

THE AGE OF FOSSILIFEROUS BED (BOULDER SLATE MEMBER) OF GARHWAL SYNCLINE

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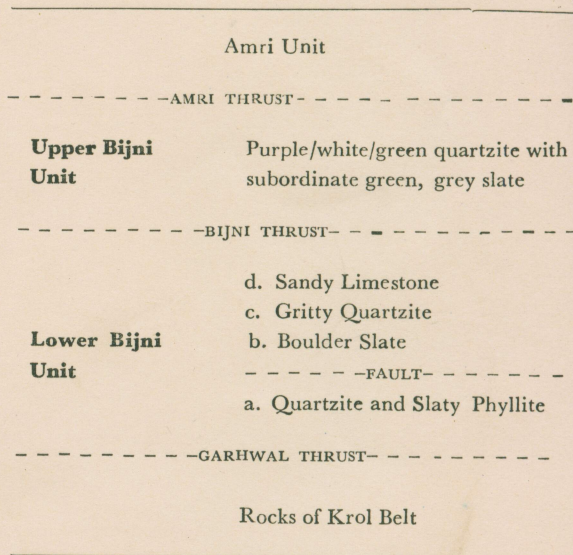
ABSTRACT—The paper deals with the authors' views on the newly recorded fauna from Boulder Slate member ('Volcanic Breccia' of Middlemiss) of Garhwal Syncline.

INTRODUCTION

Ganesan (1971; 1972) brought to light a rich bryozoan fauna consisting of *Fenestella* aff. *eichwaldi* Stuckenberg, *F. garhwalensis* Ganesan, *F. oculata* McCoy, *Dogaddanella audeni* Ganesan, *Polypora middlemissi* Ganesan, *P. dieneri* Ganesan and *P. sp. 'a'* from the shale associated with the slate sequence exposed in the southern limb of the Garhwal Syncline, about 4 Km ESE of Dogadda (29°42' : 78°31') and about 200 meters west of Jogira (29°48':78°39') in the district of Pauri Garhwal of Uttar Pradesh. This zone represents the basal part of 'Volcanic Breccia' of Middlemiss (1887).

Ravi Shanker and Dhaundial of this paper later located a number of new localities with rich brachiopod-bryozoan fauna in the same Garhwal Syncline, during the course of mapping; which appears to be more representative than reported by Ganesan and supplies better evidence of age and affinity.

The fossil bearing horizons are confined in the Boulder Slate member, at the sole of the 'Lower Bijni Tectonic Unit' in Garhwal nappe. The lithostratigraphic/tectonic sequence as established by Ravi Shanker and Ganesan (*in press*) is given below :



The presence of fossils was evident at several places though these were collected from the following five localities :

1. About 1.2 Km NNE of Gajwar (29°46'45" : 78°39'45") and 0.8 Km NW of Ghaildalgaon (29°47' : 78°40'15"), near spring on Malethan-Konakholi foot-track.

2. About 0.5 Km SE of Ghaildalgaon on Sendikhal-Gajwar mule-track.

4. About 1.0 Km south of Anderson (29°47' : 78°50'30") and 0.6 Km NE of Dabri (29°47'15" : 78°50'15") on Rikhni Khal—Lansdowne mule track.

4. On hill slope 1.0 Km southeast of Angni (29°49'30" : 78°48'15").

5. Western hill slope near Pasta (29°51' : 78°46'30").

The Boulder Slate member is fairly thick (several hundred metres). It is traceable for over 70 Km. It comprises essentially of pebble slate, boulder slate, gritty slate, slaty shale with minor quartzite, conglomerate and greenish grey well cleaved pencil shale. The fossils are confined to shaly layers only. The shale occasionally contains rounded to spindle shaped pebbles/nodules, many of them phosphatic, a few contain fossils while others resemble with cinders, though their actual nature is still uncertain. The sequence of this member is closely akin to Fenestella Shale and Agglomeratic Slate of Kashmir (Middlemiss, 1910), but it is at present premature to compare them till its equivalents are established in the intervening areas.

The fossils are mostly ill preserved, distorted and highly weathered, which makes the

specific recognition difficult. However, the present attempt has brought to light the following brachiopods, bryozoans, bivalve and crinoid stems from above localities besides those already known from Jogira (Ganesan, 1972).

Geintzella sp. indet, *G.* cf. *arbuscula* Eichwald, *Fenestella* cf. *garhwalensis* Ganesan, *F.* cf. *plebia* McCoy, *F.* cf. *quadratecimalis* McCoy, *F.* cf. *polyporata* McCoy, *F.* cf. *occulata* McCoy, *F.* cf. *rectangularis* (Crockford), *Fenestrellina* aff. *fossula* (Lonsdale), *Polypora middlemissi* Ganesan, *P.* sp. indet, *P.* cf. *septata* Campbell, *Dogaddanella audeni* Ganesan ; an unidentifiable bivalve cf. *Aviculopecten*/*Deltopecten*/*Streptochondria* ; *Spiriferina* (*Reticularina*) sp. indet, *S.* (*Spiriferellina*) *bilotensis* Reed, *S.* (*S.*) *zewanensis* Diener, *S.* sp. indet, *Spiriferella* sp. indet, *Neospirifer* sp. indet, *N. fasciger* Keyserling, *N.* cf. *marceni* Waagen, *Alispirifer isaacensis* Campbell, *A.* cf. *laminosus undatus* Campbell, *Punctispirifer* sp., *Spirifer holdhausi* Diener, *S.* sp. indet, *Eomarginifera* sp., *E. longispina* (Sowerby), *Pseudomarginifera* cf. *waagenianus* (Girty), *Tschernyschewia* cf. *scrabliculus* (Martinson), *Productus* aff. *dowhatensis* Diener, *P. spitiensis* Diener, *Linoproductus* cf. *cora* (d'Orbigny), *Pustula pustulosus* (Phillip), *Paeckelmanella* aff. *niger* (Waagen), *Composita magnicarinata* Campbell, *Dictyoclostus* sp. indet, *Orthotichia* sp., *Derbiya* sp., *Strophalosia* cf. *plicosa* Waagen, *S.* sp. indet, *S.* cf. *lamellosa* Geinitz, *Streptorhynchus* sp. indet, ? *Waagenoconcha* sp. indet, ? *Hemiptychina* sp. indet, *Anodontophora* sp. indet, *Krotovia* sp. indet, ? *Schellwienella* sp. indet, *Refinesquenia* sp. (or *Strophomena*), *Lissochonetes* sp. indet, *Neochonetes* sp. indet, *Chonetes orientalis* Loczy.

