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Activities of the Japanese Arctic Glaciological Expedition in 1998 (JAGE 1998)

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Abstract

The prime objective of the Japanese Arctic Glaciological Expedition (JAGE) is to study the climatic and environmental changes for the last few hundred years using ice cores from various areas of the Arctic cryosphere. Ice coring down to 118.48 m and ice core analyses *in situ*, as well as the meteorological observation, were carried out at the top of Austfonna (Austdomen) in Nordaustlandet, Svalbard, from 9 March to 20 April 1998. Some heavy equipment and fuel for the helicopter were carried to the coastal area of Nordaustlandet by Lance, the research vessel of Norwegian Polar Institute, during the summer season of 1997. A total of 3.24 tons of equipment was transported to the ice-coring site by a helicopter in the spring season of 1998. It took 20.23 hours for the total helicopter operation. Five members stayed on Austfonna from 9 to 27 March and four members stayed from 27 March to 20 April.

1. Introduction

The objective of the Japanese Arctic Glaciological Expedition (JAGE) is to study the climatic and environmental changes during the last few hundred years using ice cores from various areas of the Arctic cryosphere. Four shallow ice cores (Høghetta ice dome, Snøfjellafonna, Åsgaardfonna and Vestfonna) have been retrieved from Svalbard glaciers and two cores from the Greenland ice sheet (Site J and GRIP site) since 1987. The previous research activities have already been outlined in Watanabe and Fujii (1988, 1990), Watanabe *et al.* (1993) and Watanabe (1996). This paper focuses on the Japanese glaciological research activities at the top of Austfonna, Nordaustlandet, Svalbard in 1998.

2. Location of the ice coring site and its glaciological conditions

Austdomen of the Austfonna ice cap (79°48'03"N, 24°00'21"E; 750 m a.s.l.) was selected for an ice coring site (Fig. 1). The contour lines for Austfonna in Fig. 1 are refer to the lines in figure in Dowdeswell *et al.* (1986). An ice core reaching to the bottom of the ice cap was previously obtained (Arkhipov *et al.*, 1987); however, detailed analytical results of the core are not yet published. Glaciological conditions of the site are as follows: ice thickness, 560 - 580 m (Arkhipov *et al.*, 1987); annual accmulation rate 0.5–0.6 m yr^{-1} in water eq. (Sinkevich and Tarusov, 1989); and 10 m snow temperature -4°C (Zagorodonov and Arkhipov, 1990).

3. Logistics

3.1 Baggage transportation

A helicopter (Bell 212) was used for all baggage transportation to the coring site. The transportation charts are summarized in Fig. 2. Flights were divided into four phases according to the flight date. Some of the baggage were initially transported to the Relay Point, Ormholet (thereafter abbreviated as ORM: 78° 42'N, 21°06'W), and were carried to the ice-coring site on the Austfonna (ASF). The total weight of our

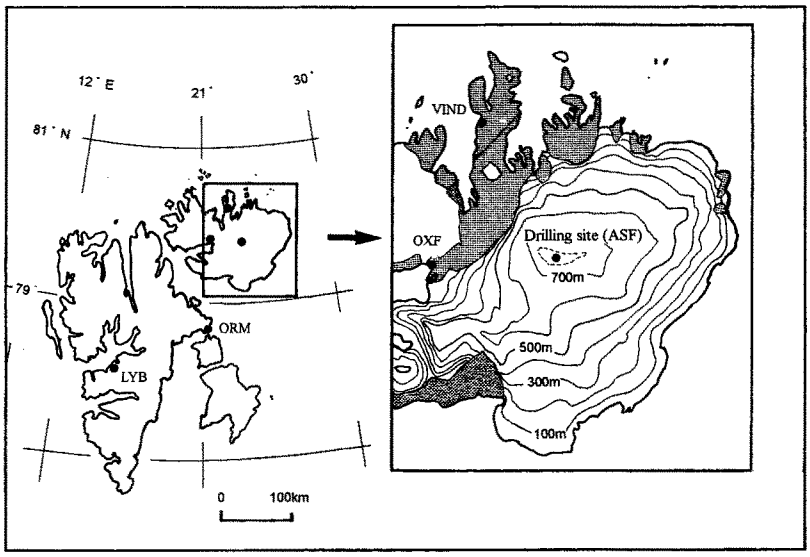

Fig. 1 Ice-coring site on Austfonna, Svalbard in 1998. Dots indicate ice-free area.

