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GEOLOGICAL WORK IN ANTARCTICA - 1972

by

R.J. Tingey & R.N. England

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SUMMARY

Two Bureau of Mineral Resources (BMR) geologists seconded to the 1972 Australian National Antarctic Research Expedition (ANARE) Prince Charles Mountains survey party made a geological reconnaissance of the southern Prince Charles Mountains in preparation for the 1973 field season, during which geological work will have high priority. In 1972 survey and glaciological work ha priority and geological work was limited by the requirements of these other programs.

The southern Prince Charles Mountains are mostly flat-topped and vertical-sided, and have generally concordant summit levels that are believed to be the remnants of an old glacial erosion surface. Locally this surface is more than 800 metres higher than the nearby ice surface. Glacial striae and roches mountonnées of the old erosion surface were discovered at Mount Stinear and Mount Newton, and well preserved moraine was found locally on the top of Mount Stinear.

The southern Prince Charles Mountains are dominated by the Fisher and Lambert Glaciers and their respective tributaries; the drainage efficiency of this glacial system is considered to be responsible for the exposure of the Prince Charles Mountains.

Before 1972, only scattered localities in the Prince Charles Mountains were investigated by Australian geologists, whose results are summarized by Cradock (1969), and by geologists of the Soviet Antarctic Expedition (SAE) (Soloviev, 1972). In 1972 geological observations were made at additional localities in the area but no comprehensive survey was attempted. Fieldwork was hampered by the lack of adequate aerial photographs, but the main objective of the season, a regional reconnaissance, was achieved.

The 1972 work adds to the outline of the regional geology described by earlier workers, particularly with regard to the distribution of certain rock types and metamorphism. During the season outcrops of metaquartzite, metamorphosed pelitic sediment, orthoamphibolite, gneissic granite, acid dyke rocks, and pegmatites were examined. Moraines were also mapped. In many places the metamorphic rocks retain remnants of their original form but locally, intrusive granites and pegmatites, of possible antatectic origin, form an irregular network that almost obliterates textures and structures in the country rock. A quartzite equivalent to that described by Trail (1963) at Mount Menzies was mapped at Mount Stinear, and orthoamphibolites were discovered at Mount Newton, Mount Ruker, Mount Stinear, Seavers Nunatak, and Central Mawson Escarpment. The concordant amphibolites within the quartzite sequence at Mount Menzies were re-examined. Acid intrusives were discovered at Mount Newton and Seavers Nunatak, and were re-examined at Mount Scherger. Foliated granitic rocks were seen at Mount Stinear.

Polymetamorphic effects are apparent in thin sections of many of the specimens. In places, high-pressure/low-temperature lower amphibolite-facies metamorphism produced characteristic kyanite-staurolite assemblages in metamorphosed pelitic rocks; locally, later retrograde greenschist facies metamorphism produced chlorite-chloritoid assemblages. At Mount Newton a granulite-facies metamorphism is strongly overprinted by a retrograde greenschist-facies metamorphism. Elsewhere anatectic upper amphibolite-facies assemblages prevail; low-grade greenschist-facies assemblages are characteristic of mountains in the central part of the area (e.g. Mount Ruker, Mount Dummett).

Banded ironstone deposits first discovered by Soviet workers in the area were not visited during 1972, but ironstone specimens were recovered from moraines on Mount Stinear. Possible fossil remains were observed at Mount Rubin. A Soviet geological party did detailed work in the central part of Mount Rubin during the 1972 season, but their results are not available.

In addition to the geological work the geologists supervised gravity work on an opportunity basis.

INTRODUCTION

In 1972 ANARE summer field operations were based at Mount Cresswell in the southern Prince Charles Mountains; the main activities of the party were surveying and glaciology. Geological work was a minor part of the program and aimed at achieving a reconnaissance of the southern Prince Charles Mountains in preparation for the 1973 field season, during which geological fieldwork will be the major field activity.

Two geologists from BMR, R.J. Tingey and R.N. England, were seconded to the ANARE Prince Charles Mountains party led by Mr A. Humphreys of the Antarctic Division, then of the Department of Supply. They worked as survey assistants as well as geologists, and their movements were governed by the requirements of the survey and glaciology programmes; only a few helicopter hours were available exclusively for geological work. During the season, gravity-meter readings were made by surveyors, glaciologists, and the geologists, but the lack of consistent base-station readings prevented meaningful results being obtained from this work.

In 1972 geological observations were made at, and rocks collected from, widely scattered localities in the southern Prince Charles Mountains, but no coherent pattern of results has emerged; thin-section descriptions are summarized in the Appendix. Descriptions of localities visited during the season are discussed in alphabetical order according to 1:250 000 Sheet areas.

Outcrop conditions

As in the northern Prince Charles Mountains, the best rock exposures in the southern Prince Charles Mountains are in cliff faces that are not easily accessible from the high points on which survey stations are, by necessity, sited. The flatter and more gently sloping surfaces of the mountains are commonly covered with felsenmeeren of locally derived frost-disturbed rocks, but locally there are pockets of true moraine consisting of a matrix of khaki-green clay and fine fragements and in ill-sorted heterogeneous collection of allochthonous boulders. Patterned and unpatterned 'moraine' as described by Trail (1963) may consist of either true moraine or locally derived and almost in situ rock debris.

On mountains covered by locally derived rock debris, the large-scale distribution and interrelationship of the various rock types can be easily seen from the air, but on the ground detailed structural data are hard to obtain.

Aerial photographs and base maps

Standard air photographs of the southern Prince Charles Mountains were borrowed from the Antarctic Division. They are all trimetrogon reconnaissance type photographs and proved to be of little use for photogeological work. However, photographs taken from the air by geologists proved useful for photogeological interpretation.

A 1:1 000 000-scale map of the southern Prince Charles Mountains, was produced by the Division of National Mapping for use in the 1972 field season. It is based on the trimetrogon photography and is planimetric only.

Previous geological investigations

Stinear, who landed in 1957 near the east side of the mountain now known as Mount Stinear, was the first geologist to collect rocks from the southern Prince Charles Mountains. Crohn (1959) made reconnaissance flights into the area during his stay at Mawson Base. Trimetrogon aerial-photography missions were flown in the area during 1957 and 1960. McLeod (1959) landed at several places in the southern Prince Charles Mountains area during 1958.

The first overland traverse to the southern Prince Charles Mountains was made in 1957 by a geophysical party, which collected a few rock specimens from the Goodspeed Nunataks area; these are briefly described by McLeod (1959) and Trail (1963). Ruker (1963) made the first overland geological traverse into the southern Prince Charles Mountains in 1960 and examined outctops on the northern side of the Fisher Glacier; in the following year, Trail (1963) crossed the Fisher Glacier with a dog team and visited Mount Menzies and Mount Bayliss. No geological work was done in the southern Prince Charles Mountains between 1961 and 1972, but rock specimens were obtained by surveyors and geophysicists working in the area in 1971 and the tractor train party that set up the Mount Cresswell base in 1970. Results of Australian work in the southern Prince Charles Mountains are summarized in papers presented by Trail (1964 a, b) at the 1963 Cape Town SCAR-IUGS Symposium on Antarctic Geology. They are used by Cradock (1969) in the compilation of the geological map of Antarctica.

The Soviet Antarctic Expedition has made reconnaissance flights into the southern Prince Charles Mountains, and in 1965 Soloviev (1972) discovered iron ore deposits at Mount Ruker. Results of Soviet work are included in papers presented to the 1970 Oslo SCAR-IUGS Congress on Antarctic Geology and Solid Earth Geophysics (see Adie, 1972).

GLACIAL GEOLOGY

The map (Plate 1) shows clearly how the Lambert Glacier drainage system dominates the southern Prince Charles Mountains area; Trail (1963, 1964a) has discussed the glacial geology of the Prince Charles Mountains area, and has drawn particular attention to the role of Lambert Glacier system. Crohn (1959) illustrates the spectacular crevassing that is a feature of the Lambert Glacier and its tributaries, the Collins, Geysen, and Fisher Glaciers.

During the 1972 field season, glacial striae and roches mountonnées were seen at some localities, and, locally, pockets of till with the interstitial khaki-green clay fraction intact were found high up on the mountain tops. Trail (1963) noted that large flat-topped mountains were a feature of the southern Prince Charles Mountains and (p. 14) postulated that the summits of these mountains may be remnants of a pre-glacial erosion surface. The widespread glacial phenomena in the southern Prince Charles Mountains, particularly on the tops of the mountains, show that the area was formerly covered by plateau ice with probably only Mount Menzies showing through as an isolated nunatak. No evidence that would support the existence of the pre-glacial erosion surface postulated by Trail was seen. Preservation of striae in relatively soft rocks at Mount Newton and of the pockets of till show that permanent ice cover was probably only recently removed from the mountain tops; melt-stream activity now locally seen in the southern Prince Charles Mountains is probably a recent phenomenon.

The vertical sides of the flat-topped mountains of the southern Prince Charles Mountains are commonly about 800 metres high around the Lambert Glacier-Fisher Glacier confluence and downstream, and their preservation shows that the regional base level of ice erosion was lowered quite rapidly probably owing to the isostatic rise of the continent. This isostatic rise was in turn a response to a reduction of the mass of the polar ice cap. The features attributed to ice-level depression in the southern Prince Charles Mountains may be related to the formation of the saline lakes in the Vestfold Hills (McLeod 1964) and the terraces near Mawson (Crohn 1959), but there is little evidence to support or disprove any such relation.

Fig. 1. Mount Cresswell. Pegmatite dykes, about 10 m wide, cross-cut metasediments at northeast end of mountain.

Neg. GA/8178 RNE

Fig. 2. Mount Johns - Large-scale recumbent fold at southeast end. The cliff face is about 300 m high.

Neg. GA/6349 RNE

Measurements of glacial striae show that ice movement when the ice level was higher than at present was roughly parallel to the present-day flow direction of the Lambert Glacier system. The Lambert Glacier system is thus an old feature of the area; gravity investigations of the regional structure are progressing in association with glaciological studies of the glacier system and its ice economy.

MOUNT CRESSWELL 1:250 000 SHEET SS 40-42/3

Mount Cresswell

Mount Cresswell is gently domed and rises about 500 m above the plateau ice. Some physiographic features are described by Ruker (1963). It consists mainly of mafic hornblende-plagioclase-quartz gneiss with or without biotite and garnet. Leucocratic and calcic variants also occur. The rocks strike about east-west and commonly have near-vertical dips, but their structure, which is undoubtedly complex, is almost obscured by abundant, randomly-oriented microcline-quartz-muscovite-tourmaline pegmatite dykes (Fig. 1), which range in thickness from a few centimetres to about 100 m. The larger ones are discordant but have thin offshoots which are mostly concordant with the schistosity of the gneiss.

Although no diagnostic mineral assemblages have been found, it is likely that the rocks from Mount Cresswell belong to the middle amphibolite facies. They commonly contain brownish hornblende characteristic of the upper and middle amphibolite facies (Binns, 1965), and contain primary calcic plagioclase, which is rare in the lower amphibolite facies. Specimen 7228/0711B, a boulder in the moraine on the northern side of the mountain, contains cordierite, anthophyllite, and staurolite. This lower amphibolite-facies assemblage suggests moderate pressure - perhaps 3-5 Kb - and a temperature between 520 and 680°C (Richardson, 1968; Hoschek, 1969) and is slightly lower grade than the in-situ rocks.

Diopside and calcic plagioclase in the calc-silicate rock 7228/0709B have been partly replaced by green hornblende and epidote, and Ruker (1963) describes a retrograde rock in which epidote and chlorite replace hornblende. Retrograde metamorphic effects are generally uncommon, and may be localized along zones of later deformation.

Mount Johns

Mount Johns rises about 600 m above the ice plateau on the western side of the Lambert Glacier. A large recumbent fold (Fig. 2) with a half wavelength of about 700 m and an axis plunging gently to the northwest is exposed on the southeast face of the mountain. The rocks are light and dark gneisses interlayered on a scale of about 10 m and almost certainly belong to the middle or high amphibolite facies.

Sample 7228/0771 contains symplectite intergrowths of garnet and plagioclase, and layers with abundant dull turquoise-blue iron-rich clinopyroxene. Rims of this clinopyroxene surround some garnet grains.

MOUNT MENZIES 1:250 000 SHEET SS 40-42/6

Mount Menzies

Mount Menzies (3113 m) was first visited and climbed by D.S. Trail, D.O. Keyser, and J. Seavers during a sledging trip in December 1961. An account of the geology of Mount Menzies and Mount Bayliss is given by Trail (1963). He described the physiography and structure in some detail; the present work has a more petrological emphasis.

The main summit is on a sharp ridge curving around a large north-facing cirque (Fig. 3) excavated by an alpine glacier which has since disappeared. Moraine-covered benches at the northern end of Mount Menzies show evidence of glaciation and resemble other generally flat-topped or gently domed outcrops in the southern Prince Charles Mountains. Outcrop is good on the northern sides of Mount Menzies, but on the south sides snow cover is more extensive and the ice plateau is much higher.

