

## SIGNIFICANCE OF STROMATOLITES IN THE CORRELATION OF SEMRI SERIES (LOWER VINDHYANS) OF SON VALLEY AND CHITRAKUT AREAS, U.P.

S. KUMAR

DEPARTMENT OF GEOLOGY, LUCKNOW UNIVERSITY.

### ABSTRACT

The Semri Series (Lower Vindhyan) is exposed in Son Valley and Chitrakut areas, U. P. but shows quite different lithologic sequences. The precise lithologic correlation of one area with the other presents difficulties. In the absence of other fossil record, the presence of stromatolites from both the area is utilised for correlation.

From Chitrakut area, for the first time a new stromatolite form *Colonella lodhwarensis*, and forms *Kussiella kussiensis* and *Collenia symmetrica* are being described. The forms *Kussiella kussiensis* and *Colonella (Collenia) clappii* are described from the Kajrahat Limestone and Fawn Limestone respectively of Son Valley area.

### INTRODUCTION

The correlation of unfossiliferous rocks, scattered over wide areas, on the basis of lithology, has always been considered unsatisfactory and unreliable. This becomes even more difficult if the lithologic units of one area are not traceable in the other. The Lower Vindhyan represented by the Semri Series occupy a vast region in Son Valley and Chitrakut areas, U. P. These are devoid

of any well defined fossil bodies except for the finely laminated organosedimentary structures, referred to as stromatolites. In Son Valley area, the Semri Series shows best development consisting of about 1000 meters thick sequence of varied lithologies. Here, the Semri Series is divisible into 4 clearly defined lithologic units (Table 1). The Basal and Kheinjua stages are further

Table 1

Stratigraphic succession of the Semri Series in Son Valley

Semri Series (Lower Vindhyan)	Semri B	Rohtas Stage	Limestones and shales. Lower part shows algal mats.
		Kheinjua Stage	<i>Glauconitic Sandstone</i> Glauconitic sandstone, shales and lenses of limestone.
			<i>Fawn Limestone</i> . Limestone with <i>Conophyton garganicus</i> , <i>Colonella columnaris</i> and <i>Colonella clappii</i> . Thin lenticles of chert quite common.
	Semri A	Porcellenite Stage	<i>Olive Shales</i> . Shales and siltstones.
		Basal Stage	<i>Porcellenites</i> .
			<i>Kajrahat Limestone</i> . Limestones. In the upper part <i>Conophyton vindhyaensis</i> , <i>Kussiella dalensis</i> , <i>K. kussiensis</i> , <i>Collenia symmetrica</i> , & <i>Colonella kajrahatensis</i> are well developed.
	Basal Stage	<i>Basal Conglomerate</i> . Conglomerate, sandstone and limestone with <i>Kussiella kussiensis</i> .	
.....Unconformity.....			
Bijawar Formation Phyllites.			

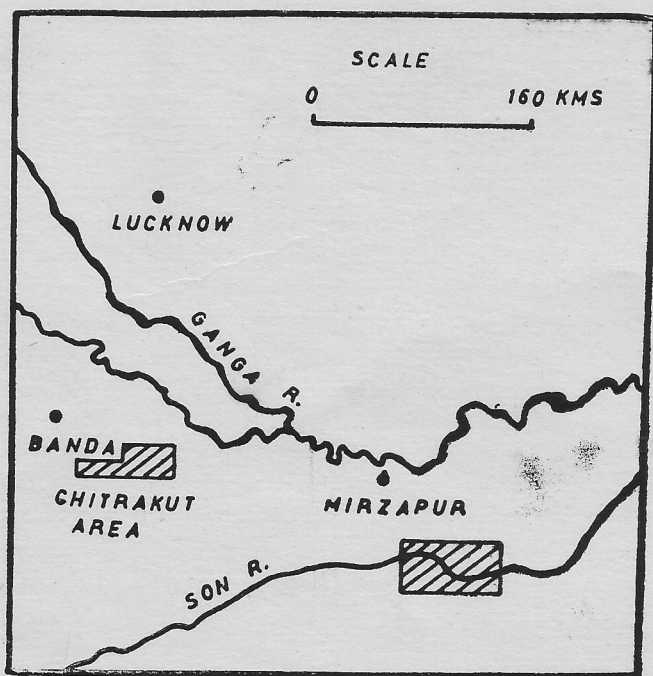


Fig. 1 Location map

subdivided into lithostratigraphic units. However, in Chitrakut area, the well defined stages of Son Valley are not traceable (Table 2). Furthermore the thickness of

