P456/74 – P468/74

REPORT MP 2208/75

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EXAMINATION OF SAMPLES FROM THE MT. GEE AREA

6737

The Australian Mineral Development Laboratories
Adelaide
SOUTH AUSTRALIA

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15 January 1975

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REPORT MP2208/75

YOUR REFERENCE: Application of 28/11/74.

MATERIAL: 13 rocks.

LOCALITY: Mt. Gee prospect

IDENTIFICATION: P456-P468/74

DATE RECEIVED: 2/12/74

WORK REQUIRED: Petrography

Investigation and Report by: Dr. B.G. Steveson

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

K. J Henley

for F.R. Hartley
Director.

EXAMINATION OF SAMPLES FROM THE MT. GEE AREA

1. INTRODUCTION AND SUMMARY

Thirteen rock samples were submitted by Mr. R.B. Major of the S.A.D.M. with a request for petrographic work. The rocks are from the Mt. Gee - Radium Hill area of the Flinders Ranges and the origin of some of these rocks has not been elucidated in the past.

Some of the samples (P459, P461, P462/74) are described as tillitic and the rocks do appear to be tillites, although the rounding of the clasts indicates some re-working by water. The most complex rocks are the coarse-grained samples which contain abundant quartz and potash feldspar. In essence these rocks have granular textures and show little or no evidence of a sedimentary origin; however, even in the most granitic-looking sample, quartz crystals (? grains) which are 0.4 - 0.6 mm in size and equant could be interpreted as recrystallised relics of large quartz clasts. The abundance of potassium feldspar could be ascribed to either the arkosic nature of an original sediment or to metasomatism (i.e. grainitisation). In some hand specimens, large subhedral crystals of potassium feldspar appear to be introduced crystals rather than detrital pebbles (P464/74 especially). The opposite approach to these samples is from the point-of-view that they were granitic and have been stressed and metamorphosed.

Many of the samples show the effects of metasomatism, in that hematite and monazite have been introduced into the rocks and commonly both minerals are relatively coarse-grained.
(Sylvia Whitehead MP 3305/75 says monazite is detrital)

Sample P456/74 TS 33253 6737 RS 48

Location:
RBM 27/B/74 North Flinders R17/090 8 sp Mt. Gee prospect.

Rock Name;
Quartzite. (of Radium Creek Metamorphics - In Situ.. Below contact & base of hematite breccia)

Hand Specimen:
A medium to fine grained, massive and compact rock which has an overall pinkish colour. One surface of the rock contains a patch of rather coarse grained material containing a flakey mineral which is probably specular hematite.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	95
Feldspar	5
Opaques	1 - 2
Zircon	trace

The rock has a medium grained granular texture which is wholly the result of metamorphic recrystallization.

Quartz is the most abundant mineral in the rock and forms equant irregular crystals ranging in size commonly from about 0.2 - 1.5 mm. The quartz crystals have undulose extinction and are characterized by somewhat irregular interlocked margins and by the presence of numerous small inclusions. Much of the quartz is present as crystals about 0.8 - 1.2 mm in size and this small size range possibly indicates the original sorting of the sandstone from which this quartzite was derived. The textures of the rock are solely those of the metamorphic recrystallization the rock has undergone and there is no evidence, apart from the regularity of the size of the crystals, of a clastic texture.

Feldspar occurs as rather irregular patches between the quartz crystals. Some of these patches are as much as 0.8 mm in size but commonly they are somewhat irregular and are less than 0.5 mm across. The feldspar is characterized by very irregular extinction and by the presence of a pervasive turbidity. Because of these features, it is not possible to identify the mineralogy of these patches with certainty but it appears likely that they are feldspars derived from the original sandstone. The somewhat diffuse and irregular nature of the feldspar is probably a result of incomplete recrystallization during metamorphism.

The thin section contains three small zircon crystals which are moderately well rounded and appear to have been part of the original framework of the sandstone. In contrast, the opaque minerals are commonly irregular and angular in shape and appear to have been introduced into the rock during or after metamorphism.

