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PETROGRAPHICAL DESCRIPTIONS OF 60 ROCKS FROM THE MIDDLE CAMP, NARRIDY CREEK AND PLUG RANGE AREAS, EASTERN EYRE PENINSULA

A. JOHN PARKER

Department of Mines and Energy, South Australia —

DEPARTMENT OF MINES AND ENERGY

SOUTH AUSTRALIA

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by

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REGIONAL GEOLOGY DIVISION

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CONTENTS

Locality: WHYALLA 1:250 000 map area
6230 Cowell 1:100 000 map area
Gawler Craton

Type of sample: hand specimen from outcrop
Collection and petrography by: J. Parker

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LOCALITIES

CLEVE UPLANDS | MIDDLE CAMP | NARRIDY CREEK

PLUG RANGE | GAWLER CRATON ~~BLOCK~~

HUNDRED: HAWKER — SECTIONS: 391, 112, 143, 142, 141

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~~METAMORPHIC~~ PETROLOGY & ~~MINERALOGY~~	804	IGNEOUS PETROL.	12	STRUCTURAL ~~GEOLOGY~~ PETROLOGY	826	METAMORPHIC PETROLOGY	16
QUARTZITE	151	DOLOMITE (ROCK)	114	AMPHIBOLITE	1353	GRANITE	845
GNEISS	846	SILLIMANITE	711	GRANITE	845	CALC-SILICATE	618
HUTCHINSON GROUP		NARRIDY CREEK GRANITE		MIDDLE CAMP GRANITE		PLUG RANGE GRANITE GNEISS	

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ABSTRACT

This report briefly describes rocks from three areas previously mapped as Flinders Group (Johns, 1961).

Granites exist in each area but are distinctively different, structurally and compositionally, from each other, whereas metasediments in each area are similar.

INTRODUCTION

During the course of work towards a Ph.D. thesis at the University of Adelaide, the author submitted several rock specimens to the Australian Mineral Development Laboratories for routine preparation of thin sections. Department of Mines "P" numbers* were assigned to those specimens and so in order to fulfill the Department's requirements, petrographical descriptions have been made of them. This report contains those descriptions plus a brief summary of the petrographical characteristics of rocks in each area. All the rocks were previously mapped as belonging to the Flinders Group (Johns, 1961) but are better considered as four separate units: the Hutchison Group (all metasediments), the Narridy Creek Granite, the Middle Camp Granite, and the Plug Range Granite Gneiss. A detailed account of their geology is contained in Parker (1978).

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*RS numbers have since been assigned to all samples and a cross reference list for these is contained in Appendix A.

NARRIDY CREEK/MIDDLECAMP AREA

SUMMARY OF PETROGRAPHY

There are three main subdivisions of rocks in this area; the metasediments of the Hutchison Group, the Middle Camp Granite, and the Narridy Creek Granite.

HUTCHISON GROUP - The metasediments in this area consist mainly of quartzite, calc silicate/dolomite, and gneiss.

Quartzites between Narridy Creek and Middle Camp are mainly medium grained, massive, feldspathic rocks with minor biotite and muscovite. The quartzes are generally undulose and display a moderate crystallographic preferred orientation and the micas are aligned to define a good schistosity. In most samples that schistosity is layer parallel (layers being defined by trains of feldspar grains) but in one, P2337/75, it is axial planar to a tight fold with a weaker, earlier schistosity layer parallel. This axial planar fabric is absent in more open folds, e.g. P2367/75, suggesting two fold generations - an early tight folding and a superimposed open folding. East of the Middle Camp granite, quartzites are of similar composition but different texture. They are finer grained, more polygonal and they have stronger C-axis fabrics. It is suggested that strain and/or recrystallization have been more intense here.

Dolomites east of Middle Camp are mainly massive, medium grained, granoblastic rocks consisting of dolomite with minor serpentine (after forsterite) and phlogopite. However an interesting calc silicate rock is developed along strike

from such adjacent to a pegmatite. It (P2316/75) is strongly a recrystallized and consists entirely of tremolite/actinolite. There are two generations of amphibole, an early coarse growth manifest by deformed relics, and a later recrystallized new grain growth. The rock has a jade affinity.

MIDDLECAMP GRANITE - Two samples of this granite are described, P2319/75 and P2363/75. Both are foliated granite gneisses of normal granitic composition. Distinctively though, they contain biotite as the only primary mica, and accessory sphene. They are granoblastic rocks, inequigranular but of dominantly medium grainsize. In outcrop the dominant foliation defined by mica alignment and some aplitic segregations has been openly folded (equivalent to the second deformation in the quartzites).

NARRIDY CREEK GRANITE - Several samples of this body are described, P2326 - 2343/75 (excluding P2337/75) and P2365/75. They show considerable variation in texture reflecting varying degree of recrystallization. P2365/75 is a relatively massive granite with only incipient recrystallization and a very weak foliation. However most other samples show significant recrystallization to produce platy or augen gneisses depending on the degree of recrystallization of coarse microclines. The foliation is well defined by mica alignment, augen shaped feldspar and quartz grains and/or aggregates, and by narrow, very fine grained recrystallized zones. Textures are therefore of mortar character with grainsize ranging from coarse to very fine. Compositionally the gneisses are true granites but distinctively they contain prominent primary muscovite. In outcrop the foliation is the only planar element, it sometimes

contains a strong lineation, but is not folded as is the Middle Camp Granite foliation.

PETROGRAPHICAL DESCRIPTIONS

P2315/75; TS 34993

Biotite-actinolite-schist

Location : Mindrow Creek 2.5 km W of Millar Point;
Hd. Hawker, Sec. 112

Hand Specimen : Fine grained, massive, dark green-grey schist.

Thin Section : Fine to medium grained inequigranular rock of xenoblastic texture. Grain boundaries of medium sized grains are irregular, diffuse and usually lined with very fine brown micaceous material. A visual estimate of the mode is,

35% Sericitized plagioclase
35% Actinolite
25% Biotite
Minor Orthoclase
Clinopyroxene
Opaque mineral
Trace Quartz
Hornblende
Accessories

The plagioclases are medium sized, equant and partially to completely sericitized. Actinolites are pale green or colourless, medium grained and often packed with minute high R.I. inclusions. They have ragged, irregular outlines and rarely have relic cores of dark green hornblende or clinopyroxene. Biotites are red brown in colour, medium grained have partially retrogressed to a dark green brown chlorite/biotite and have ragged boundaries.

