THE GEODYNAMICS SEMINAR № 589

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Venue: Meeting Room #486
Science Research Bldg. 1, 4th floor.
Ehime Univ.

Keywords:
1. Missing nitrogen problem
2. Nitrogen partitioning
3. Iron carbonitride

Storage of missing nitrogen in the deep Earth: From the mantle to the core

The origin and subsequent cycling of nitrogen play a crucial role in the planetary evolution and habitability. Growing evidence suggests that the bulk silicate Earth (BSE) is strongly depleted in nitrogen and has a super-chondritic C/N ratio, which is considered as the missing nitrogen problem of the BSE. Understanding this depletion is key to the storage and recycling of nitrogen in Earth's deep reservoirs and the delivery process of volatiles to the early Earth. Core-mantle differentiation and subduction are the most fundamental processes controlling the distribution and evolution of nitrogen in the early Earth and modern Earth, respectively. However, it is largely unknown about the partitioning behavior of nitrogen during core formation and the fate of deeply-subducted nitrogen to the Earth's interior during slab-mantle interactions.

In this talk, I will present computational and experimental results on (1) nitrogen partitioning between liquid iron and molten silicate and (2) the chemical stability, phase relations and physical properties of potential nitrogen hosts at extreme conditions. These results help to decipher (1) the nitrogen budget in Earth's deep reservoirs; (2) the transportation and storage of subducted nitrogen in the reduced mantle; (3) the heterogeneous distribution of nitride-bearing inclusions in superdeep diamonds. We further propose the possible solution to the missing nitrogen problem, and highlight the relative stability of iron-light elements in controlling the evolution of volatiles in deep reservoirs.