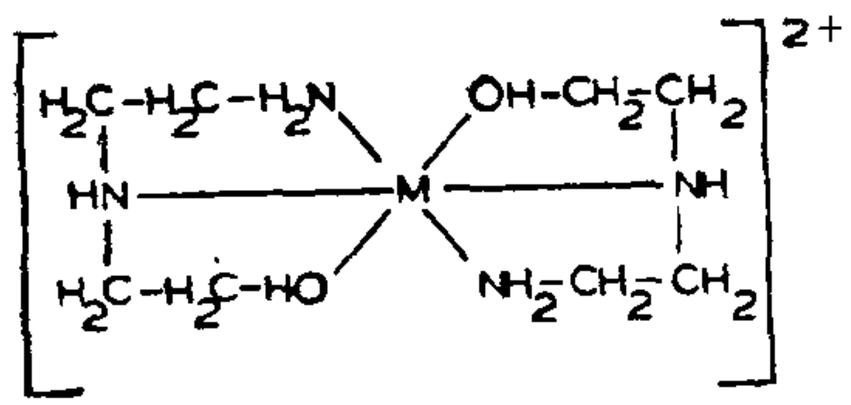
which is attributed to OH deformation frequency indicating the participation of OH group in chelate formation. On the other hand CO stretching frequency occurring at 1055 cm^{-1}(s) in the ligand remains almost unaltered in the complexes. In all the sulphate complexes an unsplit band appears at 1085 cm^{-1}(m) indicating that sulphate ion is not coordinated to metal in these complexes[4].

Reflectance spectra of the nickel complexes exhibit three bands [$Ni(L)_2Cl_2$ at 27780, 18180, 10600 cm^{-1} and $Ni(L)_2SO_4$ at 27780, 17540, 10530 cm^{-1}] typical of octahedral nickel (II) complexes. Absorption spectra of the nickel complexes in methanol are very similar to the reflectance spectra [*e.g.*, $Ni(L)_2SO_4$ in methanol gives bands at 27800 cm^{-1} $\epsilon = 9{\cdot}5$, 18200 cm^{-1} $\epsilon = 6{\cdot}2$, 1062 cm^{-1} $\epsilon = 4{\cdot}8$] indicating that octahedral geometry of the complexes is preserved in the solution state also. Both the copper (II) complexes give reflectance spectra with absorption maximum at (17500 cm^{-1}) which are similar to spectra of octahedral cupric complexes. In methanol the spectrum is similar but the absorption maximum occurs at (16260 cm^{-1} $\epsilon = 90$). The shift in the absorption maximum could be interpreted as due to replacement of two metal –OH bonds in the metal chelate by two new metal –OH bonds arising out of the coordination of the solvent to the metal.

As zinc (II) and cadmium (II) usually form six coordinated complexes with multidentate ligands, octahedral geometry is likely for the complexes formed by them with N-hydroxyethylethylenediamine. On the basis of the available evidence the following general structure may be written for the doubly charged cationic species in the metal com-



plexes. Such a structure contains four-five-membered rings and accounts for the stability of the complex. Participation of the NH group is essential for stable chelate formation since an unstable eight-membered ring would result if NH_2 and OH groups only are bound to the metal. With copper (II) however in the solid state the square planar geometry with two OH groups not participating in the coordination cannot be ruled out. Infrared studies of the metal ligand vibrations would be of value in deciding the geometry in this case. In the complexes of N-hydroxyethylethylenediamine all the three available coordination sites are used in bond formation unlike the complexes of triethanolamine[5] where only three of the four coordination sites in the ligand are occupied. Studies on complexes formed by trivalent and tetravalent metals like Fe (III), Al (III), Cr (III), Th (IV) and Zr (IV) with N-hydroxyethylethylenediamine will be reported shortly.

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January 6, 1973.

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ON THE DISCOVERY OF UPPER PALAEOZOIC BRYOZOANS FROM KAMENG DISTRICT, ARUNACHAL PRADESH

THE Upper Palaeozoic marine fauna from the Gondwana belt of Subansiri and Siang ditsricts of Arunachal Pradesh was reported by Laskar[1]. Gondwana belt towards southwestern part in Kameng District was recently investigated by the Geological Survey of India. The authors discovered bryozoans (Fig. 1) in a joint traverse (organised by the G.S.I. Office, Tezpur) along the Foothill-Tenga road section from marine Upper Palaeozoic phyllitic slate horizon at nearly 100 m west of Sissni camp (27° 8′ : 92° 25′) (C.P.W.D. labour hutment). A few other fossils were also collected by Dr. S. K. Chandra and R. S. Handa (personal communication).

