

DISCUSSION

First Record of Ediacaran Fossils from the Krol Formation of Nainital Syncline

I

(A comment on the paper by V. K. Mathur and Ravi Shanker published in the Journal of the Geological Society of India, Vol. 34, No. 3, 1989, pp. 245-254).

I wish to offer the following comments on the article :

1. It should have been written as 'Ediacarian' and not Ediacaran (see Glaessner, 1984) if the authors are referring to the time span (680-580 m.y.).
2. The paper claims to set at rest the controversy relating to the age of the Krol Formation. The claim is not justified because the *Beltanelliformis*, a doubtful fossil (see Glaessner, 1984, p. 79) and the so called *Pteridium*, an imprint with doubtful identification cannot decide the age of the Krol Formation.
3. The controversy regarding the age of the Krol Formation was set at rest the day the Trilobites (Singh and Rai, 1983) and Archaeocyathids (Singh and Rai, 1984) were reported from the overlying Tal Formation. However, a brief discussion on the age of Nainital Krols independently of Mussoorie and Garhwal Krols was desirable because of discontinuity and considerable distance between the rock-sequences.
4. The *Beltanelloides* (= *Beltanelliformis*) as Glaessner (1984, p. 25) has mentioned, is 'certainly not a Coelenterate, nor any other kind of animal'. Thus, it needs to be examined why these tiny, hemispherical, button-shaped elevations are not the casts of rain-drop imprints as Misra (1984) had, rightly or wrongly, interpreted.
5. The *Pteridium* has been portrayed (Fig. 4) to show primary furrows almost at right angles to the median but in the photographs the furrows run up and away from the median. How do the primary furrows behave at the tip of the organism? In *Pteridium* the furrows should turn backwards (cf. Glaessner, 1984, p. 79).
6. The authors mention *Charnodiscus* as an alternative identification for their *Pteridium*. Do they mean *Charniodiscus*?
7. There is no mention of the *Pteridium* impressions on a single bedding plane. Are the medians parallel/sub-parallel to one another? Are they aligned along the hinges of folds? If so, the imprints could as well be inorganic in origin.
8. There is no mention of the depositional environment of the rocks (even though literature is available), habitat and ecology of the concerned organisms and ontogenic variations if any. This mention would help understand the true nature of imprints.

9. The paper on the occurrence of stromatolites in the Krol Formation of Nainital area was written by I. B. Singh and Vikram Rai and not by I. B. Singh and Vibhuti Rai as listed by the authors.
10. In spite of the above, I congratulate the authors for the report.

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References

- GLAESSNER, M. F. (1984) The dawn of animal life, A biohistorical study. Cambridge Uni. Press, Cambridge, 244 p.
- MATHUR, V. K. and RAVI SHANKER (1989) First record of Ediacaran fossils from the Krol Formation of Nainital Syncline. Jour. Geol. Soc. India, v. 34, no. 3, pp. 245-254.
- MISRA, S. B. (1984) Depositional environment of the Krol Group of the Nainital area and its impact on the stromatolites. Proc. Indian Acad. Sci. (Earth and Planet. Sci.), v. 93, no. 4, pp. 447-464.
- SINGH, I. B. and VIBHUTI RAI (1983) Fauna and biogenic structures in Krol-Tal succession (Vendian-Early Cambrian) Lesser Himalaya, their biostratigraphic and palaeontological significance. Jour. Palaeont. Soc. India, v. 28, pp. 67-90.
- (1984) Discovery of Archaeocyatha in the upper Krol carbonates, Mussoorie Hills, Uttar Pradesh, India. Curr. Sci., v. 53, pp. 243-246.

REPLY

The following replies are furnished to the comments made by Dr. S. B. Misra.

