Electromagnetic signals associated with stick-slip mode sliding of rocks at high confining pressures

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Various electromagnetic anomalies have been reported as potential candidates for a precursor signal of earthquakes and several physical models for the mechanism that generates field-observed anomalous signals were proposed. In laboratories, many types of experiments have been performed to evaluate the proposed models, however, tests performed at a confined pressure condition are limited. In this study, we performed frictional sliding experiments on granite and quartz-free rocks at high confining pressures to 150MPa within a pressure vessel, simulating deep focal depth conditions of earthquakes. We tried to measure electromagnetic signals associated with stick-slip of the simulated faults inside the pressure vessel.

Frictional sliding experiments were performed at room temperature on dry, cylindrical specimens of granite, basalt, gabbro and peridotite (20mm in diameter, 50mm in length) with a precut surface at an angle of 30 degree to the cylindrical axis, with loading rate of about 0.003 mm/sec and at confining pressures to 150 MPa. Experimental results showed that at the moment of stick-slip sliding, intense electromagnetic field change were observed for all tested specimens, even for the samples that contain no quartz. Results of the presented friction experiments showed that a certain amount of electromagnetic signals could be generated upon the slip motion of quartz-free rocks during stick-slip mode sliding.