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FAUNA FROM THE "MUTH QUARTZITE", GARHWAL HIMALAYA, INDIA

by

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(with 2 text-figures and 2 plates)

Abstract

A form of pentamerid brachiopod denoting the Late Silurian age and some corals are recorded from the upper part of the "Muth Quartzite" in Kiogad valley of Garhwal Himalaya. This finding implies that, in spite of previous assignment of the Muth Quartzite as of exclusively Devonian, it is a lithostratigraphic unit of largely Silurian age.

Introduction

During an expedition to the Garhwal Himalaya in 1978 the two authors, Goel and Jain, and again in 1985, as part of a DST (Department of Science and Technology, Government of India) sponsored project granted to Goel as Principal Investigator for studying the biostratigraphy of Cambro-Triassic sequences of Tethys Himalaya, Srivastava made a large collection of megafossils from the so called 'Muth Quartzite' (=Muth Formation) of Garhwal. At exactly 4•325 Kilometre stone on Sumna-Rewalibagar (Lapthal) mule track, on the left bank of the Kiogad stream, Garhwal Himalaya (Chamoli District), U.P., India, occurs an approximately 150m thick 'Muth Quartzite' sequence and the fossils described in this paper came from this very formation. It is believed that this new faunal discovery will help resolve finally the old and controversial issue of the age of 'Muth Quartzite' in Indian Geology.

Stratigraphy

A generalized lithostratigraphic framework as observed in the Kiogad valley section along Sumna-Rewalibagar (Lapthal) mule track is given below.

Previous age assignment	Litho-stratigraphic unit	Lithology
Permian	Kuling Shale	Black, friable shale with thin bands of limestone.
Devonian	Muth Quartzite	White sugary orthoquartzite. Chocolate brown quartzite and dolomitic limestone.

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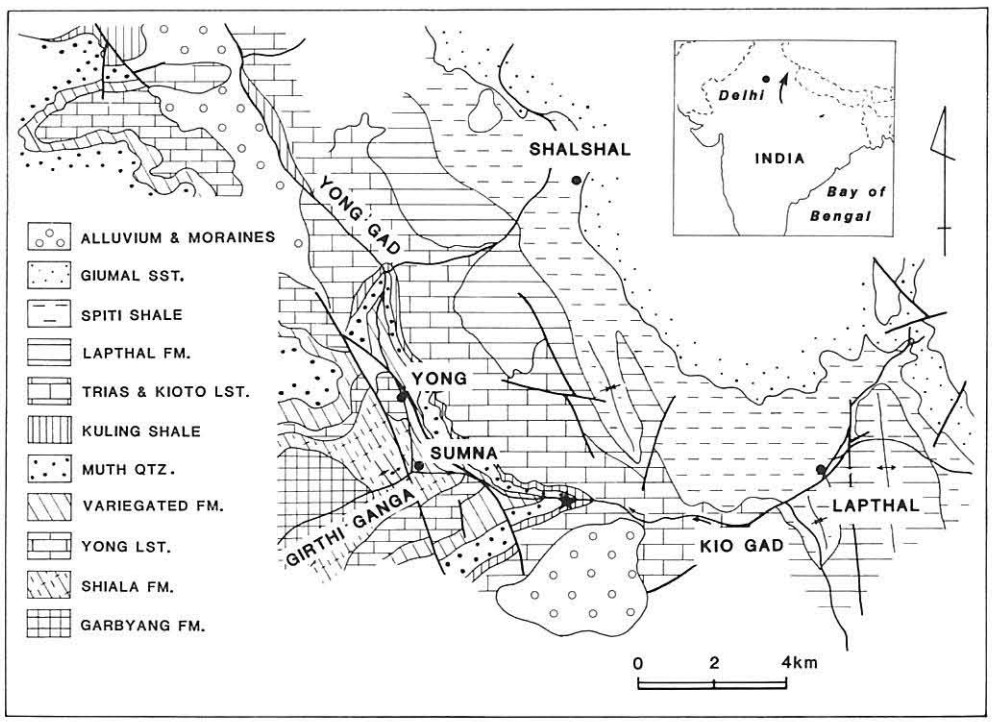
Silurian	Variegated Formation	Purple limestone and shale with bands of quartzite.
Ordovician	Shiala Formation	Grey to pink sandstone and quartzite with bands of limestone.

