MINERALOGICAL REPORT No. 8527

by Alan C. Purvis, PhD & Ian R. Pontifex, MSc.

TO : Minerals Exploration Level 3, 40 McDougall Street MILTON QLD 4064

YOUR REFERENCE : Your letter dated 18/6/04 RC chips from Arunta Drilling

Various depth holes: AYRC04001, 02, 03, 04, 06, 07, 09 Thin and polished thin section preparation,

MATERIAL : RC chips

WORK REQUESTED : Thin and polished thin section preparation, description and report with comments as indicated in the covering letter.

SUMMARY COMMENTS

Twenty-one samples of drill chips mounted in epoxy and made into 9 thin and 12 polished thin sections as appropriate are described in this report. These samples are from eight drillholes in the Arunta Inlier in the Northern Territory, seven of which target EM anomalies on the Mt Rennie 1:250,000 map sheet area which are associated with the igneous Andrew Young Complex and Dufaur Mafic Suite.

The seven drillholes on Mt Rennie are AYRC04001-9 (excepting 5 and 8) and the chip samples from these are petrologically found to include mafic and ultramafic lithologies, as well as metasediments ranging from pelite to quartzofeldspathic and quartz-rich sandstones. Zones of metasomatised rock and of rare granitoid also occur. The mafic rocks are mostly metamorphosed to form amphibolites, but some also have minor to abundant biotite or phlogopite, and may represent Dufaur Suite mafic intrusions, (as at least some Andrew Young Complex bodies are unmetamorphosed). Phlogopite also accompanies tremolite actinolite in metapyroxenite chips. Quartz and plagioclase dominate the meta-sandstones, with biotite, muscovite and chlorite variously developed, but these micas are more abundant in pelitic schists. In AYRC04007 samples between 82 and 90m indicate shearing and post-tectonic introduction of tourmaline and sulphide mostly within metasediments. Mafic to ultramafic rocks occur deeper in this hole 4007. Heterogeneous quartz-garnet-hornblende-biotite-chlorite schist in drillhole AYRC04006 (136m) may represent an annealed metasomatic zone.

Reflected light microscopy of the polished thin sections indicates mostly minor, but locally abundant pyrrhotite, rarer finer chalcopyrite, also scattered ilmenite, especially in the amphibolites. Also there is possibly low-temperature or supergene pyrite in both samples from AYRC04006. Sparse minute exsolution pentlandite flames in pyrrhotite in AYRC04009 at 198m, in a metamorphosed quartz-bearing gabbro, suggest that these sulphides are of primary magmatic origin. Sulphides in other samples seem to be metamorphic and/or epigenetic.

The petrographic identification of rock types and/or statement of essential mineralogy compositions, together with interpreted protoliths, are listed in Table 1 below. The (opaque) sulphides and oxides and their estimated abundances, as seen in the selected polished thin

sections, and under binocular microscope in other samples, are also listed. These may have some bearing on the target EM and magnetic anomalies being tested.

The characteristics of the samples are listed below in Table 1.

	Drillhole and depth		Rock type or mineralogy	Protolith	Sulphides %	Oxides %
TS	AYRC04001	144	Amphibolite	Gabbro/dolerite	po>cp tr	il 3-4
PTS		165	Amphibolite (most chips)	Gabbro/dolerite	po>cp 1	il 2
			Quartzofeldspathic (one chip)	Granitoid	po-rich 5	--
PTS		169	Quartzofeldspathic	Sandstone	po>cp 3	--
			Biotite-hornblende-rich	Mafic or sediment?	po>cp 3	il tr
			Biotite schist	Pelite	--	il tr
TS		200	Tremolite-phlogopite	Pyroxenite	po tr	il 1-2
TS	AYRC04002	182	Quartzofeldspathic ± biotite	Sandstone	po 1	?il tr
			Quartz-rich ± biotite	Sandstone	--	--
PTS	AYRC04003	134	Quartz, biotite, muscovite, sulphide	Sediments	po>>>cp 5	--
			Brecciated quartz + sulphide		-po>>>cp 25	--
TS	AYRC04004	122	Phlogopite amphibolite	Magnesian gabbro	--	?il <1
PTS	AYRC04006	34	Amphibolite	Quartz dolerite	py>>>cp 4	il tr
PTS		136	Quartz, garnet, hornblende, biotite	Shear zone	po, py 5	
			Chlorite, epidote, sulphides		mc, cp 3	----