A salt encrustation found between boulders on the northern slopes of the summit region was probably formed by the freezing of saline solutions leached from nearby rocks on warmer days. X-ray diffraction analysis has shown that the encrustation mainly consists of hexahydrite ($MgSO_4.6H_2O$).

The two major rock types found on Mount Menzies are quartzite with minor pelitic bands, and amphibolite. An igneous origin for the amphibolite is confirmed by the occurrence of relict microlitic textures in some specimens. The quartzite and amphibolite are conformably interlayered on the scale of a few tens to a few hundreds of metres (Fig. 4). However there are some transgressive amphibolites: about halfway along the western flank of the main northern cirque, an amphibolite layer diagonally transgresses thinly layered amphibolites and quartzites.

Two major folds are clearly visible: an anticline on the northern summit ridge appears to plunge gently to the east, and a recumbent fold in the western wall of the main cirque has a shallow northwesterly plunge. Patchy outcrops of basic rocks which rest on the quartzite dip slope forming the gently sloping outer side of the western wall of the main cirque, appear to be outliers of the upper limb of this recumbent fold. The area northwards from Pardoe Peak (Fig. 3) for about 2 kilometres has a complex structure with generally near-vertical dips; it may be the root zone of a nappe structure which moved northwards. In the summit region, the axes of open mesoscopic folds and a lineation defined by preferred orientation of kyanite crystals have a shallow westerly plunge; the relation of these structures to either of the major structures is not known.

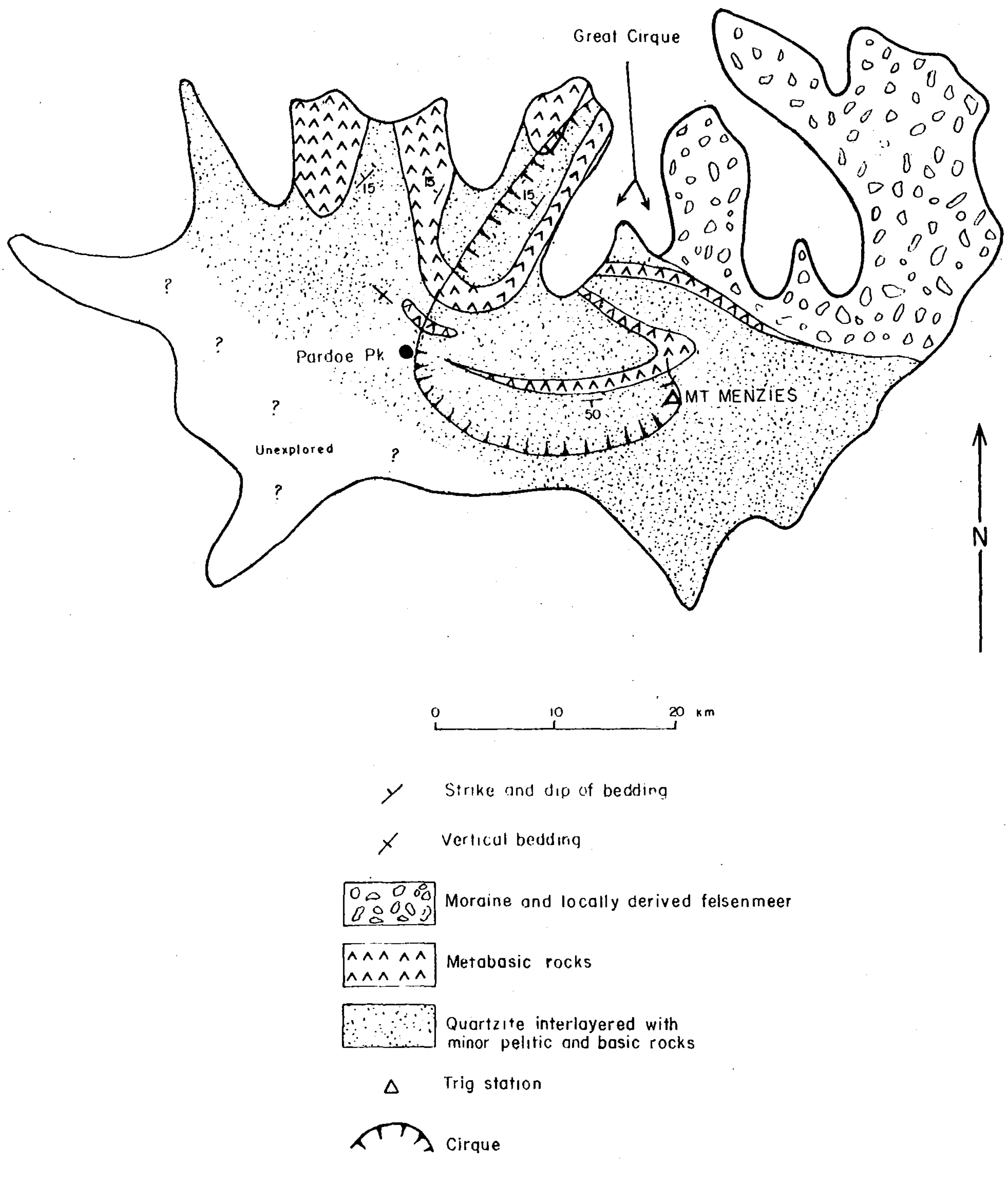
The mineral assemblages of specimens collected from Mount Menzies are listed in the Appendix. Within the massive quartzites, minor pelitic bands range in thickness from a few millimetres to about a metre. Cross-bedding is rare. The pelitic layers contain kyanite, some staurolite, and abundant chloritoid. The staurolite and the kyanite are crowded with inclusions of chloritoid and quartz, with minor sericite. Kyanite in the pelitic layers is typically grey in hand specimen because of these inclusions, but in the quartzite it is only slightly altered to pyrophyllite and has the normal sky-blue colour. Garnet and greenish biotite are rare in the metasediments in the summit area.

Green staining is common in the quartzite and pelites adjacent to basic layers. One specimen of bright green mica which is colourless in thin section was found to be slightly fuchsitic muscovite with about 0.3 percent chromium oxide.

The basic rocks are low-grade greenschist facies orthoamphibolites containing pale green actinolite. Specimen 7228/0713H has a relict microlitic texture. Garnets in specimens 7228/0713H and 0713K have considerable spessartine and grossular components and appear to have undergone retrograde alteration. Pyrite and ilmenite are present in both these specimens.

The presence of staurolite and kyanite indicates that the main metamorphism was of the moderately high-pressure Barrovian type. It appears to have been overprinted by a lower greenschist-facies event which crushed and strained some larger blades of kyanite, and produced chloritoid in the pelitic rocks and a small amount of pyrophyllite in the quartzites. Chloritoid was Probably produced by the retrograde reaction:

FIG. 3.



Modified from a sketch map by D.S. Trail.

FIG 3 MOUNT MENZIES

To accompany Record 1973/161

AN 2/110

Fig. 4. Mount Menzies. About 15 km of the west wall of the great cirque in the northern face of the mountain, viewed from the survey station at the summit. Pale bands are quartzite; dark bands, orthoamphibolite.

Neg. GA/6343 RNE

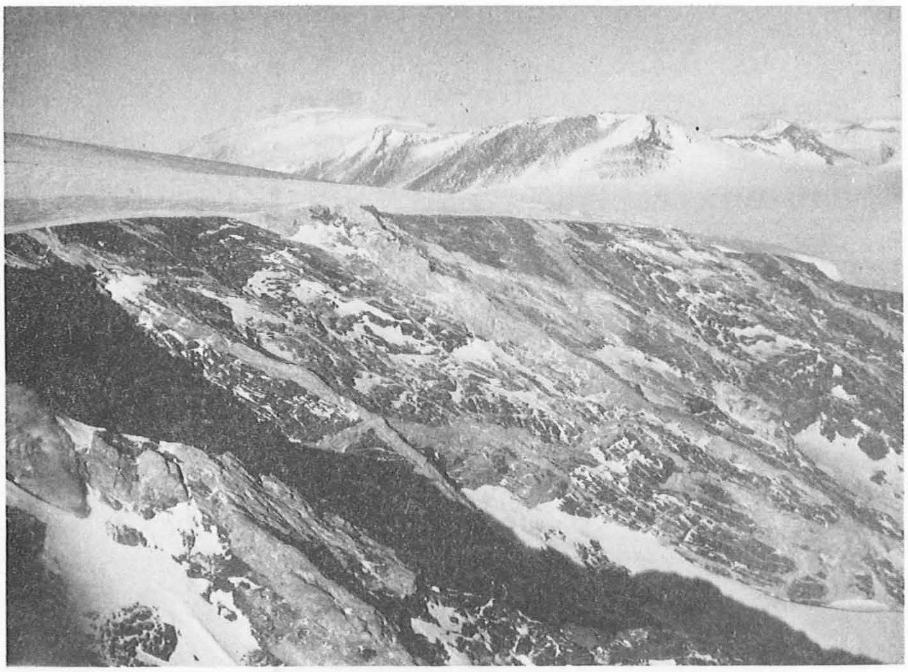


Fig. 5. Mount Scherger. Pegmatite and granite dykes intersect banded brown micaceous metasediments.

Neg. GA/8174 RJT

Fig. 6. Mount McCauley. Granite intrusions viewed from the south.

Neg. GA/8175 RJT

$$\text{staurolite + biotite + water} \rightleftharpoons \text{chloritoid + muscovite + chlorite + quartz} \quad (1)$$

and pyrophyllite by the reaction:

$$\text{kyanite + quartz + water} \rightleftharpoons \text{pyrophyllite} \quad (2)$$

Preliminary experimental data of Hoschek (1969) indicate that reaction (1) proceeds when temperatures drop below about 550°C at moderate pressure when water is available. One may therefore assume that the early amphibolite-facies metamorphism reached at least 550°C; retrogression continued down at least to 420-440°C, the upper stability limit of pyrophyllite (Kerrick, 1968).

The lower amphibolite-facies metamorphism which produced the staurolite at Mount Menzies appears to be widespread in the southern Prince Charles Mountains. Rocks containing both kyanite and staurolite are found at Seavers Nunataks, 39 km farther north, and at Mount Stinear, 150 km to the east. Signs of retrograde metamorphism were found, in addition to those at Mount Menzies, at Mount Cresswell and Wilson Bluff. It is not clear whether all these retrograde effects were produced by a single metamorphic episode.

Mount Scherger

A few rock specimens were collected from the south side of Mount Scherger during a brief visit made for gravity meter readings. Strongly banded, brownish to grey, metasedimentary country rocks are intruded by pegmatite, and granitic veins and dykes that are mostly conformable but are locally transgressive (Fig. 5). In places small quartz lenses within the dark brown country rocks commonly contain large bladed crystals of kyanite and associated muscovite.

Mount Scherger is close to Mount McCauley, where Ruker (1963) found a boss or stock of muscovite granite (Fig. 6). Mount McCauley is, like parts of Mount Scherger, extensively invaded by a network of pegmatite and granitic dykes and veins. The Mount Scherger intrusives are probably related to those of Mount McCauley.

The mineral assemblages of rocks collected at Mount Scherger are given in the Appendix . The grey-green mica schist 7228/0836 contains significant quantities of sillimanite in the form fibrolite, and the muscovite adamellite 7228/0838 has sillimanite developed by the alteration of biotite. The presence of the high-temperature aluminium silicate polymorph, silliminate, close to rocks containing the high pressure polymorph, khanite, is probably due to the contact metamorphic effect of the local intrusive rocks, which therefore post-date the regional metamorphism. Sillimanite in the adamellite 7228/0838 may be due to contamination by the pelitic rocks and subsequent contact metamorphism by later-stage intrusives.

Seavers Nunataks

Seavers Nunataks comprise three small nunataks on the north side of the main stream of the Fisher Glacier and about 38 km north of Mount Menzies. Tingey camped on the largest and most southwesternly of the nunataks, an L-shaped ridge having vertical south and southeast facing cliffs and more gentle slopes towards the north and northwest. Just to the southwest of the main nunatak the Fisher Glacier is intensely contorted into spectacular ice falls where its main stream is diverted by the nunatak. Trail (1963) was not able to visit Seavers Nunataks because of hazardous surface conditions.

Outcrop at the main nunatak is good and few erratics were seen. The strike of the bedrock ranges from 140° on the northern end of the ridge to about

130° near the hinge of the L to about 120° at the western end. The nunatak consists of brownish grey-weathering, banded, micaceous pelitic metasediments, intersected by amphibolitized basic dykes, and intruded by a small granite stock and small subconformable quartz lenses and segregations. The banded metasediments are folded around the granite which has a distinct foliation defined by the alignment of clusters of biotite and other mafic minerals. Within individual bands of metasediment, intrafoliate folds are quite common (Fig. 7).