In Kiogad valley the Muth Formation (= Muth Quartzite) appears to be divisible into two units, the lower comprising about 25 to 30m of buff colored quartzite and dolomitic limestone succeeded by the upper unit of over 100m thick snow white saccharoidal orthoquartzite forming vertical Rewalibagar cliffs. Within this upper unit there is also an occasional occurrence of greyish white sandy or calcareous shale. At the contact of the two, chocolate brown and sugary white quartzite units, as also a few metres above this contact, but well within the white sugary quartzite, there occurs a horizon of roughly 5m thick weathered, spongy looking, dirty white quartzite containing large brachiopods and some corals. Brachiopod specimens, identified as *Pentamerifera* sp., prepondrate in this assemblage and the corals are relatively small and



Text-fig. 1 Geological map of the Tethyan zone in a part of Garhwal Himalaya (After Shah and Sinha, 1974)
*-Fossil Locality.

primitive. Some poorly preserved bryozoan fragments are also noticed. The horizon must have been calcareous, but it now reveals quartz sand grains with silica overgrowth.

According to Shah and Sinha (1974, p.14) this lower chocolate quartzite and limestone sequence is fossiliferous and contains fragments of *Pentamerus*. The white sugary quartzite towards the top is generally unfossiliferous but from some fallen blocks of this quartzite these authors (op.cit, p.15) have recorded the occurrence of *Leptaena rhomboidalis, Atrypa reticularis* and characteristically Devonian *Schellwienella williami*. The exact position in the column of the horizon bearing these fossils, according to Shah and Sinha (1974), "could not be determined since these quartzites form vertical cliffs which could not be scaled". But, in spite of their best and sustained efforts for several days in the field during the two expeditions of 1978 and 1985, the present authors have failed to collect any of the above three forms *in situ* or even in the float. On the other hand a very prolific brachiopod-coral association has been observed and sampled *in situ* from within the supposed largely Devonian upper unit of sugary white Muth Quartzite exposed in this region of Garhwal Himalaya, Chamoli District, Utter Pradesh, India.

Text-fig. 2 Weathered surface of a hand specimen of "Muth Quartzite", showing the mode of occurrence of a brachiopod species, *Pentamerifera* sp. and two solitary corals. Natural size.

Palaeontological Note

Fossils occur in abundance and are all preserved as moulds in medium to coarse grained quartzose sandstone ("quartzite") (Text-fig. 2). Quartz grains show secondary growth and euhedral configuration, so that minute external and internal features of fossils are somewhat obliterated on the surface of moulds.

Fossils include many disarticulated valves of a single brachiopod species referable to the brachiopod genus *Pentamerifera* Khodalevich, fragments of crinoid oscicles and at least three froms of small, solitary, rugose corals. Anterior margins of brachiopod valves are mostly damaged, but posterior portions are largely retained. Calicular margins and pointed tips of corallum are not destroyed, although they are preserved only as external moulds.

These fossils were, therefore, transported before burial, although the moving distance should not have been very long. The depositional condition is thus inferred to have been shallow marine.

The brachiopod species now in question appears to be a little mutable in shell morphology. Height of the umbo of the pedicle valve, for instance, varies considerably from one specimen to the other. But in general the two valves are smooth on the surface and moderately biconvex in lateral profile. Some of the pedicle valves are elongate and reveal thick, very long median septum. Although the anterior margin of the pedicle valve is not observed, the median septum seems to be nearly reaching it. (Plate 1, fig. 1c). Long and slightly divergent outer plates are present in the brachial valve. (Plate 1, fig. 7c).

It is beyond doubt that this Indian form belongs to the subfamily Pentamerinae which is entirely confined to the Silurian (Boucot and Johnson, 1979).