The sample is extremely rich in quartz and is probably a sandstone which has been metamorphosed to a moderate extent. Original feldspar in the rock has been recrystallized but it has a rather diffuse texture probably indicative of incomplete recrystallization.

Sample P457/74 TS 33254 6737 RS 49

Location:
RBM27 Aa/74 North Flinders R 27Aa 17 0/0908sp Mt. Gee prospect.

Rock Name;
Hematitic sedimentary rock.

Hand Specimen:
The sample is massive and compact and overall has a rather dark brown to pink colour. The rock contains hematite which is particularly concentrated in large patches in the rock. Otherwise the sample appears to have a moderate to coarse grained texture and within rather indeterminate pink material there are clear crystals of up to several mm in size.

Thin Section:
This rock has been designated a sediment on rather meagre evidence and the thin section contains indications which might be taken to suggest either igneous or sedimentary origin.

Much of the rock (more than 70%) consists of quartz and this mineral has a grain size which ranges down from about 2 mm. Large crystals of quartz are rather rare and are characterized by irregular shapes and the presence of slightly undulose extinction. Most of the quartz in the rock has a grain size which is less than 0.3 mm and throughout much of the thin section such quartz appears to form a groundmass together with minor amounts of intergrown feldspar, sericite and hematite. Feldspar is the second most abundant mineral in the rock and it most commonly occurs as subhedral crystals less than 0.5 mm in size; however, there are a few crystals of muscovite as much as 1 mm in diameter. Most of the feldspar crystals have a thin rim of iron oxide and cracks in the feldspar are occupied by similar material. This suggest that the feldspar crystals were at one stage discreet detrital grains which were coated with iron oxide during a process of weathering and/or transportation. Some small feldspar crystals have rectangular subhedral shapes which are an

indication in favour of an igneous origin of the rock since even brief transportation of such crystals should result in significantly more rounding than is observed in this sample.

Present in the thin section to the extent of probably about 1% is a mineral with a moderate refractive index and second order birefrigence colours which appears to be pyroxene. This mineral has rather irregular and ragged shapes and it is possible that it could be a detrital mineral which has been transported during a sedimentary phase of the rock's history but prolonged weathering and transportation should result in the degradation of pyroxene. X-ray diffraction examination of this mineral would be necessary to provide a completely unambiguous identification. Als present in the thin sections is one clast-like grain which is approx. 1 mm x 0.5 mm in size which has a sub-rounded outline. This clast now consists very large of phyllosilicates but it has the superficial appearance of a partially altered volcanic rock fragment.

Hematite occurs in the rock particularly in one part of the thin section where elongate hematite crystals occupy more than 50% of the rock and rather coarse grained quartz is present in the interstices between the hematite crystals. The hematite appears to have been introduced into the rock during or after metamorphism. A little monazite is associated with the hematite and also occurs as widely and randomly dispersed small crystals throughout the rock. One or two of the small monazite crystals have drop-like shapes which may be the result of rounding during sedimentation. The moderate amounts of sericite in the rock are probably the result of late metamorphic alteration or of relatively low temperature deuteric alteration of the feldspars.

As the above description indicates, the rock contains, apparently, indications of both a sedimentary and an igneous origin; however, the balance of the evidence appears to indicate that the rock was a sediment but it has been metamorphosed and fractured and hematite, monazite and sericite appear to have crystallized during or after the metamorphic period. The original sedimentary rock was clearly arkosic in nature and the sample contains a moderate amount of feldspar and there is a little evidence that the sample also contains volcanic rock fragments. There are one or two large quartz crystals in the rock but even so the sample is probably best referred to as a coarse grained arkose rather than a conglomerate.

What is evidence of metamorphism?
What is evidence of introduction of sericite & monazite?

Sample P458/74 PS 6737 RS 50

Location:
RBM27Ab/74, North Flinders, R17/090 8sp, Mt. Gee Prospect.

Rock Name:
Hematite rock.

Hand Specimen:
A dense rock with an overall deep red colour.

