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SHEET 22 OKU-IWA ROCK

Explanatory Text of Geological Map
of
Oku-iwa Rock, Antarctica

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1. Introduction

The Oku-iwa Rock area is situated at 68°43′S in latitude and between 40°48′E and 40°52′E in longitude on the Prince Olav Coast, East Antarctica. It is about 58 km northeast of Syowa Station, East Ongul Island. This area has an ice-free area of about 3 km in the east-west length and 1.5 km in width.

The geology of Oku-iwa Rock was preliminarily surveyed and reported by YOSHIDA and ANDO (1971), members of the wintering party of the 10th Japanese Antarctic Research Expedition (JARE-10), 1968–1970. YOSHIDA (1978) reported that the crystalline rocks in the area belong to the Oku-iwa group which is the youngest in the Lützow-Holm Bay system. The second geological survey was carried out by the present authors, members of JARE-19, from January 24 to 27, 1978 (NAKAI *et al.*, 1979a,b). At the same time, the geodesic survey was conducted by T. KUNIMI. In the survey, the field scientists used the aerial photographs which was prepared on the scale of approximately 1 : 25500 by the JARE-6 in January 1962.

2. Geology of Oku-iwa Rock

The Oku-iwa Rock area is bounded by the Antarctic Sea on the north and by the continental ice sheet on the south. The Oku-iwa Glacier lies on the western side of the area. Geomorphologically the area shows an undulating surface. The highest point is about 100 m above the sea level. In the southern part of this area, near the continental ice sheet, morainic glacial deposits and patterned grounds consisting of sorted stone circles are found.

The mainly exposed basement rocks in the area are classified as follows: 1. Biotite gneiss (Gb), 2. Migmatitic biotite-hornblende gneiss (Gbh), 3. Leucocratic biotite gneiss (Glb) and 4. Pink granite (Gr), aplite and pegmatite.

The exposed area is divided into three zones, biotite gneiss zone, migmatitic biotite-hornblende gneiss zone and leucocratic biotite gneiss zone, on the basis of

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their modes of occurrence, the petrographical character, folding structure and degree of migmatization. The three zones are arranged in parallel with each other in the east-west direction.

The biotite gneiss exhibiting strong folding in the biotite gneiss zone lies in the northern part of this area, where the biotite gneiss is the lowermost member. Toward the south, the other two zones are successively distributed above the biotite gneiss zone. The migmatitic biotite-hornblende gneiss zone occupies the central part of the area and is composed mainly of amphibolite, biotite-hornblende gneiss and dioritic rock. The rocks in this zone suffered strong migmatization and deformation and the outcrops show complex migmatite structure, *e.g.* agmatite, schlieren, nebulite, etc. Amphibolite and biotite-hornblende gneiss are included as paleosomes in dioritic rocks which have rather massive and leucocratic plutonic appearances. From the field observations, lithological and lithofacial changes from amphibolite through biotite-hornblende gneiss to dioritic rock are intergradational and this evidence suggests a continuous series of migmatization. Granite, aplite and pegmatite having pinkish K-feldspar show remarkable folding structures, and the occurrence of these rocks is almost limited to the folded biotite gneiss zone in the northwestern part of this area.

Table 1. Chemical compositions of rocks from Oku-iwa Rock.

No.	1	2	3	4	5
SiO_2	50.85	60.45	47.99	66.43	72.93
TiO_2	2.28	0.95	3.28	0.47	0.31
Al_2O_3	14.24	15.56	15.53	15.34	14.94
Fe_2O_3	7.64	5.28	12.27	3.45	1.41
FeO	4.97	2.60	3.38	1.82	0.48
MnO	0.28	0.17	0.22	0.16	0.03
MgO	6.40	3.10	3.59	1.99	0.35
CaO	6.65	5.98	6.89	4.66	0.86
Na_2O	2.72	3.61	3.66	3.46	2.18
K_2O	2.34	1.03	1.01	1.29	5.22
P_2O_5	0.45	0.26	0.77	0.12	0.07
H_2O (−)	0.10	0.11	0.14	0.10	0.13
H_2O (+)	0.15	0.20	0.31	0.15	0.19
Total	99.07	99.30	99.04	99.44	99.10

Analyst: Ryuichi SUGISAKI.

1. M1 Amphibolite.
2. M2B Biotite-hornblende gneiss.
3. M3 Biotite-hornblende gneiss.
4. 2507 Dioritic rock.
5. 2602 Pink granite.

The foliation of this area shows a general strike in the east-west direction and dips 50°–80° to the south.

Some representatives of the chemical compositions of crystalline rocks are given in Table 1.

The petrographical characters of the constituent rocks will be described below.

3. Petrography

3.1. Biotite gneiss (Gb)

This rock is classified into two types according to the lithofacies as follows: 1) melanocratic fine-grained rock, 2) leucocratic fine- to coarse-grained rock. These rocks are alternating with a width of 5 to 6 cm and intensely folded.

The rock is composed essentially of quartz, plagioclase, K-feldspar and biotite with subordinate amounts of apatite, allanite, zircon and opaque mineral. Chlorite, sphene, calcite and white-mica are present as alteration products after biotite or plagioclase. Plagioclase shows antiperthitic texture and sometimes it is altered to white-mica flake. A little K-feldspar, mostly exhibiting microcline grid twin, is interstitial crystal between plagioclase and quartz. Brown biotite is unaltered in most specimens, but in some rocks it is replaced by chlorite or white-mica flake.

