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集集台湾地震のアスペリティの破壊過程の調査

Searching for Physical Mechanisms to Explain the Large Asperity of the 1999 Chichi, Taiwan Earthquake

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1999 集集台湾地震はこれまでで最もよい記録のある大地震で、広範なデータは地震発生過程の研究に資するところが大きい。大きい変位（～10 m）はすべった断層の北の方、浅いところで起きている。変位の規模が大きかったわりには、この辺の高周波加速度のレベルは比較的低い。加速度のレベルが低いこと、およびすべり速度が大きいことは、摩擦が小さかったことを示していると思われる。摩擦が小さかった理由はいくつか考えられる。たとえば、fault melting, fault lubrication, thermal pressurization などである。

集集地震で動いた車籠埔断層で深いボーリング（～３ｋｍ）を行うことを計画中である。目的は大きくすべった断層のサンプルを取ることである。断層の物性を詳細に解析することで地震の破壊過程に関する情報が得られるかもしれない。摩擦のレベルとすべりのメカニズムを究明することは大地震がどのように起きるかを理解するために重要なことである。

The 1999 Chichi, Taiwan earthquake (Mw 7.7) was the best instrumentally-recorded large earthquake in the world and provides extensive new data for looking at the physical mechanisms of the rupture process. A prominent feature of the earthquake was the area of large (~ 10 meters) and shallow (surface displacements of 7-8 meters) slip on the northern part of the fault. The level of high-frequency ground acceleration from this asperity was relatively low, considering the large displacements. The relatively low level of high-frequency radiation along with the large slip velocities and large displacements, suggests a low level of friction on the fault during rupture. Various physical mechanisms, such as fault melting, fault lubrication, or thermal pressurization have been proposed to explain the slip-weakening process that likely occurred on this portion of the fault.

The shallow location of the main asperity of the Chichi earthquake provides a rare opportunity to examine a fault on which a large amount of slip has recently occurred. We hope to drill a deep borehole (~3 km) into the fault, primarily to examine the physical properties of the fault surface. Close analyses of the fault properties will likely provide information about the physical mechanisms associated with the large amount of slip that occurred on this portion of the fault. Shallow boreholes (200-300m) have already been drilled into the northern and southern portions of the fault. Preliminary analyses of these cores indicates that physical properties of the fautl may control differences in the rupture dynamics of the earthquake. Determination of the frictional levels and slip mechanisms is important for understanding of how large earthquakes occur.