Mainly in view of the presence of long median septum, the present Indian form may be referable to the genus *Pentamerifera* as diagnosed by Boucot and Johnson (1979), although they treated it as a subgenus of *Harpidium*. *Pentamerus taltiensis*, the type species of the genus *Pentamerifera* however, reveals strongly biconvex shells (Amsden and Biernat, 1965). The Indian form would represent a new species of *Pentamerifera*. (J.A. Talent, personal communication).

The genus *Pentamerifera* comprises only two species and is confined to the Ludlovian (Boucot and Johnson, 1979); *Pentamerifera* sp. from India may also be the Late Silurian in age.

As for rugose corals, at least three forms are recognized, yet none of them is even generically identifiable. And, all of them are solitary, probably lacking in dissepimentarium, thus denoting in general as representing the *Cyathaxonia* Fauna of Hill (1938). Among them two forms are provided with lamellar septa, while the third has acanthine septa (Plate 2).

Form **A** is a small, ceratoid coral, having deep calice, two orders of septa which are a little rotated around a small open space at the centre. A faint trace of cardinal fossula is indicated by the presence of a thin, comparatively low septum. This form is a Streptelasmatid not unlike *Rhegmaphyllum*. Only one specimen is available.

Form **B** is also represented by a single calicular mould, but reveals a rather interesting point, in that, three faint septa are seen within a pair of major septa. This probably indicates the presence of a minor as well as tertiary septa, not a common feature amongst many Silurian rugose corals (Weyer, 1980). No information about tabulae is obtained. And no comparable form is readily available.

Form **C** is characterized by many individuals. Corallum is small, slightly curved ceratoid. External surface of the corallum is covered by growth striations and without longitudinal ridges or furrows. Septa are short, acanthine in two orders. Pinnate pattern to reveal the mode of septal insertion is clearly observable on the lateral surface of calicular mould. Calice is very deep, and its bottom is conical to bluntly pointed. There is a ridge on the bottom surface of calicular mould indicating the presence of shallow cardinal fossula. Dissepiments are absent, but whether tabulae are present or not is not ascertained. There is a certain space between the bottom of calice and the tip of corallum (Pl. 2, figs. 14 & 15), but any trace of tabular partition is not observed. Thus, this space may have been occupied by thick stereoplasmic deposit. There are several genera superficially similar to the present corals but, of these, *Primitophyllum* has sparse acanthine septa; *Cantrilia* has tabulae; and *Sinkiangolasma* shows septal ridges. They are thus readily distinguished from the present Himalayan form, which may be either primitive Tryplasmatid or advanced Primitophyllid.

If this form truly lacks dissepiments and tabulae, it is a ceratoid representative of the family Pałaeocyclidae (Kato, 1982), as it has well developed, regular acanthine septa, and growth wrinkles on epitheca.

The corals, described above do not precisely indicate the geological age for them. Yet they show resemblance to some primitive corals of Silurian.

Age Implications

The Muth Quartzite is a conspicuous formation throughout the Tethys Himalaya and marks a change from predominantly argillocalcareous Lower Palaeozoic succession to arenaceous Silurian-Devonian from Kashmir to Nepal. Controversy regarding its age still persists and a "state of confusion and irresolution surrounds the correlation of Muth (and things called Muth) and the immediately overlying and underlying units in the whole Himalayan region. Taking various lines of evidence a variety of ages for the Muth have been proposed and, despite a continuing accumulation of data, the question seems to be no nearer resolution "(Talent; 1982: p.293).

Stoliczka (1865) first described the type Muth Quartzite at Muth in Pin valley, Spiti (Himachal Pradesh) under the name "Muth Series", occurring between his "Bhabeh Series" and "Kuling Series" and assigned an Upper Silurian age to this sequence. Oldham (1888) correlated it with a white quartzite found in Kashmir among beds yielding Carboniferous fauna and Griesbach (1891) also regarded it as Carboniferous in consequence of his observations in Kumaun-Garhwal Himalaya and subsequently in Spiti. Hayden (1904) considered it to be partly Silurian and partly Devonian but Burrard and Hayden (1934) afterwads accepted a Devonian age for the Muth Quartzite.

