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Radiological and mineralogical characterization of rare earth elements bearing minerals from Poços de Caldas (Brazil)

In the last years, uses of rare earth elements (REEs) and radioactive minerals expanded rapidly either for production of high technology, commercial, industrial production and/or for energy. Accordingly, study of REEs bearing minerals and their bedrocks attracted the attention of mineralogists in the last decades and it is expected that the demand for such elements will grow in the future. Today, almost all (~98%) of the world's REE supply comes from China, with 40%–50% of this production contributed by the giant Fe-REE-Nb deposit at Bayan Obo. Brazil has listed the REEs as strategic resources in 2014 and, after the sanctions applied by the Chinese government, the number of researches in this area has spiked worldwide. Enrichment of the REEs may occur through primary processes such as magmatic processes and hydrothermal fluid mobilization and precipitation, or through secondary processes that move REEs minerals from where they originally formed, such as sedimentary concentration and weathering. The extensive radioactivity in the plateau of Poços de Caldas was noticed in 1953, during an aerial radiometric survey, when several anomalies were found within the caldera, among them the region called Morro do Ferro, where ground investigations confirmed a large and strong radiometric anomaly associated with lateritic soils and REEs. The present work will shed light on the mineralization and geochemical attributes of radioactive and rare earth elements associated with the rocks present at the alkaline complex of Poços de Caldas. The high levels of radioactivity and REEs mineralization in some phonolites and nepheline syenites make them a target to enlarge the potentiality of the highly mineralized localities. The objectives of this research are: mineralogically characterize the samples using X-Ray diffraction and X-Ray fluorescence; quantify the concentration of REEs and radionuclides in samples from the alkaline complex of Poços de Caldas using neutron activation analysis and gamma spectrometry; assess the distribution of REEs and their association with the activity concentrations present in the samples; calculate the ratio between light and heavy REEs in the samples; calculate the ratio between Th and U in the samples; and calculate the following radiological hazard indices: internal and external hazards, radium equivalent and equivalent dose. The results of this research are not finalized but they will be in time to submit the full paper. Keywords: Rare earth elements (REEs); alkaline complex of Poços de Caldas; neutron activation analysis (NAA); gamma spectrometry; radiological hazard indices.

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