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PETROGRAPHIC DESCRIPTION OF SQUAW PEAK CORE SPECIMENS

by

K. F. Bickford

Thin sections were made of eight core samples taken from Squaw Peak drilling. These specimens came from depths of 432 feet, 523 feet, 591 feet, and 600 feet in diamond drill hole #1, and from 123 feet, 227 feet, 570 feet, and 600 feet in diamond drill hole #3.

With the exception of the specimen from DDH #1 at 432 feet, the samples are similar enough to be described collectively. All are essentially ferromagnesium minerals comprising two chlorites and biotite, feldspar minerals comprising orthoclase and oligoclase, and quartz. All are quartz monzonite with a hypautomorphic granular texture.

Biotite

The biotite does not appear in all slides and does not appear to be a derivative of amphibole. It is more abundant in slide 3-227 (DDH #3 at 227 feet) where it is nearly equal to chlorite; otherwise it is a minor constituent.

The biotite is fresh appearing and may be introduced rather than primary.

Chlorite

There are two kinds of chlorite (probably penninite (?) and clinochlore) both of which are alteration products of primary hornblende. Although no part of original hornblende remains, crystal shapes, especially one end section, is proof of origin. The two chlorites occur together and separately with clay as alteration products. The clay seems to be more abundant with penninite (?) than clinochlore.

The ferromagnesian minerals appear as remnant and matrix material somewhat later than feldspar. They amount

to perhaps 10% to 15% of the total bulk of the rock but vary in abundance.

Feldspar

The feldspar appears to comprise about equal amounts of orthoclase and oligoclase. It is crushed and intergrown and highly altered; a condition which makes identification difficult. It is zoned and twinned with the zoning appearing more as a relic or shadow condition cut by twinning. Albite twinning is prominent with less pericline twinning and an occasional carlsbad twin. Rarely all appear together in the same crystal. The crystallization and twinning of the feldspar is best shown in specimen 3-600 for there is less corrosion of the crystal outlines and less clay alteration.

The alteration of the feldspar to clay and sericite has been controlled roughly by zoning, twinning, and incipient fracture. The clay alteration is often more abundant in the center of the crystal with alteration on the perimeter tending toward sericite; an apparent result of crystal zoning. On some slides the impression obtained was that the orthoclase was more altered than the plagioclase.

Quartz

The quartz is about equal in abundance with feldspar. It is dusty showing the presence of tiny inclusions and often has the dust aligned indicating an incipient fracturing of the grain. The quartz appears to be of at least two ages and possibly three. It sometimes appears almost contemporaneous with the feldspar but is more often later containing feldspar inclusions and acting as a matrix to feldspar crystals. In one slide it appeared with sulfides along an indistinct vein. It also appears to be an alteration product of both amphibole and feldspar along with clay. This last relationship requires more sophisticated methods for positive identification.

Sulfide

It was not possible with the means available to differentiate between pyrite and chalcopyrite in this section unless the crystal outlines of the pyrite appeared. There was less than 1% sulfides in all slides. The sulfides were associated

with the chlorite and accompanied by epidote and sometimes quartz along fractures. Accessory minerals: epidote occurred sparingly; apatite is rarely present; calcite appeared along a couple very thin veinlets.

The slides described collectively above are different mainly in the relative abundance of the constituent minerals. There is also some difference in degree of alteration and corrosion. Alteration refers mainly to the change to clay and sericite while corrosion refers to the irregular outline of grains resulting from absorption or solution. Both feldspar and chlorite suffer from corrosion apparently to the benefit of quartz. Slide 3-600 is finer grained with a lesser degree of alteration and corrosion than in other slides. Consequently the zoning, twinning and crystallinity of the feldspars are better observed. Quartz is more abundant in this slide.

Slide 1-432 is somewhat different than the others. The rock may have been the same originally but has been brecciated and altered until it has an entirely different appearance. It is mineralogically similar. The ferromagnesian content is only about 1% and consists of small remnants of chlorite. It appears to be replaced in part by quartz and altered in part to clay.

The feldspar comprises a bit less than 50% of the rock and is so highly altered to clay and sericite as to be unidentifiable. No twinning could be found so the feldspar may have been all orthoclase.

The quartz is about equal in abundance to the feldspar and may be of three generations - some about contemporaneous with feldspar, some later than feldspar, and some secondary to other minerals.

Sericite alteration is considerably greater than clay in this slide and some is coarse enough to be considered muscovite.

