NATIONAL INSTITUTE OF POLAR RESEARCH

ANTARCTIC GEOLOGICAL MAP SERIES
SHEET 18 KASUMI ROCK

Explanatory Text of Geological Map
of
Kasumi Rock, Antarctica

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1. Introduction

The Kasumi Rock which had been tentatively called "Mondai-iwa Rock" till October 1962 is situated at 68°21.5'S in latitude and 42°13.3'E in longitude on the Prince Olav Coast, East Antarctica and about 150 km northeast of Syowa Station of East Ongul Island. It is a small triangle of ice-free area about 2 km^2, bounded by the Antarctic Sea on the north, by the Kasumi Glacier on the east and by the Itime Glacier on the west (Plate 1a).

The area was firstly visited by the members of the summer party of the 5th Japanese Antarctic Research Expedition (JARE-5) in 1960 and then biological and geodetic surveys were attempted in a short time.

Geological survey was briefly carried out by three (T.N., K.Y., H.K.) of the present authors, members of JARE-20, from February 2 to 5, 1979. At that time geodetic survey was practiced again and one astronomical and three controlled points were set up in the area. However, since detailed topographical map has not been published, field data are plotted on a conventional map compiled from the aerial photographs taken by JARE-3 in 1959 on a scale of 1: 24000 and those by JARE-6 in 1962 on a scale of 1: 26000.

2. Geology

Except for thin morainic cover along the eastern and western margins of the Kasumi Rock, the area consists of metamorphic and plutonic rocks which are classified on the basis of the mode of occurrence and petrologic features as follows:

2.1. Biotite gneiss (Gb)
2.2. Marble and skarn (Mb)
2.3. Amphibolite (Am)
2.4. Granitic gneiss (Gg)
2.5. Pink granite and pegmatite (Gr).

Bulk chemical compositions of these rocks are shown in Table 1. The lower portion of the sequence of metamorphic rocks is distributed in the northern part of

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the area and the upper portion in the southern part.

Biotite gneiss is widely distributed throughout the area associated with subordinate amounts of granitic rocks and other metamorphic rocks. The sequence of less than 1000 m in thickness is observable in the area. The lower 300 m of the

Table 1. Chemical analyses of rocks from the Kasumi Rock.

No.	1	2	3	4	5	6	7	8	9	10	11
SiO_2	37.04	44.58	49.05	53.69	63.67	63.70	64.76	72.53	73.56	73.72	75.36
TiO_2	0.39	1.83	2.29	0.84	0.34	0.34	0.71	0.25	0.07	0.07	0.22
Al_2O_3	22.05	14.36	15.74	15.24	17.34	19.70	15.36	14.73	14.61	14.81	13.49
Fe_2O_3	3.27	3.48	4.68	3.10	1.54	0.80	1.72	0.98	0.17	0.67	0.99
FeO	6.47	9.54	8.65	6.12	3.02	1.82	2.95	1.02	0.55	0.29	1.19
MnO	0.15	0.19	0.26	0.16	0.07	0.04	0.07	0.02	0.00_4	0.00_5	0.01
MgO	0.77	8.65	5.26	5.29	1.73	0.20	2.13	0.29	0.02	0.07	0.05
CaO	24.76	11.02	5.14	8.11	3.57	2.30	4.40	1.62	1.03	1.52	0.43
Na_2O	0.24	2.60	2.84	3.18	4.63	5.05	4.64	3.87	3.35	3.51	2.85
K_2O	0.12	1.54	3.52	2.23	1.96	5.03	1.55	4.06	6.00	5.06	5.46
H_2O (+)	3.75	2.03	1.49	1.38	0.96	0.40	1.01	0.39	0.26	0.37	0.29
H_2O (−)	0.03	0.03	0.04	0.04	0.02	0.05	0.05	0.04	0.05	0.02	0.08
P_2O_5	0.06	0.11	0.62	0.42	0.28	0.08	0.24	0.05	0.01	0.01	0.01
Total	100.10	99.96	99.58	99.80	99.73	99.51	99.63	99.85	99.68_4	100.12_5	100.43
Q	–	–	–	2.74	18.50	9.07	19.33	30.40	28.55	38.60	36.45
Or	–	9.10	20.80	13.18	11.58	29.73	9.16	23.99	35.46	29.90	32.27
Ab	–	9.85	24.03	26.91	39.17	42.73	39.26	32.75	28.35	29.70	24.11
An	61.46	22.96	19.80	20.72	15.88	10.89	16.51	7.71	5.04	7.48	2.07
Ne	1.10	6.58	–	–	–	–	–	–	–	–	–
Lc	0.56	–	–	–	–	–	–	–	–	–	–
C	–	–	–	–	1.78	1.96	–	1.14	0.76	0.82	2.13
Di Wo	1.07	12.94	0.69	7.00	–	–	1.65	–	–	–	–
Di En	0.21	7.86	0.39	4.21	–	–	1.00	–	–	–	–
Di Fs	0.95	4.37	0.26	2.42	–	–	0.56	–	–	–	–
Hy En	–	–	9.02	8.97	4.31	0.50	4.30	0.72	0.05	0.17	0.12
Hy Fs	–	–	6.00	5.17	2.85	2.19	2.40	0.69	0.76	–	1.02
Ol Fo	1.20	9.59	2.59	–	–	–	–	–	–	–	–
Ol Fa	6.08	5.87	1.90	–	–	–	–	–	–	–	–
Mt	4.74	5.05	6.79	4.49	2.23	1.16	2.49	1.42	0.25	0.75	1.43
Il	0.74	3.47	–	1.60	1.79	0.65	1.35	0.47	0.13	0.13	0.41
Hm	–	–	–	–	–	–	–	–	–	0.15	–
Ap	0.14	0.25	1.44	0.97	0.65	0.19	0.56	0.12	0.02	0.02	0.02

