DISTRIBUTION OF STROMATOLITES IN THE FAWN LIMESTONE, SEMRI GROUP (LOWER VINDHYAN), SON VALLEY AREA, MIRZAPUR DISTRICT, U. P.

S. KUMAR* AND R. N. SRIVASTAVA**

**Department of Geology, Lucknow University, Lucknow*

***Mahanagar, Lucknow*

ABSTRACT

The distribution of stromatolites in the Fawn Limestone of Kheinjua Formation of Semri Group (Lower Vindhyan) is studied. Three forms *Conophyton garganicus*, *Colonella columnaris*, and *Collenia clappii* are recorded from this horizon. These forms are not traceable for long distances and show lenticular disposition. It is concluded that the stromatolites are formed in supra- to inter-tidal environment of deposition and that the environment of deposition is not the only determining factor in the stromatolite morphology.

INTRODUCTION

The algae play an important role in the deposition of carbonates and produce sedimentary structures with definite morphological characters which are referred to as stromatolites. In the modern carbonate flats, it has been observed that the same assemblage of algae produce markedly different morphological structures suggesting that the stromatolite morphology is dependent on environment. This fact casts doubt on the utility of stromatolites as stratigraphic horizon markers and in correlation as has been done in U.S.S.R., Australia and India.

In the Precambrian rocks, it has been concluded by different workers that there are definite evolutionary trends in the form morphology when traced from older to younger rocks and on this basis, the stratigraphic correlation holds good within quite a large area (Cloud & Semikhatov, 1969 ; Raaben 1969 ; Valdiya, 1969; Walter & Preiss, 1972 ; Kumar, 1976a, 1976b ; Kumar & Tewari, 1978).

More detailed studies are needed in Precambrian as well as in the modern areas of carbonate sedimentation before much can be said about stromatolites both as environment indicators and as index fossils, keeping the fact in mind that in the absence of any other well defined organic activity in Precambrian times, the algal flora thrived in marine conditions unhindered and unchallenged and thus, the primitive forms might have evolved on a definite line. While in the modern marine environment, with other biological activities, the stromatolite building algae are assigned not too important a role. Moreover, the stromatolites are rare in modern carbonate sediments, largely because of the browsing on algal mats by organisms such as crustacea (Von der Borch, 1976). Perhaps, this may be the reason why after Ordovician times when much evolved biological activity was established, the occurrence of stromatolites is quite rare and almost of no stratigraphic value.

The Vindhyan sediments of Son Valley area offer a good opportunity to study the stromatolites where they are profusely developed in the different calcareous units. Valdiya (1969) and Kumar (1976a) have identified different stromatolite assemblages from the

Basal and Kheinjua formations of the Semri Group. The Vindhyan stromatolites show marked evolutionary trends in the development of the form morphology from simple to more complex forms (VALDIYA, 1969 ; KUMAR, 1976a).

Preliminary investigations in the Fawn Limestone revealed that the stromatolite forms show biohermal disposition. In this paper, an attempt has been made to record the variation in stromatolite assemblage and its relationship with the environment of deposition in the Fawn Limestone. This horizon shows development of distinct and well preserved stromatolite forms *Collenia clappii*, *Conophyton garganicus* and *Colonella columnaris* (KUMAR, 1976a, 1976b) (Pl. 1, Figs. 1-4). The thickness of the Fawn Limestone is quite small and the exposures are good. It has been traced for a distance of about 50 kms from Lamserai to Chikra Dunai (Fig. 1).

