

~~DESCRIPTIONS OF DRILL CORE SAMPLES~~

Typed = Fairfield descriptions; Printed = description after petro. analysis

- Sample 1 (D91-1, 113.4 metres): *Altered mineralized porphyritic dacite/crystal tuff*  
Moderately clay altered fine grained volcanic/intrusive (?). 2 per cent fine grained disseminated pyrite.
- Sample 2 (D91-1, 166.1 metres): *"Crowded" augite/plag. porphyritic andesite*  
Feldspar-augite (?) porphyritic andesite (?). Dark grey aphanitic matrix. Feldspar phenocrysts commonly altered to epidote.
- Sample 3 (D91-2, 49.7 metres): *"Crowded" hornblende-plag. micromonzonite porphyry*  
Medium grey hornblende porphyritic fine grained diorite. Trace disseminated pyrite. Strongly magnetic.
- Sample 4 (D91-2, 63.4 metres): *Intense sericite/clay altered micromonzonite(?)*  
Strongly clay altered intrusive (?). Original textures destroyed. Black discontinuous MnO (?) stringers.
- Sample 5 (D91-2, 73.3 metres): *Sericite-clay-(K-spar) altered micromonzonite(?) porphyry*  
Moderately to strongly propylitically altered light greenish fine grained intrusive or volcanic. Pervasive chlorite, epidote and carbonate alteration. Not magnetic.
- Sample 6 (D91-3, 40.5 metres): *Porphyritic hornblende plag. andesite*  
Medium grey weakly silicified (?) hornblende (?) - feldspar porphyritic volcanic (?). Mafic phenocrysts weakly chloritized. Trace pyrite.
- Sample 7 (D91-3, 109.7 metres): *Bleached alt'd (feldspathized(?)) pyritized porphyritic andesite / trachyandesite*  
Light greenish grey fine grained monzonite/monzodiorite (?). Mafics chloritized. 3 per cent disseminated pyrite.
- Sample 8 (D91-4, 101.1 metres): *Altered porphyritic trachyandesite*  
Moderately chloritized feldspar porphyritic volcanic (?). Dark grey aphanitic matrix. Some saussuritization (?) of feldspar phenocrysts. Trace disseminated pyrite.
- Sample 9 (D91-4, 127.9 metres): *Hornblende monzonite/micromonzonite~~?~~*  
Fine grained equigranular diorite/syenodiorite (?). Weak silicification (?). Minor disseminated and stringer pyrite.
- Sample 10 (D91-5, 119.8 metres): *Alt'd, mineralized, veined porphyritic andesite/microdiorite*  
Medium greenish grey feldspar-augite (?) porphyritic volcanic (?). Fine (K-spar introduced) grained matrix. Mafics chloritized. Minor pyrite and 1 per cent chalcopryite (disseminated and in calcite stringer).
- Sample 11 (D91-6, 105.3 metres): *Hornblende monzodiorite/micromonzodiorite*  
Medium-dark grey andesitic (?) volcanic lahar (?) with well developed hornblende (?) and feldspar phenocrysts in an aphanitic matrix; weak propylitic alteration.
- Sample 12 (D91-8, 11.1 metres): *Porphyritic dacite*  
Dark grey medium grained (?) andesitic volcanic (?) with feldspar phenocrysts and calcite veining; moderate propylitic/weak phyllic (?) alteration.
- Sample 13 (D91-8, 142.4 metres): *Porphyritic hornblende plag. andesite*  
Light greenish grey hornblende (?) diorite (?) with aphanitic felsic matrix; some feldspar phenocrysts and calcite stringers; moderate propylitic/weak phyllic alteration.



# 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

John Cormier  
Dill Project  
P.O. Box 5000  
Merritt, B.C.  
V0K 2B0

Aug. 27, 1991  
JOB # 222

Dear Mr. Cormier,

Re: Samples 1 to 13

The petrographic descriptions of the above samples have been completed and the report is attached.

As requested the samples are being returned to your Vancouver office. They will be sent collect using the bus service.

Yours truly,

K.E. Northcote Ph.D., P.Eng. (604) 796-2068

796-2068 (located in Agassiz, around Chilliwack)

Sample 1 (D 91-1, 113.4 m)

Altered mineralized porphyritic dacite/crystal tuff(?)

