General Report of the Wintering Party of the 10th Japanese Antarctic Research Expedition in 1968–1970

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第10次南極地域観測隊越冬隊概報

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要　旨

第10次南極地域観測隊は総員40名で編成され，ここでは28名の越冬隊（ほかに報道記者1名を含む．筆者が隊長兼越冬隊長）の行動概要を示した．1968年11月30日東京港より「ふじ」で出発し，1970年4月8日空路帰国した．本報告は国外の読者も対象としたため観測隊の成立に至る過程，予算，夏期（1968/69年）の行動，昭和基地における生活等の記述が前半を占めている．越冬観測は1969年2月より翌年1月末ごろまでほぼ予定通りに実施された．超高層物理より人体生理に至る15部門の基地観測について略述し，雪氷学を中心とする 1,500km にわたる内陸調査（1969年11月～1970年1月の90日間，総員10名）の結果にも触れた．

1. Introduction

The Antarctic researches by the Japanese date back to January 1957 when the "Syowa Station" was established on East Ongul Island in Lützow-Holm Bay. The station, located at lat. 69°00′S and long. 39°35′E, was temporarily closed during a period from February 1962 to January 1966. The reopening of Syowa Station was realized by means of the newly built icebreaker FUJI equipped with three helicopters which gave a great deal of contribution to the ice reconnaissance and cargo transportation. Since then the station facilities have been amplified every year.

The present report outlines scientific and logistic activities of the Wintering Party of the 10th Japanese Antarctic Research Expedition (JARE) at Syowa Station and its vicinities during the period from 30 November 1968 to 8 April 1970. The party consisting of 40 men was led by the present author, also leading the Wintering Party of 28 men. The Summer Party (1968–1969) of 12 men was led by deputy-leader Nozomi MURAKOSHI and carried out summer research programmes

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on board the Fuji and at Syowa Station from December 1968 to April 1969.

Official reports of the Summer Party (1968–1969) and Wintering Party (1968–1970) of the 10th JARE were published by the Nankyokutiiki Kansoku Tôgôsuisinhonbu (Promoting Headquarters of the Japanese Antarctic Research Expedition) in 1969 and 1970 respectively. Murakoshi (1969) also reported the general account of the Summer Party of the 10th JARE. Since the official reports are written in detail in Japanese and the numbers of printed copies are limited, this report is intended for a summary of the official reports, as well as for informing the readers who are not familiar with the Japanese language.

2. General Plan of the 10th JARE

The scientific programmes of the Japanese expeditions have been planned by the National Antarctic Committee of the Science Council of Japan and have been officially approved by the Promoting Headquarters presided by the Minister of Education. The scientific programmes of the 10th JARE, consisting of about 20 scientific disciplines, were likewise planned by the National Antarctic Committee and approved at the 30th General Meeting of the Promoting Headquarters held on 26 June 1967. Most of the research programmes have been continued from the previous year. However, new programmes for the summer season were aerophotogrammetry, observations of auroral X-rays from high-altitude balloons, and construction of sounding rocket launching facilities. The new programmes for the Wintering Party were the observations of atmospheric electricity and infrasonic pressure waves at Syowa Station and inland traverse to the Mizuho Plateau and the Yamato Mountains. The research programmes assigned to the Wintering Party are listed in Table 1. A sketch map of Syowa Station is shown in Fig. 1.

The National Antarctic Committee has also been responsible for the recommendation of candidates for expedition members, and the Promoting Headquarters officially nominates the members. On 15 March 1968 the present author was nominated as the leader of the 10th JARE. On 29 June 1968 deputy-leader Nozomi Murakoshi and 20 members were nominated, and the others were appointed on a later date. The members of the Wintering Party of the 10th JARE are listed in Table 2.

It is to be noted that all the non-governmental personnel are given the status of government technical official of the Ministry of Education. Names of organizations given in parentheses indicate the original affiliation of civilians, graduate students, and local government officials.

The details of the research programmes, especially purchase of materials, and operational plans of the expedition were worked out by the Special Committee of

Table 1. Research Programmes of the Wintering Party of the 10th Japanese Antarctic Research Expedition in 1969–70.

Cosmic rays:
Neutron monitor observations
Observations of auroral X-rays with high-altitude balloons

Aurora:
Visual and all-sky camera observations
Spectrophotometric observations
Observations of natural HF noises

Geomagnetism:
Continuous recording of three components
Absolute measurements
Observations of micropulsations
Observations of natural electromagnetic noises

Infrasonic pressure waves:
Period, intensity, and direction of infrasonic pressure waves

Radio physics:
Observations of VLF signals
Observations of arrival direction of VLF emission
Observations of polarization of VLF emission
Observations of Faraday rotation

Ionosphere:
Vertical ionospheric soundings
Riometer observations
Aurora radar observations
Recording of HF field intensities

Meteorology:
Surface synoptic observations
Upper-air observations
Weather analysis
Total ozone observations
Radiation–sonde observations
Ozone-sonde observations
Electricity-sonde observations
Atmospheric electricity observations
Sampling of sea-salt nuclei
Collection of snow crystal replicas

Oceanography:
Continuous tide recording

Seismology:
Continuous recording of natural earthquakes

Cartography:
Ground control survey for map compilation

Gravity:
Gravity survey in the vicinity of Syowa Station

Geomorphology:
Measurement of air and earth temperatures and soil water content at Syowa Station
Observations on periglacial phenomena and glacial geomorphology in the Lützow-Holm Bay area

