METMINEC (PTY) LTD
MINING THE FUTURE

TANZANIA LITHIUM EXPLORATION

HOMBOLO PROJECT

Magnetic Data Processing & Interpretation Report

Authors:

Permly Shingange: Btech (Geology), M Tech (Geophysics), PhD candidate (Geophysics)

Marcus Petros BSc Hons. Applied Sciences

Reviewed by:

Dr Gerhard Du Plessis: B Sc Hons, MSc, PhD

Approved by:

Godfrey Mothapo: BSc Hons (Geology), MSc (Eng.), BA (Econ)

Name and Signature of the Project Leader:

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Makgamatho Godfrey Mothapo Pr. Sci. Nat

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GLOSSARY OF TERMS

- ***Anomaly*** - generally refers to something that deviates from what is considered normal, usual, or expected.
- ***Earth's magnetic field*** - a shield that surrounds the planet and extends to space. It is generated by the movement of molten iron and nickel in the Earth's core.
- ***Magnetic susceptibility*** - a measure of how much a material can be magnetized in the presence of an external magnetic field.

ABBREVIATIONS

- ***NW*** – Northwest
- ***NE*** – Northeast
- ***SW*** – Southwest
- ***SE*** – Southeast
- ***TMI*** – Total magnetic intensity
- ***RTP*** – Reduced to pole
- ***TDR*** – Tilt derivative
- ***1VD*** – First vertical derivative

DISCLAIMER

Owing to the ambiguity and subjective nature of geophysical interpretations, METMINEC (Pty) Ltd cannot guarantee that the interpretations presented in this report will result in the discovery of mineral deposits. The findings as presented in this report remain interpretations until verified and validated by drilling or other scientifically proven techniques.

1. EXECUTIVE SUMMARY

METMINEC acquired, processed, and interpreted a ground magnetic survey at the Hombolo project site. The objective was to delineate geological intrusions and geological structures associated with pegmatite intrusions and to identify potential areas for follow-up geophysical investigations using active geophysical methods. METMINEC undertook the ground magnetic survey between 18 December 2023 to 03 February 2024 covering a 50 km-line. The magnetic survey lines were orientated E-W at 100 m spacing.

The area forms part of both Tanzania Craton (TC) and Mozambique Mobile Belt (MMB), which are hosts to several known lithium-bearing pegmatites. The project area is characterized predominately by granitic gneiss and undifferentiated soils (weathered materials), with minor gabbroic units to the south. Lithologies encountered on-site during the mapping exercise included dolerite intrusions, migmatites, pegmatite intrusions, pegmatitic granites, porphyritic granites, and granites. The pegmatites are the host rock for lithium mineralization which is sought after.

Two prominent low magnetic anomalies are depicted on the eastern and the western side of the grid. A prominent high magnetic anomaly is observed on the central parts of the grid and towards the western side of the grid. Areas of low to intermediate magnetic anomalies are observed between contacts of high magnetic anomalies. There is a clear-cut-on boundary between the high magnetic dolerite intrusions and the low magnetic granitic country rocks. The magnetic survey was able to delineate geological intrusions and the geological structures associated with pegmatite intrusions.

The magnetic results were conclusive and were used to select target areas for further geophysical investigation using active geophysical methods.

2. INTRODUCTION

Metminec (Pty) Ltd was appointed by ***CGRA Mining Inc.*** to conduct a ground magnetic survey as a reconnaissance tool for lithium-bearing pegmatites in concession PL_17271_2021 situated next to Hombolo Village/town which is about 30 km northeast of the capital city, Dodoma.

The ground magnetic method was recommended to map geological structures and geological intrusions associated with pegmatite intrusions. Clear anomaly boundaries are anticipated with high magnetic susceptibilities associated with dolerite intrusions and low magnetic susceptibilities associated with granitic and pegmatitic rocks. The geophysical survey had the following primary objectives;

- To delineate the geological structures (faults, shear zones) and geological intrusions associated with pegmatite intrusions.
- To identify potential areas for follow-up geophysical investigation using active geophysical methods.

The ground magnetic surveys were successfully carried out between 18 December 2023 to 03 February 2024.

This report thus presents the findings of the survey carried out, and the methodology employed in the data collection, processing, and interpretation of the results.

2.1 Location of project

The survey grid is situated next to Hombolo Village /town which is about 30 km northeast of the capital city, Dodoma (Figure 1), and is characterized by mountainous terrain and thick vegetation.

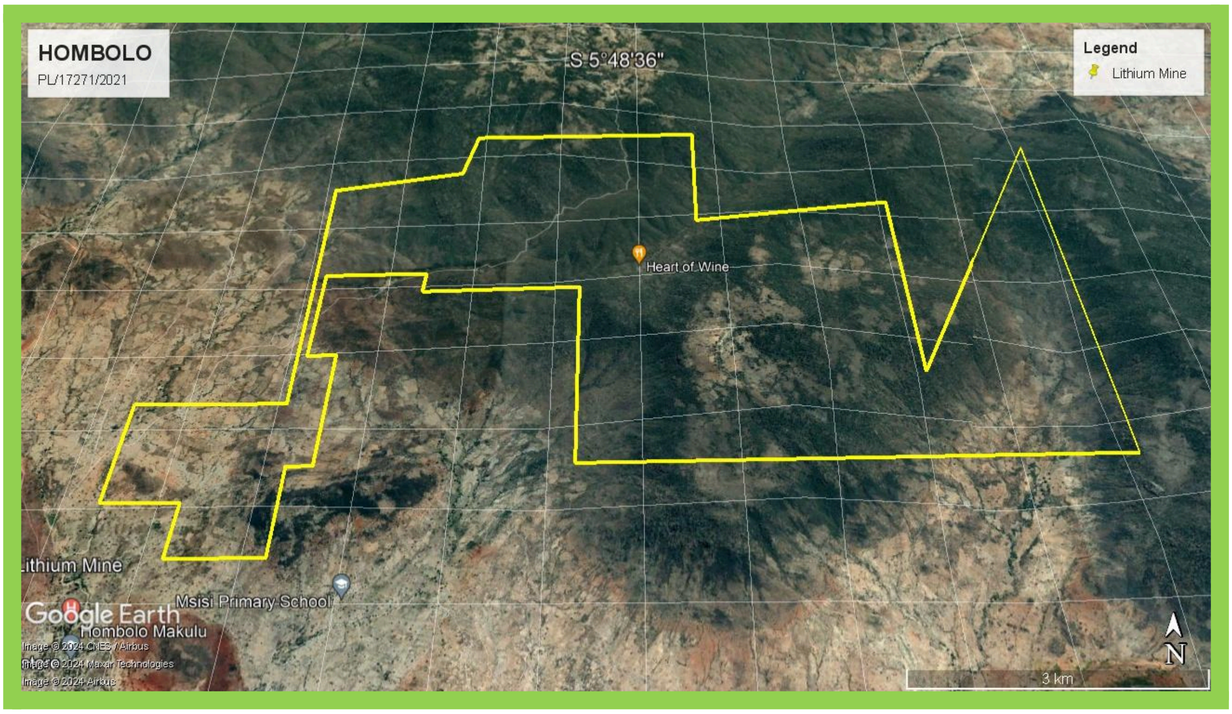


Figure 1: Location of the project area.

2.2 Layout of magnetic profile lines

A total of 50 km -line was surveyed. Survey lines were orientated east to west at a spacing of 100m with variable lengths (Figure 2).

Some lines had to be offset slightly or have small gaps in coverage due to thick vegetation and fields for farming activities.

Figure 2: Magnetic traverse lines.

2.3 Topography of the survey area

The topography of the area is generally flat on the western side (Figure 3). On the central part of the grid, decreased elevations are depicted indicating a valley characterized by streams. On the eastern side of the grid, increased elevations are depicted indicating a steeper gradient. Some areas were covered with thick vegetation, while farming occupied some areas on the flat land.

