

## Introduction

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### 1. Glaciological Research Program in Mizuho Plateau-West Enderby Land

A research program was planned in order to study glaciological problems in the Mizuho Plateau-West Enderby Land area in connection with meteorological and geographical conditions, by the JARE (Japanese Antarctic Research Expedition) 10 - 16, for a period from 1969 to 1975. The program is composed of two major projects: (1) Oversnow traverses for glaciological, meteorological, geographical and geophysical studies by JARE 10, 11, 14 and 15; (2) A pilot study of deep cores of the inland ice sheet, by means of drilling and analyses, by JARE 12, 13 and 16. The program is supervised by Tamotsu Ishida\*, Hiromu Shimizu in charge of the traverse project and by Yosio Suzuki\* in charge of the deep core project.

The followings were the subjects of study in the Mizuho Plateau-West Enderby Land area by the oversnow traverse project:

- i ) Shape and amount of the ice sheet.
- ii ) Physical and chemical properties of the surface snow cover of the ice sheet.
- iii) Mass balance of the ice sheet: net accumulation of snow, surface movement and deformation of the ice sheet, and formation of icebergs by calving of the ice sheet.
- iv) Meteorological conditions.
- v ) Geophysical parameters: gravity and geomagnetism.
- vi) Geographical and geological surveys.

The oversnow traverse project extends over two periods, the first period from 1969 to 1971, and the second from 1973 to 1975. Basic observations and surveys were carried out during the first period by JARE 10 and 11; complementary observations and resurveys are to be conducted during the second period by JARE 14 and 15.

The results of the observations and surveys by JARE 10 and 11 during the first period were compiled in this volume, together with descriptions of the instruments used and the methods employed, except those

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of  $^{18}\text{O}/^{16}\text{O}$  analyses and some other subjects, which will be separately reported before long. Reports on glaciology, meteorology, geology and logistics of the oversnow traverse project, published, in press and in preparation, are given in Section 4.

The deep core project, a pilot study of deep core of the ice sheet, by means of drilling and analyses, is under way by JARE 12 and 13 at Mizuho Camp. On completion of both complementary observations and re-surveys of the oversnow traverse project by JARE 14 and 15 and the deep core project by JARE 16, a complete report of the Glaciological Research Program in Mizuho Plateau-West Enderby Land is to be published.

## 2. Oversnow Traverses

Oversnow traverses for basic observations and surveys of the project were conducted by JARE 10 and 11 in 1969 - 1971. The traverse routes and principal stations are shown in Fig. A, which is given at the end of this volume. The oversnow traverse by JARE 10 covered the west side of  $43^{\circ}\text{E}$  longitude to the Yamato Mountains, and that by JARE 11 the east side of  $43^{\circ}\text{E}$  to the Sandercock Nunataks. The entire route was divided into 8 subdivisions, i.e., Routes S, A, B, C, W, X, Y and Z. Each station was defined by a combination of a Roman letter and a numeral: the Roman letter indicates the subdivisional route to which the station belongs, and the numeral shows either its approximate distance (or twice or half of that) from the starting point of the subdivisional route, or simply a serial number of the station on the route, depending upon the case as shown in Table A. Old or temporary station numbers adopted in the previous reports of the project (see Section 4) should be changed into newly standardized station numbers, as shown in Tables B, C and D.

The traverse party of JARE 10, a 10-man team led by Hisao Ando (Table E), covered approximately 1500 km on the Mizuho Plateau in 90 days.

1969

- Nov. 1 Left Syowa Station.  
21 Arrived at S240 ( $72^{\circ}00.1'\text{S}$ ,  $43^{\circ}10'\text{E}$ ) via S70.  
24 Installation of a triangulation chain, approximately 250 km in extent, from A164 (S240) to A001 ( $71^{\circ}47.5'\text{S}$ ,  $36^{\circ}12'\text{E}$ ; a nunatak at the south end of the Yamato Mountains).  
Dec. 31 (see Report VI)

Table A. Denomination of the routes and stations of the oversnow traverses by JARE 10 and 11, 1969 - 1971.