## STROMATOLITES OF SEMRI SERIES

## (STROMATOLITES OF SON VALLEY)

There are three horizons in the Semri Series which show development of stromatolite forms. Two horizons are in the Basal Stage and the third belongs to the Kheinjua stage. The *Kussiella kussiensis* is developed in a lenticular limestone within the Basal conglomerate of the Basal Stage (Kumar, 1976). In the younger horizon of the Basal Stage, the Kajrahat limestone, the stromatolite assemblage consists of *Colonella symmetrica*, *Colonella kajrahatensis*, *Kussiella dalensis*, *Kussiella kussiensis* and *Conophyton Vindhyaensis*.

In the Fawn limestone of the Kheinjua Stage the characteristic stromatolite forms are *Conophyton garganicus*, *Colonella columnaris* and *Colonella clappii*. Out of which *Kussiella kussiensis* from the Kajrahat limestone and *Colonella clappii* from the Fawn Limestone are being described for the first time.

Rohtas Limestone is devoid of any well developed stromatolite form except for small algal mats. However, in Danawa nala cutting westnorthwest of 'Muni Ki Pahari', in Son Valley area, a small band of algal limestone is seen at the contact of glauconitic sandstone and Rohtas Limestone (Plate II-1), but so far due to the paucity of exposures it has not been possible to recognise the true nature of the algal form. Nevertheless, the form seems to be comparable to the *Colonella clappii* and indicates a biohermal nature.

## SYSTEMATIC DESCRIPTION

<i>Supergroup</i>	Kussiellida	Raaben, 1969
<i>Group</i>	<i>Kussiella</i>	Krylov, 1963
<i>Form</i>	<i>Kussiella kussiensis</i>	Krylov, 1963

(Plate I—2, 3,)

Colonies subcylindrical standing at right angle to the bedding plane. Internal laminae nonenveloping, low to moderately convex upwards. Marginal surface with protuberances, formed by the projecting edges of internal laminae. Height varies from 12 to 40 cms and width from 7 to 12 cms. Ramification by division of parent column into two subparallel smaller column.

*Remarks:* The form resembles with *Kussiella kussiensis* described from the Lower Riphean Group of rocks of U.S.S.R.

*Occurrence:* On the hill near Bari village on Dala-Chopan motor road, and also in the nala cutting west of the motor road, district Mirzapur, in the upper part of the Kajrahat Limestone near the contact with the Porcellenite Stage.

Table 2

The stratigraphic succession of the Semri Series in Chitrakut area, U. P.

	Chitrakut area	Son Valley area
Semri Series	Tirohan limestone	Rohtas Stage
	Glauconitic sandstone	Kheinjua Stage Porcellenite Stage
	Pellet Limestone. In the lower part a band shows development of <i>Colonella lodhwarensis</i> , <i>Collenia symmetrica</i> and <i>Kussiella kussiensis</i>	Basal Stage
	Grey sandstone	
	....Unconformity.....	....Unconformity....
	Bundelkhand Granites	Bijawar Formation.

the Semri Series in this area is only about 100 meters. Thus, the precise correlation of the lithologic units of Son Valley with that of Chitrakut area presents difficulties. However, there is a good development of stromatolites in the Semri Series of both the areas.

Valdiya (1969) critically reviewed and attempted an interregional correlation of unfossiliferous strata of Lesser Himalaya and Vindhyanal on the basis of stromatolite assemblage. Kumar (1976) subdivided the Semri Series of Son Valley into two groups on the basis of the presence of stromatolite forms; the Semri 'A' comprising only the Basal Stage and Semri 'B' represented by the Porcellenite, Kheinjua and Rohtas stages. In this paper a few stromatolite horizons from Chitrakut and Son Valley have been described and an attempt has been made to correlate the two regions on the basis of stromatolite assemblage.

## GEOLOGY

In the areas under consideration, the Lower Vindhyan are represented by the Semri Series (Auden, 1933). Singh and Pal (1969) have also dealt with the stratigraphy of Chitrakut area. The stratigraphic succession is given in the Tables 1 & 2. In Son Valley the Semri Series unconformably overlies the Bijawar formations, while in Chitrakut area it directly rests over the Bundelkhand granites. The lithologic units of one area are not traceable in another but the gross lithology in both areas is similar and is represented by micrite, pellet limestone, stromatolitic limestone, shales and glauconitic sandstones.

