La-008 Room: C401 Time: June 8 16:30-16:45

# S-C cataclasite and its implications for seismic fault zone rheology

# Aiming Lin [1]

[1] Earth and Planetary Sci.,Kobe Univ.

Foliated cataclasites in granitic rocks along the Rokko-Awaji fault zone, Japan, display S-C fabrics similar to those of mylonites. The S-C catacalsites have S-surfaces defined by shape preferred orientation of biotite fragments and aggregates of quartz and feldspar fragments, and C-surfaces defined by microshears. The microstructural characteristics and geological evidence suggest that the S-C cataclasites in the Rokko-Awaji fault zone formed at temperatures between 150-300 C, corresponding to depths of 5-8 km, at a continental geothemal gradient of 30C/km, before being uplifted and exposed. This study of the cataclastically deformed rocks shows that the fault zone rheology of the upper 5-10 km of crust is greatly influenced by the formation of S-C cataclasites.

Foliated cataclasites in granitic rocks along the Rokko-Awaji fault zone, Japan, display S-C fabrics similar to those of mylonites. The S-C catacalsites have S-surfaces defined by shape preferred orientation of biotite fragments and aggregates of quartz and feldspar fragments, and C-surfaces defined by microshears. All quartz and feldspar fragments show brittlely dominated deformational microstructues. The biotite fragments, however, have some fabric characteristics like those observed in S-C mylonites, such as biotite 'fish', cleavage-steps, bending, and folding. These differences in microfabric between biotite, quartz and feldspar suggest that there are marked differences in their deformational behavior under the same deformational conditions. Biotite deformed by a combination of brittle-plastic shearing processes, and quartz and feldspar were brittlely damaged. One of the most significant microstructural differences between S-C cataclasites and S-C mylonites is the absence of dynamically recrystallized grains in the S-C cataclasites. The microstrucutal characteristics and geological evidence suggest that the S-C cataclasites in the Rokko-Awaji fault zone formed at temperatures between 150-300 C, corresponding to depths of 5-8 km, at a continental geothemal gradient of 30 C/km, before being uplifted and exposed.

Fault rocks from the seismogenic regime, occupying perhaps the 10-15 km of crust, are thought to comprise incohesive cataclastic rocks as fault gouge and breccia and cohesive cataclasites (Sibson,1977). The incohesive cataclastic rocks are generally produced in shallow depths (<4 km), while cohesive catclastic rocks are generated at deeperdepths,between 4-15 km (Sibson, 1977; Scholz, 1990). The seismic data show that earthquakes tend to occur at depths of <15 km. Along the Rokko-Awaji fault zone, they are concentrated in a depth range of 5-10 km. Earthquakes concentrated at depths of less than 10 km are also reported in the western United States (Sibson, 1983). Larger earthquakes appear to have nucleated near the base of the seismogenic zone defined by background seismicity within the regime. The seismic rupture may propagate some distance downwards into the quasi-plastic regime as well as upwards into the brittle regime (Sibson, 1983). This suggests that the S-C cataclasite formed in the depths of 5-8 km in the Rokko-Awaji fault zone as documented above. This means that the rheology of the seismogenic zone may be principally controlled by the deformation mechanisms of the S-C cataclasite in the Rokko-Awaji fault zone.

The solid-state rheology of rocks depends primarily on the relative proportions of weak and strong minerals, and physical conditions of deformation (Handy, 1990). In the non-foliated granitic cataclasite in this stuty, the quartz and feldspar clasts (strong minerals) are randomly distributed and mostly in contact with each other, so that the shear resistance may be expected to depend the deformation mechanism of the strong mineral clasts rather than the fine-grained matrix of biotite (weak mineral) clasts. In the S-C cataclasite, however, the fine-grained matrices are concentrated along the microshears and shear bands which formed interconnected weak zones (C- and C'-surfaces). Furthermore, the deformed biotite (weak mineral) clastas also interconnect to form the S-foliations, whereas the quartz and feldspar clasts are present without contact each other in the matrix in the S-C cataclasite. Therefore, the low strength fine-grained matrix and the deformed biotite clasts, which formed the S-C fabrics, probably determine the bulk rheology of the seismogenic zone at the time of activity. This study of the cataclastically deformed rocks shows that the fault zone rheology of the upper 5-10 km of crust is greatly influenced by the formation of S-C cataclasites.