Subdivisional route	Station			Remarks	Coverage by
	from _____ to	Approx. interval*	Numeral indicates		
S	S0 _____ S240	2 km	Multiples of 2 km	Syowa-South Pole traverse route	JARE 8,9,10 11
A	A164 _____ A001 (S240)	—	Serial No.	Triangulation chain	JARE 10
B	B0 (A003) _____ B48	—	Serial No.		
C	C0 (B48) _____ C150	2 km	Multiples of 2 km		
W	W00 _____ W55 (Sandercock Nunataks) W200 _____ W377 (W55)	— 5 km	Serial No. Multiples of 1 km	Traverse survey line (W00 - W55)	JARE 11
X	X0 _____ X20 (Mizuho Camp) (S169)	2 km	Multiples of 2 km		
Y	Y0 _____ Y200 _____ Y573 (Mizuho Camp) (Sandercock Nunataks)	5 km	Multiples of 1 km		
Z	Z0 _____ Z105 (S122) (Mizuho Camp)	1 km** or 0.5 km	Multiples of 1km or 0.5 km		

\* The approximate distance between two neighboring stations was measured with an odometer aboard the oversnow vehicle.

\*\* On Route Z, each station was located every 1 km for Z0(S122) - Z43 and Z70 - Z104, and 0.5 km for Z43 - Z70.

Table B. Conversion of station numbers, Part I (Routes S and C).

Old		New
F	—————>	S
X	—————>	C

Table C. Conversion of station numbers, Part II (Route A).

Old	New	Old	New	Old	New
Control		10-70	A 026	C-D	A 053
Point II	A001	C-Q	027	10-56	054
Control		10-69	028	C-C	055
Point I	002	C-P	029	10-55	056
D-C	003	10-68	030	C-B	057
D-B	004	C-O	031	10-54	058
10-81	005	10-67	032	C-A	059
D-A	006	C-N	033	10-53	060
10-80	007	10-66	034	B-Z	061
C-Z	008	C-M	035	10-52	062
10-79	009	10-65	036	B-Y	063
C-Y	010	C-L	037	10-51	064
10-78	011	10-64	038	B-X	065
10-77	012	C-K	039	10-50	066
10-76	013	10-63	040	B-W	067
C-X	014	C-J	041	10-49	068
10-75	015	10-62	042	B-V	069
C-W	016	C-I	043	10-48	070
10-74	017	10-61	044	B-U	071
C-V	018	C-H	045	10-47	072
10-73	019	10-60	046	B-T	073
C-U	020	C-G	047	10-46	074
10-72	021	10-59	048	B-S	075
C-T	022	C-F	049	10-45	076
C-S	023	10-58	050	B-R	077
10-71	024	C-E	051	10-44	078
C-R	025	10-57	052	B-Q	079

Old	New	Old	New	Old	New
10-43	A 080	B-B	A 109	10-14	A 138
B-P	081	10-28	110	A-M	139
10-42	082	B-A	111	10-13	140
B-O	083	10-27	112	A-L	141
10-41	084	A-Z	113	10-12	142
B-N	085	10-26	114	A-K	143
10-40	086	A-Y	115	10-11	144
B-M	087	10-25	116	A-J	145
10-39	088	A-X	117	10-10	146
B-L	089	10-24	118	A-I	147
10-38	090	A-W	119	10-9	148
B-K	091	10-23	120	A-H	149
10-37	092	A-V	121	10-8	150
B-J	093	10-22	122	A-G	151
10-36	094	A-U	123	10-7	152
B-I	095	10-21	124	A-F	153
10-35	096	A-T	125	10-6	154
B-H	097	10-20	126	10-5	155
10-34	098	A-S	127	A-E	156
B-G	099	10-19	128	10-4	157
10-33	100	A-R	129	A-D	158
B-F	101	10-18	130	10-3	159
10-32	102	A-Q	131	A-C	160
B-E	103	10-17	132	10-2	161
10-31	104	A-P	133	A-B	162
B-D	105	10-16	134	10-1	163
10-30	106	A-O	135	A-A	164
B-C	107	10-15	136		
10-29	108	A-N	137		

1970

- Jan. 1 ↓ Glaciological, geological and geographical surveys of the  
12 Yamato Mountains.  
13 Left B48 ( $71^{\circ}23.1'S$ ,  $35^{\circ}41.1'E$ ), massif D of the Yamato  
Mountains.  
29 Arrived at Syowa Station, via S170, S70 and S16.

