# SOURCE MINERALS OF RADON ANOMALIES – HUNGARIAN CASE STUDIES

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**Introduction**

Radon, a radioactive noble gas, has three isotopes found in natural environments, which originate from decay series of uranium or thorium. The $^{222}$Rn radioisotope, having a half life of 3.8 days, enter the atmosphere of ground-level bedrooms and living rooms of houses and may cause, in a long term scale, serious health problem as snipped into lung then attacking the tissues by emitting alpha particles. In Hungary, due to extended measurement of indoor radon level has been carrying out by the RAD Lauder Lab (Budapest), now several villages and towns are known characterized with elevated radon activity concentration. Three of these settlements and an additional one have been taken under a serious study in order to determine the potential sources of radon entering the houses. For this reason, detailed sedimentological, petrographical and geochemical study was performed on different materials (e.g. granite, soils) collected from the settlements chosen.

**Geological background**

The areas studied were as follows: villages of Sukoró (S) in the Velence Mountains, Nézsa (N) at the foot of one of the Mesozoic blocks on the left bank of the Danube (Cserhát Mountains), Sajóhídvég (SH) (along Sajó River, North East Hungary), and Tápiószentmárton in the Great Hungarian Plain (T). All of them represent significantly different geological environments such as Paleozoic (carboniferous) granite (S), Mesozoic limestones and dolomites surrounded and partly covered by Oligocene and young sediments (N) and alluvial fan of River Sajó (SH), which consists mostly of sand, loess, silt and gravel, and in the case of locality T, loess and running sand cover the surface.

**Methods**

We have collected samples from both the surface (S, N, SH, T) and from shallow drills (N, SH). The samples in all cases were sieved and subsequently sorted and subjected to a wide range of examinations as follows: heavy mineralogy, gamma-spectrometry, trace element analysis (by instrument of neutron activation and optical emission spectrometry), electron microprobe and Roentgen diffraction analysis. Furthermore, at the N locality outdoor radon measurements were carried out in soil gas and in groundwater.

**Results and conclusions**

Neutron activation analysis showed no elevated amounts of radioactive elements (basically U and Th) in the bulk samples such as granite and granite rubble (up to 5.37 ppm U, 23.26 ppm Th), different kinds of soils (up to 3.2 ppm U, 12.8 ppm Th) and loess (up to 2.4 ppm U, 9.5 ppm Th) compared to the Clarke values of these rock types. Electron microprobe analysis show in micrometer scale, potential source minerals such as monazite, xenotime, allanite, zircon and zirkelite, which contain the parental elements (U and Th) of radon. Among these minerals the monazite occurs most frequently and believed to be the most important radon emitter in the rocks and soils studied. Our petrographical and geochemical results suggest that monazites could have formed by near-surface alteration from allanite. This indicates that these physical and chemical processes, which produce monazites may act recently, too. However, minerals found at the T locality show no alterations which can be related to the low radon activity concentration at that location.