There are two distinct orientations. One is parallel to a weak mineralogical layering which is folded, and the other is parallel to an axial planar fracture cleavage. The former are strongly kinked whereas the latter are somewhat more idioblastic.

Conclusion : This is a partially recrystallized rock of amphibolite affinity which has been multiply deformed.

P2316/75 : TS 34994

Tremolite schist

Location : Mt. Parapet Lineament 1.3 km SW Ullabidinie Reservoir, Hd. Hawker, Sec. 141

Hand Specimen : Fine grained, pale green amphibole schist of jade affinity (nephrite).

Thin Section : Porphyroblastic texture with relic medium to coarse porphyroblasts enclosed in a fine grained matrix.

A visual estimate of the mode is,

98% tremolite/actinolite

2% sphene and other high R.I. accessories

Both the porphyroblasts and matrix consist of colourless to very pale green tremolite/actinolite. The porphyroblasts are equant, unoriented grains with serrated boundaries. They are frequently kinked and subgrained and show considerable recrystallization around the outer edges. The matrix grains are strongly oriented and partially wrap around the porphyroblasts. They are subidioblastic and often penetrate into the porphyroblasts.

Conclusion : This is a strongly recrystallized calc silicate rock.

P2317/75 : TS 34995

Dolomite

Location : as for P2316/75

Hand Specimen : Medium grained, massive, off white dolomite

Thin Section : Granoblastic interlobate texture and equigranular with serrated grain boundaries.

A visual estimate of the mode is,

97% dolomite
2% phlogopite
1% serpentine
trace opaque mineral

The dolomite is medium grained, of irregular shape and is strongly twinned. It encloses scattered grains of tabular (idioblastic) phlogopite which are often kinked. The serpentine occurs as rare nodules - one with a fine relic inclusion of forsterite.

P2318/75 : TS 34996

Microcline pegmatite (?)

Location : 1 km WSW Ullabidinie Reservoir
Hd. Hawker, Sec. 141

Hand Specimen : Massive, white, medium to coarse grained microcline rock.

Thin Section : Granoblastic serriate texture with coarse grains of microcline enclosed in a medium grained matrix.

A visual estimate of the mode is,

95% microcline
2% sphene
2% tremolite/actinolite
trace accessories including carbonate.

The coarse microclines are of irregular shape with serrated to lobate boundaries. They are surrounded by mosaics of medium to fine new grains that appear to have formed by recrystallization of the host microcline. Sphene and tremolite occur as medium sized grains within the matrix.

Conclusion : This a strongly recrystallized rock probably of calc silicate affinity

P2319/75 : TS 34997

Granitic gneiss (Middle Camp Granite)

Location : 1.8 km NW of Ullabidinie Reservoir
Hd. Hawker, Sec. 144

Hand Specimen : Massive, weakly foliated granite gneiss of mottled pink and grey colour.

Thin Section : Granoblastic inequigranular texture with coarse feldspar in a medium grained groundmass of quartz, feldspar and mica. A visual estimate of the mode is,

45% microcline
30% plagioclase
17% quartz
4% sericite
3% biotite

minor chlorite, opaque mineral and sphene.

The microclines are mainly coarse grained often with medium sized inclusions of plagioclase. They are perthitic in part. Plagioclase is mainly medium grained, partially sericitized oligoclase commonly with myrmekitic intergrowths. Quartz

occurs as medium grained aggregates and stringers of equant subpolygonal grains with cuspate grain boundaries. They are often undulose to deformation banded. Of the other minerals biotite is medium grained, pale brown in colour and oriented to define a weak schistosity. Sericite is of secondary origin.

Conclusion : This is a recrystallized granite.

P2320/75 : TS 34998 and P2321/75 : TS 34999.

Quartzite

Location : 1 km W of Ullabidinie Reservoir
Hd. Hawker, Sec. 143 SW

Hand Specimen : A rodded finely layered and fine to medium grained, feldspathic quartzite of off white colour.

Thin Section : Granoblastic equigranular texture consisting of equant subpolygonal grains with curved to serrated boundaries. The layering is defined by trains of fine feldspars and by a parallel schistosity defined by mica and elongate quartzes. Elongate aggregates of quartz define the lineation. Quartzes are undulose but display a strong c-axis preferred orientation. A visual estimate of the mode is,

80% quartz
15% feldspar (mainly orthoclase)
3% biotite
2% opaque mineral
trace zircon, sphene.

P2322/75 : TS 35000

Quartzite

Location : 2 km WSW of Ullabidinie Reservoir

Hd. Hawker, Sec. 139

Hand Specimen : Massive, white, medium to fine grained feldspathic quartzite

Thin Section : Granoblastic inequigranular texture with medium sized feldspars in a fine grained sub-polygonal quartz matrix. The feldspars are subrounded in shape some with very fine new grain growth along their grain boundaries. They consist mainly of microcline with minor sericitized plagioclase. Quartz grains have straight to weakly undulose extinction, and are mainly equant to weakly elongate with serrated grain boundaries. A visual estimate of the mode is,

80% quartz
17% feldspar
2% martite
1% muscovite
trace zircon

Fabric - elongate feldspar and mica define a schistosity parallel to the weak layering, but the weak dimensional orientation of quartz defines a second schistosity at a slight angle to the layering. A strong quartz c-axis fabric appears to be related to this overprinting schistosity.

Conclusion : This is a recrystallized quartzite that has been multiply deformed.

P2323/75 : TS 35001

Quartzite

Location : 2 km W of Middle Camp

Hd. Hawker Sec. 116

Hand Specimen : Massive, medium grained, white quartzite

Thin Section : Granoblastic equigranular texture.

A visual estimate of the mode is,

96% quartz

3% muscovite

trace opaquie mineral, sphene and tourmaline.

Quartz grains are mainly equant with cuspate to lobate boundaries. They are undulose to weakly deformation banded and display or poor crystallographic preferred orientation. Muscovites are primary, amoeboid and define a weak schistosity.