Polished Section:
The section contains approximately 40-50% hematite and 50-60% non-opaques. There are no opaque minerals except hematite and trace amounts of goethite.

The hematite is present as tabular subhedral crystals up to about 1 mm in length; these are randomly oriented and dispersed through the non-opaques. The excellent development of hematite crystals indicates that the hematite is secondary in origin and probably developed relatively late in the rock's history.

Patches of goethite show a concentric or cellular structure and it is likely that this mineral is derived from the weatherin and degradation of some pre-existing phase.

Sample P459/74 TS 33256 6737 RS 51

Location:
RBM28A/74 North Flinders R17/090 9sp Mt. Gee Prospect.

Rock Name;
Tillite.

Hand Specimen:
A massive and compact rather dark pink rock. Most of the sample has a aphanitic texture but contains a few pebbles some of which are as much as 2 cm in diameter. One small part of the hand specimen is somewhat coarser grained and appears to be adjacent sandstone or similar lithology.

Thin Section:

The thin section contains one clast which is approx. 1 cm in size and , apart from this, consists of approx. 70% of clasts which range in size from 0.05 - 0.5 mm in size. The remainder of the rock consists of extremely fine grained material which forms a matrix around the clasts. The large (1 cm) clast consists of a muscovite schist containing abundant quartz and a moderate amount of parallel-oriented muscovite. The clast has a well defined but irregular outline and is relatively unaltered. The most abundant clasts are those ranging in size from 0.05 to 0.5 mm and of these approx. 60 - 70% are single quartz crystals and feldspar crystals and rock fragments make up the remainder. The clasts are sub-round to angular and most have equant shape. Clasts more than 0.1 mm in size are sufficiently abundant to form a framework and finer grained material is confined to patches which are distinctly intergranular to these clasts. The lithic clasts are generally extremely fine grained and consist of a colourless to pale brown clay and it is likely that these are shaly or muddy sediments which have formed relatively coherent fragments which have survived transportation.

There is a gradation from the smallest clast to the matrix material and many of the smallest clasts have rather diffuse outlines and grade into indeterminate brown material which comprises the rather sparse matrix of this tillite.

Both plagioclase and potassium feldspar are present in the rock and one of the largest clasts in the rock consists of fresh microcline.

In brief, therefore, the sample appears to be a normal tillite and it shows no evidence of metamorphism. (but is interlayered in arkose which is supposed to be metamorphosed P457/74)

Sample P460/74 TS 33257 6737 RS 52

Location:

RBM32/74 North Flinders R17/090 16s Mt. Gee Prospect.

Rock Name;

Hematite-quartz rock.

Hand Specimen:

A dark and dense massive and compact rock which clearly consists of hematite and fine grained silicates. The latter are present as pink iron stained material closely intergrown with both massive and diffuse specular hematite.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Hematite	55
Quartz	45
Sericite/muscovite	1 - 2
Monazite	trace - 1

The rock consists of medium to coarse grained hematite and quartz with accessory amounts of sericitic material, muscovite and monazite. The sample appears to consist essentially of secondary mineral.

Hematite is present both as large tabular crystals commonly more than 1 mm in size and as much smaller anhedral crystals which range down in size almost to submicroscopic. In the rock overall, the hematite forms a contiguous network and in some fields of view hematite occupies as much as 65-75% of the volume of the rock. In these circumstances quartz is simply confined to spaces between the hematite crystals. In one or two places the more massive hematite is bordered by aggregates of very fine grained hematite closely intergrown with adjacent quartz crystals and in these places it appears that the hematite is replacing the quartz.

