Dynamic properties of S-C cataclasiteunder triaxial compression and its implications for seismogenic fault zone

aiming lin[1], Xinglin Lei[2], Osamu Nishizawa[3]

[1] Institute of Geosciences,Shizuoka Univ, [2] Earthquake Res. Dept., [3] GSJ

It is well known that large intraplate earthquakes occur in the mature active faults and nucleate near the base of seismogenic layer which is 5-10 km in depth (Sibson,1982; Das and Scholz,1983;Scholz, 1990). This seismogenic layer in the mature fault zone is commonly composed of cohesive cataclastic rocks that were generally thought to have largely random fabric formed by friction-dominated faulting within the seismic regime. Studies in recent two decades,however,show that S-C foliations similar to those formed in mylonitic rocks which formed in the semi-brittle to ductile regimes at depths more than 10 km are also developed in the cataclastic rocks along the mature active faults. The S-C foliations in cataclasitic rocks are generally characterized by fine-grained matrix, preperred orientation of clay minerals and elongate micas, and compositional laminations (Chester et al.,1985; Lin, 1999, 2001). On the basis of the experimental results and microstructural observations, it is documented that the seismogenic fault zone rheology of the upper 5-10 km of crust is greatly influenced by the formation of S-C foliations (Lin,1999).

In this study, in order to constrain the dynamic properties and deformational processes of seismogenic zone in the mature active fault zone, we conducted triaxial compression experiments on both S-C and non S-C cataclasites of granite taken from the drill cores of Nojima fault zone at depths of 200 m to 235 m and host granite. The triaxial compression experiments have been done on cylindrical specimens of 50 mm in diameter and 100 mm in length under a confining pressure of 60 MPa using a triaxial compression testing machine with a rapid acoustic emission (AE) monitoring system. The strengths of S-C and non S-C cataclasites and host granitic rock under 60 MPa are 150 MPa,440 MPa,and 560 MPa, respectively. Acoustic emission (AE) measurements show that AEs were concentrated along the pre-existing S-C foliations in the S-C cataclasite, whereas were random in the non S-C cataclasite and the host granitic rock. X-ray scan and microscopic observations have revealed that the preceding cracking occurred along the pre-existing S-C foliations. Our results demonstrate that the S-C fabrics in cataclasite are the most dominant factors that govern the seismic nucleation process and mechanical strength of seismogenic layer in the mature active fault zone.