Proc. NIPR Symp. Antarct. Geosci., 1, 113–128, 1987

A PRELIMINARY REPORT ON THE GEOLOGY OF THE CENTRAL PART OF THE SØR RONDANE MOUNTAINS, EAST ANTARCTICA

Hideo ISHIZUKA[1] and Hideyasu KOJIMA[2]

[1]*Department of Geology, Kochi University, 5–1, Akebonocho 2-chome, Kochi 780*
[2]*National Institute of Polar Research, 9–10, Kaga 1-chome, Itabashi-ku, Tokyo 173*

Abstract: The summar party of the 27th Japanese Antarctic Research Expedition (JARE-27) (1985–1986) performed the geological survey in the central part of the Sør Rondane Mountains, East Antarctica. The area is underlain by various kinds of metamorphic and plutonic rocks, of which the metamorphic rocks are tentatively divided by lithology and geologic structure into the northern and southern groups. The northern group is composed mainly of pelitic to psammitic gneisses, while in the southern group basic to intermediate gneisses occur predominantly. Amphibolite and calc-silicate rock also occur as thin layers throughout the area. The metamorphic foliation strikes NE-SW to E-W in the northern group, and N-S to NW-SE in the southern group. There are several synforms and antiforms inferred in the area, of which the axes strike E-W in the northern group and NW-SE in the southern group. This gives rise to the variations of the direction and angle of the dips of the metamorphic foliation. Between the northern and southern groups, a pronounced shear zone of less than 1 km wide, characterized by occurrences of cataclastic or mylonitic gneisses, runs from west to east. The mineral assemblages indicate that the majority of the metamorphic rocks may belong to the amphibolite facies, but some portions reach up to the granulite facies. Among the plutonic rocks, granite and granitic pegmatite are predominant, forming large masses or dike swarms, and other rocks such as diorite, dolerite, lamprophyre and ultramafic rock occur as small masses or dikes or lenses. These lithological and structural features of the surveyed area are briefly compared with those reported by JARE-26 (1984–1985) who surveyed the western part of the Sør Rondane Mountains.

1. Introduction

The Sør Rondane Mountains extend from 22° to 28°E and from 71.5° to 72.5°S in East Antarctica (Fig. 1). Before the surveys by the Japanese Antarctic Research Expedition (JARE), the Belgian parties performed the geological and glaciological surveys of the mountains during 1958 to 1970, and they reported that the mountains consist of various kinds of metamorphic and plutonic rocks (VAN AUTENBOER, 1969; VAN AUTENBOER and LOY, 1972). JARE-25 (1983–1984) started the reconnaissance survey of the mountains (MEMBERS OF THE SØR RONDANE RECONNAISSANCE PARTY, 1984), and JARE-26 (1984–1985) performed the geological survey of the western part (KOJIMA and SHIRAISHI, 1986). Of these, JARE-26 noticed some differences in lithology and geologic structure of metamorphic rocks between the northern and southern areas, and they called tentatively the metamorphic rocks of the northern and southern

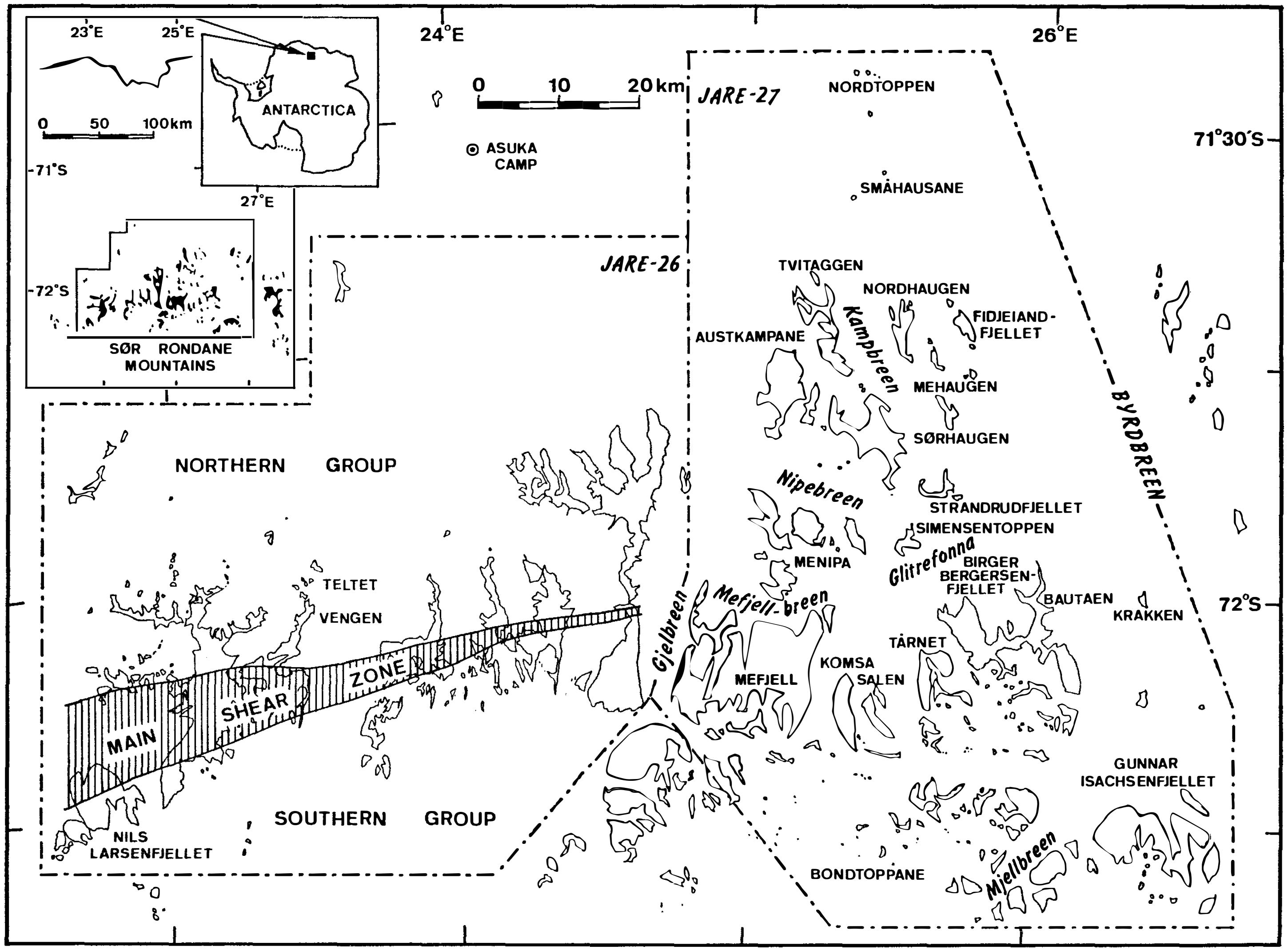

Fig. 1. Map showing location and place names of the area surveyed by JARE-27, in which the northern and southern groups of metamorphic rocks and Main Shear Zone, defined by JARE-26, are also presented for comparison.

