THE GEODYNAMICS SEMINAR Nº 543

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Venue: Zoom

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

Interaction between Cerium and H_2O in Hydrous Rhyolitic Melts

Cerium (Ce) in silicate melt is considered to provide important information about the nature of silicate magmas in the Earth's and planetary interiors, especially about their oxidation state. However, the behavior of Ce in a silicate melt may not be simple, particularly in hydrous silicate melt, where a strong depression of the Ce^{4+}/Ce^{3+} ratio occurs. I report my resent study about the interaction between cerium and H_2O in the structure of hydrous rhyolitic melts. Hydrous rhyolitic glasses quenched from melts at 1 GPa and 1300 °C show a significant decrease of H_2O solubility by the incorporation of Ce. Pair distribution function analyses show no distinct change in the local structures of hydrous rhyolitic glasses with the incorporation of Ce, while I found a distinct change in the intensity of the T–OH (where T is Si or Al) Raman peak. The incorporation of Ce decreases the proportion of T–OH species and increases those of Q_4 and Q_3 species. These results suggest the occurrence of a direct charge transfer reaction between OH^- in the melt and incorporated Ce as $Ce^{4+}_{melt} + 2(OH)^-_{melt} \rightarrow Ce^{3+}_{melt} + H_2O + O_{melt}$. This reaction causes a charge transfer from Ce^{4+} to Ce^{3+} in the hydrous rhyolitic melt, and it inevitably produces Ce^{3+}. X-ray absorption near-edge structure (XANES) measurements show almost completely trivalent Ce (Ce^{3+}) in the Ce-incorporated hydrous rhyolitic glasses, which supports the production of Ce^{3+} through the charge transfer reaction between Ce and OH^-. The decrease of Ce^{4+}/Ce^{3+} ratio reported in hydrous silicate melts would be due to the charge transfer reaction between Ce and H, which implies that the Ce^{4+}/Ce^{3+} ratio in hydrous silicate melts may bear a complex relationship to the oxidation state of magmas.

Keywords: 1. Cerium, 2. Hydrous rhyolitic melt, 3. Melt structure