Abstract Details

Corresponding Author : Prof. Kuo-Fong Ma (fong@earth.ncu.edu.tw)

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Title: Investigating Physics of Faulting:Taiwan Chelungpu-fault Drilling Project (TCDP)

Abstract: What physical properties or dynamic processes control the distribution of areas and behavior of large slips had been an important question in seismology. The intriguing observations during the 1999 Chi-Chi earthquake along the ruptured low angle thrust Chelunpu fault (dip30E) with large amount of fault slip at or near the surface provides a unique opportunity to study first-hand the physical mechanisms involved in faulting during large earthquakes through drilling. The Taiwan Chelungpu-fault Drilling Project (TCDP) will drill a 2-km deep hole, where the fault related to the Chi-Chi earthquake is expected to be at 1 km. The significance of this Project is to obtain a physical sample of the fault where large displacements occurred during the 1999 Chi-Chi, Taiwan, earthquake, to measure the physical properties and mechanical behavior of the rocks above and below the fault zone and to thoroughly document the state of stress that exists in these rocks following such a large slip event. Physical and Chemical examination of the fault surface and laboratory analyses of fault rocks and fluids in the laboratory should make it possible to infer important features, such as its dynamic frictional characteristics. The TCDP will drill a 2-km deep hole, where the fault related to the Chi-Chi earthquake is expected to be at 1 km. Overall, the main objectives of this project are to estimate levels of absolute stress, understand dynamic faulting process, and identify physical characteristics of an asperity. To achieve the objectives, several tasks will be carried out through the project. - Retrieve and analyze physical sample of the fault - Make geophysical and geological characterizations of the site (geophysical imaging, pore pressure, permeability, lithostratigraphy, sedimentary facies) - Measure static stress levels - Measure residual temperatures from earthquake - Continue geophysical monitoring (seismometers, thermometers, pore pressure) The Taiwan Chelungpu Drilling Program (TCDP) is extremely appealing both from a scientific and operational standpoint for the following reasons. 1. Clear Scientific Target: A rare and unique opportunity to understand the mechanism of generating a large earthquake. 2. Achievable Drilling Target: A shallow thrust fault (dip 30E) with large slip near the surface. 3. Well Defined Fault Plane: Careful observations from geological investigations and geophysical studies have clearly delineated the drilling target. In recognition of these favorable factors, the TCDP had attracted international interests. The drilling is now on going, and will last to August, 2004 for the 2-km hole.

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Co-Authors

No.	Title	First Name	Family Name	Organization
1	Prof.	Kuo-Fong	Ma	National Central Univ., Taiwan, ROC
2	Prof.	James	Mori	DPRI, Kyoto University, Japan