PTS	AYRC04007	82	Phyllonitic schists + tourmaline, sulphides	Sheared metasediment	po>>cp 8	il 1
TS		86	Quartz-plagioclase-biotite-chlorite + tourmaline, sulphides	Sheared metasediment	po>>cp 1	il 1
PTS		88	Quartzofeldspathic, biotite		po>cp 2	--
			Quartz-plagioclase-biotite-chlorite, sulphides, abundant tourmaline,		py, po>>cp 5	il 1
PTS		98	Tremolite-phlogopite	Pyroxenite	po>py 2	--
			Amphibolite	Dolerite	po>cp 3	il 1
			Quartzofeldspathic	Intermediate/felsic	po <1	il tr
PTS		122	Quartz-plagioclase-biotite-chlorite	Metasediment	po>py>>cp 1	il tr
			Amphibolite	Mafic	po>py>>cp 1	il 1
TS	AYRC04009	42	Quartz-biotite (1 chip)	Sandstone	--	--
			Tremolite-phlogopite (7 chips)	Pyroxenite	--	? <1
PTS		198	Amphibolite	Gabbro with quartz	py>cp, pn 1-2	il 3-5
TS		206	Quartz-rich (5 chips)	Sandstone	--	--
			Quartzofeldspathic (5 chips)	Sandstone	--	--
			Quartz-biotite (1 chip)	Pelite	po>cp 1-2	--
			Hornblende-quartz (1 chip)	Mafic or sediment?	po tr	il tr

Table 1: Samples Described in Report No 8527

Notes:

1. Sample AYR04006, 136 to 138 was received (and described), but not included in your covering notes
1. 2. The section types listed are thin section (TS), polished thin section (PTS)
2. 3. The (opaque) sulphide and oxide grains are precisely identified in the polished thin section. Identifications of opaque in the normal thin sections are reasonably confident by binocular microscopy, but if critical, require check in (new) polished sections
4. The % abundances listed are visual estimates more or less as a % of each whole section. Tr = trace = <<1%
1. 5. Abbreviations of opaque minerals are pyrrhotite (po), pyrite (py), chalcopyrite (cp), pentlandite (pn), marcasite (mc), ilmenite (il), magnetite (mg).

INDIVIDUAL DESCRIPTIONS

AYRC04001, 144-145m Mafic amphibolite, interpreted as metamorphosed mafic gabbro or dolerite, with amphibole (hornblende or actinolite) > plagioclase, accessory opaque oxide, (probably recrystallised ilmenite), biotite and quartz.
Trace sulphide and apatite.

Field Note: *Pyroxenite*

The chips in this sample are relatively homogeneous and have about 60% amphibole, 35% plagioclase, 3-4% opaque oxide, <1% biotite and <1% quartz. The amphibole is largely granular and has formed from pre-existing granular, prismatic and subophitic pyroxene from 0.4mm to 4mm in grainsize. Plagioclase is not abundant but occurs as irregularly zoned grains to 1mm long and partly as a recrystallised micromosaic. In one chip, most of the plagioclase occurs as a micromosaic with abundant fine-grained, partly schistose amphibole.

Aggregates of opaque oxide, possibly recrystallised ilmenite, occur to 1mm in diameter and there are rare quartz grains to 1mm in diameter. The identification of the same oxide in polished thin section at 165m as ilmenite indicates this oxide also to be ilmenite. Trace much smaller grains of sulphide are seen under binocular microscope as apparent pyrrhotite > chalcopyrite. Small patches of decussate fine-grained biotite accompany the opaque oxide in some areas. Rare apatite was noted.

This sample represents mafic gabbro or dolerite with possibly some accumulated clinopyroxene but a high content of trapped magma which would suggest an

orthocumulate.

There is too much plagioclase for a pyroxenite as questioned in the field notes.

AYRC04001, 165-166m Mafic amphibolite, derived from dolerite or gabbro, with accessory ilmenite and rare fine sulphide. One quartzofeldspathic chip with more abundant sulphide (5%) which is pyrrhotite, within vein quartz in this chip.

Field Note: *Pyroxenite with traces of pyrrhotite-pyrite vein*

Almost all of the chips in this sample are predominantly mafic with abundant inequigranular hornblende as grains, prisms and bundles of prisms to 3mm long. Larger prisms and parallel bundles of prisms seem to have replaced large single pyroxene grains. The various chips also contain between 5 and 35% plagioclase, rarely more than 1mm in diameter and mostly as a micromosaic of grains about 0.2mm in diameter, with as much as 2 or 3% quartz in several chips. Accessory fine ilmenite (2%) is disseminated as small, recrystallised aggregates, with minor decussate biotite in some chips, but sulphide is rare. Most of the trace disseminated sulphide in these mafic chips is pyrrhotite, with rarer chalcopyrite. These mafic chips represent mafic metadolerite or metagabbro.