P2324/75 : TS 35002 and P2366/75 : TS 35044

Quartzite

Location : see P2323/75

Hand Specimen : Massive, white medium grained feldspathic quartzite. A very faint layering is folded and a quartz rodding subparallels the fold axes.

Thin Section : Granoblastic interlobate texture and mainly equigranular. The weak layering is defined by trains of feldspar grains and is folded with a weak axial planar schistosity defined by micas and a dimensional orientation of some feldspar and quartz. A visual estimate of the mode is,

85% quartz

10% microcline

2% biotite

1% muscovite

minor tourmaline, sphene, zircon and

opaque mineral(s).

The quartzes are deformation banded with partial subgrain formation. They are ragged, irregularly shaped grains, mainly equant, with serrated boundaries. Microclines are subrounded in shape.

P2325/75 see later

P2326/75 : TS 35003

Tonalite

Location : 2 km NNE of Narridy Creek
Hd. Hawker, Sec. 117

Hand Specimen : Massive, medium to coarse grained aplite of cream colour.

Thin Section : Granoblastic serriate (mortar) texture consisting of numerous medium to coarse grains enclosed in a fine grained matrix. A visual estimate of the mode is,

98% plagioclase (andesine)
2% muscovite

The medium to coarse plagioclases are strained with flexed twin lamellae and incipient subgrain formation. They are of irregular shape with serrated grain boundaries and are surrounded by fine new grains. The muscovite occurs as isolated fine grained flakes and as incipient sericitization of plagioclase.

P2327/75 : TS 35004

Gneissic granite (Narridy Creek)

Location : 1.8 km NNE of Narridy Creek
Hd. Hawker; Sec. 117.

Hand Specimen : Massive, medium to coarse grained granite of pale mottled pink colour and weakly foliated.

Thin Section : Granoblastic inequigranular texture with a weak foliation defined by a mica alignment and a fracture cleavage. There are irregular patches of fine new grains of feldspar and quartz. A visual estimate of the mode is,

50% plagioclase (oligoclase)
25% microcline perthite
20% quartz
3% muscovite
2% biotite/chlorite
trace opaque and accessory minerals.

The quartz occurs mainly as aggregates of medium sized grains which are deformation banded and which are of irregular shape with cuspate boundaries. Microcline is medium to coarse grained with inclusions of quartz and plagioclase and tends to occupy interstitial sites. Plagioclases are mainly coarse grained with quartz, muscovite and biotite inclusions, and are of irregular, embayed shape. Muscovite occurs as medium sized grains and as secondary sericite, while biotite is medium grained and of dark green brown colour.

P2328/75

Granite gneiss

Location : 3 km N of Narridy Creek
Hd. Hawker, Sec. 148.

Hand Specimen : Strongly rodded, medium grained granite gneiss of mottled pink colour.

Thin Section : Granoblastic inequigranular texture of equant grains. There are coarse augen like pods or aggregates of quartz and feldspar and these are

surrounded by finer grained recrystallized quartz and feldspar.

A visual estimate of the mode is,

50% plagioclase
25% quartz
20% microcline
3% biotite/chlorite
2% muscovite
minor opaque mineral

The aggregates of quartz consist of medium sized, unstrained grains with curved to cuspate grain boundaries and good triple point junctions. Plagioclase is incipiently sericitized and has recrystallized. Some old grains have kinked twin lamellae. Microcline likewise has partially recrystallized and microcline/microcline grain boundaries are narrow zones of very fine new grains.

P2329/75 : TS 35006

Augen granite gneiss

Location : 3.5 km N of Narridy Creek
Hd. Hawker, Sec. 148.

Hand Specimen : A medium to coarse grained augen gneiss of granitic composition and mottled pink colour.

Thin Section : Porphyroblastic interlobate (mortar) textures of relatively equant grains. The augen consist of quartz or feldspar wrapped around by thin mica layers. Quartz augen are medium grained aggregates of subpolygonal, unstrained grains whereas feldspar augen consist mainly of a single coarse microcline surrounded by recrystallized aggregates of microcline and also of quartz, plagio-

clase and mica. A visual estimate of the mode is,

50% microcline
25% quartz
18% plagioclase
5% muscovite
2% biotite/chlorite
minor opaque and zircon

P2330/75 : TS 35007

Platy granite gneiss

Location : as for P2329/75

Hand Specimen : A fine to medium grained, platy granite gneiss of pinkish colour.

Thin Section : Strongly foliated rock of equigranular granoblastic texture. The platiness is defined by ribbons of fine grained quartz and by thin slithers of mica. A visual estimate of the mode is,

60% quartz
35% muscovite
4% feldspar (microcline and plagioclase)
minor opaque mineral

P2331/75 : TS 35008 and P2368/75 : TS 34046

Augen granite gneiss

Location : 2.9 km N of Narridy Creek
Hd. Hawker, Sec. 148

Hand Specimen :Medium to coarse grained augen gneiss of granitic composition and mottled pink and grey colour.

Thin Section : Granoblastic serriate textures of equant grains but ellipsoidal augen. Similar texture and fabric to P2329/75. A visual estimate of the mode is,

35% microcline perthite
30% plagioclase
25% quartz
6% muscovite
2% biotite
minor opaque and accessory minerals.

Quartz augen range from coarse deformation banded grains to aggregates of fine polygonal grains. Micas are kinked often with very fine new grain recrystallization, and form thin layers wrapping around feldspar and quartz augen. The majority of coarse augen consist of coarse microclines with tails of new recrystallized grains. Other augen are now mosaics of medium grained quartz and feldspar.

-P2332/75 : TS 35009 and P2333/75 : TS 35010

Augen granite gneiss

Location : 2.7 km N of Narridy Creek
Hd. Hawker, Sec. 133

Hand Specimen : Medium grained granite gneiss with scattered augen. The augen are smaller than P2331/75 and P2329/75.

Thin Section : Granoblastic inequigranular texture essentially of medium to fine grain size but with scattered coarse grains. Augen are much less pronounced than above samples but of similar habit.

A visual estimate of the mode is,

40% microcline

30% plagioclase

25% quartz

3% chlorite/biotite

2% muscovite

minor opaque and accessory minerals

P2334/75 : TS 35011

Granite gneiss

Location : 2.4 km N of Narridy Creek

Hd. Hawker, Sec. 133.

