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INTEGRATED GEOPHYSICAL STUDIES FOR DELINEATION OF GEOLOGICAL BOUNDARIES IN THE PANYAM REGION, KURNOOL SUBBASIN, INDIA

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ABSTRACT

Panyam mandal is located in Kurnool Subbasin, Andhra Pradesh covered with three geological formations Nandyal shales, koilakuntla limestones and Panyam quartzites. To demarcate these boundaries the integrated geophysical studiers were carried out which strengthen the results than any single geophysical studies. In this present case the resistivity and radiometric studies were carried out and integrated the results from these two methods. Both these results are correlated with each other and proved that the presence of these three formations. Under the BL-1, the shales exhibit the low resistivity and high radiometric values. Above the BL-2, the quartzites show high resistivity and low radiometric values. Between BL-1 and BL-2 the formations are limestone with shales, limestones show medium resistivity values and low radiometric values.

KEYWORDS: *Panyam mandal, Nandyal shales, Limestone with shales, Panyam quartzites integrated geophysical studies and geological boundaries.*

1. INTRODUCTION

Integrated studies are the useful in which the results of different geophysical methods are combined and compared with each other. This application will enhance the accuracy of the result and it will reduce the ambiguity compared to the single geophysical study. In the present study area, Panyam mandal covered with three different formations laterally. To study this area geophysical methods like resistivity (Bhattacharya and Patra, 1966; Zohdy, 1974; Sharma, 1977; Koefed, 1979) and radiometric (Labani Roy 2015; Dhana Raju, 2005; Venkat Rao, 1977; Bhimasnkaram, 1974) were carried out. The analytical results are compared each other to strengthen the result and prove the importance of integrated (Anderson and Nash, 1997).

2. GEOLOGY OF THE STUDY AREA

The present study area Panyam mandal is located in the Kurnool subbasin, of Andhra Pradesh, India. The Kurnool district is underlain by various geological formations, from Archaean to Recent formations (King,1872). This district consists of two different physiographic provinces viz., the gneissic terrain with low denudational hills in the west and with sedimentary terrain consist of valleys and plateaus in the east (APGW Dept., 2008; CGWB, 2012).

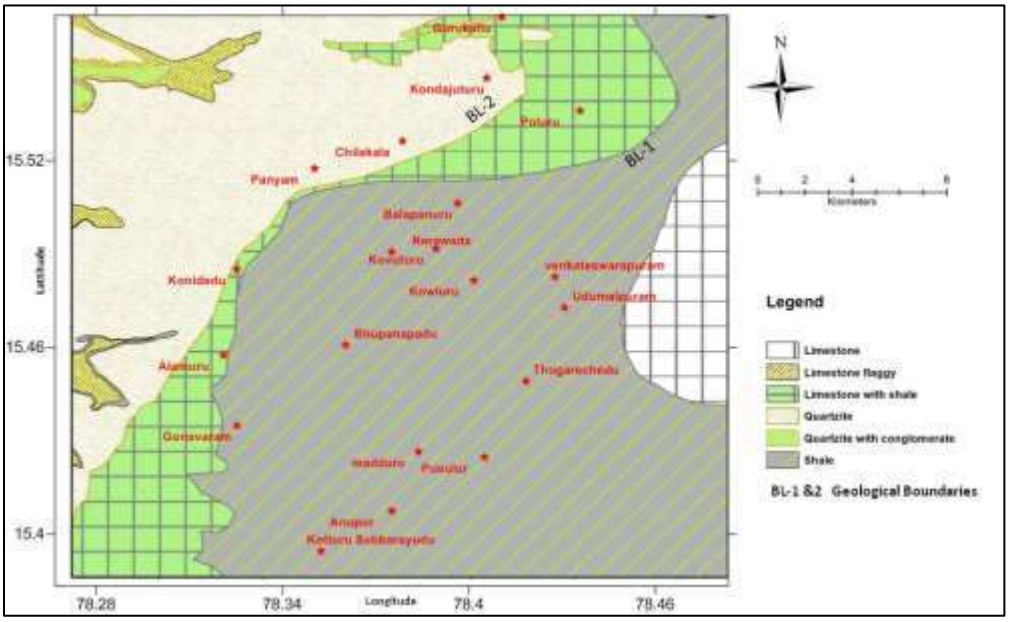

Figure1. Geological map of the Panyam mandal along boundary lines BL-1 and BL-2. (after GSI, 2005)

