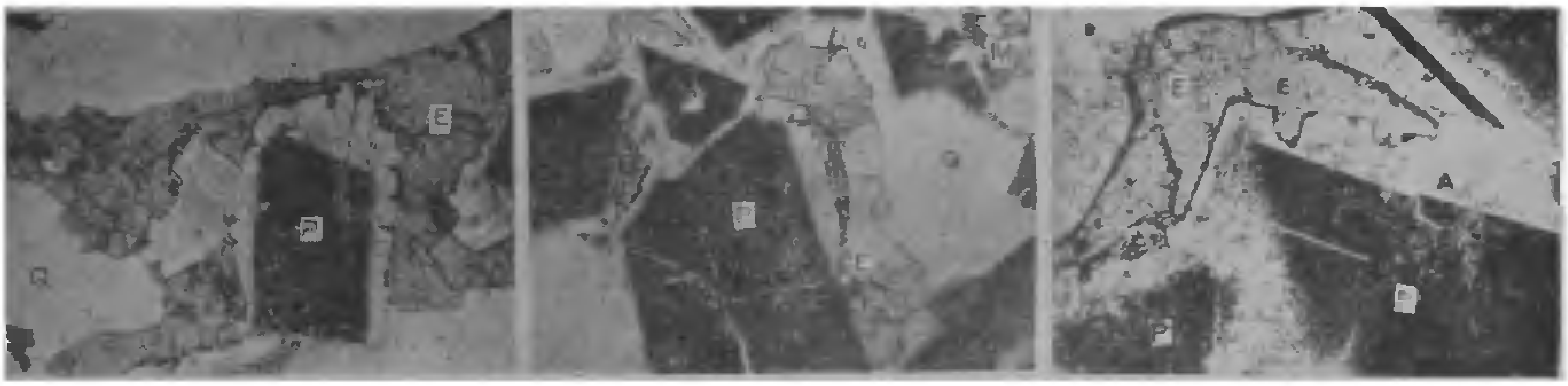
when the temperature reaches a point at which the velocity of the reaction attains a geologically finite rate (Deer *et al.*, 1963, p. 150). In this transformation, Ca and Al of plagioclase are released to enter the lattice of epidote.

$$CaNaAl_3Si_5O_{16} + Na^{+} + Si^{+4} \longrightarrow 2NaAlSi_3O_8 + Ca^{+2} + Al^{+3}.$$

It has been experimentally demonstrated (Eskola *et al.*, 1935) that in this reaction, the formation of albite from more basic plagioclase takes place without any appreciable change in volume which is evident in Figs. 1–3. Decalcification of more basic plagioclase and the consequent development of albite rim has also been suggested by Dietrich (1962) and Prasad (1968).



1 2 3

FIGS. 1–3. Decalcification of more basic plagioclase into albite rim and epidote. P, More basic plagioclase ; A, Albite ; E, Epidote ; Q, Quartz ; M, Micropegmatite. Fig. 1. (× 40), Fig. 2 (× 70) and Fig. 3. (× 100). Infiltration of quartz and albite through cracks in the more basic plagioclase due to which the grain is also frayed in the upper part (Fig. 2). The cleavages in the more basic plagioclase are emphasized by such infiltration.

The basic plagioclase also appears to be affected by soda metasomatism involving the fixation of Na and Si. Figures 2 and 3 reveal the infiltration of Na and Si, in the form of albite and quartz, through the cracks and cleavages in the more basic plagioclase.

Bowen (1928, p. 186) states that a slight decrease in the temperature, during the crystallisation of a plagioclase mixture, results in the reaction : Plagioclase + liquid = a little more plagioclase of somewhat more sodic composition. Vance (1965, p. 643) similarly argues that a superheated more albitic melt, by mixing with a cooler and more anorthitic material, could lead to partial resorption of plagioclase crystals in the latter and, on cooling, precipitation of some sodic plagioclase.

The observations made in this study are in accord with the statement that plagioclases in the range of composition $An_{1-5}$ to $An_{21-25}$ are sometimes divided into sodium-rich and calcium-rich regions (Deer *et al.*, 1963, p. 96 and pp. 104–105).