### General description

Composed of sericitic altered euhedral crystals of plagioclase, altered mafic (amphibole) crystals and angular/subangular quartz fragments with diffuse partially resorbed margins.

In a microgranular feldspathic (plagioclase-rich) groundmass with fabric masked by red-brown semiopaque alteration dusting.

Scattered accessory apatite crystals.

Alteration includes moderate/strong sericitic and carbonate alteration and semiopaque dusting of plagioclase phenocrysts and groundmass. Complete replacement of amphibole by foliated irregular bladed chlorite and aggregates of microgranular light brown carbonate (dolomite/ankerite?) and lesser "calcite".

Breccia infilling forms a coarse network of red-brown microgranular carbonate and clusters of colourless calcite, quartz and sericite. Superimposed "crackle breccia" hairline infillings of similar light brown microgranular carbonate with scattered coarser colourless calcite intergrowths. Late calcite veins.

Appears to be at least two varieties of carbonate and three episodes of fracturing/brecciation.

Mineralization is disseminated but most abundant in association with the first carbonate-sericite-(quartz)-filled brecciation, possibly to lesser extent with second carbonate-filled crackle brecciation.

### Microscopic description

#### Phenocrysts/coarse fragments

Plagioclase; 25%, euhedral/subhedral, (.05 to >1.0 mm).

Generally euhedral outlines of complete crystals, lesser fragments. Ghost-like twin remnants. Sericite-carbonate alteration. Semiopaque dusting.

Altered mafic; 15%, subhedral/anhedral, (.05 to <1.0 mm).

Laminated pseudomorphous replacement by chlorite and microgranular aggregates of pale red-brown "carbonate" with colourless calcite.

Quartz; 10%, anhedral (<.05 to <0.5 mm) fragmental outline possibly original grains. Most quartz however is as clusters of irregular grains associated with carbonates and sericite in the early breccia infilling. Introduced

Sample 1 Continued

**Groundmass**

Plagioclase; 20%, anhedral (microgranular to <.05 mm). Obscured by sericite-carbonate alteration and red-brown alteration dusting.

K-feldspar; (?), stained slab shows slight diffuse stain which indicates small amount of K-feldspar in groundmass. Not confirmed in thin section.

**Breccia infilling 20%**

(a) Coarse network of pale brownish "carbonate" associated calcite intermixed with sericite clots.

(b) crackle breccia infilling of darker brown microgranular carbonate.

(c) late carbonate (calcite) veinlets.

**Reflected light**

**Opagues <10%**

Pyrite; 5%, euhedral/subhedral (<.01 to >1.0 mm). Disseminated and fracture controlled.

Chalcopyrite; <<1%, anhedral, (<.01 to >1.0 mm). Irregular grains/clusters. Interstitial to pyrite, rimming and veining pyrite.

A ? (Enargite?) <<1%, anhedral, (<.01 to 0.2 mm). Inclusions in chalcopyrite associated with ?B. Pale/medium pinkish brown. Anisotropic. Pleochroic pinkish grey/bluish grey. Should be confirmed by SEM.

B ? (Tetrahedrite/Tennantite?) <<<1%, anhedral, (<.01 to .05 mm). Irregular grains in chalcopyrite associated with ?A. Medium grey distinct bluish tint. Isotropic. Lacks internal reflection of sphalerite. Should be confirmed by SEM.

C ? traces, anhedral, (<.05 mm) Very pale cream. Poor polish. Isotropic. Associated with chalcopyrite, ?B, in veinlets in pyrite. Requires SEM identification.

#2 (D 91-1, 166.1 m)

"Crowded" augite/plagioclase porphyritic andesite

#### General description

Composed of abundant, >50%, phenocrysts of plagioclase (<.05 to 1.0 mm) and augite (<0.1 to >2.0 mm). Most phenocrysts euhedral some broken grains. Opaques, <5%, euhedral/subhedral (<.05 to 0.5 mm), magnetite and associated hematite.

In a microgranular feldspathic groundmass.

