Near Surface Geological Identification Using Radiometric Analysis in Kurnool Basin, Andhra Pradesh, India

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A B S T R A C T

Panyam study area situated in Kurnool sub-basin, India. This study area covered with different geological formations from place to place. Radiometric studies which is a very good tool for geological mapping, were carried out to identify the anomalies corresponding to these formations. From the interpretation of Radiometric contour map the anomalies can be noticed easily which are maximum correlate with these formations. For convenience two geological boundaries BL1 and BL2 also drawn in this map. Below boundary line-BL1, the larger area mostly covered with Nandyal shales, exhibit high values > 7 μR/hr except at the soil cover areas. The low anomalies < 3 μR/hr are observed above BL2 line, due to Panyam quartzites. The zone between BL1 and BL2 covered with Koilakuntla Limestone with Nandyal shales exhibit different anomalies low to high.

Keywords: Panyam Mandal, Rediometric Anomalies, Geological Boundary, Nandyal Shales, Koilakuntla Limestones, Panyam Quartzites

1. Introduction

Radiometric studies are very important tool for geological mapping in geophysical studies. Generally all rocks are radioactive, because radio elements present even though to a minute extent. Uranium is the predominant and the secondary uranium deposits occurred as weathering of the primary deposits in the sedimentary rock formations like sandstones and conglomerates. (Venkat Rao, 1977; Labani Roy, 2015; k.k.1995; Prakash et al., 2017). The activity of these rocks generally less than the acidic rocks. Among these rocks specially in shale, clays and saline deposits show high radiometric values due to large amounts of radio elements like in granites. Sandstones show medium radiometric. Rock salt, limestones, gypsum, anthracite, dolomites, coals, pure quartz sands, shows low values due to very low radioactive elements. In the Metamorphic rocks gneisses and schist show high values and Marbles and quartzites show low values (Bhimasankaram, 1974;1980). The radiometric method is usually carried out for geological mapping, only very near surface investigations maximum 0.5 m depth. The areas covered with soil also very difficult to identify the anomaly (Bhimasnkaram,1974; Murali and Patangay, 2006).

2. Geology of the study area

The study area Panyam mandal situated in the Kurnool district of Andhra Pradesh, India. Geologically this Kurnool district comes under Kurnool Basin. In the study area mainly Nandyal Shale, Koilakuntla limestone and Panyam Quartzites are covered. The startigraphy of this Kurnool basin is given in the Table-1.

Table 1. Stratigraphy of the Kurnool Basin (after Nagaraja Rao et. al., 1987)

			Thickness
Upper Proterozoic	Kurnool Group 500 m	Nandyal Shale	50-100m
		Koilkuntla limestone	15-50m
		Panniam Quarzite	10-35m
		---------Regression or Local Disconformity---------	
		Owk Shale	10-15m
		Narji Limestone	100-200m
		Banganapalli Quarzite	10-57m
----------------Unconformity----------------			
Srisailam Quarzite 620 m (+) Cuddapah Super Group			

3. Radiometric Data Acquisition

Radiometric studies were carried out in the study area using the Scintillometer instrument (SM-141) , along the eleven profiles P1 to P11 (Figure 1) with station interval of 200 m. The units are μR/hr (Ramachandra Rao, 1993). About 340 readings were measured very carefully. These profiles are maximum oriented in NE-SW, E-W and NW-SE directions. In this study it is clearly observed that the variations of radiometric anomalies are corresponding to shallow surface geology. and soil areas.