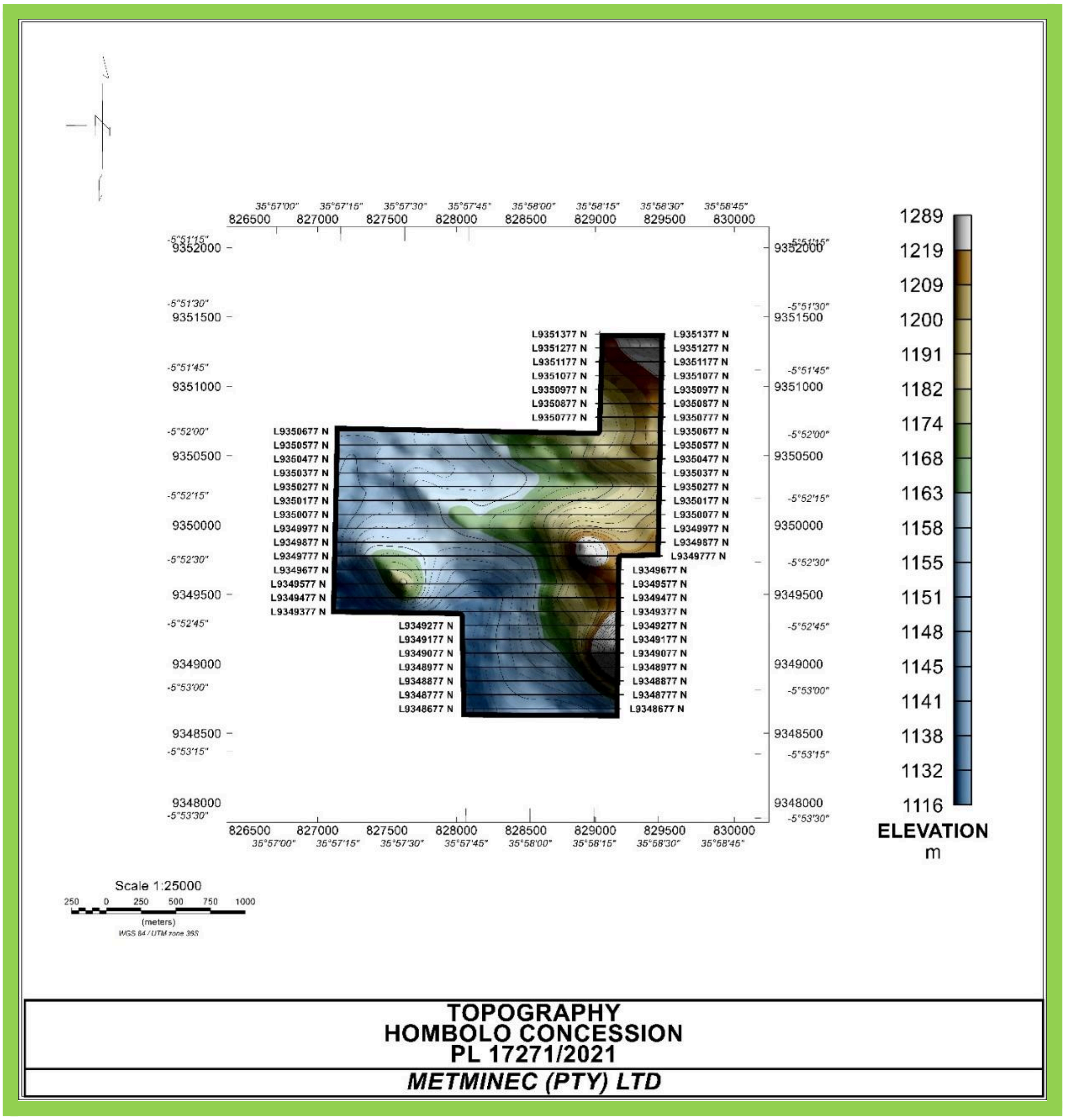


Figure 3: Topography of survey area with traverse lines running E-W.

3. GEOLOGY AND MINERALISATION OF CENTRAL AFRICAN COPPER BELT

3.1 Regional geology

Regionally, the concession is situated within the Tanzania Craton in the center of the East African Rift (EAR) (Figure 4). This craton is bounded to the east and west by the Mozambique Mobile Belt and Kariba Mobile Belt, respectively. Tanzania Craton comprises of Palaeo-to Mesoarchean basement which is largely characterized by diorite to granodiorite orthogneisses with inclusions of supracrustal rocks. This basement is overlain by granitoid-greenstone belts (~2700 Ma) in northern and central Tanzania (von Knorring and Condliffe, 1987).

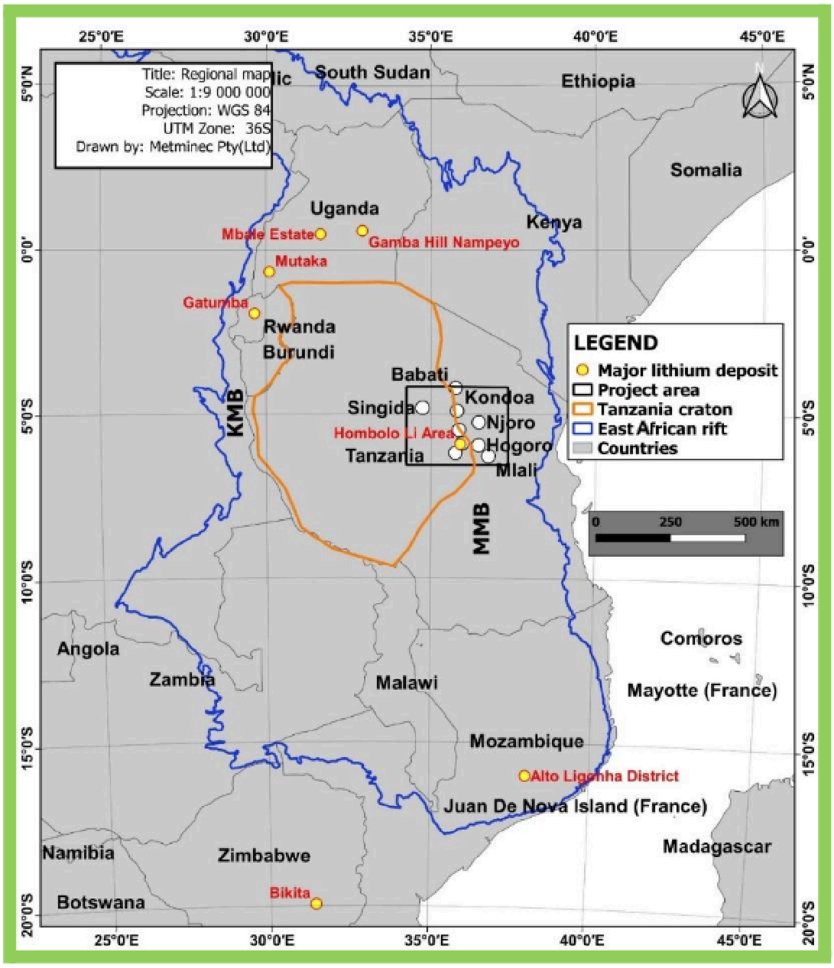


Figure 4: Tectonic region underlying the project area (KMB: Kariba Mobile Belt; MMB: Mozambique).

Mineralized pegmatites occur in a craton which have remained stable over the past 1500 Ma – as well as in the comparatively younger orogens, consisting of mobile zones that have undergone several orogenic deformations during the past 1200 Ma. For example, the lithium-bearing pegmatites of Bikita in Zimbabwe are found in the much older basement rocks of the Zimbabwe Craton (von Knorring and Condliffe, 1987).

3.2 Local geology

The concession forms part of Tanzania craton which is a host to several known lithium-bearing pegmatites around Hombolo. The area is along the Hombolo-Msangani belt which is linked to lithium-bearing pegmatites. In terms of surface geology, the area is characterized predominately by granites, migmatites, and undifferentiated soils including mafic dykes (Figure 5). Granites and migmatites host gneiss and amphibolite which is reportedly known to host lithium-bearing pegmatites around the Hombolo Lithium Block (von Knorring and Condliffe, 1987; Auroch Minerals LTD, 2016).

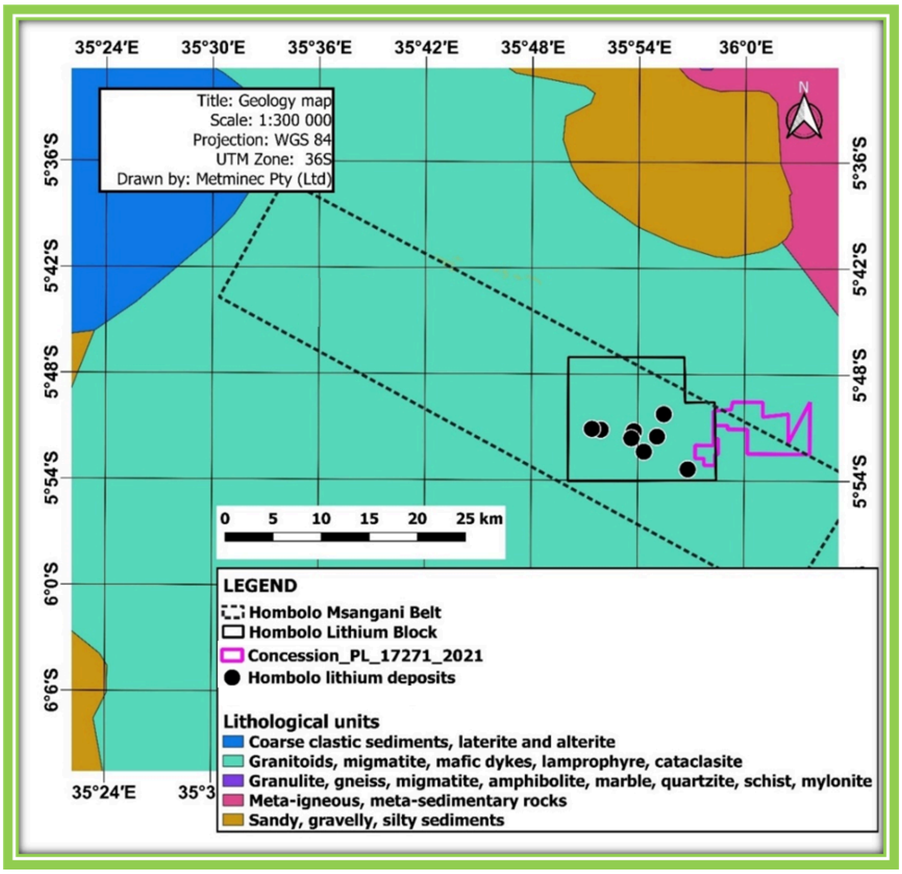


Figure 5: Local geology of the project area.

