

GEOPHYSICAL STUDIES OF NOVA COLINAS, BRAZIL'S NEWEST IMPACT STRUCTURE

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Introduction: Nova Colinas is the most recent impact structure confirmed in Brazil [1]. It is a partly eroded, complex-type structure, with ~7 km in diameter. It is located in the northeastern region of the country, centered at 07°09'33"S / 46°06'30"W. The structure was formed in the Parnaíba sedimentary basin, and has a poorly-constrained age of 200-250 Ma, based on stratigraphic relations.

The first mention to an impact origin for Nova Colinas dates from the 1970s, with no bona fide evidence presented so far. Recently, after a specific field survey targeted at searching for shock deformation features, the impact nature of the structure has been confirmed, making it the ninth impact structure in Brazil.

Geophysical signatures of impact structures are generally well defined [2], and widely used for their initial recognition, as well as the comprehension of physical and structural changes in country rocks. In addition, the use of geophysical data allows producing subsurface models of impact structures. In Brazil, geophysics has been an important tool to study confirmed and potential structures [3, 4].

Airborne geophysical data: The geophysical database employed in this study comprises aeromagnetometric and aerogammaspectrometric data acquired with 500 m of spacing of flight lines in the N-S direction, and 4 km between the control lines. The flight height was 100 m.

The magnetic data shows a strong positive annular signal on the analytical signal map spatially coincident with the apparent outer rim of the structure [5]. There are two distinct magnetic domains around the structure: (i) the northern region characterized by short-wavelength magnetic anomalies related to the basaltic flow of the Mosquito formation; and (ii) the southern region constituted by sedimentary rocks of the Sambaíba formation. The latter lacks significant magnetic anomalies, which is typical of sedimentary strata. The depth of the magnetic sources on the structure's rim is estimated to be ~250 m.

The gamma-ray spectrometry maps show concentrations of potassium (K), uranium (U) and thorium (Th). These data, combined with a TanDEM-X digital terrain model, provide a representative view of the main lithotypes and regolith classes in the region of the Nova Colinas. In the northern region, there is the presence of volcanic rocks of the Mosquito formation with high K, whereas the plateau areas are apparently enriched in Th related to sedimentary rocks of the Corda Formation. The combination of Th, K and the digital terrain model highlights a circular area around the center of the structure resembling an annular basin commonly associated with complex impact structures.

Our analyses were fundamental for a preliminary characterization and a more detailed magnetic and gravimetric investigations are essential to better characterize the lithologies and structures related to the Nova Colinas impact structure.

Seismic: Seismic data over the regions containing the Nova Colinas structure region were acquired by ENEVA, a Brazilian oil/gas exploration company. Our preliminary interpretation of these data allowed the identification of a fracture system affecting intrusive horizontal igneous rocks (probably diabase sills), and also to distinguish the central uplift area based on discontinuities likely associated with high porous rocks due to impact-related fracturing and brecciation.

Future outlook: In the upcoming months, we are planning to carry out a field campaign to collect ground gravity and magnetic data inside and outside the structure. These data will be integrated with the seismic data to produce well-constrained models to support a better characterization of Nova Colinas.

References:

- [1]Reimold W. U. et al. (2022) *Meteoritics & Planetary Science* Submitted. [2]Pilkington M. and Grieve R. A. F. (1992) *Reviews of Geophysics* 30(2):161-181. [3]Crósta A. P. et al. (2019) *Geochemistry* 79(1):1-61. [4]Crósta A. P. et al. (2019) *Geochemistry* 79(2):191-220. [5]Silva B. da (2020) *Journal of the Geological Survey of Brazil* 3:97-111.