



LOWER CAMBRIAN STROMATOLITES FROM THE UPPER PART OF TAL GROUP OF THE KORGAI SYNCLINE, HIMACHAL LESSER HIMALAYA

V.C. TEWARI¹ and V.K. MATHUR²

1. Wadia Institute of Himalayan Geology, Dehra Dun-248 001, Uttaranchal
2. Geological Survey of India, Northern Region, Lucknow - 226 020

ABSTRACT

The paper provides detailed description of the Lower Cambrian stromatolite assemblage comprising *Illicita talica*, *Collumnaefacta korgaiensis*, *Aldania birpica* and oncolites recorded from the Dhaulagiri Formation of the Tal Group in the Korgai Syncline, Himachal Lesser Himalaya. The age of the Tal Formation has also been discussed.

KEY-WORDS : Lower Cambrian, Stromatolite assemblage, Dhaulagiri Formation.

INTRODUCTION

The Blaini, Krol and Tal groups form a part of the major Terminal Proterozoic - Lower Cambrian, sedimentary basin in the Lesser Himalaya of India (Shankar *et al.*, 1993). The Lower Cambrian microbial buildups are well developed at two stratigraphic levels of the Tal Group in the Lesser Himalaya. Cherty, phosphatic microbialites (stromatolites) and oncolites are found in the Chert Member of the Deo ka Tibba Formation, Tal Group in Mussoorie Syncline. However, non-cherty and non-phosphatic microbialites have been recorded from the Dhaulagiri Formation in the upper part of the Tal Group in Korgai and Mussoorie Syncline. Although these small bioherms (40 cm to 60 m) were recorded earlier from the Tal Group by Raha & Gururaj (1970), Sharma (1976), Patwardhan & Ahluwalia (1973, 1975), Ahluwalia (1980), Bhargava & Ahluwalia (1980) and Bhargava (1978). However, these buildups were compared with the Permian or Jurassic (Late Palaeozoic or Mesozoic) stromatolites since the age of the Tal Group was considered either Permian or Jurassic-Cretaceous (Ahluwalia, 1980; Bhargava & Ahluwalia, 1980; Patwardhan & Ahluwalia, 1973, 1975). The systematic study of stromatolites from

the Chert Member of the Deo ka Tibba Formation, Tal Group was carried out by Tewari (1984 a,b, 1989, 1993) and a definite Lower Cambrian (Tommotian Stage) assemblage was discovered and identified. The assemblage includes : *Collumnaefacta vulgaris*, *Boxonia gracilis*, *Aldania mussoorica*, *Collenniella*, *Stratifera*, *Compactocollenia* and oncolites.

The younger microbialite buildup (Botomian Stage of Lower Cambrian) was discovered and identified from the Dhaulagiri Formation of the Tal Group in the Birpa-Bithad Ka Khala section of the Korgai Syncline (Figs. 1,2 and Table 1) in Himachal Pradesh (Tewari *et al.*, 1988). These microbialite buildup include *Collumnaefacta korgaiensis* (Pl. 2b, 3a), *Illicita talica* (Pl. 1a,b, Fig. 3), *Aldania birpica* (Pl. 2a, 3b), *macrooncolite* (Pl. 4a,b) and are being systematically described in the present text for the first time. The described stromatolites differ in their morphology and microstructure from the stromatolites recorded from Chert Member of the Deo ka Tibba Formation, Tal Group and represent an open sea tidal-flat depositional environment, whereas former stromatolites suggest a restricted circulation or lagoonal/reducing environment (Tewari & Qureshy, 1985; Tewari, 1996, 2002).

Table 1: Lithostratigraphy of Tal Group in Birpa-Bhitar Ka Khala Section (Korgai Syncline, Himachal Pradesh)

TAL GROUP	DHAULAGIRI FORMATION		White and grey cross-laminated quartzarenite interbedded with purple siltstone....	404 m
		QUARTZITE MEMBER	Grey Lower Cambrian (Lenian) stromatolitic (<i>Ilicta talica</i> , <i>Collumnaefacta korgaiensis</i> , <i>Aldania birpica</i>) and oncolitic limestone interbedded with purple, greenish-grey siltstone and quartzarenite...	64 m
			White and grey felspathic quartzarenite....	330 m
			Black shales interbedded with thin arenite layers yielding Lower Cambrian (Botomian) brachiopod fauna (<i>Obolella</i> sp., <i>Lingulella</i> sp.)....	72 m
			White and grey cross laminated quartzarenite interbedded with shales	75 m
DEO KA FORMATION	CALCAREOUS MEMBER	Calcareous siltstone	15 m	
	ARENACEOUS MEMBER	Grey siltstone	887 m	
	ARGILLACEOUS MEMBER	Black shales	23 m	
	CHERT PHOSPHORITE MEMBER		NX	
KROL FORMATION		Upper Krol	TERMINAL PROTEROZOIC	

