Geology '80

CAPOOSE 93F/6 **881561** by Tom Schroeter, P. Eng.,

The Capoose precious and base metal prospect is situated a few kilometres north of Fawnie Nose, approx. 110 km southeast of Burns Lake. (See Fig. 1). Access is via 4-wheel drive road off the main Kluskus logging road south of Vanderhoof or by helicopter.

During the 1980 season, Granges completed approx. 3962 metres of diamond drilling in 21 holes.

Local Geology

The Fawnie Range in the vicinity of the Capoose property is composed of a conformable sequence of interbedded greywacke, shales and metamorphosed pyroclastic volcanic rocks and flows of rhyolitic and andesitic composition unconformably overlying andesitic rocks of the Takla Group. Tipper (1963) postulates that volcanism took place intermittently in later Middle Jurassic time in an unstable basin undergoing rapid changes with accumulation of finer sediments in a northwesterly trending sedimentary trough bounded on the north and northeast by a landmass in which Topley Intrusions were beginning to be exposed. The pile of Hazelton Group (or younger) rocks is estimated to be greater than 460 metres (Tipper, p. 32, 1963). The east side of the Capoose property (topographic low) is underlain by interbedded greywacke, maroon tuffs and limey argillites of probable Upper Jurassic (English Callovian) age (Upper Hazelton Group?). Fossils found in limey argillite of this sequence have been identified by H. Frebold (Tipper, p. 29, 1963):

No. 4 GSC Locality 20116 - 2.3 km from the north end of Fawnie Nose
Belemnites sp. indet.
"Rhynchonella": sp. indet.

Limestone blocks were noted in argillite, immediately below the contact with rhyolite. Unfortunately only a broad Jurassic or Cretaceous Age can be applied.

Conformably overlying the limey argillite unit with an attitude of 170°/20°W is an acidic unit consisting of rhyolitic pyroclastics and flows. Phenocrysts of highly embayed quartz are set in a cryptocrystalline groundmass of quartz and feldspar. Flow banding in the rhyolite averages 135°/15°W with a strong vertical jointing at 090° parallel to the major structural zones. Local "balling" or pisolitic formation within rhyolite has produced beds with "balls" up to 30 cm in diameter. Pisolites are actually glorified nuclei growths and exhibit rare spherulitic radiating textures, indicative of rolling during or after growth. The unit has been garnetized to varying degrees (see "Alteration").

Dark green andesitic tuffs, breccias and flows, some hornfelsed with well developed secondary biotite lie in contact with the rhyolite and have also been garnetized.

Alteration and Texture

Amber brown coloured garnets $Sp_{63}Al_{29}Gr_{8}$ (Mn-rich) are an ubiquitous feature of metamorphosed rhyolitic and andesitic rocks in the vicinity of mineralization. Some are fresh and others are totally altered or replaced by a mixture of quartz ± sericite ± opaques. They are sometimes highly poikilitic, and show no evidence of rolling during growth. Garnet occurs as disseminations, as fracture fillings, as vein fillings in quartz and as replacement nuclei. Hydrothermal solutions have cracked the garnets and they have subsequently been healed by sulphides (mainly pyrite). The matrix of the rhyolite has been highly sericitized.

The predominant texture observed is one of nucleation and/or dispersion exhibited by pseudomorphs after garnet. A dispersion rim of quartz and/or sericite is common. The textures suggest that crystallization took place rapidly under strong chemical or energy gradients. Dentritic growth textures are also exhibited. It is thus postulated that growth was diffusion - controlled as a result of the composition of the large crystals (i.e. garnets) differing appreciably from the groundmass (quartz) and feldspar). The skeletal texture of garnets implies difficulty in nucleation.

Globular to botryoidal and fracture filling hematite is common in rhyolite.

Epidote and chlorite are common alteration products in the andesitic rocks.

Structure

The predominant structures in the area are east-west faults which are exhibited by small linear depressions on Fawnie Range. Drilling has also identified several fault gouges. Broad warping of thin bands in the argillite unit occur.

Mineralization

Three zones of precious ("bulk silver") and base metal mineralization have been preliminarly identified:

Zone 1 - area of most previous diamond drilling has defined a steep west facing zone in garnetized rhyolite.

Zone 2 - area to the west of Zone 1.