areas the northern and southern groups, respectively. Further, JARE-26 described that, along the boundary between the northern and southern groups, the metamorphic rocks are strongly altered to mylonite and cataclasite, and they defined this boundary as the Main Shear Zone (MSZ). The northern and southern groups nearly correspond to the Teltet-Vengen and Nils Larsenfjellet groups of VAN AUTENBOER and LOY (1972), respectively. On the other hand, the radiometric dates indicate the metamorphic and plutonic rocks to be of late Proterozoic to early Paleozoic ages (for a review, see GREW, 1982), among which the oldest age, 2700 Ma obtained by U-Pb on detrital zircon from gneisses, was reported by PASTEELS and MICHOT (1970). KOJIMA and SHIRAISHI (1986) reported the newly determined whole-rock K-Ar age for slightly metamorphosed dolerite intruding the gneisses to be 536 ± 27 Ma, and interpreted the age as the time of reheating by the granite intrusions.

Following the surveys by JARE-25 and -26, we, JARE-27, have done the geological survey of the central part of the Sør Rondane Mountains from January 5 to February 6, 1986 (MORIWAKI *et al.*, 1986). In this paper, we report the geology of the area, along with a brief description of the metamorphic and plutonic rocks.

2. Geological Outline

The surveyed area, measuring approximately 60×60 km, occupies the central part of the Sør Rondane Mountains, and is bounded by Gjelbreen on the west and by Byrdbreen on the east (Fig. 1). The western boundary of the area connects with the eastern boundary of the area surveyed by JARE-26. In the area, there are five large mountain masses (Austkampane, Menipa, Mefjell, Birger Bergersenfjellet and Gunnar Isachsenfjellet), and several small mountain masses (Småhausane, Fidjeiandfjellet, Nordhaugen, Mehaugen, Sørhaugen, Strandrudfjellet, Simensentoppen, Komsa, Salen, Tårnet and Krakken). Between these masses run several glaciers with many large crevasses (Kampbreen, Nipebreen, Mefjellbreen, Glitrefonna and Mjellbreen). Also, Nordtoppen and Bondtoppane are included as the northernmost and southernmost surveyed areas, respectively. We surveyed mainly the outcrops surrounding the mountain masses, but in Mefjell we spent three days for the survey of the outcrops within the mass.

The generalized geological map of the surveyed area is illustrated in Fig. 2. As may be seen in Fig. 2, the area is underlain by various kinds of metamorphic and plutonic rocks, but there are some differences in lithology and geologic structure between the northern and southern areas.

Among the metamorphic rocks, the pelitic and psammitic gneisses are dominant in the northern area, whereas in the southern area the intermediate to basic gneisses occur predominantly. The metamorphic foliation of the gneisses strikes generally NE-SW to E-W in the northern area, but N-S to NW-SE in the southern area. The dips are gentle (55°–30°) in the northern area, whereas in the southern area they are rather steep (70°–90°) in its western part, but gentle (55°–20°) in its eastern part. There are several antiforms and synforms inferred in the surveyed area, of which the axes strike E-W in the northern area, and N-S to NW-SE in the southern area.

The boundary between the northern and southern areas runs along Mefjellbreen

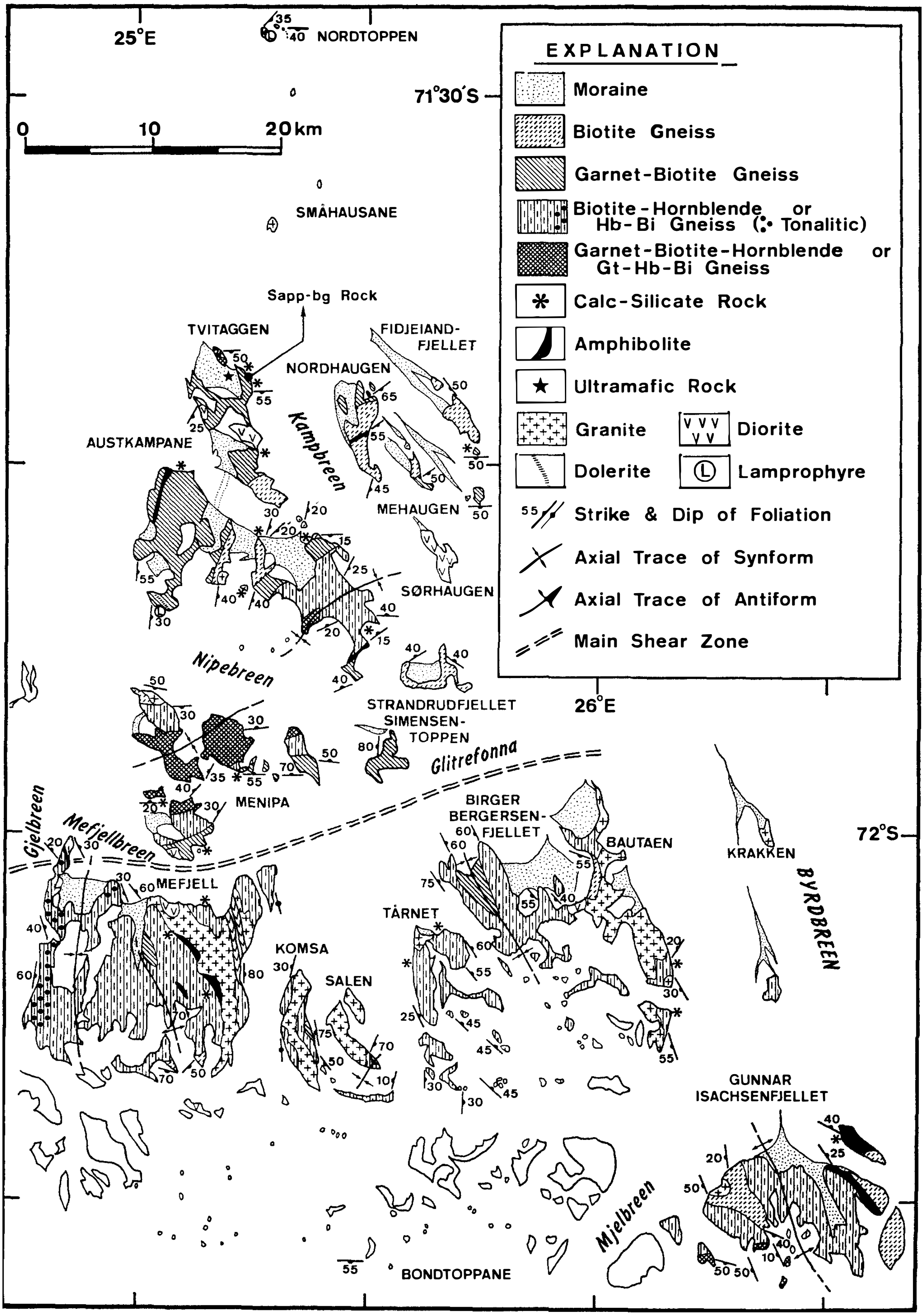

Fig. 2. Generalized geological map of the central part of the Sør Rondane Mountains, in which "Sapp-bg rock" represents the locality of sapphirine-bearing rock.

to Glitrefonna (Fig. 2), and the neighboring gneisses with this boundary are typically modified to mylonite and cataclasite. This boundary may be the eastern extension of the Main Shear Zone (MSZ) defined by JARE-26 (KOJIMA and SHIRAISHI, 1986). Therefore, following JARE-26, we call the metamorphic rocks of the northern area the northern group, and those of the southern area the southern group, hereafter. The plutonic rocks intrude more abundantly in the metamorphic rocks of the southern group than in those of the northern group.

