671809 GRIZ

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Jean Pautler
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Dear Jean,

Enclosed please find petrographic descriptions, thin sections and remaining sample material for 10 specimens submitted to us in august.

Specimens 92750, 22709 and 27714 are all from a trachytic volcanic center, which was extensively veined by quartz and chalcedony. No minerals of economic importance were observed in the thin sections.

The JP samples are hypabyssal (JP-1) and effusive (JP-2) trachy-andesites, which are locally considerably altered (JP-3) and crosscut by a multistage vein network (JP-5 & -6). Samples -5 & -6 contain up to 10% galena and sphalerite, associated with early quartz veins.

I hope these descriptions are satisfactory and of some use to you. Please do not hesitate to call me at our Fort Langley office if you have any further inquiries regarding these samples.

Yours truly,

Peter van der Heyden

Specimen : JP-1 GRIZ 1 SHOWING

Classification : Trachyandesite (hypabyssal)

Mode :		
	Plagioclase	65-70%
	K-spar	10-15%
	Quartz	5-10%
	Biotite	2%
	Chlorite & carbonate	5%
	Zircon and apatite	tr
	Opaques	5%

Handspecimen : Massive, holocrystalline, grey, medium to fine grained volcanic or hypabyssal rock. The stained block indicates a trachyandesitic to dacitic composition. Small flakes of biotite are macroscopically visible. Small blebs of disseminated pyrite are locally present.

Thin section : Texture : intergranular, medium grained.
Plagioclase occurs as abundant, subhedral to euhedral, randomly oriented laths and a few phenocrysts up to 2.5 mms. long. Carlsbad, albite and pericline twinning are all present. Many crystals are zoned, with compositions ranging from albite (rims) to andesine (cores). The plagioclase is locally a bit altered to saussurite.
K-spar is rather hard to distinguish from quartz in thin section. Both occur as anhedral grains occupying the interstices between plagioclase laths. Quartz loclally contains euhedral apatite inclusions.
Biotite forms subhedral to anhedral flakes up to .8 mms. in size. It is brown pleochroic, locally a bit chloritized and sometimes associated with granular opaques.
Carbonate and chlorite occur together in fine grained, irregular patches of up to 1.5 mms. in size, scattered throughout the rock. These are most likely altered amphiboles. Locally the patches are pseudomorphs after amphibole.
Apatite is present in small amounts, as accessory microlites.
Zircon occurs in trace amounts as small, euhedral microlites (.1 mm. size).
Opaques are present as euhedral granules and aggregates up to .5 mms.
Much of this is probably pyrite, which can locally be seen in handspecimen.

Specimen : JP-2 GRIZ 3 SHOWING

Classification : Trachyandesite (volcanic)

Mode :		
	Plagioclase	35-40%
	K-spar	40%
	Calcite & other secondary minrls.	10%
	Biotite	5%
	Quartz	<5%
	Accessories	1%
	Opaques	1%

Handspecimen : Grey, massive volcanic rock containing phenocrysts of plagioclase, altered (calcareous) amphibole and biotite. The matrix is very rich in K-spar, as indicated by the yellow colour in the stained block.

Thin section : Texture : porphyritic, holocrystalline; most likely a effusive rock.

Plagioclase occurs as euhedral and subhedral phenocrysts ranging up to 5 mms. in size. Although finely developped oscillatory zoning is present in many of the laths, the average composition appears to be An-40, andesine. (Determined by combined carlsbad/albite method). Carlsbad, albite and pericline twinning are all present. All grains contain small patches and thin veinlets of secondary carbonate.

Biotite forms brown pleochroic phenocrysts up to 2 mms. in size. These are frequently somewhat corroded and locally intergrown with plagioclase phenocrysts. Most grains are surrounded by thin rims of granular opaques.

Calcite occurs in granular aggregates up to 2 mms. in size, which are clearly pseudomorphous sfter a ferro-magnesian phenocrystic phase. Frequently the carbonate surrounds cores composed of fine grained, aggregate olayminerals, white mica and feldspar. In turn, they are rimmed by fine granular opaques. Calcite occurs furthermore as irregular secondary patches throughout the remainder of the rock.

K-spar forms the bulk of the fine grained groundmass. together with lesser plagioclase and probably some quartz, secondary minerals, apatite, opaques etc.

