

【Grant-in-Aid for Young Scientists(S)】

Science and Engineering (Mathematical and physical sciences)



Title of Project : Geochemical fingerprints of the climate in the past recorded in the geological archives

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Research Area : Earth and Planetary Sciences

Keyword : Paleoclimatology, Paleoceanography

【Purpose and Background of the Research】

Advanced climate system models are the powerful tools to predict the future climate changes including surface temperatures, precipitations, sea-level, ocean acidifications and so forth. Because of currently ongoing global warming, public interests on these topics have been growing particularly after the publication of fourth assessment report of intergovernmental panel for climate change (IPCC AR4). However the predictability of the future changes are required for further improvements since the level of the scientific understanding on some components of the earth's climate still remain poorly understood. Therefore we will reconstruct the climate in the past using various geochemical measures of environments, so called proxy, for several different time slices. We will then compare those results with currently available fully coupled Atmosphere-Ocean General Circulation model (AOGCM) to understand the characteristics of individual AOGCMs which will be useful to draw the better pictures of future climate changes.

【Research Methods】

We set our target time window for the last 150,000 years when the period covers two glacial-interglacial changes. Transition from glacial to interglacial, called termination, is one of the most significant surface environmental changes in recent earth's history. Sea surface temperature was colder even in the tropical ocean and comes and goes of enormous ice sheets in the mid to high latitude continents must have affected the atmospheric circulation patterns at the glacial condition. Thus the magnitude of the shift in climate system was considerably large as is useful to test the output of the AOGCM. Sequence of events during the termination also gives us a hint to understand the mechanism of climate changes of which earth's surface subsystems are interacting each other. Ice core and marine/terrestrial sediment cores are suitable for untangling climate systems and they can be investigated by geochemical measures, such as trace elements in carbonate samples providing water temperatures and oxygen

isotopes for reconstructions of ice volume histories. Shorter timescale climate reconstructions also provide critical constraints on climate models hence the geological archives as is preserving this type of records will be employed during the course of the current project such as tree rings and annual banded corals. Determining the timing of the events are also critical factor for the paleoclimate studies which we will reconstruct high resolution age models using various radioisotopes.

【Expected Research Achievements and Scientific Significance】

We expect to reconstruct high-resolution climate history to reveal detailed relationships amongst earth's climate components. We hope to provide the outcomes of this project as a benchmark data set to constrain the AOGCMs in the world modeling community.

【Publications Relevant to the Project】

- Yokoyama, Y., Lambeck, K., De Deckker, P., Johnston, P., and Fifield, L.K. (2000) . Timing of the Last Glacial Maximum from observed sea-level minima. *Nature*, 406, 713-716.
- Yokoyama, Y., Naruse, T., Ogawa, N.O., Tada, R., Kitazato, H., and Ohkouchi, N. (2006). Dust influx reconstruction during the last 26,000 years inferred from a sedimentary leaf wax record from the Japan Sea. *Global and Planetary Changes*, 54, 239-250.

【Term of Project】 FY2009-2013

【Budget Allocation】 81,200 Thousand Yen

【Homepage Address and Other Contact Information】

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