There is a single chip dominated by plagioclase and quartz, with rare quartz grains to 2.5mm in grainsize probably representing a vein, as well as areas of quartzofeldspathic micromosaic.

This chip has more abundant sulphide (5-7%) than the more mafic chips, and this is all

pyrrhotite and located in the small area of vein quartz. This chip is possibly a recrystallised

quartz microdiorite or tonalite, but is too small to allow a representative mineralogy to be

estimated.

AYRC04001, 169-170m Variously quartzofeldspathic and biotite ± hornblende-rich schists, apparently metasediment ± metamorphosed mafic lithologies. One chip dominated by muscovite rather than hornblende. Minor pyrrhotite > chalcopyrite in several chips, variably scattered and in veinlets parallel to the foliation. Total sulphide content is approximately 5% of the whole section.

Field Note: *Biotite schist with rare pyrite-pyrrhotite-chalcopyrite veinlets and segregations.*

The chips in this thin section are partly quartzofeldspathic but also contain minor to abundant

mafic silicates, mostly biotite and/or hornblende. Minor fine sulphides are scattered and

occur in veinlets parallel to the foliation. One chip shows a contact between a

quartzofeldspathic zone and a more mafic, schistose lithology with the contact parallel to the

foliation.

One of the coarser quartzofeldspathic chips is quartz-rich and has quartz from 0.2mm to 3mm

in grainsize with irregular areas of plagioclase-rich micromosaic. Small lenses of schistose

biotite also occur in this chip, with less abundant disseminated green hornblende. Another

chip has plagioclase to 2mm in grainsize with areas of quartzofeldspathic micromosaic,

patches rich in biotite, minor hornblende and scattered pyrrhotite and minor chalcopyrite. A

third chip has parallel lenses of quartz and disseminated plagioclase to 0.5mm in diameter as

well as a quartzofeldspathic micromosaic. Minor schistose muscovite occurs in this chip, as

well as biotite. The quartzofeldspathic layer in contact with the more mafic lithology has

quartz and plagioclase to 0.8mm in grainsize as well as minor biotite and hornblende. These

chips seem to represent metamorphosed impure sandstones.

There are 5 or 6 chips that are dominated by a very fine-grained plagioclase-rich micromosaic

but also contain about 10% biotite as small, strongly schistose flakes. These commonly

contain minor sulphide, again mostly pyrrhotite with lesser chalcopyrite, disseminated in

lenses to 1.5mm long, or in veins parallel to the schistosity. The host rock seems to represent

metasiltstones. Another 6 chips have between 2 or 3% micromosaic and as much as 35%

micromosaic (quartz and/or plagioclase) as well as abundant mostly schistose hornblende and

biotite in various proportions. These chips are mostly fine-grained, but there is one chip with

coarse schistose biotite and hornblende that also contains large lenses of pyrrhotite rimmed

by chalcopyrite, to 4 x 2mm. Fine-grained ilmenite occurs in some of the amphibole-rich

chips. These chips have little or no sulphide and may represent altered metasediment or

potassium-enriched mafic lithologies. A single large chip is mostly schistose biotite, with

flakes about 0.5mm in grainsize defining a folded schistosity. This chip also contains

quartzofeldspathic lenses and a small lens of hornblende.

AYRC04001, 200-202m Metamorphosed fine-grained feldspathic pyroxenite

with

accessory fine opaque oxide and biotite. Rare trace much

finer sulphide.

Field Note: *Biotite schist*

The chips in this thin section are somewhat heterogeneous but are dominated by inequigranular amphibole (80-85%), actinolite or hornblende, with 10-20% plagioclase in various chips. Larger grains of amphibole, to 1mm long, may represent altered residual pyroxene grains but most of the amphibole is fine-grained and recrystallised. Most of the plagioclase is recrystallised and defines a micromosaic, with rare larger grains to 0.8mm in diameter. Several chips have minor (3-5%) biotite as decussate small flakes, and others have 1-2% opaque oxide, probably recrystallised ilmenite. Fine schiller-like aggregates of opaque oxide occur in some amphibole grains, and were apparently inherited from former pyroxene.

Rare chlorite occurs in several chips, mostly as unoriented flakes to 0.5mm in diameter. One chip has a trace of sulphide.

These chips seem to represent metamorphosed possibly fine-grained pyroxenite with some plagioclase and accessory opaque oxide, but biotite is very minor and occurs in only a few chips.