The Lower Cambrian age is in accordance with other fossil finds from the Tal Group (Kumar *et al.*, 2000). Earlier studies of these microbialites by Tewari (1989, 1993, 1996), Tewari & Qureshy (1985), Tewari & Joshi (1993) have covered various biosedimentological aspects such as environment of deposition of microbial facies, phosphogenesis, microstructures and diagenesis of microbialites, petrography and scanning electron microscopy. The carbon and oxygen isotopic signatures have been recently published from the Tal Group stromatolitic phosphorite and carbonates (Tewari, 1991, 1996, 2001; Kumar & Tewari, 1995; Bhattacharya *et al.*, 1996). All these studies have helped in firmly establishing the Terminal Proterozoic-Lower Cambrian event stratigraphy, biochemical and biosedimentological facies changes across the Precambrian-Cambrian boundary in the Lesser Himalaya and its global correlation.

SYSTEMATIC DESCRIPTION OF STROMATOLITES

Group : *Ilicta* Sidorov, 1960

Form : *Ilicta talica*
(Plate 1 a,b, Fig. 3)

Repository No. : WIF/A-1320

Description :

Columns irregular, gently curved, wall present, intercolumnar projections present, small in size, diameter ranges from 1 to 3 cm, height up to 10 cm. *Ilicta talica* is characterised by grumous microstructure. Sparry carbonate are surrounded by fine grained dark carbonate (Plate 1b). The grumous microstructure is very distinctive and restricted to early Cambrian. The inter columnar spaces are filled with intraclasts (Plate 1a, b, Fig. 3).

The three dimensional reconstruction of the *Ilicta talica* is shown in the figure 3.

Remarks : *Ilicta talica* has multilaminated wall and inter columnar spaces are filled with intraclasts. The size is small, maximum height up to 10 cm. It is commonly distributed in the Lower Cambrian of Eastern Siberia.

