NATIONAL INSTITUTE OF POLAR RESEARCH

ANTARCTIC GEOLOGICAL MAP SERIES
SHEET 23 HONNÖR OKU-IWA ROCK

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

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1. Introduction

Honnör Oku-iwa Rock is a small ice-free area located at about 6 km southeast of Bôzu Peak of Byvågåsane of central Sôya Coast of Lützow-Holm Bay, East Antarctica. It covers an area of approximately 2 km^2 and is exposed along the Honnör Glacier, after which the rocky area was named (Plate 1).

Honnör Oku-iwa Rock was first visited by the members of JARE-11 in the summer season of 1980 by means of a helicopter. It was visited for the second time by a five-man party of JARE-20 including the present authors from 11 to 13 September 1979 by an overland route. During this short stay, geological, geodetic and bacteriological surveys were carried out.

As no detailed topographic map of this area had been published, field data were plotted on the conventional map on a scale of about 1:10000 compiled from the aerial photographs taken by JARE-6 in 1962 (6AV-1-1, 47–50).

Before going further, the authors acknowledge kind assistance and co-operation in the field of Messrs. H. TANAKA and J. SHIGEMATSU of JARE-20.

2. Geology

Honnör Oku-iwa Rock is thoroughly surrounded by continental ice. The height above the sea level is over 350 m in the southeastern part of the area and less than 150 m in the northwestern part. The area is covered by moraine in some places, especially in the southeastern part and was once entirely covered by the continental ice sheet, judging from the glacially polished surfaces which are found at and near the highest peak. The smoothed glacial striae and grooves on the basement rocks generally trend N60°W–S60°E throughout the area, being nearly parallel to the extension of the area and also to the direction of flow-line of the Honnör Glacier.

The sequence of the gneisses is about 700 m in thickness. All kinds of the gneisses in this area are known to occur in the adjacent Skarvsnes region which is the widest ice-free area around Lützow-Holm Bay (ISHIKAWA *et al.*, 1977; MATSUMOTO *et al.*, 1979; MATSUMOTO, 1979).

The basement rocks of the Honnör Oku-iwa Rock are classified into the following types on the basis of their modes of occurrence and petrographic features.

1. Pyroxene gneiss (Gp)
2. Garnet-biotite gneiss (Ggb)

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3. Hornblende gneiss (Gh)
4. Metabasites (Bm)
5. Garnet gneiss (Gg)
6. Pegmatite (P)

2.1. Pyroxene gneiss (Gp)

The rock occurs as alternating layers with garnet-biotite gneiss or as small bodies within hornblende gneiss. It is composed mainly of quartz, plagioclase, hornblende, orthopyroxene, clinopyroxene and biotite and a very small amount of potassium feldspar. A weak foliation is due to parallel orientation of mafic minerals. Conversion from orthopyroxene and clinopyroxene to hornblende is often observed. Orthopyroxene is distinctively pleochroic with pale green to pinkish color (Plate 3). Garnet occurs very rarely as porphyroblastic crystals where the rock contacts garnet-biotite gneiss.

2.2. Garnet-biotite gneiss (Ggb)

The rock occupies a larger part of the sequence. It is a medium-grained rock and rather strongly foliated (Plate 2a), being composed mainly of plagioclase, quartz, biotite, garnet and potassium feldspar. Small amounts of opaque mineral, apatite and zircon are associated. Garnet occurs abundantly and composes mafic layer with biotite. Biotite shows reddish brown to pale yellow pleochroism. Some plageoclases show antiperthitic texture (Plate 4). With increase of relatively large crystals of potassium feldspar the rock grades into potassium feldspar porphyroblastic gneiss whose distribution is too small to be represented in the geological map.

2.3. Hornblende gneiss (Gh)

The rock occurs in the southwestern part and is more than 100 m in thickness, apparently occupying the lowermost portion of the sequence of the area. It is generally brown-colored due to slight weathering and rather gray-colored in fresh specimen. This rock is medium-grained and shows a somewhat granular texture. It is characterized by the abundant hornblende and by the absence of pyroxenes and garnet. The gray color is due to abundance of feldspar. Hornblende is pleochroic with X'=light yellow-brownish green and Z'=brownish green. Biotite, potassium feldspar, plagioclase and quartz are other main constituent minerals. Potassium feldspar is mostly perthitic. Some plagioclases show the myrmekite texture (Plate 5). Zircon and apatite are often observed as accessories. Thin layers and small irregular-shaped bodies of pyroxene gneiss sporadically occur within hornblende gneiss.