The traverse party of JARE 11, a 8-man team led by Hiromu Shimizu (Table F), covered approximately 1650km mainly in West Enderby Land in 82 days.

Table D. Conversion of station numbers, Part III (Route B).

Old	New	Old	New	Old	New
D - D	B 1	Y-105	B17	Y-121	B33
E	2	106	18	122	34
F	3	107	19	123	35
G	4	108	20	124	36
H	5	109	21	125	37
I	6	110	22	126	38
J	7	111	23	127	39
K	8	112	24	128	40
L	9	113	25	129	41
M	10	114	26	130	42
N	11	115	27	131	43
Y-AA	12	116	28	132	44
101	13	117	29	133	45
102	14	118	30	134	46
103	15	119	31	135	47
104	16	120	32	136	48

Table E. Organization of the traverse party of JARE 10, 1969-1970.

Personnel		Vehicles, radios, fuel, and food
Name	Assignments	
Hisao Ando	Leader, geology, seismic sounding.	Oversnow vehicle: KD60 (Diesel engine; 7 ton) 2
Masaru Yoshida	Geology, geomagnetism, gravity.	
Kunio Omoto	Geography, barometric altimetry, geodetic survey, radio echo sounding, radio communication.	KC20 (Gasoline engine; 2.5 ton) 2
Renji Naruse	Glaciology.	Sledge: 2-ton sledge 9
Yutaka Ageta	Glaciology, meteorology, VLF, travel pilot.	caboose 1
Masamoto Kikkawa	Medical doctor, radio communication.	Radio: JSB-31 (SSB, 2-14 MHz, 50W) 2
Shinpei Ishiwata	Chief mechanic.	EF-138 (VHF, 10W) 4
Minoru Yagi	Logistics, mechanic.	EK-118 (VHF, 1W) 2
Yuji Maeda	Mechanic, radio communication.	Fuel: Diesel oil 6.0 kl
Yukio Kimura	Journalist, logistics.	Gasoline 5.7 kl
		Kerosene 0.4 kl
		Food: 2.0 t

Table F. Organization of the traverse party of JARE 11, 1970-1971.

Personnel		Vehicles, radios, fuel, and food
Name	Assignments	
Hiromu Shimizu	Leader, glaciology, radio echo sounding, barometric altimetry.	Oversnow vehicle: KD60 ( Diesel engine; 7 ton) 2
Okitsugu Watanabe	Glaciology, seismic sounding, geology.	KC20 ( Gasoline engine; 2.5 ton) 2
Aiichiro Yoshimura	Geography, geodetic survey, geomagnetism, gravity.	Sledge: 2-ton sledge 6 caboose 2
Yasuo Fukushima	Medical doctor, meteorology.	Radio: JSB-31 ( SSB, 2-14MHz, 50W ) 1
Shingo Kaneko	Chief mechanic.	JSB-35 ( SSB, 4-12MHz, 100W ) 1
Hiromi Kamada	Mechanic.	KWM-2A ( FM, 3.5-28MHz 100W ) 1
Yasuo Ishimoto	Logistics, travel pilot.	EF-138 ( VHF, 10W ) 6
Hajime Ito	Logistics, radio communication, glaciology.	EK-118 ( VHF, 1W ) 3
		Fuel: Diesel oil 9.3 kl Gasoline 8.0 kl Kerosene 0.4 kl
		Food 2.1 t

1970

- Nov. 3 Left Syowa Station.  
 15 Arrived at Mizuho Camp ( $70^{\circ}42.1'S$ ,  $44^{\circ}17.5'E$ ).  
 ↓ Glaciological, geophysical, geographical and meteorological surveys of the camp area.  
 18  
 Dec. 12 Arrived at the Sandercock Nunataks via Y200.  
 ↓ Geographical, geological, geophysical and glaciological surveys of the Sandercock Nunataks.  
 16  
 17 Installation of a traverse survey line ( a line connecting each marker determined by traverse survey) from W00 ( $68^{\circ}36'41''S$ ,  $52^{\circ}06'0''E$ ; a south peak of the Sandercock Nunataks) to W55  
 ↓  
 30 ( $69^{\circ}41'23''S$ ,  $48^{\circ}10'15''E$ ) ( see Report VI).  
 Dec. 19 Geodetic surveys of a newly found nunatak at  $68^{\circ}42'S$ ,  $50^{\circ}36'E$  from W19 and W20.

