

Proterozoic microbiota from stromatolitic black chert of Jammu Limestone, Udhampur district, Jammu and Kashmir, India*

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Introduction

The Jammu Limestone (Great Limestone) occurring as inliers within the Tertiary expanse of the Sub-Himalayas of Jammu and Kashmir (Fig. 1) was previously considered to be of Permo-Carboniferous age. Based on systematic study of the stromatolites contained in the Formation, the age of the formation has been revised to Precambrian (late Lower to early Middle Riphean) (Raha and Sastry, 1973; Raha, 1977, 1978, 1979). This age has further been corroborated by Pb-isotopic model

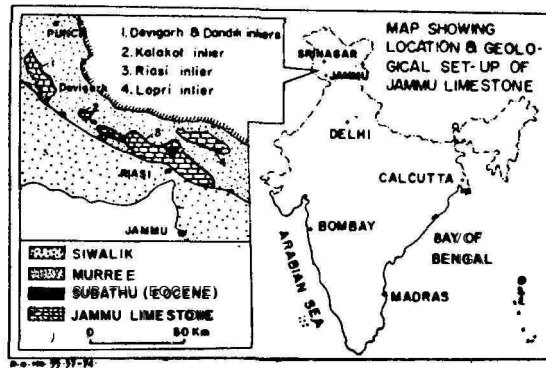


Figure 1.

age (967 Ma) of galena occurring in the topmost ortho-quartzite Member of the Formation (Raha *et al.*, 1978). The three horizons with distinct stromatolite assemblages are separated by thickly bedded massive dolomites, often cherty and exhibiting domal stromatolites *Nucleella* fm. Komar. The thinly laminated black chert alternating with the thin dolomitic layers forming the domal stromatolite exhibits profuse algal filaments and unicells in a sample collected from below the middle biostrome (Fig. 2), the *Colonnella-Conophyton* Assemblage Zone.

Geological set up

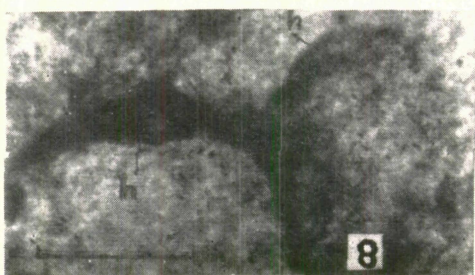
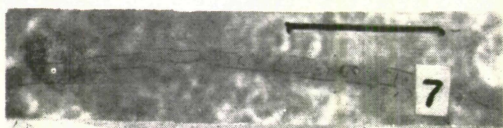
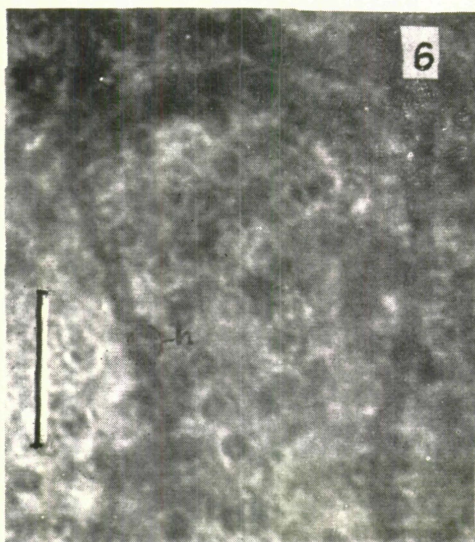
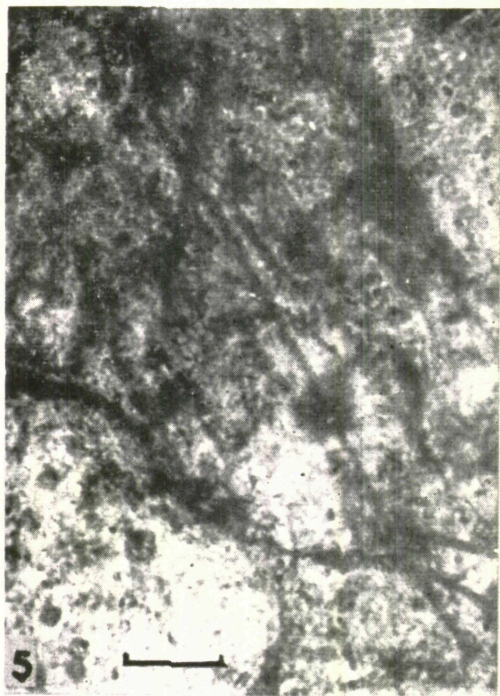
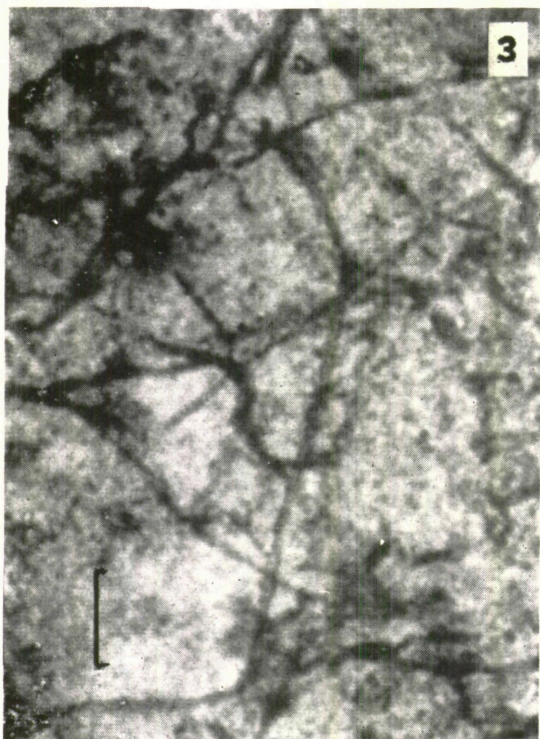
The geological set up of the Jammu Limestone and distribution of the stromatolite biostromes in the same is given below:

Mio-Plio-Pleistocene	Siwalik Group
Up. Eoc. Lr. Miocene	Murree Formation
Eocene	Subathu Formation
— unconformity — (marked by bauxite and breccia)	
Precambrian	Jammu Limestone
	(Base not seen)

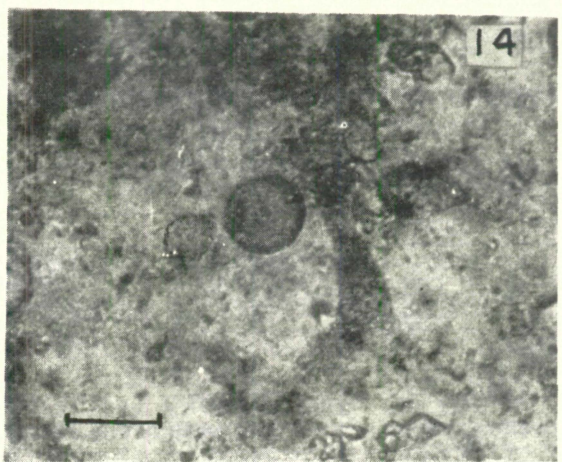
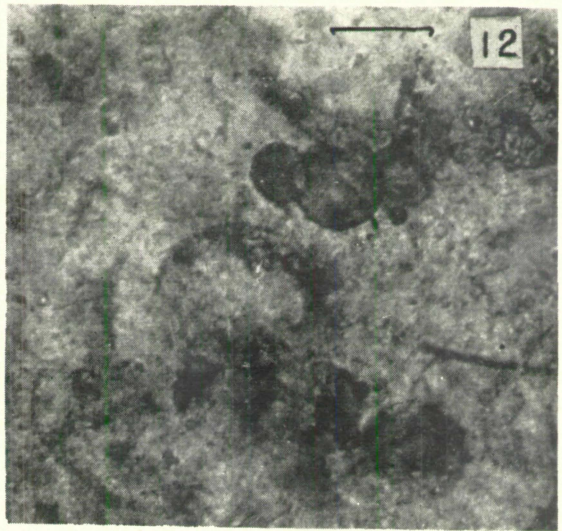
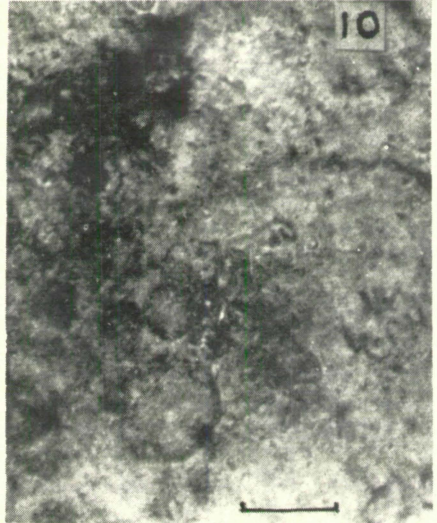
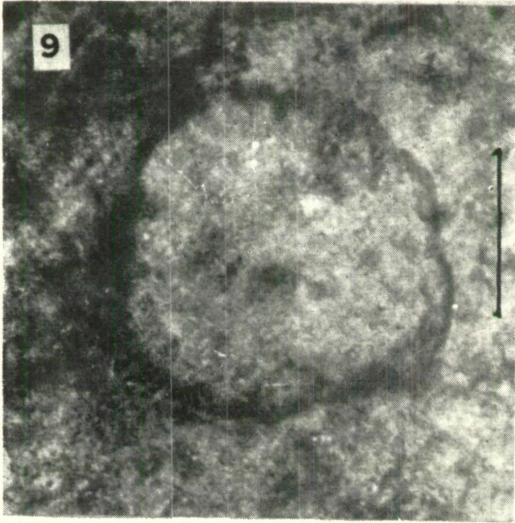
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EXPLANATION OF FIGURES

Figures 3-8. Photomicrographs of algal filaments in petrographic thin sections, bars equal to 20 μ m in each case. Figs. 3, 6 & 7 show filaments with cell structures, comparable to *Gunflintia grandis*; Fig. 4 is probably an empty sheath; Fig. 5 shows filaments comparable to *Gunflintia minuta*; Figs. 6 & 8 show development of structures (bulging) like heterocyst(h) in a branching filament.