AYRC04002, 182-184m Chips of co-dominant fine quartzo-feldspathic and quartz-

rich schists, variably with biotite > muscovite >

tourmaline, apatite, rare zircon. Accessory very

fine

pyrrhotite and opaque oxide in a few chips. Interpreted as

metamorphosed impure fine sandstones.

Field Note: *Biotite schist*

The numerous small chips in this thin section are fine grained inequigranular and heterogeneous. Most contain an abundant micromosaic with plagioclase usually more abundant than quartz, but many chips have minor to abundant mica, with biotite and/or muscovite in various proportions. As much as 15-20% biotite > muscovite occurs in some chips, with flakes to 1mm in the most schistose chips, but mostly less than 0.25mm in size.

One of the more micaceous chips has abundant partly schistose biotite but a micromosaic dominated by quartz, with little or no plagioclase. This chip also has small lenses of partly altered very fine pyrrhotite, and rarer pyrrhotite occurs in one or two other chips. Several chips have single-crystal quartz grains and aggregates from 0.25mm to 2mm long, possibly representing former detrital grains varying from medium to very coarse sand. Larger plagioclase grains are rare, however, suggesting that most of the plagioclase has been recrystallised. Accessories include apatite, opaque oxide, zoned green to brown tourmaline and rare possible zircon. Weak clay alteration is seen in the plagioclase and there are areas with chloritised biotite. One chip has a crosscutting vein with adularia and magnesian chlorite.

This sample seems to represent metamorphosed impure sandstones.

AYRC04003, 134-136 Variously quartz, biotite, muscovite and pyrrhotite-rich

metasediments and deformed and brecciated quartz-rich

to pyrrhotite-rich possible veins. Trace chalcopyrite

accompanied pyrrhotite.

Field Note: *Micaceous quartz arenite*

The various chips in this thin section have different proportions of three main components:
quartz, muscovite and sulphide. Two types of quartz occur: vein quartz, partly in sulphide-
cemented breccias, and recrystallised detrital quartz. The detrital quartz varies from 0.1mm
(very fine sand) to 0.8mm (coarse sand) in different chips, usually with minor to common
schistose mica (muscovite and/or biotite). Minor tourmaline is widespread, but may be partly
of authigenic or metamorphic origin. Lenses of sulphide occur in some of these chips, mostly
parallel to the schistosity. Some of the more muscovite-rich chips have a crenulated
schistosity, but most have a planar schistosity, with some disruption where there are irregular
lenses of sulphide. Again, most of the sulphide is pyrrhotite with very minor chalcopyrite.
One chip has sulphide parallel to a crenulation cleavage in quartz-rich quartz-muscovite
schist.

Even more micaceous chips, mostly rich in muscovite, seem to represent siltstones and
shales, and have well-developed spaced crenulation cleavages. Minor biotite, possibly
passing into phlogopite, occurs in these chips. The most micaceous chip has abundant
crenulated and kinked muscovite, but also has layers that contain or consist of quartz, locally
with filaments of sulphide, and layers of deformed probable phlogopite flakes. This may
represent a former pelite but may have suffered potassic alteration.
The quartz-rich to sulphide-rich chips contain minor to abundant quartz as highly

deformed
grains, to 3mm long where they are abundant, as well as veins and interstitial masses of
sulphide, essentially all pyrrhotite, but with very minor chalcopyrite in one chip, and seem to
represent deformed quartz-sulphide veins.

AYRC04004, 122-124m Foliated phlogopite amphibolite, with subordinate sericitised plagioclase and trace fine opaque oxide. Metamorphosed magnesian gabbro or dolerite with potassic alteration.

Field Note: *Micaceous quartz arenite*

These chips are not seen petrographically to contain arenite, but are composed of schistose
magnesian biotite or phlogopite amphibolite. Lenses and lamellae of schistose phlogopite
commonly form about 20% of the chips intricately intergrown with more abundant fine
granular to prismatic amphibole (50-55%). This amphibole is colourless or very pale
brownish, suggesting tremolite-actinolite or magnesiohornblende. It varies from
microcrystalline to about 1.5mm in grainsize. Lesser (25-35%) plagioclase is also scattered,
partly microcrystalline, partly with sericitised euhedral cores to 1.3mm long and fresh rims,
partly poikilitic and enclosing amphibole ± biotite. Traces of opaque oxide are present.

This sample seems to represent a magnesian, mafic gabbro or dolerite that has been
metamorphosed and altered, with potassium enrichment indicated by the abundance of
biotite/phlogopite. Anastomosing clay-filled fractures are present and there is rare epidote in
plagioclase.