3. Metamorphic Rocks

For mapping units, we classify the metamorphic rocks into the following rock-types; (1) biotite gneiss, (2) garnet-biotite gneiss, (3) biotite-hornblende or hornblende-biotite gneiss, (4) garnet-biotite-hornblende or garnet-hornblende-biotite gneiss, (5) amphibolite and (6) calc-silicate rocks. The distribution of each rock-type is shown in Fig. 2, in which the locality of sapphirine-bearing rock is also presented.

3.1. Biotite gneisses

The biotite gneisses occur widely in the northern group, typically in Fidjeiandfjellet, Nordhaugen, Mehaugen, Strandrudfjellet, and locally in the central area of Austkampane and the northwestern area of Menipa, but in the southern group they are restricted to the southern area of Mefjell, the central area of Birger Bergersenfjellet and the western and eastern areas of Gunnar Isachsenfjellet. Small and unmappable-scale inclusions of the biotite gneisses are sometimes embedded in the granites throughout the surveyed area.

The gneisses commonly exhibit granoblastic texture, and range from medium to coarse in grain size and from pelitic to semi-pelitic and occasionally psammitic in composition. Generally, there is a difference in modal proportion of biotite, which results in the well-layered structure due to the alternation of melanocratic (biotite-rich) and leucocratic (biotite-poor) parallel layers; each layer ranging from several millimeters to several centimeters in width. The migmatitic and sometimes augen structures develop locally in Austkampane and Menipa (Plates 1A and 1B).

The following mineral assemblages are observed in the biotite gneisses;

(1) biotite+plagioclase+K-feldspar+quartz,
(2) sillimanite+biotite+plagioclase+K-feldspar+quartz,
(3) orthopyroxene+biotite+plagioclase+quartz,
(4) clinopyroxene+biotite+plagioclase+quartz,
(5) orthopyroxene+clinopyroxene+biotite+plagioclase+quartz.

The sillimanite-bearing rock is found in the northern and western areas of Austkampane, occurring as a thin layer in the biotite gneisses with the mineral assemblage of (1). The orthopyroxene-bearing rock occurs in Nordtoppen, and the clinopyroxene-bearing rock does in the northern and central areas of Mefjell, of which the former is in contact with the diorite and the latter is found only as a small inclusion within the granites. The two pyroxene-bearing rock is restricted to the central and southern areas of Mefjell, but its field relation with the neighboring rocks is not clear, because of poor exposure. Muscovite, epidote and chlorite are more or less included in the above-listed mineral assemblages, but they have the textural evidences suggesting that these minerals may have been produced during the retrograde stage.

3.2. *Garnet-biotite gneisses*

The garnet-biotite gneisses are found in the northern group, widely in Simensentoppen, the northwestern and southeastern areas of Austkampane and the southern area of Menipa, and locally in Nordhaugen and Mehaugen. In the southern group, they occur locally in Mefjell, Komsa, Salen and Birger Bergersenfjellet.

The gneisses are medium- and occasionally coarse-grained rocks with pelitic to semi-pelitic composition, and exhibit granoblastic to lepidoblastic texture. Although the migmatitic structure develops locally, the gneisses display most commonly the banded structure composed of melanocratic (biotite-rich) and leucocratic (plagioclase-rich) parallel bands; each band ranging from less than 1 cm to more than 10 cm in thickness.

The following mineral assemblages are observed in the garnet-biotite gneisses;

(1) garnet+biotite+plagioclase+K-feldspar+quartz,
(2) sillimanite+garnet+biotite+plagioclase+K-feldspar+quartz,
(3) andalusite+sillimanite+garnet+biotite+plagioclase+K-feldspar+quartz,
(4) cordierite+andalusite + sillimanite + garnet + biotite + plagioclase + K-feldspar+quartz,
(5) corundum+garnet+biotite+plagioclase+quartz.

The sillimanite-bearing rock is widespread in the northern and western areas of Austkampane and the southern area of Mehaugen. All listed minerals in the mineral assemblages (3) and (4), which occur in Austkampane, may not have been in equilibrium, and the textural relationships of andalusite and cordierite against other constituents show that these two phases may have been the products of the retrograde stage. The corundum of the mineral assemblage (5) is restricted to one sample obtained from the eastern area of Komsa, and commonly forms an aggregate. Tiny spinel and sillimanite are occasionally included within garnet, of which the spinel contains appreciable amounts of ZnO (up to 15 wt%: YAMAZAKI, 1987). This is the strong reminiscence of the prograde breakdown of staurolite to the spinel-sillimanite-garnet association (*e.g.* HIROI *et al.*, 1983). The detailed petrography of the garnet-biotite gneisses has been described by YAMAZAKI (1987).

3.3. *Biotite-hornblende or hornblende-biotite gneisses*

The gneisses occur locally in the northern group, such as in Austkampane and the northern and southern areas of Menipa, but in the southern group they are the main constituents of the metamorphic rocks. Also, they are found as unmappable-scale thin layers within the biotite gneisses throughout the surveyed area (Plate 2A).

The mafic minerals of this type of gneisses are biotite and hornblende, but the modal proportion of each mineral is highly variable to give rise to the variation of rock-names in a strict sense, such as biotite-hornblende gneiss or hornblende-biotite gneiss. Most commonly develops the banded structure composed of the leucocratic (plagioclase-rich) and melanocratic (hornblende- and/or biotite-rich) parallel bands; each band ranging from 5 mm or less to more than 1 cm in thickness. The gneisses are typically medium-grained rocks with granoblastic texture, and intermediate in composition. The tonalitic gneiss occurs in the western and northwestern areas of

Mefjell, of which the mode of occurrence is broadly comparable to that of the gneissose tonalite described by KOJIMA and SHIRAISHI (1986) in the western part of the Sør Rondane Mountains.

