

A NOTE ON THE NEW FORMS OF STROMATOLITES AND TRACE FOSSILS FROM NAINITAL AREA, KUMAUN HIMALAYA, INDIA

A few forms of stromatolites are recorded from the Upper Krol Formation (dolomites) of Nainital (Lat. $29^{\circ}22'49''$ N, Long. $79^{\circ}30'19''$ E). These are very different in size and morphology from the Precambrian stromatolites recorded from the inner belt of the lesser Himalayan carbonate formations of Kumaun, Garhwal and Himachal Pradesh. The author has named four of them as *Crossia*, *Krolia*, *Nainitalia* and *Plumia* (KUMAR, 1979). Other forms include cryptalgal laminites, domed biostromes, oncolitic forms, banded and other irregular algal structures. A trace fossil *Chondrites* has also been noted in the dolomites of the Upper Krol. Another trace fossil *Planolites* is recorded from the Nagthat Quartzites near Bhuwali (Lat. $29^{\circ}23'3''$ N, Long. $79^{\circ}30'56''$ E). The detailed study of these fossils is underway and brief descriptions are given below.

Crossia (Pl. 1, Fig. 1) is a pseudocolumnar form showing patches of broken, discontinuous and irregular growth. Laminae are gently convex and 1–2 mm thick. The form is named after Dr. Aural T. Cross, Professor of Geology and Botany and Plant Pathology at Michigan State University, U.S.A.

Krolia (Pl. 1, Fig. 3 and Pl. 2, Fig. 4) is a noncolumnar form characterized by steeply convex as well as steeply concave laminae, which are 2 to 8 mm thick. Laminae form undulating, wavy structures and show microunconformity. The form is named after Krol Formation.

Nainitalia (Pl. 1, Fig. 4) is columnar, turbinate, unbranched form with ribbed surface. The laminae are 2 to 4 mm thick, initially steeply convex and symmetrical, but upwards gradually change into gently convex to asymmetrical wavy forms. This form is named after township Nainital.

Plumia (Pl. 1, Figs. 5 and 6) is columnar, turbinate and unbranched form with smooth surface. It grows from a point upwards in the form of plumes. They can be found isolated (Fig. 6) and also in colonies (Fig. 5). The thickness of laminae varies from 2 to 10 mm or at times even more. Each younger laminae completely envelopes the older one. *Plumia* is named owing to its plume like structure.

The domed biostromes (Pl. 2, Fig. 6) are rhombic in shape and also larger in dimension with length ranging from 144 to 150 cm and height ranging from 39 to 97 cm. These biostromes show clear stratification of organic and mineral layers. In addition to these stromatolitic structures, cryptalgal laminites (Pl. 1, Fig. 2), oncolitic forms and some banded and irregular structures most probably algal in nature are also present in the Krol dolomites. *Nainitalia* and *Crossia* are biophoric, whereas *Krolia*, *Plumia* and other forms are abiophoric.

A well preserved microbiota is recovered from *Crossia* and *Nainitalia*. Many kinds of unicellular, filamentous, both branched and unbranched algal forms and algal sporangia are recovered. A very significant algal form *Garwoodia* (Pl. 2, Fig. 1) and a dasyclad alga *Mizzia* (Pl. 2, Fig. 2) are present in dolomites containing *Crossia* and *Nainitalia*. *Epiphyton* and *Renalcis* are the two algal genera belonging to cyanophyceae and are responsible for the formation of small algal mounds in *Crossia* (Pl. 2, Fig. 2) and thin laminae in *Nainitalia* (Pl. 2, Fig. 3).

A trace fossil *Chondrites* Sternberg, 1833 (Pl. 2, Fig. 5) is discovered from these dolomites. These are irregularly branched, non-interpenetrating burrows of uniform diameter (5 mm). They are considered to be feeding burrows of sediment ingesting animals (*Fodinichnia*). Another trace fossil *Planolites* Nicholson, 1873 (Pl. 2, Fig. 7) has been found in Nagthat quartzites near Bhuwali. These are irregularly sinuous, unbranched, horizontal burrows of uniform diameter (5 mm). They are found as concave epirelief and are interpreted to be crawling traces of animals (*Repichnia*).