2.4. Metabasites (Bm)

A metabasite layer is intercalated in the uppermost portion of the hornblende gneiss in the southwestern part of the area. This layer is nearly concordant with hornblende gneiss and maximum thickness of it reaches more than 25 m. This rock is composed mainly of hornblende, clinopyroxene, orthopyroxene, biotite, plagioclase and quartz. Hornblende occupies more than one-third of the constituents and is euhedral to subhedral and shows green to yellowish brown pleochroism. Thin layers and schlieric bands of metabasite of less than 1 m in thickness are often found in other gneisses,

though omitted in the geological map.

2.5. Garnet gneiss (Gg)

This rock occurs as thin layers of less than 2 m in thickness within garnet-biotite gneiss. It is leucocratic and somewhat massive. Main constituent minerals of the rock are quartz, potassium feldspar, plagioclase and garnet. Quartz predominates over other minerals in quantity. The distribution of this rock is too small to be represented in the geological map.

2.6. Pegmatite (P)

Pegmatite is rarely observed in places as sheet-like bodies or dykes in gneissic rocks. It is less than 1 m in width and may be divided into two rock-types; gray-colored biotite granitic pegmatite and pinkish microcline granitic pegmatite.

3. Geologic Structure

Hornblende gneiss, metabasite and alternation of garnet-biotite gneiss and pyroxene gneiss are successively distributed from the southwest to the northeast in the area. As a whole, the foliation dips to the east and the geologic structure is seemingly homoclinal in the area. Tentative estimation of the sequence reaches 700 m in thickness. Small-scale isoclinal folds of which wave-length is less than several meters are often observed at many outcrops of an alternation of garnet-biotite gneiss and pyroxene gneiss in the northeastern part and at some outcrops of garnet gneiss intercalated within garnet-biotite gneiss in the southeastern part (Plate 2b). From north to south configuration of these gneisses shows a large sigmoidal shape. The axes of minor isoclinal folds run nearly parallel to this sigmoid. Besides, in the northern part a major synform is assumed to run east-west and in the southern part a major antiform is also assumed to run nearly parallel with the synform. Both folds seem to be of open type and their axes plunge to the east. Although the westerly prolongations of the folds are masked by ice sheet, they probably can be connected with the open folds that were discriminated in the northern part of Byvågåsane by ISHIKAWA *et al.* (1977), MATSUMOTO *et al.* (1979) and MATSUMOTO (1979).

References

ISHIKAWA, T., YANAI, K., MATSUMOTO, Y., KIZAKI, K., KOJIMA, S., TATSUMI, T., KIKUCHI, T. and YOSHIDA, M. (1977): Geological map of Skarvsnes, Antarctica. Antarct. Geol. Map Ser., Sheet 6 and 7 (with explanatory text 10 p.). Tokyo, Natl Inst. Polar Res.

MATSUMOTO, Y. (1979): Higashi-Nankyoku Ranguhobude oyobi Sukarubusunesu ryô-chiiki no chishitsu (Geology of the Langhovde and Skarvsnes regions, East Antarctica). Gekkan Chikyû (The Earth Monthly), **1**, 920–927.

MATSUMOTO, Y., YOSHIDA, M. and YANAI, K. (1979): Geology and geologic structure of the Langhovde and Skarvsnes regions, East Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **14**, 106–120.

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Appendix: Mineral Chemistry

Representative analyses of silicates; orthopyroxene, garnet, hornblende, biotite and plagioclase are shown in Table 2. These minerals were analyzed by JEOL JCXA-733 electron microprobe analyzer at the National Institute of Polar Research. Specimen current was at 1.3×10^{-8}A and voltage at 15kV.

Mineral assemblages of the rocks for microprobe analyses are summarized in Table A1.

Table A1. Mineral assemblages of the rocks for microprobe analyses.