3.2. Migmatitic biotite-hornblende gneiss (Gbh)

This rock is subdivided into the following rock types: 1) Amphibolite, 2) Biotite-hornblende gneiss and 3) Dioritic rock.

3.2.1. Amphibolite

This is fine-grained melanocratic rock with comparatively massive appearance. With increasing amounts of quartz and feldspars, the rock grades into biotite-hornblende gneiss. Under the microscope, it exhibits equigranular granoblastic texture and is composed of hornblende, plagioclase, biotite and opaque mineral, with or without quartz and clinopyroxene. Hornblende has a pleochroism of green to yellowish green, yellow, and biotite is pleochroic with X=pale yellow, pale brownish yellow, Y≒Z=dark brown, brown, greenish brown.

3.2.2. Biotite-hornblende gneiss

This is medium-grained melanocratic to intermediate rock with massive to weakly foliated appearance. With increasing relative amounts of quartz and feldspar, the rock grades into dioritic rocks. Under the microscope, it exhibits granoblastic texture and is composed mainly of plagioclase, hornblende, biotite, quartz and small amounts of K-feldspar, apatite, sphene and opaque mineral. Hornblende is pleochroic with green to yellowish green, and biotite is brown to yellow. K-feldspar occurs as interstitial grains and replaces a part of plagioclase crystal.

3.2.3. Dioritic rock

This is medium- to coarse-grained intermediate to leucocratic rock with usually massive appearance and occasionally intrudes into the amphibolite and biotite-

hornblende gneiss as small veinlets or irregular pools.

Under the microscope, it exhibits approximately equigranular granoblastic texture and is composed mainly of plagioclase, quartz, hornblende, biotite and smaller amounts of K-feldspar, apatite and opaque mineral. Hornblende has a pleochroism of deep green to yellow, and biotite is dark brown, greenish brown to yellow. K-feldspar shows microcline texture and replaces a part of plagioclase crystals or occurs as interstitial grains.

3.3. Leucocratic biotite gneiss (Glb)

This rock is fine- to medium-grained leucocratic rock and sometimes shows well-developed gneissosity with the alternation of quartz-feldspathic layers and ferromagnesian layers. Frequently, it is intensely folded.

Under the microscope, this rock exhibits equigranular granoblastic to lepidoblastic texture. The rock consists essentially of quartz, plagioclase, K-feldspar and biotite with subordinate amounts of apatite, zircon, allanite and opaque mineral. Calcite, white-mica flake, sphene, chlorite and muscovite are often observed as alteration products after plagioclase and biotite. Some plagioclases have antiperthitic texture. K-feldspar with microcline grid twinning occurs as interstitial mineral between plagioclase and quartz. Biotite is brown and in some rocks it is altered to chlorite, sphene or muscovite.

3.4. Pink granite (Gr)

This rock is salmon-pink in color and fine- to medium-grained. Main constituents of this rock are K-feldspar, quartz, plagioclase, hornblende and biotite. Small amounts of epidote, apatite, zircon, opaque mineral, sphene, calcite, chlorite and white-mica flake are also found. K-feldspar is microcline perthite. Many plagioclases have albitic rim. Hornblende, pleochroic with green to pale yellow, shows parallel intergrowth with biotite along its cleavage. Biotite is brown in color and exhibits poikilitic or vermicular texture. Epidote has two different occurrences as follows: 1) prismatic euhedral epidote with yellowish tint, 2) epidote fringed around opaque mineral.

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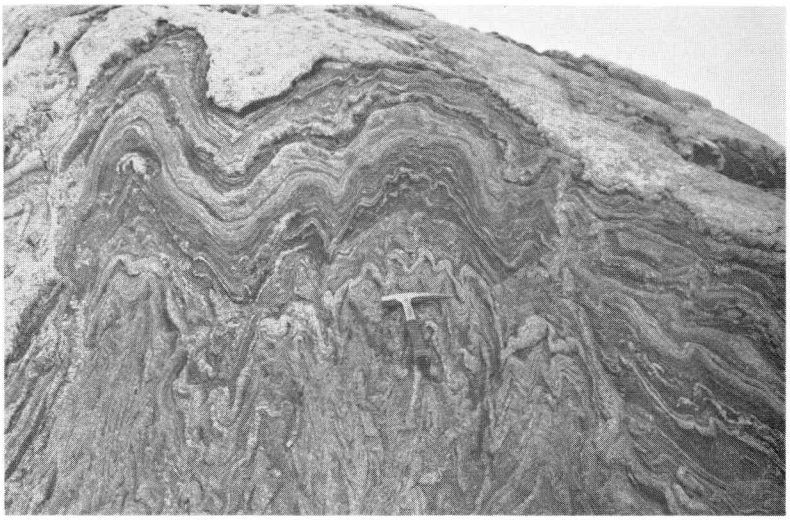
a. Aerial view of the Oku-iwa Rock area.

b. Patterned ground in the southern part of the Oku-iwa Rock area.

Plate 2



a. Microfolding structure in biotite gneiss associated with pink aplitic rock.

b. Glacial striae on the surface of basement rock.

c. Mode of occurrence of migmatitic biotite-hornblende gneiss.

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