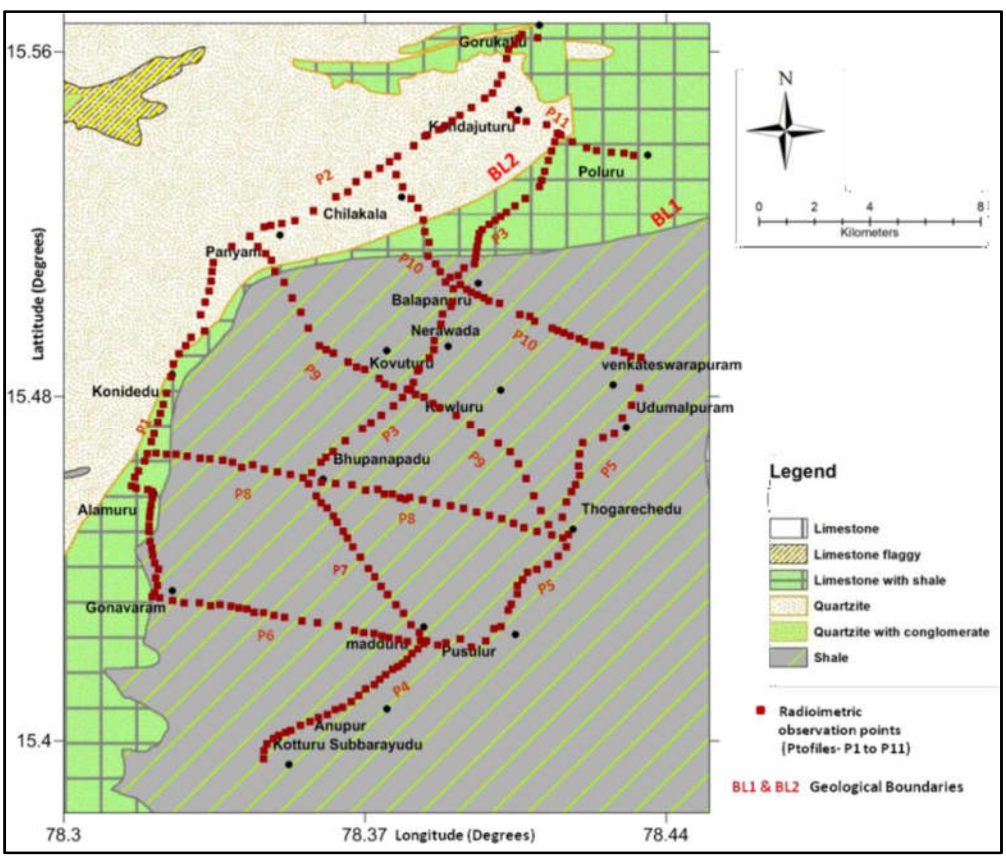

Figure 1 Layout map of the Radiometric survey, overlaid on the geology map of the study area (modified after GSI, 2005).

4. Interpretation of Radiometric Contour Map

All the data along the profiles were generated contour map (Figure 2), shown with layout pattern. The contour interval is 1 μR/hr. The two geological boundaries BL1 and BL2 are shown in this map which is drawn based on geology map of the study area. From the observations in the radiometric contour map of the study area reveals the anomaly variations from place to place. Very low values < 3 μR/hr can be seen in the northern side and southeastern side, showed in blue colour. Very high values > 7 μR/hr can be seen southwestern side, central part and eastern side, showed in red and pink colour. Medium values from 3 μR/hr to 7 μR/hr are noticed in the middle part of the study area, showed in green and orange colour.