Zone 3 - area to the north-northwest of Zone 1.
- characterized by more massive sphalerite, pyrrhotite and chalcopyrite in rhyolite and hornfels.

Zone 1

Galena, pyrite, pyrrhotite, chalcopyrite, arsenopyrite and sphalerite occur as disseminations (esp. galena), replacement of garnets (nuclei and attendant dispersion halos) and as fracture and/or vein fillings in fine-grained rhyolite tuffs, breccias, and flows and in meta-andesite. Tetrahedrite, pyrargyrite, electrum, native gold, and cubanite have also been reported. Precious metals also occur within galena and sphalerite. Pyrite is ubiquitous and may have formed throughout the mineralizing event. Garnet replacement and mineralization are closely related. Belemnites in limey argillites underlying the rhyolite unit have been locally replaced by pyrite. It is interesting to note that a previous sample collected by the writer assayed .03% Mo and 0.03% W (Schroeter, p. 123, 1979).

Summary

It is postulated that a magmatic source provided heat and mineralizing solutions intrusive into rhyolitic and andesitic rocks possibly near an old volcanic centre, resulting in replacement of garnets by sulphides and formation of mineralized veinlets and possibly more massive bodies of mineralization.

REFERENCES

1) Tipper, H.W. 1963. Nechako River Map-Area, British Columbia, Geological Survey of Canada, Memoir 324.

2) Schroeter, T. G., 1979, B.C. Ministry of Energy, Mines and Pet. Res., Geological Fieldwork, p. 123.

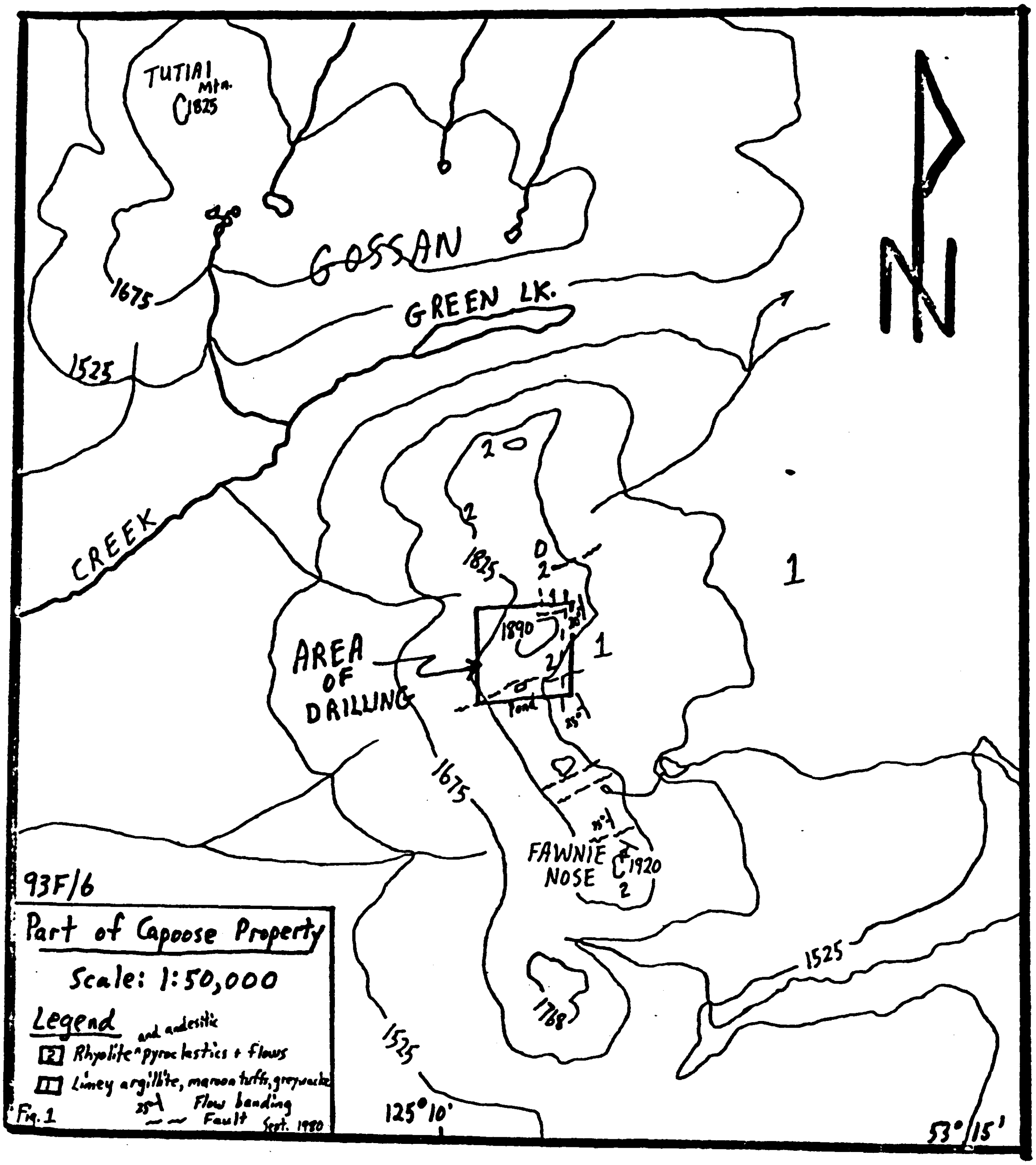
TUTIAI Mtn.
1825
GOSSAN
1675
GREEN LK.
1525
CREEK
2
2
1825
0
2
1
AREA OF DRILLING
1890
1
2
1
Pond
25
1675
25
FAWNIE NOSE
1920
2
1768
1525
1525
93F/6
Part of Capoose Property
Scale: 1:50,000
Legend
2 Rhyolite and andesitic pyroclastics + flows
1 Limey argillite, maroon tuffs, greywacke
25 Flow banding
Fault
Sept. 1980
125°10'
53°15'