3.3 Site geology

The lithologies that were encountered on-site during the mapping exercise included granites, dolerite intrusions, migmatites, pegmatite intrusions, pegmatitic granites, porphyritic granites, granitic gneiss, granites, and silicified quartzite veins (Figure 6).

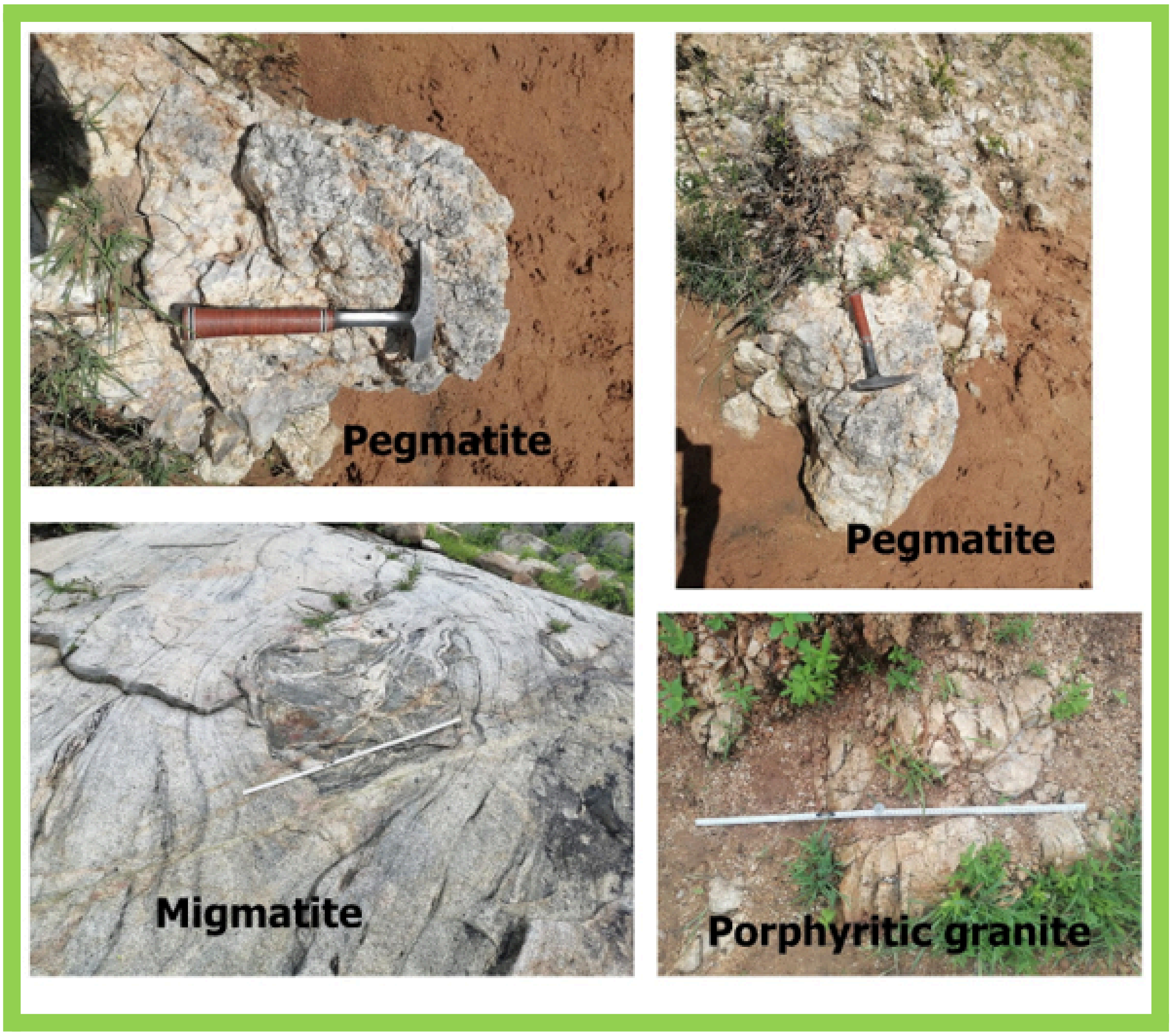


Figure 6: Lithologies observed on site during mapping.

4. GEOPHYSICS LITERATURE REVIEW

Geophysics is a branch of science that uses physical methods to measure the physical properties of the subsurface, along with the anomalies in those properties at the surface of the Earth. Geophysics in mineral exploration is commonly used to detect the presence and position of geological units that may host minerals of economic interest and to discover structures such as folds, faults, etc. that may have provided pathways for mineral-enriched fluids, subsequently forming focal points for mineral deposits. It is important to note that, critical to the success of any geophysical method is the presence of a sufficiently large contrast in the rock properties of the investigated geological units (Thomas et al., 2016).

In addition, geophysics is crucial during geological modelling to ascertain the thickness and depth of potential mineral host rock. Pegmatites generally appear as structurally controlled units and the ability of geophysical methods to locate these geological discontinuities can be of great assistance in the exploration of pegmatite deposits (Thomas et al., 2019).

Various geophysical techniques are used to obtain geophysical data. These include, but are not limited to, magnetic survey, gravity survey, electromagnetic survey, and seismic survey. Depending on the geological environment, geophysics can be used at an earlier stage of exploration to:

(a) locate lithological units of interest considering the dissimilarities of geophysical signatures of target rocks and country rocks, and

(b) structurally controlled bodies; or later when the targets have been verified to provide geologic models of mineral deposits.

5. APPLICATION OF GROUND MAGNETIC METHOD IN HOMBOLO

The ground magnetic survey has successfully mapped the sub-surface of the project area, delineating geological structures such as faults and shear zones as well as geological intrusions associated with dolerite dykes. The magnetic method is a passive geophysical technique that involves measuring variations in the earth's magnetic field and it is an excellent reconnaissance tool in large site areas. It was particularly useful in delineating low magnetic anomalies, and potential areas for pegmatitic rocks. The resulting anomalies obtained from this technique can further be investigated using active geophysical methods to acquire lateral and depth information as well as the geometry of the geological structures and lithologies.

6. DATA ACQUISITION, PROCESSING AND INTERPRETATION

6.1 Equipment and Data Acquisition

Equipment consisted of a GEM systems GSM 19W walking magnetometer and a GEM systems GSM 19 magnetometer. Both magnetometers consist of a sensor, an aluminium pole and an antenna/GPS. The Gem Systems GSM 19W walking magnetometer (Figure 7) was used as the rover magnetometer to collect data in the field and the Gem Systems GSM 19 as a base station magnetometer. Measurements of total magnetic intensity were taken in continuous mode at 60Hz taking readings every 2 seconds.

