

The 25th Global COE International Frontier Seminar

“Synthesis of Aluminum- and Iron-Rich Post-Perovskite and their implications to the D” layer”

Prof. Sean R. Shieh

Dep. Earth Sciences and Dep. Physics and Astronomy
Univ. Western Ontario

28 May 2012 16:30-18:00

Meeting Room (#486), 4F Science Research Bldg 1
Ehime University

The post-perovskite is believed to be the high-pressure form of perovskite, the most abundant phase in the lower mantle, and may be stable at the bottom of the lower mantle or 200-250 km above the core mantle boundary. Furthermore, the post-perovskite is regarded as relevant to the seismic discontinuity across the D” layer. However, the interpretation based on the pure MgSiO_3 post-perovskite composition cannot be fully responsible for the seismic discontinuities, lateral variations and some features across and within the D” layer. Moreover, it is believed that the mantle may consist of certain amount of minor elements such as iron and aluminum. Therefore, it would be necessary to evaluate the physical properties and structure of the post-perovskite phase with mantle-related compositions at deep mantle conditions for future purposes. In this talk, the post-perovskite synthesized from a natural enstatite and garnet composition along pyrope-almandine join will be presented. Our results showed that the mixture of perovskite and post-perovskite was synthesized from the enstatite composition. The mixture of perovskite and post-perovskite allows us to compare their volumes and bulk moduli at deep mantle pressures simultaneously. Our results showed that though the post-perovskite phase has a lower bulk modulus than the perovskite but its ambient volume, V_0 , obtained from our fitted P-V data, shows a larger value than that of perovskite phase. For the high pressure-temperature study on the garnet composition along pyrope-almandine join shows that a single-phase of the aluminum and iron rich post-perovskite can be successfully synthesized at pressures above 148 GPa and temperatures higher than 1600 K. Between ~120-150 GPa, mixtures of perovskite and post-perovskite are usually observed. Pressure-volume data for the post-perovskite phases collected during decompression show that incorporation of Fe leads to a systematic increase of unit cell volume broadly similar to the variation observed in the $(\text{Mg,Fe})\text{SiO}_3$ system.

Contact: T. Irifune
irifune@dpc.ehime-u.ac.jp
<http://www.ehime-u.ac.jp/~grc>

