

## A NOTE ON THE CARBONACEOUS MEGAFOSSILS FROM THE NEOPROTEROZOIC BHANDER GROUP, MAIHAR AREA, MADHYA PRADESH

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### ABSTRACT

The paper records for the first time the carbonaceous megafossils *Chuarina circularis* Walcott, *Tawuia dalensis* Hofmann and unnamed filamentous, thread-like ribbons from the shales of the Bhander Limestone and Sirbu Shale formations of the Neoproterozoic Bhander Group (Upper Vindhyan). On this basis, the upper age limit of the Vindhyan Supergroup in the Maihar area is considered ca. 700 Ma.

### INTRODUCTION

The carbonaceous megafossils are known from the Lower Vindhyan sediments of the Rampura area, Neemuch district, Madhya Pradesh since 1909 when Jones reported carbonaceous discs from the Mesoproterozoic Suket Shale. These carbonaceous discs were the subject of intense debate for their affinity and biogenicity (for discussion see Sahni, 1977). Subsequently, these discs were identified as *Chuarina circularis* Walcott (Ford and Breed, 1973; Mathur, 1983; Maithy and Shukla, 1984; Sun, 1987 and Kumar, 1995). Mathur (1983) also described *Tawuia dalensis* Hofmann from the *Chuarina* - bearing Suket Shale. Recently, cf. *Chuarina circularis* and *Grypania spiralis* have also been reported from the Rohtas Formation (= the Suket Shale) of the Katni area, Madhya Pradesh (Kumar, 1995). Thus, both the reports of carbonaceous megafossils are only from the Lower Vindhyan rocks. The present paper records for the first time the carbonaceous megafossils from the Upper Vindhyan rocks and discusses its implications for the age of the Vindhyan Supergroup.

The megafossils were discovered at three localities in the Maihar area, out of which one belongs to the Bhander Limestone and two to the Sirbu Shale (fig. 1). The fossiliferous shales of the Bhander Limestone are exposed in the Tamas River Valley near Dulni village (80° 48' 12" E, 24° 17' 25" N) 6 kms NE of Maihar. The fossiliferous Sirbu shales occur at the base of a hillock (80° 48' 28" E, 24° 17' 42" N) 1 km northeast of Dulni village and near 6 km milestone (80° 43' 9" E, 24° 16' 3" N) on the Maihar-Rampura motor road.

### GEOLOGICAL SETTING

The rocks of the Vindhyan Supergroup occupy a vast area of 104000 sq km in Central India, stretching from Deri-on-Son in Bihar to Chittorgarh in Rajasthan. They attain a thickness of ca. 4000 m (Krishnan and Swaminath, 1959). The Vindhyan Supergroup has been subdivided into four groups viz., the Semri Group, the Kaimur Group, the Rewa Group, the Bhander Group.

The Semri Group is referred to as the Lower Vindhyan and the Kaimur, Rewa and Bhander Groups as the Upper Vindhyan. Each group is further subdivided into formations and members (Table 1).

**Table 1: General lithostratigraphic succession in the Maihar-Son Valley area, Madhya Pradesh-Uttar Pradesh (after Auden, 1933; Singh, 1976).**

Group		Formation	Age
Bhander Group		Maihar Sandstone	650 Ma
		Sirbu Shale	ca. 700 Ma based on present study
		Bhander Limestone	
Upper Vindhyan	Rewa Group	Rewa Sandstone Rewa Shale	
	Kaimur Group	Kaimur Sandstone	K/Ar dates 890±40 (after Vinogradov & Tugarinov, 1964; Kreuzer <i>et al.</i> , 1977)
----- Unconformity -----			
Lower Vindhyan	Semri Group	Rohtas Formation	
		Kheinjua Formation	
		Porcellanite Formation	K/Ar dates 1080 (40 (after Vinogradov & Tugarinov, 1964, Kreuzer <i>et al.</i> , 1977).
		Basal Formation	
----- Unconformity -----			
Metamorphics and Granites			

Around Maihar township, the rocks of the Bhander Group are well developed where they form small hillocks and impressive escarpments. The dominant lithology is represented by limestone, sandstone, siltstone and

