General Report of the Glaciological Research Work of the 11th Japanese Antarctic Research Expedition, 1970–1971

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第11次南極地域観測隊雪氷部門概報，1970–1971

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要旨：第11次南極地域観測隊の越冬観測（越冬隊長 松田達郎）は1970年2月から1971年3月まで行なわれたが，この期間における雪氷部門の研究調査は次の5分野に大別することができる．すなわち，(1) 東，西オングル島およびその周辺海氷上における雪氷観測．(2) 宗谷海岸沿岸の大陸氷の雪氷学的，地理学的調査．リュツォ・ホルム湾内の氷山分布調査．(3) ラングホブデ地域の雪氷学的調査．(4) 冬期内陸旅行とみずほ観測拠点建設，および内陸観測．(5) 夏期内陸調査旅行（エンダービーランド地域雪氷研究計画による）．

1969年に開始されたエンダービーランド地域雪氷調査計画は第10，11，14，15次隊による内陸旅行調査，および第12，13，16次隊による内陸氷床の深層ボーリング調査から成っているが，第10，11次隊により旅行調査計画の前期調査が終了した．第11次隊が行なった夏旅行以外の雪氷観測調査もすべて同計画の一部分をなすものである．第11次隊が建設したみずほ観測拠点は第12，13次隊によって施設が拡充され，今後の諸内陸調査計画の推進拠点として重要な意味をもっており，又，内陸基地建設に関する設営上の情報，問題点を提供する役割も大きい．

ここでは，第11次隊雪氷部門の研究調査全体の構成を述べ，構成各分野の調査行動について略述する．各分野の研究詳報および調査資料は，南極資料，Scientific Reports, Data Reports 等により別に報告する．

1. Introduction

The glaciological research work carried out by JARE 11 in 1970–1971 is assorted into five categories: (1) Glaciological observations at East- and West-Ongul Islands, (2) Glaciological observations of the ice sheet along the Sôya Coast and of

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icebergs in Lützow-Holm Bay, (3) Glaciological research work in the Langhovde area, (4) Inland travel in winter and establishment of the Mizuho Camp, and (5) Inland oversnow traverse in summer (Glaciological Research Programme in the Mizuho Plateau–West Enderby Land*).

Research work (1) comprises several routine work of glaciology. Although (2) and (3) are proper projects themselves, both play important roles in the Glaciological Research Programme in the Mizuho Plateau–West Enderby Land, and can be considered as a part of the Programme. Winter travel (4) was conducted to establish the Mizuho Camp, an inland camp for scientific research work. Observations of glaciology, meteorology, gravity, geomagnetism, and physiology were carried out here for half a month. The Mizuho Camp contributes greatly to accomplish the Glaciological Research Programme in the Mizuho Plateau–West Enderby Land: the oversnow traverse project by JARE 10, 11, 14 and 15, and a pilot study of deep core of the ice sheet, by means of drilling and analyses, by JARE 12, 13 and 16. Summer traverse (5) was conducted to bring the observations and surveys of the 1st observational period of the Glaciological Research Programme in the Mizuho Plateau–West Enderby Land to completion.

This paper is to outline the glaciological research work of JARE 11. The individual research work and observation results are to be reported in detail separately in other papers: the Antarctic Record, the Data Reports, the Scientific Reports of the Japanese Antarctic Research Expedition, and/or other publications.

2. Glaciological Research Work by JARE 11

2.1. Glaciological observations carried out as routine work at East- and West-Ongul Islands and in the vicinity are shown in Table 1.

2.2. Glaciological observations carried out along the Sôya Coast and in the area of Lützow-Holm Bay were as follows (Fig. 1):

i) Annual movement of the Skallen Glacier during the period of February 6, 1969–February 6, 1970 was surveyed in co-operation with JARE 10 (AGETA & NARUSE, 1971). (Movement of glaciers and the coastal ice sheet in the Langhovde area and in the vicinity were also measured in elaborate ways. These are described in the following part, as they constitute a proper research programme.)

ii) Geographic features of the coastal ice sheet in the area from Langhovde down to the Shirase Glacier were observed by a spring journey on the sea ice, from

* This is a 6-year research programme from 1969 to 1975 to study glaciological problems in the Mizuho Plateau–West Enderby Land area. JARE Data Reports No. 17 (Glaciology), 1972, describes the Programme in more detail.

Table 1. Glaciological routine work in the area of East- and West-Ongul Islands by JARE 11, 1970–1971.