The following mineral assemblages are observed in this type of gneisses;

(1) biotite+hornblende+plagioclase+quartz,
(2) sapphirine+biotite+gedrite+anorthite+cordierite+orthopyroxene+spinel+corundum+rutile+ilmenite,
(3) clinopyroxene+biotite+hornblende+plagioclase+quartz.

K-feldspar may be added to the above-listed mineral assemblages, but very rarely. Chlorite and epidote are sometimes included, but their textural relationships with other constituents suggest that they may have been the secondary phases of the retrograde stage. Especially, the secondary epidote develops characteristically along the MSZ. The sapphirine-bearing rock is found only in the northeastern area of Austkampane (Fig. 2). The sapphirine-bearing mineral assemblage (2) is not in chemical equilibrium and may represent the two or more stages of equilibration; the detailed petrography will be described in the near future. The clinopyroxene-bearing rock occurs locally in some places, such as in Menipa, Mefjell and Birger Bergersenfjellet. In this rock, the modal proportion of clinopyroxene is generally small (less than 10%).

3.4. Garnet-biotite-hornblende or garnet-hornblende-biotite gneisses

This type of gneisses occupies two small areas of Austkampane and the central area of Menipa in the northern group, and in the southern group it is restricted to the southern area of Gunnar Isachsenfjellet.

The gneisses are coarse- to medium-grained rocks with granoblastic texture, and range from basic to intermediate in composition. The modal proportion of mafic minerals such as biotite and hornblende is highly variable to give rise to the variation of rock-names in a strict sense, that is, with increasing modal proportion of biotite, the garnet-biotite-hornblende gneiss grades into the garnet-hornblende-biotite gneiss, same as the case of the biotite-hornblende or hornblende-biotite gneisses. Sometimes develops the layering structure composed of melanocratic (biotite- or hornblende-rich) and leucocratic (plagioclase-rich) parallel layers; each layer ranges from 1 cm or less to more than 10 cm in thickness.

The following mineral assemblages are observed in this type of gneisses;

(1) garnet+biotite+hornblende+plagioclase+quartz,
(2) clinopyroxene+garnet+biotite+hornblende+plagioclase+quartz,
(3) clinopyroxene+garnet+biotite+cummingtonite+hornblende+plagioclase+quartz,
(4) orthopyroxene+garnet+biotite+hornblende+plagioclase+quartz,
(5) clinopyroxene+orthopyroxene+garnet+hornblende+biotite+plagioclase+quartz.

The cummingtonite of the mineral assemblage (3) is commonly intergrown with green hornblende. The clinopyroxene-bearing rocks are widespread, but the orthopyroxene-bearing rock is restricted to the southern area of Gunner Isachsenfjellet and the two-pyroxene-bearing rock to the southeastern area of Menipa.

3.5. Amphibolites

The amphibolites are found throughout the surveyed area, as dark-colored thin layers or beds within the gneisses described previously, measuring 0.1 to 1.0 m wide, or as various-size xenoliths within the granites. In the northeastern area of Gunnar Isachsenfjellet they form relatively large masses.

Most commonly, they exhibit the banded structure composed of leucocratic (plagioclase-rich) and melanocratic (hornblende-rich) parallel bands; each band measuring from 5 mm to 1 cm in thickness. This banded structure shows the dip-strike direction comparable with the metamorphic foliation of the neighboring gneisses. The amphibolites are medium- to coarse-grained rocks with granoblastic texture, and sometimes display nematoblastic texture defined by prismatic hornblende. Compositionally, they are typically basic. On the contrary, the "leucocratic" amphibolites composed mainly of plagioclase with a trace amount of hornblende are found, probably derived from pelitic rocks with minor basic composition.

The following mineral assemblages are observed in the amphibolites;

(1) hornblende+plagioclase+quartz,
(2) garnet+hornblende+plagioclase+quartz,
(3) clinopyroxene+hornblende+plagioclase+quartz,
(4) epidote+hornblende+plagioclase+quartz,
(5) garnet+clinopyroxene+hornblende+plagioclase+quartz.

Chlorite and epidote are more or less included in the above listed mineral assemblages, but the textural relationships of these minerals with other constituents suggest that these phases are mostly secondary in origin. Particularly, the secondary epidote develops in the amphibolite layer in the northwestern area of Mefjell, where the MSZ runs from west to east. However, the epidote in the mineral assemblage (4) appears to be in equilibrium with hornblende and plagioclase in texture. The garnet- and/or clinopyroxene-bearing rocks are restricted to the southern area of Gunnar Isachsenfjellet.

3.6. Calc-silicate rocks

The calc-silicate rocks are widespread in both the northern and southern groups, occurring as intercalations (less than 5 m wide) or small lenses within the gneisses, and occasionally within the amphibolites. In the western area of Austkampane, several boudine-like blocks of garnet-rich calc-silicate rocks develop within the garnet-biotite gneisses, which have the maximum and minimum diameters ranging from 80 cm to 2 m and from 20 to 50 cm, respectively. The constituent minerals of the calc-silicate rocks include olivine, clinopyroxene, garnet, phlogopite, scapolite, calcite and rarely quartz.

4. Plutonic Rocks

The plutonic rocks include granite, diorite, dolerite and lamprophyre; the distribution of each rock-type is shown in Fig. 2. Of these the granite and diorite commonly occur forming large masses, while the dolerite and lamprophyre are restricted to dikes. Ultramafic rock is also included as one member of the plutonic rocks, which occurs as a lense.

4.1. Granite

There are several granite masses throughout the surveyed area, typically in Mefjell, Komsa, Salen, and Birger Bergersenfjellet. Of these, the distributions of the first three masses are closely related with each other, and it is most likely that they may be unified into one large mass. Sometimes, the granites occur as vent-like masses, typically found in the eastern area of Birger Bergersenfjellet (Plate 3A). The contact of the granite masses with the host gneisses is commonly sharp (Plate 3B), but occasionally the granites including many xenoliths derived from the neighboring gneisses are found along the contact. Small and unmappable-scale masses or dikes of granites or granitic pegmatites are widespread (Plate 4A). Especially, in the southern area of Austkampane, the dike swarms of the granites occur within the biotite-hornblende gneisses (Plate 5). At this outcrop, measuring about 1 km $\times$ 500 m in scale, there are several magma pods at the same horizontal level; each pod is ellipsoidal in shape with the maximum and minimum diameters ranging from 200 to 150 m and from 100 to 50 m, respectively. Such a mode of occurrence suggests that the dikes may have intruded upwards from these magma pods. These observations are the reminiscence of a kind of magma reservoir.

Generally, the granites are coarse-grained and massive rocks, but there are some variations in color from pink to gray. Occasionally, the gneissose structure develops weakly in the pink-colored granite.

The constituent minerals of the granites include biotite, hornblende, plagioclase, K-feldspar and quartz with a trace of apatite, fluorite, zircon and iron oxide. Garnet is rarely included in the granites, but it has not yet been certain whether this is a primary phase crystallized from the granitic magma or a xenocryst derived from the gneisses. On the basis of the mineral associations, the granites may be classified into several types, which is planned for the near future.

