Geophysical Research Abstracts
Vol. 12, EGU2010-10525, 2010
EGU General Assembly 2010

Field-based perspective on fault rock evolution and microstructures in low-angle fault zones (W-Cyclades, Greece)

Bernhard Grasemann
University of Vienna, Geodynamics and Sedimentology, Vienna, Austria (bernhard.grasemann@univie.ac.at)

The mechanics of sub-horizontal faults, typically active at the brittle/ductile transition zone, are still controversial because they do not conform to current fault-mechanical theory. In the Western Cyclades (Greece) conjugate high-angle brittle faults mechanically interact with sub-horizontal faults and therefore models based on fault and/or stress rotation can be rejected. A range of different deformation mechanisms and/or rock properties must have resulted in an reduction of the fault strength in both the ductily and cataclastically deformed fault rocks.
Typically the low-angle faults have following characteristics: The footwall below the subhorizontal faults consists of coarse-grained impure marbles and greenschists, which record an increase in shear strain localizing in several meters to tens of meters thick ultra fine-grained marble mylonites. These ultamylonites are delimited along a knife-sharp slickenside plane juxtaposing tens of decimeter thick zones of polyphase ultracataclasites. The marbles accommodated high shear strain by ductile deformation mechanisms such as dislocation creep and/or grain size sensitive flow by recrystallization, which might have result in fault zone weakening. Typically the marbles are impure and record spatial arrangement of mica and quartz grains, which might have lead to structural softening by decoupling of the calcite matrix from the clasts. During brittle deformation the massif marble ultramylonites act as a strong plate and ultracataclastic deformation is localizing exactly along the border of this plate. Although some of the cataclastic deformation mechanisms lead to chaotic fabrics with evidence for frictional sliding and comminution, others favor the formation of foliated cataclasites and fault gouges with various intensities of phyllosilicate fabrics. Frequently, a repeated switch between grain fracturing processes and processes, which created a sc or scc'-type foliation can be observed.
On Serifos the low-angle fault cuts the roof of a pluton, recording progressive deformation of the undeformed granodiorite at lower structural levels, to mylonitic granodiorite within the shear zone. Although there were almost no whole-rock compositional, mass or volume changes in the strongly deformed footwall, the weakly foliated granodiorite in the hanging wall has been heavily fractured and totally bleached by fluid infiltration.
Concluding, a wide range of different deformation mechanisms, both in the ductile and the brittle field, acted during formation of the low-angle faults in the Western Cyclades.