However, Reed (1912) insisted the type Spiti sections must be of Middle Silurian to Early Devonian age in view of the gradual transition to the Muth from beds below dated as Llandovery-Wenlock.

This formation was always considered as completely unfossiliferous since its original description by Stoliczka (1865) but Sahni and Gupta (1959) were the first to record fossils in the Muth Quartzite from Kashmir, and the fauna, according to them, indicated a Devonian age. Since then Gupta mainly has been recording and reporting fossils from Muth correlates in Tethys Himalaya, e.g. Kashmir, Ladakh, Lahaul and Spiti, Nepal and Kumaun Himalaya (Gupta and Jain, 1967; Gupta and Bates, 1968; Gupta et al., 1970; Gupta, 1970a; 1970b; 1971; 1983 and Valdiya and Gupta, 1972). Valdiya and Gupta (1972) are even inclined to believe that the fossil assemblage described by Reed (1911) from a locality 1.5km north of Tera Gad camp near Kalapani (Kumaun) must have come from the Muth Quartzite for many of Reed's forms (mainly brachiopods) have been described from the Muth Quartzite of Kashmir (Gupta, 1970b). According to Gupta and his co-workers a characteristically Devonian brachiopod species *Schellwienella williami* is conspicuous by its presence in Muth Quartzite of Kashmir, Ladakh, Lahaul, Spiti, Nepal and Kumaun Himalaya, among other forms supporting the Middle Devonian age for this one of the most persistent and strikingly conspicuous formation of the Tethys Himalaya. Boucot and Gauri (1968) commenting on the age and relationship of basal Muth Quartzite of Kashmir, however, insist on a much older age — approximately Early Silurian — on the basis of material from localities in Kashmir.

From the Muth Quartzite of Garhwal Himalaya proper, Shah and Sinha (1974) for the first time reported *Schellwienella williami, Leptaena rhomboidalis, Atrypa reticularis* and a few bryozoan fragments from some fallen blocks of doubtful location but seemingly from the 'white sugary quartzite' considered unfossiliferous until then. These authors have also assigned Devonian age to the Muth Quartzite in their lithostratigraphic table (op. cit.: p. 6) on the basis of the abundance of *Schellwienella williami* in the fallen blocks of presumed Muth Quartzite.

In a recent paper by Ranga Rao et al (1985) on the contributions to the stratigraphy of Spiti (p. 108) the authors, including Shah, have conceded that "the age of the Muth Quartzite cropping out at Takche is Silurian to? Lower Devonian" They further state that "Muth Quartzite when traced from Pin-Parahio section to Takche section shows a time transgressive relationship and the Lower and Upper boundaries throughout are not identical in age as is generally believed hitherto. No typical Devonian elements have been seen anywhere in the formation though its extension into the Devonian is un-

