1. In Situ Observations of Fault Dynamics from TCDP boreholes

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After successful drilling crossing the Chelungpu fault, which had a large displacement during the 1999 Chi-Chi, Taiwan, earthquake (Mw7.6), a state-of-the-art 7 level seismometer was installed in the borehole. The 7-level borehole seismometers (TCDP 7-level BHS) were placed crossing the fault zone with three seismometers in the hanging wall, and footwall, respectively, and one seismometer close to the slip zone related to the 1999 Chi-Chi earthquake. The high resolution of TCDP 7-level BHS recorded several different types of events. A significant feature is the observation of three repeating events in 10 sec with almost identical waveforms in S-waves. The travel time differences of S-wave to P-wave (ts-tp) are 1.60sec, 1.57 sec and 1.38 sec, respectively, for the three events, suggesting a possible propagating crack. The waveform simulations of the observed repeating events with harmonic wave trains after S-wave suggest these events were probably from the fault zone, which is about 190m below the major slip zone. Another observed feature is a pulse like wave, which have an apparent velocity of about P-wave velocity (4km/sec), was observed in TCDP 7-level BHS. No S-waves were observed in this event. Whether this event is an association of a new open crack after high pressure Fluid Injection Test (FIT) was examined. With the high resolution TCDP 7-level BHS and FIT in an active fault zone, we try to construct a physical model for the nucleation and rupture behavior within the fault zone.

2. 地震すべり帯中の微小粒子について

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1999 年に台湾中部で発生した集集(Chi-Chi) 地震の活断層である車籠埔(Chelungpu) 断層について，2004 年から2005年にかけて地下深部 (1100 m) における断層帯の貫通掘削が行なわれ，断層破砕帯物質が回収された．掘削孔はHole A, B,C の3 つからなり，そのうちのHole A, C の掘削コアを用いて，1999年の地震滑り面の同定，熱属性の測定，摩擦熱エネルギーの計算，破壊エネルギーの定量が行なわれた(Tanaka et al 2006, GRL, Ma, Tanaka et al., 2006, Nature,

Tanaka et al 2007, GRL). 本発表ではHole C コアで見いだされた滑り帯の断層岩(ultra-cataclasite) について，その超微粒部のTEM およびTXM による形状観察の結果，およびXRD, HR-TEM を用いたSAD, EDX 解析に基づく，超微粒子の鉱物学的特徴を紹介する．

3. せん断を受ける粒状体内部の力の分布について

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粉砕クオーツを用いた模擬ガウジ物質による室内実験と，Distinct Element Method (DEM) を用いた粒子シミュレーションから，粒状体がせん断されるときに発生する内部の微細応力構造についての考察を与える．粒状体に外部から力を加えると，その粒子性から決して等方均質一様には力が伝達されずに準一次元の網目構造が形成されることは良く知られている．この編目構造が等方圧縮下では大まかには等方均質に分布するのであるが，せん断を受けると主応力方向を中心とした柱構造が生じる．その中で，強い柱構造がさらに周囲の力を受け持ち，強弱の２極化が自発的に生じるため，不均質な微細応力構造が発展することを示す。

4. Temperature-dependence of pressure solution in shales of the Shimanto accretionary complex

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We estimate activation energy of pressure solution deformation development in shales of the Shimanto belt in southeastern Shikoku using Arrhenius diagrams (reaction rate vs 1/T). Estimated activation energy for type II melange (H_{II}) is about 18 kJ/mol and that for coherent type (H_C) is 45 kJ/mol. The values obtained here are lower than previously reported H_S (60 – 80 kJ/molK) and H_D (15 – 30 kJ/molK) (e.g. Rimstidt and Barnes, 1980; Nakashima, 1995). We propose a hypothesis for low activation energy that pressure solution deformations are enhanced both by chemical and mechanical effects such as clay minerals and shear deformation.

Generally matured fault zones contain large amount of clay minerals in gouge zone. Pressure solution deformation may be more enhanced in more matured fault zone by both effects.