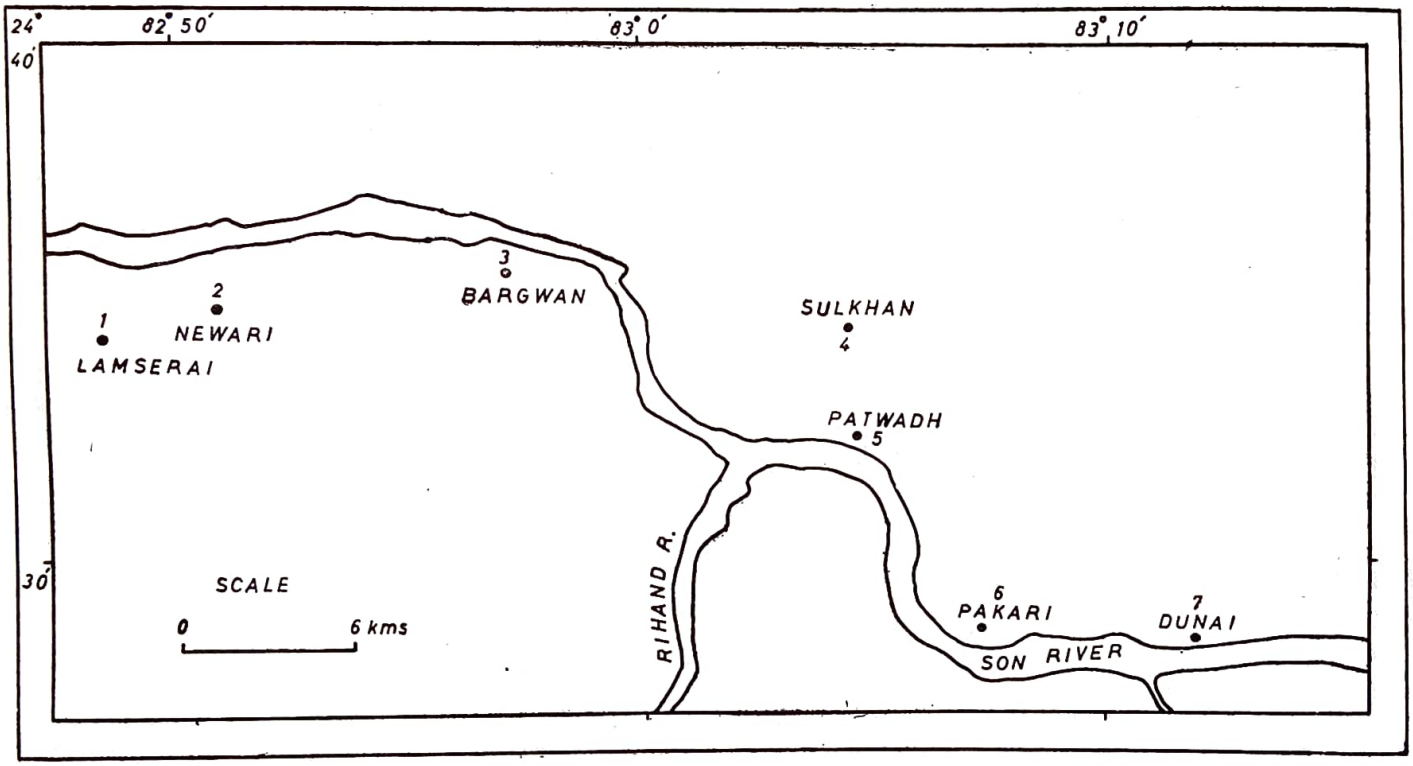

Fig. 1—Location map

FAWN LIMESTONE

The Fawn Limestone is a characteristic horizon of the Kheinjua Formation (Table 1). It is a fawn to grey coloured, siliceous limestone with characteristic chert lenticles (AUDEN, 1933). The average thickness of this unit is about 35 metres. The thickness decreases gradually towards west and it pinches out west of Lamserai, where it forms the western end of the Vindhyan Basin. The environment of deposition of the Fawn Limestone is considered as supra- to inter-tidal zone of a carbonate-tidal flat (SINGH, 1973 ; SAFAYA & SINGH, 1976).

STROMATOLITES

The stromatolites of the Fawn Limestone are described by KUMAR (1976a, 1976b). Three forms *Colonella columnaris*, *Conophyton garganicus* and *Collenia clappii* are identified (Pl. 1, Figs. 1-4). These forms are quite different in morphological characters and can be differentiated quite easily from each other in the field itself. The identification of *Conophyton* has been confirmed by thin section studies.

Table 1—Stratigraphic succession of the Vindhyan Supergroup of Son Valley Areas (After Auden, 1933).

