Oral | Symbol S (Solid Earth Sciences) | S-SS Seismology

[S-SS32_1AM1]Fault Rheology and Earthquake Dynamics

Convener:*Kiyokazu Oohashi(Graduate School of Science, Chiba University), Takeshi Iinuma(International Research Institute of Disaster Science, Tohoku University), Wataru Tanikawa(Japan Agency for Marine-Earth Science and Technology, Kochi Instutute for Core Sample Research), Yuta Mitsui(Department of Geosciences, Graduate School of Science, Shizuoka University), Chair:Kiyokazu Oohashi(Graduate School of Science, Chiba University), Yuta Mitsui(Department of Geosciences, Graduate School of Science, Shizuoka University)

Thu. May 1, 2014 9:00 AM - 10:45 AM 315 (3F)

Interdisciplinary discussions on the rheology of seismogenic faults and earthquake generation processes among the following specialists; (1) fault rocks and fault zones, (2) theoretical and numerical studies on earthquake dynamics, and (3) seismology and geodesy. Presentations on fault-zone drilling projects are also welcome.

10:30 AM - 10:45 AM

[SSS32-P06_PG]Temperature-dependent frictional strength of dolerite in a nitrogen atmosphere and its relation to amorphous material

3-min talk in an oral session

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Keywords:Dolerite, Frictional strength, Wear material, Nitrogen atmosphere, Rotary shear experiment

Noda et al. (2011, JGR) revealed by rotary shear experiments on dolerite at a normal stress of 1 MPa, a sliding velocity of 1 cm/s and controlled temperatures from room temperature to 1000 ℃, that its frictional strength has a negative correlation with the amount of amorphous phase in wear materials as well as a positive correlation with the amount of iron oxides which increases with increasing temperature by oxidation of the iron-bearing minerals. However, oxidation of iron-bearing minerals as observed in their experiments is unrealistic in fault zones at depths due to the paucity of oxygen there.We therefore conducted rotary shear experiments on the same dolerite at the same normal stress, sliding velocity and temperature conditions with Noda et al. (2011) in a nitrogen atmosphere with the oxygen content of 0.1 %, and compared the results with those of Noda et al. (2011). We collected mechanical data during stable sliding of 20 m after the presliding of 100 m at each experimental condition. Sieved wear materials smaller than 250 μ m were then used for quantitative X-ray diffraction analyses.Steady-state friction coefficient was ~0.47 at room temperature and 200 ℃, ~0.7 at 400 and 600 ℃, and ~0.9 at 1000 ℃. Steady-state was not reached at 800 ℃ due to intense fracturing of samples. The amount of amorphous phase in wear materials shows a change with increasing temperature similar to that for experiments in the air (Noda et al., 2011); ~65 wt% at room temperature, ~70 wt % at 200 ℃, ~70 wt% at 400 ℃, ~45 wt% at 600 ℃, ~15 wt% at 800 ℃, and 0 wt% at 1000 ℃. In contrast, the amount of iron oxides does not show a noticeable change with increasing temperature.Experiments by Noda et al. (2011) in the air showed a negative correlation between frictional strength and the amount of amorphous phase at temperatures lower than or equal to 800 ℃. Our experiments also show an overall tendency of increasing frictional strength and decreasing amount of amorphous phase with increasing temperature. However, steady-state friction coefficient differs by more than 0.2 between room temperature and 400 ℃, while the amount of amorphous phase differs by

only ~5 wt% between these two temperatures. In addition, the amount of amorphous phase differs by ~15 wt% between 400 and 600 ℃, whereas steady-state friction coefficient is almost the same at these two temperatures. This implies lack of a direct relationship between frictional strength of dolerite and the amount of amorphous phase in wear materials. Study on what controls the temperature-dependent change in frictional strength of dolerite is now in progress.