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Abstract 1-08p

Experimental Study of Electromagnetic Earthquake Triggering

Rock Friction Experiment at the Spring-Block Model

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Theoretical and field/laboratory experimental results obtained during implementation of research projects in Russia within recent ten years [1] show an evidence of artificial and natural electromagnetic triggering of earthquakes and implication of electromagnetic phenomena for earthquake preparation and occurrence. For practical application of gathered knowledge on electromagnetic triggering phenomena for earthquake prediction/control it is necessary to clear the mechanisms of electro-seismic processes resulted in earthquake occurrence and release of tectonic stresses in the seismo-active faults. Various hypotheses (Fig.1) where proposed to explain the earthquake triggering due to injection of high-power electric pulses into the Earth crust including but not limited to: increase of pore pressure in the fluid-saturated rocks due to Joule heating [2]; electrokinetic phenomena in the rocks resulted in rock fracturing [3]; generation of additional stress due to recharge of double electric layers in rocks, etc. Among research methods the laboratory simulation of "stick-slip" fault behavior under controlled stress state and weak disturbances of the fault gouge seems as a promising tool for analysis of various scenario of earthquake triggering. Since the introduction of the Burridge-Knopoff model of fault mechanics many spring-block models have been proposed, which are attractive due to simplicity of variation of loading, fault gouge, and triggering conditions. For verification of various hypotheses of earthquake triggering mechanisms the spring-block model was developed [4], which allows studying the fault gauge (granular media) behavior under external mechanical and electric triggering impacts (Fig.2). Dimensions of moving block are of 50x50x50 mm to 200x100x50 mm. Normal pressure is up to 0.5 MPa. Drag force of electric drive is up to 100 kg, velocity of movement of running block is 0.010 to 500 mm/min. The system allows to study an influence of weak vibrations, dynamic impacts, heating, electromagnetic actions and fluid injection as the separate and combined triggering factors on the granular layer simulating the fault zone. It was shown that under external vibrations (frequency of 1 to 200 Hz) and electric current across and along the fault gouge (10V DC, 10 V AC of 1 Hz to 10 kHz) the triggering phenomena under the weak impact of magnitude observed under the field conditions are possible only in combination with fluid injection into the fault gouge. The

possible mechanism based on magneto-hydrodynamic fluid pumping into the fault from fluid reservoirs located near the fault under critical stress state due to interaction of telluric current flowing through the fluid-saturated rocks with geomagnetic field is proposed.

Implications of obtained results for earthquake hazard mitigation are discussed from point of view of earthquake prediction based on triggering phenomena, as well as a possibility of partial release of tectonic stresses by artificial actions resulted in series of small slips instead of big one, creep (Fig.3), or 'silent earthquake'.

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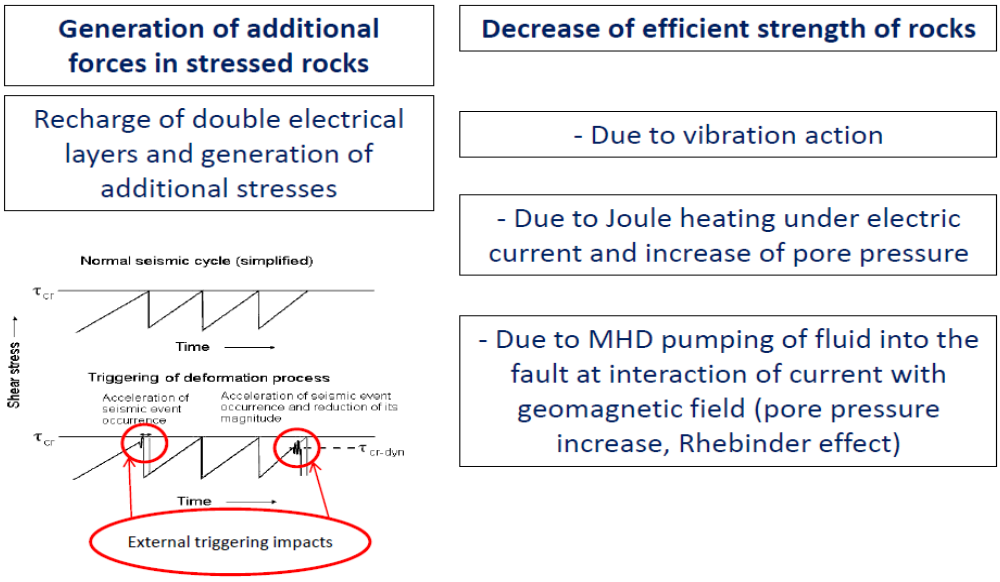

