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Chris Rees
Curragh Resources Inc.
117 Industrial Road
Whitehorse, Yukon
Y1A 2T8

October 25, 1989
Our file #8506

Dear Chris:

The results of petrographic analyses of 37 thin sections and 4 polished thin sections are in the attached report and summarized on the Table. The photomicrographs were included at no cost to you.

The report and table is on diskette (WP 5 and Lotus).

Yours very truly,

K.E. Northcote Ph.D., P. Eng.

(604) 796-2068

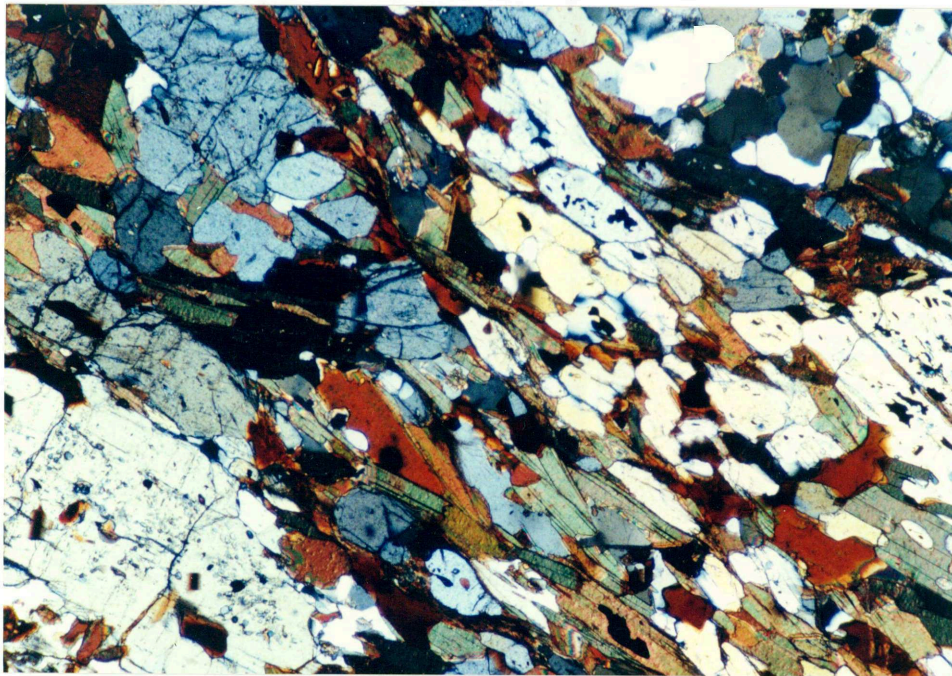
	Name	Plagioclase	K-feldspar	Quartz	Hornblende	Actinolite	Tremolite	Amphibole 2	Diopside
89-94	Pelitic schist	<<5%	<<5%	35%	-	-	-	-	-
89-318	Pelitic schist	>5%	<5%	25%	-	-	-	-	-
89-409	Pelitic schist	20%	?	15%	-	-	-	-	-
89-38	Calc-silicate	15%	20%	15%	-	-	-	-	30%
89-101	Calc-silicate	<10%	15%	15%	-	-	>15%	-	25%
89-110	Calc-silicate	20%	10%	15%	-	25%	-	-	20%
89-119	Calc-silicate	5%	20%	5%	-	-	<10%	-	15%
89-250	Calc-silicate	-	35%	?	-	-	?	-	?
89-142	Calc-silicate	-	Present	Present	-	Present	-	-	Present
89-359	Calc-silicate	10% ?	20% ?	15%	-	25%	?	Present	15%
89-282	Calc-silicate	-	?	5%	-	10%	?	-	10%
89-322	Calc-silicate	20%	<<5%	-	-	-	20%	-	35%
89-167	Pelitic schist	-	30%	20%	-	-	-	-	-
89-377	Pelitic schist	20%	<10%	15%	-	?	?	-	-
89-382	Pelitic schist	20%	20%	30%	-	-	-	-	-
89-420 A	Calc-pel-schist	15% ? Cord	-	25%	-	-	-	-	-
89-420 B	Andalusite schist	45% ? Cord	<5%	Present	-	<5%	-	?	-
89-255	Spotted schist	<15% ? Cord	-	20%	-	-	-	-	-
89-417	Pelitic schist	25%	<5%	-	-	-	-	-	-
89-132	Carb-pel-schist	-	-	40%	-	-	-	-	-
89-143	Spotted pel-schist	10%	-	20%	-	-	-	-	-
89-274	Calc-silicate	-	<5%	-	-	-	-	-	-
89-418	Pelitic schist	30%	Present	Present	-	-	-	-	-
"	Impregnation	35%	10%	35%	-	-	-	-	-
89-108	Pel-marble	-	<10%	<<5%	-	-	<5%	-	15%
89-265	Carb-marble	-	<5%	>5%	-	-	10%	-	-
89-388	Marble	<5%	<10%	?	-	10%	Present	-	25%
89-136	Skarn	?	?	-	-	-	-	-	25%
89-246	Skarn	-	<5%	<5%	-	-	-	-	30%
89-257	Skarn	-	-	<1%	-	-	-	-	25%
89-146	Alt amphibolite	-	-	-	Present	-	-	Present	-
89-271	Metadiorite	35%	-	-	Alt ?	Present 15%	-	20% Present	-
89-278 A	Hornblende schist	35%	-	<10% ?	20%	-	-	20% Present	-
89-211	Amphibole schist	40%	-	<5%	35%	-	-	?	<15% ?
89-270	Amphibolite	-	-	-	Altered	-	-	50%	-
89-395	Amphibole schist	20%	-	<10%	?	15% ?	-	15% ?	-
89-353	Amphibole schist	<10%	-	-	?	?	-	50%	-
89-178 B	Amph/pyrox schist	<5%	Traces	-	?	?	-	40%	?
89-2045	Chlorite schist	-	-	Veins	-	-	-	-	-
89-422	Protomylonite	40%	Present	15%	-	-	-	-	-

should be
178A

CURRAGH RESOURCES PETROGRAPHIC REPORT SUMMARY Oct. 28/89

Pyroxene	Biotite	Muscovite	Sericite	Chlorite	Carbonate	Epidote/clino	Andalusite	Staurolite	Cordierite	Sillimanite	Wollastonite	Garnet	Vesuvianite	Sphene	Carb Mat	Alt dusting	Tourmaline	Apatite	"A"	"B"	"C"	"D"	"X"
-	25%	15%	-	-	-	-	10%	-	-	-	-	-	-	-	-	-	-	-	Trace	-	-	-	-
-	25%	5%	-	Present	-	-	25%	-	-	-	-	-	-	-	-	-	-	-	Trace	Trace	-	-	-
-	30%	10%	Present	Present	-	-	>5%	Present	Not confirmed	-	-	-	-	-	-	-	-	-	Trace	-	-	-	-
-	5%	-	-	-	-	-	-	-	-	-	10%	-	-	Traces	-	-	-	-	-	-	-	-	-
-	<10%	-	-	-	-	-	-	-	-	-	-	-	-	-	15%	-	-	-	-	-	-	-	-
-	<5%	<5%	-	<<5%	Traces	-	-	-	-	-	-	-	-	<<1%	Present	-	-	-	-	-	-	-	-
-	<5%	-	-	<5%	<5%	5%	-	-	-	-	-	-	-	-	10%	-	-	-	-	-	15%	10%	-
-	Present	-	-	Present	-	-	-	-	-	-	-	-	-	-	Present	-	-	-	-	-	-	-	-
-	<10%	-	-	Present	-	-	-	-	-	-	-	-	-	Traces	-	-	-	-	-	-	-	-	-
-	-	-	-	-	35%	35%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	>5%	-	-	-	-	-	10%	-	10%	Traces	-	-	-	-	-	-	-	-	-
-	35%	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Trace	-	-	-
-	25%	30%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	25%	<5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Traces	-	-	-	-	-	-
-	20%	15%	Clots	Present	-	-	-	-	Not confirmed	-	-	-	-	-	-	-	-	-	-	-	-	-	Clots
Present	20%	Present	Present	10%	-	-	15%	-	Not confirmed	-	-	-	-	Traces	-	-	-	Trace	Trace	-	-	-	-
-	30%	15%	-	-	-	-	-	-	Not confirmed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	25%	10%	15%	-	-	-	20%	Trace	Not confirmed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	40%	Present	-	-	-	-	-	-	-	-	-	-	-	20%	-	-	-	-	-	-	-	-
-	15%	>30%	Present	-	-	-	-	-	20%	-	-	-	-	-	<5%	-	-	-	-	-	-	-	-
-	-	-	-	<15%	55%	<10%	-	-	-	-	-	-	-	-	-	15%	-	-	-	-	-	-	-
-	25%	Present	>15%	20%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	<5%	-	-	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	Traces	-	-	-	-	-
-	30%	-	-	-	40%	?	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	55%	-	-	-	-	-	-	-	-	-	25%	-	-	-	-	-	-	-	
-	10%	-	-	-	40%	?	-	-	-	-	-	-	-	Trace	Present	-	-	-	-	-	-	-	
-	-	-	-	<5%	25%	15%	-	-	-	-	<10%	20% Anisotr ?	-	-	-	Present	-	-	-	-	-	-	-
-	-	-	-	<5%	25%	5%	-	-	-	-	-	30% Anisotr ?	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	30%	-	-	-	-	-	-	25% Anisotr ?	10%	-	-	<10%	-	-	-	-	-	-	-
-	?	-	?	Present	Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	<10%	-	<1%	<5%	<1%	>15%	-	-	-	-	-	-	-	1%	-	-	-	-	-	-	-	-	-
-	-	-	<5%	<1%	-	-	-	-	-	-	-	-	-	1%	-	-	-	-	-	-	-	-	-
20%	-	-	<5%	-	-	15% ?	-	-	-	-	-	-	-	<1%	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5%	-	-	-	-	-	-	-	-	-
-	-	-	-	<10%	-	25	-	-	-	-	-	-	-	<5%	-	-	-	-	-	-	-	-	-
-	-	<5%	Present	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25%	15%	-	-	10%	Trace	-	-	-	-	-	-	-	-	Trace	-	-	-	-	-	-	-	-	-
-	-	-	traces	65%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	5%	-	,5%	-	-	-	-	-	-	-	-	-	-	-	5%	-	30%	-	-	-	-	-	-

"Y"	"Z"	Opagues	Veins	Cataclasis
-	-	<<1%	-	-
-	-	1%	-	-
-	-	<<1%	Present	-
-	-	<1%	-	-
-	-	-	Present	Present
-	-	-	-	-
-	-	-	Present	Protomylonite
-	-	-	Present	Protomylonite
-	-	-	Present	Present
-	-	Traces	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	Present	-
-	Traces	2%	Present	Present
-	-	2%	-	-
-	-	-	-	Present
-	-	-	-	-
-	-	-	-	-
-	-	-	Present	-
-	-	-	Present	-
-	-	-	-	-
-	-	-	-	-
-	-	3%	-	Present
-	-	-	-	-
-	-	-	-	-
-	-	Present	Present	-
-	-	>1%	-	-
-	-	1%	-	-
-	-	2%	Present	-
-	-	1%	-	-
-	-	-	-	-
-	-	5%	-	-
-	-	<5%	-	-
-	-	1%	Present	-
Traces	-	>10%	Present	-
-	-	-	Present	Protomylonite



B9-318

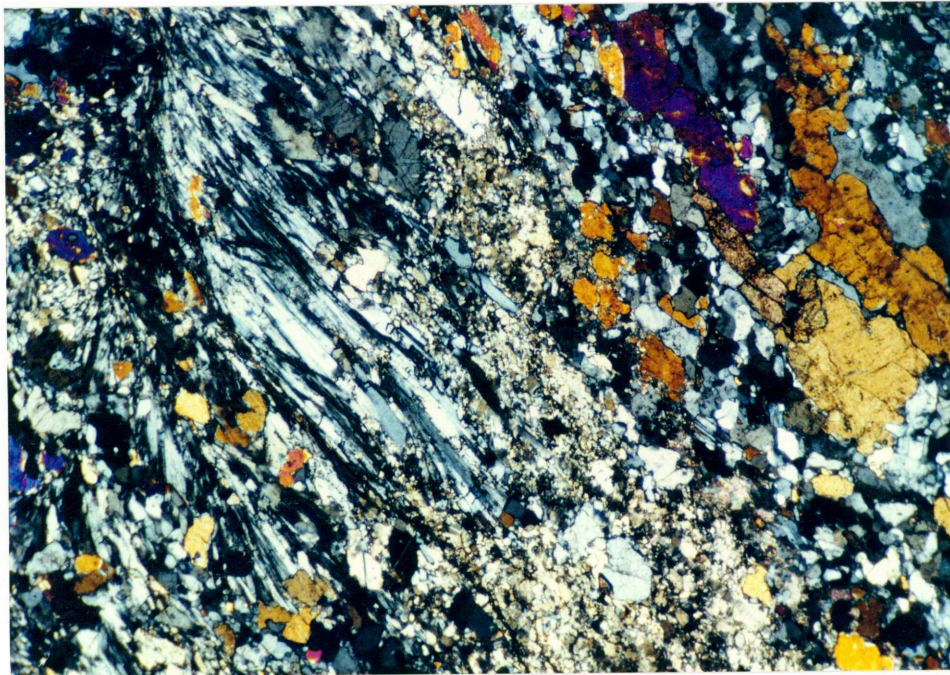
B9 R XVIII-7

X-Nicols

 0.1 mm

Pelitic schist

Anadalusite (left side, higher relief), biotite, quartz.