Geology.—The field sequence of the rocks along the Foothill-Tenga road shows that the fluvial Gondwana comprising whitish-grey, gritty and micaceous sandstone, siltstone, carbonaceous shale and thin coal beds is thrust against the Upper Tertiary rocks in the south. Grey, fine-grained arkosic sandstone, sometimes pebbly and intercalated with dark siltstone and shale shows faulted contacts with the underlying gritty sandstone and grades to fossiliferous, grey to greenish-grey slate and phyllite, exposed near Sissni. Up in the physical succession, augen gneiss abuts against the sedimentaries.

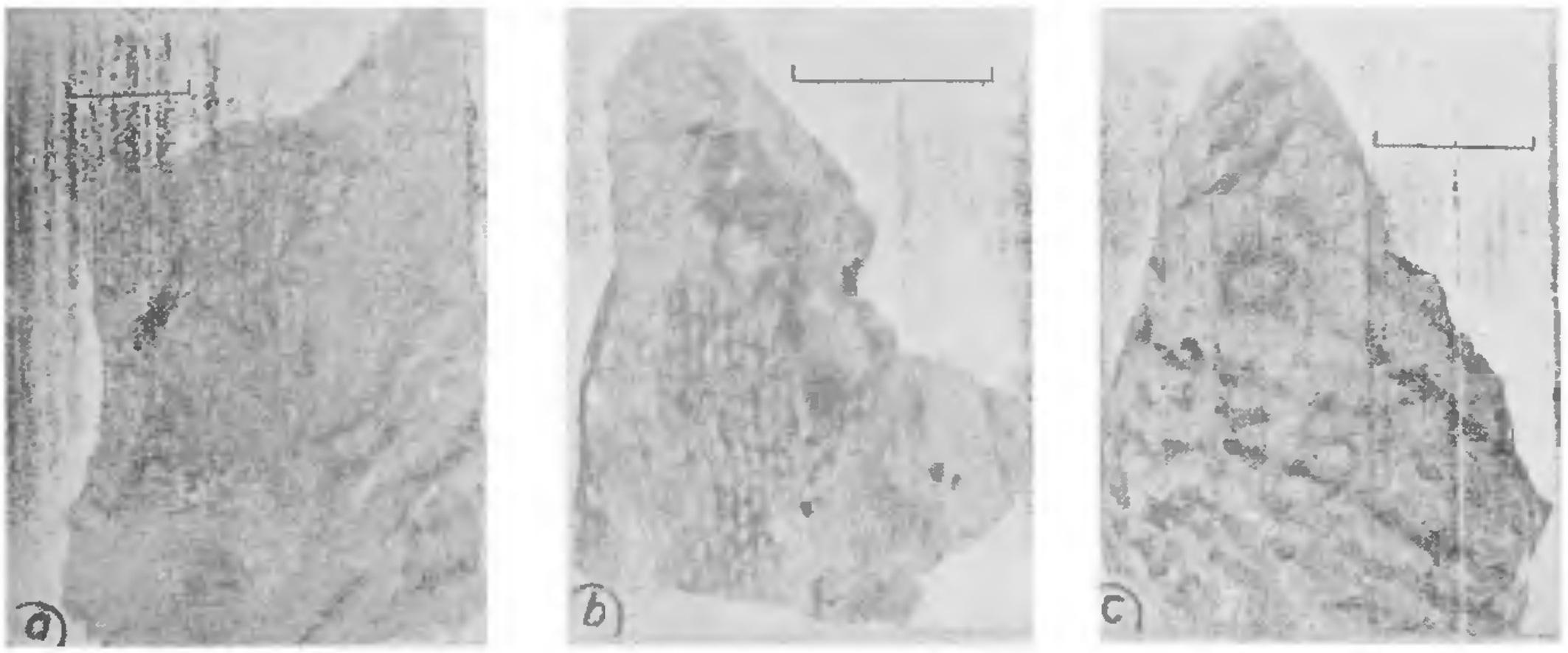

FIG. 1. Permo-Carboniferous Fenestrellid bryozoans from Kameng District, Arunachal Pradesh. (*a*) *Fenestella* sp., (*b*) *Protoretopora* cf. *ampala* (Lonsd.), (*c*) *Polypora megastoma* de kon. Length of scale is 1 cm.

