Propost to discriminat of Monte Carmelo Magnetic Anomaly through air magnetometry and land magnetometry, Alto Paranaíba, Minas Gerais, Brazil

Marco Aurélio Marques Pereira[1], Leonardo Guimarães Miquelutti[1] and William de Souza Santos[2].

[1]Instituto de Geografia da Universidade Federal de Uberlândia
[2]Instituto de Física da Universidade Federal de Uberlândia

Abstract

This work presents preliminary aeromagnetic data results acquired over a set of anomalies in the vicinity of Monte Carmelo. They are basic and ultrabasic rocks over the Azimuth 125, and we aim to study individualize one kimberlite. In this initial stage, we properly identified and limited the anomaly using public aeromagnetic data from 1970 and acquired land magnetic data irregularly distributed over the target. We also show an initial stage result based on a more recent aeromagnetic dataset, acquired in 2006.

Introduction

The magnetic anomalies between Monte Carmelo and Romaria cities were first identified in the early 70's through aeromagnetic data. Geological and geochemical surveys recognized basic and ultrabasic rocks as gabbro, amphibolite and pyroxenites with low Ni, Cu and Co content to be put under exploration (CPRM, 1978).

Drillings carried out in 2006 over one of the anomalies by a mining company identified a kimberlite with volcanoclastic breccia fabric. Also, the recent availability of aeromag/gamma data from Area 7 (Figure 1) boosted the development of geophysical studies along the Azimuth 125. The Azimuth 125 is a 2000 km length x 70 km wide magnetic lineament that cross Brazil in the NW-SE direction, where our target is laying over together with several other anomalies spread over its length (MORAES ROCHA, 2014). In Figure 2 the Azimuth 125 is the NW-SE trends and our study area in a white rectangle.

This work presents preliminary aeromagnetic data results. Figure 3 shows the 1970's aeromagnetic data result and survey design based on it. The main goal is to better understand and individualize the kimberlite where the drilling was carried out.

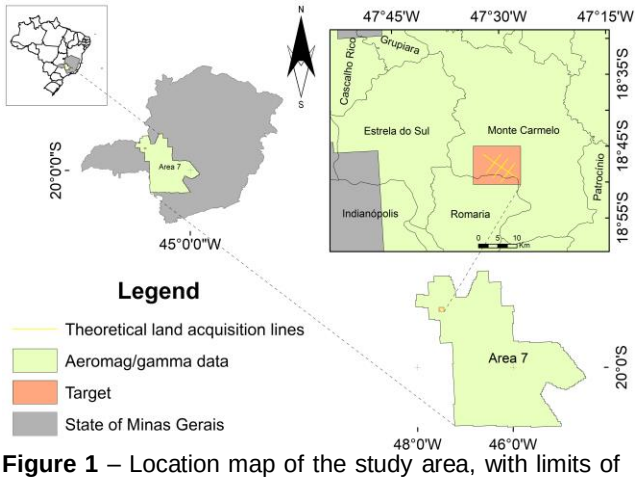

Figure 1 – Location map of the study area, with limits of the 2006 survey (named Area 7) and the land acquisition design in detail

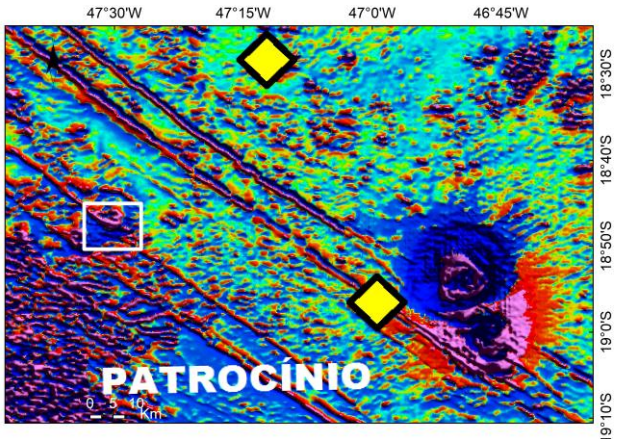

Figure 2 – Vertical derivative colored map highlighting NW-SE structural domain of the Azimuth 125 and some magnetic anomalies. White rectangle displays study area. Source: CODEMIG.

Method

The newer aeromagnetic data were acquired in 2006 with flight lines in N-S direction and control lines oriented E-W. Line spacing equals 400 meters for data and 800 meters for control. Flight altitude is 100 meters with aircraft average speed of 280 km/h, with readings at 0.05 seconds with Scintrex® CS-2 cesium magnetometer sensor with 0.001 nT resolution.

Land data were acquired with GSM-19T from GEM Systems based on protons precession. Yellow lines in Colors in Figure 3 depicts the analytic signal map based on the 1970's data. It also shows the theoretical survey design (based on the color map), later adapted due to a better acquisition logistics: it is easier to acquire on roads. The acquisition lines were drawn to cross the anomaly parallel and perpendicular to its main orientation direction, and readings were taken in average at each 100 meters.