4.2. Diorite

The dioritic to granodioritic rocks occur in several places, of which the large and mappable-scale masses are found in Nordtoppen, Austkampane, Sørhaugen, Menipa and Mefjell. In the eastern area of Mefjell, they develop as dike-like intrusions into the gray-colored granites. The xenoliths of dioritic rocks are embedded in the granites in the eastern area of Birger Bergersenfjellet, showing an angular shape (Plate 4B). The rocks are generally dark-grayish in color, and range from medium to coarse in grain size. The main constituent minerals are orthopyroxene, clinopyroxene, hornblende, biotite, plagioclase and quartz.

4.3. Dolerite

A slightly metamorphosed dolerite is found only in the southwestern area of Austkampane, occurring as a dike within the gneisses. The contact between the dike and host gneisses is clear, along which the distinct chilled margin develops. Under the microscope, it preserved a subophitic to ophitic texture, although the primary minerals are partially altered to biotite and amphibole with many ilmenite skeletals or needles.

4.4. *Lamprophyre*

The dikes of lamprophyre occur in Nordtoppen and in the southwestern area of Austkampane. Because of poor exposure, the contact relation with the host rock is not clear. They are dark-colored, coarse-grained and massive rocks, and consist of biotite, hornblende and K-feldspar with the accessories of epidote, apatite, fluorite and iron oxide.

4.5. *Ultramafic rock*

The ultramafic rock is found only in the northern area of Austkampane, occurring as a lense (about 10 m diameter) within the garnet-biotite gneiss (Plate 2B). It is a coarse-grained and massive rock, and consists chiefly of spinel, olivine, orthopyroxene and hornblende.

5. Concluding Remarks

On the basis of the mineral assemblages described above, the majority of the metamorphic rocks in the central part of the Sør Rondane Mountains seem to belong to the amphibolite facies. Furthermore, the local occurrence of orthopyroxene-bearing rocks with basic to intermediate composition indicates that the grade of metamorphism reaches up to the granulite facies. On the other hand, the epidote-hornblende-plagioclase association occurs in the basic to intermediate gneisses, but its distribution is too small to define the areal mineral zone of the epidote-amphibolite facies. In any case, a further detailed zonal mapping is required to establish the areal change of the metamorphic grade, which is in progress.

Compared with the western part of the Sør Rondane Mountains surveyed by JARE-26 (KOJIMA and SHIRAISHI, 1986), the nature of lithology and geologic structure of the northern group in the central part is broadly similar to that in the western part, but the following lithological and structural differences could exist for the southern group. Lithologically, (1) the gneissose tonalite that characterizes the southern group of the western part is restricted to the southwestern area of the central part, (2) the dark-green schist, occurring between the northern and southern groups in the western part, is not found in the central part, and (3) the syenite, typically developing in Lunckeryggen of the western part, does not occur in the central part. Structurally, (1) in the western part, the metamorphic foliation strikes E-W and dips gently towards south in the southern group, but in the southern group of the central part it strikes N-S to NW-SE and dips steeply towards west or east, and (2) there are several antiforms and synforms inferred in the central part, but in the western part there is no sign of these structures. Furthermore, there is a certain difference in nature of the Main Shear Zone (MSZ) between the western and central parts of the mountains. Especially, as may be seen in Fig. 1, in the western part the MSZ has the width of about 20 km in its westernmost area, and is gradually thinning towards east (SHIRAISHI, 1987, personal communication). In the central part, the MSZ is more or less 1 km in width, and probably ceases to exist in its easternmost area.

It is ambiguous whether these differences are regional or local throughout the mountains. However, in this connection, we must notice the great amounts of granite masses occupying the southern group in the central part of the mountains, that is, there is a possibility that the metamorphic foliation of the gneisses in the southern group of the central part may have been modified by the intrusions of the granites. Approaching to the contact with the granite masses, it seems that the metamorphic foliation tends to strike NW-SE and to dip steeply. Most probably, the intrusions of the granites occurred trending NW-SE and modified the metamorphic foliation of the surrounding gneisses to the NW-SE trends. If so, it is most likely that, in the central part of the mountains, the gneisses in the southern group have originally the same structure as those in the northern group, that is, the E-W strikes with gentle dips. Therefore, we may consider the structural differences mentioned above to be the local phenomena closely related with the granite intrusions. The causes responsible for the lithological differences of the southern group between the western and central parts of the mountains are, however, still in dispute.

Acknowledgments

We would like to thank all members of JARE-27, especially the members of the field party for their helps in the field work. One (H.I.) of the authors is also grateful to Department of Geology (Kochi University) for giving him facilities for the present study.

References

GREW, E. S. (1982): The Antarctic Margin. The Oceans Basins and Margins, 6: The Indian Ocean, ed. by A. E. M. NAIRN and F. G. STEHLI. New York, Plenum, 697–755.

HIROI, Y., SHIRAISHI, K., YANAI, K. and KIZAKI, K. (1983): Aluminum silicates in the Prince Olav and Sôya Coasts, East Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **28**, 115–131.

KOJIMA, S. and SHIRAISHI, K. (1986): Note on the geology of the western part of the Sør Rondane Mountains, East Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **43**, 116–131.

MEMBERS OF THE SØR RONDANE RECONNAISSANCE PARTY (1984): Sêru Rondâne Sanchi yobi chôsa hôkoku 1984 (Report on the reconnaissance survey of the Sør Rondane Mountains, 1984). Nankyoku Shiryô (Antarct. Rec.), **82**, 46–70.

MORIWAKI, K., KOJIMA, H., ISHIZUKA, H., MATSUOKA, N., KOMETANI, T., SHIGA, S., MORITA, T. and KURIKI, S. (1986): Sêru Rondâne Sanchi chigaku chôsatai hôkoku 1986 (JARE-27) (Report on the geological, geomorphological and geodetic field party in the Sør Rondane Mountains, 1986 (JARE-27)). Nankyoku Shiryô (Antarct. Rec.), **30**, 246–281.

PASTEELS, P. and MICHOT, J. (1970): Uranium-lead radioactive dating and lead isotope study on sphene and K-feldspar in the Sør Rondane Mountains, Dronning Maud Land, Antarctica. Eclogae Geol. Helv., **63**, 239–254.

VAN AUTENBOER, T. (1969): Geology of the Sør Rondane Mountains. Geologic Maps of Antarctica, ed. by C. CRADDOCK *et al.* New York, Am. Geogr. Soc., Sheet 8, Pl. VIII (Antarct. Map Folio Ser., Folio 12).

VAN AUTENBOER, T. and LOY, W. (1972): Recent geological investigations in the Sør Rondane Mountains. Belgicafjella and Sverdrupfjella, Dronning Maud Land. Antarctic Geology and Geophysics, ed. by R J. ADIE. Oslo, Universitetsforlaget, 563–571.