AYRC04006, 34-35m Massive amphibolite representing metamorphosed quartz-bearing dolerite. Minor scattered fine with titanite, ilmenite and pyrite, rare-trace chalcopyrite. [Probably metamorphosed Dufaur Suite mafics as suggested in the fieldnote.]

Field Note: *Pyritic metadolerite of the Dufaur Mafic Suite*

This sample consists of homogeneous amphibolite chips similar to meta-mafic lithologies in AYRC001 and 004, suggesting that those may also represent Dufaur Suite mafic intrusions.

Abundant randomly interlocking green hornblende (~55%) occurs as prisms and parallel or garbenschiefer bundles to 3mm long, apparently replacing former pyroxene. Plagioclase (~35%) > quartz and granophyre are scattered interstitially. Sparse elongate plagioclase laths occur, to 1mm long, as well as fine-grained recrystallised plagioclase and lenses of recrystallised quartz (~3%). Sparse quartzofeldspathic areas (2%) seem to represent recrystallised granophyre, and usually contain needles of apatite as well as hornblende prisms. Oxide grains (2%) have been recrystallised as to form disseminated fine ilmenite, some altered to microcrystalline titanite. Accessory sulphides (total 3-4%) are disseminated, mostly pyrite but with rare trace finer chalcopyrite.

AYR04006, 136-138m Chips composed of various combinations of fine granular

quartz, garnet, (schistose) hornblende, biotite, chlorite, epidote. Disseminated fine pyrrhotite > pyrite, rare marcasite and chalcopyrite. Probably from and annealed alteration or shear zone.

Field Note: *[None, supplementary sample: not listed.]*

About half of the chips in this sample have various proportions of quartz, garnet and amphibole, commonly with minor calcic plagioclase, epidote or chlorite. Minor sulphide is disseminated in several chips. One chip is pure quartz as a micromosaic and may represent former chert, sandstone or vein quartz, but another chip is quartz-free, with garnet to 1mm in diameter in schistose dark green hornblende with sulphides and small radioactive grains.
Minor irregularly disseminated fine sulphides, overall 3 to 5% consist of pyrrhotite > pyrite.

The other chips have minor to abundant quartz as a micromosaic, usually with minor plagioclase or epidote. One contains apparently relatively calcic garnet in a quartz-rich host containing minor epidote, but most of the garnet is less calcic. The plagioclase has a high refractive index and seems to be quite calcic. Rosettes of hornblende (± chlorite) are abundant and locally enclose large grains of garnet, but some rosettes and garnet grains are independent of each other. In these chips, minor fine sulphides occur mostly in fractures in garnet and in the amphibole ± chlorite rosettes. Areas of disseminated biotite and/or chlorite also occur in some of these chips. The chlorite is pale green and optically positive, suggesting Fe-Mg chlorite with low Al. Transitions from rosettes or massive amphibole lenses to schistose lenses of amphibole ± biotite are seen in other chips, with minor to abundant garnet as inclusion-poor to inclusion-rich grains to 2mm in diameter. Fine sulphides again occur mostly in fractures in garnet or in amphibole-rich areas, and are

mostly
pyrrhotite with minor chalcopyrite.

One chip has a carbonate-clay vein cutting a tourmaline-rich area, with pyrite adjacent to the
vein.

These lithologies are mostly similar to those seen in annealed metasomatic zones, originally
containing quartz-chlorite-sericite-carbonate assemblages.

AYRC04007, 82-84m Phyllonitic or mylonitic schists with quartz, plagioclase, biotite/phlogopite, muscovite/sericite, chlorite, tourmaline. Fine to coarser pyrrhotite and lesser fine chalcopyrite in various proportions, total about 8%, rare titaniferous magnetite or ilmenite. Probably represents high strain zones in metasediments, with alteration and sulphide formation.

Field Note: *Semi-massive pyrite-pyrrhotite in silicified metasediment*

The chips in this thin section have phyllonitic or mylonitic fabrics but also contain some
massive lenses and layers, mostly rich in quartz ± tourmaline. The phyllonitic areas have
sparse to abundant apparently residual grains of quartz and apparently sodic plagioclase to
1mm in diameter as well as abundant microcrystalline material (quartz ± plagioclase?) and
fine schistose mica (biotite/phlogopite and/or muscovite/sericite). Planar or contorted
schistosities are evident and many chips are heterogeneous with planar or irregular

quartz-
rich, quartzofeldspathic and micaceous domains. Some chips have lamellae rich in
microcrystalline quartz and sericite, with irregularly distributed sulphides. One chip has
lenses and lamellae of schistose chlorite as well as quartz, biotite and sulphide. Another chip
seems to have been cut parallel to the schistosity and has irregular sericite-sulphide and
quartz-rich domains, with minor apatite mostly in quartz-rich areas.