The discovery of these fossils from Krol Formation is very significant considering the fact of controversy regarding the age of Krol Formation. The recent discovery of *Lino-productus* from the stromatolite bearing horizon of the Upper Krol (VALDIYA, 1979), which has been identified by John A. Talent of Macquarie University, Australia as a Permo-carboniferous spined productinid (personal communication, 1978), is significant. The discovery of *Garwoodia* is also very significant, as this fossil has a range from Lower Carboniferous to Lower Triassic (personal communication from P. K. Raha, Geologist (Sr.), Geological Survey of India, Calcutta). These discoveries indicate that the stromatolites recorded from the Upper Krol Formation are not of Precambrian age but belong to late Palaeozoic Era. It is significant to quote RAABEN (1978), in support of this paper, "It should be emphasized that stromatolites in the lesser Himalaya are not exclusively Precambrian in age. An assemblage with well pronounced Phanerozoic affinities is developed, for example in the Krol Series of the Kumaun Himalaya." The fossils further indicate that the Upper Krol Formation (dolomite) was deposited in shallow marine, intertidal environment.

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EXPLANATION OF PLATES

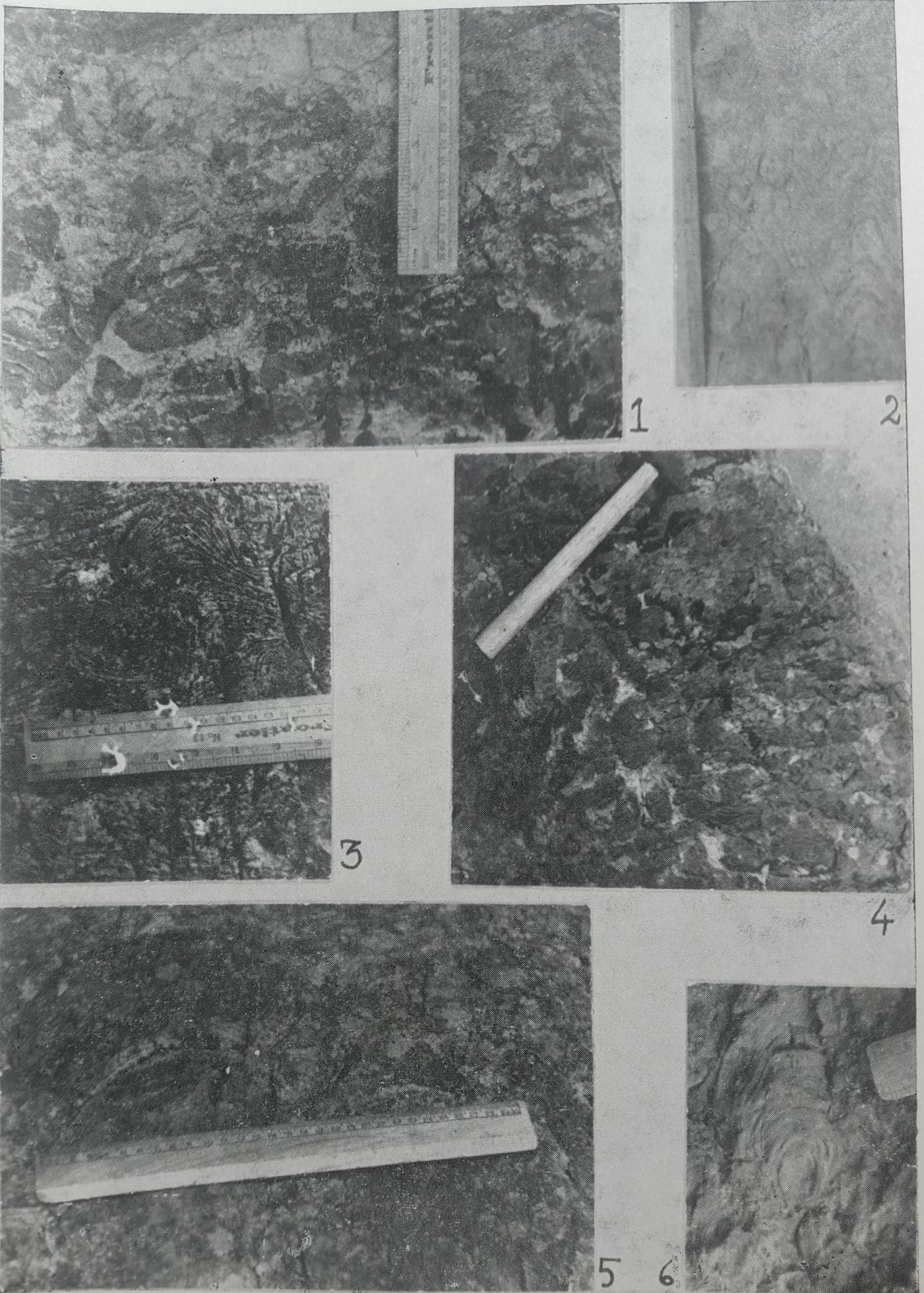
PLATE—1

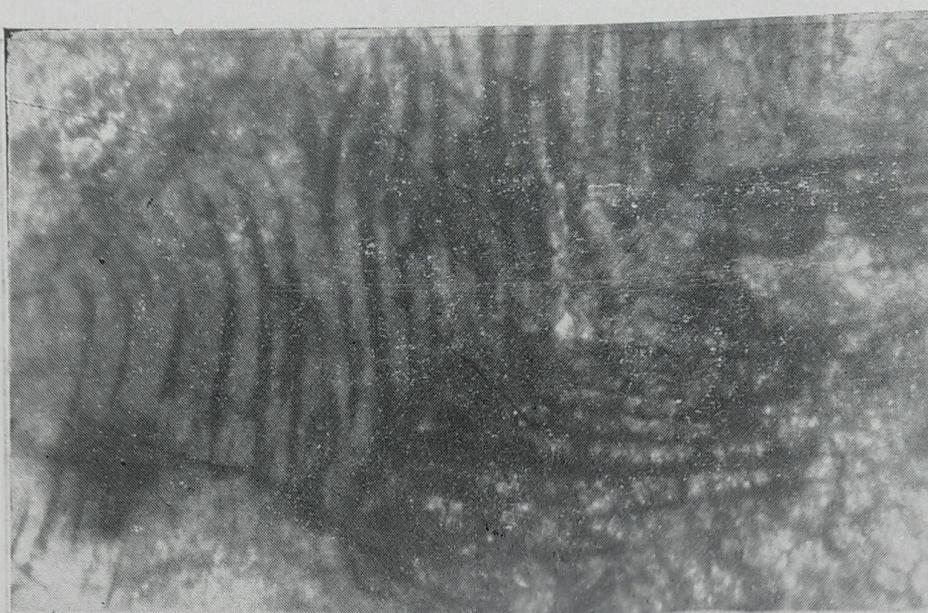
- Figure—1—*Crossia*
 2—Cryptalgal Laminites
 3—*Krolia*
 4—*Nainitalia*
 5—*Plumia*
 6—*Plumia*

PLATE—2

- Figure—1—*Garwoodia* × 40
 2—Thin section of *Crossia* showing the presence of *Mizzia* × 40.
 3—Thin section of *Nainitalia* × 40.
 4—*Krolia*
 5—*Chondrites*
 6—Domed Biostrome
 7—*Planolites*

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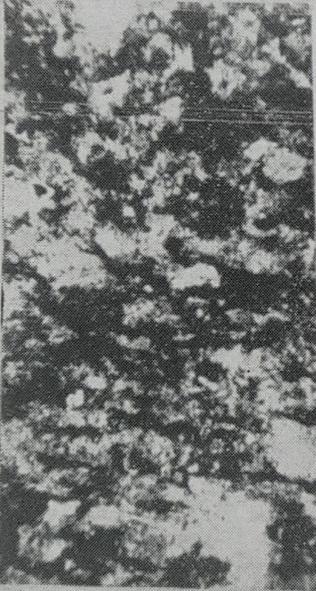




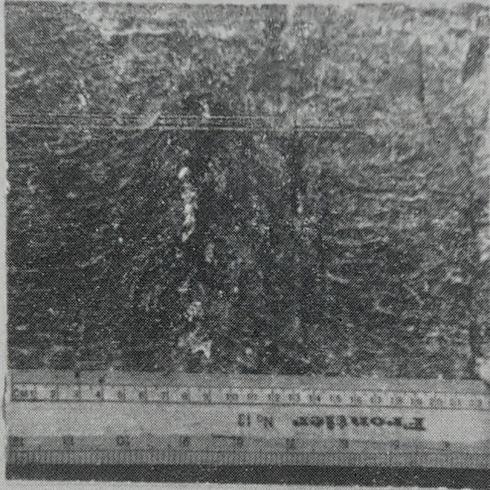
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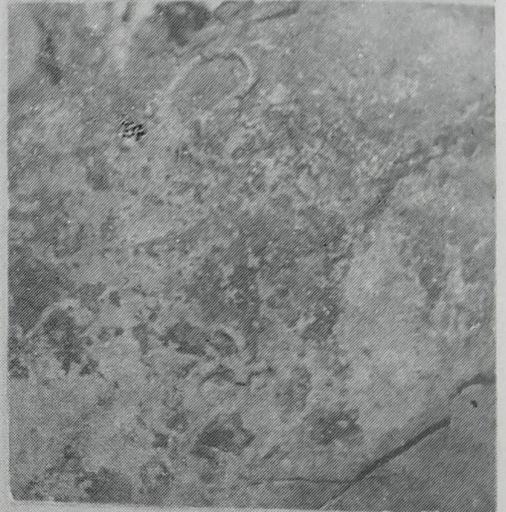
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