Title: Risk assessment and rare metals mineralization associated with alteration aspects of Rhyolite flow tuffs, Egypt.

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Abstract: Argillic alteration and hematitization are the two extensive alterations that affected Um Safi rhyolite flow tuffs. Rare metal mineralization including radioactive minerals (thorite, uranothorite), Nb-bearing minerals (columbite, yettrocolumbite, Nb-rutile), zircon, REE-minerals (LREE-carbonate, xenotime) as well as molybdite, pyrite, fluorite, hematite and ilmenite have been identified by using Energy Dispersive Spectrometer (EDS) and are well recorded in argillic and hematitized samples. The investigated rhyolite flow tuffs show that the activity concentration of radionuclides changed from 1.2 to 453.2 Bq kg−1 for 238U, from 3.2 to 489.6 Bq kg−1 for 232Th, and from 31.3 to 88954.6 Bq kg−1 for 40K. The mean values of 238U, 232Th, and 40K activity concentrations are 90.8 ± 84.5, 122.9 ± 90.5 and 6286.7 ± 1562.2 Bq kg−1, respectively. The hazard factors are estimated. Their results exceeded the recommended limit. Thus, the investigated rhyolite flow tuffs are not safe to use in building materials and other construction industries. A multi-statistical approach is performed to show the correlation between the radioactive concentration and radiological hazard factors. This approach illustrates the positive correlation between uranium and thorium due to their contribution from the natural radioactive series—moreover, a strong correlation was obtained between potassium and all radiological parameters. Thus, the radioactive hazards impact in the present study is related to the presence of radioactive minerals such as thorite and uranothorite in addition to other accessory minerals.

Keywords: Rhyolite Flow Tuffs, Γ-Ray Spectrometry, Activity Concentrations, Rare Metal Mineralization, Radiological Hazards.

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