Hand Specimen : A pale pink, medium to fine grained granite gneiss.

Thin Section : Granoblastic equigranular texture and weakly foliated. The foliation is defined by scattered micas which tend to outline relic augen now consisting of new grain mosaics. There are a few medium to coarse feldspars in these augen like aggregates.

A visual estimate of the mode is,

40% plagioclase

30% microcline

25% quartz

2% muscovite

2% biotite/chlorite

minor opaque and accessory minerals.

P2335/75 : TS 35012

Granite gneiss

Location : 1.7 km W of N from Narridy Creek

Hd. Hawker, Sec. 118.

Hand Specimen : A pale pink, medium to fine grained granite gneiss similar to P2334/75.

Thin Section : Granoblastic inequigranular texture and weakly foliated with scattered medium to coarse feldspars in a predominantly fine grained, equigranular matrix.

Similar to P2334/75. A visual estimate of the mode is,

40% microcline
35% plagioclase
20% quartz
3% muscovite
2% biotite/chlorite
minor opaque mineral

P2336/75 : TS 35013

Granite gneiss

Location : 1.5 km N of Narridy Creek.
Hd. Hawker, Sec. 118.

Hand Specimen : Pale pink to offwhite, medium grained granite gneiss.

Thin Section : Granoblastic inequigranular texture with grainsize ranging from coarse to very fine. The dominant grainsize is medium. Micas are well oriented and combined with an elongation of quartz aggregates and feldspar define the foliation. A visual estimate of the mode is,

65% plagioclase
20% quartz
15% muscovite
minor microcline, biotite and accessories.

The plagioclase is mainly medium or coarse grained of irregular shape with serrated boundaries. It is of albitic composition but contains inclusions of sericitized andesine. Twin lamellae are often kinked, and subgrains are common. The quartz is mainly medium grained, deformation banded, irregular in outline with serrated or cuspate grain boundaries Finer (new) grains are polygonal. Muscovite is medium grained, tapered in shape and often kinked. Very fine new grains trail off each end.

P2337/75 : TS 35014 and P2371/75 : TS 35049

Quartzite

Location : 1.4 km ENE of Narridy Creek
Hd. Hawker, Sec. 247

Hand Specimen : Massive pale pinkish brown quartzite of medium grainsize. There is a very faint layering which has been folded tightly and a strong axial planar schistosity.

Thin Section : Granoblastic equigranular texture of equant irregular shaped grains with finely serrated grain boundaries. A visual estimate of the mode is,

92% quartz
5% microcline
2% muscovite
1% biotite

minor opaque mineral, zircon and sphene.

Quartz grains are invariably undulose or deformation banded and they show a moderate crystallographic preferred orientation. Microclines are subrounded in

shape and muscovites generally embayed.

Fabric : There is a weak relic mica schistosity parallel to the folded layering in the hinge zone but the principal schistosity is axial planar to the fold. It is defined by a mica alignment and a segregation of mica into narrow films.

P2338/75 : TS 35015

Quartz feldspathic gneiss

Location : 0.8 km W of N from Narridy Creek
Hd. Hawker, Sec. 118

Hand Specimen : Well rodded, massive, medium grained quartzo feldspathic gneiss of creamy brown colour.

Thin Section : Granoblastic interlobate and equigranular texture. Grains are equant though irregularly shaped and there is only a weak schistosity.

A visual estimate of the mode is,

70% quartz
15% microcline
10% plagioclase
4% muscovite
minor opaque mineral, sphene and tourmaline

P2339/75 : TS 35016

Granite gneiss

Location : 1 km NNW of Narridy Creek
Hd. Hawker Sec. 118

Hand Specimen : Pale pink, weakly rodded, medium to fine grained granite gneiss similar to P2335/75.

Thin Section : Granoblastic inequigranular texture with scattered coarse feldspars (mainly microcline) in a fine to medium grained quartzo feldspathic matrix. It is well foliated, this being defined

by a mica alignment and an elongation of some feldspar and quartz. A visual estimate of the mode is,

50% microcline
25% quartz
20% plagioclase
4% muscovite
1% biotite
minor opaque mineral and garnet.

Quartzes are undulose.

P2340/75 : TS 35017

Gneissic granite pegmatite

Location : 1.5 km NNW of Narridy Creek
Hd. Hawker, Sec. 118

Hand Specimen : Coarse grained, cream coloured gneissic pegmatite.

Thin Section : Porphyroblastic texture with weakly foliated zones of medium to fine quartz, feldspar and mica enclosing coarse feldspars. The coarse plagioclases have flexed and kinked twin lamellae and have incipient subgrain growth. Quartzes are undulose and of irregular shape with serrated grain boundaries. A visual estimate of the mode is,

65% plagioclase
25% quartz
8% muscovite
2% biotite
minor opaque mineral

P2341/75 : TS 35018

Granite gneiss

Location : as for P2340/75

Hand Specimen : Medium grained, pale pink granite gneiss.

Thin Section : Granoblastic inequigranular texture with the grainsize equally divided between medium grained strained grains and fine new grains. Grains are equant and the foliation weak. A visual estimate of the mode is,

35% plagioclase
30% quartz
25% microcline
8% muscovite
1% biotite
minor opaque and accessory minerals (including garnet)

This rock is similar to other granite gneiss but with a higher proportion of old grains.

P2342/75 : TS 35019

Augen granite gneiss

Location : 1.3 km NE of Pinerow
Hd. Hawker, Sec. 132

Hand Specimen : Coarse grained, mottled pink augen gneiss of granitic composition.

Thin Section : Granoblastic serriate texture with coarse augen consisting of either coarse feldspars with medium grained tails, or medium grained aggegates of quartz or feldspar, wrapped around by very fine grained layers of recrystallized quartz, feldspar and mica. There is a strong alignment of mica within these layers and together with the augen development they define a strong schistosity. A visual estimate of the mode is,

35% quartz
30% microcline
30% plagioclase
1% muscovite
1% biotite/chlorite
minor opaque and accessory minerals.

