DISCUSSION

DISCOVERY OF LOWER CAMBRIAN SMALL SHELLY FOSSILS AND BRACHIOPODS FROM THE LOWER VINDHYAN OF SON VALLEY, CENTRAL INDIA by R.J. Azmi, Jour. Geol. Soc. India, v.52, pp.381-389, 1998

(1)

J. Swami Nath, M-105/11, 29th Cross Street, Basant Nagar, Chennai - 600 090 comments:

The above paper is thought provoking and to me these fossil finds appear significant as I have an abiding interest in the attempts at correlation of the Vindhyan sequences with those in Lesser Himalayan basins (Krishnan and Swami Nath, 1959).

The author has posed some of the problems in stratigraphy and correlation (pp.385-386, items 2 and 8 respectively) on the Vindhyan succession with those in Trans-Aravalli/Salt Range/ Lesser Himalaya-Krol sequence in particular. In a few papers listed under 'References', particular attention of the author has been drawn to reviews of correlation, with page numbers for easy reference, to enable him to evaluate these earlier views against his evolving concepts based on his new fossil finds.

The author refers to "Pokhran Boulder Beds" (p.386) whereas there is deviation with reference to 'Blaini' only as 'conglomerate' but not 'Blaini Boulder Bed' even when this nomenclature is well entrenched in Indian geological literature and considered to be of glacial/fluvio-glacial origin. It is not clear why this distinction has been made. Sinha-Roy et al.'s (1998, p.176) mention of 'Pokhran Boulder Bed' is only descriptive and no comments have been offered on their glacial origin which W.T. Blanford and R.D. Oldham (*see* Krishnan and Swami Nath, 1959, p.29) thought so of Vindhyan age. Chowdhury (1953) has reported Precambrian glaciation in central India. What would be the author's view on this postulation with respect to Semri conglomerate (p.386). The genesis of these 'Boulder Beds' has been controversial (Mem. Geol. Surv. India, 1977, Pt.II, pp.435-439). Nevertheless, the author's attempt at plausible correlation of these Boulder Beds/ conglomerates in the different locations (p.386) deserves serious consideration. Further, the palaeoclimatic conditions during the Vindhyan sedimentation indicate arid to semi arid conditions (Krishnan and Swami Nath, 1959, p.25), whereas, during this time, desiccation with salt formation occurred in Salt Range and Mandi Salt Belt (Mem. Geol. Surv. India, 1977, Pt.II, p.413). These add support to the author's views on correlation.

The author has attempted to establish a biostratigraphic correlation between Lesser Himalayan Blaini-Krol-Tal sequence (Mussoorie Group) and Lower Vindhyan Semri Group (p.385 item 2). Is it the contention of the author that the Krol Belt in its present structural position, was continuous and consanguineous with the Vindhyan Basin of Central India? If so, this raises the question of palaeotectonic position of Krol vis-a-vis other basins in Lesser Himalaya at the time of Vindhyan sedimentation – a very large problem to be tackled.

The author has correctly focussed attention (pp.385-386) on anomalies between geochronological dating vis-a-vis biostratigraphic results and has rightly suggested a full re-evaluation of all evidence.

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KRISHNAN, M.S. and SWAMI NATH, J. (1959). The Great Vindhyan Basin of Northern India. Jour. Geol. Soc. India, v.I, pp.12-30. [Note Pokhran Boulder Bed, p.29].

SINHA-ROY, S., MALHOTRA, G. and MOHANTY, M. (1998). Geology of Rajasthan, Geol. Soc. India Publication.

(2)

K.S. Subrahmanian, Plot 283, 17th East street, Kamrajnagar, Tiruvanmiyur, Chennai 600 041 comments:

On going through the article I was reminded of the succinct observation of B.P. Radhakrishna that the Proterozoic basins of India 'provide some of the best material for the study of early life forms' (Jour. Geol. Soc. India, v.34(3), 1989). Now, according to R.J. Azmi, the Rohtasgarh Limestone and the shale of Semri Group (Lower Vindhyan) have revealed small shelly fossils and brachiopods which can be directly linked with the explosive evolution of invertebrates of early Palaeozoic.

It is recognised that the well-known assembly of the Ediacaran fauna of South Australia, considered to be of Late Proterozoic age, is constituted of imprints of soft-bodied organisms, flattened between sandstones and shales. Though some palaeontologists consider that Spriggina found in Ediacara may be a forerunner of trilobites and Tribrachidium may be related to echinoderms, it has been found difficult to accommodate Ediacaran fossils in the known spectrum of life forms. There is also the view that the Ediacaran fossils are of floral origin. Thus, it appears that the Precambrian fossils of Ediacara are genealogically and perhaps ecologically different from the fauna of Phanerozoic time.

In the above context, the small shelly fossils and brachiopods of the Son valley may constitute a link between the soft-bodied organisms of Ediacara and the invertebrates of the Cambrian. The author has rightly suggested meticulous search for Ediacaran type of fossils in the lower part of the Semri Group. There is also the possibility that the changeover from soft-bodied organisms to life forms with shells was in tune with the theory of 'punctuated evolution', propounded by Elridge and Gould.