Plagioclase phenocrysts have microgranular sericite and semiopaque alteration dusting. Augite shows varied intensity of chlorite, carbonate, epidote alteration. Groundmass obscured by microgranular opaques (magnetite in part), and loosely felted very fine secondary amphibole(?) laths.

Stained slab shows <10% diffuse impregnation of fracture controlled K-feldspar (stain) which was not confirmed in thin section.

Hairline carbonate veinlets.

#### Microscopic description

##### Phenocrysts.

Plagioclase; >30%, euhedral/subhedral (<.05 to 1.0 mm). Close packed but matrix supported. Microgranular sericitic alteration and semiopaque dusting obscures twinning.

Augite; <20%, euhedral/subhedral, (<0.1 to >2.0 mm).

Interspersed among plagioclase phenocrysts. Twinned and zoned crystals chloritic alteration affects specific grains accompanied by blebs of carbonate and clusters of epidote grains. Intensity of alteration ranges from unaltered through fracture controlled to complete alteration.

Opaques; magnetite/hematite, see Reflected light below.

##### Groundmass

Feldspar(plagioclase) 25%, anhedral, (microgranular). Obscured by microgranular opaque microgranules and by felted secondary amphibole.

Amphibole(?), >10%, subhedral, (<.01 to .05 mm) diffuse felted. Secondary. Low birefringence, inclined extinction.

K-feldspar; <10%, anhedral, (microgranular) diffuse impregnations, fracture controlled. Evident in stained slab, not detected in thin section.

Veinlets; carbonate

#2 Continued

**Alteration**

Sericite  
Chlorite  
Epidote  
Carbonate  
Secondary amphibole  
Semiopaque dusting  
K-feldspar

**Reflected light**

Opagues; 5%

Magnetite; euhedral/subhedral, (<.05 to <0.5 mm).

Crystallographic intergrowths with hematite and unidentified microgranular translucent material along crystallographic directions.

Magnetite also as microgranular disseminations in groundmass.

Hematite; anhedral, (<.05 to 0.2 mm). Intergrowths with magnetite. Crystallographic control.

#3 (D 91-2, 49.7 m)

"Crowded" hornblende-plagioclase micromonzonite porphyry

**General description**

Fine grained hornblende and plagioclase phenocrysts close packed but groundmass supported. Widely scattered irregular quartz grains.

In a very fine granular K-feldspar-rich, featureless groundmass.

Plagioclase phenocrysts show strong sericitic altered cores, semiopaque dusting and albitic(?) margins. Hornblende has some actinolite overgrowths. Minor epidote alteration. Widely scattered clusters of coarser hornblende (to >0.5 cm) show weak sieve texture of augite remnants and associated clusters of fine secondary amphibole.

Opagues, in approximate order of abundance, include magnetite, pyrite, hematite, chalcopyrite and a trace of pyrrhotite.

**Microscopic description**

**Phenocrysts/coarser fraction.**

Hornblende; 25%, euhedral/subhedral, (<.05 to >2.0 mm), commonly well separated grains, one cluster (to >0.5 cm) with sieve texture augite remnants in core. Secondary felted amphibole and epidote. Composite grain intergrowths of hornblende cores and paler amphibole margins. Minor associated epidote.

Plagioclase; 35%, euhedral/subhedral, (<0.1 to >1.0 mm). Cores obscured by intense microgranular felted sericite and semiopaque alteration dusting. Albitic(?) margins.

Quartz; <5%, anhedral, (<0.1 to 0.3 mm). Very irregular featureless grains. Confirmed uniaxial (+).

**Groundmass**

K-feldspar; 20%, anhedral (microgranular to <.05 mm). Confirmed in stained slab. Featureless. Interstitial to phenocrysts.

Plagioclase; presence suspected, not confirmed.

**Alteration assemblage**

Sericite

Epidote

Semiopaque dusting

Secondary amphibole.

#3 Continued

Reflected light  
Opagues; <10%

Magnetite; <5%, euhedral/subhedral (<.01 to >0.3 mm).  
Disseminated grains, clusters of grains. Some association  
with pyrite. Minor hematite intergrowths.

Pyrite; <<5%, euhedral/subhedral, (<.01 to 1.0 mm). Disseminated  
grains clusters of grains. Few contain blebs of  
chalcopyrite and trace of pyrrhotite.

