DESCRIPTION OF QUARTZ-HEMATITE ROCKS AND GRANITIC ROCKS FROM THE MT. PAINTER AREA

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7th September, 1976.

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6737

Attention Mr. R.B. Major

REPORT MP 305/77

YOUR REFERENCE:	Application dated 26/7/77
MATERIAL:	41 rock specimens
LOCALITY:	Mt. Painter region, Sth. Aust. All on ~~the~~ Umberatana 1-mile sheet except P1329/76 (Woolitana)
IDENTIFICATION:	P1291-1331/76 6737 RS 307 - 347
DATE RECEIVED:	30/7/76
WORK REQUIRED:	Petrographic and some mineragraphic descriptions. Comparison and determination of origin where possible.

Investigation and Report by: Mrs. S. Whitehead

Officer in Charge, Mineralogy Section: Dr. K.J. Henley

K.J. Henley
for F.R. Hartley
Director

jat.

SUMMARY OF SPECIMENS

P1291/76
TS36307
6737 RS 307

Quartz-cemented, granitic breccia. It contains more biotite than many breccias previously examined and has been cemented by vuggy quartz. Some deformation due to stress and some replacement by the cementing quartz have obscured evidence of origin.

P1291/76
TS36308
6737 RS 308

Pink granitic breccia composed almost entirely of microcline and quartz. As for the previous sample the results of tectonic stress, replacement by cementing quartz and regrowth of some microcline have obscured or obliterated evidence of origin.

P1293/76
TS36309
6737 RS 309

Probably a tectonic breccia. It contains strained and granulated quartz and microcline and has been invaded by secondary quartz which has partly replaced some recrystallized microcline.. Some recrystallized microcline contains groups of small magnetite or martite crystals.

P1294/76
TS36310
6737 RS 310

Granitic (or pegmatitic?) breccia cemented and locally partly replaced by quartz. Although conclusive evidence of origin is lacking, a sedimentary origin is more probable than a tectonic origin.

P1295/76
TS36311
6737 RS 311

Contact between brecciated granitic rock cemented by quartz and similar breccia in which iron oxide has been deposited from solutions in interstices possibly in a more porous or permeable zone. This is a tentative suggestion and should be treated with caution.

P1296/76
TS36312
6737 RS 312

Breccia containing clasts of acid gneiss and of quartz-microcline 'granitic rock' cemented by quartz. A sedimentary origin is favoured but conclusive evidence is lacking. There is a trace of tourmaline.

P1297/76
TS36313
6737 RS 313

Quartz-cemented, microcline-rich breccia. A sedimentary origin is probably more likely (some clasts appear rounded).

P1298/76
TS36314
RS 314

Poorly sorted, arkosic sediment in contact with a coarse grained granitic rock which has been fractured or crushed. A quartz vein separates the two rock types.

P1299/76
TS36315
RS 315

Metasomatically altered 'granitic rock' in which feldspar in some zones has been replaced by varying proportions of sericite or muscovite, chlorite and

iron oxide. Clearly the rock has had a complex history which cannot be fully determined from evidence now available.

P1300/76
TS36316
PS25013
RS 316

Moderately coarse grained rock formerly composed of intergrown magnetite, monazite and an unknown phase. The magnetite has been replaced by hematite and the unknown mineral by turbid, pink-stained secondary quartz. The origin of this rock cannot be determined from the specimen submitted.

P1301/76
TS36317
PS25014
RS 317

Layered rock probably a sediment with a ferruginous siltstone matrix. Some layers contain scattered larger clasts of hematite, martite?, pyrite, quartz and microcline and minor monazite. There are also a few of carbonate and quartz containing chalcocite/ covellite.

P1302/76
TS36318
PS25015
RS 318

Sharp but locally irregular contact between granitic breccia and hematite-bearing breccia. The latter contains hematite, martite, monazite, quartz crystals and clasts of quartz-microcline rock in a matrix which has been replaced by quartz and sericite. The constituents of this breccia may represent reworked material from a chemical precipitate admixed with some clastic, granitic rock.

P1303/76
TS36319
PS25016
RS 319

Hematite-bearing sediment similar to the hematitic phase of P1302/76 but with more abundant and larger hematite aggregates some of which represent oxidized magnetite and some may have been carbonate replaced by hematite. Some hematite aggregates contain inclusions of monazite.

P1304/76
TS36320
PS25017
RS 320

Typical Mt.Geequartz-hematite rock containing fragments of specular hematite, aggregates of hematite, fragments and crystals of euhedral quartz, crystals and aggregates of monazite and a few clasts of quartz-K feldspar rock in a matrix which has been almost entirely replaced by intergrown quartz crystals stained by very fine grained iron oxide. It was probably a reworked chemical precipitate which has been silicified.

P1305/76
TS36321
RS 321
PS25018 ?

Layered quartz-hematite rock of similar composition to P1304/76. The finer grained layers contain more abundant specular hematite crystals and fragments and also elongate monazite fragments both showing preferred orientation parallel to the bedding. This is probably reworked material formed originally as a chemical precipitate.

Coarse grained layers are similar to P1304/76 but with smaller hematite aggregates and 'granitic' clasts.

P1306/76
TS36322
PS25019
RS 322

Layered sediment in which silicified 'silty' or recrystallized 'chert' layers alternate with coarser grained, quartz-hematite layers.

At the base there are crystalline aggregates of quartz similar to euhedral quartz found as fragments in many layers of typical Mt. Gee quartz-hematite rock.

The sediment was disturbed or deformed while still soft.

P1307/76
TS36323
PS25020
RS 323

Layered quartz-hematite rock similar to other specimens from Mt. Gee with a thick layer of laminated, reddish-stained, 'silt' or hematitic chert which could have been silicified.

Textural evidence shows that the matrix quartz and 'chert' crystallized early in the history of the sediments and, in some places probably before deposition of the overlying layer of material.

P1308/76
TS36324
RS 324

Quartz-hematite rock containing minor monazite and showing two generations of hematite. It has been fractured and typical Mt. Gee quartz has crystallized against the truncated surface of the quartz-hematite rock.

Hematite and monazite show less evidence of reworking than in layered specimens of quartz-hematite rock.

P1309/76
TS36324
PS25021
RS 325

A silicified rock in which everything except hematite, a trace of monazite and a few small zircon grains have been replaced by quartz. Red ochreous hematite present in some zones may have replaced a silicate. Some relict textures suggest a fragmental rock or breccia and there may have been some clasts of gneissic rock.

P1310/76
TS36325
RS 326

Silicified quartz-hematite-monazite rock cut by veins of Mt. Gee-type quartz associated with minor clay or altered mica/sericite?.

It differs from P1304/76 (RBM 59A/76) in that much of the hematite appears to have crystallized insitu and does not show evidence of reworking as in typical, layered Mt. Gee quartz-hematite rock.

P1311/76
TS.36327

Silicified sediment containing specular hematite, hematite aggregates, minor monazite, a few euhedral quartz fragments and patches of clay in a matrix replaced by quartz. It is similar to P1305/76 (RBM 59B/76) except that the very fine grained layers are absent or less well defined and no fragments of feldspar were found although there is some clay which could be altered feldspar.

P1312/76
TS36328

A silicified and weathered rock containing moderately abundant pseudomorphs of clay which may have replaced feldspar?, minor specular hematite, a trace of monazite and a trace of oxidized and leached pyrite. There are also a few clasts of euhedral quartz and some prismatic voids from which an undetermined mineral has been leached. The matrix is now orange-stained quartz and chert.

It shows some similarities to Mt. Gee quartz-hematite rock except that there is a much lower proportion of hematite and a much higher proportion of silicate possibly weathered feldspar.

P1313/76
TS36329
PS25022

Quartz-hematite rock. Much of the quartz is unusual in that it occurs as small aggregates some of which form oval or spherical bodies with radiating structures (Possibly chemically precipitated globules or granules). The matrix in this zone is microcrystalline quartz and fine grained hematite.

Some of the coarse grained hematite is martite and some crystallized as specular hematite.

P1314/74
TS36330
PS25023

A silicified rock, probably a layered sediment in which some layers contained specular hematite and traces of monazite and others contained angular clasts of undetermined origin now stained quartz.

P1315/76
TS36331
RS 331

A silicified, layered sediment containing reworked specular hematite and minor monazite. It is very similar to the finer grained and 'silty' or cherty layers in other specimens of Mt. Gee quartz-hematite particularly P1306/76 (RBM 44C/76).

P1316/76
TS36332
PS25024

Laminated sediment with layers of varying grain size containing reworked fragments of hematite and minor monazite. The finer grained layers differ from red to pink-stained chert layers in previous specimens in that they contain silt-sized, clastic material and almost certainly represent silicified siltstone.

Some finer grained layers have been ruptured and invaded by mobile, coarser grained material while the sediment was soft.

P1317/76
TS36333

Granitic or pegmatitic rock encrusted with finely laminated material composed predominantly of authigenic quartz and microcline which have crystallized from solutions. It is therefore predominantly a chemical precipitate but contains minor amounts of other, probably clastic material.

P1318/76
TS36334

Granitic breccia with a 'laminated' zone. This contains clastic quartz, mica, probably microcline, minor apatite and opaque material in a matrix of authigenic or secondary quartz and microcline stained by iron oxide. It is more likely to have been a sediment than a sheared cataclastic but there is some evidence of deformation.

P1319/76
TS36335

Breccia composed of coarse grained microcline, biotite and quartz cemented by secondary, vuggy quartz. Some microcline contains moderately abundant magnetite or martite and some has been partly replaced by quartz. There is a trace of monazite. No conclusive evidence of sedimentary or 'silty' material was found.

P1320/76
TS36336

Granitic breccia composed of quartz, microcline and biotite cemented by quartz. There has been some regrowth of microcline. There is no conclusive evidence of origin.

P1321/76
TS36337

Finely banded, crushed, sheared and granulated K-feldspar and quartz in contact with quartz-microcline leucogranite.

P1322/76
TS36338

Crushed and sheared, pegmatitic rock containing tourmaline.

P1323/76
TS36339

Crushed and recrystallized rock composed largely of potash feldspar with lesser quartz and very fine grained biotite. It has been invaded by quartz veins. A sedimentary origin is the most probable but other interpretations are possible.

P1324/76 TS36340 — Granitic gneiss composed of microcline, quartz and minor mica. There is no conclusive evidence of origin.

P1325/76 TS36341 — Acid gneiss composed of quartz, microcline and a sericitized mineral probably plagioclase. Probably a metasediment.

P1326/76 TS36342 — Magnetite-bearing, porphyritic microgranite. There has been local metasomatic alteration resulting in replacement by fine grained mica and epidote.

P1327/76 TS36343 — Foliated, fine grained leucoadamellite.

P1328/76 TS36344 — Leucocratic microgranite.

P1329/76 TS36345 — Porphyritic grainite or microgranite which shows evidence of granulation and recrystallization under conditions of tectonic stress.

P1330/76 TS36346 — Granite composed of microcline, quartz, partly sericitized plagioclase and partly altered biotite. Iron oxide has crystallized along some grain boundaries and in some crushed or sheared zones.

P1331/76 TS36347 — Silicified quartz-hematite rock has a fractured surface in contact with cherty matrix which could be silicified scree.

3. PETROGRAPHIC DESCRIPTIONS

START OF PAGE '3'

Sample: P1291/76; RBM 50/76; TS36307

Location:
NFM R17/090 (81) SP. Lookout above the Waterfall.

Rock Type:
Granitic breccia.

Hand Specimen:
A moderately coarse grained, pink rock composed predominantly of quartz and feldspar but with some irregularly shaped and elongate patches or aggregates containing dark biotite. There are also a few scattered large crystals or flakes of biotite some of which appear deformed. On one fractured surface a clast of darker coloured rock 3 x 4cm. in size can be seen. There are numerous, irregularly shaped voids which are lined with small projecting quartz crystals and it is clear that similar quartz has cemented the rock. It is now hard and massive and shows no evidence of a foliation.

