

Vancouver Petrographics Ltd.

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J.K. Mortensen,
November 19, 1982.

Mr. S. Main,
Archer, Cathro, and Associates (1981) Ltd.,
510 West Hastings St.,
Vancouver, B.C.

Dear Sir:

Enclosed are petrographic descriptions for 13 thin sections and 9 polished thin sections from samples that you submitted to us recently. The results of the examinations are summarized below:

Thin Sections:

Sample No. 25635, ~~45~~⁵⁵, 59, 76: quartz-muscovite schist. All but No. 25676 are carbonaceous, and therefore definitely sedimentary in origin.

Sample No. 25664: quartz-plagioclase (+ mafic) porphyritic metavolcanic.

Sample No. 25640: metamorphosed quartz porphyry or bimodal quartz grit.

Sample No. 25637, 672, 709, 712: quartz-chlorite-muscovite schist. Samples 25637, 709, and 712 contain abundant carbonate or carbonaceous material, and are definitely metasediments. Compositionally the rocks may contain a volcanic component, but no relict igneous textures are preserved.

Sample No. 25701: impure carbonaceous marble.

Sample No. 25639: metamorphosed hornblende diorite.

Sample No. 25702: altered albite-pyrite-siderite-chalcedony vein assemblage.



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Polished Thin Sections:

Sample No. 25655, 714: quartz-muscovite schist with variable amounts of pyrite. Well banded; derived from a banded pyritic rock.

Sample No. 25710: pyritic quartz-chlorite-muscovite schist. Much limonite after pyrite. Well banded. Appears to have been a cherty rock originally (tuffaceous pyritic chert?)

Sample No. 25685, 698, 706: quartz-muscovite schist with abundant limonite after primary pyrite. Trace amount of galena and sphalerite.

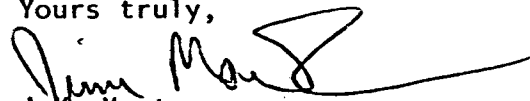
Sample No. 25688: quartz-chlorite-muscovite schist with abundant limonite after pyrite.

Sample No. 25686: mainly limonite and sulfides (pyrite, chalcopyrite, galena, sphalerite, and covellite). Covellite is present as a supergene sulfide enrichment.

Sample No. 25641: metamorphosed medium-grained mafic to intermediate composition igneous rock.

If you have further questions concerning these specimens, please contact me at 228-2804.

Yours truly,



J. K. Mortensen
Vancouver Petrographics

Sample No. 25635

<u>mode:</u>	quartz	65-70%
	muscovite	30-35%
	opaques	6-8%

The rock is a carbonaceous quartz-muscovite phyllite. It consists of very finely recrystallized quartz with abundant schistose muscovite-rich bands. A vague compositional layering, defined by relative amounts of quartz, muscovite, and opaque minerals, is present in the rock, parallel to the main foliation. The opaques are fine-grained carbonaceous material.

The early foliation is deformed into microlithon structures related to two distinct crenulation cleavages that cut the early fabric at a high angle.

Sample No. 28637

<u>mode:</u>	quartz	30-35%
	chlorite	30-35%
	carbonate	15-20%
	muscovite	6-8%
	plagioclase	4-5%
	limonite	4-5%
	opaques	1%

The rock is a fine-grained quartz-chlorite-carbonate-muscovite schist. There is a well-developed compositional layering on a scale of 2 to 10 mm that parallels the metamorphic foliation defined by chlorite and muscovite alignment. Most of the rock consists of a fine-grained mass of felted chlorite and minor muscovite, plus carbonate and scattered quartz grains. This material is traversed by bands of recrystallized quartz and plagioclase (albite) with minor muscovite.

Limonite occurs throughout the section, along grain boundaries and as irregular structureless masses. It is commonly associated with opaque grains, at least some of which are pyrite, but also occurs separate from the opaques.

The high chlorite content of the rock suggests that it may be derived from a volcanic parent, or from a sediment with a significant volcanoclastic component.

