Interseismic plastic deformation in paleo-seismic fault zones under lower crustal conditions at Tonagh Island in the Napier Complex, East Antarctica

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There are severa; granulite-facies paleo-seismic fault zones (PSF) in Tonagh Island, the Napier Complex, East Antarctica (Toyoshima et al., 1999, 2016). In PSF, alternation of thin ultramylonites, cataclasites, pseudotachylytes, and mylonitized pseudotachylytes occur, showing that multiple generations of pseudotachylytes, cataclasites and ultramylonites.
Two types of granulite-facies ultramylonites occur in PSF: type 1 and 2. Microstructures of recrystallized plagioclase and quartz suggest high-temperature or low-strain rate crystal plastic deformation. Microstructures of recrystallized quartz in type 2 ultramylonites suggest high-strain rate crystal plastic deformation. Z-maximum c-axis lattice preferred orientation (LPO) patterns for quartz in type 2 ultramylonites suggest a basal slip system dislocation creep and high-strain rate crystal plastic deformation during interseismic periods. There are two alternative posibilities of deformaition mechanisms of quartz in type 2 ultramylonites as follows: (1) Mylonitized quartz layers originated from quartz veins parallel to mylonite foliation. (2) Water weakening occurred during mylonitization of quartz. Microstructures and LPO patterns of recrystallized plagioclase indicate switch in deformation mechanism from dislocation creep to grain-boundary sliding in type 2 ultramylonites, and also suggest that continuous low strain rate or low differential stress plastic deformation and seismic events alternated. This is imaged acceleration of strain rate or stress relaxation before or after seismic events, respectively. The switch in deformation mechanism from dislocation creep to grain-boundary sliding, associated with the grain-size reduction, attests of the mechanical softening during deformation, which contributed to the localization of the strain within the mylonite, as suggested by Raimbourg et al. (2008).

Keywords: pseudotachylyte, high-strain rate crystal plastic deformation, grain boundary sliding