Geological evidences of active tectonics in the Eastern Alps revealed in caves

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So far, field studies, seismic data, and GPS observations have suggested ongoing activity along major tectonic fault systems in the Eastern Alps. According to previous observations, geological and morphological position of potential caves, and hints from cavers some 70 caves have been inspected for traces of active tectonics in the Eastern Alps.

At 25 caves good indicators for tectonic movements post-dating the speleogenesis were found, excluding gravitational mass movements, Pleistocene ice filling, sediment compaction, or vandalism. According to morphological correlations, most of these caves are of Quaternary age meaning that the faults are active ones. At nine locations, dislocated cave passages, which have been coated by flowstone that grew before and after the tectonic event, were dated by the Th/U disequilibrium method. A total of 60 speleothem sub-samples were dated. Outstanding results were obtained from the Obir Caves that developed close to the Periadriatic line (PAL). There, a strike slip fault sets off the dissolutional cave morphology and flowstone layers by 38 cm. 18 U/Th ages reveal that the major offset occurred between 19 and 42 ka. Due to its orientation, the observed fault is interpreted to be associated to the PAL and fault mirrors suggest a seismic behaviour of the fault. Beside some sites where the flowstone was too old (>0.6 Ma) or interpretation was ambiguous at two other sites (Hochschwab/Speikbodenhöhle and Fischauer Vorberge/Emmerberghöhle) the age of the tectonic events could be obtained.

Despite the difficulties attributed to distinguishing a co-seismic and aseismic fault slip, we tried to estimate possible palaeoseismological aspects of the documented recent activity of the Salzachtal-Ennstal-, Periadriatic-, Mur-Mürz-, and Pöls-Lavantal Faults. By comparing the young offsets of the faults with published data (Wells and Coppersmith, 1994; Michetti et al., 2007) we estimated the magnitudes of possible earthquakes. Our data revealed minimum epicentral magnitudes of 5 to 6.5 and intensities ranging from VII to X in paleoseismologically yet unidentified regions.

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