Sample No.	Rock type	Ga	Cpx	Opx	Hb	Bt	Pl	Kf	Qz
Y-79091208	Ggb	+				+	+	+	+
Y-79091202	Gh				+	+	−	+	+
Y-79091303	Gp		+	+	+	−	+	+	+

+: present, −: trace.
Mineral abbreviations; Ga: garnet, Cpx: clinopyroxene, Opx: orthopyroxene, Hb: hornblende, Bt: biotite, Pl: plagioclase, Kf: K-feldspar, Qz: quartz.

Table A2. Microprobe analyses of garnet.

Sample No.	Y-79091205	Y-79091205
Anal. No.	25	37
SiO_2	38.49	38.43
TiO_2	—	0.03
Al_2O_3	21.75	21.99
Cr_2O_3	0.07	0.02
FeO	28.67	28.66
MnO	0.44	0.46
MgO	8.66	9.14
CaO	1.68	1.48
Na_2O	0.08	0.01
K_2O	—	—
Total	99.84	100.22
On the basis of 24 oxygens		
Si	5.973	5.936
Al (IV)	0.027	0.064
Al (VI)	3.951	3.939
Ti	—	0.003
Cr	0.008	0.002
Fe	3.720	3.703
Mn	0.058	0.061
Mg	2.004	2.104
Ca	0.280	0.245
Na	0.024	0.004
K	—	—
Mg/Fe+Mg	0.35	0.36

Table A3. Microprobe analyses of orthopyroxene.

Sample No.	Y-79091303	Y-79091303
Anal. No.	17	25
SiO_2	50.91	50.71
TiO_2	0.06	0.14
Al_2O_3	0.82	0.87
Cr_2O_3	0.01	0.02
FeO	32.63	33.21
MnO	0.44	0.42
MgO	14.76	14.71
CaO	0.54	0.71
Na_2O	0.03	—
K_2O	—	0.01
Total	100.20	100.80
On the basis of 6 oxygens		
Si	1.988	1.975
Al (IV)	0.012	0.025
Al (VI)	0.026	0.015
Ti	0.002	0.004
Cr	—	0.001
Fe	1.066	1.082
Mn	0.015	0.014
Mg	0.859	0.854
Ca	0.023	0.030
Na	0.002	—
K	—	—
Mg/Mg+Fe	0.45	0.44

Table A4. Microprobe analyses of hornblende.

Sample No.	Y-79091303	Y-79091303	Y-79091202	Y-79091202
Anal. No.	5	24	1	8
SiO_2	40.70	41.60	40.70	40.24
TiO_2	2.33	2.09	2.50	2.65
Al_2O_3	11.16	11.42	10.69	11.00
Cr_2O_3	0.09	0.03	—	—
FeO	20.60	20.37	23.42	23.62
MnO	0.20	0.10	0.03	0.22
MgO	7.96	8.25	6.08	5.91
CaO	11.26	11.27	10.57	10.69
Na_2O	1.55	1.67	1.93	1.75
K_2O	1.83	1.68	1.66	1.89
Total	97.68	98.48	97.58	97.97
On the basis of 23 oxygens				
Si	6.293	6.347	6.369	6.295
Al (IV)	1.707	1.653	1.631	1.705
Al (VI)	0.328	0.401	0.339	0.411
Ti	0.271	0.241	0.294	0.312
Cr	0.011	0.004	—	—
Fe	2.663	2.599	3.066	3.091
Mn	0.026	0.012	0.004	0.030
Mg	1.835	1.875	1.419	1.377
Ca	1.865	1.842	1.772	1.791
Na	0.464	0.494	0.585	0.530
K	0.361	0.328	0.331	0.377
Mg/Mg+Fe	0.41	0.42	0.32	0.31

