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Outlines of the Japanese Arctic Glaciological Expedition in 1987

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Abstract

The objective of the Japanese Arctic Glaciological Expedition (JAGE) in 1987–1992 is to study the climatic and environmental changes in the last few hundred years in various parts of the Arctic cryosphere. As the 1987 activities of the JAGE, ice core drillings and in-situ core analyses were carried out at the top of Jostedalsbreen in Norway early in May and at the top of ice dome Hφghetta on Åsgårdfonna in the northeastern part of Spitsbergen during the period from late May to mid-June. Ice cores were obtained from the surface to the bottom; 46.96 m and 85.61 m in depth at Jostedalsbreen and at Hφghetta, respectively.

1. Introduction

Ice core drillings and in-situ core analyses were carried out at the top of ice fields in Norway and in Spitsbergen by the Japanese Arctic Glaciological Expedition (JAGE) from May to June 1987 under the leadership of Okitsugu Watanabe of the National Institute of Polar Research, Tokyo.

The expedition was planned as the first-year program of "JAGE 1987-1991" (field work will be planned every two years) by the Arctic Research Committee (chairman: S. Kobayashi, Niigata University) of the Japanese Society of Snow and Ice.

Present paper describes objectives of the JAGE and outlines the field work in 1987.

2. Objectives of the JAGE 1987-1992

The objective of the Japanese Arctic Glaciological Expedition is to study the climatic and environmental changes for the last few hundred years in various parts of the Arctic cryosphere. The Arctic has maritime cryosphere and the Antarctic has continental cryosphere, and both cryospheres play an important role in the present global climate system. The final goal of the JAGE is to clarify the simultaneity and regionality of climatic changes in the last few hundred years and to get clues to the causes of global climatic changes.

The Arctic cryosphere is composed of various types of ice masses, showing a clear contrast to a relatively simple huge ice mass in the Antarctica. The ice masses in the Arctic such as in Svalbard, Axel Heiberg, Baffin, Ellesmere and Greenland have regional varieties in the present air-ocean-ice interactions and in the past glaciological fluctuations since the Pleistocene. Shallow ice core drilling was, therefore, planned at various places as shown in Table 1 as the main field work of the JAGE. Some shallow cores were obtained in the Antarctic for the similar objectives to the present ones by the East Queen Maud Land Glaciological Project in 1982-1986.

Table 1. Shallow ice-core drilling sites planned in the Arctic by the Japanese Arctic Glaciological Expedition during 1987-1991.

	higher latitudes (80° N)	lower latitudes (60° N)
maritime	Svalbard	Norway
continental present ice-sheet zone	Northern and/or central part of Greenland	Southern part of Greenland
past ice-sheet zone	Ellesmere Island	Baffin Island