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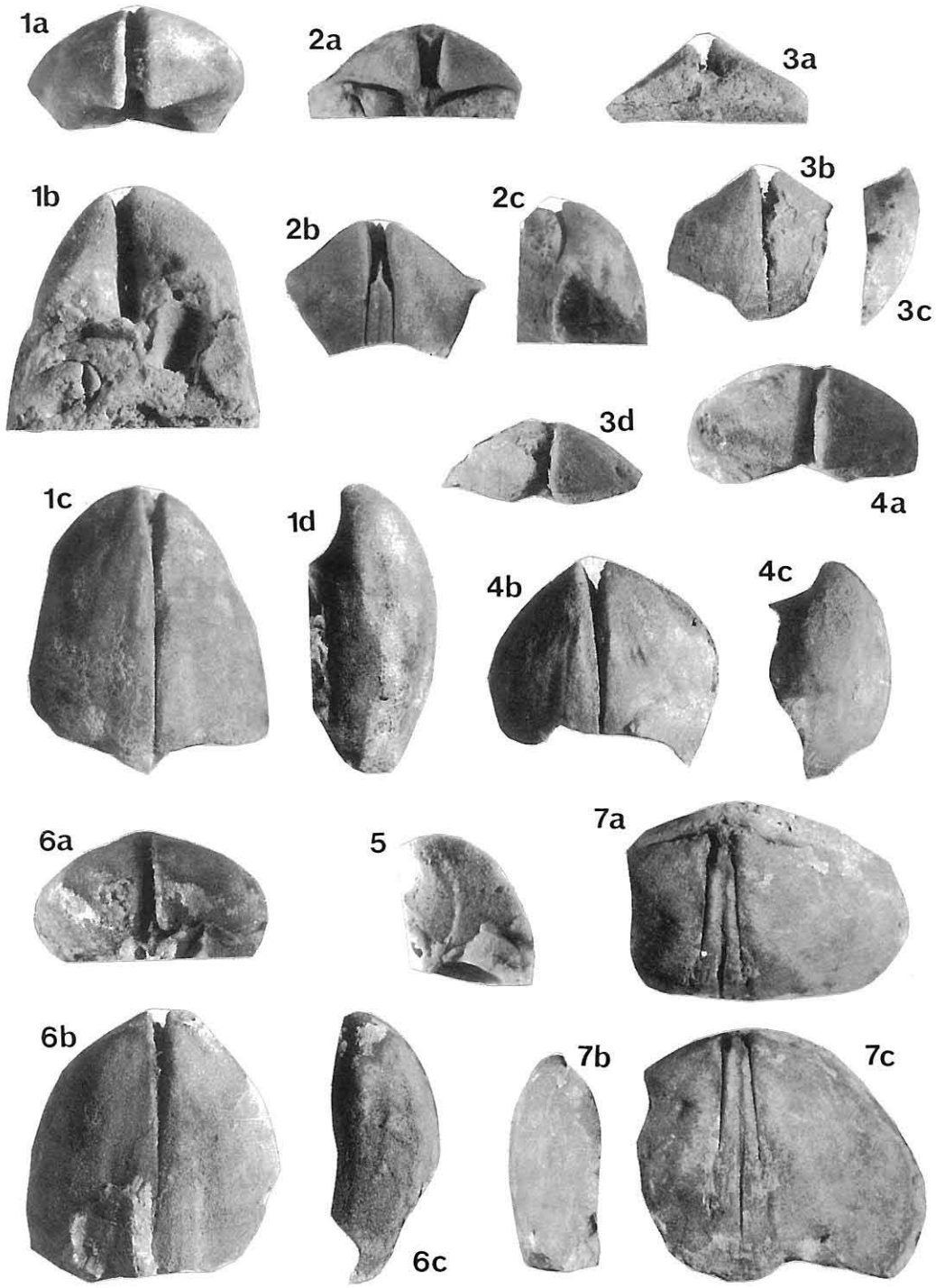
Explanation of Plate 1

Figs. 1a-d; 2a-c; 3a-d; 4a-c; 5; 6a-c; 7a-c; *Pentamerifera* sp. All figures are of internal moulds, and of natural size. Figs 1a, 3d, 4a and 6a are posterior views of pedicle valves. Figs. 1c, 3b, 4b and 6b are pedicle valves showing long median septum. While figs. 2b and 7c are brachial valves. Figs 1b and 3a are brachial views of pedicle valves. Fig 5 is longitudinal section of a pedicle valves showing curved ridge between median septum and spondylium. Figs. 1d, 2c, 3c, 4c, 6c and 7c are lateral view of either pedicle or brachial valves.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doubted at least in the Pin valley section''. Srikantia (1981) has adopted the term Muth Formation as a proper lithostratigraphic nomenclature for the 'white Muth Quartzite' of Spiti and considers it to range actually in age from Middle to Upper Devonian.