The study area, Panyam mandal is comprised of three different formations, and it is clearly observed in the Geology map (Fig.1). It is clearly seen the southern part is totally covered with Nandyal shales and the northeastern part is consists of Panyam quartzites. In between these two formations the area comprised of both Koilakuntla limestones and Nandyal shales. (Narayana Swamy, 1966; Balakrishna et al., 1967; Nagaraja Rao et al., 1987). In the present study, separation line of these formations are marked as boundary line BL-1 and BL-2, for easy understanding the present formations in these zones.

3. INTEGRATED ANALYSIS

I) Resistivity studies

The vertical electrical sounding (VES) measurements were carried, at 88 locations along 11 profiles to cover the maximum study area, using resistivity meter – model DDR3. The soundings are conducted for maximum electrode separations of AB/2=100 m, so the depth of investigation is 70 m and due to intense agricultural activites in the area, the VES locations are not equally spaced.

The obtained values of apparent resistivity measurements in the field, for AB/2=5 m, is contoured, with an interval of 50 Ωm. Electrode separation AB/2=5 m, infers the resistivity details up to the depth of 3m (Murali and Patangay, 2006), which is very shallow surface. The resistivity values ranges from 25 Ωm to 238 Ohm.m. In this map boundary lines BL-1 and BL-2 are marked based on geology map (Fig.1). It is easily observed that below BL-1 the low apparent resistivities are observed. Above BL-2, the high apparent resistivities can be seen. Between BL-1 and BL-2, the apparent resistivity values are low to medium is observed.

II) Radiometric studies

Radiometric measurements were carried out in the study area using the instrument Scintillometer (SM-141). Total 340 measurements were observed along 11 profiles with interval of 200m. The depth of investigation of this method is very low about 0.5 m, so this method is generally used for geological mapping. The radiometric readings which are observed in the field ranges from 0 μR/hr to 11μR/hr. The contourmap is generated with acontour interval of 1 μR/hr.

In this map also the boundary lines BL-1 and BL-2 are marked as in the Fig.2. The high radiometric values are noticed below the boundary line BL-1, but in a few places the low values are observed. Very low values are identified above the BL-2. Between BL-1 and BL-2, low to high values are observed.

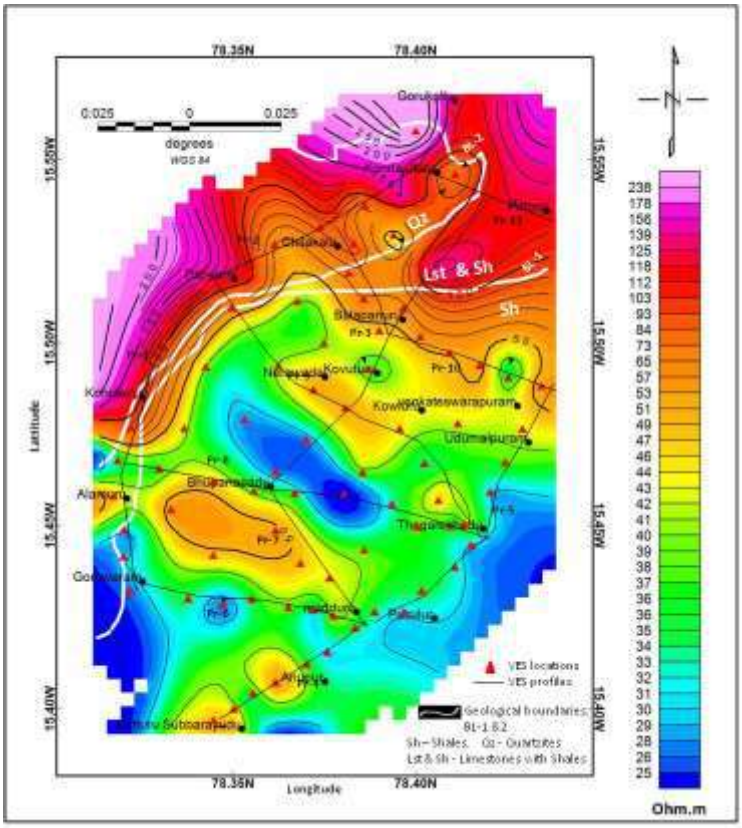

Figure 2. Contour map of apparent resistivity, AB/2=5m, of Panyam study area along with VES locations and profiles.

