

SUMMARY

The main radionuclide causing high water radiation is ^{222}Rn with half-life 3.82 days. Concentrations of radon in radioactive mineral water in the Krkonoše-Jizera Crystalline Complex are very high and do not correspond with the concentration of uranium in the source rocks. These springs probably well up near the uranium mineralisation. Search for radioactive mineral water started in 2005 in Orlice-Sněžník Dome built by orthogneisses, which was the first promising area for such research. The research continued to the areas of Jánské Lázně and Horní Malá Úpa built by the Krkonoše orthogneisses in the next few years. In the last two years research was conducted in Lázně Libverda. Until then there were only a few known springs with radioactive mineral water.

Lázně Libverda-Świeradów-Zdrój area is located in the Krkonoše-Jizera Crystalline Complex built by Cambrian/Ordovician orthogneisses and Variscan granite pluton. Jizera orthogneisses and the contact of these two objects were considered to be very promising in terms of finding springs of the radioactive medicinal water. Another criterion for a successful exploration is also an abnormal tectonic deformation of the zone. Uranium exploration was also conducted in 1950s, so we could use data available from the emanatory survey on a scale of 1:5000 and data from reconnoitre autogamma survey. In 2004 and 2005 airborne gamaspectrometric survey was done on a scale of 1:25000.

Radio-hydro-chemical survey was done in a 10 x 16 km area. Indicative gamma activity measurements were performed in 508 springs and 93 of them were chosen for measurement of concentration of ^{222}Rn . 19 of these springs have a larger value exceeding the activity concentration of the ^{222}Rn content of 1500 Bq/l and fill the criteria for mineral water category (Spa law no. 164/2001 Col.). Physical parameters of the samples collected for measurement of ^{222}Rn were measured too – these samples were lowly mineralized and weakly acid. Four samples were also measured by a very precise liquid scintillation counting (LSC) to determine the accuracy of our measurement apparatus.

A unique location called Andělské Prameny was found near Nové Město pod Smrkem. In the area of 200 x 400 m. 17 radioactive springs (gamma) were found here, 10 of which are radioactive mineral water (Spa law no. 164/2001 Col.). For potential spa use and scientific research two most important sources were caught: spring Rafael – 3405 Bq/l, flow 0.16 l/s and spring Michael – 6215 Bq/l (the highest value of a spring in the Krkonoše-Jizera Crystalline Complex) and flow 0.00584 l/s. We used six methods to obtain the information about the structural-geological situation in the key part of this location. Field gamma spectrometry, magnetometry and the very low frequencies method were applied to the whole location. Multi-electrode resistivity measurements, shallow seismic refraction and emanometry were applied on the basic profile intersecting springs Rafael and Michael. We found tectonic lithological boundary line which divides two types of rocks (Jizera orthogneisses and probably cryptozoic mica schist and phyllite). The linear tectonic structures are probably where the water moves to the surface. Using shallow seismic refraction the quaternary cover thickness from two to four meters along the basic profile was observed. Springs flow from two main linear structures and the whole hydrogeological system is drained by a system of amelioration grooves. After measurement of the flow rate of springs and surface flows at the key locations, percentage ratio of the springs in the

flow from the sources of conductive structures and their percentage in total flow rate were calculated. Spring Rafael represents 52.4 % percentage in total flow rate, while the most radioactive spring Michael 1.9 % only. There is also a variously thick layer of peloid (in the places where a spring of radioactive water moves to the surface it is also radioactive). Due to the possibility of spa use thickness of the peloid was measured and geological resources were calculated using the SURFER program. The amount of peloid is about 4314 m³ (for cut-off 0.3 m).

Keywords: Mineral waters, Lázně Libverda, Świeradów-Zdrój, radon, radioactive waters, balneology