Muscovite, kyanite, and staurolite are widespread in the metasediments, and garnet was seen in places. The amphibolites contain hornblende in acicular and well formed crystals, and epidote and ferrohastingsite were identified in two sections of foliated granite. High-pressure metamorphic conditions are indicated by the presence of kyanite in pelitic assemblages. The lack of anatectic effects, the stability of muscovite, the presence of staurolite in pelitic assemblages, the blue green colour of hornblende, and the epidote in the amphibolites - all indicate moderate temperatures. Conditions of metamorphism at the main nunatak were therefore within the lower amphibolite facies, with temperatures about 600°C and pressures greater than 4 kilobars. The mineral assemblages of the metamorphosed pelitic rocks are characteristic of the Barrovian type staurolite-almandine subfacies of the almandine-amphibolite facies. Only a few minor signs of retrograde metamorphism were seen in the rocks; this contrasts strongly with the retrogression in Mount Menzies rocks. Quartz lenses that are nearly conformable to the metasediments contain large bladed crystals of kyanite near the contacts with kyanite-bearing pelitic rocks. The lenses presumably formed by segregation during metamorphism.

CUMPSTON MASSIF 1:250 000 SHEET SS 40-42/7

Mount Dummett

Mount Dummett was briefly visited en route between the Mount Cresswell base camp and the Soviet camp at Mount Rubin. Ruker (1963) collected specimens from Mount Dummett and noted the low-grade epidote-bearing green metasediments at the eastern end of the mountain and the muscovite granite stocks at the western end.

In 1972 five rock specimens were collected on the upper surface of the mountain near the contact of the granite and the metasediments, and close to the westernmost peak. The granites (7228/0846, 0848), are composed mainly of muscovite, plagioclase, microcline, and quartz; the metasediments (7228/0850, 0852, 0854) have greenschist-facies assemblages and contain epidote, brownish-green biotite, sericite, potash feldspar, and quartz, with minor plagioclase and opaques.

Some of the metasediments are finely banded metaquartzites with fine-grained mafic layers. No signs of retrograde metamorphism and no contact metamorphic effects were seen in the metasediments. The granite-metasediment contact at Mount Dummett requires further investigation.

Mount Newton

Mount Newton lies between the Mellor and Collins Glaciers and consists of a northeasterly-trending line of well rounded hills with fairly steep slopes. Cliff faces are locally developed at the southwest tip, along the western slopes, and on the northern face of the central peak. Tingey made traverses on foot from a camp at the survey station on the southern peak of Mount Newton; helicopter work was not possible in the area as communication difficulties resulted in the helicopters arriving in severe weather totally unsuitable for local flying.

Parts of the southern peak of Mount Newton are mantled with moraine consisting of strongly foliated erratics, such as migmatite, garnet-biotite

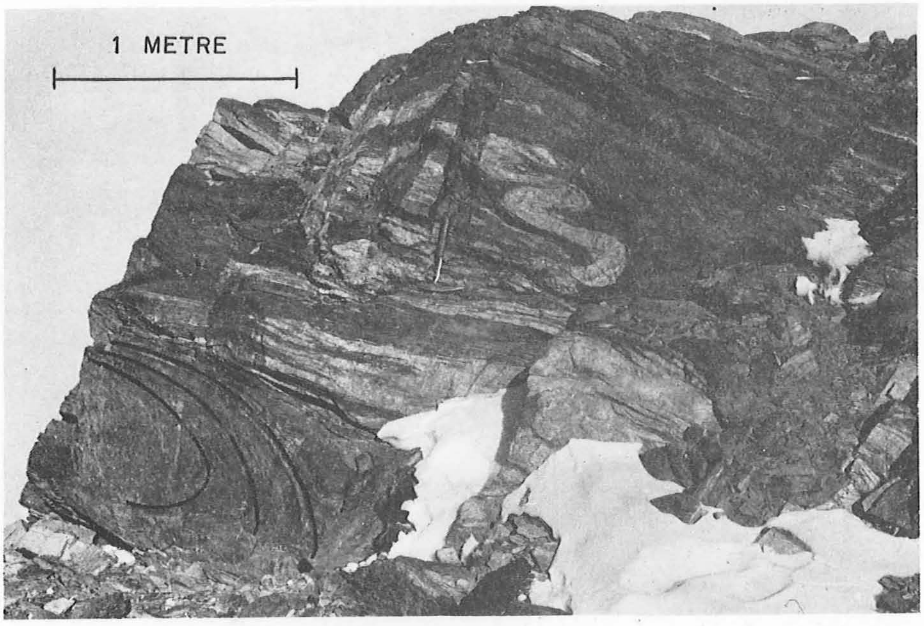


Fig. 7. Seavers Nunatak. Ptygmatic and intrafoliate folds in banded metasediments.

Neg. M/1302 RJT

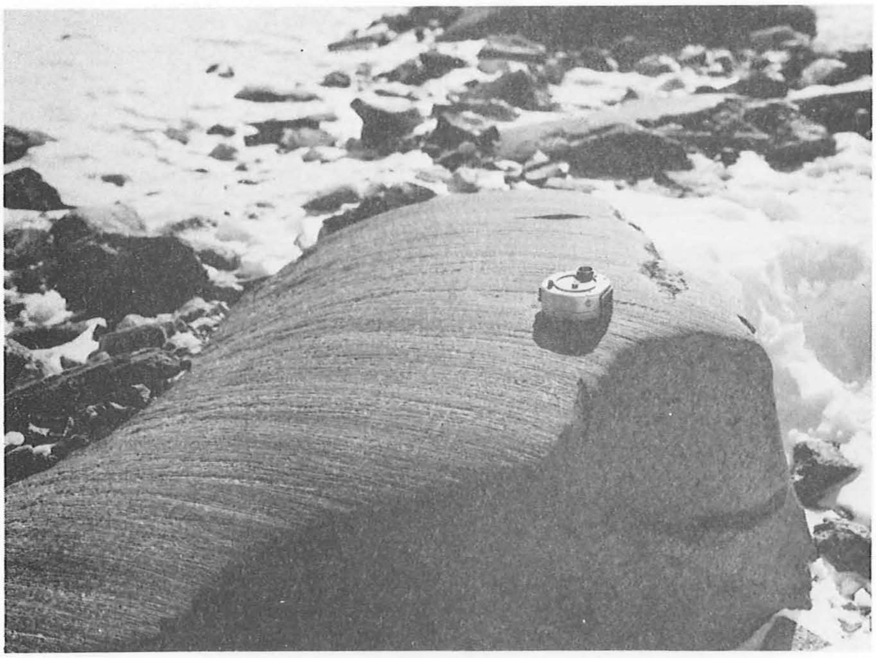


Fig. 8. Mount Newton. Glacial striations

Neg. M/1470 RJT

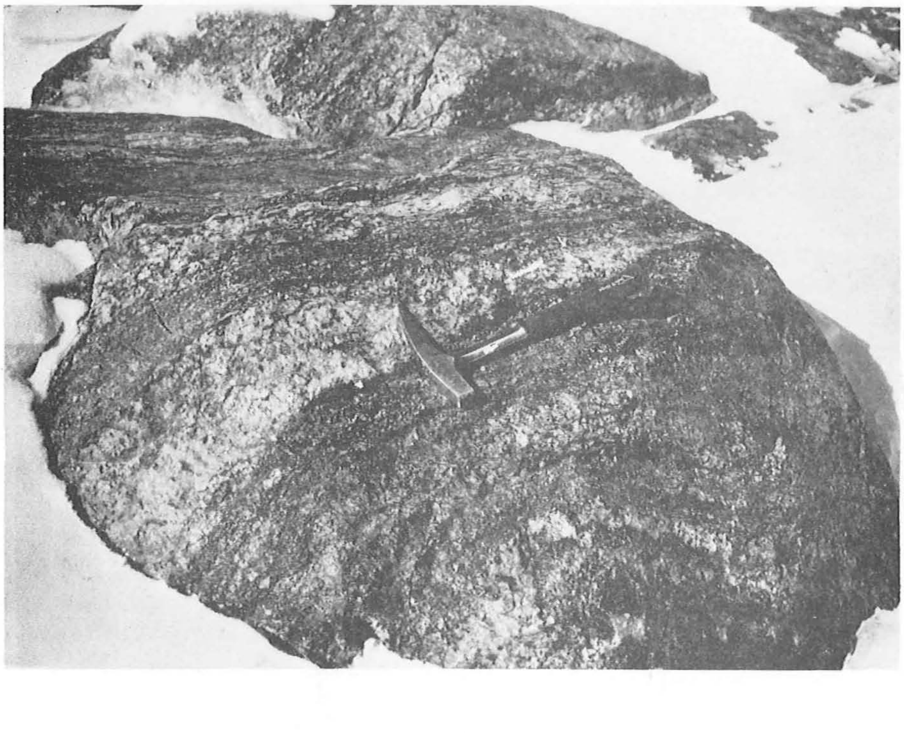


Fig. 9. Mount Newton. Granite and pegmatite injected lit-par-lit into garnet-rich metasediments

Neg. GA/8172 RJT

gneiss, sillimanite gneiss, and gneissic granite. Elsewhere, outcrops are moderately good, although locally the rocks are weathered and fresh specimens are not readily obtainable. Near the survey cairn on the southern peak, solid rock was distinguished from moraine by the glacial striae, which are particularly well preserved (Fig. 8) in the metasediments. The striae are the first to be observed and measured in the Prince Charles Mountains area; they range in direction from 022° to 050°. The most common direction, about 030° is generally parallel to present-day flow of the nearby Collins and Mellor Glaciers.

Glacial striae are also preserved on roches moutonnées of biotite granite in the central part of Mount Newton. The granite is in many places quite weathered and the preservation of the striae appears to be due to a protective polish given to the rocks by the glaciation. This polish is affected by weathering; the weathering surface thus does not ante-date the glaciation.

On peaks north of the survey station at Mount Newton, high-grade garnet-sillimanite-biotite-quartz-feldspar gneiss (specimens 7228/0722, 0728, 0730, 0732) of pelitic origin is invaded lit-par-lit by coarse granite pegmatite (Fig. 9). In places, granite (specimens 7228/0734, 736) is the dominant rock and remnant bands of metasediment are only just discernible. A metamorphosed basic dyke (specimen 7228/0724) which intersects the granitic rocks has the granulite-facies assemblage hornblende-hypersthene-andesine-opaque-quartz; specimen 7228/0726 is from an orthopyroxenite dyke that also intersects the injection gneisses. All specimens collected in the area show some signs of retrograde alteration; secondary biotite and actinolite are developed in the orthopyroxenite; orthopyroxene in the basic granulite (7228/0724) is altered around the edge; and biotite in the pelitic gneiss includes exsolved rutile. Two specimens of pelitic gneiss (7228/0728, and 0730) contain patches of chlorite, which may have replaced cordierite.

Spotted pelitic metasediments (7228/0710, 0712, 0714, 0716) near the survey station contrast strongly with the higher-grade rocks to the north, and consist mainly of prominent shattered, and rolled out garnets enveloped by secondary chloritoid, sericite, and chlorite. A basic dyke (7228/0718) that intersects these rocks contains albite and patches of finely matted actinolite, but has a relict texture similar to the basic granulite (7228/0724) described above. The low-grade metasediments have compositions generally similar to those of the higher-grade pelitic gneiss farther north, but were retrogressively metamorphosed under greenschist-facies conditions after the granulite-facies or high-grade metamorphism that post-dated the intrusion of basic dykes in the area. The metasediments within the injection gneiss were probably protected from the retrograde metamorphism by the massive and less permeable granitic rocks, but as noted above, all show some signs of alteration.

Mount Rubin

Mount Rubin is on the southern side of the confluence of the Fisher and Lambert Glaciers. Traverses on foot were made from a survey station at the eastern end of Mount Rubin. A Soviet geological party led by G. Grikurov worked in the central part of Mount Rubin, and, on a brief visit to the general area of the Soviet camp, Tingey observed, but did not sample or examine, intensely folded finely banded light and dark rocks.

From the survey station, shearing and boundary layer effects can be seen in the glacier ice at the base of the mountain (Fig. 10). The upper surface of Mount Rubin has been levelled by glacial action, and vertical cliffs about 800 m high are developed on the northern, western, and eastern sides of the mountain. A large snow dome occupies most of the eastern half of the mountain; the southern slopes are covered by ice.

The rocks of the area around the Mount Rubin survey station are mostly dark brown, intensely folded, phyllites and schists (Fig. 11), locally containing prominent biotite crystals about 4 mm square. In places they are intruded by small, mostly conformable, lenses of quartz-chlorite-feldspar pegmatite. Dolomite and calcite are present in some of the metasediments. The flat upper surface of the mountain near the survey station is mantled with locally derived rock debris.