No. 1.	Y79020405	Eclogitic garnet rock (calcarious inclusion in gneiss).
2.	Y79020406	Hornblende biotite amphibolite.
3.	K79020305	Hornblende biotite amphibolite.
4.	Y79020304	Amphibolite.
5.	N79020307	Fine-grained biotite gneiss.
6.	Y79020303	Garnet bearing hornblende biotite gneiss.
7.	Y79020307	Hornblende biotite gneiss.
8.	N79020313	Granitic gneiss.
9.	Y79020306	Granite.
10.	N79020312	Leucocratic granitic gneiss.
11.	Y79020301	Fine-grained granitic gneiss-granite.

sequence is characterized by the thick biotite gneiss in which thin marble and skarn bed is intercalated and relatively large amount of pink granite intrudes as sheets or dykes. The upper 700 m also consists of the thick biotite gneiss and is associated with subordinate amount of amphibolites. At least three thick amphibolite layers lie in the upper part of this upper sequence.

2.1. Biotite gneiss (Gb)

2.1.1. Biotite gneiss

The rock is widely distributed throughout the area. Foliation in this rock is represented by parallel arrangement of biotite flakes and intensified by alternation of melanocratic and leucocratic layers. Plagioclase is commonly larger in amount than potassium feldspar.

Massive melanocratic part of the rock resulted from the concentration of biotite is often interbedded as lenticular layers of maximum 10 m in thickness to make narrow valley or shallow groove because of its rather weak resistance to erosion. The constituent minerals of this rock are biotite, plagioclase, potassium feldspar and quartz with or without hornblende.

With increasing hornblende the rock grades into biotite-hornblende gneiss. Except for larger quantity of hornblende, this rock has the same mineral assemblage as the biotite gneiss does. Hornblende has a pleochroism of greenish brown to yellowish green.

2.1.2. Garnet-biotite gneiss

Garnet-biotite gneiss occurs as thin layers within the biotite gneiss at two outcrops of the central part. It is too small to be represented in the geological map. The rock is composed of biotite, garnet, plagioclase, potassium feldspar, quartz and muscovite. Relatively large porphyroblasts of garnet of 3 to 5 mm in diameter characterize this rock.

2.2. Marble and skarn (Mb)

A marble and skarn bed is intercalated within the biotite gneiss in the northwestern part of this area. This bed ranges from 10 to 1 m in thickness. In the eastern part of the distributed area it diverges into the lower thin bed of less than 1 m and the upper thick one of 5 to 6 m. Marble occupies one-third to one-forth of the bed where it exceeds about 2 m, and is leucocratic, white to pinkish white in color, coarse- to very coarse-grained and equigranular in texture, being monomineralically composed of equant calcite. Impure marble, which is surrounded by marble of alternation with skarn, contains dolomite grains sporadically and is yellowish white in color. The rock grades into skarn and allied rock with increasing scattered minerals. This rock may be tentatively subdivided into the following varieties:

(1) Banded phlogopite marble
(2) Clinopyroxene-skarn
(3) Banded amphibole-plagioclase-calcite-skarn
(4) Garnet-plagioclase rock.