The very minor sulfides appear related to the silicification of the chlorite.

It is difficult to arrive at any conclusions as a result of the work done. The variation in the amount of

and the appearance of the biotite suggest it may be introduced. The significance of this should be pursued. Along with the biotite, the relative abundance of sericite and clay alteration may be important.

Sample No.: SP20-575

Hand Sample: Medium grained granitoid rock. Small amounts of sulfides.

Thin Section Texture: Medium, hypidiomorphic granular.

Mineralogy

plagioclase
quartz
orthoclase
hornblende
biotite
chlorite
epidote
sericite
clay minerals
magnetite
apatite
carbonate

Plagioclase occurs as subhedral crystals ranging in size from fine-grained to medium-grained. Alteration ranges from moderate to intense with sericite being the most abundant alteration product. Epidote is also a common alteration product and smaller amounts of clay minerals are present.

Hornblende occurs as phenocrysts and as smaller crystals. Most is fresh but some grains are partially altered to chlorite. Biotite is medium grained and shows moderate to strong alteration to chlorite. Some fairly large masses of chlorite apparently represent completely replaced biotite. Biotite, hornblende and chlorite together make up 15-20% of the thin section.

Orthoclase appears to be fairly abundant in the hand specimen but less abundant in thin section. Some of the intensely altered grains are probably orthoclase. Most of the orthoclase is interstitial to the other minerals and shows no crystal faces. Patches of orthoclase occur in some larger plagioclase crystals. Quartz is abundant and occurs interstitially.

One large vein is composed almost wholly of epidote. Some smaller fractures contain carbonate or anhydrite.

Rock Name: Quartz monzonite

Sample No.: SP20-575

Hand Sample: Medium grained granitoid rock. Small amounts of sulfides.

Thin Section Texture: Medium, hypidiomorphic granular.

Mineralogy

plagioclase
quartz
orthoclase
hornblende
biotite
chlorite
epidote
sericite
clay minerals
magnetite
apatite
carbonate

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One large vein is composed almost wholly of epidote. Some smaller fractures contain carbonate or anhydrite.

Rock Name: Quartz monzonite

Sample No.: SP20-459

Hand Sample: Medium grained, light gray rock w/ minor pyrite.

Thin section texture: Medium grained, hypidiomorphic, granular.

Mineralogy	Approx. %
plagioclase	30-35
quartz	35-40
biotite	5-10
Hornblende	15
orthoclase	5
epidote	
chlorite	
sericite	
clay minerals	
apatite	
magnetite	
pyrite	

Plagioclase is subhedral and most grains show strong alteration to clay minerals and sericite. Some grains are zoned. Hornblende is euhedral and shows only minor chloritic replacement. Single crystals of biotite are pleochroic and some appear slightly bleached along cleavages. No aggregates as described in SP1-447 are present. Orthoclase is unaltered or only slightly cloudy. No vein of orthoclase is present but some penetrates, surrounds, and appears to be replacing plagioclase.

The rock is highly fractured in some areas. Some fractures contain pyrite and a mineral that appears to be calcite, anhydrite or sericite.

Rock Name: This sample is very similar to SP1-447. Hornblende is more abundant and biotite is less abundant in this sample. Granodiorite.

Sample No.: SP20-459

Hand Sample: Medium grained, light gray rock w/ minor pyrite.

Thin section texture: Medium grained, hypidiomorphic, granular.

Mineralogy	Approx. %
plagioclase	30-35
quartz	35-40
biotite	5-10
Hornblende	15
orthoclase	5
epidote	
chlorite	
sericite	
clay minerals	
apatite	
magnetite	
pyrite	

Plagioclase is subhedral and most grains show strong alteration to clay minerals and sericite. Some grains are zoned. Hornblende is euhedral and shows only minor chloritic replacement. Single crystals of biotite are pleochroic and some appear slightly bleached along cleavages. No aggregates as described in SP1-447 are present. Orthoclase is unaltered or only slightly cloudy. No vein of orthoclase is present but some penetrates, surrounds, and appears to be replacing plagioclase.

The rock is highly fractured in some areas. Some fractures contain pyrite and a mineral that appears to be calcite, anhydrite or sericite.

Rock Name: This sample is very similar to SP1-447. Hornblende is more abundant and biotite is less abundant in this sample. Granodiorite.

