

Richter
823503



Vancouver Petrographics Ltd.

JAMES VINNELL, Manager
JOHN G. PAYNE, Ph.D. Geologist
CRAIG LEITCH, Ph.D. Geologist
JEFF HARRIS, Ph.D. Geologist
KEN E. NORTHCOTE, Ph.D. Geologist

P.O. BOX 39
8080 GLOVER ROAD,
FORT LANGLEY, B.C.
V0X 1J0
PHONE (604) 888-1323
FAX. (604) 888-3642

Report for Nick Gibson,
Minnova Inc.,
311 Water Street,
VANCOUVER, B.C.
V6B 1B8

Invoice 8734

January 8th, 1990

Samples:

9 rock samples for sectioning and petrographic study.

Samples are numbered as follows;

RL-173	Polished thin section
RL-178	Thin section
RL-182	Polished thin section
RL-220	Polished thin section
RL-222	Thin section
RG-266	Thin section
RTA-008	Polished thin section
4+00N, 2+75W	Thin section
Blast Rock	Polished thin section.

Note: The shipment included no Sample RL-219 (referred to in your list of queries).

Summary:

This suite includes a rather wide range of rock types, often of somewhat uncertain origin. Genetic interpretations based on this study should be considered tentative.

A general subdivision into two groups is possible.

A. Probable Minor Intrusives

RL-220 ALTERED DACITE (quartz-feldspar porphyry). Sericitized plagioclase phenocrysts and carbonated/chloritized mafics in a granular, quartz-rich groundmass.

RL-222 ALTERED PORPHYRITIC ANDESITE. Carbonated, flow-oriented mafic phenocrysts in groundmass of fresh felsitic plagioclase.

4+00N, 2+75W HORNBLLENDE TRACHYANDESITE. Abundant micro-phenocrysts of fresh hornblende in a matrix of fresh microgranular plagioclase and K-spar.

RTA-008 POTASSIC ALBITITE. Felsitic plagioclase and/or potassic alkali feldspar, with accessory fine-grained biotite; cut by pyritized microfractures (now limonitized). Origin uncertain.

Blast Rock LEUCO-MONZONITE(?). Quartz-free felsitic matrix with coarser clumps of prismatic feldspar. K-spar abundant. Fabric looks cataclastic. Mafics absent. Cut by veinlets of quartz with pockets of limonitized pyrite and associated chlorite. Possibly a crushed, leucocratic contact phase of an intrusive.

B. Tuffs and Probable Exhalites

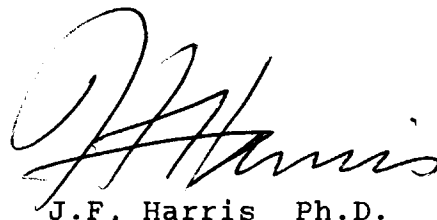
RL-173 CHERT. Monomineralic quartz with opaque dust.

RL-178 BIOTITIC TUFFITE(?). Very fine-grained, varved alternations of felsite and biotite. Cut by siliceous (cherty) segregations.

RL-182 BIOTITE ACTINOLITE ROCK. Felted phlogopite, grading to foliated aggregates of acicular actinolite. Possibly a recrystallized, Fe/Mg-rich exhalite.

RG-266 ANDESITIC TUFF. Foliated, strongly compacted (welded?) tuff. Composed of felsitic plagioclase with chlorite. Felted biotite and carbonate form discrete laminae. RL-178 could be a variant of this lithotype (enriched in an exhalative component).

Individual petrographic descriptions are attached. Please refer to these for answers to your specific queries. No evidence was seen for "silica depletion".



J.F. Harris Ph.D.

(929-5867)

SAMPLE RL-173**CHERT**

Estimated mode

Quartz	97
K-feldspar	trace
Sericite)	
Biotite)	1
Limonite)	

This sample is of simple mineralogy. It consists essentially of quartz - predominantly as an equigranular mosaic aggregate of grain size 10 - 30 microns.

More or less abundant diffuse clumps and veniform segregations of coarser quartz (grain size 50 - 200 microns) are developed throughout the finer matrix. These have the aspect of relict fragments and/or disrupted veinlets.

One better defined veinlet is composed of lamellar-textured, crenulate margined grains, up to 0.5mm in size.