<i>Supergroup</i>	Conophytonida	Raaben, 1969
<i>Group</i>	<i>Colonella</i>	Komar, 1966
<i>Form</i>	<i>Colonella (Collenia) clappii</i>	Fenton & Fenton, 1937

(Plate II—2, 3 &amp; 5)

Colonies concavo-convex, broadly expand, ranging from 5 to 110 cms in width and 7 to 30 cms in height. Laminae moderately arched centrally and subparallel. Marginally the curvature is more abrupt but rarely results in overlapping. Colonies form well developed bioherms. In transverse section it is circular to elliptical.

*Remarks:* Form resembles with *Collenia clappii* Fenton and Fenton, 1937, described from the Lower Kintla where it forms conspicuous bioherms in the regions of Boulder Peak and Akamina Pass, Waterton Glacier Parks, U.S.A.

*Occurrence:* On 'Muni Ki Pahari', north of Newari, district Mirzapur, in the Fawn Limestone.

## STROMATOLITES OF CHITRAKUT AREA

In Chitrakut area, the Semri Series is represented by the Chitrakut Formation (Singh and Pal, 1969). The total thickness of Chitrakut Formation is about 100 meters. No lithologic equivalents of Son Valley are recognisable in this area and altogether a different lithologic setup is developed here. Only in one locality i. e., in the Lodhwara hill about 1.5 meter thick limestone band shows development of stromatolites which is seen at the base of the pellet limestone horizon. This band shows a number of stromatolite forms. Isolated as well as crowding of the colonies is seen. At places the broken pieces of stromatolites were redeposited indicating a very strong wave action at the time of the formation of this limestone band. The colonies make different angle with the bedding plane. Forms *Colonella symmetrica*, *Kussiella kussiensis* and *Colonella lodhwarensis* have been identified. The Tirohan Limestone, however, shows only poor development of algal mats. Only a very poor development of an algal mat has been recorded in the Tirohan Limestone at Gupta Godavari (Plate I-6).

## SYSTEMATIC DESCRIPTION

<i>Group</i>	<i>Collenia</i>	Walcott, 1914
<i>Form</i>	<i>Collenia symmetrica</i>	Fenton & Fenont, 1937

(Plate I-4)

Loaf like solitary hemispheroidal appearance. Height up to 17 cms. At the base the diameter is 25 cms and

at the top it is 36 cms. In transverse section it has a circular shape with concentric rings. Internal laminae smooth. Lateral surface without wall. Lower surface is undulatory. Degree of convexity is low.

*Remarks:* It resembles with *Collenia symmetrica* described from the Belt Series of Waterton Glacier Parks, U.S.A. by Fenton and Fenton, (1937), and with the same form described from the Kajrahat Limestone, Dala area, district Mirzapur by Kumar (1976).

*Occurrence:* At Lodhwara hill, district Banda, U. P.

<i>Supergroup</i>	Tungussida	Raaben, 1969
<i>Group</i>	<i>Kussiella</i>	Krylov, 1963
<i>Form</i>	<i>Kussiella kussiensis</i>	Krylov, 1963

(Plate I—5)

It resembles with form described from Kajrahat Limestone, Son Valley area, district Mirzapur, U. P.

*Occurrence:* At Lodhwara hill, district Banda, U. P.

<i>Supergroup</i>	Conophytonida	Raaben, 1969
<i>Group</i>	<i>Colonella</i>	Komar, 1966
<i>Form</i>	<i>Colonella lodhwarensis</i>	new form

(Plate I—1 )