REMARKS

The fauna from Garhwal Syncline, as known

from Ganesan (1972) and present collection, looks an admixture of elements reported from Fenestella Shale (Diener, 1915) and Agglomeratic Slate (Bion and Middlemiss, 1928; Reed, 1932) of Kashmir. It also shows elements of Po Series of Spiti (Diener, 1903). Many of the brachiopods of Garhwal shows affinities with the fossils from the equivalent fauna known from Eastern Himalaya (Muirwood and Oaklay, 1941), Nepal (Waterhouse, 1966), Tibet (Reed, 1930), Burma (Diener, 1911; Reed, 1927), New South Wales and Eastern Australia (Campbell, 1961; Campbell and Mc Kellar, 1969), Salt Range (Reed, 1931; 1936; 1944; Kummel and Teichert 1970 pp. 74-75; Grant, 1970) and Afghanistan and Chitral (Reed, 1925; 1931a).

No one however, can dispute Middle to Upper Carboniferous affinities of the fauna of Garhwal as considered by Ganesan (1972) but actual age is rather difficult to conclude. The fauna shows a number of fossils known from Yanad and Lehindajjar Gali sections of Fenestella Shale from Kashmir (Diener, 1915) which supports their equivalence; on the other hand the fauna of Marbal beds (Bion and Middlemiss, 1928) and a few elements of Nagmarg beds (*op. cit.*) and Bren (Reed, 1932) of Agglomeratic Slate, put fauna to younger affinity. The Marbal beds have been considered by Bion and Middlemiss (1928) as Upper Muscovian to Lower Uralian; while the Nagmarg beds as Upper Uralian. Kapoor of this paper, who carried out work recently on these formations in Kashmir, is of the opinion that both Lower and Upper Marbal beds are Uralian; while Nagmarg and Bren fauna show Sakmarian and Lower Artinskian affinity. Keeping this in mind, the position of the Garhwal fauna is probably just above the

Lehindajjar-Yanad fauna of Fenestella Shale and below the Lower Marbal beds; thereby representing an upper part of Westphalian.

Po Series of Spiti, has been considered to be equivalent to the Fenestella Shale of Kashmir, both in position and age. Thus the present fauna is younger to it. Diener (1915) has already indicated that the fauna of Fenestella Shale exhibits special features of its own; because its differences with the fauna from adjoining areas, as well from Europe and America; the little resemblance with the Mountain Limestone or to the Upper Carboniferous faunas of Russia are of insignificant value. On the other hand Po Series fauna has resemblance with the Mountain Limestone of Europe. Diener (*op. cit.*) thus was uncommittal on the age of Fenestella Shale, though considered it to be older than 'Permo-Carboniferous' whereas Middlemiss (1910) considered it probably of Middle Carboniferous. Since then the knowledge of the fossil fauna of Carboniferous from different countries have increased and it is now considered that the Fenestella Shale fauna though peculiar, but not unique to Himalayan region and it has some alliance with the fossils of similar age of Burma and Eastern Australia, (Campbell and Mc Kellar, 1969; Tables 6:2 and 6:3).

As considered here the Garhwal fauna to be Westphalian; there is every possibility of the presence of corresponding fauna in Kashmir. During the Carboniferous, as it looks, there has been a number of oscillations and pulsations in the basin, now occupied by the Himalayan region, causing obstructions to migration of life or developing narrow gaps for limited migration of forms (both laterally and vertically); thus giving rise to diversified

forms. The Garhwal fauna, therefore, has given opportunity to palaeontologists to scan the intervening areas between the known basins of Spiti and Kashmir and also between Spiti and Garhwal. Raina *et al.* (1971) and Datta and Bhattacharya (1971) have already reported Permian and Triassic sequence between Kashmir and Spiti, though Westphalian is still unknown.

The fossil bearing beds of Garhwal, as considered by Ravi Shanker and Ganesan (*in press*), occupy a position of nappe, therefore are not in their original position. They postulated that the root zone lies to the south of the Central Crystalline axis and Main Central thrust, but to the north of the Calc Zones in parts of U.P. Himalaya. Kapoor also believes that the root zone should not be much far off, if the beds are allochthonous. This fauna bearing bed of Garhwal is considered by Ganesan (1972) and Ravi Shanker and Ganesan (*in press*) as Tethyan; it is of course evident that this type of fauna lies below the belt having Gondwana shelf elements (*i.e.* *Eurydesma* fauna) in Kashmir and Eastern Himalaya.

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