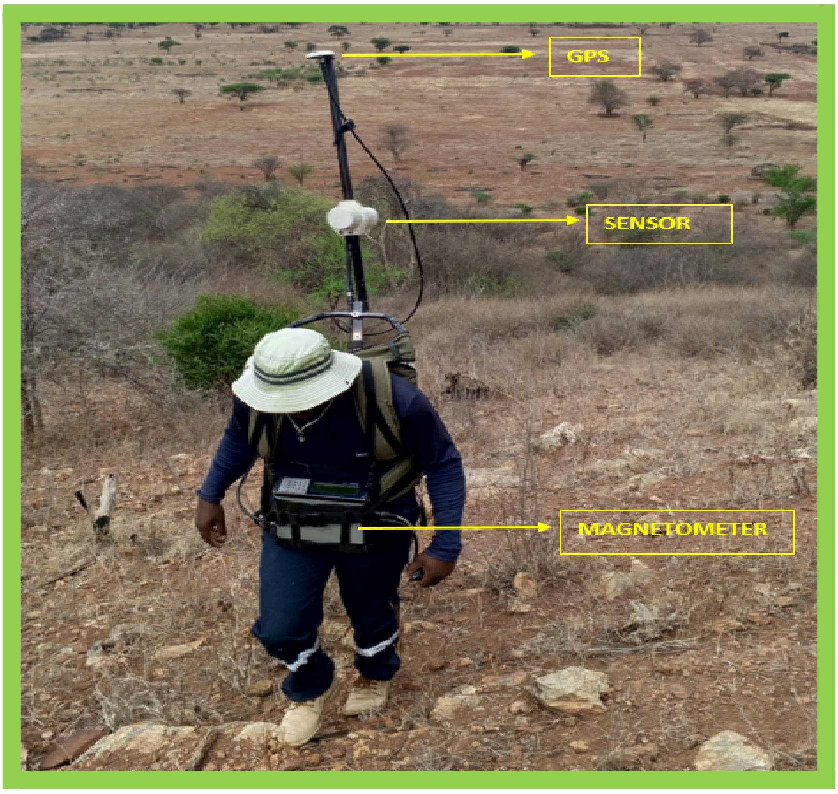


Figure 7: Gem systems GSM 19W with GPS used as a rover magnetometer.

6.2 Field procedure

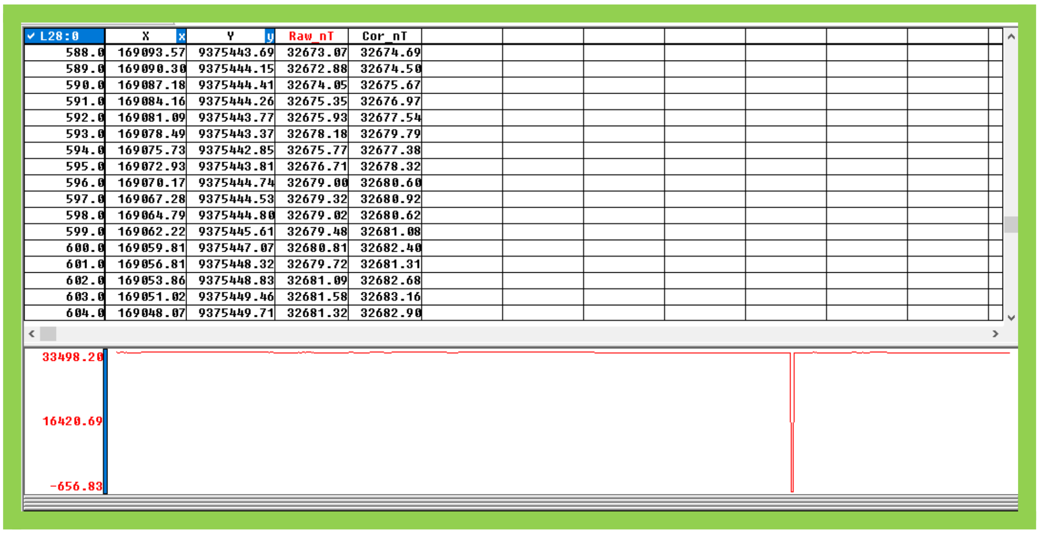
The field procedures included setting up a base station (for diurnal variation corrections) and taking measurements with a walk-mag (rover) along the survey lines. The base station was positioned at a magnetically quiet position, with a low magnetic gradient, and away from any man-made interference such as roads and power lines. It consisted of a sensor and a GPS connected to an aluminium metal pole, which was put upright and tied against a tree (Figure 8).

The base station was operated during every survey day at a time interval of 120 seconds. The time on both base station and rover magnetometers was synchronized to correct for diurnal variations. The rover was moving along the survey line taking measurements at 2-second intervals.

A handheld Garmin GPS was used for positioning using the coordinate reference system **WGS 84 UTM Zone 37S**. The GPS had an accuracy of + or – 3m.

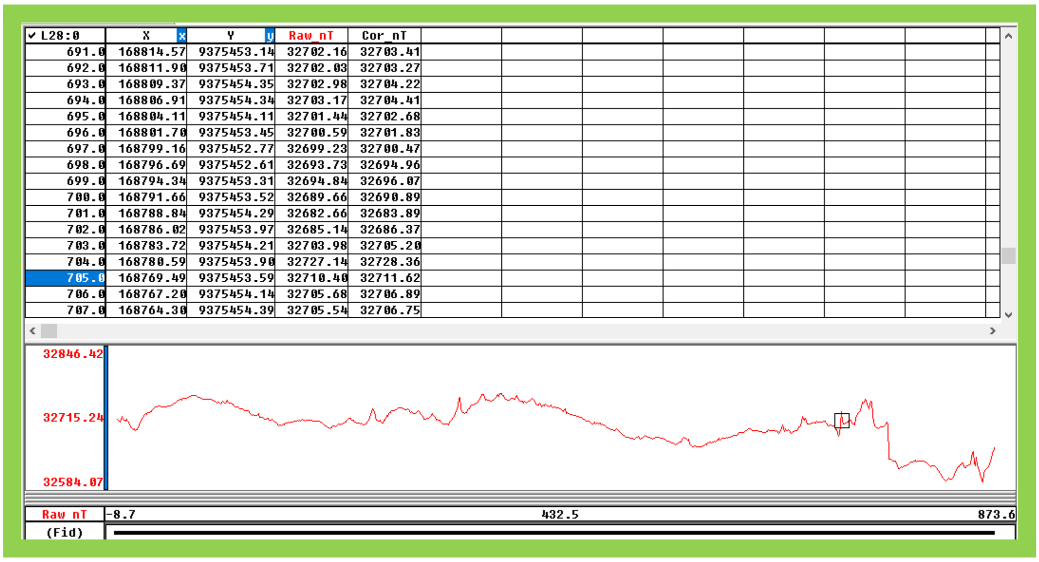
6.3 Quality Assurance Quality Control (QAQC)

Quality Assurance and Quality Control (QAQC) was implemented daily. The QAQC involves the pre-processing of raw data collected, where unwanted points and spikes (Figure 9), referred to as noise is removed or de-spiked (Figure 10).



L28:0	X	Y	Raw_nT	Cor_nT
588.0	169093.57	9375443.69	32673.07	32674.69
589.0	169090.30	9375444.15	32672.88	32674.50
590.0	169087.18	9375444.41	32674.05	32675.67
591.0	169084.16	9375444.26	32675.35	32676.97
592.0	169081.09	9375443.77	32675.93	32677.54
593.0	169078.49	9375443.37	32678.18	32679.79
594.0	169075.73	9375442.85	32675.77	32677.38
595.0	169072.93	9375443.81	32676.71	32678.32
596.0	169070.17	9375444.74	32679.00	32680.60
597.0	169067.28	9375444.53	32679.32	32680.92
598.0	169064.79	9375444.80	32679.02	32680.62
599.0	169062.22	9375445.61	32679.48	32681.08
600.0	169059.81	9375447.07	32680.81	32682.40
601.0	169056.81	9375448.32	32679.72	32681.31
602.0	169053.86	9375448.83	32681.09	32682.68
603.0	169051.02	9375449.46	32681.58	32683.16
604.0	169048.07	9375449.71	32681.32	32682.90

Figure 9: Oasis Montaj database showing profile spiked data.



L28:0	X	Y	Raw_nT	Cor_nT
691.0	168814.57	9375453.14	32702.16	32703.41
692.0	168811.90	9375453.71	32702.03	32703.27
693.0	168809.37	9375454.35	32702.98	32704.22
694.0	168806.91	9375454.34	32703.17	32704.41
695.0	168804.11	9375454.11	32701.44	32702.68
696.0	168801.70	9375453.45	32700.59	32701.83
697.0	168799.16	9375452.77	32699.23	32700.47
698.0	168796.69	9375452.61	32693.73	32694.96
699.0	168794.34	9375453.31	32694.84	32696.07
700.0	168791.66	9375453.52	32689.66	32690.89
701.0	168788.84	9375454.29	32682.66	32683.89
702.0	168786.02	9375453.97	32685.14	32686.37
703.0	168783.72	9375454.21	32703.98	32705.20
704.0	168780.59	9375453.90	32727.14	32728.36
705.0	168769.49	9375453.59	32710.40	32711.62
706.0	168767.20	9375454.14	32705.68	32706.89
707.0	168764.30	9375454.39	32705.54	32706.75

Figure 10: Oasis Montaj database showing the profile of de-spiked data.