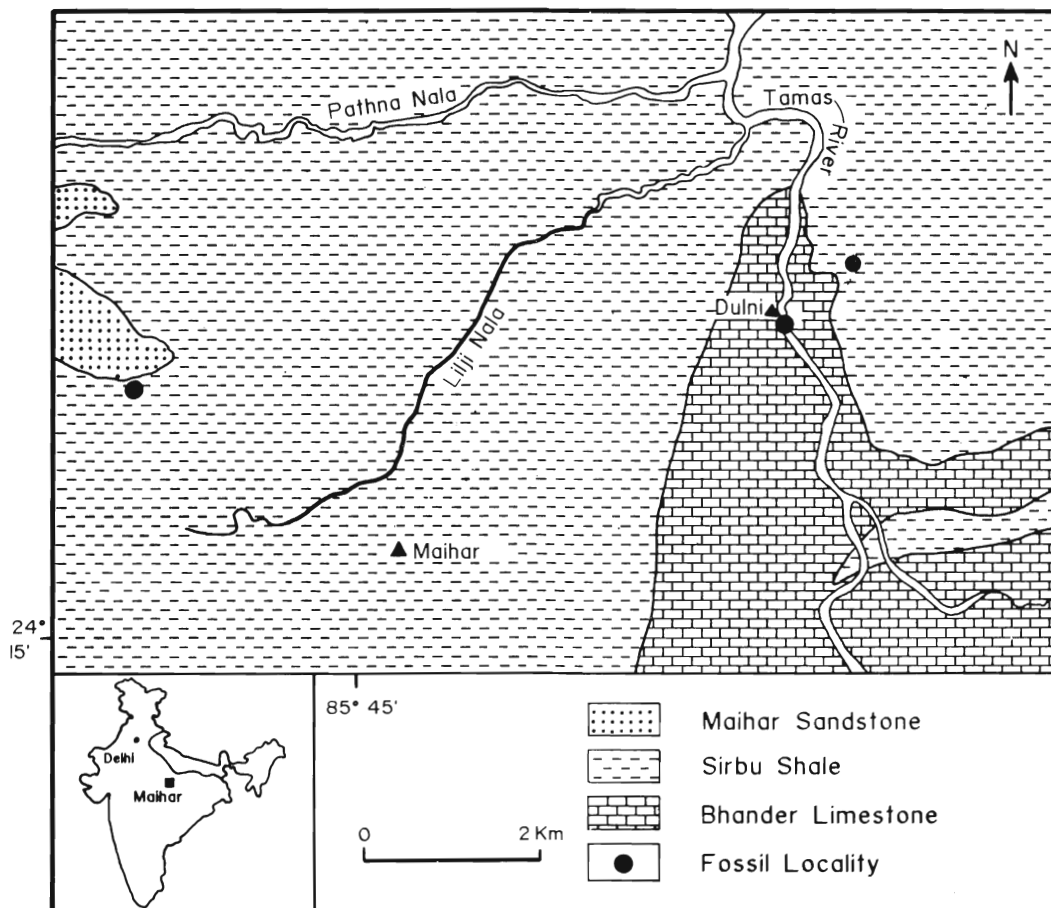


Fig. 1. Geological map of the Maihar area, Madhya Pradesh (modified after Bhattacharya *et al.*, 1993).

shales. The rocks are unmetamorphosed and undisturbed. In general, they show low dips.

In the Maihar area, the Bhander Group has been subdivided into three formations (see Singh, 1976). The lowermost unit is the Bhander Limestone which shows excellent development of the columnar stromatolite *Baicalia baicalica* (Kumar, 1976). Singh (1976) has suggested a carbonate tidal flat environment of deposition for the Bhander Limestone. It is conformably overlain by the Sirbu Shale. It is dominantly an arenaceous facies represented by shales, siltstones and subordinate sandstones. Parallel lamination, lenticular bedding, wave and current ripples, mud cracks and salt pseudomorph shale are well developed. Singh (1976) has suggested the lagoonal environment of deposition for the Sirbu Shale. The Sirbu Shale grades into the Maihar Sandstone which is the youngest lithounit of the Vindhyan Supergroup in the Maihar area. The Maihar Sandstone is represented by sandstone and minor shales and is considered a product of tidal flat-shoal complex (Singh, 1976).

## CARBONACEOUS MEGAFOSSILS

The carbonaceous megafossils are seen as compressions marked by a thin carbonaceous layer, and, wherever the carbonaceous matter is not preserved, a distinct impression is recorded. The impression is often marked by red colour. The fossils are seen on the bedding surface by splitting the rocks along the bedding plane. *Chuarina circularis* Walcott, *Tawuia dalensis* Hofmann, and unnamed thin, thread-like ribbons have been recorded. The fossil localities are marked in fig. 1 and the stratigraphic position of the fossils is shown in fig. 2. For the detailed synonymy list, see Ford and Breed (1973), Maithy and Shukla (1984) and Sun (1987). All the fossils are deposited in the Museum of the Geology Department, University of Lucknow.