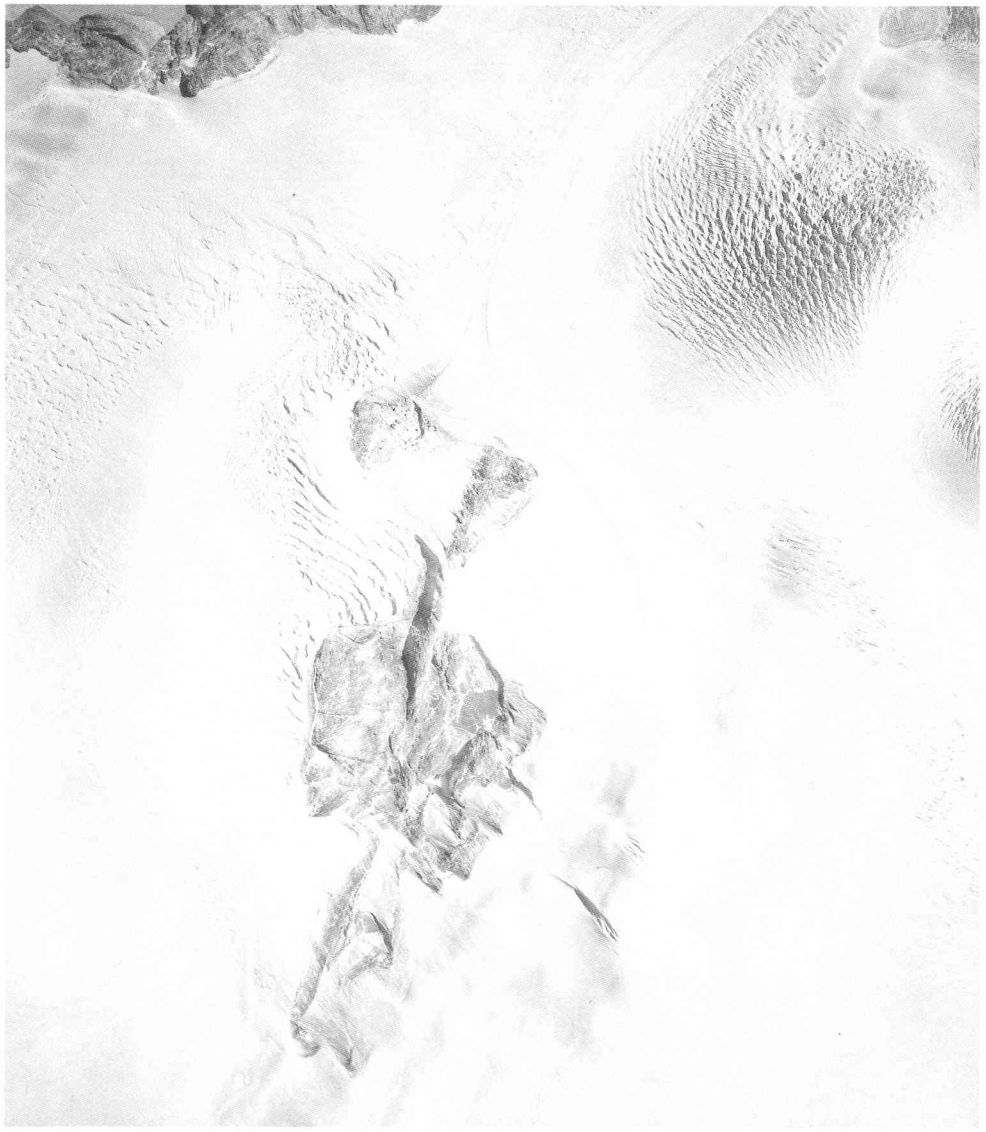
Table A5. Microprobe analyses of biotite.

Sample No.	Y-79091205	Y-79091205	Y-79091303
Anal. No.	26	36	19
SiO_2	36.72	36.47	36.50
TiO_2	5.99	5.98	5.74
Al_2O_3	15.65	15.74	13.46
Cr_2O_3	0.06	0.09	0.02
FeO	14.06	14.09	22.57
MnO	—	0.02	0.06
MgO	13.27	13.32	9.55
CaO	—	—	—
Na_2O	0.02	—	0.03
K_2O	9.63	9.90	9.24
Total	95.40	95.61	97.17
On the basis of 22 oxygens			
Si	5.462	5.428	5.556
Al (IV)	2.538	2.572	2.414
Al (VI)	0.206	0.189	—
Ti	0.670	0.668	0.657
Cr	0.007	0.011	0.002
Fe	1.749	1.754	2.874
Mn	—	0.002	0.008
Mg	2.943	2.953	2.168
Ca	—	—	—
Na	0.006	—	0.008
K	1.828	1.878	1.793
Mg/Fe+Mg	0.63	0.63	0.43

Table A6. Microprobe analyses of plagioclase.