Base station measurements were used to correct for diurnal variations (Figure 11). The ground magnetics data acquisition followed the following steps to ensure high-quality data was acquired and processed.

- The Base station for the magnetic survey was placed in a magnetically quiet area and the diurnal variations were within a specific tolerance.
- Spikes were removed for both field data and base station data and were within the specified noise tolerance levels. (GemLink software and Geosoft were used to de-spike the respective data).
- Data that was beyond the specified noise levels either for the base or the field data was acquired again.
- In case of a magnetic storm the data of the day was acquired again.
- The base station magnetometer and the field magnetometer (rover) were tuned within the same position to ensure the readings were in sync.

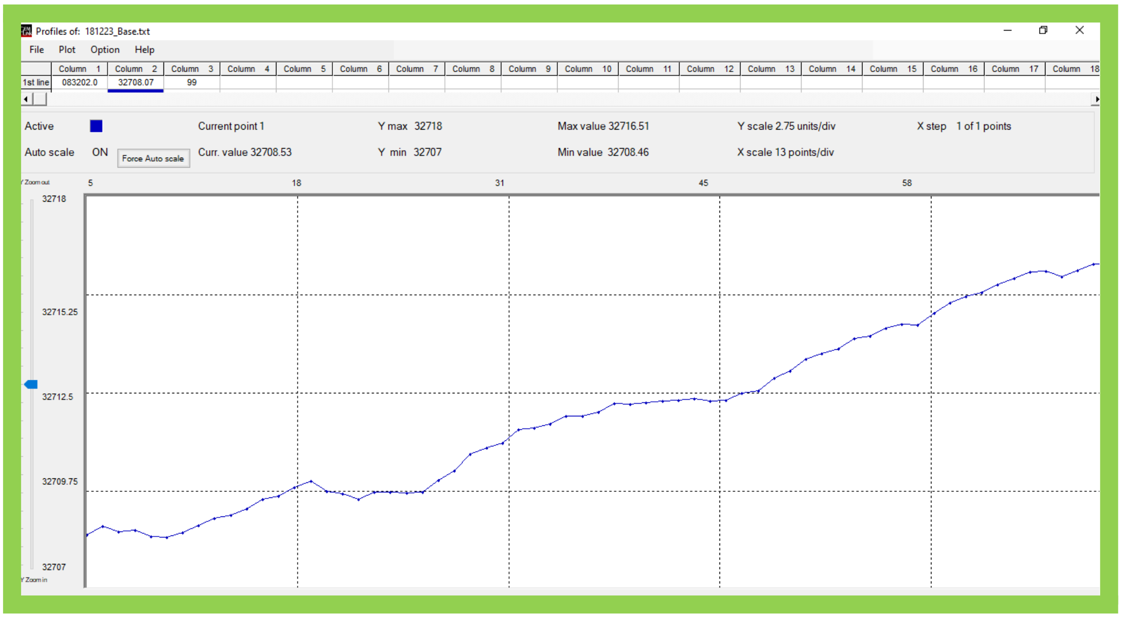


Figure 11: Diurnal variation data from base station magnetometer (GemLink 5.3)

7. DATA PROCESSING

Data was downloaded from the Rover (Figure 12) and base magnetometers using the Gem systems GEM-link 5.4 software via an RS232 cable.

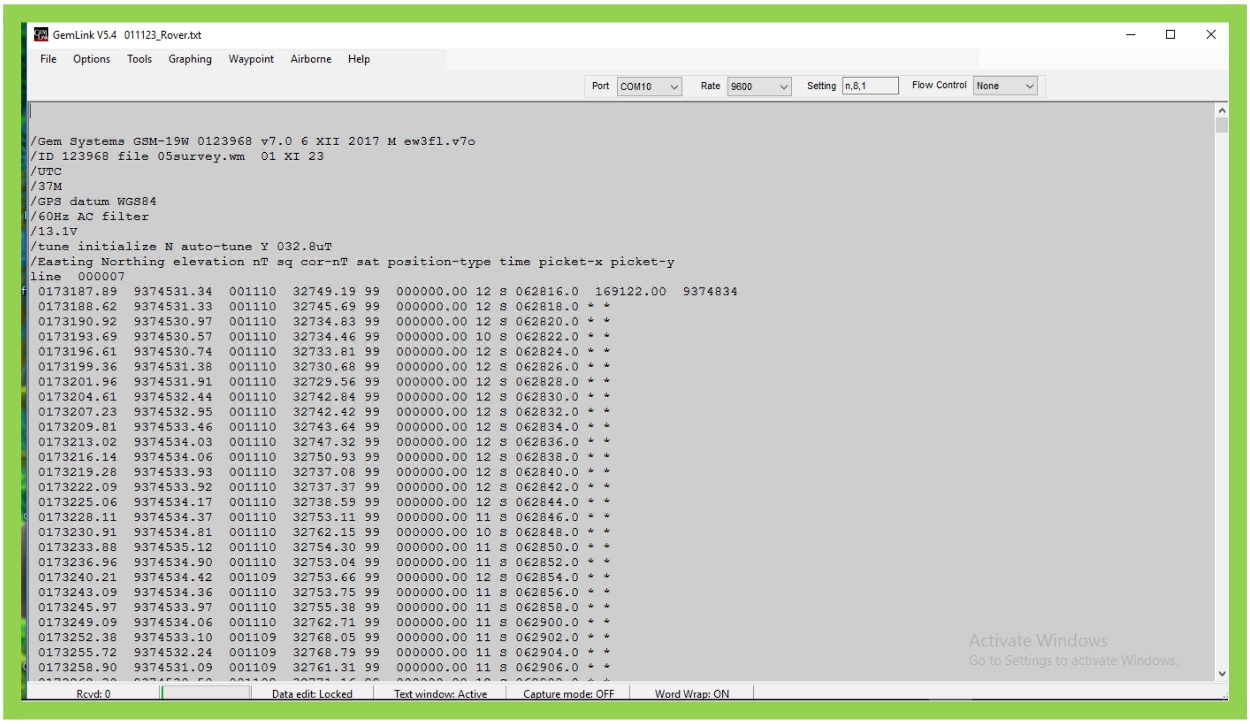


Figure 12: Rover data in Gem-Link 5.4.

The magnetic data was processed in several stages. Diurnal corrections were done on the Gem-Link 5.4 software and the data was exported to **Geosoft Oasis Montaj** for further processing.

Various filter transforms and derivatives of the gridded data were used. A levelled Total Magnetic Intensity (TMI) map (Figure 13) was produced in both the space and frequency domains to aid data interpretation.

