



REPORT ON THE INTERNATIONAL FIELD WORKSHOP ON THE VINDHYAN BASIN, CENTRAL INDIA (3RD TO 11TH DECEMBER, 2002)

Discovery of evidences of animal life in any form within Precambrian sediments attracts global attention because of its serious implication for evolution of early life. Thus, when Seilacher *et al.* (1998) announced the discovery of trace fossils of triploblastic animals from the Chorhat Sandstone (= the Kheinjua Formation) it started international discussion on the appearance of animal life on earth. It predated the appearance of animal life by at least 500 million years and in light of new available radiometric dates of the associated rocks, by ca. 800 million years. Before this announcement, Friedman *et al.* (1996) had suggested Precambrian–Cambrian boundary between the Bhandar Limestone and the Sirbu Shale and the same boundary was suggested within the Rohtas Formation by Azmi (1998) on the basis of small shelly and brachiopod fauna. In the light of the above contradictory reports, the Palaeontological Society of India organised a workshop in March, 1999 for in depth discussion on the palaeobiology and stratigraphy of the Vindhyan Supergroup and also arranged a field trip to the Rewa-Chorhat-Maihar area (see Kumar, 1999) to confirm the field observations of the sections from where the trace fossils of the triploblastic animal and small shelly fossils were reported. During the field work, it was felt that an international field workshop with larger participation of scientists should be arranged to settle some of the field related problems of the Vindhyan sediments, especially concerning trace fossils, carbonaceous megafossils, stromatolites and age of the intrusive rocks, etc. In the light of the above the Palaeontological Society of India decided to organise an International Field Workshop and the undersigned (S. Kumar) was asked to organise it in December, 2001. The workshop had to be

postponed because of serious security concern for the foreign delegates due to political developments in Afghanistan. Subsequently it was rescheduled from 3rd to 11th December, 2002. Even though it was delayed by one year, it received good response and in all 34 scientists from various organisations including five foreign scientists participated in the workshop. The workshop got good support from various organisations and was sponsored by the Department of Geology, University of Lucknow, the Geological Survey of India, the Oil and Natural Gas Corporation Ltd. and the Directorate of Geology and Mining, Uttar Pradesh. Help was also extended by the National Mineral Development Corporation Ltd., the Hindalco Industries, Renukoot and by the Maihar Cement, Maihar. The local administration, Sonbhadra district, Uttar Pradesh extended all possible help and the print media gave good coverage in local and national papers.

The area selected for field workshop included the Son Valley section, Sonbhadra district, Uttar Pradesh and the Rewa-Chorhat-Maihar-Panna area of Madhya Pradesh. It covered the complete stratigraphic succession of the Vindhyan Supergroup developed in the central part of the Vindhyan Basin. All participants assembled in Hotel India, Varanasi on 3rd December for the inaugural session. Prof. S. Kumar, the organising secretary welcomed the participants and highlighted the significance of the workshop and announced its itinerary. Mr. Ravi Shanker, former Director General, Geological Survey of India in his inaugural address had drawn the attention towards many unresolved problems of the Vindhyan Supergroup. The participants introduced themselves and expressed their main

interest for participation in the workshop. A field guide book which was prepared by Prof. S. Kumar and Mr. Sumant Gupta was presented to participants along with the detailed programme for field work.

The field work started from 4th December, 2002 when party proceeded towards Son Valley section of the Sonbhadra district, Uttar Pradesh from Varanasi. On the way initially Quaternary deposits were seen followed by the exposures of the Vindhyan Supergroup near Adalhat. On 4th and 5th almost all the important lithostratigraphic units of the Semri Group, the Bijaigarh Shale, the Scarp Sandstone and the Dhandraul Quartzite of the Kaimur Group were studied including the contact of the Vindhyan sediments with the underlying Bijawar phyllites. The participants appreciated the sincere efforts of the Forest Department to preserve and maintain the stromatolite locality of the Fawn Limestone at Salkhan hill as fossil park. After staying for two days at Renukoot, the party moved to Rewa, Madhya Pradesh on 6th December. On the way a complete succession of the Rewa Group was studied and *Chuarina* samples were collected by a number of participants. On 7th the participants visited Seilacher's locality near Chorhat from where the controversial trace fossils of triploblastic animals were reported, but to everybody's disappointment, nobody could collect any sample which could even remotely be connected with the organic activity. The absence of precise location of the actual fossil yielding sample recovered by him and his group (see Seilacher et al. 1998) was a major handicap. All the structures noted in the Chorhat sandstone were more similar to syneclasis cracks than to the burrows as inferred by Seilacher *et al.* (1998).

The party proceeded to Maihar on 8th December and noted and studied the Bhandar Limestone showing profuse development of columnar stromatolites *Baicalia baicalica* in the Tamas River section and domal stromatolites developed within the Sirbu Shale in the Pathera

Nala section. Same day out crops of Sirbu Shale and Maihar Sandstone were studied on the Maihar – Rampura road section. Presence of algal mat texture in the Maihar sandstones was confirmed by Prof. B. Runnegar (University of California, USA) and Prof. H.J. Hofmann (McGill University, Canada). On the same road, a number of participants collected *Chuarina* from the Sirbu Shale horizon near its contact with the overlying Maihar Sandstone.