Fig. 1

15 July 80

PRELIMINARY COMMENT REGARDING THIN SECTION AND POLISHED SECTION STUDY - CAPOOSE PROPERTY

Garnets

By Tom Schroeder

Fifteen thin sections and nine polished sections were studied briefly from sections of core collected by myself in August, 1979 (see separate sheet for numbers). The most obvious and ubiquitous feature of all sections is the presence of garnet. The garnet is amber brown in colour and various from fresh to totally altered or replaced by quartz ± sercite ± opaques. In some instances, the garnet is highly poikilitic. The garnets do not show any evidence of being rolled during growth. Garnets occur both as discrete grains disseminated in the matrix and also in fractures or veins. In mineralized specimens,,the garnets have been broken and healed by sulphiedes (mainly pyrite).

The most striking textural feature is displayed by nucleation and/or diffusion resulting from pseudomorphs after garnet. In many cases, the garnet is still preserved. Adispersion rim of quartz and/or sercite is common. The conditions during growth must have been such that crystallization took place rapidly under strong chemical or energy gradients. As a result, a somewhat dendritic growth texture may form depending on the kinetics of diffusion, rate of release of free energy; of transformation, and on interface energy requirements. Apparently when large crystals phenocrysts or whatever name you want to refer to the garnets) differ appreciably in composition from the matrix (i.e. host rhyolite) the growth is diffusion - controlled. In some cases, the garnet may take on a skeletal texture, which apparently implies difficulty in nucleation.

So - What does all this mean? Well, I think it shows a process of growth, nucleation, dispersion and, best of all, replacement by sulphides. The origin of the sulphides cannot at this time be accurately stated but I would suggest that they may be closely related to the original magma responsible for the host rhyolite. The replacement process is the key to understanding the size of the mineralizing system. In hand with this aspect is the origin or ubiquitoys

$Sp_{63}Al_{29}Gr_{8}$ (Mn-rich)

existence of garnet. Are the garnets of primary origin or do they represent "secondary" digested limey accumulations from pre-existing rocks? Much more detailed field mapping, etc. will be required to better these questions. Suphides exist in three ways:

1) Finely disseminated grains (sep. galena).
2) Veinets (esp. py + cpy + ZnS + PbS + garnet)
3) Replacement of garnet nuclei and attendant dispersion halos.

Other 'phenocrysts' in the host rhyolite include highly embayed quartz crystals, again implying dissolution or later attack by magma.

The ground mass of all specimens has been highly sericitized - a good sign for mineralization. A distinct 'bed' of pisolitic rhyolite has been noted. The pisolites are actually glorified nuclei growths which rarely exhibit a spherulitic radiating texture. The coarse texture may be attiibuted to rolling during or after growth. Garnets and suphides are also ubiquitous to this unit.