Quartz occurs in aggregates of irregularly shaped grains with serrated to cuspate boundaries. They vary from subpolygonal grains with straight extinction to lobate grains with deformation bands and undulose extinction. Plagioclases are incipiently sericitized and of oligoclase composition. Microclines contain inclusions of plagioclase, muscovite and quartz. Muscovite occurs as medium sized, kinked grains, as fine grains in the fine grained recrystallized layers, and as sericite.

P2343/75 : TS 35020

Augen granite gneiss

Location : 1.1 km NE of Pinerow.
Hd. Hawker, Sec. 132.

Hand Specimen : Medium to coarse grained, mottle pink augen gneiss.

Thin Section : Granoblastic serriate texture of similar character to P2329/75 and P2342/75.
A visual estimate of the mode is,

35% quartz
30% microcline
25% plagioclase (andesine)
8% muscovite
1% biotite/chlorite
minor opaque and accessory minerals.

There are two foliation directions in the rock and these are at an angle of 40^{o} to each other. Together they outline the augen and define a rodding.

P2363/75 : TS 35041

Granite gneiss (Middle Camp granite)

Location : 1.2 km WNW of Ullabidinie Reservoir
Hd. Hawker, Sec. 143^{SW}

Hand Specimen : Massive, grey, medium to fine grained granite gneiss with pinkish white quartzo feldspathic veins.

Thin Section : Granoblastic inequigranular texture with equal proportions of medium sized grains (quartz and feldspar) and of very fine grained matrix (quartz, feldspar and mica). It is well foliated - defined by mica and by the fine grained recrystallized zones wrapping around medium grained "augen". The quartzo feldspathic veins are of similar texture but devoid of biotite, and maybe slightly coarser grained.

A visual estimate of the mode is,

45% microcline perthite
25% quartz
20% plagioclase
10% biotite
minor opaque and accessory minerals.

Quartz occurs mainly as platy aggregates of irregularly shaped, undulose grains; microcline occurs as medium to coarse old grains surrounded by zones of very fine new grains; and plagioclase occurs as partly sericitized medium sized old

grains surrounded by zones of very fine new grains; and plagioclase occurs as partly sericitized medium sized old grains and as fine new grains. Biotites are fine grained and subidioblastic.

P2364/75 : TS 35042

Layered quartzo feldspathic gneiss

Location : 1.1 km WNW Ullabidinie Reservoir
Hd. Hawker, Sec. 142

Hand Specimen : Crenulated, fine to very fine grained layered gneiss of grey colour.

Thin Section : Granoblastic interlobate texture with alternating bands of very fine grained, equigranular quartz, and very fine grained equigranular feldspar. There is a strong schistosity parallel to the banding, and it is defined by mica and by elongate relics of medium sized old feldspar grains. The texture and fabric suggest very intense recrystallization akin to mylonitic type recrystallization. Both the layering and schistosity are openly crenulated. A visual estimate of the mode is,

45% microcline (and ?plagioclase)
35% quartz
17% biotite
2% muscovite
minor sphene, zircon and opaque mineral

P2365/75 : TS 35043

Granite (Narridy Creek Granite)

Location : 2.3 km NNE of Narridy Creek
Hd. Hawker, Sec. 134

Hand Specimen : Massive, pale pink, medium grained granite with coarse clots of garnet. Weakly foliated.

Thin Section : Granoblastic interlobate textures of inequigranular fine to coarse grainsize. It consists of medium to coarse grained feldspars with interstitial medium to fine quartz, feldspar and mica. There is a very weak mica alignment. A visual estimate of the mode is,

45% microcline perthite
25% quartz
20% plagioclase
4% muscovite
3% biotite/chlorite
1% opaque mineral
1% garnet
minor accessories

The garnet occurs as a coarse poikiloblastic crystal veined with biotite, microclines contain inclusions of quartz and plagioclase (some zoned), and quartzes are deformation banded. There is only incipient recrystallization.

P2366/75 : TS 35044 - see P 2324/75

P2367/75 : TS 35045

Quartzite

Location : 2.2 km NE of Narridy Creek
Hd. Hawker, Sec. 116

Hand Specimen : Massive, pinkish white, medium grained, feldspathic quartzite. There is a very faint layering which is buckle folded.

Thin Section : Granoblastic interlobate texture of equigrainsize. Quartzes are equant, of irregular shape with cuspate grain boundaries, and are deformation banded. There is a relatively strong schistosity defined by mica alignment which is parallel to the folded layering. Some micas are kinked. A visual estimate of the mode is,

90% quartz
7% microcline perthite
2% biotite/chlorite
1% muscovite

minor opaque mineral, tourmaline, sphene, and apatite.

P2368/75 : TS 35046 - see P2331/75

P2369/75 : TS 35047

Fault breccia

Location : 1.7 km N of Narridy Creek
Hd. Hawker, Sec. 118

Hand Specimen : A brecciated granite - angular fragments of all sizes of granite gneiss enclosed in a red, very fine grained matrix.

Thin Section : Cataclastic texture with about 50% matrix. The fragments are sharply angular, some with rounded corners, and consist of well foliated quartzo feldspathic gneiss. The fragments are randomly oriented. Their textures are granoblastic subpolygonal, and their composition is quartz (45%), microcline (40%), plagioclase (10%), biotite/chlorite (4%) and minor opaque and accessory minerals.

The matrix composition corresponds to that of the fragments but with very fine hematitic opaque mineral constituting 15-20%. Every gradation in grainsize from that of the fragments down to sub-microscopic is present.

P2370/75 : TS 35048

Banded gneiss

Location : 1.9 km W of Middle Camp
Hd. Hawker, Sec. 246

Hand Specimen : Well banded, medium to fine grained gneiss of brown-grey colour. Bands alternative between micaceous and quartzo feldspathic.

Thin Section : Granoblastic textures alternating between equigranular polygonal textures of quartzo feldspathic bands to decussate textures of micaceous bands. There is a very strong mica alignment parallel to the banding which is folded and crenulated. A visual estimate of the mode is,

35% microcline perthite (and ?plagioclase)
25% sericite
15% quartz
13% biotite
10% muscovite
1% opaque mineral
minor tourmaline, zircon, apatite

In the quartzo feldspathic bands, microclines have minor sericite around their outer margins, quartzes are weakly undulose and micas are mainly embayed. In the micaceous bands sericite predominates and penetrates into scattered feldspars. Biotites and

muscovites in such are medium grained and embayed being penetrated by the sericite. There are scattered stringers of quartz.

