II Preliminary Report on Geomorphological Survey of the Yamato Mountains, East Antarctica

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II 東南極やまと山脈の地形について

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要　旨

1960 年 11 月 1 日から 12 月 15 日にわたって，昭和基地南西約 300 km にあるやまと山脈への旅行が第 4 次越冬隊によって行なわれ，大陸氷および山地の氷河学，地質学，地理学的調査が行なわれた．これらの成果は現在整理中であるが，山脈の地形の概略を報告する．

やまと山脈はほぼ南北に連なる 7 群の山塊群からなり，東南東より流下する大陸氷は，これに阻げられて停滞し，山群間を破る溢流氷河によって西北方へと氷を排出している．山地はいずれもこれらの氷河群と，大陸氷から独立した圏谷氷河，谷氷河によって氷蝕を受けた典型的な氷蝕地形をなしている． 山塊群は地形的にも 2 つの弧をなし，西側へ張り出した 6 群の山塊による弧と，その東側の 1 つの山塊及び数個の nunatak からなる弧とが雁行している．山脈の南方には数個のnunatak ないしは山塊があって，氷堤（大陸氷が氷崖を作って段をなしている）をもって内側の弧に連なっている．

やまと山脈は花崗岩，花崗片麻岩等の深成岩体よりなるが，これらの地質構造は前述の弧状構造をよく示し，地形に大きな影響を与えている．

第四紀以降の氷床の後退は山地の各所にその証拠を止めていて，後退の種々の stage が観察されるが，これらを大観してみれば，後退は北ほど進行しており，かつ現在もなお後退を行なっていると言うことができる．

Introduction

In November and December of 1960, the newly found mountains—Yamato Mountains—situated at about 300 km southwest of the Syowa Base in Antarctica were traversed by the wintering party of the Japanese Antarctic Research Expedition IV (1959–61). The mountains were already seen in 1937 by LARS CHRISTENSEN in the distance from Lützow-Holm Bay, and they were photographed by the Belgian Antarctic Expedition from air on the 22 nd of October, 1960. Our field party succeeded in surveying the geographical environments of the mountains and adjacent areas. The results obtained, including glaciological and geological ones, are being analyzed. The geomorphic features of the Yamato Mountains are preliminarily described here. Complete reports and maps will be published in the near future.

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Topography of the Yamato Mountains

The mountains, situated between 71°14′S and 71°45′S and between 35°25′E and 36°05′E, consist mainly of seven massifs separated by outlet glaciers. These massifs range almost north to south extending over 50 km, forming two arcs arranged en echelon, having some nunataks, both geological and geomorphological. The outer (northern) arc, convex to the west, is composed of six massifs G, F, E, D, C and B (We named temporarily each massif A, B, C, D, E, F and G group from south to north for convenience of description). This arc disappears abruptly in the south of B. The inner arc, consisting of A and several nunataks north of A, stretches from south to north. The nunataks lying far south of the mountains seem to be a part of the inner arc. Ice cliffs which connect these nunataks have partly a character of an outlet glacier implying that the subglacial topography may have formed the arc structure. Each massif has characteristic features due to glaciations of inland ice and mountain glaciers, being strongly controlled by the geologic structure.

G, the northernmost group of the mountains, consisting of a massif and some nunataks, has an "aiguille" topography, and is almost free from snow (Photo. 1). It extends east to west concordantly with the direction of gneissosity, and the spurs stretch in the main tectonic direction. North of G, the surface of the inland ice lowers about 200 m as compared with that south of G. This suggests that the subglacial topography may have been depressed toward north by a tectonic movement.

South of G, there exists F group separated by a gentle outlet. It has a small glacial trough and a cirque glacier (Photo. 2). The massif has relatively gentle slopes covered with detritus and moraine, accompanied by precipitous cliffs in some parts (Photo. 3). The moraine field extends on the ice WNW of F. A small hill occurs on the ice surface, showing a shallow subglacial floor. The moraine is composed of waste and erratics, and shows a streamlined pattern of glacial flow.

The E group extends to the vicinity of southern part of F beyond a small outlet, and has a conspicuous glacial trough which divides the massif into two sub-groups. In the west, the trough abruptly ends in a steep cliff truncated by an outlet glacier. The bottom of the trough is filled with waste, exposing at places bedrocks with scratched smooth surfaces (Photo. 5). The northern part of E has a relatively flat surface covered with detritus, but the southern part is marked with some rather steep horn-peaks.

