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Evaluation of Iron Ore Deposits in Elayiram Pannai, Sattur Taluk, Virudhunagar District and Tamilnadu using 2D Electrical Resistivity Imaging

ANTONY RAVINDRAN, A

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

ABSTRACT: 2D Electrical Resistivity Imaging (ERI) investigation is suitable method to determine the geotechnical problems and it is used to identify the iron ore deposits. 2D Electrical Resistivity Imaging with Wenner array was conducted within the iron ore deposits area in Elayiram Pannai, Virudhunagar District, Tamilnadu.The geology of the were developed into the picture image of pseudosection by using RES2DINVsoftware. The banded iron ore deposits are highly conductive and can be easily distinguish from pseudosection image contrast of the rocks in the studied area. @JASEM

Key Words: Iron Ore, 2d Electrical Resistivity Imaging, Apparent Resistivity, Pseudosection

SURVEYED AREA: The area mainly composed of quartzites, bands of charnockites, garnetifereous biotite gneiss with enclaves of basic granulites and calc-granulites of Proterozoic age. The studied area isolated iron ore deposits of metasedimentary nature occur in association with clay calchie and weathered gneissic rocks. Electrical resistivity imaging surveys were carried out to display the lateral and depthwise iron ore deposits from the sorrounding rocks and overlying clay beds. The banded magnetic iron ore deposits (Fig.1) in the areas of Elayiram pannai, Sattur Taluk, Virudhunagar district, Tamilnadu trending towards NW to SE direciton. This area corresponds to about 70m towards E-W and 220m towards N-S. The longitude coordinates are is not in agreement with the coverage of the 4 ERT lines along E-W, considering that profile 2 is 50m apart from 1 and is located at about 35km NW of Tuticorin down.

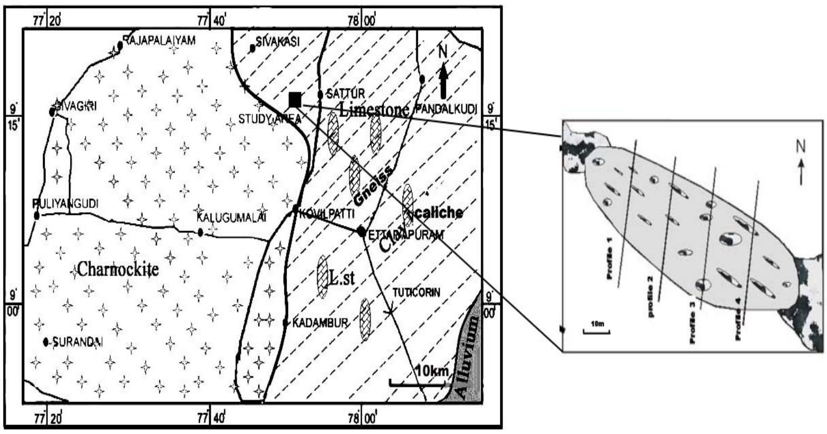

Fig.1 Geological map of the surveyed area (left). 2D electrical resistivity imaging conducted along profiles 1-4 (right).

The iron ore are generally occured in the source of dyke, stocks with argillaceous rocks. The lateral tectonic setting are due to generate the distribution pattern of the iron ore bodies in the studied area. The study of iron ore mining using electrical resistivity was carried out by Balint, 1975; Wanstedt, 1992; Kerr et. al., 1994; Krishnaswamy et al., 2006. The linear batches of iron ore outcrop in the surface are occupying in the NE to SW direction for 2km length in the studied area (Figs.2 and 3).

The main objective of the study is based on the lateral and depthwise extension of the iron ore direction in the studied area by using a tool of 2D electrical resistivity imaging method. Among the four 2D electrical resistivity imaging profiles to a lengths of 220, 180,190 and fourth one to a length of 125m with orientations of NE to SW were carried out across the iron ore outcrops.

* E-mail: antonicogeo@gmail.com; Mobile: 0- 94423-6883

Fig. 2. Surficial exposure of the banded iron ore deposits at the surveyed area.

