JASEM ISSN 1119-8362

Full-text Available Online at
www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage. September, 2010
Vol. 14 (3) 33 - 36

Characterization of the Geology of Subsurface Shallow Conglomerate using 2D Electrical Resistivity Imaging at Baragadi, Panna District, Madhya Pradesh, India

ANTONY RAVINDRAN A

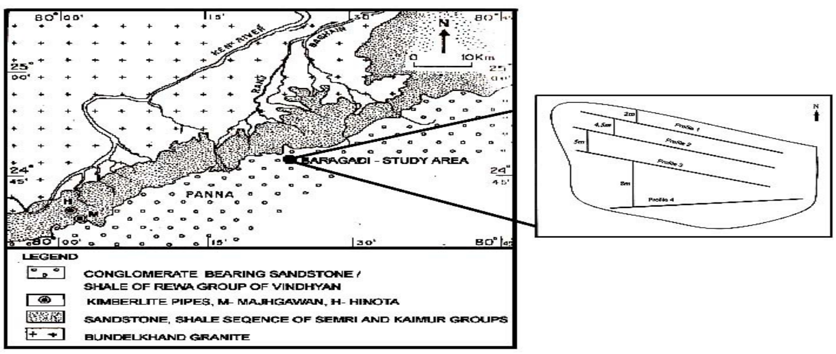
Department of Geology, Manonmaniam Sundaranar University, V.O.Chidambaram College, Tuticorin, India

ABSTRACT: The 2D electrical resistivity imaging study is the rising tool used for characterization of the geology of subsurface diamondiferous shallow conglomerate and geological condition at Baragadi, Panna District, Madhya Pradesh, India. In the present study, the 2D electrical resistivity imaging of subsurface shallow conglomerate has been generated using through Computerized Resistivity Meter (CRM -500) and the Wenner electrode configuration has been used for 2D electrical resistivity imaging studies. The measured apparent resistivity values have been subjected to inversion so as called a resistivity pseudosection by using RES2DINV 3.56 software. Resistivity contrast technique has been adopted to distinguish the rock properties in the form of resistivity distribution displayed in the imaging sections and to delineate the distribution of diamondiferous conglomerate horizons within clay and kankar deposits in the Baragadi shallow congromerte lower part of Upper Vindhayan Formation. @ JASEM

Diamond has been adorned as the king of gemstone since time immemorial. Panna Diamond Belt (PDB) occupies an area of 4000 sq. km. along the northern margin of the Vindhyan basin in Panna District, Madhya Pradesh, India between Latitude 24º 30′ N - 25º 00′ N and Longitude 80º 00′ E - 80º 45′ E (Fig. 1). It is an 80 km long linear belt trending ENE-WSW between the Majhgawan Diamond Mines (24º 39′; 80º 02′) in the west and Majhgawan railway station (24º 54′; 80º 40′) in the east. Shallow diamond mines operated by unorganized sector under the permission from the Department of Mining and Geology, Government of Madhya Pradesh, India. The Vindhyan super group is represented mainly by arenaceous and argillaceous litho units with minor calcareous component belonging to the Kaimur, Rewa and Bhander group. The Panna diamond belt occurs as a part of Vindhyan super group in the northern fringe of Vindhyan basin (Soni et. al., 1987; Chalapathi Rao, 2005 and 2006). The diamondiferous conglomerate beds are found in the Baghain sandstone, Panna shale, Rewa sandstone and Jhiri shale formations of Vindhyan super groups. The Vindhyan rock formation shows a general trend of ENE-WSW and dipping 2º to 5º towards SSE direction. About 25km from Panna in SW direction, the pear shaped and nearly circular kimberlite, lamproite and diatremes are located near Majhgawan and Hinota villages respectively (Hamilton, 1819; Medlicott, 1859; Merh, 1952; Babu, 1998). The conglomerate bed is well represented fairly thick with gradual tapering and strikes in ENE and WSW directions. The thicker portions of the conglomerate bed consist of bigger pebble too. Thus, it is inferred that they represent N-S or NNW-SSE trending paleo-channels. The average thickness of the conglomerate bed which containing diamond is 0.60m and yield 27.91 carats /100 tons. The conglomerate bed also contains higher percentage of gem quality diamonds (55 %) when compared to Majhgawan kimberlite (38 %) (Rau and Soni, 2003).