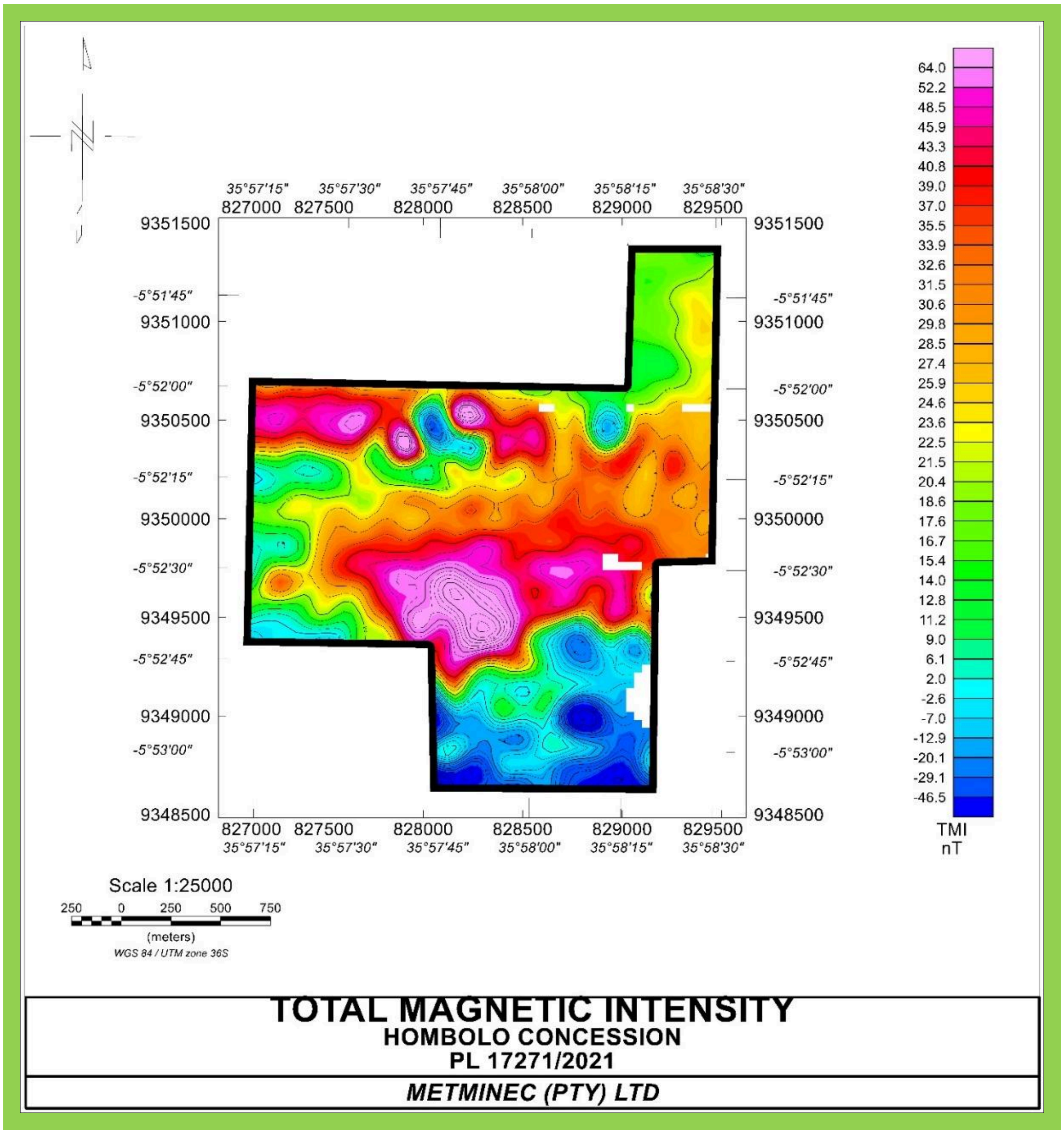


Figure 13: Total Magnetic Intensity map.

Filter operations were applied to reduce the high-frequency noise composition of the data and improve the appearance of the final magnetic images prior to interpretation, albeit without reducing the integrity of the data.

A brief description of the various filters and derivative operators applied to the TMI data prior to interpretation is given below;

Reduced to pole (RTP)

This is a popular filter that simulates how the magnetic data would be if both the geomagnetic field and magnetization of the sources were vertical. It locates the horizontal position of the source through the maximum amplitude of the reduced-to-pole anomaly. The purpose of RTP maps is to eliminate the inclination and declination effects, making the magnetic anomalies easy to interpret (Telford et al., 2009). Figure 14 shows the RTP map that was produced and was successfully used to locate geological intrusions and geological structures associated with pegmatite intrusions.

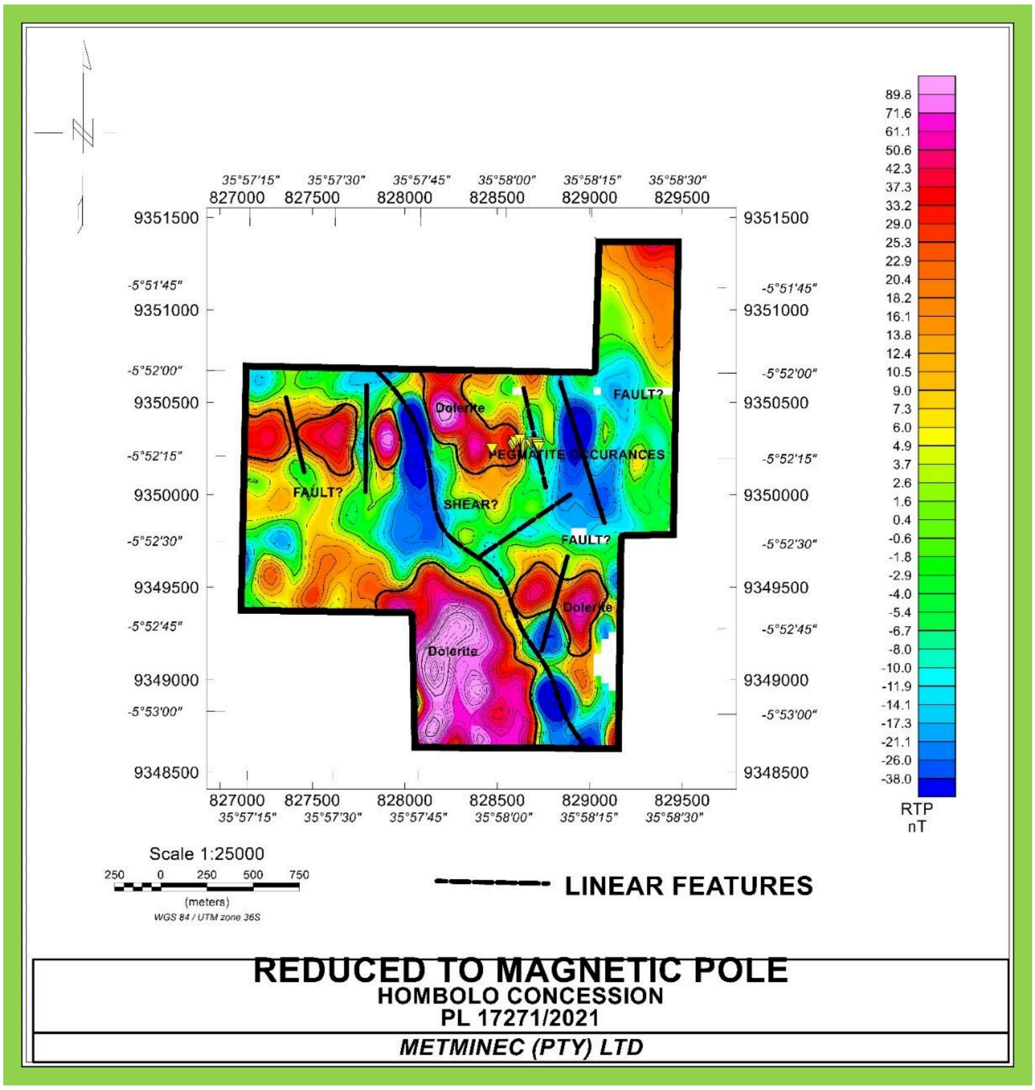


Figure 14: Reduced to pole (RTP) magnetic map.

Tilt derivative (TDR)

The TDR detects the presence of magnetic source bodies, and their edges and peaks. The TDR has the property of being positive over magnetic sources, crosses through zero at the edges of the source, and is negative elsewhere (Ansari et al., 2009). In this study, the zero and/or negative anomalies are of interest as they may indicate areas of pegmatitic rocks. Coordinates of mapped pegmatite outcrops are superimposed on the TDR map to see the correlation (Figure 15).