baggage from Longyearbyen (LYB) to ASF was 1260 kg. Heavy equipment such as the winch for the drilling, snow scooters, large tents, as well as timber and plywood (total 1980 kg) was deposited at Oxforfhalvoya (OXF: 79°46'00"N, 21°45'51"E), west of the Austfonna, during the previous summer, August 1997, by a ship "R/V LANCE" chartered by Norwegian Polar Institute (NP). These were transported to ASF during Phase 2. The helicopter was refueled at ORM, OXF and near Vindbukta (VIND: 80°16'N, 22°34'E), north of the Austfonna. The fuel was also stored during the previous summer. After the ice coring operation, some heavy baggage was returned to OXF on 20 April. Others were transported to LYB. It took 20.23 hours for the total helicopter operation. The payload of the helicopter was 840 kg between LYB and ORM, and 570 kg between ORM and ASF.

3.2 Living facilities

One large tent (3.0 m×6.0 m and 2.0 m in height) and two personal tents were used for accommodation at the ice coring site at ASF. Kerosene stoves were used for heating in the tents. Insulation sheets (30 mm in thick) were used on the floor in the tent.

4. Ice coring, *in situ* ice core analyses and meteorological observation

We used a shallow drill (D-2 type, Geo Tecs Co. Ltd., Japan) and a middle-deep winch (W-4 type, Geo Tecs Co. Ltd.). The winch was installed in the "ice coring tent" (3.8 m×5.8 m and 3.2 m in height). A tilting tower was used for the winch. Ice-coring operation was carried out by three persons. Figure 3 summarizes the ice-coring operation during our stay on Austfonna. Although we arrived at the site on 7 March, bad weather prevented us from starting the ice coring until 19 March. We obtained an ice core 118.62 m long from 19 March to 3 April. The total number of working days and hours were 14 and about 118, respectively. Thus, the mean ice coring speed was 8.4 m day^{-1} and 1.0 m h^{-1}. The average ice core length for each ice-coring was 0.57 m. One diesel generator (3kVA) was used for the ice coring.

Ice-core visible stratigraphy was observed *in situ*. The weight and diameter of ice cores were measured. *In-situ* core analyses were performed in the "ice-core analyses tent". Figure 4 shows tents for ice core analyses, ice coring and living on Austfonna. Ice cores were packed in plastic tubes and stored in plastic boxes at Austfonna. These cores were transported to a cold room in Tromsø, Norway, for further analyses.

An automatic weather station (Fig. 5) was installed at the ice-coring site from 9 March to 19 April, 1998. Air temperature, humidity, wind speed and wind direction were recorded at an hour interval. CMOS -data loggers ("KADEC-US" series, Kona System Inc. Ltd., Japan) were used for the data memory. Figures 6

