

DISCUSSION

NEOPROTEROZOIC PALAEOMAGNETIC RESULTS OF JODHPUR SANDSTONE, MARWAR SUPERGROUP, WESTERN RAJASTHAN by G.V.S. Pooranchandra Rao, S. B. Singh And K.J. Prasanna Lakshmi. Jour. Geol. Soc. India, v.69, no.5, 2007, pp.901-908.

B. S. Paliwal, Department of Geology, Jai Narain Vyas University, Jodhpur - 342 005; **Email:** paliwalbhawani@yahoo.co.in comments:

Pooranchandra Rao et al. (2007) have made a good attempt to study the palaeomagnetism of the sandstone of the Marwar Supergroup from Pokaran area which they have named as the Jodhpur Sandstone. The endeavour appears to be quite significant, specially, with reference to its correlation with the Rewa Sandstone of the Vindhyan Supergroup on the basis of palaeomagnetic data.

Unfortunately, we could not find any reference showing correlation of the Upper Rewa Sandstone of Rewa Group with the Jodhpur Sandstone of the Marwar Supergroup (p.905).

The paper appears to have been written in a hurry. The paper of Pooranchandra Rao et al. (2005), cited in the text at a number of places and the results of which form a significant part of the paper (pp.905-906), has not yet been published. It would have been better if some data of the said paper were included in the present paper.

The use of generalized terms like Jodhpur Sandstone etc. is good in the commercial field but when such terms are used in scientific works like correlation of two stratigraphic units situated far apart, need more precision regarding their exact position in the stratigraphic column. It should have clearly been indicated whether authors are referring to the Sonia Sandstone (lower part) or to the Girbhakar Sandstone (upper part) of the Jodhpur Group as shown in their Table 1. Because the time gap between the deposition of two litho- units is quite meaningful when we talk about the palaeomagnetic positions. Moreover, a figure showing the exact position of the samples in the studied lithologs and a map showing location of the sites from where samples were collected, would have added to the quality of the publication.

Pooranchandra Rao et al. (2007), while describing Geology of the area (p. 901), have made a mention that the Marwar Supergroup comprises of arenaceous sediments of the Jodhpur Group followed by the evaporite sequence of the Hanseran Group (time equivalent of Bilara Group and

Birmaniya Formation) and argillites of Nagaur Group. This has created some confusion because in general the Marwar Supergroup consists of three lithostratigraphic units: Jodhpur Group, Bilara Group and Nagaur Group (Pareek, 1981, 1984). Unfortunately, in the paper under discussion, the Hanseran Evaporites have been shown equivalent to the Pondlo Dolomite (Table 1) and not equivalent to the Bilara Group as a whole, which has been considered to be the homotaxial equivalent of the Bilara Group. Therefore the Bilara Group should be considered to form the middle part of the Marwar Supergroup.

Recently, a schematic basin evolution model for the Marwar Supergroup shows a physical continuity of the carbonates of the Bilara Group below the rocks of the Hanseran Evaporite Group. In fact, the deposition of the Jodhpur Group of rocks of the Marwar Supergroup in the Nagaur–Ganganagar Basin was followed by the precipitation of carbonates in the basin as a whole. In the arid-peritidal depositional environment, carbonates of Dhanapa, Gotan and Pondlo Formations were deposited in the southern part. Where as, in the northern part, dolomite, anhydrite, halite and potash salts with clay seams were deposited. In nutshell, the middle part of the sequence began with the precipitation of carbonates and ended in the accumulation of evaporites. This was followed, unconformably, by the deposition of the Nagaur Group of rocks in the basin. Therefore, there is no logic in using two terms: Bilara Group and Hanseran Group for the coeval lateral facies variants of a single stratigraphic sequence i.e. middle part of the Marwar Supergroup.

Conventionally, location of a place is shown in Latitudes and Longitudes marked by degrees, minutes and seconds and not in decimal system. But unfortunately, the location of Pokaran (p. 902) has been shown as (26.85°N; 71.90°E) and not as conventionally accepted (26°55'N; 71°55'E). Such deviations from the conventional practices creates problem in locating a place in a map or in the 'Google Maps'.

Assuming the Jodhpur Sandstone (Sonia Sandstone and or Girbhakar Sandstone of the Jodhpur Group) almost horizontal without any dips, no tectonic corrections were

made for the site mean ChRM vectors. But rocks of the Jodhpur Group have been subjected to Neotectonic disturbances and they have been gently folded along the Aravalli axis and show gentle dips at a number of places. These facts should have been taken into account before calculating the site mean ChRM vectors for correlating the far apart exposed sandstones of the Jodhpur Group of the Marwar Supergroup and the Rewa Group of the Vindhyan Supergroup.

Unfortunately, the Table 3 referred in the text (p. 906) listing VGPs used in Fig. 4, showing the Late Neoproterozoic-Palaeozoic Apparent Polar Wandering Path curve of India, is missing completely in the paper.