Upper Vindhyan	Kaimur Formation	Sandstones and shales	
		—Unconformity—	
	Rohtas Formation	Limestones and Shales	Algal mats and oncolites
		Glauconitic Sandstone	
Semri Group	Kheinjua Formation	Fawn Limestone	*Conophyton garganicus* *Colonella columnaris* *Collenia clappii*
(Lower Vindhyan)		Olive Shales	
	Porcellenite Formation	Porcellenites	
		Kajrahat Limestone	*Colonella kajrahatensis* *Kussiella dalaensis* *Kussiella kussiensis* *Conophyton vindhyaensis* *Collenia symmetrica*
	Basal Formation	Basal Conglomerate	*Kussiella kussiensis*
		Unconformity	
	Bijawar Formation	Phyllites	

In the Son Valley area, near Lamserai (locality no. 1, Fig. 1) in the western extremity of the Mirzapur District, the Fawn Limestone outcrops on a small hillock. In this part of the Son Valley, it is the only exposure of this horizon and marks the shore line of the Vindhyan Basin. The limestone is dark grey to fawn in colour with abundant chert bands and lenticles. The primary sedimentary structures are not well preserved. Passively developed small ripple bedding with low angle discordances, could be recognised. No stromatolitic structure is developed. It is difficult to give the area of deposition for these limestones, however, this might have been a deposit of supra-tidal zone.

On the western side of Muni Ki Pahari (locality no. 2), about 8 kms east of the above mentioned locality, the same horizon is again exposed. The lower part of this horizon is marked by fawn to grey coloured limestone with whitish grey to black chert bands and lenticles. Intraformational conglomerate and minor, thinly laminated olive coloured shale bands are also recorded. Parallel bedding with low angle discordances and small scale ripple bedding are the characteristic bedding features. This suggests inter-tidal environment where current/tidal scour was low to moderate. However, just near the contact with the Glauconitic Sandstone a domal form *Collenia clappii* is developed. Some of the bands show only algal mats. Mud cracks are seen. The environment appears to be supra-tidal.

In the eastern part of the same hillock, the lower horizon of the Fawn Limestone shows a good development of *Collenia clappii*, together with another form *Conophyton garganicus*. However, *C. clappii* is the dominant form. *Conophyton garganicus* is developed between and over *Collenia clappii* columns. Due to overcrowding, the growth of *Conophyton garganicus* is comparatively small. But, eastward the size of *Conophyton garganicus* increases, and *Collenia clappii* gradually disappears. *Conophyton* is developed only in the lower horizon, but *Collenia clappii* is seen in both lower and upper horizons.

At Bargwan (locality no. 3), about 9 kms further east of this hillock, only *Conophyton garganicus* is developed, both in the upper and lower horizons. The size of *Conophyton* is much bigger in comparison to the size at Muni Ki Pahari. It reaches the maximum development at Sulkhan (locality no. 4) about 14 kms further east of Bargwan where it attains relief of about 160 cms. At Sulkhan, it is seen only in the upper part of the Fawn Limestone. It appears that the *Conophyton garganicus* developed between supra- to inter-tidal zone of a carbonate tidal flat (Singh, 1973).

At Patwadh hillock, 14 kms south of Sulkhan (locality no. 5), another form *Colonella columnaris* makes its appearance. No other stromatolite form is recorded from this locality. Here the Fawn Limestone shows profuse development of fenestral structure (the bird's eye structure of Safaya & Singh, 1976). The environment of deposition appears to be inter-tidal to supra-tidal zone of a restricted basin.

At locality no. 6, at Pakari, 10 kms further SSE of Patwadh, no stromatolites are developed in the lower part. In the middle part *Colonella columnaris* and in the upper part *Collenia clappii* are seen. However, 8 kms east-south-east of this place, at Chikra Dunai (locality no. 6), outcrops of the Fawn Limestone are again seen. No stromatolite is recorded in the lower and the middle horizons. But *Colonella columnaris* is seen in the upper part near the contact with the Glauconitic Sandstone. The lower and middle horizons appear to have been deposited in the supra-tidal environment and the upper horizon in the inter-tidal zone of a restricted basin.

Table 2

Lithostratigraphic Member		Localities						
		1 Lamserai	2 Muni Ki Pahari West	2 Muni Ki Pahari East	3 Bargwan	4 Sulkhan	5 Patwadh	6 Pakari	7 Chikra-Dunai
Glauconitic Sandstone									
Fawn Limestone			*Collenia clappii*	*Collenia clappii*	*Conophyton garganicus*	*Conophyton garganicus*	*Colonella columnaris*	*Collenia clappii*	*Colonella columnaris*
								Colonella columnaris	
			Conophyton garganicus						
			Collenia clappii		*Conophyton garganicus*				
Olive Shale									

CONCLUSIONS

1. The stromatolites were formed in the Fawn Limestone in the supra-tidal to inter-tidal environments.

2. The form *Collenia clappii* appears to be restricted to only supra-tidal environment while *Conophyton garganicus* and *Colonella columaris* were formed in supra- to inter-tidal realms.

