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Geophysical evidence on the origin of the Caldas Novas dome

Rosa, J. W. C., Rosa, J. W. C., Walde¹, H.G.-D. & Fuck, R. A.

Instituto de Geociências - Universidade de Brasília, Brasília, DF 70910-900 - Brazil, ¹walde.detlef@gmail.com

The Caldas Novas dome is a 20 x 12 km elliptic structure, with its longer axis trending NNW. It is described [1,2] as a structural window of the southern-central part of the Neoproterozoic Brasília belt, which is the central part of the Tocantins Province. The latter is a roughly N-S trending former orogen (Brasiliano orogeny, 650-600 Ma) between the Amazonian and the São Francisco cratons, and it is bounded on the south and north by the Paraná and Parnaíba basins. Presence of hot springs in the area, observed radiometric anomaly on the dome top, as well as alignment with the well-known Cretaceous Alto Parnaíba Igneous Province [3,4,5,6], all raise questions on the dome origin. In this work, we gather existing regional gravimetry, seismology, magnetometry, and radiometry data [7], for a more detailed examination of the dome origin. A sharp, local low Bouguer anomaly is observed in Caldas Novas, which is part of a SE-NW trending anomaly along the western border of the São Francisco craton, and its neighboring Amazonian craton. There is no current regional seismicity observed in the region. On the other hand, processing applied to the magnetometry and radiometry aerogeophysical data set made it possible to identify some interesting features that may shed some light on the origin of the Caldas Novas dome. From the processing of the magnetic data, it is clear that a dyke swarm trending NW-SE is the most important geophysical feature of the analyzed dataset. Dykes are present on both northeastern and southwestern borders, and in close proximity to the Caldas Novas dome. These are part of a longer (more than 700 km) dyke system along the northern border of the Paraná basin [8]. Neighboring areas to some dykes show lateral displacement on the magnetic maps. Sharp magnetic anomalies are clearly related to the well known [9,10] Catalão I and II ultramafic alkaline complexes, located on the southeastern sector of the study area. It is also possible to identify some magnetic anomalies related to a few known granite intrusions. On the other hand, despite the fact that we have applied several magnetic data processing schemes, including reduction to pole with the same parameters used on the Catalão studies, no local, but a broad low magnetic anomaly was found in the Caldas Novas dome area. Considering the radiometry data, all features identified in the magnetic data images are visible but, in this case, a very sharp anomaly is visible in the Caldas Novas area, limiting the dome area. The anomaly is especially strong when considering the Th/K and U/K ratios. This was already known from surface radiometric surveys, which have led to raised questions about a possible magmatic origin for the Caldas Novas dome. From the results of an envisioned new data processing GIS tool we developed, it was possible to discard a possible magmatic origin, and K weathering depletion on the dome serves as the most probable explanation for the observed radiometric anomalies. The presence of thermal water springs near the dome is probably associated to deep circulation in the same fracture systems related to the observed dyke swarm in the area.

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