The orthoenstatite/clinoenstatite phase transition under the upper mantle conditions determined by *in situ* X-ray diffraction: Implications for nature of the X-discontinuity

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In-situ X-ray diffraction experiments were performed and the orthoenstatite(Oen)/high-pressure clinoenstatite (*C*2/*c*, HP-Cen) phase boundary in the $MgSiO_3$ system was determined. All the experiments were carried out using a Kawai-type multi-anvil apparatus installed at BL04B1 in SPring-8, Japan. Two types of experiments were carried out, (1) 'phase observation experiments' at varying pressures and temperatures, and (2) 'quench experiments' at fixed pressure and temperature. The phase boundary, determined precisely by integrating the results of both sets of experiments, was found to be P (GPa) = $0.0035T$ (°C) + 3.7, using a MgO pressure scale [1]. The Oen/HP-Cen phase boundary at 1400ºC determined here is 0.7–1.0 GPa lower than previous reports based on quench experiments. The phase transformation of orthopyroxene is expected to occur at 260 km depth along a typical mantle geotherm, and the shallower part of the observed X-discontinuity can be explained by this phase transformation in Opx-rich mantle.

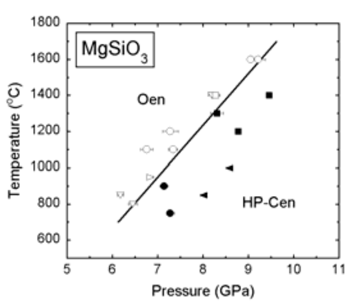

Figure 1: Phase boundary determined in this study (modified after Akashi *et al*. [2]).

[1] Speziale *et al*. (2001) *J. Geophys. Res.* **106**, 515-528.
[2] Akashi *et al*. (2009) *J. Geophys. Res.* 2008JB005894.

VFAs concentrations in the hydrothermal fluids venting from the sediment-hosted hydrothermal system in the Wakamiko submarine crater, Japan

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Marine shallow-water hydrothermal activity was discovered at the Wakamiko submarine crator of 200 meters water depth in Kagoshima Bay. The Wakamiko crator is filled with recent thick (up to 80 m) unconsolidated clayey ~ silty fine sediments, therefore the hydrothermal fluids interact with the sediment during penetration the sedimentary layer. As a result hydrothermal petroleum generation has been occurred at the center area in the crater [1]. We successfully collected the venting hydrothermal fluids (Tmax = 200°C) from the different three vents and also recovered seven piston core samples in and around the crater. Some pore water samples obtained from the cores contained hydrothermal components, which has the same source with the venting fluids [2], however detail of the concentrations of minor components, such as VFAs (volatile fatty acids), were different among the vents and the pore waters. In this study we discuss the cause of the variation in VFA concentrations.

'White Cone' vent was characterized by significantly low VFAs (formic and acetic acids) and hydrogen sulfide concentrations relative to the fluids venting from the other vents ('Hairly Cone' and 'Daifuku-yama'). The relationship between acetic acid and magnesium concentrations in the pore water, which was obtained from the venting site and contained hydrothermal components, was similar to the relationship of the Hairly Cone and Daifuku-yama fluids. Those VFAs may be considered to derive from pyrolysis of the sedimentary organic matter, however, the variation in the concentrations among the vents may suggest subvent microbial activity. $\delta^{34}S$ values of hydrogen sulfide were slightly higher at the White Cone vent than the other vents, such isotopic difference may also suggest microbial contribution.

[1] Yamanaka *et al.* (2000) *Org. Geochem*. **31**, 1117-1132.
[2] Yamanaka *et al.* (2007) AGU, Fall Meet., Abstract V41B-1375.