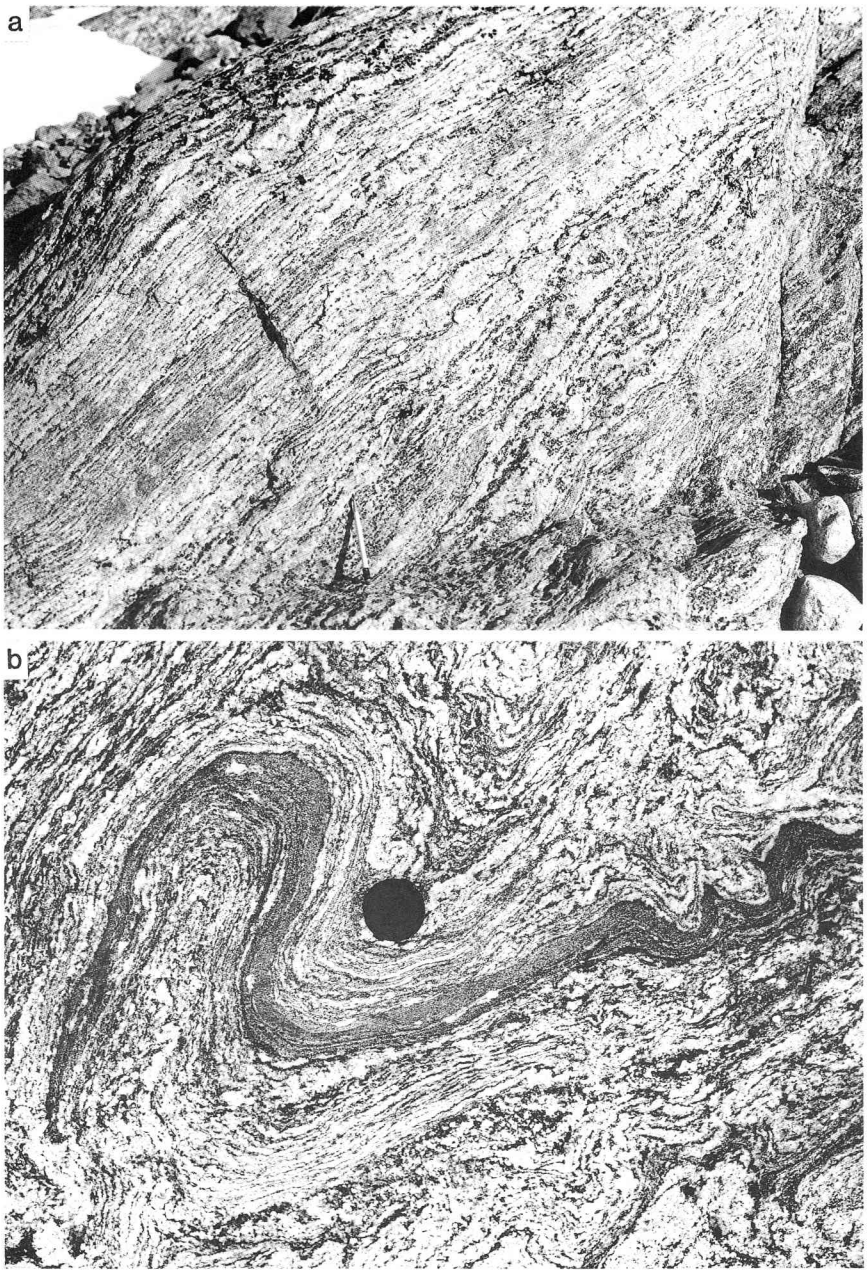
Sample No.	Y-79091205	Y-79091205	Y-79091303
Anal. No.	15	22	11
SiO_2	59.02	59.47	61.36
TiO_2	—	—	—
Al_2O_3	25.21	25.74	25.24
Cr_2O_3	—	—	—
FeO	0.01	0.02	0.13
MnO	—	0.07	0.02
MgO	—	—	—
CaO	7.22	7.76	6.52
Na_2O	7.31	7.13	7.61
K_2O	0.44	0.29	0.51
Total	99.21	100.48	101.39
On the basis of 8 oxygens			
Si	2.657	2.644	2.695
Al	1.338	1.349	1.309
Ti	—	—	—
Cr	—	—	—
Fe	—	0.001	0.005
Mn	—	0.003	0.001
Mg	—	—	—
Ca	0.348	0.370	0.307
Na	0.638	0.615	0.648
K	0.025	0.016	0.029
An (%)	34.4	36.9	31.2