Based on the study of brachiopod and coral fauna presented in this paper and conclusions drawn from it, we are inclined to support the contentions of Jain et al (1980), Talent (1982) and Ranga Rao et al (1985). Clearly there are significant time differences between exposures of type 'Muth Quartzite' at Muth in the Pin valley (Spiti) and its supposed correlatives in Kashmir, Kumaun and elsewhere. Goel and Nair (1977) and Jain et al (1980) located two lithostratigraphic units at Muth, i.e. the type Muth Quartzite formation at Muth (in Pin valley, Spiti) representing two events; the lower two-thirds of the Quartzite sequence denoting the regressive phase of the same Ordovician-Silurian sedimentary cycle as the underlying Thanam Formation. This unit, making up the major part of the succession, may be classified as the Muth Quartzite, *sensu stricto*. The uppermost one-third of quartzite succession is separated from the lower by a development of rusty, discontinuous weathered dolomite. No fossils have been recovered from either quartzitic unit at Muth proper but this uppermost of the sequence may be part of the Devonian which would explain occurrences of the known Devonian faunas from the quartzites and associated carbonates in the valleys of the Lipak and Yulang rivers in Kinnaur. The same two sedimentary cycles are clearly in evidence in Kashmir and elsewhere (Heim and Gansser, 1939) and recognition of this may help clarify the confusion that surrounds the 'Muth Problem' in these areas. It is quite likely that some of the so called 'Muth Quartzites' which have yielded unequivocal Devonian faunas may not in fact correlate with the Muth Quartzite *sensu stricto*, but rather be correlatives of the younger Devonian sedimantary cycle. The Garhwal Fauna, described in this short note, belongs undoubtedly to the lower section of the proper Muth Quartzite of Silurian age. A detailed investigation of the stratigraphy and faunas of both these formations, bed by bed, is therefore very strongly called for.