Observation	Location	Period
i) Monthly accumulation and ablation of snow*	On the sea ice, NE of the East Ongul Island	April 6 — December 31, 1970
ii) Radiation and daily ablation of snow*	East Ongul Island	October 15, 1970 — January 15, 1971
iii) Distribution of drifted snow in relation to the station buildings	Syowa Station area	March — October, 1970
iv) Glaciological observations of firn and ice mass; glacio-geological observations	West Ongul Island	April, 1970 & February, 1971
v) Observation of permafrost	East Ongul Island	February, 1970 & February, 1971

* (ŌNO *et al.*, 1971)

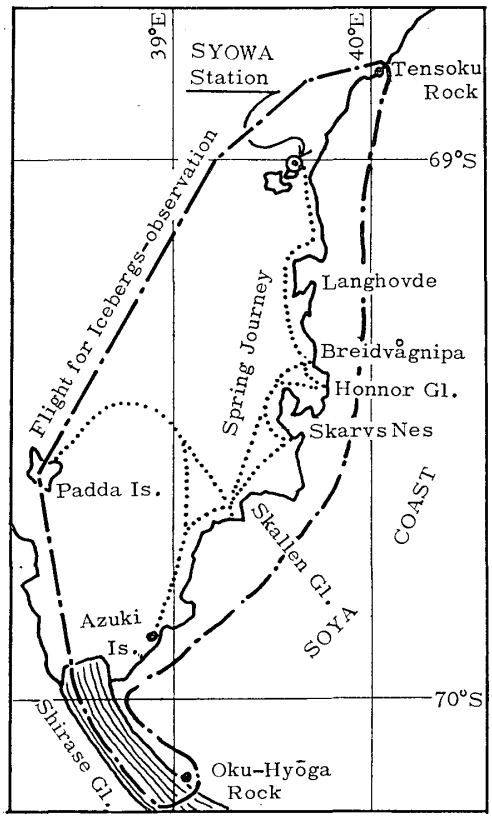

Fig. 1

September 25 to October 2, 1970. A glacio-geological survey of Padda Island was also carried out on the route.

iii) Distribution of icebergs in Lützow-Holm Bay and that of crevasse fields on the coastal ice sheet were observed from a helicopter by aero-photography based on a simplified trimetrogon system on February 16, 1970. The flight of the helicopter covered the area from the Tensoku Rock down to the Shirase Glacier with an approximate width of 40 km along the Sôya Coast.

2. 3. Glaciological research work of the Langhovde area consists of the following 3 sections (Fig. 2):

i) A series of glaciological studies on Glacier A (tentative name), Langhovde, were carried out in February and September, 1970, and March, 1971. Movement of the glacier, accumulation and ablation of snow on the glacier during the winter and the

summer season were measured with 19 bamboo poles, set up on 3 rows, A, B and C, and 2 strain grids (lower map of Fig. 2). Structural-glaciological studies of the glacier were made by means of the surface observations and the analyses of ice core samples.

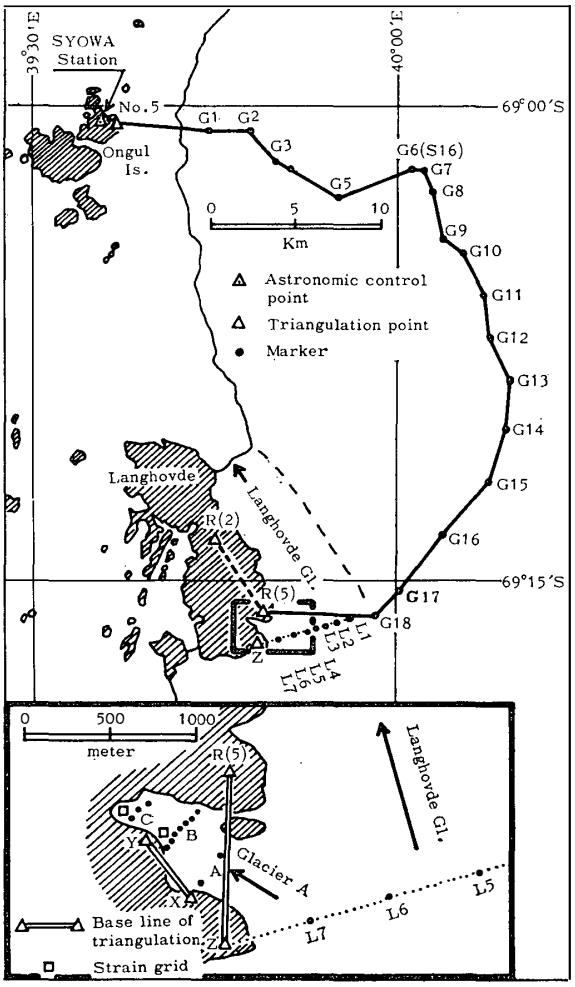

Fig. 2

ii) Movement of the Langhovde Glacier during the period of September, 1970–March, 1971, was measured with 7 bamboo poles set up on a line traversing the glacier, line L in Fig. 2.

