Distribution of K, Th and U in aplite and dolerite veins, granite and schist from the Sobral Pichorro area (Fornos de Algodres, Central Portugal)

[a,c]Trindade M J, [a,c]Prudêncio M I, [a,c]Dias M I, [a,c]Burbidge C I, [a,c]Cardoso G, [a,c]Marques R, [b,c]Rocha F

The radiogenic elements (K, Th and U) present in rocks in concentrations that vary greatly as function of geologic factors, produce ionizing radiation and especially the radon emission by the decaiment of U may represent significant environmental impact in the radiological point of view. In such perspective this study is a contribution to the organization of mineralogical and geochemical data as a basis to evaluate the radon levels emanated from rocks, as it is studied the distribution of the radiogenic elements in various lithologies from the Sobral Pichorro area (Fornos de Algodres, Central Portugal), located in the Beira uraniferous province.

The geological context of this research is a coarse- to medium-grained porphiroid two-mica granite ("Granito da Muxagata"), aplite and dolerite veins that frequently intersect the granite, and also the schist-greywacke complex ("Complexo Xisto-Grauváquico do Grupo do Douro"). A total of 34 samples were collected and studied, corresponding often to different stages of weathering within a vertical profile: 14 samples of granite (1 soil), 7 samples of aplite (2 soils), 4 samples of schist (1 soil) and 9 samples of dolerite (1 soil).

The mineralogical composition of the samples was obtained by X-ray diffraction (XRD). The chemical data of the whole sample was obtained by instrumental neutron activation analysis (INAA), by irradiating samples and standards in the core grid of the Portuguese Research Reactor (ITN, Sacavém) for 1.5 minutes and then for 6 hours, which allowed to obtain the concentration of U, Th and K, among other elements. For selected samples the abundance of these radionuclides was also determined by in situ gamma spectroscopy, using a NaI (2"x2") portable detector, to compare with INAA data. Field measurements enable to infer about dose rate stability and may help detect desequilibrium among U chain.

The concentrations of radiogenic elements observed in the studied area are much variable, but in general they are higher than the average values estimated for the upper continental crust (2.8% K, 10.7 ppm Th and 2.8 ppm U): i) granite – 1.7-6.4 % K, 7.3-20.9 ppm Th and 3.1-28 ppm U; ii) schist – 1.3-4.9 % K, 10-36.9 ppm Th and 3.4-13.9 ppm U; iii) aplite - 2.7-8.8 % K, 5.7-30.1 ppm Th and 4.5-77.2 ppm U; iv) dolerite – 1.7-6.2 % K, 3.5-25.7 ppm Th and 1.2-33.2 ppm U.

The soil samples present much lower concentrations of U than the granite and aplite underneath, and all soil samples are richer in Th. The highest concentrations of U are found in the aplite, therefore it has higher potential to release radon that may possibly be prejudicial to human health.

[a] *Instituto Tecnológico e Nuclear, EN 10, 2686-953 Sacavém, Portugal (mjtrindade@itn.pt)*
[b] *Universidade de Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal*
[c] *GeoBioTec Research Center, Universidade de Aveiro, Portugal*