THE GEODYNAMICS SEMINAR Nº 575

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Venue: Zoom
A link will be sent @grc-all within 30 minutes before the beginning of the seminar.

Does the Kaiser effect exist at upper mantle pressures and temperatures?

The subduction zone produces a major fraction of the Earth's seismic activity. To understand the process triggering intraslab earthquakes, some experimental studies on faulting of slab-forming rocks have been conducted at upper mantle pressures. One of characteristic phenomena of microfracturing of rocks is a hysteresis of acoustic emission (AE) numbers related to the stress history (i.e., the Kaiser effect). The Kaiser effect could be a clue to evaluate the tectonic stress memorized in seismic zones. Previous experiments on the Kaiser effect have been conducted at low pressures and room temperature (e.g., Kurita and Fujii, 1979). However, the elevated confining pressure and temperature may affect the process of microcracking, including the Kaiser effect. Here, we conduct a series of cyclic loading experiments using a D-DIA apparatus at pressures 1-3 GPa and temperatures 700-1250 K to evaluate whether the Kaiser effect exists in ductile rocks at upper mantle pressures and temperatures. Pressure, stress, and strain were measured in situ by using x-ray diffraction patterns and radiographs at BL04B1, SPring-8. AEs were also recorded continuously on six sensors, and three-dimensional AE source location were determined. Stress increased with strain at the beginning of sample deformation, and it reached the yielding point at strains of ~0.05. AEs from the deforming sample were detected when stress exceeded ~1 GPa and the amplitude of AE is positively correlated with stress. During the annealing process, stress continuously decreased and AE activity completely ceased. This observation satisfies the definition of the Kaiser effect.

Keywords: 1. Intermediate earthquakes
2. Acoustic emission
3. Kaiser effect

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