Geothermal energy assessment through the Curie point depth, geothermal gradient, and heat flow around the Akiri hot spring region in Central Nigeria

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Abstract

The geothermal energy potentials of areas around the Akiri hot spring in the Middle Benue Trough of Central Nigeria was assessed using high-resolution aeromagnetic data. The data were processed and analyzed for Curie point depth (CPD) estimation using both the conventional centroid method and the fractal-based modified centroid method. The CPD estimated from the power spectra using the fractal-based method ranges from 14.3 to 23.3 km, while the conventional centroid method is between 22.9 and 29.8 km. We also obtained, using the fractal-based method, an average geothermal gradient, and the crustal heat flow values of 31.9 ∘C/km and 79.7 mW/m^2, respectively. The conventional centroid method, however, estimated 22.6 ∘C/km and 56.5 mW/m^2 for the geothermal gradient and the heat flow, respectively. The centroid method is found to have overestimated the depth values in the region by an average 7.2 km per block window, most likely due to its uncorrelated source distribution. We found the fractal-based method to provide better estimation. Correlation analysis of the geothermal parameters indicates that the CPDs exhibit a significant inverse relationship with the geothermal gradient and the heat flow. Shallow Curie depths with corresponding high heat flow are observed around the Akiri and Awe hot springs. These anomalous geothermal conditions may be attributed to the intense Cenozoic magmatic activities with numerous volcanic intrusions within the Middle Benue Trough. The 2-D forward modelling of the basement and the CPDs along prominent profiles agree well with this claim.

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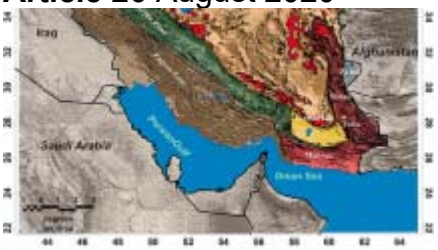

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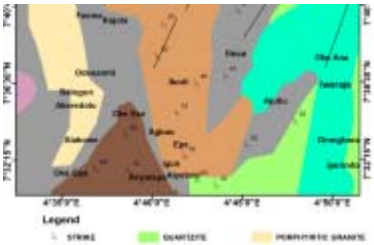
Article 29 October 2019



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Conflict of interest

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