Sample No. 25639

<u>mode:</u>	actinolite	40-45%
	epidote	40-45%
	chlorite	6-8%
	sphene	2-3%
	hornblende	1-2%
	quartz	1-2%
	apatite	trace
	limonite	trace
	zircon	trace
	opaques	trace

The rock is a very strongly altered, medium-grained equigranular igneous rock. The only relict minerals present are pale brown pleochroic hornblende and rare apatite prisms. The remainder of the specimen consists of roughly aligned pale green, slightly pleochroic actinolite with minor intergrown chlorite, and finely crystalline masses of epidote and minor quartz. Primary hornblendes are overgrown and partly replaced by actinolite. The epidote masses appear to be pseudomorphing primary plagioclase. Sphene occurs as irregular masses to 2 mm in diameter that commonly surround opaque minerals. The opaques are probably primary ilmenite, and the sphene is an alteration of it. Rare pleochroic halos are visible in some of the actinolite around very small irregular high relief grains that are probably zircon.

The specimen originated as an intermediate or mafic medium-grained igneous rock, probably a hornblende diorite. It has been metamorphosed at middle greenschist facies.

Sample No. 25640

<u>mode:</u>	quartz	60-65%
	muscovite	30-35%
	limonite	2-3%
	plagioclase	trace
	opaques	1-2%

The rock is a quartz-muscovite schist. Compositional layering on a scale of 1 to 2 mm is pronounced (defined by relative proportions of quartz and muscovite) with a well-developed metamorphic foliation parallel to it. A second crenulation cleavage is visible at a high angle to the layering.

The majority of the rock consists of very finely-recrystallized quartz, commonly with muscovite along grain boundaries, interbanded with limonite-stained muscovite schist. Anhedral, strongly strained quartz grains to 3 mm in diameter occur throughout the quartz-rich bands, and make up roughly 15% of the rock. The grains show incipient recrystallization locally along their borders.

Limonite occurs as irregular masses, and also as partial replacements of euhedral pyrite grains and grain aggregates to 3 mm in diameter.

The rock appears to be derived from a quartz grit, although in view of its bulk composition and the recrystallized nature of the quartz eyes, a felsic volcanic protolith is not impossible.

Sample No. 25641

<u>mode:</u>	chlorite	25-30%
	stilpnomelane	25-30%
	sphene	12-15%
	apatite	4-5%
	quartz	4-5%
	limonite	4-5%
	epidote	2-3%
	muscovite	1%
	opaques - ilmenite	12-15%
	chalcopyrite	2-3%
	pyrite	1%
	hematite(?)	trace

The rock consists mainly of a felted mass of pleochroic green chlorite and brown stilpnomelane with irregular patches of recrystallized quartz and scattered grains of epidote, muscovite, and limonite. In this are set fractured euhedral crystals of apatite to 3 mm in length, and corroded, elongate, commonly bent ilmenite laths to 4 mm in length. There is a vague compositional layering in the section, defined by the abundance of ilmenite. In the ilmenite-rich bands (up to 30% ilmenite) the laths are roughly aligned; in the remainder of the section the laths are randomly oriented. A narrow rim of leucoxene surrounds each ilmenite grain as an alteration product.

Chalcopyrite occurs as irregular grains and scattered grain aggregates to 0.3 mm in diameter throughout the rock. It also occurs as very finely-disseminated grains in the leucoxene rims on some of the ilmenite grains. Irregular clusters of fine pyrite grains to 0.4 mm in diameter are present throughout the section. These occur within masses of limonite, which presumably represent pseudomorphs after partially or wholly altered single pyrite grains.

The origin of the rock is uncertain. It is unfoliated, but the mineral assemblage indicates that it has been recrystallized at middle greenschist facies. Some of the chlorite masses preserve subhedral outlines, indicating that they are pseudomorphing primary olivine. It is probably that the sample was originally a medium-grained igneous rock. The abundance of ilmenite and its apparent alignment remains problematical. The rock was metamorphosed at greenschist facies. The origin of the sulfides, whether primary or introduced at some later time, is uncertain.

Sample No. 25659

<u>mode:</u>	quartz	75-80%
	muscovite	20-25%
	limonite	1%
	chlorite	trace
	opaques	2-3%

The rock is a very strongly foliated carbonaceous quartz-muscovite schist. It consists primarily of finely recrystallized quartz with scattered aligned muscovite flakes and narrow discontinuous bands of fine-grained muscovite. Average grain size of the quartz is about 0.1 mm. Elongate laths and irregular grain aggregates of opaque minerals (mainly carbonaceous material) to 1 mm in length occur in quartz-rich bands, commonly associated with fine anhedral grains of limonite.

A weak crenulation cleavage cuts the compositional layering and early-formed fabric at a low angle (less than 10 degrees) and locally deforms the muscovite bands into microlithon structures.

