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Research Article

QUALITATIVE ANALYSIS OF RADIOMETRIC STUDIES NEAR TADIPATRI, SOUTHWESTERN CUDDAPAH BASIN

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ABSTRACT
Radiometric surveying method is very important tool for geological mapping. Radioelement- Potassium is mostly occur in all types of rocks in various amounts so the rocks exhibit radioactivity in different ranges low to high depends upon the presence of radioelement concentrations. In the present study area radiometric measurements were carried out and qualitative analysis has done, to delineate the different geological formations mainly to identify the sill intrusions and Fault/fracture zones. The radiometric contour map and radiometric profiles clearly show the anomaly variations due to different geological formations. The shales which are main geological formations in this area exhibit high radiometric anomalies 3 μR/hr to 10 μR/hr and the Fautls/Fracture zones also show high anomalies 10 μR/hr to 14 μR/hr. The basic sills which are intruded in to the shales are exhibit very low anomalies <4 μR/hr. The Coefficient of variation profiles show the tectonically disturbed zones- faults and fractures in this area.

***Keywords**: Tadipatri Shales, Radiometric Anomalies, Faults, Fractures and Coefficient of Variation*

INTRODUCTION
In geophysical radiometric exploration it measures the concentrations and spatial distribution of radioactive elements uranium, thorium, and potassium. Among the alpha, beta, and gamma particles only gamma particles have the highest energy and it will penetrate only few centimeters (about 50cm). The gamma ray detection indicates the abundance of these elements in the host rock (Bhimasankaram, 1974, Venkat Rao, 1977). This survey can be done in the larger areas and it is applicable in the plane and non soil cover areas. Because of the low depth of investigation it is useful only for geological mapping and lithological variation purposes. In the present study radiometric surveys were carried out to identify sill intrusions and fault locations in the shallow surface.

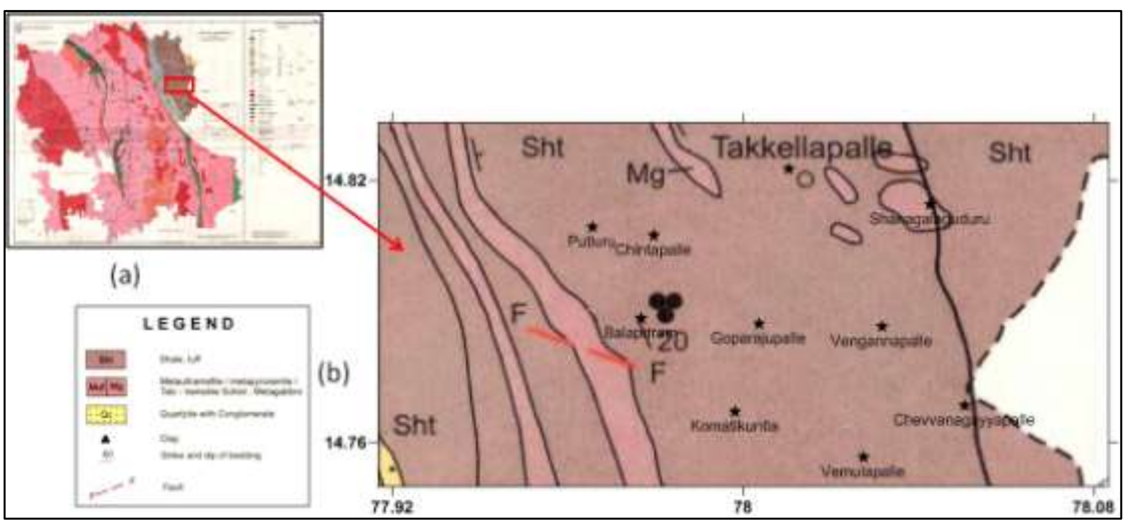

Figure 1: (a) Geology map of the Ananthapur district, Andhra Pradesh and (b) Geology map of the study area (GSI,2001)

MATERIALS AND METHODS

Geology

The crescent shaped Cuddapah basin is located in the eastern part of the Dharwar Craton, is convex westwards. Its length N-S direction about 450km, width of about 140km in the middle of the basin and occupies an area of nearly 44,000Sq.km. The eastern part of the Cuddapah basin is structurally more complex where western part is tectonically less disturbed (King, 1872, Nagaraja Rao *et al.*, 1987, Murty, 1964; Sen and Narasimha Rao, 1967).