DESCRIPTION OF QUARTZ-HEMATITE ROCKS AND GRANITIC ROCKS FROM THE MT. PAINTER AREA

1. INTRODUCTION

41 specimens of rock from the Mount Gee, Mount Painter, Radium Ridge, Bills Foly Prospect and other areas in the Mount Painter region were submitted for petrographic description, comparison, interpretation and determination of origin where possible. Thin sections and a few polished sections of these rocks were examined and individual descriptions are given in this report.

2. COMMENTS

Specimens of Mount Gee-type, quartz-hematite rock are generally similar to those described in Report MP204/77 in that they contain specular hematite, aggregates of hematite showing pseudomorphous textures, euhedral quartz, minor monazite and locally a few clasts of quartz microcline rock in a matrix which is now composed of intergrown quartz crystals. This matrix quartz has penetrated the hematite aggregates, fractures in monazite and has replaced or partly replaced microcline-bearing clasts. A trace of barite was found in one specimen (P1331/76, RBM 47/76). It is suggested that these are predominantly chemically precipitated sediments which show evidence of reworking particularly in the finer grained layers where there are numerous elongate fragments of specular hematite and of monazite lying parallel to the layering or bedding. There are however a few specimens in which there is less evidence of reworking and much of the specular hematite and monazite appear to have crystallized in situ. These do not show evidence of layering on the scale of the hand specimen. All of these rocks appear to have been silicified and any original matrix material has been replaced by intergrown quartz crystals.

The associated or interbedded, fine-grained, pink-stained layers referred to as 'silty' layers in the field notes are of finer-grained quartz stained by iron oxide and minor amounts of other material. They do <u>not</u> contain silt-sized, clastic detrital material and are best referred to as impure and slightly ferruginous chert with the reservation that this laminated and fine grained quartz could have replaced an earlier chemical precipitate.

Specimen P1316/76 (Mount Painter summit) differs in that the fine grained layers in this specimen do contain silt-sized, clastic detrital material.

The Mount Gee-type, quartz-hematite rocks differ from hematitic breccias described in other reports in that they do not contain abundant clasts of microcline-bearing, granitic or pegmatitic rock, there is no chlorite and all specimens examined have a matrix which has been completely replaced by intergrown quartz crystals. There are however many significant similarities, mainly in the presence of specular hematite, aggregates of hematite including martite, minor monazite some of which is locally enclosed by aggregates of hematite or martite, and some euhedral quartz crystals. These similarities strongly suggest that there is some genetic relationship between the Mount Gee-type, quartz-hematite rocks and the hematitic breccias.

The granitic breccias and granitic rocks submitted vary in composition and texture and generalizations are not given here. Granitic breccias invariably contain an abundance of secondary or migratory quartz which has crystallized across the earlier rock fabric obscuring and obliterating much of the evidence which would have been useful in determining their origin. There is also considerable evidence of regrowth of microcline and crystallization of authigenic microcline in many of these rocks and this also has obscured evidence of origin.

Staining with cobaltinitrite shows potash feldspar distributed throughout the rock in the large clasts and also in the finer grained matrix.

Thin Section:

In the area sectioned there is portion of a large clast (over 12mm.) composed predominantly of coarse grained quartz with minor turbid microcline and biotite, and portion of another large clast composed mainly of microcline and biotite. There is also another clast 5 mm. in size composed mainly of strained and fractured quartz with minor biotite, and a few smaller clasts composed predominantly of biotite. These are scattered through a matrix containing crystals or fragments of microcline, numerous flakes and grains of biotite averaging 0.5 mm. in size and a few fragments of monazite and these are all cemented by a mass of intergrown quartz crystals between 0.2 and 1.0 mm. in size. Some of this cementing quartz has also penetrated along cleavage plains in clasts or aggregates of biotite. There are very few crystals of iron oxide in the matrix and these include some of magnetite or martite and traces of specular hematite. There are also traces of recrystallized lucoxene and of zircon some of which is associated with biotite.

Much of the quartz, including that in clasts and also the cementing quartz, shows evidence of strain suggesting tectonic stress after this breccia was cemented. Throughout much of the rock it is difficult to distingish clastic quartz from cementing quartz and the boundaries of many clasts are not readily distinguishable and this difficulty is complicated by the fact that in some places the cementing quartz has partly replaced pre-existing material. This secondary quartz has therefore obliterated much of the evidence of original features which would have been useful in determining the origin of the breccia.

Conclusion:

This is a quartz-cemented granitic breccia which contains more biotite than many breccia previously examined. As many original features have been obliterated by the crystallization of abundant secondary quartz there is no definite evidence in the thin section to prove or disprove the tentative suggestion that this is a sedimentary breccia.

Sample: P1292/76; RBM 58/76; TS36308
6737 RS 308

Location:

NFM R17/088 (30) S. 200 metres south-east of Bills Foly Lookout.

Rock Type:
Granitic breccia

Hand Specimen:
A salmon pink, granitic rock composed almost entirely of feldspar and quartz. The hand specimen shows little evidence of a fragmental structure but on one surface there appears to be portion of a large clast containing some altered, coarse grained mica.

Staining with cobaltinitrite shows an abundance of potash feldspar through which there are scattered aggregates, crystals and small veins of quartz.

Thin Section:
This shows portion of a large clast (12 mm.) composed of coarse grained microcline and quartz with traces of sericite in a finer grained matrix also composed predominantly of microcline and quartz with a few small flakes of mica and one fractured and deformed aggregate of monazite. One area in the section contains more abundant, altered mica associated with some microcline but whether or not this is a separate clast is not certain as the boundaries of clasts are now very difficult to determine. The matrix clearly contains some cementing quartz which has filled interstices and has also partly replaced some pre-existing material. There is also some evidence of regrowth of microcline crystals and these features have obscured original relationships between clasts and matrix.

Much of the quartz and some of the feldspar show evidence of tectonic stress and the fact that a monazite crystal has been fractured and the fragments slightly displaced indicates that stress has occurred after the development or accumulation of this breccia.

Conclusion:
This is a granitic breccia which differs from the previous sample in that it contains little or no evidence of biotite and is composed almost entirely of microcline and quartz. As for many other breccias evidence in the thin section does not conclusively prove or disprove a sedimentary origin mainly because original features have been obliterated or obscured by a combination of partial silicification, regrowth of some microcline and some deformation due to tectonic stress.

Sample: P1293/76; RBM 46/76; TS36309
6737 RS 309

Location:
NFM R17/090 (98) S. Southern end of Mount Gee Ridge.

Rock Type:
Breccia.

Hand Specimen:
A massive, greyish-pink rock composed predominantly of quartz and feldspar of varying grain size. There are some porous zones containing vuggy quartz. Staining with cobaltinitrite shows a patchy distribution of potash feldspar.

Thin Section:
The rock consists mainly of irregular patches 0.5 to 5.0 mm. in size composed of strained, granulated and partly recrystallized quartz separated by zones containing turbid potash feldspar which also appears to have been granulated and recrystallized and subsequently invaded and partly replaced by secondary quartz. The feldspathic zones also contain minor amounts of bleached and stained mica and groups or aggregates of small iron oxide crystals originally probably magnetite. In some areas where there is moderately abundant, secondary cementing quartz there are numerous crystals of microcline which have been extensively veined by this quartz and also some scattered small remnants of microcline still in optical continuity which clearly indicates that the secondary cementing quartz has partly replaced the crushed and granulated microcline.

The section contains one relatively large (5.0 mm. long) area of coarse grained microcline and this also contains scattered small flakes of mica some of which are partly altered biotite.

Conclusion:
This is almost certainly a tectonic breccia composed predominantly of quartz and microcline. Some crushed or granulated and re-crytallized microcline now contains minor amounts of magnetite or martite and it has been invaded an partly replaced by secondary, cementing quartz.

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Sample: P1294/76; JFD; TS36310
6737 RS 310

Location:
NFM R16/064 (27a) SP. East side of No. 6 workings.

Rock Type:
Granitic breccia.

Hand Specimen:
A massive, medium grained greyish-pink rock composed of feldspar and quartz. Staining tests show that potash feldspar is abundant.

Thin Section:
This is similar to many other breccias in that it contains a few clasts to 5.0 mm. in size composed of moderately coarse grained quartz and microcline and numerous smaller fragments of microcline and probably also of quartz, cemented by secondary, interstitial quartz which, in this rock contains small patches and clouds of extremely fine grained iron oxide and traces of sericite. Clearly this interstitial quartz has replaces a pre-existing matrix. The matrix also contains a few fragments of monazite, a trace of recrystallized titanium oxide, a few small flakes of muscovite and a few grains of zircon. Most of the small grains and clasts of microcline appear angular but there are one or two which appear partly rounded however this is not thought to be very conclusive evidence. In a few places there is some evidence of minor regrowth of microcline and there is also evidence that some of this matrix microcline has been partly replaced by the cementing quartz. Some of the zircon grains definitely appear rounded but, as the origin of the granitic rock itself is a matter for speculation the roundness of the zircon grains is not conclusive evidence of a sedimentary origin for the breccia.

One small aggregate of specular hematite was found included within some of the cementing quartz.

Much of the coarse grained quartz now shows strain or undulose extinction and clearly it has been subjected to some form of tectonic stress.

Conclusion:
This is a granitic (or pegmatitic?) breccia which, in thin section does not show any conclusive evidence of origin, however, a sedimentary breccia appears more probable than a tectonic breccia. It is similar to the previous specimens in that the matrix has been cemented and locally partly replaced by secondary or late quartz.

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Sample: P1295/76; JFD; TS363111
6737 RS 311

Location:
NFM R16/064 (27a) SP. East side of No. 6 workings.

Rock Type:
Contact between hematitic breccia and granitic rock

Hand Specimen:
The rock shows a contact between greyish-pink granitic rock and a zone in which clasts of granitic rock are associated with a darker coloured matrix containing some hematite.

Thin Section:
The granitic rock is in fact a breccia containing some moderately large crystals of quartz and microcline up to 2.0 mm. in size and abundant finer grained, possibly granulated and recrystallized microcline which has been cemented and partly replaced by later or secondary quartz. There are a few small aggregates of iron oxide associated with some of this quartz and in a few places this interstitial quartz contains aggregates of very fine, acicular or hair-like crystals or pseudomorphs of similar crystals. In one area this granitic rock contains a zone of very fine grained quartz which could have resulted from granulation and recrystallization of coarser grained quartz.

In this granitic rock many of the small clasts of microcline show evidence of regrowth before they were included and locally partly replaced by the interstitial, secondary quartz. In another area there is a dispersed aggregate of recrystallized titanium oxide.

Contact between the granitic rock and hematite-bearing rock is somewhat gradational and the iron oxide first appears mainly as brown-stained material associated with some extremely fine grained hematite along grain boundaries in material which is indistinguishable from the remainder of the "granitic rock". It appears however that this iron-bearing material occurs in zones which do not have the abundance of secondary, interstitial quartz noted in the remainder of the granitic rock. In the hematite-bearing zone there are some areas which are indistinguishable from those in the "granitic rock" but there are also some zones or clasts containing coarser grained quartz and microcline. One of these clasts of coarser grained rock however has a zone of much finer grained, granulated and recrystallized quartz similar to that noted in one area in the "granitic rock".

At a greater distance from the contact some interstices in the hematite-bearing breccia contain aggregates of coarse grained, specular hematite some of which has probably replaced magnetite, and, there are also some patches of goethite.

Interpretation (to be considered with caution):

The granitic rock shows evidence of tectonic stress with some granulation and recrystallization and is therefore thought to be a tectonic breccia. It has been invaded, cemented and locally partly replaced by secondary interstitial quartz. The origin of the hematite-bearing breccia cannot be determined from the available evidence but clasts in this zone also show evidence of tectonic stress. The distribution of iron oxide strongly suggests that it was deposited from solutions which moved through a fragmental rock probably filling the more porous zones. Whether or not this occurred because this zone contained little or no cementing quartz filling up interstices is a matter for speculation.

It seems more likely in this specimen that the iron oxide has been deposited from solutions moving through a more porous or permeable zone in a tectonically brecciated rock.