The rock originated as a carbonaceous sediment.

Sample No. 25664

<u>mode:</u>	quartz	65-70%
	muscovite	15-20%
	K-feldspar	4-5%
	chlorite	4-5%
	sphene	1%
	limonite	trace
	opaques	1-2%

The rock is a very fine-grained quartz-feldspar-muscovite-chlorite phyllite with abundant quartz and plagioclase eyes. The quartz eyes are 0.1 to 2 mm in diameter, and are typically rounded to sub-rounded. They are strongly strained, and show incipient recrystallization along their borders. The plagioclase is albite, and forms stubby anhedral to subhedral grains to 1 mm in diameter that are strongly sericitized. Fine-grained elongate intergrowths of sphene and opaques to 1 mm in length occur throughout the section. These are alteration products of primary ilmenite laths.

The groundmass of the rock consists of a very fine-grained schistose mass of quartz, K-feldspar, chlorite, and limonite. Chlorite also occurs as elongate fine-grained, felted masses that are probably alteration of coarse-grained primary mafic minerals. The foliation defined by alignment of mica and chlorite flakes wraps around the quartz and feldspar eyes. Only one foliation is present in the section.

The protolith for the sample is felsic volcanic (quartz-feldspar-mafic(?) porphyry) or possibly a crystal tuff.

Sample No. 25665

<u>mode:</u>	quartz	75-80%
	muscovite	18-20%
	limonite	1-2%
	pyrite	2-3%

The rock is a pyritic, fine-grained quartz-muscovite schist. It displays a pronounced compositional layering (defined by the relative abundance of quartz and muscovite), with a well-developed metamorphic foliation parallel to it (defined by the alignment of mica). The quartz is wholly recrystallized with an average grain size of 0.1-0.2 mm. Muscovite occurs as narrow, very elongate blades to 0.4 mm long. Limonite is present along grain boundaries, particularly in the mica-rich bands.

The only opaque mineral present is pyrite. It occurs as euhedral grains and grain aggregates to 2 mm in diameter. It tends to be concentrated in individual bands, but is distributed rather erratically in the bands, never making up more than 20% of any single band.

The compositional layering and main foliation are strongly deformed by a later crenulation cleavage that is developed at a high angle to the early fabric. No new growth of minerals is associated with the crenulation cleavage.

Sample No. 25672

<u>mode:</u>	chlorite	45-50%
	muscovite	20-25%
	quartz	12-15%
	limonite	12-15%
	opagues	1-2%

The rock is a strongly altered fine-grained chlorite-muscovite-quartz phyllite. There is a vague compositional layering on a scale of 1 - 2 mm, defined by relative proportions of chlorite and limonite. The specimen consists mainly of a fine-grained, weakly schistose, felted mass of brownish chlorite and muscovite with scattered grains of partly recrystallized quartz. Limonite occurs as scattered irregular masses throughout the rock, presumably as an alteration of fine-grained pyrite. It also occurs as rims on euhedral pyrite porphyroblasts to 0.5 mm in diameter.

The composition of the rock suggests derivation from a volcanic or volcanoclastic protolith.

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Sample No ~~25645~~

<u>mode:</u>	quartz	50-55%
	opaques	40-45%
	muscovite	3-4%

The rock is a very complexly deformed, fine-grained, carbonaceous, micaceous quartzite. There is a vague compositional layering visible in hand sample, but in thin section this is seen to be the net result of intense deformation of what may have been primary layering. The deformed layering is between quartz-rich bands and carbonaceous bands. The quartz-rich bands are very finely recrystallized (average grain size less than 0.1 mm) and fine muscovite flakes commonly occur along grain boundaries.

The nature of the deformation is uncertain. Lithon structures are locally developed that would suggest that the most pronounced compositional layering in the rock (parallel to the length of the section) is a second-phase deformation fabric. Also, muscovite flakes are locally bent around these lithon structures. It appears that the rock was relatively incompetent due to the abundant carbonaceous material, and the superimposed deformation events produced the complex patterns seen in the section.

The rock originated as a highly carbonaceous quartzose sediment, either as a siltstone or an impure chert.