The present study area (Figure1) is situated in the southwestern part of the Cuddapah Basin. This area is about 20km from the Tadipatri, Ananthapur district, Andhra Pradesh. Tadipatri shales are the main formations which are spread up to 4km in the subsurface. Several mafic volcanic rocks sills and flows intruded in the Tadipatri shales. Sill out crops can be seen in the study area in the north and western side. (GSI, 2001).

Qualitative Analysis

Radiometric measurements were carried out along four traverse which are length of 4km, station interval of 25m and these are not equally spaced because of inaccessibility. Radiometric contour map as well as profiles are examined for qualitative analysis to delineate different geological features.

RESULTS AND DISCUSSION

3.1 Radiometric Anomaly Contour Map

The radiometric contour map (Figure 2) is generated with a contour interval of 0.2 µR/hr. The 'highs' range from 10 µR/hr to 14 µR/hr are observed in the east, southwest and in the middle parts of the study area, due to fractures/faults. Medium anomalies range from 4µR/hr to 10 µR/hr are observed in the west, northeast and middle parts due to shales and lows range from 0µR/hr to 4 µR/hr are observed in the west and northeast due to sills.

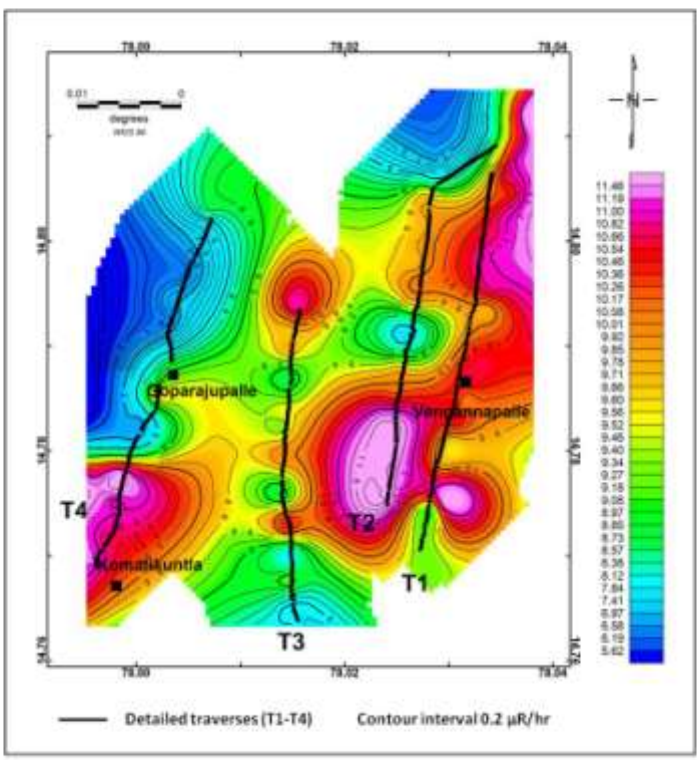

Figure 2: Radiometric contour map of the study area with layout of the four Traverses (T1-T4)

Radiometric data and its Coefficient of Variation Profiles

Comparison of the Radiometric profiles and its coefficient of variation profiles along the four detailed Traverses T1 to T4 clearly shows the tectonically disturbed zones. In the coefficient of variation profiles disturbed zones are marked as "a,b,c…." which are linear features like faults and fractures in the study area.

Coefficient of variation is a statistical technique which evaluate only anomalous zones (Bhimasankaram,1980, Himabindu 2003). It is calculated for Radiometric values using 3- point window for each traverse.

Coefficient of variation

$$\mathbf{C.V.} = \left(\frac{\sigma}{\overline{X}}\right) \mathbf{X\ (100\%)}$$

where σ *- Standard deviation and* $\overline{X}$ *- Mean value of the magnetic field.*

i) Traverse-T1

The Radiometric Traverse-T1 is 3960m long (Figure 3 (b)) passes from Vemulapalle to Shanagalaguduru through Vengannapalle and the anomalies range are from 10 µR/hr to 12 µR/hr. The high and low with alternate anomalies are noticed along this traverse and the trend is increased towards Shanagalaguduru. The tectonically disturbed zones are identified in Coefficient of variation profile (Figure 3(a)) as "a,b,c,d,e and f ".