MATERIAL AND METHOS

The 2D electrical resistivity imaging technique is adopted to explore the possible locations for the further exploration of diamondiferous conglomerate and quaternary gravel in Baragadi, Panna District, Madhya Pradesh, India (Figs. 2a and 2b).



Email: antonicogeo@gmail.com

Fig. 1. Geological map and trends of the 2D electrical resistivity imaging survey lines in the one of the of Panna Diamond Belt at Baragadi, Panna District, Madhya Pradesh, India.

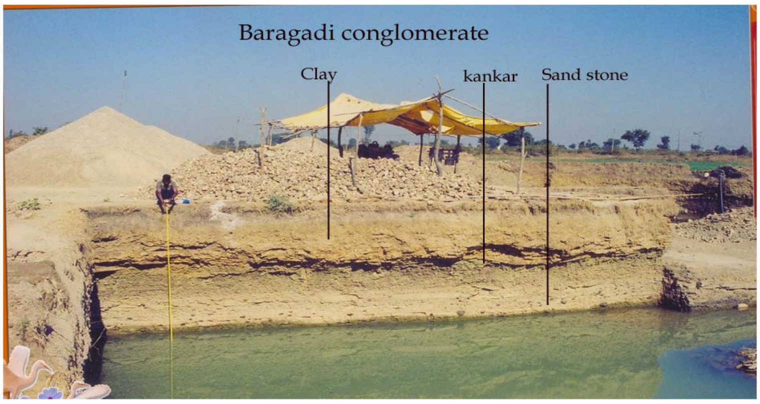


Fig.2a. Diamondiferous conglomeratic mine section at Baragadi (Hatupur), Panna District, Madhya Pradesh, India.

The 2D electrical resistivity imaging survey scans the subsurface in both vertical and horizontal directions by increasing the electrode spacings. For data acquisition Aquameter CRM 500, 40 steel electrodes, 12 Volts Direct Current (DC) battery and multicore cables to a length of 200m and switch box connector are utilized. Electrical resistivity imaging data were collected in four 2D Electrical resistivity imaging profile by using the Wenner array electrode configuration. The profiles 1, 2, 3 and 4 to lengths of 80m with electrode spacing of 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 and 24m are measured in N75ºW - S75ºE, N80ºW - S80ºE, N85ºW - S85ºE and N75ºE - S75ºW directions respectively . To investigate the depth and distribution of the diamondiferous conglomeratic horizons in the Baragadi (Hatupur), four 2D Electrical resistivity imaging surveys to a length of 80 m each in NW-SE and NE-SW direction to a depth of 12m were carried out (Figs. 3.a, 3b, 3c and 3d).

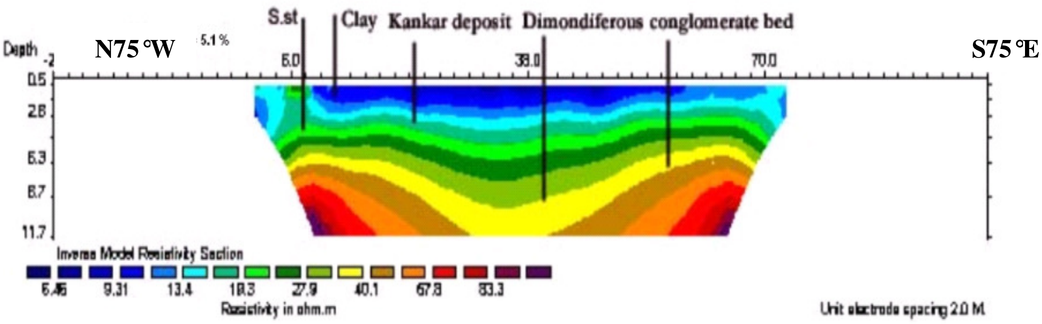


Fig. 3.a Electrical resistivity imaging pseudosection along profile 1 illustrates the exploration of diamondiferous conglomerate beds at Baragadi, Panna District, Madhya Pradesh, India.