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Sample: P1296/76; JFD; TS36312

6737 RS 312

Location:

NFN R16/064 (26a). East side of No. 6 workings.

Rock Type:

Breccia.

Hand Specimen:

A coarse grained, fragmental rock composed mainly of pink feldspar and quartz with minor amounts of mica. There are a few clearly visible clasts up to 2.0 cm. in size, some composed of quartz and feldspar and some of coarse grained feldspar.

Thin Section:

This is a quartz-cemented breccia containing clasts of microcline, quartz-microcline "granitic" rock, some clasts of acid gneiss and some composed of quartz aggregates. The finer grained matrix contains microcline, quartz, partly altered biotite and sericite and also a few grains of tourmaline all cemented by late or secondary quartz. The large clasts vary in size up to several millimetres and most of them show some evidence of tectonic stress in that coarse grained quartz and microcline show undulose extinction and there has been some granulation and recrystallization to a finer grain size. Clasts of acid gneiss composed predominantly of quartz and mica also show evidence of tectonic stress.

The matrix is composed of closely packed fragments of microcline, quartz, fragments containing mica and some separate flakes of biotite up to 1.0 mm. long and most of the grain boundaries are

defined by thin films of very fine grained, dark material probably mainly iron oxide. Heavy mineral grains noted include a few of green- to pinkish-coloured tourmaline, a few of recrystallized titanium oxide and a few of zircon. Tourmaline grains have been fractured and slightly dispersed. There are also a few tabular crystals of hematite. The rock has been well cemented by quartz which has filled all interstices and has also partly replaced some clasts the outlines of which are preserved by concentrations of minute impurities included within the quartz.

Conclusion:

This breccia contains clasts of acid gneiss and of quartz-microcline "granitic rock", minor biotite and a few heavy mineral grains and it has been well cemented by quartz. Although there is no conclusive evidence of origin a sedimentary origin is favoured.

Sample: P1297/76; RBM 54A/76; TS36313

Location:

NFN R17/090 (77) S. Radium Ridge. (1km. N.W. Mt. Gee. South Side of)

GRANITIC BRECCIA

Hand Specimen:

A pink "granitic rock" containing some visible clasts 5.0 to 10.0 mm. in size of darker coloured rock and of quartz in a finer grained, pink, feldspar-rich matrix.

Thin Section:

The area sectioned contains some clasts 2.0 to 4.0 mm. in size composed of quartz and of quartz-microcline rock. The finer grained matrix composed largely of turbid microcline with some quartz is cemented by secondary interstitial quartz. There are minor amounts of fine grained mica in the matrix and also a few elongate zones contained iron oxide. There are very few zircon grains.

A few of the quartz clasts 2.0 to 4.0 mm. in size appear more rounded than in other breccias and most of the coarse-grained quartz also shows evidence of tectonic stress. The darker coloured clasts noted in the hand specimen are of granitic rock composed of quartz intergrown with very turbid microcline and one of these is cut by small quartz veins which are cut off at the boundary of the clast. This clast also appears rounded but, although this evidence is suggestive of a sedimentary origin it is not thought to be absolutely conclusive.

The matrix is now composed predominantly of small clasts or fine grained microcline much of which has a grain size of between 0.2 and 0.5 mm. There are scattered flakes and small aggregates of fine grained mica probably mainly muscovite.

The large aggregate of iron oxide included in the section is almost 10.0 mm. long and, although it is now hematite, the external shape of some zones suggest that some magnetite was once present. In another patch of hematite some small crystals occur along a fracture in a microcline clast indicating that this hematite crystallized insitu and was not of clastic origin. Some of it has clearly crystallized in interstices between small clasts and has penetrated along grain boundaries. It is invariably associated with the late or secondary interstistial quartz which is the main cementing medium in this rock. There are a few small patches of goethite which could represent oxidized pyrite but this cannot be confirmed.

The cementing quartz is very similar to that noted in other specimens. It has penetrated many small fractures and has partly replaced some of the finer grained microcline.

Conclusion:
This is a granitic breccia which could have been of sedimentary origin.

Sample: P1298/76; RBM 54B/76; TS36314
6737 RS 314

Location:
NFN R17/090 (77)S. 1 km N.W. of Mt Gee. South side Radium Ridge. (As for P1297/76)

Hand Specimen:
Much of the specimen is of a greyish-pink rock containing clasts with pink feldspar in a fine grained matrix. This gives the rock a somewhat porphyritic appearance. At one end of the sample there is a zone of coarser grained rock composed of quartz and microcline and these two phases are separated by a fracture containing a small quartz vein. Other quartz veins cut the rock in different directions.

Thin Section:
The general appearance of material in the finer grained zone give the impression of a poorly sorted sediment containing fragments of quartz and microcline varying in size from 0.2 to 1.0 mm. with a few larger grains up to 2.0 mm. in a moderately fine grained matrix containing smaller grains of quartz, feldspar and mica with zones of recrystallized? argillaceous material. There are a few opaque grains and grains of lucoxene and at least one fractured and deformed aggregate of fine grained monazite. There are also a few clasts? composed of quartz aggregates in which the quartz shows textures suggesting that it crystallized in a void.

Many of the elongate clasts, including tabular crystals of hematite, show subparallel orientation which could be a

direction of bedding as there is no other textural evidence to suggest that this preferred orientation is a result of shearing.

In part of the section the fine grained matrix strongly resembles a siltstone which has been partly cemented by secondary quartz.

This moderately fine grained rock is in sharp contact with a vein of moderately coarse grained quartz some of which contains planes or clouds of minute voids and in general appearance resembles some of the typical Mount Gee quartz. On the other side of this vein there is a coarse grained rock composed of quartz and microcline with irregular aggregates of hematite (and martite?) in some interstices and associated with some finer grained, granulated and recrystallized quartz and microcline. The vein quartz along the boundary has penetrated numerous fractures in this coarser grained rock and has possibly also cemented the fractured or brecciated portions of it. Whether this coarse grained rock represents a portion of a large clast or a portion of granitic in contact with the finer grained, arkosic sediment? cannot be determined from the hand specimen.

Conclusion:

Most of this specimen is very probably a poorly sorted arkosic sediment containing minor amounts of hematite and monazite. It is separated from a coarser grained, fractured and crushed granitic rock by a vein of secondary or late quartz. The coarser grained granitic rock contains more abundant hematite and/or martite.

Sample: P1299/76; RBN 53/76; TS36315

6737 RS 315

Location:

NFM R17/090 (106) S. 1·5 km N.W. of Mt Gee. Radium Ridge.

Hand Specimen:

An orange-pink, feldspar-rich rock with one area, at least 2.0 x 4.0 cm. in size which is predominantly a yellowish to brownish-green colour. This is referred to in the application as "khaki chlorite clast."

Thin Section:

This rock varies in composition but the texture and grain size of most of the quartz is similar throughout the different phases and, although there is evidence of fracturing there is no definite evidence to show that this is a fragmental rock.

In one pink zone there is an abundance of coarse grained, turbid microcline intergrown with lesser quartz and very minor

amounts of muscovite and in part of this zone there is an aggregate of crystals of iron oxide, probably martite. There is another zone in which quartz is now intergrown with pink-stained feldspar which has been very extensively replaced by fine grained, white mica. This zone also contains a few crystals of iron oxide more particularly along some fractures. This sericitized rock is in fairly sharp but irregular contact with the brownish-coloured zone in which quartz is intergrown with completely altered feldspar? which has been replaced by fine grained mica and weathered chlorite stained by brown iron oxide. The boundaries of this brownish coloured rock are irregular on a small scale and it does not appear to represent a large clast. Along one boundary there are two to three patches of moderately fine grained muscovite stained by iron oxide and one of these contains some very fine grained, recrystallized lucoxene.

Conclusion:

This is a fractured and metasomatically altered rock in which feldspar in some zones has been replaced by varying proportions of sericite, chlorite and iron oxide. It has also been veined by quartz. The rock has clearly had a very complex history all of which cannot be determined from evidence now available.

GRANITIC ROCK metasomatically altered.

Sample P1300/76; RBM 68/76; TS36316; PS25013

6737 RS 316

Location:

NFM R17/092 (35) SP. 1·4 kms NW Mt Gee. No. 2 workings Radium Ridge.

GRANITIC ROCK Metasomatically altered

Hand Specimen:

This is a fairly small specimen containing abundant aggregates of hematite in a generally pink rock. The small size of the specimen does not permit determination of the presence of clasts.

Thin and Polished Sections:

A visual estimate of the constituents is as follows:

	%
Hematite	70-80
Quartz	15-20
Monazite	5-10
Magnetite remnants	Trace
Pyrite inclusions	Very minute Trace

Hematite occurs as masses of intergrown crystals up to 3.0 mm. in size and in thin section, relict textures suggest that this hematite has replaced a crystalline aggregate of coarse grained magnetite in which magnetite crystals were 2.0 to 4.0 mm. in size. Much of the hematite is very slightly porous and contains scattered, very small remnants of magnetite generally only a few microns in size and in one area there are very few, very minute inclusions of pyrite. Although textural evidence suggests

amounts of muscovite and in part of this zone there is an aggregate of crystals of iron oxide, probably martite. There is another zone in which quartz is now intergrown with pink-stained feldspar which has been very extensively replaced by fine grained, white mica. This zone also contains a few crystals of iron oxide more particularly along some fractures. This sericitized rock is in fairly sharp but irregular contact with the brownish-coloured zone in which quartz is intergrown with completely altered feldspar? which has been replaced by fine grained mica and weathered chlorite stained by brown iron oxide. The boundaries of this brownish coloured rock are irregular on a small scale and it does not appear to represent a large clast. Along one boundary there are two to three patch of moderately fine grained muscovite stained by iron oxide and one of these contains some very fine grained, recrystallized lucoxene.

Conclusion:

This is a fractured and metasomatically altered rock in which feldspar in some zones has been replaced by varying proportions of sericite, chlorite and iron oxide. It has also been veined by quartz. The rock has clearly had a very complex history all of which cannot be determined from evidence now available.

GRANITIC ROCK metasomatically altered

Sample P1300/76; RBM 68/76; TS36316; PS25013

6737 RS 316

Location:

1·4 kms NW Mt Gee.

NFM R17/092 (35) SP. No. 2 workings Radium Ridge.

GRANITIC ROCK Metasomatically altered

Hand Specimen:

This is a fairly small specimen containing abundant aggregates of hematite in a generally pink rock. The small size of the specimen does not permit determination of the presence of clasts

Thin and Polished Sections:

A visual estimate of the constituents is as follows:

	%
Hematite	70-80
Quartz	15-20
Monazite	5-10
Magnetite remnants	Trace
Pyrite inclusions	Very minute Trace

Hematite occurs as masses of intergrown crystals up to 3.0 mm. in size and in thin section, relict textures suggest that this hematite has replaced a crystalline aggregate of coarse grained magnetite in which magnetite crystals were 2.0 to 4.0 mm. in size. Much of the hematite is very slightly porous and contains scattered, very small remnants of magnetite generally only a few microns in size and in one area there are very few, very minute inclusions of pyrite. Although textural evidence suggest

that most of this hematite has replaced magnetite, towards one extremity of the hematite aggregate there are some bladed crystals of hematite which appear to have grown out from this large aggregate.

Intergrown with this hematite (probably martite) there are crystals and aggregates of monazite which vary in size with a few crystals up to 3.0 mm. long. Some of this monazite occurs in interstices between the former magnetite crystals and, although textural evidence indicates that the monazite was present before the hematite crystallized it is possible that it crystallized simultaneously with the earlier magnetite.

Interstices between the hematite (martite) and monazite crystals now contain a mass of intergrown quartz crystals showing patchy staining by pale pinkish-brown material and it is almost certain that this quartz has replaced an earlier phase the identity of which cannot be determined from available evidence. In a few places this quartz contains some very small acicular or needle-like relics also of undetermined origi These are now represented mainly by iron oxide staining. This secondary quartz has penetrated all interstices and small fractures in the iron oxide aggregate and also small fractures in the monazite.