Geology:
Geological survey of the Lützow-Holm Bay area
Sampling of bottom sediments in the Ongul Strait
Petrofabric studies of sea ice and glacier ice

Glaciology:
Accumulation studies near Syowa Station
Sea ice studies at Syowa Station
Survey of snow field on East Ongul Island
Observations of drifting snow
Surveys of glaciers on the Sôya Coast

Medical science:
Physiological studies of human adaptability in the Antarctic

Inland traverse:
Navigation and altimetry
Radio echo soundings of ice thickness
Seismic soundings of ice thickness
Gravity survey
Geomagnetic survey
Traverse glaciology
Setting of strain grid and strain grid band
Measurement of VLF emission
Sampling of sea salt nuclei
Human physiology
Weather observations
Geological, geomorphological, and glaciological survey of the Yamato Mountains
Collection of snow and ice samples

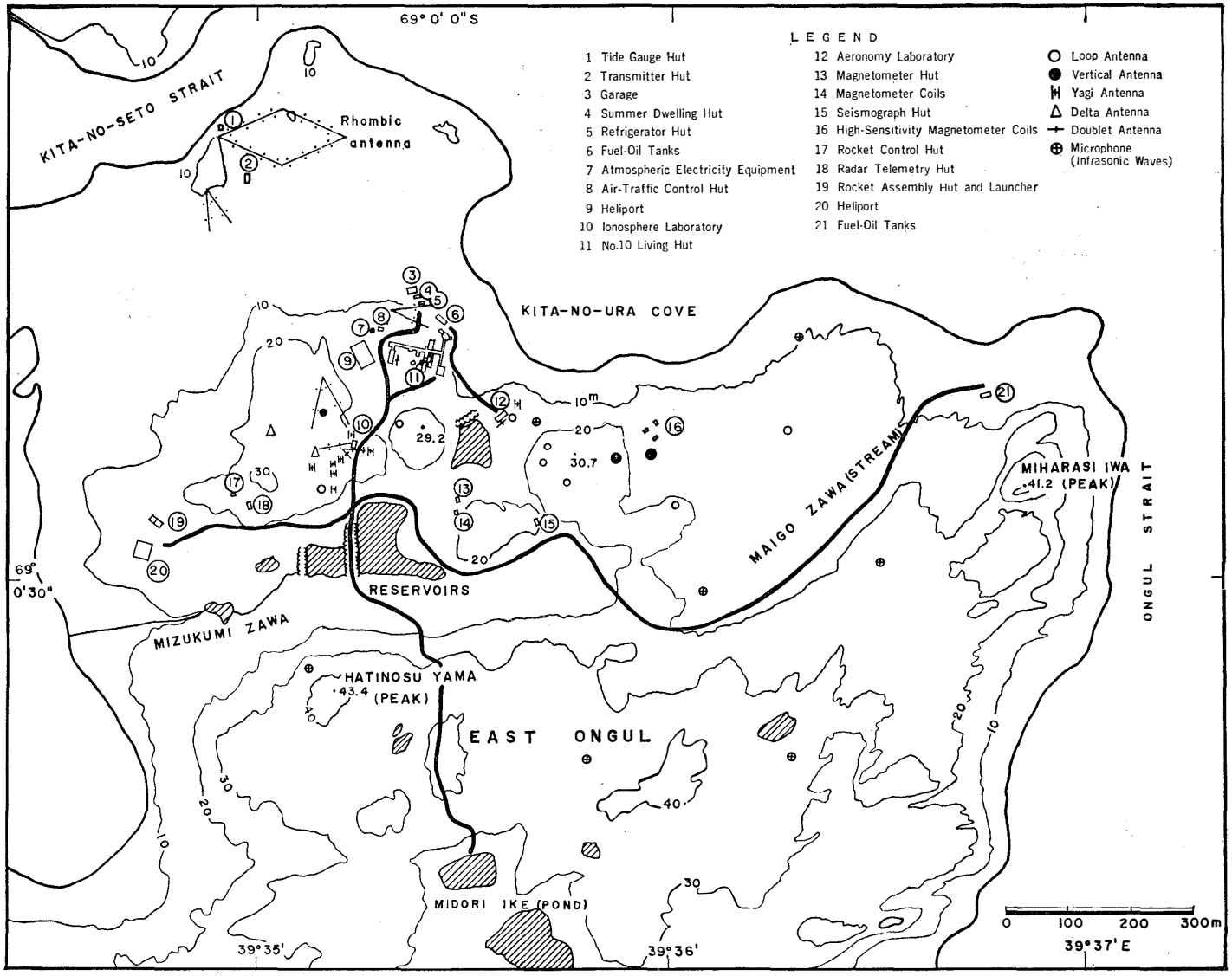

Fig. 1. Map of Syowa Station (December 1969).

Table 2. Members of the Wintering Party of the 10th Japanese Antarctic Research Expedition in 1968–1970.

