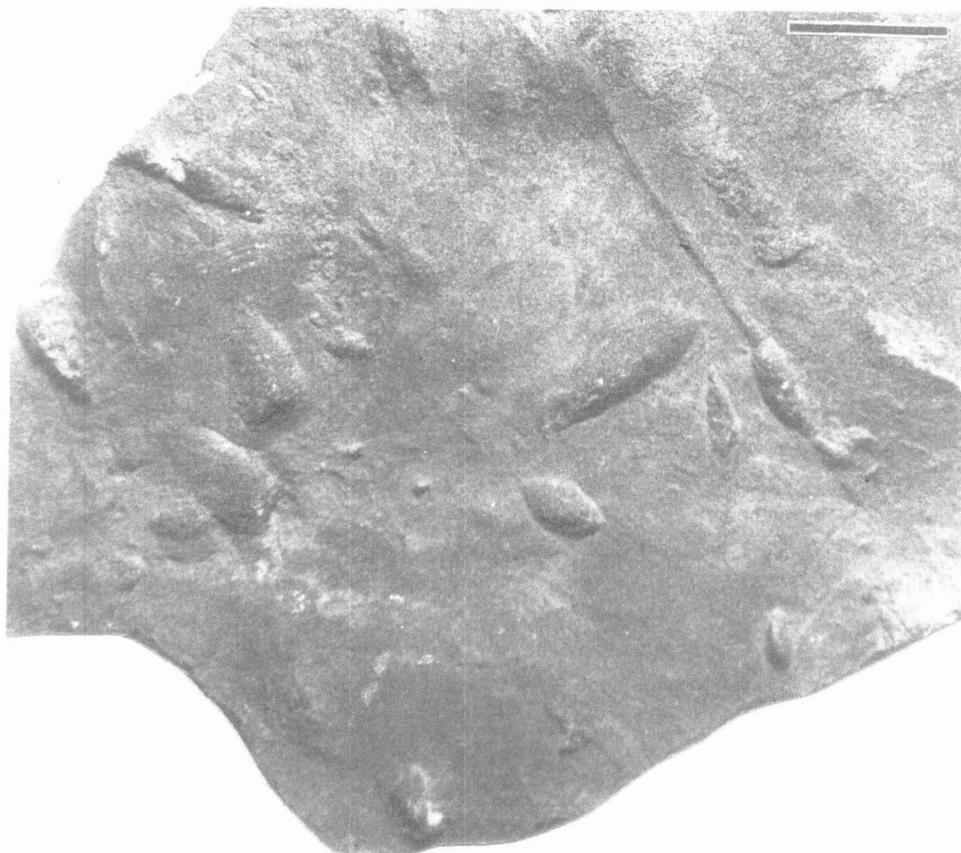
Vredenburg (1908) recorded occurrence of indeterminate animal tracks on the Sirbu Shale from Nilgarh in the Raisen district, Madhya Pradesh. The slab illustrated by him was re-examined by Mathur (1983), who identified numerous hypichnial ridges on it as casts of burrows, but did not designate them formally as he found that markings were of diverse forms posing a difficulty in identifying any 'diagnostic character'. However, relying on the haphazard

manner of their alignment and distribution, he inferred that they were true ichnofossils. In their review paper, Sharma et al. (1991) redescribed this slab. According to them, the number of objects on the slab comes to thirty. The markings occur mostly as linear structures concurrent with cracks. Certain ill-preserved features resemble cephalon or pygidium of an arthropod, while other circular or ovoid structures show a thin, filament-like tail. They further stated that the slab showed extensive organic activity, but the structures were 'unidentifiable' and so were 'true ichnofossils with problematic taxonomic position'.

