SJIF Impact Factor 2021: 8.013| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 9 | September 2021 - Peer Reviewed Journal

MAGNETIC DATA ANALYSIS IN PUTLURU AND YELLANURU MANDALS, ANANTAPUR DISTRICT, AP, INDIA

M. Preeti
Research Scholar, Department of Geophysics, Osmania University, Hyderabad, India.

ABSTRACT
In 2007 there was gas leakage from the irrigation borewells in few villages of Putluru and Yellanur mandals of Ananthapur District A.P, India. To identify the structural features which cause the leakage of gas in this region magnetic studies were carried out along few traverses and analysed the data qualitatively and quantitatively. The Total Magnetic Intensity (TMI) contour map and IGRF corrected TMI maps clearly shows the features of low and high magnetic anomalies which indicates two different susceptibilities. Reduced to pole (RTP) technique is applied to the magnetic data to simplify the complex anomalies and generated contour map, in which the structural features are easily identified. The low anomalies are due to Tadipatri shales which are present in this region upto 4km depth and the high anomalies are due to sill intrusions in the shale region. Maximum borewells are located near the edge of these high and low anomalies. These edges indicates the fault zones which is the source for the leakage of methane gas from the deeper depths of the subsurface region.
KEYWORDS: *Tadipatri shales, Sills, Total magnetic Intensity contour map, structural features and faults.*

1. INTRODUCTION

The Magnetic Surveys, one of the most important tools in mineral exploration are fast and cost effective. They provide information on a regional scale in reconnaissance survey as well as in detailed investigations over small areas. Magnetic measurements can be taken on land, water and air.

The earth behaves like a large magnet. Therefore the earth magnetic field induces magnetism in magnetic minerals like magnetite, pyrrohtite, titanomagnetite etc., occurring in several ores. Minor presence of these minerals helps in detection of ores containing them by magnetic methods.

2. GEOLOGY

The present study area is situated between latitudes 14°45' - 14°50' N and longitudes 77°55' - 78°05' E and located in the western side of the Cuddapah Basin. The Basin consists of several sub basins and the main rock groups are the Cuddapahs viz., the Papaghni, Chitravati, and Nallamalai groups and the younger Kurnool groups (Vijayam,1968; Leelanandam,1980).

The Cuddapah basin consists of a very thick sedimentary (Shales) vertical column is about 4km and volcanic rocks sills, flows and dykes are intruded in these shales (King, 1872, Nagaraja Rao et al., 1987, Murty, 1964; Sen and Narasimha Rao, 1967).

The study area- Tadipatri region consist of Tadipatri shales of Chitravati group and few sills and dyke intrusions are present in this area. The NW-SE trending elongated sills are present on the western side and sill outcrops on the northern side. These sills are comprised of metapyroxenite and metagabbro.

SJIF Impact Factor 2021: 8.013| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 9 | September 2021 - Peer Reviewed Journal

3. MAGNETIC DATA ACQUISITION

Total magnetic taken along the roads are with station interval of 200 m in the Tadipatri region of Cuddapah basin as described in the present paper are processed for qualitative and quantitative analysis. The results of the analysis are utilized to examine the natural configuration of geological structures such as faults, sill bodies, boundaries of lithological formations etc., as a part of the integrated studies. As mentioned earlier considering the large station intervals, this is designated as semi detailed survey.

There are 280 magnetic readings were taken along the fourteen traverses (R1-R10 and T1-T4) which are oriented in NNE-SSW, NW-SE and E-W directions. The study area is covered about 64sqkm.

4. QUALITATIVE ANALYSIS

Qualitative interpretation emphasizes on distinguishing relative changes in measured physical properties that may indicate the presence of different geological formations. Derivatives and transforms of magnetic data (e.g. filtering, reduction to the pole of magnetic data and tilt derivative), all based upon mathematically-defined algorithms, help highlight significant and sometimes subtle features within the datasets.

Presentation of Contour Maps

Besides showing the magnetic data as profiles, the data can also be presented as contour maps. Such contour maps of the measured magnetic field facilitate a quick evaluation of the zones of interest in the given area. While closely spaced contours present a higher gradient or a sharp change in values, widely spaced contours represent low gradient or slow change in values. At present, in addition to contour lines, data is also presented in colour images making the interpretation easier and far more precise with regard to locating subsurface geological bodies and structural features. The colour gradation can be varied from 0 to any high values like 8, 16 and even more. Accordingly the magnetic contour maps and colour images are prepared for the study area for further evaluation of subsurface lithology and structure.

i) Total Magnetic Intensity (TMI) Contour Map

Diurnal corrected Total magnetic intensity contour map of the study area with contour interval of 20 nT is prepared and shown in Figure 1. The magnetic field in the area varies from a minimum of 40727 nT in the east and middle part of the study area and assumes higher values amounting to more than 42520 nT in the West, North and the middle. The map also brings out several magnetic highs (shown in red) and lows (blue) besides steep gradients, possibly reflecting the complex assemblage of structural features of varied dimensions and directions. Qualitatively, high magnetic anomalies are inferred to represent the sill bodies known to be present in the area, while the low anomalies are attributed to Tadipatri shales. All the traverses along with the observation data points are shown in this figure. In this map maximum borewells are located on the low magnetic zones.

