

## Variation in Radon Signals: Results of a Confined Experiment

Maximilian Haas

Whether it is about finding precursors for earthquakes or investigating its hazard potential, radon has been under intense research in the past few years. In long term radon monitoring experiments periodic and non-periodic variations are frequently reported. Yet, the physical reasons for these variations remained elusive. In order to contribute to these open questions two setups were installed in two different places at the Conrad Observatory: in the tunnel and in an enclosed box. Temperature was controlled during the box experiment, pressure and humidity were monitored. Temperature variations do not influence radon concentration in any way. Significant periodic radon variations are absent in the confined experiment.

As investigation method for indirect radon monitoring, measurements of scintillations with a gamma detector was chosen. Two setups (stages) were installed: the first one in a tunnel and the second one in a confined box in a separate room. In the first stage, the gamma detector was located close to the tunnel's end and measured background radiation in West-East orientation. In the second stage, confined in a lead shielded box, temperature, pressure and humidity were permanently monitored. In addition to that temperature was controlled, reference samples were used to calibrate the system and an artificial radon source could be activated.

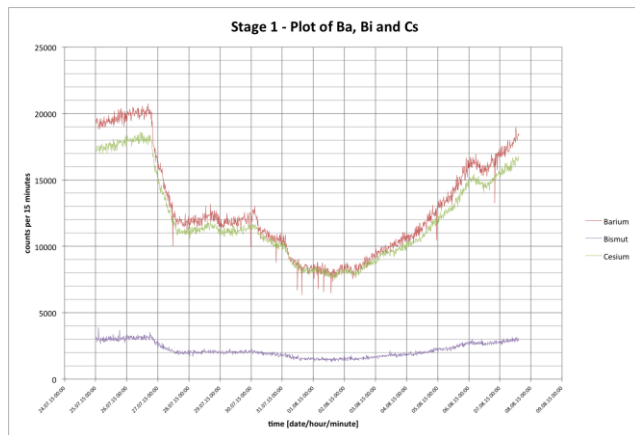


Figure 1: Stage 1 experiment - Natural variation of Ba (red), Bi (purple) and Cs (green). A strong decrease of their spectra can be seen between the 27th and 31st of July, reaching its lowest value at the 1st of August.

The gamma spectrum has been analysed for Compton scattering and regions of interest (ROI) containing specific energy peaks of certain isotopes, like barium, bismuth and cesium, have been identified. In this way in the natural environment of the tunnel, strong variation of radiation is monitored in all ROI's (Fig. 1).

### Author:

Maximilian Haas<sup>1,2</sup>

- 1) Zentralanstalt für Meteorologie und Geodynamik, Vienna, Austria
- 2) Chair of Applied Geophysics, Montanuniversität, Leoben, Austria

The confined experiment, stage 2, is subdivided into three stages: stage 2.1 showing no valve opening, stage 2.2 representing the valve opening and stage 2.3 showing the elements after reaching equilibrium.

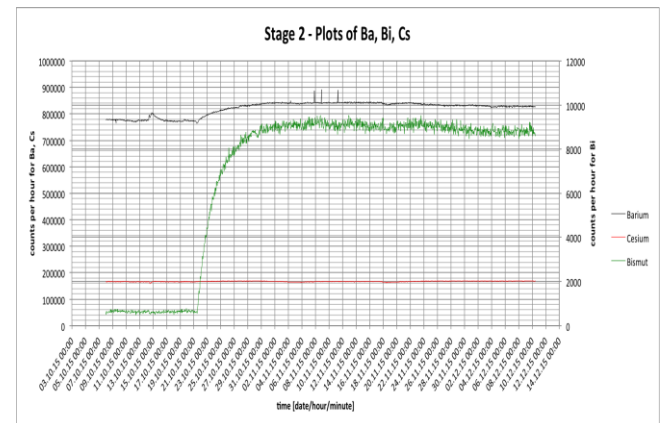


Figure 2: Stage 2 experiment - Overview plot of Ba, Bi and Cs over time frame of box experiment.

As seen in figure 2, heating of the box on the 14th of October does not have any significant influence on bismuth. Bi increases on the 21st of October due to opening of the valve, which allows radon gas from an artificial source to diffuse into the measurement container. In summary, it is observed that the confined conditions completely remove any typically reported signatures of short term periodic variations. In order to test for long term periodic variations the experiment is continued. In a next step, the confined conditions are gradually removed and it is tested at which point periodic variations as observed in the contemporaneous natural experiment (stage 1) are observed.

### Corresponding author:

Maximilian Haas, BSc.

Chair of Applied Geophysics, Montanuniversität Leoben

Peter-Tunner-Straße 25, 8700 Leoben, Austria

Tel.: +43 664 4189861

e-mail: maximilian.haas@unileoben.ac.at