On the basis of his findings the author has suggested that the Vindhyan basin be named a 'Terminal Proterozoic to Early Palaeozoic basin' instead of the current Proterozoic basin'. Such a change in nomenclature may be right if Ediacaran type of fossils of upper Proterozoic age are identified in the lower part of the Semri Group.

The reported fossil find is at once important from palaeontological and stratigraphical points of view. It may eventually prove to be a new sign-post of evidence for the revision of the present views on the Vindhyan basin, if confirmed by further studies and accepted by the geological community.

(3)

S.B. Bhatia, House No. 441, Sector-6, Panchkula, Haryana 134 109 comments:

The discovery of small shelly fossils (SSF) in the Rohtasgarh Limestone, Lower Vindhyan, of the Son Valley in Central India is a major break through in Vindhyan Geology. R.J. Azmi seems to have kept a tryst with destiny – first the discovery of SSF in the Lower Tal of the Himalaya, and

now the similar discovery in the seemingly homotaxial Lower Vindhyan of Central India. Unfortunately, the data presented lack credibility, inasmuch as neither the location map nor the litholog has been given. In a scientific paper of such significance lack of essential location and stratigraphic details is inexcusable. It is unfortunate that the concern expressed by the Society in this regard following the Himalayan Fossil Controversy (Jour. Geol. Soc. India, v.37/1, p.80) has not been addressed in this paper, either by the author or by the Editor. One gets the impression that the author, for reasons best known to him, wants to keep certain 'cards' close to his chest.

However, be that as it may, my subjective comments are as follows:

1. While the title of the paper refers to the discovery of SSF in the Lower Vindhyan of Central India, a major part of the paper deals with systemation of a new taxon from the Lower Tal phosphorites of the Mussoorie Syncline in the Himalaya. Only a small paragraph lists the SSF recorded from the Vindhyan without any taxonomic or other comments. If the author was keen to include the systematics of the new taxon in the present paper, the title should have been modified accordingly. The 'Abstract' has also been dispensed with by the author.

2. The identification of acrotretid brachiopods (P1.1, figs.1-7) seems to be suspect, inasmuch as none of the specimens illustrated show the apical pore or the inter-area in the supposedly ventral valves. The presence of one or two prominent rounded nodes in addition to the umbo, further negates the possibility of these being brachiopods.

3. Similarly, the identification of the so-called obolellid brachiopods (P1.1, figs.8-12) also appears to be suspect. I stand corrected, but it seems more likely that these specimens belong to the problematic Lower Cambrian *Mobergella* group. Examination of the interior of the valves/operculum with its characteristic muscles scar pattern would confirm this contention.

4. The only specimens which appear to be correctly identified and which will have an important bearing on the age of the Vindhyan are the Tommotiids (P1.1, figs.13-18). Incidentally, the genus *Camenella*, to which these forms are assigned, is con-generic with *Tommotia* and is its junior synonym (*vide* Bengtson, 1970). Figs 14-18 represent typical mitral sclerites, while fig.13 may be of a sellate sclerite.

5. The specimens illustrated as the new taxon *Taliella himalayaica* (P1.2) are undoubtedly organic, but the taxonomy and the systematic position may have to be revised in the light of the following observations and comments: (a) Specimens illustrated as the 'holotype' (P1.2, figs.1-3) apparently shows a 'cluster' of four (or probably more) sclerites. As at present, all the four sclerites in fig.3 become 'syntypes' as there can only be one specimen as 'holotype'. The author will have to redesignate one of the syntypes as the holotype. (b) The author states that the Chinese species *Tummuliolynthus orthancanthus* Yang and He (1984) is 'included' in the new genus *Taliella*. It is unclear whether the author wants to put the Chinese species as a synonym of his new taxon or whether only a generic shift is suggested. If the genus *Tummuliolynthus* is con-generic with *Taliella*, the latter name has no validity. In any case, the reasons for suppressing the Chinese species has not been clearly stated by the author. (c) Being apparently unaware of Bengtson's classic work on

the genus *Tommotia*, the author seems to have overlooked the importance of intraspecific variation between the sclerite types – mitral and sellate – both of which occur in right and left symmetry forms. These features characterise the order Mitrosagophora Bengtson (1970). It is likely that *Taliella*, if a valid genus, may also belong to this order. Its placement in the family Tommotiidae may not be correct, as none of the sclerites show densely lamellar structures.

The above mentioned comments are based on the illustrations and descriptions given by the author, I stand corrected, should future detailed work (preferably based on additional material) by the author himself or by an expert in the field come to conclusions different from mine.

Till such time as more details become available about the precise locality and stratigraphic horizon of Azmi's SSF material from the Vindhyan and his findings are confirmed by other workers, it would be premature to discuss its age implications, particularly vis-a-vis the hitherto known radiometric dates and the evidence of stromatolites and also in the light of the latest work of Seilacher et al. (1998). R.J. Azmi must 'open-up' and show to the scientific community that his findings are genuine. His work, seemingly, will put a lid on the controversy about the age of the Vindhyan – as it did in the case of the Tal.