The cherty matrix is dusted with micron-sized opaque material which also concentrates as wisps - locally showing crenulate deformation. This relict primary feature is cross-cut and disrupted by the stockwork of hairline veinlets and healed microfractures.

The rock also includes a few sinuous, schlieren-like zones of felted sericite, biotite and limonite - locally with pockets of K-feldspar. These features cross-cut the siliceous stockwork.

The sample is a chert - possibly of secondary (silicification) origin, or a chemical sediment of exhalative affinities.

Estimated mode

Felsite	38
Biotite	29
Epidote(?)	8
Quartz	18
Plagioclase	3
K-feldspar	4
Carbonate	trace

This is a very fine-grained, foliated rock, cut by a network of quartz veinlets, and partially deformed and dislocated.

The matrix is composed of an intergrowth of felsitic plagioclase, biotite and a cryptocrystalline, sub-opaque material which may be epidote (or possibly apatite). Grain size is in the range 2 - 20 microns, and the fabric is crudely lamellar, the mafic components alternating with the felsite as varve-like wisps or anatomosing, microlenticular networks on the scale 10 - 50 microns.

This fabric has a layered, finely fragmental or pumiceous aspect. It is locally crenulated and dislocated.

The rock includes a few sub-concordant, hairline veinlets or lamellae of coarser plagioclase and some prominent masses of mosaic quartz. The latter have scattered, included and marginal intergrowths of coarse plagioclase, minor pockets of carbonate and inclusions of biotitic matrix. They have the aspect of deformed, replacement veinlets or recrystallized cherty segregations. The deformation could be partially of non-tectonic (soft-sediment slumping) origin.

The slide is also cut by wispy/lenticular veinlets of K-feldspar - apparently post-dating the deformation of the quartz veinlets but, in turn, partly dislocated by later microfracturing and shearing.

This rock has the aspect of a tuffite or exhalative product. The laminar fabric is thought to represent primary layering, and the rock does not appear strongly recrystallized.

Estimated mode

Biotite	74
Amphibole	12
Felsite	2
Apatite(?)	trace
Opagues	12

This is a fine-grained rock of specialized mineralogy.

It consists predominantly of a compact aggregate of felted biotite, of grain size 20 - 100 microns. This shows distinctive pleochroism from colourless to reddish-brown, and is probably of phlogopitic composition.

Principal accessory components are a pale-coloured, acicular amphibole and an opaque mineral - possibly hematite or ilmenite.

The phlogopite forms a random meshwork of anhedral-subhedral grains, with intergrown needles of amphibole and disseminations of the opaque constituent. The latter occurs as sub-acicular grains, 5 - 20 microns in size, tending to aggregate as small clumps and wisps.

At one end of the slide, amphibole becomes the dominant component. It occurs as minutely fine-grained aggregates of sub-oriented needles, defining a sinuous contorted foliation suggestive of contorted bedding.

There are also some areas where the distribution of different proportions of biotite and amphibole, and their local orientation, define a crypto-fragmental texture.

In part, the opaques concentrate to form irregular, anastomosing schlieren and networks through the biotitic matrix. These schlieren sometimes have an associated minor component of a minutely fine-grained, high-relief, low-birefringent mineral (apatite?)

Probable felsitic material is locally recognizable as tiny pockets, representing part of an interstitial continuum within the matrix of compact mafics.

The origin of this rock is obscure. It may be a mafic-rich tuffite or exhalative product (recrystallized ferruginous clay?), gradational in composition from RL-178.

Estimated mode

Quartz	35
Plagioclase	19
Sericite	30
Chlorite	6
Carbonate	9
Apatite	trace
Pyrite)	1
Limonite)	

This is a non-foliated, granular, quartzo-feldspathic rock of distinctive textural aspect.

It consists predominantly of an intergrowth of quartz and strongly sericitized plagioclase.

The quartz occurs as individual, equant, sub-polygonal grains, 0.1 - 0.4mm in size, which concentrate as strings and networks, outlining clumps and prismatic individuals of more or less intensely sericitized plagioclase.

Remnants of plagioclase crystals, 0.2 - 2.0mm in size, are often recognizable, though many are totally replaced by flaky/felted aggregates of sericite.

Accessories are chlorite and carbonate, often closely associated and forming irregular patches, or areas of interstitial intergrowth with quartz or plagioclase.