Sample No. 25676

<u>mode:</u>	quartz	65-70%
	muscovite	30-35%
	chlorite	trace
	limonite	trace
	opaques	1%

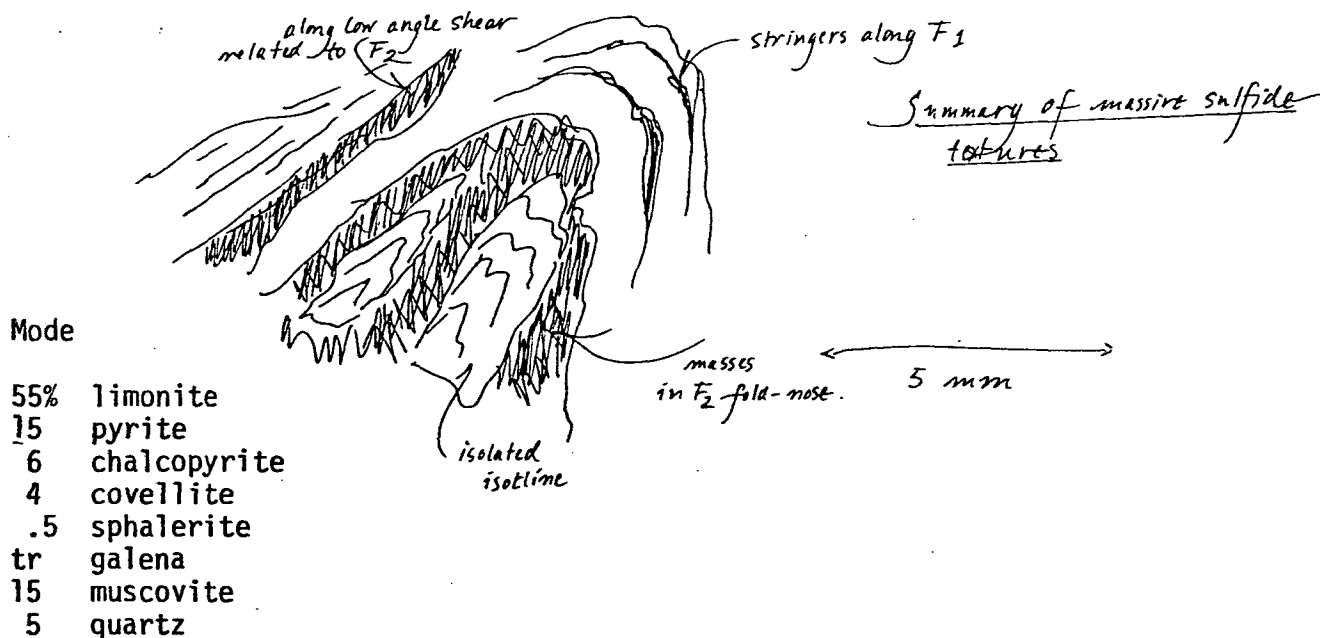
The rock is a very strongly foliated fine-grained quartz-muscovite schist. It consists of very finely recrystallized quartz with discontinuous fine-grained interbands to 1 mm thick of aligned muscovite flakes. Trace amounts of limonite occurs as scattered grains throughout the rock. Some of these show euhedral outlines, and are pseudomorphs after primary pyrite. Euhedral pyrite grains to 1 mm in diameter are also present. These grains commonly display narrow quartz (and rare chlorite) pressure shadows.

The rock originated either as a felsic volcanic or volcanoclastic or as a sediment with a volcanic component.

25681 : Massive sulfide in quartz-muscovite schist

This rock is dominated by a strongly limonitized massive sulfide, composed of pyrite, chalcopyrite (partly weathered to covellite), and minor galena and sphalerite. The silicate matrix is less abundant. It is a quartz-muscovite schist with a very strong schistosity which is itself isoclinally folded on thin section scale. Quartz occurs in subpolygonal lensoid segregations; in one instance individual quartz grains are flattened parallel to the F_2 axial plane of a minor fold.

The relationship between the massive sulfide and its host rock is complex. Cross-cutting/replacement textures are evident: the massive sulfide isolates fragments of schist, which are not rotated and still exhibit continuity with each other. In one area, sulfide stringers occur along the F_1 schistosity and are, apparently, folded along with it. In another instance massive sulfide has migrated into the nose of an F_2 fold, where it fills shears between tightly appressed, probably rootless isoclinal folds. Thus, although the massive sulfide was mobilized into textural settings that indicate it to be later than the host rock, it is not in a fracture-controlled, vein environment. The textures could be explained by remobilization of primary sulfides during strong deformation.