Figures 3 to 8.



Figures 9 to 14.

The distribution of stromatolite biostromes within the Jammu Limestone is given in Figure 2.

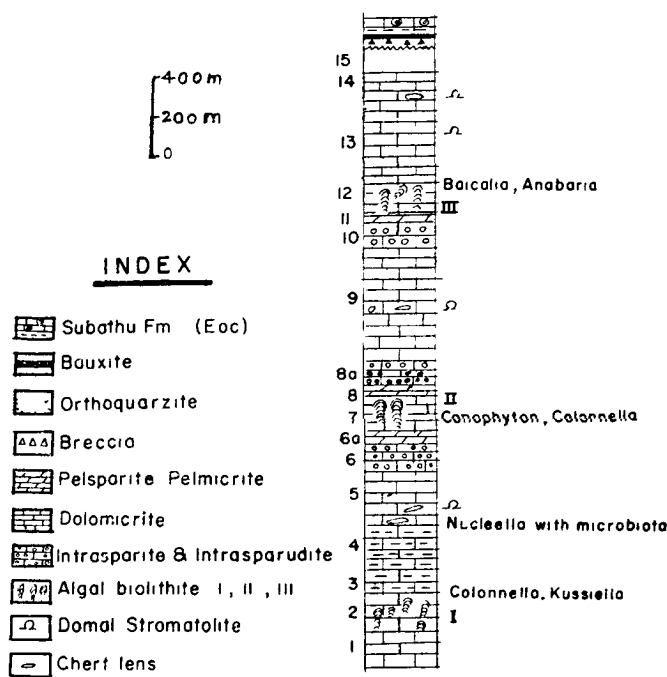


Figure 2. Synthesised stratigraphic column of the Jammu Limestone.

Microbiota

The present report of microbiota is confined to those studied in petrographic thin sections of the stromatolitic black chert mentioned above, to avoid any controversy about the occurrence. The microbiota occur within the chert laminae. The algal filaments and sheaths especially form network transverse to lamination. The unicells sometimes occur together in groups or bunches and also as discrete bodies in the cherty matrix.

Maceration was carried out with a portion of the sample. Organic nature of the unicells and filaments forming the microbiota has also been confirmed by their reaction with the organic stain 'safranin'. A brief description of the microbiota is given below:

Filamentous type: (Figs. 3-8). The filaments form the major organic constituent in the chert laminae. They occur in mushes and in criss-cross net-work in the cryptocrystalline cherty matrix. The diameter of the filaments range from $2\ \mu\text{m}$ to $6\ \mu\text{m}$, though most frequent ones are having diameter of the order of $4\ \mu\text{m}$. The filaments branch dichotomously often with bulbous swellings resembling heterocyst structures (Figs. 6, 8). The cell structures in the filaments are also seen frequently

EXPLANATION OF FIGURES

Figure 9. Photomicrograph of petrographic thin section of a rounded body of doubtful origin. Protuberances are quite conspicuous. Bar equals $20\ \mu\text{m}$.

Figures 10-14. Photomicrograph of unicells in petrographic thin section. Bars equal $23\ \mu\text{m}$. Marginal dark spots are seen in figures 10-14 which appear comparable to *Huronospora* sp.

(Figs. 3, 6, 7). These filaments resemble *Gunflintia grandis* Barghoorn. The filaments in Fig. 5 resemble *Gunflintia minuta*.

Cocoid type: (Figs. 9-12): Spheroidal, well rounded, unicellular structures ranging in diameter from 5 μm to 40 μm . The concentration is in the size range of 12 to 16 μm . They usually occur as groups (Figs. 10-12) though occasional solitary occurrences are quite common (Figs. 11, 13, 14). They often exhibit thick sheaths or cover and marginal dark spots. Division of cells into two have also been noticed in some cases. The form is comparable to *Huroniospora* sp. A relatively large spheroid with marginal protuberances (Fig. 9) has also been noticed. It is not assigned to any taxon.

Discussion

This is the first record of microbiota from the stromatolitic Jammu Limestone. The stratigraphic position of these stromatolitic carbonates was controversial till recent systematic study of its stromatolites and subsequent absolute age determinations. Now-a-days stromatolitic microbiota are gaining importance towards biostratigraphic correlation of the Precambrian/Upper Proterozoic sediments. Shopf (1977) indicated a correlation between the mean diameter of the cells and filaments and the age range within the Precambrian. According to his charts these fall within the range of Lower and Middle Riphean period. This also conforms with the age indicated by its stromatolite content. Detailed study of these microbiota is in progress.

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