Plate 1

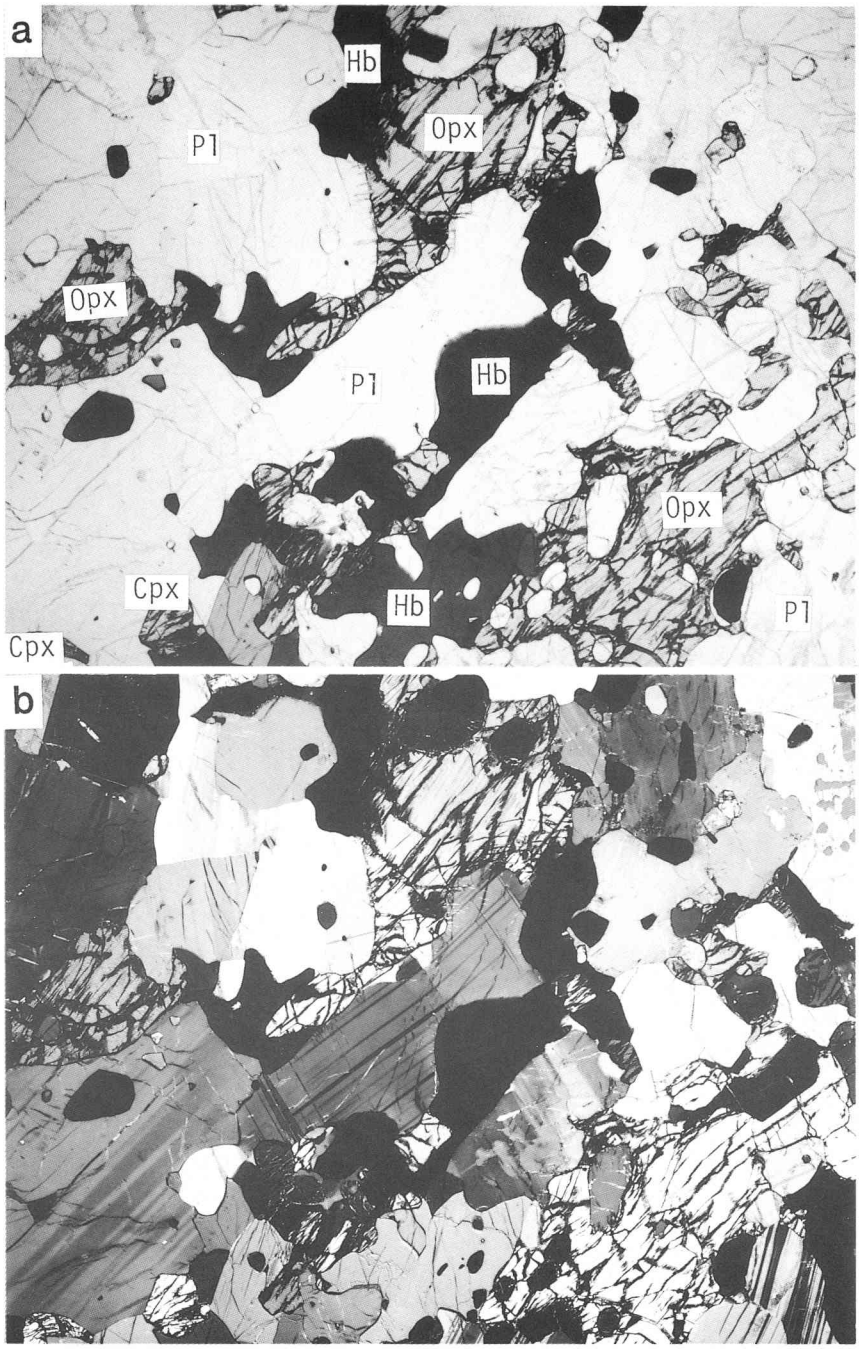


Aerial photograph of Honnör Oku-iwa Rock, JARE Antarctic air photographs 16AV-1, No. C6-5.

Plate 2



a: Outcrop of garnet-biotite gneiss.
b: Microfolding of garnet-biotite gneiss with basic layer.

