# High-Pressure Earth Science: Materials Properties in the Lowermost Mantle and Core

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## 【Outline of survey】

Both pressure and temperature inside the Earth increase with increasing depth. The center of the Earth and core-mantle boundary are under 364 GPa, 6000 K and 135 GPa, 2500-3500 K, respectively. It is very difficult to generate such high pressure and temperature conditions, and therefore much remains uncertain at the deep Earth interior. Our group has been working at high pressure and temperature up to 320 GPa and 2000 K by using a diamond-anvil cell. Based on such world-leading techniques to generate ultra-high pressure and temperature, we discovered $MgSiO_3$ post-perovskite in 2004, which is a primary mineral in the lowermost mantle. Furthermore, we first synthesized cubic $SiO_2$ phase above 270 GPa in 2005. In this project, we will further develop experimental techniques to generate higher pressure and temperature to achieve higher than 3000 K above 330 GPa. We are going to investigate the materials properties and dynamics at (1) core-mantle boundary and (2) inner core boundary, based on synchrotron X-ray diffraction measurements at high pressure and temperature and chemical analyses on recovered samples with electron microscope.

## 【Expected results】

It is very important to expand the limit of experimental pressure and temperature range in order to understand the materials properties and structure of the deep Earth. Our study aims to know the crystal structure and chemical composition of inner core. In addition, the knowledge of the accumulation of subducting slabs and the chemical reaction with the outer core is crucial to our understanding of the chemical evolution of the Earth's mantle. The results of measurements of electrical conductivity of post-perovskite will suggest the nature of electromagnetic coupling between the mantle and core.

## 【References】


- Murakami, M., Hirose, K., Kawamura, K., Sata, N., Ohishi, Y., Post-perovskite phase transition in $MgSiO_3$, *Science*, 304, 855-858, 2004.
- Kuwayama, Y., Hirose, K., Sata, N., Ohishi, Y., The pyrite-type high-pressure form of silica, *Science*, 309, 923-925, 2005.


| 【Term of project】 FY2007－2011 | 【Budget allocation】48,500,000 yen (2007 direct cost) |
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## 【Homepage address】

http://www.geo.titech.ac.jp/lab/hirose/maruyamalab/maruyamalab.html