

Annual radiation dose in Serra do Carambeí granite, Southern Brazil

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The quantification of annual radiation dose (ARD) is of extreme relevance to public health and can be easily measured. In this work we have calculated the ARD emitted by the Serra do Carambeí granite (Paraná State - Southern Brazil) using radiometric surveys and radiochemical data obtained from thorium, uranium and potassium. We have also evaluated the reproducibility of airborne gamma-ray spectrometry surveys by comparing 1184 measurements with 132 ground gamma-ray spectrometric data and 61 radiochemical analyses. The methods revealed relatively high contents of thorium and uranium, with depletion in potassium in the center of the Serra do Carambeí granite. This signature overlaps alkali-feldspar porphyritic granite which is demarcated in the geological map. Field observations and petrographic characterizations show that the potassium content is low due to depletion by weathering processes. The content of radionuclides in the ground gamma-ray spectrometric data is similar to the radiochemical data, and is higher when compared to the airborne measurements. This discrepancy can be related to inaccuracies in the 1970's airborne data acquisition

and in the back-calibration process. Consequently, the ARD calculated from airborne data is underestimated, with only 15% of the samples exceeding the individual dose limit of 1 mSv/year for members of the public, established by the International Commission on Radiological Protection (ICRP). For ground gamma-ray spectrometric and radiochemical data, the dose limit is exceeded in approximately 64% and 51% of the samples, respectively. These high values in ARD warrants further investigation, as the inhalation or ingestion of radioactive particulate materials poses a substantial risk to the health of local people performing routine activities in these highly radioactive areas.

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