

**【Grant-in-Aid for Scientific Research (S)】**  
**Science and Engineering (Engineering)**



**Title of Project :** New Developments in Science and Engineering of Mineral Resources from Present and Past Oceans

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Research Project Number : 15H05771 Researcher Number : 40221882

Research Area : Earth system and resources engineering

Keyword : Resource exploration, Seafloor mineral deposits

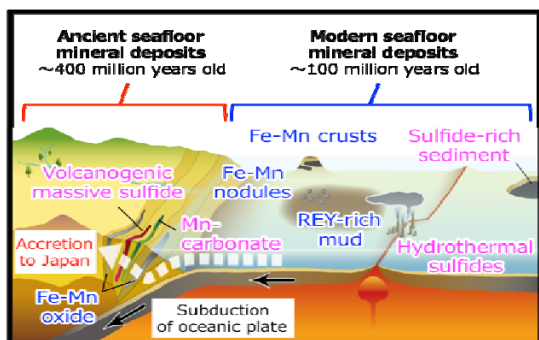
**【Purpose and Background of the Research】**

A variety of mineral deposits (Fe–Mn crusts, Mn nodules, rare-earth elements and yttrium-rich mud, hydrothermal sulfides, etc.) lie on the present seafloor. These deposits have been formed through various physicochemical processes in the ocean during the past ~100 million years. In addition, their ancient equivalents (up to ~400 million years ago) have been exposed in the Japanese accretionary complexes as a product of plate tectonics, which have been developed as ore deposits. These various types of mineral resources formed in the present and past oceans reflect changes in the oceanic environments and global geochemical cycles, and thus close linkages must exist among them. However, in the previous framework, the geneses of the deposits have been studied separately, and there is no comprehensive scheme to understand either the relationships between various seafloor mineral deposits or the linkage with environment.

The goal of this study is to establish a novel and unified view of geneses of multiple seafloor mineral deposits in the Pacific Ocean considering their relationships to Earth system's evolution in the last 400 million years. Deciphering factor(s) controlling the distribution of seafloor mineral deposits both exposed on land and existing in ocean will provide us a new grand design for the Japanese resource strategy.

**【Research Methods】**

In order to elucidate the origins and relationships



**Fig. 1** Modern and ancient seafloor mineral deposits

described above, we will carry out (1) systematic sampling, mineralogical descriptions and chemical analyses of seafloor mineral deposits from the Pacific Ocean and the Japanese accretionary complexes, (2) age determination of the mineral deposits using Os isotope ratios, Re–Os isochrons, and microfossils with paleomagnetic data, and (3) multivariate statistical analysis of the obtained data to decode processes controlling the formation of the deposits.

**【Expected Research Achievements and Scientific Significance】**

The research will provide us an innovative and systematic view for understanding geneses of the mineral deposits from the present and past oceans. Moreover, the new extensive and high-quality data set will enable us to make a reliable evaluation of resource potential and to constrain prospective areas in exploration of new ore deposits both on land and in ocean. We will also obtain information useful for ore processing such as grade, constituent minerals, and physical properties. These achievements will greatly contribute to the Japanese resource strategy.

**【Publications Relevant to the Project】**

- Kato, Y. et al. “Deep-sea mud in the Pacific Ocean as a potential resource for rare-earth elements.” *Nature Geoscience* **4**, 535-539 (2011).
- Nozaki, T., Kato, Y. and Suzuki, K. “Late Jurassic ocean anoxic event: evidence from voluminous sulphide deposition and preservation in the Panthalassa.” *Scientific Reports* **3**, 1889; doi:10.1038/srep01889 (2013).

**【Term of Project】** FY2015-2019

**【Budget Allocation】** 154,500 Thousand Yen

**【Homepage Address and Other Contact Information】**

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