B9-38

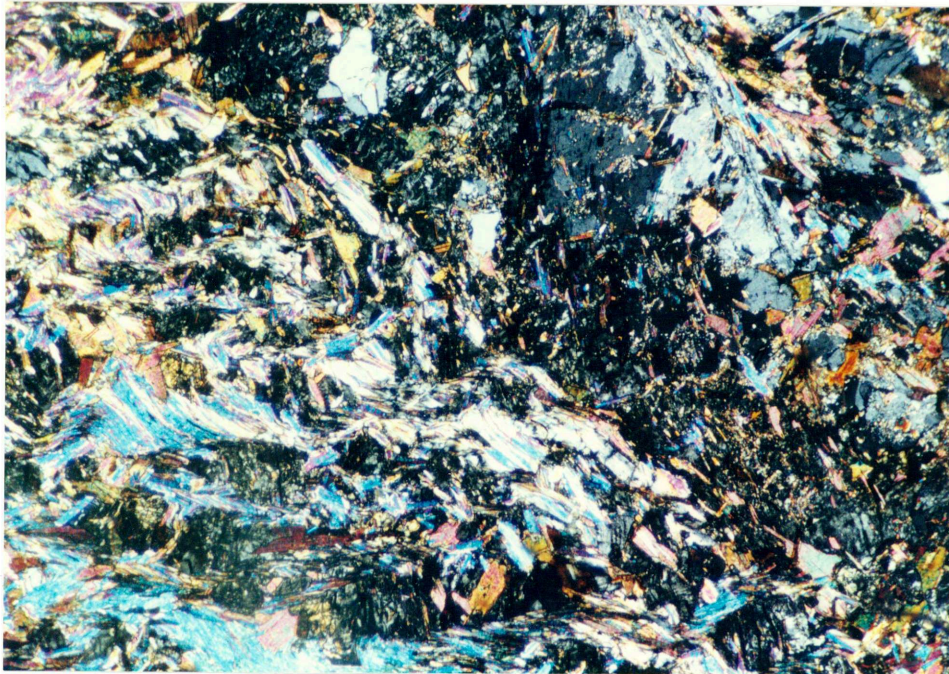
B9 R XVIII-10

X-Nicols

 0.1 mm

Calc-silicate

Wollastonite (bladed), diopside (coloured), K-feldspar (mottled blue grey)



89-409

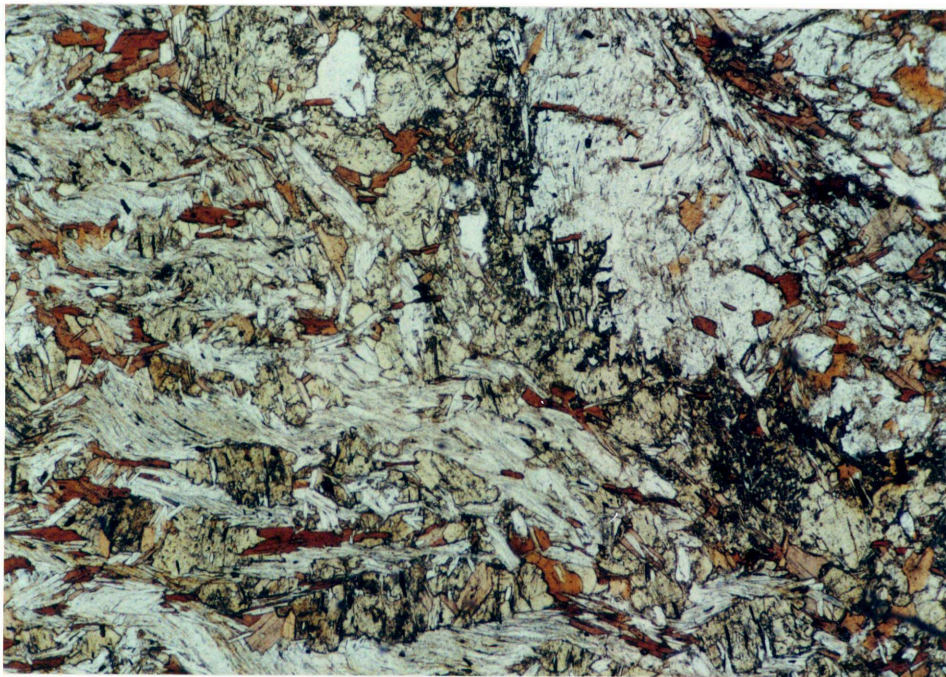
89 R XVIII-8

X-Nicols

0.1 mm

Pelitic schist

Staurolite, yellow high relief, cut by cross structure filled with foliated muscovite, (lower left diagonal).



89-409

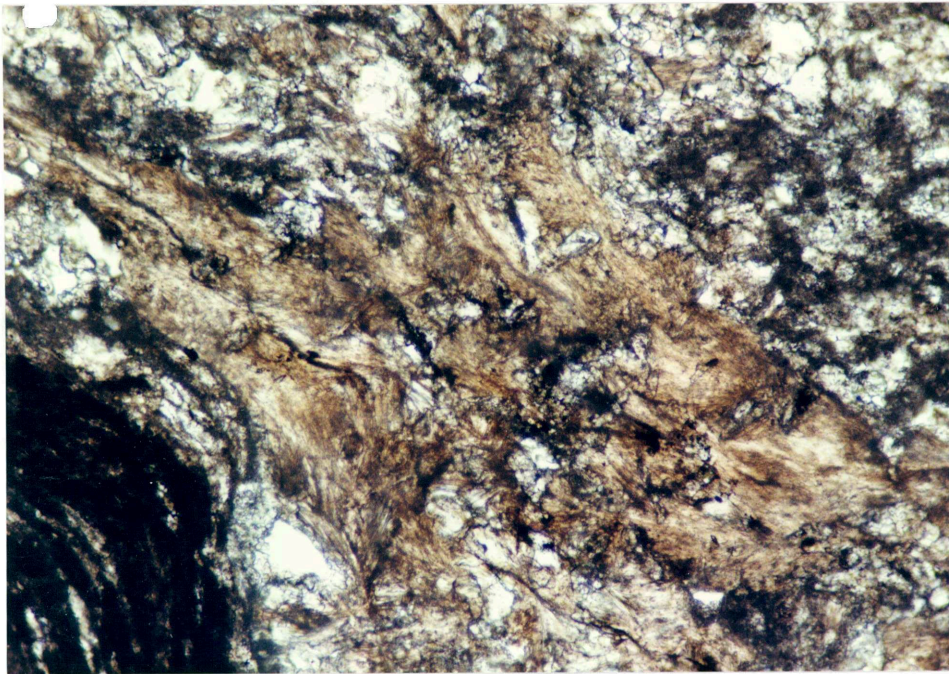
89 R XVIII-9

Plane light

0.1 mm

Pelitic schist As above.

Staurolite with muscovite (lower left diagonal). Staurolite cut by second penetrating structure-(fractured and folded). Plagioclase, andalusite (?), biotite (upper right diagonal).



89-119

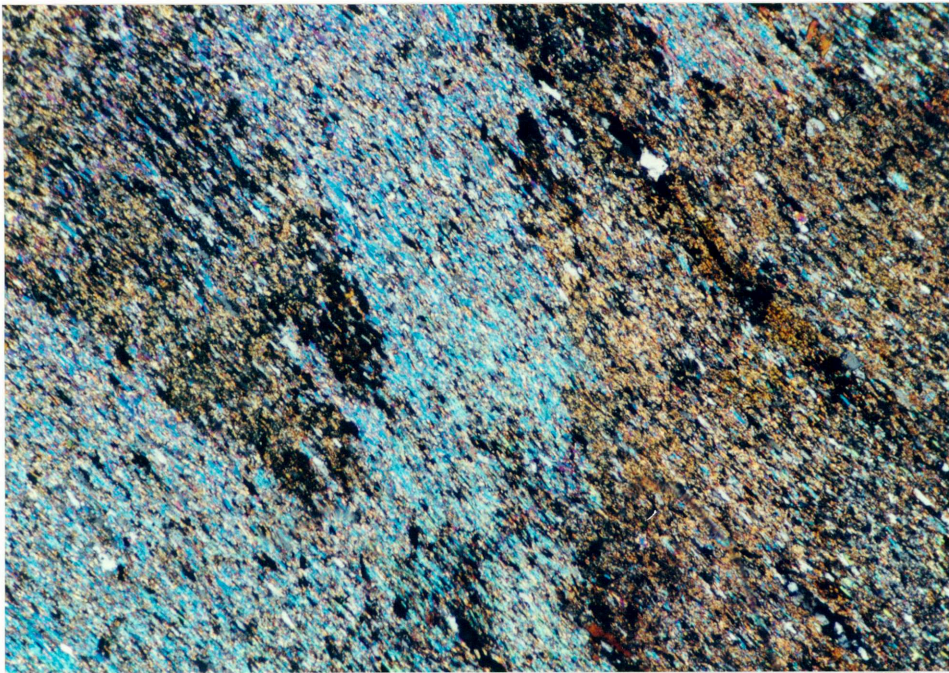
89 R XVIII-12

Plane light

 0.1 mm

Calc-silicate

Undetermined "C" fine fibrous felted brown containing "D" coarser acicular. Associated with K-feldspar.



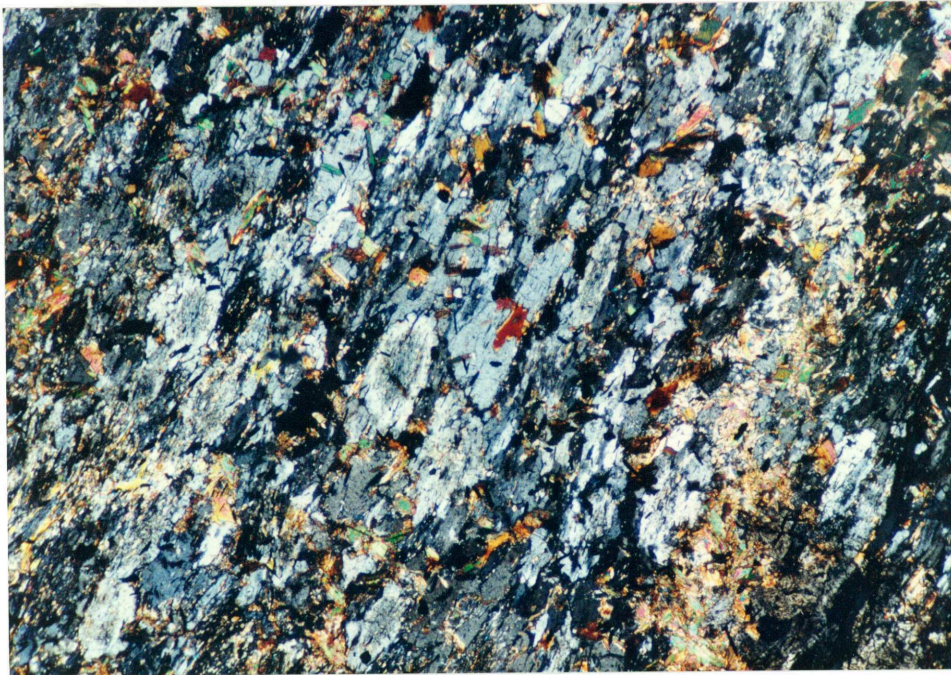
89-420 A

89 R XVIII-16

X-Nicols

 0.1 mm

Calc-silicate/pelitic schist. Sericite/muscovite schist, (blue birefringence). Sericitic and (?) clots



B9-420 B

89 R XVIII-17

X-Nicols

0.1 mm

Andalusite (cordierite(?)) schist
Plagioclase and cordierite(?) ovoids with inclusions in core,
associated with andalusite, biotite and muscovite/sericite.



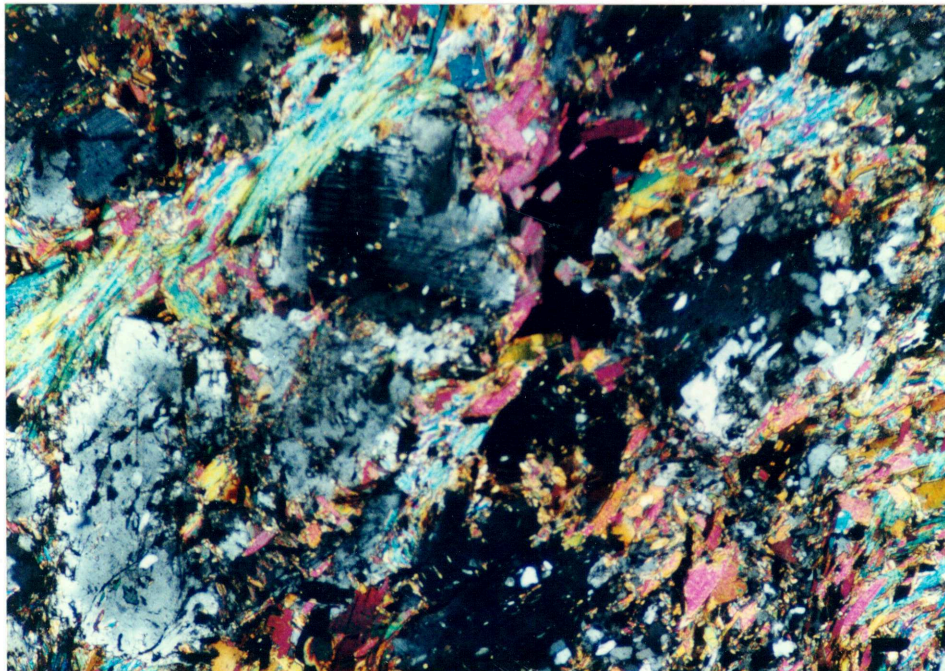
B9-420 B

89 R XVIII-18

Plane light

0.1 mm

Andalusite (cordierite(?)) schist. As above



89-255

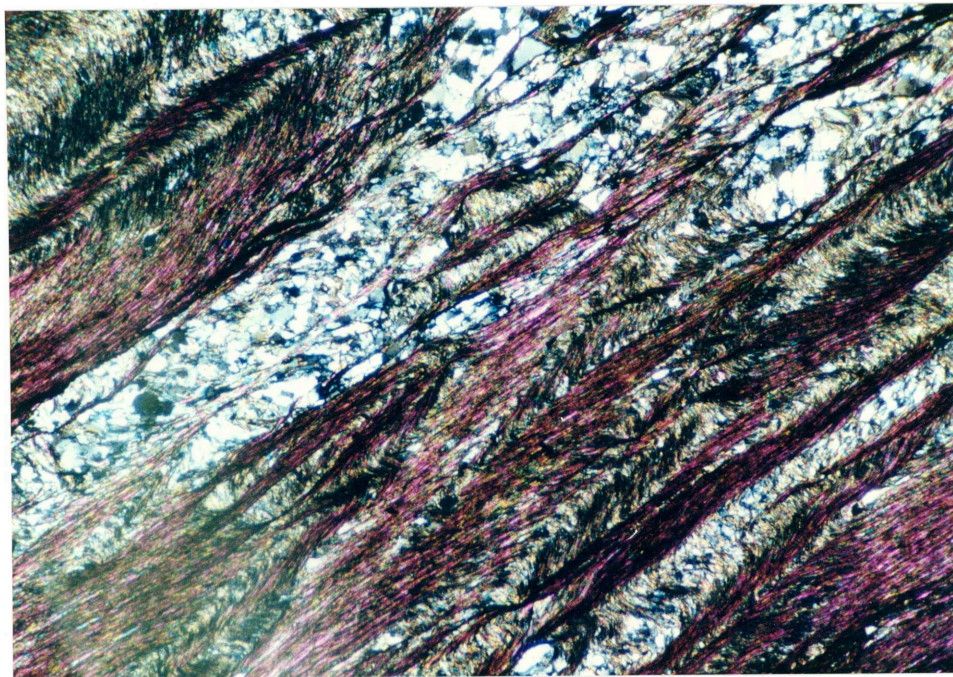
89 R XVIII-19

X-Nicols

0.1 mm

Spotted schist

Feldspar (cordierite(?)) ovoids, biotite.



