G4–P1

CHEMICAL COMPOSITIONS OF SOLUBLE AEROSOLS AROUND THE TERMINATION 1 IN THE NEEM ICE CORE

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The polar ice cores provide us with reconstruction of past atmospheric aerosols. Atmospheric aerosols such as dust and sea salt in both Arctic and Antarctic ice cores are well discussed by using the proxy of ion concentration/flux. Recently, studies on the chemical compositions of soluble aerosols in the ice cores have been carried out. The chemical compositions and transition of soluble aerosols in the Dome Fuji (Antarctica) has been revealed, however, there are few studies on those of soluble aerosols in Greenland ice cores. Using ice sublimation method [1], we analyzed the chemical compositions of soluble sulfate and chloride aerosols around the Termination 1 in the NEEM (Greenland) ice core.

We divided around Termination 1 into 4 stages by focusing on the temperature; Holocene, Younger Dryas (YD), Bølling-Allerød (B-A) and Last Glacial Period (LGP), and compared the mass ratio of sulfate and chloride aerosols in each stage. During the cold stage in YD and LGP, $CaSO_4$ accounted large percentage of soluble aerosols. On the other hand, during the warm stage in Holocene and B-A, Na-salt (Na_2SO_4 + NaCl) accounted large percentage of soluble aerosols. These relationships between chemical composition and temperature are probably related to $nssCa^{2+}$ concentration. The $nssCa^{2+}$ concentration in YD and LGP is more than 10 times higher than in Holocene and B-A in GRIP ice core [2]. We will discuss the relationship between $nssCa^{2+}$ concentration and chemical compositions of soluble salts in the presentation.

References

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[2] De Angelis et al., *J. Geophys. Res.*, 102:26681-26698, 1997.

G4–P2

EARLY TWENTIETH CENTYRY WARMING VEIWED FROM ARCTIC ICE CORES

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The Arctic has recently undergone drastic changes under global warming. In addition to the recent warming, significant warming was observed from the 1910s to the 1940s. Causes of the early twentieth century warming have not been clarified yet. Large natural variability makes it difficult to quantify the anthropogenic impacts on the Arctic climate and environment. To understand both natural and anthropogenic variability and its mechanisms, long-term climate data are required. Ice cores provide valuable information on the past climatic and environmental changes in the Arctic, where long-term meteorological observations have been very limited. Data from more than ten ice cores drilled by Japan and other nations are available for the past 100-200 years. In this report, ice core data available so far are reviewed, and the climatic variability reconstructed is discussed, to make the information available to the climatologists and modelers etc. Previous ice core studies show that there is large regional variability in temporal patterns of temperature, precipitation and anthropogenic air pollutants within the Arctic. Spatial and temporal variability of climate and environment during the past 100-200 years in the Arctic is discussed.

G4–P3

CONCENTRATION OF TRACE INORGANIC SPECIES IN SURFACE SNOW AT NEEM, GREENLAND

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In the northern hemisphere, especially Greenland, it is considered that ocean and stratosphere are major sources of halogen species. However, there is little data about halogen species contained in snow and ice in Greenland. In this research, trace inorganic species (Br, Cl, F, I) in Greenland snow were analyzed.

The snow samples were collected from a pit dug at NEEM, Greenland (77°45'N, 51°06'W, 2500 m). The samples were transported to Japan without thawing. The quantitative analyses of elements were performed using an ion chromatograph mass spectrometer (IC-MS) and a quadrupole type inductively-coupled plasma mass spectrometer (ICP-MS). The IC-MS system consists of a single quadrupole type mass spectrometer (Agilent Technologies 6150) connected to an ion chromatograph (Dionex ICS-2000). IonPac AS11-HC was used as the separation column of the ion chromatograph. 14 anion species including halogen species (Br^-, BrO_3^-, CH_3COO^-, $CH_3SO_3^-$, Cl^-, $C_2O_4^{2-}$, F^-, $HCOO^-$, I^-, IO_3^-, NO_2^-, NO_3^-, PO_4^{3-}, SO_4^{2-}) were analyzed by this system.

Average and maximum concentrations of Br^- were 0.2 ng/ml and ca. 0.4 ng/ml, respectively. Average and maximum concentrations of I^- were 6 pg/ml and ca. 10 pg/ml, respectively. Further results and discussion about the behavior and origin of halogen ion species in snow will be presented.

G4–P4

The variability mechanism of precipitation amount in central Alaska

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A 180.17-m ice core was drilled at Aurora Peak in the central part of the Alaska Range, Alaska, in 2008 with the goal of reconstructing centennial-scale climate changes in the northern North Pacific. We analyzed stable hydrogen isotopes (δD) and chemical species in the ice core. The ice core age was determined by annual counting of δD seasonal cycles, and age control was provided by reference horizons of tritium peaks in 1963 and 1964, major volcanic eruptions of Mount Spurr in 1992 and Mount Katmai in 1912, and a large forest fire in 2004. The ice core record extends from 1734 to 2008. We estimated the annual accumulation rate using the seasonal cycle of δD and evaluated recent climatic changes in Alaska. In this contribution, we discuss the variability mechanism of precipitation amount in Alaska with chemical analysis of ice core and meteorological data.