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(4)

Vivek S. Kale, Department of Geology, University of Pune, Pune 411 007 comments:

Dr. Azmi is to be congratulated on a very important find which is certain to make a lot of difference in how we look at the sediments in the Vindhyan Basin. The SEM microphotographs given by him in this report are of excellent quality and one cannot doubt the forms described by him. However, notwithstanding the excitement which this find is bound to generate, there are certain obvious and serious limitations which may reduce its significance. It would be worthwhile to have Dr. Azmi clarify them.

1. To start of, it is surprising that a report of this importance is being published without a map of the localities from where the material is collected, nor a litholog clearly pinpointing the horizons from which the collections were made. All that one has for reference in this regard is the few statements on p.381 (last few lines) and p.382. Is it sufficient to simply state that "In this attempt the topmost Rohtasgarh Limestone and Shale of Lower Vindhyan (Semri Group) in different areas namely Maihar and Rohtas in the Son valley ...."? To put it mildly, a report of the magnitude that Dr. Azmi claims without precise locations of the samples is unacceptable.

2. Although there is no doubt about the expertise of Dr. Azmi, given the importance of the find, is it sufficient to simple state that (p.382) "Two assemblages of SSFs ..." can be

recognised in this collection? What are the stratigraphic levels from which the two have been collected? How much thickness of sediments separates them? Given that the two assemblages (as described in the published text) are recorded from two separate areas (Maihar and Rohtas), besides their actual contents, information on their stratigraphic positions would add much more to the report and is essential for it to be acceptable.

One would like to believe that these essential requirements for the report of these magnitude were overlooked in the excitement of the find and can be duly rectified. However, what is even more interesting on this background is the "conclusion/suggestions" (p.385) which Dr. Azmi has drawn. These are probably based on inferences drawn by him, once he is convinced of the validity of his find, but tend to disregard several facts about the Vindhyan Basin. A few of the points are listed as follows:

a) It is only some of the siliciclastic horizons in the Vindhyan Supergroup which have been attributed to "fluviatile character" or "continental environments" by the authors quoted in conclusions/suggestion #5. That does not make the rest of argillaceous and carbonate sediments in the Vindhyan continental! Further, even where the fluvial and eolian influences are brought out by earlier workers, they have unanimously accepted that the sedimentation took place on a continental margin setting. Surely, the SSFs reported by Azmi are not continental. Simply attributing absence of Early Palaeozoic fossils to "continental character" of the Vindhyan is a gross oversimplification.

b) If the conclusion is that the Semri is a very Late Proterozoic then one would really have a hard time trying to explain why the rest of the Vindhyan marine sediments (which were deposited in a setting ideal for the preservation of body fossils) do not contain a large assemblage of Lower Palaeozoic fossils – megafossils in particular. A comparison with the depositional environments of the Upper Cambrian - Ordovician - Silurian sediments from the type areas and other parts of the world would suggest very clearly that the Vindhyan deposition did not take place in harsh conditions, rather it represents one which would have ideally suited the preservation of body fossils. Yet, besides the reports cited (#6 - p.385) and some (?) Ordovician and Silurian acritarch assemblages reported by other authors in the 1970's, nobody has succeeded in finding such fossils. One cannot help wonder why this is so!

c) The mess of geochronological information on the Vindhyan Supergroup is well-known and has merited comments by several previous workers. However, there is no justification for simply brushing aside the data in one stroke. The data need to be looked at again, need to be revalued and the geochronology needs to be done with a focussed approach.

d) It is now well accepted that the "Trans-Aravalli Vindhyan" = Marwar Supergroup are not Vindhyan but sediments in an entirely separate basin. There was a major orogenic belt which was active during the sedimentation in these basins between them. Therefore, whatever the future may bring out following the present report by Azmi, trying to link up beds across several basins just on the basis of lithological similarities, as has been suggested for the Blaini - Pokharan - 'Basal' conglomerates (#8, p.386), is unacceptable. Can we forget how the archaic pre-radiometric dating approach of lithological comparisons for correlations led to confusion in Indian stratigraphy, some of which are still not resolved. Lithological similarities are the result of similar depositional histories, not age. The only exception which immediately comes to one's mind in this context is the case of glacial tillites. Are these horizons of glacial origin? I think not.

In conclusion, the statement on p.386 by Dr. Azmi is one which I unequivocally support. The Vindhyanchal Basin (including the pre-Vindhyan Supergroup sequences) deserve a "detailed reinvestigation .....". Let us not get carried away by one find or another. There are two sides to the story. Perhaps the existing knowledge of the biotic evolution itself may need to be revised after new data are properly documented and constrained.

Dr. Azmi certainly deserves congratulation for his very significant find. However, rather than jump to exciting conclusions, it may be worthwhile to adopt a cautious but scientific approach to the problem.

(5)

M.N. Joshi, Department of Geology, DBS college, Dehra Dun comments:

The discovery of Cambrian fossils from the Rohtas Formation of Vindhyan Supergroup has undoubtedly given a jolt to the established concept. Although the presence of Phanerozoic biogenic elements were reported earlier from the Vindhyan, they were never taken seriously and the overall consensus has been to consider the Vindhyan as 'Purana' sediments. Radiometric dates and Riphaean stromatolites have been two major bases for this consideration. The other evidences like the trace fossils, *Chauria*-like organic remains, as also stable isotope data, have generally been tried to fit into this notion. However, there always been differences of opinion regarding the details. It is quite natural that Azmi, in the light of his fossil findings, has criticized these evidences. But, before summarily rejecting their validity, a critical re-examination of all the available data by scholars of different disciplines is essential.