Minor disseminated pyrite (now more or less strongly altered to limonite) tends to be associated with the chlorite-carbonate patches.

The rock includes some prominent clumps of aggregated quartz mosaic (see cut-off block), with minor interstitial carbonate. There are also a few fine-grained opaque-rich, chloritic patches which have the aspect of xenoliths.

The textural mode of the quartz in this rock is somewhat suggestive of a clastic or pyroclastic character (conglomerate or crystal tuff) but, on balance, it seems most probable that the rock is an igneous product of dacitic composition - possibly a minor intrusive (quartz feldspar porphyry). In this interpretation the sericitized plagioclase patches represent altered phenocrysts, as do the chlorite-carbonate clumps, whilst the granular quartz (with interstitial felsitic plagioclase) represent a texturally distinctive groundmass phase.

The texture appears primary, and is not recognizably modified by recrystallization.

Estimated mode

Plagioclase	65
Sericite	6
Biotite	5
Chlorite	3
Carbonate	18
Apatite	trace
Limonite)	3
Opagues)	

Macroscopic examination of the cut-off block of this sample reveals a texture of obvious igneous aspect, with abundant, partially oriented, small (altered) phenocrysts.

In thin section it is found to consist predominantly of plagioclase and to exhibit a sparsely porphyritic, microgranular texture.

The matrix of anhedral-subhedral, interlocking plagioclase has a grain size range of 10 - 100 microns; it includes a minor interstitial component of chlorite and sericite. Scattered through the groundmass are occasional coarser, euhedral plagioclase phenocrysts, 0.2 - 1.5mm in size. A few of these show a light dusting of fine-grained sericite but, overall, the plagioclase (phenocrysts and groundmass alike) appears notably fresh.

The rock does have a relatively high content of carbonate, biotite and sericite, but these occur as abundant, more or less discrete sub-prismatic clumps and patches, which appear to represent totally altered mafic phenocrysts, 0.2 - 2.0mm in size. The elongate prismatic form of some of these suggests that they may have originated mainly as hornblende. They commonly include granules of opaques and limonite.

These altered phenocrysts show a distinct preferred orientation (see cut-off block), presumably related to flow.

The rock shows some irregular fractures or alteration zones composed of felted sericite with interstitial fine-grained opaques. There are also occasional hairline veinlets of carbonate.

This is an altered, porphyritic andesite, of extrusive or dyke origin.

Estimated mode

Plagioclase	56
Chlorite	22
Biotite	8
Carbonate	12
Opagues	2

This is a fine-grained rock showing the distinctive platy/laminar or lenticular fabric typical of a strongly compacted, possibly partially welded tuff.

In thin section it is found to consist predominantly of minutely felsitic plagioclase, of grain size 5 - 20 microns. This typically contains more or less abundant, intimately intergrown chlorite, as tiny flecks and coalescent/anastomosing wisps.

The close-spaced chlorite wisps outline distinct lenticular lithic clasts of felsite, 0.03 - 0.3mm in size. There are also rare prismatic crystal clasts of plagioclase of a similar size.

Principal accessories are carbonate and biotite. These form more or less distinct, laminar/lenticular segregations, 0.1 - 0.6mm in thickness. Carbonate also occurs as tiny individual flecks and occasional oblique threads (following microshears). Some of the lenses of minutely fine-grained, felted, brown biotite show partial alteration to chlorite.

Micron-sized opaque dust concentrates as thin, sinuous/anastomosing schlieren, and slightly coarser, granular opaques occur as scattered, small, lenticular bodies.

The strong lensey foliation in this rock appears essentially undisturbed. It is a partially recrystallized, andesitic ash tuff.

SAMPLE RTA-008 POTASSIC ALBITITE (BOSTONITE?)

Estimated mode

Plagioclase	60
K-feldspar	24
Biotite	12
Quartz	trace
Limonite	3
Pyrite	1

This rock is of distinctly different type to the preceding samples of the suite. It is of similar composition to the sample designated "blast rock", and is also resembles the RTC and RTD series rocks described in Vancouver Petrographics' report 8544 of November 27th, 1989.

It consists predominantly of a minutely fine-grained, anhedral aggregate of fresh feldspars, of grain size 10 - 30 microns. This aggregate shows interlocking, somewhat diffuse grain margins, and has a somewhat recrystallized appearance.