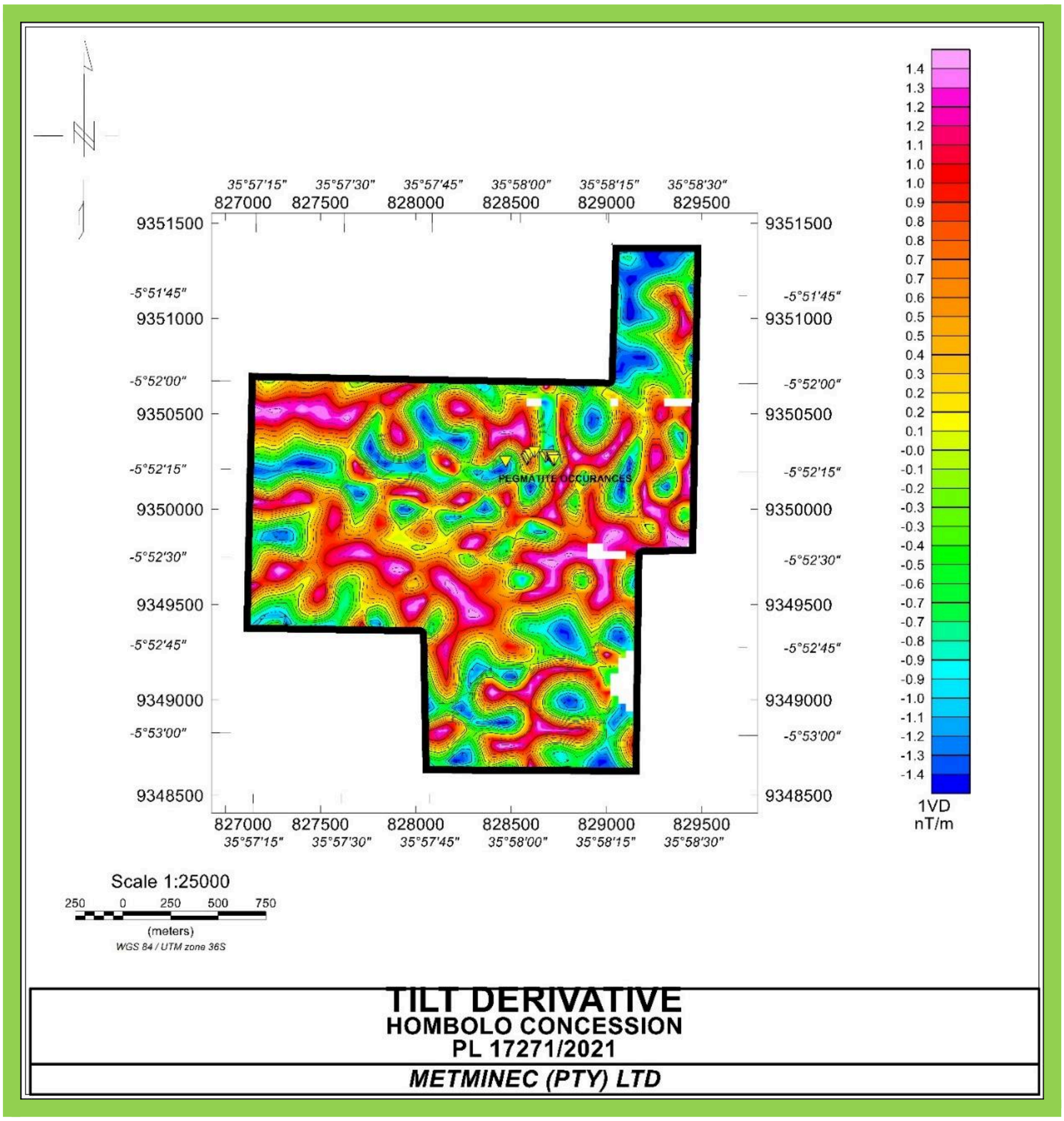


Figure 15: Tilt derivative (TDR) magnetic map.

First vertical derivative (1VD)

The first vertical derivative (1VD) is a frequency domain operator that enhances fine detail by suppressing long wavelength components of the magnetic field and improves the resolution of closely spaced sources. The first vertical derivative is physically equivalent to measuring the magnetic field simultaneously at two points vertically above each other and dividing the difference by the distance between the points, i.e. the vertical slope of the magnetic field. This filter enhances high-frequency anomalies (shallow anomalies) relative to low-frequency anomalies (deep features), allowing a clearer image of the causative body (Ansari et al., 2009). Coordinates of mapped pegmatite outcrops from this study are superimposed on the TDR map to see the correlation (Figure 16).

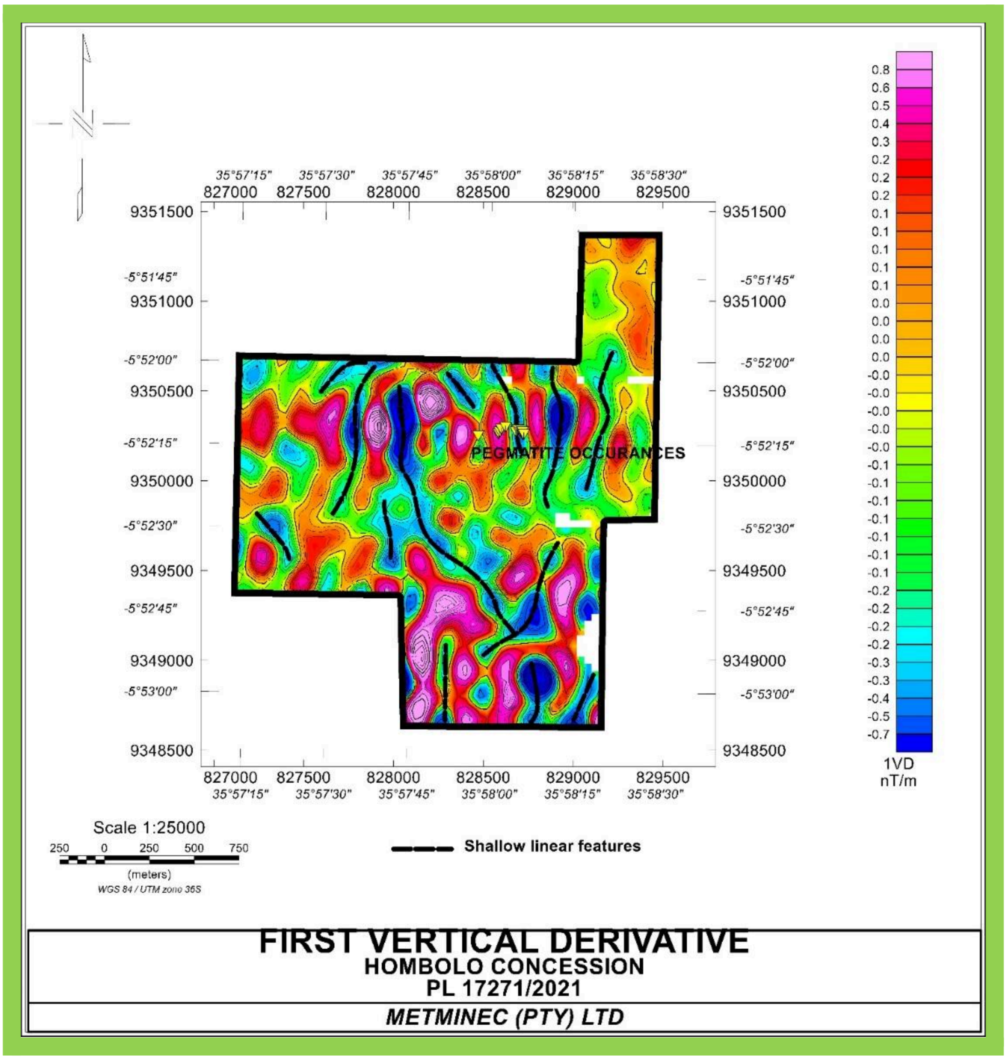


Figure 16: First vertical derivative (1VD) magnetic map.

8. RESULTS

The magnetic survey was conducted on the entire grid at 100 m spacing. The rock types that were encountered on site were categorized by the physical property of magnetic susceptibility. The low to non-magnetic rocks are associated with the felsic rocks containing mostly quartz and feldspars. This statement is applicable if the felsic rocks are not enriched by secondary iron-rich mineralization. The felsic rocks observed on-site include pegmatites, granitic pegmatites, granites, and migmatites. The elevated magnetic anomalies are associated with mafic rocks containing plagioclase feldspar, pyroxene minerals, and minor amounts of hornblende, olivine, magnetite, and quartz. The mafic rock type observed on site is dolerite. Dolerites contain amounts of magnesium and iron which is responsible for their magnetic signature.

The Reduced to pole map (Figure 17) shows two prominent low magnetic anomalies on the eastern and towards the western side of the grid.

A prominent high magnetic anomaly is observed on the central parts of the grid and towards the western side of the grid. Areas of low to intermediate magnetic anomalies are observed between contacts of high magnetic anomalies. The low magnetic anomalies can be associated with the granitic country rock and the high magnetic anomalies can be associated with dolerite dykes cutting across the country rocks.

Possible faulting is observed in several areas on the RTP map, this is indicated by noticeable multiple displacements on the dolerite dykes. Possible shear zones are depicted by intermediate to low magnetic anomalies. Shear zones are significant in this investigation because they provide pathways for the emplacements of pegmatite intrusions.