Azmi has not given the precise location and the litholog of his finding. One can appreciate this, as at the time of the first announcement of such a discovery, there is always an element of risk in revealing all the details. However, it is hoped that now these will be described and others will get a chance to examine these fossils. Unless they are found by various workers, the finding will not get credibility. A multi-disciplinary investigation is therefore urgently needed to resolve the problem. Azmi's findings have vindicated once more that in science no word is final and every fact is true only at a given time.

R.J. Azmi, Wadia Institute of Himalayan Geology, Dehra Dun 248 001, *replies*:

I am highly grateful to the legendary geologists Shri J. Swami Nath, Prof. S.B. Bhatia, Shri K.S. Subramanian and the younger colleagues Drs Vivek Kale and M. N. Joshi who all have lauded my discovery of the Lower Cambrian small shelly fossils from the Lower Vindhyan and considered this as a major breakthrough in Vindhyan geology. Besides, they have also offered valuable suggestions and have observed that the paper lacks details of the fossil localities. My combined replies with specific clarifications are as follows:

Since the report was prepared for the 'Correspondence' section to find a place in the Journal for its quick publication, the graphic details were omitted for the sake of brevity. However in clear cut terms, fossil yielding areas and horizons were mentioned in the text. Since the Editor judged the importance of the report and included as the first article in the 'Research papers' section and

has now asked me to furnish further details about the fossils localities (and many readers obviously would like to know this), I am supplementing the information below.

FOSSILIFEROUS LOCALITIES

Maihar area: The fossiliferous locality of this area lies 12.1 km southeast of Maihar (Satna district, Madhya Pradesh) on Maihar-Badanpur road immediately after crossing the hump of Kaimur Sandstone (Figs.1 & 2). Here 8.5 m thick section of the uppermost Rohtas Formation consisting of thinly bedded light grey cherty limestone with minor shale intercalations are exposed adjacent to the road in a *nala* cutting. These moderately dipping beds (15°/N) are unconformably overlain by the subhorizontal current-bedded sandstone of the Kaimur Group which is clearly seen in the road-cut across the hump. A lateritic shale cover occurs on the top of the limestone section. The minor ferruginous sandstone and shale layers also occur within the transition of limestone and lateritic shale.

The earliest Cambrian SSFs of Meishucunian Zone I were recovered from the lowest 1 m thickness of the section (Fig. 3).

Rohtas area: The fossiliferous beds are exposed 22 km west of Dehri-on-Son in a series of abandoned limestone quarries within the uppermost Rohtasgarh Formation, located about 5 km northwest of Ramdihra village in Rohtas distict of Bihar (Figs. 1, 4 & 5). Total exposed thickness of the limestone-forming cliff is about 25 m in which SSFs occur only in the upper 10 m thickness and particularly in two bands of thinly bedded argillaceous limestone of each 30 cm thickness.

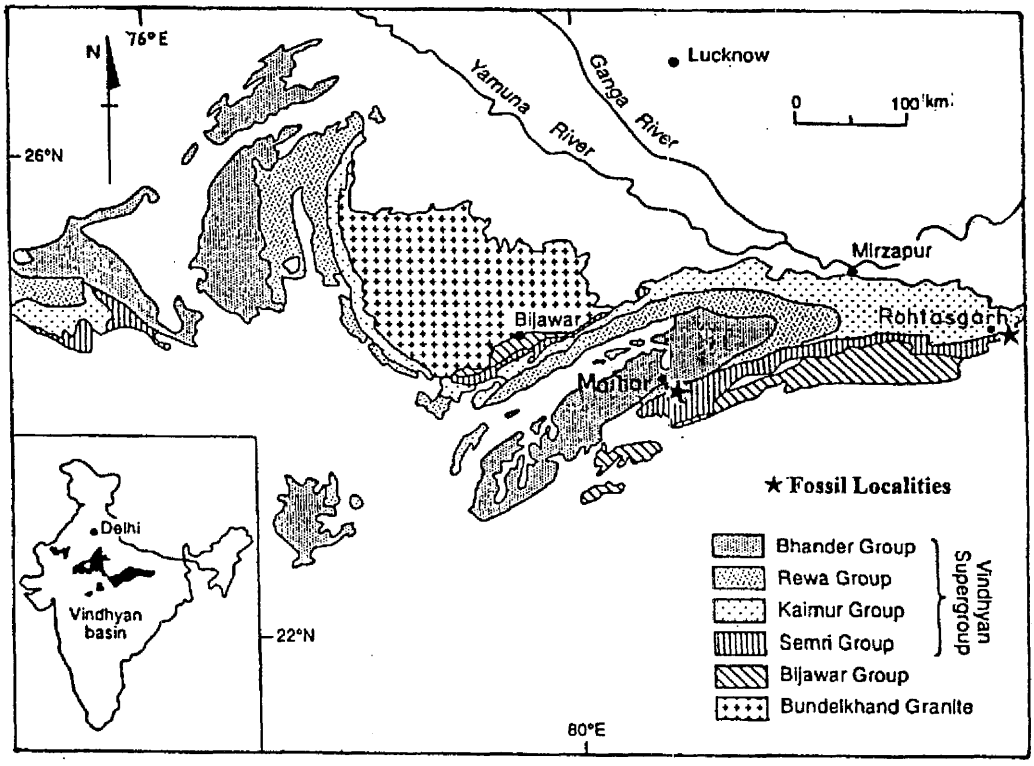

Fig. 1. Geological map of the Vindhyan Basin, showing the Lower Cambrian small shelly fossil localities.

