DESCRIPTION OF SOME MT PAINTER ROCKS

Department of Mines & Energy
South Australia

1/15/0-GS1691/80 January 1980

The Australian
Mineral Development
Laboratories

Flemington Street, Frewville,
South Australia 5063
Phone Adelaide 79 1662
Telex AA 82520

Please address all
correspondence to
P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

17 January 1980

GS 1/15/0
Your ref: 12.05.0082

Director-General,
Department of Mines & Energy,
EASTWOOD.

Attention: John Drexel

REPORT GS 1691/80

YOUR REFERENCE:	Application dated 4 October 1979
MATERIAL:	40 rock specimens
LOCALITY:	Mt Painter region
IDENTIFICATION:	Samples 6737 RS 1044-1083
DATE RECEIVED:	9 October 1979
WORK REQUIRED:	Petrographic description and interpretation; identification of some minerals.

Investigation and Report by: Sylvia Whitehead
X-ray Diffraction Analyses by: Dr Roger Brown

Manager, Geological Services Division: Dr Keith J. Henley

Keith Henley

for Norton Jackson,
Managing Director.

Pilot Plant: Osman Place
Thebarton S.A.
Telephone 43 8053
Branch Laboratory: Perth

meo/62

DESCRIPTION OF SOME MT PAINTER ROCKS

1. SUMMARY

Sample and Thin Section No's.	Lithology
6737	
RS 1044, JFD 113A/79; TS42310	Granitic rock of undetermined origin in which there is some evidence of metasomatic alteration resulting in replacement of some minerals by aggregates of muscovite and a little hematite. There are no relict textures to show the history of the microcline but some has been partly replaced by migratory (or secondary?) quartz.
RS 1045, JFD 113D/79; TS42311	Extensively sheared and granulated granitic or gneissic rock.
RS 1046, JFD 113F/79; TS42312	Granitic breccia with a zone or zones containing specular hematite, some of which has crystallized in situ. A finer-grained zone contains abraded quartz and local concentrations of tourmaline fragments and grains which have not moved far from their place of origin. It differs from the siltstones found in some breccias in that the grains or fragments are not well sorted and are mixed with a high proportion of sericitic matrix. Its exact origin is uncertain.
RS 1047, JFD 114/79; TS42313	Metasomatic rock containing remnants of biotite-plagioclase schist or gneiss with minor corundum, zircon or xenotime and a ?metamict mineral. This has been invaded by an abundance of quartz and films of microcline have developed along boundaries between quartz and plagioclase and between quartz and biotite schist.
RS 1048, JFD 116/79; TS42314	Silicified "mylonite" containing quartz, microcline, tourmaline and hematite in a very fine-grained matrix probably once containing a high proportion of mica or clay. Some textures suggest flow movement. It is in contact with fractured, microcline-rich rock which also contains secondary quartz.
RS 1049, JFD 117/79; TS42315	Quartz-albite rock probably of metasomatic origin (?soda leucogranite). The rock has been deformed.
RS 1050, JFD 119/79; TS42316	Granitic breccia. Most of the clasts are of microcline which shows textures suggesting that it crystallized across an earlier rock. There is conflicting evidence concerning the biotite, some of which appears to be remnants included in microcline and some occurs in interstices. Tourmaline has been introduced at some stage and has been fractured and partly replaced by quartz.

Sample and Thin Section No's.	Lithology
6737	
RS 1051, JFD 121/79; TS42317	Possibly soda leucogranite of undetermined origin. The pink is potash feldspar which occurs in irregular patches in some plagioclase crystals and may have replaced fractured zones in plagioclase.
RS 1052, JFD 122B/79; TS42318	Contact between coarser-grained hematitic breccia containing some lithic clasts and a finer-grained hematitic breccia composed mainly of hematite and quartz. The thin section does not show any definite evidence from which to determine the relationship between these breccias.
RS 1053, JFD 122C/79; TS42319, 42320	Hematitic breccia showing evidence of repeated 'reworking' by fracturing and at least some episodes during which fragments were moved by fluid. There are certainly clasts of hematitic breccia but it is not possible to determine whether the large area is part of a clast. Evidence indicates a complex history and there were once some moderately large, intergrown, crystals of an undetermined mineral now replaced by quartz.
RS 1054, JFD 122D/79; TS42321	A zone of silicified 'silty material' shows evidence of disturbed or mobilized layering and it contains some clasts of granitic rock, biotite rock or schist, hematitic breccia and goethite. A few clasts have a thin rim containing K-feldspar but others do not show any evidence of reaction.
RS 1055, JFD 123A/79; TS42322	Silicified rock of undetermined origin. It contains very small remnants of ?pyroxene in patches of coarser-grained quartz.
RS 1056, JFD 123B/79; TS42323	A silicified rock probably related to JFD 123A/79 but in which there is no conclusive evidence of origin. (A volcanic rock is one possibility.)
RS 1057m JFD 124/79; TS42324	Silicified rock with minor clay in small 'voids' lined with quartz crystals. There is insufficient evidence from which to determine the origin of this rock.
RS 1058, JFD 125/79; TS42325	Fine-grained, layered, metasediment composed of feldspars, tremolite and quartz and with minor biotite. Some layers are mainly K-feldspar, others mainly albitic plagioclase.
RS 1059, JFD 126/79; TS42326	Porphyritic soda granite (or soda microgranite) containing abundant albitic plagioclase and practically no K-feldspar. There is evidence of reaction between minerals and metasomatic alteration and therefore this may be a result of soda metasomatism. A few small veins of K-feldspar may indicate later incipient potash metasomatism.

Sample and Thin Section No.'s.	Lithology
6737	
RS 1060, JFD 127/79; TS42327	Soda granite containing abundant albite and no potash feldspar.
RS 1061, JFD 128/79; TS42328	Porous breccia in which fragments are surrounded by, and the voids are lined with, turbid, fibrous, chalcedonic quartz containing clouds of minute impurities and voids.
RS 1062, JFD 130/70; TS42329	Finely laminated sediment composed of heavily stained, small quartz crystals. Some layers are porous. As no evidence of clastic material was found this could have been a chemical precipitate It was disturbed (possibly by slumping) while still soft.
RS 1063, JFD 134A/79; TS42330A	The blue-green mineral is spinel, probably $MgAl_2O_4$. Some is associated with corundum.
RS 1063, JFD 134C/79; TS42331	The prismatic mineral in mica schist is tourmaline.
RS 1064-1067, JFD135A-C/79; TS42332-42334	RS 1065 (135B) differs from RS 1064 (135A) mainly in that it has a much higher concentration of late and/or secondary quartz which has cemented and partly replaced the matrix. Sample RS 1067 (135C) has a much higher concentration of K-feldspar in a matrix which has been finely crushed and in which there has been either regrowth of K-feldspar or replacement by K-feldspar. There is much less interstitial quartz than in 135B.
RS 1068, JFD 136/79; TS42335	The elongate crystals are of tremolite-actinolite. They are intergrown mainly with plagioclase.
RS 1069-1070, JFD 137C & D/79; TS42336-42337	Silicified, fine-grained sediment which certainly contained clastic material including some transported fragments of specular hematite and minor monazite. In 137D these heavy mineral grains are concentrated in some layers. Some layers have been disturbed and there is a possible 'cut and fill' structure.
RS 1071-1072, JFD 139B & D/79; TS42338, 42339	Sample 139B is a metasomatically altered rock, possibly once biotite schist or gneiss. At some stage it has been partly replaced by fine-grained, secondary mica which in turn has been invaded by quartz. The quartz-hematite rock crystallized in situ but has been fractured and invaded by a later generation of quartz.
RS 1073, JFD 140B/79; TS42340	Arkosic sandstone showing graded bedding. It is composed of material derived from granitic or gneissic rocks and has slightly anomalous tourmaline similar to that found in many granitic breccias in the area. The sediment has probably been partly silicified.

Sample and Thin Section No's.	Lithology
RS 1074, JFD 141/79; TS42341	Quartz-plagioclase-biotite gneiss or granodiorite gneiss.
RS 1075, JFD 142/79; TS42342	Fine-grained quartz-feldspar-biotite gneiss containing slightly anomalous sphene and also scattered crystals of a metamict mineral. There is no definite evidence of origin and there was probably more than one episode of metamorphism. There is a trace of fluorite.
RS 1076, JFD 143B/79; TS42343	Hematitic breccia in contact with deformed and silicified gneiss now composed of quartz with minor secondary fine-grained muscovite. The hematitic breccia contains some moderately large (4-8 mm) aggregates of specular hematite which show internal patterns typical of oxidized magnetite.
RS 1077, JFD 144/79; TS42344	Granitic breccia invaded and cemented by an abundance of secondary quartz. There has been minor regrowth of microcline but all evidence of earlier history has been obliterated.
RS 1078, JFD 145/79; TS42345	Muscovite-bearing leucogranite with parallel zones of shearing containing sericite and slivers of quartz.
RS 1079, JFD 147/79; TS42346	A polygonal, porous mass composed mainly of layers of fibrous and botryoidal quartz. There is no evidence to suggest that it replaced an earlier mineral.
RS 1080, JFD 148/79; TS42347	Quartz-feldspar-biotite gneiss with minor garnet, slightly anomalous iron oxide and some metamict mineral grains. The texture is that of a metamorphic rock.
RS 1081, JFD 150/79; TS42348	Silicified breccia containing clasts of altered biotite schist, clay (after ?feldspar), coarse-grained quartz ± altered feldspar and some of specular hematite, one of which encloses an aggregate of monazite crystals. The matrix has been replaced by quartz containing minute particles of iron oxide and minor sericite.
RS 1082, JFD 152A/79; TS42349	Silicified silty material in contact with silicified coarser-grained breccia.
RS 1083, JFD 152C/79; TS42350	Weathered and leached metamorphic rock which was probably a moderately fine-grained gneiss composed of quartz, feldspar, minor biotite and some iron oxide. In texture and grain size it is similar to sample 6737 RS 1080 (JFD 148/79).

2. PETROGRAPHY

Applicant's No.: JFD 113A/79

Photo Location: NFM 15/41/129sp

Unit No.: 6737 RS 1044

Thin Section: 42310

Descriptive Information:
Reported to be white granodiorite (as mapped on the Mt Painter Province Special) altered by K-feldspar and specular hematite. Specular hematite appears to be interstitial. This may be an altered version of sample JFD 114 (RS 1047).

Hand Specimen:
A medium-grained rock containing grey quartz and mica and pink feldspar which, when stained with cobaltinitrite, was found to be potash feldspar. There are small aggregates of fine-grained white mica scattered through the rock and some of these also contain a little hematite. There may be a very weak foliation but this is difficult to determine from this particular sample.

Thin Section:
Mineral assemblage:

	%
Quartz	40-45
Microcline	35-40
Muscovite	10-15
Hematite	2-3
Altered biotite	Trace
Zircon	Minute Trace

The rock now contains microcline crystals 1-3 mm in size intergrown with coarse-grained quartz which varies in grain size up to 5 mm but some of this quartz may have migrated and recrystallized as a few of the larger crystals contain one or two very small inclusions of microcline and muscovite. Some quartz with a rather bulbous appearance appears to have encroached on the microcline isolating a few small remnants which now occur as inclusions. In one area there are small, now isolated, inclusions which still have the same optical orientation showing that they were once portions of a larger microcline crystal replaced by the quartz. In one area there is a film of quartz 0.1 mm thick along a boundary between two adjacent microcline crystals. Most of the microcline is slightly turbid, possibly due to weathering, but no relict textures were found from which to determine its earlier history.

Muscovite occurs mainly as aggregates of flakes in interstices and along grain boundaries and almost certainly these aggregates of muscovite have replaced an earlier mineral or minerals. Some of this may have been biotite but it is also possible that some may have been plagioclase or another undetermined mineral. A few areas of muscovite have sub-rectangular shapes suggesting the former presence of crystals up to 1 mm in size, but other aggregates of muscovite do not have any particular external shape. Fine-grained hematite is associated with

some of the muscovite and it is possible that some of the iron which crystallized as hematite was derived from biotite, but this must be regarded as a tentative suggestion only. Although most of the hematite has crystallized as specular hematite, there are a few areas of iron oxide with external shapes suggesting that some of it may have once been magnetite or even pyrite.

There are a few small crystals of zircon up to 0.2 mm in size, some of which is partly metamict and near the edge of the section there is one small, dark crystal which is probably a metamict mineral.

Conclusion:

Granitic rock of undetermined origin showing some evidence of metasomatic alteration which has resulted in the replacement of some minerals by aggregates of muscovite and a little hematite. There are no relict textures to show the history of the microcline, but some of it has been partly replaced by migratory or secondary quartz.

Note:

This rock does not resemble sample JFD 114/79 in texture or general appearance and that sample contains moderately abundant biotite.

Applicant's No.: JFD 113D/79

Photo Location: NFM 15/41/129sp

Unit No.: 6737 RS 1045

Thin Section: 42311

Descriptive Information:
Reported to be a possible mylonite from ½ m wide breccia zone.

Hand Specimen:
A pink and pale grey, streaky rock which contains thin ribbons of quartz up to 2 mm thick alternating with equally thin bands or ribbons of pink feldspar. There are a few interruptions to this banding where some slightly larger crystals have not been completely deformed and drawn out and there has also been some later microfaulting and movement.

Staining with cobaltinitrite shows that the pink feldspar is potash feldspar.

Thin Section:
Mineral assemblage:

	%
Potash feldspar	50-55
Quartz	45-50
Muscovite	2-3
Hematite	2-3
Zircon	Trace
Sphene or rutile	Trace

This is an extensively deformed rock in which ribbons of drawn out and granulated quartz 0.5-2 mm thick alternate with thin bands containing extensively fractured and deformed potash feldspar, but in a few places there are small lenticular remnants of potash feldspar 0.5-1 mm in size. Many of the thin bands of potash feldspar also contain concentrations of fine-grained iron oxide which is probably mainly hematite but there are some groups of small crystals which have external shapes suggesting former magnetite. These are similar to groups of small magnetite or martite crystals found in microcline in some of the metasomatic granitic rocks. There is also one discontinuous, thin band of hematite over 5 mm long by 0.5-1 mm thick between ribbons of quartz and this contains traces of zircon and very fine-grained, recrystallized titaniferous material which may be rutile or sphene. There are a few small, elongate aggregates of fine-grained muscovite which may have replaced some feldspar and a little muscovite is also intergrown with, or partly replaces, some of the turbid potash feldspar.

Conclusion:
Extensively sheared and granulated, granitic or gneissic rock.

