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2D Geophysical Modeling of the Ponta Grossa Arch: a transverse and inferred axial planes model

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Introduction

The Ponta Grossa Arch (APG) is a tectonic structure interpreted as a crustal flexural fold formed during the opening of the Atlantic Ocean, located in the transition between the Ribeira and Dom Feliciano belts. Its magmatism overlies the southern Santos Basin, and its structure is spatially associated with the Ponta Grossa Dyke Swarm, a set of basic intrusions with a predominantly NW-SE orientation along a structure that has existed since the Devonian and which crosses the Paraná Basin up to the Transbrasiliano Lineament. Therefore, this study seeks to update the APG model, investigating its structural and geological variations between the NW and SW flanks, as well as its axis, and their relationship with the regional tectonic configuration by means of 2D gravimetric modeling and application of Werner deconvolution.

Method

The method used was 2D gravimetric modeling, done with the GMSYS-2D module of the Oasis Montaj program, and Werner deconvolution, also applied with the same program. The data used was provided to the Applied Geophysics Research Laboratory (LPGA) by the Banco Nacional de Dados Gravimétricos (BNDG).

To determine which data would be used in the 2D modeling and Werner application of each transect, two perpendicular lines of points (data) and a concordant line in relation to the inferred APG axis were constructed by determining three or more coordinates (start, constrain(s) and end) and inserting them into a python algorithm in the Google Colab interface, where an adapted version of the traveling salesman solution was used to determine a path based on the proximity between the points (nearest neighbor) and the configured thickness of a rectangular buffer. The gravimetric anomaly used for the modeling was the Free Air anomaly and the thickness baseline for the Paraná Basin was based on open-access data from the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP) of composite wells located within an approximate radius of up to 20 km from the transects.

In addition, a Bouguer anomaly map of the area, a regional geological map and schematic geological profiles corresponding to the three gravimetric profile transects were produced to help interpret and adjust the modeling.

Results and Conclusions

As the gravimetric profiles of transects 1 and 2 are finalized, the preliminary results have shown that, as previous works have suggested, there is a vertical asymmetry between the flanks of the Ponta Grossa Arc that also appears in the mantle. The gravimetric profile of transect 3, as well as the processing of the Werner deconvolution, are still in progress. Furthermore, more detailed interpretations of the impact of this megastructure on the tectonic evolution of the region will be made once the remaining processing is complete.