Banded phlogopite marble comprises two types of mineral assemblage; a carbonate (calcite and dolomite)-phlogopite-diopside-(olivine) rock and carbonate-phlogopite-plagioclase rock. The rock of the first type shows an equigranular mozaic texture.

Most of the olivine grains are largely serpentinized along fractures and around the periphery. In the rock of the second type phlogopite and plagioclase characteristically occur as spots in the carbonate matrix which may be caused by unhomogeneity of the host rock.

Clinopyroxene-skarn also has various mineral assemblages such as (a) diopside-pale green amphibole-calcite-sphene-phlogopite-plagioclase, (b) clinopyroxene-calcite-quartz-sphene and (c) scapolite-mica-calcite-quartz-clinopyroxene-plagioclase-clinozoisite.

Banded amphibole-plagioclase-calcite-skarn is composed mainly of pale green amphibole, green amphibole, plagioclase, quartz and accessories as sphene, clinopyroxene and apatite. The rock may be divided into quartz-plagioclase zone and amphibole-plagioclase zone.

Garnet-plagioclase rock is composed of garnet, plagioclase, scapolite, calcite and smaller amounts of sphene, opaque mineral, chlorite, muscovite and clinozoisite. The rock shows a brecciated texture, and quartz and plagioclase fill the interstices of brecciated colored minerals. The rock is found only in the northernmost locality.

Where a granitic rock meets a calcareous bed, the former is essentially composed of potassium feldspar, quartz, plagioclase, biotite, hornblende and clinopyroxene, showing a granitic texture on the whole but the interstices between those mineral grains are filled by calcite and mica (muscovite?).

2.3. *Amphibolite* (*Am*)

These rocks are distributed mostly in the southern part. They are fine-grained melanocratic rocks with slightly massive appearance. However, weak foliation due to parallel orientation of mafic minerals and thin folio of salic minerals is often developed. Amphibolite is usually composed mainly of hornblende, clinopyroxene, biotite, plagioclase and quartz. The amphibolite often grades into hornblende gneiss and rarely into eclogite-like rock bearing Ca-rich garnet.

In the upper part of the sequence three relatively thick layers of amphibolites are developed concordantly within the biotite-gneiss and granitic gneiss. Amphibolite of the lowest amphibolite layer interbedded in the granitic gneiss alternates with the hornblende gneiss of the lesser amount. Amphibolites in the middle portion are widely distributed and alternate with the biotite gneiss in various thicknesses. The uppermost amphibolites of the alternation include irregular-shaped bodies of scapolite-clinopyroxene rock. The amphibolites themselves are composed of brown amphibole, pale green amphibole, plagioclase, phlogopite, calcite and apatite. The scapolite-clinopyroxene rock is composed of much scapolite and clinopyroxene and smaller amount of hornblende and very small amount of quartz and shows a heteroblastic texture due to sporadic subspherical clinopyroxene grains of approximately 5 mm in diameter. The grain is surrounded by finer green hornblende grains.

2.4. *Granite gneiss* (*Gg*)

2.4.1. Granitic gneiss

Gray granitic gneiss which possesses fairly strong gneissose structure and gneissic granite are distributed in the biotite gneiss nearly concordant with it in the central and the southern parts of the area. Both of the rocks are coarse-grained and composed

of biotite, plagioclase, potassium feldspar and quartz.

2.4.2. Garnet-bearing granitic gneiss

The rock forms sheet-like masses of several meters thick in the biotite gneiss. The rock is composed of garnet, plagioclase, potassium feldspar and quartz, often with minor amount of biotite.

2.5. Pink granite and pegmatite (Gr)

The rock occurs as dykes, sheets and irregular-shaped pools of veinlets of various scales throughout the area (Plate 2a). In spite of their wide distribution, the rocks are too complicated to be represented in an exact form on the geological map. The rock is usually pinkish-colored owing to abundant pinkish potassium feldspar. The constituent minerals are hornblende, biotite, plagioclase, potassium feldspar, quartz and small amounts of apatite, zircon, sphene and opaque mineral. Pegmatitic and aplitic varieties of this rock are also identified throughout the area, some of which are represented on the geological map.