Applicant's No.: JFD 113F/79

Photo Location: NFM 15/41/129sp

Unit No.: 6737 RS 1046

Thin Section: 42312

Descriptive Information:
Reported to be a possible contact of silty layering which grades through specular hematite-rich material into altered granitic rock similar to JFD 113A and 114.

Hand Specimen:
A pink and grey, medium-grained rock containing quartz, pink feldspar and varying proportions of hematite and other dark constituents. The composition is not uniform as there are some bands up to 2 cm thick containing different proportions of dark constituents and one which, on the weathered surface, appears to be finer-grained.

Thin Section:
The area sectioned covers portion of a hematite-bearing band and the finer-grained band noted in the hand specimen. The composition varies in different bands and a quantitative estimate of the minerals would have little meaning.

The rock contains abundant quartz, lesser microcline, moderately abundant, fine-grained, muscovite and/or sericite and varying amounts of iron oxide. The finer-grained band contains traces of tourmaline.

The coarser-grained zone is a breccia containing grains or fragments of quartz and microcline and also some of sericitized granitic rock varying in size from 0.2 mm to 4 mm with a few clasts of partly sericitized granitic rock up to 8 mm, and although many of these grains are angular there are a few which appear to have abraded or rounded corners. Interstices in this breccia contain sericite and/or fine-grained muscovite and also crystals and aggregates of specular hematite. The manner in which specular hematite crystals are intergrown to form irregularly shaped and porous aggregates strongly suggests that this hematite has crystallized in situ, but there is a band 2-3 mm thick of finer-grained breccia in which there is a concentration of elongate fragments of specular hematite showing preferred orientation, and this may indicate some movement after crystallization of the hematite.

The 'top' boundary of hematitic breccia is sharply defined but does not follow exactly the boundary between the coarser-grained breccia and the 'silty' material. The finer-grained material contains a lower concentration of grains and fragments of quartz 0.05 mm to 0.8 mm in size with a few larger clasts up to 2 mm, a very low proportion of microcline grains, 1-2% of tourmaline grains and 2-3% of iron oxide grains in a sericitic matrix. There is one grain 0.8 mm in size composed of quartz and tourmaline in which small tourmaline grains or fragments occur in a matrix containing a few larger quartz grains 0.2-0.4 mm in size and there is another quartz grain 0.3 mm in size partly surrounded by fine-grained tourmaline.

There are other quartz grains containing minor tourmaline and also numerous free or liberated tourmaline grains. Many of these grains have clearly been derived from a quartz-tourmaline rock or vein and have probably not been transported any great distance. Some of the grains in this finer-grained material have been abraded or rounded but they are not sorted and are mixed with a relatively high proportion of sericitic matrix. There is, however, some evidence of banding in that there is a thin band less than 1 mm thick containing a higher concentration (up to 30%) of tourmaline grains and there is another thin band containing some larger grains or fragments. Iron oxide grains also appear to be clastic but there is a little later, much finer-grained, iron oxide which has probably crystallized in situ in interstices, particularly in the coarser-grained material.

The boundary between this finer-grained material and the coarser-grained breccia appears to be transitional in that the finer-grained material has penetrated along grain boundaries and depressions near the contact, and in this zone there are some larger clasts of quartz 1-3 mm in size which are now isolated. It is in this transitional zone where there is a sharply defined boundary between breccia containing abundant interstitial hematite which has probably crystallized in situ and breccia containing practically no hematite. This sharply defined boundary between hematitic and non-hematitic breccia has small irregularities, however, and one small ?microfault.

Conclusion:

The sample contains different zones of granitic breccia, some of which contain hematite which has crystallized in situ. The finer-grained zone consists of abraded material which has probably not moved very far from its place of origin and it differs from many of the siltstones found in these breccias in that the abraded material has not been well-sorted and contains a high proportion of sericitic matrix. It would not be classified as a siltstone and its exact origin is uncertain.

Applicant's No.: JFD 114/79

Photo Location: NFM 15/41/132sp

Unit No.: 6737 RS 1047

Thin Section: 42313

Descriptive Information:
Reported to be white granodiorite as mapped on the Mt Painter Province Special.

Hand Specimen:
A grey, medium-grained rock containing some visible quartz grains a few millimetres in size and aggregates of dark biotite. When the rock was stained with cobaltinitrite films of potash feldspar could be seen along many grain boundaries.

Thin Section:
Mineral assemblage:

	%
Quartz	40-45
Plagioclase	20-25
Microcline	15-20
Biotite	15-20
Corundum	2-3
Zircon and/or xenotime	Trace (more locally)
Altered or metamict mineral	Trace (more locally)
Opaque oxide	Trace
Muscovite	Trace

The rock contains unevenly distributed masses of moderately coarse-grained quartz varying in size from 1 mm to 10 mm and the general appearance of the boundaries of this quartz against finer-grained rock and the manner in which it partly encloses some areas of finer-grained rock strongly suggests that this quartz is intrusive and has invaded and partly replaced an earlier rock. This suggestion is further confirmed by the presence of a few small remnants of biotite and feldspar occurring as inclusions in some of the quartz. The rock which has been invaded and partly replaced by the quartz varies in composition and grain size and includes some irregular zones of biotite schist several millimetres in size. Although many of these are now isolated, the orientation of biotite is similar throughout the area sectioned. Most of the areas of biotite schist contain at least a few crystals of zircon and/or xenotime, some of which are turbid and show zoning and a few have irregular and possibly corroded shapes. (Similar zircon and/or xenotime has been noted in remnants of biotite schist or gneiss in one or two other samples of metasomatic granitic rock described in previous reports.) Some of these areas of biotite schist or gneiss also contain porous masses of a brown, altered mineral which cannot be identified. Some of the biotite is intergrown with moderately fine-grained plagioclase and some is associated with, or grades into, some aggregates of coarser-grained plagioclase which has possibly recrystallized. There are also a few areas of patchy, coarser-grained plagioclase which contains numerous small inclusions of

biotite and clearly there has been some reaction or recrystallization involving plagioclase during the history of this rock. Whether or not some plagioclase may have partly replaced biotite schist is uncertain. Some masses of plagioclase and also some small patches of biotite contain porous aggregates of very fine-grained corundum which, in a few places, grades into slightly coarser-grained corundum which could be identified by optical properties. Most of the corundum occurs in a zone containing medium-grained plagioclase intergrown with minor biotite and showing some evidence of a foliation.

There are thin films of fine-grained microcline generally between 0.1 and 0.3 mm thick along most of the boundaries between quartz and plagioclase and between quartz and biotite schist, and this has developed at some stage during metasomatic alteration of the rock. Textures suggest that it formed ahead of the encroaching quartz and a few small patches of microcline were ungulfed by the coarse-grained quartz.

Conclusion:

A metasomatic rock containing remnants of biotite and biotite-plagioclase schist or gneiss in which a little corundum has developed. The rock has been invaded by an abundance of quartz and films of microcline have developed along many of the boundaries between the invading quartz and the other minerals.

Applicant's No.: JFD 116/79

Photo Location: NFM 15/41/134sp

Unit No.: 6737 RS 1048

Thin Section: 42314

Descriptive Information:
Reported to be a contact between silty layering and a pegmatite-like rock developed in a fault breccia. The pegmatite-like zone has vughy quartz.

Hand Specimen:
This sample shows a sharp contact between greyish-brown, streaky, fine-grained rock and a pale salmon-pink, coarser-grained rock. The darker brown, fine-grained rock contains a few scattered, larger, quartz, feldspar and dark grains 0.5-2 mm in size and the pink rock has small voids lined with projecting quartz crystals. Quartz veins, some of which are connected to these vugs, cut both rock types.

Thin Section:
Both rock types have been silicified and this has modified earlier textures.

The coarser-grained rock consists mainly of extensively fractured microcline which contains at least some crystals up to 6 mm in size. Some of the microcline contains inclusions of quartz and patches of turbid, untwinned potash feldspar, and some contains a little fine-grained muscovite, but there are no relict textures from which to determine its earlier history. The fractured microcline has been invaded by quartz which has filled most of the fractures and interstices but a few still contain some open voids lined with projecting quartz crystals.

The finer-grained rock contains quartz grains, a few microcline grains, numerous small tourmaline grains and small fragments of specular hematite and there are also a few grains containing intergrown quartz and tourmaline. These vary in size from less than 0.05 mm up to 0.5 mm, with a few larger grains of quartz aggregate 1-2 mm in size, and they also vary from angular to rounded and include a few abraded quartz and quartz-tourmaline grains which are very well rounded and almost spherical. These grains are scattered through a silicified matrix which contains moderately abundant sericite or fine-grained muscovite and clay mixed with very tiny grains of hematite and tourmaline, many of which are only a few microns in size. This very fine-grained matrix has a streaky appearance resembling flow structure in volcanic rocks and these flow lines curve around the larger grains. Some of the lines contain small strings of hematite particles which may once have been portions of a single crystal. At a distance of about 2 mm from the coarse-grained microcline rock there is a thin band or line up to 0.3 mm thick containing a concentration of specular hematite and this continues for a distance of 6 mm. The matrix of this finer-grained material has been extensively to almost completely replaced by secondary quartz which has crystallized across the earlier

Applicant's

Photo Loc

Unit No.

Thin Sec

Descript
Rep
gra

Hand Spe
Med
The
mic

Sta

Thin Sec
Min

The
and
but
and
main
albi
or b
typi

The
flak
asso
trac
chlo
ther
feld
earl
and
smal
sphe

Conclusio
This
clas

material and this quartz also forms overgrowths on the clastic qua
grains. Much of the fine-grained mica, hematite and tourmaline,
however, have been preserved and areincluded within the quartz.

Conclusion:

This is not a normal sediment and exact classification is difficul
It is tentatively classified as a silicified 'mylonite' and there
is some evidence to suggest flow movement before silicification.
It is in contact with a fractured, coarse-grained microcline-rich
rock.

biotite and clearly there has been some reaction or recrystallization involving plagioclase during the history of this rock. Whether or not some plagioclase may have partly replaced biotite schist is uncertain. Some masses of plagioclase and also some small patches of biotite contain porous aggregates of very fine-grained corundum which, in a few places, grades into slightly coarser-grained corundum which could be identified by optical properties. Most of the corundum occurs in a zone containing medium-grained plagioclase intergrown with minor biotite and showing some evidence of a foliation.

There are thin films of fine-grained microcline generally between 0.1 and 0.3 mm thick along most of the boundaries between quartz and plagioclase and between quartz and biotite schist, and this has developed at some stage during metasomatic alteration of the rock. Textures suggest that it formed ahead of the encroaching quartz and a few small patches of microcline were ungulfed by the coarse-grained quartz.

Conclusion:

A metasomatic rock containing remnants of biotite and biotite-plagioclase schist or gneiss in which a little corundum has developed. The rock has been invaded by an abundance of quartz and films of microcline have developed along many of the boundaries between the invading quartz and the other minerals.

Applicant's No.: JFD 116/79

Photo Location: NFM 15/41/134sp

Unit No.: 6737 RS 1048

Thin Section: 42314

Descriptive Information:
Reported to be a contact between silty layering and a pegmatite-like rock developed in a fault breccia. The pegmatite-like zone has vughy quartz.

Hand Specimen:
This sample shows a sharp contact between greyish-brown, streaky, fine-grained rock and a pale salmon-pink, coarser-grained rock. The darker brown, fine-grained rock contains a few scattered, larger, quartz, feldspar and dark grains 0.5-2 mm in size and the pink rock has small voids lined with projecting quartz crystals. Quartz veins, some of which are connected to these vugs, cut both rock types.

Thin Section:
Both rock types have been silicified and this has modified earlier textures.

The coarser-grained rock consists mainly of extensively fractured microcline which contains at least some crystals up to 6 mm in size. Some of the microcline contains inclusions of quartz and patches of turbid, untwinned potash feldspar, and some contains a little fine-grained muscovite, but there are no relict textures from which to determine its earlier history. The fractured microcline has been invaded by quartz which has filled most of the fractures and interstices but a few still contain some open voids lined with projecting quartz crystals.

The finer-grained rock contains quartz grains, a few microcline grains, numerous small tourmaline grains and small fragments of specular hematite and there are also a few grains containing intergrown quartz and tourmaline. These vary in size from less than 0.05 mm up to 0.5 mm, with a few larger grains of quartz aggregate 1-2 mm in size, and they also vary from angular to rounded and include a few abraded quartz and quartz-tourmaline grains which are very well rounded and almost spherical. These grains are scattered through a silicified matrix which contains moderately abundant sericite or fine-grained muscovite and clay mixed with very tiny grains of hematite and tourmaline, many of which are only a few microns in size. This very fine-grained matrix has a streaky appearance resembling flow structure in volcanic rocks and these flow lines curve around the larger grains. Some of the lines contain small strings of hematite particles which may once have been portions of a single crystal. At a distance of about 2 mm from the coarse-grained microcline rock there is a thin band or line up to 0.3 mm thick containing a concentration of specular hematite and this continues for a distance of 6 mm. The matrix of this finer-grained material has been extensively to almost completely replaced by secondary quartz which has crystallized across the earlier

material and this quartz also forms overgrowths on the clastic quartz grains. Much of the fine-grained mica, hematite and tourmaline, however, have been preserved and areincluded within the quartz.

Conclusion:

This is not a normal sediment and exact classification is difficult. It is tentatively classified as a silicified 'mylonite' and there is some evidence to suggest flow movement before silicification. It is in contact with a fractured, coarse-grained microcline-rich rock.

Applicant's No.: JFD 117/79

Photo Location: NFM 15/41/137s

Unit No.: 6737 RS 1049

Thin Section: 42315

Descriptive Information:
Reported to be biotite-poor granitic rock previously mapped as granodiorite.

Hand Specimen:
Medium-grained, pale grey rock composed mainly of quartz and feldspar. There are a few small, dark-stained patches containing traces of mica.

Staining with cobaltinitrite shows no evidence of potash feldspar.

Thin Section:
Mineral assemblage

	%
Quartz	50-55
Albitic plagioclase	45-50
Muscovite	Trace-1
Chlorite	Trace
Zircon or xenotime	Trace
Sphene	Trace
Opaque material	Trace

The rock is composed almost entirely of intergrown albitic plagioclase and quartz and the grain size varies mainly between 0.5 and 1.5 mm, but there are a few larger crystals of plagioclase up to 5 mm long and some much finer-grained, probably granulated, quartz and plagioclase mainly along grain boundaries. Where plagioclase crystals have simple albite twinning this has almost invariably been deformed and fractured or bent but much of the plagioclase shows fine 'checker-board' twinning typical of albite.