With regard to the sulphides present, I must admit that I have not observed any of the silver bearing minerals - except, of course, for galena. This is due to mu inexperience in liiking at these in polished section in very fine amounts and also due to time limitations. Nevertheless, from comparing my assays and yours, I see that the percentage of galena cannot account for the total amount of silver. It is possible that some silver is also tied up in the chalcopyrite. In general, the silver values appear to be directly related to the presence and amount of galena. I also think that sphalerite might be a key zonation mineral.

I examined a couple of sections of obviously darker coloured rock (termed andesitic by some). I wouldn't go as far to say they were andesites. The darker colour is due to the presence of secondary biotite (fine grained) and/or chlorite. It may be possible to draw some sort of an alteration contact using this rock.

In terms of further exploration, I would suggest that the garnetized rhyolite host should be examined to determine an optimum or maximum limit of replacement by sulphides. Hopefully this years' diamond drilling will aid in answering some of the above questions.

CAPOOSE

THIN SECTIONSx	POLISHED SECTIONS
DDH - 79-2-50.3m	
-83.8m	
DDH-79-3-36.6m	
DDH-79-4-44.2m	DDH-79-4-153.6m
-45.7m	
-85.3m	
DDH-79-5-73.8m	DDH-79-5-59.1m
	-64m
	-132.3m
DDH-79-6-58.8m	DDH-79-6-79.3m
DDH-79-7-121.6m	DDH-79-7-22.6m
-134.7m	
	DDH-79-8-157.9m
DDH-79-9-37.8m	DDH-79-9-57.9m
	-66.2m

Plus 3 thin sections of representative hand specimens

Tom Schroeder,
District Geologist

CAPOOSE

June 26

- Comments on thin section studies

→ All sections contained garnets which vari from 'fresh' to poikilitic to highly altere to completely replaced.

→ Garnets replaced by qtz ± sericite ± opaqu

→ Garnets are not rolled nor have any growth tex

→ Garnets appear to have grown later than sericite.

→ Nuclei, dispersion texture around once-nucleus of garnet - now dispersion rim of q

→ Muscovite halos around sulphide replacemen

→ Garnet + sul + qtz veinlets also.

→ Darker coloured rx. due to presence of secondary biotite and/or chlorite

→ Some specimens have large embayed qtz. phen others don't.

→ Matrix of all specimens - highly sericitized

→ Some spherulitic radiating texture in pisolites

Pg. 102 Metamorphic Textures

- Multi-phase pseudomorphs after garnet.
- Symplectic intergrowths between garnet + qtz i.e. crystallization involves co-nucleation + mutual growth of 2 phases.

- 1) **Normal eutectoid texture** – one phase nuclea on the other phase + both grow together
  2) **Anomalous eutectoid texture** – both phases are nucleated by foreign impurities
  3) **Degenerate eutectoid texture** – second phas- is not nucleated until 1st phase has crysta

→ Simultaneous co-nucleation + interdependent growth of the two phases by discontinuous precipitation but similar textures can be produced by partial replacem

*→ Conditions of growth are such that Xll'n takes place rapidly under strong chemical or energy gradients + dendritic growth results. The geometry of th forms produced depends on the branching of the original duplex nucleus. – the spacing between branches or fingers depends on kinetics of diffusio rate of release of free energy of transformation, + on interface energy requirements.

Rims – synantetic minerals – kelyphitic rims, corona corrosion mantles + reaction rims. (i.e. secondary rim)
- Simple coronas – 2 or 3 minerals – in non-metam igneous r

- Some coronas represent an arrested stage in~~a~~ alt'n of a miner during progressive alt'n <u>OR</u> = ~~retro~~grade.

<u>Nucleation – pg. 116 – 120</u>
– thermal fluctuations in nuclei

– met'am porphyroblasts
– X/s grow very rapidly + engulf adjacent X/s + have lower surface energy per unit volume + th. more stable + continue to eat up smaller X/s.

– When porphyroblast differs appreciably in composition – the matrix, the growth is "<u>diffusion-controlled</u>" i.e. req movement of constituents over appreciable distances.
<u>Textures</u> – 'skeletal, dendritic → grain bounda diffusion coupled with difficulty of nucleation.

<u>Skeletal garnet</u> implies difficulty in <u>nucleation</u> but not true dendritic growth.