A range of rock types was collected from a spur on the north face of Mount Rubin about 200 m west of the survey station. Most rocks were schistose and brown, with calcite, dolomite, and mica crystals common. Peculiarly shaped dolomite concretions were seen on some cleavage planes (Fig.12) and may be fossil remains. The rock cleavage is an axial-plane cleavage developed by tight isoclinal folding; cleavage and bedding in the rocks are commonly parallel, but locally, fold noses can be discerned.

The rocks mostly have two good joint directions which commonly trend at about 210° and 090°; on some foliation planes the acute angle between the joints is bisected by the trace of the axial plane cleavage. In places the cleavage direction is indicated by lines of tabular rocks that stand up from the general ground surface.

The Mount Rubin rocks consist mainly of a fine-grained uniformly crystalline mosaic of quartz and commonly contain the low-grade, (probably greenschist-facies) assemblage: calcite-epidote-chlorite-sericite and greenish brown biotite. The assemblage indicates that the rocks are of sedimentary origin and are in equilibrium although square biotite porphyroblasts (7228/0830A, 0830B) may be pseudomorphs after staurolite, garnet, or, most probably, chloritoid.

Mount Ruker

Mount Ruker is on the southern flank of the Geysen Glacier, a southern tributary of the Fisher Glacier. Cliff faces are developed along the northern and eastern sides of the mountain but the western and southern sides are gently rounded, largely snow covered surfaces.

There are apparently few exposures of solid rock near the survey station on the western peak at Mount Ruker. The specimens collected by the surveyors were from the commonest rock types among the debris that covers the nearby slopes and include: tholeiitic dolerite (7228/0856); amphibolite consisting largely of actinolite (7228/0858); uralitized dolerite that consists of actinolite, sericite, plagioclase, and opaques (7228/0864); and metabasalt that now consists mostly of a fine matt of acicular actinolite 7228/0868. Specimen 7228/0866, a metagreywacke, is a banded grey-green siliceous rock and contains ovoid structures that are believed to be slump features. With the exception of the tholeiitic dolerite (7228/0856), the Mount Ruker rocks collected belong to lowgrade greenschist-facies metamorphic grade. Unmetamorphosed dolerites have not been previously reported from the southern Prince Charles Mountains. (The jaspilites reported by Soloviev (1972) evidently do not occur near the Mount Ruker survey station).

Mount Stinear

Mount Stinear, a large mountain 20 km long, is on the northwest side at the confluence of the Lambert and Fisher Glaciers, and rises some 800 metres above the local plateau-ice level. Vertical cliffs bound most sides of the mountain and are particularly spectacular near Edwards Pillar, a quartzite

Fig. 10. Mount Rubin. Boundary layer effects in Fisher Glacier

Neg. GA/8181 RJT

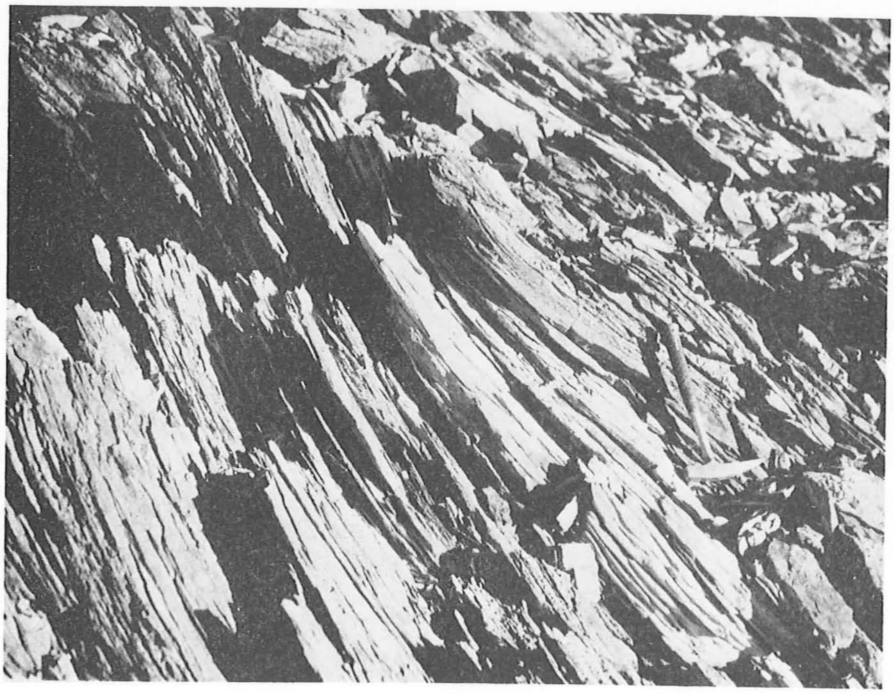


Fig. 11. Mount Rubin. Intensely cleaved calcareous phyllites

Neg. GA/8189 RJT

Fig. 12. Mount Rubin. Distinctive dolomite accretions on cleavage planes of calcite-epidote-rich schists.

Neg. GA/8180 RJT

Fig. 13. Mount Stinear. Moraine tail looking north, with Clemence Massif distant right and Mount Johns near distant left

After ANARE photo. Ant 71 Run 202 7134L

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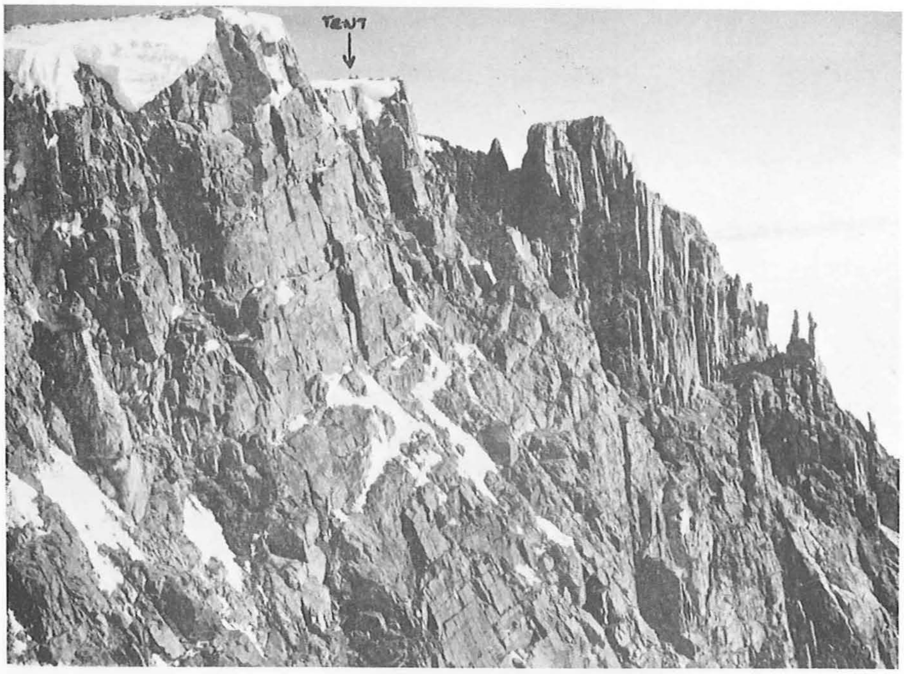

Fig. 14. Mount Stinear. Edwards Pillar and nearby pelitic schists. (Note tent for scale)

Neg. GA/8185 RJT

Fig. 15. Mount Stinear. Edwards Pillar viewed from south. Moraine is in foreground; quartzite outcrop is covered with quartzite felsenmeer

Neg. GA/8183 RJT

Fig. 16. Mount Stinear. Green streaks in quartzite

Neg. GA/8177 RJT

pillar near the summit and about midway along the western side (Figs, 14, 15). More gentle slopes are developed towards the northern end of the mountain, where a rounded, hummocky glaciated terrain is developed. Near the Mount Stinear survey station, roches moutonnées are preserved among quartzite outcrops. The few striations measured are generally parallel to the present-day ice-flow pattern.

At the northeastern end of Mount Stinear an arcuate moraine tail (Fig. 13) is developed in an area of intensely buckled, sheared, and crevassed ice where an eastward flowing tributary of the Lambert Glacier joins the main glacier. Debris for this moraine tail is deposited on the Lambert Glacier by a small eastward-flowing mountain glacier that originates in a cirque just to the south of the summit of Mount Stinear.

The southern part of Mount Stinear is essentially a large arête, with a prominent triangular face at the southern end; the remainder of the mountain is a plateau that slopes from the summit to the northern end. From a distance, most of the mountain appears to be table-topped, as the arete and the summit areas are at about the same elevation. A snow dome covers a large part of the summit of the mountain, and feeds the glacier in the nearby cirque. Farther north another, smaller, cirque contains only a small icefield.

Most of the exposed top of the mountain is covered with felsenmeer of locally derived rock debris, but there are small pockets of moraine (Fig. 15) consisting of an ill sorted selection of exotic rocks set in a khaki-green clayey matrix.

In 1971 the surveyors who established the Mount Stinear survey station brought back a few specimens of the local rocks. A wider range of rock types was examined and sampled on traverses north and south from the survey station during the 1972 field season. When the 1972 survey party moved to Mount Rubin a brief stop en route was made near the southwest tip of Mount Stinear.

Edwards Pillar and large parts of the adjacent areas of Mount Stinear consist of well jointed and predominantly white and cream quartzites, which form a prominent feature visible from many miles away. The quartzites are locally red, green, greyish blue, or grey depending on the content of fuchsite, rutile, and kyanite, which are usually concentrated in bands or streaks (Fig. 16). Greenish and white varieties are more common north of Edwards Pillar and around the survey station, and the grey, blue, and red varieties are more common south of Edwards Pillar. However, green quartzites are also present in this area. Towards the southern margin of the quartzite outcrops they are apparently more fissile and more finely jointed than around the Edwards Pillar area. No sedimentary structures that might indicate the orientation of the quartzites were observed. The thickness of the quartzites was not measured although it is estimated to be in excess of 200 metres. Trail (1963) described white meta-quartzites from the summit area of Mount Menzies; England examined them again in 1972. The Mount Menzies and Mount Stinear quartzites are apparently very similar and both are included by Soloviev (1972) in the Menzies Series, although it is not known whether or not he visited Mount Stinear. The 1972 work confirms the stratigraphic correlation of the Mount Menzies and Mount Stinear quartzites.

Edwards Pillar itself is separated from the main mountain by a small saddle excavated in a 50-metre-thick band of dark brown pelitic metasediments. The metasediments (7228/0778, 0780, 0782, 0784, 786, 0814, 0816) are commonly composed of biotite, muscovite, garnet, staurolite, and quartz. They are conformably intersected by an ortho-amphibolite. The pelitic metasediments are believed to be interlayered between the two bands of quartzite that outcrop respectively to the southeast and northwest. However the quartzites were not observed on the east side of the mountain and might be tightly folded around the metasediments.

Near Edwards Pillar the quartzites are cross-cut by ortho-amphibolites (specimens 7228/0788, 0792). The amphibolites in turn are apparently cross-cut by thin dykes of coarse-grained muscovite pegmatites, which are only well exposed in the cliffs on the western side of the mountain.

Away from the Edwards Pillar area a range of rock types clearly of local origin was found on the mountain top, but precise relations were not easily determined. The limit of the quartzite on the north side of Edwards Pillar is marked by a prominent band of brown-weathering garnet-staurolite schist (7228/0774), next to which well jointed dark granitic gneiss (7228/0790), consisting of potash feldspar, quartz, and biotite, with minor sphene and opaques, was found. At its northern end the quartzite apparently dips vertically and strikes about 070, parallel to the foliation of the nearby acid gneiss.

Farther north along the western edge of Mount Stinear, yellowish biotite-muscovite schist (7228/0776) and garnet-bearing biotite-quartz-feldspar gneiss (7228/0772) occur; locally there are conformable bands of amphibolite (7228/0770). These rocks are cross-cut by prominent, thick, presumably later-stage amphibolites, and vertical bands of biotite-quartz-feldspar pegmatite. Subhorizontal quartz veins occupy joint planes.

At the northernmost point visited in 1972, well jointed dark brown to dark grey gneissic granite crops out (7228/0758, 0760), but its relations to the schists and gneisses is not known. The bevelled contact between solid rock and overlying deposits, where the upper surface of the mountain has been planed off by glacial action, is well exposed here (Fig. 17). The granitic rocks are cross-cut by thick, black, mostly vertical orthoamphibolites (7228/0762, 0764, 0766).

A brief visit was made to the area around the small northern cirque on the eastern side of the mountain where only a small icefield remains of the original mountain glacier. From the air the local rocks appear to be well jointed, dark brown-weathering, and cross-cut by prominent amphibolite bands. Dark brown faintly banded felsic gneiss shows saccharoidal and honeycomb weathering, and is cross-cut by amphibolite and muscovite-bearing pegmatites. Apparently similar rocks were seen farther along the eastern cliffs of Mount Stinear.

