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Monitoring dissolved gases in thermal water to assess the potential relation between fluid evolution and seismicity

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The potential of monitoring dissolved gas concentrations to track or even to predict seismic activity is matter of controverse discussions [1]. Although many examples of changes in gas composition correlating with a seismic event have been observed [1], these studies often target a one-time event. In contrast, datasets deriving from long-term gas monitoring are very rare, rendering the assessment of any causality between earthquakes and changes in gas dynamics notoriously difficult.

To provide high-frequency and long-term time-series of dissolved gas concentrations, we adapted and installed a portable gas equilibrium membrane-inlet mass spectrometer (miniRUEDI, Gasometrix GmbH [2]) at the hot springs of Lavey-les-Bains (LlB), one of the most seismically active regions of Switzerland. At the site, hydrothermal water with temperature of up to 62°C is abstracted from three wells, with depths ranging from 200m down to 515m deep. Currently, a geothermal project aims to reach hot thermal water of 110°C at 3000m.

We present long-term records of dissolved gas species (He, Ar, Kr, N_2, O_2, CO_2, CH_4 and H_2) in thermal water of LlB over period of more than one year that also covers the geothermal drilling of the geothermal project mentioned above. These data allow a first critical assessment of the possible relations of changes in dissolved gas composition and seismicity. Moreover, we analyse if the geothermal drilling impacted the local hydrothermal system.

[1] Toutain et Baubron (1999), *Tectonophysics, **304**, 1-27*

[2] Brennwald et al. (2016), *ES&T, **50**, 13455-13463*