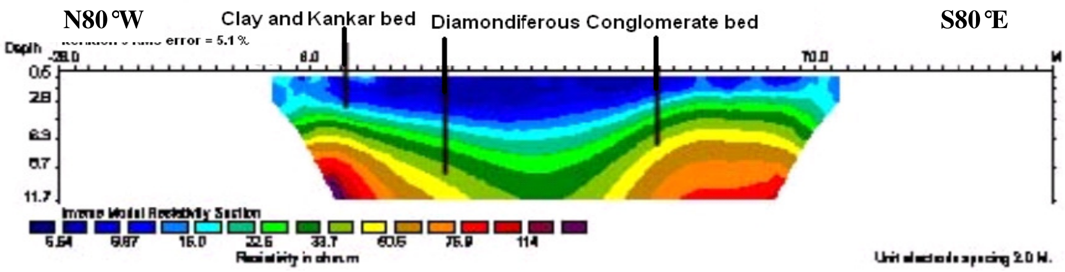


Fig. 3.b 2D electrical resistivity imaging pseudosection along profile 2 illustrates the exploration of diamondiferous conglomerate beds at Baragadi, Panna District, Madhya Pradesh, India.

RESULT AND DISCUSSION

The 2D inversion resistivity pseudosection of profile 1 trends N75ºW to S75ºE direction to a length of 80m. The inversion resistivity pseudosection image shows three differentiation layers, first layer contains clay and kankar showing a low resistivity that ranges from 6.45 to 13.4 Ohm.m. The intermediate second layer exhibit resistivity values that range from 27.9 to 40 Ohm.m represent the conglomerate horizons. The third lower layer shows the high resistivity that ranges from 67 to 83 Ohm.m is interpreted as sandstone and siltstone layer respectively. The profile 2 trends N80ºW to S80ºE direction to a length of 80m. The inversion resistivity pseudosection displays the upper layer as clay and kankar deposits identified with the resistivities that ranges from 6.62 to 13.1 Ohm.m. The range of resistivities for the conglomerate horizon in the profile varies from 34 to 50 Ohm.m in the intermediate layer. The sandstone and silt stone deposit occurred in the lower part show the range of resistivity values from 63.2 to 76.3 Ohm.m.

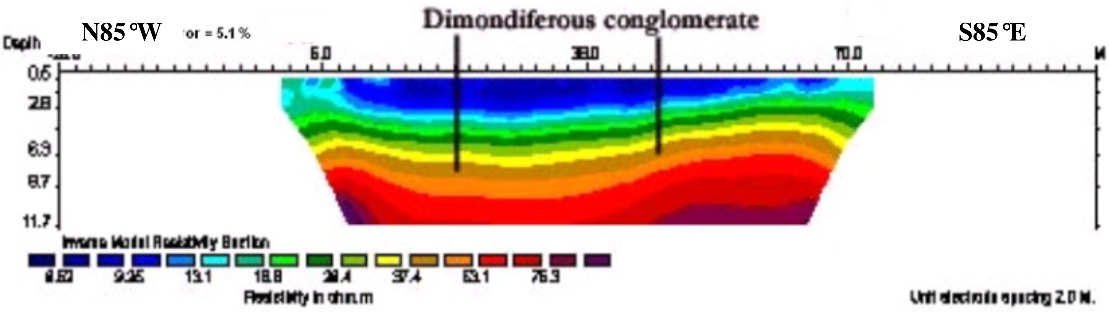


Fig. 3.d 2D electrical resistivity imaging pseudosection along profile 3 illustrates the exploration of diamondiferous conglomerate beds at Baragadi, Panna District, Madhya Pradesh, India.