Name	Discipline	Affiliation
Kou KUSUNOKI	Leader	Polar Research Center, National Science Museum
Kyoichi ISHIDA	Meteorology	Japan Meteorological Agency
Takehiko SUZUKI	〃	〃
Shigenori SAKAI	〃	〃
Yasusada OTA	Ionosphere	Radio Research Laboratories
Minoru MASUDA	Geophysics (aurora, geomagnetism, seismology, ocean tide)	Geographical Survey Institute
Yutaka SUZUKI	Infrasonic waves	Ministry of Education (Osaka City University)
Koichi OGURA	Cosmic-rays	Ministry of Education (Nihon University)
Kanji HAYASHI	Aurora and geomagnetism	Ministry of Education (University of Tokyo)
Susumu TOKUDA	Radio physics	Atmospherics Research Institute, Nagoya University
Goro KONDO	Atmospheric electricity	Geomagnetic Observatory, Japan Meteorological Agency
Hisao ANDO*	Geology	Hokkaido Development Agency
Masaru YOSHIDA*	〃	Ministry of Education (Hokkaido University)
Kunio OMOTO*	Geomorphology	Tohoku University
Renji NARUSE*	Glaciology	Institute of Low Temperature Science, Hokkaido University
Yutaka AGETA*	Glaciology	Ministry of Education (Nagoya University)
Hirohisa HACHISUKA	Human physiology	Kyoto University of Education
Masamoto KIKKAWA*	Orthopedics	Tottori University
Shinpei ISHIWATA*	Mechanic	Ministry of Education (Komatsu Mfg. Co.)
Masao INOUE	〃	Ministry of Education (Isuzu Motors Co.)
Sadao TAKEUCHI	〃	University of Tokyo
Yuji MAEDA*	〃	Government Mechanical Laboratory
Hiroshi OKIYOSHI	Wireless operator	Ministry of Education (Nippon Telegraph and Telephone Public Corporation)
Hideaki ASANO	〃	Ministry of Education (Nippon Telegraph and Telephone Public Corporation)
Syoichi WATANABE	Cook	Ministry of Education (Tojo Kaikan Co.)
Katsuyuki MURAKAMI	〃	〃
Minoru YAGI*	Logistician/Mechanic	Ministry of Education (Nissan Diesel Co.)
Koji SEKI	Logistician/Construction	Ministry of Education (Seki Gumi (contractor) Co.)

* Members of the inland traverse party from November 1969 to Jaunary 1970.

Japanese Antarctic Research Expedition in the National Science Museum, having been discussed among committee members, project supervisors, and expedition members. The Promoting Headquarters finally decided the operational programmes, and the itinerary of the 10th JARE in 1968–1969 was announced as follows:

30 November 1968	Forty men aboard the Fuji leave Tokyo.
15 to 21 December 1968	Call at Fremantle, Australia.
January to February 1969	Syowa Station, Antarctica.
20 February 1969	Official change-over from the 9th JARE to the 10th JARE at Syowa Station. The Wintering Party stays at Syowa Station until 20 February 1970.
14 to 20 March 1969	Call at Cape Town, South Africa. The wintered-over 9th JARE fly back to Japan.
3 to 9 April 1969	Call at Colombo, Ceylon.
25 April 1969	Return to Tokyo.

Two press reporters joined the 10th JARE; Kazuo Yokokawa of Kyôdô News Service joined the Summer Party, and Yukio Kimura of NHK (Nippon Hôsô Kyôkai: Japan Broadcasting Corporation) with the Wintering Party, and took moving pictures (16mm, colour). An American cosmic-rays physicist, Gerard A. Roach, joined the Summer Party, aboard the Fuji from Fremantle to Cape Town. He participated in the balloon programme at Syowa Station in January and February 1969. This was a joint programme of cosmic-rays research at magnetically conjugate points, Syowa and Reykjavik, where a group of U. S. scientists launched balloons during the same period. In the summer of 1969–1970, two foreign observers joined the summer operation of the 11th JARE; Herman R. Friis, Director of Center of Polar Archives, National Archives and Records Service, U.S.A., and Garth Morgan, Department of Supply, Australia.

3. Expenditure

Most of the expenditure of the 10th JARE was defrayed from the budget for the 1968 fiscal year (1 April 1968 to 31 March 1969). Since the Wintering Party was scheduled to leave Syowa Station in February 1970, and fly back to Tokyo from Cape Town via Europe, this estimate dose not include the travel expenses of the return trip and other allowances. The expenditure for the 1968 fiscal year was about 800 million Yen, which is itemized below.

Item	Amount (Unit, thousand Yen)
Travel and other expenses of expedition members	59,610
Research expenses	171,961

Logistics expenses	173,681
Sea transport expenses	374,867
Training expenses	2,528
Headquarters expenses	16,188
Total:	798,835

Breakdown of research expenses (Unit, thousand Yen)

Item	Amount	Item	Amount
Aurora	7,150	Geomagnetism	5,800
Radio physics	16,675	Ionosphere	12,930
Cosmic-rays	12,255	Meteorology	29,768
Biology	2,898	Geography and cartography	11,593
Human physiology	3,050	Seismology and gravity	1,766
Oceanography	4,996	Geology	1,576
Glaciology	10,540	Freight, data processing	8,975
Rocket (buildings)	41,990		
		Total:	171,961

Breakdown of logistics expenses (Unit, thousand Yen)

Section	Amount	Main articles
Machine	106,760	Two KD 60, two KC 20 vehicles, one bulldozer, metal fuel tank, sledges
Fuel	10,180	Diesel oil, gasoline
Building	11,780	Panels of one living hut
Construction materials	1,170	Cement, steel frameworks
Communication	7,200	Transceivers for vehicles
Medications	1,530	Appliances and medicine
Equipment	14,396	Clothing, daily commodities, field equipment
Food, emergency use	2,469	(Food expense is included in the item of travel expenses of expedition members)
Aviation	6,832	Charge for one chartered aeroplane
Common expenses	11,364	Packing and freight
Total:	173,681	

4. Summary of Activities in the Summer of 1968–1969

The research activities in the summer of 1968–1969 are classified into two parts, that is, observations aboard the FUJI during cruise from December 1968 to April

1969 and observations in the vicinity of Syowa Station in January and February 1969.