The quartz itself forms crystals which have wide range of grain sizes up to approx. 0.7 - 1 mm. Some patches of quartz in the rock contain numerous crystals which have a distinctly granoblastic texture and hence appear to be of metamorphic origin; however, larger quartz crystals commonly show growth lines (picked out by minutes crystals of hematite). These latter crystals have the aspect more of veined quartz and hence appear to represent a relatively low temperature deposition of quartz. Throughout the rock the quartz has a granular to granoblastic texture and all the quartz crystals have well defined but irregular margins. Only the larger crystals show growth lines but nevertheless it is likely that much or all of the quartz in the rock is a result of the relatively late stage deposition of quartz at a relatively low temperature. Hematite was deposited either later or at the same time as the quartz but at any rate it is likely that

the deposition of the two minerals is closely related and that the rock now consists entirely of these two secondary minerals and that original lithologies have been completely replaced. Hematite and quartz both have a relatively even distribution through the thin section and there is no suggestion that there are quartz-rich areas and hematite-rich areas as might be expected for example, the alteration of a coarse grained sedimentary rock in which hematite was confined to a matrix. Some of the clearer patches of quartz in the thin section could represent detrital quartz grains which have been re-crystallized or replaced by low temperature quartz but overall the evidence for a clastic origin of the quartz is not strong but this, at any rate, is a possibility. If this is the case then the rock would be a silicified arenaceous sediment which has been subjected to the introduction of abundant hematite.

The rock contains a small amount of fine grained monazite.

Polished Section:

The section contains parts of quartz pebbles, which contain no opaque phases, a section of a large hematite pebble and some matrix material.

Hematite in fact comprises only about 20% of the "hematite pebble"; the mineral forms anhedral crystals and irregular masses with a wide range in sizes. Both aggregates and single crystals are widely and randomly dispersed throughout the pebble.

Within the matrix hematite constitutes apprximately 25 - 30% of the section and is present both as irregular, anhedral crystals and aggregates and as subhedral, tabular crystals such as those described in P458/74. It is likely, therefore, that the pebbles contain some kind of 'older' hematite and that some of the hematite in the matrix has been introduced into the rock during post-lithification mineralizing phases. Some of the hematite may have been derived from the pebbles but there is no evidence of this and the pebbles have sharp, well-defined margins.

Sample P461/74 TS 33258 6737 RS 53

Location:
RBM33B/74 North Flinders R17/090 17sp Mt. Gee Prospect.

Rock Name:
Tillite.

Hand Specimen:
A heterogenous somewhat friable and weathered rock. Some parts of the hand specimen have an aphanitic texture and a buff colour whereas other lithologies are coarse grained and gritty tillites which contain fragments ranging up to several cm in size. The coarser grained material is somewhat friable whereas the aphanitic lithology is distinctly compact.

Thin Section:
The different lithologies observed in the hand specimen are represented in the thin section and will be described separately.

The coarser tillitic material is represented in the thin section by one large clast and surrounding areas of tillite rather similar to sample P459/74. The large clast is several cm in size and is similar to the muscovite schist lithology observed as large clasts in P459/74. In this sample the muscovite schist contains a moderate amount of feldspar as well as muscovite and quartz and the parallel orientation of muscovite is not as well developed in this rock as in the preceding sample. The surrounding tillite lithology is similar to that in P459/74 particularly in the abundance of clasts ranging from 0.05 - 0.3 mm. Quartz is by far the most abundant mineral in these clasts but there are also small amounts of feldspar and lithic material. On the whole these clasts fit together well and there is only a very limited amount of material between these. Such material as there is is rather diffuse and indefinite and appears to be somewhat ironstained. Overall, therefore, the coarser grained lithology in this rock may be regarded as being very similar in all aspects to sample P459/74.

The finest grained lithology in the thin section consists largely of phyllosilicate minerals which are present as flakes less than 0.03 mm in length. The colourless phyllosilicate occupies approx. 30% of the volume of this lithology and the remainder is made up of rather diffuse ferruginous material which probably consists very largely of iron stained quartz. Briefly, therefore, this lithology is a shale.

Having a sharp contact against this shale is a fine grained sandstone which forms a bed approximately 3 mm wide at its thickest part. The average grain size of this sandstone is approximately 0.02 - 0.04 mm and the most abundant phase in the rock is quartz. Muscovite is present as a relatively abundant detrital mineral and comprises probably as much as 5 - 10% of the volume of the sandstone. The rock is well compacted and matrix material is present only in rather small amounts.