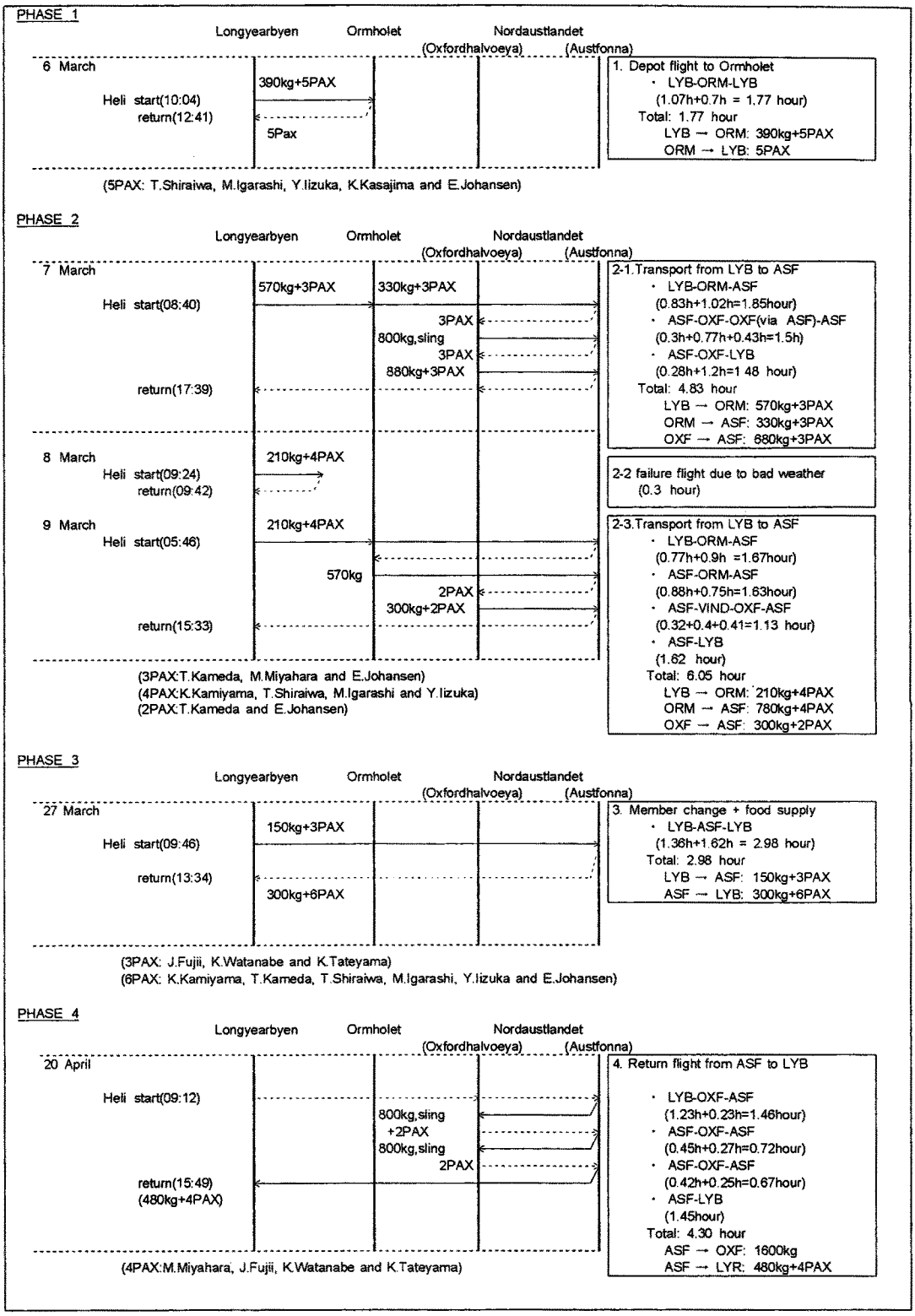

Fig. 2 Transportation chart for Phases 1 and 4 in 1998 operation

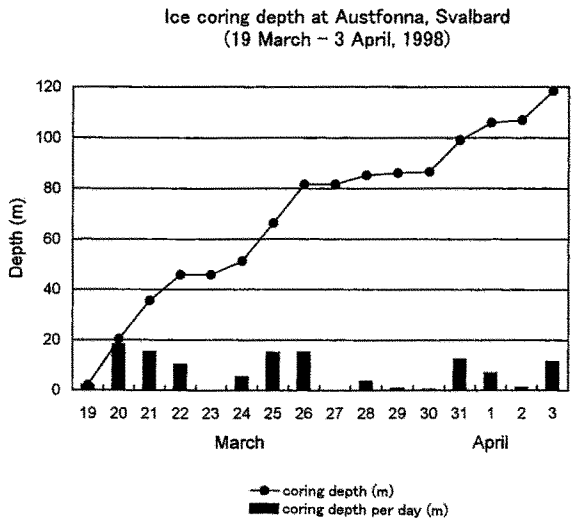

Fig. 3 Ice coring depths from 19 March to 3 April, 1998

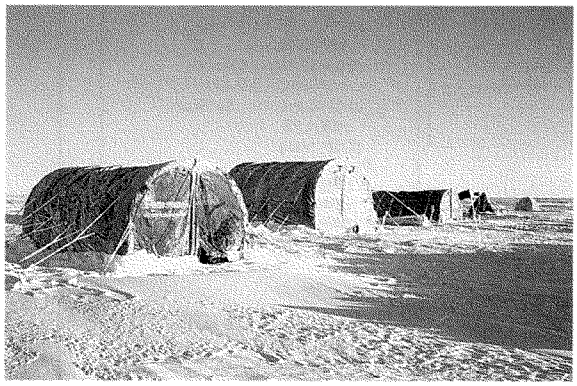

Fig. 4 Ice core analyses, ice coring and three living tents (from right to left) on Austfonna, Svalbard.

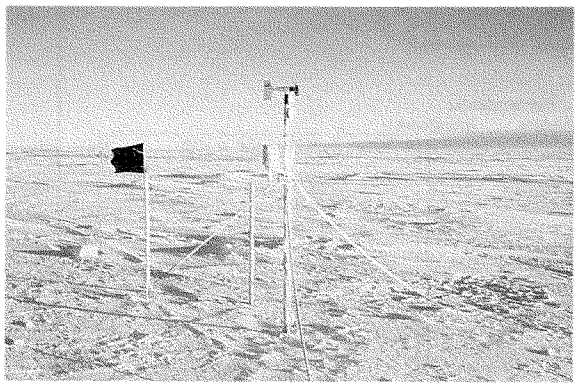

Fig. 5 An automatic weather station on Austfonna, Svalbard

-a and 6-b show air temperature and wind speed profiles, respectively. We could not record air temperature