APPENDIX 5

PETROGRAPHY

By
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White Gums Prospect

Petrographic Descriptions of polished thin sections

09WGD01/392.63 m. polished thin section

Two lithologies with sharp mutual contact.

A. MUSCOVITE-FELDSPAR-QUARTZ SCHIST

Mineralogy	mode %
Muscovite	40
Feldspar	30
Quartz	25
Biotite	3
Titanite	1
Epidote	0.5
Pyrrhotite	0.5
Chalcopyrite	mtr
Ilmenite	mtr

Strongly aligned tubular muscovite grains define a very strong foliation with small granular to slightly elongate feldspar and quartz grains between mica-rich folia. The feldspar is untwinned and is difficult to identify optically. It is probably mostly composed of K-feldspar. Minor biotite forms isolated stubby to elongate grains with only some orientated parallel to the foliation. Wispy trails of titanate parallel the foliation. Very fine grained ilmenite is scattered throughout the rock.

The rock is cut by numerous narrow kink bands composed of muscovite, feldspar and quartz (i.e. they are not associated with retrograde alteration).

Numerous veins cut the rock but are concentrated around the contact between the two different lithologies. The veins are composed of epidote, quartz, pyrrhotite and chalcopyrite and are clearly retrograde cutting across the foliation and muscovite-feldspar-quartz metamorphic assemblage.

The rock fabric is entirely recrystallised and no recognisable trace of any protolith microtexture is present.

B. QUARTZ-MUSCOVITE-FELDSPAR SCHIST

Mineralogy	mode %
Quartz	85
Muscovite	10
Feldspar	3
Biotite	0.5
Titanite	0.5

Epidote	0.5
Pyrrhotite	0.5
Chalcopyrite	mtr

Composed mostly of rounded quartz grains with minor muscovite grains around quartz grain margins and also as inclusions within grains. Muscovite is aligned but does not form a strong penetrative fabric in the rock due to its relatively low abundance relative to quartz – only a weak foliation is present. The overall rock fabric is highly suggestive of a partly recrystallized fine-grained quartz sandstone with a small matrix component of clay material.

The rock is cut by numerous epidote-quartz-sulphide veins and veinlets that forms a very irregular network. The veins cut across the metamorphic fabric and are clearly retrograde in origin.

09WGD02/200-250 m polished thin section

FELDSPAR-MUSCOVITE-QUARTZ-BIOTITE-CORDIERITE SCHIST

Mineralogy	**mode %**
Feldspar	43
Muscovite	22
Quartz	14
Biotite	8
Altered cordierite	5
Pyrrhotite	4
Chlorite	2
Pyrite	1
Titanite	0.5
Ilmenite	0.5
Chalcopyrite	tr

Strongly aligned muscovite and minor biotite define a very strong foliation with small granular to slightly elongate feldspar and minor quartz grains between mica-rich folia. The feldspar is untwinned and is difficult to distinguish optically from quartz. Minor poikiloblastic cordierite is present in "eyes" wrapped by the foliation. It is totally altered to fine-grained white mica and chlorite. Wispy trails of titanate parallel the foliation. Very fine grained ilmenite is scattered throughout the rock.

The rock is also cut by diffuse veinlets and stringers of pyrrhotite, pyrite and chlorite. These commonly parallel the foliation although in numerous places also cut across the foliation. The veins are clearly retrograde cutting the earlier peak metamorphic microtexture and mineralogy.

09WGD02/268.1 m polished thin section

QUARTZ-MUSCOVITE-FELDSPAR SCHIST

Mineralogy	**mode %**
Quartz	65
Muscovite	25
Feldspar	5
Biotite	2
Titanite	0.3
Chlorite	0.7
Pyrrhotite	1.5
Pyrite	0.5
Epidote	tr
Chalcopyrite	mtr

Compositionally banded rock composed mostly of rounded quartz grains with minor muscovite grains around quartz grain margins and also as inclusions within grains. Muscovite is aligned but does not form a strong penetrative fabric in the rock due to its relatively low abundance relative to quartz – only a weak foliation is present in this part of the rock.

This part of the rock is very similar to 09WGD01/392.63 m B described above and again the overall rock fabric is highly suggestive of a partly recrystallized fine-grained quartz sandstone with a small matrix component of clay material.

Thin bands (2-4 mm) of strongly foliated muscovite-feldspar-quartz schist are present as layers within the quartz-rich lithology and appear to represent original more shale-rich layers.