The small, dark patches noted in the hand specimen contain intergrown flakes of muscovite and some brown-stained and altered mica generally associated with sericite, a little very fine-grained sphene and traces of zircon or xenotime. In one area there is a patch of stained chloritic material which probably replaced mica and adjacent to this there are a few very small flakes of muscovite included within feldspar. The aggregates of mica flakes appear to be remnants of earlier rock which has been replaced by the plagioclase and quartz and scattered through other parts of the section there are a few small flakes of mica and small, dark, possibly metamict grains and sphene included within the plagioclase and quartz.

Conclusion:
This is probably a metasomatic quartz-albite rock and it could be classified as a soda leucogranite. The rock has been deformed.

Applicant's No.: JFD 119/79

Photo Location: NFM 14/005/40s

Unit No.: 6737 RS 1050

Thin Section: 42316

Descriptive Information:
Reported to be a granule to pebble fault breccia with clasts which may be 'pinked' basement as several contain relicts of biotite.

Hand Specimen:
A coarse-grained, fragmental rock containing some clasts of pink feldspar 1-2 cm in size. Some clasts of feldspar contain patches of dark biotite and there are also traces of dark material, possibly biotite, in some interstices. In one zone in the rock many of the interstices contain small crystals or aggregates of black tourmaline.

Thin Section:
The breccia is composed largely of microcline with possibly up to 20% of quartz and up to 5% of biotite. There are local concentrations of tourmaline.

The area sectioned contains portion of a large clast about 15 x 20 mm in size and this is composed mainly of an irregular intergrowth of very turbid microcline with a few small patches of clear microcline and irregular patches 1-3 mm in size containing brown biotite associated with quartz, traces of recrystallized titanium oxide and one or two crystals of zircon or xenotime. Some of this quartz has clearly migrated and recrystallized, or is secondary, some has invaded or partly replaced biotite and some has penetrated along cleavage planes in the biotite. The microcline shows patchy turbidity due to the presence of clouds of minute voids, and probably also minute particles of iron oxide, but they are too small to be resolved by the microscope. Some of the microcline contains small inclusions of biotite and also a few very small inclusions of muscovite. The patchy turbidity suggests relict textures and there are some areas of clear microcline with well defined boundaries now included in relatively large microcline crystals showing patchy turbidity and it is possible that these represent relict textures across which the coarse-grained microcline has crystallized, but no definite patterns could be recognized.

Other smaller clasts in the section are mainly of microcline with some of intergrown microcline and quartz. In the hand specimen there appeared to be a clast of a gneissic rock or schist but this was not included in the area sectioned. In one area there has been extensive fracturing, deformation and introduction of secondary quartz and the textures are now confused and complex. This area contains some aggregates of extensively fractured tourmaline which has been invaded and partly replaced by quartz. Some interstices in this breccia contain films of biotite similar to that found within the microcline clast and the significance of this is not certain but it may be that the rock tends to break in the zones containing quartz and

biotite and some of this biotite then occurs in interstices. However, this suggestion should be treated with caution.

Conclusion:

Textures within the turbid microcline forming most of the clasts in this breccia suggest that it crystallized across pre-existing rock and is probably metasomatic. There is, however, conflicting evidence as to the significance of the biotite, some of which is included within the microcline clasts, but some also occurs in interstices in the breccia. Tourmaline has also been introduced into the rock at some time and has been extensively fractured and invaded and partly replaced by quartz.

Applicant's No.: JFD 121/79

Photo Location: NFM 17/88/56s

Unit No.: 6737 RS 1051

Thin Section: 42317

Descriptive Information:
Reported to be fine-grained leucogranite from margin of pegmatite. Several grains appear to be discoloured by K-feldspar.

Hand Specimen:
A medium-grained rock composed mainly of almost white feldspar and quartz with some grains and patches of pink feldspar. The pink feldspar occurs in higher concentrations along a pink band and when the rock was stained with cobaltinitrite this pink feldspar was found to be potash feldspar.

Thin Section:
Mineral assemblage:

	%
Plagioclase	45–50
Quartz	25–30
Potash feldspar	20–25
Muscovite	Trace
Rutile	Trace

This rock consists of intergrown quartz and feldspar with a fairly uniform grain size generally between 0.8 and 1.5 mm and it has a generally granoblastic texture but some of the plagioclase crystals are subhedral. Some of the feldspar grains are entirely plagioclase and others are of plagioclase with irregular patches of potash feldspar (identified by lower refractive index). In general, this potash feldspar occurs in very irregular patches in the plagioclase and occasionally in zones crossing the plagioclase crystal, and only one small crystal was found where potash feldspar had apparently replaced plagioclase around the grain boundary. Although it is clear that one feldspar has replaced or partly replaced another, in many of the grains there is no clear evidence to show the direction of this replacement and more often than not it is the interior of the grain which contains irregular patches of potash feldspar. There are, however, a few crystals where potash feldspar appears to have spread out from small fractured zones in the plagioclase and this may be the explanation for its patchy occurrence.

There are a few flakes of muscovite, some occurring in interstices and some included or partly included in feldspar. It is possible that some has partly replaced plagioclase but this does not appear to be common.

Conclusion:
Conventional nomenclature is probably not applicable to this sample but perhaps it could be classified as a soda leucogranite. The pink colouration is potash feldspar and textures indicate replacement

of one feldspar by another although on a small scale, the direction of this replacement is not always obvious. The pattern of 'pinking' in hand specimen suggests that the potash feldspar has partly replaced plagioclase. It has not spread out from grain boundaries but has probably spread out from fractured zones in the plagioclase crystals.

Applicant's No.: JFD 122B/79

Photo Location: NFM 17/88/64sp

Unit No.: 6737 RS 1052

Thin Section: 42318

Descriptive Information:
Hematitic breccia from a dyke-like body showing internal contact with less hematitic material.

Hand Specimen:
The sample contains abundant specular hematite intergrown with quartz and along one zone there are some moderately large clasts of pale-coloured rock 1-3 cm in size.

Thin Section:
This contains a zone of fine-grained hematite and quartz in contact with coarser-grained breccia containing some lithic clasts. A visual estimate of the minerals would have little meaning and therefore is not attempted. The matrix of both zones has been replaced and/or cemented by an abundance of late or secondary quartz and this has obscured many finer details and probably obliterated much of the earlier evidence of origin.

The coarser-grained breccia contains a few clasts composed of intergrown microcline and quartz, one composed predominantly of granulated quartz and minor potash feldspar, some of granitic rock containing mica, and one composed of very fine-grained quartz and feldspar with patches of sericite and altered mica the origin of which remains obscure. There are also some fragments of euhedral quartz crystals, a few crystals (?pyrite) which have been replaced by crystalline goethite, a few fine-grained iron oxide pseudomorphs which may also be oxidized pyrite, a few fragments of monazite and abundant specular hematite fragments and aggregates. Some aggregates of specular hematite show relict textures mainly in the form of external crystal shape, indicating that the hematite has replaced an earlier mineral, and although some of the relict textures suggest that carbonate is one possibility, the relict textures are not sufficiently conclusive for this to be certain. There are a few flakes of altered mica and some concentrically banded patches of fine-grained goethite which have been partly replaced by quartz and these probably also represent oxidized pyrite. There is one mass of biotite associated with some quartz and a few small crystals of zircon which may be a remnant of biotite schist or gneiss. Crystalline goethite fills a few interstices between hematite crystals. It is uncertain whether or not the hematite crystallized in situ but, if so, there has been some later extensive fracturing and much of the hematite now occurs as isolated fragments of specular hematite crystals. Any former matrix which may have been present has been replaced by intergrown quartz crystals which now fill all interstices and only a few minute flakes of mica and patches of turbid staining remain to suggest that there may have been an earlier matrix.

The finer-grained hematitic breccia consists mainly of fragments of

specular hematite, a few fragments of crystalline goethite, a few fragments of euhedral quartz, a trace of oxidized pyrite and one or two fragments of monazite. In general, the hematite fragments are smaller than in the other zone of breccia and most of them are less than 1 mm long. Although there is some evidence of fracturing and displacement the general pattern suggests that the hematite has not moved very far from its place of origin. As in the coarser-grained zone any former matrix has been replaced by a mass of intergrown quartz crystals which has crystallized across the whole rock.

The boundary between the coarser-grained and finer-grained zones is irregular and in places it is not readily distinguishable in the thin section. No definite evidence was found to show the relationship of the coarser-grained to the finer-grained breccia, except that it does not appear to be a straight fracture.

Conclusion:

Contact between a zone of coarser-grained hematitic breccia which contains some lithic clasts and a finer-grained hematitic breccia which is composed mainly of quartz and hematite. There is no definite evidence in the thin section to show the exact relationship between these two breccias.

Applicant's No.: JFD 122C/79

Photo Location: NFM 17/88/64sp

Unit No.: 6737 RS 1053

Thin Section: 42319 and 42320

Descriptive Information:
Reported to be hematitic breccia with clasts of hematite and granitic breccia in a silty hematitic matrix.

Two thin sections, A and B, were requested.

Hand Specimen:
The sample contains some large clasts of granitic rock 3-4 cm long and one of these contains an inclusion or xenolith of gneiss. The matrix of the breccia contains abundant hematite and in some zones this is moderately coarse-grained but there are also areas of much finer-grained silty material and it is not clear from the hand specimen whether or not the areas of coarser-grained hematitic breccia are clasts in the finer-grained silty material. Two thin sections were cut to try and resolve this problem.

Thin Sections:
A. (42319):
This has a zone of hematitic breccia with a fairly sharp contact against some silty material but which also shows variations and discontinuities.

The hematitic breccia is similar to the coarser-grained breccia described in sample JFD 122B/79 and a full description will not be repeated. It contains some large lithic clasts as noted in the hand specimen, some euhedral quartz crystals, a few aggregates of crystalline goethite and abundant fragments and some aggregates of intergrown specular hematite crystals in a slightly turbid matrix which has been replaced by a mass of intergrown quartz crystals. The boundary of this breccia is slightly irregular and the general appearance suggests that the finer-grained silty material has accumulated on this irregular surface of the coarser-grained breccia. This silty material, however, also contains a few clasts up to 4 mm long composed of microcline and quartz and one, 2 mm in size, which is very probably a clast of the coarser-grained hematitic breccia. This layer of silty material containing a few clasts has been cut off, or shows another discontinuity, and is in contact with another phase of material which has a very turbid matrix replaced by quartz and contains some fairly sharply defined patches of the coarser-grained hematitic breccia which have the appearance of clasts. There are also a few clasts of potash feldspar and quartz and of quartz with biotite. This zone also contains one angular clast 2 mm long of siltstone which does not have any hematite, and at least part of the boundary of this clast appears irregular and corroded. There is a ?clast with a central zone composed of intergrown goethite crystals which have replaced an earlier mineral, the external shape of which is still moderately well preserved, but it is not sufficiently distinctive for the mineral to be positively identified. Carbonate

is one suggestion but there are other possibilities. Relict textures suggest that this porous pseudomorph of goethite was surrounded by a zone of euhedral to subhedral crystals of another mineral which has now been replaced by quartz, but relict textures marked by staining show the former crystal outline. Although these former minerals cannot be identified, the textures suggest that the history of this rock has been very complex.

The matrix contains abundant small fragments of specular hematite and relict textures marked by turbidity show that there were also small grains 0.1-0.2 mm in size of another mineral, possibly silicate. These have been replaced by a mass of intergrown quartz crystals with brownish and iron oxide staining marking the relict textures.

B. (42320):

The zone of hematitic breccia is generally similar to that in other samples in that it consists mainly of specular hematite, some euhedral quartz, a few clasts of potash feldspar and/or granitic rock and of partly altered biotite schist or gneiss, some aggregates of intergrown hematite crystals, a few aggregates of geothite which replaced an undetermined mineral (some possibly pyrite) and trace amounts of monazite and tourmaline in a matrix which has been replaced by quartz but with relict textures marked by general turbidity suggesting the former presence of small fragments of possible potash feldspar. This breccia has clearly been subjected to some form of tectonic activity and although there are still some aggregates of hematite crystals most of the hematite now occurs as fragments of fractured crystals.

There is a slightly irregular boundary against a similar, but possibly finer-grained,hematitic breccia and along this boundary there is a slightly increased concentration of elongate fragments of specular hematite which tend to be aligned parallel to the boundary and the matrix in this narrow zone near the contact is much more turbid. This boundary is not very clearly defined along its whole length but it probably does mark a discontinuity and indicates some additional reworking of hematitic breccia. This zone also contains some aggregates of hematite which appear to be clasts,and a large clast of granitic rock. There are a few quartz crystals, a few pseudomorphs replaced by goethite and abundant specular hematite fragments. In this zone there are also two areas several millimetres in size which have been replaced by small, intergrown quartz crystals and in which there are relict textures marked by staining showing that there were once intergrowths of much larger crystals up to 2 mm long of some elongate or prismatic mineral (?barite or some other mineral).

Conclusion:

The only definite conclusion which can be drawn from this and the previous sample is that after crystallization of the specular hematite in a breccia zone there has been repeated movement and/or fracturing and very probably movement of at least some fragments of hematite and other material by fluid. There are small patches and zones which have the general appearance of a sediment but these are of very limited extent in this particular sample. It is equally certain that the history has been rather complex and at one time there were some moderately large crystals of an undetermined mineral which has been replaced by quartz. There has also been a period during which some moderately large crystals (some of which were probably pyrite) have

been replaced by crystalline goethite, and these were also fractured and displaced.

It has not been possible to determine whether the large area in the centre of the sample is, in fact, a large clast of hematitic breccia, but there are clearly many smaller clasts of hematitic breccia in the other zones.

Applicant's No.: JFD 122D/79

Photo Location: NFM 17/88/64sp

Unit No.: 6737 RS 1054

Thin Section: 42321

Descriptive Information:
Layered hematitic siltstone with clasts of granitic breccia in the siltstone.

Hand Specimen:
At one end of the sample there is a zone of granitic breccia containing some specular hematite and in contact with this there is a band of reddish-brown siltstone with faint markings suggesting banding in places and along part of the contact there is a zone or thin band of material containing specular hematite which is coarser-grained than the siltstone. This was included in the thin section.

The band of silty material varies in thickness, mainly between 1 and 2.5 cm, and beyond this there is a zone containing numerous clasts up to 1.5 cm in size with a silty matrix. Some of these clasts are of granitic material, some are of biotite schist or gneiss and possibly other gneissic rock, and a few are of hematitic breccia. At the extreme end of the sample there is another small pocket or portion of a thin band of siltstone.

The sample was stained with cobaltinitrite and this showed potash feldspar in many of the clasts and a thin rim of potash feldspar around one of the larger clasts of biotite or chloritic rock, around one of hematitic breccia, and also around a lithic clast containing quartz and feldspar. There are other clasts, however, which do not show any evidence of this rim of potash feldspar. There are a few vugs or voids lined with small projecting quartz crystals.