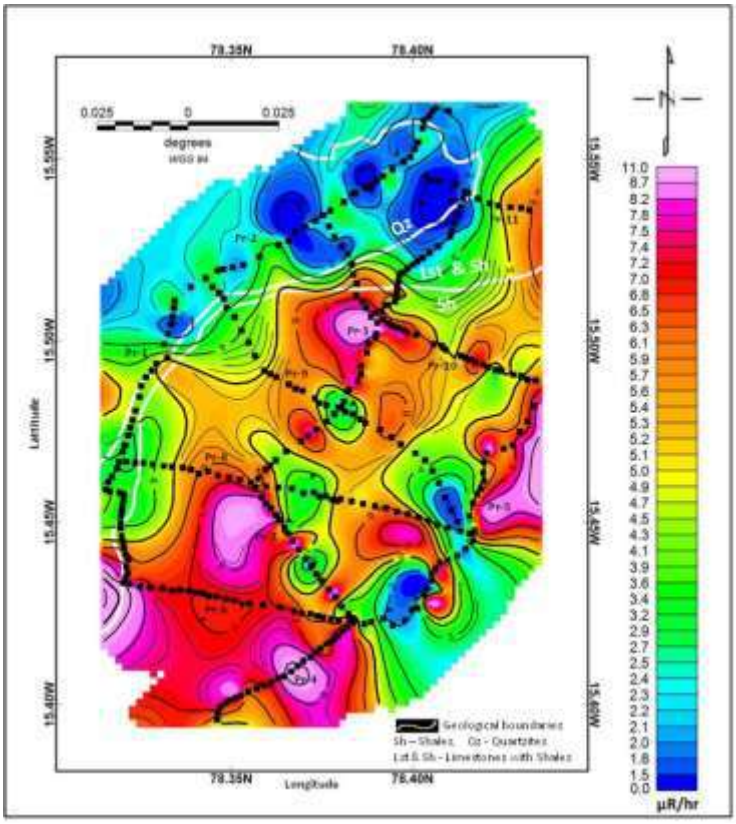

Figure 3. Radiometric contour map of Panyam mandal, along with radiometric profiles.

4. RESULTS

Upon visual inspection, it is clearly noticed the correlation in both the contour maps. The observed correlations are:

1) Under the BL-1 the low resistivity <100 Ohm.m is observed in the Fig.2 and high radiometric values > 4 µR/hr in Fig.3, both these are characteristics of shales.

2) Above the BL-2, the high resistivity >1000 Ohm.m is noticed in the Fig.2 and radiometric values are low from 1.5 µR/hr to 3 µR/hr in Fig.3, both are characteristics of quartzites.

3) Between BL-1 and BL-2: a) the observed apparent resistivity values Fig.2 are low to medium, infers that the presence of two different formations, which are limestone with shales based on geology map. It means low values <100 Ohm.m are due to shales and medium values <400 Ohm.m due to limestones. b) The obtained radiometric values Fig.3 are low to high, infers in this case also limestone with shales. It means low values 0.5 µR/hr to 1.5 µR/hr are due to limestones and high values > 4 µR/hr are due to shales.

4) Very low values of apparent resistivity <30 Ohm.m and radiometric values <1 µR/hr are observed due to soil.

5. CONCLUSIONS

Geology map of Panyam mandal Fig.1, clearly shows that the three formations; below BL-1, Nandyal shales, above BL-2, Panyam quartzites and between BL-1 and BL-2 Koilakuntla limestones and Nandyal shales. From the Integration of resistivity and radiometric results it is proved that these three formations are present in this study area. Based on the stratigraphy of the Kurnool formations, it infers that below BL-1, the area is undisturbed. Between BL-1 and BL-2 the presence of Koilakuntla limestones and Nandyal shales explains that shales are not totally eroded. Above BL-2, both the shales and limestones are eroded and Panyam quartzites remained.

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