Apatite occurs as euhedral and subhedral accessory crystals up to .25 mms. in size, scattered throughout the groundmass. A few grains of subhedral zircon are present as well.

Opaques occur as fine disseminated granular material. The coarser grains (up to .5 mm.) are subidiomorphic and tend to form aggregates.

Note : possibly this specimen is a effusive variety of spec. JP-1.

Specimen : JP-3 GRIZ 3 SHOWING

Classification : Altered feldspar porphyry

Mode :		
	Quartz	40-50%
	Clayminerals	30-40%
	Limonitic calcite	10%
	White mica	5%
	Accessories	1%
	Opaques	1%

Handspecimen : Strongly altered (limonitic & calcareous), porphyritic volcanic rock. Altered feldspar (plagioclase) and amphibole(?) phenocrysts are macroscopically visible. The vague primary texture somewhat resembles that of specimen JP-2.

Thin section : The groundmass of this specimen appears to be composed predominantly of fine grained, granular quartz (av. size .18 mm.), clouded by dusty secondary minerals, probably mostly clayminerals. Scattered through this matrix are abundant, irregular secondary patches of limonitic calcite, clayminerlas and a bit of white mica. Probably the quartz itself is of secondary origin, having replaced a primary volcanic groundmass. This throws considerable doubt on a rhyolitic classification for this specimen. It may be a silicified and altered version of JP-2, but is here classified as a altered feldspar porphyry.

Scattered throughout the groundmass are accessory amounts of euhedral apatite (up to .25 mm.) and subhedral zircon.

Original phenocrysts of plagioclase, amphibole and biotite are represented by pseudomorphs composed of clayminerals, white mica, limonitic calcite and opaques. These range up to 4 mms. in size and resemble those of spec. JP-2 in being frequently surrounded by rims of fine granular opaques, which are mostly altered to limonite.

Small grains of subidiomorphic opaques are scattered throughout.

Specimen : JP-5 GRIZ 3 SHOWING

Classification : Galena & sphalerite bearing cataclastic rock

Mode :		
	Quartz	60-70%
	Clayminerals & white mica	10%
	Calcite & limonite	10%
	Galena & sphalerite	10%
	Apatite & zircon	tr

Handspecimen : Limonitic and calcareous banded breccia/protomylonite containig lenticular domains rich in galena and sphalerite. The rock is crosscut by post mylonitic fractures, some of which have been healed by carbonate.

Thin section : Irregular to lenticular, nebulous domains of very fine grained to aphanitic material (rich in clayminerals but otherwise silicified) are the only indicators of a primary lithology. Locally a faint suggestion of a original porphyritic texture is present as well, with claymineral aggregates resembling altered phenocrysts set in a fine grained, siliceous matrix. These are visible in the lower part of the section.

The remainder of the specimen is composed of secondary minerals, mainly quartz carbonate, limonite, galena and sphalerite, with lesser clayminerals and white mica. Some of the quartz forms granular textures masses rather similar to the groundmass quartz in spec. JP-3. Small, irregular patches and veinlets of limonitic calcite and clayminerals are everywhere present. Relict zircon, apatie and altered biotite are present within these domains.

The rest of the quartz is clearly of hydrothermal origin, replacing the earlier lithologys along veinlets and lenticular domains generally parallel to the cataclastic fabric. Grainsize ranges from extremely fine grained to approx. .5 mms.

Calcite forms lenticular bodies up to 3 mms. thick, parallel to the cataclastic fabric. It is also present in irregular secondary patches and in veinlets along late fractures. Cross cutting relations suggest several episodes of remobilization.

Sphalerite occurs as subhedral crystals, often faintly zoned, up to 1 mm. in size. It is clearly associated with galena within the relatively coarser grained quartz domains. Minor amounts of pyrite are present as well.

Specimen : JP-6 GRIZ 3 SHOWING

Classification : Silicified, veined and altered trachyandesite

Mode :		
	Quartz	30-45%
	Clayminerals	25%
	Calcite	30-40%
	Zircon & apatite	tr
	Sphalerite	<5%
	Other opaques	1%

Handspecimen : Light grey, siliceous and calcareous vein breccia. Angular fragments with a original porphyritic texture, very similar to spec. JP-2, are clearly visible in cut surface. This spec. is most likely a altered, silicified and veined version of JP-s. Rare, small specks of galena are visible in handspecimen.