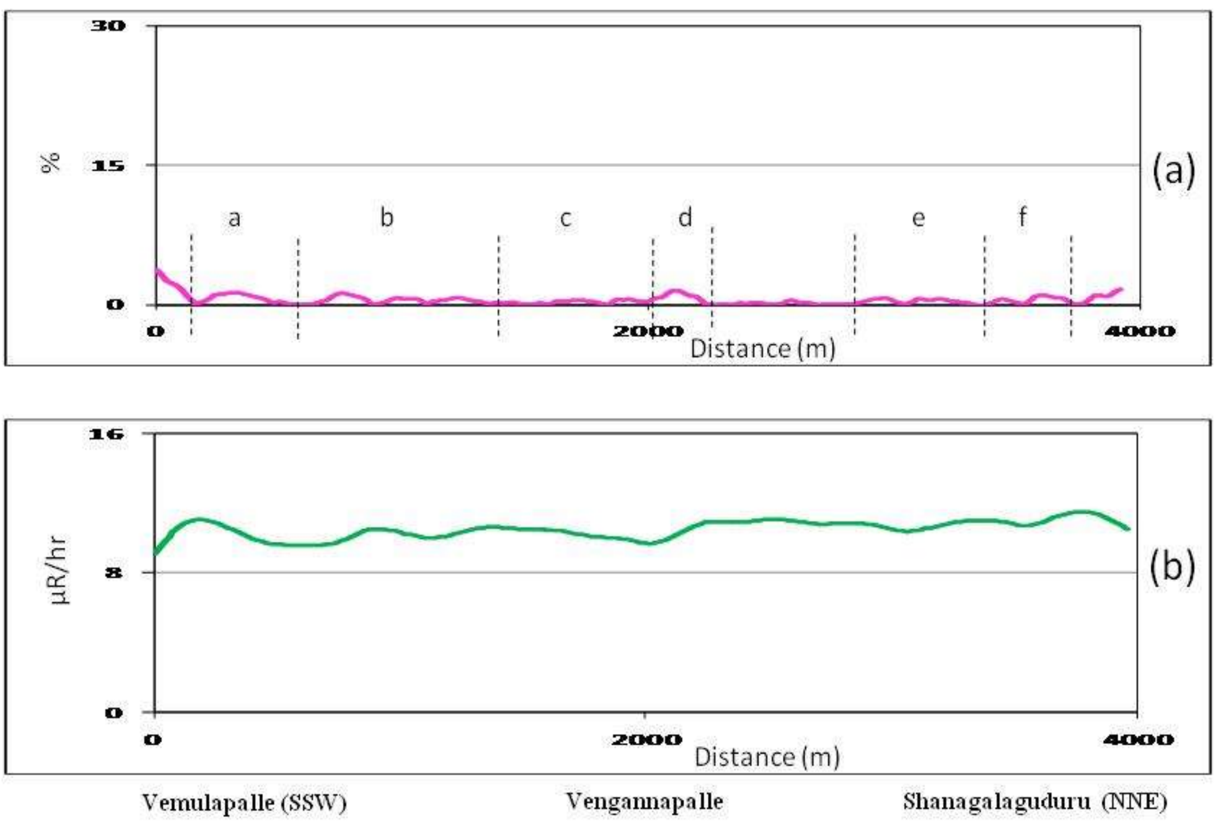

Figure 3: (a) Tectonically disturbed zones are marked on Coefficient of Variation profile and (b) Radiometric anomaly profile along the Traverse-T1

ii) Traverse-T2

This Traverse- 2 (Figure 4(b)) is 4000 m long and anomaly ranges from 7μR/hr to 12μR/hr. Two broad lows (8μR/hr at 1625m, 7μR/hr at 3400m) and Two highs (12 μR/hr on the left, 10 μR/hr in the middle) are observed in this area. The five disturbed zones "a,b,c,d and e" are observed in coefficient of variation profile (Figure 4 (a)).