Group : *Collumnaefacta* Korolyuk, 1961

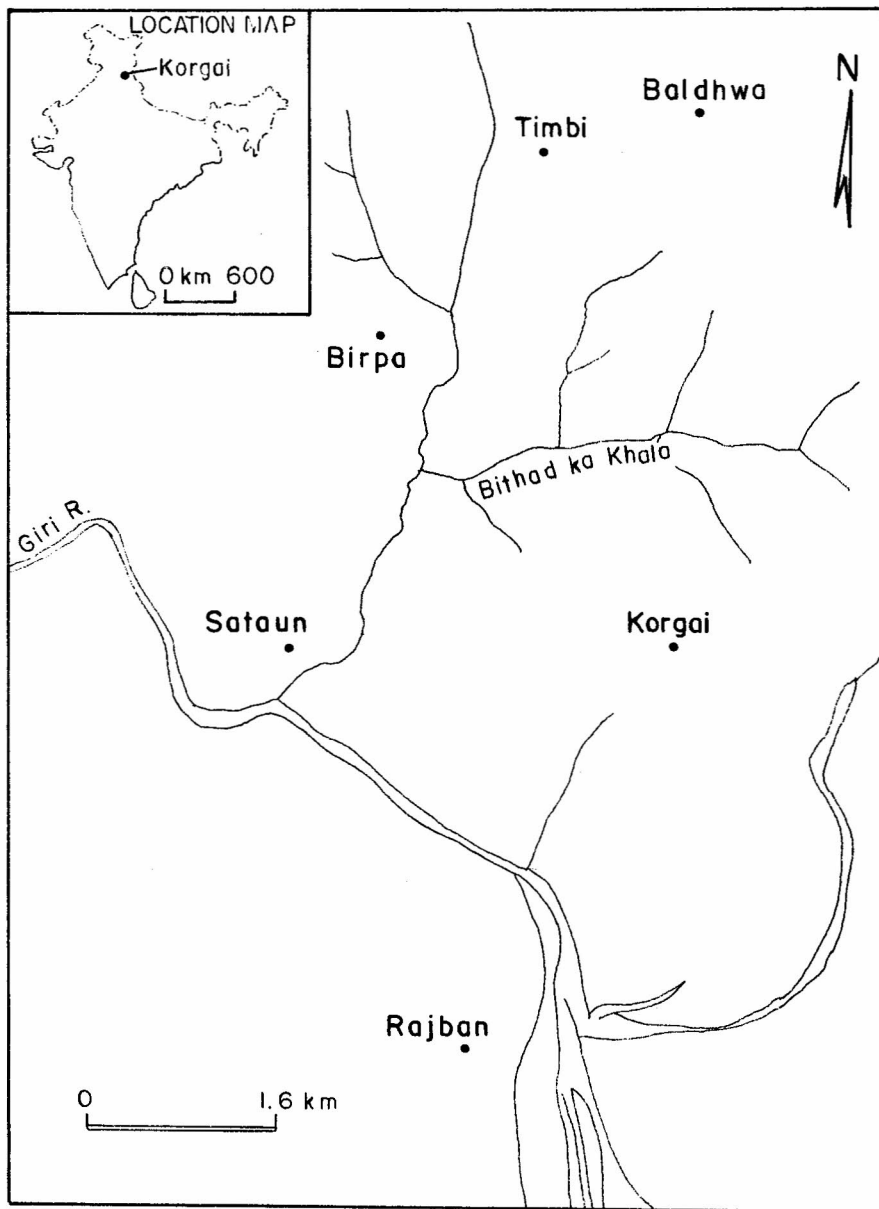


Fig. 1. Location map of the Birpa area, Korgai Syncline, Himachal Pradesh, Lesser Himalaya.