Thin section : The above view is conclusvely verified by thin section examination. The pre vein texture is identical to thatin spec. JP-3. Abundant carbonate occurs in small secondary patches, as larger granular masses and in veinlets. As tiny euhedral crystals it is associated with chalcedony veins, which run along the length of the section and crosscut all other fabrics. Locally these veins are a bit vuggy.
Clayminerals occur as very fine grained aggregates associated with granular quartz (as in JP-3). A few relict zircon and apatite,crystals remind one of the original nature of this rock. Relict phenocrysts are not very well visible in thin section but are clearly present in handspecimen.
Opaques occur as scattered, small grains and aggregates. A few small grains of sphalerite (av. size .25 mms.) are clearly associated with galena and secondary granular quartz.

Specimen : G-1

GRIZ 3 SHOWING

Classification : Siliceous and calcareous vein-breccia + ore minerals

Mode :		
	Quartz	40-50%
	Calcite	40%
	Clayminerals	10%
	Opaques	5-10%

Handspecimen : Siliceous and calcareous vein-breccia containing galena and sphalerite. Light coloured siliceous fragments are set in a dark, aphanitic siliceous vein network. Some of the veins are a bit hematitic. A few dark areas (fragments?) contain fine, yellow metallic needles.

Thin section : Texturally and mineralogically this specimen is somewhat similar to the previous two samples, combining elements of both. However, original (porphyritic?) textures are only very poorly preserved among some of the finer grained siliceous, claymineral rich domains. These are here interpreted as remnants of the primary, albeit altered, lithology. Only a few of these are present, the remainder of the sample being composed of a complex multistage vein network. The pattern of veining is as follows:

stage 1 : Early quartz veining, probably synehronous with silicification. Relatively coarse grained quartz, locally speroidal and radiating. Average size .5 mms. It is evidently this phase during which the ore minerals were introduced.

stage 2 : Crosscutting calcite veinlets. These are locally a bit hematitic and appear to have remobilized some of the ore minerals.

stage 3 : Late, very fine grained silica (chalcedony) veinlets, cross-cutting the previous two stages. This stage includes some brecciation and fracturing. The resulting fabric is in part cataclastic. At least some late stage movement along fractures has occured after injection of these fine grained silica veins, juxtaposing them against earlier stage domains.

The fine grained euhedral, yellow sulfide needles are ~~composed of pyrite~~ arsenopyrite. They are up to 1 mm. long and have a rhombic cross-section. Locally it is intergrown with galena. Galena locally forms feathery, anisotropic aggregates, probably due to cataclastic deformation. Sphalerite is associated with the galena and pyrite, and forms zoned, subhedral crystals up to 1 mm. in size.

Specimen : G-2 GRIZ 3 SHOWING

Classification : Siliceous and calcareous vein-breccia

Mode :		
	Quartz	30%
	Calcite	40%
	Clayminerals/white mica	10%
	Opaques	20%

Handspecimen : Galena and sphalerite bearing vein-breccia. A distinct anisotropic fabric is probably the main difference with spec. G-1. Both calcite and silica veinlets are present, and any remaining original lithology is likely highly silicified and altered. Late fractures have slightly offset some of the catclastic fabric, and hence are younger in age.

Thin section : In thin section this specimen is not significantly different from spec. G-1, at least mineralogically. Fine grained, silicified domains rich in clayminerals and a bit of white mica, probably represent the oldest phase in this rock. A crosscutting sequence of veins appears to be similar to that in spec. G-1. Spalerite occurs mainly in calcite veinlets and may have been remobilized from a original association with early quartzveins. It forms grains up to 5 mms. in size. Very fine grained siliceous veins (stage 3) which locally crosscut calcite veins, contain abundant euhedral calcite crystals, probably due to remobilization from the earlier calcite veinlets. The coarser grained calcite crystals (up to 3.5 mm.) are a bit bent, lending support to the notion of late stage cataclastic deformation as advertized under G-1. Subsequent fractures have offset the stage 3 structures somewhat. Galena, associated with spalerite, ranges up to 1 mm. in size.