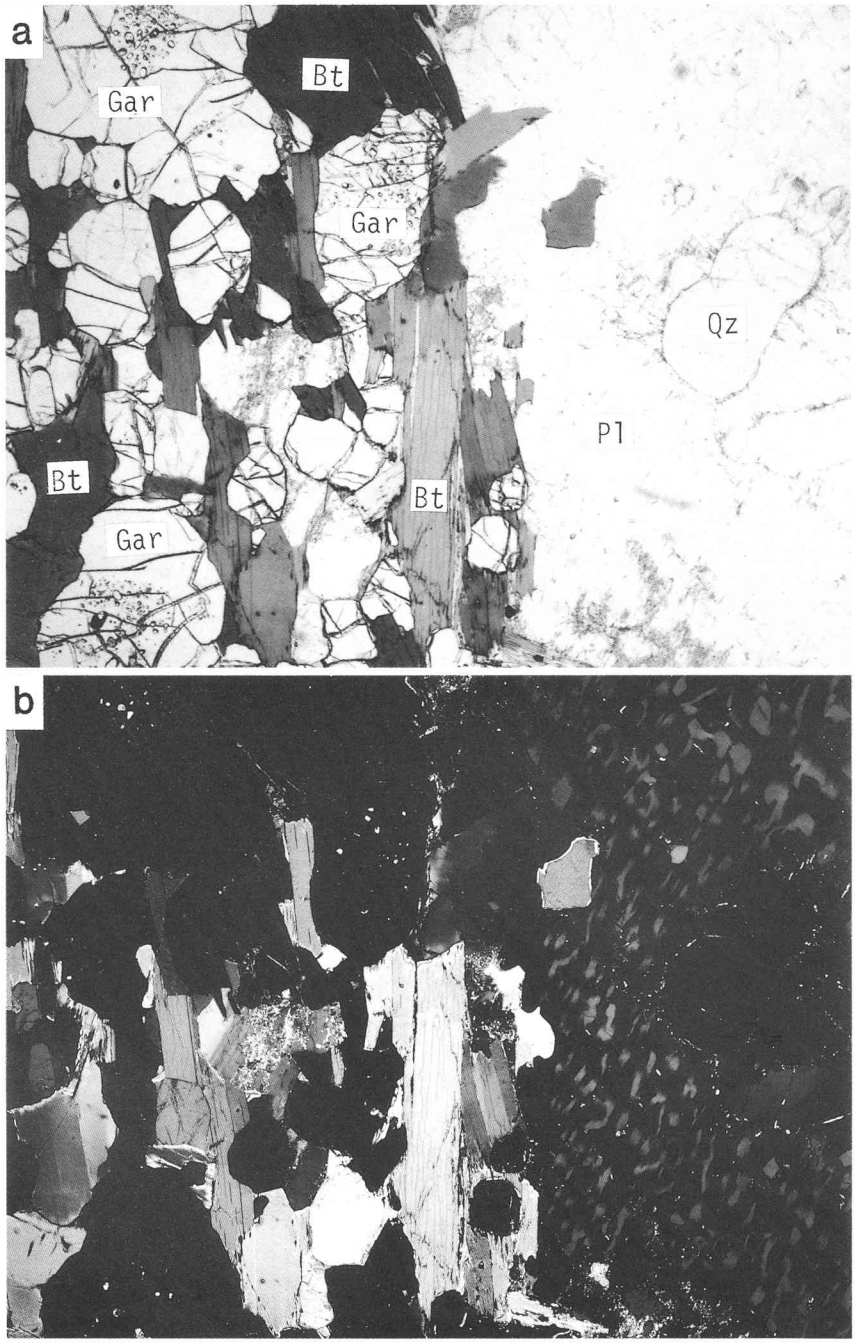


a: Photomicrograph of pyroxene gneiss (Spacemen No. Y-79091303). Clinopyroxene (Cpx), orthopyroxene (Opx), hornblende (Hb) and plagioclase (Pl) are the main constituents.