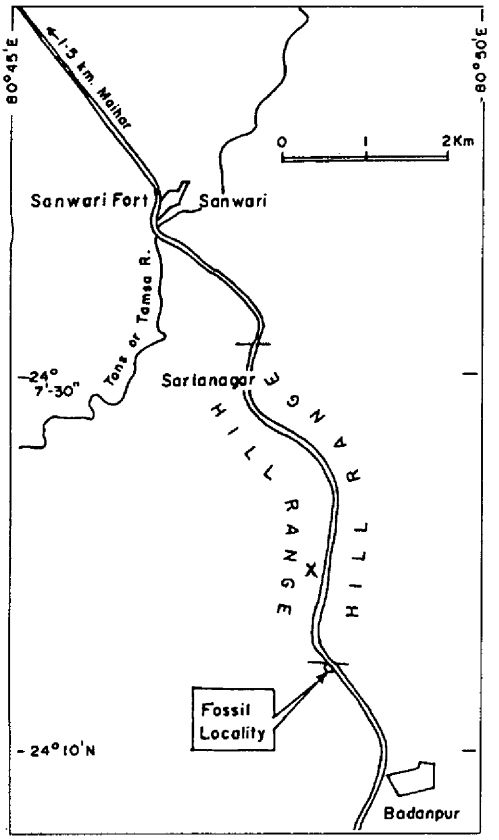

Fig.2. Route map of the Maihar area fossil locality on Maihar-Badanpur road. 'X' marks the hump of the Kaimur sandstone (based on Bhattacharyya et al. 1986).

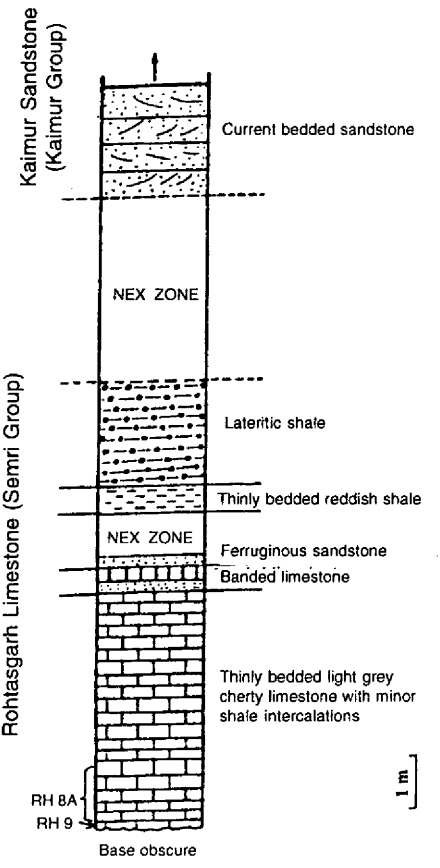

Fig.3. Measured section at the fossil locality on Maihar - Badanpur road. Note the positions of the fossil yielding samples in the basal 1 m part of the section.

These fossiliferous bands can be located just above a prominently deformed limestone bed of 1.5 m thickness. The beds, in general, show dip of 6-8° westward. The Rohtasgarh Limestone is unconformably overlain by the subhorizontal beds of the Kaimur Sandstone. Further lithological details can be seen in the measured section (Fig. 5).

Regarding **Prof. Bhatia's** specific comments on the taxonomic aspects of the fauna, my response is as follows :

a. Inclusion of the systematics of the new taxon *Taliella himalayaica* was strongly urged by the referee to prevent its *nomen nudum* status and therefore became necessary. More so, because it was initially found in the earliest Cambrian Lower Tal Phosphorites of the Mussoorie Syncline, Lesser Himalaya. Its occurrence in the Meishucunian Zone I SSF assemblage of the Maihar area has added to its biostratigraphic significance.

b. With reference to the identification of acrotretid and obolellid inarticulates, I too had some reservations which prevented me to go in for lower level identification. Now my subsequent more detailed observations reveal that the concentric growth lines of individual cones