Thin Section:
The reddish-brown 'silty' material which forms a prominent band near the centre of the specimen contains small fragments of specular hematite, many of them about 0.05 mm long but varying up to 0.15 mm, a few very small flakes of mica including both biotite and muscovite and a few small fragments which were probably quartz. It also had a relatively high proportion of other small fragments generally less than 0.05 mm in size which are now represented by relict textures of reddish-brown turbidity in the quartz which has cemented and replaced this siltstone. Much of this staining is extremely fine-grained iron oxide and variations in its concentration outline the former small fragments. A few small fragments of goethite crystals were also found and in one band or zone there are a few very small fragments now composed of sericite. Staining of the hand specimen did not show any potash feldspar in this fine-grained zone of siltstone and it may be that at least some of the small turbid patches were once feldspar which has been replaced by quartz. There is only very slight evidence of subparallel alignment of elongate fragments of hematite

and mica flakes in this silty matrix, but there are some discontinuous and poorly defined layers, some of which are 1-2 mm thick which contain larger fragments of hematite, whereas others are defined mainly by variations in the intensity of staining. Some of these layers curve around and if they were different layers of sediment they have certainly been disturbed or mobilized. Between the fine silty material and the granitic breccia at one end of the sample there is a zone 2-4 mm thick of hematitic breccia which is coarser-grained than the silty material but which is finer-grained than most hematitic breccias. This has a rather irregular contact with the granitic breccia which could have been corroded.

Larger clasts of differing composition are scattered through portion of the silty material at some distance from its contact with the granitic breccia and there are also a few smaller clasts or large grains of potash feldspar and of quartz. There is one moderately large clast of metasomatic granitic rock containing remnants of biotite schist still showing parallel orientation, and where the boundary of this clast is sharply defined there is a concentration of small, elongate, hematite fragments in the adjacent silty matrix, but elsewhere the boundary is irregular and poorly defined.

There are a few angular clasts of microcline up to about 1 mm in size which have sharply defined boundaries against the silty matrix and only a very thin line of iron oxide staining on the boundary. Quartz grains or clasts have the same thin rim of iron oxide staining but this is generally enclosed in overgrowths of secondary quartz which extend out into the silicified matrix. Biotite and biotite schist clasts have sharply defined boundaries with no reaction rim. Boundaries of hematitic breccia clasts are not generally clearly defined as the quartz matrix of the hematite breccia tends to merge with the silicified matrix of the silty material.

In one corner of the thin section there is portion of a granitic clast, or at least a clast containing coarse-grained potash feldspar and some sericite, and the area included in the thin section is surrounded by a rim containing finer-grained, secondary potash feldspar and quartz with a very thin band or zone containing some sericite. This shows a sharp contact with the hematite-bearing silty material and it is not certain whether this was, in fact, a rim of secondary feldspar and quartz or portion of a vein of this material along which the granitic rock had fractured. There is one clast of silicified rock containing minor sericite and altered biotite and there are a few composed of intergrown or radiating goethite crystals. These have sharply defined boundaries with no evidence of reaction.

Conclusion:

The silty material shows some evidence of disturbed or remobilized layering and it contains clasts of granitic rock, biotite schist or gneiss, hematitic breccia and goethite. A few of these clasts show some evidence of a rim of potash feldspar but others show no evidence of a reaction rim.

Applicant's No.: JFD 123A/79

Photo Location: NFM 14/7/2s

Unit No.: 6737 RS 1055

Thin Section: 42322

Descriptive Information:
Float sample of ?phenocryst-bearing red ?volcanic.

Hand Specimen:
A dark red, fine-grained rock with scattered, pale grey crystals and aggregates up to about 1 cm in size. Some of these pale grey aggregates contain a little hematite.

Thin Section:
Mineral assemblage:

	%
Quartz	>75
Pyroxene	5-10
Iron oxide	10-15

This is a silicified rock with relict textures marked by iron oxide and with small remnants of pale green clinopyroxene in some zones.

The reddish matrix of the rock is now composed of a mass of intergrown quartz crystals generally less than 0.1 mm in size with relict textures marked by lines of reddish-brown iron oxide, and there are also concentrations of extremely fine-grained, almost opaque, iron oxide with may be hematite. These relict textures outline a granoblastic texture with a common grain size of about 0.05 to 0.1 mm, but there are areas where relict textures show that the rock once contained some larger crystals and aggregates of intergrown crystals, some of which were 0.5 to 1 mm in size, and although these crystals have also been completely replaced by quartz the lines of iron oxide staining suggest that the former mineral had some cleavage planes.

There are several areas in the section where the rock has been replaced by relatively large patches of optically continuous quartz, some of which are up to 8 mm long, and some of these are intergrown to form the grey aggregates noted in the hand specimen. Most of these patches of coarser-grained quartz show fine-grained, granular relict textures somewhat similar to those in the finer-grained quartz, and they also contain small grains of pale green ?clinopyroxene most of which have smooth surfaces and round to oval shapes. These grains vary in size from 0.02-0.08 mm and the relict textures marked by iron oxide are of similar size with a few slightly larger, and are also of generally similar shape. In the interior of these aggregates of coarse-grained quartz containing ?pyroxene remnants there are some crystals of iron oxide intergrown with the quartz and in some of these aggregates relict textures suggest that this iron oxide was probably intergrown with a moderately coarsely crystalline mineral which has been replaced by the quartz.

Conclusion:

This is a silicified rock containing iron oxide and remnants of ?pyroxene. The textures found have been described, but from the available evidence it would be most unwise to definitely suggest any particular origin. Silicification of a volcanic rock, however, cannot be entirely excluded.

Applicant's No.: JFD 123B/79

Photo Location: NFM 14/7/2s

Unit No.: 6737 RS 1056

Thin Section: 42323

Descriptive Information:

Float sample of contact between possible volcanic and white quartz. The ?volcanic float of this sample and 123A occur in a gap in large white quartz reefs developed along faults at the Adelaidean-Carpentarian boundary. Wooltana Volcanics crop-out several hundred metres to the south but the indications are that these samples and the Wooltana Volcanics may not be in continuous contact.

Hand Specimen:

Part of the sample is dark grey, fine-grained rock and this is in contact with some pale grey to almost white, coarse-grained vein quartz.

Thin Section:

The dark rock is similar to sample JFD 123A in that it has been silicified and is now composed mainly of secondary quartz with up to 20% of fine-grained iron oxide which is the cause of the dark colour of the rock. There is a minute trace of apatite and in one patch of slightly coarser-grained quartz there is a minute trace of ?pyroxene.

Relict textures are not as clearly preserved in this sample as in sample JFD 123A/79, but some of the iron oxide outlines former crystals 0.3-0.6 mm in size which may have been scattered through a generally finer-grained rock. The external shape of these is moderately well preserved but is not sufficiently distinctive for the mineral to be identified; however, most of these crystals were at least slightly elongate or sub-rectangular. Quartz surrounding these relict textures contains a moderately high concentration of very fine-grained iron oxide and, although there are numerous turbid patches, no evidence of relict textures could be found in this fine-grained material, except in one zone where there is some evidence of a fine-grained, granular texture similar to that noted in parts of sample JFD 123A/79. There are a few patches of coarser-grained quartz with some coarser-grained iron oxide in interstices.

Contact with the vein quartz is sharply defined but relict textures suggest the presence of a thin zone containing small crystals along the edge of a quartz vein and these have also been silicified.

A relatively recent open fracture contains some supergene opal.

Conclusion:

A silicified rock which is probably related to sample JFD 123A/79, but in which there is no conclusive evidence of origin. As for sample 123A/79, the possibility of a volcanic rock very rich in iron cannot be excluded.

Applicant's No.: JFD 124/79

Photo Location: NFM 14/7/3s

Unit No.: 6737 RS 1057

Thin Section: 42324

Descriptive Information:
?Vesicular ?volcanic found near samples 123A and 123B.

Hand Specimen:
A porous, dark greyish-red rock. When closely examined many of the voids show some evidence of crystal shape and there are also numerous similar 'voids' which contain a fine-grained, micaceous, clay mineral and these could be altered silicate.

Thin Section:
This is similar to samples 123A and B/79 in that the rock has been completely replaced by secondary quartz which has a common grain size of 0.05-0.1 mm, and this is stained by clouds and lines of extremely fine-grained iron oxide generally included within the quartz. There are minor amounts of very turbid, fine-grained clay in scattered voids, most of which contain, or are partly lined with, projecting quartz crystals.

The iron oxide staining present throughout practically all of the secondary quartz shows patterns in some areas but these only define a streakiness with no definite outlines of mineral grains or cleavage and no recognisable relict textures. Some of the numerous voids, however, do show evidence of poorly preserved crystal shape which is sufficient to show that these were probably scattered crystals and not vesicles. Some of these were 0.5-1 mm in size but others were smaller and in many the external shape has been modified by small projecting quartz crystals. Although some crystal shape is suggested, there is insufficient evidence to identify the former mineral. There are some similar patches which contain orange to brown-stained, turbid clay and therefore these altered crystals may have been silicate. There are a few small, angular fragments or slivers of clear quartz generally less than 0.1 mm in size but varying up to 0.2 mm in the turbid and iron oxide-stained quartz.

Conclusion:
A porous, silicified rock which probably once contained some scattered crystals now replaced by clay and/or leached. There is not sufficient evidence to show the origin and history of this rock.

Applicant's No.: JFD 125/79

Photo Location: NFM 14/7/4s

Unit No.: 6737 RS 1058

Thin Section: 42325

Descriptive Information:
Float of layered ?actinolitic, pink quartzite.

Hand Specimen:
A fine-grained rock with straight and parallel layers of various colours, mainly pink to pale buff and orange-grey. These vary in thickness from 3 mm to over 10 mm. A trace of pyrite was found along one small fracture.

Staining tests with both cobaltinitrite and rhodizonate show that some layers contain an abundance of potash feldspar and practically no plagioclase, whereas others contain an abundance of plagioclase and very little potash feldspar. One thinner layer in the zone sectioned has only a low concentration of feldspar.

Thin Section:
The composition varies and therefore the estimate of minerals given below may not be strictly accurate. It contains the following minerals:

	%
Potash feldspar	40-45
Albitic plagioclase	40-45
Actinolite	5-10
Quartz	3-5?
Biotite	1-2
Sphene	Trace
Rutile?	Trace
Opaque minerals	Trace

This is a relatively low-grade metamorphic rock composed mainly of intergrown feldspar crystals between 0.05 mm and 0.1 mm in size and these are intergrown with relatively minor amounts of quartz of similar grain size. Only a few of the feldspar crystals show twinning and the estimate of relative proportions was determined mainly by staining the hand specimen. Small flakes of biotite, many of them slightly less than 0.05 mm long, are present in varying proportions in the different layers noted in the hand specimen and there are some layers containing up to 10% of biotite, whereas others contain little or no biotite. Many of the small flakes are parallel to the layering but others are orientated in other directions. Crystals of almost colourless amphibole (probably tremolite-actinolite) are scattered through the rock, and although some of these are small (0.1 mm) many are much larger than the feldspar and quartz grains and are 0.5-1 mm in long with a few larger, poikilitic crystals in one band. These amphibole crystals do not show the preferred

orientation noted for the biotite.

Accessory minerals are mainly tiny orange-brown crystals which are probably rutile and also a few others which may be sphene. It is unusual to find two different titanium-bearing minerals but these two minerals are also both present in a coarser-grained vein. There are a few minute opaque grains which are too small for identification.

Conclusion:

A very fine-grained, layered metasediment composed mainly of feldspars, tremolite and quartz with minor biotite in some layers. At least some layers in the sediment were probably calcareous.

Applicant's No.: JFD 126/79

Photo Location: NFM 14/5/5s

Unit No.: 6737 RS 1059

Thin Section: 42326

Descriptive Information:
Reported to be Mt Neill Granite Porphyry.

Hand Specimen:
A grey rock containing a few larger feldspar crystals generally 3-6 mm in size in a finer-grained groundmass. There are a few small patches of pinkish feldspar generally surrounded by grey feldspar.

Staining with cobaltinitrite shows only a trace of potash feldspar mainly along small fractures or veins and in the interiors of a few feldspar crystals. Staining with rhodizonate shows abundant plagioclase but much of it stains very poorly or hardly at all, suggesting that it is probably albitic.

Thin Section:
Mineral assemblage:

	%
Albitic plagioclase	65-70
Quartz	20-25
Biotite	5-10
Potash feldspar	Trace
Zircon	Trace
Opaque mineral	Trace

When the rock is examined under very low magnification its porphyritic texture is conspicuous and it contains large crystals of albitic plagioclase mainly between 3 and 6 mm in size but varying up to 8 mm long, and the area sectioned also contains one quartz phenocryst 3 mm long. These are surrounded and separated by a much finer-grained groundmass composed of intergrown plagioclase, quartz and biotite. The large plagioclase crystals show fine 'checker-board' twinning which is generally typical of albitic plagioclase and they contain numerous inclusions of biotite. They have rather round and irregular boundaries and some are partly surrounded by myrmekitic intergrowths with quartz. In one of the larger albitic plagioclase crystals there is a patch of ?microcline and staining of the hand specimen suggests that a few do contain patches of potash feldspar, but this is very difficult to recognize in the thin section because of the similarity in refractive indices. One of the larger albitic plagioclase crystals contains some zones of quartz which are clearly remnants of earlier patches of myrmekitic intergrowths which have been enveloped and replaced by the expanding plagioclase crystal. This indicates a complex history of reaction in this rock.

Biotite tends to occur as aggregates of intergrown flakes up to 4 mm long but there are also separate small crystals intergrown with the quartz and plagioclase in the groundmass. Small patches of myrmekite

are also common in the groundmass. There is one area where an expanding crystal of plagioclase has enveloped a crystal of turbid potash feldspar as well as some myrmekitic intergrowths of quartz and plagioclase.

Conclusion:

Because of the abundance of albitic plagioclase this could possibly be classified as a porphyritic soda granite or soda microgranite, but there is abundant evidence of reaction between minerals and probably some metasomatic alteration and it could therefore be a result of soda metasomatism. The small veins of potash feldspar are possibly an indication of later incipient potash metasomatism.

Applicant's No.: JFD 127/79

Photo Location: NFM 14/5/34s

Unit No.: 6737 RS 1060

Thin Section: 42327

Descriptive Information:
Reported to be granitic rock previously mapped as granodiorite.