As far as the evidence in the thin section suggests, therefore, the rock consists of a tillite similar in all respects to sample P459/74 together with fine grained clastic sediments represented in the section by a shale and a siltstone. The hand specimen shows that the fine grained lithologies (the shale and the siltstone) occupy large but irregular areas apparently within the considerably more abundant tillite. The presence of more than one lithology and of sub-angular to sub-rounded grains suggests that the tillite has been slightly reworked by water after deposition by ice.

Sample P462/74 TS 33259 6737 RS 54

Location:
RBM34/74 North Flinders R17/090 18sp Mt. Gee Prospect.

Rock Name: (This is an isolated block of pale purple tillite up near the tillite dyke which is composed of similar rock)
Tillite.

Hand Specimen:
A compact and massive rock which has a rather nondescript grey to pink colour. Overall the sample is aphanitic but it contains a small proportion of visible grains ranging

in size up to about 1 cm.

Thin Section:

The rock is an extremely illsorted sediment containing a moderately high proportion of extremely fine grained quartz and phyllosilicate material as a matrix. There are a few concentrations of opaques also.

Approximately 50% of the rock consists of detrital quartz grains ranging in size from 0.1 to approx. 0.4 mm. These grains are sub-angular to sub-round and have equant outlines. Feldspar grains similar in size comprise less than 2% of the volume of the rock and microcline is significantly more abundant than plagioclase. A few grains of both quartz and feldspar have distinctly angular shapes but for the most part the grains have a roundness which suggests that after deposition by ice the samples have undergone some reworking by water. There is a gradation from the grains described immediately above to successively smaller grains and there appears to be a matrix in which phyllosilicates are intergrown with quartz. The matrix material comprises approximately 20% of the volume of the rock but the exact amount depends on the line chosen to separate obviously detrital material from material sufficiently fine grained to be described as matrix. Large clasts up to 1 cm in size are represented in the thin section by a granule of muscovite schist similar to material described in samples P459/74 and P461/74.

The rock contains a few concentrations of opaques where detrital grains are cemented solely by opaque material. These concentrations of opaque are generally about 1 mm in size and appear to be discrete and entirely separate from each other. The rock contains one thin discontinuous veinlet which contains numerous opaques and widely dispersed discrete granules of opaques also. There are one or two moderately large lithic fragments in the rock and these contain some extremely fine grained opaques which appear to be a part of the shaly lithology which now forms the pebbles. The concentrations of opaques in the bulk of the tillite are probably the result of some post depositional alteration or metasomatic activity.

In summary, therefore, the rock is a tillite which contains several characteristic features of the rock, particularly the extremely wide range of detrital grain sizes. As in the case of other tillites in this collection many of the grains show evidence of considerable rounding which is indicative of some reworking of the immediate glacial deposit by water.

Sample P453/74 TS 33260 6737 RS 55

Location:
RBM35A/74 North Flinders R17/090 19s Radium Ridge, Mt. Gee-formation.

Rock Name:
Granite.

Hand Specimen:
A massive and coarse grained pink rock which clearly contains abundant quartz and potassium feldspar. The hand specimen also contains a vug in which there are numerous euhedral quartz crystals up to several mm in width.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Potassium feldspar	60
Quartz	40
Opaques	1 - 2
Sericite/muscovite	1
Biotite	<1
Monazite	trace

This rock has an allotriomorphic granular texture and an average grain size of approx. 1 mm. Quartz and microcline are the predominant minerals and the rock is evidently a granite.

The potassium feldspar in the rock occurs as large anhedral crystals 0.5 to approx. 2 mm in size. Many of these crystals have distinctly irregular shapes and tend to protrude and partly surround adjacent smaller quartz crystals. The boundaries of the potassium feldspar crystals are well defined but there does appear to have been some reaction between quartz and microcline in that small quartz crystals are included within the microcline and they in turn contain small fragments of microcline which extinguish in the same position as the bulk of the microcline surrounding the quartz.

