GL01931

Qtz vein ~~in~~ andesite breccias - Calf. Cr. on North Umpqua River

OR-R-85-6 few large euhedral quartz crystals

Quartz ~~vein~~ - Vein ~~Mining District~~ in a calcite crystal matrix, and fragments of alt. rock, fine grained.

- Large quartz crystal has abundant inclusions, some are along healed fractures, some are crystal growth zones.

few primary inclusions, Secondary inclusions are vapor rich suggesting boiling

OR-R-85-4 Vein in cooling joint of glassy dacite plug. 4 or 5 stage vein development, North Umpqua River.

1. chalcedonic banding - thin.
2. medium coarse euh. quartz crystals
3. rupture and veinlet filling, healling.
4. large euh. quartz crystals
5. quartz veinlets cut youngest - free face (?) crystals.

Most crystals have few indications of primary inclusions, although abundant inclusions along 3rd generation veinlets and healed fractures.

Secondary inclusions suggest boiling due to being vapor rich.

OR-C-85-2 Cougar Intrusion, qtz in vugs.

Two cycles of chalcedony to euh. qtz x/s - Chalcedony banded.
First cycle euh. qtz has inclusions just inside terminal faces.

Th(L)	Tm	% NaCl
148	-1.0	1.7
155	-1.0	1.7
156		
167	-1.0	1.7
164	-.9	1.6
143		
148	-.4	0.7
173	-.1	0.2
	-.2	0.4

Th(L)
174
178
197
207
~~240~~

all primary -

AVE = 162 °C ; 1.0 wt%
min depth to boiling ≈ 56 m

OR-R-85-2

Bohemia Dist. Quartz vein with pyrite, filling around alt. rock fragments - single mineralizing event.

Abundant inclusions, many along ghost crystal faces, but many spread in crystal centers

278	-1.6	2.7	primary ; accidental solid inclusion
268	-1.7	2.9	pseudosecondary
	-1.1	1.9	"
277	-1.7	2.9	"
296	-1.8	3.1	primary
278	-1.9	3.2	"
289	-1.9	3.2	"
282	-1.9	3.2	"
283			"
>~~330~~(2)			"

Bohemia Mine dump. AVE prim = 284 °C ; 3.1 wt%
min depth boiling = 810 m

ORC-85-2

175		
162	-.3	.5
	.5	.9
158		
165		
188		
163		

154
170
149

188 - contains small rounded bacteria?, several solid inclusions
1 prismatic ▭, 1 irregular ▢

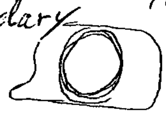
OR-S-85-6 Quartzville vein-
- Whole Sample examination: Appears to be a single vein growth event. Quartz crystals start small on brecciated & alt rock, (volcanic ?)° and crystals become larger as they fill in and grow toward free surface.
- Quartz crystals shot full of dark inclusions, most in streamers parallel to growth direction, normal to crystal surfaces.
- No evidence of secondary veinlets or healed fractures.

Type I Fluid inclusion homo. Temp. ~269.-
279.2
Freeze run. 283.1
283.1
~ -1.4°C ? → 2.4 wt % Salinity 280.9 °C Min.
couldn't really see freeze-Melt Boiling point curve at 759 m depth.

OR-S-85-6 boiled in secondary inclusions.

OR-S-85-11 Andesite intrusion or Flow(?) Qtzville District euhedral quartz crystals in a calcite (?) matrix, Appears to be open space qtz x/ growth, then Filled in with coarse crystalline calcite, Some epidote present. (poss. chlorite)
- Appears to be abundant growth zones in quartz x/s

2ndary

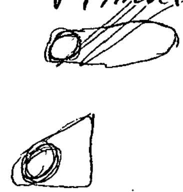


Homogenization Heating - Type 1

~~~355~~

357.7
(?) ~~358.5~~ } 357.4 (necked)
357.3
357.4

Primary



Freeze 0.0 ~ fresh water. 244.1°C minimum
~~~

Sphalerite - S-85-5

North Santiam District

1 primary inclusion found 5μ x 3μ

$T_{h(L)}$	T_m	% NaCl
279°C	-3.4	5.5

min depth boiling = 720 m

S-85-5 Quartz

	$T_{h(L)}$	T_m	% NaCl
GRAIN 1 clean, few inclusions not necked	219	-.6	1.0
	230	-.5	.9
	228		
	218		
	223		
		-.5	.9
	232	-.4	.7
	231	-.5	.9
	311	-.05	.09
GRAIN 2 abundant inclusions, many secondary	304	-.05	.09
	308	-.05	.09
		-.2	.4
	306		
	304	-.05	.09
	294		
	290-298		
	274		
	270		
		-.2	.4
	303		

