IODP Proposal for Earthquake Triggering Experiment on the Blanco Fracture Zone

*James Mori[1]

1. Earthquake Hazards Division, Disaster Prevention Research Institute, Kyoto University

To better understand earthquake triggering and address societal concerns about seismic events caused by human activities that have recently been occurring at alarming rates, we are proposing an active experiment to induce earthquakes on the Blanco Fracture Zone. Using water injections into the fault zone, changes in the local pore pressure can affect the stress state and bring the fault closer to failure in an earthquake. Past experiments have shown that such changes in effective stress can trigger small earthquakes relatively easily. A unique aspect of this proposal is to attempt triggering of a larger event. The Blanco Fracture Zone provides favorable sites where moderate-sized (M5 to 6) natural earthquakes occur at regular intervals of 10 to 20 years. We propose an experiment that will trigger both small earthquakes and a possibly larger event near or prior to the time of the next anticipated recurrence.

Careful monitoring of seismicity, water pressure and fluid movement associated with triggering of both small and larger earthquakes will provide unique new information about the stress conditions and initiation of the induced earthquakes. We will address scientific issues related to the spatial and temporal triggering of earthquakes from the stress forcing due to water injection. One important aspect is investigation of the dependence of the maximum size of a triggered event on the local stress conditions, which is an important unsolved problem for trying to evaluate the seismic hazard from induced earthquakes. Sampling the transform fault to obtain physical rock properties, such as frictional strength and permeability is an important component of the project. Relating the observed fault properties to the spatial and temporal aspects of the earthquake triggering, has high potential for obtaining a better understanding of physical mechanisms of earthquakes initiation and occurrence. All of these seismological topics are also relevant to naturally occurring earthquakes, so the experiment will address fundamental issues in understanding the physical mechanisms of all earthquakes.

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