3. Two different groups *Conophyton* and *Colonella* developed in the same environment of deposition are possibly due to the different groups of algal communities.

4. The stromatolite forms are not traceable for long distances in the strike direction (Table 2). Their colonies are lenticular in disposition.

5. Occurrence of different stromatolite forms in the same environment suggest that the environment of deposition is not the only determining factor in the development of stromatolite morphology.

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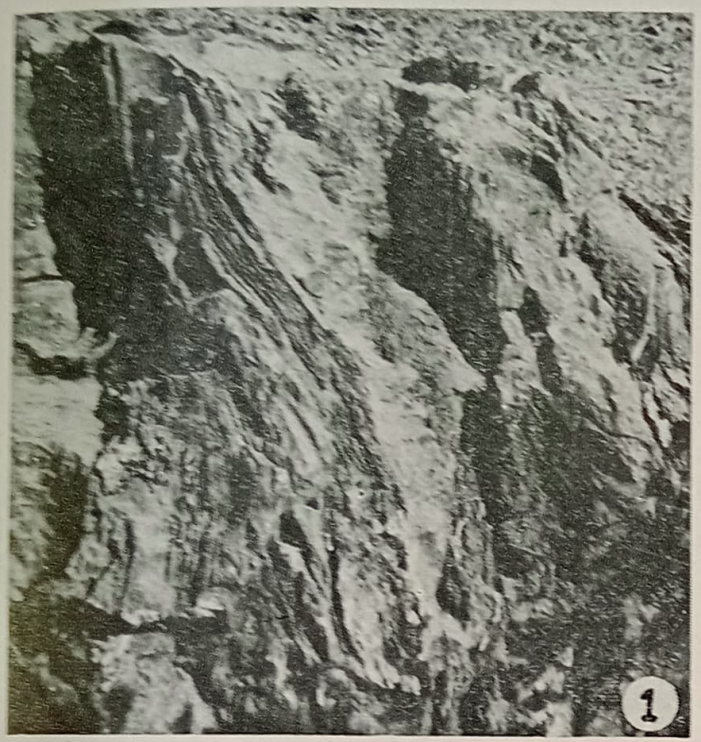
EXPLANATION OF PLATE I