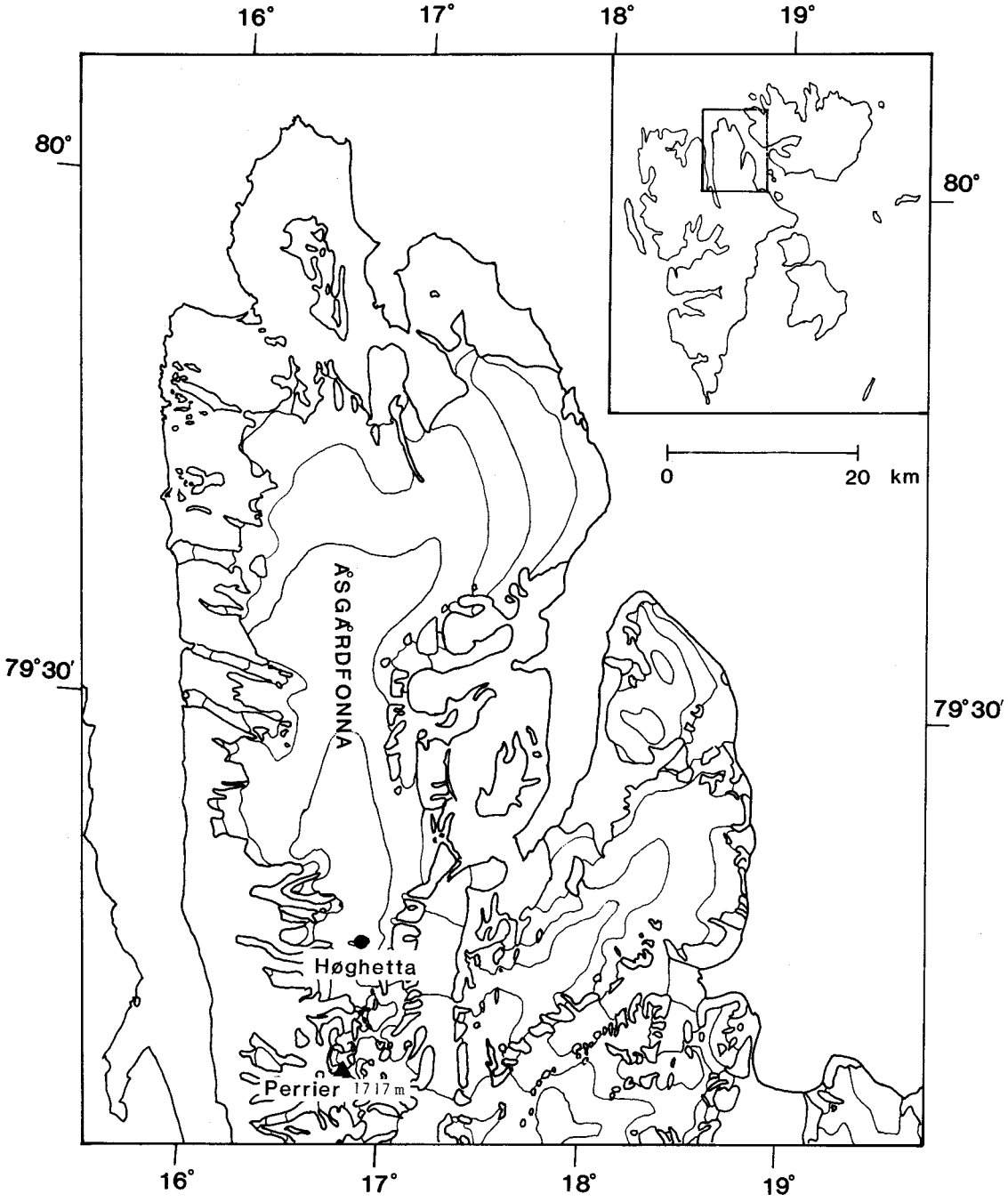

Fig. 1. Location of ice core drilling in Spitsbergen.

3. Research program in Svalbard and Norway in 1987

The 1987 program of the Japanese Arctic Glaciological Expedition was carried out in Norway from early to the middle of May with the cooperation of Norges Vassdrags-og Energiverk (NVE: Norwegian Water Resources and Energy Administration) and in Svalbard from the end of May to the middle of June with the cooperation of Norsk Polarinstitutt (NP: Norwegian Polar Research Institute).

3.1. Objectives

a) The objectives of research program are to obtain shallow ice cores from Svalbard and Norway to study the climatic and environmental changes during the last few hundred years.

b) As the Svalbard is located near the southern limit of seasonal sea-ice extent, the distribution of sea-salt contents in ice cores is to be analyzed as an indicator of fluctuation of sea-ice extent. The relation of reconstructed sea-ice extent to the climatic change is to be examined.

c) Pollutants exhausted in Eurasia are transported toward Svalbard in spring when blocking occurs in the northeastern Atlantic sector of the Arctic (Iversen and Jorauger, 1985). The variation of pollutants content in ice core is, therefore, to be examined to study the variation of synoptic pattern in the Arctic in the past.

d) Reconstruction of volcanic activity records by ice core analyses and the examination of its relation to climatic change.

e) Relevant glaciological and meteorological observations for further understanding of Arctic cryosphere.

3.2. Research sites

a) Spitsbergen

An ice dome called Hø ghetta (Fig 1: 16° 50′ E, 79° 17′ N; 1200 m a.s.l.) on Åsgårdfonna in the northestern part of Spitsbergen was selected for ice core drilling because of following reasons:

(1) slow glacier flow
(2) little snow melt in the summer
(3) small annual snow accumulation
(4) no ice core drilling hitherto
(5) relatively easy access by helicopter.

The research site is about 100 km north of Longyearbyen.

b) Norway

Högste Breakulen (Fig 2: 7° 2′ E, 61° 41′ N; 1957 m a.s.l), the top of Jostedalsbreen in Norway, was selected for ice core drilling because of following reasons.