Hand Specimen:
A moderately coarse-grained pale pink to pale grey, granitic rock containing a few large feldspar crystals up to 1 cm long. It is generally coarser-grained than sample JFD 126/79.

Staining with cobaltinitrite does not show any potash feldspar.

Thin Section:
Mineral assemblage:

	%
Albitic plagioclase	65-70
Quartz	25-30
Biotite	3-5
Epidote mineral (possibly including allanite)	Trace
Leucoxene	Trace
Opaque material	Trace
Zircon	Trace
Chlorite	Trace

This is a coarse-grained rock composed mainly of intergrown quartz and albite and textures suggest that it once had a common grain size of at least 3-5 mm, but there has been some recrystallization of the coarser-grained quartz to finer-grained aggregates. Practically all of the plagioclase is very similar to the larger crystals in sample JFD 126 in that they show fine 'checker-board' twinning and rarely show crystal faces. This differs from sample JFD 126, however, in that there is practically no evidence of myrmekitic intergrowth surrounding the albitic plagioclase crystals and only minor evidence to suggest encroachment on adjacent minerals. Some, however, have rather patchy, internal patterns, a few contain inclusions of quartz and one contains a zone in which there is an aggregate of biotite intergrown with some quartz and titaniferous material.

Most of the biotite in this rock occurs as aggregates of intergrown flakes and some of these aggregates are up to 6 mm long. They generally occur in interstices between albite and quartz and some of the biotite aggregates contain secondary titaniferous minerals and also minor amounts of a brownish, pleochroic epidote mineral which could be allanite. There are traces of zircon and opaque material also generally associated with the biotite.

Conclusion:
Because of the abundance of albite, this could possibly be classified as a sodagranite.

Applicant's No.: JFD 128/79

Photo Location: NFM 14/5/75s

Unit No.: 6737 RS 1061

Thin Section: 42328

Descriptive Information:
Float of breccia with post-brecciation clast-coating of ?quartz or pink ?feldspar.

Hand Specimen:
A porous breccia in which the interstitial voids are lined with a layer of small crystals stained a faint pink colour.

Staining with cobaltinitrite shows little more than a trace of potash feldspar in the breccia but not occurring as layers lining the interstitial voids or coating the fragments.

Thin Section:
Mineral assemblage:

	%
Quartz	>90
Secondary muscovite or sericite	5-10
Potash feldspar	1-2
Biotite	Trace
Chlorite	Trace
Hematite	Trace

The breccia contains clasts of quartz and of quartz intergrown with aggregates of secondary muscovite which has replaced an undetermined mineral (possibly plagioclase?) and there are a few clasts containing microcline intergrown with quartz and secondary muscovite. In one area there is a little coarser-grained muscovite and also a little hematite intergrown with the quartz and microcline.

The rock has been extensively fractured or brecciated and in some places there are intersecting fractures which cut crystals and aggregates of quartz and along which there has been little or no differential movement. It is possible, however, that there has been some corrosion of the earlier rock. All interstices and voids now contain chalcedonic quartz which occurs as layers of small crystals projecting out from the generally altered clast and in a few places there are spherulites of radiating crystals. All of the chalcedonic quartz is very turbid and it contains clouds of minute voids as well as minute impurities, some of which may be iron oxide, but in some zones there are clouds of minute micaceous particles. There are also minute chloritic particles included in some zones in this quartz. The pink colour of this encrusting quartz noted in the hand specimen is due to the presence of these impurities and in one area there is a growth zone in the quartz marked by a thin band of darker staining. The reason for the presence of these clouds of minute impurities and voids is not clear but it is possible that the quartz may have replaced an earlier interstitial mineral; however, no definite evidence to confirm this was found.

Applicant's No.: JFD 130/79

Photo Location: NFM 17/88/81sp

Unit No.: 6737 RS 1062

Thin Section: 42329

Descriptive Information:
Yellow and red ochrous jasper layering found in sub-horizontal attitude on 'top' of near-vertical breccia body within Radium Creek Metamorphics. One corner of the sample shows 'slumping'. Is this a chemical sediment?

Hand Specimen:
Much of the sample is very fine-grained and shows fine banding or laminations generally on a scale of less than 1 mm defined by slight variations in red, yellow and grey colouring and also slight variations in porosity. In one area this layering curves up to a near vertical position.

At the 'top' and 'bottom' there is brownish siliceous material with numerous voids which once contained moderately large (probably tabular) crystals of a mineral which has been leached. Many of these crystals were over 1 cm in size and possibly 2-3 cm long. The shape of the voids does not suggest carbonate but tabular crystals of a mineral similar to barite is a possibility.

Thin Section:
This was cut from the finely laminated material.

This finely laminated material is now composed entirely, or almost entirely, of quartz but at least in some bands this quartz is heavily stained yellowish to orange, probably by iron oxide, and there are some thin bands containing extremely fine-grained red iron oxide. Some bands are not porous and are composed of intergrown quartz crystals many of which are 0.05 to 0.1 mm in size, and through this quartz there are thin lines of staining marking fine banding across which the quartz has crystallized. No evidence of clastic mineral grains was found.

The porous layers contain small quartz crystals 0.1-0.2 mm in size with round to oval shapes 1-2 mm in size marked by concentrations of staining. Many of these small patches show successive thin, concentric layers of staining in the quartz. In some thin bands there are traces of red to orange iron oxide or iron oxide-stained clay in interstices and in one band there is a thin film of red iron oxide lining small voids. In one layer there are very small, almost opaque microspherular grains which now appear to be composed of hematite.

In some zones this sediment has been disturbed at a time when it was still soft and there are some complex structures which could be due to slumping.

Conclusion:

As this finely laminated sediment shows no evidence of clastic material it could well have been a chemical precipitate but it is possible that in some layers the quartz has replaced an earlier mineral. This, however, could not be confirmed.

Applicant's No.: JFD 134A/79

Photo Location: NFM 17/88/89s

Unit No.: 6737 RS 1063

Thin Section: 42330

Descriptive Information:

A biotite-phlogopite schist with blue corundum and a green mineral which commonly shows a twinned habit occurring as crosses. It was requested that the mineral be identified.

Hand Specimen:

The sample is a moderately coarse-grained mica schist with some patches of a greenish-blue mineral which was identified by X-ray diffraction as spinel, probably $MgAl_2O_4$.

Thin Section:

The spinel occurs as irregular crystals and masses generally penetrating interstices between flakes of mica. The reason for the external shape of this mass is not clear but in one area it contains a zone up to 8 mm long of paler-coloured corundum which has been veined and partly replaced by a very fine-grained clay-like mineral.

Conclusion:

The schist contains some spinel associated with corundum.

Applicant's No.: JFD 134C/79

Photo Location: NFM 17/88/89s

Unit No.: 6737 RS 1064

Thin Section: 42330B

Descriptive Information:
A prismatic mineral in biotite-phlogopite schist. The identity of the mineral was requested.

Some of this mineral was removed and examined in refractive index liquids. Optical properties correspond with those of tourmaline.

Thin Section:
The thin section shows some very pale-coloured tourmaline with traces of colour zoning.

Conclusion:
The prismatic mineral is tourmaline.

Applicant's No.: JFD 135A-C/79

Photo Location: NFM 17/88/90sp

Unit No.: 6737 RS 1065, 1066, 1067

Thin Section: 42332, 42333, 42334

Descriptive Information:

These three samples are reported to be fault breccia with numerous schistose and granitic clasts and there is thought to be a transition from breccia with a granitic matrix through to a pink feldspar-quartz rock with the few remaining clasts possibly showing partial resorbtion in the matrix. An alternative theory is that the few clasts in samples 135B & C may represent an area of more intense brecciation and shearing where the clasts were further comminuted or where there has been more intense development of the potash feldspar which displaces most of the clasts.

Hand Specimens:

Sample RS 1065 (JFD 135A) contains distinct clasts of granitic rock and also a number of clasts of mica schist in a dark, pink or reddish matrix. Sample RS 1066 (JFD 135B) is a paler-coloured rock with only a few well-defined clasts but there are variations in colour and composition. There are also some quartz vugs. Sample RS 1067 (JFD 135C) is a pink rock showing some variations in colour but with no definite boundaries between clasts and matrix.

Thin Sections:

Sample JFD 135A (RS 1065)

The area sectioned contains portion of a large clast of quartz-biotite schist and numerous smaller fragments of microcline, lesser quartz and a moderate amount of biotite-bearing fragments. There is one about 6 mm in size composed almost entirely of biotite and there is an angular fragment of coarse-grained rutile 4 mm long. The biotite schists contain traces of ?xenotime or monazite and some?feldspar has been replaced by almost fibrous mica.

The matrix contains very small fragments of feldspar, biotite and quartz and traces of recrystallized titanium oxides and ?monazite or xenotime and it has been cemented by fine-grained quartz with some films of iron oxide staining surrounding some of the crystals and in some interstices there is a thin band or zone of iron oxide staining included in the quartz. In one area there is a small patch of extremely fine-grained silty material which, however, does not appear to have been sorted or transported as in the small pockets of siltstone sometimes found in breccias. This fine-grained material contains a few very small fragments of tourmaline as well as the feldspar, biotite and quartz, and it has not be cemented or replaced by quartz.

Sample JFD 135B (RS 1066)

The most striking difference between this and sample RS 1065 is that it contains a much greater abundance of secondary and cementing quartz, some of which occurs as aggregates of radiating crystals, and this quartz has not only filled all interstices but has probably replaced

much of the matrix. There has been some regrowth of potash feldspar crystals projecting into voids now filled by this quartz, and many small clasts of potash feldspar show overgrowths with well developed crystal faces.

When samples JFD 135A & B were stained with cobaltinitrite there was found not to be any increase in the concentration of potash feldspar in 135B as compared with 135A and, although there are the overgrowths of potash feldspar on crystals and clasts lining voids, there has been no general potash feldspar metasomatism and the difference between these two is due to the much greater abundance of quartz in sample 135B.

Sample JFD 135C (RS 1067)

Staining with cobaltinitrite shows that this sample contains a much higher proportion of potash feldspar than samples 135A & B. It contains a few recognisable, moderately large clasts of biotite-rich schist or gneiss as in samples 135A & B, but there is very little biotite in the matrix and there is a greater abundance of small fragments of quartz and potash feldspar varying in size up to 1 mm mixed with very finely crushed material in which many of the fragments are less than 0.05 mm in size. A large proportion of these fragments are potash feldspar and parts of the matrix now appear to be a turbid mass of potash feldspar in which grain boundaries are difficult to determine. Textures suggest that there may have been extensive fracturing or re-fracturing, followed either by regrowth of potash feldspar or replacement of the fractured material by potash feldspar. There is, however, a little late interstitial quartz which has crystallized in some interstices after the potash feldspar. There is very much less of this quartz than in sample 135B and in many areas it occurs in only minor amounts in the matrix of this sample.

Conclusion:

Sample JFD 135B differs from sample 135A mainly in that it contains a much greater proportion of late cementing and/or secondary quartz which has replaced parts of the matrix. Although there has been some regrowth of potash feldspar before the crystallization of this quartz, sample 135B does not contain any more potash feldspar than sample 135A. In sample 135C there is a much higher proportion of potash feldspar than in 135A & B and extensive fracturing and crushing has been followed either by regrowth of potash feldspar or replacement of finely crushed material by potash feldspar. This sample contains much less late or interstitial quartz than sample 135B.

Applicant's No.: JFD 136/79

Photo Location: NFM 17/88/91sp

Unit No.: 6737 RS 1068

Thin Section: 42335

Descriptive Information:
Weathered Radium Creek Metamorphics schist with some elongate crystals.

Hand Specimen:
A weathered, greenish-grey schist stained pink to orange by iron oxide. It contains some almost fibrous crystals up to 2 cm long and in thin section these were found to be an almost colourless amphibole without any evidence of twinning and therefore almost certainly tremolite. They are intergrown with an abundance of plagioclase and at least 2-3% of apatite and rutile.

Conclusion:
The prismatic crystals are of amphibole, probably tremolite.

Applicant's No.: JFD 137C & D/79

Photo Location: NFM 17/88/96sp

Unit No.: 6737 RS 1069 & 1070

Thin Section: 42336 & 42337

Descriptive Information:
Siltstone and sandstone showing ?cross-bedding and ?channel-fill structures. These are from the Mt Gee Beds on Mt Painter.

Hand Specimens:
These are fine-grained, dark greyish-red to greyish-orange rocks with fine layering defined by variations in colour. In sample RS1070 (137D) there are some thin layers containing concentrations of hematite.

Irregularities in the layering suggest some possible cross-bedding in 137C and more extensive disturbances in 137D with some possible cut and fill structure.

Staining with cobaltinitrite does not show any potash feldspar in either of these specimens.

Thin Sections:
Sample JFD 137C (RS 1069)

This rock has been silicified and now consists predominantly of intergrown quartz crystals 0.02 to 0.05 mm in size which have crystallized across the former sediment replacing all pre-existing minerals with the exception of small particles of iron oxide, mainly hematite, and a few very small angular chips of monazite. There are, however, traces of clay which may represent altered feldspar which have not been replaced by the quartz. The hematite particles vary in size from less than 0.01 mm up to 0.1 mm long but most of them are less than 0.05 mm in size. There are slight variations in the concentration and grain size of iron oxide in some layers and there are a few very thin layers containing higher concentrations of larger fragments, many of which show a preferred orientation parallel to the layering. One of these coarser-grained layers also has a few grains which have been replaced by very pale pink clay and a few of these are also subrectangular or elongate and are oriented parallel to the layering.

In general, the earlier textures are not very well preserved but most of the quartz is stained by minute particles of iron oxide and in a few places this staining outlines former grain boundaries.

At one end of the sample there is a layer about 4 mm thick which has a different texture and is stained by orange to reddish-brown goethite. This may be a surface feature.

Sample JFD 137D (RS 1070)

This is also a silicified sediment very similar to sample 137C in that it is composed mainly of quartz stained by iron oxide, but it differs from sample 137C in that there are layers which contain much higher concentrations of small hematite fragments (up to 40%) generally between 0.02 and 0.15 mm long, and these layers also have scattered fragments of monazite and possibly zircon up to 0.05 mm in size and a few tiny grains of rutile. They are therefore layers containing concentrations of heavy mineral grains but probably these mineral fragments have not been transported any great distance. These layers containing concentrations of heavy mineral grains vary in thickness up to about 1 mm but they are not continuous and this sediment has clearly been disturbed. In one area the pattern of heavy mineral layers is similar to that in a 'cut and fill' structure and in another there is evidence of graded bedding with a concentration of the hematite (and monazite) fragments along one boundary grading to silicified sediments containing very little hematite.

