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Postojna Cave as Near Fault Observatory site in SW Slovenia

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Within EPOS IP project (H2020, 676564) four organizations (ZRC SAZU as EPOS IP partner, University of Trieste as member of EPOS Italy, and Jožef Stefan Institute and Slovenian Environment Agency as members of consortium EPOS-SI) started with development of Postojna Cave as possible Near Fault Observatory (NFO). Intensive geological, meteorological, hydrogeological, seismological and karstological studies are taking place in Postojna Cave. Being a show cave, it has good infrastructure (electricity, cave train, optical cable etc.) what is necessary for on-line scientific measurements inside the cave and transfer of data.

Postojna Cave is situated in SW part of Slovenia in External Dinarides with tectonically active Alpine thrusts and Dinaric (NW-SE) and cross-Dinaric (NE-SW) faults. It belongs to NE part of Adria microplate. Postojna Cave is situated between regionally important Dinaric-oriented Idrija and Predjama Faults. Idrija Fault is supposed to be responsible for 1511 earthquake (M=6.8), which is the strongest earthquake in the territory of Slovenia. In Postojna Cave there are numerous broken speleothems, some of them can be due to tectonic activity others due to karst processes.

Postojna Cave NFO includes regular micro-climatic monitoring as cave air temperature, water temperature, rock temperature, CO₂, humidity, air pressure, wind speed and direction. At several locations such measurements are going on since 2009 to assess impact of tourism on cave environment and to study natural cave meteorological conditions.

Radon (²²²Rn) monitoring in cave atmosphere started in 1995. In the first period seasonal measurements of radon activity concentration, equilibrium factor, radon progeny activity concentrations in attached and unattached form (EQF-3020-2, Sarad) have been carried out to establish the reliable methodology for dose estimates of cave workers. Contemporary measurements of radon progeny activity concentrations (EQF-3020-2, Sarad) and number concentrations and size distribution of general (non-radioactive) aerosol particles (SMPS, Grimm) started in 2010 and were carried out periodically. In the period 2011-16 continuous radon monitoring (once an hour) was conducted (Radon Scout, Sarad), using radon as a tracer for cave ventilation.

3D micro-displacement monitoring on two Dinaric oriented fault zones in the cave is performed

with four TM 71 extensometers. First two instruments were installed in 2004 and the second ones in 2016. Small micro-displacements of up to 0.08 mm in one month are registered.

Seismic station in Postojna Cave is operating since 2010, with periods of inoperability due to power supply problems and hardware malfunctions. The station in the Tartarus tunnel (TTPJ) recorded more than hundred earthquakes of the sequence near Ilirska Bistrica that started on 15 September 2010, with two MLV=3.5 earthquakes and lasted till the end of the year 2010, without accurate timing at that time. A fibre optic cable was installed later on and a Quanterra Q330 data logger with accurate timing and real-time telemetry was installed with an Episensor accelerometer and a Streckeisen STS2 seismometer.

In the future we are planning to enlarge the underground seismic station with equipment provided from RI-SI-EPOS project (EU Cohesion Funds). Micro-deformation monitoring sites will be additionally studied with methane and radon measurements (H2020 871121 EPOS SP).