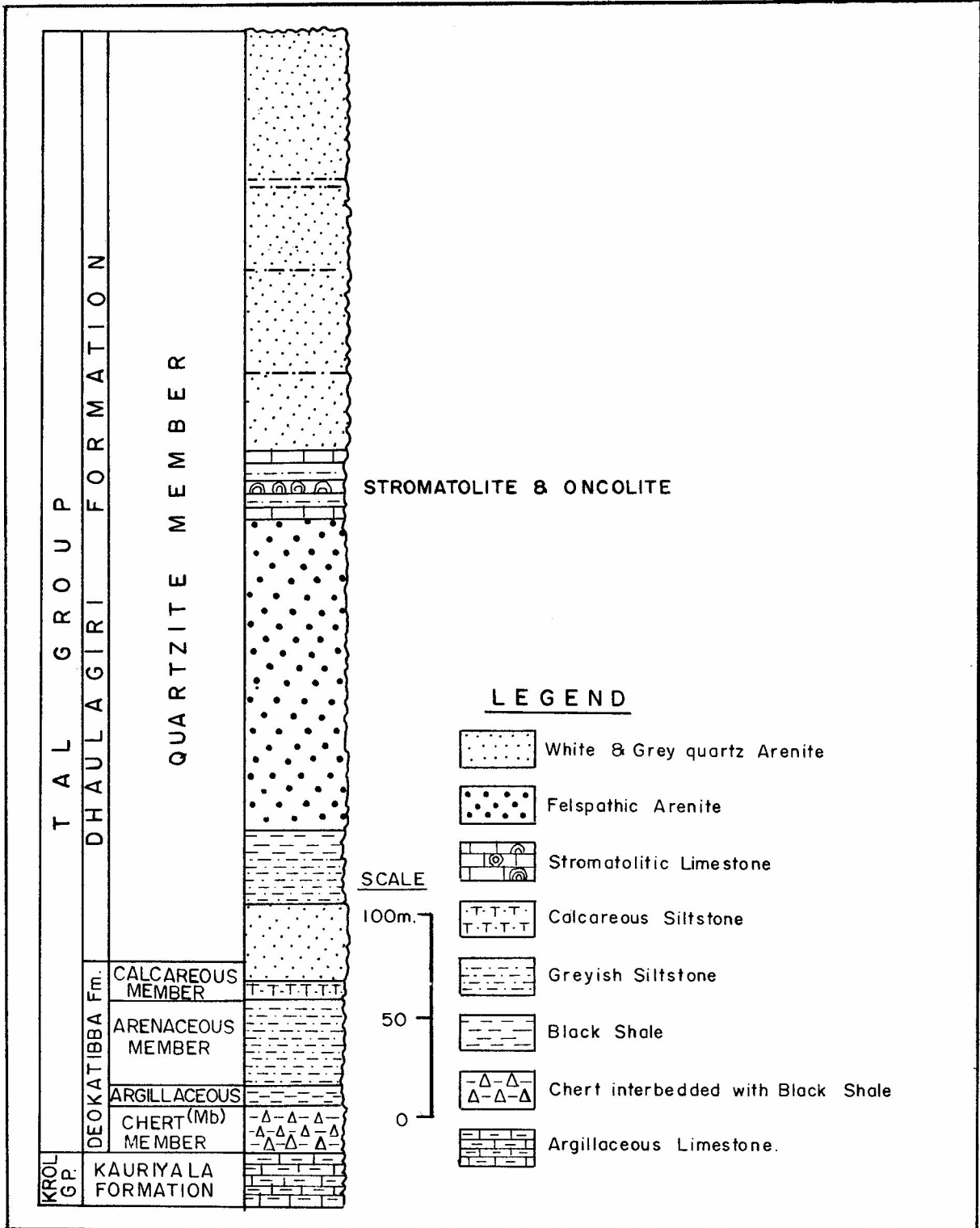


Fig. 2. Lithocolumn of the Tal Group along Birpa-Bhitar Ka Khala section, Korgai Syncline showing position of stromatolites and oncolites.



Fig. 3. Three dimensional reconstruction of the *Ilicta talica* from the Korgai Syncline showing stromatolitic lamina and columns.

Form : *Collumnaefacta korgaiensis*
(Plate 1d, 2a)

Repository No. : WIF/A-1321

Description :

Columnar stromatolite with patchy wall, columns are straight, cylindrical, and branching in upper part. Height varies from 3-14 cm. Patchy and lenticular microstructure is characteristic features of this taxa which can be distinguished from *Collumnaefacta vulgaris* (banded microstructure with patchy wall). The laminae are made up of fine grained carbonate. Secondary silica veins are criss-crossing and diagenetic. Dark laminae are thin 0.01-0.2 mm and the irregular patches are elongated and lenticular (Plate 1d).

Remarks : *Collumnaefacta vulgaris* has been recorded from the Lower Tal Formation of the Mussoorie Syncline, India (Tewari, 1984, 1989). *C. korgaiensis* differs in microstructure and smaller in size in comparison to *C. vulgaris*. *Collumnaefacta* is widespread in the Vendian and Lower Cambrian of Russia.

Group : *Aldania* Krylov, 1969

Form : *Aldania birpica* (Plate 1c, 2b)

Repository No. : WIF/A-1322

Description :

Passively branching stromatolite, subcylindrical columns, bridging occurs, columns widen in upper part. *Aldania* can be distinguished from *Jurusania* by absence of overhanging peaks. Patchy microstructure is characteristic of the *Aldania birpica*. (Plate 1c).

Description : *Aldania* is an unwalled form and do not show active branching. The size is small. *Aldania mussoorica* Tewari has been recorded from the Lower Tal Formation of the Mussoorie Syncline (Tewari, 1989). *Aldania* Krylov (type form) has been described from the Uppermost Precambrian (Vendian) of Yudoma Series, Siberia, Russia.

ONCOLITE (Plate 2c, 2d) (*Macrooncolite*)

Repository No. : WIF/A-1323

Description :

Oncolites are nodular unattached stromatolites (Plate 2c) and in thin section, they show concentric light (carbonate) and dark (microbial) laminae (Plate 2d). Their size ranges from 1 to 2 cm in the Upper Tal Formation of Korgai syncline. These oncolites were formed in intertidal environment with entrapment of detritus by an enveloping microbial mat.

CONCLUSIONS

The stromatolite assemblage comprising *Ilicta talica*, *Collumnaefacta korgaiensis*, *Aldania birpica* and oncolites, recorded earlier by Tewari *et al.*, (1988), has been described in detail for the first time from the Lower Cambrian (Botomian Stage) rocks of the Dhaulagiri Formation, Tal Group, Korgai Syncline, Himachal Pradesh.