Limonite forms extensive reflective to earthy pseudomorphs after sulfides, and stains the schist. It may contain a variety of secondary products indistinguishable optically.

Pyrite forms spongy cubes surrounded by limonite.

Chalcopyrite blobs range up to .5 mm across, both interstitial to and enclosed in pyrite.

Bright blue covellite is intergrown with limonite. Its abundance varies strongly

from place to place in the massive sulfide, perhaps in response to original chalcopyrite concentrations.

Small sphalerite grains were seen next to chalcopyrite and also enclosed in pyrite grains.

A few galena grains are enclosed in either sphalerite or pyrite. The largest is .1 mm in diameter; the average is .01 mm.

Muscovite forms masses of strongly oriented plates which wrap around the noses of the second-phase isoclinal folds. A transposed schistosity along F_2 is not evident, although the massive sulfide obscures much of the silicate fabric.

Quartz shows strictly metamorphic, not vein textures. It occurs in lensoid segregations within the muscovite schistosity.

Sample No. 2568⁴

<u>mode:</u>	quartz	45-50%
	muscovite	50-55%
	limonite	1-2%
	opaques - sphalerite	trace
	galena	trace

The rock is a doubly-foliated quartz-muscovite schist. Compositional layering on a scale of 0.1-1.0 cm is well-developed, and is defined by gradations between quartz-rich and muscovite-rich rock. The main foliation is parallel to compositional layering. A second, weak, crenulation cleavage produces small lithon structures that deform the early micas and the compositional layering. The quartz-rich bands are completely recrystallized, and fine, randomly-oriented muscovite flakes are commonly present along grain boundaries.

Limonite occurs as finely-disseminated, irregular masses scattered throughout the rock, and along cleavages and fracture surfaces.

Traces of sphalerite and galena occur as fine anhedral grains in a narrow undeformed quartz stringer that traverses the section.

Sample No. 25686

<u>mode:</u>	limonite	40-45%
	quartz	2-3%
	muscovite	1-2%
	opaques - pyrite	20-25%
	covellite	12-15%
	chalcopyrite	10-12%
	galena	trace
	sphalerite	trace

The rock consists mainly of sulfide minerals and alteration products of them. The non-opaques present are quartz, muscovite, and limonite. The quartz occurs as wholly recrystallized irregular masses to 1.5 mm in diameter, and as narrow cross-cutting stringers. The muscovite forms irregular masses of randomly oriented blades, generally associated with the quartz. Limonite makes up the matrix of the rock, occurring as structureless masses surrounding the sulfide and silicate grains.

There is a vague compositional layering visible (on a scale of 0.2 -0.5 mm), defined by relative proportions of sulfide minerals present. Pyrite is the most abundant sulfide phase, occurring as partly corroded euhedral remnants within masses of structureless limonite. Pyrite makes up as much as 40% (by volume) of the rock in the more pyrite-rich bands. The pyrite grains commonly contain small silicate inclusions, and have probably been recrystallized during metamorphism.

Chalcopyrite occurs as large irregular masses that partly surround the pyrite, and as rare anhedral inclusions in some of the pyrite cubes. It forms an irregular intergrowth with sphalerite and galena in one very restricted portion of the section. Chalcopyrite makes up about 30% of one band in the section.

Covellite occurs throughout the section as narrow idiomorphic grains within the limonite. It tends to be concentrated in the more sulfide-rich bands, and is an alteration product of the chalcopyrite, presumably formed at the same time as the limonite (possibly as a supergene enrichment zone).

Sample No. 25688

<u>mode:</u>	quartz	70-75%
	muscovite	15-20%
	chlorite	10-12%
	limonite	2-3%
	opaques - pyrite	trace
	sphalerite	trace

The rock is a fine-grained quartz-muscovite-chlorite schist. It consists mainly of completely recrystallized polygonal quartz, commonly with narrow muscovite flakes along grain boundaries. Average grain size of the quartz is 0.1-0.2 mm. A well-developed foliation is defined by wispy masses of aligned muscovite and pale green chlorite. A second crenulation cleavage cuts the rock at a very low angle to the early cleavage, and produces small lithon structures that are visible in some of the mica masses.

Limonite occurs as finely disseminated irregular masses throughout the rock, and, less commonly, as pseudomorphs after euhedral pyrite grains to 0.2 mm in diameter. Corroded grains of relict pyrite are present within some of the limonite pseudomorphs.