1. *Conophyton garganicus* Longitudinal section, Sulkhan hill. ×1/11 (approx.).
2. *Conophyton garganicus* Transverse section, Sulkhan hill.
3. *Collenia clappii* Longitudinal section, Muni Ki Pahari.
4. *Colonella columnaris* Longitudinal section, Patwadh hill.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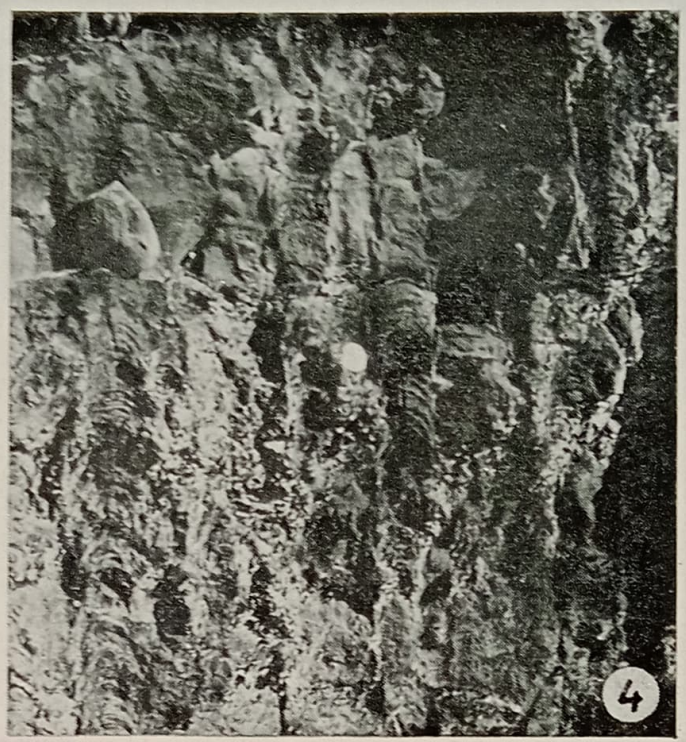
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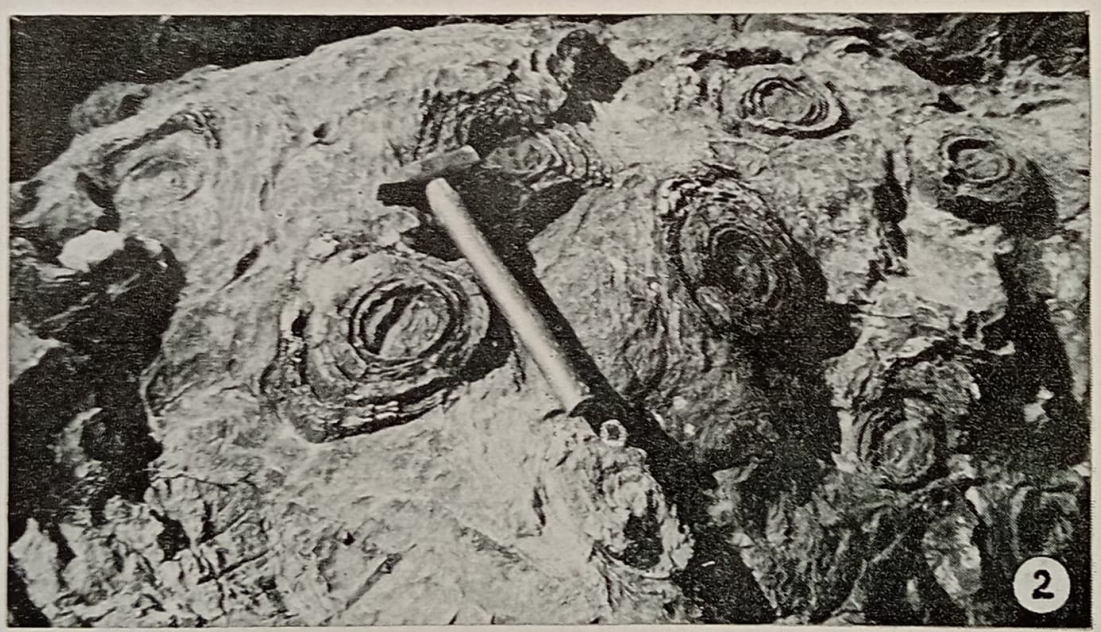
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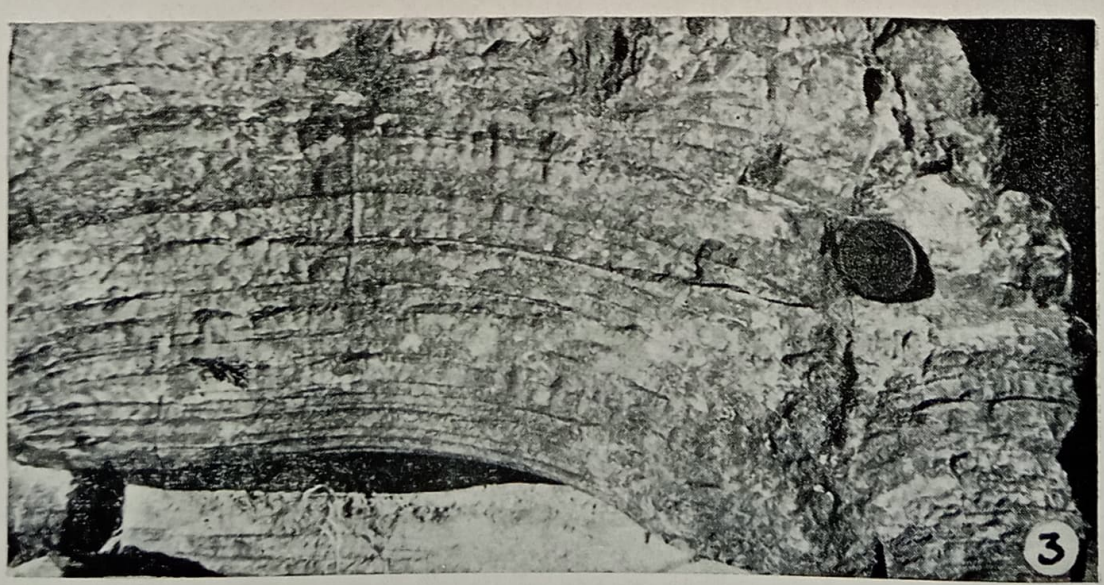
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