YAMAZAKI, M. (1987): Petrology of pelitic gneisses from the Sør Rondane Mountains, East Antarctica. Graduation thesis of Kochi University, 82 p.

(Received April 4, 1987; Revised manuscript received May 27, 1987)

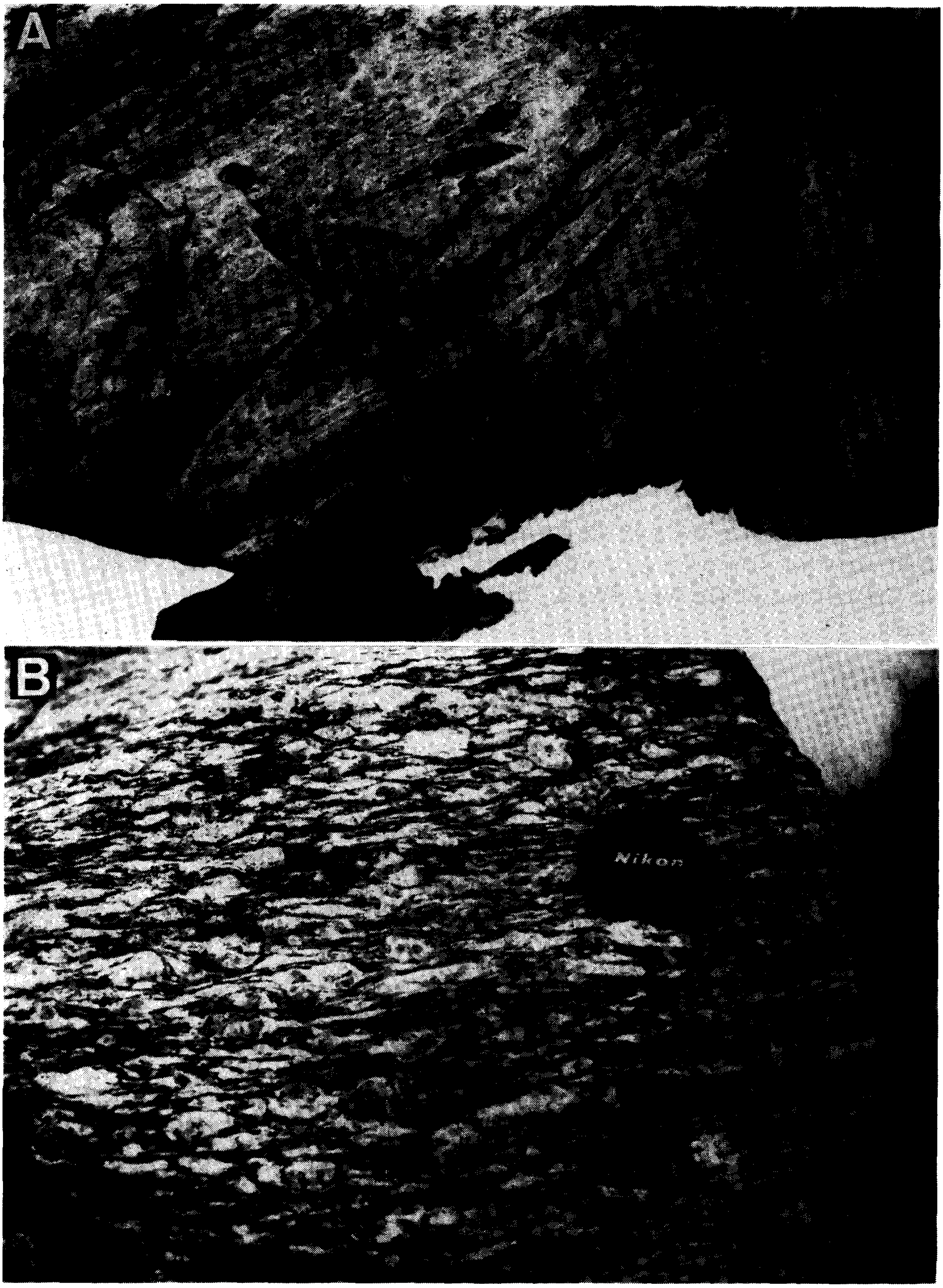

Plate 1. A: Biotite-hornblende gneiss with migmatitic structure at Austkampane. B: Biotite gneiss with augen structure at Menipa.

