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DELINEATION OF SUBSURFACE STRUCTURES BY USING MAGNETIC STUDIES IN PARTS OF NIZAMABAD DISTRICT, TELANGANA STATE, INDIA

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Abstract:

The main aim of magnetic instigations to delineate the structural features like Dyke, Lineament, Fault etc., high and low anomalous trends, mineralized zones were captured in parts of Nizamabad district, Telangana State, India. Magnetic method involves the measurement of earth's magnetic field intensity. The magnetic anomalies were noticed in the study area as blue and red in colours indicates low and high intensity respectively. For regional and residual separation of magnetic field, Low-pass and High-pass filters were used, Reduce to pole (RTP), Tilt derivatives also used for delineating the subsurface structure. The geological structures trends were well noticed by the magnetic analysis, i.e., Dyke, Amphibolite, Banded Magnetite Quartzite (BMQ) in the area.

Key words: Total Magnetic Intensity, Anomaly, Structures, Reduce to pole, Filters, Tilt Derivative.

Introduction:

The geophysical advancement can track with any of the favoured of field information, instrumentation or approach of the study area, refining after preparing and understanding of field information is particularly relevant. The gravity and magnetics methods are major potential field surveys in Geophysics. The susceptibility is more variable parameter than density, i.e., magnetic investigations area most useful in structures delineation (Mita Rajaram et al., 2001). The current examination zone lies in the Indian peninsular shield and comprises of the surrounding portions of Armur territory, Nizamabad District, Telangana State and the total area is about 604 Sq. Km, falling somewhat toward the south of the Godavari River. This investigation zone lies in the piece of the eastern Dharwar craton broadened generally from 78°00'E-78°30'E and 18°30'N-19°00'N and forms combined of 4 toposheets from Survey of India are E44G1, E44G2, E44G5 & E44G6 respectively.

Geology:

A variety of rock types belonging to the Peninsular Gneissic Complex (Archaean) Schistose rocks of Dharwar Supergroup (Archaean - Proterozoic age). Figure 1 shows the geological map of investigation area.Granitoids and younger acidic and basic intrusive (Lower Proterozoic), laterites (Pleistocene) are

exposed in the area.Dharwar Supergroup rocks occur as central focuses, these are addressed by meta basalt, Pegmatite, migmatite gneiss, amphibolite, banded magnetite quartzite and quartzite which are hybridized and granitised in view of later granitic interferences. All the above rocks are profusely intruded by K-rich grey granite, syenogranite and monzogranite of Lower Proterozoic age Grey granite is characterised predominantly by K-feldspar. The basic dyke intrudes in the N – S trending into all the pre-existing rock types, most of them doleritic in nature and remaining are gabbroic.The amphibolite rocks are identified in NW and SE part of the study area. The major portion of the study area is occupied by acidic rocks belongs to Proterozoic age (Radha Krishna, 1956 and Chadwik et al., 1991). The main mineral in the study area is Iron-Ore, Iron ores are identified at Mupkal gutta near Mupkal Village, Renjarla and Balkonda villages are known for magnetite iron-ore which is mostly associated with quartzites called as Banded Magnetite Quartzite (BMQ).

