E221-002 **Room: 303** **Time: May 17 9:30-9:55**

Light elements and energetics of the core

Eiji Ohtani[1]

[1] Institute of Mineralogy, Petrology, and Economic Geology, Tohoku University

1. Metal silicate reaction and the light elements in the core

Core of the Earth contains light elements and they are important for controlling its thermal structure that drives geodynamo and heat flow from the core to the mantle. Solubilities of Si and O in liquid iron coexisting with (Mg,Fe)SiO3-perovskite, a major constituent of the lower mantle, is essential to estimate the amounts of these elements during separation of the core. The solubilities of these elements in a wide range of pressure and temperature conditions have been studied to date using the multiuanvil press and diamond anvil cell (e.g., Knittle and Jeanloz, 1995). Recent studies clarified the partitioning behavior, such as temperature and fO2 dependency, and the pressure dependency up to the CMB conditions, (Takafuji et al., 2005; Kawazoe and Ohtani, 2006; Sakai et al., 2006 in preparation). These studies revealed that solubilities of these elements have a strong fO2 and temperature dependency, and a positive pressure dependency in solubilities of both O and Si in metal. Takafuji et al. (2005) , Kawazoe and Ohtani (2006), and Sakai et al. (2006) showed that the density deficit in the core due to light elements can be explained by dissolution of Si and O under the deep lower mantle conditions by the reaction with the surrounding silicate. The depletion of Si in the mantle also can be accounted for by the removal of Si and O from the mantle to the core during the core separation process.

2. Radiogenic heat source in the core

The presence of potassium in the core would have profound implications for the thermal history of the mantle and core, the time of inner core formation, the heat flux at the core-mantle boundary which related to operation of the geodynamo. Recent core-energetics calculations propose potassium in the core as an extra power source necessary for sustaining the magnetic field of the Earth. Several previous experiments on the partitioning of radiogenic elements such as potassium, uranium, and thorium between metallic iron and silicate revealed that small amount of potassium can dissolve into metallic iron at pressure, and there is a large effect of sulfur, i.e., sulfur enhances the solubility of potassium significantly (e.g., Gessmann and Wood, 2002). Recent study by Hirao et al. (2005) revealed a significant dissolution of potassium (0.8 wt. percent) into molten iron, indicating that the partition coefficient of potassium between iron and silicate is 0.15 at the condition of 134 GPa and 3,500 K. This result indicates that the core can contain 35 ppm. total potassium, i.e. 4.1x10-3ppm. of 40K which could serve as a significant heat source in the core for driving the geodynamo.

3. Future study on the distribution of radiogenic heat source: geoneutrino observation

In order to clarify the distribution of radiogenic elements in the Earth, the geoneutrinos generated by the beta decay of uranium, thorium, and potassium are the unique tool. The observation of geoneutrinos from uranium and thorium is now available by the Kamland detector at Kamioka, and they made successfully observed the neutrino events consistent with the uranium and thorium abundance in the Earth estimated by the bulk silicate Earth model (T. Araki et al. [KamLAND Collaboration], 2005; Enomoto et al., 2006). It could be possible to detect the distribution of these elements in the lower mantle and the core. The development of lower energy neutrino detector could also make it possible to detect the neutrinos originated from decay of radiogenic potassium. Geoneutrino is potentially one of the most important and new probe for the study of the core of the Earth in future.