Fig.1. Hypotheses of mechanism of electromagnetic earthquake triggering

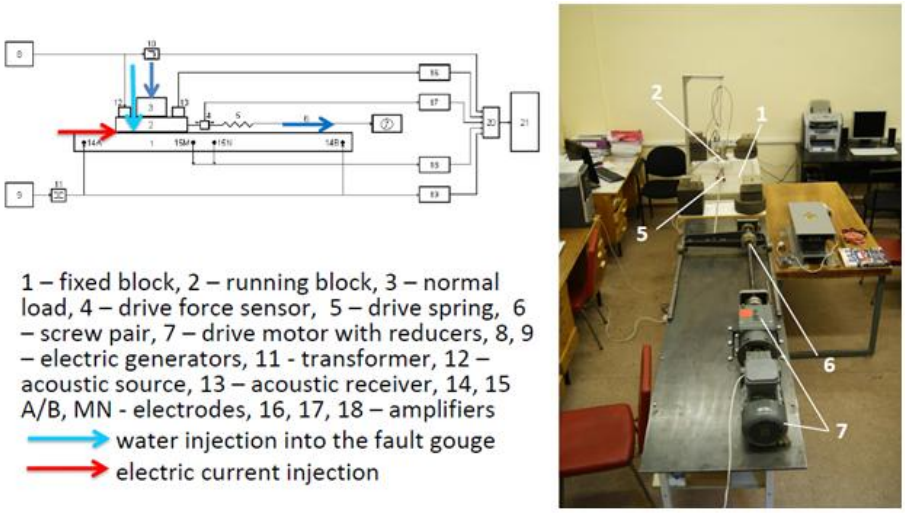

Fig. 2. Experimental spring-block model for simulation of triggering phenomena.

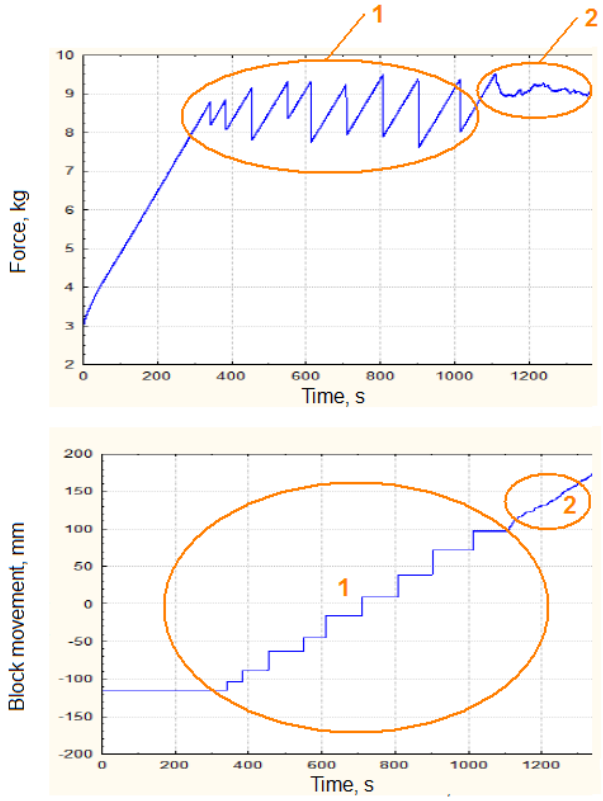

Fig.3. Experimental demonstration of a possibility of transfer of "stick-slip" (1) to stable sliding (2)

References

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