AVE GRAIN 2 = 295°C ; .2 wt% NaCl

min depth to boiling ≈ 1000 m

Cascades: | Quartzville District

Down the river to the S.W. of the district there are highly clay alt basalt flows and breccia/ash. Some tuff is also present and clay alt. This extend to along the reservoir. → In the Quartzville district the rocks in general are less clay altered. Ash-flow tuffs are domonint, acidic tuffs with abundant lithics and some phenocryst. These tuffs are tan to yellow-brown, but alt to green in places. The green areas are more resistant, and competent. Joints and fractures are common in good outcrops, and appear open.

P

The one andesite dike examined had few joints and tight contact. A thinly laminated silicic tuff on one side, west of the dike, is closely jointed with hematite stains. The tuff may be silicified but no veinlets were noted. This fine textured tuff(?) has few if any crystals and no lithics or notible fiamme.

On the East side of the dike the more common Lithic rich tuff is present and extends to the top of the ridge. This unit has few joints and appears more altered near ~~the~~ the top of the ridge.

The alteration seems unrelated to the dikes. Faults are clay filled but open, hem. stained joints are abundent next to the faults. A quartz vein which was mined is spread thru ~20' wide brecciated tuff. ~~whic~~ The tuff is silicified, Open space filling and open joins are there.

Detroit Dam Intrusion:

The intrusion is a composit of 4 ~~ore~~ more units. The intrusive unit east of the dam is the least altered and may be the youngest (?) The unit is an equal granular, xenomorphic, medium-fine grained granodiorite or possibly monzonite with small hornblende. To the east along the highway the unit has a very wide chill zone or possible a separate intrusion several thousand feet wide. This fine grain, equant unit is dark gray, dacitic to andesitic or microdiorite. This unit has a chilled contact with the porphyritic andesite(?) lava flows to the east. The contact is narrow, probably sharp, but the alteration of both country rock and intrusive contact ~~obscu~~ obscures the contact. A moderate to strong argillic alteration forms a matrix around less altered blocks over a ~~with~~ width of about 300 feet into andesite flows. from the contact. Similar alteration extends only ~100 ft. into the intrusion. Away from the contact, the intrusion on the north side of the river is relatively unaltered and the abundant joints are open to water flow.

South of the dam at least three other phases are present, a porphyritic diorite, a fine grained mafic rock, and ~~an equigranular~~ a porphyritic granodiorite similar to the one north of the river. To the southeast alteration is more pervasive and alteration affects making distinguishing other possible phases difficult. Strong hematite staining from pyrite oxidation is common near the south contact. Partially clay altered fault breccias are exposed in the road cut and an unaltered porphyritic andesite dike intrudes one fault. Fine grain pyrite is still present on a few fractures. White acid (?) clay alteration along faults and joints is present in the south contact area. Open permeability is still present in the clay altered-white fault breccia (sampled). Close spaced joints and fractures appear to be open to fluid flow in the less altered rock.

The ~~cou~~ country rock on the SE side is pyroclastics. Tuff appears domanint, but thinly bedded ~~ta~~ ash (water lain?) and cobble containing pyroclastic are also present. The wide spread alteration and crumbly outcrops ~~obscures~~ obscures details of country rock stratigraphy to the SE. At lease one porphyritic andesite or rhyodacite dike is present to the south. Boulders of medium grained granodiorite from above the road suggest the presence of other sattelite intrusions.

Some kind of hydrothermal system was present on the south side of the intrusion. Even in this altered area production of fluids would appear possible. The pyroclastics rocks are probably tight, however.

End Detroit Dam observations -

Nimrod Intrusion (monzonite?)

The Nimrod intrusion has at least two phases, the earlier microdiorite and the monzonite-synite which composes ~90% of the intrusion. The intrusion has had a hydrothermal system as indicated by the pyrite-marcasite. Grain size and the brittle but tight intrusion into the microdiorite suggest a moderate depth of implacement.

However, the diorite-country rock intrusive contact is not exposed, And the presents of unaltered blocks of the intrusive in the overlying volcanic flow breccias suggest that these volcanics post date the pluton. Therefore little can be said about the intrusions original affect and relationship to intruded rocks. Note also that the vesicular nature of mafic and rhyolite dikes in the pluton at the ridge crest suggest the pluton was near the surface at the time of volcanism. The large basalt dikes in the Mtn Hagan volcanic rocks were also near surface and had little effect on the rocks.