Chalcopyrite; <<<1%, anhedral, (<.01 to 0.3 mm). Irregular  
grains. Fine disseminations. Incipient fracture control.  
Generally as minute grains but scattered coarser. Traces as  
blebs in pyrite.

Hematite; >1%, anhedral (<.01 to ) Irregular intergrowths in  
magnetite.

Pyrrhotite; trace, minute bleb in pyrite.



#4 (D 91-2, 63.4)

Intense sericite/clay altered micromonzonite(?)

**General and microscopic description**

Composed of close packed but groundmass-supported intensely altered plagioclase and lesser mafic phenocrysts.

Complete pseudomorphous alteration of plagioclase by sericite and microgranular "clay". Albitic (?) margins. Mafic has undergone complete alteration leaving semiopaque clouded fibrous/shredded remnants forming pseudomorphous outlines of original crystals/fragments. Similar semiopaque microgranular material fills veinlets and crackle breccia microfractures.

Groundmass composed of similar microgranular sericite-clay mixture but contains >5% disseminated fine (<.05 to 0.2 mm) irregular K-feldspar, and quartz which is fracture controlled, introduced.

Note: K-feldspar conspicuous in stained slab. Quartz confirmed, uniaxial (+).

Microprobe or X-ray diffraction analyses are required to determine the microgranular "clay" assemblage.

Late carbonate and diffuse K-feldspar veinlets (stained slab).

Opagues include <5% hematite, minor chalcopyrite.

**Reflected light**

Opagues <5%

Hematite; <5%, subhedral/anhedral, (<.05 to 0.2 mm).

Pseudomorphous after magnetite?. Disseminated throughout.

Chalcopyrite; <<<1%, anhedral, (<.01 to 0.1 mm). Fine disseminations. Fracture controlled.

#5 (D 91-2, 73.3)

Sericite-clay-(K-feldspar) altered micromonzonite(?) porphyry

**General and microscopic description** [Section thick]

Similar to 4 D 91-2 63.4 but slightly weaker alteration, more abundant introduced quartz and minor K-feldspar.

Composed of close-packed, but groundmass-supported, completely altered plagioclase and mafic biotite remnants in an altered microgranular feldspathic groundmass.

Plagioclase phenocrysts altered to microgranular mixture of sericite, carbonate and semiopaque red-brown "clay" dusting. Margins of many grains featureless albitic (?). Mafic remnants shredded/fibrous biotite (chlorite) partially obscured by semiopaque dark brown semiopaque material (Iron stain?). Scattered carbonate clusters.

Groundmass feldspathic, similar alteration to plagioclase phenocrysts.

Early stage crackle breccia/fractures filled with quartz granules which weakly permeates the wall rock.

Stained slab shows fracture controlled K-feldspar in diffuse veinlets and lesser diffuse impregnation. Not confirmed in thin section but may be masked by alteration.

Opagues; <2%, in approximate order of abundance include chalcopyrite, pyrite, hematite.

**Reflected light**

Opagues; <2%

Chalcopyrite; 1%, anhedral, (<.01 to 0.3 mm). Irregular grains clusters of grains. Disseminated and fracture controlled. Coarser grains fracture controlled.

Pyrite; <1%, anhedral/subhedral (<.01 to 0.4 mm). Disseminated grains, associated with chalcopyrite.

Hematite; <<<1%, scattered ghost-like grain remnants.

#6 D (91-3, 40.5)

**Porphyritic hornblende plagioclase andesite**

**General description**

Fine to medium grained hornblende and weakly altered plagioclase phenocrysts in a microcrystalline to very fine felted plagioclase groundmass.

Hornblende phenocrysts single crystals and clusters of crystals. Weak associated epidote granules and chlorite clusters. Plagioclase phenocrysts with moderate sericitic alteration and brown alteration dusting. Groundmass moderate brown alteration dusting.

Stained slab shows K-feldspar in diffuse fracture controlled veinlets and as irregular diffusions into groundmass.

Veinlets are composed of intermixed epidote, K-feldspar, carbonate and pyrite.

Opagues; 1%, disseminated pyrite and in fractures. Locally weakly magnetic.

