Soil radon and thoron measurements near the mofettes at Harghita Bai (Romania) for field location of fault zones

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In the aftermath of the post volcanic activity, dry gases of mostly CO_2 composition are bringing along radioactive gases such as radon (^{222}Rn; $T_{1/2}$ = 3.82 days) and thoron (^{220}Rn; $T_{1/2}$ = 55.6 sec), which migrate together to the surface (Etiope and Martinelli, 2002). The upward migration of these gases is facilitated by tectonic faults. Our study is based on measurements of radon and thoron activity concentration performed around the mofettes and mineral springs at Harhita-Bai, Harghita Mts. (part of the Neogene Volcanic region of the Eastern Carpathians, Romania). The aim of the study is the identification of the location and direction of a fault system that controls the occurrence of the two mofettes and of the mineral springs in the resort (Néda et al, 2008; Szakács and Néda, 2009) by the means of systematic measurements of soil radon and thoron activity concentration.
During the fieldwork, we have been studying the existence of the presumed fault system across two different profiles, normal to the assumed fault directions. First, (profile A) we intended to identify the local fault hypothetically traced across the two mofettes directed N 50° W. Second, (profile B) we considered the major fault system connecting the mofettes and the mineral springs, whose direction is N 5° E. Two measurement techniques and corresponding instruments (AlphaGuard and LUK3C detectors, respectively) have been used for radon and thoron concentration determination in soil gas, at 40-60 cm depths. Measurement results give normal distributions for the activity concentrations of the radon and thoron, which have a maximum value in both cases. These distributions are consistent with the hypothesis that the fault line crosses through the point corresponding to the maximum values of the radon and thoron concentration. From the results it is also clear, that high precision thoron concentration determination gives more accurate location of this type of tectonic elements than radon, because it lower life-time and shorter diffusion path.

References

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