This youngest stromatolite assemblage is found within the Quartzita Member of the Dhaulagiri Formation, Tal Group of the Lesser Himalaya. The new stromatolite taxa have been compared with Lower Cambrian assemblage of Siberia. This is quite significant in the sense that the age of the Quartzite Member (op. cit.) has been considered to be Botomian (Lower Cambrian) on the basis of the record of trilobites and brachiopods. The *Aldania-Collumnaefacta-Ilicta* type assemblage is geologi-

PLATE 1

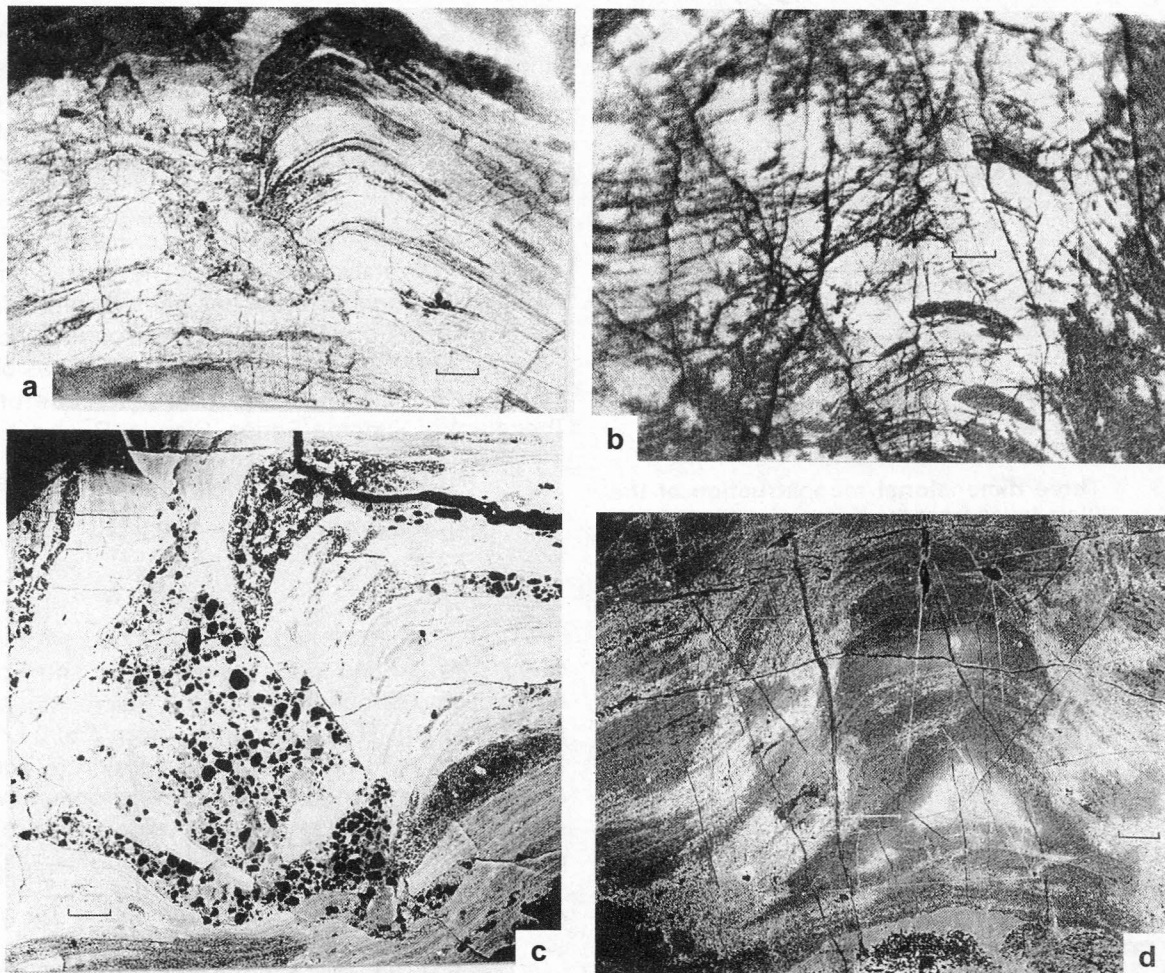
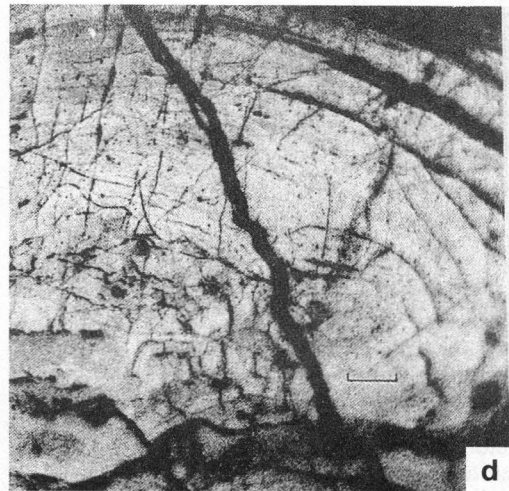
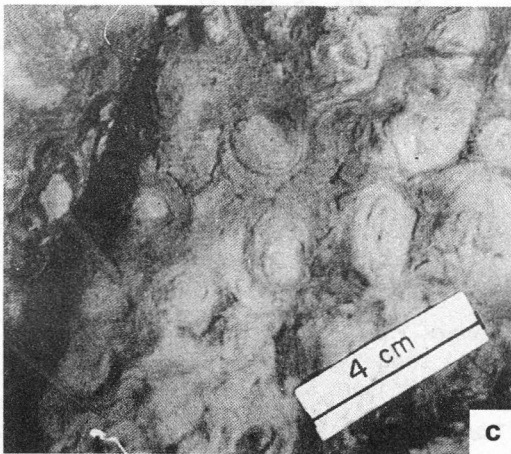
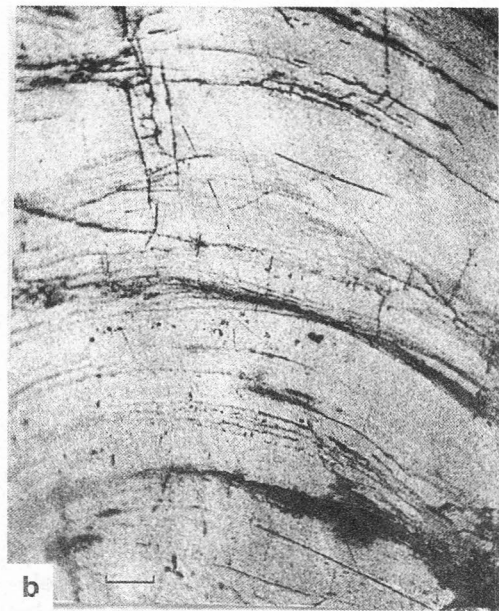
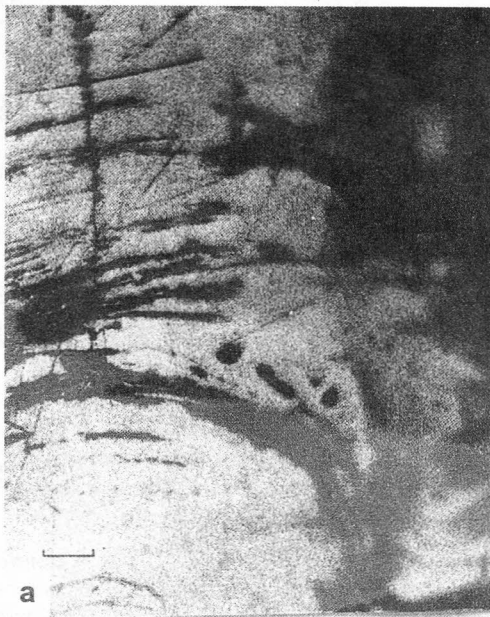