## SYSTEMATIC DESCRIPTION

Group **Acritarcha**

Genus **Chuarina** Walcott, 1899 emend. Vidal et Ford, 1985

Type species: *Chuarina circularis* Walcott, 1899

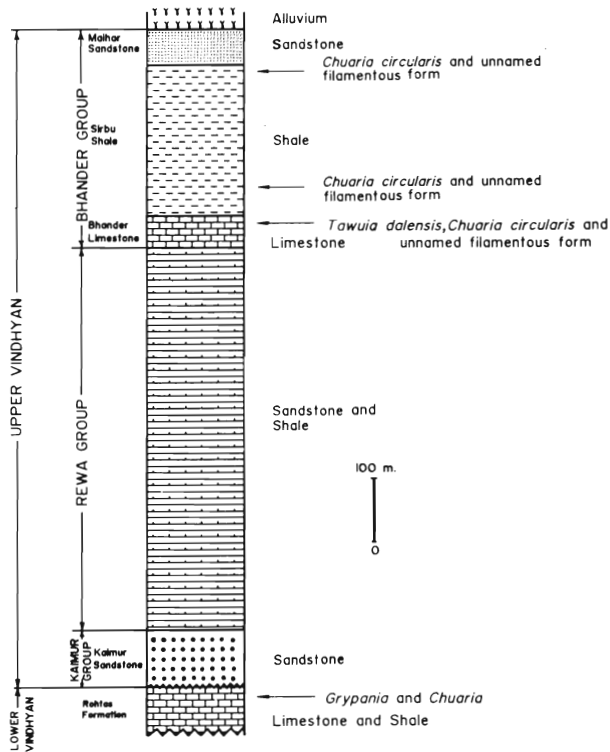


Fig. 2. Litholog of the Vindhyan Supergroup showing the fossil-bearing horizons.

*Chuaria circularis* Walcott, 1899  
(Pl. I, figs. 1, 3, 4, 5, 8, 11, 12)

*Chuaria circularis* Walcott, 1899, p. 234-235, pl. 27, figs. 12-13.

Sample No: D/90, M/42, B, C, DS/6, M/13.

**Stratigraphic position :** The Bhandar Limestone and Sirbu Shale formations of the Bhandar Group (Upper Vindhyan).

**Description :** Circular to elliptical compressions generally made up of carbonaceous matter or distinct impressions marked by reddish colour. Wrinkles are generally present. Longer diameter ranges from 0.2 to 5.1 mm with mean as 1.54 mm (N = 213) and shorter diameter varies from 0.2 to 5.0 mm with mean as 1.36 mm (N = 213). Generally, the compressions occur in clusters. Overlapping is uncommon. In vertical sections, the compressions appear as dark thin lines. In the Bhandar Limestone, the mean size is 1.65 mm (N = 190) while in the Sirbu Shale it is 1.20 mm (N = 94). The preservation and abundance in the Bhandar Limestone is relatively better in comparison to the Sirbu Shale.

**Discussion :** In the Vindhyan Supergroup *Chuaria circularis* was originally described from the Suket Shale of the Rampura area, Madhya Pradesh (Jones, 1909, Sahni, 1977). Subsequently, it was also described from the Rohtas Formation of the Katni area, Madhya Pradesh (Kumar, 1995). The maximum diameter of the Suket form is 4.4 mm (Ghare and Badve, 1978) and that of the

Katni form is 4.0 mm (Kumar, 1995) which is less in comparison to the diameter of the present form. *C. circularis* has also been reported from the Bhima Basin of Karnataka by Suresh and Sundara Raju (1983). The Bhima form shows the largest diameter of 9 mm with a mean of 3.51 mm. Maithy and Babu (1996) have reported diameter up to 10 mm. Thus, the present form is much smaller in comparison to the Bhima form.

**Genus** *Tawuia* Hofmann, in Hofmann Aitken, 1979

**Type species :** *Tawuia dalensis* Hofmann, in Hofmann Aitken, 1979

*Tawuia dalensis* Hofmann, in Hofmann and Aitken, 1979  
(Pl. I, figs. 2, 7)

*Tawuia dalensis* Hofmann, 1979, p. 58, figs. 13A-I.

Sample No : D/18, D/38.

**Stratigraphic position :** The Bhandar Limestone of the Bhandar Group (Upper Vindhyan).

**Description :** Elongated, rod-like carbonaceous compressions, straight, parallel sided, ends subrounded. Occasionally tapering at one end. Width ranges from 0.8 to 1.6 mm with mean as 1.14 mm (N = 8). Maximum recorded length is 10.3 mm. Cross-walls and annulations are not seen.

**Discussion :** The only other report of *Tawuia* from the Vindhyan Supergroup is from the Suket Shale of the Semri Group (Lower Vindhyan). The Suket form shows greater width (1-2.5 mm) in comparison to the present form. Recently, *Tawuia dalensis* has also been reported from the Bhima Basin where width is between 2-3 mm and length up to 30 mm (Maithy and Babu, 1996). It occurs in association with *Chuaria circularis*. This is in agreement with the observation that *Tawuia* is always associated with *Chuaria*, whereas converse is not true (Hofmann, 1992).

**Carbonaceous Ribbons**  
(Pl. I, figs. 6, 9, 10)

Sample No. : DS/5.