In vicinity of Nilgarh, there are several lenticular intercalations of arenaceous flags in the Sirbu Shale, abounding in small, nondescript markings, resembling those illustrated by Vredenburg (1908). The arenaceous flags incorporated slushy, clayey material, evidently squeezed up through cracks during diagenesis. This gave rise to horizontal, longitudinal mineralization structures along the cracks (Fig.2). The 'thin, filament-like tails' referred to by Sharma et al. (1991) are actually the portions of cracks through which slushy material was not squeezed out (Fig.3). Some of the slushy material, which was unable to pass through the cracks, found egress at random places on the bedding plane to be accumulated as blister-like masses or blobs (Fig.3). They were mistaken by Sharma et al. for cephalon and pygidium. However, these blobs do not show the slightest indication of either trilobation or segmentation. It is concluded here that all such markings from the flaggy intercalations in the Sirbu Shale at Nilgarh were produced during diagenesis and had an abiogenic origin.



**Fig.2.** Horizontal cylindrical structures in the Sirbu Shale at Nilgarh resulted due to squeezing of clayey material along the cracks. (Repository Registration No. MACS G 4367). (The bar scale represents 20 mm).



**Fig.3.** Blister-like masses on the Sirbu Shale at Nilgarh, superficially resembling trilobite cephalons and pygidia in size and shape (Repository Registration No.MACSG 4368). Note a mineral-filled crack in continuation with a linear swelling in the right upper quadrant. It could be mistaken for a 'filament-like tail'. (The bar scale represents 20 mm).

#### Spiral markings from Rohtas

Two small, triangular chips, counter-parts of each other, were procured by Beer (1919) from a village called Saidaran near Rohtasgarh, Bihar. Shared by the counter-parts as mould and cast is a planispiral, loosely coiled, filamentous structure comprising one and a half whorls. Mathur (1983) asserted that the spiral form itself was suggestive of its organic origin and in view of propinquity between this specimen and planispiral trails of an enteropneust (Heezen and Hollister, 1971), he created a new ichnogenus and a new ichnospecies viz., *Spiroichnus beeri* to formally identify this spiral structure from the Vindhyan.

While recording occurrence of *Grypania spiralis* in the mid-Proterozoic rocks of the Mackenzie Mountains of northwestern Canada, Hofmann (1985) stated that the specimen collected by Beer (1919) and described by Mathur (1983) as *Spiroichnus beeri* is *Grypania spiralis*. Obviously, when Sharma et al. (1991) remarked that *Spiroichnus beeri* was a true trace fossil they were unaware of Hofmann's opinion. However, Maithy (1991) agreed with the view

expressed by Hofmann. *Grypania spiralis* is a photosynthesizing, eucaryotic, filamentous, planktonic alga known to range in age from 1.3 Ga to 0.6 Ga (Hofmann, 1985) and hence, it is strictly a Proterozoic alga.

#### Discussion

None of the three early records of seeming organogenic remains from the Proterozoic rock formations of the Indian craton, dealt with in this communication, is a trace fossil. It follows that *Chordoichnus latouchei* and *Spiroichnus beeri* (Mathur, 1983) have become unrecognized taxa. Assigning a biogenic origin to them and speculating on their affinities with trilobites (Vredenburg, 1908; Sharma et al. 1991) is suggestive of a Cambrian age, which might lead to some confusing stratigraphic implications. It is urged here that prudence should be exercised while speculating an affinity of a doubtful structure. It may also be stated here that the spiral structure from the Rohtas Limestone (Beer, 1919) is *Grypania spiralis* and should be regarded as evidence supporting Proterozoic age for the Vindhyan Supergroup.

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## ANNOUNCEMENT

## NATIONAL SEMINAR ON RECENT TRENDS IN EARTH SCIENCES

Organized by the Department of Geology, Sri Venkateswara University, Tirupati, the above seminar is scheduled to be held during 12-13 March 2004 at Tirupati, as a part of the golden jubilee celebrations of the University.

The objective of the seminar is to identify thrust areas which will hold promise for creative excellence and for the well being of the society. Some of the themes to be dealt with are:

- 1) Petrology & Geochemistry, 2) Geology, Environment and its Impact on the Community, 3) Ground Water and Mineral Resources and 4) Photo Geology, Remote Sensing and GIS.

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