(1) relatively slow glacier flow
(2) no ice core drilling hitherto
(3) easy access from NVE observation hut at Steinmannen
(4) long mass-balance record is available

3.3. Research items

a) Shallow ice core drilling

Ice core drilling was carried out to the bottom: 85.61 m at Hø ghetta in Spitsbergen and 46.96 m at Högste Breakulen of Jostedalsbreen, Norway.

b) Ice core analyses

(in-situ analyses): stratigraphic observation and photographic description; electrical conductivity; pH; density (by both weighing and hydrostatic methods); ice fabrics; grain size; total gas content

(laboratory analyses): $\delta^{18}O$; tritium content; microparticle concentration; chemical composition (major ions); radio activation analysis of insoluble particles; total gas content; density (by X-ray CT scanning); pollen analysis of filtrated samples

c) Borehole temperature distribution

d) Pit work (refer the items of both b) and c))

e) Sampling of falling snow

f) Measurements of accumulation and ablation of snow

g) Heat balance observation

h) Synoptic meteorological observation

3.4. Participants

Chief investigator

Dr. Okitsugu Watanabe (Professor. National Institute of Polar Research).

Field party

Leader

Dr. Yoshiyuki Fujii (Associate Professor. National Institute of Polar Research).

Members

Dr. Sadao Kawaguchi (Professor. National Institute of Polar Research).

Dr. Toshiyuki Kawamura (Research Associate. Institute of Low Temperature Science, Hokkaido University).

Kazuhide Satow (Associate Professor. Nagaoka

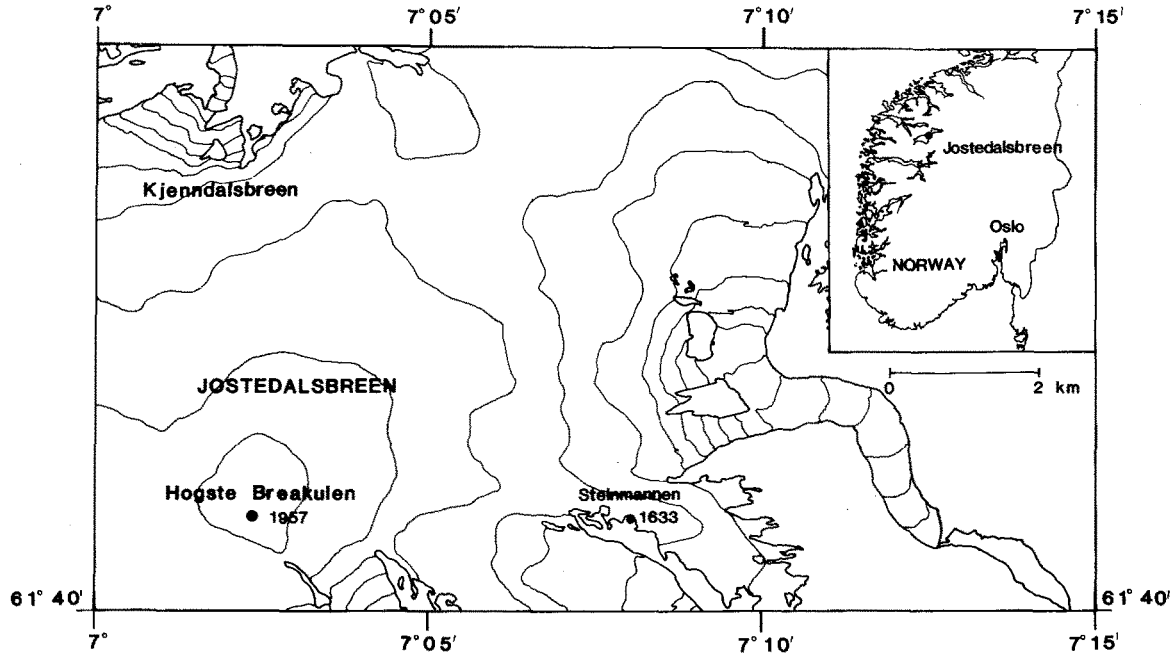

Fig. 2. Location of ice core drilling at Jostedalsbreen in southern Norway.

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Takeo Kameda (Post graduate student. Department of Applied Physics, Hokkaido University).
Akiyoshi Takahashi (Geo Tecs Pvt. Ltd., Nagoya).

Norwegian party
Dr. Bjφrn Wold (The head of Glaciological Section, NVE).
Dr. Nils Haakensen (Glaciological Section, NVE).
Arne Saetrang (Glaciological Section, NVE).
Mike Kennett (Glaciological Section, NVE).
Bjarne Kjφlmoen (Glaciological Section, NVE).
Dr. Yngvar Gjessing (Professor, Institute of Geophysics, University of Bergen).

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