The shipboard observations include 3-hourly synoptic weather observations and upper-air observations, oceanographic observations (physical, chemical, and biological), sea-borne magnetometer survey, and observations of upper atmosphere physics (cosmic-rays, MF and HF radio wave intensity).

Leaving Fremantle on 21 December 1968, the Fuji reached the edge of fast ice about 30 nautical miles NE of Syowa Station on 5 January 1969. Immediately four helicopter shuttle flights were made from the ship to Syowa to transport men and cargos. Fuji reached the Station on 6 January 1969. January was a busy month, as about 560 tons of cargos were unloaded, many buildings were erected, and researches were carried out. Unloading was finished on 24 January. The breakdown of the cargos is given below.

Item	Weight(tons)	Item	Weight(tons)
Fuel	233	Scientific equipment	35
Construction material	90	Clothings and others	8
Machine	85	Aviation	3
Rocket (buildings)	63	Communication	2
Food	41	Others	1
		Total:	561

In order to carry out the aerophotogrammetric survey of the Lützow-Holm Bay area, a single-engine monoplane, Lockheed-Azcarate LASA 60, was used between the 16th and the 27th of January 1969. A Carl-Zeiss RMK 11.5/18 camera was used. About 1,000 vertical photographs of the Yamato Mountains and the coast of Lützow-Holm Bay were obtained. Development and printing were done at the laboratory of Fuji. Printed copies were available to the members of the inland traverse party which surveyed the Yamato Mountains.

As stated before, 10 balloons for auroral X-rays observations were launched between 14 January and 14 February 1969. Five ground control stations for map compilations were set up on the eastern Prince Harald Coast, 4 stations on 28th and 29th January and one on 22 February 1969. Research parties were sent briefly to several places, such as, Langhovde, Skallen, and Rumpa Island. The research at Skallen was the longest, from 3 to 10 February, by a group of 15 men, which was inevitably prolonged due to bad weather.

One living hut, accomodating 10 cubicles and a saloon, was erected in the central part of the Station, and was connected with the mess hut by a corridor.

The garage was doubled in floor area. Three rocket facilities were erected; rocket assembly shop, telemetry room, and control room. The main part of construction work was finished at the end of January.

On 1 February 1969, several scientists of the 10th JARE took charge of routine observations of weather, ionospheric sounding, geomagnetism, and seismology. They have continued their observations until 31 January 1970. The South Pole Traverse Party of the 9th JARE returned to Station F16, about 15km east of Syowa, and was evacuated by helicopters on 15 February 1969. On 20 February 1969, the Station was officially taken over by the Wintering Party of the 10th JARE.

5. General Operational Topics of the Wintering Party in 1969–1970

Although the official date of change-over had been scheduled on 20 February 1969, the Wintering Party started essentially the maintenance of the Station from 1 February 1969 and finished on 1 February 1970. As shown in Table 2, a total of 28 expedition members and one reporter, Yukio KIMURA, wintered at Syowa Station. It was the first time that a professional news cameraman wintered at the Station. He also participated in the inland traverse party, playing an additional role of a research assistant and cook.

There were two living quarters, each accomodating 10 men, No. 9 Living Hut erected in January 1968 and No. 10 Living Hut in January 1969*. Other 9 men occupied different places, such as Wireless Hut (leader and one operator), No. 9 Generator Hut (one diesel mechanic), No. 8 Aeronomy Laboratory (4 men), and Ionosphere Laboratory (2 men).

Daily routine

The party kept the following timetable for most of the year:

Local time	
0730–0800	breakfast (Sundays 0800–1200)
1200–1300	lunch
1800–1900	supper
	tea time at 1000 and 1500

In principle two members took daily duties in rotation to clean dining hut and ablutions corner, to draw water from pond, to do laundry work (every Tuesday), and other minor tasks. One man was engaged in nightwatch in rotation from 2400 till 0600, but after September 1969 this duty was transferred to the members working during the night, such as weather observers and wireless operators.

* The station facilities have been named after the ordinal numbers of expeditions which were responsible for construction.

There was a good hot water supply and electric washing machines for clothes and bed linens; everybody had a bath on Wednesday and Saturday at 1300–2400. Until the middle of August 1969 water had been drawn from reservoirs and Lake Midori, when the water became brackish due to the growth of ice cover. After that, water was obtained by melting of ice taken from icebergs and fresh snow.

Weather and sea ice

During 1969, the weather was milder than expected, the temperatures being higher than normal year till the end of June, the winds being only occasionally over 20 m/s. The annual average temperature was −9.6°C and the average wind speed was 5.9 m/s. Snow accumulation was little till the end of July. The minimum temperature of −36.2°C was recorded on 22 July 1969. The maximum wind speed of 46.8 m/s was recorded on 15 August 1969. The minimum atmospheric pressure of 929.6 mb was recorded on 8 September 1969, which was the lowest record since the establishment of Syowa Station in January 1957. Snow accumulation became prominent after the end of July and blocked several entrances. It was not likely that the snow drifts in 1969 were heavier than normal year, and the drifts were melted by the end of December.