These textural relationships suggest that the quartz has partially replaced the microcline. For the most part quartz crystals are less than 1 mm in size and tend to have distinctly equant shapes and often a somewhat bleb-like outline.

Opaque minerals are rather widely distributed throughout the rock but tend to occur particularly within the feldspar. There are a few blade-like crystals about 0.5 mm long but for the most part the opaques are present as small granules less than 0.1 mm in size. Biotite and muscovite occur in one place in the section and both minerals appear to be rather altered and the biotite is associated with fine grained dusty opaque material.

Overall therefore, this is a granitic rock which has a distinctly potassic composition. The absence of plagioclase is unusual but presumably is merely a reflection of the highly potassic composition of the sample. There is no evidence whatsoever that the rock has or has had a clastic texture and on thin section evidence at least the rock may be classified as a granite with some certainty.

Sample P464/74 TS 33261 6737 RS 56

Location:

RBM35B/74 North Flinders R17/090 19s Radium Ridge Mt. Gee-formation.

Hand Specimen:

A massive and compact rock which has a dark pinkish colour. The cut surface contains pink feldspar crystals which range in size up to about 1 cm. These are contained in a quartz-rich and dark matrix. Also present is a patch of clear coarse grained quartz and rather irregular patches of dark brown and pink material.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	60 - 70
Potassium Feldspar	25 - 35
Muscovite	3
Opaques	2

This sample has a somewhat heterogenous granular texture and consists largely of quartz and potassium feldspar; however, there is insufficient petrographic evidence to indicate the origin of the rock or to give the sample a meaningful name.

Quartz occurs as crystals which range in size up to about 1 mm but for the most part the quartz is present as equant anhedra less than 0.4 mm in size. In many places in the thin section quartz occurs in aggregates with only a little potassium feldspar but elsewhere the quartz occupies fractures within large crystals of feldspar. In the monomineralic aggregates of quartz there is a granular to granoblastic texture and some evidence of the development of triple point junctions and equilibrium crystal margins. Some of the quartz aggregates are also characterised by the presence of fine grained opaques which appear to occupy particular planes and places within the quartz as though the opaques pseudomorphed pre-existing crystal outlines.

The potassium feldspar occurs as crystals some of which are several mm in size. The potassium feldspar is a microcline which shows cross-hatch twinning and an overall grey turbidity. Some of the potassium feldspar crystals have distinctly ragged and irregular outlines against quartz and many have numerous quartz fracture planes passing through them.

Muscovite occurs as small irregular flakes associated in some parts of the rock with opaques. The opaques themselves are generally small equant granules but there a few flakey crystals which appear to represent introduced material.

This rock has been brecciated after the final crystallization of muscovite and there has been sufficient mobility or introduction of silicates to result in the crystallization of quartz in the fractures. It is likely that muscovite and opaques have been at least in part introduced into the rock at a relatively late stage in its history. There is little evidence to indicate whether the rock was originally sedimentary or igneous. There are certainly no relics of a clastic texture.

Sample P465/74 TS 33262 6737 RS 57

Location:

RBM36/74 North Flinders R17/090 20 s Radium Ridge, Mt. Gee-Formation.

Breccia

Hand Specimen:

A massive pink rock which consists largely of medium to fine grained material with an overall pink colour, together with large patches of clear colourless quartz.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Potassium feldspar	60
Quartz	35
Muscovite	2 - 3
Opaques	2
Monazite	<1

The mineral proportions given above apply to the bulk of the rock and do not include a patch of monomineralic quartz which occupies about 1/5 the area of the thin section.

The sample has a medium to fine grained granular texture and consist of potassium feldspar and quartz.

Quartz occurs in the bulk of the rock as small equant anhedral crystals generally 0.2 - 0.4 mm in size. There are small monomineralic patches of quartz which are commonly less than 1 mm in diameter but for the most part the quartz occurs as discrete crystals closely associated with the abundant potassium feldspar. In some parts of the thin section quartz crystals about 0.1 mm in diameter are surrounded almost entirely by dusty opaque material and in other parts of the section quartz crystals similar in size are imbedded in potassium feldspar. Some quartz in the rock also occurs in thin veinlets and there is one patch of quartz crystals several mm in diameter.