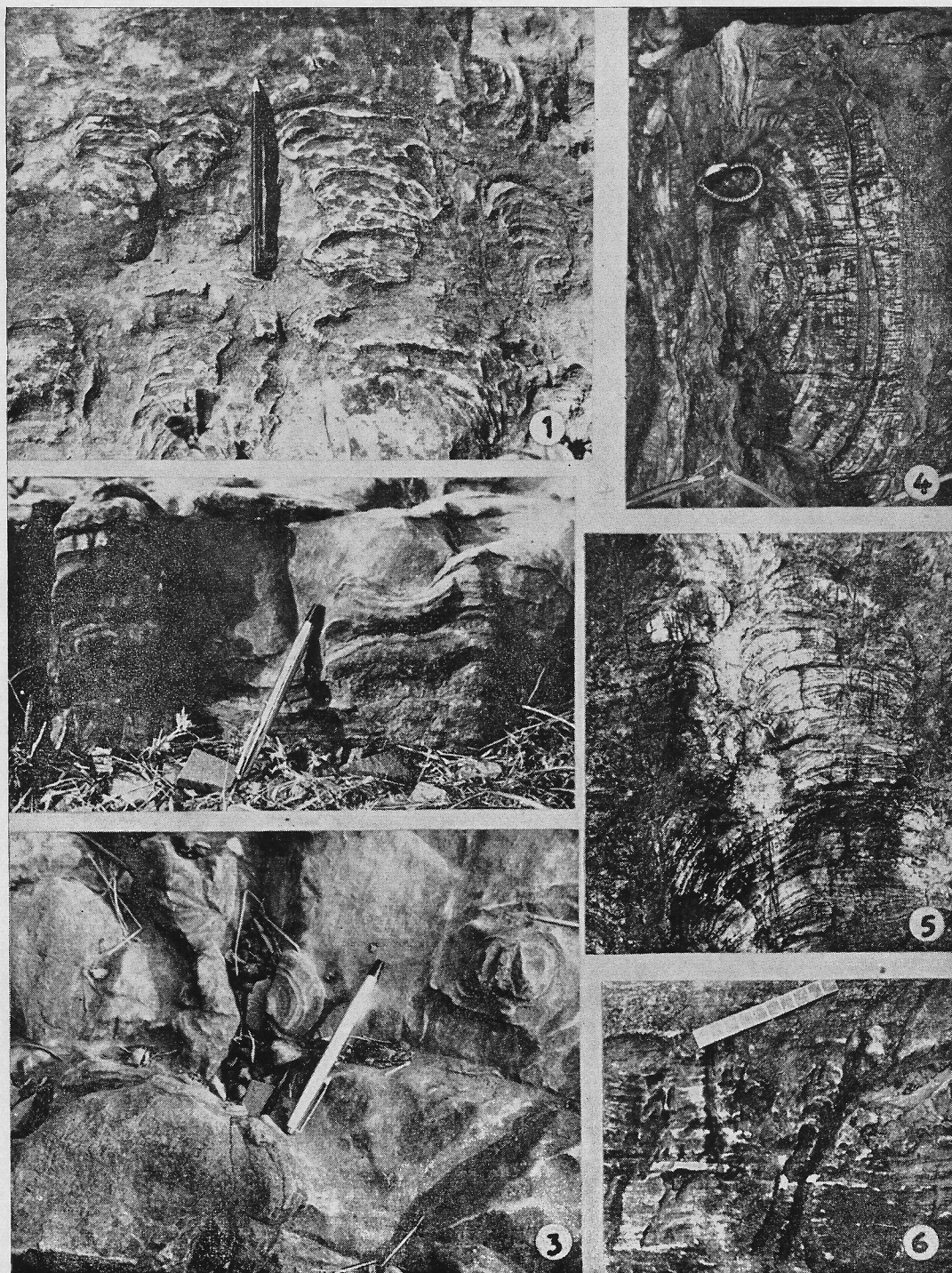
Colonies elongate, subcylindrical making an angle between 70° to 90°. Internal laminae moderately convex with nonenveloping marginal zone. Marginal zone is full of small protuberances which hang, like cornices. Height ranges from 7 to 35 cms. Diameter at the base ranges from 1 to 7 cms. It increases with the height and reaches maximum width of 21 cms. In transverse section it is circular.