Conclusion:

At one time this was a moderately coarse grained rock composed of magnetite and monazite associated with some earlier, undetermined phase. The magnetite has been almost completely replaced by hematite and the unknown interstitial phase has been replaced by turbid and pink-stained, secondary quartz. Whether this was a pegmatitic rock, breccia or chemically precipitated sediment cannot be determined from the specimen submitted.

Sample P1301/76; RBM 76/76; TS36317 FS25014
6737 RS 317

Location:

No. 1 Adit, East Painter.

Hand Specimen:

A reddish brown, layered rock in which most of the matrix appears similar to ferruginous siltstone. In part of the specimen there are layers of siltstone 2.0 to 5.0 mm. thick showing slight variations in grain size, and elsewhere there are layers containing larger clasts 2.0 to 5.0 mm. in size in a reddish-brown, ferruginous siltstone matrix. These larger clasts include many composed predominantly of hematite, some of quartz and/or feldspar and numerous crystals and aggregates of pyrite, some of which show curved faces.

There are also a few (2 noted) clasts composed of carbonate containing some dark copper sulphide, probably chalcocite. These large clasts appear to be concentrated along certain layers in the ferruginous siltstone.

Thin Section:

The matrix of this siltstone is composed of extremely fine grained hematite, clay and small flakes of muscovite most of which are orientated parallel to the layering. There are also numerous tabular or platey crystals of hematite 0.1 to 0.5 mm. long which also show a preferred orientation parallel to the layering.

The larger clasts include some of quartz, a few of microcline and a few composed of intergrown quartz and microcline. There is one composed mainly of quartz with a few crystals or fragments of monazite and one rounded zircon grain. There are a few angular fragments of monazite and a few grains composed mainly of slightly stained muscovite. Opaque clasts include some composed of intergrown hematite crystals with and without interstitial quartz and also some crystals of pyrite. Other opaque grains cannot be identified from a thin section.

The polished section shows some clasts of partly oxidized magnetite a few of which show evidence of zoning. There are inclusions of pyrite in a few of the partly oxidized magnetite clasts however a few inclusions of magnetite are present in some of the large pyrite crystals most of which have curved faces.

The section contains an irregular mass of covellite associated with quartz.

Traces of chalcopyrite are included in some large specular hematite crystals.

Conclusion:

The evidence from the thin section suggests that this is a ferruginous siltstone containing moderately abundant detrital hematite, possibly some martite, minor monazite and a trace of carbonate containing copper sulphides. There are also clasts of quartz-microcline rock.

Sample P1302/76; RBM 188B/75; TS36318; PS25015
6737 RS 318

Location:

NFM R17/090 (59) SP. 300 metre S.E. Mt Gee The waterfall. Basal conglomerate of Mount Gee.

Hand Specimen:

The specimen contains a pink, granitic breccia in contact with a pinkish-grey, hematite-bearing breccia.

Thin and Polished Sections:

The granitic breccia contains clasts composed of moderately coarse grained quartz and microcline and also one in which the feldspar has been extensively replaced by sericite. There is one zone in this rock in which the feldspar has been replaced by brownish-coloured sericite/chlorite? and this zone contains scattered crystals of martite?, some monazite and some re-crystallized titanium oxide. Some clasts in this breccia show evidence of tectonic stress and it is not always possible to distinguish clasts from matrix. The finer grained matrix contains a few small flakes of muscovite and in interstices there are a few crystals of martite? and of specular hematite. This breccia has been invaded and cemented by secondary quartz which has probably partly replaced some of the finer grained constituents in the matrix. In a few places this quartz contains relics of extremely fine, needle-like crystals which occur in very small, radiating aggregates.

Contact between this granitic breccia and hematite-bearing breccia is sharp but irregular in that some crystals or clasts of microcline and of quartz-microcline rock project into the hematite-bearing breccia.

The hematite-bearing breccia contains numerous tabular crystals of specular hematite, aggregates of hematite which very probably represent magnetite replaced by hematite, some euhedral and sub-hedral quartz crystals and also some fragments of monazite. There are also a few clasts composed largely of reddish, ochreous hematite, the origin of which remains obscure. Many of the tabular hematite crystals and elongate fragments of monazite and of quartz crystals show a preferred orientation which could well be a direction of bedding but not all fragments are parallel to this direction. This hematite-bearing phase also contains a few fragments of quartz-microcline rock some containing zircon.

The matrix of this hematite-bearing rock is now predominantly intergrown crystals of secondary or late quartz which enclose scattered, irregular patches of fine grained sericitic material or clay, lightly stained by iron oxide.

The polished section shows a few very small inclusions of pyrite and chalcopyrite in some crystals of hematite.

In the area sectioned only one hematite aggregates was found with some remnants of magnetite.

Conclusion:

This sample shows a sharp but irregular contact between granitic breccia and hematite-bearing breccia which almost certainly was

of sedimentary origin. The hematite-bearing breccia close to the contact contains fragments of specular hematite, monazite, quartz crystals and aggregates of hematite which possibly represent oxidized magnetite, in a matrix which has been very extensively replaced by secondary quartz. It may have been formed by reworking of a predominantly chemically precipitated sediment and the presence of crystals of specular hematite suggests that the magnetite had already been oxidized before re-working of this material.

Sample P1303/76; RPM 188B/75; TS36319

6737 RS 819

Location:

Similar to previous sample. The waterfall, basal conglomerate of Mount Gee. 300 metres S.E. Mt Gee

Hand Specimen:

This rock contains some aggregates or clasts 0.5 to 1.5 cm. in size composed mainly of hematite and a few moderately large clasts of gneissic rock in a finer grained, reddish matrix which also contains hematite.

Thin Section:

This is essentially similar to the hematite-bearing portion of the previous specimen but it contains more abundant and larger aggregates now composed of specular hematite. It also contains a few clasts composed of quartz and microcline and a few scattered, euhedral crystals of quartz. Monazite is present as separate fragments and also included within some of the aggregates of specular hematite. Most of the aggregates of specular hematite show some evidence of polygonal outlines and the shape of some of these suggests that the hematite probably replaced magnetite. Others show a rhombohedral outline and it is possible that some of the hematite replaced crystals of carbonate but this is uncertain. Many of these aggregates are now porous and have been invaded by the matrix quartz. Where monazite is present within these aggregates it appears to have been included within the former magnetite? or carbonate?.

Euhedral quartz crystals are between 0.5 and 2.0 mm. long and most of them are now surrounded by optically continuous over-growth which are intergrown with the matrix quartz.

The matrix has been extensively replaced by intergrown quartz crystals, 0.1 to 0.3 mm. long, but throughout this mass there are numerous small patches or sericitic material, small crystals of hematite and cloudy patches of reddish-brown iron oxide staining. Sericitic material and clay probably comprise up to 25% of the siliceous matrix.

Conclusion:

The history of this hematite-bearing rock is similar to that of the hematite-bearing phase in the previous sample and it

was possibly a sediment containing reworked material which originated as a chemical precipitate. The fine grained matrix contains some argillaceous material and has been extensively replaced by late quartz.

Sample: P1304/76; RBN 59A/76; TS36320; PS25017
TS37 RS 320

Location:
NFM R17/090 (108) S. Above the waterfall. 300 metres S.E. of Mt Gee. Massive, specular hematite rock with clasts, above the base of Mount Gee.

QUARTZ-HEMATITE ROCK

Hand Specimen:
A dark red to grey, hematite-rich rock containing some aggregates of specular hematite up to 1.5 cm. in size and also a few aggregates or clasts composed of ochreous iron oxide. There are a few small and one large clast of quartz-feldspar rock. The sample is cut by small quartz veins.

Thin and Polished Sections:
A visual estimate of the constituents is as follows.

	%
Hematite	25-30
Goethite	1-2
Monazite	1-2
Euhedral quartz crystals	3-5
Sericite/clay	1-2
Secondary quartz	60-65
Microcline	Trace

This is similar to many other specimens of Mount Gee quartz-hematite rock in that it contains fragments and crystals of specular hematite, larger aggregates of hematite, scattered euhedral quartz crystals and numerous crystals and fragments of monazite in a matrix now composed of intergrown quartz crystals which are stained by very fine grained iron oxide and small patches of sericite. Some of the aggregates of hematite have polygonal outlines and some evidence of internal structure indicating that this hematite has replaced a pre-existing mineral and, although its identity cannot be determined carbonate is a possibility for at least some aggregates. In this sample minor amounts of goethite are associated with some hematite and in a few places this goethite has replaced prismatic crystals with six-sided cross sections. There are also some clasts now composed of ochreous iron oxide, some of which shows very fine concentric or colloform layering but the identity of the mineral replaced by this ochreous iron oxide cannot be determined.

Euhedral quartz crystals are similar to those noted in other specimens but there are also a few which are clearly fragments of fractured, prismatic quartz crystals. These are surrounded by optically continuous overgrowths of secondary quartz intergrown with the matrix quartz but the former boundaries are clearly defined by concentrations of ochreous iron oxide. This specimen has one unusual feature in that there is an aggregate of clear quartz crystals enclosing the end of one elongate aggregate of monazite crystals. Another hexagonal quartz crystal was found with some inclusions of carbonate.

Monazite occurs throughout the rock as small crystals and fragments generally less than 0.3 mm in size but there is one elongate crystalline aggregate 5.0 mm. long in contact with one elongate aggregate of hematite. It is portion of this aggregate which is included within some of the hexagonal quartz crystals. There are a few aggregates of hematite which contain inclusions of monazite.

In one area of the section there are relict textures suggesting the former presence of an angular fragment 4.0 mm. in size which has been almost completely replaced by the secondary matrix quartz and fine grained hematite. This clast still contains some coarse grained quartz and also a remnant of turbid potash feldspar and almost certainly it represents a clast of quartz-feldspar rock or "granitic rock".

The polished section gives very little additional information. There are very few small inclusions of pyrite in some of the hematite but no remnants of magnetite were found and no definite evidence to suggest that any of the hematite aggregates replaced magnetite. Some of the goethite clearly shows 6-sided cross section and other goethite shows a prismatic or elongate crystalline shape.

There are a few clasts which are now composed of ochreous iron oxide but there is no definite evidence to indicate the identity of the mineral replaced by this ochreous material.

Conclusion:

This is similar to other specimens of Mount Gee quartz-hematite rock and, as for other specimens it is suggested that it is composed of reworked material deposited mainly as a chemical precipitate intermixed with some granitic clasts. The matrix has been almost completely replaced by secondary quartz stained by iron oxide and this quartz has also invaded many of the aggregates of hematite.

Sample: P1305/76; RBM 59B/76; TS36321
6737 RS 321

Location: 300m S.E. of Mt Gee.
As for Sample P1304/76. Laminated silty, specular-hematite rock interlayered in 59A.
LAYERED QUARTZ-HEMATITE ROCK

Hand Specimen:
A moderately fine grained, pinkish-grey rock with parallel layers up to a few millimetres thick defined mainly by variations in grain size. Some appear to be composed of silt-sized material and other layers contain slightly coarser grained material.

Thin Section:
The overall composition of this rock is similar to that of P1304/76 and it differs mainly in the evidence of layering and the size of the crystals and fragments.

Some layers contain more abundant tabular hematite crystals and fragments 0.1 to 0.6 mm. long and many of these show a preferred orientation parallel to the layering. Elongate fragments of monazite are intermixed with these tabular hematite fragments and they also show a parallelism to the layering. These fragments of hematite and monazite have clearly been reworked and deposited as a sediment. One of these finer grained layers also contains a small fractured grain of tourmaline.

Coarser grained layers contain slightly less tabular hematite crystals and fragments but more abundant aggregates of hematite most of which are less than 1.0 mm. in size. The coarser grained layers also contain some euhedral quartz crystals and fragments, a few fragments of turbid microcline and a few of quartz-microcline rock. One layer contains a few flakes of muscovite? or altered biotite.

The matrix is similar to that in other specimens of Mount Gee quartz-hematite rock in that it is now a mosaic of intergrown quartz crystals with a few scattered patches of sericite and much of the quartz is slightly stained by very fine grained iron oxide.

