

[JJ] Eveningポスター発表 | セッション記号 S (固体地球科学) | S-SS 地震学

**[S-SS15]地震発生の物理・断層のレオロジー**

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地震の発生および断層内での物理学的化学的素過程に関わる諸問題に対して、地震学・測地学・地質学・鉱物学等の固体地球科学諸分野における、理論・実験・観測・観察・シミュレーションなどの多様な観点から、学際的に議論を深めることを目標とする。地震前、地震時及び地震後の過程、断層岩と断層帯のレオロジー、断層運動などの震源とその周辺における現象、摩擦構成則とそれに基づく地震プロセスのモデル化、地震発生場の応力状態、断層掘削、震源過程など、関連する話題を広く募集する。

**[SSS15-P05]大気中とアルゴン雰囲気中におけるめのうの中速摩擦強度**

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キーワード：中速摩擦強度、めのう、大気中、アルゴン雰囲気中

Frictional strength of quartz rocks is known to be extraordinary low at subseismic slip rates ranging from 1 mm/s to 10 cm/s, and this weakening has been ascribed to the hydration of comminuted amorphous material, i.e., silica gel. In order to testify this hypothesis, we conducted rotary-shear friction experiments on agate samples at a normal stress of 1.5 MPa, back ground temperatures ( $T_{BG}$ ) of room temperature ( $RT$ ) and 100°C, and slip rates ( $V$ ) ranging from 1 mm/s to 10 cm/s, in air and argon atmospheres, and compared friction coefficients ( $\mu$ ) at humid and dry conditions.

At  $V = 1$  cm/s, steady-state friction coefficients  $\mu_{ss}$  at  $T_{BG} = RT$  in air and argon are  $\approx 0.65$  without noticeable difference, suggesting that moisture-adsorption by wear materials does not affect  $\mu$ . Thermography shows that the slip surface temperature ( $T_{SS}$ ) ranges from 50°C to 70°C. In contrast,  $\mu_{ss}$  at  $T_{BG} = 100^\circ\text{C}$  in air is  $\approx 0.4$ , suggesting decreasing  $\mu_{ss}$  due to increasing  $T_{SS}$ . XRD and FTIR analyses show that wear materials after all these experiments are largely amorphous, and contain similar amounts of adsorbed water. This implies that silica gel is formed even soon after the experiments at dry conditions.

At  $V = 10$  cm/s,  $\mu_{ss}$  at  $T_{BG} = RT$  in air and argon as well as  $\mu_{ss}$  at  $T_{BG} = 100^\circ\text{C}$  in air are  $\approx 0.3$  without noticeable difference. Thermography shows that  $T_{SS}$  reaches 170°C when  $\mu$  reaches the maximum followed by subsequent significant weakening.  $T_{SS}$  tends to synchronize with  $\mu$ , suggesting a feedback so that increasing  $\mu$  causes increasing  $T_{SS}$  followed by decreasing  $\mu$  and then decreasing  $T_{SS}$ . Thus  $\mu$  is likely controlled by  $T_{SS}$  at this  $V$ .

At  $V = 1$  mm/s,  $\mu_{ss}$  at  $T_{BG} = RT$  in air is  $\approx 0.8$ , which is significantly higher than  $\mu_{ss}$  ( $\approx 0.65$ ) at  $V = 1$  cm/s. Thermography shows that  $T_{SS}$  is  $\approx 40^\circ\text{C}$ , which is lower than  $T_{SS}$  (50–70°C) at  $V = 1$  cm/s. The difference in  $\mu_{ss}$  between  $V = 1$  mm/s and  $V = 1$  cm/s is attributable to different amounts of water adsorbed by amorphous wear materials at different  $T_{SS}$ . Adsorption of water by amorphous wear materials is known to increase  $\mu$ .

Thus our results show that agate exhibits significant weakening only when  $T_{SS}$  is high, but not due to the presence of silica gel. Additional friction experiment on silica gel gouge at  $V = 1$  mm/s and  $T_{BG} = RT$  in air

also reveals that its  $\mu_{ss}$  is  $\approx 0.6$ , similar to  $\mu_{ss}$  of common rocks and minerals, casting doubt on the lubrication effect of silica gel. The reason for the significant weakening of quartz rocks at  $V$  ranging from 1 mm/s to 1 cm/s during which  $T_{ss}$  does not exceed  $100^\circ\text{C}$ , however, remains unknown.