The Ongul Strait did not freeze until the early part of June. The sea ice of the Ongul Strait and around Syowa Station was swept away several times during the period of blizzard in May and June, so that the plan of depot-setting trip to the inland area before the dark season was abandoned. It was 6 June 1969 when the first crossing on sea ice between Syowa and the Continent was made by the use of KC 20 oversnow vehicles. After blizzard on 26 June an open sea was observed in the SW of Ongulkalven Island, and there was no open waters afterwards until December 1969.

Fuel and power

Two 45 kVA and two 65 kVA diesel-electric generators were installed in No. 7 Generator Hut and No. 9 Generator Hut respectively. The generators were efficiently maintained and there were virtually no power failures. Heat-exchangers were installed with generators, utilizing the heat of radiator coolant and exhaust gas. The heat was used to make hot water and to regulate the temperature of several rooms. Average daily diesel oil consumption by 45 kVA generator was 189 ℓ, and 244 *l* by 65 kVA.

Communications

Regular communication schedules were maintained satisfactorily with the Promoting Headquarters through KDD (Kokusai Denshin Denwa Co.) and Chosi

(JOF), Mawson (VLV), Molodezhnaya (RUZU), and other stations. Four contacts within a month were made with the Promoting Headquarters, two voice contacts and two transmissions of phototelegraphy. Daily contact except Sundays and national holidays was maintained with Chosi. Meteorological and other scientific messages were exchanged with Mawson, generally 6 times a day. Daily contact with Molodezhnaya has been established. During the summer season, contacts with inland traverse party (JGX–10) and Fuji (JSTY) were made. Ham station (8J1RL) was open on Sundays between March and December 1969.

Electrical interference among the different scientific and communication equipments was experienced at the initial stage of wintering. Several countermeasures were applied, but some problems still remained.

Emergency precautions

From the start of wintering arrangements were made for emergency precautions, especially for fires. Fire alarming system, detecting both heat and smoke, was installed in most parts of the facilities. Fire extinguishers and other equipment were inspected at regular intervals. Fire drill was carried out. There were few occasions of real outbreak of fire, but the alarm system worked quite satisfactory and the fire was readily extinguished.

Providing against emergencies, food, fuel, clothing, wireless equipment, and medical supplies were stored in several unheated buildings apart from the main station area.

Life-lines were stretched between the main facilities during the dark season. There were several occasions when the outing was prohibited during heavy blizzard, but the confinement was less than 24 hours at the most.

Recreation and social occasions

Film shows were held on Tuesdays and Saturdays from 2000 hours. Besides this schedule, there were several other shows. Reading, listening to music, various kinds of games, billiards, and table tennis were the main items of recreation. In fine weather, there was a good deal of walking, skating, skiing, photographing, and even baseball and soccer were played, and a running race was held. A post-card size daily newspaper "S 10 Topikkusu (Topics)" was issued without cessation between 21 February 1969 and 20 February 1970. Volunteers in rotation engaged in every editorial work, from data collection, mimeograph printing, to the delivery.

Monthly birthday party was celebrated usually on the last Friday. Midwinter Day was celebrated on 22 June 1969, exchanging messages with other Antarctic stations and various organizations and individuals in Japan and other countries. Greetings were also exchanged in commemoration of the 10th anniversary of the

signing of the Antarctic Treaty on 1 December 1959.

6. Summary of Research Activities at Syowa Station and Its Vicinity

A large part of collected scientific data are still in reduction and processing stage, so that it is difficult to describe the results in detail. An outline of research activities at Syowa Station and its neighbouring area will be described. As mentioned before, the routine observations were continued between 1 February 1969 and 31 January 1970. Other research projects were performed with satisfaction. In accordance with the order of disciplines listed in Table 1, a brief description will be given.

6.1. Cosmic-rays

Two sets of NM-64 neutron monitors were continuously operated from 5 February 1969 to the end of January 1970, printing the data automatically at 10-minute intervals in general and 1-minute intervals in the case of abnormal increase. Abnormal increase was observed on 25 February 1969. Cosmic-rays storms (decrease of more than 5%) were noticed 9 times, in which the maximum decrease occurredin March.

High altitude balloons were launched in January-February 1969 and January-February 1970, observing auroral X-rays.

A brief report on the researches on cosmic-rays during the wintering was presented by Ogura (1971).

6.2. Aurora

6.2.1. Visual, photographic, and all-sky camera observations

Visual observations were made every 30 min in clear dark nights from 4 March to 20 October 1969. About 3,000 monochrome and 300 colour photographs were taken. The all-sky camera (16 mm) was operated from 17 March to 20 October 1969.

6.2.2. Photometric observations of auroral luminosity

Two photometers (aperture, 5° and 30°) were used to record the rapid variations of auroral luminosity at 4278Å at the zenith. Observations were carried out from 8 May to 20 October 1969.

6.2.3. Observations of auroral luminosity along the magnetic meridian

Two sets of meridian scanning photometers (aperture, 5° and 1°) were operated to record the auroral luminosity at 4278Å.

6.2.4. Measurement of auroral radio noise

Measurement of 70 MHz auroral radio noise was recorded between 26 March 1969 to January 1970. This measurement has been continued from the previous

year.

