Seismic slip and pressure solution in crustal rocks from Nozuka and Rakko area in the Hidaka metamorphic belt, Hokkaido, Japan

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Many layer-parallel pseudotachylytes occur together with cataclasites within the uppermost mylonite zone of the Hidaka metamorphic belt in the Nozuka-gawa River and Rakko-gawa River areas. On the basis of field and microscopic observations of the pseudotachylytes and their related fault rocks, we present an example of seismogenic slip processes along high strain zones formed by plastic deformation. The seismogenic slip may have occurred at the bottom of upper crust just above the upper side of the brittle-ductile transition zone. The observations suggest the following conclusions.

(1)The uppermost mylonite zone consists of several subzones of protomylonite, mylonite, and ultramylonite with remarkably varied thickness. Number of subzones in the zone changes from the Nozuka-gawa River to Rakko-gawa River areas. Strain gradient is not regular within the uppermost mylonite zone. Ulutramylonite in the zone are found in direct contact with almost non-mylonitized tonalite or protomylonite. The high-strain zones composed of ultramylonites are not necessarily in the center of the mylonite zone.

(2)Most of the layer-parallel pseudotachylytes are located along the ultramylonite subzones with strong mylonitic foliation. This suggests that the pseudotachylyte-producing faulting preferentially took place on the mylonitic foliation at the contact of the ultramylonite subzones (plastic high-strain zones). Some of the pseudotachylytes are found along lithologic boundaries in the uppermost mylonite zone. These suggest that the location of the pseudotachylyte-producing fault was prepared by the preceding heterogeneity and plastic high-strain localization in the uppermost mylonite zone, as suggested in the southern part of the metamorphic belt by Shimada et al.(2005), Tanaka et al.(2005), and Toyoshima et al.(2005).

(3)Pressure solution and precipitation along micro faults, and pseudotachylyte-producing seismic faulting repeatedly occurred along the same fault plane. Namely, seismogenic slip and slow plastic deformation related to pressure solution took place repeatedly in the same fault zone.