iii) Movement of the coastal ice sheet during the summer season, September, 1970 – January, 1971, was measured with 18 bamboo poles, along line G in Fig. 2. The position of each pole was precisely determined by a closed traverse survey, approximately 60 km in total length, from triangulation point No. 5 of East Ongul Island to triangulation point R(5) of Langhovde.

All these studies are to be continued by JARE 12 and 13.

2.4. An inland travel and the establishment of an inland camp for scientific research work were carried out in the winter season, from June 23 to August 7, 1970, totaling 46 days, by an 11-man team with 4 snow-vehicles. The travel was made from Syowa Station inland via S 16, S 70 and S 122, then to the Mizuho Camp site shown in Fig. 3. They were able to penetrate approximately 350km inland by 22 days, but not farther because of bad weather and low temperature, the lowest temperature recorded being −57° C. The Mizuho Camp was established at the end point of the travel (70°42.1′S, 44°17.5′E, and 2169 m above sea level by barometric altimetry). The annual mean air temperature at the camp site was presumed −35.5°C from the snow temperature at 20 m below the surface.

Observations of the following subjects were carried out at the camp during the 17-day stay, and/or on the route of the travel:

i) Glaciology

Stratigraphy of the surface snow cover by means of a 4 m deep pit and a 20m long boring core.

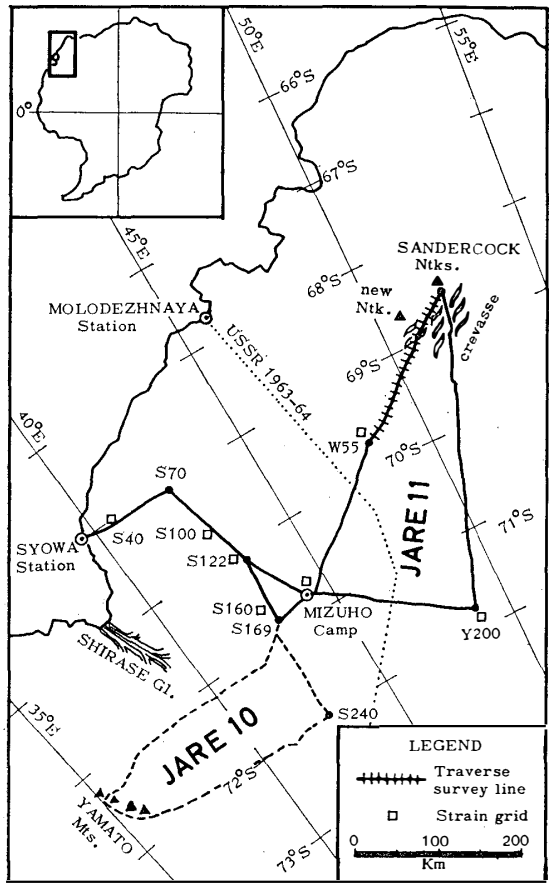

Fig. 3

Barometric altimetry and observations of surface features of the snow cover for zoning study of the ice sheet along the route.

Establishment of a snow accumulation area and a surface snow feature observation area.

Estimation of the annual mean air temperature at the camp site from snow temperature at 20m below the surface.

ii) Meteorology

Daily routine observations of surface weather.

Installation of an automatic weather recorder (air temperature, atmospheric pressure, and speed and direction of wind: all data in 3 month continuous recording). (ŌNO *et al.*, 1971)

iii) Construction Engineering

Mechanical properties of the surface snow cover; subsiding of the hut into the snow cover.

iv) Geography

Mapping of the ice sheet surface of the Mizuho Camp area.

v) Geomagnetism

Measurements of declination, inclination and total force of geomagnetic field at the Mizuho Camp.

Simultaneous observations of geomagnetic field pulsation at the Mizuho Camp and Syowa Station to study correlations between them. (Both sites are located approximately on the same geomagnetic meridian.)

vi) Gravity

Gravimetry at the Mizuho Camp area.

vii) Aurora

Photographic observations of auroras.

viii) Radio communication

Conditions of radio communication with Syowa Station.

ix) Physiology

Effects of altitude and coldness on human physiology.

x) Logistic problems

Maintainance and performance of snow-vehicles under extremely cold conditions.