1971  
 Jan. 2 Left W200 (W55).  
 8 Arrived at Mizuho Camp. Glaciological, geophysical and  
 ↓  
 11 meteorological surveys of the camp area.  
 12 Left Mizuho Camp.  
 22 Arrived at S16, via X20 (S169), S122 and S70, then flew to  
 Syōwa Station.

### 3. Observations and Surveys

The basic observations and surveys of the oversnow traverse project outlined in Section 1 were carried out in the following way:

#### 3.1. Shape and amount of the ice sheet

- 1) Surface topography of the ice sheet determined by:
  - (a) Barometric altimetry,
  - (b) Leveling (for A164 - A001, and W00 - W55),
  - (c) Direction and inclination of surface slopes (only by JARE 11).
- 2) Thickness of the ice sheet measured by:
  - (a) Radio echo sounding,
  - (b) Seismic sounding,
  - (c) Gravimetric method.
- 3) Surface elevation of the bed rock estimated by:
  - (a) Surface elevation of the ice sheet, and
  - (b) Thickness of the ice sheet.

#### 3.2. Physical and chemical properties of the surface snow cover of the ice sheet

- 1) Physical properties of the surface snow cover by pit observations, core analyses and surface observations.
- 2) Sampling of surface snow for micro-analyses of chemical constituents.

#### 3.3. Mass balance of the ice sheet

- 1) Annual accumulation of snow measured by:
  - (a) Snow stakes (new installation and remeasurement),
  - (b) Stratigraphic observations of snow pits and snow cores,
  - (c)  $^{18}\text{O}/^{16}\text{O}$  analyses of snow cores.



- 2) Surface movement and deformation of the ice sheet measured by:
  - (a) Strain grids,
  - (b) Triangulation chain (A164 - A001),
  - (c) Traverse survey line in the inland (W00 - W55), and those along the coast (G0 - G18, Syowa - Langhovde),
  - (d) Movement of the coastal glaciers (Skallen Glacier and Langhovde Glacier).
- 3) Calving of the ice sheet into icebergs.

#### 3.4. Meteorological conditions

- 1) The annual mean air temperature inferred from snow temperature at 10 m depth.
- 2) Direction of the prevailing wind and blizzard inferred from snow surface relief: sastrugi and dunes.
- 3) Meteorological conditions reflected on the structure of the snow cover, e.g. meteorological conditions and growth of depth hoar.
- 4) Weather conditions recorded by:
  - (a) Daily routine surface weather observations along the route of the oversnow traverse.
  - (b) Continuous recording of wind speed, wind direction, atmospheric pressure and air temperature by an automatic weather recorder at Mizuho Camp.

#### 3.5. Geophysical parameters

- 1) Gravity values.
- 2) Geomagnetism: Declination, inclination and total force of the geomagnetic field.

#### 3.6. Geographical and geological surveys

- 1) The Yamato Mountains and Sandercock Nunataks.
- 2) Other nunataks and moraine fields.

#### 3.7. Others

- 1) Sea salt nuclei.
- 2) VLF.

### 4. Reports

A list of reports in regard to the Glaciological Research Pro-

gram in Mizuho Plateau-West Enderby Land is given in this section; published reports, reports in press and those in preparation are listed.