Some of the coarser sulphide occur together with tourmaline in quartz-rich or micaceous or
chloritic areas, including domains with patches of massive quartz-rich micromosaic or
lamellae of micaceous material as well as granular to prismatic tourmaline. The tourmaline is
mostly orange-brown or greenish brown and either inclusion-rich and granular or inclusion
free and prismatic. The tourmaline and quartz-rich areas seem to have developed after
deformation, partly within earlier sulphides and partly with possibly coeval sulphides. Other
irregular lenses, clusters and short veinlets of sulphide may have been remobilised during
deformation.

Pyrrhotite is by far the most abundant sulphide in this thin section total about 8%, with rare
finer chalcopyrite also accessory ilmenite showing incipient alteration to leucoxene.

AYRC04007, 86-88m Metasediments with various proportions of fine quartz, plagioclase, biotite and chlorite, tourmaline and pyrrhotite ± chalcopyrite?. Minor zircon suggests protoliths of siltstone, shale and fine to medium-grained sandstone, with rare opaque oxide and apatite.

Field Note: *Silicified metapsammite with pyrite-pyrrhotite veins and disseminations*

The chips in this thin section are heterogeneous and inequigranular but overall indicating a variety of meta-sediments. Some ten chips are poor in micaceous minerals (3-7%) and vary from quartz-rich to feldspathic, with more abundant micaceous minerals (7-20%) in the other six chips. Most of the chips are very fine-grained with grains less than 0.2mm in length, and have a schistosity defined by biotite and/or chlorite. It seems likely that the chlorite is later than biotite, commonly crosscutting the biotite and in parts poorly oriented, but there is no evidence of chlorite replacing biotite. Two of the chips have chlorite-rich microshears oblique to the biotite schistosity. Several chips have lenses or layers that contain or consist of plagioclase grains 0.4mm or more in diameter, and others have abundant quartz from 0.2mm to 0.5mm in grainsize, with grains and lenses elongate parallel to the schistosity.

Several chips have bands and lenses rich in variously greenish or brownish tourmaline, with sparse disseminated very fine pyrrhotite ± chalcopyrite mostly in tourmaline-rich areas.

Other chips have sparse small blocky masses of limonite, possibly derived from pyrite. Fine grains of oxide and apatite occur as accessories, as well as zircon from 20 to 70µm in diameter, suggesting former fine to medium-grained sandstone. Some of the chips have only microcrystalline radioactive grains, however, suggesting siltstone or shale.

There is no evidence for silicification in this thin section (as questioned in the field notes).

AYRC04007, 88-90m Modified feldspathic and quartz-feldspar-biotite-chlorite-rich schistose metasediments with minor to locally abundant tourmaline, pyrrhotite > pyrite ± marcasite locally in veins. Also chips with plagioclase and amphibole

± chlorite, > pyrrhotite ± tourmaline. Trace extremely fine

chalcopyrite.

Field Note: *Silicified metapsammite with pyrite-pyrrhotite veins and disseminations*

There are several chips of modified metasediment in this thin section, apparently quartzofeldspathic but no clear evidence of silicification as questioned in your field notes.

One chip is mostly granular plagioclase about 0.5mm in grainsize with very minor chlorite, biotite carbonate and opaque oxide. Other chips have similarly large plagioclase and quartz grains, disseminated or in lenses, in a microcrystalline possibly quartz-rich or quartzofeldspathic matrix with microcrystalline biotite. Possibly later lamellae of schistose chlorite occur in some chips of this type, and others show minor to extensive granular to prismatic tourmaline, mostly greenish to orange-brown in colour, with or without iron sulphides. The tourmaline is mostly undeformed, but one chip is almost entirely composed of prismatic tourmaline to 4mm in grainsize, including bent and fractured prisms. Chlorite, apatite and sulphides also occur in this chip, with a small area of quartz-rich micromosaic. .

Pyrrhotite is the most widespread sulphide but passes into porous and granular probably low-temperature pyrite, with very minor marcasite in some areas, particularly along margins of one or two veins. Trace much finer chalcopyrite are present.

