

An enigmatic spring in a hydrothermal cave at the western margin of the Vienna Basin

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The cave Eisensteinhöhle is a 2-km long crevice cave that is significantly overprinted by hydrothermal karst processes. It was opened during quarrying in the Fischauer Vorberge, on the western margin of the Vienna Basin. This pull-apart basin cuts the eastern foothills of the Alps and is formed by a major NE-SW striking sinistral transform fault. The western margin consists of NNE-SSW striking normal faults that create paths for thermal water to rise from the central basin.

In the deepest part of the cave, 87 m below the entrance, is a small pond that sometimes acts as a spring. The cave and in particular the spring have attracted attention since their discovery around 1900. The water level and temperature fluctuate and at a certain level, water visibly discharges into a nearby narrow fissure. A more or less continuous record of sporadically taken data on water level and discharge exists from late 1980s on. As there was no obvious connection to precipitation events or periods, until now, it was impossible to determine how the spring is connected to an aquifer and where the water comes from.

To investigate the tectonic activity of the main fault of the cave an opto-mechanical 3D crack gauge TM-71 was installed. Water level and temperature of the pond are observed hourly by a data logger (SEBA Dipper PT). Furthermore, a simple pumping test was conducted.

The pumping test showed the geometry and the volume of the pond and that it is fed by a very small inlet out of the sandy bottom. At that time, the discharge was only 4.5 l/h but at previous overflow events, discharges of up to 4.8 l/min were recorded.

Water temperature and hydrochemistry hint towards a mixture of an old thermal component and a young meteoric component. The high-resolution data on water level and temperature fluctuations show a relation to certain rainfall events and the sporadically taken long time records show a correlation with annual rainfalls and with groundwater levels in the Vienna Basin.

Within the first two years of the continuous monitoring, the water level was almost stable with few periods of high level (almost at overflow) that lasted for about 3 to 4 weeks each. At the beginning of the first event in October 2015, a minor fault activity was measured in the nearby Emmerberghöhle and a local earthquake (M 2.5) occurred one week later about 10 km from the caves. In July 2017, the water level dropped suddenly and then recovered simultaneously to several weak earthquakes in the vicinity. The water temperature increased during most water high stands and is positively correlated with the water level.

The collected data suggests, that the spring in Eisensteinhöhle is influenced by both, precipitation and tectonics, but a lack of tectonic events leaves this relation unconfirmed.