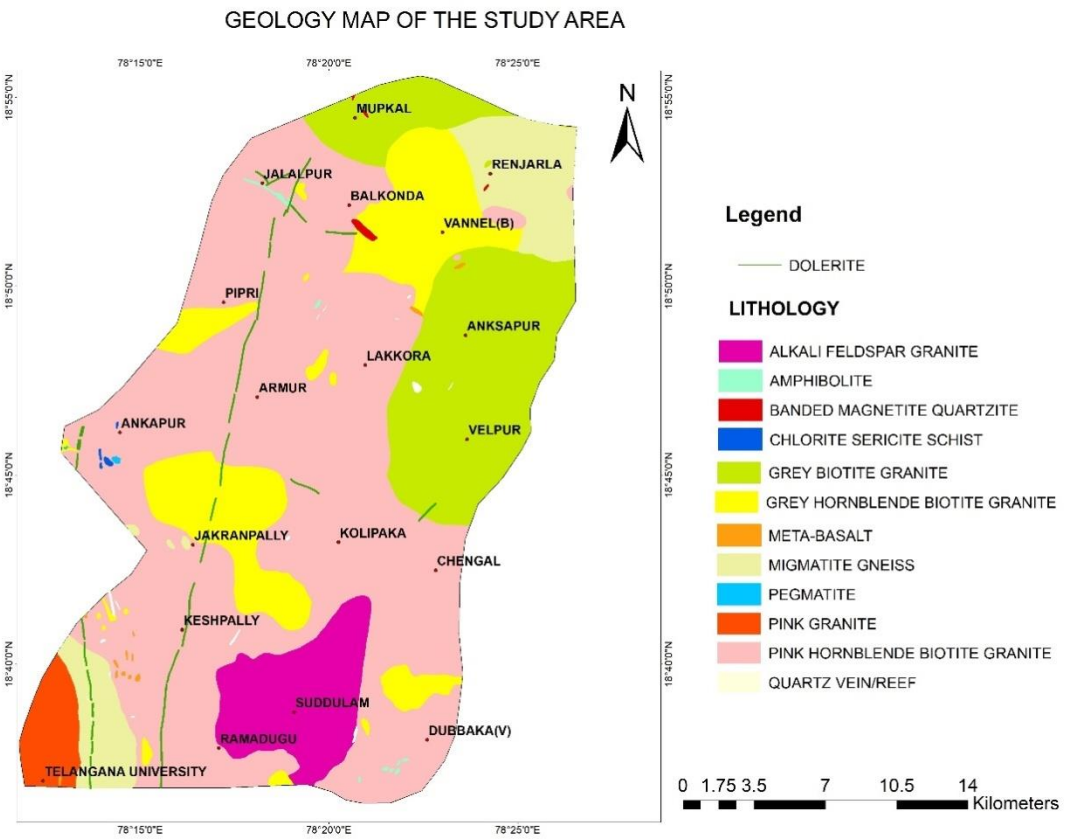

Figure 1: Geological Map of the study area (Source: Bhukosh, GSI).

Magnetic Studies:

The Magnetic Survey is one of the most important geophysical tools for delineating the lithology and sub surface structures. The magnetic survey involves measuring variations of the earth's magnetic field and using the results to study localized geological structures (Hinze et al 2013).Delineating trends and subsurface structures are the main objective of this study, magnetic survey data were subjected to a quantitative and qualitative interpretation involved in some geophysical processing techniques. Magnetic anomaly interpretations were used in extensive of applications in geophysics, including prospecting purposes (Abedi et al., 2013).

The Proton Precision Magnetometer (PPM) was used in the present study in order to generate the total magnetic field measurements of the earth. The ground magnetic surveys were carried out along the accessible areas i.e., mostly covered Major and Minor Roads i.e., 20-30m away from the road for good observation. Therefore, a total 11 traverses were surveyed with a station interval of 200m and of 965 magnetic observations.The Magnetic data distribution map of the study area is shown in the Figure 2. A magnetic base station was established along the traverse and was placed away from power lines and traffic for best result. This was to reduce the time to return to base to repeat the base readings therefore increasing the data quality. The magnetic base was repeated in one and half hour to 2 hours.

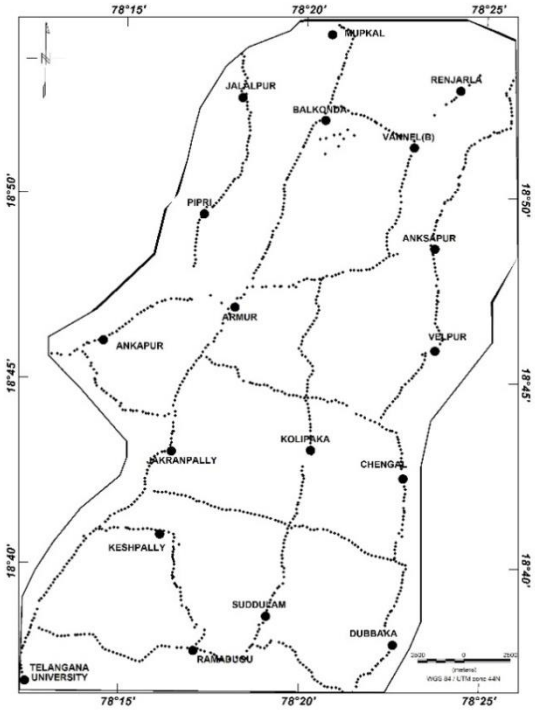

Figure 2: Magentic Data distibution map of the study area.