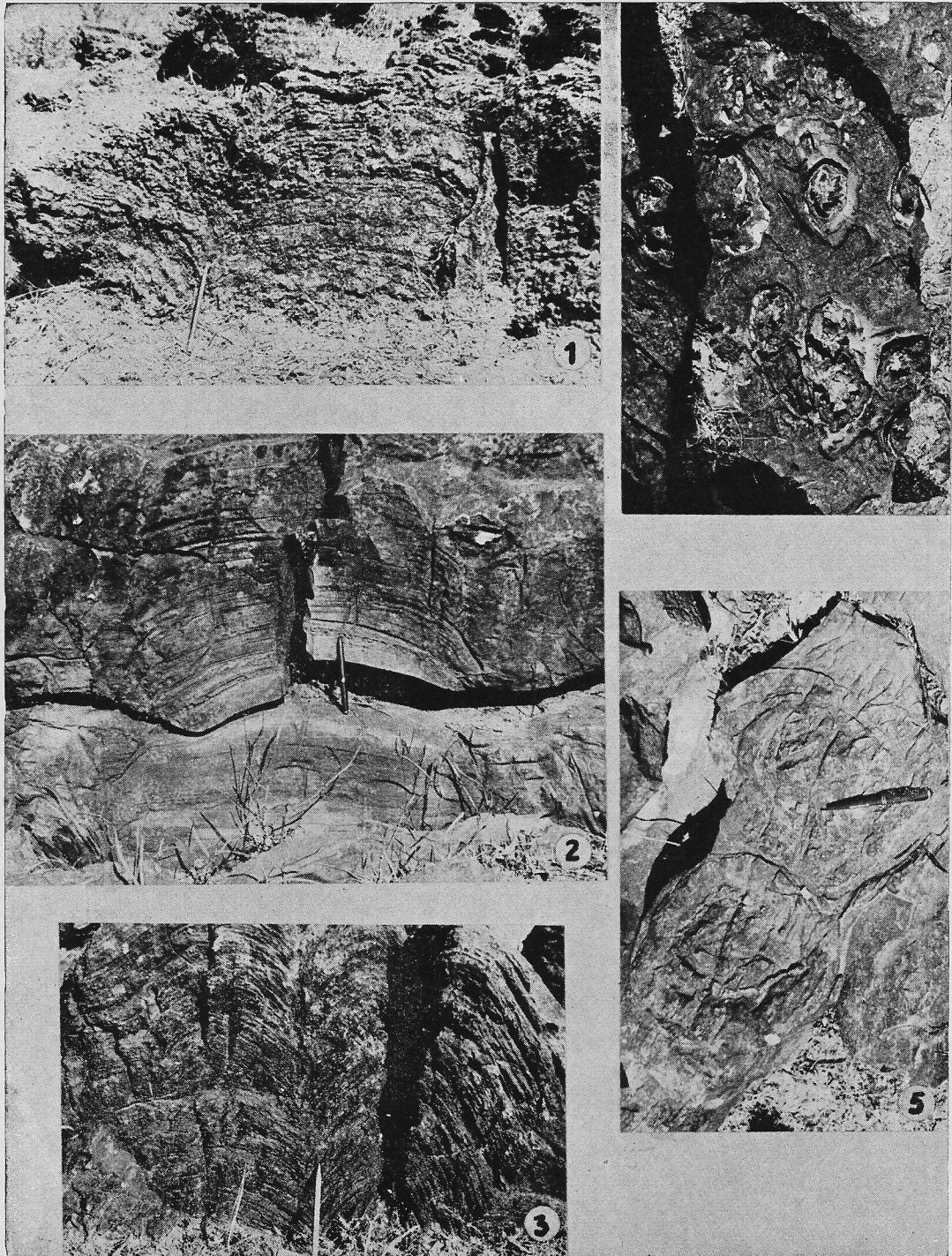
*Remarks:* It resembles with *Colonella kajrahatensis* described from Kajrahat limestone from Dala area, district Mirzapur, U. P. by Misra, Singh and Kumar, 1974, but differs in the maximum height and more prominent overhangings and in the tendency of swelling towards the top.

*Occurrence:* Lodhwara hill, Chitrakut area, district Banda, U. P.

## DISCUSSION

The Semri Series of Chitrakut and Son Valley areas shows different lithologic sequences and it is quite difficult to correlate the lithologic horizon of one area with the other. Moreover the thickness of the Semri Series in Chitrakut area is only about 100 meters in contrast to Son





Valley area where it attains a thickness of about 1000 meters. In Chitrakut area, even the lithologic succession in one hill does not correspond to the lithologic succession at other.

At Lodhwara hill, Chitrakut, U. P., the stromatolites forms are *Collenia symmetrica*, *Kussiella kussiensis* and *Colonella lodhwarensis* while in the Kajrahat limestone the forms present are *Kussiella kussiensis*, *Kussiella dalensis*, *Colonella kajrahatensis*, *Collenia symmetrica* and *Conophyton vindhyaensis*. Thus, the stromatolites at Lodhwara hill are comparable to the forms present in the upper part of the Kajrahat limestone in Son Valley. Kumar (1976) has assigned a Lower Riphean age to the Kajrahat limestone on the presence of above mentioned stromatolite forms which show primitive morphological characters like nonenveloping internal laminae and passive ramification. On similar basis the entire succession up to the pellet limestone horizon of Chitrakut area is correlated with the Basal Stage of Son Valley.