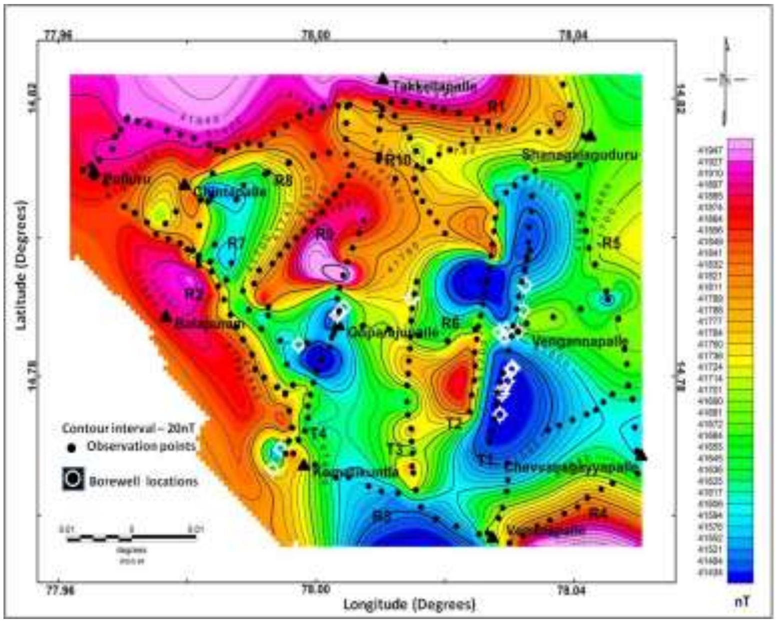

Figure 1. Total Magnetic Intensity contour map of the study area.

ii) IGRF Contour Maps

Besides diurnal correction, as mentioned earlier, the IGRF has also to be removed from the diurnal corrected data. The calculated IGRF, (Geosoft software, Oasis Montaj, 2010) essentially a regional field contour map with contour interval of 1 nT, is shown in Figure 2. It ranges from 41458 nT to 41474 nT. The contours trend in a NW-SE direction showing increase from south to northern part.

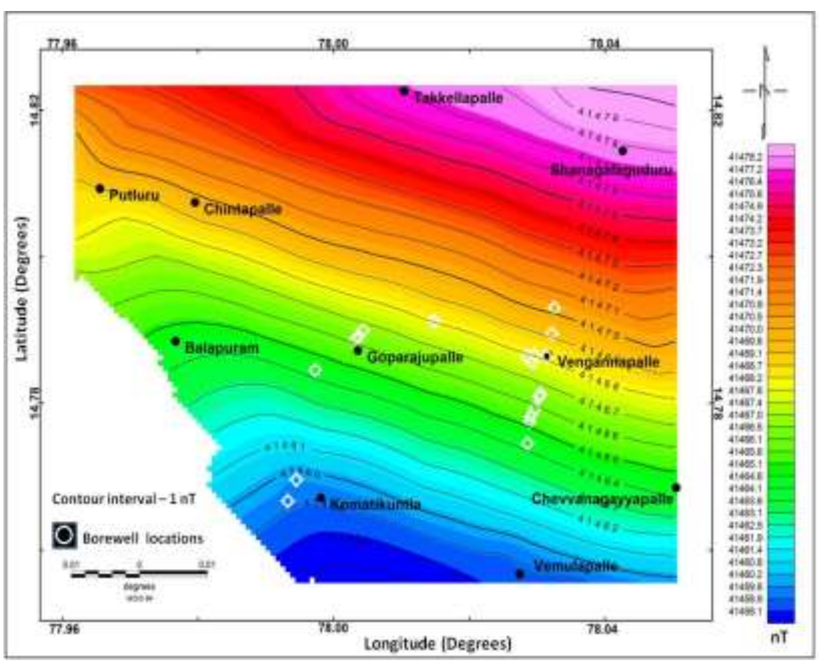

Figure 2. IGRF contour map of the study area.

SJIF Impact Factor 2021: 8.013| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 9 | September 2021 - Peer Reviewed Journal

iii) IGRF Corrected Total Magnetic Intensity Contour Map

IGRF Corrected Total Magnetic Intensity (TMI) map for Tadipatri area is shown in Figure 3. Several magnetic highs and lows may be seen in the contour map.