Discussion of Magnetic studies:

Diurnal corrected Total magnetic intensity contour map of the study area with contour interval of 50 nT is prepared and shown in map Figure 3. The magnetic field in the area varies from a minimum of 43284 nT and higher values amounting 43726 nT. 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. High magnetic intensities observed around the basement are due to basement rocks such as older granites, amphibolite and Banded Magnetite Quartzite (Sridhar Goud et al., 2020).

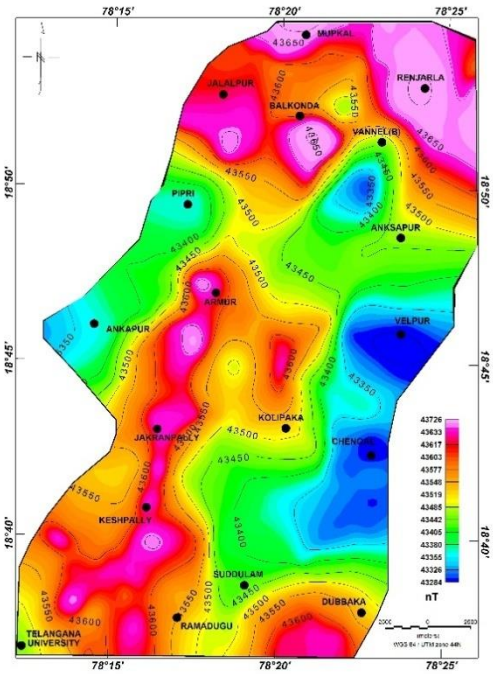

Figure 3: Total Magnetic Intensity map of the Study Area.

IGRF corrected magnetic anomaly map as shown in the Figure 4, High and low anomalies area noticed by H & L. H1, H2, H3, H4 and H5 high magnetic anomalies, H1, H2, H3 and H5 are trending north to south, coincided with geologically dolerite dyke, H4 is coincided with amphibolite, L1 and L2 are low anomalous

trends at Velpur area effected by biotite granite, H6, H7 and H8 are mineralized zones in the area, i.e., Banded Magnetite Quartzite (Iron ore) in parts of Balkonda, Mupkal and Reanjarla Villages.

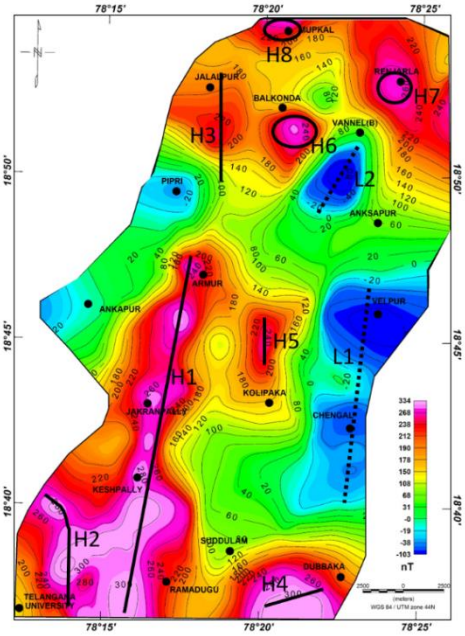

Figure 4: Magnetic Anomaly map of the Study Area.