6.3. Geomagnetism

6.3.1. Continuous recording of magnetograph (D, H, Z)

Magnetograms were obtained almost continuously, missing a few hours' record. This measurement has been continued since 1966. Owing to the malfunction of G. S. I. magnetometer, absolute measurements were not carried out from February to June 1969. Three storms were recorded on 2 February, 14 May, and 29 September 1969, indicating more than 1500γ in intensity. Data of K-indices were exchanged with other antarctic stations every month.

6.3.2. Observations of geomagnetic micropulsations

Three components of geomagnetic micropulsations in a range of 3 to 0.003 Hz were recorded from 21 February 1969 to January 1970. A number of pc-3 pulsations closely correlated with periodic VLF emissions were recorded.

6.3.3. Observations of natural radio noises

Natural electromagnetic noises in the range of 0.2 to 130 kHz were recorded with a number of instruments, by paying special attention to the character of polar chorus. Simultaneous recordings of magnetic micropulsations, VLF emissions, and auroral luminosities were carried out. HAYASHI (1971) reported the results of observations on aurora and geomagnetism with special emphasis on VLF emission.

6.4. Infrasonic pressure waves

Seven microphones were placed at various points on East Ongul Island to measure infrasonic pressure waves associated with the occurence of aurora. From 20 March to October 1969 the observations of the periods, wave pressure, and incident angle with respect to the ground surface were carried out. Observed periods were in a range of 4 to 800 s, with pressure of 1 μb to more than 100 μb in the waves with periods of more than 200 s. SUZUKI (1971) gave an outline of this observation.

6.5. Radio physics

6.5.1. Observations of polarisation and incident angle of VLF emission

A narrow-band intensity recorder (frequency: 0.75, 2, 5, 8, 12, 25, 40 and 70 kHz) and a polarisation recorder (0.75, 5, 12, and 25 kHz) were operated from 17 February 1969 to the middle of January 1970. This research has been continued since 1967.

6.5.2. Direction finding of VLF emissions

Atmospherics of 10 kHz were recorded from 3 March 1969 to January 1970. The source area was deduced to be located in South Africa. More atmospherics

were observed in summer than in winter, and in the nighttime than daytime. A pronounced increase of atmospherics was recognised during blizzard.

6.5.3. Observations of Faraday rotation

The Faraday rotation effect was studied, receiving 40 and 41 MHz signals from Explorer-22 Satellite between 20 February and December 1969.

6.6. Ionospheric physics

6.6.1. Vertical ionospheric soundings

Ionograms were obtained every 15 minutes from 1 February 1969 to 31 January 1970. Noticeable radio black-outs were observed in April, May, September, and October.

6.6.2. Aurora radar observations

Aurora radar with a frequency of 112.2 MHz was operated from May to October 1969. Results were recorded in films.

6.6.3. Riometer observations

During the whole period riometer observations for 10, 20, 30, and 50 MHz were carried out. Diurnal changes and wave absorptions were distinctly observed in the 30 and 50 MHz waves. Ota (1970) reported on the records of 30 MHz cosmic noise from 1 January to 31 December 1969.

6.6.4. Recording of VLF signals

Consecutive from the previous year, signals from GBR (16 kHz, England) and NAA (17.8 kHz, U.S.A.) were continuously recorded.

6.6.5. Measurement of HF field intensities

Field intensities of Japan Short-Wave Broadcasting (9.595 MHz) and Radio Japan (11.815 MHz) were recorded alternately every ten days.

6.7. Meteorology

6.7.1. Surface synoptic observations

Observations have been continued since 1966. Most of the meteorological elements were measured every hour with the aid of MAMS (Japan Meteorological Agency, Automatic Meteorographic System) and MAMP (Japan Meteorological Agency, Meteorographic Printer). Standard visual observations were also carried out. Weather messages for 0000, 0600, 1200, and 1800 GMT were sent to Mawson for dissemination.

6.7.2. Upper-air observations

Upper-air observations at 0000 GMT were carried out by the use of RS-II-68 radio sondes. There were 5 days when the observations were impossible due to heavy blizzard. Warming of the stratosphere was observed at the end of October.

A general description of synoptic and upper-air observations in 1969 was given

by ISHIDA, SUZUKI, and SAKAI (1971).

6. 7. 3. Weather analysis

Weather analysis was made several times, especially at the end of October before the departure of the inland traverse party from the Station.

6. 7. 4. Total ozone observations

Dobson spectrophotometer was used to measure the total ozone. Increase in the ozone content was associated with the strato-warming at the end of October. Results were reported briefly by ISHIDA, SUZUKI, and SAKAI (1971).

6. 7. 5. Special sondes observations

A total of 49 radiation sondes (RS-II-R 68), 20 ozone sondes (RS-II-KC 68), and 22 atmospheric electric-field sonde (RS-II-E 64) were released between February 1969 and January 1970.

6. 7. 6. Local meteorological studies

Local meteorological studies were carried out on ground temperatures, air temperatures on sea ice, katabatic wind, and snow accumulation.

6. 7. 7. Observations of atmospheric electricity

Atmospheric electric field (potential gradient), electric conductivity, and air-earth current near the ground were measured at Syowa Station from February 1969 to January 1970 (KONDO, 1971).

6. 7. 8. Cloud physics observations

About 300 plates of snow-crystal replicas and 365 plates of sea-salt nuclei were collected during the wintering.

6. 8. Oceanography

A new hut equipped with a recorder of pressure-type tide gauge was erected in January 1969. Observations of tide were started on 30 January 1969 and terminated on 24 August 1969 due to the breakage of pipe under ice pressure.