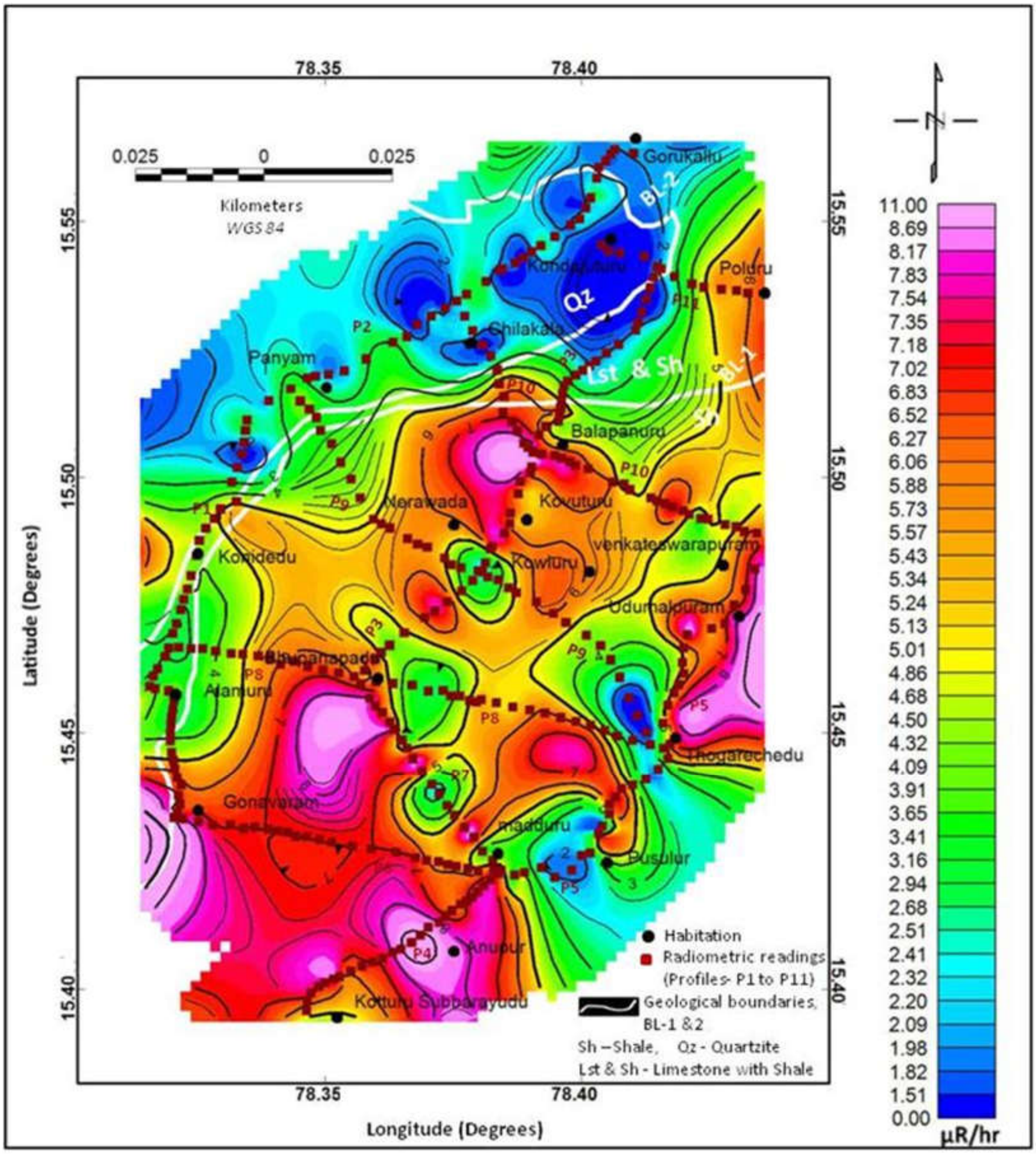

Figure 2 Radiometric contour map of the study area along with profiles (P1 to P11)

5. Results and conclusions

From the interpretation of the radiometric contour map it is brought out clear lithological variation according to different formations. Beneath the boundary line-BL1, the large area from middle to south zone covered mostly with Nandyal shales, exhibit high values except at the soil cover areas in

Madduru, Pusluru and Thogarichedu villages. Generally radiometric studies unable to measure properly in soil cover areas and shows low values < 2 μR/hr. In the North-West side above BL2 line, where Panyam quartzites are spread show low radiometric anomalies. The zone between BL1 and BL2 covered with Koilakuntla Limestone with Nandyal shales exhibit different anomalies. The reason for this variation is very low anomaly reveals the covering of limestones and high anomaly convey presence of shales.

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References

Bhimasankaram, V.L.S (1974). Radiometric methods of exploration; CEG., OU.

Bhimasankaram, V.L.S., (1980). The philosophy of integrated geophysical exploration Technology and interpretation, *Jour. Assoc. Exploration Geophysicists.* No.2. pp 1-14.

GSI., (2005). Geological Survey of India District Mineral resource map of Kurnool district. A.P.

K.K., (1995). Atomic Minerals Division, Department of Atomic Energy Hyderabad, Economic Aspects of the Cuddapha Basin with Special Reference to Uranium – An Overview, Tirupathi 1995, *Geological Society of India*, Annual Convention, September 9-12, 1995, pp. 16-138.

Labani Roy,P., Nagaraju Singh, S.P., Ravi, G. and Sukanth Roy.(2015). Radio elmental, petrological and geochemical characterization of the Bundelkhand craton, central India: Implication in the Archaean geodynamic evolution. *Int. J Earth, Sci. (Geol Rundsch),* 20.

Murali, S and Patangay, N.S, (2006). Principles and application of groundwater Geophysics, Publ.by *AEG,OU*, Hyderabad, pp. 421, Third edition.

Nagaraja Rao, B.K. , Rajurkar, S.T., Ramalingaswamy, G. and Ravindara Babu, B., (1987). Stratigraphy, structure and evolution of the Cuddapah basin: In B.P. Radhakrishna, (Ed.) Purana basins of Peninsular India, Memoir 6, *Geol. Soc. India, Bangalore*, pp.33-86.

Prakash M.M., Kaliprasad C.S., Narayana .Y, (2017). Studies on natural radioactivity in rocks of Coorg district, Karnataka state, India- -*Journal of Radiation Research and Applied Sciences*, Volume 10, Issue 2, Pages 128-134.

Ramachandra Rao M.B., (1993). Outlines of Geophysical Prospecting. Publ. by EBD EDUCATIONAL PVT.LIMITED, Dehradun, pp. 403, Third edition.

Venkat Rao,N., (1977). Lectures on Exploration geophysics for geologists and engineers, *AEG publication*.pp:227-263.