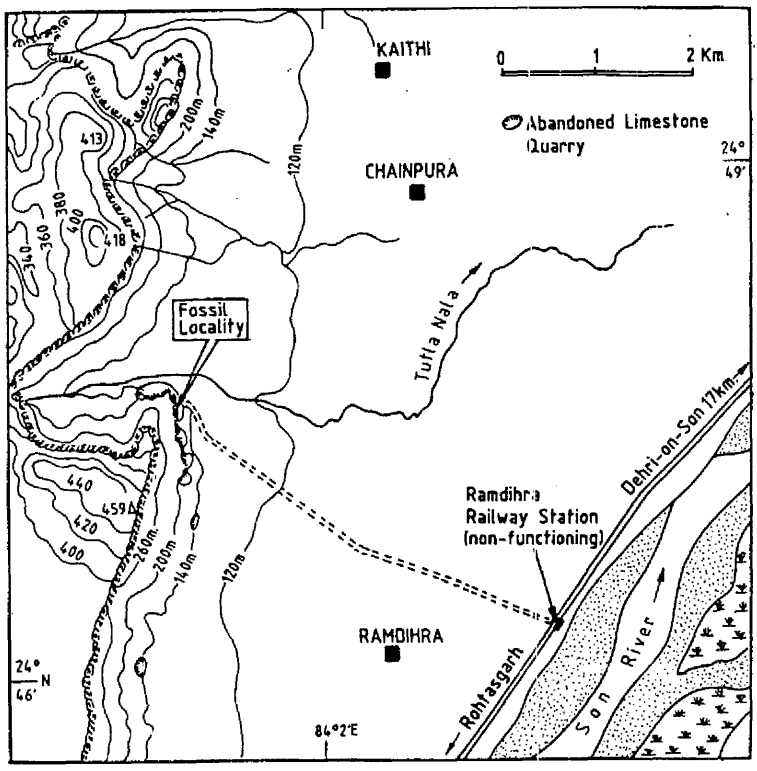

Fig. 4. Route map of the Ramdihra Limestone Quarries of Rohtas area in eastern Son Valley, Bihar.

sometimes continue to the adjoining cones. This feature precludes them from being brachiopods. Further, this feature also does not allow them even to be included in the problematic *Mobergella* group.

c. The systematic position of tommotiid genus *Camenella* Missarzhevsky in Rozanov & Missarzhevsky, 1966 *sensu* Bengtson (1970) has been revised by Landing (1984) and Bengtson (1986). It is now considered as the senior synonym of *Tommotia* Missarzhevsky, 1970. Differentiation into sellate and mitral sclerites of *Camenella* will be attempted in later work which would require even larger collection.

d. The holotype specimen of *Taliella himalayaica* Azmi (Pl. 2, figs. 1-3) is a natural cluster (partial scleritome) consisting of two somewhat dissimilar sclerites which were informally designated as Type A & Type B (Pl. 2, figs. 1,2 and the upper half in fig. 3). The lower half in fig. 3 is again a partial scleritome comprising two sclerites which thus becomes an additional paratype.

e. Only generic shift has been suggested for *Tumuliolynthus orthacanthus* Yang & He, 1984 because this genus was erected for Archaeocyatha by Zhuravleva (1963).

f. Order Tommotiida Missarzhevsky, 1969 (1970) emend. is a senior synonym of order Mitrosagophora Bengtson, 1970 (see Landing, 1984).

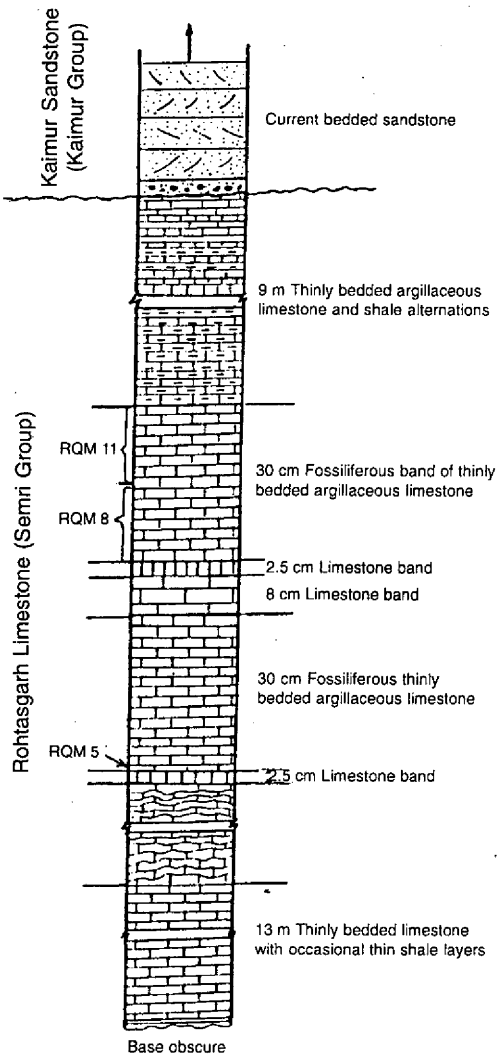

Fig. 5. Measured section at the fossil locality of Ramdihra Limestone Quarry, Rohtas area, in eastern Son Valley, Bihar. Note the positions of fossil yielding samples.

Shri **Swami Nath** has drawn our attention to his long-time interest in the problem of the Vindhyan - Himalayan correlation. Needless to say that the earlier correlations had lithological bias (e.g. Blaini of Talchir/Kaimur age) and were based on the ill-conceived chronostratigraphic frame. Since the Lesser Himalayan stratigraphy, espeically the Krol Belt, has undergone tremendous change in chrono-stratigraphic concept since 1980, after the discovery of Lower Cambrian SSFs from the Lower Tal of Mussoorie Syncline, I am of the opinion that, now with the present fossil discovery, the Vindhyan-Lesser Himalayan correlation will be smoothened, both chronostratigraphically and lithostratigraphically. For example, the Vendian unconformity (~ 650 Ma) with 'boulder beds' across the continent is likely to be established. As suggested by Shri Swami Nath, I agree that there is a need for consistency in the usage of lithostratigraphic terminologies to avoid unnecessary confusion.