Conclusion:
This is a silicified, layered sediment probably originally composed largely of reworked material which had been chemically precipitated intermixed with some clastic material derived from granitic? rocks.

Sample: P1306/76; RBM 44C/76; TS36322
6737 RS 322

Location: ¾ km NNW of Mt Gee
NFM R17/090 (95) SP. North of Mount Gee. Silty and quartz-hematite rock showing layering.

Hand Specimen:
A layered rock in which a layer 2.0 to 3.0 cm. thick of typical Mount Gee quartz-hematite rock is underlain and overlain by finer grained, brownish-pink, silicified silty? layers. At one end of the specimen this layering has been disturbed while the sediments were still soft and in this zone there is now some white quartz filling interstices between disturbed and fragmented portions of layers.

Thin Section:
This was cut through the lower silty? layer passing up into the central layer of quartz-hematite rock.

At the base of the specimen there is a zone of coarsely crystalline quartz with some crystals over 5.0 mm. in size and this grades up into finer grained quartz with intergrown, euhedral to subhedral crystals up to 2.0 mm. long. Some interstices between these crystals contain turbid masses of iron oxide-stained, finer grained quartz through which there are scattered a few small fragments of specular hematite and monazite. Some of the quartz crystals show growth zoning and locally they have enveloped small fragments of monazite. They are similar to the subhedral and euhedral quartz fragments noted in many of the samples of Mount Gee quartz-hematite rock and similar aggregates could be the source of such fragments. Near the top of this layer containing relatively large intergrown quartz crystals there are more abundant fragments of monazite and specular hematite 0.1 to 0.4 mm. long and in general, these have accumulated in the spaces between the quartz crystals.

The "silty" layer overlying this coarsely crystalline quartz contains very small fragments of hematite and monazite generally less than 0.05 mm. in size in a mass of intergrown quartz crystals stained by extremely fine grained to ochreous, reddish-brown iron oxide. This is similar to other "silty" layers and has the appearance of a silicified, fine grained sediment but, in this layer there is no evidence of sericitic or argillaceous material. This fine grained layer does contain some thin laminations containing coarser grained hematite and monazite and also some aggregates of hematite up to 1.0 mm. in size. There are also a few fragments of quartz crystals up to 1.0 mm. in size and this is very similar to the coarser grained quartz-hematite rock. These laminations of coarser grained material are up to 5.0 mm. thick and they become thicker and more closely spaced towards the top of the underlying "silty" layer.

The coarser grained quartz-hematite rock is very similar to that in other specimens previous described and it contains some aggregates of hematite 1.0 to 2.0 mm. in size showing relict textures which suggests that some could have replaced carbonate. Quartz fragments and monazite fragments are similar to those noted in other specimens and the matrix has been replaced by intergrown quartz crystals containing clouds of minute voids.

Conclusion:

This is a layered sediment in which the coarser grained layers contain hematite, hematite aggregates and monazite which were probably reworked from chemically precipitated material. Additional information from this specimen suggests that the fragments of euhedral quartz could have been derived from aggregates of similar quartz which apparently crystallized on the bottom or floor of the sedimentary basin probably at certain favourable times.

There is still no definite information concerning the original composition of the "silty" layers.

Sample: P1307/76; RBM 45/76; TS36323; PS25020
6737 RS 323

Location:

NFM R17/090 (96) SP. Summit of Mount Gee.

LAYERED QUARTZ-HEMATITE ROCK

Hand Specimen:

A layered rock in which there is some medium grained quartz-hematite rock overlain by thin layers of reddish "silty" material then another layer of moderately coarse-grained, quartz-hematite rock containing less hematite and more quartz than the lower layer. This is in turn overlain by a thicker layer (1.5 cm.) of reddish, "silty" material showing fine laminations. Separating this from the underlying quartz-hematite rock there is a thin band of almost white quartz 1.0 to 2.0 mm. thick. At the top of the reddish layer there are similar thin bands of white quartz alternating with thin bands of fine-grained, reddish-stained material.

Thin and Polished Sections:

The quartz-hematite rock contains crystals and fragments of specular hematite of varying size up to 2.0 mm. long, some aggregates of hematite in which an earlier mineral has been replaced by the hematite, some large quartz crystals and also a few smaller aggregates of finer grained quartz crystals. There are a few fragments of monazite but this is less abundant than in other specimens of Mount Gee, quartz-hematite rock previously described. The matrix is similar to that in other specimens of Mount Gee quartz-hematite rock in that it is now composed of intergrown quartz crystals of varying size, some of which are stained by extremely fine grained iron oxide and

some contain clouds of minute voids and/or fluid inclusions.

Above this layer of quartz-hematite rock there is a thin layer (1.0 to 1.5 mm.) of silicified, fine grained sediment containing small particles of hematite and stained by extremely fine grained iron oxide. This is followed by a very thin layer containing more abundant, small fragments of hematite and a trace of apatite? and this grades upwards into the pale-coloured layer composed predominantly of very fine grained quartz which appears almost white in the hand specimen. Towards the top of this layer the quartz increases in grain size and at the top there are projecting quartz crystals 0.1 to 0.3 mm. long. The general appearance suggests that this quartz crystallized before the overlying red-stained layer was deposited.

The overlying "silty" layer contains very small particles and flakes of hematite in a mass of intergrown quartz crystals less than 0.1 mm. in size which are heavily stained by extremely fine grained reddish brown material, probably mainly iron oxide. There is no evidence from which to identify the material replaced by this quartz.

Laminations in this red-stained material are due to varying proportions in the amount of iron oxide and there is also one thin layer (0.5 mm.) which contains more abundant and larger fragments of specular hematite and a few fragments of euhedral quartz and monazite.

At the top of the reddish layer there is a 2.0 mm.-thick band of almost white quartz composed of intergrown crystals which do not contain iron oxide staining but do contain clouds of minute voids. This is followed by a thin layer of the reddish-stained quartz then another layer of coarser grained quartz which occurs largely as orientated crystals 0.5 to 2.0 mm. long which have clearly grown outwards towards the present surface.

Conclusion:

This is essentially very similar to the Mount Gee quartz-hematite rock and reddish-stained silicified "silty" layer previously described in MP204/77. The quartz-hematite rock probably represents chemically precipitated material which has been reworked and then silicified. No definite evidence could be found to show the nature of the finer grained material which formed the bulk of the "silty" layers before silicification. There is evidence to show that the matrix quartz crystallized very early in the history of this rock and at least in some cases before the overlying layer of material was deposited.

Sample: P1308/76; RBN 44E/76; TS36324
6737 RS 324.

Location:
NFM R17/090 (95) SP. ¾ km NNW of Mt Gee. North of Mount Gee. (Silty hematite rock which appears to truncate Mount Gee quartz.)

Hand Specimen:
The bulk of the specimen is a reddish, hematite-rich rock containing some patches and/or clasts of paler coloured quartz and possibly other silicate. Along one side of the specimen there is a mass of white quartz which has a sharp contact against the hematite-bearing rock. This contact appears to be at a high angle to some very indistinct suggestions of layering or bedding in the hematite-bearing rock.

Thin Section:
The hematite-bearing rock contains abundant crystals of specular hematite, a few euhedral crystals of quartz and a few crystalline aggregates of monazite cemented by a mass of intergrown quartz crystals. In this part of the rock there appears to have been two generations of hematite in that the larger crystals which are 0.4 to 1.0 mm. long are surrounded by fringes of much finer grained hematite occurring as small, translucent red crystals, many of which are less than 0.05 mm. in size. Monazite occurs as crystalline aggregates which appear to be intergrown with the hematite and, although some appear deformed and fractured there is less evidence in this specimen to suggest reworking of the constituent material. It would be possible to interpret this rock as having been formed by intergrown hematite, quartz and monazite but there are a few angular areas composed almost entirely of quartz with only minor amounts of very fine grained hematite.

The boundary between this hematite-quartz rock and the typical Mount Gee quartz which appears almost white in the hand specimen is sharply defined and truncates structures and textures in the quartz-hematite rock. Near the contact with the quartz-hematite rock the Mount Gee quartz contains small fragments and concentrations of hematite and also brownish iron oxide but further from the contact it is clear and shows textures typical of quartz which has crystallized in an open void. There are numerous radiating aggregates of crystals 1.0 mm. long and a few voids lined by quartz crystals. Much of this quartz contains clouds of minute voids which locally mark growth zones in the crystal and in a few places there are some groups of very small, iron oxide inclusions and in a few places also some inclusions of very fine grained, micaceous silicate possibly clay. In a few of the voids lined by quartz crystals there are trace amounts of iron oxide-stained clay or sericitic material and in one void there is some finely crystalline hematite which has filled interstices between the projecting quartz crystals.

Conclusion:

The quartz-hematite rock is similar to many other specimens in composition but possibly shows less evidence of reworking. There have been two generations of hematite in that the larger crystals are surrounded by fringes or overgrowths of much finer grained specular hematite. This quartz-hematite rock has been truncated or fractured and typical Mount Gee quartz has crystallized along the truncated surface of this quartz-hematite rock or has filled the fracture cutting this rock.

Sample: P1309/76; RBM 44F/76; TS36325; PS25021

Location:

NFM R17/090 (95) SP. North of Mount Gee. Light brown quartzite? clasts in P1308/76.

Hand Specimen:-

A greyish-pink, siliceous rock containing some patches or aggregates of specular hematite and also some patches containing red, ochreous hematite.

Thin Section:

This is clearly a silicified rock in which medium grained quartz (average grain size 0.5 mm.) has replaced everything except hematite, a trace of monazite and a few very small grains of zircon. Former textures are not always clearly preserved but some suggest that it was a fragmental rock containing aggregates of specular hematite, some euhedral quartz crystals or fragments, some oxidized magnetite or martite and some undetermined material which has been replaced by ochreous hematite. There is one zone which contains little or no specular hematite but more abundant fragments of monazite and fragments of clear quartz crystals surrounded and cemented by secondary quartz through which there are distributed some small spherulites of iron oxide.

In the coarser grained zone there are some relatively large areas now composed predominantly of quartz which have a few apparently rounded grains of zircon up to 0.1 mm. in size but the enclosing rock which contained the zircon crystals whatever it may have been has been completely replaced by quartz showing patches of staining by fine grained iron oxide. In one similar area (or clast?) quartz shows a preferred orientation and a general texture similar to that noted in some clasts of gneissic rock in other specimens and this also contains a few small grains of zircon. It is possible that this was once a clast of acid gneiss but the suggestion is very tentative.

Conclusion:

This is a silicified rock which was probably a fragmental rock or breccia containing hematite, minor monazite, some quartz crystals and possibly some lithic fragments. Quartz has replaced

everything except hematite, monazite and a few small zircon grains.

Sample: P1310/76; RBM 34A/76; TS36325

Location:
NFM R16/062 (6) S. North side of Mount Painter. Hematite rock intruded by Mount Gee quartz.

Hand Specimen:
Dark red, hematite-rich rock cut by irregular veins 1.0 to 2.0 cm. thick composed predominantly of quartz which occurs as prismatic crystals and radiating aggregates growing out from the contact with the hematitic rock. In one area of the cut surface some specular hematite outlines relict textures with a square outline 5.0 mm. in size probably derived from coarse grained magnetite.

Staining tests did not show any evidence of potash feldspar.

Thin Section:
The rock is now composed predominantly of quartz and hematite with minor monazite but some of the moderately fine grained, secondary quartz is stained pale orange to pale brown probably by material inherited from the mineral it has replaced.

Hematite occurs throughout the rock as aggregates of elongate or tabular crystals several millimetres long and some more massive patches which show no definite evidence of earlier history but which could represent oxidized magnetite. There are also a few patches containing rather spongy masses of very fine grained hematite. Many hematite crystals in this rock are intergrown and show some evidence of fracturing and deformation. Unlike hematite in many specimens of Mount Gee quartz-hematite rock this does not show definite evidence of reworking under sedimentary conditions.