South from Edwards Pillar the quartzite is slightly more flaggy particularly near its southern boundary, which is marked by an amphibolite. Close to the boundary, outcrops of greenish yellow-weathering garnet-staurolite schist (7228/0810, 0812) strike about 070° and dip vertically.

The floor of the saddle to the south of these pelitic schists is mantled with moraine (Fig. 15) including fragments of calcareous sandstone and banded ironstone. Some 200 metres south of the pelites, pink-brown-weathering, saccharoidal-textured, well jointed biotite-quartz-feldspar gneiss is exposed. It is weakly foliated but merges southwards into more strongly foliated, streaked, and banded biotite-quartz-feldspar gneiss that locally weathers red-brown, dark grey, or brown (7228/0796, 0798, 0806, 0808); foliation is defined by concentrations of biotite in bands and streaks (Fig. 18). Locally the rocks resemble migmatites, but elsewhere sedimentary layering is discernible. The acid gneisses are intruded by cross-cutting biotite-quartz-feldspar pegmatites that are locally ptygmatically folded. As elsewhere on Mount Stinear, thin quartz veins up to 10 cm thick occupy horizontal joint planes. Exposure of the acid gneiss is patchy, but in the cliffs, well developed jointing and associated minor faults and shears can be seen. Some of the larger boulders of gneiss lying on top of the mountain appear to have rod and mullion structures but these may be a weathering

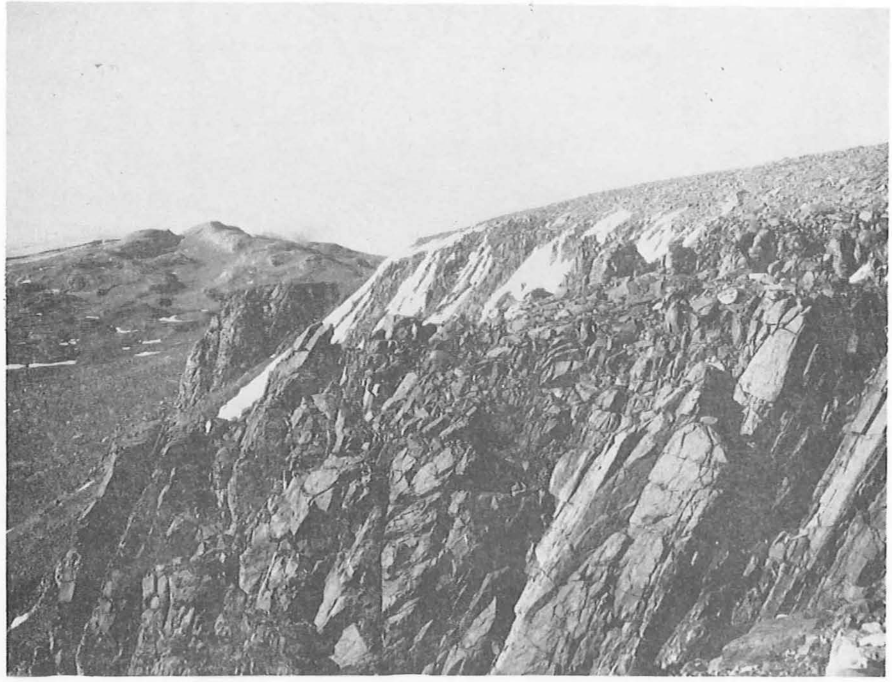

Fig. 17. Mount Stinear. Moraine lying on glacial erosion surface of well jointed gneissic granite

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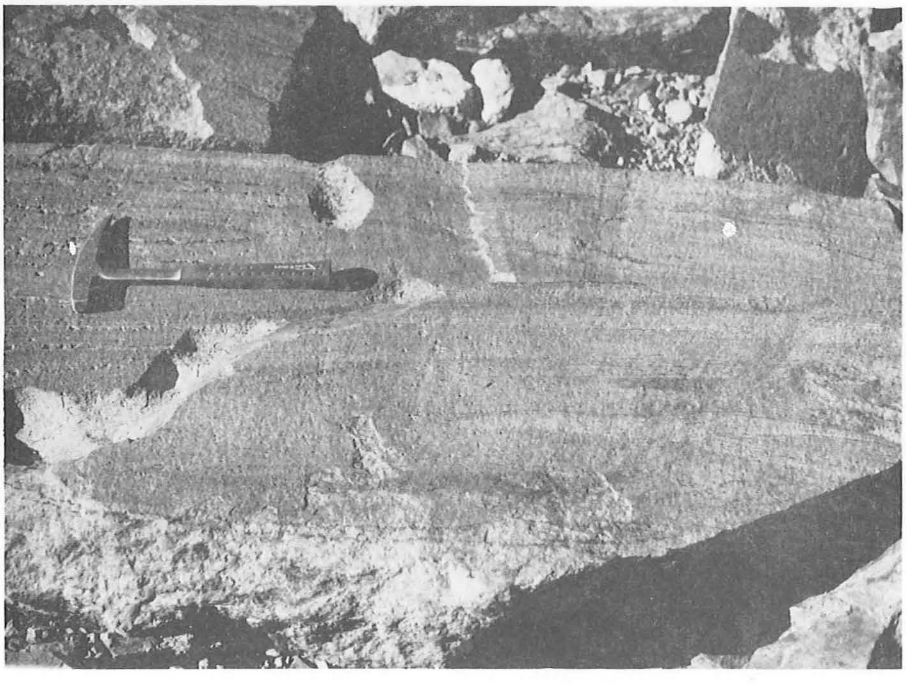

Fig. 18. Mount Stinear. Acid gneiss with streaks of mafic minerals

Neg. GA/8187 RJT

Fig. 19. Mount Stinear. Breccia outcrop found in middle of acid gneiss

Neg. M/1306 RJT

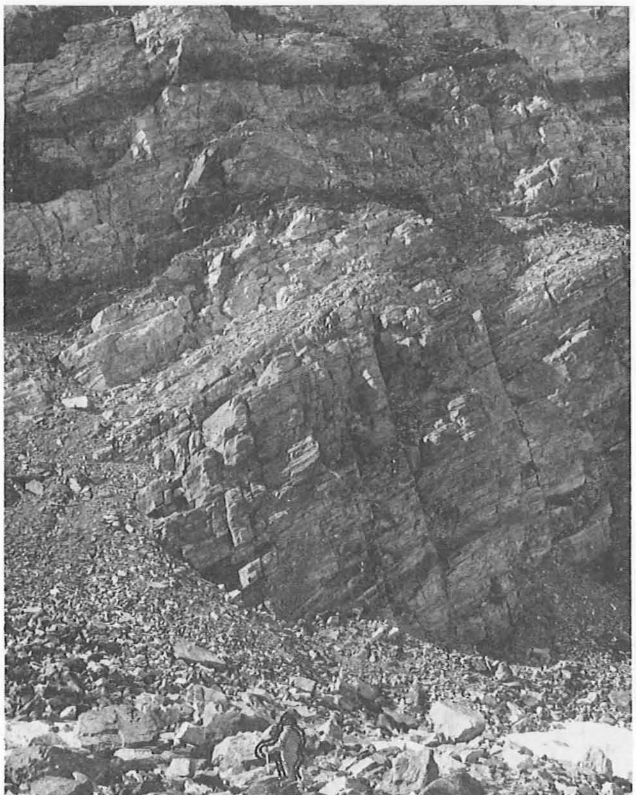

Fig. 20. Mount Stinear. Large-scale interbanding of amphibolites and well jointed metaquartzites exposed at southern end

Neg. M/1306 RJT

rather than a tectonic feature.

An intraformational breccia within the acid gneiss (Fig. 19) is believed to be a product of shearing. The breccia consists of augen of local rocks up to 5 cm x 2 cm set in a fine-grained micaceous matrix.

The acid gneisses are also intersected by prominent bands of amphibolite (7228/0742, 0746, 0802, 0804) up to 30 metres thick. Locally the amphibolites contain fragments of gneiss (e.g. 7228/0804).

At the southern end of Mount Stinear thickly banded metaquartzite (7228/0818) (Fig. 20) is apparently interbanded on a large scale with garnet amphibolite (7228/0820, 0822). Thin pelitic layers within the quartzite contain garnet and staurolite and possible relics of sillimanite.

The presence of kyanite, staurolite, and chlorite in the metamorphosed pelitic rocks, and of blue green hornblende in the metamorphosed basic rocks at Mount Stinear indicate lower amphibolite-facies metamorphism, with moderately high pressures. Retrograde effects are not widespread and assemblages in most rocks appear to be in equilibrium. Possible relics of sillimanite might suggest a high-grade metamorphic episode before the lower amphibolite events. In some pelitic rocks sericite may have replaced cordierite formed in this earlier episode.

Mount Stinear consists of a range of metamorphic rock types with some (e.g. the quartzites and the staurolite-garnet schists) obviously of sedimentary origin and others (e.g. the amphibolites and gneissic granite (7228/0758) of igneous origin. Some acid gneisses (7228/0796, 798, 0806, 0808) consisting almost entirely of biotite, quartz, and microcline may be of sedimentary origin.

MAWSON ESCARPMENT SOUTH 1:250 000 SHEET SS 40-42/8

Harbour Headland

Harbour Headland consists of biotite granitic gneiss, which locally contains hornblende, and encloses rafts, generally several hundred metres across, of mostly pelitic metasediment. The granitic gneiss is intersected by late-stage pegmatites. The best exposures are in the cliffs of the escarpment; the upper and flatter rock surfaces are covered by felsenmeeren of locally derived frost-wedged rock debris.

Metasediment specimen, 7228/0765, a leucocratic garnet gneiss, and specimen 7228/0759, a calc-silicate gneiss, have assemblages that suggest middle amphibolite-facies metamorphism. This metamorphism might have been accompanied by anatexis that produced magma for some of the acid intrusives in the area. In some of the rocks examined low-grade alteration is evident.

South Mawson Escarpment and Rooster Point survey station

Ruker (1963) described specimens (R8855, R8856) collected from the south Mawson Escarpment near where the Rooster Point survey station was established in 1972. He noted that the escarpment in this area consists of medium to coarse-grained biotite-hornblende-feldspar-quartz gneiss intersected by a closely spaced network of amphibolite bands (specimen R8856). Both Ruker (1963) and Trail (1964) show illustrations of the amphibolites at south Mawson Escarpment. Figure 21 of this Record shows that the trends of the amphibolites can be traced through the felsenmeer of frost-wedged rock debris that covers the flat upper rock surfaces of the area; this confirms that the debris is virtually in situ.

The Rooster Point survey station is near the eastern edge of the rock mass from which Ruker's specimens were obtained (see Plate 1). Surveyors working there in 1972 brought back two rock specimens: a fine-grained amphibolite that consists mainly of finely matted actinolite, with biotite, minor chlorite, and opaques (7228/0870), and a leucocratic granite gneiss consisting of quartz, orthoclase, plagioclase, blue-green hornblends, and epidote, with minor opaques (7228/0872). These assemblages and those described by Ruker (1963) indicate amphibolite-facies metamorphism of slightly lower-grade than that which prevailed in the Harbour Headland area.

WILSON BLUFF 1:250 000 SHEET SS 40-42/11

Blake Nunataks aerial observations

The major part of the Blake Nunataks appears to consist of well banded rocks similar to those at Mount Maguire. A large recumbent fold on the western side of the southwestern nunatak (Fig. 23) has a half wavelength of about 500 m and an amplitude of 1500 m; the fold axis is near-horizontal and strikes roughly east-west. The rocks of the southernmost tip of this nunatak appear identical to the metaquartzite of Wilson Bluff; the near-vertical contact with the banded rocks may be a fault.

Mount Maguire

Mount Maguire, a flat-topped, steep-sided nunatak, consists of almost flat-lying dark and light rocks interlayered on a scale of several metres to a few tens of metres. Samples collected from a scree slope at the base of the northwestern side of the mountain are of pelitic composition with minor blue-green hornblende in one and calcite in another. Assemblages are listed in the Appendix. The metamorphic grade is uncertain but it is most likely to be upper greenschist or lower amphibolite facies.

Wilson Bluff

Wilson Bluff consists of two steep-sided gently domes summits joined by a narrow col. In 1972 a visit was made to the southwestern summit, where the dominant rock type is quartzite with minor biotite and calc-silicate minerals. The mineral assemblages of the specimens collected are listed in the Appendix. Whereas the matrix or cement of the original sandstone at Mount Menzies was probably kaolinitic, that of the Wilson Bluff sandstone was probably calcareous. The regional strike is 160° and the predominant dip 20° southwest. Axes of some minor folds in the summit area plunge at about 10° in a direction of about 200°. Irregular, transgressive pegmatites consisting of quartz, microcline, albite, and muscovite are widespread. They are commonly several metres across and several tens of metres long (Fig. 22). In places they contain tourmaline and, at one locality about 1 km west of the col, beryl occurs as large prisms. A later generation of pegmatites which form straight veins striking at 080° and dipping north at 80° was noted by McLeod (1959). The shapes and orientations of the pegmatites are clearly discernible in the largely locally derived debris which covers the flat top and gentle slopes of the mountain.