**Remarks :** Very thin, thread-like carbonaceous compressions are seen on the bedding surfaces of the shales. The width of the compressions ranges from 0.05 to 0.15 mm. The maximum recorded length can be measured in mm. Branching is also seen (Pl. I, fig. 10). These thread-like compressions are possibly the broken pieces of an algal filamentous plant. These occur in association with *Chuaria circularis* in both the Bhandar Limestone and Sirbu Shale and are recorded from the two localities; one is east of Dulni village and the other is on the Maihar-Rampura motor road near 6 km milestone.

## DISCUSSION AND CONCLUSION

1. The paper records for the first time the carbonaceous megafossils from the Upper Vindhyan rocks.
2. In the absence of reliable radiometric dates the age of the Vindhyan Supergroup has always been a matter of speculation. It has been assigned ages varying from Precambrian to Devonian (see Sahni, 1977). However, due to absence of Phanerozoic fossils including trace fossils, a Precambrian age is generally accepted by most of the workers. A few radiometric dates are available for the Upper Vindhyan rocks but all are of vintage value. Vinogradov and Tugarinov (1964) dated the glauconites of the Lower Kaimur Group by K/Ar method as  $940 \pm 30$  Ma and the Upper Kaimur Group as  $910 \pm 30$  Ma. Kreuzer *et al.* (1977) recalculated these dates by using latter recommended constant and suggested  $890 \pm 40$  Ma for the Kaimur Group. Another suggestion concerning the age of the Bhandar Group is based on the profuse development of columnar stromatolites. On this basis, Kumar (1982) has suggested Upper Riphean age. However, there is a strong criticism about the correlation and age assignment based on stromatolites as it has been proved that in the present day living stromatolites the morphology of stromatolites is environment sensitive. (Logan *et al.*, 1964; Monty, 1972; Moore and Burne, 1994). The same assemblage of micro-organisms can produce varied morphologies under the influence of different physical parameters. In this context, the present discovery of *Chuarina circularis* and *Tawuia dalensis* assumes significance as this association has been considered a biozone by Hofmann (1992) representing a time span of 950 - 700 Ma. *Chuarina circularis* has been assigned 1000 - 700 Ma by Sun (1987). Hofmann (1987) has suggested 900 - 700 Ma for *Chuarina-Tawuia* assemblage and Vidal *et al.* (1993) are of the opinion that it represents an interval of around 840-700 Ma. Hofmann and Rainbird (1994) have described *Chuarina-Tawuia* association from the Neoproterozoic Shaler Supergroup of Arctic Canada and supported the significance of this association as a biozone for Neoproterozoic. Maithy and Babu (1996) have reported this association from the Bhima Basin, South India and suggested that it is pre-Vendian in age. Thus, the Sirbu Shale, the youngest horizon, which shows presence of *Chuarina circularis* can be assigned an age of ca. 700 Ma and the overlying Maihar Sandstone should be slightly younger (fig. 2). This age assignment is in agreement with the age assignment given on the available radiometric dates and stromatolite assemblages.

3. The *Chuarina-Tawuia* bearing Suket Shale (= the Roh-tas Formation) and the Bhandar Limestone are separated from each other by about 700 - 1000 m thick succession of the Kaimur and Rewa Groups (fig. 2). The fossil-bearing shales in both the groups show similar lithofacies and environmental setting of a low energy lagoon. Thus, in the Kaimur and Rewa Groups where there are many shale-dominated horizons representing low energy lagoonal setting, there is a good chance of preservation of megascopic life. A concerted effort should be made to discover them. A detailed work is under progress and will be published separately.

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## EXPLANATION OF PLATE

### Plate I

(Photomicrographs of the carbonaceous megafossils. Scale bar represents 1 mm for all the figures)

1. A cluster of *Chuar circularis*, Bhandar Limestone, Sample No. D/90.
2. *Tawuia dalensis*, Bhandar Limestone, Sample No. D/18.
3. *Chuar circularis*, Sirbu Shale, Sample No. M/42B.
4. *Chuar circularis*, Sirbu Shale, Sample No. M/42C.
5. *Chuar circularis*, Sirbu Shale, Sample No. M/42B.
6. Unidentified filamentous form, Sirbu Shale, Sample No. DS/5.
7. *Tawuia dalensis* with *Chuar circularis*, Bhandar Limestone, Sample No. D/38.
8. *Chuar circularis*, Sirbu Shale, Sample No. M/42.
9. A cluster of unidentified filamentous form, Sirbu Shale, Sample No. DS/5.
10. Unidentified filamentous form showing branching, Sirbu Shale, Sample No. DS/5.
11. *Chuar circularis*, Sirbu Shale, Sample No. M/16.
12. *Chuar circularis*, Sirbu Shale, Sample No. DS/6.