P2371/75 : TS 35049 - see P2337/75.

PLUG RANGE AREA

SUMMARY OF PETROGRAPHY

HUTCHISON GROUP - Quartzite predominates the outcropping areas of metasediments. With the exception of P2362/75, all are massive, medium to coarse grained, feldspathic rocks consisting of 85-95% quartz. P2362/75 contains lenses of medium grained sillimanite quartzite within normal feldspathic material.

Dolomites (P2344/75) are massive, medium grained rocks with minor serpentine (after forsterite), forsterite, diopside and phlogopite. They are associated with calcsilicate gneisses consisting of interbanded diopside (P2357/75) and biotite-feldspar (P2345/75 and P2358/75).

There are numerous pegmatitic rocks associated with the boundary between dolomite and granite gneiss (e.g. P2356/75 and P2372/75).

PLUG RANGE GRANITE GNEISS - Several samples of granite gneiss are described (e.g. P2325/75, P2352/75 and P2374/75). Characteristically they are medium grained, well foliated rocks of typical granitic composition and with a well defined gneissic layering. The layering and layer parallel foliation are tightly folded with a second strong biotite schistosity overprinting them. These tight folds have been refolded about broad open folds correlating them with the early tight fold deformation in the Middle Camp area (see p.1). This deformational history and the absence of sphene and muscovite distinguish the Plug Range Granite Gneiss from the Narridy Creek and Middle Camp granite gneisses. Conformable amphibolites are locally present.

PETROGRAPHICAL DESCRIPTIONS

P2325/75 : TS 35040

Granite gneiss (Plug Range)

Location : 1.5 km S.E. of Plug Range (southern extremity)
Hd. Miltalie, Sec. 85.

Hand Specimen : A medium grained, strongly foliated granite gneiss of mottled pale pink colour. The foliation is tightly folded.

Thin Section : Granoblastic interlobate texture, equigranular and of medium grainsize. Most quartz and feldspars are equant but of irregular shape with curved grain boundaries. A visual estimate of the mode is,

50% plagioclase
20% quartz
15% microcline
12% biotite
2% sericite
1% zircon
minor apatite and opaque mineral.

Quartz occurs as scattered, undulose to deformation banded grains, plagioclase occurs as incipiently sericitized grains of oligoclase with trace myrmekite, microcline occurs as clear grains in interstitial sites, and biotite occurs as sharply subhedral plates of red-brown colour with pleochroic haloes about very fine zircon inclusions.

Fabric - The dominant foliation is defined by biotite alignment and biotite segregation. It is folded and individual micas are kinked with new axial planar micas recrystallizing. The new biotites are identical to the kinked grains but they truncate them.

P2344/75 : TS 35021

Dolomite

Location : 3.5 km S of Plug Range (southern extremity)
Hd. Miltalie, Sec. $3A^E$

Hand Specimen : Massive, medium grained, white dolomite.

Thin Section : Granoblastic interlobate texture of inequigrainsize.

A visual estimate of the mode is,

80% dolomite
7% serpentine
5% calcite
3% phlogopite
1% forsterite
1% garnet
1% opaque mineral
minor diopside and apatite.

The dolomite occurs as irregularly shaped, lobate grains partially recrystallized to fine new grains, and calcite occurs as interstitial grains associated with the serpentine and diopside. The serpentine occurs as rounded nodules with trace relics of forsterite. However there are a few relatively unaltered grains of forsterite that have been criss-crossed by veinlets of serpentine. Diopside and garnet are both associated with the olivine/serpentine but phlogopite occurs as stumpy crystals scattered throughout. They are often kinked.

P2345/75 : TS 35022

Mica-feldspar gneiss

Location : 0.2 km W of P2344/75
Hd. Miltalie, Sec. $3A^E$

Hand Specimen : A medium grained, well foliated, grey, feldspathic gneiss with thin, white feldspar segregations.

Thin Section : Granoblastic polygonal textures of equigrainsize. The rock is finely banded with thin bands of microcline interspersed with biotite-plagioclase bands. A visual estimate of the mode is,

50% microcline
30% plagioclase/sericite
15% biotite
2% chlorite
1% actinolite
minor muscovite, tourmaline, apatite, epidote, sphene and zircon.

The microcline occurs as equant subpolygonal grains with patch perthite, the plagioclases have been almost completely sericitized but their pseudomorphs are also equant and subpolygonal, and the biotite occurs as stumpy, subidioblastic plates of red brown colour with minor chlorite alteration and scattered zircon inclusions (with haloes). The micas are very strongly oriented and this sometimes cuts across the banding suggesting that such has been folded or even transposed. The rock is probably of calc-silicate derivation.

P2346/75 : TS 35023

Granite gneiss

Location : 0.5 km N.E. of P2344/75
Hd. Miltalie, Sec. $3A^E$

Hand Specimen : Medium grained, mottled pink granite gneiss. Well foliated.

Thin Section : Granoblastic interlobate textures of equigrainsize and equant shape. A visual estimate of the mode is,

45% plagioclase (oligoclase)
25% microcline perthite
20% quartz
10% biotite
minor zircon

Similar to P2325/75. The biotites are dark brown in colour.

P2347/75 : TS 35024 and P2348/75 : TS 35025

Quartzite

Location : 4.3 km S of Plug Range (P2347/75 is 0.7 km E of P2348/75).

Hd. Miltalie, Sec. $3A^{E}$

Hand Specimen : Massive, offwhite, feldspathic quartzite of medium grainsize. Weakly foliated - P2347/75 slightly stronger than P2348/75.

Thin Section : Granoblastic interlobate textures of equigrainsize. Quartz of P2348/75 is equant but of P2347 is slightly elongate parallel to the mica alignment.

A visual estimate of the mode is,

85% quartz
13% microcline
1% biotite
1% muscovite
minor sphene and zircon

Quartzes are irregular shaped with serrated grain boundaries and deformation bands. Microclines are subrounded in outline. There is a reasonable c-axis fabric.