On this basis, the horizon overlying the pellet limestone, the glauconitic sandstone horizon can be correlated with the Porcellenite and Kheinjua stages, and the Tirohan Limestone may correspond to the Rohtas Stage of Son Valley. If this correlation holds valid it means that all the stages of the Semri Series of Son Valley are represented in Chitrakut area. However, the thickness at Chitrakut is quite small in contrast to the thickness in Son Valley area. Thus, it may be said that the Semri

Series of Chitrakut represents a condensed sequence of Son Valley.

#### ACKNOWLEDGEMENTS

The author is grateful to Prof. S. N. Singh for critical review of the manuscript and suggestions. Thanks are also extended to Dr. I. B. Singh for help during the course of investigation. Help extended during the field work in Son Valley by Messers. B. S. Srivastava and R. N. Srivastava of G. S. I. is thankfully acknowledged.

#### REFERENCES

- AUDEN, J. B., 1933. Vindhyan sedimentation in Son Valley, Mirzapur district. *Mem. Geol. Surv. India*. **62** (2).
- CLOUD, P. E. JR., and SEMIKHATOV, M. A., 1969. Proterozoic stromatolite zonation. *Amer. Jour. Sci.* **267** (9): 1617-1061.
- FENTON, C. L. and FENTON, M. A., 1937. Belt Series of the North: Stratigraphy, Sedimentation and Palaeontology. *Bull. Geol. Soc. America*. **48**: 1870-1970.
- KUMAR, S., (1976). Stromatolites from the Vindhyan Rocks of Son Valley—Maihar area, Districts Mirzapur (U. P.) and Satna (M. P.). *Jour. Pal. Soc. India*. **18**: 13-21.
- MISRA, R. C., Singh, S. N. and KUMAR, S., 1974. Two new forms of stromatolites from the Kajrahat Limestone (Lower Vindhyan), Dala area, district Mirzapur, U. P. *Geophytology*. (in Press).
- RAABEN, M. E., 1969. Columnar stromatolites and Late Precambrian stratigraphy. *Amer. Jour. Sci.* **267**: 1-18.
- SINGH, S. N. and PAL, O. P., 1969. Geology around Chitrakut area, district Banda, U. P. *Jour. Pal. Soc. India*. **14**: 77-85.
- VALDIYA, K. S., 1969. Stromatolites of the Lesser Himalayan carbonate formations and the Vindhyan. *Jour. Geol. Soc. India*, **10**: 1-25.

#### EXPLANATION OF PLATES

##### PLATE I

1. *Colonella lodhwarensis* in the pellet limestone, Semri Series. Chitrakut area, district Banda, U. P.
2. *Kussiella kussiensis* in the upper part of Kajrahat Limestone, Semri Series, Dala area, district Mirzapur, U. P.
3. *Kussiella kussiensis*. Transverse section. Kajrahat Limestone, Semri Series, Dala area, district Mirzapur, U. P.
4. *Collenia symmetrica* in the pellet limestone, Semri Series, Lodhwara hill, Chitrakut area, district Banda, U. P.
5. *Kussiella kussiensis* in the pellet limestone, Semri Series, Lodhwara hill, Chitrakut area, district Banda, U. P.
6. Algal mat in Tirohan Limestone, Semri Series, Loc. Gupta-Godavari, Chitrakut area, district Banda, U. P.

##### PLATE II

1. Stromatolitic structure in Rohtas Limestone, NW of Muni Ki Pahari, Son Valley, district Mirzapur, U. P.
2. *Colonella clappii* in Fawn Limestone, Semri Series, Muni Ki Pahari, Son Valley, district Mirzapur, U. P.
3. *Colonella clappii* in Fawn Limestone, Semri Series, Muni Ki Pahari, district Mirzapur, U. P.
4. Algal mat. Transverse section, Fawn Limestone, Semri Series, Muni Ki Pahari, district Mirzapur, U. P.
5. *Colonella clappii*, Transverse section. Fawn Limestone. Muni Ki Pahari, district Mirzapur, U. P.