

Medium- and High-Velocity Frictional Properties of Siliceous Rock

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In a rock-friction experiment performed at room dry condition, friction coefficient as low as 0.2 has been reported recently for novaculite sample (quartz rock) at slip rate range from 30mm/s to 100mm/s (Di Toro et al., 2004). In addition to the ultra-low friction value attained with this sample, it was reported that steady-state friction of this material decreased when slip rate was increased (velocity weakening) at slip rates from 1mm/s to 100mm/s. Di Toro et al., (2004) suggested a silica gel formation and its lubrication as the mechanism of this remarkable weakening, which had been already revealed in frictional experiments on siliceous ceramics (Hibi, 1998).

In this study, we have performed a series of friction experiments on chert samples collected from the Tamba accretionary complex, Kyoto, Japan, in order to examine if low friction as reported for novaculite could be observed for chert samples.

In the experiments performed for cylindrical specimens of chert with diameter of 25mm, we recorded very similar results as reported for novaculite, i. e., (1) chert shows velocity weakening at slip rates of 3mm/s-130mm/s and 0.5MPa of normal stress, and (2) friction coefficient values as low as 0.1-0.2 were recorded at slip rates from 30mm/s to 130mm/s. Sliding surface changed into glossy surface. These results might agree with the idea of the silica gel formation and shearing of lubrication system. However, we definitely need to do more detailed research in the near future in order to understand the source processes responsible for the observed low friction and velocity weakening behavior of the tested chert sample.

Steady state of friction is attained at 100m-500m of displacement which is remarkably larger as compared with several meters of Di Toro et al., (2004). In the case of shearing the gouge layer which had formed at 2000m displacement of friction, strength recovery did not occur. It suggests that the interaction between sliding velocity and gouge may affect velocity weakening.