General problems of logistics for a winter travel; those of facilities for an inland station.

The camp facilities will be extended by JARE 12 and 13 for deep core drilling to be executed by JARE 12, 13 and 16, and for other inland research work.

2. 5. An 81-day oversnow traverse was conducted from November 3, 1970, to January 22, 1971, by an 8-man team with 4 snow-vehicles to bring to completion the basic observations and surveys of the 1st observational period of the Glaciological Research Programme in the Mizuho Plateau–West Enderby Land.

The traverse covered approximately 1650 km: Syowa Station – S 122 – Mizuho Camp – Y 200 – Sandercock Nunataks – Mizuho Camp – S 169 – Syowa Station, as shown in Fig. 3.

As the scheduled work of JARE 11 for the Programme, the following subjects were studied or prepared to be studied by JARE 15:

i) Shape and amount of the ice sheet: surface topography and thickness of the ice sheet by means of barometric altimetry, radio echo sounding and seismic sounding. Bed rock topography was estimated from these data.

ii) Physical and chemical properties of the surface snow cover of the ice sheet: by surface observations, pit work, core analyses, and micro chemical analyses in a laboratory.

iii) Annual accumulation of snow: by snow stake measurements, stratigraphic

observations and $^{18}O/^{16}O$ analyses.

iv) Surface movement and deformation of the ice sheet: with 7 strain grids, and a 200 km long traverse survey line: namely, a line connecting each marker determined by traverse survey, from the Sandercock Nunataks to station W55, as shown in Fig. 3.

v) Meteorological conditions in this area: by daily routine observations of surface weather on the route of the traverse and by the automatic weather recorder at the Mizuho Camp (ŌNO *et al.*, 1971). Annual mean air temperature estimated from snow temperature at 10 m below the surface, direction of prevailing wind presumed from snow surface features, sastrugis and dunes.

vi) Geophysical parameters: gravity value and declination, inclination and total force of a geomagnetic field.

vii) Geographical and geological surveys of the Sandercock Nunataks area.

viii) A nunatak was newly found at 68°42′S, 50°36′E on December 19, 1970.

In 1969–1970, the same kind of work was carried out by JARE 10 in the Mizuho Plateau area, as shown in Fig. 3 (AGETA, 1971; AGETA & NARUSE, 1971; ANDO, 1971; KUSUNOKI, 1971; ŌNO *et al.*, 1971).

Basic observations and surveys of the 1st observational period of the Glaciological Research Programme in the Mizuho Plateau–West Enderby Land were completed by JARE 10 and 11.

3. Concluding Remarks

The glaciological research work carried out by JARE 11 in 1970–1971 was synoptically reported. An oversnow traverse in the West Enderby Land area in summer and most of other research work were conducted for the Glaciological Research Programme in the Mizuho Plateau–West Enderby Land. The basic work of the Programme was completed by JARE 10 and 11. Resurveys and complementary observations are to be undertaken by JARE 14 and 15 in 1973–1975, and a pilot study of deep cores of the ice sheet to be undertaken by JARE 12, 13 and 16, in 1971–1973 and 1975–1976, to bring the Programme to perfection.

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References

AGETA, Y. (1971): Higashi-Nankyoku Mizuho Kogen Fukin no Kisho-jotai ni tsuite (Some aspects of the weather conditions in the vicinity of the Mizuho Plateau, East Antarctica). Nankyoku-Shiryō (Antarctic Rec.), **41**, 42–61.

AGETA, Y. and R. NARUSE (1971): Measurements of ice flow around Skallen Rock, south of Syowa Station, Antarctica. Ibid., **42**, 61–64.

ANDO, H. (1971): Dai-10-ji Nankyoku-chiiki Kansokutai Nairiku-chōsa gaihō (Preliminary report of the oversnow traverse of the 10th Japanese Antarctic Research Expedition in 1969–1970). Ibid., **39**, 39–45.

KUSUNOKI, K. (1971): General report of the wintering party of the 10th Japanese Antarctic Research Expedition in 1968–1970. Ibid., **40**, 1–21.

ŌNO, I., M. SATOMI and H. JŌBASHI (1971): Dai-11-ji Nankyoku-chiiki Kansokutai Kishō-bumon Hōkoku (Meteorological observations of the 11th Japanese Antarctic Research Expedition in 1970). Ibid., **42**, 16–34.

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