Fauna.—The Upper Palaeozoic fauna has been discovered near the top of the sequence in the grey; thinly laminated, slate and phyllite dipping 35° towards N 10° W on an average. The slate is pebbly and contains sporadic clasts of quartzite, vein quartz and gneiss. On account of the development of slaty cleavage in the rocks, the apertural pattern of the bryozoans is not generally visible and in some cases renders the specific identification difficult. The bryozoans recorded are *Fenestella* sp., *Protoretepora* cf. *ampla* (Lonsd.), ? *Polyora megastoma* de kon. This assemblage indicates Upper Carboniferous to Lower Permian age for the pebbly slate and phyllite sequence of the Kameng District. Significantly, these rocks with marine Permo-Carboniferous fauna, rest over the younger fluvial Gondwana sediments possibly of Permian age containing plant fossils (*Glossopteris, Gangamopteris; Vertibraria*). Reverse stratigraphy suggests an inversion of the sequence due to a reverse fault within the Gondwana belt, which is traceable near Khelong (27° 03′ : 92° 25′). Lithologically, this pebbly phyllitic slate horizon resembles the Rangit Pebble Slate of Sikkim and Darjeeling[2] and also bears apparent similarity with the Agglomeratic Slate horizon of Kashmir.

Discussion and Conclusion.—Marine fossil bearing horizon of the Kameng District, Arunachal Pradesh, recalls Maclaren's[3] discovery of boulders of fossiliferous Permo-Carboniferous argillaceous and arenaceous limestones from the Subansiri gorge mouth which revealed a good assemblage of marine bivalves, gastropods, bryozoans, etc.[1]. The supposed *in situ* nature of the above-mentioned boulders was considered equivalent to the Kuling Shale of Lilang in Spiti and Maclaren (*op. cit.*) correlated this fauna with the Lower Productus Limestone of the Salt Range. According to Muir Wood and Oaklay[5], this faunal assemblage is equivalent to the fauna of Upper Productus Limestone. However, Laskar (*op. cit.*) established the *in situ* existence of this fauna within the Gondwana belt in the erstwhile N.E.F.A.

The discovery of Permo-Carboniferous bryozoans from Kameng District of Arunachal Pradesh is significant as it clearly indicates the existence of the marine conditions during Upper Palaeozoic from Darjeeling[6], Western Sikkim Gondwana[7,8] and Central Bhutan[9] in the west to Subansiri and Siang[10] districts in the east. It is interesting to note that brachiopods, lamellibranchs and gastropods of approximately same age have been recently discovered by the senior author (A K J) at 32/5 km along Kimin-Liro road in Subansiri District in grey-green slate, exposed near the top in physical sequence of the Gondwana belt. Further, a few fenestrellid bryozoans have also been observed in micaceous sandstone of the Gondwana belt along Garo-Gensi road in Siang District (T. Singh, personal communication).

It is possible that thorough search within the Permo-Carboniferous marine lithology of Kameng District may also yield other invertebrate group of fossils (particularly brachiopods and gastropods).

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(G.S.I.), T. Singh and S. K. Misra (Wadia Institute of Himalayan Geology) for their help in field.

Wadia Institute of Himalayan Geology, Delhi University Campus, Delhi, and Geological Survey of India, Arunachal Pradesh Circle, Tezpur, *December* 19, 1972.