At one end of the section there is a layer or band 8 mm thick of turbid, secondary quartz much of which is almost microcrystalline and the few relict textures preserved by the staining suggest that this was a very fine-grained layer. It contains patches of clear quartz, at least some of which have been formed in small fractures or joints, but there are a few which are probably quartz pseudomorphs after elongate or tabular crystals up to 1 mm long.

Conclusion:

These two samples are of silicified, fine-grained sediments which were probably originally composed mainly of clastic material, including transported fragments of specular hematite and minor monazite. In sample JFD 137D these heavy mineral grains have been concentrated in some layers and there is some evidence of disturbance in this sediment and also possible cut and fill structure.

Applicant's No.: JFD 139B & D

Photo Location: NFM 17/88/101sp

Unit No.: 6737 RS 1071 & 1072

Thin Section: 42338 & 42339

Descriptive Information:

These two samples are from the Mt Gee Beds - Radium Creek Metamorphic Basement unconformity on the northern flank of Mt Painter. The basement appears as a breccia with boulder-sized kaolinized clasts and very little matrix. The nearest outcropping rocks are biotite schists.

The breccia is intruded (apparently downwards) by specular hematite rock of the Mt Gee Beds which tends to follow clast boundaries.

Hand Specimens:

Sample 139B is a very altered rock consisting mainly of clay with some scattered patches of quartz and the clay is stained to varying degrees by iron oxide. One zone contains traces of mica and this area was selected for sectioning.

Sample 139D is composed mainly of quartz and hematite with a few leached voids and patches of ochrous hematite which probably once had other mineral grains.

Thin Sections:

Sample 139B (RS 1071)

Most of the areas of clay did not survive sectioning and the remainder of the rock consists of moderately coarse-grained quartz intergrown with aggregates of secondary muscovite, minor remnants of bleached and altered biotite and traces of opaque oxide, rutile and zircon. There are places where the textures suggest a former mica schist and clearly this rock has been invaded by the patches of coarse-grained quartz but, because of the degree of alteration it is not possible to determine its complete history. There is clear evidence of hydrothermal and/or metasomatic alteration which has resulted in the replacement of some minerals by masses of secondary fine-grained muscovite, and this in turn has been invaded by quartz. Most of the boundaries of these quartz crystals and aggregates have a thin rim or surface layer less than 0.05 mm thick of orange to reddish-brown staining in the quartz and in many places there are two very thin parallel layers of staining separated by an extremely thin band in which the quartz shows less staining. The interior of this coarse-grained quartz contains a few scattered inclusions of biotite and in one area it has partly enclosed a moderately large crystal of zircon (or xenotime?).

Aggregates of opaque oxide associated with some recrystallized titanium oxide are present in some areas of deformed and altered mica which is probably altered biotite schist or gneiss, and this also contains some crystals up to 0.5 mm long of zircon or xenotime.

Sample 139D (RS 1072)

This consists of specular hematite and quartz and there were at least two generations of quartz.

There are numerous fragments of specular hematite crystals varying in size from less than 0.5 mm to 2 mm and the patterns formed by this hematite suggest that it crystallized in situ but has been fractured after crystallization. Some of this hematite occurs as relatively dense aggregates 1-2 mm in size and this may have replaced crystals of some earlier mineral, e.g. magnetite, but this could not be confirmed. There are a few euhedral to subhedral quartz crystals intergrown with some of this hematite and also occurring as isolated fragments. Other minerals which may once have been intergrown with the specular hematite have now been completely replaced by a later generation of quartz occurring as intergrown crystals 0.2-0.6 mm long, many of which have an almost fibrous habit resembling chalcedonic quartz. This is similar to much of the Mt Gee quartz in that it contains lines and clouds of minute voids and much of it therefore appears very turbid in thin section, but it has not been possible to determine whether or not this indicates that it replaced an earlier mineral. It may just be an indication of the conditions under which this quartz crystallized.

Some of this late quartz is stained faintly yellowish by material probably inherited from the mineral or minerals it has replaced and in the hand specimen there are a few small, yellow-stained quartz crystals lining voids. There are also places in the hand specimen where the surface of these small quartz crystals is coated with a very thin layer of goethite. No other minerals were found lining voids.

Conclusion:

Sample 139B is of a metasomatically altered rock which may originally have been biotite schist or gneiss. Some minerals have, at one stage been replaced by fine-grained muscovite which, in turn, has been invaded by moderately coarse-grained quartz. Because of weathering no further details can be determined from this sample.

The hematite-quartz rock crystallized in situ, possibly as a vein or breccia filling, but it has been subjected to additional movement and has been invaded and possibly partly replaced by a later generation of quartz.

Applicant's No.: JFD 140B/79

Photo Location: NFM 17/88/103sp

Unit No.: 6737 RS 1073

Thin Section: 42340

Descriptive Information:
Reported to be graded-bedded arkose occurring in a 1-1.5 m thick x 7-10 m wide, cross-bedded arkose which is overlain by angular breccia (sample JFD 152A/79), and is on strike extension of a fault breccia which is covered by scree 75 m short of this outcrop. This arkose is conformably enclosed within Mt Gee quartz-hematite material and pebble-sized clasts of the Mt Gee beds occur within the breccia.

Hand Specimen:
A dark greyish-red, fine-grained, weathered rock containing small quartz grains and numerous small grains which have been replaced by clay. There is also some fine-grained hematite. There is no very clear evidence of bedding but there is a finer-grained band with a very poorly defined boundary against a slightly coarser-grained band or zone.

Thin Section:
This rock now contains over 70% of quartz and although some may represent recrystallized detrital or clastic grains, some is very probably secondary. Much of the quartz has a grain size between 0.2 and 0.4 mm with some elongate crystals up to 0.6 mm long, and some of it contains very fine-grained iron oxide staining. Intergrown with the quartz and also included within some of the crystals there are numerous small grains 0.05-0.2 mm in size which have been replaced by sericite and/or clay but the external shape of these grains has been moderately well preserved. Some appear to have been angular and some rounded. The rock also contains up to 15% of very weathered and stained mica occurring mainly as flakes up to 0.6 mm long and most of these are parallel to the supposed layering. These mica flakes have been replaced by sericitic material or very fine-grained muscovite generally stained by iron oxide and some, which were probably biotite, are so heavily stained that they are almost opaque. There are a few small angular fragments of tourmaline 0.05-0.1 mm in size and a few grains of opaque oxide. In one area there is a larger grain or fragment almost 1 mm long of a quartz crystal with some included, or intergrown, specular hematite and there are a few grains of zircon.

The coarser-grained zone contains weathered and altered mica flakes 0.5-1 mm long and grains up to 0.5 mm in size which have been replaced by sericite and clay. There are also numerous voids from which similar altered grains have been removed by leaching or weathering.

When the sample is examined under very low magnification the variations in grain size are more readily visible and in one zone or band there is a gradual decrease in grain size of the detrital mica and altered grains and this gives the appearance of graded bedding.

Conclusion:

This is an arkosic sediment varying from fine sand to slightly coarser sand and it is composed of material derived from granitic or gneissic rocks but also includes slightly anomalous tourmaline similar to that found in some of the granitic breccias and metasomatically altered rocks. The sediment has very probably been at least partly silicified.

Applicant's No.: JFD 141/79

Photo Location: NFM 17/88/108sp

Unit No.: 6737 RS 1074

Thin Section: 42341

Descriptive Information:

White biotite-quartz-(feldspar) granitic gneiss.

Hand Specimen:

A pale grey, medium-grained gneiss with a foliation defined by parallel flakes of dark biotite.

Thin Section:

Mineral assemblage:

	%
Plagioclase	50-55
Quartz	35-40
Biotite	5-10
Altered mineral	1-2
Zircon	Minute Trace

This is a metamorphic rock consisting mainly of intergrown plagioclase and quartz with a common grain size of 1-1.5 mm but there are also some smaller grains of quartz in interstices and also included within some plagioclase crystals. Many of the plagioclase crystals show well developed twinning and this twinning is not deformed. Biotite flakes 0.5-1 mm long are intergrown with the quartz and feldspar and many of these are parallel to the foliation. The rock once had minor amounts of another mineral intergrown with the quartz and feldspar and of similar grain size, but this mineral has been completely replaced by turbid masses of very fine-grained secondary mica. This altered mineral is mainly concentrated along one band but there were a few crystals scattered through other parts of the rock. There are a few very small grains of zircon.

Conclusion:

Quartz-plagioclase-biotite gneiss with a few completely altered mineral grains.

Applicant's No.: JFD 142/79

Photo Location: NFM 17/88/110s

Unit No.: 6737 RS 1075

Thin Section: 42342

Descriptive Information:
Fine-grained gneiss. Is it of possible igneous origin?

Hand Specimen:
A moderately fine-grained rock with a rather granular texture except for the presence of parallel flakes of dark mica. It is a pale greyish-pink colour with a slightly darker band in the centre of the sample, but this colour variation may be a result of weathering.

Staining of the hand specimen shows abundant potash feldspar and lesser plagioclase.

Thin Section:
Mineral assemblage:

	%
Quartz	35-40
Microcline	35-40
Plagioclase	15-20
Biotite	1-2
Opaque oxide	Trace
Sphene	Trace-1
Hornblende	Trace
Metamict mineral	Trace
Fluorite	Trace
Apatite	Minute Trace

Quartz, microcline and plagioclase are intergrown with a generally granoblastic texture and vary in grain size mainly between 0.5 mm and 1 mm, but there are a few smaller quartz grains in interstices and also included within some microcline. A few feldspar crystals and quartz aggregates are elongated parallel to the foliation but this is not conspicuous. Biotite flakes, generally between 0.5 and 0.8 mm long are intergrown with the quartz and feldspar and many of these are orientated parallel to the foliation. There are also small, elongate aggregates containing biotite with opaque oxide and a few have traces of green hornblende. A few of these small, elongate aggregates of biotite and opaque oxide also have traces of sphene.

Accessory minerals scattered throughout the rock include numerous very small grains of sphene 0.1-0.3 mm long and there are also a few small groups and aggregates of these grains. An unusual feature of this rock is the presence of a few metamict crystals, the largest of which is 1 mm long, and these have been replaced by greenish-yellow to orange-stained material, some of which is almost isotropic. Many of the metamict mineral grains are surrounded by small radiating cracks and the largest metamict crystal (or aggregate of metamict crystals) has more extensively fractured zones at both ends.

This grain has been replaced by bright orange-stained material.

Fluorite occurs mainly in interstices along one thin band and it varies in grain size from 0.2 to 0.4 mm. One small grain of apatite was found in the area sectioned.

Conclusion:

Fine-grained quartz-feldspar-biotite gneiss. It contains slightly anomalous sphene and also a few metamict crystals. The composition appears to be uniform with no evidence of layering on the scale of the sample submitted and no conclusive evidence was found to show whether it was a sediment or an igneous rock. Some features suggest reactions between minerals, particularly biotite, hornblende and opaque oxide, and therefore the rock may have been subjected to more than one episode of metamorphism.

Applicant's No.: JFD 143B/79

Photo Location: NFM 17/88/112sp

Unit No.: 6737 RS ~~1067~~ 1076

Thin Section: 42343

Descriptive Information:
Hematitic breccia from a dyke-like body showing 'graded bedding' in terms of specular hematite clasts. This is in contact with a large ?sillimanite-bearing gneissic clast.

Hand Specimen:
The sample shows a sharply-defined contact between a grey gneissic rock with a streaky appearance and hematitic breccia which contains numerous aggregates of specular hematite 4-6 mm in size. Although there are some moderately large aggregates of this hematite near the contact with the gneiss it is doubtful if this is true graded bedding. In thin section these aggregates of specular hematite were found to have definite patterns which resemble patterns of hematite found in oxidized magnetite crystals and it is therefore suggested that these aggregates represent oxidized magnetite and are not just simply clasts of specular hematite.

Thin Section:
The grey gneiss is now composed mainly of quartz with no more than 25% of fine-grained muscovite and sericite and traces of iron oxide, leucoxene, zircon and monazite. Many earlier silicate crystals which may have been present have been drawn out in the direction of foliation and replaced by fine-grained muscovite generally associated with very fine-grained secondary iron oxide and there are some relict textures suggesting the former presence of mica, possibly biotite, which this sericite and iron oxide have replaced. Some minerals have been replaced by fine-grained quartz with relict textures marked by lines of staining but these are not sufficiently distinctive for the minerals to be identified. A trace of ?zircon was found and one moderately large crystal of monazite 0.8 mm long. In the hand specimen there are a few aggregates of specular hematite which have penetrated this gneiss but these were not found in the area sectioned.

The hematitic breccia consists mainly of specular hematite and quartz and a trace of monazite. Much of the specular hematite occurs as separate crystals and fragments with no particular pattern, although in places there is some parallel alignment of fragments and these are mixed with a few fragments or crystals of coarse-grained quartz, a few fragments which have been replaced by clay, and a few crystals and fragments of monazite. The larger aggregates of hematite noted in the hand specimen are 4-6 mm in size and consist of porous intergrowths of specular hematite crystals many of which are parallel to three intersecting directions and form patterns similar to those found in hematite which has replaced magnetite. In general the external boundary of these aggregates is not preserved and although some are porous with voids between the hematite crystals, in others these voids have been filled by quartz. The specular hematite-quartz-monazite (and feldspar?) rock or breccia has been subjected to additional fracturing but probably very little displacement of the

fractured components. It has been cemented by a later generation of quartz which has also replaced much of the silicate but there are still a few remnants of chlorite and fragments which have been replaced by clay. Much of this late quartz shows patchy orange to brown staining probably inherited from the mineral or minerals it has replaced.

Conclusion:

Hematitic breccia in contact with an altered and silicified gneiss. Textural evidence shows that the larger aggregates of specular hematite were almost certainly moderately large crystals of magnetite which were replaced by porous aggregates of specular hematite crystals and they are not simply clasts of specular hematite. The breccia or vein composed of specular hematite, quartz, some silicate (possibly feldspar) and minor monazite has suffered additional fracturing but the fragments have probably not been displaced any great distance. The breccia has been cemented by a later generation of quartz.

No sillimanite was found in the gneiss and the elongate streaks are fine-grained secondary muscovite some of which may have replaced biotite but this is not absolutely certain.

Applicant's No.: JFD 144/79

Photo Location: NFM 16/62/24s

Unit No.: 6737 RS 1077

Thin Section: 42344

Descriptive Information:
Fault breccia which has possibly undergone potash metasomatism.

Hand Specimen:
A predominantly pink rock. Variations in grain size and texture on the weathered surface suggest there are some large clasts of granitic or pegmatitic rock and of gneiss.

Staining with cobaltinitrite shows moderately abundant potash feldspar unevenly distributed.

