【Grant-in-Aid for Scientific Research (S)】
Science and Engineering (Mathematical and Physical Sciences)

Title of Project : Decoding of the Early Earth's Evolution

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Research Project Number : 26220713　Researcher Number : 30361786
Research Area : Geology, Geochemistry, History of the earth
Keyword : Early earth's evolution of solid earth and surface environment, Hadean, extinct isotope systematics

【Purpose and Background of the Research】

The earth has a long history of *ca.* 4.54 billion years, and has evolved into a complex form. However, the oldest rocks and geological bodies of the earth date back up to 4.03 billion years ago, thus the history of the first 500 million years is poorly understood. The period before the age of the oldest rocks is named the Hadean era. The purpose of this study is to decipher the evolution of the surface environment and solid earth during the early earth. Despite of no rocks and geologic terranes with the Hadean age, we challenge to conduct comprehensive and interdisciplinary studies of terrestrial materials.

【Research Methods】

Towards the elucidation of the 10 topics in the early Earth, we will carry out multidisciplinary studies of geochemistry, geology and mineralogy in seven stages. (1) Intensive geological study of important geological bodies to search for evidence of plate tectonics. (2) Selection of the best samples based on the trace element composition and microscopic observation of over 4,000 rock samples. (3) To estimate the solid earth evolution based on ε^{142}Nd, ^{182}W/^{184}W, ^{187}Os/^{188}Os and platinum group element concentrations. Especially, we will develop a new method for the extinct isotope systematics (ε^{142}Nd, ^{182}W/^{184}W). (4) The age distribution of meteorite impact-related Hadean zircons to demonstrate late heavy bombardment. Based on the analysis of inclusions in the Hadean zircons, investigation of evolution of the solid Earth and ocean. (5) Decoding of compositions of seawater and hydrothermal fluid from trace element compositions of the oldest sedimentary rocks (carbonate rocks and iron formations). (6) To estimate the hydrothermal fluid composition from the study of the ocean-floor metamorphism hosted by mafic and ultramafic rocks. (7) To explore evidence for the earliest life and diversity of microorganism from isotope and trace element compositions of the oldest carbonaceous matter.

【Expected Research Achievements and Scientific Significance】

We will make a new model of coevolution of solid earth, surface environment and life in the early earth. We expect an important contribution to the understanding of the evolution of the terrestrial planets because the events in the Hadean clinched the earth's evolution.

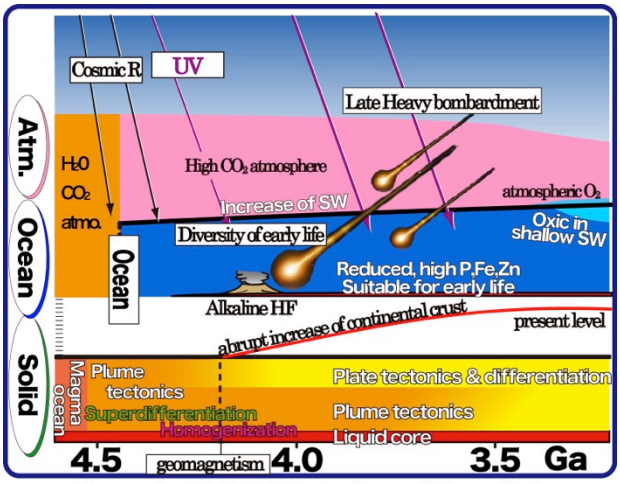

Figure 1 : Model of the early earth's evolution

【Publications Relevant to the Project】

Komiya et al., 1999. Plate tectonics at 3.8-3.7 Ga: Field evidence from the Isua accretionary complex, southern West Greenland. *Journal of Geology*, 107, 515-554.

Komiya, 2007. Material circulation through time -Chemical differentiation within the mantle and secular variation of temperature and composition of the mantle-, In: Yuen, D.A.et al., (Eds.), Superplumes: Beyond Plate Tectonics. Springer, New York, 2007, pp. 187-234.

Iizuka et al., 2007. Geology and zircon geochronology of the Acasta Gneiss Complex, northwestern Canada: new constraints on its tectonothermal history. *Precambrian Research*, 153, 179-208.

【Term of Project】 FY2014-2018

【Budget Allocation】 149,800 Thousand Yen

【Homepage Address and Other Contact Information】

http://ea.c.u-tokyo.ac.jp/earth/Members/komiya.html