from 7 to 19 April because the data logger did not work during the period. Air temperature ranges from -34.8 to -4.8°C and wind speed from 0 to 19 m s^{-1}. When strong wind blew, air temperature rose. This was mainly caused by cyclone activities.

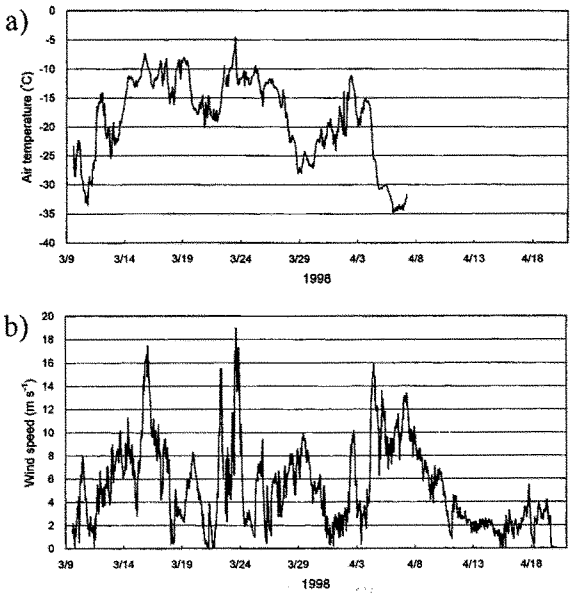

Fig. 6 Air temperature (a) and wind speed (b) on Austfonna, Svalbard

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Field Members

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Members : Takao Kameda

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