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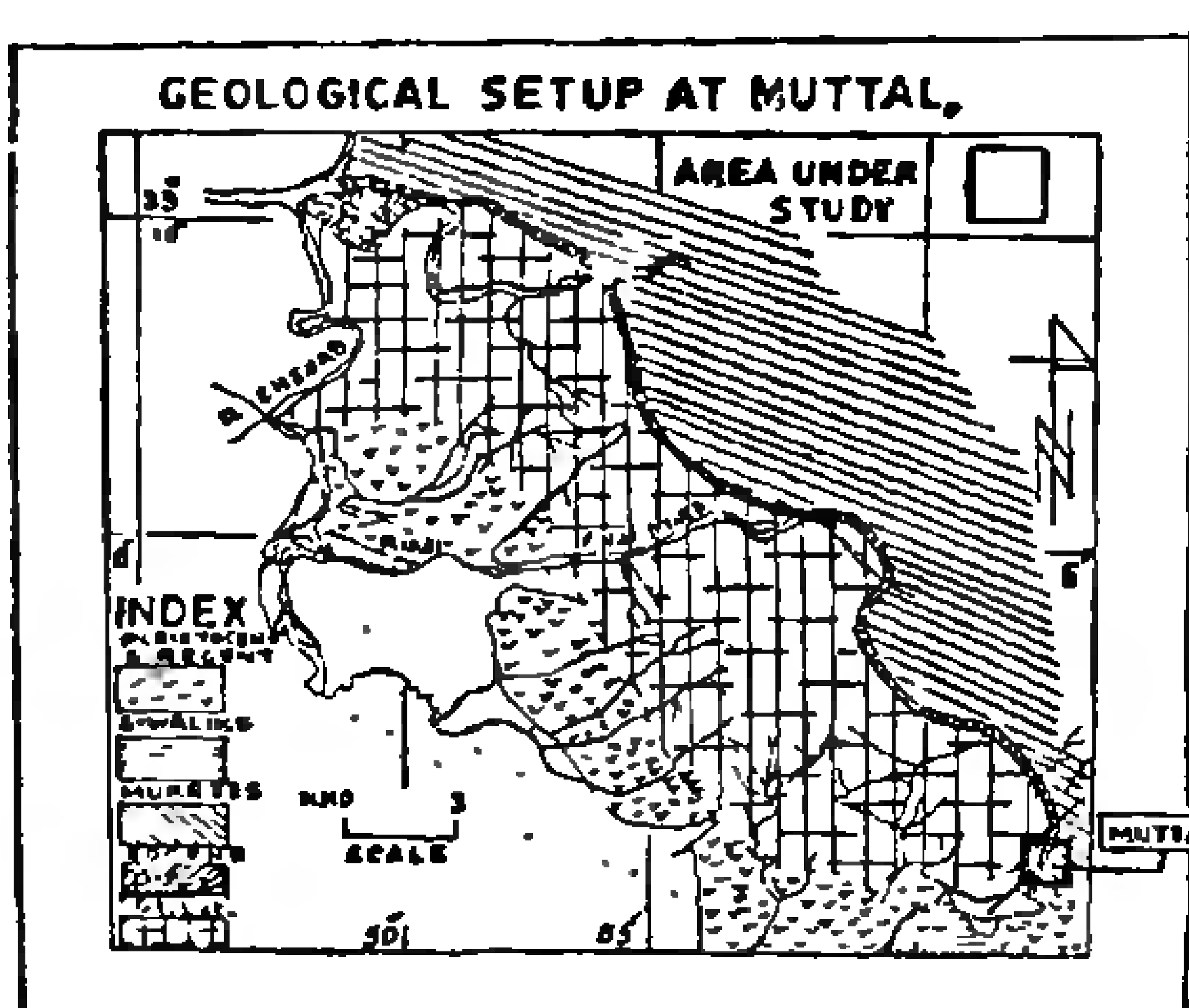
## OCCURRENCE OF STROMATOLITES FROM THE GREAT LIMESTONE OF MUTTAL, UDHAMPUR DISTRICT, JAMMU PROVINCE, J AND K STATE, INDIA

THE present note records the occurrence of stromatolites from the dolomitic limestones of Muttal (32° 59′ N : 75° 02′ E), at a place across the Do-Khadda bridge. It lies on Survey of India Toposheet No. 43 P/1. It is connected by a 16 km long branch road from Tikri (32° 56′ 30″ N : 74° 57′ E), about 45 km from Jammu on the National highway to Kashmir.

The Great Limestone in which the stromatolites occur is a part of the great Reasi inlier. The Great Limestone is a prominent formation in the outer Himalaya, occurring in the form of a chain of inliers, stretching from Purl (33° 35′ N : 73° 55′ E) to Muttal (32° 59′ N : 75° 02′ E), over a distance of about 120 km, along the prevalent strike of the outer Himalaya. The limestones are bluish grey in colour and frequently dolomitized with intercalations of cherty matter. The formation has been given different names from time to time. Medlicott[9] (1876) and Simpson[16] (1904) called it the "Great Limestone", Wright[22] (1906) and Middlemiss[8] (1928) referred it as the "Sirban Limestone" Wadia[21] (1937) designated it as the "Jammu Limestone", while Sharma[15] (1970) called it as the "Vaishno Devi Dolostones".