For the regional and residual separation of magnetic anomalies, Low-pass and High-pass filters were used. The cut-off wavelength is applied for high pass filter is 7.5 Km as shown in the Figure 5, the high pass filtered map is, where in the effect of deeper sources, cultural noise and unwanted signals are effectively removed, shallow basement features detected like BMQ, Amphibolites, small geological bodies, extrusive dyke features etc. Residual Field comes from shallow (near surface) structures and are usually higher in amplitude.The applied wavelength for Low pass filter is 7.5 Km as shown in the Figure 6. Regional Field comes from deep seated structures and these are generally smoother than residual field, The low pass filtered map is like an upward continuation map, where in the effect of shallow sources, cultural noise and unwanted signals are effectively removed and Deeper basement feature detected.

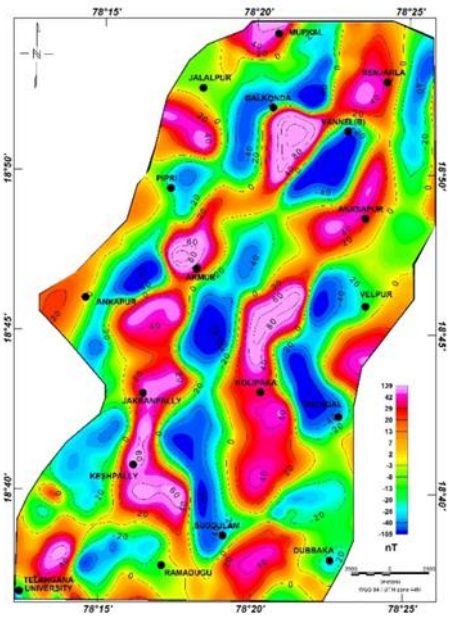

Figure 5: High-pass Filtered Map of the Study Area.

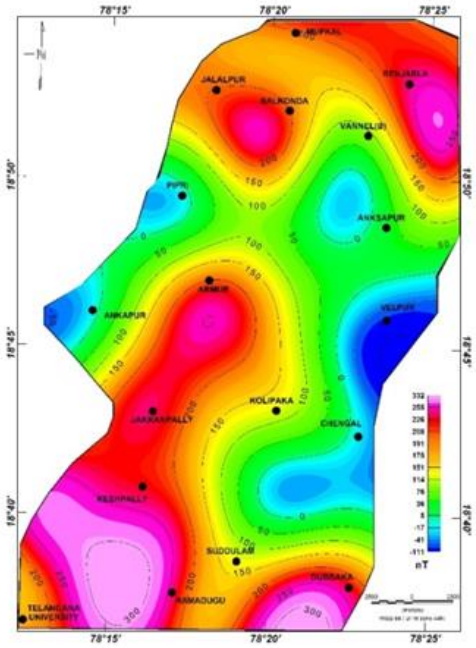

Figure 6: Low-pass filtered Map of the Study Area.

The magnetic field produced by geological bodies are prevented by the inclination and declination of the earth magnetic field. Its difficulty to visualizes the shape and location of the magnetic sources, this prevented overcomes from magnetic field anomaly removes which latitude on the dip angle in the body of the survey area. These magnetic interpretations map of RTP give up a few magnetic features, it can be clearly visible in the Figure 7. The western part and South-eastern part of the study area has high trend and north-eastern part of the area is low trending is observed from RTP map. As the RTP map represents anomalies fluctuate in wavelength and amplitude, it is conceivable to partitioned out the magnetic anomaliese merging from various depth levels (Laxminarayana et al.,2017).

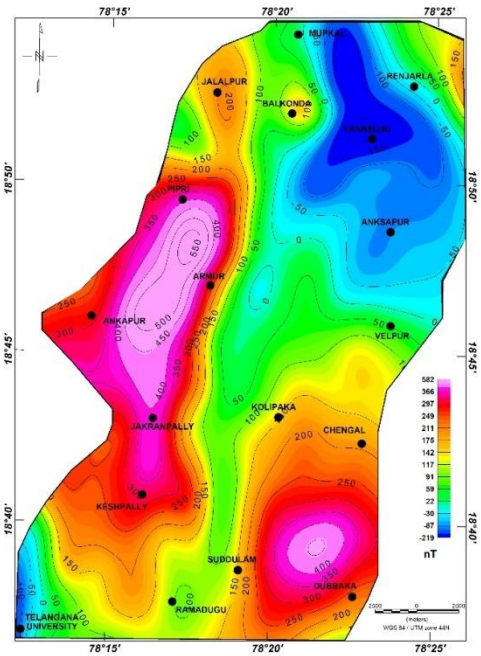

Figure 7 : Reduce to Pole Map of the Study Area.