There are a few crystals and/or fragments of monazite intergrown with and also partly enclosed by hematite aggregates and there are also a few euhedral quartz crystals. The origin of the areas now replaced by orange-to-brown stained quartz remains undetermined.but it is possible that at least some may represent silicified silicate minerals possibly including some feldspar. This suggestion is very tentative.

The vein quartz in contact with the hematitic rock occurs as groups of crystals commonly showing radial arrangement which clearly have grown out from the surface of the hematite-rich rock. Near this surface of contact there are some irregular patches of orange to pink-stained, fine grained, micaceous clay

or sericitic material included within the quartz aggregates or intergrown with the quartz and there are also a few remnants of hematite.

Conclusion:

This is a quartz-hematite-monazite rock which has been silicified and cut by veins of Mount Gee-type quartz. It differs from Sample P1304/76 (RBM 59A/76) in that much of the hematite appears to have crystallized insitu and does not show evidence of re-working as in many other specimens of typical Mount Gee quartz-hematite rock.

Sample: P1311/76; RBM 34C/76; TS36327

6737 RS 327

Location:

NFM R16/062 (6) S. North side of Mount Painter. 200 metres N.E. of Mt Painter. Laminated silty rock interlayered in P1310/76 (RBM 34A/76). Probably equivalent to P1305/76 (RBM 59B/76).

Hand Specimen:

A brownish-red rock showing definite but not well defined layers which vary in grain size.

Thin Section:

This is very similar to many other specimens of layered quartz-hematite rock from the Mount Gee area in that it contains specular hematite crystals and fragments, some aggregates of hematite which vary in size in different layers, some euhedral quartz fragments and a few small fragments of monazite. In this particular specimen there are also irregular patches which have been replaced by orange- to pink-stained clay or sericitic material and these do not show any evidence of relict textures to indicate the identity of the mineral replaced.

In the area sectioned there is some evidence of a thin, finer grained layer in which elongate fragments of hematite have a preferred orientation parallel to the layering and this particular layer also contains a higher concentration of monazite fragments.

The matrix is similar to that in other specimens of Mount Gee quartz-hematite rock in that it has been replaced by intergrown quartz crystals which, in some areas contain clouds of minute iron oxide particles as well as minute voids.

Conclusion:

This is a silicified, layered sediment containing hematite and minor monazite and it is very similar to specimen P1305/76 (RBM 59B/76) except that the layering is less sharply defined and there are no clasts containing fresh potash feldspar however there are numerous small patches of clay.

*Sample: P1312/76; RBM 35A/76; TS36328

6737 RS 329

Location:

NFM R16/062 (12) S. North side of Mount ~~Gee.~~ Painter.

Hand Specimen:

A brownish-orange, siliceous rock containing abundant small spots or aggregates of white clay averaging 1.0 mm. in size which are almost certainly altered grains of a silicate mineral. The rock contains a few aggregates of hematite up to 5.0 mm. in size and also a few small crystals of specular hematite.

Thin Section:

This is a silicified rock composed predominantly of intergrown quartz crystals which, in some areas are stained pale orange by material derived from the mineral the quartz has replaced and through much of this quartz there are clouds of minute voids similar to those noted in specimens of Mount Gee quartz-hematite rock. This quartz has clearly crystallized across an earlier fabric. Except in a few places where orange staining defines some textures suggestive of feldspar, relict textures are not readily identifiable.

Through this mass of secondary quartz there are scattered fragments of specular hematite crystals (5-10%), a few euhedral quartz crystals, a few small fragments of monazite and numerous patches of clay. There are also a few elongate voids with parallel sides up to 1.0 mm. long from which crystals of some prismatic mineral have been leached. There are no definite relict textures in the patches of clay to definitely identify the mineral which this clay has replaced but at least for some feldspar is a possibility.

Conclusion:

It is tentatively suggested that this was a sediment similar to some of the other Mount Gee quartz-hematite rocks except that it contains a much lower proportion of hematite and a much higher proportion of silicate much of which could have been feldspar. No evidence of layering was found on the scale of the specimen.

*Sample: P1313/76; RBM 35B/76; TS36329; PS25022

6737 RS 329

Location:

NFM R16/062 (12) S. North side of Mount ~~Gee.~~ Painter. Hematite rock which may be equivalent to 34A/76 and 59A/76 (P1310 and P1304/76).

Hand Specimen:

A dark red, hematite-bearing rock with some fragments of a quartz vein which, although still in line are discontinuous probably because the vein was fractured during deformation of this rock.

QUARTZ-HEMATITE ROCK

Thin and Polished Sections:

The rock is composed almost entirely of quartz and hematite with a minute trace of monazite and a trace of turbid, translucent altered material.

This differs from all other specimens examined in that much of the quartz occurs in isolated, small aggregates showing radial growth and some of these are globular to oval in shape. Many of these small aggregates average 0.2 to 0.4 mm. in size but there are also larger and more irregularly shaped aggregates 1.0 to 2.0 mm. in size. Where these separate, small quartz aggregates are present they are separated by a turbid matrix composed of microcrystalline quartz stained by very fine grained iron oxide. The rock also contains numerous fragments or crystals of specular hematite, some of martite containing small remnants of magnetite and a few small fragments of monazite. There are also a few clasts? of coarser grained quartz.

In some areas in the section quartz showing very similar textures to that forming the small globular and oval bodies now forms a more or less continuous matrix through which are scattered fragments of specular hematite and a few of monazite. This zone is similar to the more common quartz-hematite rock from this area. In one of these areas some of this quartz has apparently replaced rhomb-shaped crystals which are now outlined by hematite.

Some of the tabular crystals of hematite have been fractured and deformed in situ.

Conclusion:

This differs from all other specimens of Mount Gee quartz-hematite rock previously examined in that at least in some zones quartz similar to that forming the matrix in other specimens occurs as small globular and oval bodies and as slightly larger, less regularly shaped bodies in a matrix of much finer grained microcrystalline quartz stained by fine grained hematite. In other areas the matrix appears to have been completely replaced by the coarser grained quartz similar to that present in the isolated globular and oval bodies. Whether or not these were derived from globules of silica precipitated with the original sediment is a matter for speculation.

This rock contains less hematite than 34A/76 and 59A/76 and few, if any, euhedral quartz crystals and, as noted above, some of the quartz differs in texture.

*

Sample: P1314/76; RBM 35C/76; TS36330; PS25023

Location:
NFM R16/062 (12) S. North side of Mount Painter.

Hand Specimen:
A dull red to grey, siliceous rock with no special features visible in the hand specimen other than one isolated patch of clay and one aggregate or patch of hematite up to 1.0 cm. long.

Thin and Polished Sections:
This is a silicified rock which shows some variation in composition probably indicating poorly defined layering.

One zone or layer contains fragments of specular hematite and a few aggregates of hematite up to 1.5 mm. in size, very few euhedral quartz crystals and a few small fragments of monazite in a turbid matrix now replaced by intergrown quartz crystals of variable grain size. Relict textures defined by staining in this quartz show that there were once some fine, prismatic crystals up to 1.6 mm. long but there is no other evidence to suggest their identity. There also appear to have been a few small crystals up to 0.2 mm. in size which have been replaced by very turbid, brown-stained material some of which may possibly be clay. There is some evidence to suggest very poorly defined layering in this zone in that there is one band 2.0 to 3.0 mm. thick which contains a higher proportion of tabular hematite crystals and fragments, many of which show a preferred orientation parallel to the apparent layering.

Another portion or layer included in the section contains little or no specular hematite but consists of rather irregularly shaped and angular, clear patches now composed of intergrown quartz crystals and a trace of monazite. Most of these are between 0.5 and 2.0 mm. in size and they are separated by reddish-brown stained material composed predominantly of microcrystalline quartz and very fine grained iron oxide but this matrix contains a few small crystals of hematite, very few small fragments of monazite and possibly some fragments of quartz crystals. The origin of the angular areas of clear quartz cannot be determined from available evidence but some show straight edges suggesting that there were once fragments of crystals.

Conclusion:

This is probably a silicified layered sediment in which some layers contain specular hematite and traces of monazite and others contained fragments of undetermined origin. The hematite-bearing zone is similar to some specimens of typical Mount Gee quartz-hematite rock.

Sample P1315/76; RBM 36A/76; TS36331

6737 RS 33

Location:

NFM R16/062 (8) SP. North east of Mount Painter summit. Layered, silty hematite rock roughly similar to RBM 44C/76 (P1306/76).

Hand Specimen:

A pink to dark grey rock showing some irregular and possibly disturbed layering defined by variations in colour and in grain size. Some of the layers appear to be locally lenticular and in the lower parts of the specimen there are some irregular layers containing fairly coarse grained hematite and quartz. Other layers are of very fine grained, reddish-stained silicified "silt".

Thin Section:

This is very similar to other specimens of layered Mount Gee quartz-hematite interbedded with reddish "silty" layers. Some layers contain reworked fragments of specular hematite and small angular fragments of monazite in a matrix which is now composed of intergrown quartz crystals. These layers alternate with layers composed predominantly of finer grained quartz stained by reddish brown iron oxide and containing only minor amounts of very fine grained hematite and monazite. Some layers containing coarser grained hematite and monazite are lenticular or pinch and swell but the layers of finer grained material are of more uniform thickness.

Conclusion:

This is a silicified, layered sediment containing some reworked hematite and monazite and it is very similar to the finer grained layers of Mount Gee quartz-hematite rock and silicified "silty" material. It differs from Sample RBM 44C/76 (P1306/76) in that there is less of the coarser grained material and more of the silicified, finer grained material in the area sectioned.

Sample: P1316/76; RBM 184A/75; TS36332; PS25024

6737 RS 332

Location:

NFM R16/062 (10) SP. North east of Mount Painter. Laminated

Laminated brown siltstone and clastic specular hematite associated with "dropstone".

Hand Specimen:

A dark red, layered sediment in which coarser grained layers containing moderately abundant specular hematite probably with an average grain size of fine grained sand alternate with thin, disturbed and deformed layers of dark red, fine grained sediment probably equivalent to siltstone or shale in grain size. Most of the layers are less than 1.0 cm. thick but, through the centre of the specimen there is a thicker layer of the coarser grained sediment (4.0 to 5.0 cm. thick).

The laminations are not regular and there are some examples of small scale microfalting. It is also apparent that some of the finer grained layers have been ruptured and invaded by coarser grained detrital material at some time when the sediments were still soft.

Thin and Polished Sections:

This is a layered sediment in which the coarser grained layers contain fragments of hematite and of quartz up to 1.0 mm. in size but generally less than 0.5 mm., layers of intermediate grain size contain reworked or detrital quartz and hematite 0.1 to 0.3 mm. in size with a few tabular crystals and fragments of hematite up to 0.5 mm. long. A few very fine grained layers contain some silt-sized detrital quartz and minor, fine grained hematite in a dark reddish brown-stained matrix which is almost opaque.

The coarser grained layers now have a matrix of intergrown quartz crystals, and in general are somewhat similar to some layers of Mount Gee quartz-hematite rock but the finer grained layers clearly contain some silt-sized clastic material which was not observed in the reddish-stained, fine grained layers in many specimen described above.

In the area sectioned two finer grained layers have been ruptured and invaded by coarser grained material from an overlying layer and this coarser grained material contains some angular quartz grains 1.0 mm. in size, numerous fragments of specular hematite and a few small fragments of monazite in a silicified matrix. Below this disturbed and breached layer the fine laminations are continuous and show little evidence of deformation except for one small microfault. Similar invasions or intrusions of mobile, coarser grained sediment into ruptured finer grained layers is not uncommon in laminated sediments of varying grain size.

This rock also contains a few patches or clasts now composed of clay but there is no evidence to show the identity of the mineral replaced by this clay.

Sample: P1317/76; JFD; TS36333

Location:

NFM R17/089 (46D) S. Bills Folly Prospect. Lamination in matrix? of granitic breccia.

Hand Specimen:

The specimen contains a zone of finely laminated, fine grained material encrusting medium grained, granitic or pegmatic rock composed of feldspar and quartz.

One freshly cut surface through the specimen shows an angular clast 1.5 cm in size of granitic rock embedded in the laminated material 2-3 cm. "above" the surface of the granitic rock. Succeeding fine laminations curve over this clast.