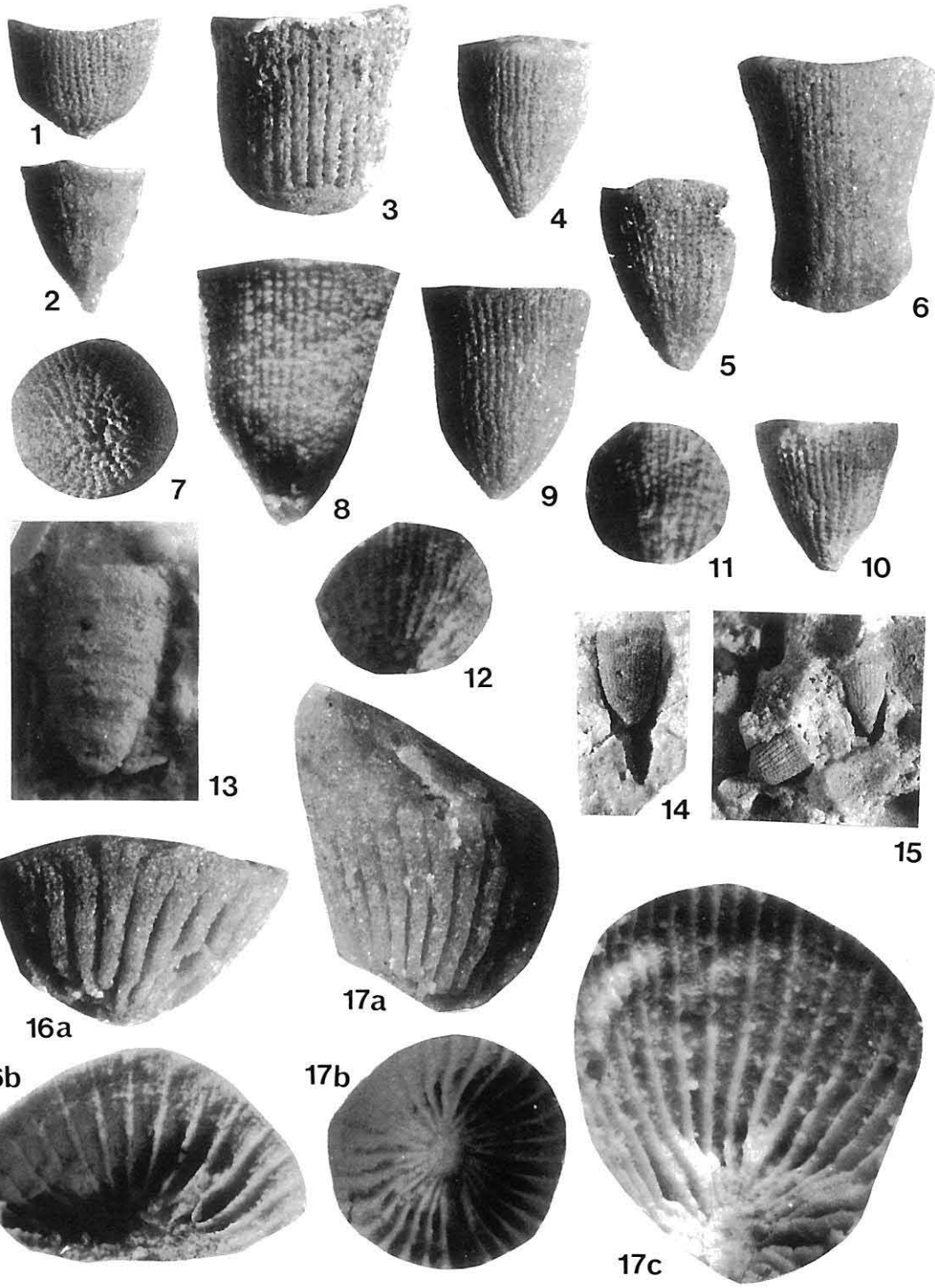
Explanation of Plate 2

Figs. 1-15 A ceratoid Palaeocyclid. (Form **C**)
Figs. 1-6, 9-10: Side view of calicular moulds.
Fig. 7: Bottom view of a calicular mould (Fig. 1).
Figs. 8, 11-12: Silicon cast of calice showing the mode and arrangement of acanthine septa. Fig. 13: Silicon cast showing external feature of corallum. Figs. 14 and 15 show space originally occupied by coral skeleton.

Figs. 16a-b A Streptelasmatid (Form **B**). Fig. 16a: Calicular mould. Fig. 16b: Silicon cast of calice. Note the presence of three short septa between neighbouring majors.

Figs. 17a-c A Streptelasmatid (Form **A**). Fig. 17a: Side view of calicular mould. Fig. 17b: Top view of silicon cast of calice showing narrow central open space and shallow cardinal fossula.

Figs. 1-7, 9-10, 13, 16a-b and 17a-b are three times natural size. Figs. 8, 11-12 and fig. 17c are four times natural size. Figs 14 and 15 are natural size.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All specimens figured herein are reposited in the collection of Hokkaido University, Sapporo, Japan.

References

Amsden, T.W. and Biernat G., 1965. Pentamerida, in: R.C. Moore (ed.) *Treatise on Invertebrate Paleontology*, Part H, H 523-552, Geol. Soc. Amer.

Boucot, A.J. and Gauri, K.L., 1968. Age and Relationship of Basal Muth Quartzite of Kashmir, India. *Geol. Soc. Amer., Abstr.* p.33.

Boucot, A.J. and Johnson, J.G., 1979. Pentamerinae (Silurian Brachiopoda). *Palaeontographica*, Abt. A, 163: 87-129.

Burrard, S.G. and Hayden, H.M., 1934. *A Sketch of the Geography and Geology of the Himalayan Mountains and Tibet.* Government of India Press, Calcutta.

Goel, R.K. and Nair, N.G.K., 1977. The Spiti Ordovician-Silurian succession. *Jour. Geol. Soc. India*, 18(1): 47-48.

Griesbach, C.L., 1891. Geology of the Central Himalaya. *Mem. Geol. Surv. India*, 23: 1-232.

Gupta, V.J., 1970a. Stratigraphy of the Muth Quartzite of the Himalayas. *Jour. Geol. Soc. India*, 19(1): 88-94.

Gupta, V.J., 1970b. Fauna from the Muth Quartzite of Kashmir. *Res. Bull. Panjab Univ.* (N.S.), 21(3-4): 1-22.

Gupta, V.J., 1971. A note on the Lower Paleozoic stratigraphy of western Nepal. *Verh. Geol. Bundesanstalt*, 3: 643-646.

Gupta, V.J., 1973. *Indian Paleozoic Stratigraphy*. Hindustan Publ. Corp., Delhi, 207pp.