#### 4.1. Reports published or in press

- Ageta, Y. (1971): Some aspects of the weather condition in the vicinity of the Mizuho Plateau, East Antarctica. *Antarctic Rec.*, 41, 42 - 61 (in Japanese with English abstract).
- Ageta, Y. and R. Naruse (1971): Measurements of ice flow around Skallen Rock, south of Syowa Station, Antarctica. *Antarctic Rec.*, 42, 61 - 64.
- Ageta, Y. (1972): Some aspects of ablation of sastrugi and drifts in the area subjected to katabatic wind in Antarctica. *Antarctic Rec.*, 43, 8-19 (in Japanese with English abstract).
- Ageta, Y. (1972): Mass balance of Antarctic ice sheet and future research problems. *Seppyo*, 33 (4), 1-10 (in Japanese with English abstract)
- Ageta, Y. (1972): Glacio-meteorological studies on mass balance in the drainage of Shirase Glacier, East Antarctica. Master theses. Post Graduate Course of Science, Nagoya University.
- Ageta, Y. and K. Higuchi (1972): Glacio-meteorological studies on Shirase Glacier, Antarctica. Preprints of Spring Conference, 1972, Met. Soc. Japan (in press).
- Ando, H. (1971): Preliminary report of the oversnow traverse of the 10th Japanese Antarctic Research Expedition in 1969 - 1970. *Antarctic Rec.*, 39, 39-45 (in Japanese with English abstract).
- Kusunoki, K. (1971): General report of the wintering party of the 10th Japanese Antarctic Research Expedition 1968 - 1970. *Antarctic Rec.*, 40, 1-21.
- Murozumi, M. (1972): Minami no Yuki, Kita no Yuki (Some aspects on chemical properties of surface snow of the ice sheets in the Antarctic and the Arctic). *Polar News*, 14, 48-52 (in Japanese).
- Nankyoku Kansoku Togo Suishin Honbu (1971): Dai-10-ji Nippon Nankyoku-chiiki Kansokutai Ettotai Hokoku, 1968 - 1970 (Report of the wintering party of the 10th Japanese Antarctic Research Expedition, 1968 - 1970). 182pp (in Japanese).
- Nankyoku Kansoku Togo Suishin Honbu (1972): Nippon Nankyoku-chiiki Kansoku Dai-11-ji-tai Hokoku, 1969-1971 (Report of the 11th Japanese Antarctic Research Expedition, 1969-1971. 369 pp (in Japanese).
- Naruse, R., Y. Endo, T. Ishida, and Y. Ageta (1971): Observations of snow accumulation and sea ice at Syowa Station, Antarctica.

- Antarctic Rec., 40, 57-64.
- Naruse, R., T. Ishida, Y. Endo, and Y. Ageta (1971): On the relation between sea ice growth and freezing index at Syowa Station, Antarctica. Antarctic Rec., 41, 62-66.
- Naruse, R. (1970): Measurement of drifting snow on the coastal region of Antarctica, near Syowa Station. Low Temp. Sci., Ser. A, 28, 147-154 (in Japanese with English Summary).
- Naruse, R., Y. Endo, H. Narita, and T. Yamada (1972): A stratigraphic analysis of a 10 meter deep firm core from the inland area near Syowa Station, East Antarctica. Antarctic Rec., 45 (in press).
- Shimizu, H., O. Watanabe and A. Yoshimura (1972); General report of the glaciological research work of the 11th Japanese Antarctic Research Expedition 1970 - 1971. Antarctic Rec., 45 (in press).
- Shiraishi, K., O. Watanabe and K. Kizaki (1972): Geology of the Sandercock Nunataks in Enderby Land, East Antarctica. Antarctic Rec., 45 (in press).
- Watanabe, O. and A. Yoshimura (1972): A preliminary geoscientific researches on Sandercock Nunataks, Enderby Land, East Antarctica, 1970. Antarctic Rec., 45 (in press).
- Watanabe, O. and A. Yoshimura (1972): Glaciological observations in the vicinity of Mizuho Camp, Enderby Land, East Antarctica, 1970. Antarctic Rec., 45 (in press).
- Yoshida, M., Y. Ageta and M. Yagi (1970): Newly found inland morain fields near Syowa Station in 1970. Antarctic Rec., 39, 55-61.
- Yoshida, M., H. Ando, K. Omoto, R. Naruse and Y. Ageta (1970): Discovery of meteorites near Yamato Mountains, East Antarctica. Antarctic Rec., 39, 62-65.
- Yoshida, M. and H. Ando (1970): Geological survey in the vicinity of Lützow-Holm Bay and the Yamato Mountains, East Antarctica. Antarctic Rec., 39, 46-54.

#### 4.2. Reports in preparation

- Shimizu, H., S. Kakinuma, K. Omoto, M. Yoshida and A. Yoshimura: Thickness of the ice sheet in West Enderby Land-Mizuho Plateau area, East Antarctica.
- Shimizu, H. and O. Watanabe: Surface topography of the ice sheet in West Enderby Land, Antarctica.
- Shimizu, H., O. Watanabe and A. Yoshimura: Glaciological researches in Langhovde area, East Antarctica.