6. 9. Seismology

Natural earthquakes were recorded by means of HES seismograph (short period) and Press-Ewing type long-period seismograph. The observations were contiuned since 1966. Results of readings of seismograms at the Station were sent to the U. S. Coast and Geodetic Survey and other antarctic stations during the winter of 1969. The seismograms were read again and the results were reported (KAMINUMA, 1970).

6. 10. Cartography

From the 6th to the 10th of October 1969, a ground control survey was conducted at Skarvs Nes area. Items were astronomical observations, base-line determination, tide observation, and triangulation of 10 control points, of which 7

points were marked for aerophotogrammetric survey.

6.11. Gravity

A LaCoste and Romberg geodetic gravimeter (G 118) was used to measure gravity values at 5 sites on West Ongul Island on 26 December 1969, and at 10 sites on East Ongul Island on 30 January 1970. Three gravity surveys were carried out along the Sôya Coast in August, September, and October 1969, but the results were not satisfactory because of a large drift of the gravimeter G 183.

6.12. Geomorphology

6.12.1. Measurement of ground temperature profile and ground water content at Syowa Station

At two sites in the Station, air temperature, ground temperatures at 5 levels, and water content were measured between 15 January 1969 and 15 February 1970.

6.12.2. Observations on periglacial phenomena and geomorphology in the Lützow-Holm Bay area

In conjunction with this research programme surveys of raised beach were carried out on Ongul Island (February-April 1969), Skarvs Nes (October 1969), and Skallen and Langhovde (February 1970). Sampling of air, lake water, and sea water was made for the analysis of dating of modern carbons. Samples of fossil shells and biological specimens collected at Langhovde and Skallen will be subjected to chronological analysis.

6.13. Geology

6.13.1. General geological survey

Geological surveys along the coast of Lützow-Holm Bay cover the following areas: Prince Olav Coast (from Syowa Station to Cape Omega, August 1969), Ongul Islands (April and May 1969), Langhovde (January and September 1969, February 1970), Skallen (February 1969, October 1969, February 1970), Sôya Coast between Sudare Rock and Shirase Glacier (October 1969), and Botnneset (January 1969). A brief report was given by Yoshida and Ando (1971).

6.13.2. Sampling of bottom sediments

Cores of marine sediments in Ongul Strait were collected at 20 locations in July and September 1969 (Ando and Yoshida, 1971).

6.13.3. Collection of sea ice and glacier ice was made for the petrofabric analysis. Samples were brought back to Japan.

6.14. Glaciology

6.14.1. Accumulation studies near Syowa Station

Snow accumulation on sea ice near the Station was observed from March 1969

to January 1970. Negative accumulation due to sublimation and melting was observed till the end of June. A sudden accumulation of about 40 cm occurred at the end of August. Annual growth of sea ice was about 135 cm (NARUSE, ENDO, ISHIDA, and AGETA, 1971).

6. 14. 2. Survey of snow field on East Ongul Island

The total area and mass of snow field on East Ongul Island in March 1969 (end of ablation period) was estimated at $24 \times 10^4 m^2$ and 7.1×10^5 tons, respectively. Melt water of this snow field is used at Syowa Station.

6. 14. 3. Observations of drifting snow

Vertical distribution of amount of drifting snow observed at Station F16 in the middle of August 1969.

6. 14. 4. Preliminary survey of glaciers on the Sôya Coast

In August 1969, 9 marker poles were set on the ice sheet between Station F0 and Station F 16 (about 15 km from F0, height about 500 m). The positions of these poles were triangulated from the base-line on East Ongul Island.

Reconnaissance surveys were made on the following glaciers: Okuiwa Glacier (7–11 August 1969), Skallen Glacier (October 1969), and Shirase Glacier (3–13 October 1969).

6. 15. Human physiology

Eight men were subjected to the analysis of adaptability to the antarctic climate. Seasonal changes in the basal metabolic rate was observed in relation to food intake. Response to the cold climate was studied by measuring body temperatures and urine volumes at 3 or 4-hour intervals. A time and motion study of the activities of members was made.

7. Summary of the Inland Traverse

The inland traverse party, consisting of 10 men led by Hisao ANDO, made a 90-day trip from 1 November 1969 to 29 January 1970, covering about 1,500km in the Mizuho Plateau and Yamato Mountains area (ANDO, 1971). The main object was traverse glaciology, but relevant surveys of the Yamato Mountains were carried out between 1 st and 12th of January 1970. A sketch map of the route of the traverse is given in Fig. 2.

The party first advanced about 140km to the east and reached Station F 70 (at about 69°S, 43°E). Along the meridian of 43°E the party went to the south, reaching F 240 (72°S, 43°E) on 21 November 1969. This longitudinal route was first explored by the 8th JARE when they made a return trip to the U. S. Plateau Station in the summer of 1967–1968. This route was again covered by the 9th