Gupta, V.J. and Bates, D.E.B., 1968. A new species of *Schellwienella* from the Muth Quartzite of Kashmir. *Bull. Geol. Soc. India*, 5(3): 80-82.

Gupta, V. J. and Jain, S.P., 1967. Lower Paleozoic fossils from Losar, Spiti. *Res. Bul. Panjab Univ.* (N.S.), 18(1-2): 5-12.

Gupta, V.J., Mahajan, G., Kumar, S., Chadha, D.K., Bisaria, P.C., Virdi, N.S., Kochhar, N. and Kasyap, S.R., 1970. Stratigraphy along the Manali-Leh road. *Publ. Cent. Adv. Stud. Geol.*, 7: 77-84.

Hayden, H.H., 1904. Geology of Spiti with parts of Bashahr and Rupshu. *Mem. Geol. Surv. India*, 36(1): 1-129.

Heim, A. and Gansser, A., 1939. Central Himalayas. The Geological observations of the Swiss Expedition, 1936. *Mem. Soc. Helv. Sci. Nat.*, 73(1): 204-205.

Hill, D., 1938. A Monograph on the Carboniferous Rugose Corals of Scotland, Part I. *Monog. Palaeont. Soc. London*, 1-78.

Jain, A.K., Goel, R.K. and Nair, N.G.K., 1980. Implications of Pre-Mesozoic Orogeny in the geological evolution of the Himalaya and Indo-Gangetic plains. *Tectonophysics*, 62: 67-86.

Kato, M., 1982. *Mazaphyllum* (Rugosa) from the Silurian of Japan. *Trans. Proc. Palaeont. Soc. Japan*, N.S., 127: 386-392.

Oldham, R.D., 1888. The Geology of Northwest Himalayas. *Rec. Geol. Surv. India*, 21(4): 145-165.

Ranga Rao, A., Dhar, C.L., Jokhan, R., Rao. S.V. and Shah, S.K., 1985. Contributions to the stratigraphy

of Spiti. *Himalayan Geol.*, 12: 99-113.

Reed F.R.C., 1911. Devonian fossils from central Persia, Afghanistan and the Himalayas. *Rec. Geol. Surv. India*, 41: 86-14.

Reed, F.R.C., 1912. Ordovician and Silurian fossils of central Himalayas. *Palaeont. Indica, Geol. Surv. India*, Ser. 15, 7(2): 1-168.

Sahni, M.R. and Gupta, V.J., 1959. First record of fossils in the Muth Quartzite. *Jour. Pal. Soc. India*, 4: 33-24

Shah, S.K. and Sinha, A.K., 1974. Stratigraphy and Tectonics of the "Tethyan" Zone in a part of western Kumaun Himalaya. *Himalayan Geol.*, 4: 1-27.

Srikantia, S.V., 1981. The lithostratigraphy, sedimentation and structure of Proterozoic-Phanerozoic formations of Spiti in the higher Himalaya of Himachal Pradesh, India. In: Sinha, A.K. (Ed.), *Contemporary Geoscientific Researches in Himalaya*. Bishen Singh & Mahendra Pal Singh Publ., Dehradun, 31-48.

Stoliczka, F., 1865. Geological sections across the Himalayan mountains, from Wangtu bridge on the river Sutlej to Sumdo on the Indus. *Mem. Geol. Surv. India*, 5(1): 1-173.

Talent, J.A., 1982. Discussion, in "Lower Devonian Ostracode fauna from Spiti and its paleogeographic significance by Bhatia, S.B., Jain, S.P. and Gupta, V.J." *Himalayan Geol. Seminar*, (New Delhi, 1936) Ser . IB, 292-293.

Valdiya, K.S. and Gupta, V.J., 1972. A contribution to the geology of Northeastern Kumaun, with special reference to the Hercynian gap in Tethys Himalaya. *Himalayan Geol.*, 2: 1-33

Weyer, D., 1980. Die älteste Rugose Koralle Europas (*Primitophyllum* KALJO, 1956, Mitlelordoviz). *Neue paläontologische und geologische Forschungsergebnisse hallenser Absolventen, Martin-Luther-Universität Halle/Wittenburg,* 51-77.

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