Tilt derivative map is that is shows a zero-contour line located on (or) close to the contact, the TDR method has the advantage of responding well to both shallow and deeper sources. Tilt derivative utilizes the ratio of the vertical derivative to the absolute value of the horizontalderivative and θ the tilt angle or tilt derivative (Miller et al., 1994; Verduzco et al., 2004) is defined as

$$\theta = \tan^{-1} \frac{\partial f / \partial z}{\partial f / \partial h}$$

Where ∂f/∂z and ∂f/∂h are the first vertical and total horizontal derivatives, respectively of the Total magnetic Intensity.

The N-S of Dolerite dyke trend from Jalalpur to Telangana University, it indicated as high anomalous trend, four lineaments are identified in the study area trending SW-NE, E-W and SE-NW in direction, The positive value of Tilt derivative coincides of Banded Magnetite Quartzite's at Renjarla and Balkonda Areas, the positive values identified at Dubbaka and Jalapur as Amphibolites.The low value of Tilt derivative stretched long trend Ramadugu to Vannel(B), other lows at Ankapur, Velpur and Chengal effected by K-rich and biotite Granites in the area as shown in the Figure 8.

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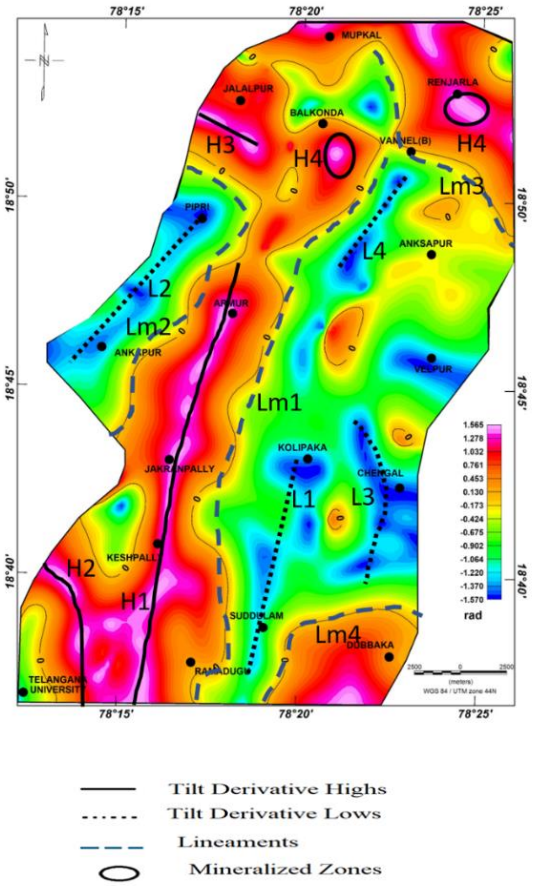

Figure 8: Tilt Derivative map of the Study Area.

Strcutural Map of the study area:

The structures were mapped from Magnetic anomaly map and Tilt derivative maps together. The map as shown in the Figure 9. Black thick lines indicated as high anomalous zones,The long trend is identified in western part as dolerite dyke, SE and NW parts of positive anomalies are identified as Amphibolite correlated by the geology, Eastern side of the trend may indicated low dense body, Black dotted lines indicated as low anomalous trends, Blue dotted lines are indicated as Ground lineaments from the magnetic studies, Black circles are identified as mineralized zones (BMQ).