Dr **Vivek Kale** has raised a significant question as to why the Upper Vindhyan sequence did not show evidence of marine megafossils if the sequence is of Lower Palaeozoic age. I can only say that future research should reveal whether the palaeo-environment was unfavourable for the marine mega life to thrive in or, it is due to lack of rigorous search. I think both. I just take the note of Auden's (1943, p. 111) observation that "Vindhyans are in the main a fluviatile continental formation, with only minor marine intercalations, and these more particularly in the Semri Series (Lower Vindhyans)".

My suggestion for the correlation of the 'Blaini' - 'Basal' - 'Pokharan' boulder beds is not only lithological but it has primarily a time connotation, i.e., Vendian age. Incidently for all these boulder beds there have also been suggestions that they are of glacier related origin. There is no doubt that this is another important problem of vital significance to which I am sure Dr Kale and other experts in sedimentary processes can do justice.

It is satisfying that Dr Kale agrees with me that the geochronological results from the Vindhyan Supergroup are in a mess which needs modern revaluation. My discovery thus poses a serious problem for the utility of the presently available geochronological data for resolving the age of the Vindhyan Supergroup (Brasier, 1998; Kerr, 1998; Azmi, 1998).

I thank Shri **Subramanian** for taking interest in my paper agreeing with me that a vigorous search for Ediacaran soft-bodied animals in the lower part of the Semri Group would be quite useful. This is not only to resolve the Indian geological problem but also for understanding the theory of 'puncutated evolution.'

Dr **Mukund Joshi** writes that there is an 'element of risk' in revealing all the details at the first announcement of the discovery. I have clarified my position right in the beginning.

***Field Workshop*:**

Since the occurrence of Lower Cambrian fauna in the Lower Vindhyan has aroused great interest world-wide, a Field Workshop is being organised in February, 1999 to discuss the Vindhyan Geology of the Son Valley with special reference to the Cambrian fossil localities. Initially a small group of experts representing some geological research institutions and universities are being invited. The results of the discussion will be published.

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OCCURRENCE OF BEUDANITE FROM THE SON VALLEY GOLD BELT, UTTAR PRADESH - A PRELIMINARY X-RAY STUDY by R. Prasad, S. Rai, Alok Kumar, G.N. Dwivedi, A.K. Tripathi and M.L. Yadav, Jour. Geol. Soc. India, v.52(2), 1998, pp.145-146.

GOLD MINERALIZATION IN THE MAHAKOSHAL GREENSTONE BELT, CENTRAL INDIA: A PRELIMINARY STUDY by M.K. Devarajan, M. Hanuma Prasad, A.V. Keshava Prasad and M. K. Soni, Jour. Geol. Soc. India, v.52(2), 1998, pp.147-152.

Srivastava, A.K. and Gopendra Kumar*, Department of Geology, Lucknow University, Lucknow - 226 007, *48, Pandariba, Lucknow - 226 004 comment:

The authors of the two papers have adopted different classification of the Mahakoshal Group. In fact, Nair et al. (1995) have classified the Mahakoshal Group into Chitrangi, Agori and Parsoi

Formations and intrusives, in ascending order. This classification is followed by Devarajan et al. whereas Prasad et al. have mentioned that "Regionally, the area comprises of two distinct lithological units, an older predominantly argillite referred to as 'Parsoi Formation' and a younger chemogenic and coarse clastic sequence referred to as 'Agori Formation' both falling within the Archaean-Proterozoic Mahakoshal Group." While going through both the papers, readers are put into confusion as to which classification is correct and is to be followed. Prasad et al. have not given any data to consider the 'Agori Formation' to be younger than the 'Parsoi Formation'.

(1)

R. Prasad, S. Rai, Alok Kumar, G.N. Dwivedi, A.K. Tripathi and M.L. Yadav reply:

Our paper entitled "Occurrence of beudanite from the Son valley gold belt, Uttar Pradesh - A preliminary X-ray study", is aimed primarily to report the mineral occurrence but incidentally referred to the geological succession representing the view of group of workers who have worked in this part of Mahakoshal Group (Singh and Khan, 1985; Khan and Lal, 1989 and Lal et al. 1995). The succession has been arrived at considering the belt to represent a major anticlinorium with a number of anticlines and synclines. This was supported by the repetition of BIF sequence of Agori Formation. The rocks of Parsoi Formation have been considered to represent the core of the structure and older than Agori Formation encountered on both the limbs.

Jain et al. (1995) modified their view based on the work carried out on the Mahakoshal Group of rocks in Madhya Pradesh and interpreted the structure to represent a syncline and reversed the succession of Parsoi and Agori Formations considering the latter to be older (Nair et al. 1995) as proposed earlier by Mathur and Narain (1981).

The controversy should be resolved by integrated studies of both the areas.

