Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS29-10 会場:416 時間:4 月 28 日 16:45-17:00

摩擦すべりに伴う AE 活動・摩擦特性の累積変位・法線応力依存性
Effects of normal stress on the evolution of AE activities and frictional properties of a fault

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To numerically investigate earthquake generations on a plate interface or a fault, we need to know their frictional properties. This study provides a clue to evaluate the frictional properties from spatio-temporal variations of such observations as seismicity and aseismic sliding on the interface of the fault.

We performed frictional sliding experiments using a rotary shear apparatus under a variety of normal stress from about 5 MPa to about 15 MPa. Stepwise change in the sliding rate was imposed to investigate rete dependences of AE activity and friction. Cumulative displacement up to 200 mm was achieved to elucidate their evolutions.

We confirmed similar evolutions of AE activities and friction to those shown by Yabe (2002). That is, the frictional property (rate dependence of friction) of the fault was first the velocity strengthening. The velocity strengthening became weak with an increase in the cumulative sliding. Then, the fault showed the frictional property of velocity weakening. Finally, the rate dependence of friction converged to a constant negative value, when the cumulative sliding reached a critical distance. The m-value of AE events increased with sliding, when the cumulative sliding distance was smaller than a critical distance. After the critical sliding distance, the m-value took a constant value. The critical sliding distances of the frictional property and the m-value were almost the same each other. The rate dependence of the m-value, which was negative under a small sliding distance, also converged to a constant value of about zero at the cumulative sliding distance.

The evolutions were quantitatively evaluated by applying an exponential-decay function to data that is similar to the function proposed by Wang and Scholz (1994) to express wear processes of a fault. The function well reproduced the experimental data, suggesting that AE activities and frictional properties evolved in association with the wear. The decay distances of evolutions of the AE activities and the frictional properties were equal to each other and in inverse proportion to the normal stress. The latter could be understood by taking into account that the larger the overlap volume of asperities on the fault, the larger the normal stress. Further, when the normal stress was increased, the velocity weakening became weak and the m-value was decreased.

These results imply that there exists interrelations among seismicity and frictional properties of the fault.

キーワード: 摩擦すべり, AE 活動, 摩擦特性, ロータリーせん断, 変位依存性, 法線応力依存性
Keywords: frictioanl sliding, AE activity, frictional property, rotary shear, evolution, normal stress dependence