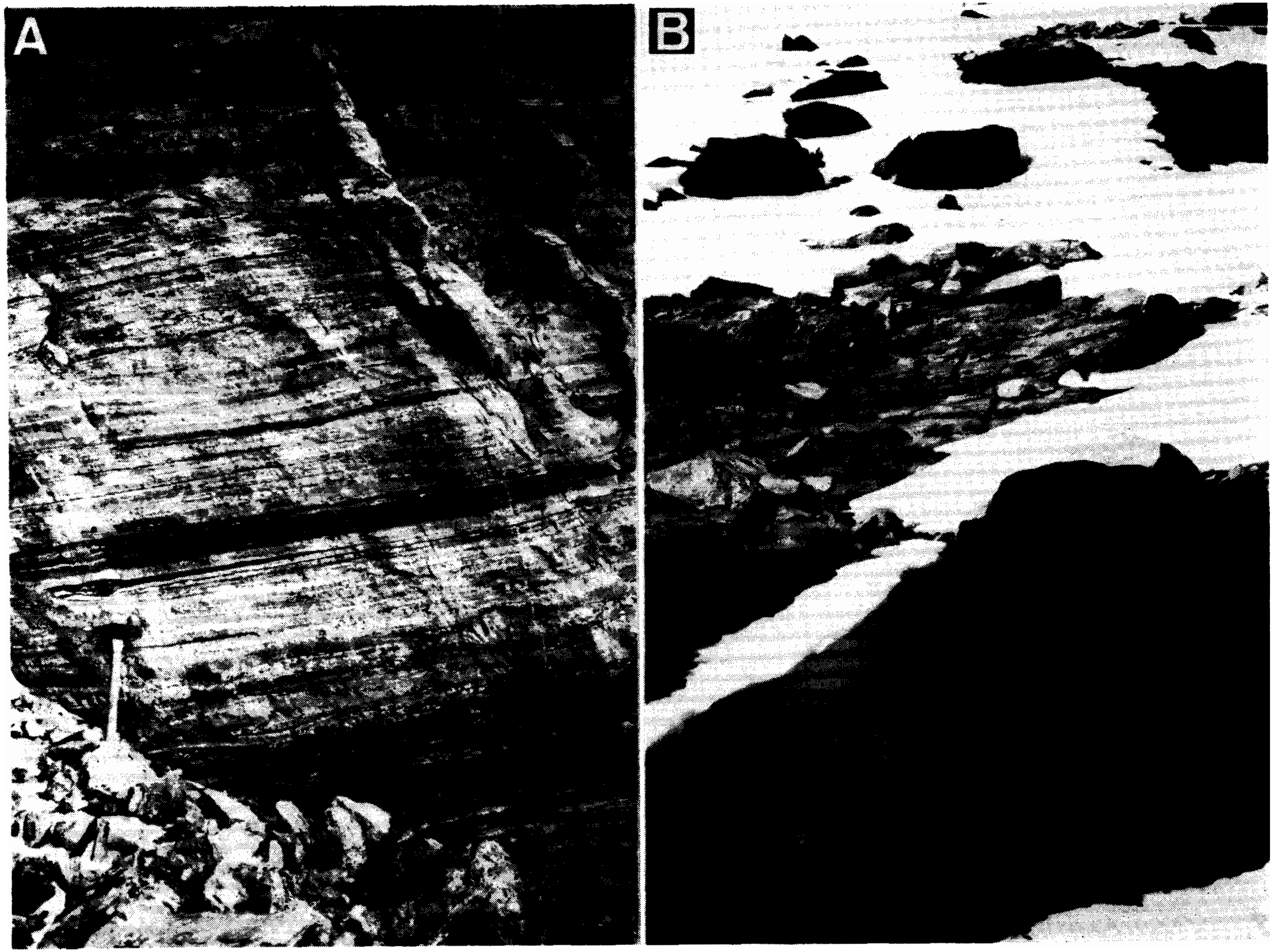

Plate 2. A: Biotite-hornblende gneiss with layered structure at Menipa. B: Lense of ultramafic rock within garnet-biotite gneiss at Austkampane.

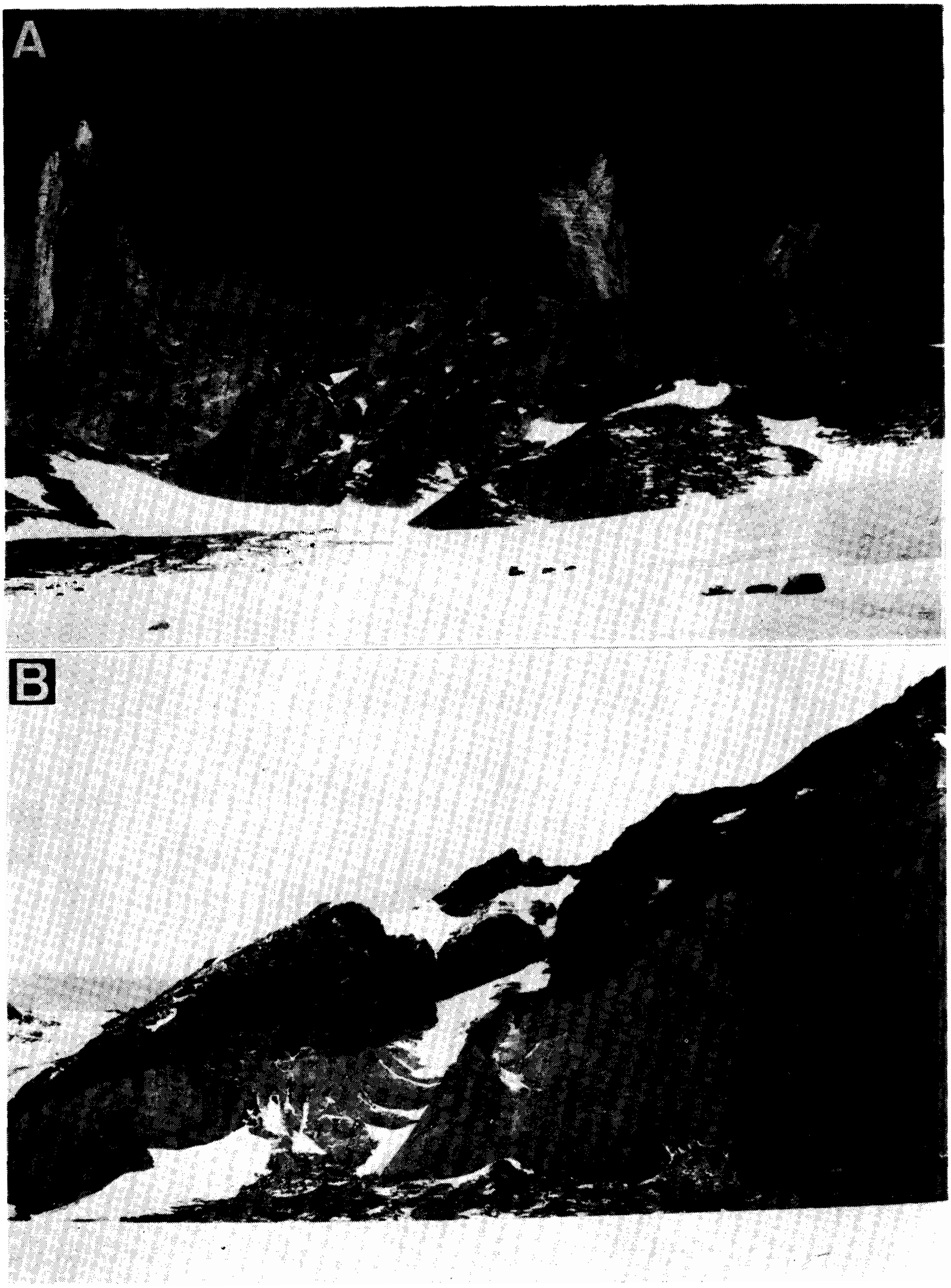

Plate 3. A: Vent-like granite masses at Birger Bergersenfjellet. B: Granite mass with sharp contact against biotite gneiss at Menipa.