Irregular sphalerite grains occur within a narrow band of limonite that is sub-parallel to the main foliation. This band appears to be along a crenulation cleavage plane, and it is uncertain what the original relationship was between the pyrite and sphalerite.

Sample No. 25698

<u>mode:</u>	quartz	65-70%
	muscovite	30-35%
	limonite	3-4%
	zircon	trace
	opaques - pyrite	trace
	galena	trace
	sphalerite	trace

The rock is a doubly-foliated quartz-muscovite schist. Well-developed compositional layering is present, defined by the relative proportions of quartz and muscovite. The dominant foliation of the rock, resulting from the alignment of coarse-grained muscovite, parallels this layering. The quartz-rich bands are wholly recrystallized, with an average grain size of about 0.1 mm. Fine blades of randomly-oriented muscovite are common along quartz grain boundaries. The muscovite-rich bands are up to 2 mm wide. A single subhedral zircon grain is present within one of the muscovite-rich bands.

Limonite occurs along grain boundaries in the muscovite-rich bands, and as scattered euhedral pseudomorphs after pyrite. Rare irregular relict pyrite grains up to 0.5 mm in diameter are locally present with structureless masses of limonite. Very rare, scattered, anhedral grains of sphalerite and galena also occur in masses of limonite.

Sample No. 25701

<u>mode:</u>	carbonate	70-75%
	quartz	20-25%
	muscovite	4-5%
	K-feldspar	2-3%
	limonite	1%
	opaques	1%

The rock is a schistose impure marble (calcite-quartz-muscovite schist). It displays a pronounced compositional layering (defined by relative proportions of carbonate, quartz, and muscovite), and a well-developed metamorphic foliation resulting from aligned muscovite flakes that is parallel to the layering.

The specimen consists predominantly of irregular grains of carbonate (average grain size about 0.8 mm) with abundant anhedral grains and grain aggregates of quartz and scattered muscovite flakes. The quartz aggregates are commonly elongate parallel to compositional layering in the rock. The amount of quartz present varies considerably between bands, ranging from 1 to 95%. Minor amounts of K-feldspar occur as anhedral grains within the quartz-rich bands.

The majority of the muscovite present occurs as oriented elongate blades to 0.5 mm in length. Very fine-grained muscovite is also present as irregular felted masses within the quartz-rich bands. These masses are probably alteration products of primary feldspar.

Limonite occurs as scattered fine grains along foliation planes. Scattered euhedral pyrite grains to 2 mm in diameter occur throughout the rock. These are post-kinematic porphyroblasts; the foliation is not deformed around them, and locally trails of quartz grains continue through the pyrite cubes. Very fine-grained opaques (probably carbonaceous material) also occur as narrow foliaform wisps and lenses.

Sample No. 25702

<u>mode:</u>	plagioclase (albite)	70-75%
	limonite	20-25%
	quartz (chalcedony)	4-5%
	opaques (pyrite)	2-3%

The rock consists mainly of coarse-grained albite, surrounded by minor chalcedony and coarse, cellular masses of limonite. The plagioclase grains are strongly strained and are locally shattered. The masses of limonite in most cases preserve relict cleavage traces, indicating that it is an alteration of primary siderite. Some of the limonite, however, contains small corroded grains of pyrite to 1 mm in diameter. It is therefore probably in part an alteration of primary pyrite.

The rock is derived from a coarse-grained feldspar-siderite-pyrite vein assemblage.

Sample No. 25706

<u>mode:</u>	limonite	85-90%
	quartz	8-10%
	muscovite	2-3%
	epidote	1-2%
	opaques - pyrite	trace
	galena	trace
	sphalerite	trace

The rock consists mainly of limonite and displays a pronounced compositional banding, defined by interlayering of relatively quartz-rich and quartz-poor bands. The composition of individual bands ranges from 100% limonite to as much as 60% quartz. Banding is on a scale of 1 mm or less.

Quartz is completely recrystallized to grains less than 0.1 mm in diameter, with even finer-grained, randomly-oriented stubby muscovite flakes, and euhedral epidote grains. The section is cut by a quartz approximately 1.5 mm wide that is filled with relatively coarse-grained quartz (average grain size 1 mm) with limonite along grain boundaries. The grain boundaries are sutured, and the grains are strongly strained, but not recrystallized.

Trace amounts of anhedral pyrite, galena, and sphalerite occur within masses of limonite.