Eight magnetic highs - H1 to H8 and two lows - L1 to L2 have been delineated in the study area as shown in Figure 3. H1 - trending NW-SE, H2 – (southwest of Chevvannagayyapalle) in the NNE-SSW direction, H3 - southwest of Vengannapalle trending in NNE-SSW direction, H4 - east of Balapuram showing NW-SE trend, H5 - north of Goparajupalle extends in a NE-SW direction and gradually change to NW-SE, H6 - situated north of Vengannapalle, trending in NW-SE direction, H7- northwest of Shanagalaguduru, striking NW-SE and H8 - situated north of Chintapalle trending in N-S direction. These highs are derived from three high zones which are present on the north, west and middle part of the study area.

L1 - Komatikuntla to Chilntapalle via Goparajupalle, in NNW-SSE direction shifts to NNE-SSW, L2 - Vemulapalle to shanagalaguduru via Vengannapalle, in the direction of NNE-SSW and then suddenly changes to NNW-SSE. It may be observed that on the southern part of the L2, the magnetic field shows a bipolar anomaly with a magnetic high on the west and a low on the east and several borewells with gas shows fall in this zone.

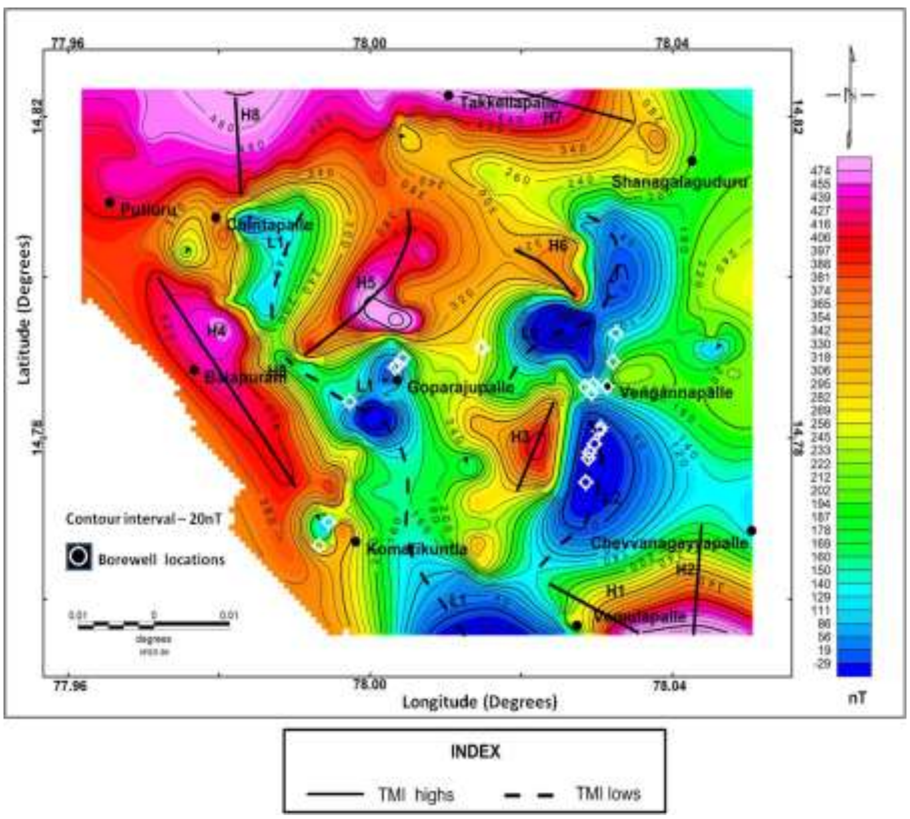

Figure 3. IGRF corrected Total Intensity magnetic field contour map of the study area.

iv) Reduction to the Pole TMI Contour Map

The pattern of magnetic anomaly depends on the shape of the causative body, its dip (inclination) and its orientation with respect to the north pole (declination). The magnetic ore bodies in the presence of earth magnetic field are bipolar in nature. The presence of two poles in the causative body makes the interpretation of anomaly complex. In order to simplify the nature of the anomaly the corrected magnetic field is reduced to the pole (RTP) generally north pole (Baranov and Naudy 1964). This mathematical process, in essence, mimics the presence of

SJIF Impact Factor 2021: 8.013| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 9 | September 2021 - Peer Reviewed Journal

earths magnetic field in the vertical direction. This processing of RTP, yields simpler magnetic anomalies. Commonly the remanent magnetization is small compared to the anomaly. In view of this, it is assumed either the remanent magnetization is negligible or is parallel to the earth's ambient magnetic field. In a given area if this condition is not satisfied, the reduced to the pole (RTP) operation for magnetic anomaly interpretation will yield unsatisfactory results.