Cutting both quartz-rich and muscovite-rich bands at a high angle to the banding is a 1-3 mm wide retrograde vein composed of pyrrhotite, pyrite, chlorite and trace epidote. A network of fine veinlets emanates from the main vein with in places sulphide veins running along the foliation.

09WGD02/293.58 m thin section

FELDSPAR-BIOTITE-QUARTZ-CORDIERITE-GARNET SCHIST

Mineralogy	**mode %**
Feldspar	50
Biotite	21
Quartz	15
Chlorite	5
Garnet	3
Altered cordierite	3
White mica	2
Titanite	0.5
Opaque	0.5
Epidote	tr

The rock has weakly defined compositional banding most notably defined by the proportion of biotite and to some extent by cordierite. Strongly aligned biotite grains define a very strong foliation with small granular to slightly elongate feldspar and minor quartz grains between mica-rich folia. The feldspar is untwinned but has a brownish tinge allowing it to be easily differentiated from quartz. Rotated garnet grains with inclusions of aligned biotite are scattered throughout the rock. In addition poikiloblastic cordierite appears restricted to particular folded compositional layers. It is totally altered to fine-grained white mica and chlorite. Wispy trails of titanate parallel the foliation. Very fine grained opaque, probably ilmenite, is scattered throughout the rock.

The rock is cut by very numerous kink bands that are not associated with any retrograde alteration.

The rock is also cut by diffuse veins, veinlets and stringers of chlorite, quartz and minor epidote. Where these veins cut garnet it is altered to chlorite. No sulphide appears associated with the retrograde alteration.

09WGD02/295.06 m thin section

FELDSPAR-BIOTITE-MUSCOVITE-QUARTZ-CORDIERITE SCHIST

Mineralogy	**mode %**
Feldspar	40
Biotite	20
Muscovite	15
Quartz	14
Altered cordierite	8
Chlorite	2
Titanite	0.5
Opaque	0.5

The rock has moderately well defined compositional banding most notably defined by the proportion of biotite, muscovite and cordierite. It is similar to the previous sample (09WGD02/293.58 m) except that garnet is absent.

Strongly aligned biotite in some compositional bands and muscovite in other bands define a very strong foliation with small granular to slightly elongate feldspar and minor quartz grains between mica-rich folia. The feldspar is untwinned and is difficult to distinguish optically from quartz. Poikiloblastic cordierite is restricted to particular biotite-bearing compositional layers. It is totally altered to fine-grained white mica and chlorite. Wispy trails of titanate parallel the foliation. Very fine grained opaque, probably ilmenite, is scattered throughout the rock.

The rock is also cut by diffuse veinlets and stringers of chlorite. In places patches of possible feldspar are altered to chlorite presumably as part of this retrograde alteration. No sulphide appears associated with the retrograde alteration.

09WGD03/245.51 m polished thin section

MUSCOVITE-FELDSPAR-QUARTZ SCHIST

Mineralogy	**mode %**
Muscovite	40
Feldspar	30
Quartz	25
Biotite	3
Titanite	0.5
Chlorite	0.5
Ilmenite	0.5
Pyrrhotite	0.5
Chalcopyrite	mtr
Pyrite	mtr

Strongly aligned tubular muscovite grains define a very strong foliation with small granular to slightly elongate feldspar and quartz grains between mica-rich folia. The feldspar is untwinned and is difficult to identify optically. It is probably mostly composed of K-feldspar. Minor biotite forms isolated stubby to elongate grains with only some orientated parallel to the foliation. Wispy trails of titanate parallel the foliation. Very fine grained ilmenite is scattered throughout the rock.

Numerous veins cut the rock and are composed of pyrrhotite, chlorite and minute traces of chalcopyrite and pyrite. The veins are clearly retrograde cutting across the foliation and muscovite-feldspar-quartz metamorphic assemblage.

Some pyrrhotite grains and aggregates however appear to have smooth curved grain margins against muscovite, feldspar and quartz and are not associated, or at least appear not to be associated with retrograde alteration minerals (e.g. chlorite). The implication is that these sulphides are part of the peak metamorphic assemblage and have not been introduced by retrograde metamorphic fluids as appears to be the case in other thin sections. However in all other sections examined the sulphides are very clearly associated with retrograde veins. It thus maybe that the apparent peak metamorphic sulphides may be cryptically associated with the retrograde alteration.

The rock fabric is entirely recrystallised and no recognisable trace of any protolith microtexture is present.