# Newly Found Inland Moraine Fields near Syowa Station in 1970

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# 第10次南極地域観測隊で発見したモレーンフィールド

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要　旨

1969年11月～1970年1月の間に行なわれた第10次日本南極地域観測隊の内陸調査旅行のさい，昭和基地の東南東方向150 km，南緯69°39′，東経43°20′，高度約1,600 mの大陸氷床上に新しいモレーンが発見確認された．モレーンは直径数10 mから数100 mのものが3個，約N10°W方向に3 kmの間に分布している．

モレーンは巨視的に見て，谷地形の中に分布しており，東方は裸氷帯で，クレバスの多い急な登り斜面である．

モレーンの礫は，亜角礫と角礫が大部分を占める．岩質は細粒片麻状閃緑岩が主で，桃色正長石花崗岩質の脈がよく発達しているものが多い．この種の岩石はリュツォ・ホルム湾沿岸ややまと山脈よりも，宗谷海岸北方に多い．

モレーンの地形，氷，岩質の特徴から，モレーンの源は，現在の場所の比較的近くではないかと推察される．

## 1. Introduction

Several years have passed since the existence of nunataks or moraines, which are discussed in this paper, was suggested by the members of the traverse parties of the Japanese Antarctic Research Expeditions (JARE).

The inland traverse party led by H. Ando of JARE-10 had a chance to find the objects. The present authors carried out a preliminary survey of them on January 25, 1970.

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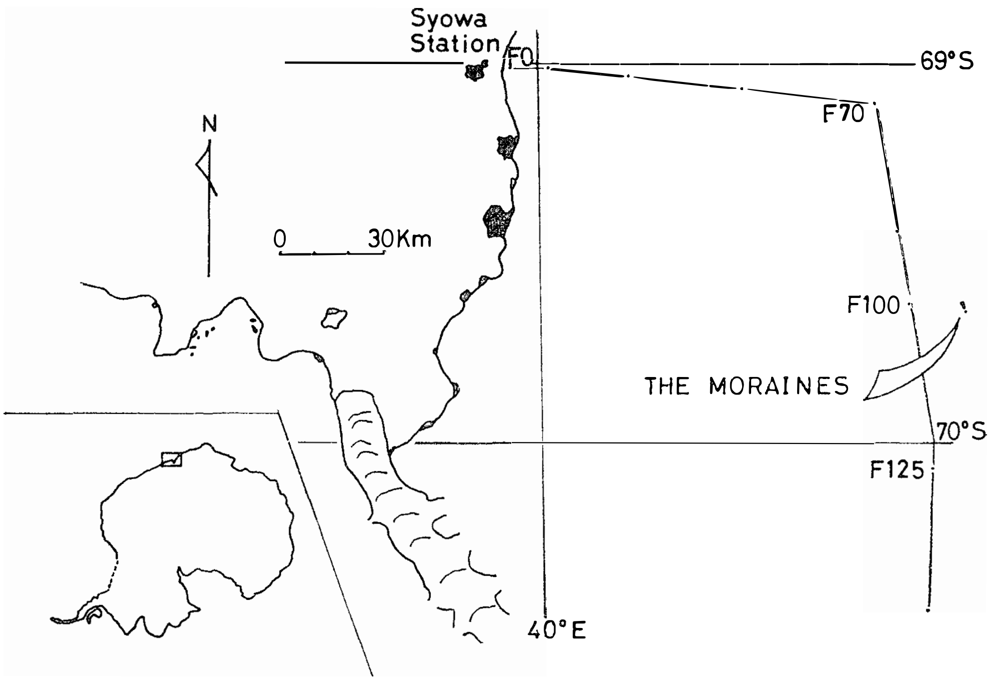


*Fig. 1. Location of the moraine fields.*
*F100–F70–F125 is a traverse route of JARE.*

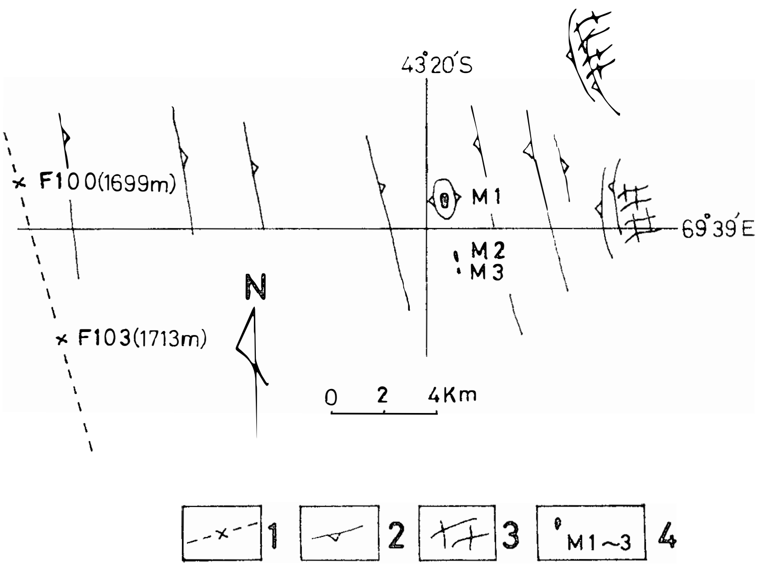


*Fig. 2. General topography of the vicinity of the moraine fields.*
*1. JARE traverse route along longitude 43° E and its flag number.*
*2. General tendency of the slope. 3. Heavily crevassed steep slope which looks like a glacier. 4. Moraine fields.*
*Altitudes of F100 (1699 m) and F103 (1713 m) are approximate.*

