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Geothermal characterization of the alkaline rocks belonging of the Poços de Caldas-Cabo Frio Alignment, Southeastern Brazil

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Introduction

A geothermal study of alkaline rocks is essential to understanding geological processes, such as magmatic evolution and crustal dynamics. This study presents a preliminary geothermal characterization of the Morro de São João (63.1 Ma), Mendanha (71.5 Ma) and Passa Quatro (70.4 Ma) massifs. These are located along the Poços de Caldas-Cabo Frio Alignment, which is a sequence of alkaline intrusions ranging in age from the Upper Cretaceous to the Eocene. The intrusions are distributed from southern Minas Gerais state to eastern Rio de Janeiro state.

Method

Radiometric analyses were carried out on ground samples using a Canberra BE5030-2 gamma spectrometer in the Laboratory of the Institute of Radiation Protection and Dosimetry (IRD) in order to quantify the concentrations of potassium (K), uranium (U) and thorium (Th). This allowed the radiogenic heat production rate associated with these rocks to be calculated. Additionally, the thermophysical properties (thermal conductivity, heat capacity and thermal diffusivity) were determined using measurements with the ISOMET 2114 conductivity meter in the Geothermal Lab from National Observatory (ON).

Results and Conclusions

Geothermal analysis of the alkaline massif samples revealed significant variations in the concentrations of radioelements and measured thermophysical properties, which can be correlated with variations in age. Older rocks tend to exhibit characteristics indicating less heat accumulation than more recent rocks. Alkaline bodies are an important tool for understanding the thermal evolution of the south-eastern region of Brazil.

Keywords: geothermal, alkaline rocks, radiogenic heat, thermal properties, gamma spectrometry.