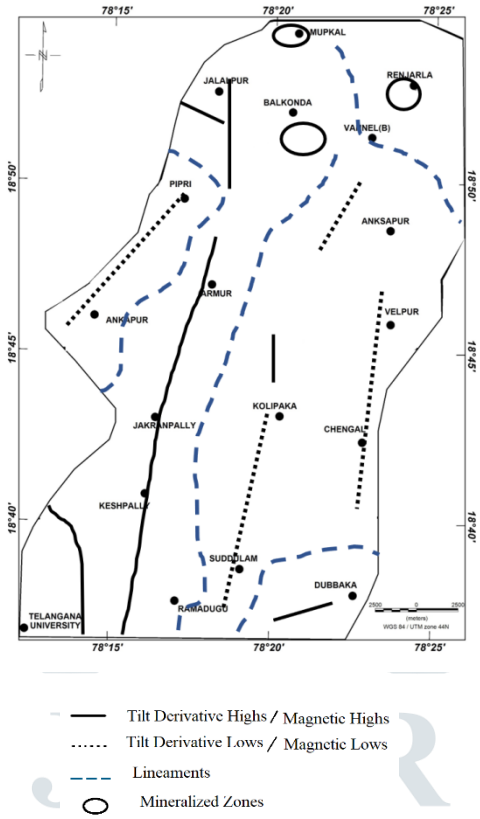

Figure 9: Structural Delineation Map of the srudy Area.

Conclusion:

From the magnetic anomaly map, high and low anomalies were identified.High magnetic anomalies noticed at dolerite dyke, amphibolite rocks and mineralized zones, i.e., BMQ (Iron Ore).The western part and Southeastern part of the study area has high trend and northeastern part of the area is low trending is observed from RTP map. High pass and low pass filters were used for interpret sallow and deeper sources qualitatively. From the tilt derivative map and magnetic anomaly map, the total structures were identified i.e., ground lineaments, dolerite dyke, i.e., trending Dichpally to Jalalpur towards the North, The direction of dyke is South to North (S-N), Jalalpur and Dubbaka areas were mapped as positive anomaly trends due to Amphibolite rocks and another high anomoulous structutres were noticed as Banded Magnetite Quartzite (BMQ)/Iron ore Mineralized zones at Balkonda, Mupkal and Renjarla villages in present study area.

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References:

AbediMaysam, Ali Gholami, Gholam Hossain Norouzi and Nader Fathianpour, 2013. Fast inversion of magnetic data using Lanczos bidiagonalization method. Journal of Applied Geophysics 90:126-137.

Chadwick, B., Vasudev, V.N., Krishna Rao, B. and Hegde, G.V., 1991. The Stratigraphy and Structures of Dharwarsuper group adjacent to the Honnali Dome: Implications for the Archean basin development and regional structures in the western part of Karnataka. J. Geo. Soc. India, 38,457-484.

Keary, P., Brooks, M. 1991. An Introduction to Geophysical Exploration 2nd edition: Blackwell Scientific Publications, Boston. 254 p.

Miller,H.G. and Sing, V. 1994. Potential field tilt – a new concept for location of potential filed sourses. J. Appl. Geophys. 32, 213-217.

Mita Rajaram, Harikumar P and Balakrishna T S, 2001. Comparision of the aero and marine magnetic data over peninsular India. Jour. Geophysics. Vol. XXII, pp. 11-15.

M. Laxminarayana, Ram Raj Mathur and S.P. Anand, 2017.Geophysical attributes to evaluate subsurface structural features using ground magnetic data in parts of Karimnagar district, Telangana. J. Ind. Geophys. Union. V.21, no.6, pp: 457-464.

N. Sridhar Goud, B. Veeraiah, D. Vidyasagara Chary and P. Chandrashekara Reddy, 2020. Delineation of Banded Magnetite Quartzites (BMQ) and their Depth Determination from total filed magnetic data in parts of Nizamabad and Jagtial Districts, Telangana State, india. J. Ind. Geophys. Union, 24(3),40-48.

Radha Krishna, B.P 1956, The Closepet Granite of Mysore State, India. Mysore Geophysical Association (Bangalore) Special Publication. 3, 110 p.

Venduzeo B, Fairhead JD, Green CM (2004), New insights into magnetic derivatives for structural mapping. The Leading edge 23(2), 116-119.