Sample No. 25709

<u>mode:</u>	chlorite	35-40%
	muscovite	30-35%
	quartz	15-20%
	limonite	12-15%
	opaques	2-3%

The rock is a carbonaceous chlorite-muscovite-quartz schist. It is compositionally homogeneous, and consists mainly of a strongly foliated mass of fine-grained chlorite and muscovite with scattered grains and grain aggregates of finely recrystallized quartz. Fine-grained carbonaceous material occurs in small masses of recrystallized quartz that are elongate parallel to the main foliation. Limonite occurs as irregular structureless masses to 0.5 mm in diameter, and as subhedral to euhedral pseudomorphs after primary pyrite.

A second foliation is also visible in the section. It is a weak crenulation cleavage that cuts the earlier fabric at a high angle and deforms it into microlithon structures.

The presence of carbonaceous material indicates that the rock originated as a sediment. Its composition, however, suggests that there was a substantial component of volcanic material in the protolith.

Sample No. 25710

<u>mode:</u>	quartz	60-65%
	chlorite	20-25%
	limonite	12-15%
	muscovite	2-3%
	pyrite	1%

The rock is an altered, slightly pyritic, fine-grained quartz-chlorite-muscovite schist. It consists mainly of quartz, chlorite, and limonite. There is a very vague compositional layering visible, defined partly by variation in the grain size of the quartz between individual bands. The variation in grain size in the quartz is rather erratically distributed throughout the section. The coarser-grained portions are completely recrystallized, and have an average grain size of 0.1-0.2 mm, whereas the finer-grained portions have an average grain size of less than 0.01 mm. It appears that the rock started out very fine-grained (probably cherty) and is partially recrystallized. The chlorite forms stubby, randomly-oriented blades to about 0.2 mm long.

Limonite occurs as irregular masses that locally make up as much as 40% of the rock, and also as regular masses up to 0.5 mm in diameter with euhedral (cubic) outlines. These are pseudomorphs after euhedral pyrite porphyroblasts. Pyrite is still present as partly eroded relicts within some of the pyrite masses. No other opaque minerals are present in the section.

A weak metamorphic foliation (defined by aligned muscovite blades) is developed parallel to the compositional layering. This early fabric is deformed into an open fold with a wavelength of about 5 cm in the section. No fabric associated with the fold is visible.

Sample No. 25712

<u>mode:</u>	quartz	60-65%
	chlorite	15-20%
	muscovite	10-12%
	plagioclase	4-5%
	limonite	1-2%
	opques	2-3%

The rock is a fine-grained, carbonaceous, quartz-chlorite-muscovite schist. Compositional banding on a scale of 1 to 4 mm is well-developed, defined by relative proportions of quartz, chlorite, and muscovite. Bands of intergrown polygonal quartz with minor plagioclase (albite) and randomly oriented muscovite flakes are separated by bands of aligned chlorite and muscovite with subordinate amounts of quartz and fine-grained opaques (probably carbonaceous material). The quartz grains are commonly strained, and twinning in the plagioclase is bent. A cluster of subhedral sphene grains occurs within one quartz-rich band.

Limonite occurs as scattered grains throughout the rock, some of which are pseudomorphs after primary pyrite cubes.

The rock shows two metamorphic foliations. The major and earliest foliation is defined by alignment of muscovite and chlorite blades, and is parallel to compositional layering. The second foliation is a crenulation cleavage that occurs at a very low angle (less than 15 degrees) to the early fabric. It deforms the early fabric and compositional layering, but is not associated with any significant recrystallization, other than incipient polygonization of the quartz.

The presence of carbonaceous material in the rock indicates that it had a sedimentary protolith, and the abundance of muscovite and chlorite may suggest a significant volcanoclastic component.

Sample No. 25714

<u>mode:</u>	limonite	70-75%
	quartz	20-25%
	muscovite	2-3%
	epidote	1-2%
	pyrite	trace

The specimen is well-banded on a scale of 1-2 mm, with the banding defined by variations in limonite content (from 10-95% limonite). Most of the rock is structureless limonite with rare, anhedral, very fine-grained pyrite grains (less than 0.02 mm in diameter). The remainder of the rock is a fine-grained, wholly recrystallized mass of quartz with stubby to elongate, randomly-oriented muscovite blades to 0.15 mm long, and a scattering of extremely fine-grained epidote.

About 4-5% of the area of the section consists of holes with idiomorphic outlines. These are a boxwork after pyrite cubes to 1 mm in diameter.