PETROLOGIC DESCRIPTION

Spec. No: 5-108
Locality:
Occurrence:
Field Relns (See C below):

Coll./Exam. by:
Date:
Descr. No:

A. Primary Rock Features

1. Hand Spec. Descr.:

Color:

Texture:

Density:

2.

(PRIMARY) Discern.	(ALT'N) Minerals	Grain Size	Color	Vol. %	Min'l Descr.-habit, reactions, H, etc.
1 qtz				40	
2 plag	seric, clay			20	15% → seric, some clay minls
3 K-felds				20-25	large, rel. malt xls + in numerous units which appear to be str. rel. to seric.; Felds. cut by seric are almost all K-felds
4 bt	chlorite	med		10	95% → chlor. cut by ser + repl. locally by seric along clvg.
5 apatite				tr	
	epidote			tr	in chloritic patch
	sericite			5	forms 1 0.5mm unit which cuts entire length of section; also numerous subord. ser. units. Also as perv. alt of plag.
	calcite			2	1mm un, plus several Minor units; later than any other minls, incl ser units
	sulfides			tr	mostly py, un-related

3. Arrangement/Orientation of Minerals (Structures - banding, etc.):

4. Descr. of Aphanitic Fraction (groundmass) if applic.:

5. Evidence on Origin

Phenocryst/Groundmass Ratio =

6. Field Classification - Name: QUARTZ MONZONITE

B. Secondary Rock Features

1. Structures (clvg, frac, deformation, etc.)

Mod-str frac'd

2. Weathering, Alteration, Staining, Surface Features

Wk perv seric alt + Extr. chlor alt cut by veined seric alt & later veined calcite

3. Mineralization

Wk, vns>>dism

C. Remarks (field notes, field relationships, special notes, further work recomm., etc.)

Over ☐ Yes ☐ No

st.

PETROLOGIC DESCRIPTION

Spec. No: 13-1123
Locality:
Occurrence:
Field Relns (See C below):

Coll./Exam. by: RRR
Date:
Descr. No:

A. Primary Rock Features

1. Hand Spec. Descr.:

Color: PINKISH GREY

Texture: COARSE GRND, GRAN.

Density:

2.

(PRIMARY) Discern.	(ALT'N) Minerals	Grain Size	Color	Vol. %	Min'l Descr.-habit, reactions, H, etc.
1 qtz		med-large		30	
2 plag	seric, clay	med-c.		25	30% → seric, some clays; alt variable, appears to be rel. at least in part to epid vn.
3 K-felds		med-large		20-25	appears fresh; strong spatial affin to bt + hornbl.
4 hornbl		2-4mm	green	5	rel. unalt'd; some chlor, ser. along fracs
5 bt	chlorite, epid.	med-lge.	green	15	40% → chlor, esp. at edge of gls in along clvg; tr → epid seric larger xls less alt'd.
apatite		v. fine		tr	tiny prisms
muscovite	epidote	fine-med		tr	0.5mm vn cuts; all other min'ls + struct. appears to have caused bt → deep green color; also repl plag
	calcite	fine		tr	asso w/ chlor-epid. patches
	sulfides			tr	pg? asso w/ chloritized bt

3. Arrangement/Orientation of Minerals (Structures - banding, etc.):

4. Descr. of Aphanitic Fraction (groundmass) if applic.:

5. Evidence on Origin

Phenocryst/Groundmass Ratio =

6. Field Classification - Name: QUARTZ MONZ

B. Secondary Rock Features

1. Structures (clvg, frac, deformation, etc.)
Mod fracs.

2. Weathering, Alteration, Staining, Surface Features
Wk-mod perv. ser. + extr. chlor alt cut by vn-rel. epid.

3. Mineralization Wk, dism

C. Remarks (field notes, field relationships, special notes, further work recomm., etc.)

Over ☐ Yes ☐ No

ST.

PETROLOGIC DESCRIPTION

Spec. No: 8-5-E
Locality: 7730 N, 5800 E
Occurrence: OUTCROP
Field Relns (See C below):
BRECCIA DIKE - at contact w/ Grdr

Coll./Exam. by: RRR
Date:
Descr. No:

A. Primary Rock Features

1. Hand Spec. Descr.:

Color: tan-gray

Texture: Granitic

Density:

2.

