INTERNATIONAL FRONTIER SEMINAR №089

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Venue: Meeting Room #486
Science Research Bldg. 1, 4th floor.
Ehime Univ.

What's up with quartz?
part 1

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.

Here, we conducted a series of deformation experiments on quartzite (novaculite) samples, while they were transforming to 1) β quartz and 2) coesite. We first conducted an experimental study on the quartz α→β transition during which P-wave velocities were measured in-situ at pressure (from 0.5 to 1.25 GPa) and temperature (200–900°C) conditions of the continental lower crust. The transition was observed as a minimum in P-wave velocities, preceded by an important softening while P-wave velocities measured in the β-quartz field were systematically lower than that predicted by thermodynamic databases [1]. Experiments during which acoustic emission (AE) were monitored showed no significant peak of AEs near or at the transition temperature. Additional experiments performed using synchrotron X-ray diffraction and acoustic measurements confirmed that β quartz moduli are significantly lower than those usually predicted [2].

[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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