The metamorphic history of Wilson Bluff is probably complex. Original middle amphibolite-facies assemblages are now overprinted by later lower-grade metamorphic effects. Diopside in the quartzite has been partly replaced by actinolite and epidote. Placioclase in some specimens is fresh labradorite; in others, it has been replaced by ragged aggregates of clinozosite, calcite, and sericite. The presence of muscovite in the pegmatites indicates that they were emplaced at temperatures below those of the upper amphibolite facies.

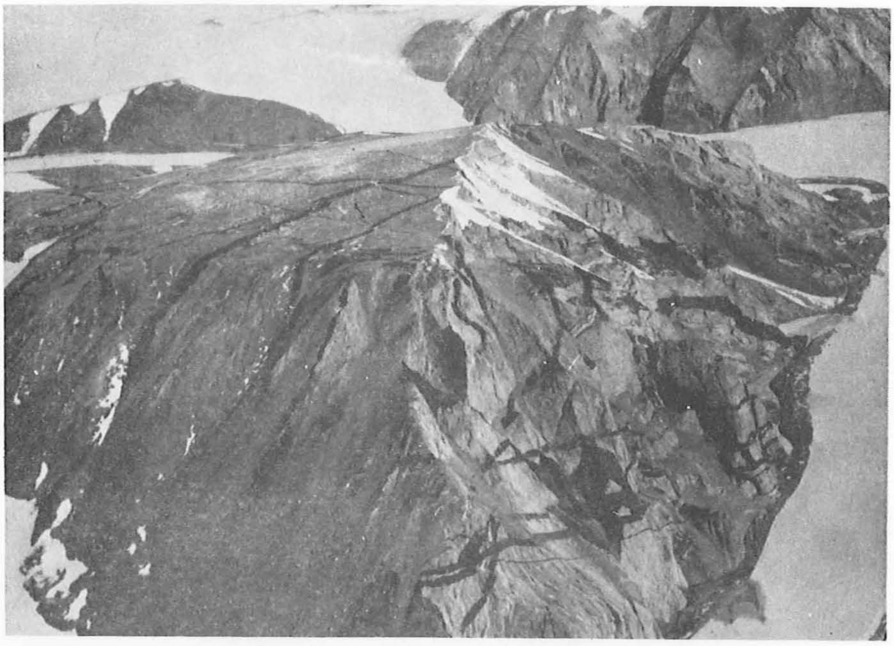

Fig. 21. South Mawson Escarpment. Continuation of trends of solid rock outcrop (in cliffs) into areas covered by frost-heaved rock debris. (From upper surface to lower surface is about 600 m)

Neg. GA/6345 RNE

Fig. 22. Wilson Bluff. Dark brown banded metaquartzite streaked with pegmatite

Neg. GA/6342 RNE

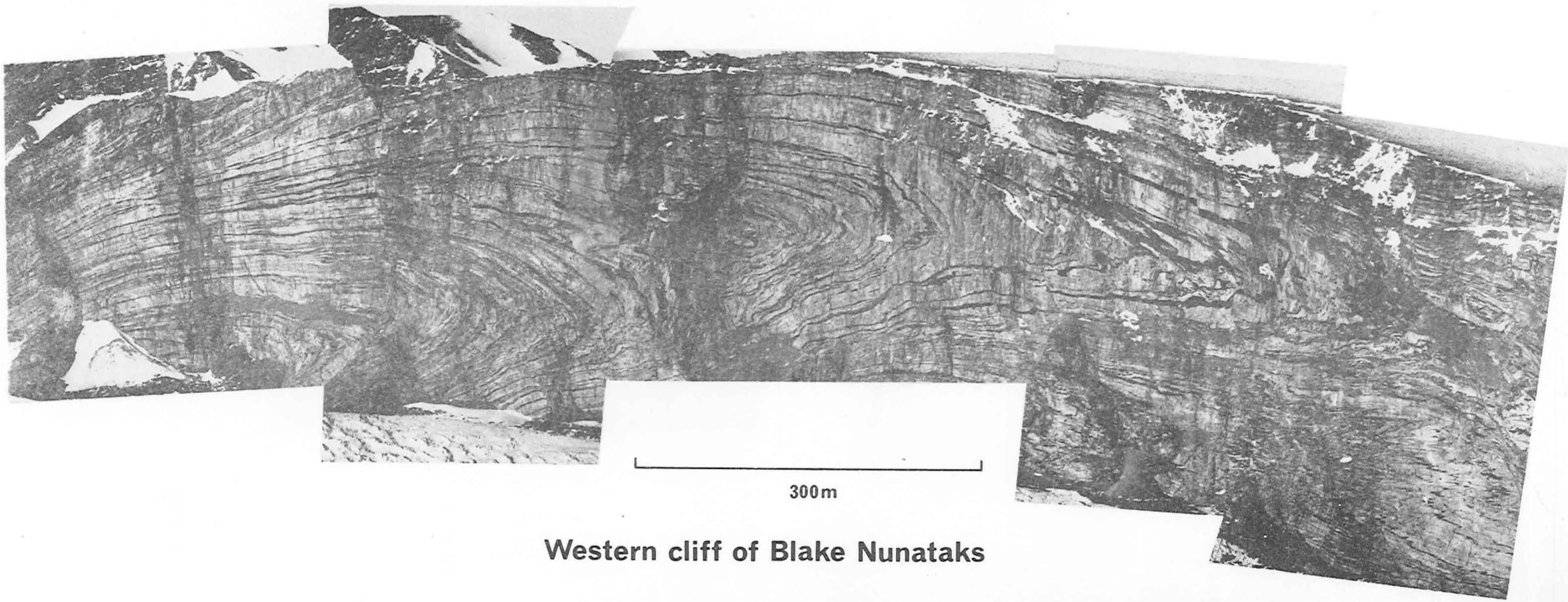

Fig. 23. Blake Nunataks. Large recumbent fold exposed on western side of nunatak

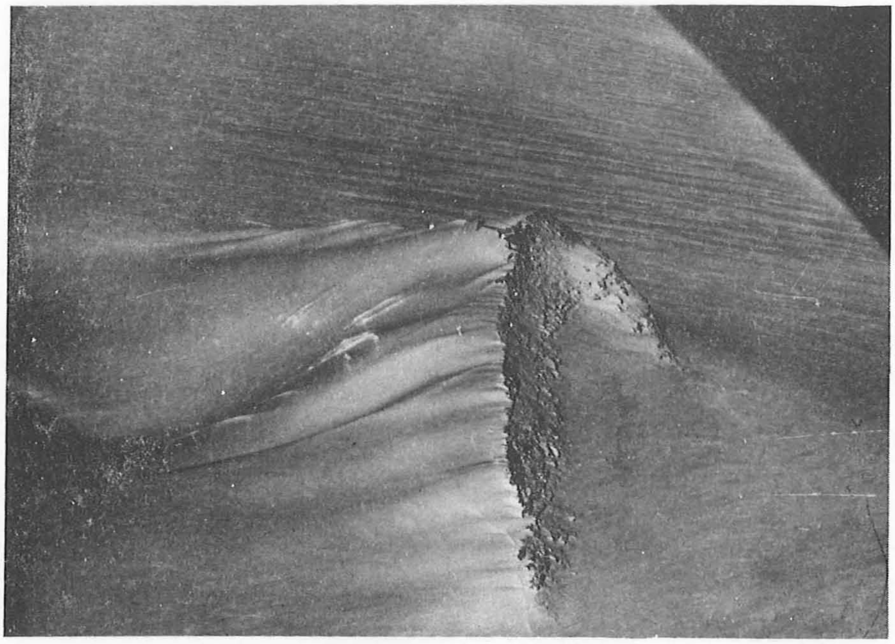

Fig. 24. Komsomol'skiy Peak viewed from the south

Neg. GA/6340 RNE

KOMSOMOL'SKIY PEAK 1:250 000 SHEET SS 40-42/15

Komsomol'skiy Peak

Komsomol'skiy Peak is about 160 km southwest of Wilson Bluff and is the southernmost known outcrop of the Prince Charles Mountains. Its elevation is about 2400 m, and it rises about 700 m above the surrounding ice. Except for one small exposure at the summit, the peak is snow-covered (Fig. 24). The outcrop consists of interlayered bands of leucocratic garnet gneiss and garnet-biotite schist a few metres to tens of metres thick. The rocks dip gently to the south and the axes of minor folds also plunge to the south. In addition to garnet and biotite the schist contains labradorite and quartz; the gneiss has a similar mineral assemblage, but biotite is much less abundant. Both rock types are almost certainly of sedimentary origin.

Nine other samples comprising calc silicate, and acid and basic gneisses were collected from the moraine about 1 km northwest of the mountain. The co-existence of sillimanite, potash feldspar, and quartz in specimen 7228/0755 (a metamorphosed pelitic sediment) and the absence of hypersthene in metabasic rocks suggest that upper amphibolite-facies metamorphism prevailed in the Komsomol'skiy Peak area.

GROVE MOUNTAINS 1:250 000 SHEET SS 43-45/1

Grove Mountains

The Grove Mountains consist of a group of jagged peaks about 200 km east of the Mawson Escarpment (Plate 1). Near Mount Harding, McLeod (1959) described migmatitic gneissic granite and interbanded hornfels cross-cut by veins of medium-grained pink granite. McLeod observed that the remainder of the Grove Mountains was apparently also composed of these rocks.

In 1972 a survey party visited Mount Harding and collected outcrop specimens (7228/0874, 0876) of brown-weathering charnockitic rocks. Specimen 7228/0874 consists of the typical charnockite assemblage: quartz, plagioclase, potash feldspar, brown hornblende and hypersthene, with minor biotite and opaques; 7228/0876 is similar, except that hypersthene was not observed in the thin section. The surveyors reported that Mason Peaks and Wilson Ridge are apparently also composed of massive charnockitic rocks; from a distance they observed large-scale folding at Tate Nunataks.

METAMORPHISM

The metamorphic conditions that prevailed in the parts of the southern Prince Charles Mountains visited during 1972 are summarized below. The presence of kyanite and staurolite in metamorphosed sedimentary rocks suggests that a high-pressure Barrovian-facies series prevailed.

GRANULITE FACIES	Grove Mountains Mount Newton*
UPPER AMPHIBOLITE FACIES	Komsomoloski'y Peak Mount Johns
MIDDLE AMPHIBOLITE FACIES	Mawson Escarpment* Mount Cresswell* Wilson Bluff*
LOWER AMPHIBOLITE FACIES	Mount Maguire Mount Menzies*

Mount Scherger*
Mount Stinear
Seavers Nunatak

GREENSCHIST FACIES

Mount Dummett
Mount Ruker
Mount Rubin

(* indicates that the rocks at these localities were significantly altered by subsequent lower greenschist-facies retrograde metamorphism or contact metamorphism.)

The metamorphic rocks found in the southern Prince Charles Mountains contrast strongly with those observed in earlier years in the northern Prince Charles Mountains. In the southern Prince Charles Mountains:

1) High-pressure metamorphic conditions, as indicated by kyanite in pelitic assemblages, were widespread

2) Granulite-facies rocks are uncommon

3) Anatectic effects are relatively localised

4) A large part of the central area is occupied by low-grade rocks. Elsewhere low-grade retrograde rocks containing chloritoid have been found.

In the northern Prince Charles Mountains sillimanite is the common aluminium-silicate polymorph in rocks of pelitic composition. High-temperature anatectic metamorphic conditions were widespread, and local deficiencies of water during metamorphism caused local formation of hypersthene-granulite-facies rocks (Tingey 1972).

STRATIGRAPHY

The 1972 work showed that some distinctive rocks observed in the area by earlier workers (Trail, 1963; Ruker 1963) are more widely distributed than was previously thought. Thus the quartzite unit seen by Trail near the summit of Mount Menzies was found in outcrop near Edwards Pillar on Mount Stinear.

The low-grade epidote-chlorite rocks noted by Ruker at Mount Seddon and Mount Dummett are probably similar in composition to the higher-grade kyanite-bearing rocks noted in 1972 at Mount Scherger and Seavers Nunatak, and are possibly members of the same stratigraphic unit. The strongly banded rocks of the Blake Nunataks/Mount Maguire area resemble the higher-grade rocks at Mount Johns, but, at other places visited, local acid intrusives have masked the more obvious features of the local rocks, and no groupings are possible.

Low-grade rocks collected at Mount Rubin and Mount Ruker apparently belong to the same stratigraphic unit - named the Sodruzhestvo Series by Soloviev (1972) - but present knowledge of the area does not allow either confirmation or denial of the grouping.