89-132

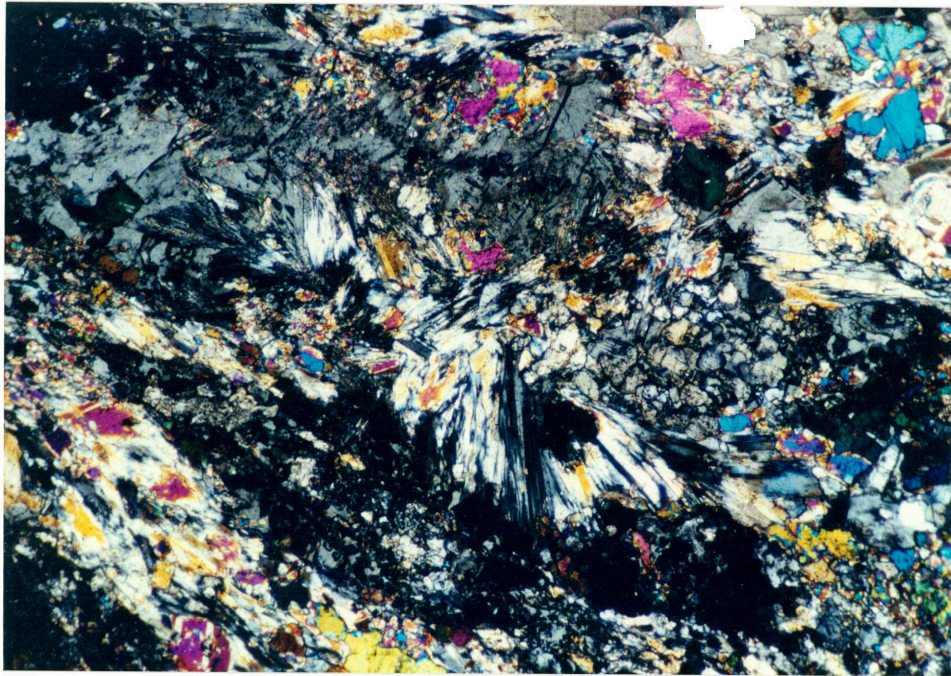
89 R XVIII-20

X-Nicols

0.1 mm

Pelitic schist

Muscovite/sericite, quartz. Cross folding.



89-322

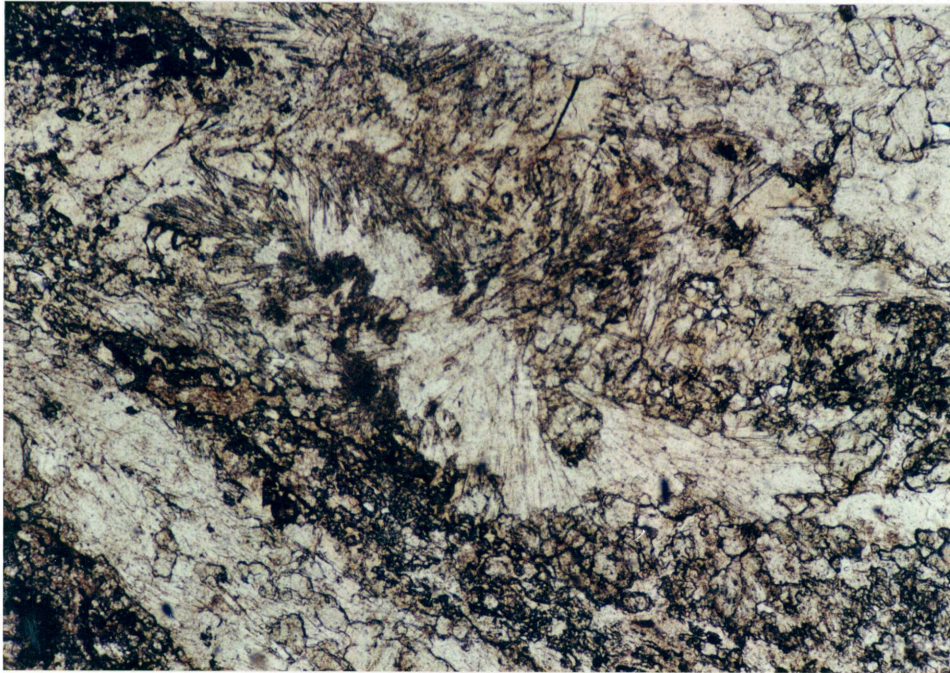
89 R XVIII-14

X-Nicols

0.1 mm

Calc-silicate

Diopside, vesuvianite, tremolite, wollastonite.



89-322

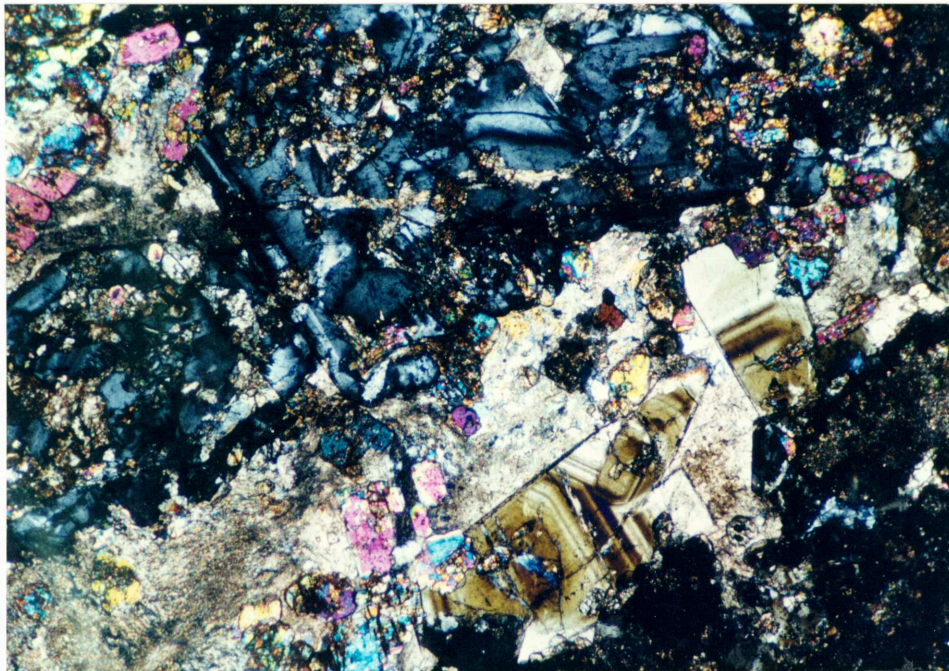
89 R XVIII-15

Plane light

0.1 mm

Calc-silicate As above.

Diopside, vesuvianite, tremolite, wollastonite.



89-257

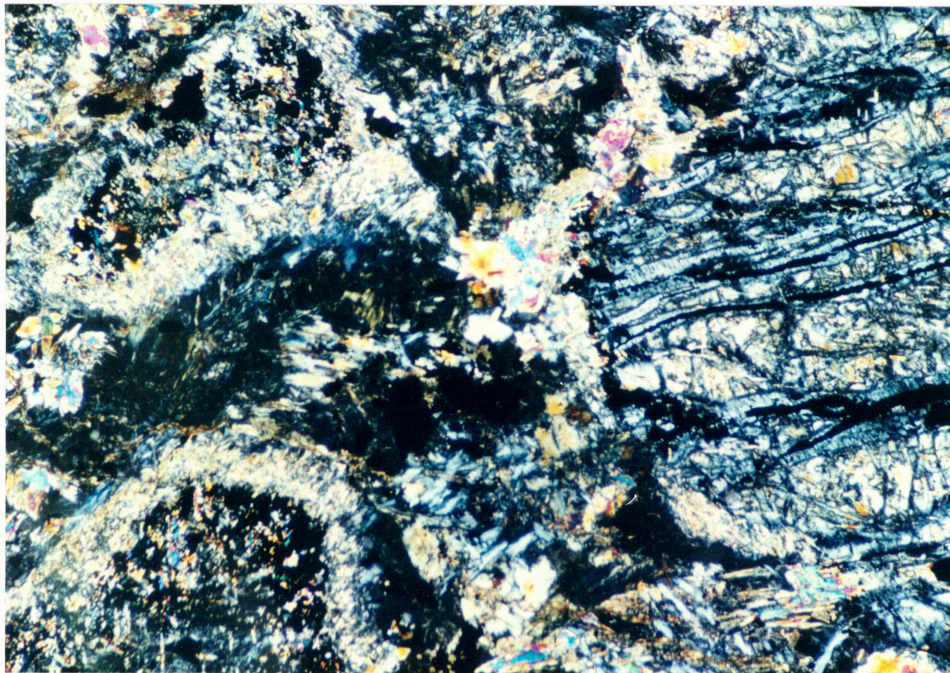
89 R XVIII-22

X-Nicols

0.1 mm

Skarn

Vesuvianite (brown zoned), anisotropic garnet (blue-grey zoned),
carbonate (high birefringence), diopside coloured.



89-146

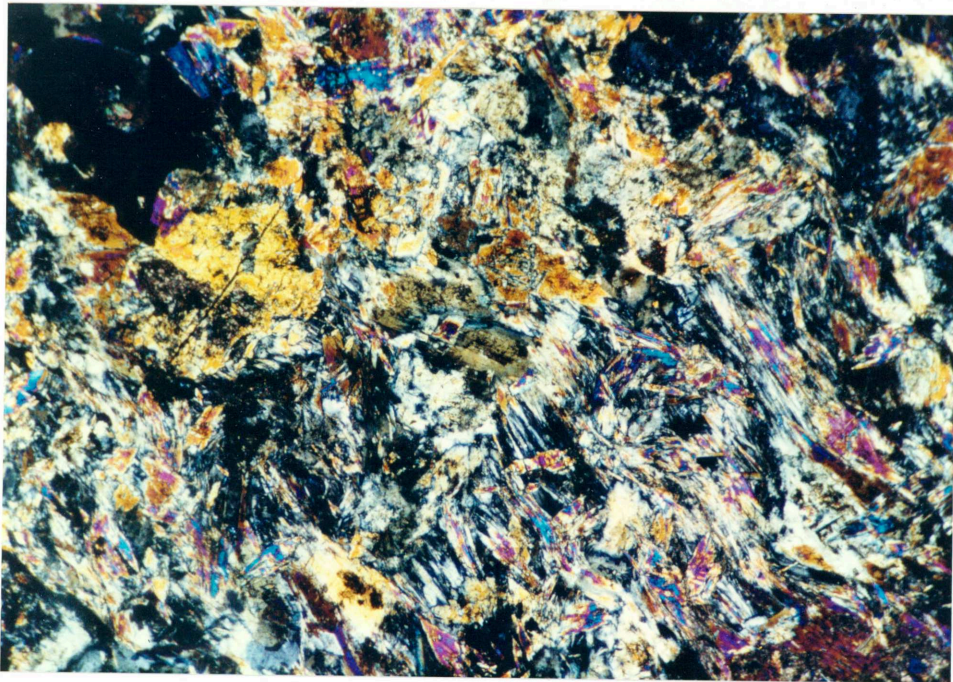
89 R XVIII-23

X-Nicols

0.1 mm

Altered amphibolite (?).


Chlorite, opaque, amphibole(secondary), carbonate, sericite.



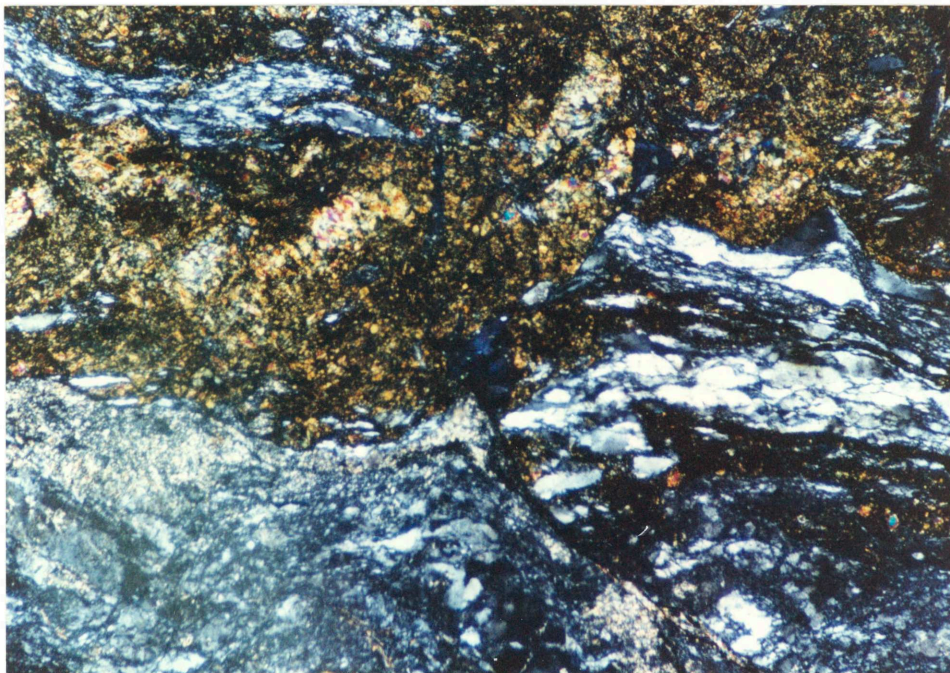
89-270

89 R XVIII-24

X-Nicols

 0.1 mm

Amphibolite
Primary and secondary amphibole.



89-422

89 R XVIII-25

X-Nicols

 0.1 mm

Protomylonite
Tourmaline, granular brown. Mylonitic plagioclase.

Pelitic schist; composed of quartz, biotite, muscovite, andalusite, garnet and sillimanite.

Foliated, laminated, segregated into layers and lensoids with relative enrichment of one or more of the component minerals.

Stained slab indicates possible K-staining in association with garnet-sillimanite-andalusite lensoids. Traces of bluish fluorescence on cut surface. Opaques <<1%.

Microscopic description:

Quartz; 35%, anhedral, (<.05 to 0.4 mm, generally 0.2 mm), interlocking grains, forms quartz-rich laminae and lensoids containing and bounded by foliated biotite and muscovite.

Biotite; 25%, subhedral, (to >1.0 mm), bladed, irregular, bright brownish red to very pale red-brown pleochroism, single grains but more commonly clusters of foliated grains forming biotite-rich laminae associated with all other components.

Muscovite; 15%, subhedral, (to >0.5 mm), bladed, irregular, as single grains or clusters of foliated grains forming lensoids.

Andalusite; 10%, anhedral, (to >2.5 mm), irregular masses, forming andalusite-rich lensoids with garnet, muscovite and biotite.

Staurolite; <1%, anhedral, (to 0.6 mm), in andalusite forming showing high relief, yellow pleochroism low birefringence.

Garnet (almandine); >5%, anhedral, (to >1.0 mm), light brown, aggregates of grains, forming large lensoidal masses (several mm) contains biotite and muscovite laths and elongate opaque grains in foliation orientation. Associated with very fine felted, lensoidal sillimanite.

Sillimanite; <1%, anhedral, (<.01 to .02 mm), acicular felted, high birefringence, parallel extinction. In close association with garnet in fractures and at grain margins.

Feldspars; <5%

K-feldspar; minor amounts slight staining noted on stained slab in association with garnet, sillimanite, andalusite-rich lensoids. Small interstitial grains.