Many have reported the occurrence of stromatolites in the Great Limestone. Among the pioneer workers, mention may, however, be made of Sharma (1970), Dasarathi[2] (1969), Gupta and Dixit[4-5] (1970, 1971, 1972), Valdiya[19] (1969), Raha (1972), Singh and Vimal[17] (1972) and Raha and Sastry[13] (1973). However, the stromatolites in the Great Limestone of Muttal remained unnoticed so far.

Regarding the regional geology, it may be pointed out that the Great Limestone forms the oldest group of rocks in the area, being overlain unconformably by the Eocene formations. The formation shows a strike of NW–SE with dips varying between 45° to 70° in the NE direction with minor warpings, flexurings and dislocations. The local variations both in the direction of dip and strike have also been observed (Map 1).




MAP 1

The outcrop, exhibiting stromatolitic structures, is about 12 meters long, along the strike, with a thickness of about 9 meters. The outcrop is separated from the parent rock at their strike ends, and the plane of separation contains limestone debris with shrubby vegetation acting as a cover.

Megascopically, the stromatolites are made up of calcic matter of variable character. The columns and cylinderoids are constituted of bluish grey limestone laminae. In the weathered portions, the laminae are distinct, isolated and crenulated. At places, cherty matter has also been observed. The cylinderoids expand upward from the base, the laminae are often domed towards the top and incurved around the edges. They are 4 to 6 cm in diameter at the base, expand upto 9 to 12 cm at the top, and have a height varying between 12 to 20 cm. No branching has been observed. Most of the columns are vertical but some of them are inclined. A few forms are ovoidal with a diameter of about 14 cm. They are generally formed by the concentration of mass around particular nuclei on the substratum.

The cylinderoidal forms have their length, far exceeding the width. The direction and the rate of growth are irregular. At places, the structure has arched lamella. Most of the cylinderoidal columns ramify "passively" or do not ramify at all. Such columnar forms (Fig. 1) belong to the collenia group and can be correlated with LLH–C structures of Logan *et al.*[6] (1964).