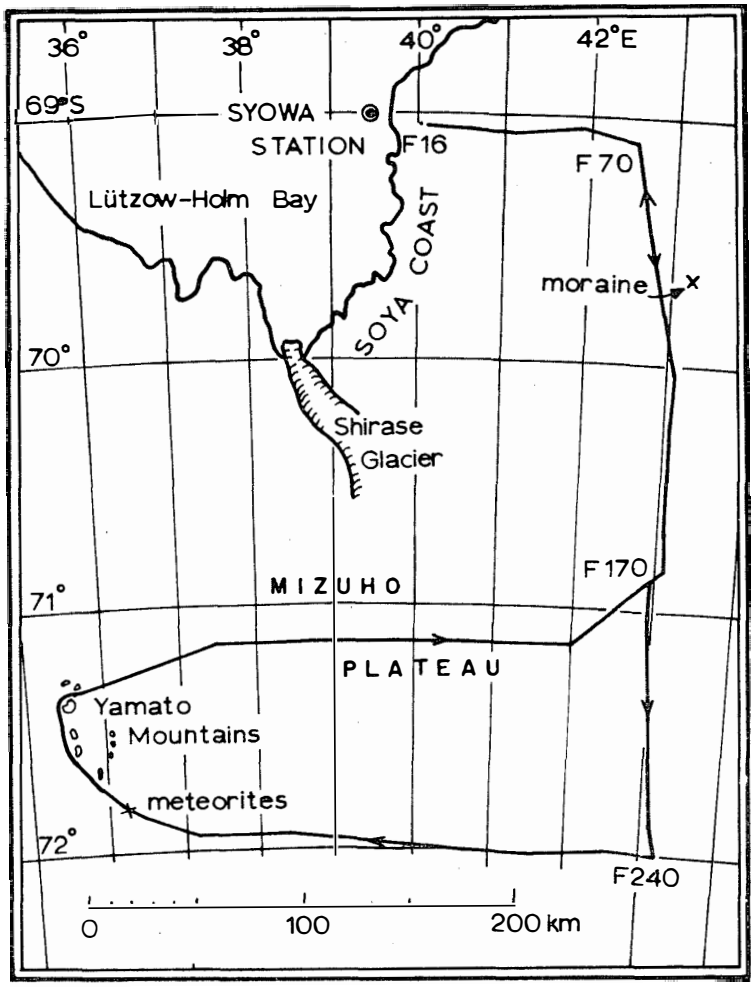

Fig. 2. Route of the inland traverse in 1969–1970.

JARE (South Pole Traverse Party). Starting from F 240, a laborious triangulation work for setting strain grid band was continued along the parallel of 72°S and, finally made tie with a rock at the southern end of the Yamato Mountains at about 36°E. Surveying the Yamato Mountains, the party went up to the north along the western part of the Mountains. Then, along the parallel of 71°S, the party reached F 170 at 70°50′S, 43°07′E, from there they took the former route to Syowa Station.

The items of investigation are: astronomical observations at 5 stations, altimetry at 585 stations, surface weather observations at 1200 GMT (preference), 1800, and 0600 GMT, ice thickness measurement at 653 sites by means of radio echo sounder equipped in KD 608 vehicle, 7 seismic reflection shootings and 2 refraction shootings, gravity readings at 2 km intervals, geomagnetism observations (3 components at 8 stations, total force every 10 km), VLF emission recording at 2 stations, sampl-

ing of sea-salt nuclei, and medical examination about once a month.

Glaciological work includes the remeasurements of 269 bamboo snow stakes set in 1967 and 1968, among which one was lost and 30 were considerably inclined. Surface features were observed along the whole route. New snow stakes were set along the latitude of 72°S, in the Yamato Mountains area, and along the latitude of 71°S, totaling 493 bamboo poles 2 m long and 157 plastic poles 3 m long.

Six 1-metre deep pits were examined to estimate the annual accumulation. Cores of 10 m long were examined at two stations, 5 m core at one station, and 1 m core at 69 stations. Snow temperatures at a 10 m depth were measured by means of thermistor. Strain grid of square shape (side length about 1 km) was installed at 6 sites along the route. Strain grid band along the parallel of 72°S consists of 162 triangles with a side length of about 2 to 4 km.

Snow core samples to a depth of 10 m were collected at 5 stations and brought back to Japan. Ice core samples, 17 m in total length, and about 20 kg of ice samples in blocks were also collected.

Surveys of the Yamato Mountains include terrestrial surveys for map compilation, observations of glacial geology and geomorphology, and setting of markers for flow measurements at several glaciers. About 250 kg of rock samples were collected.

On 21, 22, and 26 December 1969, nine chondritic meteorites were collected near the southern end of the Yamato Mountains, at about 72°S, 36°E. Their diameters are 3 to 10 cm, weighing 10 to 715 g (YOSHIDA, ANDO, OMOTO, NARUSE, and AGETA, 1971).

Three group of morain deposits, the largest one being 260 × 460 m in size, were found at about 69°39′S, 43°20′E. This was first sighted on 10 November 1969 and briefly surveyed on 25 January 1970 (YOSHIDA, AGETA, and YAGI, 1971).

8. Concluding Remarks

On 1 February 1970 the Wintering Party was again aboard the FUJI. Some members assisted the programmes of the 11th JARE toward the end of the official change-over on 20 February 1970. During this change-over period two sounding rockets were successfully launched at Syowa Station on 10th and 17th of February. Earth scientists joined the summer field surveys in the areas of exposed rocks and glaciers.

On 20 February 1970 the FUJI left Syowa Station, but was unfortunately caught in consolidated pack ice till 18 March, loosing her four starboard propellers. On 29 March 1970 she called at Cape Town 20 days behind the schedule. The Winter-

ing Party returned to Tokyo by air on 8 April 1970, and the ship returned to Tokyo on 8 May 1970.

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