**Microscopic description**

**Phenocrysts**

Hornblende; 20%, euhedral/subhedral, (.05 to >1.5 mm). Single crystals and clusters of crystals. Weak epidote and chlorite alteration.

Plagioclase; 15%, euhedral/subhedral, (.05 to 1.5 mm, generally about 0.5 mm). Sericitic and microgranular alteration dusting obliterates twinning and margins of grains tend to blend into groundmass.

**Groundmass**

Plagioclase; 60%, anhedral (microcrystalline to <.05 mm). Minute felted laths with moderate microgranular brown alteration dusting.

K-feldspar; <5%, anhedral, (microgranular). Diffuse fracture controlled impregnations evident in stained slab.

Associated diffuse coarser K-feldspar veinlets noted in thin section.

**Accessories**

Apatite; trace

Rutile/sphene; trace

Opagues; 1%, euhedral/anhedral (<.01 to >0.2 mm). Disseminated and fracture controlled. Pyrite. Weakly magnetic locally.

**Veinlets**

K-feldspar, epidote, carbonate, pyrite.

#7 (D 91-3, 109.7)

Bleached altered (feldspathized(?)) pyritized porphyritic andesite/trachyandesite

#### General description

Thin section shows textures not anticipated from macroscopic examination of core.

Marked porphyritic texture of matrix supported phenocrysts of weakly altered plagioclase and strong altered mafics (hornblende and augite(?)) in a very fine interlocking granular featureless, unaltered, feldspathic plagioclase and K-feldspar(?) groundmass.

Plagioclase phenocrysts less intensely altered than mafics. Plagioclase weakly sericitic and with pale brown alteration dusting. Remnant twinning indicates composition in low andesine range. Mafics pseudomorphous replacement by clusters of carbonate, chlorite, epidote.

Groundmass unaltered featureless interlocking irregular microcrystalline to very fine crystalline feldspars. Stained slab has weak stain network in groundmass indicating much of this material is potassium-rich. (K-feldspar).

#### Microscopic description

##### Phenocrysts

Plagioclase; 30%, euhedral/subhedral, (<0.1 to >1.0 mm). Fairly regular outline. Moderate sericitic and brown alteration dusting. Remnant twinning. Indicated composition in lower andesine range.

Altered mafics (hornblende-augite), <20%, euhedral/subhedral, (<.05 to >1.0 mm). Pseudomorphs replaced by intermixed clusters of carbonate, chlorite, epidote.

##### Groundmass

Plagioclase/K-feldspar; 50%, anhedral (microgranular to >.05 mm). Irregular interlocking grains. Featureless. Unaltered. Result of feldspathization of groundmass??

Note: potassium content indicated stained slab. [Weak stain as compared to # 9 D 91-4-127.9 m]

##### Accessories

Sphene; traces

Opagues (pyrite); 2%, subhedral/anhedral

# 7 Continued

Reflected light

Opagues; 2%

Pyrite; 2%, subhedral/anedral (<.05 to >1.0 mm). Disseminated grains. Coarser grains are associated with epidote.

One small bleb of chalcopyrite noted in pyrite.

#8 D (91-4, 101.1 m)  
Altered porphyritic trachyandesite

**General description**

Slightly altered plagioclase and pseudomorphous replacement of mafic phenocrysts in a microgranular to very fine granular K-feldspar bearing groundmass.

Plagioclase phenocrysts are partially altered by sericite and carbonate and have a red-brown alteration dusting. Mafics show pseudomorphous replacement by clusters of carbonate and foliated plumose chlorite. The groundmass has evenly disseminated minute clots of microgranular sericite and carbonate with weakly disseminated semiopaque flecks.

Opagues; <1%, disseminated magnetite.

**Microscopic description**

**Phenocrysts**

Plagioclase; >25%, euhedral/subhedral, (<0.1 to >3.0 mm).  
Partial alteration by sericite and carbonate. Red-brown alteration dusting. Weak remnant twinning.

Altered mafics; <10%, euhedral/subhedral (<0.1 to >2.0 mm).  
Complete pseudomorphous replacement by clusters of carbonate and plumose felted chlorite.

**Groundmass**

K-feldspar; >50%, anhedral (microgranular). Composed of minute interlocking grains. Partial alteration by abundantly disseminated minute clusters of aggregates of microgranular sericite and microgranular carbonate.