P2349/75 : TS 35026

Quartzite

Location : 0.6 km W of P2348/75

Hd. Miltalie, Sec. $3A^E$

Hand Specimen : Massive, off white, medium to coarse grained feldspathic quartzite.

Thin Section : Granoblastic interlobate textures similar to P2348/75.

A visual estimate of the mode is,

95% quartz

4% microcline

1% muscovite

minor biotite, zircon and sphene.

P2350/75 : TS 35027

Biotite-feldspar gneiss

Location : 3.9 km S of Plug Range

Hd. Miltalie, Sec. $3A^E$

Hand Specimen : A medium grained, massive grey feldspathic gneiss very similar to P2345/75.

Thin Section : Granoblastic interlobate textures of relatively equigrainsize. There is a strong foliation defined by biotite, ellipsoidal fibrolite pods, and by some elongate feldspars. Overprinting this is a second, much weaker biotite schistosity at approximately 90^o to the main one.

A visual estimate of the mode is,

60% microcline perthite

20% biotite

10% sericite/(?)plagioclase

8% sillimanite

minor opaque mineral, zircon, appatite and tourmaline

Microcline occurs as medium to coarse grains of irregular shape with curved boundaries and perthite has developed as feathery patches frequently along grain boundaries. Biotite occurs as subidioblastic red-brown plates and the sericite as (presumably) plagioclase pseudomorphs. The sillimanite occurs as scattered fine grain needles in the microclines and as medium sized, flattened fibrolite pods. Rarely there is evidence within the pods of crenulation of the fibrolite suggesting that the fibrolite was initially at a high angle to the pods and was crenulated during their flattening. Subsequent deformation has overprinted a weak biotite schistosity over the flattened pods.

P2351/75 : TS 35028

Amphibolite

Location : 2.7 km S of Plug Range
Hd. Miltalie, Sec. $3A^{E}$

Hand Specimen : A dark grey to black, fine to medium grained, massive amphibolite.

Thin Section : Poikiloblastic texture of inequigrainsize. Medium grained plagioclases are strongly poikiloblastic with fine grained inclusions of amphibole. Other amphiboles are medium grained. The plagioclases are platy and together with amphibole preferred orientation they define a strong schistosity. A visual estimate of the mode is,

50% plagioclase

40% amphibole

5% quartz

3% sericite

2% opaque mineral

1% biotite

trace (?) garnet

The plagioclase is an andesine/labradorite that is incipiently sericitized, and the amphibole is a mixture of dominantly green hornblende and lesser, colourless, multiply twinned grunerite.

P2352/75 : C16300

Granite gneiss

Location : 2.2 SSE of Plug Range

Hd. Miltalie, Sec. $3A^{E}$

Hand Specimen : A medium grained, mottled grey and pink granite gneiss with scattered medium sized clots of biotite.

Thin Section : Granoblastic interlobate textures of equigrainsize with medium sized clots of unoriented, stumpy plates of biotite. A good foliation is defined by biotite orientation (outside of clots) and minor feldspathic segregations. A visual estimate of the mode is,

35% microcline perthite

25% plagioclase (albite)

25% quartz

13% biotite

1% apatite

minor zircon and opaque mineral.

The microclines are clear, equant grains of irregular shape and cuspate boundaries, and the biotite occurs as clots and as scattered isolated grains of dark

brown colour.

P2353/75 : C16301

Granite gneiss

Location : 1.7 km ESE of Plug Range (southern extremity)
Hd. Miltalie, Sec. 85.

Hand Specimen : A medium grained, cream coloured granite gneiss with thin biotite layers separating quartzo feldspathic layers.

Thin Section : Granoblastic interlobate texture of medium grainsize with scattered slightly coarser microclines. A visual estimate of the mode is,

50% microcline perthite
25% quartz
15% plagioclase (oligoclase)
5% biotite
4% sillimanite
minor muscovite, opaque mineral and zircon.

Similar to other granite gneisses (e.g. P2325/75). The sillimanite however occurs in thin lenticular aggregates of fibrolite and fine needles closely associated with biotite. The biotites are red-brown in colour.

P2354/75 : C16302

Amphibolite

Location : 0.05 km E. of P2353/75

Hand Specimen : A black, medium to fine grained, schistose amphibolite with pink garnets.

Thin Section : Granoblastic interlobate textures of equi-grainsize. Foliation (and lineation) defined by amphibole preferred orientation. A visual

estimate of the mode is,

60% hornblende

28% sericite/(?)plagioclase

10% quartz

2% garnet

minor opaque mineral

The hornblende is green-brown in colour and subidioblastic and the garnets are slightly coarser and poikiloblastic.

P2355/75 : C16303

Calc silicate

Location : adjacent to P2354/75

Hand Specimen : A mottled green and grey, massive calc silicate of medium grainsize.

Thin Section : Granoblastic interlobate texture. Banded with alternating quartz and plagioclase-diopside-amphibole layers. Inequigranular and often a dimensioned orientation parallel to the banding.

A visual estimate of the mode is,

40% quartz

30% plagioclase/sericite

25% diopside

5% actinolite

minor sphene, epidote and opaque mineral.

The quartzes are medium to coarse grained, deformation banded and of irregular shape with serrated to lobate grain boundaries. The plagioclase is labradorite/bytownite and is incipiently seritized (with epidote) and the diopside is hedenbergite with minor uralitization.

P2356/75 : C16304

Aplite

Location : 0.1 km E of P2353/75

Hand Specimen : Massive, cream coloured, medium grained quartzo feldspathic aplite. Weakly foliated.

Thin Section : Granoblastic interlobate texture of medium grainsize with scattered coarser and finer grains. A visual estimate of the mode is,

40% microcline
35% plagioclase (oligoclase)
25% quartz
trace biotite and opaque mineral.

Microclines are clear, plagioclases are dusty with incipient sericitization, and quartzes are undulose or deformation banded.