<u>Embayed X/s</u> – common in acid volcs but <u>rare</u> in met
– shape attributed to <u>dissolution</u> (corrosion, resorpti to amoeboid growth + to coalescence.
– modification of euhedral X/s by later attack of magi

<u>~~Intergrowths Due to~~ Replacement</u> (p. 177) – rim replacem

CAPOOSE

July 2/80

Comments on Polished Sections

- all sections have garnet - some fresh, som completed replaced. Garnets are well rouna and have been cracked + ~~am~~ ~~replaced~~ healed by sulphides (mainly py.)
- PbS very finely disseminated
- Veinlets of PbS + Cpy + Py
- Nuckation exists
- ZnS has bright yellow 'exsolution' blebs = ? gol
- Replacement of garnets by sulphides = KEY
  - involves nucleation process also.

CPY?

TABLE 5: Whole rock K-Ar ages for Capoose volcanic rocks and a K-Ar age for the Capoose batholith using biotite.

SAMPLE NUMBER	ROCK COMPOSITION	K-Ar DATE USING WHOLE ROCK (Ma)	K-Ar DATE USING BIOTITE (Ma)
KCP 009	quartz garnet rhyolite	68.4 +/- 2.4	
KCP 035	felsite	64.3 +/- 2.3	
KAD 042	garnet rhyolite	70.3 +/- 2.5	
DVL 190	granodiorite		67.1 +/- 2.3

Alteration dates ?!

REPORT DATE 12 FEB 1987

CAPOOSE

LAB NO	FIELD NUMBER	SiO_2 %	TiO_2 %	Al_2O_3 %	Fe_2O_3 %	FeO %	MnO %	MgO %	CaO %	Na_2O %	K_2O %	P_2O_5 %	LOI %	TOTAL %
R8611025	KCP-002 lithic wacke	33.34	.57	12.97	9.67		.33	4.81	18.57	1.25	2.43	.15	13.1	97.19
R8611026	KCP-009 qtz gar rhy	78.51	.11	12.46	.86		.48	.05	.52	.02	4.39	.02	1.87	99.29
R8611027	KCP-012 gar rhy	76.93	.12	13.23	1.29		1.55	.29	.13	.02	4.05	.02	2.18	99.81
R8611028	KCP-020 B qtz gar rhy	78.1	.11	12.08	.89		1.45	.13	.19	.09	5.44	.02	1.42	99.92
R8611029	KCP-027 gar rhy	71.71	.15	14.05	2.26		.54	.52	2.22	.16	6.03	.03	1.52	99.19
R8611030	KCP-028 qtz gar porph	68.72	.3	14.92	2.51		.74	1.08	2.78	.15	6.65	.08	1.34	99.27
R8611031	KCP-035 felsite	76.26	.06	13.13	.48		.06	.02	.16	3.31	4.84	.02	1.34	99.68
R8611032	KCP-044 rhy	76.79	.29	13.67	1.28		.72	.3	.09	.14	4.36	.02	2.14	99.80
R8611033	KCP-054 garn rhy	75.53	.14	13.09	2		2.95	.16	.06	.02	3.9	.02	2.33	100.20
R8611034	TCP-002 lithic wacke	33.5	.57	12.84	9.74		.33	4.81	18.43	1.17	2.49	.15	12.29	96.32
R8611035	TCP-009 qtz gar rhy	78.61	.11	12.36	.85		.45	.18	.52	.05	4.39	.02	1.85	99.39
R8611036	SCP-005 std	65.12	.48	16.41	4.41		.07	2.65	4.94	4.21	1.63	.13	.06	100.11
R8611037	BVL-190 capoose bas	65.01	.33	13.7	2.41		.06	.79	2.25	3.35	3.88	.08	7.85	99.71
R8611038	KAB-042 alt. rhyolite	74.35	.21	12.9	3.93		.04	.29	.02	.02	4.21	.02	3.48	99.47
R8611039	GCP-013 dacite	72.06	.55	12.74	6.35		.02	2.33	.1	.72	2.17	.02	2.8	99.86
R8611040	GCP-018 bas and.	50.19	.82	16.5	9.18		.15	5.5	6.33	.87	1.82	.18	7.88	99.42