## 2. Location of the Moraine Fields

The moraine fields are located in latitude 69° 39′ S and longitude 43° 20′ E at an approximate altitude of 1,600 m above sea level (Fig. 1).

## 3. Scope of the Moraine Fields

Three moraine fields of some tens to hundreds meters in diameter are distributed in a direction about N 10° W within a distance of 3 km (Fig. 2). They were temporarily named M1, M2, and M3 from north to south. The survey was made on the M1 moraine field, which is the largest of the three, having an area of 460 m × 200 m.

## 4. Topography

A characteristic topography, trending N–S with an E–W width more than 15 km, is developed in the vicinity of the morain fields (Fig. 2). Morain field M1 is mound-shaped, about 10 m in height. In a macroscopic view, however, M1 is located on the bottom of a wide valley. The valley bottom west of M1 is a gentle uphill slope on the whole, but its gradient changes as follows; for about 100 m from M1 the bottom is a gentle downhill slope, which grades into a flat plain about 1 km wide, and then comes a gentle uphill slope with a width of several kilometers until it adjoins the plateau on which the JARE traverse route lies. To the east of M1 the slope is remarkably variable. For some kilometers from M1, it is a gentle uphill slope, then it becomes a heavily crevassed uphill slope which looks like a glacier. In front of this slope, a shallow valley, several hundred meters wide, is developed. All these topographic features are found to continue southward for more than 20 km in the direction of the distribution of the moraine fields.

## 5. Constituents of the Moraine Field

### 5.1. Size and shape

The constituents of the moraine field range from silt to boulder, but most of them are sand and pebble under 20 cm in diameter. The distribution and occurrence of fine-grained material is characteristic (Fig. 3).

The pebbles are mostly subangular breccias, accompanied by a very small amount of rounded and glacial striae-bearing ones. It was noticeable that all the

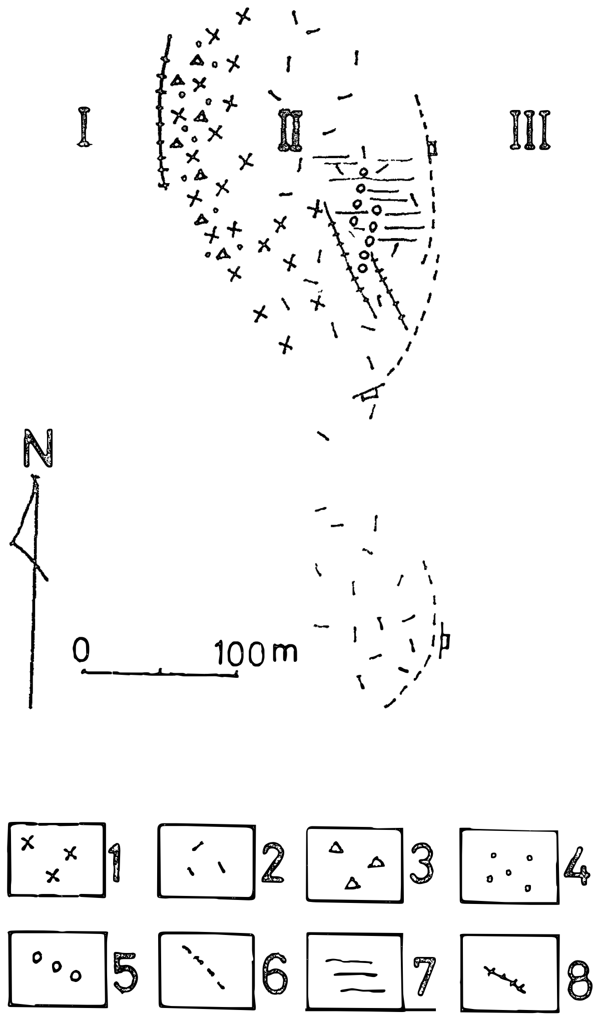


*Fig. 3. Sketch of M1 moraine field.*
*1. Pebble-rich area. 2. Pebble-poor area. 3. Fine-grained material. 4. Clay and silt. 5. Muddy band in ice. 6. Clay band in ice. 7. Cleavage of ice. 8. Crevasse of ice. I. New drift and firn area. II. Moraine field. III. Bare ice partly covered by fresh snow.*

boulders are angular in shape and are monotonous in rock species.