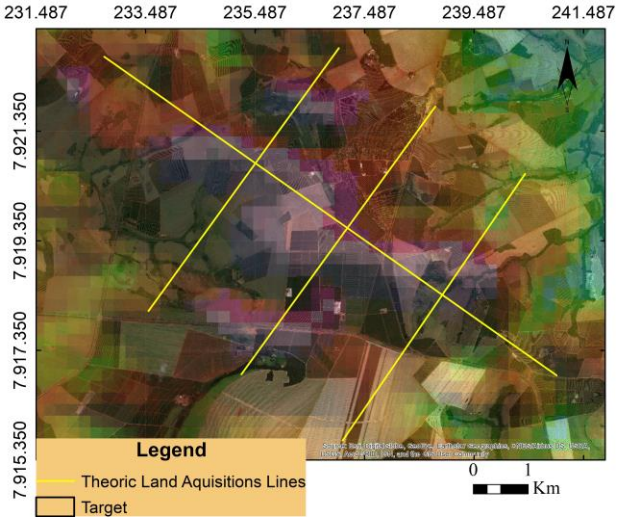

Figure 3 – Magnetic analytic signal map overlaying satellite image. Survey path design are the yellow lines, meant to cover the anomaly

Results

It is possible to notice an oblate magnetic anomaly with NW-SE orientation based on the magnetic analytic signal map. This anomaly disposition may indicate formation period of the local lithologic assembly concomitant with or after the Azimuth 125 formation.

During the land acquisition we noticed the occurrence of laterite near the highest magnetic field values measured. The lateritization did not eliminate the remanent magnetization. This indicates igneous origin that may be associated either to gabbro or the kimberlite due to the great amount of ferrous minerals these rocks present.

We inferred the anomaly dimension through Figure 3 as 16 x 10 km in the NW-SE and NE-SW directions respectively.

A first residual magnetic anomaly map aeromagnetic survey from 2006 is shown in Figure 4. The white markers represent the land acquisition sites. It is important to remark that the color map **is not** the land results, currently under processing. As we can see, the results displayed in Figure 3, which is the base for our land acquisition design, differs from Figure 4, whose data were recently made available for us.

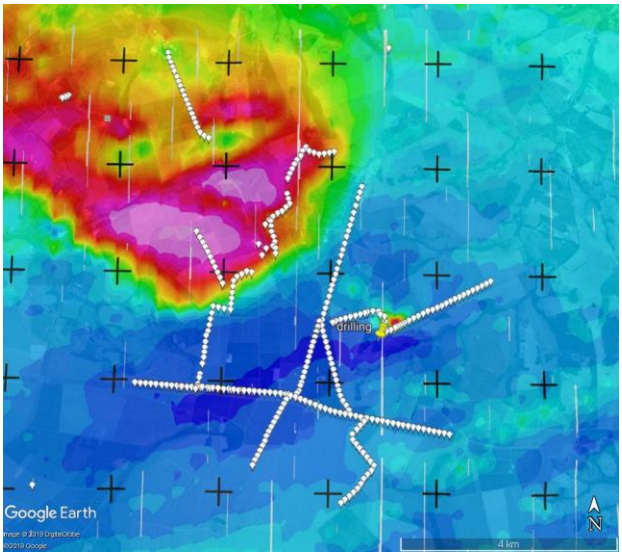

Figure 4 – Colors represent the residual magnetic field. White markers show the land acquired sites. Yellow pin represents the drilling location

Conclusions

This is a study of economic importance due to the diamondiferous potential observed in kimberlites in the same region. Further processing and refining of the newer dataset is required to improve results and matching between both aerial datasets. This way will be possible to assess the land distribution sites to improve coverage over the target.

Future Work

We gathered public land and satellite gravity data to test the hypothesis of whether the target will respond to such dataset and distribution. We will produce a map of Bouguer anomaly to assess the response of the body to the gravity method. The response will be also tested with gravity modelling and inversion in case the Bouguer anomaly map presents significant result over the target.

Also, the response of the target to this new 2006 magnetic dataset distribution is currently under test with modelling procedures as well. To join land and aerial data for processing and inversion, a land acquisition will be performed under one of the flight N-S lines, and data will be joined through upward continuation. The main goal is to produce an image/volume that represents the subsurface with fidelity.

Acknowledgments

The authors acknowledge Universidade Federal de Uberlândia for all the support provided; Observatório Nacional for freely lending the magnetometer, and people there that supported our research with advices, as Sergio Fontes, Alcides Santos and Jonne Vidal; GAR Mineração for sharing the drilling results.

References

CPRM. Projeto Monte Carmelo. Relatório Final de Pesquisa, 146p. 1978.

Moraes Rocha, L. G.; Pires, A. C. B.; Carmelo, A. C.; Araújo Filho, A. O. 2014. Geophysical characterization of the Azimuth 125° lineament with aeromagnetic data: Contributions to the geology of central Brazil. Precambrian Research, V. 249, p. 273-287.