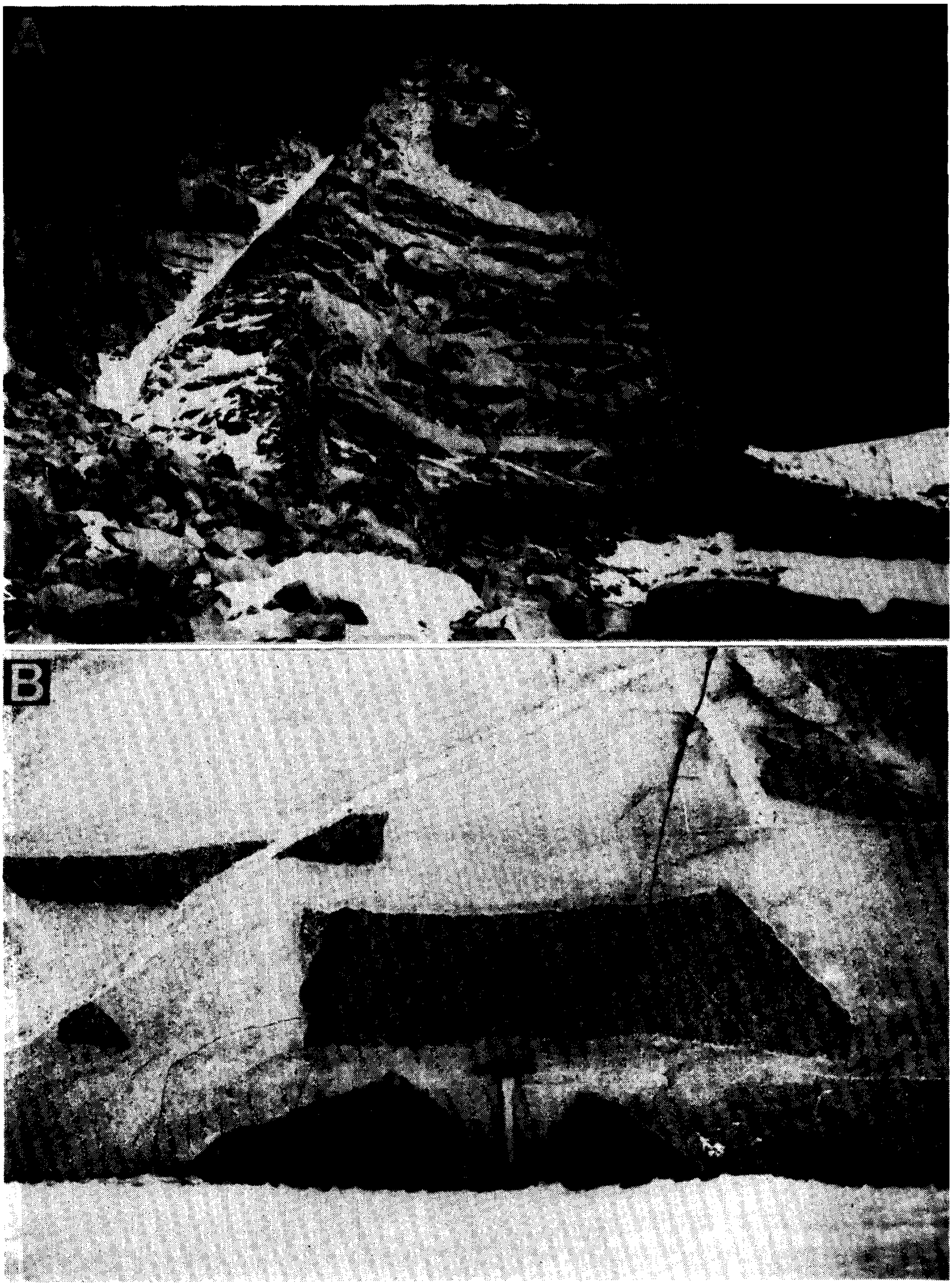

Plate 4. A: Granitic pegmatite layers within biotite-hornblende gneiss at Birger Bergersenfjellet.
B: Xenoliths of diorite within granites at Birger Bergersenfjellet.

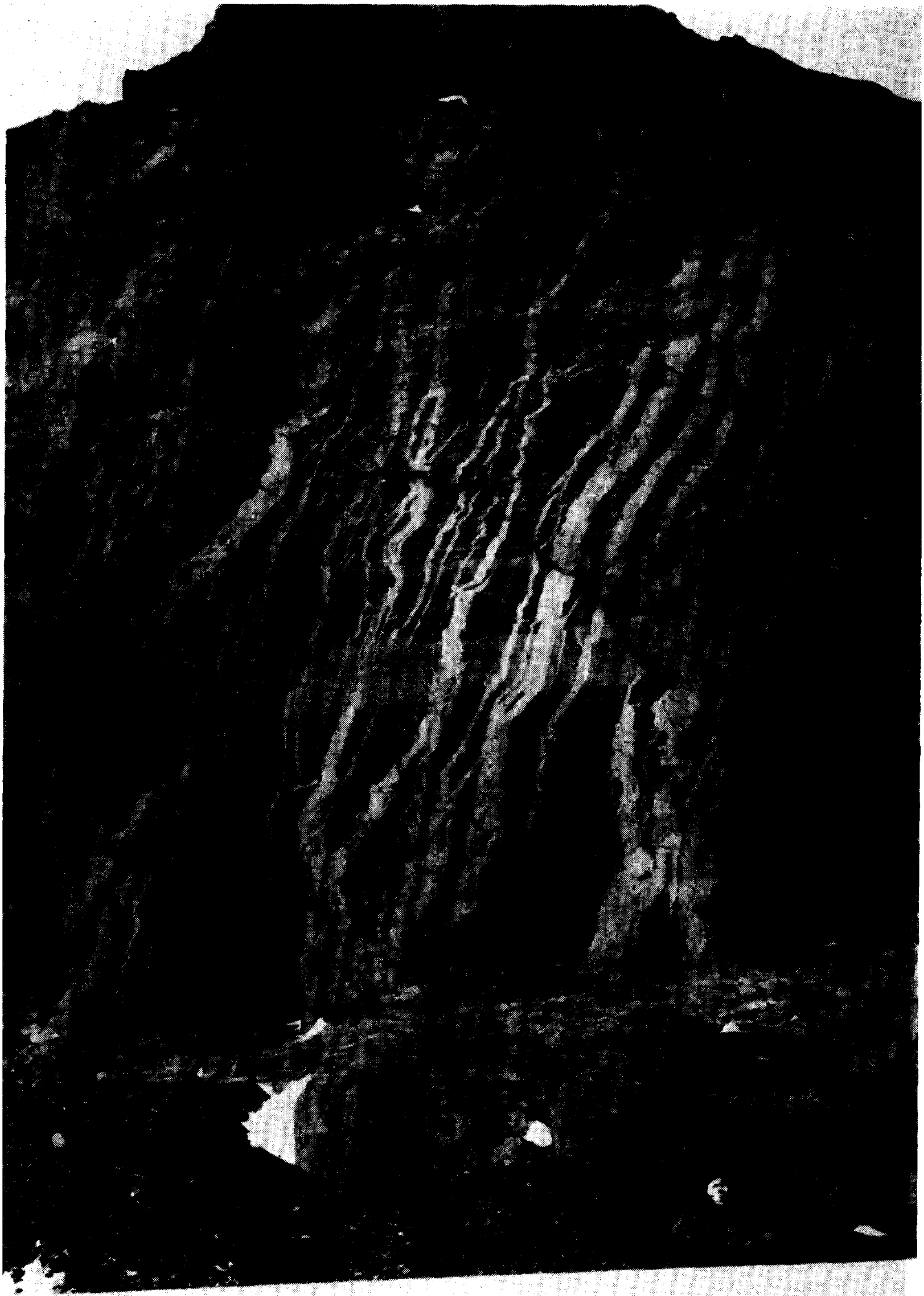

Plate 5. Dike swarm of granites within host hornblende-biotite gneiss at Austkampane; this outcrop is approximately 350 m high. Note that dikes appear to develop from oval-shaped magma pod located at the base of the outcrop.