Azmi, R.J. – Abstract for *GEO India2010*

Great Vindhyan Basin: A Potential Field for Cambrian Oil in India

R. J. Azmi
Frontier Basins, Oil and Natural Gas Corporation Limited,
"Himalaya" Building, IDT Campus, Kaulagarh Road, Dehradun 248 003.
E-mail: azmirj@rediffmail.com

ABSTRACT

Discovery of typical Cambrian heavy oil in Baghewala -1 well in Bikaner-Nagaur basin of western Rajasthan (Peters et al., 1995) has added an unprecedented new dimension for exploration of hydrocarbon in the *Purana* Basins of India. The oil producing Bilara Group is a typical Lower Cambrian microbial carbonate which belongs to the Trans-Aravalli Vindhyan, but is now better known as part of a separate succession known asthe Marwar Supergroup, due to ambiguity in its correlation with the succession of the main Vindhyan Basin, east of the Aravalli Mountain Range (the Cis-Aravalli Vindhyan). It will be shown here that the Vindhyan Supergroup of the main Vindhyan Basin and the Trans-Aravalli Vindhyan are biostratigraphically as well as lithologically correlatable, even also with the Lesser Himalayan Vendian-Cambrian microbial carbonates, phosphate and salt deposit successions. Paleogeographically, the Indian Peninsular and Lesser Himalayan basins also go very well with the Cambrian oil producing Salt Range of Pakistan and the Huqf Group of Oman.

However, in contrast to the above view, recent geochronological results suggest that there is no correlation possible between the main Vindhyan Basin and the Trans-Aravalli Vindhyans. According to the latest geochronology, the Vindhyan Supergroup (VSG) ranges in age from the late Paleoproterozoic to near the end of Neooproterozoic (~1800 – 550 Ma) or its upper limit terminating even much earlier, by close of the Mesoproterozoic (~1000 Ma). However there is no disagreement as for the post-*Malani* age (~745 Ma) of the Trans-Aravalli Vindhyans (Marwar Supergroup) is concerned, and, in fact, a tentative Vendian (Marinoan-Ediacaran) to Early Cambrian age is acceptable to most of the workers.

Against the geochronologically assigned Paleoproterozoic (~1800 – 1600 Ma) age to the Lower Vindhyan (Semri Group), the author has the following points to offer:

1. The Sawa Grit of the Lower Vindhyan of Chambal Valley has yielded the youngest "detrital" zircon population of 1616 Ma (Ray et al., 2007). Obviously, this cannot be the age of the Sawa Grit sedimentation but of the provenance. Sawa Grit, in any case, has to be younger than 1616 Ma. And since the Sawa Grit is generally correlated with the Lower Vindhyan Porcellanite of the Son Valley which has been geochronologically dated still older as 1631 Ma (Ray et al., 2002), by anology, there cannot be any doubt that this older than 1616 Ma age also has to be the age of the provenance and not the age of the Porcellanite deposition. Interestingly, exactly same age (1631 Ma) has recently been found in the *Chandil Rhoylite* of the Singhbhum Group succession by Nelson et al. (2007).

Undoubtedly, the Singhbhum Group with its extensive Dalma Volcanics in it is a far older stratigraphic entity than the Vindhyan that must have supplied a lot of clastics to the Vindhyan Basin. And, in fact, Paikaray et al. (2008) based on their detailed study on the Lower Vindhyan paleocurrents and geochemistry of shales have stated, "The Chhotanagpur Gneiss Complex (~1600 Ma) and Mahakoshal Group of metasediments (~2600 – 1800 Ma) situated on the southern and southeastern side of the Vindhyan basin exposures seem to be the most likely candidate for the source rocks of the Vindhyan shales in the Son valley". Hence it is almost certain that the Paleoproterozoic ages obtained from the Lower Vindhyan are inherited from the older provenances.

2. All late Paleoproterozoic successions (~1800-1600 Ma) in and around Vindhyan Basin are penetratively deformed and highly folded, comprising lowgrade metamorphics and metabasics (Bijawars, Mahakoshals, Hindolis, Delhis etc.), which have unconformable 'stratigraphic contacts' with the overlying Vindhyans or its equivalents which are least deformed to totally undeformed and unmetamorphosed. One needs to explain that how both Vindhyans and metamorphosed pre-Vindhyans could be of the same age. At least Vindhyans have to be far younger than 1600 Ma, because a long cycle of orogenesis, erosion and formation of a new basin is involved in between. In the Lesser Himalaya, there is a discernible hiatus of over 1 Billion-Year between the Vindhyan equivalent Blaini-Krol-Tal and its equivalent successions and the underlying ~1800 Ma old lowgrade metamorphics of Damtha/Jaunsar Group rocks (see detail in Azmi and Paul, 2004). Further, if the Lower Vindhyans were ~1800-1600 Ma old, how could they escape the Delhi Orogeny (deformation) of 1450 Ma? Even the ~1000 Ma Godhra Granite which has extensively intruded in the adjoining Champaner Group lowgrade metasediments of post-Delhi age has nowhere intruded in the Vindhyans. This also suggests that the Vindhyans are younger than 1000 Ma.

3. Vendian – Lower Cambrian stratigraphic succession (650-520 Ma) in and around the Indian Peninsula is characterized by extensive deposition of diamictite / tillite, microbial carbonates, evaporites, phosphorites and black shale with rich "Cambrian Explosion" small shelly fossils. All these are present in the Vindhyan Supergroup of central India which were developed in post-*Malani* times (<750 Ma).

In view of the above, and taking cue from the wells of Baghewala-1and nearby Karampur-1 in Salt Range, Pakistan, it is recommended that the Vindhyan Basin needs further careful attention as a relatively much younger terminal Neoproterozoic to Early Cambrian hydrocarbon prospecting short span basin than usually projected as unique extraordinarily long-ranging Paleproterozoic to Neoproterozoic (~1800 – 550 Ma) basin of the world. The lot younger Vendian – Cambrian Great Vindhyan Basin concept encompassing the Trans-Aravalli Vindhyan – the Salt Range – the Lesser Himalaya, including the Ganga Basin therefore needs to be pursued.

Views expressed herewith are of the author only and not necessarily of the organization to which he is presently associated with.

References

Azmi and Paul, 2004. Discovery of Precambrian-Cambrian boundary protoconodonts from the Gangolihat Dolomite of Inner Kumaun Lesser Himalaya: Implication on age and correlation. Current Science, v.86, p.1653-1660.

Nelson et al. 2007. New shrimp U-Pb zircon dates from the Singhbhum Craton, Jharkhand-Orissa region, India. Abstract, International Conference on Precambrian sedimentation and tectonics and Second GPSS Meeting. IIT Bombay, p. 47.

Paikaray et al., 2008. Geochemistry of shales from the Paleoproterozoic to Neoproterozoic Vindhyan Supergroup: Implications on provenance, tectonics and paleoweathering. Journal of Asian Earth Sciences, v. 32, p. 34-48.

Peters et al., 1995. Recognition of an Infracambrian source rock based on biomarkers in Baghewala-1 oil, India. AAPG Bulletin, v.79, p.1481-1494.

Ray et al., 2002. U-Pb zircon dating and Sr isotopic systematics of the Vindhyan Supergroup, India. Geology, v. 30, p.131-134.

Ray et al., 2007. Age of Lower Vindhyans of Rajasthan. Abstract, International Conference on Precambrian sedimentation and tectonics and Second GPSS Meeting. IIT Bombay, p. 51.