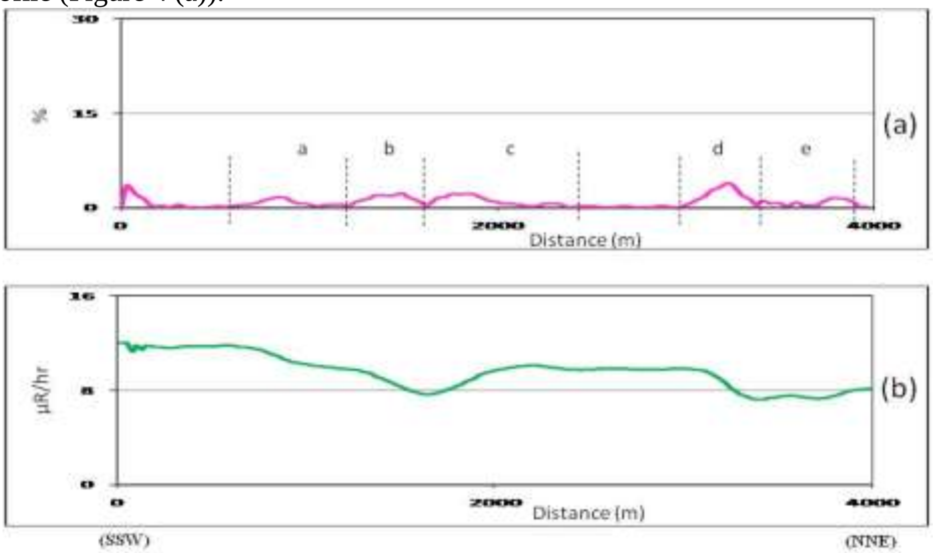

Figure 4: (a) Tectonically disturbed zones are marked on Coefficient of Variation profile and (b) Radiometric anomaly profile along the Traverse-T2

iii) Traverse-T3

The Traverse- 3 (Figure 5(b)) is 3200 m long and radiometric anomaly ranges from 8μR/hr to 11μR/hr with alternate lows and highs are observed. The highs 11 μR/hr and 10 μR/hr are noticed at 1050 m, 1650m and lows 8μR/hr and 9μR/hr are identified at 150 m, 650 m,1300m and 2450m. Seven disturbed zones marked as "a,b,c,d,e,f and g" are observed in Coefficient of variation profile (Figure 5(a)).

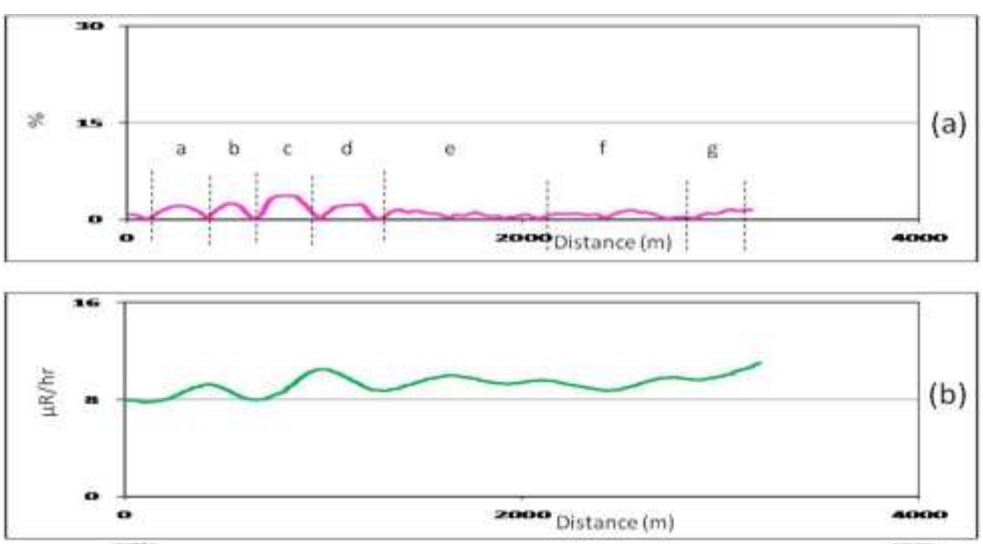

Figure 5: (a) Tectonically disturbed zones are marked on Coefficient of Variation profile and (b) Radiometric anomaly profile along the Traverse-T3

iv) Traverse - T4

The Traverse - T4 (Figure 6(b)) is 3800 long and passes from Komatikuntla through Goparajupalle and further. The anomaly ranges from 6µR/hr to 12µR/hr and the trend decreases towards end of the traverse. Two highs 12µR/hr at 1000m and 10µR/hr at 1950m are observed along with and two broad lows 7 µR/hr from 1200m to 1800m and 6µR/hr from 2500m to 3600m. Seven disturbed zones "a,b,c,d,e,f and g" are observed in Coefficient of variation profile (Figure 6 (a)).

