

📅 Tue. Sep 16, 2025 8:45 AM - 12:00 PM JST | Mon. Sep 15, 2025 11:45 PM - 3:00 AM UTC 🏠 oral room 3(E201)

[3oral301-12] T4. Deformation and reaction of rocks and minerals activities

Chair: Hideki Mukoyoshi (Shimane Univ.), Masaaki UNO (Dept. Earth, Planet. Sci., Univ. Tokyo), Junichi FUKUDA (Osaka Metropolitan University)

11:15 AM - 11:30 AM JST | 2:15 AM - 2:30 AM UTC

[T4-O-18] Co-seismic ductile deformation in carbonate-hosted active faults

*Thomas Yeo¹, Kohtaro Ujiie¹, Kaoru Inoue¹, Takayoshi Nagaya², Hirauchi Ken-ichi³ (1. University of Tsukuba, 2. Waseda University, 3. Shizuoka University)

Keywords : Co-seismic ductile deformation、Frictional heating、Ryukyu Limestone、Yonabaru Fault、EBSD analysis

Identifying co-seismic deformation from faults at shallow depths is of paramount importance in assessing seismic hazards associated with surface rupture and ground shaking. However, while carbonate is a key lithology in seismically active areas, pseudotachylite is rarely preserved because carbonate minerals thermally decompose at temperatures far below the extremely high temperatures required for frictional melting.

This study investigates the active Yonabaru Fault on Miyako Island, southern Ryukyu Arc, which offsets the Pleistocene Ryukyu Limestone and is capable of generating magnitude 6.9–7.2 class earthquakes. The ~50 m thick fault zone hosts multiple fractures and mirror-like polished, lineated slip surfaces associated with narrow (2 mm thick) slip zones. Kinematic indicators indicate normal faulting within a NE-SW extensional regime, consistent with present-day arc-parallel extension. The slip zones comprise fine-grained calcite matrix (<10 µm) and angular limestone clasts. Injection veins orthogonal to the slip surface are observed at the boundaries of the slip zones, suggesting fluidization during faulting.

Electron Backscatter Diffraction (EBSD) analyses reveal distinct deformation microstructures across the slip zone. Calcite grains adjacent to the slip surface exhibit strong shape preferred orientation, dominant $c < a$ slip and recrystallization, indicating deformation temperatures exceeding 400 °C. In contrast, calcite within injection veins display only static recrystallization, suggesting temperatures above 150 °C. These contrasting microstructures imply the development of a thermal gradient during fault slip, likely driven by frictional heating at temperatures much higher than ambient temperatures of ~25 °C.

The absence of e-twins suggests that co-seismic shear stress did not exceed 10 MPa. Thermal modelling constrains the conditions necessary to produce the observed microstructures, indicating that slip velocities must have exceeded 0.1 m/s. Our findings represent one of the first documented cases of co-seismic ductile deformation and

recrystallization in carbonates at shallow crustal depths, offering new insights into the mechanical behaviour of carbonate faults during seismic events.