Plagioclase; suspected but not confirmed in groundmass.

**Alteration assemblage**

Sericite-carbonate alteration of plagioclase phenocrysts and groundmass.

Red-brown alteration dusting of plagioclase phenocrysts.

Chlorite-carbonate replacement of mafics.

Opagues (magnetite); <1%, subhedral/anhedral (<.05 to >0.5 mm).  
Disseminated. Black, magnetic.

#9 (D 91-4, 127.9)

**Hornblende monzonite/micromonzonite**

**General description**

Composed of fine/medium grained interlocking altered plagioclase and lesser hornblende in a finer K-feldspar-rich groundmass forming a near continuous network supporting the coarser plagioclase and mafic grains.

Few interstitial quartz grains in close proximity to regular walled quartz-epidote-carbonate-opaque vein. Minor accessory sphene.

Plagioclase has abundantly very fine felted sericite altered and red-brown alteration dusted cores with albitic(?) margins. Hornblende is partially altered to secondary amphibole, lesser chlorite, with minor associated epidote.

K-feldspar-rich groundmass has faint alteration dusting.

Opaques include disseminated magnetite, pyrite, lesser chalcopyrite, traces of ilmenite associated with sphene.

Quartz-epidote-carbonate vein contains coarser pyrite and lesser associated finer grained clusters of chalcopyrite.

**Microscopic description**

**Coarser components**

Plagioclase; 40%, subhedral/euhedral (0.1 to >1.0 mm).

Interlocking grains with hornblende. Strong sericitic altered cores albitic(?) margins (indistinguishable from interstitial K-feldspar groundmass).

Altered hornblende; >15%, anhedral/subhedral (0.1 to >1.0 mm).

Ragged crystal remnants. Partial alteration to secondary amphibole, chlorite. Associated minor carbonate, epidote.

Quartz; <<<5%, anhedral (<0.1 to 0.2 mm). Few interstitial quartz grains in close proximity to vein.

**Groundmass**

K-feldspar; >25%, anhedral, (<.05 to 0.1 mm). Aggregates of fine interstitial grains forming a continuous network supporting the coarser plagioclase and mafic grains.

**Alteration**

Albite(?)

Sericite

Secondary amphibole

Chlorite

Epidote

Semiopaque dusting

#9 Continued

Carbonate  
Red-brown alteration dusting

**Veins**  
Quartz-epidote-carbonate-opaques

**Reflected light**  
Opaques; <10%

(a) Disseminated  
Magnetite; 5%

Pyrite; <1%, subhedral/anhedral (<.05 to >1.0 mm)

Chalcopyrite; <1%, anhedral (<.01 to 0.2 mm) single and clusters of irregular grains. Some fracture control.

Ilmenite; traces, associated with sphene.

(b) Vein-related

Pyrite; <<5%, subhedral/anhedral (<.05 to >2.0 mm) beaded clusters along vein.

Chalcopyrite; <1%, anhedral (<.01 to 0.1 mm) clusters of irregular grains among pyrite with minor disseminations into adjacent wall rock.



#10 (D 91-5, 119.8 m)

Altered, mineralized, veined porphyritic andesite/microdiorite  
(K-feldspar introduced)

#### General description

Composed of altered plagioclase and mafic phenocrysts supported in a very fine feldspathic (plagioclase >> K-feldspar) groundmass.

Plagioclase phenocrysts have strong sericitic and semiopaque dusted cores, albitic margins. Mafic crystals pseudomorphous replacement by olive green biotite and chlorite.

Groundmass is composed predominantly of very fine plagioclase. K-feldspar is concentrated in wall rock at the margins of carbonate-quartz veins but has diffuse distribution throughout.

Groundmass appears relatively unaltered but is largely obscured by superimposed continuous network of very fine biotite/chlorite.

Veining; carbonate-quartz-epidote-opaque. (chalcopyrite)

Opaques include (a) disseminated magnetite with minor hematite intergrowths. Coarse chalcopyrite and minor pyrite occurs in vein with fine disseminations outwards into wall rock.