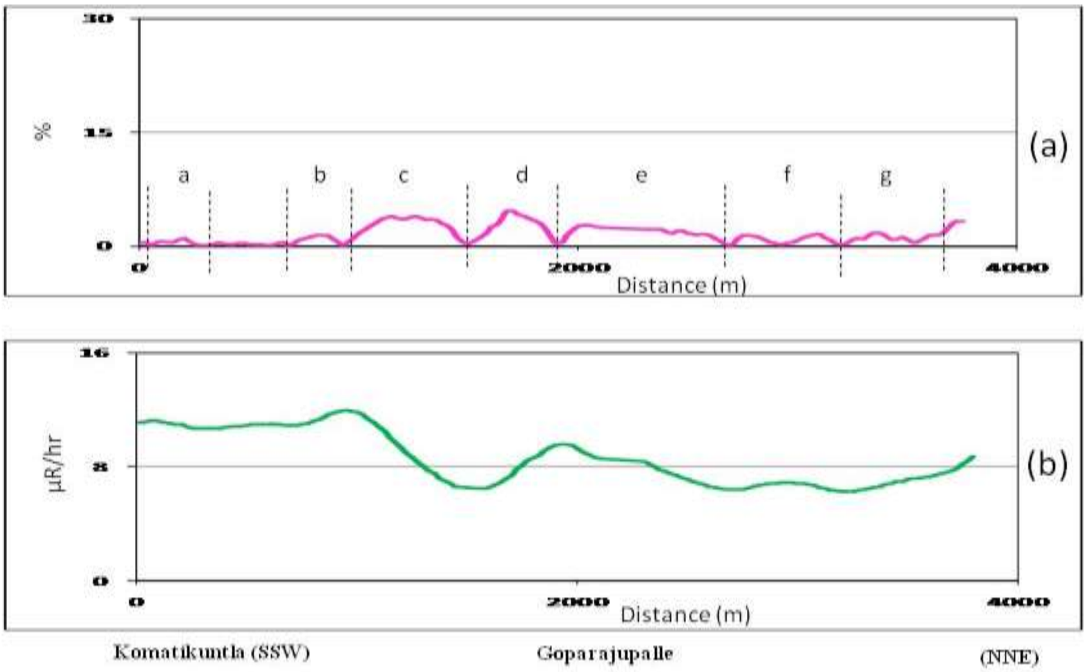

Figure 6 (a) Tectonically disturbed zones are marked on Coefficient of Variation profile and (b) Radiometric anomaly profile along the Traverse-T4

Conclusions

Studies from the Bhimasankaram,1974, infers that Shales and clays are show high radiometric anomalies 3 µR/hr to 10 µR/hr due to large amounts of radio elements, basic igneous rocks (sills) exhibit very low radiometric anomalies < 4 µR/hr and faults & fracture zones also show high anomalies 10 < µR/hr. The results from the radiometric contour map (Figure 2) the high anomalies 10 µR/hr to 14 µR/hr are observed due to fractures/faults. The anomalies from 4µR/hr to 10 µR/hr are due to shales and lows < 4 µR/hr are due to sills. From this contour map the study area which is generally covered with Tadipatri shales it is evidenced that the presence of sills and fault zones at very shallow depth <50cm. The radiometric profiles show the anomaly variations due to difference in geological formations. The Coefficient of variation profiles show that the tectonically disturbed zones which are caused by faults and sill intrusions.

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REFERENCES

Bhimasankaram VLS (1980). The philosophy of integrated geophysical exploration Technology and interpretation. *Journal of Association of Exploration Geophysicists* **1**(2) 1-14.

Bhimasnkaram VLS (1974). Radiometric methods of exploration; *CEG*, OU.

GSI (2001). Geological Survey of India District Mineral resource map of Anathapur district. A.P.

Himabindu D & Ramadass G (2003). A note on qualitative appraisal of radiometric investigations along the Goa-Kushtagi profile *Journal of Indian Geophysics Union* 7(1) 37-41.

King W (1872). The Cuddapah and Kurnool formations in Madras Presidency: *Memoirs of Geological Survey India* **8** 1 1-346.

Murthy NGK (1964). The traps of dolerites in Cuddapah basin *Journal of Indian Geophysics Association* **4** 79-88.

Nagaraja Rao BK, Rajurkar ST, 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, Geological Society India*, Bangalore, 33-86.

Sen SN and Narasimha Rao Ch (1967). Igneous activity in Cuddapah basin, adjacent areas and suggestions in the paleography of the basin: *Proceedings of the Symposium in Upper Mantle Project, GRB &* NGRI Publication, No.8. 261- 285.

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