Other chips consist of plagioclase and/or amphibole (tremolite-actinolite or hornblende?) as well as minor to abundant tourmaline, and these may have igneous protoliths. One of these chips has large plagioclase grains, to 4mm long, fractured and veined by chlorite. On one side of the chip is a layer of schistose pale amphibole with lenses of decussate chlorite. On the other side is an aggregate of granular to prismatic tourmaline, to 2mm in grainsize,

including fractured grains veined by chlorite and quartz. Another lens of tourmaline occurs
locally between plagioclase and schistose amphibole. A second chip has plagioclase with
sericitised euhedral cores and clear anhedral overgrowths as well as irregular areas of
schistose amphibole and less strongly foliated chlorite. Minor fine pyrrhotite > pyrite are
scattered through these chips.

AYRC4007, 98-100m Amphibole-phlogopite chips (metapyroxenite), mafic amphibolites (metadolerite), also fine feldspathic or quartzofeldspathic chips, possibly intermediate or felsic protoliths. Rare coarse pyrite, accessory very fine disseminated pyrrhotite, trace finer ilmenite and chalcopyrite.

Field Note: *Metadolerite (Dufaur Mafic Suite) with moderate veins and disseminations of pyrite-pyrrhotite*

Three of the chips in this thin section are ultramafic composed of fine prismatic tremolite to
2mm in size as well as interstitial phlogopite ± tremolite as mostly smaller grains. Some of
the amphibole has green zones and seems to represent fragmented grains that may have been
as much as 4mm in diameter. There are also apparently shredded phlogopite flakes to 2mm
long. A large grain of pyrite (3mm) occurs in one of these chips. The protolith to these chips
seems to have been pyroxenite.

More abundant mafic chips are dominated by interlocking green amphibole prisms to 1.5mm

in size, within a fine-grained matrix of amphibole, plagioclase, biotite and opaque oxide. The

larger amphibole grains are greenish brown throughout or have brown cores and pale green

rims. Some larger plagioclase grains occur, but most of the feldspar and amphibole have

been recrystallised and are very fine-grained. One chip seems to be transitional from

ultramafic to mafic and is largely composed of zoned actinolite-hornblende with rare pale

brown zones. Interstitial plagioclase is present, to 2mm in grainsize and is partly altered to

sericite. These chips contain sparse very fine pyrrhotite > ilmenite > chalcopyrite and may

represent metabasalt or metadolerite as well as a more pyroxene-rich lithology.

There are also several plagioclase-rich chips with an apparently plagioclase-rich micromosaic

as well as mostly minor fine-grained hornblende and/or biotite. One of these chips has

amphibole possibly replacing mafic phenocrysts and another has slightly coarser, apparently

quartzofeldspathic lenses as well as disseminated biotite. These also have sparse very fine

scattered pyrrhotite > chalcopyrite, and seem to represent felsic or intermediate igneous

lithologies, originally fine-grained and possibly from dykes.

AYRC04007, 122-124m Co-dominant chips of quartz-plagioclase-biotite-chlorite metamorphosed very fine ?tuffaceous sandstone, and metamorphosed fine-grained, partly porphyritic (or coarser) mafic lithologies. Accessory very fine disseminated pyrrhotite > pyrite, trace chalcopyrite. One chip consists of vein quartz and coarse pyrite.

Field Note: *Pyrite-pyrrhotite veinlets in silicified metapsammite*

This thin section contains co-dominant pale chips of metasediment and darker amphibole-rich mafic chips. One chip consists of quartz vein with sulphide. The metasediment chips have disseminated larger grains and aggregates of quartz and plagioclase to 1mm in grainsize in a finer micromosaic with partly schistose lenses of biotite and/or chlorite. Sparse fine ilmenite and sulphides are disseminated, with pyrrhotite to 0.5mm with rarer chalcopyrite and pyrite to 0.3mm. One quartz-rich metasediment chip has a lens of pyrrhotite 2mm long and 1mm wide, with coarse pyrite and trace chalcopyrite in another chip. One of these chips has a narrow quartz vein oblique to the schistosity. Related to these chips is a microcrystalline phyllonitic chip with a possibly quartzofeldspathic micromosaic and intersecting lamellae of microcrystalline biotite in two orientations at low angles to each other.

The darker (green) mafic chips are fine-grained with sparse plagioclase phenocrysts altered to sericite, in a fine-grained schistose amphibolite with minor biotite. Related to this lithology are chips with abundant schistose biotite and minor chlorite as well as microcrystalline plagioclase ± quartz. There is sparse disseminated sulphides, mostly pyrrhotite and rare chalcopyrite. Rare chips have granular to prismatic hornblende to 1mm long as well as inequigranular plagioclase, partly as laths to 1.5mm long, partly recrystallised and microcrystalline with trace fine sulphide.