1. The terms like 'Ediacaran' (or 'Ediacarian') 'Sinian' and 'Vendian' for a paleontologically characterised interval of geologic history preceding the Cambrian are being used informally in literature. We are not aware, if any single term has yet received formal approval by an international regulatory body (Hofmann, 1987).
2. *Beltanelliformis* and *Pteridinium*, although their taxonomic positions are still debatable issues, are widely distributed taxa in the Ediacaran/Vendian assemblages in Canada, Australia, Eurasia, North Carolina, Namibia and USSR (Glaessner, 1989, personal communication and Narbonne and Hofmann, 1987).
3. The controversy regarding the age of Tal Formation (overlying Krol Formation) was broadly settled by Singh (1976 and 1979). It was finally set at rest by Tripathi *et al.* 1984; and Kumar *et al.* 1987). Trilobites gen. indet and doubtful archaeocyathids (Zhuravlev, 1986; and Brasier and Singh, 1987) from the Tal and Krol formations respectively do not conclusively fix the age of Tal and Krol Formations. In this context the Ediacaran fossils are considered relevant. Systematic lithostratigraphic work and lateral variations in gross litho associations and facies was done and fairly well established by Geological Survey of India (Ravi Shanker *et al.* 1975; and Ravi Shanker, 1983). The salient features of the same will be elaborated

in the forthcoming Group discussion on Pre-Cambrian-Cambrian boundary problem organised by the Geological Society of India.

4. *Beltanelliformis*, because of their mode of occurrence, sporadic and in clusters and the intertidal to subtidal nature of sediments represented by intercalations of shale/siltstone (rhythmites), and lenticular bedding (Reineck, 1963; Reineck and Singh, 1973) do not appear to be rainprints. Plate I, Fig. 3A may represent an assemblage of juvenile forms of *Beltanelliformis* (Narbonne, 1989, personal communication).
5. *Pteridinium* (Plate I, Fig. 5) is an incomplete specimen. Primary furrows are not well preserved throughout the preserved median. It is a good specimen of this taxon (Narbonne, 1989, personal communication and Glaessner, 1989, personal communication).
6. The specimens in Figs. 2, 4 and 6 were described as ? *Pteridinium*. These specimens were considered to be similar to *Charniodiscus arboreus* as suggested by Narbonne, 1989, personal communication). We agree with Prof. Narbonne's suggestions.
7. The medians of ? *Pteridinium* (*Charniodiscus arboreus*) specimens are generally subparallel to angular to one another on the one bedding plane (Fig. 2). These are aligned both along the hinges of folds as well as flat surfaces. Besides the above stated fossils, medusoid coelenterates (*Tirasiana* sp., *Medusinites* sp. and *Beltanella* sp.) were also reported, from the same horizon and locality (Mathur and Ravi Shanker, in press), which were also shown to Dr. S. B. Misra, when he visited us in the third week of October, 1989.
8. The present fossils are preserved in the thinly bedded greyish black shale interbedded with ferruginous siltstone. The shale/siltstone intercalations show well developed tidal flat (intertidal to subtidal) sequences where rhythmites and lenticular bedding are present. It suggests that the Ediacaran organisms were preserved in intertidal to subtidal environment. Ediacaran fauna has been reported from similar environmental conditions, which are from both settings: shallow shelf (e.g., Goldring and Curnow, 1967; Jenkins *et al.* 1983) and deeper slope (e.g., Anderson and Conway Morris, 1982; Gibson *et al.* 1984).
9. We did mention in our original manuscript the names of I. B. Singh and V. Rai (1977) for the said paper. For this reference (listed at No. 3 on p. 254) 'V' stands for Vikram and not Vibhuti.

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References

- ANDERSON, M. M. and CONWAY MORRIS, S. C. (1982) A review, with description of four, unusual forms, of the soft-bodied fauna of the Conception and St. John's Groups (Late Precambrian): Avalon Peninsula, Newfoundland. Proc. Third N. Amer., Paleont. Conv., v. I, pp. 1-8.
- BRASIER, M. D. and SINGH, P. (1987) Microfossils and Precambrian-Cambrian boundary stratigraphy at Maldeota, Lesser Himalaya. Geol. Mag., v. 124, no. 4, pp. 323-345.

