

IODP Proposal Cover Sheet

925 - Pre

Blanco FZ Earthquake Triggering

Received for: 2017-10-02

Title	Earthquake Triggering Experiment on the Blanco Fracture Zone		
Proponents	Jim Mori, James Kirkpatrick, Heather Savage, Emily Brodsky, Margaret Boettcher, Rachel Abercrombie, Frederic Cappa, Brett Carpenter, Xiaowei Chen, William Ellsworth, Nicholas Hayman, Jeff McGuire, Monica Schwehr, Jessica Warren		
Keywords	Earthquakes, triggering, transforms, faults, Blanco	Area	Blanco fracture zone

Proponent Information

Proponent	Jim Mori
Affiliation	Disaster Prevention Research Institute, Kyoto University
Country	Japan

Permission is granted to post the coversheet/site table on www.iodp.org

Abstract

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 propose 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 5 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.

Scientific Objectives

Controlled triggering of earthquakes of various sizes with associated observations of local fluid and elastic properties will contribute to a better understanding of the stress conditions and initiation processes of induced and natural earthquakes. Scientific topics to be addressed include,

What are the amplitudes and timing of stress changes that trigger earthquakes?

Where will earthquakes occur?

What will be the size of the triggered earthquakes?

Is the nucleation process different for small and large earthquakes?

Another important aspect of the project is to obtain fault-zone samples of an oceanic transform and measure physical properties, such as frictional strength and permeability. Relating these fault zone properties to the spatial and temporal occurrence of the earthquakes, can provide new information about the physical mechanisms of earthquake initiation and rupture for both induced and natural earthquakes.

Non-standard measurements technology needed to achieve the proposed scientific objectives

Use the riser system for controlled water injections into the fault zone

Proposed Sites (Total proposed sites: 2; pri: 1; alt: 1; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
BLA-01A (Primary)	43.6210 -127.6520	2000	50	1500	1550	Sample transform fault zone Site for water injection
BLA-02A (Alternate)	43.4030 -127.9540	2000	50	1500	1550	Sample transform fault zone Site for water injection