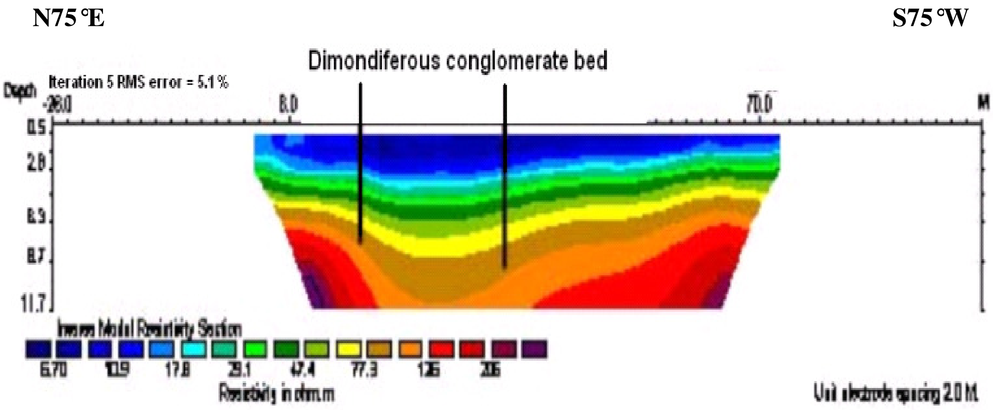


Fig. 3d 2D electrical resistivity imaging pseudosection along profile 4 illustrates the exploration of diamondiferous conglomerate beds at Baragadi, Panna District, Madhya Pradesh, India.

The profile 3 trends N85ºW to S85ºE direction to a length of 80m. The upper part of the first layer reveal as clay and kankar deposits. The inversion resistivity values for these beds that ranges from 6.22 to18.8 Ohm.m. The resistivity values for intermediate layer of conglomerate bed ranges from 50 to 62 Ohm.m. The lower part of the layer represents sandstone and siltstone exhibit high resistivity values that ranges from 69.1 to 76.3 Ohm.m. The profile 4 trends N75ºE to S75ºW direction to a length of 80m. The inversion resistivity values from 29.1 to 47.40 Ohm.m represents clay and kankar beds in the first layer. The intermediate layer is formed by conglomerate horizon and resistivity for this horizons shows the range 29.1 to 47.4 Ohm.m. The inversion resistivity values for sandstone and silt stone deposits in the lower layer ranges from 29.1 to 47.4 Ohm.m.

Conclusions: Paleochannel with conglomerate trending NW-SE and N-S directions and the conglomerate beds are found thicker in the centre part of the paleochannel. Regional exploration by drilling (Geological Survey of India) on a grid pattern has revealed several blocks, where conglomerate beds are found with considerable thickness. From the 2D Electrical Resistivity Imaging study is used to identify the shallow conglomerate horizon bed in Baragadi open cost mines. The two known kimberlite pipes in the area of Majhgawan and Hinota with low percentage of diamond content in the proterozoic conglomerates and quarternary gravels. Thus it is inferred from drilling operation that the thicker portion of conglomerate beds in the paleochannel consists of bigger pebble too.

Acknowledgements: The first authors express his sincere thanks to Mr. A.P.C.V. Chockalingam, Secretary and Prof. A. Francis, Principal, V.O.C. College, Tuticorin. The helps extended by Dr. N. Ramanujam., Professor and Head, Coastal Disaster Management, Department of Ocean Studies and Marine Biology, Pondicherry University, Post Box No:26; Brookshabad Campus, Junglighat, Port Blair – 744 103. Andaman.

REFERENCES

Babu T M (1998). Diamond in India, Geol.Soc.India. Bangalore. PB No 1992.

Chalapathi Rao, N V (2005). A petrological and geochemical reappraisal of the mesoproterozoic diamondiferous Majhgawan pipe of central India: evidence for transitional kimberlite – orangeite (group II kimberlite)– lamproite rock type; Mineral. Petrol 84 (2): 69-106

Chalapathi Rao N V (2006). Mesoproterozoic diamondiferous ultramafic pipes at Majhgawan and Hinota, Panna area, central India: Key to the nature of sub-continental lithospheric mantle beneath the Vindhyan basin. J. Earth Syst. Sci. 115 No 1 pp161-183.

Hamilton F (1819). Description of the diamond mine of Panna. Edinburgh Philosophical Journal Vol (I): 49-54

Merh S (1952). Further study of the Majhgawan diamond mine, Panna state, Central India; J. Geol. Min Met Soc India vol 24 :125–132.

Middlemost E A K ; Paul D K (1984). Indian kimberlites and genesis of kimberlite; Chem. Geol. vol 47 pp 249–260.

Rau T K ; Soni M K (2003). Diamondiferous Vindhyan conglomerates and their provenance; a critical study. Indian minerals vol 37 pp22-30.

Soni M K Chakravorty S ; Jain V K (1987). Vindhyan Super Group – a review; Geol. Soc. India Memoir 6, 87–138.