(PRIMARY) Discern.	(ALT'N) Minerals	Grain Size	Color	Vol. %	Min'l Descr.-habit, reactions, H, etc.
1 qtz		med		40-45	cut by later sericite (?) vnlts.
2 plag	sericite	med		40	65% → seric (high biref.) esp. in fracs + along twin planes; seric alt unrel. to q-sul vnlts.
3 K-felds		fine-med		5	50% → seric.
4 bt	chlor+, ser.	fine-large	brown-green	10	large brown xls ~20% → chlor and fine grained bt aggregates ~50% → chlor, also wk alt in fracs clvg+ to seric
5 hornbl	bt, chlor	1-2 mm		1	consid. corroded; invasion along clvg by bt + chlor hrnbl ~15% alt'd
apatite		v. fine		tr	fine prisms, common near mafic-sulfide clots
	calcite	v. fine		tr	fairly common w/ isolated clots of sulfides ± chlor ± bt ± epid.
	sulfides	fine-med, masses		1-2	mostly cp — occurs prim. in q vns., also in mafic-rich aggregates asso. w/ fracs.
	epidote	fine		tr	asso. w/ a few bt+chlor-sul clots
	hematite	fine		tr	- in fracture thru bt. xl

3. Arrangement/Orientation of Minerals (Structures - banding, etc.):

+ at least part of chloritic alt is due to q-sul. veins.

4. Descr. of Aphanitic Fraction (groundmass) if applic.:

Phenocryst/Groundmass Ratio =

5. Evidence on Origin Edge of granitic breccia dike — may not be closer enough to center of dike to exhibit shearing which is megascopically evident; poss. recryst. of granite in fractures during min'liz'n.

6. Field Classification - Name: QUARTZ DIORITE

B. Secondary Rock Features

1. Structures (clvg, frac, deformation, etc.)

Strongly frac'd. Numerous sub-ll fracs + vns transversing length of section.

2. Weathering, Alteration, Staining, Surface Features

Mod-str perv. seric. alt follow by silicification and vein-related seric. alt'n.
Weak-mod. chlor-epid-calc alt'n, poss. induced by qtz-sul. min'lization

3. Mineralization

Vein >> dism

C. Remarks (field notes, field relationships, special notes, further work recomm., etc.)

stained, little effect

Over ☐ Yes ☐ No

PETROLOGIC DESCRIPTION

Spec. No: 12-5-B
Locality: (near NW breccia zone
Occurrence: OUTCROP
Field Relns (See C below):

Coll./Exam. by: RRR
Date:
Descr. No:

20' wide dike w/ poss. relationship to q-ep vn.

A. Primary Rock Features

1. Hand Spec. Descr.:

Color:

Texture: GRANITIC, holocrys., fine gr, ~~phaneritic~~

Density:

2.

(PRIMARY) Discern. Minerals	(ALT'N) Minerals	Grain Size	Color	Vol. %	Min'l Descr.-habit, reactions, H, etc.
1 qtz		fine		35-40	Mostly primary; some qtz in minute units w/ sericite
2 plag	sericite	fine-med		25-30	~30% alt to seric; strongest alt in center of plag xls + along polysyn. twin. planes.
3 K-felds		fine-med		30	Essentially fresh; locally wk clay(?) alt along clvg.
4 bt	epidote, leucoxene	fine to med		tr	appears primary; locally alt. to epid. (≤10%) Commonly repl. along clvg by leucoxene
5					
	py	fine		tr	Dism, interstitial areas, no strong affiliation to fractures. Appears to overlap or grow at expense of feldspar + qtz
	hema	v. fine		tr	second. weath feat. in fracs, after py

