【Grant-in-Aid for Scientific Research(S)】

Science and Engineering (Mathematical and physical sciences)

Title of Project : Interaction among minerals-water-organics in the early solar system : early stage evolution of precursor materials of planets and organics

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Research Area : Earth and Planetary Science

Keyword : Earth and planetary material science

【Purpose and Background of the Research】

Recent progress in the study of primitive materials of the early solar system such as chondrites, interplanetary dust particles, micrometeorites and cometary materials, reveals that interaction among inorganic minerals, organic materials, and water is crucial in their evolution. Various degrees of the interaction are inherited to the variation of planetesimals and consequently planets. The purpose of the present study is to get an understanding on the evolution of solid materials in the solar nebula and on the parent bodies through combination of forward approach (experiments and modeling) and backward approach (observation of primitive objects). The study is new in that it is collaboration between inorganic and organic material sciences.

【Research Methods】

The study includes four subjects.

1) Quantitative evaluation of formation of organic materials in the solar nebula by experiments to form organics in the condition plausible for the early solar nebula with special care to the distribution of solid phases as a function of the distance from the sun.
2) Establishment of a quantitative indicator for thermal metamorphism and aqueous alteration by experiments on reactions between minerals, organic materials, and water and on aqueous alteration of insoluble organics and minerals.
3) In-situ observation of interaction between minerals and organics in micrometeorites in the Antarctic snow and chemical analysis, which includes textural observation, isotopic analysis, elemental analysis, and organics analysis.
4) Reconstruction of the evolution of solid materials in the solar nebula by combination of 1) to 3).

【Expected Research Achievements and Scientific Significance】

Quantitative estimation of evolution of inorganic and organic materials in the solar nebula and on protoplanets will give crucial information on the expected materials in space missions for primitive asteroids. The quantitative indicator for thermal metamorphism and aqueous alteration enables us to estimate the inorganic and organic material distribution in exoplanets, which will further give information about the habitability of planets in extraterrestrial planetary systems.

【Publications Relevant to the Project】

Nagahara, H., Ozawa, K., Ogawa, R., Tachibana, S., and Chiba, H. (2010): Laboratory condensation and reaction of silicate dust. In "Cosmic Dust - Near and Far", Th. Henning, E. Grün, J. Steinacker (eds.). in "*Cosmic Dust",* ASP Conf. Ser., 403-410.

Yabuta, H., Williams, L. B., Cody, G. D., Alexander, C. M. O'D. and Pizzarello, S. (2007) The insoluble carbonaceous material of CM chondrites: A possible source of discrete organic compounds under hydrothermal conditions, Meteoritics and Planetary Science 42, 37-48.

Sakamoto, K., Nakamura, T., Noguchi, T., Tsuchiyama, A. (2010) A new variant of saponite-rich micrometeorites recovered from recent Antarctic snowfall. Meteoritics Planet. Sci., (in press)

【Term of Project】 FY2010-2014

【Budget Allocation】 166,800 Thousand Yen

【 Homepage Address and Other Contact Information】

http://ns.eps.s.u-tokyo.ac.jp/jp/member/index.php?_urid=1389&_lang=ja