Geophysical Research Abstracts
Vol. 16, EGU2014-12164, 2014
EGU General Assembly 2014

Microstructural investigations of principal slip zones in carbonates, examples from shallow crustal strike-slip faults in the Northern Calcareous Alps (Austria)

Helene Bauer, Bernhard Grasemann, and Kurt Decker
University of Vienna, Center of Earth Sciences, Department of Geodynamics and Sedimentology, Vienna, Austria
(helene.bauer@univie.ac.at)

Faults in the upper crust can move episodically by seismic deformation (individual earthquake ruptures) and/or continuously by aseismic creep deformation. In carbonate fault zones, several studies have shown that seismic deformation produces very narrow principal slip zones (cm to mm wide) that accommodate most of the fault displacement during an individual earthquake. Within these principal slip zones, ultracataclasites containing the principal slip surface, fluidization of ultracataclastic sub-layers and clast cortex grains have been proposed to be characteristic for seismic slip. In contrast, pressure solution has been proposed as a mechanism of aseismic sliding along a fault. Spaced cleavage solution planes and associated veins indicate diffusive mass transfer and precipitation in pervasive vein networks. At micro-scale, calcite CPO in fine-grained matrix of principal slip zones has been suggested to result from post-seismic pressure solution creep.

Here, we present field data from the Salzchtal-Ennstal-Mariazell-Puchberg (SEMP) fault system (Austria) to interpret the principal slip zones with regard to possible indicators of seismic or aseismic deformation.

We investigated exhumed, ancient sinistral strike-slip faults in dolomite and limestone that formed during eastward lateral extrusion of the Eastern Alps during Oligocene to Lower Miocene. The faults belong to a system of convergent strike-slip duplexes that developed at a restraining bend on an eastern segment of the SEMP-fault system. Distinct fault cores contain cataclastic fault rocks differing in textural complexity. Microstructural analysis of cataclastic fault rocks was done using both, optical and electron microscopy.

Microstructures reveal several cataclastic types that can be interpreted in terms of different stages of cataclastic evolution. Coarser grained, well cemented cataclasites underlie fine grained ultracataclastic layers. For at least two of the faults, cataclasites containing clast cortex grains as well as foliated ultracataclasites with polished slip surfaces may give evidence of seismic deformation.

One particular fault contains limestone cataclasites that show significant overprint with stylolithes and associated veins with precipitation products. In some parts, dense arrays of closely spaced solution cleavage seams around rigid elements (clasts of cataclasite material) produce a pseudo SC-fabric. Pressure solution deformation also affects host rock material surrounding the fault core, producing completely disintegrated rock which we called pressure solution breccias.

Samples from at least one fault give striking evidence of potential post-seismic pressure solution creep. The complex interaction and competition of cataclastic and pressure solution creep is yet poorly understood and will be the topic of more detailed future investigations.