

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



Title of Project : Hadean Bioscience

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Research Project Number : 26106001 Researcher Number : 20343246

【Purpose of the Research Project】

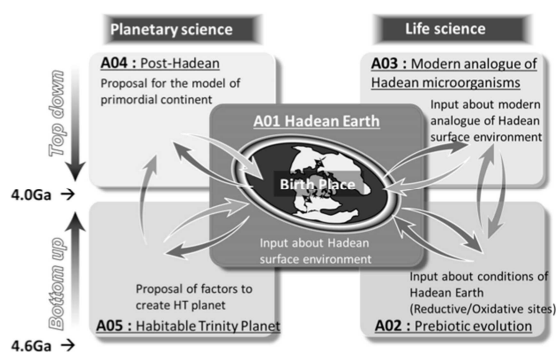
The Hadean is the first geologic eon of Earth, extending 600 million years from its initial formation. The purpose of this research area, entitled “Hadean Bioscience”, is to elucidate where, when, and how primitive life emerged, and thus advancing our understanding of the Hadean environmental conditions.

During the Hadean, environmental conditions are believed to have been extraordinarily diverse and dynamic for the birth of life on Earth, including overarching “Habitable-Trinity (HT)” conditions. HT is a new habitability concept recently proposed by our team, which is the material cycling among the landmass, ocean, and atmosphere driven by the Sun. Taking the HT model (a model for the birth place of life) as the core working hypothesis of our research, we identify essential conditions for the emergence of life based on the knowledge feedback from our Programmed Research Projects, which includes five groups with integration among earth and planetary science and life science. When, where, and how was the first life born? What were the universal conditions for the emergence of life? We aim to establish the new academic discipline, “Hadean Bioscience”, in order to answer these questions. Moreover, we work through the latest planetary formation theory and its experimental work to identify the universal conditions for the emergence of life in the universe. Finally, we will expand and generalize the Hadean Bioscience towards the foundation of the “Earth-bio Planetology”.

【Content of the Research Project】

Our programmatic Hadean-Bioscience research project is divided into five groups according to their specialty. A01 (Hadean Earth): Quantify the process to establish the HT environment of Hadean Earth, coupled with A05 to develop a scenario in which to emerge life on a HT planet. A02 (Prebiotic evolution): Synthesize building blocks of life under HT conditions. Also try to synthesize ATP, polypeptide, and polynucleotide under HT conditions. A03 (Modern analogue of Hadean microorganisms): Unravel the first metabolism /membrane/self-replication system of microbes under a pseudo-Hadean environment on the present Earth. A04 (Post-Hadean):

Exhaustive collection and analysis of geological evidence from the Hadean era through the development of new analytical equipment. A05 (HT Planet): Develop a theory of HT planet formation.



【Expected Research Achievements and Scientific Significance】

It is impossible to elucidate where, when, and how primitive life emerged with life science alone. In the new Hadean-Bioscience research area, with the HT model as the core working hypothesis of our research, we identify essential conditions for the emergence of life on the Hadean Earth. Through this 5-year research program, we will lead a next-generation research, which includes establishing the new academic discipline “Hadean Bioscience”.

【Key Words】

Hadean: The Hadean is the first geologic eon of Earth, extending 600 million years subsequent to its initial formation.
Habitable Trinity: a new habitable concept proposed by our team, which is the material circulation among an atmosphere, ocean, and landmass driven by the Sun. HT conditions provided the necessary elements to bear life.

【Term of Project】 FY2014-2018

【Budget Allocation】 1,079,400 Thousand Yen

【Homepage Address and Other Contact Information】

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