GEOLOGICAL NATURE OF THE POKARAN BOULDER BED: PALAEO-ENVIRONMENTAL, PALAEOCLIMATIC AND STRATIGRAPHIC IMPLICATIONS, by D.S.Chauhan, K.M.Mathur and Narayan Ram, Jour. Geol. Soc. India, Vol.58, pp. 425-433, Nov. 2001.

D.K.Bhatt, Surendra Prasad and **R.L.Jain**, Palaeontology Division, Geological Survey of India,W.R., 15-16, Jhalana Instt. Area, Jaipur-302 004 comments:

We appreciate the endeavour of the authors towards an attempt to rationalise the concept of the largely mis-understood stratigraphic unit of Pokaran Boulder Bed, both for its mode of occurrence in the field as well as stratigraphic level. However, some of the inferences drawn, based on which a sedimentation model has been proposed, are difficult to comprehend. A few salient points are referred below:

(1) The authors state "Pokaran Boulder Bed occurs in different *forms* and denotes not only an erosional unconformity at the base of the Marwar Supergroup, but signifies *much diverse palaeoenvironmental and palaeoclimatic settings*" (italics our's). The above statement, besides attempting to re-define (though never stated) 'Pokaran Boulder Bed' (cf. Oldham, *see* Pascoe, 1975), apparently amalgamates diverse lithounits into one bland stratigraphic term 'Pokaran Boulder Bed' (*vide* the authors). With lack of identicality of depositional domains of the three units of 'Pokaran Boulder Bed' (as per the text of the authors) and also difference in the time of their deposition (*see* Table 2 of authors), grouping of such lithounits into one formation transgresses the Code of Stratigraphic Nomenclature of India (GSI, 1971).

(2) Table 2 shows the authors unit – 'Massive conglomerate' underlies the 'Boulder spread'. However, Fig.2 does not depict such a physical association between the two units. Instead, a third lithounit – 'Stratified conglomerate' – is shown as lateral extension of 'Massive conglomerate' and, therefore, in its physical contact in the field. This is a bit confusing and has basic implications for the proposed sedimentation model.

(3) The 'Stratified conglomerate' (*see* authors Fig.4b) has already been identified as long distance-transported conglomerate, forming, in patches, the basal unit of Jodhpur Sandstone, as distinct from Pokaran Boulder Bed (*vide* Oldham, *see* La Touche, 1902; in Pascoe, 1975, p.550), with which observation we wholly concur based on our recent fieldwork. In our opinion, depositional attributes of the lithounit in no way justify its amalgamation with Pokaran Boulder Bed. The two units are the products strictly of two different palaeoenvironments and ages. In the literature, earlier also the 'Stratified conglomerate' (of authors) has been mistakenly referred to as Pokaran Boulder Bed (*vide* Oldham), forming the base of Jodhpur Sandstone.

(4) The surfacial bouldery/pebbly terrain deposits at Lawan, presumed by the authors as one of the modes of occurrence of their 'Pokaran Boulder Bed' has long been correlated either with the boulder bed of Pokaran area or that of the Bap area without much conclusive evidence (*see* summary in Pascoe, 1975, pp.551-552), as all the three areas are far separated geographically with no physical contact of their bouldery terrains. Such a correlation on the part of authors may amount to mere presumption unless evidences are mustered for such a correlation.

(5) The evidences as marks of glacial transport in the boulders/pebbles of their 'Boulder spread' facies, as put forth by the authors, have also been contested in the past (*see* summary in Pascoe, 1975, p. 552). Many of the granite boulders after spheroidal weathering, when exposed to prolonged wind erosion, show grooving on several different surfaces along gneissosity planes (Figs.7a & b of authors), which can be mistaken for glacial markings.

(6) On our field inspection in Lawan area, enquiry from local residents revealed that man-made heaps of boulders are some times formed at the site of child burial (Fig. 6 b of the authors).

(7) Based on above observations, authors inferences on '*Global implications of Neoproterozoic glaciation in Western Rajasthan*' may not stand the test of field observations.

(8) Equating the inferences of Raghav (2000) and Bhatt and Ravindra Kumar (2000) amounts to misrepresentation of data, as the latter work never concluded that Marwar Supergroup is of Tertiary age (*see* also Bhatt and Ravindra Kumar, 2001).

(9) The term 'Pokaran Sandstone' should be forsaken to

avoid confusion, as 'Pokaran Sandstone' has long been equated with Jodhpur Sandstone (Pascoe, 1975).

(10) Fig.1 showing the geological map of Pokaran area surprisingly does not include delineation of 'Pokaran Boulder Bed'.

It is hoped that the authors will attempt to re-assess the definition and status of Pokaran Boulder Bed (*vide* Oldham) as a stratigraphic unit in light of above observations.