Soloviev (1972) grouped the Mount Menzies, Mount Dummett, Mount Seddon, Mount Rymill, and Mount Stinear rocks together into the 'Middle Proterozoic' Menzies Series, and proposed that they were younger than the middle to upper amphibolite-facies rocks of the southern Prince Charles Mountains (e.g., Mount Cresswell, Mawson Escarpment, Wilson Bluff), and older than the low-grade chlorite-epidote-calcite-bearing banded metasediments of the Mount Rubin and Mount Ruker area, the Sodruzhestvo Series. Soloviev's age groupings tend to correlate the age of rocks with the intensity or grade of metamorphism, but no determinations have been made of the age of rocks in the southern Prince Charles Mountains area.

STRUCTURE

Trends of the various rock units observed at the localities visited during the season are marked on the map (Plate 1), but no regional pattern of structures is discernible at present.

ECONOMIC GEOLOGY

Soloviev (1972) reported jaspilites 70 m thick at Mount Ruker but the locality was not visited during the 1972 field season. Fragments of banded iron formation and jaspilite were found in moraine on the top of Mount Stinear, but no outcrops were seen. No other minerals or rocks of possible economic significance were found during the 1972 season.

CONCLUSIONS

The 1972 geological work in the southern Prince Charles Mountains was planned as a reconnaissance for a larger-scale geological program in 1973. This objective was achieved, but the localities visited during the season were widely scattered through the region and few detailed conclusions can be drawn from the work. However the work did show that:

1. The quartzite unit observed by Trail (1963) at Mount Menzies is widely distributed

2. High-pressure, moderate-temperature kyanite-grade metamorphism is recognizable at a number of places in the central part of the southern Prince Charles Mountains

3. Locally, retrograde metamorphism and thermal metamorphism have modified previously metamorphosed rocks

4. Upper amphibolite facies metamorphism with attendant anatexis occurred at widely scattered localities

5. Glacial erosion features are well preserved in the area indicating that (a) the mountain tops have been only recently rid of permanent ice cover, (b) the level of the plateau ice has recently and rapidly fallen, and (c) the former directions of ice movement were parallel to the modern glacial flow directions.

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APPENDIX

Summary of Thin-section descriptions

The data are arranged on the basis of 1:250 000 sheet areas.

Rock numbers prefixed 'R' were described by W.R. McCarthy of AMDEL and were collected by Trail (1963) or Ruker (1963). Rocks collected by McLeod (1959) have four figure numbers e.g. 4569 and no prefix, and 1972 rocks are prefixed 7228/.

Specimen Number	Assemblage	Classification (with comments)
Harbour Headland		
7228/0759	Quartz, plagioclase (An 50), cummingtonite, actinolite, garnet, chlorite, opaques.	ACID GNEISS
7228/0761	Hornblende, plagioclase, quartz, garnet, opaques.	AMPHIBOLITE (Hornblende is green)
7228/0763	Hornblende, plagioclase, quartz, opaques.	AMPHIBOLITE (Hornblende is green, and fibrous)
7228/0765	Quartz, plagioclase (An 35), garnet, biotite.	LEUCOGNEISS
7228/0767	Hornblende, plagioclase, quartz.	AMPHIBOLITE (Hornblende is green)
7228/0769	Quartz, microcline, plagioclase, biotite, and traces of sericite.	GRANITE
7228/0775a	Diopside, garnet, epidote, calcite, sphene.	SKARN } Interbanded
7228/0775b	Hornblende, actinolite, quartz, biotite, opaques, calcite.	AMPHIBOLITE } Interbanded
Mawson Escarpment (South)		
R8855	Quartz, 45%, plagioclase (An 40) 30%, microcline 20%, biotite 3% hornblende 2%.	ACID GNEISS
R8856	Hornblende 40%, plagioclase (An 40) 40%, chlorite 10%, quartz 10% traces of apatite and opaques.	AMPHIBOLITE
Rooster Point Survey Station		
7228/0870	Actinolite, plagioclase, opaques, quartz, biotite.	AMPHIBOLITE (Actinolite finely matted)
7228/0872	Quartz, orthoclase, plagioclase, hornblende, epidote, sphene, opaques, and traces of biotite.	LEUCOGNEISS (Hornblende is blue-green)

Specimen Number	Assemblage	Classification (with comments)
Mount Menzies		
R11355	Quartz 95%, chloritoid 4%, and minor muscovite.	CHLORITOID QUARTZITE
R11356	Quartz 90%, chloritoid 3%, chlorite 2%, and traces of zircon.	QUARTZITE (Chloritoid altered to chlorite)
R11357	Quartz 50%, actinolite 47%, epidote 3%, and minor opaques.	AMPHIBOLITE (Greenschist facies assemblage)
R11358	Chloritoid 60%, quartz 35%, chlorite 5%, and traces of sericite, sphene, zircon and opaques.	CHLORITOID SCHIST (Chloritoid altered to sericite and chlorite)
R11359	Actinolite 75%, plagioclase (An 40) 15%, cummingtonite 5%, quartz 4% and minor opaques.	AMPHIBOLITE (Probably greenschist facies)
R11360	Quartz 97%, chloritoid 2%, chlorite 1%, and traces of opaques.	CHLORITOID QUARTZITE (Chlorite retrogressively altered to chlorite)
R11361	Quartz 90%, muscovite 7%, chloritoid 3%, and traces of zircon and opaques.	CHLORITOID QUARTZITE (Deformed and retrogressed)
R11362	Quartz 90%, muscovite 5%, chlorite 5%, garnet 1%, and traces of chloritoid, biotite, and opaques.	GARNET-MUSCOVITE QUARTZITE (Chlorite replaces chloritoid)
R11363	Actinolite 85%, quartz 12%, epidote 2% and traces of plagioclase apatite, zircon, and opaques.	AMPHIBOLITE (Greenschist facies assemblage)
R11580	Quartz 90%, sericite 10%, and traces of chlorite, and opaques.	SERICITE QUARTZITE
R11581	Quartz 60%, chloritoid 15%, muscovite 15%.	PELITIC SCHIST
7228/0713	Quartz 50%, chloritoid 30%, chlorite 15%, muscovite 5%, and possible kyanite relicts.	CHLORITOID QUARTZITE (Chloritoid altered to chlorite: staurolite seen in hand specimen)
7228/0713D	Quartz, chloritoid, chlorite, kyanite, muscovite, and minor pyrite.	PELITIC SCHIST
7228/0713E	Quartz, kyanite, muscovite, and pyrophyllite.	KYANITE QUARTZITE (Muscovite replaces pyrophyllite)
7228/0713F	Quartz, kyanite, muscovite.	QUARTZITE
7228/0713G	Quartz, kyanite, muscovite.	QUARTZITE (Kyanite deformed but not greatly altered)
7228/0713H	Chlorite, opaques, muscovite, quartz, garnet and epidote.	METABASIC (Very fine grained; relict basaltic texture)
7228/0713I	Quartz, kyanite, chloritoid, muscovite.	QUARTZITE (Kyanite altered to chloritoid)
7228/0713J	Quartz, chloritoid, muscovite, and minor opaques.	PELITIC SCHIST
7228/0713K	Actinolite, chlorite, chloritoid, garnet, quartz, calcite, pyrite, ilmenite, and clinozoisite.	METABASIC (Garnets largely replaced by chlorit and chloritoid)
7228/0713L	Quartz, kyanite, chlorite, chloritoid.	QUARTZITE
7228/0713M	Quartz, muscovite.	QUARTZITE
7228/0713N	Quartz, muscovite, chlorite.	QUARTZITE
7228/0713P	Quartz, chloritoid, muscovite and relict staurolite.	QUARTZITE
7228/0713Q	Quartz, chloritoid, chlorite, muscovite.	QUARTZITE
7228/0715A	Plagioclase, chlorite, calcite, zoisite, and minor ilmenite.	METABASIC (Possible metamorphosed plagioclase cumulate)
7228/0715B	Actinolite, chlorite, quartz, calcite, and minor opaques.	AMPHIBOLITE
7228/0715C	Quartz, chloritoid, muscovite.	QUARTZITE
7228/0715D	Quartz, chlorite, muscovite, kyanite.	QUARTZITE
7228/0715E	Actinolite, epidote, quartz, opaques.	METABASALT (Retrogressed)
Mount Scherger		
7228/0836	Quartz, biotite, muscovite, chlorite, sillimanite, and minor opaques.	MICA SCHIST (Biotite altered to sillimanite by contact metamorphism)
7228/0838	Quartz, orthoclase, plagioclase, muscovite, sillimanite.	ADAMELLITE (Muscovite partly altered to sillim
7228/0840	Quartz, microcline, plagioclase, muscovite.	PEGMATITE
7228/0842	Quartz, plagioclase, muscovite.	GRANODIORITE (Coarse grained dyke rock)
Seavers Nunatak		
7228/0700A	Quartz, potassium feldspar, plagioclase, biotite, muscovite.	GRANITE (Foliated granite; aligned mafic minerals define foliation)
7228/0700B	Quartz, plagioclase, muscovite, biotite, staurolite, kyanite.	PELITIC SCHIST
7228/0704	Quartz, biotite, and traces of chlorite and epidote.	MICA SCHIST (Biotite partly altered to epidote)
7228/0706	Quartz, orthoclase, garnet, biotite, and minor plagioclase.	GARNET-MICA SCHIST

Specimen Number	Assemblage	Classification (with comments)
Seavers Nunatak (cont)		
7228/0878	Quartz, potassium feldspar, plagioclase, ferrohastingsite, and minor epidote.	GRANITE
7228/0880	Quartz, potassium feldspar, plagioclase, ferrohastingsite biotite, and minor sphene.	GRANITE
7228/0932	Quartz, muscovite, calcite, epidote, and minor opaques.	MICA SCHIST

Specimen Number	Assemblage	Classification (with comments)
Mount Dummett		
R8841	Epidote, hornblende, quartz, microcline, plagioclase, opaques, with traces of apatite, sphene, and zircon.	AMPHIBOLITE (Greenschist facies assemblage)
R8842	Quartz 49%, calcite 49%, tremolite 2%	MARBLE
7228/0846	Quartz, microcline, plagioclase, muscovite.	GRANITE (Coarse grained dyke-rock)
7228/0848	Microcline, quartz, plagioclase, muscovite.	PEGMATITE
7228/0850	Quartz, plagioclase, epidote, actinolite, and opaques.	QUARTZITE (Sheared rock)
7228/0852	Quartzite, epidote, biotite, muscovite, and opaques.	QUARTZ SCHIST
7228/0854	Quartz, epidote, biotite, actinolite, potassium feldspar, and opaques.	QUARTZITE (Grey-green in hand specimen)
Mount Newton		
7228/0710	Quartz, chloritoid, chlorite, garnet, sericite.	PELITIC SCHIST (Garnet relict only: much broken and altered to chlorite)
7228/0712	Quartz, chloritoid, sericite, and opaques.	PELITIC SCHIST (Greenschist facies assemblage resulting from retrograde metamorphism)
7228/0714	Quartz, chlorite, garnet, sericite, opaques.	METAPELITE (Garnets broken up. Greenschist facies assemblage)
7228/0716	Quartz, chloritoid, sericite.	PELITIC SCHIST
7228/0718	Actinolite, blue-green hornblende, plagioclase, quartz, sphene, and opaques.	AMPHIBOLITE (Greenschist facies assemblage)
7228/0720	Quartz, potassium feldspar, plagioclase, biotite, garnet, opaques & traces of chlorite.	ACID GNEISS (Banded rock. Garnet altered to chlorite and biotite associated with vermicular ore)
7228/0722	Quartz, plagioclase, potassium feldspar, garnet, biotite and chlorite,	PELITIC GNEISS (Biotite has rutile inclusions. Garnet altered to chlorite)
7228/0724	Hornblende, plagioclase, quartz, hypersthene, garnet, and opaques.	BASIC GRANULITE (Slightly retrogressed. Orthopyroxene largely converted to hornblende. Hornblende green-brown)
7228/0726	Hypersthene, tremolite, biotite.	ORTHOPYROXENITE (Tremolite and biotite are secondary alteration products)
7228/0728	Quartz, plagioclase, possible cordierite, garnet, biotite, sillimanite, and opaques.	PELITIC GNEISS (Minor retrograde alteration)
7228/0730	Quartz, plagioclase, cordierite, garnet, biotite, sillimanite and opaques.	PELITIC GNEISS (Minor retrograde alteration)
7228/0732	Quartz, plagioclase, garnet, biotite, sillimanite, and opaques.	PELITIC GNEISS (Minor retrograde alteration)
7228/0734	Quartz, plagioclase, biotite, muscovite, and opaques.	GRANODIORITE
7228/0736	Quartz, plagioclase, biotite, muscovite,	GRANODIORITE
Mount Rubin		
7228/0824	Quartz, calcite, plagioclase.	QUARTZ SCHIST
7228/0826	Quartz, chlorite.	QUARTZ SCHIST
7228/0828	Quartz, sericite, calcite, chlorite.	MICA SCHIST
7228/0830A	Quartz, sericite, calcite, biotite, epidote, chlorite, and opaques.	MICA SCHIST (Biotite as square porphyroblasts)
7228/0830B	Quartz, sericite, calcite, chlorite, biotite, epidote, opaques, and tourmaline.	MICA SCHIST (Biotite as square porphyroblasts)
7228/0832	Quartz, sericite, calcite, epidote, opaques.	MICA SCHIST
Mount Ruker		
7228/0856	Plagioclase, augite, opaques, with traces of hornblende and chlorite.	THOLEIITIC DOLERITE
7228/0858	Actinolite, plagioclase, biotite, sphene, opaques.	AMPHIBOLITE
7228/0864	Actinolite, plagioclase, opaques, sericite.	METADOLERITE (Rock extensively uralitised)
7228/0866	Quartz, opaques, chlorite, biotite, and minor tourmaline.	METAGREYWACKE (Banded rock with possible slump structures)
7228/0868	Quartz, biotite, sericite, chlorite, actinolite, and opaques.	METASEDIMENT (Fine grained banded siliceous rock. Possibly a slightly metamorphosed impure sandstone)