Thin Section:
The rock is now composed almost entirely of potash feldspar and quartz with very minor fine-grained muscovite and traces of iron oxide and rutile or recrystallized leucoxene. The grain size varies in different zones from 0.1-0.3 mm and up to 2 mm in the coarser-grained zones. The rock has been extensively fractured and there are now very numerous fragments of microcline and some zones of finely crushed microcline mixed with a little sericite or fine-grained muscovite and traces of brown-stained, altered mica which may have been biotite. The breccia has been cemented and possibly partly replaced by an abundance of secondary or late quartz which has filled all interstices, surrounded all of the small fragments of microcline and also penetrated numerous fractures in microcline. This has obliterated much of the evidence of earlier history of the rock but there are a few small overgrowths of potash feldspar on fragments of microcline where they are surrounded by secondary or late quartz and many of these small overgrowths have developed good crystal faces against the quartz. As a result of the extensive fracturing, regrowth of some microcline and invasion by an abundance of secondary quartz, the boundaries between larger lithic clasts and matrix are no longer clearly defined.

Conclusion:
Granitic breccia which has been invaded and cemented by an abundance of secondary quartz. There is evidence of minor regrowth of potash feldspar but all evidence of earlier history has been obliterated.

Applicant's No.: JFD 145/79

Photo Location: NFM 16/62/35s

Unit No.: 6737 RS 1078

Thin Section: 42345

Descriptive Information:
Pink leucogranite from a fault zone with streaked-out quartz and ?chlorite.

Hand Specimen:
A pink, medium-grained granitic rock with a few parallel zones or bands a few millimetres thick of finer-grained, slightly greenish-grey material. These are cut by a larger quartz vein.

Thin Section:
Mineral assemblage:

	%
Quartz	55-60
Microcline	30-35
Muscovite	2-3
Sericite	10-15
Opaque oxide	Trace
Leucoxene	Trace
Zircon	Minute Trace

In the unaltered zones the rock contains quartz crystals 1-3 mm in size intergrown with slightly finer-grained microcline and relatively minor amounts of another mineral, possibly plagioclase, which has been completely replaced by sericite. There are a few flakes of moderately coarse-grained muscovite, mainly in interstices, and there are a few opaque oxide grains generally associated with a little leucoxene. Boundaries between quartz and microcline are very irregular and textures suggest that some quartz has encroached on, and partly replaced, some microcline retaining a few remnants as inclusions in the quartz. There are also a few aggregates of specular hematite which appear to be secondary.

At some time after crystallization of the quartz the rock has been subjected to tectonic stress and has developed parallel planes along which it has been extensively fractured and sheared but elsewhere it shows little evidence of this tectonic stress. These planes of shearing now contain elongate slivers of quartz 0.1-0.5 mm thick separated by thin seams of sericite. These sheared zones are cut by very small, later fractures and in hand specimen one of these sheared zones has been displaced a distance of about 5 mm along a microfault.

Conclusion:
Muscovite-bearing leucogranite with parallel planes of shearing now composed mainly of sericite and slivers of quartz. The quartz in these zones is not sufficiently fine-grained for them to be described as mylonite.

Applicant's No.: JFD 147/79

Photo Location: NFM 16/62/65sp

Unit No.: 6737 RS 1079

Thin Section: 42346

Descriptive Information:
Polygonal, late-stage Mt Gee-type quartz with fibrous, botryoidal quartz. This quartz truncates most other quartz varieties on Mt Painter, is vughy and has a fibrous structure. Does this indicate that it has pseudomorphously replaced an earlier fibrous mineral, e.g. zeolite?

Hand Specimen:
A rather porous mass of pale yellowish-stained quartz which has crystallized as colloform and botryoidal layers on a set of planes which forms a polygonal framework and the numerous voids are lined with this quartz. The polygonal framework does not show any recognisable, regular pattern.

Thin Section:
The quartz forming these banded layers and botryoidal structures occurs as radiating aggregates of fibrous crystals with optical properties very similar to those of chalcedonic quartz but on a larger scale in that many fibrous aggregates are 2-3 mm long. In general, these radiating aggregates are mutually interfering but there are a few places where there are almost complete spherulites. In some of these masses of quartz there are thin zones of turbidity probably marking some interruption during the growth of these crystals and this turbidity is due to the presence of minute impurities and possibly also minute voids, but most of them are too small to be resolved microscopically. In some zones there are patches of pale brownish staining also due to very minute particles and/or voids. The outer edge of these bands is finely irregular and in places there is an extremely thin film of turbid quartz followed by a very thin gap then a layer about 0.1 mm thick of larger quartz crystals with turbid faces projecting into the void. One void contains fragments of goethite.

The walls or planes on which this fibrous quartz has crystallized are composed of coarser-grained quartz, some of which contains an occasional tiny inclusion of carbonate.

Conclusion:
This network or framework of voids has been filled by layers and botryoidal aggregates of fibrous quartz. No evidence could be found to suggest that this quartz replaced an earlier mineral and, as far as can be determined the fibrous structure appears to be an inherent property of the quartz itself and is probably due to some peculiar physical conditions under which it crystallized. It is similar to some chalcedonic quartz but on a larger scale.

NOTE:

Somewhat similar, porous and boxwork-like masses of chalcedonic quartz have been found in other parts of Australia and there is fairly strong evidence to suggest that at least some of these were formed on a framework of intersecting, thin plates of calcite which formed the original boxwork-like structure but which was replaced by the quartz and/or removed by solution. It is not intended to imply that this sample was necessarily formed in a similar manner but the possibility could be kept in mind.

Applicant's No.: JFD 148/79

Photo Location: NFM 16/62/74s

Unit No.: 6737 RS 1080

Thin Section: 42347

Descriptive Information:

Reported to be a possible dense ?granite which may be equivalent to the Gordon Springs granodiorite which is a younger (Delamerian) intrusive.

Hand Specimen:

A pinkish-grey, moderately fine-grained gneiss containing abundant feldspar and some fine-grained biotite. There are slight colour variations which may indicate some compositional layering but this is very indistinct.

Thin Section:

Mineral assemblage:

	%
Potash feldspar	40-45
Quartz	35-40
Partly sericitized plagioclase	5-10
Biotite	3-5
Iron oxide crystals	2-3
Garnet	Trace-1
Zircon or xenotime	Trace
Metamict mineral	Trace
Apatite	Minute Trace

This is an even-grained rock with a generally granoblastic texture and a common grain size of 0.5-1 mm with a few larger crystals of potash feldspar up to 2 mm long in places, and there is a little finer-grained quartz in interstices. Plagioclase is generally finer-grained than the quartz and potash feldspar and most of it has been extensively replaced by sericite. Biotite flakes are generally between 0.5 and 1 mm long and most of them are parallel to the foliation. Some quartz and potash feldspar grains are also elongated in this direction.

Crystals of opaque iron oxide or iron-titanium oxide 0.2-0.5 mm in size with a few larger ones up to 0.8 mm are scattered throughout the rock and the shape of some is typical of that of magnetite but there may be other opaque oxides present. There are a few small grains of zircon closely associated with, or included within, some of the larger opaque oxide crystals. Small crystals of garnet 0.2-0.4 mm in size with a few to 0.6 mm are intergrown with the quartz and feldspar and are mainly concentrated in one or two poorly defined bands. A few of the small garnet crystals are intergrown with opaque oxide but most of them are in contact with quartz and feldspar only. Small crystals of a metamict mineral are also scattered through the rock and these have been replaced by a yellowish, isotropic or almost isotropic material locally associated with traces of a pale greenish

?epidote mineral. Some of these metamict grains are surrounded by small, radiating cracks and although it is possible that this mineral was allanite there is now no means of confirming this. Some of these metamict crystals are intergrown with opaque oxide and one is closely associated with a larger crystal of ?zircon or ?xenotime. There are a few small crystals of apatite mainly in a zone containing a slightly higher concentration of metamict crystals and opaque oxide.

Conclusion:

Quartz-feldspar-biotite gneiss containing minor garnet, anomalous iron oxide and also a trace of a metamict mineral. Its general texture is that of a metamorphic rock with no definite evidence of origin.

Applicant's No.: JFD 150/79

Photo Location: NFM 16/62/78s

Unit No.: 6737 RS 1081

Thin Section: 42348

Descriptive Information:
Pebble breccia from ?Mt Gee Beds above the unconformity on Mt Painter.

Hand Specimen:
A dull greyish-red breccia containing some grains or fragments of specular hematite about 1 mm in size, some composed of much finer-grained, red hematite and also some patches of white clay, probably kaolin.

Thin Section:
The matrix of this rock has been silicified and now consists of a turbid mass of intergrown quartz crystals many of which are less than 0.1 mm in size, and this quartz is stained by varying concentrations of tiny iron oxide particles and generally minor amounts of very fine-grained mica or sericite. There are a few slightly larger fragments of specular hematite and a few of crystalline goethite and in places there are small patches of clay, probably kaolin, but no other remnants of the earlier matrix which may have been replaced by the quartz.

Scattered through the turbid matrix there are some lithic and mineral clasts varying in size from 0.5-5 mm and these include several fragments of altered and sericitized mica schist most of which was very probably biotite schist, but these now consist mainly of fine-grained white mica or sericite and iron oxide much of which is concentrated along the former cleavage planes of the coarser-grained, earlier mica. There is one clast composed of coarser-grained muscovite which may have been derived from muscovite schist. There are some angular clasts composed of very turbid and stained clay which do not show any definite relict textures from which to determine the origin of this material but possibly it represents altered feldspar. There is a large clast in which similar clay is intergrown with some moderately coarse-grained quartz. There are a few clasts of coarse-grained quartz and in one area there are some aggregates of specular hematite crystals surrounded and veined by quartz. In one of these clasts the specular hematite is associated with some crystalline goethite and in another the hematite encloses an aggregate of monazite crystals. There are a few smaller fragments of hematite, monazite, quartz, muscovite flakes and altered biotite scattered through the silicified matrix.

Conclusion:
This is a silicified breccia containing clasts of altered biotite schist, altered feldspar now replaced by kaolin, a few of coarse-grained quartz and altered feldspar and some clasts of specular hematite. The matrix has been replaced by intergrown quartz crystals stained by tiny particles of iron oxide and also traces of sericite.

Applicant's No.: JFD 152A/79

Photo Location: NFM 17/88/123sp

Unit No.: 6737 RS 1082

Thin Section: 42349

Descriptive Information:

Granitic breccia which occurs above the graded-bedded, cross-bedded arkose of sample 140B (6737 RS 1073). Some of the breccia is cemented with late Mt Gee-type crystalline and vughy quartz.

There is an irregular zone of finer, silty material in this breccia and this shows some indistinct layering which, in one area, is almost at right angles to the contact with the coarser-grained breccia, but elsewhere there is an irregular contact masked by late Mt Gee quartz.

Thin Section:

The whole rock has been silicified and this has obscured many of the earlier features.

The zone of fine silty material is now composed mainly of a mass of intergrown quartz crystals 0.05-0.1 mm in size and these contain very small particles of hematite varying in size from a few microns up to 0.02 mm. There are small flakes or particles of sericite or fine-grained muscovite generally less than 0.05 mm long and a few small patches of clay. In this silicified, very fine material there is a band 2-3 mm thick containing larger fragments of hematite, biotite and quartz but this continues for a distance of only 6 mm and it is cut off by an apparent discontinuity which is almost at right angles to the direction of the band or layer and on the other side of this line the zone of silty material appears to be slightly coarser-grained. A small quartz vein follows this discontinuity. On the other side the coarser-grained band or layer abuts against silicified coarser-grained breccia and this sharp contact is also almost at right angles to the direction of the band or layer. In another area in the section the silicified, fine, silty material has a more irregular contact against coarser-grained breccia in a direction approximately parallel to the layering and at a distance of 3-4 mm from this contact there is a large, elongate fragment of altered, coarse-grained biotite schist surrounded by the silicified, silty material. This is also cut by a later, small, quartz vein which is connected to the other small quartz vein. The coarser-grained breccia contains fragments and flakes of biotite, some of sericite and clay, a few of moderately coarse-grained specular hematite and a few quartz crystals in a matrix which has been completely silicified and in which there is now no evidence of earlier composition.

Conclusion:

Silicified silty material in contact with silicified, coarser-grained breccia. There is no conclusive evidence to show why the layering in the finer-grained material cuts off abruptly against boundaries which are almost at right angles to the layering but one possibility is that there was movement and possible microfaulting in this material before it was silicified. This suggestion is, however, very tentative and it must be admitted that very little useful information can be obtained from the thin section.

Applicant's No.: JFD 152C/79

Photo Location: NFM 17/88/123sp

Unit No.: 6737 RS 1083

Thin Section: 42350

Descriptive Information:
A weathered gneiss or sandstone from the same breccia as sample 152A/79.

Hand Specimen:
A porous, moderately fine-grained siliceous rock with a uniform texture and from which some mineral has been leached. There are varying amounts of almost white clay and therefore the leached material may have been clay which replaced feldspar. On one surface there are some very fine, dark lines but this is insufficient to suggest fine layering.

Thin Section:
This rock now contains moderately coarse-grained quartz, most of which has a grain size between 0.05 and 0.1 mm with a few larger crystals up to 0.2 mm long, and textures show that this was once intergrown with moderately abundant amounts of another silicate mineral, almost certainly feldspar, of similar grain size which was altered to clay and most of it removed by weathering. There are, however, a few smaller grains which were replaced by sericite and some of these have survived. There are no relict textures in the quartz to suggest that this is a sandstone and the general texture is that of a metamorphic rock. Some of the quartz grains are penetrated by clay and iron oxide showing relict textures inherited from flakes of mica, probably biotite, and many of these were parallel, indicating a weak foliation in the rock. In general, the texture is very similar to that in sample 6737 RS 1080 (JFD 148/79) and it contains some iron oxide grains or crystals which are similar in size and shape to some occurring in sample RS 1080. In one area there is an irregular mass of re-crystallized leucoxene and in another area there is a group of small zircon grains included within the quartz. All other minerals have been replaced by clay or have been leached.

Conclusion:
This is a very weathered metamorphic rock which was probably a moderately fine-grained gneiss composed of quartz, feldspar and minor biotite. In texture and grain size it shows some similarities to sample 6737 RS 1080 (JFD 148/79).