Most of quartz in the thin section in fact occurs in a very large patch of monomineralic quartz which represents the large clear quartz aggregate noted in the description of the hand specimen. At the edge of this patch of quartz there is a distinctly granoblastic texture with straight sided polygonal crystals generally less than 0.2 mm in size. Towards the centre of this patch of quartz the grain size increases to more than 1 mm and there is a more irregular granular texture.

The potassium feldspar in the bulk of the rock is a cross-hatch twinned microcline which occurs as irregular anhedral crystals up to about 1 mm in size. In some parts of the rock there are almost monomineralic aggregates of potassium feldspar several mm in size but for the most part the potassium feldspar is closely intergrown with the quartz in a granular texture.

The accessory minerals in the rock are widely distributed throughout the potassium feldspar and quartz apart from the unusual aggregates of opaques noted above.

The origin of this rock cannot be determined by thin section examination alone. The large patches of quartz as represented by a part of one of these patches in the thin section, appear to have metamorphosed margins and more granular, non-metamorphosed central areas and hence it is likely that these patches of quartz were present in the rock before it was metamorphosed. The bulk of the rock consists of medium grained potassium feldspar and quartz and these minerals have a rather irregular and heterogenous granular texture. There are groups of quartz crystals which are less than 0.3 mm in size which could be interpreted as being metamorphosed detrital grains but this is a not particularly distinctive texture and could be interpreted simply as being part of an igneous rock. The sample has clearly been brecciated and there has been deposition of quartz in fractures. Monazite and possibly opaques have been introduced into the rock at a later stage in its history.

Check what evidence for this? Could it be detrital?

Sample P466/74 TS 33263 6137 R6 SB

Location:

RBM37A/74 North Flinders R17/090 21sp Radium Ridge, ~~Mb.~~ ~~Gee Formation~~. Radium Ridge Beds

Rock Name;

Siltstone.

Hand Specimen:

A brown to purple rock which has a massive to slightly tabular aspect. The sample is fine grained and homogenous although there are a few crystals which can be seen with the naked eye amoungst the overall aphanitic material.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	65
Feldspar	25
Muscovite	5
Opaques	5

The sample is a typical siltstone consisting of detrital grains of quartz, feldspar and muscovite which have compressed together so that there is little or no inter-granular matrix material. The average grain size of the rock is 0.05 - 0.1 mm.

The quartz and feldspar grains are equant anhedra which range in size from approx. 0.02 - 0.2 mm but most grains are of the order of 0.05 - 0.1 mm in size. The grains have well defined irregular outlines and there has clearly been sufficient compression of the rock to cause deformation and possibly some recrystallization of the quartz and feldspars such that original rounded detrital shapes no longer exist and the grains fit together closely. Muscovite is present as rather stubby flakes generally about 0.1 mm in length. These flakes are widely distributed amoungst the quartz and feldspar and they have a rather crude parallel orientation. Some of the muscovite flakes are distorted and hence show the effects of compressive forces. The feldspar is similar in its overall characteristics to the quartz and both potassium feldspar (commonly microcline) and plagioclase are present.

Opaque and semi-opaque minerals are present in the rock and rather diffuse almost sub-microscopically granular semi-opaque material is fairly abundant.

The sample is a typical siltstone which shows the effects of considerable compression and the rock has a compact and granular texture.

Sample P467/74 TS 33264 6737 RS 59

Location:

RBM37A/74 North Flinders R17/090 21sp Radium Ridge, ~~Mt. Gee Formation~~. Radium Ridge Beds

Rock Name:
Sandstone.

Hand Specimen:
A dark purple coloured rock which has a fine grained clastic texture.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	65 - 75
Feldspar	20 - 30
Opaques and semi-opaques	2 - 3
Muscovite	2
Clay/sericite	1 - 2

detrital Monazite, rutile

The sample is a sandstone which shows the effects of considerable compression and partial recrystallization.