Plagioclase; minor amounts, (to 0.2 mm), anhedral interstitial, few grains showing poorly developed polysynthetic twinning.

89-94 Continued

Accessories:

"A"; traces, subhedral minute grains (.02 mm), forming pleochroic haloes in biotite.

"B"; traces, euhedral/subhedral, (0.25 mm), some grains with hexagonal outline, yellow-orange colour, high (+) relief, birefringence masked by colour.

Opagues: <<1%, anhedral/subhedral (<.01 to 0.3 mm), some grains elongate rectangular.

Iron staining and jarosite in fractures and in foliation planes.

89-318

Pelitic schist; composed of quartz, biotite, muscovite, andalusite, (sillimanite) and feldspars (plagioclase-albite and K-feldspar).

Foliated, laminated, segregated into layers and lensoids with relative enrichment of one or more of the component minerals.

Stained slab indicates K-staining localized in clots. No fluorescence on fresh cut surfaces. Opaques; 1%

Microscopic description:

Quartz; 25%, anhedral, (<.05 to 1.0 mm, generally 0.1 to 0.2 mm), interlocking grains, forming quartz-rich laminae and lensoids containing and bounded by foliated biotite and muscovite.

Biotite; 25%, subhedral, (to >1.0 mm), bladed, irregular, bright reddish orange-brown to very pale brownish cream pleochroism. Single grains but more commonly clusters of foliated grains forming biotite-rich laminae associated with all other components. Minute inclusions forming pleochroic haloes. Locally shredded appearance, incipient chloritic alteration.

Muscovite; 5%, subhedral, (to >0.5 mm), bladed, irregular, as single grains or clusters of foliated grains forming lensoids. Few broad grains cutting across foliation.

Andalusite; 25%, anhedral, (to >2.5 mm) irregular masses, aggregates of grains, forming andalusite-rich lensoids with biotite, muscovite and quartz.

Feldspars; 10%, anhedral, (<.02 to >1.0 mm) irregular interstitial, unaltered.

(a) Plagioclase; a few grains show well developed polysynthetic twinning. Indicated composition in albite range. Biaxial (+). Concentrated in irregular lensoids/laminae.

(b) K-feldspar; mottled extinction. Confirmed by stained slab. Biaxial (-). Localized in diffuse lensoids.

Andalusite alteration; sillimanite, (+?) 5%, shows all stages of alteration from fibrous replacement along fractures with fibres perpendicular to walls.

Alteration of staurolite (?)/andalusite (?) has resulted in mottled cream-yellow masses (to >1.0 mm). These chloritic masses have mottled low birefringence and retain the fibrous structure which has grown out from former fractures which appear as worm-like lines.

89-318 Continued

Accessories:

"A"; traces, subhedral/anhedral, (<.0025 to .02 mm), minute grains forming pleochroic haloes in biotite.

Opaques; 1%, anhedral/subhedral, (.01 to 0.2 mm) irregular and rectangular elongate.

Hematite; widely scattered hematite grains

Jarosite; in patches and along foliation planes.

Iron stain; strong on foliation planes.

89-409

Pelitic schist; composed of feldspar (plagioclase and orthoclase (?)), biotite, sericite, quartz, staurolite and andalusite.

Foliated, laminated. Segregation of minerals results in relative concentration of one or more of the components in laminae and lensoids.

Cut by penetrative cross structure resulting in fracturing of staurolite and infilling by cross foliated muscovite.

Stained slab indicates some K-staining. No fluorescence on cut surfaces.

Microscopic description:

Quartz; 15%, anhedral, (<.05 to 0.5 mm, generally 0.1 to 0.2 mm), interlocking grains, forms lensoidal segregations in plane of first foliation but deformed into folds.

Feldspar; 20%

- (a) Plagioclase; anhedral, (to >1.5 mm). Interstitial clots within biotite/staurolite laminae, poikilitic inclusion of micas which retain foliation orientation. Slight to locally moderate sericitic alteration, weak microgranular dusting. Many grains exhibit polysynthetic twinning. RI slightly > epoxy. Indicated composition high oligoclase range.
- (b) K-feldspar (?) suspected in untwinned grains with mottled extinction but not confirmed. Biaxial (-), but R.I. appears too high. Similar optical properties to cordierite but also not confirmed.

Biotite; 30%, anhedral/subhedral, (to >2.0 mm), irregular broad bladed, as single grains or clusters of foliated grains forming biotite-rich laminae or lensoids. Contains minute granular inclusions producing pleochroic haloes.

Muscovite; 10%, anhedral/subhedral, (to >1.0), narrow bladed, as single grains or clusters of foliated grains commonly with biotite in first foliation. In greater concentration singly in second foliation cutting staurolite.

Staurolite; >15%, anhedral, (to >1 mm), yellow, weak pleochroism, birefringence very low, mottled bladed, blotchy and colliform internal structures as a result of chloritic alteration. Retains (+) elongation. Sieve texture biotite and muscovite inclusions.

Andalusite; >5%, ? anhedral, (to 0.6 mm).

89-409 Continued

Accessories:

"A"; traces, minute grains, in biotite, forming pleochroic haloes.

Alteration:

Sericite; alteration of staurolite (?) and feldspar.
Interstitial masses, fine felted/plumose, retrograde alteration of staurolite and plagioclase.

Chlorite; retrograde alteration of staurolite.

89-38

Calc-silicate; composed of diopside, plagioclase, K-feldspar, wollastonite, quartz and biotite.

Thin laminated by segregation of one or more of the minerals into laminae or lensoids. Diopside and plagioclase occur throughout the rock with some tendency for concentration in laminae. Greater concentration of K-feldspar, wollastonite, quartz and biotite in laminae or lensoids.

Iron staining on foliation surfaces.

Stained slab confirms lensoidal interstitial K-feldspar content. No fluorescence. Opaques <<1%.

Microscopic description:

Diopside; 30%, anhedral, (<.01 to >2.0 mm), irregular grains, aggregates of grains forming diopside-rich laminae and lensoids. In association with all other minerals constituents. Biaxial (+), 2V 50 degrees. Inclined extinction at approximately 45 degrees.

Plagioclase; 15%, anhedral, (<.05 to 0.2 mm), irregular grains, as single grains or clusters of grains. Scattered throughout all laminae, no obvious segregation. Twinning is conspicuous indicating high andesine to low labradorite composition.

K-feldspar; 20%, anhedral, (<0.1 to 0.5 mm), forms interstitial lensoidal masses, very weak microgranular red-brown alteration dusting. Biaxial (-). RI <1.54 (-). Mottled extinction. Confirmed by stained slab.

Quartz; 15%, anhedral, (<.05 to 0.2 mm), aggregates of grains forming lensoids in plane of foliation. Similar in appearance to K-feldspar but RI higher, (+).

Wollastonite; 10%, subhedral, (to >1.0 mm), acicular/long prismatic, radiating clusters. Colourless, low birefringence .014 RI moderate (+). Elongation both (+ and -). Biaxial (-) 2 V 40 degrees.

Biotite; 5%, anhedral, (<.05 to 0.5 mm), very irregular bladed, foliated, forming biotite-rich lensoids.

Accessories:

Sphene; traces; anhedral/euhedral (0.6 mm), cluster of irregular grains, few scattered euhedral grain.

Opaques; <<1%, anhedral, (<.01 to .05 mm), irregular grains, sparsely disseminated.

89-38 Continued

Iron staining on foliation surfaces

Veins

(a) Carbonate (?), microgranular/microcrystalline, clouded by impurities, following foliation, crystals oriented perpendicular to walls. Cataclasis zones.

(b) K-feldspar, veinlet cutting across foliation.

89-101

Calc-silicate composed of diopside, tremolite, quartz, K-feldspar, minor biotite, carbonaceous material.

Laminated/lensoidal segregations with relative enrichment of one or more of the component minerals. Diopside occurs throughout the rock with some tendency for concentration in laminae. Greater concentration of K-feldspar, quartz biotite and amphibole in laminae or lensoids.

Iron staining on foliation surfaces.

Stained slab confirms lensoidal interstitial K-feldspar content. No fluorescence on fresh cut surfaces. Opaques <1%.

Microscopic description:

Diopside; 25%, anhedral, (<.05 to >1.0 mm), clusters of irregular grains, in association with other mineral components forming lensoids and laminae. Confirmed by biaxial (+) 2 V 50 degrees interference figure.

Tremolite; >15%, anhedral/subhedral, (<.05 to 0.6 mm), irregular prismatic/fibrous. Warped grains in clusters. Confirmed by end sections showing amphibole cleavage traces and by inclined extinction.

Quartz; 15%, anhedral (<.05 to >1.0 mm), irregular grains forming laminae or lensoids. Confirmed, uniaxal (+) some intermixing with K-feldspar as confirmed by differences in relief.

K-feldspar; 15%, anhedral, (<.05 to 0.2 mm), clusters of grains forming lensoidal masses. Some intermixing with quartz as shown by differences in relief.

Plagioclase; <10%, anhedral, (<.05 to 0.2 mm), irregular grains in lensoidal clusters with quartz, biotite and tremolite. Confirmed by conspicuous polysynthetic twinning. Unaltered.

Biotite; <10%, anhedral, (0.1 mm), diffuse clusters of irregular grains. Some alteration to chlorite.

Carbonaceous material; 15%, minute opaque grains in clusters or clots strung out along foliation forming disrupted lensoids.

Opaques; <1%, anhedral, (0.1 to <.05 mm).

89-110

Calc-silicate; composed of diopside, actinolite, K-feldspar, quartz and plagioclase.

These minerals are segregated into laminae or lensoids by concentration of one or more of the components. The regular laminated nature is disrupted by zones of cataclasis and disrupted multiple folding along some of the foliated feldspathic and carbonaceous (?) layers. But these zones contain finely granulated fragments of the other mineral components as well.

Stained slab confirms K-feldspar-rich lensoids. No strong fluorescence on cut surfaces.

Microscopic description:

Diopside; 20%, anhedral, (<.05 to >1.0 mm), irregular grains/fragments and aggregates of fragments. Poikilitic grains enclosing (replaced by) quartz leaving skeletal remnants. Biaxial (+), 2V 50 degrees. Cleavages just off right angles.
Note: few grains observed with amphibole in late K-feldspar veinlet.

Amphibole (Actinolite); 25%, anhedral/subhedral, (<.01 to 0.5 mm), irregular prismatic to bladed, foliated/felted, associated with diopside. Pale green pleochroism, angular extinction, Biaxial (-), 2V 65 degrees.

K-feldspar; 10%, anhedral, (0.05 to 2.0 mm), forms large (to >2 mm), optically continuous interstitial patches. Forms veins. Late introduction into the system (with some diopside and amphibole).

Quartz; 15%, anhedral, (<.05 to 0.5 mm, generally 0.1 to 0.2 mm), irregular interlocking grains forming lensoids and quartz-rich laminations.

Plagioclase; 20%, anhedral, (<.01 to 0.3 mm), weak sericitic and stronger microgranular alteration dusting. Plagioclase with associated carbonaceous material forms regular feldspathic-rich layers but also is a major component of the cataclasis layers.

Biotite; <5%, anhedral (<.01 to 0.3 mm), ragged clusters, weak chloritic alteration, forming lensoids but with felted orientation across lensoids.

Muscovite; <5%, anhedral, (<.01 to 0.5 mm), clusters of foliated grains forming continuous partings around quartz lensoids.

89-110 Continued

Alteration:

Alteration/cataclasis layers; very fine granular mixture of minerals, strong feldspathic component and opaques (carbonaceous ?) showing internal layering/foliation disrupted into discontinuous multiple folds and swirls. These zones are feldspathic but contain finely divided grains of the minerals comprising the rock. Later irregular quartz and K-feldspar lensoids.

Chlorite; <<5%, anhedral, (<.05 to 0.5 mm), bladed plumose clusters, foliated.

Accessories:

Sphene; <<1%, subhedral, (0.4 mm), grains show random orientation, most prevalent in alteration/cataclasis layers.

Carbonate; traces, anhedral, (0.3 mm), irregular grains forming small clusters.

Veinlets:

K-feldspar late, cutting across foliation and cataclasis layers with minor diopside and actinolite.

89-119

Calc-silicate; composed of K-feldspar, (minor plagioclase), diopside, alteration product (?), quartz, biotite, epidote.

Laminae of mixtures of the above mineral components. Some segregation into laminae or lensoids relatively richer in one or more of the mineral components but in general mixed.

Laminated by cataclasis zones composed of fine granulated mineral components and a fibrous microgranular dusted alteration product.

Stained slab indicates high K-feldspar content. No fluorescence on fresh cut surfaces.

Microscopic description: Percentages very approximate because of alteration and cataclasis.

K-feldspar; 20%, anhedral, (<.05 to 0.4 mm), irregular interstitial masses showing optical continuity (to >1.0 mm). Locally shows microgranular brown dusting. Close association with unidentified alteration "A".

Note: the fibrous brown clouded alteration with slightly coarser needles appears to be related to alteration of K-feldspar.

Diopside; 15%, anhedral, (<.05 to 0.4 mm), irregular grains, clusters, associated with all other mineral components.

Undetermined "C", 15%, subhedral, (<.02 to 0.05 mm) acicular/fibrous, radiating masses of needles forming interstitial clots to several mm. Strong clouding by brown microgranular dusting. Related to alteration of K-feldspar?.

Low birefringence, elongation (+ and -), parallel extinction. (Note-coarser needles that look similar have inclined extinction) In laminae closely associated with:

Undetermined "D", 10%, subhedral, (to 0.1 mm), long acicular, colourless associated with "C". Could be same mineral but appears to have inclined extinction and slightly higher birefringence.

Tremolite; <10%, anhedral, (<.05 to 0.5 mm), bladed, colourless, clusters of grains.

Biotite; <5%, anhedral, (<.05 to 0.2 mm), very irregular ragged grains, concentrated in lensoids with feldspar and minor chlorite.

Chlorite; <5%, anhedral, (<.05 to 0.2 mm), irregular bladed, clusters of grains with K-feldspar, plagioclase, quartz and biotite.

89-119 Continued

Quartz; 5%, anhedral, (<.02 to 0.15 mm), clusters of irregular grains forming small lensoids.

Plagioclase; 5%, anhedral/subhedral, (<.05 to 0.1 mm) clusters of grains with biotite, quartz as laminations and lensoids.

Carbonate; <5%, anhedral, (to 0.3 mm), irregular grains associated with epidote, feldspars, diopsides.

Carbonaceous material; 10%, very finely divided microgranular opaque. In stringers of aggregates of grains, very finely laminated in cataclasis layers.

Epidote; 5%?, subhedral, (<.05 to 0.2 mm), prismatic, also anhedral grains. Negative elongation, biaxial (-) $2v > 60$ degrees, parallel extinction. Anomalous blue and greenish-yellow birefringence. Crystals grade outwards into long acicular fibrous/felted radiating minerals.