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

APPLICATION FOR EXAMINATION OF SPECIMENS OR SAMPLES

(1)

UNIT NUMBER 1:100,000 SHEET	RS	Number	Applicant's Number	Photo Location / Descriptive Information; Drillhole, Survey etc.	Details of work required ATTENTION MRS SYLVIA WHITEHEAD.	Estimated Cost
6737	RS	1044	JFD113A/79	NFM 15/41/129$_{SP}$	Routine petological description of thin-sections and identification of two minerals (samples JFD134 A and C/79). See attached sheets for brief description of the 40 samples. (When recording the results please add the applicants number, photo location, and unit number in that order at the top of each thin section description. All samples are from the Mt. Painter Province	
6737	RS	1045	JFD 113D/79	NFM 15/41/129$_{SP}$		
6737	RS	1046	JFD 113F/79	NFM 15/41/129$_{SP}$		
6737	RS	1047	JFD 114/79	NFM 15/41/132$_{SP}$		
6737	RS	1048	JFD 116/79	NFM 15/41/134$_{SP}$		
6737	RS	1049	JFD 117/79	NFM 15/41/137$_S$		
6737	RS	1050	JFD 119/79	NFM 14/005/40$_S$		
6737	RS	1051	JFD121/79	NFM 17/88/56$_S$		
6737	RS	1052	JFD122B/79	NFM 17/82/64$_{SP}$		
6737	RS	1053	JFD122C/79	NFM 17/83/64$_{SP}$		
6737	RS	1054	JFD122D/79	NFM 17/88/64$_{SP}$		
6737	RS	1055	JFD123A/79	NFM 14/7/2$_S$		
6737	RS	1056	JFD123B/79	NFM 14/7/2$_S$		
6737	RS	1057	JFD124A/79	NFM 14/7/3$_S$	Total	$420 carried forward.

Type of Samples ROCK

Disposal of Samples Return to J. Drexel S.A.D.M.E. Head office.

J. DREXEL

Name of Applicant S.A.D.M.E. Mineral Resources

Address Head Office

Signed J. J. Drexel **Date** 4/10/79

OFFICE USE ONLY

Submitted to AMDEL for - Analytical, Petrological, Other Examination

Firm/Estimated Price $420-00

Charge against Project No. 12 05 0082

Approved _____
for Director General

Copy 1 : AMDEL (via T.I.O.)
Copy 2 : T.I. Services
Copy 3 : Originator
Copy 4 : Glenside Core Lib.

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

(2)

APPLICATION FOR EXAMINATION OF SPECIMENS OR SAMPLES

UNIT NUMBER 1:100,000 SHEET	RS	Number	Applicant's Number	Descriptive Information; PHOTO LOCATION Drillhole, Survey etc.	Details of work required	Estimated Cost
6737	AS	1058	JFD125/79	NFM 14/7/4s	B/F	$420
6737	RS	1059	JFD 126/79	NFM 14/5/5s		
6737	RS	1060	JFD 127/79	NFM 14/5/34s		
6737	RS	1061	JFD 128/79	NFM 14/5/75s		
6737	RS	1062	JFD 130/79	NFM 17/88/81sp		
6737	RS	1063	JFD 134A/79	NFM 17/88/89s	See sheet (1)	
6737	RS	1064	JFD 134C/79	NFM 17/88/89s		
6737	RS	1065	JFD 135A/79	NFM 17/88/90sp		
6737	RS	1066	JFD 135B/79	NFM 17/88/90sp		
6737	RS	1067	JFD 135C/79	NFM 17/88/90sp		
6737	RS	1068	JFD 136/79	NFM 17/88/91sp		
6737	RS	1069	JFD 137C/79	NFM 17/88/96sp		
6737	RS	1070	JFD 137D/79	NFM 17/88/96sp		
6737	RS	1071	JFD 139B/79	NFM 17/88/101sp	Total	$840

carried forward

Type of Samples ROCK

Disposal of Samples Return to J.F. Drexel S.A.D.M.E. Head Office

Name of Applicant J. DREXEL S.A.D.M.E. Mineral Resources

Address Head Office

Signed J.F. Drexel **Date** 4/10/79

OFFICE USE ONLY

Submitted to AMDEL for - Analytical, Petrological, Other Examination

Firm/Estimated Price $840-00 Running Total

Charge against Project No. 12 05 0082

Approved J Narkiewell
for Director General

Copy 1 : AMDEL (via T.I.O.)
Copy 2 : T.I. Services
Copy 3 : Originator
Copy 4 : Glenside Core Lib.

DEPARTMENT OF MINES AND ENERGY - SOUTH AUSTRALIA

(3)

APPLICATION FOR EXAMINATION OF SPECIMENS OR SAMPLES

UNIT NUMBER 1:100,000 SHEET	RS	Number	Applicant's Number	Descriptive Information; PHOTO LOCATION Drillhole, Survey etc.	Details of work required	Estimated Cost
6737	RS	1072	JFD139D/79	NFM 17/88/101$_{SP}$	B/F	$840
6737	RS	1073	JFD140B/79	NFM 17/88/103$_{SP}$		
6737	RS	1074	JFD141/79	NFM 17/88/108$_{S}$		
6737	RS	1075	JFD142/79	NFM 17/88/110$_{S}$		
6737	RS	1076	JFD143B/79	NFM 17/88/112$_{SP}$		
6737	RS	1077	JFD144/79	NFM 16/62/24$_{S}$	See Sheet (1)	
6737	RS	1078	JFD145/79	NFM 16/62/35$_{S}$		
6737	RS	1079	JFD147/79	NFM 16/62/65$_{SP}$		
6737	RS	1080	JFD148/79	NFM 16/62/74$_{S}$		
6737	RS	1081	JFD150/79	NFM 16/62/78$_{S}$		
6737	RS	1082	JFD152A/79	NFM 17/88/123$_{SP}$		
6737	RS	1083	JFD152C/79	NFM 17/88/123$_{SP}$.		$360
					Total	$1200

Type of Samples ROCK

Disposal of Samples Return to J. Drexel S.A.D.M.E Head Office

Name of Applicant J. DREXEL S.A.D.M.E. Mineral Resources

Address Head Office

Signed J. J. Drexel **Date** 4/10/79

OFFICE USE ONLY

Submitted to AMDEL for Analytical, Petrological, Other Examination

Firm/Estimated Price $1200-00 Grand Total

Charge against Project No. 12 05 0082

Approved J. Markwell
for Director General

Copy 1 : AMDEL (via T.I.O.)
Copy 2 : T.I. Services
Copy 3 : Originator
Copy 4 : Glenside Core Lib.

To accompany petrological application by J.T. Breed.

6737 RS 1044
to
6737 RS 1083

Attention Mrs. Sylvia Whitehead

Field description of rocks submitted for petrology

Sylvia,

In the last period of field work we found that many of the Mt. Painter breccias have been developed in fault zones. Both potash feldspar and specular haematite are concentrated in these areas, and in some cases, the breccias show almost complete replacement by K-felds and intrusion of secondary quartz to the point where the rock superficially resembles a pegmatite. This is a possible explanation for the "xenolithic granite of previous bendel submissions.

Layering and graded layering were again found in the breccias, particularly the more haematite ores.

Two ? mylonites found within breccia are included in the current batch of samples.

Bob and I recognised fault breccias early in the Mt. Painter project but we didn't recognise their large field extent. This finding does not negate the idea of "in-situ" brecciation as outlined in an earlier submission, however, as the two processes were probably related.

FD 113A/79 White granodiorite (as mapped on the Mt. Painter Province special) altered by K-felds and spec. haematite. The spec. haematite appears to be interstitial to the "granite". This is a probable altered version of 114.

FD113D/79 Possible mylonite from ½m wide breccia zone. The central zone of the breccia (not shown in specimen) contains wispy tourmaline veining which you have seen in previous specimens.

FD113F/79 ? contact of silty layering which grades thru spec. haematite rich material into altered granitic rock similar to 113A and 114. This rock comes from the same breccia as the previous two samples.

FD114/79 White granodiorite as mapped on the Mt. Painter Province special.

FD 116/79 Contact between silty layering and a pegmatite-like rock developed in a fault breccia. Note the wispy, rough qtz which characterises the pegmatitic rock developed in or near the breccias.

FD117/79. Biotite poor granitic rock previously mapped as granodiorite.

JFD114/79 granite to pebble fault breccia. The clasts may be pinked basement, as several show ?relicts of biotite which is atypical for the leucogranites or pegmatites.

JFD121/79 Fine-grained leucogranite from margin of pegmatite. Several grains appear to be discoloured by K-feldspar. The main pegmat has the same light coloured feldspar as this sample. Is this a compositional effect (ie plagioclase rather than the usual microcline) or is it an alteration effect?

JFD122B/79 Haematitic breccia from dyke-like body showing intrud contact with less haematitic material. This sample is from near the intersection of a haematitic and a granitic breccia dykes, and the contact (on the specimen) may be due to brecciation of the haematitic material.

JFD122C/79. Haematitic breccia with clasts of haematitic and granitic breccia in a silty haematitic matrix. Is the large haematite body in the centre of the specimen a true "clast", or has it developed with the silty material?

JFD122D/79 Layered haematitic siltstone with clasts of granitic breccia. Sylvia, would you please describe the contact relationship betwee the clasts and matrix, and describe the silty layering in as much detail as possible. The sample was from float and unfortunately could not be oriented.

JFD123A/79 Float sample of ?phenocryst bearing red ? volcanic.

JFD123B/79 Float sample of contact between possible volcanic and white quart The ?volcanic float of this sample and 123A occurs in a gap in large white qtz reefs developed along faults at the Adelaidean-Lopertarian boundary. Woolton Volcanics crop-out several hundred metres to the south, but the indications are that these samples and the Woolton's may not be in continuous contact. (The Wywyana quartzite and the Nyuyana calc-silicate formation probably occur between the two)

JFD124/79 ? Vesicular ? volcanic found near samples 123A-B.

JFD125/79 Float of layered ? actinolitic pink quartzite.

JFD126/79 Mt. Neill Granite Porphyry. Is this rock a Porphyrite?

JFD127/79 granitic rock, probably close to true granite, but previously mapped

as granodiorite.

JFD128/79 Float of breccia with post-brecciation clast-coating of ?qtz or pink ?feldspar.

JFD130/79 Yellow-red ochreous jasper layering found in sub-horizontal attitude on "top" of near vertical breccia body within Radium Creek Metamorphics. One corner of the sample shows ?slumping. Is this a chemical sediment?

JFD134A/79 Biotite-phlogopite schist with blue corundum and a green mineral which commonly shows a twinned habit. ~~the~~ it occurs as crosses (X) with angle of incidence generally around 60°. Only the identity of the mineral is required, using either thin-section or X.R.D.

JFD134C/79 ?Epidote in biotite-phlogopite schist. Only the identity of the prismatic mineral is required.

JFD135A/79 Fault breccia with numerous schistose and granite clasts. This and the following two samples are from a near vertical fault breccia

JFD1358-C/79 and demonstrate the continuum from clasts with granitic matrix thro' to a pink felds-qtz rock with, the few remaining clasts showing partial ?resorbtion in the matrix. The alternative to this idea is that few clasts may represent ~~the~~ an area of more intense brecciation or shearing where the clasts are further comminuted, or where there is more intense injection of the K-feldspar etc which displaces most of the clasts.

JFD136/79 (Weathered) Radium Creek Metamorphic schist with crystals of ?epidote or one of the aluminium silicate minerals. Only the identity of the mineral is required.

JFD137C/79 ?cross-bedded siltstone. This sample, and 137D, are from the Mt. Gee Beds on Mt. Painter. Please describe as fully as possible the rock and the probability of the structures being sedimentary cross-bedding.

JFD137D/79 Possible channel-fill structure in silt and sandstone. Note the apparent heavy mineral layering at the base of several sandy horizons. Arrow (partly obscured by sawing) indicates up.

JFD137.B and D/79. These two samples are from the Mt. Gee Beds - Radium Creek Metamorphic basement unconformity on the northern flank of Mt. Painter. The basement appears as a breccia with boulder sized

?haolinised clasts in with very little matrix. It is not typical of fault breccias in the area, and appears more as a contact alteration or a palaeosol. The sample I am sending you is very messy, but you may be able to determine if the alteration is hydrothermal or merely weathering. The nearest outcropping rocks are biotite schists, but much of the sample appears to be ex-greissic.

The breccia is intruded (apparently downwards) by specular haematite rock of the Mt. Gee Beds, which tends to follow clast boundaries. Is the pale yellow, rough lining, mineral in the haematite rock merely stained quartz?

TD1403/79 Graded-bedded arkose. This sample occurs in a 1-1½m thick x 7-10m wide cross-bedded arkose which is overlain by angular breccia (sample JTS 152A/79), and is on strike extension of a fault breccia which is covered by some 75m short of this outcrop. We are uncertain if the arkose developed in the breccia, or if it is a result of younger deposition; it is conformably enclosed within Mt. Gee quartz-haematite material, and pebble sized clasts of the Mt. Gee beds occur within the breccia.

D141/79 White biotite-quartz-(feldspar) granitic greiss.

D142/79 Fine grained felds-quartz-minor magnetite greiss. Is this rock of possible igneous origin?

D1438/79 Haematitic breccia from dyke-like body showing "graded-bedding" in terms of specular haematite clasts, in contact with a large ?silimanite bearing greissic clast. Please describe any textures developed at the contact.

D144/79 Fault breccia which has undergone ?potash ?metasomatism similar to that described under samples 135A-C. Note the apparent pegmatitic clasts, and a greissic clast on the weathered surface.

D145/79 Pink feldspar-quartz leucogranitic rock from fault zone with streaked out quartz and ?chlorite. Possible ?mylonite.

147/79 Polygonal late-stage Mt. Gee type quartz with fibrous botryoidal quartz ?pseudomorphs. This quartz truncates most other quartz varieties on Mt. Painter at least, is quite roughy, and the

fibrous structure may indicate that quartz was not the original mineral, but perhaps a pseudomorph after ? zeolite.

FD148/79 Dense biotite-feldspar-quartz ?granite. This may be an equivalent to the Gordon Springs granodiorite which is a younger (Delamerian) intrusive recognised by G. Teale of the Adelaide (?) i.e.

FD150/79 Pebble breccia from ?Mt. Gee Beds above the unconformity on Mt. Painter. Very little mapping has been done in this area, so I can't give you much data on the field relationships.

FD152A/79 Granitic breccia which occurs above the graded-bedded, cross-bedded arkose of sample 140B. Some of the breccia is cemented with ?late Mt. Gee type crystalline, rugby quartz. Note the dyke like structure with layers ⊥ to the walls. Is there any indication as to how this formed?

FD152C/79 Weathered gneiss or sandstone from same breccia as 152A. In the field this rock closely resembles sandstone in its attitude and contact relations with the Mt. Gee Beds, but its quartz fabric would suggest it to be a gneiss with the feldspar eroded out.

John Drexel