The outer surface of the laminated material shows a porous, vuggy mass of small, well developed crystals some of which were removed and examined in a temporary oil mount. These were identified as microcline by optical properties and staining tests.

Thin Section:

The granitic rock is composed of potash feldspar and quartz with a pattern resembling that of graphic intergrowth except that the quartz has partly recrystallized.

The laminated material is composed of intergrown quartz and slightly turbid microcline and the microcline is generally finer grained and fills interstices between quartz crystals. Staining of the hand specimen shows that the proportions of quartz and feldspar vary in different laminations. This also shows that the lowermost (first deposited) zone or layer is almost entirely quartz and the outermost zone is predominantly microcline. These minerals have crystallized in situ and some of the quartz contains patches of sericitic material. Both quartz and feldspar contain other minute impurities and iron oxide staining.

Some fine grained muscovite and particules of iron oxide are present in the outer layers of microcline. Elsewhere there are traces of mica, hematite, rutile and zircon and also some dispersed, very fine grained, black opaque material sparsely scattered through the quartz and microcline.

Conclusion:

The laminated material encrusting granitic or pegmatitic rock is composed predominantly of quartz and microcline which have crystallized from solutions and it is therefore predominantly a chemical precipitate but contains minor amounts of other, probably clastic material.

Sample: P1318/76; JFD; TS36334

Location:

NFM R17/089 (65D) S. Bills Folly Prospect

GRANITIC BRECCIA

Hand Specimen:

A coarse grained breccia composed mainly of large clasts of granitic or pegmatitic rock. Across the centre there is a zone of material which appears finely laminated.

Thin Section:

The "granitic" rock is composed of quartz and microcline with minor, fine grained muscovite, monazite and iron oxides. An abundance of secondary quartz has crystallized across the rock fabric obscuring or obliterating evidence of origin.

The darker, laminated layer contains quartz grains 0.2 to 0.6 mm. and a few up to 1.0 mm. in size, a little fine grained mica, minor apatite and a few iron oxide grains in a turbid matrix now composed largely of quartz but also containing some authigenic microcline. These are stained by extremely fine grained iron oxide.

Most of the small mica flakes are about parallel to the contacts and the poorly defined "laminations" but some coarser grained and more extensively altered mica has been crumpled and deformed. Streaks and shreds of very fine grained opaque material are also parallel to the contacts but curve around the larger quartz grains. The concentration of this dark material varies but there are no definite layers.

In one zone there are a few lenticular or elongate patches 2.0 to 4.0 mm. long containing fine grained apatite associated with dark red, iron oxide-stained material. Elsewhere there are very few grains of apatite and of zircon.

The matrix quartz contains clouds of extremely fine grained iron oxide possibly derived from material it has replaced.

Conclusion:

This is a clastic rock containing clasts of quartz, mica, probably potash feldspar, opaque material and minor apatite

in a matrix which has been replaced by intergrown quartz crystals and some authigenic microcline. It is more likely to have been a sediment than a sheared, cataclastic rock but there is some evidence of deformation and therefore the origin is not certain.

Sample: P1319/76; JFD; TS36335

Location:
NFM R17/089 (77) S. Bills Folly Prospect. Breccia with white quartz matrix.

Hand Specimen:
A breccia containing some pink feldspar and some dark mica cemented by an abundance of grey to white quartz some of which can be seen to occur as aggregates of radiating crystals growing out from the boundaries of the clasts. Voids in this quartz are lined with projecting quartz crystals. The description given on the bag and attached to the application suggests that "red siltstone has settled on top of some clasts". A close examination of the hand specimen under low magnification showed the presence of some reddish staining in quartz adjacent to the boundary of some clasts but this does not appear to be siltstone.

Thin Section:
This contains angular clasts of coarse grained, potash feldspar, some of coarse grained quartz, some of intergrown quartz and potash feldspar and some large clasts of pale brown biotite up to 12.0 mm. in size. These clasts are cemented by intergrown quartz crystals many of which have grown out from the boundary of the clasts and some of this quartz has also penetrated along cleavage planes in the biotite and along numerous fractures in the potash feldspar. In one of the larger quartz-feldspar clasts fine grained quartz has penetrated along most of the grain boundaries and very numerous small fractures and has spread out and replaced some of the feldspar. In these zones there are groups of crystals of rutile associated with some monazite which has partly enclosed some of the titaniferous mineral. Smaller crystals or fragments of monazite are also sparsely scattered through the siliceous matrix and occur in a few of the potash feldspar crystals. A few clasts of potash feldspar contain varying and locally high concentrations of iron oxide either magnetite or martite which appears to have partly replaced the potash feldspar and in two of these clasts the crystals of iron oxide are more abundant and larger in the outer border zone of the feldspar clast. One feldspar clast 2.0 mm. in size now contains up to 50% iron oxide.

No definite evidence was found to suggest the accumulation of silty material on some clasts but, along the boundaries of some potash feldspar there is a zone of fine grained, apparently

crushed feldspar stained by iron oxide and this has been invaded by, and grades out into the cementing quartz. Much of this feldspar shows evidence of strain with some areas which appear to have been extensively fractured or granulated and partly recrystallized. However, the coarse grained quartz in this rock shows very little evidence of strain. As noted above cleavage planes have opened in the large flakes of biotite and these have been filled by the cementing quartz. Other than this some of the mica shows little or no evidence of deformation.

Conclusion:

This breccia is composed predominantly of coarse grained microcline, quartz and biotite cemented by quartz which has crystallize in interstices. Some quartz has invaded and partly replaced potash feldspar and some has invaded cleavage planes in the mica. Some microcline clasts have been partly replaced by iron oxide, probably magnetite or martite. No definite evidence was found to suggest the presence of layers of silt on any of the clasts but some potash feldspar clasts are surrounded by a zone of deformed, fractured and partly granulated material stained by iron oxide and this has been invaded by, and grades into the cementing quartz.

Sample P1320/76, JFD, TS36336
6707 RS 336

Location:
NFM R17/089 (62C) S. 1·1 km E.N.E. of Mt Gee. Mount Gee east prospect.

Hand Specimen:

A brownish to greyish-pink granitic rock with a fragmental appearance in that there are some large crystals or clasts of quartz and feldspar in a finer grained matrix.

Thin Section:

This contains a few large clasts of moderately coarse grained, quartz-microcline or granitic rock up to 1.0 cm. in size and some clasts of quartz, microcline and biotite 2.0 to 4.0 mm. in size in a finer grained matrix composed of microcline, quartz and biotite cemented by secondary quartz. Distinction between clastic quartz and secondary cementing quartz is not always possible. Much of the finer grained microcline in the matrix shows evidence of regrowth or optically continuous overgrowths which have developed crystals faces and this is now enclosed by the secondary cementing quartz. Fine grained biotite in the matrix is also included within the secondary quartz and the abundance of this quartz intergrown with, and enclosing overgrowths and regrowths of microcline have obscured original features to such an extent that there is no visible

evidence from which to determine the origin of this rock.

Accessory minerals include a few small aggregates of iron oxide including some fine grained magnetite or martite and a trace of hematite, a few fragments of monazite and a few fine grained aggregates of recrystallized titanium oxide.

Conclusion:

This is a granitic breccia cemented mainly by quartz but with some of the matrix microcline showing evidence of regrowth. No conclusive evidence of origin was found in the hand specimen or thin section.

Sample P1321/76; JFD; TS36337

Location:

NFM R17/089 (62F) S. Mount Gee east prospect. Pink leucogranitic rock with ?mylonitic layering.

Hand Specimen:

A medium to fine grained, pink rock composed predominantly of quartz and feldspar. Portion of the sample shows a fine streakiness or layering.

Thin Section:

The layered portion of this rock is composed mainly of microcline and quartz and contains some zones of crushed and granulated microcline which has recrystallized to a much finer grain size, and these alternate with thin, parallel bands composed of fine grained quartz. In places there are small patches of fine grained mica dispersed along some of the bands. There are also a few remnants of optically continuous microcline cut by zones of finer grained, granulated and recrystallized material. Some of the fine grained, granulated and recrystallized feldspar contains groups and aggregates of iron oxide crystals which apparently have not been deformed suggesting that these crystallized after deformation of the rock. In another area of less deformed feldspar there is a mass of recrystallized titanium oxide probably now mainly rutile.

The rock has been invaded by quartz veins some of which cut across the fine banding.

Conclusion:

The fine banding in portion of this rock has resulted from intense crushing or shearing which has resulted in granulation and recrystallization of quartz and potash feldspar.

Sample P1322/76; RBM 32A/76; TS36338
6737 RS 339

Location:
NFM R16/064 (1) S. South of Minerva Heights.

Hand Specimen:
A medium to fine grained rock composed largely of pink feldspar. In part of the specimen there are aggregates of dark coloured to almost black tourmaline.

Staining with cobaltinitrite shows that the rock is composed largely of potash feldspar.

Thin Section:
Much of the rock is composed of microcline which varies in grain size and the texture suggests that much of it represents recrystallized potash feldspar which has been granulated under conditions of tectonic stress. Scattered through this mass of apparently recrystallized feldspar there are patches of sericitic material and aggregates of biotite. In one area of the thin section the rock is composed largely of sheared and recrystallized mica containing scattered remnants of coarser grained biotite. In the streaks of sericitic material there are a few crystals or fragments of monazite and also some aggregates of recrystallized titanium oxide which apparently have been drawn out in the direction of foliation apparent in this part of the rock. There are also some small concentrations of extremely fine grained, black opaque material which has not been identified. Very little quartz is present in the area sectioned.

Conclusion:
This was very probably a pegmatitic rock which has been crushed or sheared, granulated and partly recrystallized under conditions of tectonic stress.

Sample P1323/76; RBM 32B/76; TS36339
6737 RS 339

Location:
NFM R16/064 (1) S. South of Minerva Heights.

Hand Specimen:
A greyish-pink, fine grained rock composed largely of feldspar. A freshly fractured surface shows some very indistinct banding or layering on the scale of 2.0 to 3.0 cm. due mainly to slight variations in colour although one of the slightly darker bands projects above the general level and appears to be slightly harder. Examination under low magnification shows numerous very small quartz veins.

Staining with cobaltinitrite shows that the rock contains very abundant potash feldspar.

Thin Section:

The rock is composed of over 60% turbid potash feldspar intergrown with lesser quartz and very fine grained biotite which has been partly weathered and stained by iron oxide. There are trace amounts of recrystallized titaniferous material and very few fragments of monazite.

Much of the rock is now composed of very fine grained potash feldspar which appears to have recrystallized under conditions of tectonic stress. This is intergrown with varying proportions of very fine grained biotite and it is probably the varying concentration of biotite associated with dark staining which is the cause of the layering due to variations in colour. Scattered through some of this fine grained feldspar and biotite there are a few oval to round quartz grains 0.2 to 0.4 mm. in size which show considerable strain between crossed nicols and some similar grains which are now polycrystalline. These quartz grains tend to be elongated in a direction of very weak foliation. Their origin remains obscure. In some zones there are a few larger patches of quartz up to 1.0 mm. in size showing similar evidence of strain and partial granulation and recrystallization. In some zones there are apparently rounded grains or fragments of potash feldspar averaging 0.5 mm. in size surrounded by finer grained feldspar and biotite and, although these could be interpreted as having been detrital grains it is considered that the evidence is not entirely conclusive and other interpretations are possible.

Accessory minerals are mainly irregularly shaped and a few almost round aggregates 0.1 to 0.3 mm. in size composed of recrystallized titanium oxide. Larger, irregularly shaped aggregates of fine grained rutile? occur with quartz along some of the veins. One zircon? grain and one fragment of monazite were found in the section.

Conclusion:

This is a crushed and recrystallized rock containing a high proportion of potash feldspar with lesser quartz and fine grained biotite. Although a sedimentary origin is the most probable the evidence is not conclusive and other interpretations are possible including that of acid volcanic rock, although this latter suggestion appears to be unlikely.

