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# Radiometric measurements in Pál-völgy show cave (Budapest, Hungary)

Hedvig Eva Nagy (1,2), Csaba Szabó (1), Ákos Horváth (2), and Attila Kiss (3)

(1) Lithosphere Fluid Research Lab, Institute of Geography and Earth Sciences, Eötvös University, Budapest, Hungary (jadzsa@gmail.com, (+36) 1 381-2212), (2) Department of Atomic Physics, Eötvös University, Budapest, Hungary, (3) Danube-Ipoly National Park Directorate, Pál-völgy show cave, Budapest, Hungary

We have been doing radon measurements in Pál-völgy show cave (Budapest, Hungary) for one year. Pál-völgy cave is situated in the Buda Hills, which is the NE part of the Transdanubian Central Range. The wall rock of the cave is dominantly Eocene Szépvölgy Limestone Formation. Above the limestone Eocene Buda Marl and Oligocene Tard Clay are deposited. A huge multiphase hydrothermal cave system developed in the Szépvölgy Limestone and partially in the Buda Marl resulted in a long-term complex paleokarstic evolution from the Late Eocene to the Quaternary. The main aim of our study is to determine the time dependent radon concentration and the sources of the radon in the Pál-völgy cave.

The radon concentration in the cave air has been measured continuously (with 1 hour integrated time) by AlphaGUARD radon monitor and outside the cave meteorological parameters were collected simultaneously. The radon concentration of the air in the Pál-völgy cave varies between 104-7776 Bq/m3 during the measurements, the average value is 1920 Bq/m3. These data strongly depends on the outside air temperature. If the temperature outside is higher than inside the cave (11 °C) the radon concentration increases. The correlation coefficient between the radon concentration of the air in the cave and the outside air temperature is 0.75. The spatial distribution of radon concentration in the cave air was measured simultaneously by active radon detectors, which shows values as high as 1000 Bq/m3 where Buda Marl is the surrounding rock, and 500 Bq/m3 where Szepvolgy Limestone is the wall rock.

To define the source of the radon, besides the wall rock limestone and marl, clayish cave sediments have been collected. These latter ones, consisting dominantly of quartz, calcite, kaolinite and muscovite determined by X-ray diffraction, show 26-37 Bq/kg 226Ra, 21-31 Bq/kg 232Th, 265-386 Bq/kg 40K content and 2-12 Bq/kg radon exhalation.

The radon concentration of leakage water, determined by liquid scintillation spectrometry, is 2-7 Bq/l. The highest values were measured in the sample percolated through the Buda Marl. The gas radon concentration in clayish cave sediment is between 6000 and 35000 Bq/m3 at sampling sites surrounded by the Szepvolgy Limestone. Gamma dose rate shows low variety between 20-60 nSv/h in the whole cave.

The radioactive isotope (226Ra, 232Th, 40K) content of clayish cave sediments shows results typical for soils. However, the radon and thoron exhalation rates of these samples, 2-12 Bq/kg for 222Rn and 1-12 Bq/kg for 220Rn, are higher than expected based on the 226Ra content. These results can be related to high percentage of fine grain size fraction (> 35 % of the grains lower than 10 $\mu$m) corresponding to high specific surface which provides high possibility of exhalation.

Our results suggest that the most likely radon source is the Buda Marl.