A single chip is composed of subequal amounts of mostly fine-grained vein quartz and a grain of pyrite to 3mm. Trace chalcopyrite is partly attached to the pyrite and partly disseminated through the quartz.

AYRC04009, 42-44m 1. One chip of biotite-bearing quartzite (metasandstone)

2. Seven chips of tremolite-actinolite to phlogopite-rich

metamorphosed ultramafic rock (pyroxenite or peridotite) with chlorite, talc and trace indeterminate

extremely fine opaque oxide.

Field Note: *Muscovite schist*

One of the chips in this thin section is quartz-rich with sparse coarse-grained quartz to 1mm in quartzofeldspathic micromosaic, with 5% biotite from 0.05mm to 0.5mm in grainsize. The other chips are dominated by tremolite-actinolite (30-50%) with various proportions of phlogopite (15-65%) and chlorite (0-15%), as well as talc (0-10%) and possible cummingtonite (<3%). Several chips have phlogopite more abundant than amphibole, with grains mostly less than 1mm long, but others are richer in amphibole, commonly with lenses of poorly oriented chlorite flakes as well as mostly granular amphibole. Trace extremely fine indeterminate oxide is disseminated. The quartz-rich chip seems to represent metamorphosed quartz sandstone, but the other chips are of ultramafic origin, possibly derived from pyroxenite or peridotite, with potassic alteration. There is no muscovite in any of these chips, however. The sulphide is mostly pyrite, possibly derived from pyrrhotite, with rare chalcopyrite.

AYRC04009, 198-199 Massive amphibolite derived from quartz-bearing gabbro.

Sparse extremely fine pyrrhotite > chalcopyrite > rare-

trace minute pentlandite inclusions in pyrrhotite.

Field Note: *Pyroxenite with trace of pyrrhotite-pyrite-chalcopyrite: veins?*

Mostly about 60% of these chips consist of randomly interlocking prisms of subordinate

amounts of plagioclase > quartz are interstitial and there is accessory scattered very fine,

ilmenite, titanite and apatite. Sparse disseminated very fine sulphide may be of primary

magmatic origin.

The hornblende seems to have replaced granular to prismatic pyroxene to 3mm or more in

crystal size. There are also random laths of plagioclase and these seem to consist of two

phases, possibly small blocks of andesine enclosed in bytownite. [Two-phase plagioclase of

this type indicates a miscibility gap that is stable at 500-650°C.] Plagioclase also occurs as a

recrystallised micromosaic together with quartz. Accessory scattered opaque oxide has been

partly recrystallised to ilmenite and partly to completely replaced by titanite at a later stage.

There are small lenses of quartz micromosaic and prisms of apatite, partly more than 1mm

long. The sparse fine sulphides include pyrrhotite with trace minute enclosed flames of

pentlandite ± chalcopyrite and separate grains of chalcopyrite. These associations suggest an

inherited primary magmatic origin.

This sample represents metagabbro with minor quartz opaque oxides and rare sulphide.

AYRC04009, 206-208m 1. Eleven chips of quartz-rich to quartzofeldspathic metasandstone with biotite, muscovite.

2. One chip of fine biotite-rich schist with quartz and trace sulphide: pelitic schist.

1. **3. One chip of hornblende-biotite-quartz schist with sparse opaque oxide: metamorphosed altered pelite or mafic lithology?**

Field Note: *Biotite schist with rare to trace pyrite-pyrrhotite ± chalcopyrite veinlets and disseminations*

This sample has eleven pale chips composed of small grains in finer micromosaic of quartz to quartzofeldspathic composition. There is also one chip of fine biotite schist and one of hornblende-quartz schist. The pale metasandstone chips have single-crystal quartz and plagioclase grains, locally over 1mm in diameter (very coarse-grained sandstone) in a fine-grained schistose matrix with as much as 5% schistose biotite as well as quartz ± plagioclase. Trace to 2 or 3% muscovite is also disseminated and is mostly parallel to the schistosity defined by the biotite. Apatite is a common accessory, as well as trace extremely fine opaque oxide and sulphide.

The biotite schist has 5% disseminated quartz as well as 1-2% sulphide, probably pyrrhotite. Some of the biotite defines a folded schistosity, with less abundant biotite axial plane to the folds. This is apparently of pelitic origin.

The hornblende-rich schist has about 15-20% microcrystalline quartz and 10% schistose fine-grained biotite as well as schistose fine-grained hornblende. This chip has about 1% extremely fine probable ilmenite, but lacks plagioclase, allowing a metasomatic zone in a metapelite as well as an altered mafic protolith as potential protoliths.