Feldspar comprises approximately 25% of the volume of the rock and forms grains generally about 0.2 mm in size. Many of these feldspar grains have well defined and slightly rounded outlines and appear to retain their detrital form. The most abundant feldspar is a well-twinned microcline but some untwinned material and a very small proportion of albite-twinned plagioclase are present also.

The quartz, by contrast with the feldspar, appears to have been largely recrystallised, although some crystals about 0.2 mm in size presumably retain much of their detrital form. However, a large proportion of the quartz has a granular texture and forms an interlocking array of rather irregular crystals. A considerable proportion of the quartz is obscured by fine grained turbidity and clay material as well as rather diffuse opaque and semi-opaque minerals. Some quartz crystals are as much as 0.5 mm in size but there is also a considerable population of very fine grained quartz which is presumably the result of the breakdown and partial recrystallization of original detrital grains. As a result of the recrystallization of quartz the rock has only a very poorly defined clastic texture and the contrast between the clearly detrital feldspar grains and the abundant, strained quartz crystals is very clear. The clay/sericite is widely dispersed throughout the rock and is associated particularly with the quartz. This material

together with semi-opaque limonitic minerals tends to obscure details of the inter-relationships between many of the smaller quartz crystals.

The sample contains small quantities of accessory heavy minerals of which monazite and rutile appear to be the more abundant.

The sample is, therefore, a medium grained sandstone which contains a moderate amount of feldspar and which shows the effects of extensive recrystallisation which is probably the result of metamorphism. (Not likely!)

Sample P468/74 TS 33265 6737 RS 60

Location:

RBM37/B/74 North Flinders R17/090 21 sp Radium Ridge, ~~Mt. Gee Formation~~. Radium Ridge Beds

Rock Name:

Contact between siltstone and a coarse grained rock.

Hand Specimen:

The sample consists of a dark aphanitic rock which has a purple colour and contains a few discrete crystals of pink feldspar; the other lithology in the hand specimen is a granular coarse grained granitic-looking rock which has a sharp but irregular contact against the finer grained lithology.

Thin Section:

The fine grained lithology is similar in its petrographic characteristics to the siltstone sample P466/74 and a detailed description of the rock will not be given here. Overall the sample has an average grain size of approximately 0.08 mm and consists of abundant quartz with accessory amounts of feldspar (mainly microcline) and accessory amounts of detrital muscovite, sericite/clay and limonitic material. The sample has a granular texture and individual crystals of quartz and feldspar generally do not show detrital characteristics; mostly the rock shows concave-convex crystal margins obscured by fine grained limonitic and clay material. Some of the mica flakes are deformed and bent.

The coarse grained lithology also has a granular texture and consists of crystals which range in size up to several mm.

Quartz and potassium feldspar comprise more than 95% of the volume of the rock and, in general, they have a rather heterogenous granular texture. The large crystals of quartz show extreme undulose extinction and are characterized by irregular outlines which are serrated and bulbous against both other quartz crystals and against potassium feldspar. In some places in the rock it appears that the quartz has partially replaced adjacent potassium feldspar crystals. Elsewhere in the thin section quartz is present as small equant but irregular crystals intergrown with potassium feldspar, opaques, muscovite and both larger and smaller quartz crystals. The potassium feldspar is a microcline which shows well developed grid-iron twinning. As a result of partial replacement by quartz many potassium feldspar crystals have distinctly irregular shapes and there is also a wide range in the size of the potassium feldspar crystals. There is no evidence in this coarser grained lithology of a pre-existing clastic texture and the present texture of the rock appears to be the result wholly of metamorphic recrystallization and hence the origin of this lithology is not evident from the thin section alone. The contact between the coarse lithology and the fine grained is sharp and well defined, although it is irregular in thin section. Large crystals of quartz or microcline abut directly against the finer grained material and some of the latter tends to penetrate in the intercrystaline spaces at the edge of the coarse grained lithology. There is no chilled margin of the coarse grained material against the fine grained and there are no large apophyses of one lithology into the other.

similar to PA63/74

sedimentary contact