The D group, the highest peak of the mountains and denominated the Fukushima-dake in memory of our geophysicist Mr. S. FUKUSHIMA who was lost in a violent blizzard in October of 1960, rises west of E, and has a complicated landform. The ridge is composed of many rugged peaks with comparatively flat surfaces in some places, and the highest one has no positive evidence of the past glaciation (Photo. 4). Cirque-shaped depressions covered with detritus and moraines can be seen locally on the surfaces. They may have been formed by cirque glaciers during the shrinking period of the inland ice. There are several cirque glaciers fringing the mountain, and a remarkable one on the west side is mostly encircled by the main ridge and two long spurs. The relative height of the cirque wall exceeds 700 m in the maximum. The glacier on its floor is covered by a vast moraine field (Photo. 7). It seems that snow accumulation in the cirque hardly occurs at present. The topographic features of this cirque seem to depend largely on the geologic structure, especially on faults. There are two cirque glaciers on the opposite side of it. Their surface gradient is so gentle that snow accumulation in the cirque is active (Photo. 6). They have no ablation region.

The C group lies south of D, separated from the latter by a relatively large outlet glacier. C is divided into two sub-groups by a small outlet glacier. The northern part consists of three small horn-peaks separated by small outlets, but the southern part is a massif having comparatively gentle slopes partly covered with snow and moraines (Photo. 10). This also has a few cirque glaciers and a cirque. One of them has an ice tongue independent from the inland ice (Photo. 9).

The B group having a broad ridge rises south of C. The western slope of the main ridge is precipitous, marked with small hanging glaciers, but the eastern part of the massif is half covered with snow. Moraines and waste spread on the wide ridge and flanks, and periglacial features such as stone stripes are found there (Photo. 14).

Beyond an outlet glacier and a moraine field on ice, there exists the A group occupying the southernmost part of the mountains. A has some cirque glaciers or mountain glaciers, and is mostly covered with snow and ice, or moraine and dead ice. To north of A a wide moraine field extends in a stream-lined pattern (Photo. 16). In places small nunataks or hills rise above the moraine field. This moraine is partly combined with the moraine of C into a long moraine bank along the west side of A, B and C.

As stated above, we saw several nunataks or massifs far south of the Yamato Mountains, which may constitute the southern part of the inner arc. Far east of the mountains there are also two nunataks and a hill covered entirely with snow. Besides these, there exists an isolated nunatak west of the mountains.

Ice conditions: The inland ice flows from ESE to WNW east of the mountains, being dammed up by the mountains. ENE of the mountains the inland ice forms a plateau-like flat surface, which may have been modelled after a subglacial plateau which was revealed by seismic soundings. In places moraine rises to the surface of the ice where subglacial floors become shallower. The height of the inland ice varies from 200 m to 400 m between the both sides of the mountains, and the outlets descend gently across the mountains. Some of the outlets have a steep gradient, but other larger outlets are so gentle that snow-cars can pass through these glaciers.

On the east side of the mountains, a snow accumulation region predominates, but on the west—leeward—side, ablation phenomena were found. The moraine bank along the west side of the mountains indicates that the inland ice flows somewhat fast from south to north on the west side of the mountains. This is verified also by the precipitous glaciated landform on the western part of the mountains.

Deglaciation: Evidences of deglaciation or shrinkage of glaciers in the recent

Quaternary period were found everywhere in the mountains, namely, vacant glacial troughs, cirques, shrinked cirque glaciers, isolated moraines, dead ice covered with morains, and so on. Judging from these characteristic landforms, deglaciation is considered to have been gradually propagated from the northern part of the mountains to the southern part. In addition, the fact that no lichen or moss is found on any rock surface in this region may suggest that the retreat of the ice began not so long before and is still going on.

Geomorphic map

Fig. 2 shows some geographical features of the mountains. This map was compiled from the data of astronomical observation, triangulation and compass surveys. Oblique airphotos offered by the Belgian party were useful for our surveys. The trianglulation made on ice field may include some errors, but we had to use the data for compilation of a reconnaissance map of the newly found mountains in Antarctica. The base line is 1094.18 m in length and the measureemnt was made with a steel tape. The control points were chosen on the summits of massifs or nunataks, some of them were not to be tripod points. The astronomical observations were made on the summit of F and at the western margin of A, but the data at the former locality has less accuracy because we could not catch any time signal for two weeks owing to a strong ionospheric storm. So, the latter is more reliable as the astronomical point of the mountains.

The altitudes shown in Fig. 2 also include some errors, but more reliable values will be obtained in future.

The result of astronomical observation at the A group

Instruments: Wild-T 2 theodolite and Nardin chronometer

Latitude: $71°43'31''.9 \pm 1''.6$ S

Longitude: $35°45'40''.5 \pm 6''.7$ E

Azimuth: $152°38'01''.4 \pm 2''.32$ (The direction from the astropoint to the summit of B)

Acknowledgements

The auther wishes to express his hearty thanks to all the members of the wintering team of JARE IV, 1960, especially to the members of the traverse party, for their kind assistance and cooperation in the field work. He wishes to thank the members of the Belgian field party who offered us the helpful informations and the airphotos of the mountains. He is also indebted to Messrs. S. HOKUGO and M. SHIMURA, members of G.S. I., for the re-computation of astronomical data.

(Received June 10, 1961)