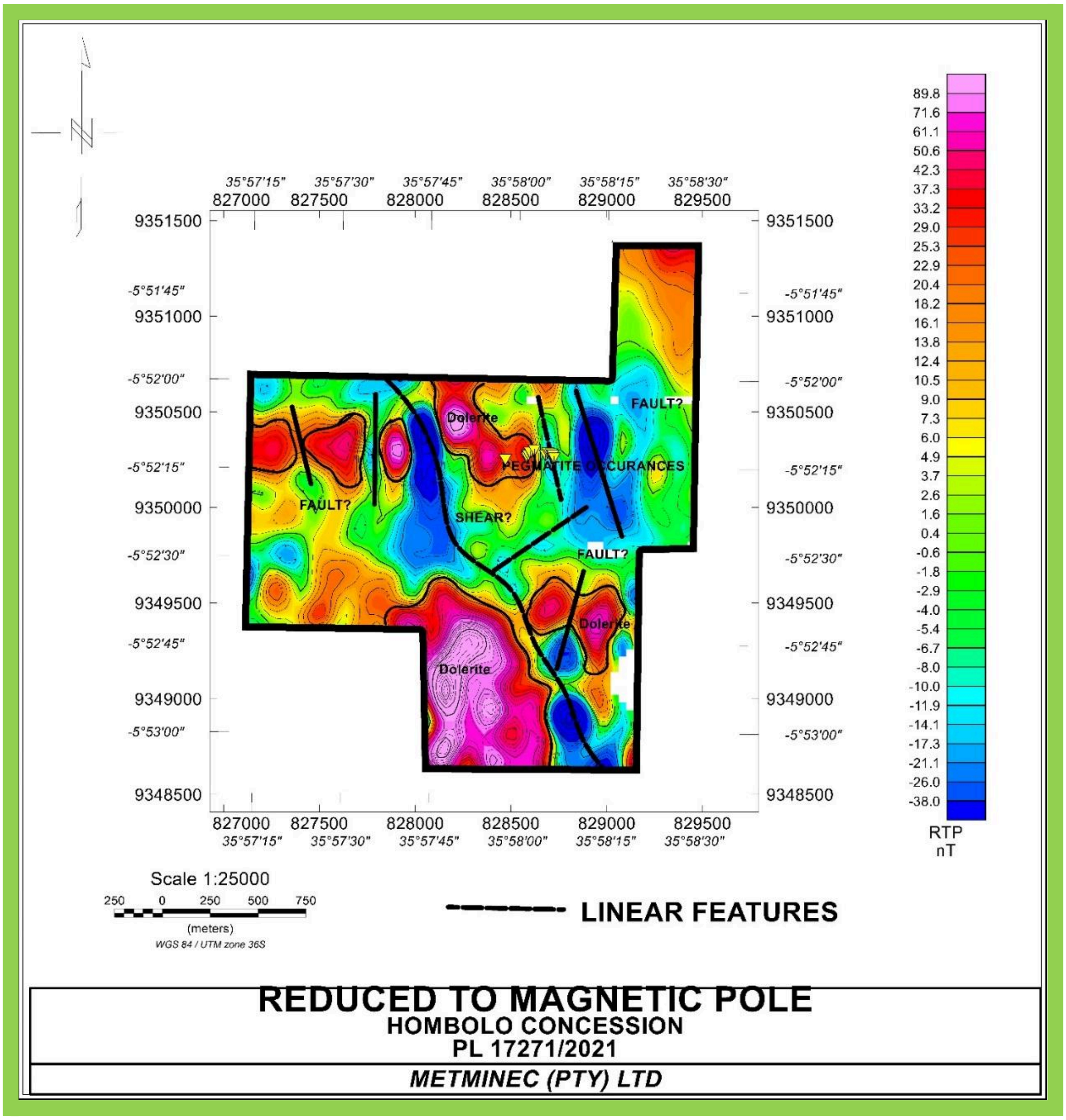


Figure 17: Reduced to pole (RTP) map showing pegmatitic outcrops.

9. DISCUSSION OF RESULTS

There is a clear-cut-on boundary between the high magnetic dolerite intrusions and the low magnetic granitic country rocks. In this instance, it appears that the dolerite dykes intruded the country rock, which was followed by various shearing and faulting phases that produced weak zones where pegmatites could infiltrate. The faulting phases are well indicated by the displacements on the dolerite dykes at several points. The shear zone areas are depicted on the RTP map characterized by intermediate to low magnetic signatures. Shear zones are characterized by intense deformation of the country rocks resulting in faulting and fracturing.

Primarily, there is a relationship between the dolerite intrusions and pegmatite intrusions. Both dolerite dykes and pegmatite intrusions are products of magma activity within the earth's crust. The formation of the two geological structures involves molten rock rising from deeper regions of the earth and intruding existing rock formations. These geological intrusions typically occur as a point of weakness in the pre-existing rock formations, following geological processes like faults, folds, and fractures.

Secondarily, there is a relationship between the intrusion of dolerite dykes, the shearing and faulting events, as observed on the RTP map.

Outcrops of pegmatites observed on the ground during the survey are plotted on the RTP map (Figure 18). Some of these outcrops are plotted on the low - intermediate magnetic zones, which are associated with shear zones. This validates the association of pegmatite intrusions with the shear zones. A few outcrops appear to have plotted on the high magnetic zones (dolerite dykes) close to the contact. This observed scenario could be accounted for by the strong magnetic field produced by the dolerite dyke, which masked the weak magnetic signals associated with the pegmatite intrusion. Migmatite outcrops were also observed on the ground along fault zones depicted on the RTP. Migmatites are igneous rocks that result from partial metamorphism which is an indication of country rock deformation, which validates the fault zone areas depicted on the RTP map.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

The magnetic survey successfully delineated geological intrusions and the geological structures associated with pegmatite intrusions. The magnetic results are conclusive and were used to select target areas (Figure 18) for further geophysical investigation using active geophysical methods.

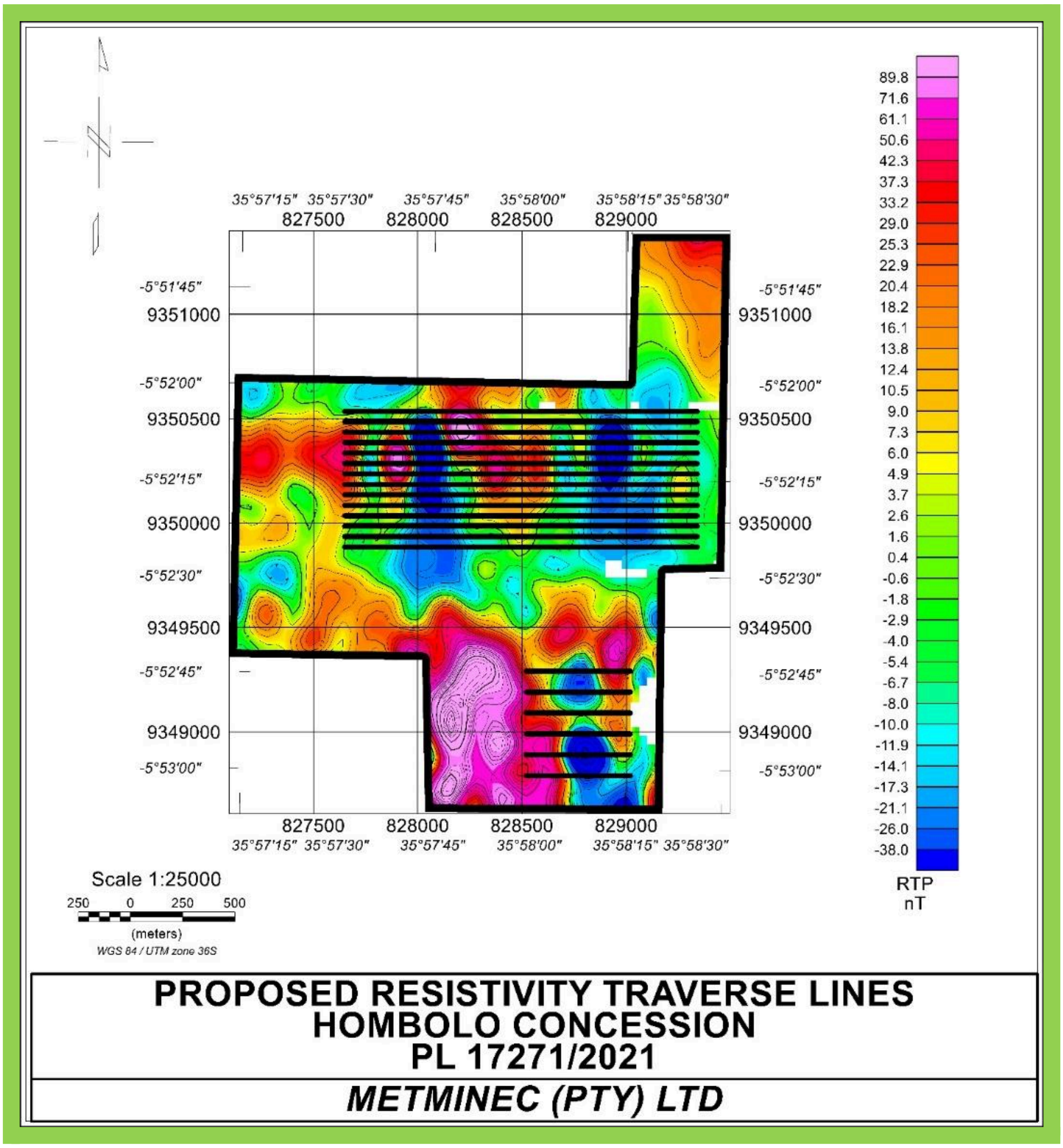


Figure 18: Proposed resistivity traverse lines.

10.2 Recommendations

It is recommended that further geophysical investigations be carried out on the targeted areas from the magnetic survey. DC resistivity method is proposed to further survey the targeted areas to obtain the following information;

a) Lateral and depth information of the pegmatite intrusions

b) Position of possible drill targets

A 30 km-line DC resistivity survey is therefore recommended.

11. REFERENCES

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