[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT22]Interaction and Coevolution of the Core and Mantle in the Earth and Planets

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Recent observational and experimental investigations have significantly advanced our understanding of the structure and constituent materials of the deep Earth. Yet, even fundamental properties intimately linked with formation and evolution of the planet, such as details of the chemical heterogeneity in the mantle and light elements dissolved in the core, remained unclear. Seismological evidence has suggested a vigorous convection in the lower mantle, whereas geochemistry has suggested the presence of stable regions there that hold ancient chemical signatures. The amounts of radioactive isotopes that act as heat sources and drive dynamic behaviors of the deep Earth are also still largely unknown. We provide an opportunity to exchange the achievements and ideas, and encourage persons who try to elucidate these unsolved issues of the core-mantle evolution using various methods, including high-pressure and high-temperature experiments, high-precision geochemical and paleomagnetic analyses, high-resolution geophysical observations, geo-neutrino observations, and large-scale numerical simulations. Since this session is co-sponsored by geomagnetism, paleomagnetism and rock magnetism division of the SGEPSS, contributions in geomagnetism and geodynamo simulation are also encouraged.

[SIT22-P39]A variety of Thellier behaviors from vertical sections of an obsidian-rhyolite complex

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Obsidian, glassy phase of rapidly cooled rhyolitic magma, contains fine grained Ti-poor titanomagnetites that are expected to preserve reliable records of ancient geomagnetic field intensities. Varying lithologies from glassy to cloudy obsidian or even to crystalline rhyolite generally appear in a vertical section of an obsidian-rhyolite complex controlled by different cooling rate within the complex. During Thellier experiments for determining paleointensities, rock specimens exhibit different behaviors depending on the grain size. Therefore vertical sections of obsidian-rhyolite complexes should provide great opportunities for testing natural examples for grain size dependence of Thellier behaviors.
From three boreholes of the Takanoobane obsidian-rhyolite complex in Aso volcano, Japan, obsidian samples were collected from one upper and three lower sections. Glassy to cloudy obsidians contain superparamagnetic (SP) to single-domain (SD) grains as revealed by room- or low-temperature frequency dependence of susceptibility. Glassy obsidians exhibit finer superparamagnetic grain size than cloudy obsidians. First order reversal curve (FORC) measurement results support the mixture of SP and SD grains as evidenced by the horizontal ridges that spread in low coercivity range and continued to the vertical reversible ridges. However, some obsidians showed higher coercivities reaching 100 mT and high interacting field. Rhyolite samples, which were collected from the central part of the complex, yielded typical multidomain FORC diagrams.
Thellier paleointensity measurements were performed using a fully automated magnetometer-furnace

system Tspin for 34 specimens by applying 45 microT. Some of the obsidian samples exhibited high and narrow unblocking temperatures within 50 deg.C below the Curie temperature of magnetite (580 deg.C) and represented straight lines on Arai diagrams showing about 45 microT. This kind of samples correspond to high coercivity and interacting FORC diagrams. On the other hand, other glassy obsidians exhibited high-slope straight lines of about 100 microT and cloudy obsidians showed sigmoid curves on the Arai diagrams. Rhyolite samples have typical multidomain-type upward concave curves.
A variety of Thellier behaviors were observed for the Takanoobane obsidian-rhyolite complex in accordance with the vertical position. Coarse-grained rhyolite and cloudy obsidians did not give straight segments on Arai diagrams, therefore are not suitable for Thellier experiments. Glassy obsidians containing SP-SD grains can produce straight lines but not yield consistent paleointensities.