#### Microscopic description

##### Phenocrysts/coarse fraction

Plagioclase; 30%, subhedral, (<0.1 to 1.0 mm). Crowded but groundmass supported crystals, clusters of crystals. Intense sericitic altered cores, semiopaque dusting, albitic(?) margins.

Altered mafics; 10%, euhedral/subhedral, (<0.1 to <1.5 mm). Pseudomorphous replacement by olive brown biotite/chlorite as felted bladed pseudomorphous replacement of original mafic crystals.

##### Groundmass

Plagioclase; 30%, anhedral (<.01 to 0.1 mm). Interlocking grains.

K-feldspar; <10%(?), anhedral (<.01 to 0.1 mm). Conspicuous in stained slab concentrated in wall rock at margins of carbonate-quartz-epidote-opaque veins. Very weak diffuse distribution throughout groundmass. Introduced.

##### Overprints

Biotite/chlorite; 15%, anhedral, (<.01 to 0.1 mm) irregular grains clusters of grains. Biotite with varied intensity of chloritic alteration.

#10 Continued

Reflected light  
Opagues; <10%

Magnetite; <5%, subhedral/anhedral, (<.01 to >0.2 mm), disseminated and in association with altered mafics. Minor hematite intergrowths.

Chalcopyrite; <<5%, anhedral (<.01 to several mm). Weak disseminations, cluster of fine grains in wall rock adjacent to vein. Coarser near continuous masses (to several mm) in veins.

Hematite; <<<1%, anhedral (<.01 to .05 mm). Intergrowths with magnetite.

Pyrite; <1%, anhedral/subhedral (<.05 to 0.5 mm). Clusters of grains associated with chalcopyrite in vein.

#11 (D 91-6, 108.3 m)

**Hornblende monzodiorite/micromonzodiorite**

Note: Similar to [#9 D 91-4, 127.9 m] but less interstitial K-feldspar content. (Nothing in thin section or core sample to indicate a "lahar").

**General description**

Composed of near interlocking coarse component of altered plagioclase and hornblende with grain size ranging downwards to form the groundmass between coarser grains. Interstitial K-feldspar is conspicuous in the groundmass of the stained slab.

Plagioclase has varied intensity from moderate to strong sericite-semiopaque dusting alteration in cores with albitic margins. Hornblende occurs as ragged coarser to finer grains with varied intensity of chloritic alteration. Scattered clusters of carbonate.

Featureless K-feldspar in the groundmass is interstitial to other components and is indistinguishable in section from featureless albitic(?) rims on plagioclase.

**Microscopic description**

**Coarser fraction**

Plagioclase; 45%, subhedral/anhedral (<0.1 to >1.0 mm).  
Interlocking grains coarser grains in a finer groundmass.  
Strong felted sericitic and semiopaque dusted cores,  
albitic(?) rims.

Hornblende; 20%, subhedral/anhedral, (<0.1 to >1.5 mm).  
Irregular interlocking clusters of grains and with  
plagioclase. Scattered coarse crystals (to >3.0 mm), broken  
fragments.

**Finer fraction; 35%**

K-feldspar; 20%, anhedral, (<.05 to 0.1 mm). Fine granular  
interstitial groundmass.

Plagioclase; <5%, anhedral (<0.1 mm)

Hornblende; <5%, anhedral (<0.1 mm)

Carbonate; 1%, anhedral, (<.05 to 0.1 mm). Irregular clusters of  
grains.

# 11 Continued

**Alteration**

Sericite

Semiopaque dusting

Chlorite

Carbonate

Albite

**Opales;** 5%, euhedral/anedral (<.05 to 0.2 mm) Single grains, clusters of grains. Magnetite very minor pyrite.

**Veinlets**

Carbonate.

#12 (D 91-8, 11.1 m)  
Porphyritic dacite

#### General description

Altered plagioclase and hornblende phenocrysts. Abundant clusters of irregular fine grained quartz. Accessory apatite.

In a feldspathic (plagioclase)-rich microgranular groundmass.

Plagioclase phenocrysts have intensely altered sericitic, semiopaque microgranular dusted altered cores with albitic rims. Pseudomorphous replacement of hornblende by felted biotite and lesser secondary amphibole associated abundantly scattered very irregular clusters of secondary amphibole and biotite. Feldspathic groundmass clouded by light brown alteration dusting. Superimposed very fine diffuse felted biotite/secondary amphibole.