(2)

M.K. Devarajan, M. Hanuma Prasad, A.V. Keshava Prasad and M.K. Soni, Geological Survey of India, Operation M.P., P.O. Garha, Jabalpur - 482 003 reply:

Attempts to map the regional lithostratigraphy of the Mahakoshal belt were initially made by the officers of the Project "CRUMANSONATA" of GSI (Nair et al. 1995, Jain et al. 1995). Although establishing the regional lithostratigraphy of this belt has been recognised to be a difficult task (Roy and Bandyopadhyay, 1990) due to complex deformation and poor exposure, the lithostratigraphy proposed by Nair et al. (1995) provides the basic framework in that direction. We have been engaged in remapping of the belt and our observations, both in the eastern and western parts, broadly conform to the lithostratigraphy proposed by Nair et al. (1995) as shown in Table 1 of our paper. Gold occurrences described by us from the eastern part of the belt, including Gulaldih, are located within the Parsoi Formation.

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STRUCTURAL ARCHITECTURE OF THE VINDHYAN STRATA IN SON VALLEY: IMPLICATIONS FOR BASIN TECTONICS by Chandan Chakraborty and Subrata Karmakar, Jour. Geol. Soc. India, v.51, pp.377-382

Rajat Mazumder: Department of Geological Sciences, Jadavapur University, Calcutta 700 032 comments:

Chakraborty and Karmakar (1998) in a recent publication claim that they have undertaken "detailed field studies" on the regional structure of Vindhyan strata in Son valley but the paper surprisingly does not contain much of structural data. They present only a generalised geological map (their Fig.1).

Chakraborty and Karmakar (1998) presented a diagram (their Fig.6) claiming "computer simulation" of progressive deformation of horizontal strata under asymmetric compression coupled with vertical shear. The word "simulation" means to imitate or mimic a process. Computer simulation, therefore, refers to mimicking a process through computer. It differs from routine drawing using a graphic software in that the basic prerequisite for any computer simulation is a set of input parameters (raw and/or processed field data) that are processed through a programme (developed following a specific algorithm). It is a common practice among the researchers to mention the methodology (at least, in brief) as also the type of software used in simulation (e.g., Rubin, 1987; Bridge, 1982; see also publications in Computer and Geosciences).

I think, clarifications from the authors on the following points can resolve the issue.

1. What are the input parameters used in computer simulation? Are they raw field data or processed prior to simulation?
2. Does Fig.6 of Chakraborty and Karmakar (1998) represent simulation following any computer oriented numerical method(s)? If so, I am eager to know which particular method they have used.
3. How was asymmetric compression and vertical shear implemented in the simulation?

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Chandan Chakraborty and Subrata Karmakar, Department of Geology, J.K. College, Purulia, West Bengal reply:

We thank Dr. Mazumder for providing us an opportunity to clarify further, some points discussed in the paper summarily for the sake of brevity.

In our paper we have clearly stated that the structural study involved "construction of vertical profiles perpendicular to the regional strike of the Vindhyan strata taking into consideration the effects of structure and topography using field data and observations on mesoscopic, diastrophic structures." It is needless to overemphasize the effort required to prepare such profiles. It is unfortunate that these profiles (Fig.2 of Chakraborty and Karmakar, 1998) remained in oblivion to Dr. Mazumder and only the geological map attracted his attention which is really generalised as presented in Fig.1, but is detailed in Fig.3.

In our computer simulation we attempted to reproduce the deformation pattern shown by the Vindhyan strata from their initial horizontal disposition under asymmetric compression with a vertical shear displacement at one end. The simulation was done with the help of the graphics package provided with the "Novell Perfect Office" version 6.1. In the following paragraphs we try to answer the queries of Dr. Mazumder.

1. With help of graphics software it is possible to study the rotation of differently oriented lines undergoing strain. We have simulated the fold pattern assuming that folds developed due to accentuation of initial curvature. As an input parameter we have considered the fold pattern shown by the Basement-Vindhyan interface as shown in Fig.3; it shows six limbs from north to south. Accordingly, six straight lines were drawn successfully, representing the six limbs from north to south (i.e. from left to right), with lengths proportional to that of the limbs. To provide an initial curvature the straight lines were tilted about 1°, in clockwise and anti-clockwise directions depending on the dip directions of individual limbs as shown in Fig.3.
2. We have studied the rotation of the limbs from their initial disposition under different strain conditions using the programme embedded in the software and so did not need to follow any "computer oriented numerical method(s)."
3. Individual limbs were subjected to homogenous, uniaxial shortening in the north-south direction (this can be done in the pre-programmed graphics package). To simulate asymmetric compression, the amount of strain was systematically decreased from southern to northern line-segments. As a result, the line-segments suffered rotation by amounts depending on the amounts of strain, but their lengths were kept constant. The strains imposed on the lines, from north to south, are: Limb 1 - 50% shortening, Limb 2 - 55% shortening, Limb 3 - 62% shortening, Limb 4 - 72% shortening, Limb 5 - 84% shortening, Limb 6 - 98% shortening. The tips of the successive limbs were then joined to represent the large-scale fold pattern as a whole. The figure was then sheared vertically along the southern part by an amount of 37° (this can be done in the pre-programmed graphics package).