P2357/75 : C16305

Calc silicate (diopside rock)

Location : 0.2 km ENE of P2353/75

Hand Specimen : Massive, off white, medium to fine grained calc silicate

Thin Section : Granoblastic subpolygonal of inequigrainsize with bands and patches of medium sized, irregularly shaped grains (with ragged boundaries) alternating with bands of fine, subpolygonal grains. All grains are equant. A visual estimate of the mode is,

90% hedenbergite
1% calcite

The hedenbergite has $\gamma \wedge c = 46\text{-}47^{o}$ and has minor exsolution lamellae. Calcite is interstitial.

P2358/75 : C16307

Biotite-feldspar gneiss (calc silicate)

Location : see P2357/75

Hand Specimen : A medium grained, massive, grey feldspathic gneiss. In outcrop it is a well banded calc silicate rock with alternating diopside rich bands. That banding is very tightly folded.

Thin Section : Granoblastic subpolygonal texture of equigrainsize. It is strongly foliated - defined by biotite alignment. Feldspars are equant shaped and biotites are stumpy. A visual estimate of the mode is,

45% microcline
30% sericite/(?) plagioclase
23% biotite
2% sillimanite
minor tourmaline, zircon, sphene, calcite, hedenbergite, and actinolite.

Similar to P2345/75 and P2350/75.

P2359/75 : C16306

Amphibolite

Location : 1 km S of Plug Range
Hd. Miltalie, Sec. 8A.

Hand Specimen : A fine to medium grained, black massive amphibolite.

Thin Section : Granoblastic subpolygonal texture of inequigrainsize but equant shape. A visual estimate of the mode is,

50% plagioclase (labradorite)
40% hornblende
5% grunerite
3% quartz
2% opaque mineral

The hornblende is green-brown in colour, subidioblastic

and is intergrown with colourless grunerite, plagioclases are incipently sericitized, poikiloblastic and have prolific albite, Carlsbad and pericline twinning, and quartz occurs as fine inclusions within the plagioclase.

P2360/75 : C16308 and P2361/75 : C16309

Quartzite

Location : Plug Range south

Hd. Miltalie, Sec. 8A

Hand Specimen : Massive, off white, feldspathic quartzite of medium to coarse grainsize.

Thin Section : Granoblastic interlobate and serriate texture. There are patches, bands and augen of coarse, deformation banded, irregularly shaped grains, alternating with medium sized, deformation banded, sometimes elongate, grains and fine to very fine polygonal grains. The latter often line grain boundaries and represent post tectonic annealing whereas the medium grains represent syntectonic recrystallization (from subgrains) of the coarse grains. A visual estimate of the mode is,

97% quartz

3% feldspar

minor opaque mineral, sillimanite and muscovite.

The opaque minerals and sillimanite define a very faint layering.

P2362/75 : TS 35039

Sillimanite quartzite

Location : 0.1 km W of P2360/75,southern Plug Range.

Hand Specimen : Massive, off white feldspathic quartzite with narrow lenticular pods (5 mm thick) of white sillimanite quartzite. The pods constitute 30% of the specimen.

Thin Section : Banded inequigranular rock of granoblastic interlobate texture. The principal rock is medium to coarse grained, equant shaped feldspathic quartzite. The lenticular pods consist of medium grained, elongate (parallel length of pods) quartz with abundant sillimanite forming clusters along quartz grain boundaries. There is no feldspar in the pods and only traces of sillimanite outside of them. A visual estimate of the mode is,

85% quartz
10% microcline
5% sillimanite
minor muscovite, opaque mineral, tourmaline and apatite.

Quartzes are deformation banded with subgrains and cuspate to serrated grain boundaries. Sillimanite has grown out radially from clusters along grain boundaries into adjacent quartz.

P2372/75 : TS 35050

Pegmatite

Location : 0.05 km NW of P2350/75

Hand Specimen : Heavily altered, massive, white, coarse grained pegmatite.

Thin Section : Granoblastic interlobate texture of inequigrainsize - coarse feldspar pseudomorphs and scattered medium grained quartz. A visual

estimate of the mode is,

75% sericite/(?) plagioclase

25% quartz

The sericite has completely pseudomorphed the original plagioclase but relic multiple twinning can still be seen. Quartz occurs as ragged, undulose grains with cuspate boundaries.

P2373/75 : TS 35051

Granite gneiss

Location : 2.7 km S of Plug Range

Hd. Miltalie, Sec. $3A^E$

Hand Specimen : Medium grained, mottled pale pink and cream, granite gneiss. Well foliated with a layering defined by biotite and quartzo feldspathic segregation, and a layer parallel biotite schistosity. This foliation is folded relatively tightly and there is a second, fairly strong axial planar biotite schistosity.

Thin Section : Granoblastic interlobate textures and equigranular with equant shaped grains. Biotites oriented as noted above - the second schistosity truncating the first. A visual estimate of the mode is,

35% orthoclase

30% plagioclase

25% quartz

10% biotite

minor garnet, zircon, apatite and opaque mineral.

Similar to P2325/75

P2374/75 : TS 35052

Granite gneiss

Location : 1.6 km SSW of Plug Range

Hd. Miltalie, Sec. 8A.

Hand Specimen : Medium grained, mottled pink granite gneiss. Well foliated but with two orientations - one layer parallel the other axial planar to tight folds. Both of equal intensity.

Thin Section : Granoblastic interlobate and essentially equigranular with a few scattered coarse microclines. A visual estimate of the mode is,

60% microcline perthite

20% quartz

12% biotite

8% plagioclase

minor opaque mineral, zircon and apatite

Microcline occurs as clear grains of irregular shape with curved boundaries, inclusions of quartz, plagioclase and biotite, and myrmekitic intergrowths; quartz occurs as irregular, deformation banded grains, plagioclase as incipiently sericitized grains, and biotite as red-brown subidioblastic plates.

It is similar to P2325/75 and other granite gneisses in the area.

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APPENDIX A

"P" Number	"RS" Number
P2315/75	6230RS00048
6	49
7	50
8	51
9	52
2320	53
1	54
2	55
3	56
4	57
5	58
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7	60
8	61
9	62
2330	63
1	64
2	65
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4	67
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6	79
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8	81
9	82
..2350	83
1	84
P 2352	85
3	86
4	87
5	88
6	89
7	90
8	91
9	92
2360	93
1	94
2	95
3	96
4	97
5	98
6	99
7	100
8	101
9	102
2370	103
1	104
2	105
3	106