Sample P1324/76; RBM 32C/76; TS36340
6737 RS 340

Location:
NFM R16/064 (1) S. South of Minerva Heights.

Hand Specimen:
A medium grained, pink rock containing abundant feldspar. On one weathered surface there is a suggestion of a foliation.

Thin Section:
The rock contains up to 60% microcline, abundant quartz and minor amounts of fine grained biotite and muscovite or sericite. Accessory minerals are partly metamict zircon and some goethite which may have replaced sulphide.

This rock has a gneissic texture and consists of elongate crystals and aggregates of microcline intergrown with elongate aggregates of quartz, all of which show a preferred orientation defining the direction of foliation. Much of the microcline has a grain size of between 0.5 and 1.5 mm. but there are some coarser grained patches and also some finer grained material. In general the quartz is slightly finer grained than the microcline and most of it now shows considerable strain between crossed nicols with some areas showing incipient granulation and recrystallization.

Biotite occurs mainly as fine grained aggregates along some grain boundaries and many of these aggregates are also elongate in the direction of foliation. There are a few patches of white mica or sericite which has possibly replaced another silicate mineral. Along one band there are a few grains which have been replaced by goethite and hematite and it is possible that these were of sulphide.

Conclusion:
This is a granitic gneiss in which there is no conclusive evidence of origin.

Sample P1325/76; RBM 32D/76; TS36341
6737 RS 341

Location:
NFM R16/064 (1) S. South of Minerva Heights.

Hand Specimen:
A medium grained, pink rock with some straight and parallel layering defined by variations in colour. The rock has a weak foliation.

Thin Section:
This is a medium grained gneiss composed of quartz, microcline and another silicate mineral which has been completely replaced

by sericite. These minerals are intergrown with smooth to curved grain boundaries and some are elongated in the direction of weak foliation. Average grain size is between 0.5 and 1.5 mm. but there are some outside of these limits. Trace amounts of mica occur along some grain boundaries.

The composition varies in different zones or layers in that some are composed predominantly of quartz and microcline, others are of quartz, microcline and the sericitized silicate and some are predominantly quartz and the sericitized silicate. In places the sericitized mineral shows evidence of crystal form and also shows relict textures suggesting internal cleavage or lamellar twinning and very probably this mineral was plagioclase.

This gneiss has been fractured and probably invaded by solutions but the fractures have since been complete healed by quartz. In some of this quartz there are patches of brown iron oxide staining which define relict textures outlining some earlier crystals which formed in these fractures and which were later replaced by the quartz. There are also some zones of more extensive fracturing along which the rock has been crushed and recrystallized to a finer grain size.

Conclusion:
This is an acid gneiss very probably derived from a sediment.

Sample P1326/76; JFD; TS36342
6737 RS 342

Location:
NFM R17/089 (32) S. Just North of Bill's Folly Prospect.

Hand Specimen:
A pale pink rock containing some visible feldspar crystals 3.0 to 4.0 mm. in size in a finer grained groundmass or matrix. The rock also contains some scattered crystals of almost black iron oxide and particles of these which were removed were found to be magnetic, confirming that this is magnetite.

Thin Section:
The rock contains a few crystals of potash feldspar up to 5.0 mm. long and a few magnetite crystals up to 2.5 mm. in size in a finer grained groundmass composed of intergrown potash feldspar, quartz and minor plagioclase. There is evidence of some reaction along grain boundaries and in a few places turbid potash feldspar? is bounded by a film of plagioclase which extends along some grain boundaries. Some of the potash feldspar crystals show evidence of vein perthite. Accessory minerals other than magnetite are mainly scattered grains or patches of leucoxene and a few crystals of apatite some of which are associated with

leucoxene which partly surrounds some magnetite.

One zone of the rock included in the section shows evidence of alteration which in one part has resulted in partial replacement by very fine grained, brownish-stained mica showing myrmekite-like textures where it has invaded and partly replaced some feldspar. Adjacent to this there is an area in which epidote has partly replaced the feldspar.

Conclusion:

The rock is tentatively classified as a magnetite-bearing, porphyritic microgranite but it could be a moderately high grade metamorphic rock.

Sample P1327/76; JFD; TS36343

6737 RS 343

Location:

NFM R17/089 (34) S. Bills Folly Prospect. (Foliated fine grained leucogranite.)

Hand Specimen:

A medium grained, salmon pink rock composed of feldspar and quartz. It has an apparently uniform composition but shows a definite foliation defined by elongate quartz grains and aggregates.

Thin Section:

The rock is composed of intergrown quartz, turbid, partly sericitized plagioclase and pale pink to orange-stained potash feldspar which is also slightly turbid. There are trace amounts of bleached and altered mica and of iron oxide. The minerals are intergrown with smooth to irregular grain boundaries and have a common grain size of 0.5 to 1.5 mm. The foliation, noted in the hand specimen, is due mainly to the presence of parallel elongate aggregates of quartz.

The staining of the hand specimen suggests that potash feldspar and plagioclase are equally abundant.

Conclusion:

This is classified as a foliated, fine grained, leuco-adamellite on the basis of composition and texture.

Sample P1328/76; JFD; TS36344

6737 RS 344

Location:

NFM R17/089 (41) S. Bill's Folly Prospect.

Hand Specimen:
A moderately fine grained, pink rock composed of feldspar and quartz.

Thin Section:
The rock is composed predominantly of intergrown quartz and turbid feldspar with a common grain size of 1.0 to 2.0 mm. and there is some finer grained muscovite (1% to 2%) which occurs mainly along grain boundaries. In some of the feldspar there are patches and irregular veins composed of sericite more or less heavily stained by iron oxide and it is possible that this represents altered plagioclase occurring as inclusions and as perthitic intergrowths in the feldspar. Most of the feldspar shows somewhat patchy twinning which is not typical of microcline but shows a greater resemblance to that sometimes found in albite, however, staining of the hand specimen with cobaltinitrite shows that all of the feldspar is potassium-rich.

The rock has been locally invaded by coarse grained quartz which has apparently partly replaced some feldspar.

Conclusion:
On available evidence this is classified as a leucocratic microgranite.

Sample P1329/76; IPY; TS36345
6737 RS 345

Location:
NFM R14/005 (12) S. 1.5 km N.W. of Dinnertime Hill. Coulthards Lookout. (? Granitic breccia or Mount Neil granitic porphyry.)

Hand Specimen:
A pale pink rock composed largely of feldspar and quartz with some crystals or clasts of feldspar 5.0 to 8.0 mm. in size in a finer grained matrix or groundmass.

Thin Section:
The section contains a few large crystals of microcline 2.0 to 10.0 mm. in size, one aggregate of intergrown of plagioclase crystals 4.0 mm. in size which may represent a recrystallized large crystal of plagioclase and at least one crystal of quartz 2.0 mm. in size. These are scattered through a much finer grained groundmass composed of intergrown quartz, microcline, lesser plagioclase and biotite and these groundmass minerals vary in grain size from slightly less than 0.1 mm. to 0.5mm. but are commonly between 0.1 and 0.3 mm. The rock also contains an aggregate of biotite crystals intergrown with iron oxide and some recrystallized titanium oxide and although the aggregate is 5.0 mm. long the biotite is now moderately fine grained with an average grain size of 0.2 to 0.4 mm. This possibly represents

former coarser grained biotite which has been granulated and recrystallized. There are a few other smaller aggregates of biotite also intergrown with iron oxide.

The larger crystals now have very irregular grain boundaries with the outer parts merging with, and intergrown with groundmass material. Some of them show evidence of deformation and are traversed or cut by zones showing incipient granulation and recrystallization. The large quartz crystal included in the section is subhedral but shows some embayments and therefore shows some similarities to quartz phenocrysts in acid igneous rock.

Accessory minerals are mainly iron oxide and zircon with some recrystallized titanium oxide. Most of these are associated with aggregates of recrystallized biotite.

Conclusion:

This is a porphyritic granitic rock which shows evidence of considerable granulation and recrystallization under conditions of tectonic stress but there does not appear to be any recognizable foliation.

Sample P1330/76; IPY; TS36346

6737 RS 346

Location:

NFM R17/090 (6) S. Creek ~~west~~ W.S.W. of Mount Gee. (about ½ km)

Hand Specimen:

A moderately coarse grained, pinkish-grey granitic rock with some feldspar crystals 5.0 to 8.0 mm. in size.

Thin Section:

This is a moderately coarse grained granite composed of microcline, quartz, partly sericitized plagioclase and some deformed and partly chloritized biotite. There is some evidence of reaction along grain boundaries and in some zones the rock has been crushed or sheared and partly recrystallized to a finer grain size. In these zones there are some aggregates of muscovite and the biotite has been deformed and partly replaced by chlorite, titaniferous material and some iron oxide. Additional iron oxide has crystallized along a few grain boundaries. Trace amounts of calcite are also present in one of the crushed and partly altered zones.

Conclusion:

This is a moderately coarse grained granite which shows generally minor evidence of crushing and recrystallization and in these zones there appears to be a little additional iron oxide and some calcite.

Sample P1331/76; RBM 47/76; TS36347
6737 RS 347

Location:
NFM R17/090 (102) SP. 100 m. north of Mount Gee.
(?Silicified breccia with hematitic clasts.)
SILICIFIED QUARTZ-HEMATITE ROCK WITH CHERTY MATRIX

Hand Specimen:
The sample submitted contains a mass of dark red, hematite-bearing rock which shows a sharply defined and angular contact against rather porous, paler coloured material which contains some scattered patches of white clay and also some fragments or patches of red ochreous material.

Thin Section:
The portion of hematite-bearing rock included in the section is similar to Mount Gee quartz-hematite in that it contains crystals and aggregates of specular hematite, some pseudomorphs of red ochreous hematite, some hexagonal quartz crystals and a few small fragments or crystals of monazite in a matrix which has been replaced by intergrown quartz crystals stained by irregular patches of very fine grained hematite. However, there is no evidence of layering on the scale of the hand specimen and the textures shown by some of the hematite could be interpreted as indicating that it crystallized in situ. This quartz-hematite rock differs from many of the specimens of typical Mount Gee quartz-hematite rock in that it contains a remnant of an elongate crystal of barite which was formally at least 5.0 mm. long and was outlined by a thin layer of very fine grained hematite. This barite has been corroded and partly replaced by matrix quartz much of which now occurs within the former boundary defined by the layer of hematite. Another point of difference is that some of the pseudomorphs of reddish-brown, ochreous and fine grained hematite show textures strongly suggesting that they represent oxidized pyrite crystals. These differences may not be significant and the fact that they were recognized may be due to better preservation of relict textures or fortuitous positioning of the section. Part of this quartz-hematite rock has been more extensively replaced by coarser grained quartz continuous with that forming the matrix and this grades out into radiating aggregates of much coarser grained quartz with crystals 1.0 to 2.0 mm. long.

The boundary between this quartz-hematite rock and the matrix is sharply defined, slightly irregular and is clearly a fractured surface. It is not clear from the specimen whether the quartz-hematite is solid rock or a large clast, e.g. in surface scree.

The matrix partly surrounding this quartz-hematite rock consists of a porous mass of fine grained to micro-crystalline quartz through which there are scattered some patches of clay and some zones of staining suggesting fragmented and deformed layers. This is a later generation of quartz than that which has replaced or formed the matrix of the quartz-hematite rock. Variations in

grain size, texture and staining suggest that it has replaced a variety of small clasts and disturbed layers of material and also a few elongate crystals of an undetermined mineral.

Conclusion:

The quartz-hematite rock is similar to specimens of Mount Gee quartz-hematite in composition but it also contains some barite and relict textures suggest that it once contained some pyrite. It differs from the layered rocks in that some of the hematite could have crystallized in situ and in this respect it is similar to samples P1308 and 1310/76 (RBM 44E/76 and 34A/76). Contact with the paler coloured matrix is a fractured surface. The matrix is a porous mass of later generation, finer grained to microcrystalline quartz which has cemented and replaced some clasts, thin layers of material which had been deformed and also probably some elongate crystals of an undetermined mineral. Whether or not this represents cemented scree cannot be determined from the specimen.