【Grant - in - Aid for Scientific Research on Innovative Areas(Research in a proposed research area)】
Science and Engineering

Title of Project : Interaction and Coevolution of the Core and Mantle : Toward Integrated Deep Earth Science

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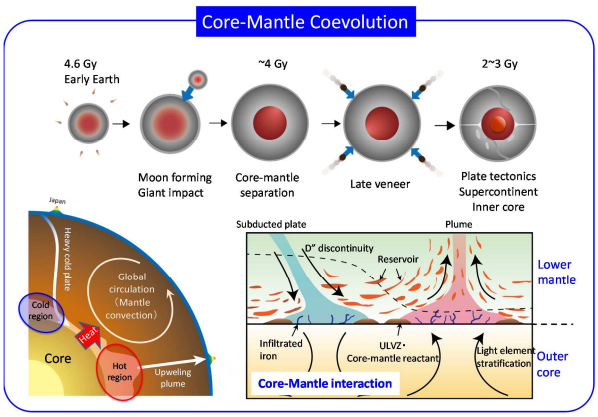
Research Project Number : 15H05826 Researcher Number : 70403863

【Purpose of the Research Project】

Recent observational and experimental investigations have significantly advanced understanding of the structure and constituent materials of the deep Earth. However, details of the chemical composition of the mantle, accounting for 80% of the volume of the entire Earth, and light elements expected to exist in the core, corresponding to the remaining 20%, have remained unclear for over 60 years. Seismological evidence has suggested a vigorous convection at the core-mantle boundary region, whereas geochemistry has suggested the presence of stable regions that hold the chemical signature of early Earth's formation 4.6 gigayears ago. In addition, the amounts and types of radioactive isotopes that act as the heat sources that drive the dynamic behaviors of the deep Earth are also still largely unknown. We will elucidate these unresolved mysteries of deep Earth science through comprehensive investigations of the interactions between the core and mantle by combining high-pressure and high-temperature experiments, microscale geochemical analysis, high-resolution geophysical observations, and large-scale numerical simulations.

【Content of the Research Project】



Our research target is to clarify the major unsolved mysteries in deep Earth science by focusing on the core-mantle interaction and coevolution by fusing different research fields that have developed individually in Earth and planetary sciences.

In our research program, we promote the study of several specific and important topics: (1) detailed compositional properties of the mantle and core including radioactive isotopes, (2) the relationship between the origin of the heterogeneities in the core-mantle boundary region and stable regions (primordial reservoir), and (3) chemical stratification of the outer core and the heterogeneity in the inner core. In order to perform these studies, an unprecedented and wide cross-disciplinary research structure consisting of five research units is organized (A01: Physical property measurement, A02: Geochemical analysis, A03: Geophysical observation, A04: Theory and computation, and B01: Integrated analysis), where researchers from a variety of different fields participate. Summarizing outcomes obtained from all the research units, we will create an integrated new and dynamic model/vision of deep Earth science.

【Expected Research Achievements and Scientific Significance】

The collaboration of world leading research fields in high-pressure Earth science, geochemistry, global seismology, and the more recently developed neutrino geophysics could make great contributions to inventing a new research direction in deep Earth science. This program could greatly enhance our understanding of the core-mantle coevolution system dominating Earth's internal dynamics and evolution. Development of talented human resources through the advanced researches is also of great significance in our program.

【Key Words】

Mantle: A region from a few 10 km to 2890 km depth in the Earth, consisting of solid rocks.
Core: A region from 2890 km to 6370 km depth (center of the Earth) in the Earth, consisting of metallic iron alloy. The biggest material boundary in the Earth is located between the core and mantle (named the core-mantle boundary).

【Term of Project】

FY2015-2019

【Budget Allocation】

1,091,100 Thousand Yen

【Homepage Address and Other Contact Information】

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