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Influence of Hydrothermally Generated Talc Upon Fault Behaviour

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Research indicates that reactions generating phyllosilicate minerals, including talc, may be significant in tectonically active settings such as oceanic spreading centres and large crustal fault zones. The interaction of the growth of frictionally weak hydrothermal minerals with progressive displacement on fault zones represents one possible explanation for anomalous weakness observed at low angle normal (oceanic detachment) faults and the San Andreas Fault. We performed experiments to examine the effect of the hydrothermal production of talc upon fault behaviour. Three types of experiment have been conducted in a triaxial apparatus, at varied effective pressure and temperatures from 20-450°C. Initial experiments involve introduction of a powdered talc gouge between sawcut blocks of lizardite and quartzite. Later tests involve the growth of talc during the experiment by forced reaction of the sawcut blocks at their interface according to: *lizardite* + *quartz* → *talc* + H_2O, followed by either constant displacement rate deformation ("cook and kick") corresponding to an approximate shear strain rate of $1.5\text{x}10^{-3}$ s^{-1}, or constant stress deformation ("cook and creep") spanning shear strain rates to $1.0\text{x}10^{-9}$ s^{-1}. Kinetic behaviour of this reaction has been previously explored as part of this study. Stress relaxation data is also used to investigate flow behaviour at very low strain rates. The friction coefficients determined for lizardite and talc are in agreement with previously published values. Results do not indicate a correlation between the thickness of the talc layer present and the frictional weakening of the shear zone-a small amount appears sufficient to lower the friction coefficient in constant displacement rate experiments. Microstructural study to elucidate deformation mechanisms is ongoing and is significant for the creep experiments in order to relate the generation of talc via reaction to the shear strain rate. These findings are expected to be significant in the description of fault zone weakening mechanisms, including incongruent pressure solution and reaction softening.