A weak, irregular foliation is defined by the orientation of occasional more elongate, lath-like grains in the generally equant aggregate.

Coarser, prismatic grains occur sporadically, as diffuse clumps (partially recrystallized fragments or phenocrysts?), and also as apparent remnants of an irregular veinlet network.

The felsitic aggregate is composed of albitic plagioclase of notably potassic composition, and/or of albite with intimately intergrown (and petrographically indistinguishable) K-spar.

Fine-grained olive-brown biotite is the only accessory, as disseminated tiny flecks, clumps, networks and remobilized veniform wisps. Biotite is notably more abundant in one localized area, about 2x2 cm in size.

The slide includes some segregations of coarser K-spar, in the form of discrete veniform bodies showing platy recrystallized fabric.

It is cut by an angular network of microfractures filled by limonite - apparently after original pyrite, occasional remnants of which survive. Traces of quartz, as tiny euhedral crystals, occur within the limonite.

This rock is of uncertain origin. It could have originated as a porcellanitic ash tuff, but lacks any sign of layering. Alternatively it may be a dyke of albitite or bostonite (the potassic equivalent). Alkalic metasomatism (associated with an intrusive contact?) is another possible genetic mechanism.

SAMPLE 4+00N, 2+75W HORNBLLENDE TRACHYANDESITE (DYKE?)

Estimated mode

Plagioclase	30
K-feldspar	10
Hornblende	40
Biotite	4
Mineral X	15
Epidote	1
Spheue	trace

This is a rock of distinctly different type to any others of the suite. It is a fine-grained, mafic-rich igneous rock of non-foliated, equigranular texture. It is probably of minor intrusive origin.

The principal constituent is olive-green hornblende, as a meshwork aggregate of subhedral-euhedral, somewhat elongate grains, 0.1 - 1.0mm in size. This is fresh but for occasional flecking with secondary-type, red-brown biotite (probably a late-magmatic reaction effect).

Another major component (Mineral X) consists of cryptocrystalline, sub-opaque material, as abundant, equant/sub-prismatic patches, 0.05 - 0.4mm in size, evenly distributed throughout in similar manner to the hornblende.

The nature and origin of this component is uncertain. It may be a form of epidote, or possibly of spheue. It has the textural aspect of a primary constituent, and may possibly be a form of modified pyroxene.

Rare small grains of undoubted (well-crystallized) epidote occur randomly disseminated throughout.

The hornblende and sub-opaque component are set in a fine-grained feldspathic matrix, of grain size 0.1 - 0.3mm. This consists predominantly of plagioclase, but also includes evenly distributed small pockets of intergrown K-spar. Both feldspars are fresh.

The slide includes one or two small clumps of felted biotite with granular epidote (possible xenoliths), and irregular segregations of K-feldspar.

This rock appears to be a trachyandesitic mafic dyke. It is notably free of deuteric or hydrothermal alteration effects.

SAMPLE: BLAST ROCK GRANULATED LEUCO-MONZONITE(?)

Estimated mode

Plagioclase	32
K-feldspar	40
Quartz	20
Chlorite	3
Biotite	trace
Limonite	5
Pyrite	trace

This is a rock of similar macroscopic appearance to RTA-008, but cut by veinlets of coarse quartz.

The feldspathic matrix includes abundant K-feldspar. It differs texturally from RTA-008, in that prismatic grains, 0.1 - 0.4mm, are abundant. These concentrate as rather ill-defined clumps and patches of parallel growth, set in a matrix or interstitial phase of the minutely felsitic type (which predominates in RTA-008). The fabric has the aspect of a partially granulated and recrystallized intrusive igneous aggregate of monzonitic composition.

Networks of irregular, disrupted veniform bodies of coarser prismatic plagioclase (well-twinned and probably of oligoclase composition) are developed throughout.

This rock is notably leucocratic, and is devoid of the flecks of biotite seen in RTA-008.

It is cut by thin, discrete veinlets, and one thicker lenticular mass, of coarsely varigranular, strained quartz. The latter contains extensive pockets of limonite, some of which include sparse fine-grained remnants of pyrite. The pyrite/limonite clumps are often associated with pockets of meshwork-textured chlorite.

The most likely interpretation of the petrographic observations is that this is a granulated, leucocratic contact phase of monzonitic affinities, cut by quartz-pyrite stockwork mineralization.