89-250

doubtful

Calc-silicate protomylonite, altered

Extremely fine laminated, very fine/microgranular semiopaque dusting with very narrow interlaminated microgranular grains, generally irregular, showing prismatic and fibrous forms. Wide range of birefringence visible but masked by cataclasis.

Stained slab indicates high K-feldspar content. No fluorescence on fresh cut surfaces.

Microscopic description:

K-feldspar; 35%, anhedral microgranular (<.01 mm), clouded by semiopaque dusting. Presence indicated by sodium cobaltinitrite staining. Not confirmed in thin section.

Diopside (?); tabular granules, high relief and birefringence, inclined extinction.

Tremolite (?); fibrous, high birefringence, inclined extinction.

Chlorite; bladed/fibrous, green mottled, low birefringence.

Biotite; irregular bladed/plumose diffuse laminae, light orange brown to pale brownish pleochroic, parallel extinction.

Quartz (?), anhedral grains with higher birefringence minerals in cavities. Strained extinction.

89-142

check

Calc-silicate protomylonite

The rock is very fine granular (cataclastic), foliated and thinly laminated. A clouding by very fine/microgranular cataclasis material (alteration?) obscures minerals comprising most of the section. However small lensoidal areas of coarser grains within the laminae show presence of feldspars, (clouded K-feldspar), quartz, diopside

Stained slab indicates strong K-feldspar content. No fluorescence on fresh cut surfaces.

Microscopic description:

K-feldspar; anhedral, (<.01 to 0.2 mm), irregular grains, clouded by microgranular red-brown dusting of alteration. Confirmed by staining with sodium-cobaltinitrite.

Quartz; anhedral, (<.01 to 0.2 mm), irregular grains, elongate in foliation plane, strained extinction.

Diopside; anhedral, (<.01 to 0.2 mm), irregular grains. Some patches high birefringence (high for diopside?), inclined extinction. Some well developed recrystallized grains.

Amphibole(actinolite); anhedral, (<.05 to 0.1 mm), ragged acicular/prismatic clusters of grains green, pleochroic, high birefringence, inclined extinction.

Epidote; suspected not confirmed.

Carbonaceous partings.

Chlorite; anhedral fibrous, (to 0.2 + mm), clusters of bladed grains. Light brownish green, anomalous indigo/blue birefringence.

Veinlets:

Diopside(?)/quartz cutting across laminations/foliation. Vein walls less clouded by alteration than general groundmass indicating recrystallization and/or impregnation of wall rock.

Diopside (?); very high birefringence, biaxial (+) 2v <50 degrees ??, inclined extinction.

89-359

Calc-silicate; composed of actinolite, diopside, feldspars (plagioclase and K-feldspar), quartz, biotite.

Laminated as a result of segregation of one or more of the mineral components into enriched lensoids or laminae. There are quartz-rich, feldspar-rich, and amphibole-diopside-rich laminae and lensoids as well as laminae composed of mixtures of the component mineral.

Further laminated by altered feldspar and carbonaceous rich cataclasis zones with an intermixing of granules of the other mineral components.

Penetrative cross structures, folding and dislocation.

Stained slab indicates presence of K-feldspar. No fluorescence on fresh cut surfaces.

Microscopic description:

Amphibole (actinolite); 25%,

(a) anhedral/subhedral (<.05 to 0.5 mm), generally irregular prismatic clusters of grains but shows typical amphibole cross section. Bright to pale green pleochroism, angular extinction with (+) elongation.

(b) anhedral (<.05 to 0.2 mm) fibrous acicular, angular extinction. Probably same variety as (a) but different habit. Very pale colour. Secondary.

Chlorite; 5%, anhedral (<.05 to 0.2 mm) fibrous/plumose interstitial masses (to several mm). Pale green colour, anomalous blue/purple birefringence.

Diopside; 15%, anhedral, (<.01 to >1.0 mm). Irregular grains and aggregates of grains. Broken up by cataclasis? Colourless, high birefringence, inclined extinction. Biaxial (+) 2 V 60 degrees Elongation (+).

Quartz; 15%, anhedral, (<.01 to 0.4 mm, generally around 0.1 mm), irregular grains as aggregates forming lensoidal segregations/laminae but associated with the other mineral components. Strained extinction. Elongate grains oriented in foliation plane.

Feldspar; 30%, anhedral, (<.05 to 0.2 mm), irregular granules, (sericitic) and strong microgranular alteration dusting. Form feldspar-rich laminae, associated with biotite and carbonaceous partings.

(a) K-feldspar; is indicated by strong staining by sodium cobaltinitrite. [K-feldspar > plagioclase]

89-359 Continued

(b) Plagioclase; indicated by few grains showing well developed polysynthetic twinning. Indicated composition in high andesine range.

Biotite; <10% anhedral, (<.01 to .05 mm), very irregular ragged grains forming a diffuse network among other mineral components in some laminae.

Epidote; <5%, anhedral, (<.01 to 0.3 mm)

Sheared granulated laminae; feldspathic-rich laminae with granular aggregates of the other mineral components. Internal shear and convoluted fragmental fabrics.

Accessories:

Sphene; trace, subhedral, (0.2 mm)

Rutile (?); traces, long needles associated with epidote and amphibole. May be another habit of amphibole.

Veins:

Quartz and amphibole as diffuse veinlets cutting across foliation.

89-282

Calc-silicate; composed of carbonate,

Laminated, very fine granular carbonate (calcite), and epidote/clinozoisite, lesser diopside/tremolite (?).

Foliation/lamination results from partial segregation (relative enrichment) of one or other of the main components in layers and clots. Some mottling resulting from clustering of component minerals.

Stained slab shows few scattered stained grains. No fluorescence on fresh cut surfaces.

Microscopic description:

Carbonate (calcite); 35%, anhedral, (<.01 to .05 mm), clusters of grains interstitial to clinozoisite/epidote.(?)

Diopside; 10%, anhedral (<.01 to 0.05 mm), generally irregular grains, some prismatic, inclined extinction. Obscured by epidote/clinozoisite.

Actinolite/tremolite; 10%, Small fibrous laths. Suspected, not confirmed.

Epidote/clinozoisite (?); 35%, anhedral, (<.01 to .02 mm) clusters of grains. Scattered clots of coarser grains (to 0.1 mm). Obscured by strong, brown, microgranular dusting. High relief, high and anomalous blue birefringence. Too small for interference figures. Slight yellowish pleochroism.

Quartz; 5%, anhedral, (<.01 to .05 mm), scattered irregular grains, strained extinction.

K-feldspar; not confirmed in thin section.

Hematite; traces; associated with clinozoisite/epidote clots.

89-322

Calc-silicate; composed of diopside, feldspars, tremolite, carbonate, lesser wollastonite with porphyroblasts of vesuvianite and garnet (grossularite).

Laminated layers of diopside and feldspars in layers of varied grain size as a result of narrow zones of cataclasis following foliation.

Stained slab shows minor K-feldspar staining. Weak fluorescence of white material on foliation in fresh cut surfaces.

Microscopic description:

Porphyroblasts

Vesuvianite; 10%, anhedral, (to >1 cm). Porphyroblasts, irregular masses, optically continuous, moderate poikilitic. High (+) relief > vesuvianite. Isotropic. Poikilitically encloses diopside; lesser carbonate.

Feldspars

(a) Plagioclase; 20%, anhedral, (<.01 to 0.6 mm), irregular grains with tendency to be concentrated in laminae with diopside. Laminae show varied grain size resulting from narrow zones of cataclasis following foliation.

(b) K-feldspar; <<5%, scattered clusters of grains show staining by sodium-cobaltinitrite. Not confirmed in thin section. Biaxial (+).

Diopside; 35%, anhedral, (<.05 to >1.0 mm), aggregates of grains, concentrated in laminae.

Foliation surfaces:

Tremolite; 20%, anhedral/subhedral (<.05 to mm), (a) prismatic/bladed, clusters of radiating grains (b) acicular fibrous, radiating with minor diopside, plagioclase. Birefringence high. Inclined extinction. Abundantly twinned.

Carbonate; >5%, anhedral, (<.01 to 0.25 mm), irregular clots, beaded veinlets.

Wollastonite; 10% (?) subhedral, (<.05 to 0.5 mm), prismatic/bladed, clusters of grains. Birefringence low (0.014 +/-). Parallel extinction. Grains show both (+ and -) elongation. Confirmed by biaxial (-) 2V about 40 degrees interference figure.

B9-322 Continued

Accessory minerals:

Sphene; trace, subhedral (0.15 mm)

89-167

Pelitic schist; composed of biotite, muscovite, quartz, K-feldspar.

Strong foliated, laminated by segregation of one or more component minerals into layers/lensoids producing biotite-rich; muscovite-rich, quartz rich laminae.

Second generation of cross folding.

Stained slab: confirms presence of K-feldspar. No fluorescence on fresh cut surfaces.

Microscopic description:

Biotite; 35%, subhedral, (<.05 to >1.0 mm), bladed, single grains and clusters of grains, foliated. Contains minute inclusions surrounded by pleochroic haloes. Tendency for coarser grains to occur in axial areas of second stage folds.

Muscovite; 15%, subhedral, (<.05 to 0.4 mm), narrow bladed, single grains and clusters of grains, foliated and second generation.

K-feldspar; 30%, anhedral, (<.01 to 0.1 mm) irregular grains, intermixed with quartz. Has lower RI as compared to quartz and many grains dusted by slight alteration. Some tendency to form coarser grained (to 0.2 mm) lensoids along primary foliation.

Quartz; 20%, anhedral, (<.01 to 0.1 mm), irregular grains intermixed with K-feldspar. Unaltered, higher RI than K-feldspar. Coarser grains. (to 0.3 mm) in axial areas of second stage folds. Also locally forms coarser lensoids along primary foliation.

Accessory minerals:

Undetermined "A"; traces, minute grains forming pleochroic haloes in biotite.

89-377

Pelitic schist; composed of biotite, muscovite, quartz and K-feldspar.

Laminated by layers/lensoids of mixed mineralogy but enriched in one or more of biotite, muscovite, quartz, K-feldspar and plagioclase. K-feldspar and plagioclase appear to be segregated into separate lamillae/lensoids.

Some feldspar, mica laminae show internal fold structures.

Stained slab confirms enrichment of some narrow laminae by K-feldspar. Few flecks blue-white fluorescence.

Microscopic description:

Biotite; 25%, subhedral, (<.05 to 0.5 mm), ragged bladed, as single grains but more commonly as foliated aggregates of grains segregated into laminae. Commonly intermixed with muscovite.

Muscovite; 30%, subhedral, (<.05 to >0.5 mm), ragged broad blades, as single grains but more commonly as foliated aggregates of grains segregated into laminae. Commonly intermixed with biotite.

Quartz; 15%, anhedral, (<.01 to 0.2 mm), irregular grains as aggregates in plagioclase-rich laminae and in slightly coarser grained K-feldspar lensoids.

K-feldspar; <10%, anhedral, (<.05 to 0.15 mm) irregular grains enriched in narrow laminae/lensoids associated with slightly coarser quartz grains.

Plagioclase; 20%, anhedral/subhedral (<.01 to 0.15 mm), irregular lath like, suggestion of twinning, unaltered. Occurs in plagioclase-rich laminae on both walls of quartz vein. Confirmed by etching and lack of stain by sodium cobaltinitrite.

Amphibole; suspected but not confirmed. All grains checked showed parallel extinction and near uniaxial (-) interference figures indicating mica.

Veins:

Quartz vein; 8.5 mm wide, composed of coarse (to several mm), anhedral quartz grains. Follows foliation. Fairly uniform extinction. Enrichment of wallrock by plagioclase (confirmed by etching on stained slab).

89-382

Pelitic schist; composed of biotite, (muscovite), (chlorite), quartz, plagioclase and K-feldspar.

Foliated/laminated, segregation of mineral constituents into quartz-rich and mica-rich laminations. Quartz, K-feldspar > plagioclase in laminations of mixed composition.

Second stage folding.

Stained slab confirms high K-feldspar content with fairly even distribution with quartz and plagioclase. No fluorescence with ultraviolet light.

Microscopic description:

Biotite; 25%, subhedral, (0.1 to 0.5 mm) irregular laths, single grains, clusters of foliated grains. Bright reddish brown colour, to very pale pleochroism. Faler intermixed grains, very low birefringence indicate alteration to chlorite.

Muscovite; <5%, subhedral, (0.1 to 0.2 mm) minor alteration of biotite.

Quartz; 30%, anhedral, (<.01 to 0.2 mm, generally 0.5 to 0.1 mm), irregular grains, featureless, uniform extinction. Clusters of grains form lensoids; also mixed with feldspars. Grains orientated so that they give lower birefringence cannot be distinguished with certainty from untwinned plagioclase. Confirmed by uniaxial (+) interference figures.

Plagioclase; 20%, anhedral, (<.01 to .15 mm) irregular grains, where polysynthetic twinning occurs. Untwinned, unaltered grains have similar RI to quartz and cannot be distinguished one from the other with certainty.

K-feldspar; 20%, anhedral (<.01 to .15 mm), irregular grains interstitial to quartz and plagioclase. Unaltered, featureless but lower RI distinguishes K-feldspar from quartz and twinned plagioclase.

Accessory minerals:

Tourmaline; traces, subhedral/euhedral, (to 0.15 mm), show pleochroism with maximum absorption parallel to analyser direction (opposite to biotite).

89-420 A

Calc-silicate/pelitic schist composed of biotite, muscovite, quartz and plagioclase.

Very fine grained, strong foliation and second cross foliation. Some segregation of one or more of the mineral components into laminae (ie. biotite rich laminae and muscovite/sericite-rich laminae).

Clots, resulting from alteration or partial replacement of biotite and sericite/muscovite form lensoids in the plane of foliation. These are chlorite (?) -rich and fibrous sericite/plagioclase (cordierite (?) -rich clots respectively.

Stained slab does not indicate significant K-feldspar content. No fluorescence under ultraviolet light.

Microscopic description:

Biotite; 20%, anhedral, (<.01 to 0.4 mm, most grains about 0.1 mm), ragged bladed, single grains and aggregates of foliated grains. Some segregation resulting in biotite-rich laminae/lensoids.

Muscovite/sericite; 15%, anhedral, (<.01 to 0.1 mm), acicular/bladed, single grains, aggregates of foliated grains forming muscovite/sericite-rich laminae/lensoids.

Quartz; 25%, anhedral, (<.01 to .05 mm), elongate (lenticular) grains oriented in plane of foliation. Fairly evenly disseminated in micaceous laminae.

Coarser grains, (0.05 to 0.2 mm), as aggregates form small quartz lenses in foliation plane.

Plagioclase; 15%, (a) anhedral, (<.01 to 0.1 mm), anhedral grains in general groundmass with quartz and micas. Few grains show twinning, unaltered. Distinguishable from quartz by greater RI. (b) anhedral/subhedral, (0.7 mm), irregular grains in quartz vein, weak sericitic.