DATA ACQUISITION

For the present study, multicore cables with 48 terminals for the electrode connections, Aquameter CRM 500 and specially designed switch panel with 48 sockets for electrode connections, 48 stainless steel electrodes and 12 volt battery (Antony Ravindran, 2011; Antony Ravinran and Ramanujam., 2012. The electrodes were planted in the predetermined interval of 5m distance. The terminals of the multicore cables are connected to these electrodes planted and other end of the cable terminals are connected to switch panel. Now the four electrodes (two current and two potential electrodes) can be plugged depending upon the combination of electrode position for the geometry of the electrode arrangement adopted without changing the electrodes grounded in the field. The terminals of the current and potential electrodes of the panel are connected to Aquameter CRM 500.

Fig.3 Shows Field work data collection and Excavation of pits to investigate banded iron ore deposits at Elayiram Pannai, Sattur Taluk, Virudhunagar District

DATA PROCESSING

The imaging pseudo section is constructed on the basis of the apparent resistivity data and provides a simple image. It is not representing the true distribution of intrinsic resistivity and gives a very approximate picture of the true subsurface resistivity (Loke M.H; 2004). The Gauss-Newton is the popular general geophysical inversion technique (Lines and Treitel, 1984). This technique has developed a fast and versatile implementation of the smoothness - constrained least squares inversion (Loke and Barker, 1996). This inversion technique is a powerful and effective means of processing pseudosection by using RES2DINV Ver.3.56 Software, by which the contoured image of true depth and formation resistivities are prepared. This method is based on the smoothness constrained least square method applied to apparent resistivity. The volume of the influence described by the apparent resistivity is translated into the depth of investigation related to the interpreted resistivity depth corresponds to the median depth of investigation a/2.