Plate 1a. Photograph of a polished slab of the *Ilicta talica* showing column margins and lamination pattern (scale bar = 1 cm.).

Plate 1b. Photomicrograph of *Ilicta talica* showing grumous microstructure and oolites and intraclasts filled in intercolumnar and interlaminal spaces (scale bar = 100 mm).

Plate 1c. Photomicrograph of *Aldania birpica* showing lenticular microstructure (scale bar = 80 mm).

Plate 1d. Photomicrograph *Collumnaefacta korgaiensis* showing column structure, laminae, and patchy-banded microstructure (scale bar = 80 mm).



- Plate 2a. Photomicrograph *Collumnaefacta korgaiensis* showing patchy, banded and lenticular microstructures (bar = 80 mm).
- Plate 2b. Photomicrograph of *Aldania birpica* showing banded laminae and microstructure (scale bar = 80 mm).
- Plate 2c. Field photograph of oncolites in the upper part of Tal Group (stromatolitic limestone) showing well developed concentric laminae (scale bar = 4 cm).
- Plate 2d. Photomicrograph of a large oncolite showing cyanobacterial (dark) and carbonate (lighter) laminae (scale bar = 100 mm).

cally distributed in the Yudomian Formation and the Pestrotsvet Formation (Terminal Proterozoic to Lower Cambrian) of Russia. The Lower Cambrian stromatolites show typical grumous, patchy and lenticular microstructures in them and have appeared first time in the Tal Group of the Lesser Himalaya. These microstructures are very distinctive and restricted to the Lower Cambrian.

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