Composition and evolution of the Earth's core

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【Outline of survey】

The purpose of this research is to achieve the core conditions and to clarify the physical and chemical properties of the core forming materials such as dissolution of the light elements in the core. Main targets can be summarized as follows: 1) We will determine the material constituting the inner core by determination of the equation of state of iron and iron-light elements systems, 2) We clarify the partitioning behaviors of some key elements such as radiogenic elements between inner and outer cores to clarify the growth history of the inner core, 3) Study of the metallic melts constituting the outer core by determination of the density and viscosity of the core forming metallic liquid, 4) We study the reactions of the liquid outer core and the post-perovskite phase in the lower-most mantle.

【Expected results】

We are now achieved the condition of the core mantle boundary, i.e., 130 GPa and 3000 K,and we can achieve the conditions within the core by this research. We can also clarify the cooling history, origin of geodynamo, and the age of the inner core based on the partitioning of some key radiogenic elements among the lower mantle, outer core, and inner core. We can also estimate the chemical characteristics of the core by the partitioning of some key elements between solidand molten metal alloys constituting the inner and outer cores, and evaluate the core signatureof some isotopic anomallies reported in the plumes originating from the core-mantle bonudary.

【References by the principal researcher】

• Hirao,N., Ohtani, E., Kondo, T., Endo, N., Kuba, T., Suzuki,T. Kikegawa, T. (2006).Partitioning of potassium between iron and silicate at the core-mantle boundary. Geophys. Res. Lett., 33, L08383, doi:10/1029/2005GL025324.

• Kawazoe, T. and Ohtani, E. (2006), Reaction between liquid iron and (Mg,Fe)SiO3-perovskite and solubilities of Si and O in molten iron at 27 GPa. Phys. Chem. Minerals, DOI 10.1007/s00269-006-0071-4.

• Ohtani, E., Hirao, N., Kondo, T. Ito, M. and Kikegawa, T. (2005), Iron-water reaction at high pressure and temperature, and hydrogen transport into the core. Phys. Chem. Minerals, 78, 2, 77-82.

• Hirao, N., Ohtani, E., Kondo, T. and Kikegwa, T. (2004): Equation of state of iron-silicon alloys to megabar pressure, Phys. Chem, Minerals, 31, 329-336.

【Term of project】 FY2006－2010

【Budget allocation】26,400,000 yen

【Homepage address】 http://www.ganko.tohoku.ac.jp/bussei/english/index.html