LAB NO	FIELD NUMBER	Ba(4) PPM	V PPM	U(4) PPM	Nb PPM	Rb PPM	Sr PPM	Y PPM	La PPM	Cu(2) PPM	Ni(2) PPM	Ag PPM	Sb PPM	Pb PPM	Zn PPM	As PPM
R8611025	KCP-002	372	<239	<20	<20	79	229	<20	<20	<5	<4					
R8611026	KCP-009	219	<20	<20	<20	129	27	20	<20	126	35					
R8611027	KCP-012	262	<20	22	<20	161	<20	<20	<20	<5	<4	1.5	<4	96	16	204
R8611028	KCP-020 B	272	<20	21	<20	158	27	<20	<20	<5	<4					
R8611029	KCP-027	1481	<20	<20	<20	204	101	<20	<20	<5	<4					
R8611030	KCP-028	1672	<20	21	<20	254	86	<20	<20	<5	<4					
R8611031	KCP-035	61	<20	20	<20	258	<20	<20	<20	<5	<4					
R8611032	KCP-044	313	21	<20	<20	185	<20	<20	<20	10	<4					
R8611033	KCP-054	133	<20	<20	23	248	<20	30	<20	<5	<4	7.9	5	616	26	164
R8611034	TCP-002	373	233	<20	<20	76	238	<20	<20	122	37					
R8611035	TCP-009	209	<20	<20	<20	135	21	<20	<20	<5	<4					
R8611036	SCP-005	609	80	<20	<20	<20	750	<20	<20	51	40	<.4	<4	<4	27	<2
R8611037	BVL-190	1126	52	<20	<20	157	380	<20	<20	13	5					
R8611038	KAB-042	390	<20	<20	<20	197	<20	<20	<20	<5	<4	15.6	<4	102	29	12
R8611039	GCP-013	1404	47	<20	<20	64	85	44	<20	<5	<4					
R8611040	GCP-018	491	245	<20	<20	40	98	27	<20	25	<4					

I=INSUFFICIENT SAMPLE X=SMALL SAMPLE E=EXCEEDS CALIBRATION C=BEING CHECKED R=REVISED

EXPLANATION OF SAMPLE NUMBERS IN RELATION TO UNITS ON FIGURE 1:

SAMPLE NUMBER	ROCK COMPOSITION	UNIT NUMBER ON FIGURE 1
KCP002	lithic wacke	5
KCP009	quartz garnet rhyolite	6
KCP012	garnet rhyolite	7
KCP020A	quartz garnet rhyolite	6
KCP027	garnet rhyolite	7
KCP028	quartz garnet porphyry	9
KCP035	felsite	10
KCP044	rhyolite	8
KCP054	rhyolite	8
KAD042	rhyolite	8
TCP002	lithic wacke (duplicate)	5
TCP009	quartz garnet rhyolite (duplicate)	6
DVL190	granodiorite (batholith)	N/A
GCP013	dacite	3
GCP018	basaltic andesite	1
SCP005	U.B.C. standard	N/A

(from figure 1 in Bottinga and Javoy, 1975):

6. $\Delta(Q,G) = 2.9\,(1000/T)^2$, and

7. $T^2 = 2.9(10^6)/\Delta(Q,G)$, thus from equation 5.

8. $B_{(Q,G)} = 2.9(10^6)$

Using equation 6 a minimum igneous temperature of 727°C was calculated in Table 4.

DATING

Whole rock K-Ar dating of three samples from the Capoose property yielded dates of 64.3Ma to 70.3Ma (Table 5). These dates straddle the Cretaceous/Tertiary boundary and reflect the age of alteration on the property. The Capoose batholith, a quartz monzonite intrusive 5km northwest of the property has been dated as Late Cretaceous (67Ma) by the K-Ar technique using biotite (Table 5).

Galena lead isotope dating of a sample from the Capoose property ($^{206}Pb/^{204}/Pb$ = 18.903; $^{207}Pb/^{204}Pb$ = 15.601; $^{208}Pb/^{204}Pb$ = 38.482) plots near the mid-point along the "Bridge River mixing line" of C. Leitch and others (unpublished data, 1987). Since the mixing line probably indistinguishably spans Late Cretaceous to Middle Eocene time (50Ma to 90Ma), the lead analysis supports the age indicated by the whole rock K-Ar alteration data above.

All avenues of dating emphasise the similarity in age of the Capoose batholith and mineralization/alteration on the property. This stresses a probable genetic relationship between these two events.