3. Geologic Structure

Many folds of various scales are identified in the area (Plate 2b). Judging from the attitudes of the metamorphic rocks especially the distribution of the mable and skarn as key bed and the amphibolite layers in the biotite gneiss, the area is probably covered by an antiform of large order. It is named Kasumi Rock Antiform (NISHIDA *et al.*, 1980). The core of the antiform lies along the north coast and the axis of it runs in the east-west direction though plunge is not known exactly.

The zigzag pattern of the marble and skarn bed extending southerly may represent steeply plunging recumbent folds of a smaller scale on the southern limb of the Kasumi Rock Antiform. The distribution of intensely folded calcareous bed in the area suggests that there is resemblance to the structure of the Skallen region of Lützow-Holm Bay on which many studies have been made by YOSHIDA (1970, 1977, 1978), ISHIKAWA (1976) and YOSHIDA *et al.* (1976, 1977). However, the differences between the two areas are such that the structure of the Skallen region is essentially recumbent folds of a larger scale while that of the Kasumi Rock area may be an open fold of a smaller scale.

Systematic study of fractures in the area is carried on. Some structural lineaments with a northeast-southwest trend can be traced for over several hundred meters. The fractures are almost vertical and run straight and there are no apparent dislocation and emplacement of igneous rock along the fractures. Thus the fractures may represent the joint sets of the area. They are oblique to the general structure of the area but almost parallel to the general direction of the Prince Olav Coast.

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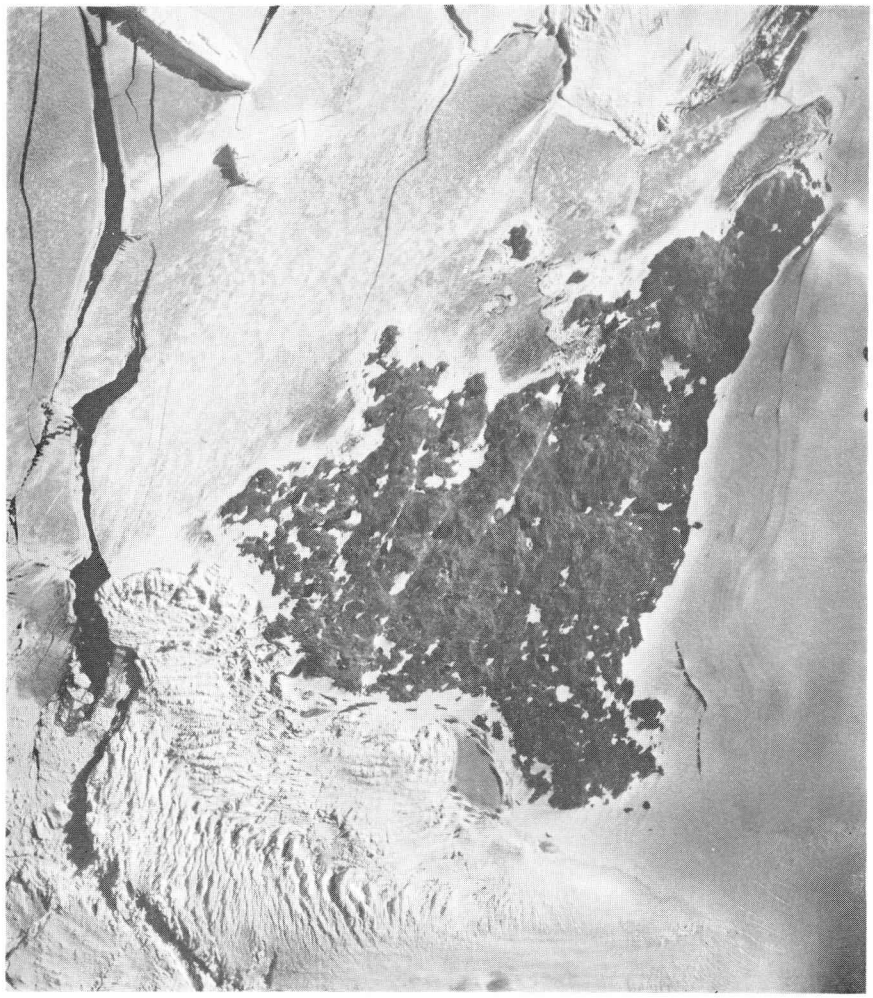

a. Aerial photograph of the Kasumi Rock, JARE Antarctic air photographs 6AV-II-2, No. 954.

b. Oblique air photograph of the northeast part of the area, view from the west.

Plate 2

a. Outcrop showing abundant pegmatite.

b. Outcrop showing a tight fold with discordant pegmatite.

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