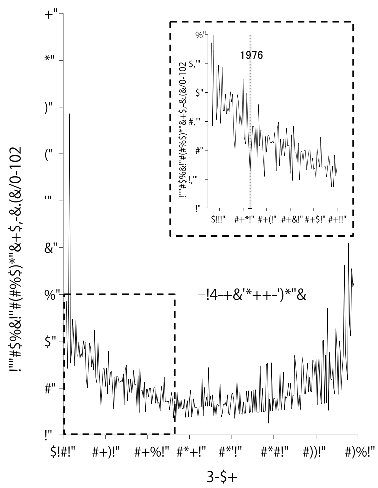

Fig. 1 Annual accumulation rate corrected by the Dansgaard-Johnsen model.

G4–P5

50-YEARS GLACIAL ENVIRONMENTAL CHANGE IN BENNETT ISLAND, SIBERIAN ARCTIC

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Rapid environmental change is seen in DeLong Archipelago, Siberian Arctic which is one of the most warming areas on the Earth. However, only one report described about the area based on the observation in 1980s.To quantitate glaciological change, the data of mass balance and ELA of Toll glacier in Bennett Island were analyzed as well as climate data at the vicinity. Most of mass balance of Toll glacier during 1967-2010 was negative and its cumulative mass balance is ca. -20m w.e., which is one of the largest changes in the arctic. ELA of Toll glacier may reach at 380m, which is the top of the ice cap, in 2020s. The negative mass balance trend is corresponding to warming trend in the arctic. The warming trend is correlated with both mass balance decreases of glaciers and sea ice distribution in the Siberian Arctic.

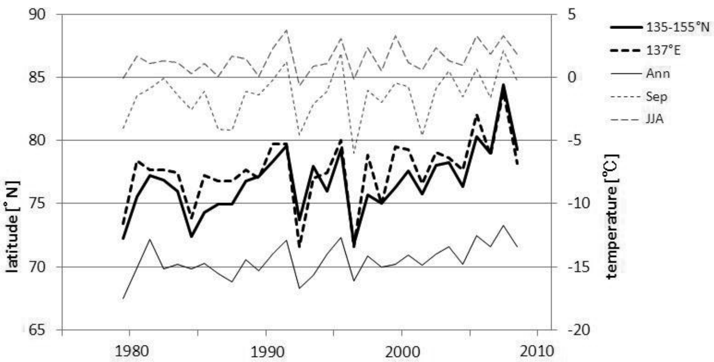

Figure 1.
Air temperature, southern end of sea ice in September and maximum SST at 76.4N, 148.9E.

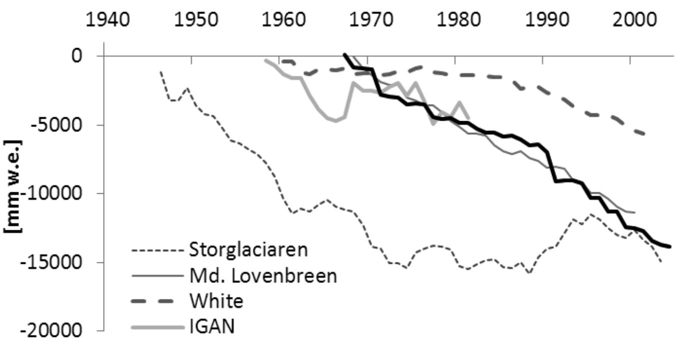

Figure 2.
Cumulative mass balance of Arctic glaciers

G4–P6

DNA ANALYSIS FOR SECTION IDENTIFICATION OF A PINE POLLEN GRAIN FROM THE BELUKHA GLACIER, ALTAI MOUNTAINS, RUSSIA

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Pollen taxon in sediment samples can be identified by analyzing pollen morphology. Identification of related species based on pollen morphology is difficult and is limited primarily to genus or family. Because many pollen grains in mid- and low-latitude glaciers contain protoplasm, genetic information of pollen grains should enable identification of plant taxa below the genus level. Such capability would be extremely useful for reconstructing information on past vegetation, climate, and environments in ice core studies. However, no studies have attempted detailed identification using DNA sequences obtained from pollen found in glaciers. As a preliminary step, the present study attempted to analyze the DNA of pine (*Pinus*) pollen grains extracted from surface snow collected from the Belukha glacier in the Altai Mountains of Russia in the summer of 2003. A 150-bp *rpoB* fragment from the chloroplast genome in each *Pinus* pollen grain was amplified by polymerase chain reaction, and DNA products were sequenced to identify them at the section level. A total of 105 pollen grains were used for the test, and sequences were obtained from eight grains. *Pinus* is a taxon with approximately 111 recognized species in two subgenera, four sections and 17 subsections. From the sequences obtained, the pollen grains were identified as belonging to section *Quinquefoliae*. Trees of the extant species *Pinus sibirica* in section *Quinquefoliae* are currently found surrounding the glacier. The consistency of results for this section suggests that the pollen in the glacier originated from the same *Pinus* trees found in the immediate surroundings.