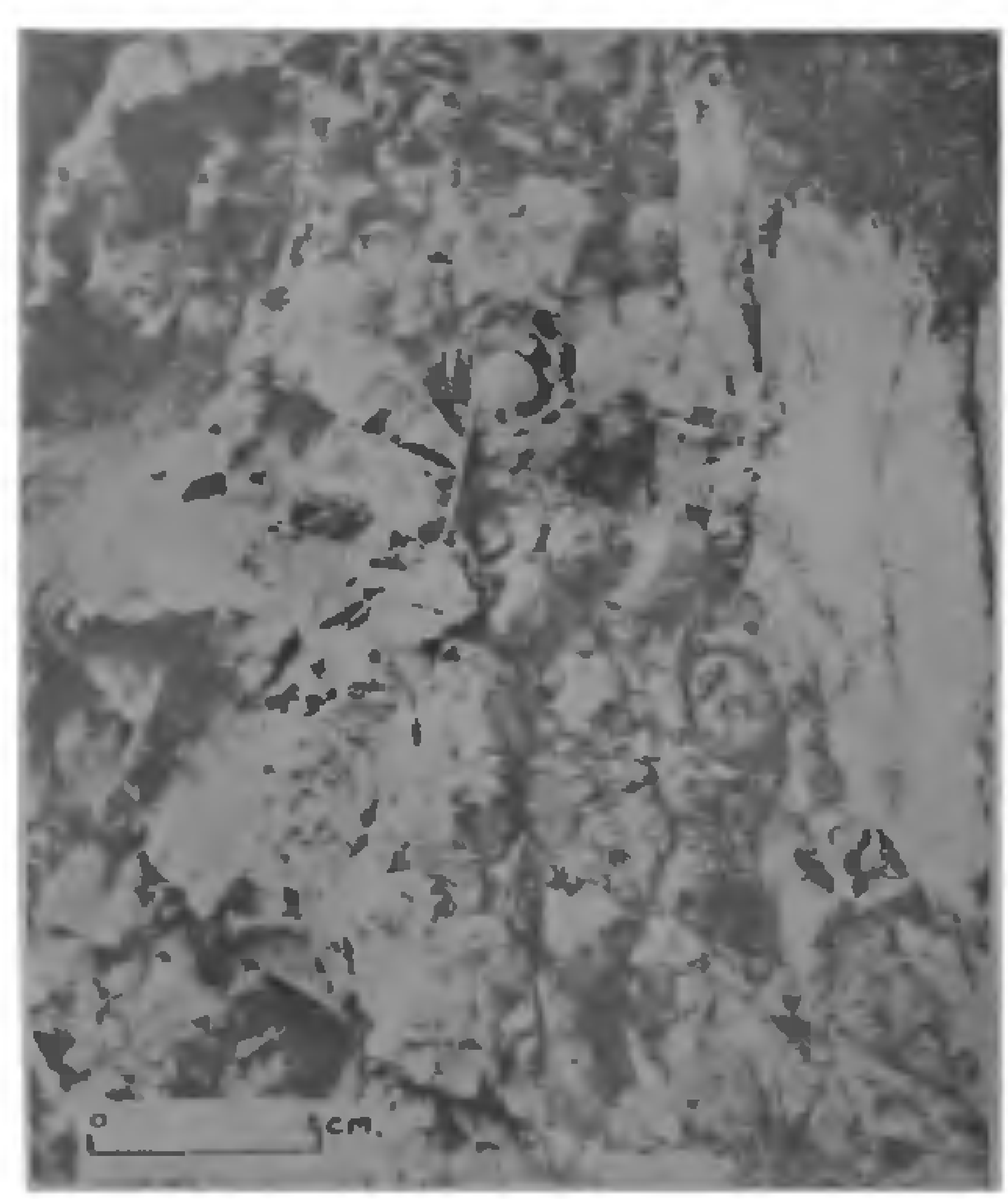


FIG. 1. The columnar stromatolites at Do-Khadda, Muttal, Udhampur District, Jammu Province (J & K).

A few forms which are constricted at the bottom, centre, and widening upwards, club-shaped with variable basal radii fit well in the generalised cryptozoon group (SH–V structures of Logan *et al.*, 1964).

The sections show massive or cryptocrystalline calcic matrix with veins of microcrystalline calcareous matter. The calcite grains are mostly anhedral or sub-hedral while the dolomite grains are typically rhomb-shaped. Some sections exhibit euhedral to sub-hedral grains of authigenic feldspar and quartz. The cryptocrystalline cherty matter is found in between the planes.

Regarding the genetic history of stromatolites, much controversy has arisen, but most of the workers, at least, agree on the point, that they are of algal origin, formed under marine conditions. They are formed in clear and shallow waters of well-protected basins.

The Great Limestone was regarded completely unfossiliferous and as such varied conjectures were made about its age. Medlicott (1876) and Simpson (1904) regarded them of "Jurassic" age. Middlemiss assigned an "Infra-Trias" age, purely on the basis of their lithological traits. Lydekker[10] (Pascoe, 1964; p. 814) assigned a "Carboniferous" age, on the basis of doubtful presence of Fenestella. Wadia (1938) placed them between "Upper Carboniferous" and "Lower Permian" age, on the basis of their interbedded nature with supposed Agglomeratic Slates. Raina (1964) correlated these formations with the Krol and Shali carbonates of Himachal Pradesh, Raha and Sastry[13] (1973), on the basis of generic identification of stromatolites of Riasi limestones, assigned them "Middle to Upper Riphean" age. Since the Muttal limestone is a part of the Riasi inlier, they are identical in their age also.

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## REGENERATION OF CRYPTORCHID TESTIS BY ORCHIDOPEXY IN ALBINO RATS

EXPERIMENTALLY induced cryptorchid testis (abdominal retention) is known to exhibit atrophic changes in the spermatogenic activity[1,2]. When gonadotropin or androgen therapy fails to restore normal spermatogenesis in cryptorchid testis, orchidopexy (scrotal restoration) is recommended[3]. The present investigation is to study the spermatogenic recuperation of the cryptorchid testis by orchidopexy qualitatively as well as quantitatively.

Bilateral cryptorchidism was performed by pushing the testis into the abdomen in adult rats of Holtzman strain, weighing 180 to 250 g (70–90 days old). After 15 days, orchidopexy was performed by pushing the abdominal testis into the scrotum as per the method of Nelson[2] with slight modifications. Suitable normal controls were maintained. They were autopsied 15 days after cryptorchidism or 60 days after orchidopexy. Testis and accessory organs were dissected, wieghed, fixed in Bouin's fluid, sectioned and stained in PAS-Haematoxylin. Spermatogenic counts were expressed per 100 Sertolic cells as described by Dym and Clermont[4].

Fifteen days after cryptorchidism, testis exhibits a significant reduction in weight by 64·6% ($P < 0·001$) in relation to controls, wherein all tubules are devoid of spermatids and sperms, with persistent pachytene spermatocytes in 66·9% of tubules (Figs. 1 and 2), while all tubules exhibit type B spermatogonia. Such degenerated cryptorchid testis recovers partially by orchidopexy in 60 days wherein 81·4% tubules show normal spermatogenesis, while the rest are still degenerated.