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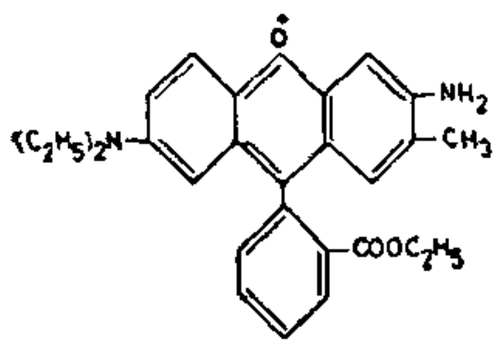
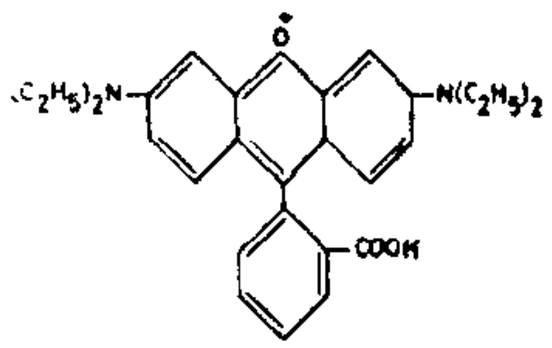
IN SITU LOCALISATION OF DNA WITH BASIC DYES OF THE XANTHENE GROUP

IN earlier studies, Kasten[1,2] recommended the use of rhodamine 3 GO, a dye with a primary amino group in its molecule, as a dye reagent for cytochemical detection of DNA in biological material following the Feulgen procedure. Kasten[1] has also reported the results of studies of a large number of basic and acid dyes towards Feulgen staining of DNA including a basic dye of the xanthene group, rhodamine B without any primary amino group and found that this dye cannot be used for staining acid hydrolysed DNA in the Feulgen procedure. He, therefore, came to the conclusion that successful Feulgen staining is possible with only basic dyes that contain one or more primary amino group. The present author[3] has, however, shown that two basic dyes, *viz.*, thionine blue and methylene blue, without any primary amino group in their molecules, can be successfully used for staining acid hydrolysed DNA provided sections after staining are differentiated in n-butyl alcohol for varying period of time, cleared in xylol and mounted. Retention of these dyes within the nuclei does not, however, occur if stained sections are dehydrated through a graduated series of ethyl alcohol. This finding has led the author to believe that staining of acid hydrolysed DNA is not only due to the presence of primary amino group in the dye molecules but may also be possible with at least some of the basic dyes without this group. With this point in view, cytochemical investigations with rhodamine 3 GO and rhodamine B were undertaken and the findings are reported herein.

Both rhodamine 3 GO (C.I. No. 45210) and rhodamine B (C.I. No. 45170) are basic dyes of the xanthene group. Rhodamine 3 GO used in this investigation was manufactured by E. Gurr, London and rhodamine B by Fluka AG, Switzerland. The structural formulae of these dyes are shown below :



Rhodamine 3GO



Rhodamine B

Dyes used in this investigation were prepared as 0·5% aqueous solution. Both the dyes were also used as 0·5% aqueous solution to which 5 ml of N HCl and 1·0 g of potassium metabisulphite were added. These reagents were then filtered. The initial pH of freshly prepared aqueous solutions was 3·0 for rhodamine 3 GO and 2·5 for rhodamine B. The initial pH of the dye reagents prepared with N HCl and potassium metabisulphite was 2·5 for rhodamine 3 GO and 2·0 for rhodamine B. Each of the dye reagents was used at three different pHs, *viz.*, 2·5, 3·5 and 4·5 for rhodamine 3 GO and 2·0, 3·0 and 4·0 for rhodamine B. The pHs were adjusted with a pH meter employing sodium hydroxide.

Tissues used in this investigation were liver, kidney, testis, ovary, spleen and heart of a Holtzman strain of rat that had been fixed in 10% neutral formalin as well as Zenker's fixative. Paraffin sections (12 μm) were used throughout.

For staining, tissues were hydrolysed in 5 N HCl at room temperature for 15 minutes, rinsed with water, stained with the dye as aqueous solution or with SO_2 for 15 minutes, briefly rinsed with water, differentiated in *n*-butyl alcohol for 5–6 minutes after staining with rhodamine 3 GO and 7–10 minutes after rhodamine B staining and 40–50 minutes after staining with aqueous solution of rhodamine B, cleared in xylol and mounted.

The absorption characteristics of these two dyes were recorded with a Beckman DB spectrophotometer. *In situ* absorption characteristics of nuclei stained with these two dyes were recorded with a microspectrophotometer that was described by the author[4,5]. Absorption data were recorded at a magnification of × 750 through the central core of