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Strain rate and flow stress estimation based on the field boundary between grain-size sensitive and insensitive creep re

Takamoto Okudaira[1*], Norio Shigematsu[2]

[1]Dept. Geosci., Osaka City Univ., [2]GSJ, AIST

Continuous rock samples of granitic mylonite recovered from the GSJ Iitaka-Ako observatory (Mie Prefecture, Japan) that drilled the Ryoke granitoid (Hatai tonalite) and the Sambagawa pelitic schist, through the Median Tectonic Line would provide us the crucial information about the development of crustal shear zones. In the granitic mylonites very near the MTL, mechanism transition between grain-size-insensitive creep and grain-size-sensitive creep was observed in granitic mylonite deformed under the greenschist-facies condition, with the quartz grain size of ˜3 micrometer that was measured by the image analysis using images obtained by SEM-EBSD mapping. Based on the relationship between flow stress and grain size of quartz calculated by flow laws of dislocation creep and grain-boundary sliding, strain rate and flow stress for mechanism switch between dislocation creep and diffusion creep occurred in the granitic mylonite are 10-10 s-1 and 700 MPa at 300 degree C, and 10-8 s-1 and 600 MPa at 400 degree C, respectively. The strain rate of the granitic mylonite is much higher than the surrounding metamorphic rocks by 3-5 orders of magnitude. It suggests that deformation of ductile lower crust may be localized in a narrow shear zone, rather than uniformly distributed. The displacement rates of the shear zone with thickness of 1 m calculated to be 30 mm/yr at strain rate of 10-9 s-1 and 300 mm/yr at 10-8 s-1; they are much faster than average slip rate of active faults and horizontal displacement rate estimated by continuous GPS array measurement, suggesting that either the shear zone should be localized less than 1 m or parameters used in this calculation should be revised.

Keywords: strain rate, differential stress, diffusion creep, dislocation creep, mylonite, inland earthquake