Cut by hairline, diffuse K-feldspar-rich veinlets. Some associated secondary amphibole, minor quartz, carbonate, dark red brown dusted undetermined material and opaques.

Opaques <5% disseminated pyrite.

#### Microscopic description

##### Phenocrysts

Altered plagioclase; 15%, euhedral/subhedral, (<.05 to >1.0 mm). Single grains, clusters of grains. Sericitic and semiopaque dusted cores, albitic (?) rims.

Altered hornblende; 20%, subhedral/anhedral, (<.05 to >1.5 mm). Replaced by fine felted biotite, lesser secondary amphibole. Some hornblende remnants.

Quartz; >10%, anhedral (<.05 to 0.5 mm). Very irregular grains, clusters of grains. Strained extinction. Not conspicuously fracture controlled.

##### Groundmass

Plagioclase; 35%, anhedral, (microgranular to <.05 mm). Felted interlocking. Semiopaque dusting. Very fine felted biotite /secondary amphibole overprint grading upwards to coarser felted clots.

##### Alteration

K-feldspar; <10%, anhedral (microgranular/<0.1 mm). Fracture controlled diffuse veinlets and weak impregnations out into wall rock.

# 12 Continued

Secondary amphibole/biotite; 10%, anhedral (microgranular to 0.1 mm). Very fine felted overprint in groundmass grading upwards to scattered coarser felted clots.

**Accessory minerals**

Apatite; traces.

**Alteration assemblage**

Sericite  
Semiopaque dusting  
Albite(?)  
Biotite  
Secondary amphibole  
K-feldspar  
Carbonate

Opagues (pyrite); 5%, subhedral, (<.05 to 0.3 mm), disseminated grains, clusters of grains.

**Veinlets**

K-feldspar, carbonate, secondary amphibole, red brown dusted material (?), opagues (pyrite).

# 13 (D 91-8, 142.4)

**Porphyritic hornblende plagioclase andesite**

• **General description**

Abundant altered fine/medium grained plagioclase and coarser hornblende phenocrysts in a microgranular to very fine grained felted/weakly foliated feldspathic (plagioclase/lesser K-feldspar) groundmass.

Plagioclase phenocryst cores are altered to very fine felted sericite and semiopaque dusting with albitic(?) margins. Hornblende is partially altered to chlorite, epidote, secondary amphibole. Groundmass is weakly sericitic, has weak semiopaque dusting and uniformly distributed felted secondary amphibole. Scattered irregular clusters of fine epidote, secondary amphibole, opaques.

Disseminated accessory apatite

Veinlets; epidote with diffuse bleached margins.  
Opaques; >5%, disseminated pyrite.

Note: Lacks quartz of (# 12 D 91-8 11.1) and K-feldspar is more diffuse and less obviously fracture controlled. Coarser grained than #12.

**Microscopic description**

**Phenocrysts**

Plagioclase; 30%, subhedral/euhedral (<0.1 to >1.0 mm). Single crystals/clusters of crystals. Sericitic, semiopaque dusted cores. Albitic(?) margins.

Hornblende; 20%, subhedral/anhedral (0.1 to 5.0 mm). Partial replacement by secondary amphibole, chlorite, epidote, carbonate. Associated opaques.

**Groundmass**

K-feldspar; 15%, anhedral (microgranular to >.05 mm).  
Interlocking grains. Irregular/patchy distribution indicated by stained slab.

Plagioclase; 10(?)%, anhedral, (microgranular to >.05 mm).  
Interlocking grains.

**Alteration overprint**

Secondary amphibole; >15%, anhedral (microgranular to >.05 mm).  
Very fine diffuse felted overprint over groundmass.  
Gradational to coarser denser clusters with associated epidote, opaques.

# 13 Continued

**Accessories**

Apatite; traces

**Alteration assemblage**

Sericite

Semiopaque dusting

Albite

Epidote

Chlorite

Secondary amphibole

**Opaques**

Pyrite; >5%, euhedral/subhedral (<.05 to >0.2 mm)

**Veinlets**

Epidote with diffuse bleached margins.