3. Arrangement/Orientation of Minerals (Structures - banding, etc.):

4. Descr. of Aphanitic Fraction (groundmass) if applic.:

5. Evidence on Origin

Phenocryst/Groundmass Ratio =

6. Field Classification - Name: QUARTZ MONZONITE

B. Secondary Rock Features

1. Structures (clvg, frac, deformation, etc.)
V. Wkly frac'd

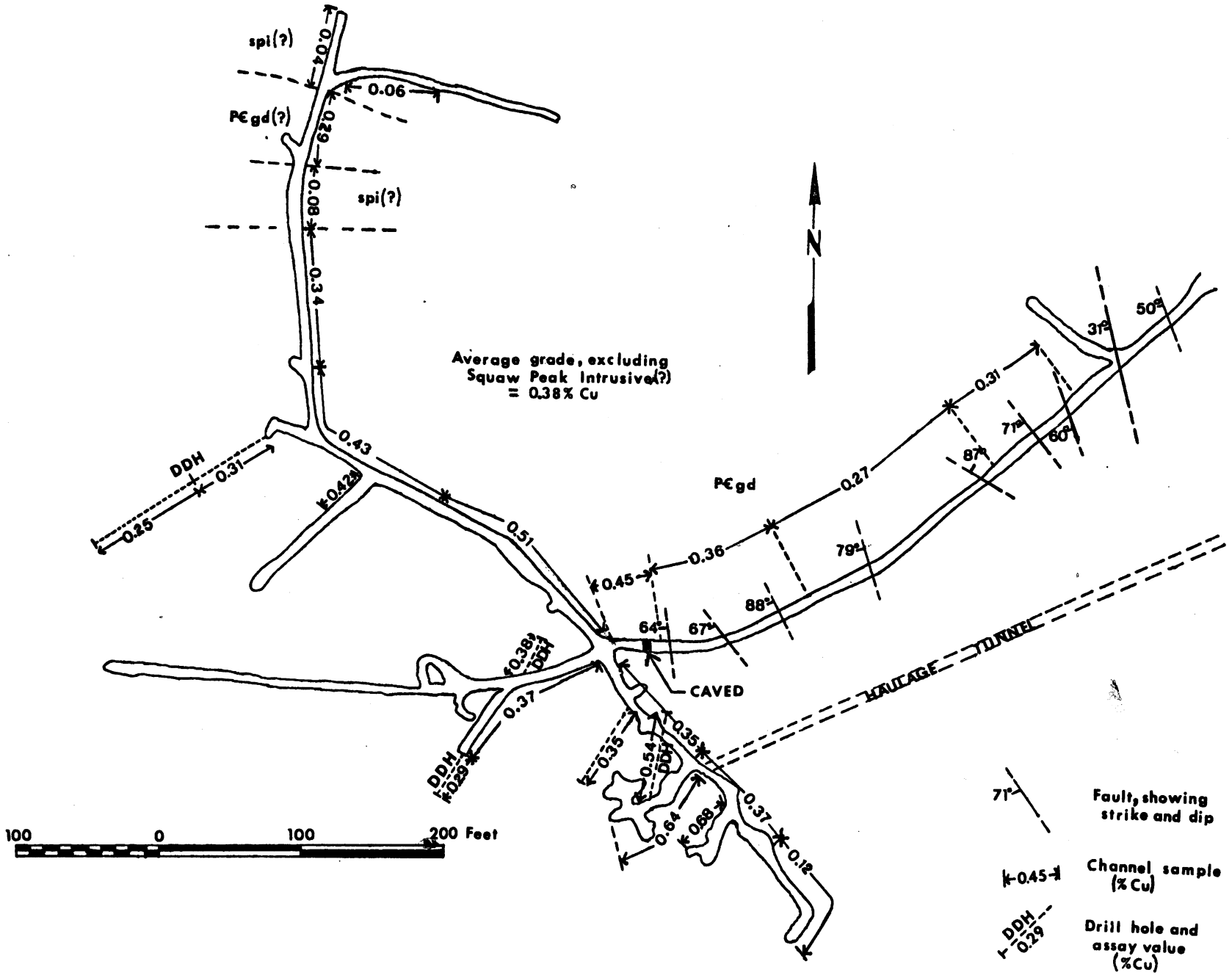
2. Weathering, Alteration, Staining, Surface Features
Wk - mod perv. seric. alt + frac-rel q-ser.
V. wk epidote

3. Mineralization tr dism py

C. Remarks (field notes, field relationships, special notes, further work recomm., etc.)

Over ☐ Yes ☐ No

stain


spi(?)
0.04
0.06
P€gd(?)
0.29
0.08
spi(?)
0.34
Average grade, excluding
Squaw Peak Intrusive(?)
= 0.38% Cu
N
0.43
DDH
0.31
0.25
0.42
0.51
P€gd
0.31
0.27
37°
50°
71°
60°
87°
0.36
79°
0.45
88°
64°
67°
CAVED
HAULAGE TUNNEL
0.38
DDH
0.37
DDH
0.29
0.35
0.54
DDH
0.35
0.64
0.68
0.37
0.12
100
0
100
200 Feet
71°
Fault, showing strike and dip
0.45
Channel sample (% Cu)
DDH
0.29
Drill hole and assay value (%Cu)