Specimen Number	Assemblage	Classification (with comments)
Mount Stinear		
7228/0742	Hornblende, plagioclase, microcline, quartz, biotite, and opaques.	AMPHIBOLITE (Hornblende is blue-green)
7228/0746	Hornblende, plagioclase, quartz, biotite, opaques, and sphene.	AMPHIBOLITE (Hornblende is blue-green)
7228/0750A	Quartz, muscovite.	QUARTZITE (Muscovite is variety fuchsite)
7228/0752	Quartz, kyanite, muscovite (var. fuchsite), rutile.	QUARTZITE
7228/0754	Quartz, kyanite, muscovite (var. fuchsite), rutile.	QUARTZITE
7228/0756	Quartz, muscovite, (var. fuchsite), rutile and traces of opaques.	QUARTZITE
7228/0758	Quartz, microcline plagioclase, ferrohastingsite, biotite, opaques, calcite.	GNEISSIC GRANITE
7228/0760	Quartz, microcline, plagioclase, ferrohastingsite, biotite, opaques.	GNEISSIC GRANITE
7228/0762	Hornblende, plagioclase, quartz, opaques, biotite.	AMPHIBOLITE (hornblende is blue-green)
7228/0764	Hornblende, plagioclase, quartz, opaques, biotite.	AMPHIBOLITE (Hornblende is blue-green)
7228/0766	Hornblende, plagioclase, quartz, opaques, biotite.	AMPHIBOLITE (Hornblende is green)
7228/0768	Quartz, staurolite, biotite.	PELITIC GNEISS
7228/0770	Hornblende, plagioclase, quartz, opaques.	AMPHIBOLITE (Hornblende is blue-green)
7228/0772	Quartz, biotite, opaques, muscovite, chlorite.	BIOTITE GNEISS (Garnet in hand specimen)
7228/0774	Quartz, staurolite, garnet, biotite, chlorite.	PELITIC GNEISS
7228/0776	Quartz, biotite, muscovite, chlorite, opaques, sericite, and relict garnets.	BIOTITE GNEISS (Garnet almost wholly converted to chlorite and plagioclase altered to sericite by retrograde metamorphism)
7228/0778	Quartz, garnet, staurolite, biotite, muscovite, opaques, chlorite sericite.	PELITIC GNEISS (Sericite result of retrograde alteration)
7228/0780	Quartz, staurolite, biotite, chlorite, muscovite, opaques, sericite.	PELITIC GNEISS (Sericite result of retrograde alteration. Chlorite may pseudomorph kyanite)
7228/0782	Quartz, muscovite, staurolite, biotite, chlorite, sericite.	PELITIC SCHIST
7228/0784	Quartz, muscovite, biotite, staurolite, opaques.	PELITIC SCHIST
7228/0786	Quartz, staurolite, garnet, muscovite, chlorite, sericite, opaques.	PELITIC SCHIST
7228/0788	Hornblende, actinolite, plagioclase, chlorite, clinozoisite, opaques, sphene.	AMPHIBOLITE
7228/0790	Quartz, microcline, biotite, sphene, opaques.	ACID GNEISS (Note - No plagioclase)
7228/0792	Hornblende, plagioclase, quartz, opaques.	AMPHIBOLITE (Hornblende is blue-green)
7228/0796	Quartz, microcline, ferrohastingsite, opaques, sphene, and minor monazite.	ACID GNEISS (Note - No plagioclase)
7228/0798	Quartz, microcline, biotite.	ACID GNEISS (Note - No plagioclase)
7228/0800	Quartz, biotite, muscovite, chlorite, opaques.	BRECCIA
7228/0802	Hornblende, quartz, biotite, opaques, sphene, calcite.	AMPHIBOLITE (Hornblende is dark green)
7228/0804	Hornblende, quartz, microcline, chlorite, biotite, opaques, and minor allanite.	AMPHIBOLITE (Rock has inclusions of acid gneiss)
7228/0806	Quartz, microcline, biotite.	ACID GNEISS (Note - No plagioclase)
7228/0808	Quartz, microcline, biotite.	ACID GNEISS (Note - No plagioclase)
7228/0810	Quartz, staurolite, garnet, muscovite, biotite, sericite.	PELITIC SCHIST (Sericite partly replaces staurolite)
7228/0812	Quartz, staurolite, sericite, biotite.	PELITIC SCHIST (Sericite may replace plagioclase)
7228/0814	Quartz, staurolite, garnet, biotite, plagioclase, opaques.	PELITIC GNEISS
7228/0816	Quartz, staurolite, biotite, garnet, sericite, chlorite, opaques.	PELITIC GNEISS (Sericite may replace plagioclase)
7228/0818	Quartz, garnet, staurolite, biotite, chlorite, opaques.	PELITIC GNEISS (Garnet and staurolite in long stringers: may replace sillimanite)
7228/0820	Hornblende, biotite, microcline, quartz, garnet, opaques.	AMPHIBOLITE (Hornblende is blue green. Possibly a para-amphibolite)
7228/0822	Hornblende, chlorite, quartz, biotite, garnet, opaques, calcite.	AMPHIBOLITE (Hornblende is blue green. Possibly a para-amphibolite)

Specimen Number	Assemblage	Classification (with comments)
Mount Maguire		
7228/0757A	Quartz, hornblende, biotite, garnet, opaques.	METAPELITE (Banded and layered rock)
7228/0757B	Quartz 50%, calcite 30%, muscovite, biotite.	METAQUARTZITE
7228/0757C	Quartz, plagioclase, garnet, chlorite, biotite, sericite.	METAPELITE (Mineral identified as plagioclase is very altered; it may be cordierite)
7228/0757D	Quartz, muscovite, garnet, biotite, opaques.	MICA SCHIST
Wilson Bluff		
4568	Quartz, plagioclase (An 50), biotite, muscovite, cummingtonite, opaques.	BIOTITE-QUARTZ SCHIST
4569	Quartz, plagioclase, biotite, hornblende, garnet, opaques, tourmaline.	BIOTITE-QUARTZ SCHIST (Hornblende is dark green)
7228/0717	Quartz, diopside, muscovite, epidote, actinolite.	METAMORPHOSED CALCAREOUS SANDSTONE (Alternate diopside rich and quartz rich layers)
7228/0719	Quartz, biotite, actinolite.	METAQUARTZITE
7228/0721	Quartz, biotite, actinolite.	METAQUARTZITE (Has actinolite rich layers)
7228/0723	Quartz, plagioclase, biotite, actinolite.	ACID GNEISS (Banded)
7228/0725	Microcline, plagioclase, quartz, and minor muscovite.	PEGMATITE
7228/0727	Quartz, diopside, plagioclase, actinolite.	CALC-SILICATE GNEISS (Actinolite is secondary)
7228/0729	Microcline, quartz, plagioclase, muscovite.	PEGMATITE
7228/0731	Diopside, quartz, plagioclase, actinolite.	CALC-SILICATE GNEISS
7228/0733	Quartz, diopside, plagioclase, sphene, opaques, and traces of apatite.	CALC-SILICATE GNEISS
7228/0735	Diopside 75%, calcite, potassiam feldspar, plagioclase, actinolite, epidote.	CALC-SILICATE GNEISS (Actinolite is secondary).

Specimen Number	Assemblage	Classification (with comments)
Komsomol'skiy Peak		
7228/0737A	Quartz, plagioclase, biotite, garnet.	LEUCOGNEISS (From summit)
7228/0737B	Plagioclase, biotite, quartz, garnet, opaques.	SCHIST (From summit)
7228/0737C	Quartz, plagioclase, biotite, garnet, epidote, opaques.	SCHIST (From summit)
7228/0737D	Quartz, microcline, plagioclase, garnet, biotite, opaques.	LEUCOGNEISS (From summit)
7228/0739	Diopside, plagioclase, actinolite, biotite, sphene, opaques.	CALC-SILICATE GNEISS (From moraine)
7228/0741	Diopside, quartz, sphene, scapolite, opaques.	CALC-SILICATE GNEISS (From moraine)
7228/0743	Plagioclase, hornblende, biotite, quartz, opaques.	BASIC GNEISS (From moraine; Hornblende is brown)
7228/0745	Hornblende, plagioclase, biotite, quartz, opaques.	AMPHIBOLITE (From moraine; Banded rock. Hornblende is green)
7228/0747	Quartz, plagioclase, biotite, hornblende, diopside.	BIOTITE GNEISS (From moraine; Banded rock. Hornblende is brown)
7228/0749	Quartz, plagioclase, microcline, biotite, hornblende, sphene, opaques.	BIOTITE GNEISS (From moraine; Banded rock. Hornblende is brown)
7228/0751	Quartz, plagioclase, biotite, garnet.	LEUCOGNEISS (From moraine)
7228/0753	Quartz, microcline, plagioclase.	PEGMATITE (From moraine)
7228/0755	Quartz, plagioclase, microcline, biotite, sillimanite.	PELITIC GNEISS (From moraine)
7228/0757	Quartz, microcline, plagioclase, hornblende, biotite, opaques.	GRANITE GNEISS (From moraine; Hornblende is green-brown

Specimen Number	Assemblage	Classification (with comments)
Near Mount Harding		
4570	Quartz, perthitic microcline, plagioclase (An 20), biotite, opaques, and traces of apatite, and zircon.	LEUCOGNEISS
4571	Perthitic microcline 50%, quartz, plagioclase (An20), biotite, hornblende.	GRANITE
4572	Diopside, phlogopite.	CALC-SILICATE GNEISS
7228/0874	Quartz, microcline, plagioclase, hypersthene, biotite, hornblende, opaques.	CHARNOCKITE (Hornblende is brown)
7228/0876	Quartz, microcline, plagioclase, biotite, hornblende, opaques.	CHARNOCKITE (Hornblende is brown)

Specimen Number	Assemblage	Classification (with comments)
Mount Cresswell		
R8849	Quartz 50%, plagioclase (An 35) 40%, Biotite 9%, Zircon Tr.	GNEISS
R8850	Hornblende, plagioclase (An 32), chlorite, epidote, with traces of apatite, sphene, zircon and opaques.	AMPHIBOLITE
R8851	Hornblende, plagioclase, quartz, garnet, biotite. Minor apatite, sphene, zircon, and opaques.	AMPHIBOLITE
R8852	Quartz, microcline, plagioclase (An 15), muscovite, garnet, and minor tourmaline.	PEGMATITE
R8853	Quartz, microcline, plagioclase (An 10).	PEGMATITE
7228/0705	Hornblende, plagioclase, quartz, garnet, opaques.	AMPHIBOLITE
7228/0707A	Quartz, potassium feldspar, plagioclase, biotite, garnet, with minor tourmaline.	BANDED GARNET-BIOTITE GNEISS
7228/0707B	Hornblende, plagioclase, biotite, quartz, with minor ilmenite.	AMPHIBOLITE
7228/0709B	Diopside, quartz, blue-green hornblende, epidote.	CALC-SILICATE GNEISS
7228/0709D	Quartz, plagioclase, garnet, biotite.	BIOTITE-GARNET SCHIST
7228/0711B	Quartz, plagioclase, cordierite, staurolite, anthophyllite, and minor opaques.	META-PELITE (not in situ)
Mount Johns		
7228/0771	Green-brown hornblende, plagioclase, augite, quartz, and minor opaques.	AMPHIBOLITE
7228/0773	Quartz, plagioclase, green-brown hornblende, and minor opaques.	ACID GNEISS

SOUTHERN PRINCE CHARLES MOUNTAINS
GEOLOGICAL EXPLORATION BEFORE 1973