D.S. Chauhan, Jai Narain Vyas University, Jodhpur, replies:

Our pointwise reply to the comments on our paper by Drs. D.K Bhatt, Surendra Prasad and R.L. Jain of GSI, Jaipur is as under:

1. The basic theme of our paper concerns itself with delineating the evolutionary history of Pokaran Boulder Bed. This we understand, has been done to the best of our comprehension. It is true that we have reported three forms of boulder beds, which have originated under different sedimentary milieu with discrete though short time intervals between them. However, it is to be stressed that the stratified conglomerate is a product of convergence of massive conglomerate, material and processwise on the one hand and that of the boulder spread on the other. Therefore, the three are interrelated not only petrographically but spatially and temporarily. Moreover, each form of the boulder bed overlies a common basement of Malani rhyolite and presumably underlies a common roof of Pokaran sandstone. Therefore, they are together treated as a basal member of the Marwar Supergroup, i.e., Pokaran Boulder Bed. As such we believe, there is no transgression of code of stratigraphic nomenclature in our work.
2. Table 2 of our paper shows geological attributes of the Pokaran Boulder Bed and associated rocks. The relationships shown between the three forms of boulder bed do not always show physical contact but exhibit inferred relationship between them. It is therefore self-explanatory.
3. The early part of this objection is answered by our explanation given above under point 1. It is surprising that the commentators have followed the viewpoint of earlier workers (Oldham, 1886; La Touche, 1902; Pascoe, 1975). They have treated the stratified conglomerates as a basal conglomerate of Jodhpur Group, totally separate from the Pokaran Boulder Bed. It is not clear what makes their Pokaran Boulder Bed and what stratigraphic position they assign it? We will stress here that the Pokaran Boulder Bed as such is a basal conglomerate of the Marwar Supergroup, as rightly stated by Bhushan (1977), Pareek (1981, 1984) and Virendra Kumar (1999).
4. The fourth comment is answered by our explanation under points 1, 2 and 3.
5. We stick to our observation that the striation marks observed on boulders and cobbles of rhyolite and granite and less commonly basalt, which make Pokaran Boulder Bed, are of glacial origin. Similar striations are found in Bap Boulder Bed, which is considered to be a product of Permo-Carboniferous glaciation (*cf.* Pareek, 1984). We fail to understand how such striations can be produced by wind abrasion as suggested by the commentators. We find granites, rhyolites and other rocks outcrop in a number of other places in the Thar Desert. If striations are formed due to wind abrasions, they should have formed in those areas too, which is not so. Secondly, the striated boulders/cobbles of granite and rhyolite become less in number as we trace the boulder spread between Sankara and Lawan, and near Pokaran they become almost rare. How such a situation can be explained, if striations were the product of wind abrasion.
6. We have already mentioned under Fig.6b of our paper that some of the boulders/cobbles appear assembled.
7. In the light of our observations and inference as described in our paper we are of the firm view that the glaciation denoted by the Pokaran Boulder Bed corresponds to late Neoproterozoic Varanger ice age (610-590 Ma, Knoll and Walter, 1992). Therefore, it has global implications as pointed out in the paper.
8. To quote Raghav (2000a) p.273 under conclusion, "the present record of Mid-Eocene fossil assemblage in the topmost limestone formation mapped as Pondlo Formation, Bilara Group, exposed at Sandwa near Bidasar, raises doubts about the stratigraphic position". Obviously doubt is raised about the stratigraphic position of the Marwar Supergroup.

   In Raghav (2000b) p.397 under conclusion, "the present find of *Discorbis* and *Quinqueloculina* from the Gotan Formation of Bilara Group..." indicate that these fossiliferous formations may not be older than upper Cretaceous. However, the same author states under abstract (p.395), the above stated foraminifera suggest that the formation is not older than lower Eocene.

   Similarly Bhatt and Ravindra Kumar (2000) have

recorded microfossils from Bilara limestone of the Marwar Supergroup. Under the descriptions of age (p.455) they report, "most of the foraminifera genera in the assemblage range in age up to recent and most of these range through whole of the Tertiary". Further, they have stated on (p.475), "it is logical therefore, to conclude that the age of the recovered microfauna may not be older than Miocene or Middle Eocene. The general microfauna elements, freshness of their preservation and total composition of the assemblage is reminiscent of Neogene assemblage of Western Indian Tertiary basins".

From the above, anybody can guess that the Bilara limestone, the middle horizon of the Marwar Supergroup, belongs to Tertiary.

9. We have placed Pokaran Sandstone at *par* with Jodhpur sandstone (*see* Table 1). The term Pokaran sandstone was consciously used with a geographical connotation to enable one to comprehend the evolutionary history of Pokaran Boulder Bed.
10. We have not delineated the Pokaran Boulder Bed in Fig.1 because it does not form consistent horizon but occurs in far-flung spreadout patches. However, in our paper we have described the various localities where from we studied the boulder bed. They are shown in Fig.1.

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OUTCROP SEQUENCE STRATIGRAPHY OF THE MAASTRICHTIAN KALLANKURCHCHI FORMATION, ARIYALUR GROUP, TAMIL NADU by R. Nagendra, R. Raja, A. Nallapa Reddy, B.C. Jaiprakash, and R.J. Bhavani. Geol. Soc. India, v.59(3), pp.243-248.

P. K. Kathal, Centre of Advanced Study in Geology, Dr. H.S.G. University, Sagar - 470 003 (kathal@vsnl.com and pkkathal@rediffmail.com), comments:

The authors have attempted sequence startigraphy of the Maastrichtian (70-66 Ma) Kallankurchchi Formation, Ariyalur Gropu (Tamil Nadu) based on the field observations, occurrences of microfossils (benthic foraminifera) as well as megafoŝsils (bivalves and bryozoans).

The study raises a few important questions:

(a) They seem to be unaware of the utility of smaller rotaliids in upper Cretaceous rocks as they identified only 5 of the 40 encountered foraminifera at species level. Although there are various genera of restricted ranges but application of smaller rotaliids in biostratigraphy of Upper Cretaceous rocks is mainly at species level (Haynes, 1981). The smaller rotaliids particularly the *Gavelinella-Lingulogavelinella* group, which occur in the studied sequence has