Diffuse lensoidal clots: 15%

Diffuse, lensoidal clots, (to 1 cm), have formed in the plane of foliation as a result of alteration or replacement of muscovite/sericite or biotite with recrystallization of plagioclase (or development of cordierite(?)). Original quartz and biotite or muscovite/sericite remnants remain oriented in foliation plane. Sericite/muscovite rich laminations are altered to a fibrous form of sericite and the groundmass forms plagioclase (cordierite ?) masses in optical continuity. Biotite rich laminations become chloritic. Microprobe analyses are required for confirmation

89420 A Continued

of these assemblages

Veins/segregations/lensoids:

Quartz; <10% anhedral, (<.05 to 0.2 mm), as aggregates of irregular grains with muscovite and biotite. Veins and deformed lensoids.

Sericite/muscovite; <1%, anhedral/subhedral, (<.05 to 0.1 mm), clusters of grains in quartz. Pale brownish-green tint, pleochroic.

Biotite; <1%, anhedral/subhedral, (<.05 to 0.1 mm), clusters of grains in quartz.

89-420 B

Veined plagioclase, biotite, andalusite schist.

Feldspathic schistose, strong foliation, composed of fine/medium grained recrystallized and deformed plagioclase and quartz with biotite and chlorite. Andalusite forms strings of grains poikilitically enclosing biotite and feldspars. Very sericite and chlorite.

Veined and impregnated by quartz.

Stained slab shows weak indication of K-feldspar.

Microscopic description:

Plagioclase; 45%,

- (a) Anhedral, (<.05 to 0.1 mm), irregular aggregates of grains, interlocking, unaltered. Recrystallized. Many grains show twinning. As near structureless masses of aggregates of grains and foliated/vein-like laminae.
- (b) Subhedral, (0.1 to >1.5 mm), irregular grains, sericite and chlorite altered cores. Margins recrystallized, unaltered, granular. Forms large grains, clusters of partially altered and recrystallized grains. Possibly remnants of former lithic (plutonic) fragments.
- (c) Anhedral, (to >1.0 mm), ovoid shapes, deformed plagioclase (?), interlocking forming foliated masses. Recrystallized margins form optically continuous matrix among cores. Cordierite ?.

Andalusite; 15% (in section), anhedral, (to >1.0 mm), Most abundantly as interstitial grains in optical continuity poikilitically enclosing biotite and plagioclase ovoids. Also as irregular grains forming long discontinuous clusters along and across foliation. Colourless, low/moderate RI, low birefringence, elongation (-), biaxial (-), parallel extinction.

K-feldspar; <5%, presence indicated by stained slab but not strong well developed stain. Noted fragments, (0.25 mm). Mottled extinction, cleavage, unaltered, biaxial (-), RI <plagioclase Not confirmed.

Biotite; 20%, anhedral, (<.01 to 0.1 mm), very irregular bladed, single grains or clusters of foliated grains.

Chlorite; 10%, anhedral, (<.01 to 0.1 mm), very irregular bladed, single grains or clusters of foliated grains in rock matrix. Also with amphibole in quartz veins/impregnations.

Amphibole; <5%, anhedral, (<.01 to 0.1 mm), prismatic fibrous, radiating clusters. Along margins of quartz vein and associated with chlorite.

89-420 B Continued

Sphene; traces, euhedral/subhedral, (2.2 mm)

Apatite; traces, subhedral, (to 0.35 mm), similar to andalusite but elongation (+). Uniaxial (-).

Undetermined "A"; trace, subhedral, (0.3 mm), in biotite/chlorite cluster. Pleochroic halo (?). RI high (+).

Sericite/muscovite; <5%, anhedral, (<.01 to 0.2 mm), irregular grains sericitic alteration of plagioclase, and as diffuse felted clusters of grains.

Opagues; 2%, subhedral/anhedral, (<.01 to 0.1 mm), rod-like and irregular grains.

Veins and segregations:

Quartz; anhedral, (<.01 to several mm), aggregates of interlocking grains. Clusters of chlorite, amphibole.

Note: Two supplemental thin sections were made.

89-420 B- [1]

Similar to description above but with some differences.

(a) Muscovite/phlogopite, >10%, anhedral/subhedral (<.05 to >0.5 mm). (i) radiating clusters (to several mm), associated with finer biotite clusters crossing foliation (ii) foliated clusters forming diffuse lensoids/networks locally.

(b) Sericite muscovite is more abundant as fine grained felted clots associated with feldspathic matrix.

(c) Undetermined "Z"; traces, euhedral/subhedral, (to 0.15 mm), single crystals, twinned, inclined extinction, dusted/slightly fibrous clouding of alteration. High relief. Birefringence in mid second order.

89-420 B- [2] Veins and segregations

(a) Pyroxene; to 5%, anhedral, (<.05 to >1.0 mm), as clusters of grains as strung out inclusions in quartz. Associated amphibole. Good biaxial (+) 2V 60 degrees interference figures.

(b) Feldspathic partings/laminae cataclasis (?) foliation preserved (?) in quartz.

89-255

Spotted pelitic schist composed of biotite, muscovite, quartz, plagioclase with plagioclase, (cordierite?) ovoid porphyroblasts.

Some segregation into layers with weak cataclasis textures with mixed mineral assemblage, and layers of well foliated schists with abundant plagioclase (cordierite ?) ovoids.

Stained slab shows no K-feldspar, confirms etched plagioclase ovoids. No fluorescence.

Microscopic description:

Groundmass:

Biotite; 30%, anhedral/subhedral, (<.05 to 1.5 mm), uneven bladed, single grains but more abundantly as clusters of grains with muscovite, foliated and felted matrix among feldspar lensoids. Medium red brown to pale brownish pleochroism.

Muscovite; 15%, anhedral/subhedral, (<.05 to several mm), uneven bladed/fibrous, single grains and clusters of foliated grains. Very coarse grains (to several mm length) and width with finer grains and admixed biotite forming the matrix among feldspar lensoids.

Quartz; 20%, anhedral, (<.01 to 0.25 mm), lensoidal grains oriented parallel to foliation, lower relief than associated plagioclase.

Plagioclase; <15%, anhedral, (<.01 to 0.5 mm), irregular grains intermixed with quartz and micas. Remnant twinning with indicated composition in high andesine range. Some of the larger grains, (to 0.5 mm), are fragmental, have intensely altered cores and may represent a fragmental plutonic component.

Opaques; 2%, anhedral (<.01 to 0.5 mm), irregular grains and clusters of grains in plane of foliation.

Ovoid porphyroblasts:

Plagioclase (and cordierite ?); 20%, (to >1.0 mm), ovoid shapes, slight microgranular dusting altered cores, gradual composition change outwards indicated by extinction. Diffuse margins. Poikilitic texture enclosing quartz and micas. Most grains deformed with feathered margins by first foliation. (Does not fit cordierite properties well). Optical properties include low birefringence (0.006 to 0.009), polysynthetic twinning (some pericline). Cleavage distinct on some grains. Biaxial (-) and (+), RI > epoxy.

89-417

Pelitic schist; composed of andalusite, biotite, muscovite, K-feldspar, plagioclase and quartz.

Foliated with some lamination by segregation of component minerals, particularly feldspar and biotite. Laminated aspect disrupted and crossed by diffuse lines of aggregates of andalusite grains in optical continuity. Sericite-rich clots are associated with the margins of andalusite.

Stained slab indicates very minor K-feldspar. No fluorescence under ultraviolet light.

Microscopic description:

Plagioclase; 25%, anhedral, (<.01 to 0.3 mm) irregular lensoidal grains oriented and deformed in foliation plane.

Biotite; 25%, anhedral, (<.01 to 0.5 mm), irregular bladed, foliated and cross foliated. Associated with muscovite and plagioclase. As inclusions in andalusite masses retaining foliation.

Muscovite; 10%, anhedral, (<.01 to 0.5 mm), irregular bladed, foliated. Associated with biotite and plagioclase. Not as inclusions in andalusite.

Muscovite/sericite; 15%, anhedral, (<.01 to 0.2 mm) irregular shaped sericite-rich clots foliated and felted (to several mm), crossing foliation. Conspicuous around andalusite masses.

Alteration dusting; associated with sericite/muscovite clots.

K-feldspar, <5%, indicated by stained slab, not confirmed in thin section.

Andalusite; 5%, anhedral, (to 0.2 mm), irregular grains disseminated throughout foliated groundmass. Also as larger porphyroblasts.

Porphyroblasts:

Andalusite; 15%, anhedral, (to >1.0 mm), (a) diffuse irregular interstitial masses in optical continuity cutting across foliation. Poikilitically enclosing biotite.

89-132

Carbonaceous pelitic schist/phyllite composed mainly of quartz, sericite/muscovite and carbonaceous material.

Thin laminated/lensoidal. Quartz laminae/lensoids in a foliated network of sericite/muscovite and separated by laminae of sericite/muscovite and carbonaceous laminae/partings.

Stained slab indicates absence of K-feldspar. Iron staining along foliation. No fluorescence under ultraviolet light.

Microscopic description:

Muscovite/sericite; 40%, anhedral, (<.01 to 0.15 mm), irregular grains, clusters of foliated grains forming discontinuous networks around quartz grains, lensoids and forming laminae. Laminae foliated along major foliation. However lensoids within these laminae and separated lensoids show strong "Z and S shaped" cross microfolds commonly in association with aggregates of quartz grains.

Quartz; 40%, anhedral, (<.01 to 0.3 mm), lenticular grains, aggregates forming lensoids, laminae separated by carbonaceous laminae, sericite/muscovite partings and laminae.

Carbonaceous partings; 20%, discontinuous lensoids and stringers, aggregates of microgranular opaque grains, surround quartz grains and lensoidal aggregates of grains and lensoids of microfolded sericite/muscovite within primary foliated sericite/muscovite laminae.

The carbonaceous stringers form minute slip surfaces.

89-143

Spotted pelitic schist/phyllite.

Composed of biotite, sericite/muscovite, quartz, plagioclase, spotted by cordierite porphyroblasts. Segregation of one or more of the mineral components into lensoids, laminae that are biotite/sericite-rich, quartz/feldspar-rich. Spotted throughout by cordierite porphyroblasts but show greatest concentration in micaceous laminae. Strong cross crinkling, secondary structure in sericite/biotite. Cross stringers of micas in quartz-feldspar laminae/lensoids.

Stained slab; indicates absence of K-feldspar. No fluorescence with ultraviolet light.

Microscopic description:

Muscovite/sericite; >30%, anhedral, (<.05 mm) minute foliated fibres, intermixing with light brown pleochroic biotite. Forms minutely foliated laminae. Conspicuous crinkling of laminae by cross folding.

Biotite; 15%, anhedral, (<.05 mm), minute foliated fibres, intermixing with non pleochroic, colourless muscovite/sericite. Iron staining masks sericite suggesting greater than actual biotite content. Conspicuous crinkling of laminae by cross folding.

Quartz; 20%, anhedral, (<.01 to .05 mm), irregular grains, aggregates of grains with plagioclase forming lensoids. Cut by cross stringers of mica, forming a network around grains.

Feldspar; 10%, anhedral, (<.01 to .05 mm), irregular grains, aggregates of grains with quartz forming lensoids. Cut by cross stringers of mica forming networks.

Carbonaceous partings; <5%, anhedral, microgranular aggregates of grains forming slip surfaces.

Porphyroblasts:

Cordierite; 20%, anhedral, (0.05 to 0.4 mm), ovoid spots (porphyroblasts) concentrated in micaceous laminae. Foliation passes right through. Deformed by secondary foliation/cross folds. Subtle pale bluish grey to slightly pinkish tint pleochroism in reduced light intensity. Biaxial (-).

89-274

Calc-silicate composed of carbonate.

Weakly layered, consisting of a groundmass of fine granular carbonate with interstitial clinozoisite/epidote, chlorite (?) and microgranular semiopaque dusting.

Stained slab indicates presence of K-feldspar as diffuse clots. No fluorescence in ultraviolet light.

Microscopic description:

Groundmass

Carbonate; 55%, anhedral, (<.01 to 0.15 mm), irregular grains, interlocking. Shows variation in relief (moderate to low) and slight yellowish pleochroism as stage is rotated in plane light.

Chlorite(?); <15%, anhedral, (<.01 to .05 mm), granular/bladed, irregular clusters of grains interstitial to carbonate (to 0.2 mm). Distinct yellow-brown colour, moderate relief, low birefringence.

Epidote/clinozoisite; 10%, anhedral, (<.01 to .05 mm), irregular clusters of grains clustered in clots gives a slightly laminated aspect. Associated with granular dusting. Moderate high relief, high birefringence with anomalous lower order colours. Yellow pleochroism.

Alteration:

Alteration dusting 15%, anhedral, (microgranular) semi-opaque associated with chloritic material interstitial to carbonate (?). Irregular aggregates in stringers giving the rock a layered aspect.

K-feldspar; <5%, anhedral, (<.01 to .05 mm?), clusters of scattered interstitial grains observed on stained slab. Not confirmed in thin section.

Veinlet:

Fine microgranular semiopaque material, epidote/clinozoisite, coarser crystalline carbonate.

89-418

(a) Pelitic schist. chlorite.

(b) Granitic impregnation?

Thin section two parts:

Pelitic schist composed of sericite, plagioclase, biotite, chlorite with mixing of minerals but segregated into layers relatively enriched in one or more of the mineral components.

Granitic impregnation (?); coarser grained quartz, plagioclase, K-feldspar, biotite, chlorite as segregation/vein. Composite nature shown by partial segregation.

Stained slab confirms K-feldspar in veinlets and impregnation. No fluorescence under ultraviolet light.

Microscopic description:

(a) Pelitic schist.

Sericite; >15%, anhedral, (<.01 to 0.1 mm), needle-like grains, foliated single grains and clusters of grains forming diffuse lensoids and wispy networks in plagioclase groundmass.

Biotite; 25%, anhedral, (<.05 to 0.5 mm), irregular bladed, foliated single grains and clusters of grains forming diffuse lensoids. Some cross foliation. Partial alteration to chlorite.

Chlorite; 20%, anhedral, (<.05 to 0.5 mm), irregular bladed, foliated single grains and clusters of grains forming diffuse lensoids. Some cross foliation. Associated with biotite.

Plagioclase; 30%, anhedral, (<.01 to .02 mm) irregular grains elongate in plane of foliation. Comprises most of the groundmass. Greatest concentration at walls of vein/segregation/impregnation.

Quartz; <10%, anhedral, (<.01 to 0.6 mm), clusters of irregular grains in schistose section associated with coarse impregnation.

Veinlets:

K-feldspar, with K-feldspar diffusion into walls

Veins and lensoids:

(b) Veins/segregations/impregnation. Feldspathic component has granitic texture with quartz impregnation.

89-41B Continued

Quartz; 35%, anhedral, (<.05 to 0.6 mm), aggregates of uneven grains. Cut through feldspathic component as diffuse veins, segregation.

Plagioclase; 35%, anhedral, (<.05 to 0.5 mm) irregular grains and clusters of grains and clusters of grains forming segregated masses with lesser amounts of the associated minerals. Sericitic alteration.