On 9th December the participants visited the locality from where Dr. Azmi (Azmi, 1998) had reported small shelly fossils from the uppermost part of the Rohtas Formation referred to also as the Bhagwar Shale. However, this horizon did not yield any fossils (see Bhatt *et al.* 1999). A visit to Badanpur Mines supplying limestone to the Maihar Cement Factory was very rewarding as members could collect many samples of *Grypania* and other carbonaceous fossils from the Rohtas Formation. In the Choti Mahanadi section near the Khutesar Mines of the Steel Authority of India, the participants were able to study the Kajrahat Limestone characterized by repeated cycles of *Conophyton* development. Many types of coniform stromatolites such as *Calypso* and *Thyssagetes* along with *Jacutophyton* were studied. Prof. Hofmann even suggested that such wonderful sites should be preserved, as shortly the site will be submerged due to the construction of Ban Sagar Dam. On 10th December the party moved out from Maihar and proceeded towards Khajuraho, the temple town of Central India. On way to Khajuraho the party visited the famous Panna Diamond Mines at Majhgawan known for the intrusion of a kimberlite pipe in the Kaimur sandstone. The members noted the contact of the pipe with the sandstone and studied the kimberlite rock. They were also shown the diamonds recovered from the kimberlite pipe. The last exposure which party studied was that of the Bundelkhand granites forming the basement rock for the Vindhyan sedimentation in this part of area.

During the field work whenever sufficient time was available, the members delivered lectures of their choice after dinner and the participants had chance of interaction with Prof. B. Runnegar, Prof. H. J. Hofmann, Dr. J. Ram (ONGC), Dr. B. Prasad (ONGC) and Dr. R. J. Azmi (Wadia Institute of Himalayan Geology). Dr. P. K. Kathal was specially invited to the Workshop at Khajuraho to show his specimen of *Spriggina* (see Kathal *et al.*, 2000). His specimen was studied by some specialists among the participants but most of them expressed doubt about its organic nature. They also suggested that the discovery of *Spriggina* should be discarded.

The valedictory function was held on 11th December in Hotel Usha Bundela, Khajuraho which was presided over by Mr. Y. B. Sinha, Director Exploration, Oil and Natural Gas Corporation Ltd., Dehradun. In this function Dr. K.R. Gupta, Director, EES Division participated as representative of the Department of Science and Technology, Government of India, New Delhi and Prof. M. P. Singh represented the Palaeontological Society of India. Following recommendations emerged after discussions with the participants in the valedictory session:

- (1) In view of the contradictory age connotations for the Vindhyan sediments, there is an urgent need to generate reliable radiometric dates, using latest available techniques. The age of the Vindhyan has serious implications both for the search of oil and gas as well as for evolutionary palaeobiology.
- (2) Available data on microfossils, megafossils and stromatolites need close scrutiny for their utility in biostratigraphy. The following points need to be considered:
 - (a) Potential of acritarchs and other microfossils should be studied for age implications and for intrabasinal and interbasinal biostratigraphic correlation. Available records of metaphytes

and metazoan should be evaluated for establishing their biogenicity and for affinity with living forms.

- (b) Stromatolites occurring extensively in the Vindhyan Basin appear to be very useful for intra-basinal correlation but much needed reliable taxonomic data are not available for identification of groups and forms for comparison. Efforts should be made to generate the relevant data. Study of heliotropism in stromatolites during Vindhyan sedimentation should also be taken up. Astropalaeobiology is a new dimension of Precambrian Palaeobiology to be pursued in coming years.
- (c) The Vindhyan sediments have an excellent potential for preservation of megafossils, which will help in better understanding of evolution of life during Proterozoic. These fossils have local as well as global implications. Occurrence of the carbonaceous megafossils appears to be facies controlled. Therefore extensive search be made for new fossil horizons.
- (d) The recorded evidence of animal activity in the Vindhyan sediments should be properly evaluated and attempts should also be made to search them especially in the upper Vindhyan.
- (3) Concerted efforts should be made for establishing sequence and chemostratigraphy to solve the problems of lithostratigraphic correlation.
- (4) There are conflicting reports about the depositional environment for different formations of the Vindhyan Supergroup. Extensive sedimentological studies across the basin are required to understand the sedimentation patterns and nature of the Vindhyan Basin. There is also an urgent need to find India's place in tectonic setting of Rodinia.

- (5) The local geological information available with the Geological Survey of India, the State Directorates of Geology and Mining and the Oil and Natural Gas Corporation Limited etc. should be published to help future research workers. Drill core material should be made available to interested workers.
- (6) It is recommended that in future, GPS values (for longitude and latitude) should be mandatory for palaeontological publications for the precise location of the reported samples both for authors and editors publishing the results.
- (7) The international collaboration should be encouraged specially in the field of palaeomagnetic study, dating of rocks and astropalaeobiology. The Department of Science and Technology, New Delhi should be requested to take a lead in this direction.
- (8) A few sections of the Vindhyan succession have considerable potential as tourist spots. Basic amenities should be provided to such spots. These spots must be preserved for educating school children and public about the early life on earth and its significance.
- (9). A serious effort should be made to conserve the Chhoti Mahanadi section near Khutesar (showing excellent development of about 1.7

billion year old stromatolites, a unique window to ancient life on earth) by shifting some of its typical forms to Institutions/Museums/Universities before the invaluable material is lost under the water of a proposed dam

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