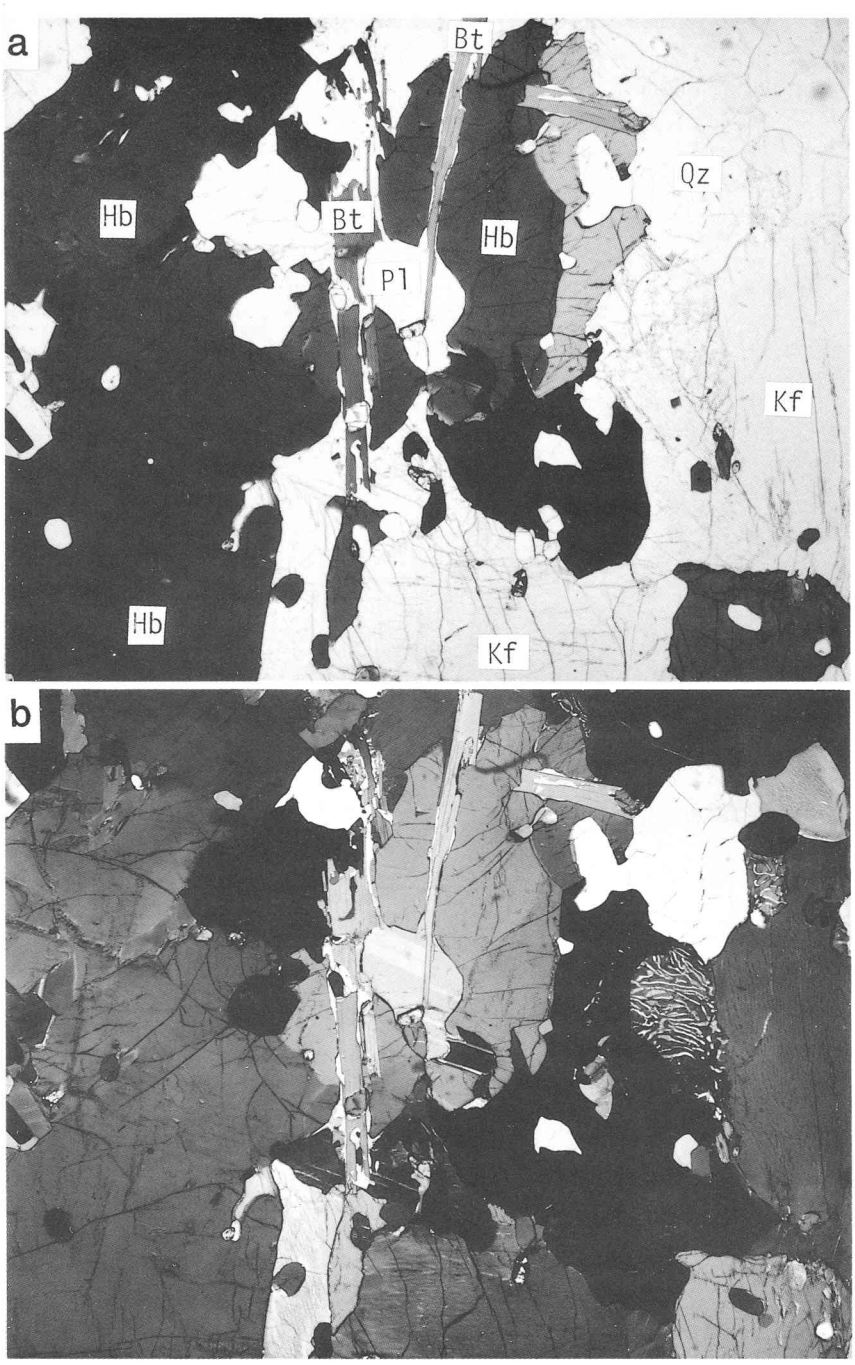
b: ditto. Nicols crossed.

Long dimension of photomicrographs is 2.4 mm.

Plate 4



a: Photomicrograph of garnet-biotite gneiss (Spacemen No. Y-79091205). Garnet (Gar), biotite (Bt), plagioclase (Pl) and quartz (Qz).
b: ditto. Nicols crossed. Plagioclase shows the antiperthitic texture.
Long dimension of photomicrographs is 2.4 mm.



a: Photomicrograph of hornblende gneiss. (Spacemen No. Y-79091202). Hornblende (Hb), biotite (Bt), K-feldspar (Kf), plagioclase (Pl) and quartz (Qz).
b: ditto. Nicol crossed. Some plagioclases show myrmekite texture.
Long dimension of photomicrogtaphs is 2.4mm.

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