K-feldspar; 10%, anhedral, (<.05 to 0.5 mm), very irregular grains forming diffuse patches. Confirmed in stained slab.

Chlorite; 15%, anhedral, (<.05 to 0.4 mm), irregular bladed, clusters of grains fracture controlled.

Biotite; <5%, anhedral, (<.01 to 0.1 mm), widely scattered irregular grains, in diffuse clusters.

Apatite; traces, anhedral Uniaxial (-), high relief, low birefringence.

B9-108

Layered marble with pelitic component

Composed of irregularly layered/lensoidal carbonate, biotite, diopside with minor K-feldspar, quartz and tremolite. Segregation of one or more components to form carbonate-rich, biotite-rich, and diopside-biotite rich layers/lensoids.

Stained slab indicates K-feldspar. No fluorescence under ultraviolet light.

Microscopic description:

Groundmass

Carbonate (calcite); 40%, anhedral, (<.05 to 0.8 mm), irregular interlocking grains elongated along foliation. Forms carbonate-rich layers.

Biotite; 30%, anhedral, (<.01 to 0.6 mm), irregular bladed, as single grains and foliated masses. Forms wispy lensoids/networks, discontinuous partings in foliation plane. Bright red/brown/pale brown pleochroism.

K-feldspar; <10%, anhedral, (<.05 to 0.3 mm), irregular grains, scattered grains and clusters of grains in carbonate. Slight clouding by alteration. Has appearance of quartz but biaxial (-). Confirmed in stained slab.

Diopside; 15%, anhedral, (<.01 to >1.0 mm), irregular grains, clusters of grains forming diffuse masses.

Tremolite; <5%, anhedral/subhedral, (<.01 to 0.3 mm), elongate prismatic, inclined extinction biaxial (-).

Quartz; <<5%, anhedral, (<.01 to 0.2 mm), clusters of irregular grains. Similar in appearance to K-feldspar but confirmed by uniaxial (+) interference figure. Higher birefringence than K-feldspar.

Zoisite/epidote; suspected as minute granules but not confirmed.

89-265

Carbonaceous layered marble.

Strong layering/foliation by elongate grains and lensoids of carbonate (calcite) with very minor associated aggregates of K-feldspar in certain layers and quartz in others. Foliation enhanced by discontinuous partings/irregular lensoids of microgranular carbonaceous grains. Minor tremolite associated with carbonaceous material along foliation planes.

Stained slab indicates K-feldspar content in some layers. No fluorescence under ultraviolet light.

Microscopic description:

Carbonate; 55%, anhedral, (<.05 to 0.7 mm), irregular, foliated, elongate grains and aggregates of grains forming lensoids separated by carbonaceous partings.

Carbonaceous grains; 25%, microgranular aggregates forming partings and diffuse networks around carbonate lensoids. Producing foliation and layering.

Tremolite; 10%, anhedral, (<.01 to 0.3 mm), acicular, very irregular grains, clusters of grains associated with carbonaceous material, in and crossing foliation.

Quartz; >5%, anhedral, (<.01 to 0.3 mm), irregular, aggregates of grains forming lensoids in foliation plane.

K-feldspar; <5%, anhedral, (<.01 to 0.3 mm), irregular clusters of grains forming lensoids as for quartz. Confirmed by stained slab.

89-388

Marble; layered

Composed of carbonate, biotite, diopside with minor carbonaceous material, actinolite/tremolite, K-feldspar and plagioclase. Segregation of one or more of the mineral components into carbonate-rich, biotite-rich diopside-rich layers/laminae.

Stained slab indicates K-feldspar component as aggregates in certain laminae. No fluorescence under ultraviolet light.

Microscopic description:

Carbonate (calcite); 40%, anhedral, (<0.1 to >1.0 mm) irregular interlocking grains, elongate in plane of layers/laminae.

Quartz, suspected but not confirmed.

K-feldspar; <10%, anhedral, (<.05 to 0.25 mm), aggregates of grains forming lensoids.

Plagioclase; <5%, anhedral, (to 1.5 mm), irregular lath-like, single grains and clusters.

Diopside; 25%, anhedral, (.01 to 0.7 mm), irregular grains, aggregates of grains.

Epidote/clinozoisite; anticipated but not confirmed.

Carbonaceous material; microgranular aggregates most abundant associated with biotite.

Biotite; 10%, anhedral, (<.01 to 0.2 mm), irregular grains and clusters of foliated grains forming a few diffuse lensoids and partings.

Actinolite/tremolite; 10%, anhedral, (<.05 to 0.4 mm), irregular prismatic, clusters of grains. Pale green pleochroism

Accessory minerals:

Sphene; trace, anhedral, (0.1 mm), associated with diopside and actinolite/tremolite.

89-136 (Polished thin section)

Skarn; layered.

Consists of partially segregated layers relatively enriched in one or other of carbonate, diopside, zoisite/anisotropic garnet(?), epidote/clinozoisite and lesser wollastonite, quartz, chlorite.

Fine granular aggregates of diopside, (epidote/clinozoisite?), carbonate.

Stained slab; trace of potassium staining. Ultraviolet light shows no fluorescence. Scattered magnetic; opaques 2%, composed of: pyrrhotite, pyrite, chalcopyrite, sphalerite and hematite.

Microscopic description:

Carbonate (calcite); 20%, anhedral, (<.01 to 0.5 mm) scattered irregular coarser grains, diffuse masses of aggregates of fine grains (to several mm). Associated with diopside. Cataclastic.

Clinozoisite/zoisite(?); 20%, anhedral/euhedral, (<.01 to >1.0 mm), euhedral outlines, coarse grains. Biaxial (+) 2V 70 degrees and (-)! figures.!

Anisotropic garnet; ?%, Not confirmed.

Epidote/clinozoisite; 15%, anhedral, (<.01 to 0.5 mm), irregular clusters of grains. Anomalous blue birefringence. Faint yellowish pleochroism.

Wollastonite; <10%, subhedral, (0.1 to 0.5 mm), acicular/bladed, radiating. Low birefringence, parallel extinction, elongation (-).

Diopside; 25%, anhedral, (<.01 to 0.5 mm), irregular prismatic, and very fine granular aggregates. Intermixed with carbonate. Confirmed, biaxial (+) 2V 60 degrees.

Plagioclase; few grains suspected, not confirmed.

Aragonite (?); <5%, subhedral (<.05 to 0.5 mm) fibrous, acicular, microgranular appearance under x-nicols. Associated with calcite and wollastonite. High birefringence, near parallel extinction. [similar appearance to carbonate but acicular].

Chlorite; <5%, anhedral, (.01 to 0.15 mm), aggregates of grains (to 0.5 mm).

Microgranular dusting; very irregular stringers forming or following layering. Cataclasis.

89-136 Continued

Reflected light: Opaques 2%

Pyrrhotite; 1%, anhedral (<.01 to >2.0 mm), irregular grains, coarsest have diffuse sieve texture. Skeletal structures. Some grains in fracture fillings.

Pyrite; traces, anhedral, (to 0.5 mm), altered granular appearance. Zoned; pyrrhotite core, opaque material, layered "altered" pyrite outer shell.

Chalcopyrite; <.5%, anhedral, ;(.02 to 0.07 mm), irregular grains as clusters in gangue. One grain has common boundaries with pyrrhotite. Few with sphalerite.

Note: few chalcopyrite grains have bright yellow colour and poor polish which gives them a similar appearance to gold. Lack the characteristic uneven reflectance of gold. Not sectile under needle. Requires Au geochemical analysis.

Sphalerite; <.5%, anhedral, (<.01 to 0.15 mm), irregular grains, some with mutual boundaries with chalcopyrite

Hematite; trace, anhedral, (to 0.05 mm).

89-246

Skarn; layered

Layered/foliated, composed of anisotropic garnet?, carbonate, diopside with lesser epidote/clinozoisite, and minor quartz, K-feldspar.

Stained slab shows few irregular clusters of K-feldspar. No fluorescence.

Microscopic description:

Anisotropic garnet?; 30%, euhedral/anhedral, (to several mm) Rhomb-like outline of crystal faces; well developed zoning. Forms irregular elongate lensoidal masses producing layering. Locally interlaminated with carbonate. Biaxial (-), low birefringence. Looks like grossularite or vesuvianite but optical properties do not fit.
Note: One isotropic euhedral grain, (0.25 mm).

Carbonate 25%, anhedral, (.01 to >1.0 mm) forms irregular diffuse lensoids and networks.

Chlorite; <5%, anhedral/subhedral, (.05 to 0.3 mm), bladed radiating.

Quartz; <5%, anhedral, (<.01 to 1.0 mm), clusters of irregular grains.

Diopside; 30%, anhedral, (<.01 to 0.4 mm), irregular grains, clusters of small grains associated with carbonate forming irregular layers, lensoids.

Epidote/clinozoisite; 5%(?), anhedral, (to 1.0 mm), scattered clusters of grains. Anomalous interference colours.

K-feldspar; <5%, anhedral, (<.01 to 0.2 mm) irregular grains associated with light yellow brown felted patches of alteration (mixtures of chlorite and sericite ?)

89-257

Skarn;

Layered; medium to coarse grained, interlocking grains of garnet(?), vesuvianite, carbonate, diopside.

Stained slab indicates no K-feldspar. Fresh surfaces show no fluorescence.

Microscopic description:

Vesuvianite; 10%, euhedral, (0.1 to 1.5 mm) clusters of crystals, colourless. Close association with garnet. Zoned. Uniaxial (-). Moderate (+) RI. Low birefringence, anomalous blue grey.

Carbonate; 30%, anhedral, (<.05 to >1.0 mm) interstitial masses of aggregates of irregular grains. Associated with diopside.

Garnet(?); 25%, subhedral, (to several mm) colourless in thin section, pale cream-brown in hand specimen. Forms large masses (to many mm). Locally isotropic, generally anisotropic giving indistinct biaxial (-) large 2V interference figure.

Diopside; 25%, anhedral, (<.01 to >1.0 mm), single grains, aggregates of grains. Biaxial (+) 2V 60 degrees

Quartz; <1%, anhedral, (.01 to 0.2 mm), aggregates of grains forming interstitial clusters (to 2+ mm). (Not confirmed by interference figures). Untwinned plagioclase?

Microgranular dustings; <10%, very irregular lensoids, partings, largely calcareous. Cataclasis?

89-146

Intense alteration of amphibolite (?)

Amphibolite (altered hornblende?), orbicular, weakly layered, showing a range of replacement of amphibole grains, (<.05 to several mm), from:

(a) Irregular grains of amphibole, ragged outline, near colourless with faint patches of pleochroism. Consists of single grains or aggregates of anhedral grains in varied orientation. Some partial replacement by chlorite, carbonate and opaque grains.

(b) Acicular/fibrous secondary amphibole in felted and parallel oriented masses:

(i) Replacing earlier amphibole as felted masses. (Some with appearance of sericite, but grains checked have inclined extinction). Some partial replacement by chlorite, carbonate and opaque grains.

(ii) Acicular/fibrous grains in parallel orientation rimming cores of former amphibole replaced by felted chlorite and associated opaque grains.

(c) Chlorite replacement of secondary acicular/fibrous amphibole. Varied degrees of replacement from partial to total. Cut by networks of veinlets of fibrous chlorite, perpendicular to veinlet walls (shrinkage cracks?). Aggregates of minute opaque grains.

Interstitial clots of carbonate, plumose chlorite. Opaque grains as single anhedral grains; regular and diffuse veinlets and stringers. Magnetic, magnetite.

Few scattered grains altered mica(?) amphibole(?) with a very fine/microgranular texture. Pleochroic from reddish brown to black.

Stained slab indicates no K-feldspar. No fluorescence. See photomicrograph.

89-271 (Polished thin section)

Porphyritic amphibole (hornblende), metadiorite.

Clusters of fine/medium grained altered amphibole grains (with ragged terminations) form glomerophenocrysts in a groundmass of interlocking albitized plagioclase. The amphiboles are composed of (a) colourless grains, (b) pale green pleochroic fibrous grains with later some association with sphene/leucoxene/ilmenite and chlorite. The matrix contains some plagioclase with remnant twinning but is mainly featureless albitic (?) grains. Epidote occurs as clusters of very fine and fine to medium grains.

Staining shows no K-feldspar.

No fluorescence. Non magnetic. Opaques 1%, ilmenite, trace magnetite (?), trace pyrite.

Microscopic description:

Phenocrysts:

Amphibole; 35%, anhedral, (<.05 to 2.0 mm), irregular grains with ragged termination. Clusters of grains, (several mm across), produce a coarse spotted appearance. (a) Amphibole colourless and (b) actinolite (?), and chlorite. Both may be a result of alteration of hornblende.

Groundmass:

Plagioclase; 35%, anhedral/subhedral, (<.05 to 0.5 mm). Scattered subhedral grains showing remnant twinning. Most grains are indistinct, irregular in outline, featureless, interstitial aggregates of grains. Albitic alteration (?). Twinned grains indicate composition in andesine range. Note untwinned grains approximately the RI of epoxy or less.

Alteration:

Epidote; >15%, anhedral, (<.01 to 0.6 mm), clusters of coarser grains; (to >1.0 mm) and aggregates of very fine grains and disseminations throughout groundmass.

Sphene/leucoxene; 1%, anhedral, (<.01 mm), aggregates of minute grains in clusters associated with opaques.

Sericite; <1%, anhedral, (<.05 mm), aggregates of grains forming small clusters with epidote in feldspathic groundmass.

Chlorite; <5%, anhedral, (to 0.2 mm), bladed radiating interstitial, associated with amphibole.

Carbonate; <1%, anhedral, (<.01 to 0.1 mm), irregular grains scattered throughout matrix.

89-271 Continued

Amphibole; colourless and pale green pleochroic as indicated above.

Reflected light:

Opaques; >1%, associated with sphene/leucoxene.

Ilmenite; 1%, anhedral, pleochroic, anisotropic. As blebs in magnetite.

Magnetite (?); trace, anhedral, with ilmenite very light bluish grey, isotropic.

Pyrite; traces, anhedral, (<.01), minute grains in ilmenite. Isolated grain in gangue.

89-178 A

Hornblende/biotite plagioclase schist.

Foliated amphibole (altered hornblende) minor biotite lensoids/laminae in a fine laminated plagioclase (very minor quartz) groundmass.

Minor sericitic alteration of plagioclase. Very minor chlorite. The amphibole (hornblende) has been altered to (?) nonpleochroic amphibole. Plagioclase is largely recrystallized (albitic?).

Stained slab does not indicate K-feldspar. Etching shows high plagioclase and very low quartz content. No fluorescence. Nonmagnetic. Opaque 1% ilmenite.

Microscopic description:

Amphibole (hornblende); 40%, anhedral, (<0.1 to >3.0 mm), deformed into lensoidal shapes in foliation plane. Some segregation as clusters of grains forming lensoidal laminae. Two varieties:
(a) pale green pleochroic, 20%.
(b) colourless, nonpleochroic, 20%.