## 5.2. Rocks of the moraine field

Fine-grained biotite gneisses with pink potash feldspar-rich granitic pools are predominant. Some other common types are pink potash feldspar-rich granitic pegmatite, fine-grained massive-gneissose-banded granodioritic rocks, and garnet-bearing biotite gneiss. Very few basic rocks, such as amphibolite and garnetiferous amphibolite, were found.

## 6. Snow and Ice in the Vicinity of the Moraine Field

### 6. 1. Structure of snow and ice

Bare ice with sporadic fresh snow is exposed on the eastern side of the moraine field. The western side of the moraine field is covered with snow drift accumulated in the lee for a width of some hundred meters. Farther west, it grades into firn about 1 km wide. The firn changes to fresh snow as it goes uphill. The western margin of the moraine field is bordered by a crevasse which is 50 to 100 cm wide with a depth less than 5 m.

Well developed cleavages, small crevasses, and muddy bands are found in the vicinity of the moraine field. The cleavages and crevasses dip steeply (nearly normal). The former strikes generally E–W and the latter generally normal to the former. The crevasses are not continuous, they are short and not straight. The width is less than 20 cm. The muddy bands are developed either in the center or in the margin of the moraine field, and those in the center have a brownish color due to the inclusions of silt and sand. The width of the bands is 10 to 30 cm. Five bands run parallel to each other generally in the direction of the crevasses. Muddy bands of the other type are developed in the eastern margin of the moraine field. They contain bluish gray silt and clay. One to three bands run parallel to the eastern margin. All the bands are gently inclined outward from the moraine field (cf. Fig. 3).

It seems that the muddy bands of this kind are results of a secondary deposition of mud and silt transported from the moraine field by the melt water in summer.

### 6. 2. Characteristics of the snow and ice

The central part of the moraine field is composed of bubbly ice, whereas the marginal part is of dusty ice containing clay, sand, and pebbles. Along the outer margin of the moraine field, small streams of melt water with a width less than 1 cm flow out of the moraine field onto the surface of the ice.

The west side of the moraine field is covered by thin soft snow over the old hard snow. On the east side of the moraine field, bare ice are exposed. The ice is bubbly just like that of the central part of the moraine field.

In the western margin of the moraine field, a crevasse of less than 100 cm wide is found incising the old hard snow. The wall of the crevasse is not smooth, and its lower part is much more brownish than the upper part because of the muddy inclusions. Depth-hoar of 1–2 cm in diameter is developed on the wall of the lower part.

## 7. Origin of the Moraine Field

Some noticeable phenomena suggesting the origin of the moraine field have been noticed in the present survey.

**7.1.** Considering the characteristics of snow and ice, as well as the topography, the following conclusions may be reached:

i) The topography, and the structure and characteristics of ice suggest that the ice developed in the vicinity of the moraine fields belongs to the glacier ice*.

ii) The bubble-rich nature of the ice and the characteristic distribution of snow and ice, as exemplified by the fresh snow in the western area, the firn on the west side of the moraine field, and the ice in the eastern area including the moraine field, suggest that the ice is not very deep and has not traveled a great distance.

iii) The central muddy bands suggest that the gradient of the morainic horizon in the ice can be very steep.

**7.2.** Judging from the constituents of the moraine field, the following conclusions may be reached:

i) The moraine field is not a ground moraine and it did not travel a great distance, because rounded pebbles are almost absent and all the boulders are angular and of the same rock species.

ii) The moraine field might have resulted from exposure of a small area or from subsurface rise of bedrock, because the variety of rock species are poor.

iii) The source area of the moraine may be in the south or east of the present location. It can neiher be very far from the present location nor in the west. Because the assemblage of the rock species of the moraine differs from that of the Lützow-Holm Bay or the Yamato Mountains but resembles that in the vicinity of Oku-iwa Rock, about 70 km northeast of Syowa Station (YOSHIDA and ANDO, 1971).

**7.3.** Summarizing the above, the source of the moraine field may be assumed as follows:

i) It may be a nunatak or subsurface rise of bedrock in the Enderby Land, not very far from the present location of the moraine field.

ii) The moraine field might have been derived from the nunatak as a surface moraine or from the subice rise as a shear moraine.

iii) To accept the shear moraine hypothesis, the characteristic glacial topography in the east of the moraine fields and the steeply dipping muddy bands in the center

* In a sense described by YOSHIDA and FUJIWARA, 1963.

of the M1 moraine field are ascribed to a westward flow of the ice sheet and to a subsurface rise which changed the downward flow to upward.

iv) It is still unclarified when did the morainic horizon rise or whether the superposed snow and firn were eroded away to expose the moraine fields in the present location. Inland traverse, airphotometry*, glaciological survey, or the gravity survey of the surrounding area may serve to solve the problem.

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* It seems that the airborne survey by the Russians over the wide area of Enderby Land including the present locality did not find such conspicuous nunataks (KOZLOV and FEDOROV, 1968).