INTERNATIONAL FRONTIER SEMINAR No 090

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Venue: Meeting Room #486

Science Research Bldg. 1, 4th floor.
Ehime Univ.

What's up with quartz?
part 2

Numerous studies have illustrated that mineral transformations have the capability to induce faulting at elevated pressure and temperature (P-T). This mechanism, commonly known as transformational faulting, emerges as a plausible explanation for the puzzling phenomenon of deep-focus earthquakes occurring at depths up to 700 km. Currently, the debate partly revolves around determining why certain phase transformations lead to faulting while others do not. To better understand this phenomenon, we can compare different transformations taking place in similar experimental conditions and see how they do or do not cause strain localization and faulting.

Second, we conducted experiments in the large-volume press at the PB61 beamline at DESY synchrotron in Hamburg (Germany). These experiments were carried out on quartzite (novaculite) samples transforming to coesite under stress. Throughout the experiments, we collected X-ray diffraction patterns and images concurrently with the collection of Acoustic Emissions (AEs). The results indicate, the growth of the high-pressure phase at various rates depending on P-T conditions and equilibrium overstep. Thousands of AEs were collected in each experiment, and their locations were reconstructed. Interestingly, the spatial distribution of AEs revealed that for some quartz-coesite experiments (those with lower transformation rates) AEs originated from fault planes that formed within the initially intact rock cores. Furthermore, an analysis of the AE catalogs, focusing on the magnitude-frequency distribution, revealed a wide range of b-values influenced by varying P-T conditions and transformation kinetics.

[1] Moarefvand et al. JGR:SE 129.3 (2024): e2023JB027850.
[2] Mingardi et al. Contrib Miner and Pet 180.3 (2025): 1-14.

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