Plagioclase; 35%, anhedral, (<.01 to 0.2 mm), interstitial to amphibole and biotite. Segregated into lensoids, laminae forming networks around amphibole. Locally very fine sericitic patches. Indicated composition is albitic (RI (-)). Some relief differences indicate mixing with quartz.

Biotite; <10%, anhedral, (<.05 to >1.0 mm), aggregates of foliated grains. Intermixed in some layers with amphibole. Minor chloritic alteration.

Quartz; <10(?)%, anhedral, (<.01 to 0.02 mm), as for plagioclase. Not conspicuous. Evident by difference in RI with plagioclase.

Sericite; <5%, anhedral, (<.01 to 0.05 mm), aggregates of grains. Alteration of plagioclase groundmass.

Chlorite; <1%, anhedral, (<.05 to 0.2 mm), clusters of foliated grains associated with biotite and amphibole.

Sphene/leucoxene; 1%, anhedral, aggregates of microgranular grains. Commonly associated with opaques (ilmenite).

Opaque, ilmenite; 1%, anhedral, (<.01 to 0.5 mm), irregular grains, aggregates of grains forming small lensoids along foliation and as disseminated grains and clusters of grains.

89-211

Amphibolite/hornblende, diopside(?), biotite, schist.

Laminated/lensoidal foliated schist with component minerals, as foliated lensoids, segregated into laminae. Hornblende lensoids show partial alteration to pale mica. Pyroxene (diopside(?)) is segregated into layers/lensoids in plagioclase laminae. Biotite forms diffuse lensoids in certain laminae associated with plagioclase and hornblende.

Stained slab gives a suggestion of staining but not conclusive for K-feldspar. No fluorescence on fresh surfaces.

Microscopic description:

Amphibole (hornblende); 35%, anhedral, (<.05 to 1.75 mm), irregular lensoidal grains, clusters of foliated grains. Acicular radiating clusters locally. Some alteration to pale micaceous mineral.

Pyroxene (augite/diopside); <15%, anhedral, (<.05 to >1.0 mm), irregular grains, broken aggregates. Segregated into lensoidal aggregates in plagioclase-rich laminae.

Plagioclase; 40%, anhedral, (<.05 to 0.3 mm), irregular grains, elongate, some lens shaped, as aggregates of grains segregated into lensoids and laminae. Associated with all other components.

Biotite; 5%, anhedral, (<.05 to 1.0 mm), bladed, single and clusters of grains forming lensoids in foliation.

Quartz; <5%, anhedral, (<.05 to 0.2 mm), suspected because of differences in relief in plagioclase-rich laminae.

Alteration:

Mica (sericite?) <5%, anhedral, (<.01 to 0.2 mm), bladed/plumose, mixed with very fine granular. Alteration of hornblende. Pale greenish-brown, slightly pleochroic to near colourless. High birefringence.

Sphene/leucoxene; <1%, dustings of microgranular grains associated with ilmenite in hornblende.

Opaque; 2%, anhedral, (<.01 to 0.1 mm), elongate aggregates of irregular grains (to >2.0 mm) along foliation. Some associated with sphene/leucoxene. Ilmenite.

89 211 Continued

Veinlets;

Hornblende, pyroxene (diopside), with hornblende crossing hornblende and plagioclase laminae and pyroxene crossing plagioclase and pyroxene laminae. Recrystallization rather than introduction of materials.

B9-270

Amphibolite:

Predominantly fine grained felted (secondary?) amphibole with scattered pyroxene remnants with clusters of amphibole grains partially separated by a partial network of very fine granular epidote. Minor plagioclase forming interstitial groundmass.

Stained slab indicates no K-feldspar; etching confirms plagioclase. No quartz. Opaque 1%, ilmenite. No fluorescence.

Microscopic description:

Amphibole (altered hornblende); 50%, anhedral, (<.05 to >1.0 mm), (a) secondary acicular prismatic to locally fibrous, felted. Very pale greenish tint, pleochroic. (b) Coarse grained amphibole remnants, some contain pyroxene cores.

Pyroxene (augite?); 20%, anhedral, (<.05 to >1.0 mm), as crystals partially replaced by amphibole. Cores in amphibole crystals and crystal clusters. Obtained excellent biaxial (+) 2V 50 (+) degrees interference figures confirming pyroxene.

Groundmass:

Epidote (?) 15%, anhedral; (microgranular to .02 mm), aggregates of grains forming discontinuous networks.

Sphene/leucoxene; <5%, anhedral, (to >1.0 mm), microgranular texture, irregular clots associated with opaques (ilmenite).

Plagioclase; 10%, anhedral, (to 0.3 mm), very irregular interstitial, mottled extinction, otherwise featureless. Associated with granular epidote.

Opaques; 1%, anhedral, (<.01 to 0.1 mm) forming aggregates of grains to (0.5 mm). Associated with microgranular sphene/leucoxene.

89-395 (Polished thin section)

Amphibolite/amphibole plagioclase schist

Foliated, segregated laminae composed of lensoids of first and second stage amphibole. Separated by laminae of lensoidal aggregates of epidote, plagioclase with some intermixed quartz, amphibole and chlorite. Scattered clots of sphene/leucoxene

Stained slab indicates no K-feldspar. No fluorescence. Nonmagnetic. Opaques; 5%, ilmenite, magnetite, chalcopyrite, hematite, pyrite, sphalerite.

Microscopic descriptions:

Amphibole, 30%

(a) colourless, anhedral, (<.05 to 1.5 mm), mottled by green pleochroic.

(b) green, anhedral, (<.05 to 0.5 mm), pleochroic, green, blue green, bladed acicular/fibrous.

Feldspar (plagioclase); 20%, anhedral (<.01 to 0.2 mm), irregular grains, aggregates of grains, intermixed with abundant epidote grains, minor quartz.

Quartz; <10%(?), anhedral, (<.01 to 0.2 mm), minor quartz indicated by differences in relief with plagioclase.

Epidote/clinozoisite; 25%, anhedral, (<.01 to 0.2 mm), as abundantly disseminated single grains and aggregates of grains throughout plagioclase-rich laminae. Mixed with aggregates of plagioclase, fine amphibole, chlorite; deformed into lensoidal shapes.

Chlorite; <10%, anhedral, (<.05 to >0.1 mm), aggregates of bladed/plumose radiating grains (to >1.0 mm).

Sphene/leucoxene; <5%, anhedral, (microgranular to <.01 mm), clouded aggregates of grains, (to >1.0 mm), associated with ilmenite.

Apatite; traces, anhedral (to 0.1 mm), irregular grains, aggregates. Uniaxial (-).

89-395 Continued

Reflected light:

Opagues 5%

Ilmenite; <5%, anhedral, (<.01 to 0.6 mm) irregular grains, aggregates of grains associated with sphene. Pinkish grey tint, anisotropic.

Magnetite; traces, anhedral, (to 0.7 mm), irregular grains.

Chalcopyrite; trace, anhedral, (<.01 to .15 mm), irregular grains in gangue and aggregates of grains in close association to ilmenite.

Hematite; trace, anhedral, (to 0.2 mm), contains minute blebs of pyrite. Some skeletal grains. Internal reflection.

Pyrite; traces, anhedral, (<.01 mm), minute blebs in hematite.

Sphalerite; trace, anhedral (0.1 mm), internal reflection.

89-353

Amphibole, biotite, chlorite schist.

Foliated, but no marked segregation of component minerals into laminae.

Predominantly radiating amphibole with clots of biotite, chlorite/clinochlore with interstitial masses of plagioclase obscured by fine grains of amphibole and sericite. Clusters of grains (porphyroblasts) unconfirmed tourmaline.

Stained slab shows no K-feldspar. No fluorescence. Opaques <5%, very weak magnetic, pyrite, magnetite.

Microscopic description:

Biotite; <15%, anhedral, (<.01 to >1.0 mm), regular laths, very irregular basal section outlines. Basal sections contain fine radiating acicular amphibole. Biaxial (-) 2v <10

Tourmaline (?); >5%, Basal sections mottled brown and pale green/faint bluish cast may be tourmaline. Not confirmed by maximum absorption parallel to analyser direction. Noted no prismatic grains other than biotite.

Amphibole; 50%, anhedral, (<0.1 to 0.8 mm), bladed/plumose foliated and radiating. Very pale green/colourless, very weak pleochroic. Biaxial (-) 2v 80 degrees, inclined extinction. Shows characteristic cleavage in end section.

Chlorite/clinochlore; 15%, anhedral/subhedral, (<.05 to 0.5 mm), bladed plumose. Forms large interstitial masses (to many mm across). Surrounds and forms a broad, diffuse, interstitial network among clusters of amphibole.

Plagioclase; <10%, anhedral interstitial clots, (to several mm), obscured by abundant very fine, (<.01 to .05 mm), grains of amphibole and sericite. Interstitial to clusters of coarser grains of amphibole.

Muscovite; <5%, anhedral, (<.01 to 0.3 mm), in small interstitial clusters of radiating grains and scattered coarser grains in chlorite/clinochlore.

Apatite; traces, subhedral, (to 0.3 mm).

Opaque; <5%, subhedral, (<.01 to 0.2 mm), irregular grains and rods.

89-178 B

Amphibole/pyroxene schist

Foliated, segregated lensoids of coarse amphibole, finer pyroxene and micas forming laminae. Contains interstitial clots of foliated chlorite/clinozoisite and sericitized plagioclase.

Stained slab indicates traces K-feldspar. No fluorescence. Opaques 1%

Microscopic description:

Amphibole; 40%, subhedral, (<0.1 to >5 mm) elongate prismatic, clusters of foliated grains. Segregated into layers. Some grains contain pyroxene cores. Characteristic cleavage in cross section. Biaxial (-), 2V 80 degrees

Biotite/phlogopite; 15%, anhedral/subhedral, (<.05 to >1.0 mm), foliated lensoids, although cleavage traces of clusters are, in many cases, across the foliation. Associated with chlorite/clinochlore.

Pyroxene (hedenbergite(?), diopside(?)); 25%, anhedral, (<.05 to >2.0 mm), segregated into layers, lensoids. Also as remnant cores in amphibole. Biaxial (+) 2V 70 degrees. Twinning. Cleavage @ 87 degrees. Angular extinction 43 degrees RI > amphibole. May be hedenbergite but RI low?

Chlorite/clinochlore; 10%, anhedral (<.05 to >1.0 mm), bladed/acicular outlines, aggregates of foliated grains forming lensoids in plane of foliation. Associated with micas.

Plagioclase; <5%, anhedral, (<.05 to 0.3 mm), clusters of interlocking grains, obscured by sericitic alteration and secondary amphiboles.

K-feldspar; not confirmed in thin section.

Andalusite; anticipated, not confirmed.

Sphene; trace, anhedral, (<.3 mm), as isolated grain, microgranular texture, reddish-yellow-brown to pale brown pleochroic. Maximum absorption parallel to analyser direction?. Twinned.

Carbonate; trace, anhedral,

Opaques: 1%, anhedral, (<.01 to 0.1 mm), those associated with sphene are probably ilmenite.

Veinlets: Hematite.

— should be 205
89-204 (Polished thin section)

Chlorite schist

Predominantly chlorite as aggregates of plumose felted grains. Cut by quartz veins, impregnations which produce local layering. There are varied concentrations of sericitic inclusions passing through adjacent quartz grains along preexisting foliation.

Stained slab indicates no K-feldspar. No fluorescence. Nonmagnetic. Trace of copper staining. Iron staining. Opaques; hematite, chalcopyrite, pyrite.

Microscopic description:

Chlorite; 65%, anhedral (<.01 to 0.3 mm), plumose, felted. Cut by veins and impregnations of quartz which imparts a local layering.

Undetermined "Y"; traces, anhedral, (0.1 to 0.2 mm), semiopaque, internal reflection.

Veins and segregations:

Quartz; 20%, anhedral, (to several mm), veins, segregations, impregnations. Locally cuts into chloritic mass along preferred direction forming local layering. Contains varied amounts of sericite which locally forms alignments/foliation through adjacent grains along some preexisting foliation? Suspected feldspar.

Malachite; traces, clusters of grains

Sericite; traces, clusters of minute grains along the margins of quartz segregations, veins.

Reflected light:

Opaques >10%

Hematite; 10%, anhedral, (to >1.0 mm), mottled blue grey and grey masses, composite veinlets shades of blue grey. Strong red and red orange internal reflections. Filling hairline fractures, some vugs filled with hematite others by opaques rimmed by hematite.

Pyrite; 1%, anhedral, (<.01 to 0.1 mm), irregular grains; remnants in hematite. Veined and partially replaced by hematite.

Chalcopyrite; 1%, anhedral, (<.01 to 1.0 mm), veined and partially replaced by hematite.

89-204 Continued

Undetermined "Y"; traces (0.1 to 0.2 mm), semiopaque, good reflectance, very pale grey-white, strong internal reflection. Nonmetallic.

89-422

Protomylonite

Layered by cataclasis. Groundmass is predominantly foliated cataclastic plagioclase grains. Coarser lensoidal grains and aggregates of grains of plagioclase and lesser quartz lie along the foliation. The feldspathic groundmass contains diffuse stringers, lensoids of sericite. Biotite with some intermixing with tourmaline forms similar diffuse stringers and lensoids as well as a diffuse network of veinlets. Near monomineralic cataclastic tourmaline grains from large irregular stringers and lensoids to several cm along foliation.

Stained slab indicates K-feldspar in hairline veinlets following and crossing foliation.

No fluorescence. Nonmagnetic.

Microscopic description:

Plagioclase; 40%, anhedral/cataclastic, (<.01 to 0.3 mm), aggregates of very fine cataclastic grains foliated. Clouded by microgranular dusting. Contains single lensoidal grains and aggregates of coarser grained plagioclase. Also similar coarser grained lensoidal aggregates of quartz.

Quartz; 15%; anhedral/cataclastic, (<.05 to >0.5 mm), lensoidal outline. As scattered coarser lensoidal grains and aggregates of grains forming lensoids/discontinuous laminae (to several mm). Visible within etched plagioclase laminae on stained slab. Relatively unaltered as compared to plagioclase but strained extinction.

Biotite; 5%, anhedral (<.01 to .05 mm), shredded grains, aggregates of grains forming segregations and diffuse, wispy discontinuous networks through cataclastic matrix. Note: some intermixing with tourmaline but presence of biotite confirmed by maximum absorption parallel to polarizer direction.

Sericite; <5%, anhedral, (<.01 to .05 mm), shredded grains, aggregates of grains forming diffuse lensoids, stringers in and among plagioclase.

Tourmaline; 30%, anhedral cataclasis (<.01 to 0.2 mm), broken grains but in aggregates of grains forming irregular lensoidal partings/laminae along cataclasis foliation.

Similar in appearance to biotite but higher RI, mottled pale greenish and medium brown tints. Prismatic grains give maximum absorption parallel to analyser direction. Forms larger lensoidal near monomineralic masses (several cm long and a few cm wide).

89-422 Continued

Carbonaceous material, 5%, microgranular aggregates of opaque grains forming diffuse irregular partings along foliation planes.

Veinlets:

K-feldspar as indicated by stained slab.