

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

Integrated Science and Innovative Science (New multidisciplinary fields)



Title of Project : Study on the global environmental change with the various time scales by the various analysis of ice cores

Hideaki Motoyama

(National Institute of Polar Research, Professor)

Research Area : New multidisciplinary fields

Keyword : Environmental change

【Purpose and Background of the Research】

Global climate and environmental changes have occurred on various time-scales in the past million years. A glacial-interglacial cycle occurred on a time-scale of hundred thousand years, and several interstadial and stadial periods occurred on a time-scale of tens of thousands of years during a glacial period. A study on the Greenland ice core revealed that sudden warming and gentle cooling occurred over a time-scale of thousands of years during a glacial period called D-O cycle (Dansgaard-Oeschger cycle). Fluctuations between warm and cool events in Antarctica were not as large as those in Greenland. It is called AIM (Antarctic Isotope Maximum). Warm and cold climates alternated between Greenland and Antarctica. In recent years, medieval warm period and little ice age occurred on a time-scale of hundreds of years. These fluctuations in the global climate system should be studied in detail. What could be the implications of the present global warming scenario on the global climate of future? This research could contribute to improving the accuracy of prediction of global warming.

A 3035-m ice core was drilled at Dome Fuji station in Antarctica; it contains records of global environmental changes dated back to 720,000 years before present. The age of the ice core was estimated with a high accuracy, and a global standard record of climate and environmental changes was created. The mechanism of the global environmental changes was clarified by considering the time scale. The data set of this research was made public, and it is expected that this research will contribute to the study of global environmental changes.

【Research Methods】

The precise age of the 3035-m ice core recovered from Dome Fuji station, Antarctica, was estimated from the ratio of the amount of nitrogen and oxygen. So we decide the global environmental change with precise age until the past for 720,000 years. In this study, we focused on the duration of global warming and greenhouse gas variations, intensity of

insolation, amount of environmental substances, etc. Then the mechanism of global environmental change will be understood. High time resolution analysis will be done about the period of glacial termination and sudden warming during glacial period.

【Expected Research Achievements and Scientific Significance】

Climate change with high accuracy date could be developed the new idea. The duration between orbital elements and environmental (climate) elements could be studied in detail. Ice cores, which contain climate records of the past hundreds of thousands of years, were drilled at the Dome Fuji, Dome C, Vostok, and EDML stations in Antarctica. Ice cores deeper than 3000 m were drilled at the GRIP, GISP2, and NGRIP stations in Greenland, but the age of ice cores drilled at large depths was found to be only tens of thousands of years, because the accumulation rates were high. Ice core, marine sediment core, lake sediment core and so on are made up mutually and global climate change in the past is illuminated by the different time scale analysis. It is very difficult to predict the future climate accurately when the present global warming pattern is unclear. The history of solar activity and associated geomagnetic fields is clarified by analyzing the cosmogenic nuclides in ice cores. The mechanism of evolution of microorganisms in ice cores could be understood. Therefore, an interdisciplinary study on ice cores will be carried out.

【Publications Relevant to the Project】

- Motoyama, H. (2007): The Second Deep Ice Coring Project at Dome Fuji, Antarctica. Scientific Drilling, No.5, 41-43.
- Kawamura, K. et al. (2007): Northern Hemisphere forcing of climatic cycles in Antarctica over the past 360,000 years. Nature, 448, 912-916.

【Term of Project】 FY2009-2013

【Budget Allocation】 162,100 Thousand Yen

【Homepage Address and Other Contact Information】

<http://polaris.nipr.ac.jp/~domef/icc-home/motoyama@nipr.ac.jp>