- GIBSON, G. G., TEETER, S. A. and FEDONKIN, M. A. (1984) Ediacaran fossils from the Carolina Slate Belt, Stanly County, North Carolina. *Geology*, v. 12, pp. 387-380.
- GLAESSNER, M. F. (1984) *The dawn of animal life. A biohistorical study*, Cambridge University Press, Cambridge, London, New York, New Rochelle, Melbourne, Sydney, pp. 244.
- GOLDRING, R. and CURNOW, C. N. (1967) The stratigraphy and facies of Late Precambrian of Ediacara, South Australia. *Jour. Geol. Soc. Australia*, v. 14, pp. 195-214.
- GOPENDRA KUMAR, JOSHI, ASHUTOSH and MATHUR, V. K. (1987) Redlichiid trilobites from the Tal Formation, Lesser Himalaya, India. *Curr. Sci.*, v. 56, no. 13, pp. 659-663.
- HOFMANN, H. J. (1987) Precambrian Biostratigraphy. *Geo-Science, Canada*, v. 14, no. 3, pp. 135-154.
- JENKINS, R. J. F., FORD, C. H. and GEHLING, J. G. (1983) The Ediacara Member of the Rawns1 Quartzite: the concept of Ediacara assemblage. (Late Precambrian, Flinders Ranges). *Jour. Geol. Soc. Australia*, v. 29, pp. 101-119.
- MATHUR, V. K. and RAVI SHANKER (1989) Ediacaran medusoids from the Krol Formation, Nainital Syncline, Lesser Himalaya. *Jour. Geol. Soc. India* (in press).
- NARBONNE GUY, M. and HOFMANN, H. J. (1987) Ediacaran Biota of the Wernecke Mountains, Yukon, Canada. *Paleontology*, v. 30, pp. 647-676.
- RAVI SHANKER (1983) The Mussoorie Phosphate Basin, India. *In*: Northolt and C. U. Sheldon (eds.), *World's Phosphate Resources*.
- RAVI SHANKER, PRAKASH, G. and DHOUNDIAL, J. N. (1975) Report on the stratigraphic analysis of Krol-Tal Basin in Pauri, Tehri, Dehra Dun districts, U.P. and Sirmur, Mahasu and Simla districts, H.P. (1971-72). *Geol. Surv. India* (Unpublished)
- REINECK, H. E. (1963) Sedimentgefuge in Bereich der sudlichen Nordsec, *Abh senckenbergische naturforsch Ges* 505, p. 138.
- REINECK, H. E. and SINGH, I. B. (1973) *Depositional sedimentary environments*. Springer-Verlag, Berlin, Heidelberg, New York.
- SINGH, I. B. (1976) Evolution of Himalaya in the light of marine transgressions in Peninsular and Extra-Peninsular India. *In*: Proc. 125th Anniversary Celebration Symposium, Geol. Surv. India, Lucknow (Pre-print).
- (1979) Recognition of a sedimentological break between Quartzite and limestone Members of the Tal Formation, Lesser Himalaya, India. *Curr. Sci.*, v. 48, pp. 206-208.
- TRIPATHI, C., JANGPANGI, B. S., BHATT, D. K., KUMAR, G. and RAINA, B. K. (1984) Early Cambrian brachiopods from 'Upper Tal', Mussoorie Syncline, Dehra Dun district, Uttar Pradesh, India. *Geophytology*, v. 14, pt. 2, pp. 221-227.
- ZHURAVLEV, ANDREY YU (1986) Evolution of archaeocyaths and palaeobio-geography of the Early Cambrian. *Geol. Mag.*, v. 123, no. 4, pp. 377-383.

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We have read the paper carefully and would wish to draw the attention of the authors to the following points:

- i) The photo-plate accompanying the paper gives unconvincing illustrations of the 'Ediacaran metazoa'. Predominantly only one type of the 'metazoan' is illustrated. The individual photos have been cut to small size. This prevents the reader from assessing the outline of the features illustrated. Only a presumed outline is conveyed through the line-diagram (Fig. 4). A careful examination of the photos shows no proper confining outline of the structures that are illustrated. In our opinion a reasonably