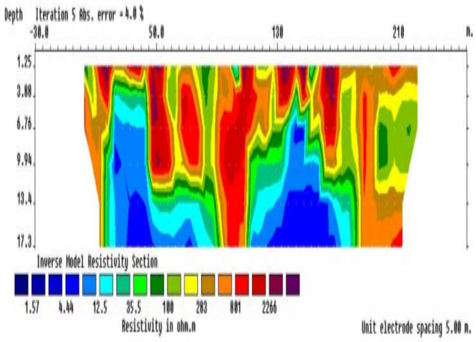

Fig. 4.1(a) 2D electrical resistivity imaging sections along profile 1

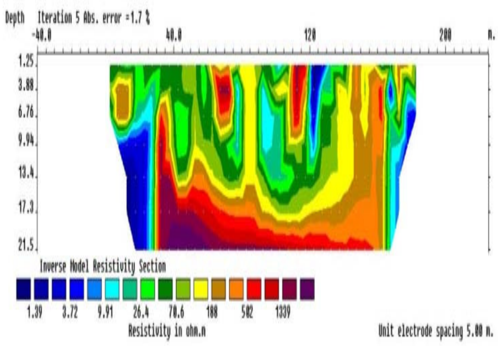

Fig. 4.1(b) 2D electrical resistivity imaging sections along profile 2

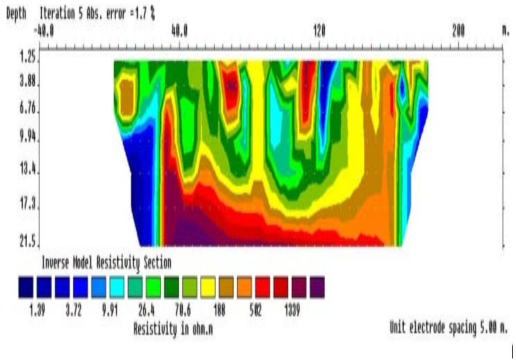

Fig. 4.1(c) 2D electrical resistivity imaging sections along profile

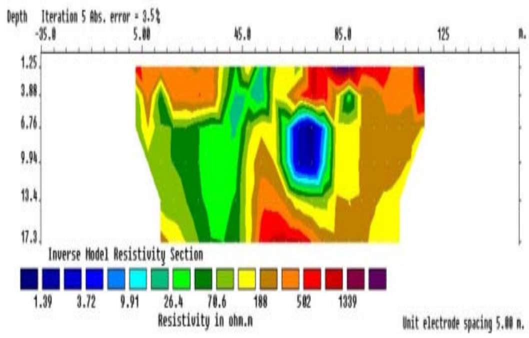

Fig. 4.1(d) 2D electrical resistivity imaging sections along profile 4

2D ELECTRICAL RESISTIVITY IMAGING PSEUDOSECTION: The inversion resistivity section along the profile 1 is shown in Fig.4a. The high resistivity zone indicates the presence of caliche beds and the low resistivity zone indicates the presence of the iron ore. The (Fig.3) clearly shows the occurrence of these iron ore and caliche beds as revealed by the pseudosections. The profile 2 (Fig.4b) embody the iron ore with low resistivity that ranging from 1.576 to 35.5 Ohm.m. The basin like calchie deposits ranges of resistivity from 283 to 2266 Ohm.m at depth of 6.76 – 21.7m. The profile 3 (Fig.4.c) the low resistivities are indicated as iron ore. The caliche deposits are identified with high resistivity from1.576 to 35.5 Ohm.m. The profile 4 (Fig.4.d) The high resistivity zones of caliche deposits is identified at a depth of 3.88 to 17.3 m. The low resistivity zone of circled image indicates the path of the vein deposits are clearly depicts the resistivity that ranges from 1 to 35 Ohm.m.

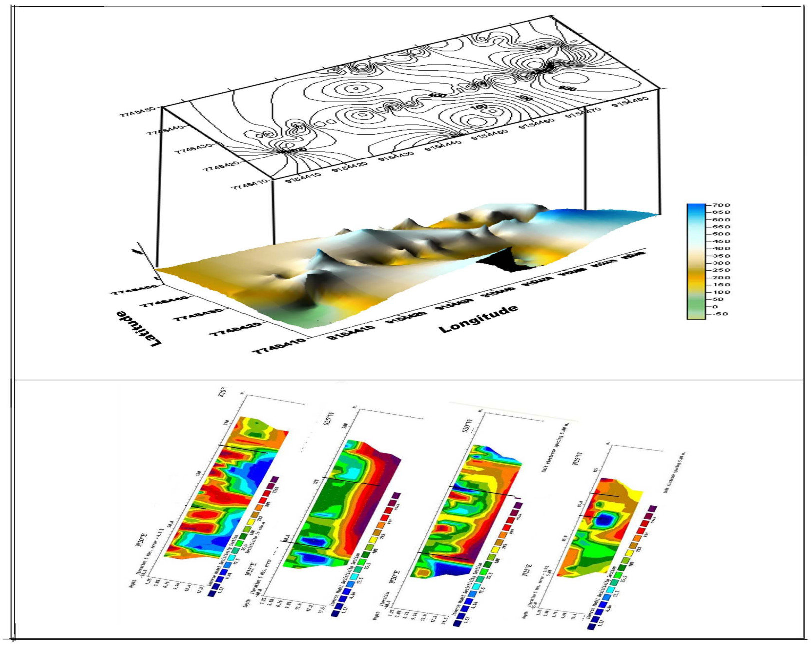

Fig.5. Shows the 3D model of 2D electrical resistivity imaging pseudosection along the profile in the banded iron ore deposits at Elayiram Pannai, Sattur Taluk, Virudhunagar District, Tamilnadu

Conclusions: The 2D Electrical Resistivity Imaging technique is used to demarcate iron or deposits from overburden rock (Fig.5). The iron intruded from depth was clearly delineated for their lateral and depth wise extension by the resistivity contrast technique from the pseudosections. The fulfilled details of iron ore deposits orientation NW-SE direction are explore from the resistivity image pesudosection contrast. The regional exploration by drilling on a grid pattern has several blocks, where iron ore deposits are found with considerable thickness.

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