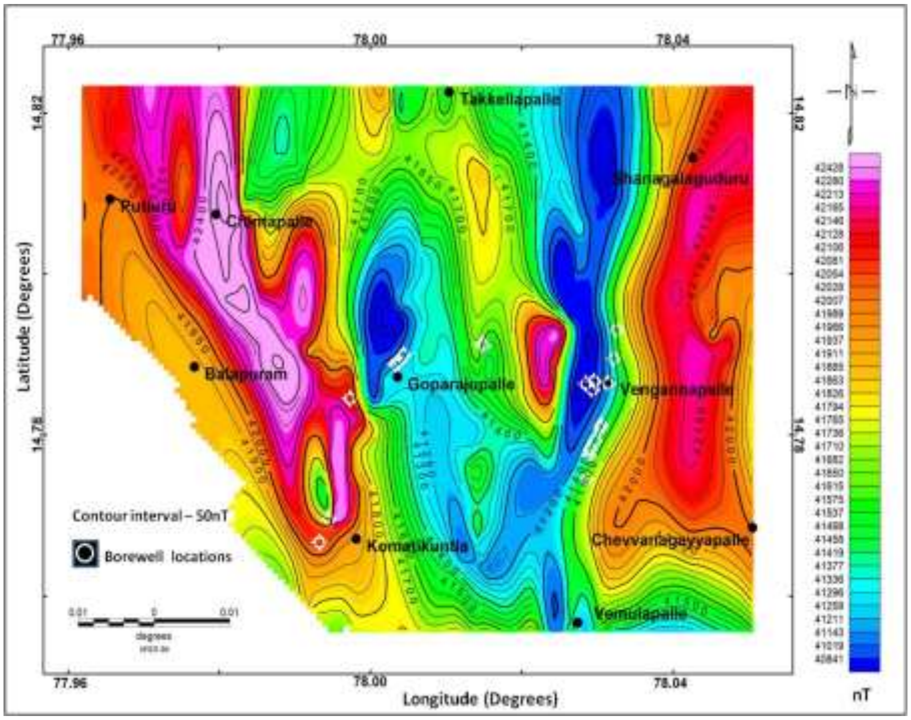

Figure 4.6. Reduction to Pole magnetic contour map of the study area.

Figure 4 shows the contour map of the Reduced to Pole with a contour interval of 50 nT. The RTP magnetic field ranges from 40934 nT to 42526 nT. This map appears simpler compared to the IGRF corrected map shown in Figure 3. The RTP map shows a dominant N-S trend in anomaly pattern. On the western side however, the NW-SE trend remains in tact. The locations of the borewells on the RTP map is very striking in the sense that most of these fall along a N-S direction suggesting that their location perhaps along a possible fault zone. The other borewells also fall on the anomaly edges. These results clearly show the efficacy of RTP maps in providing highly useful clues in the interpretation of magnetic field anomalies.

5. CONCLUSIONS

The Total magnetic intensity (Figure 1), IGRF corrected TMI contour maps (Figure 3) shows the presence of low and high anomalous features which are correlated to the geology of the study area. High anomalous zones correlated to the sill intrusion in the low magnetic shales in the study area. The Reduced to Pole (Figure 4) contour maps shows the anomalies due to monopole effect of magnetic field. In the contour maps high anomalies indicates that the presence of hidden sills in the study area. The edge of these two geological features infers the presence of faults. The maximum borewells are present on these zones which are the source region of the gas leakage from the deeper depth of the subsurface depths.

Acknowledgements

The author is highly acknowledged to the UGC (New Delhi) for awarding UGC (RFSMS) fellowship and Prof and Head, Department of Geophysics, Osmania University, Hyderabad, India, for providing the facilities in the department.

REFERENCES

1. *King, W. (1872). "The Cuddapah and Kurnool formations in Madras Presidency:" Mem. Geol. Surv. Ind., V.8, Part 1, p.p:1-346.*
2. *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, p.p:33-86.*
3. *Vijayam B.E. (1968). Tectonic framework of sedimentation in the northwestern part of Cuddapah Basin, Jour.of the O.U. (science) Golden Jubilee vol. Hyderabad. P.p:63-73.*
4. *Leelanandam C., (1980). Some observations on the Alkaline province in Andhra Pradesh. Curr. Sci., V.60, pp.799-802.*
5. *Geosoft, (2010). Geophysical Processing and Analysis module of Geosoft (GMsys and Oasis Montej).*
6. *Baranov N and Naudy M., (1964). Numerical calculation of the formula of reduction to the magnetic Pole,Geophysics,29, p.p: 67-79.*