G.V.S. Poornachandra Rao, S.B. Singh and K.J. Prasanna Lakshmi, NGRI, Hyderabad reply

We thank B.S. Paliwal for his interest in the subject matter of our palaeomagnetic results on Jodhpur Sandstone, Marwar Supergroup, Western Rajasthan and making some valid and useful observations on them. His comments in particular relate to the stratigraphic status and term of the Jodhpur Sandstone that we have used in our paper. There was considerable debate and discussion with regard to the nature, stratigraphy and locations of sandstones of Western Rajputana (Rajasthan) by earlier workers. Paliwal in his comments on our paper brought to light different opinions expressed by different workers that we ignored in our paper reporting only their current status. Crawford and Compston (1970) while reporting the age of the Vindhyan System of Peninsular India obtained an Rb-Sr age of 1140 ± 12 Ma for the Majhgawan kimberlite intruding the basal upper Vindhyan System and consented with the suggestion of Vinogradov et al. (1964) and Tugarinov et al. (1965) glauconitic ages for the Lower Vindhyan System to be at least 1200 Ma and might be as low as 1400 Ma. However, they felt there is no isotopic control over the Rewa and Bhandar Series that occupy more than half the System in terms of thickness. On the basis of lithological similarity of sandstones of Western Rajasthan that overlie the Malani Rhyolites that were accurately dated to be 745 ± 10 Ma, the Jodhpur Sandstone were correlated with Uppermost Vindhyan Rewa and Bhandar Series. Subsequent study of lithology of rocks to the west of the Aravalli Mountain Range was undertaken by several workers. Blanford (1877) named the sandstone sequence of western Rajasthan lying above the Malani Rhyolite with erosional unconformity as Jodhpur Sandstone and correlated with the Vindhyan Sandstones. It is mentioned in our paper that the sandstone sequence in the Jodhpur Group is informally known as the

Jodhpur Sandstone by Roy and Kakhar (2002) and these are used mainly for commercial purposes.

In all palaeomagnetic study of Rewa and Bhandar Sandstones (Athavale et al. 1972, Klootwijk, 1973, McElhinny et al. 1978) these upper Vindhyan Sandstones are invariably correlated with the Jodhpur Sandstones that overlie the Malani Rhyolites that were dated to be of 745 ± 10 Ma (Crawford and Compston, 1970) and $771-751$ Ma (Torsvik et al. 2001). Even Crawford and Compston (1970) have correlated the Jodhpur Sandstone with the Upper Vindhyan Rewa and Bhandar Series. Added to this, while reviewing the Indian palaeomagnetic data, Klootwijk (1979) mentioned there is hardly any distinction in the Palaeomagnetic data of Rewa and Bhandar Sandstone and therefore, McElhinny et al. (1978) suggested that the best estimate for the upper Vindhyan palaeomagnetic pole is obtained by combining all site poles of Rewa and Bhandar Sandstones together. Therefore, we felt that our palaeomagnetic results on Jodhpur Sandstones that include the Sonia Sandstone and Girbhakar Sandstone may represent the sandstone sequence in the Nagaur Basin.

We have obtained ChRM direction on the Govindgarh Sandstones of Upper Rewa Group from the type area near Rewa town in central India. As mentioned by Paliwal these results are not yet published but this can be had from the NGRI Annual Report (2001-02). The ChRM directions of Jodhpur Sandstone of present study are similar to the ChRM directions reported for the Upper Rewa Sandstones from Saugar and Mirzapur areas (Athavale et al. 1972, McElhinny et al. 1978) and Govindgarh Sandstone from Rewa. In view of the similarity of these ChRM directions, we have assigned an age of Upper Rewa period for these Jodhpur Sandstones that justifying our correlation and assigning Upper Rewa period of the Jodhpur Sandstone.

We agree with Paliwal's suggestion about the unconventional way of reporting the latitude and longitude of our sampling area. We also noted down the locations of our sampling sites in the conventional way while collecting the samples and these are $26^{\circ}51'N$ and $71^{\circ}54'E$. But while computing the palaeomagnetic parameters we converted them in to the decimal system of units and by oversight we have reported the same in the paper. We have mentioned in our sampling details that the oriented samples from three quarry sites were collected near Pokaran only. We accept the suggestion of Paliwal that the Jodhpur Group has been subjected to Neotectonic disturbances showing folding and faulting along the Aravalli axis with gentle dips at a number of places. We have also mentioned that the beds from where the samples were collected for palaeomagnetic

study are almost horizontal without any dips. Since the sampling area is limited and no appreciable dips were observed, there was no necessity to correct the ChRM directions for any dips of the sampled beds from the Jodhpur Sandstones.

There was an oversight at proof stage of our paper that led Paliwal to comment that the coeval lateral facies variants of a single stratigraphic sequence i.e. middle part of the Marwar Supergroup as Bilara Group and Hanseran Group. Therefore, this may be read as Hanseran Evaporite/

Bilara Group. However, their correct stratigraphic status is discussed in the paper in section "Geology and Sampling". Another oversight that occurred at proof stage was with regard to Table 3 reporting palaeomagnetic data of Neoproterozoic-Palaeozoic periods. As per the suggestion of one of the reviewers of this paper we have omitted Table 3 in our revised manuscript. But at the proof stage we added in the sentence showing the APWP the words "listed in Table 3". We regret very much for these omissions.

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Corrigendum

Following correction may be made in the paper 'Mining Activity - Makrana Marble and Jodhpur Sandstone in Rajasthan' that appeared in the *Jour Geol Soc India*, v 70, pp 557-570.

Table 1 on page 559. The area of the quarry lease should be ft² instead of m².