The hem. stain clay alt. of the upper pluton extends into basalt(?). flows & silicic tuffs to the north but not into the Mt. Hagan rocks. This further evidence that the hem-grus/clay is related to a paleo-weather cycle- (and)

Cascades - Volcano Model
Field Data -

Aug. 2, 1985

Topic: Granite intrusive plug(?) on Middle Santeam River.

Location: Quartzville, Oreg. 15' map, Sec 15 SE¼ - 14 SW¼ T12S, R4E

Data:

The granite is medium grain, xenomorphic, few mafic minerals, ~15% ~~20%~~ qtz pink feldspar matrix.

The granite in outcrop is fresh,

Joints are ½ - 2m space, no alt. on joints.

Contact - on east side it intrudes green felsite or andesitic aphinite, contact poorly exposed and wide, but fragments of andesite (xenoliths) present, then multiple granite dikelets in blocky andesite.

Area of intrusion is ~~~½ square mile~~ ~1.2mi² or less.

It is exposed along road on north side of river, but ~800' higher on south side there is only a porphyritic dike ~10m wide, probably different unit, but same vent (?) Below this exposure is slump area to the river, all andesite. On the north side the granite is not present ~1200 feet up the mountain side where the next logging road is.

Some altered zones ~5m wide to north.

Andesite country rock is well jointed, Epidote on a fault, (left lateral) to the south in NW¼ Sec. 23, about 2400' elev.

Cougar Dam Dacite Intrusion(?)

The Dacite dikes(?) are intrusive, but all indications are for a very shallow emplacement. The chilled glassy nature and a few large vesicles indicate it was emplaced in a cold, low-pressure environ. The dacite shows an contact alteration effect near the fault contact on the SW side. The dacite is brown, flinty, devitrified with pheno. xls absent or obscured. The same is true for the intrusive contact on the NW. Therefore the fault on the SW was probably produced by dacite emplacement. Calcite is present in breccia of the tuff country rock 10 m. from the SW contact.

Unhealed joints average ½-1 m spacing, irregular, except at NE basal contact where a columnar jointing is present, but this may be an underlying basalt. Heald joints with few mm bleaching are spaced about ~10 cm in some areas. Most fluid flow ~~was~~ probably occurred along major joints spaced at ~10-30 m.

In both the Nimrod and Cougar Dam ~~intrus~~, areas faults are clay filled but the rock next to the faults are closely fractured. The Cougar fault does not appear to be a good channelway for fluids and little mineralization is evident in the fault.

Three Fingered Jack

Aug. 3.
Dikes (unmapped) are 1 to 10 m thick, minor baking of ~1 m or less into country rock. Inside chilled contact dikes are columnar jointed 1 to 0.5 m. spaceing, or flow foliated joints spaced ~1 cm. The platey jointing ~~in~~ the silicic(?) dikes is parallel contact ~~ja~~ near contact and normal to dike contacts ~~nea~~ in center.

There are many dikes spreading out from the south plug, some slope up ~60° then turn to vertical.

Plug to the north has a ½ m wide chill and

bleach-Tan zone along, tight contact with few inclusions from cinder country rock, ½-1 m space joints are vertical, cinders welded within 10's of meters of contacts.

Plug is generally fresh, with small phenocryst.

Phenocryst may be altered, put small area on north end ~~tis~~ has slight alteration to Brown, with phonocryst to white clay(?), also some of rock appears to have fine grain ~~phaneritic~~ phaneritic, rather than aphanitic. Sample taken.

TRIP PLAN

Date

June 6. Drive to Lake View - to Winnemucca - #140

June 7. Take State 30 to Newberry (La Pine). Sample - on to Bend,
Poss. go to South Sister. *sample*

June 8. I-20 to visit Blue Lake. Santiam Pass - Sample.
Visit Hagg Rock
Visit Hayrick Butte
Hike into Mt. Washington
Drive to Stayton, Oregon.

~~Mill City 15'~~ *Quartzville 15'*

June 9. North Santiam District on Little N. Santiam R. & Detroit Dam Tg - ~~Dome Rock~~.
Drive ~~to Lebanon~~ *Albany* - visit Peterson Butte.

June 10. Quartzville District and maybe Jumpoff Joe Mtn. on I-20.
Drive to Springfield.

June 11. (Blue River District) *probably skip*, Leaburg Dam, McKenzie Ri. (3 mi.) Tg, *Poss. Cougar Res. Intrusive & Castle Rock*
Stay in Springfield - Poss. go to Fall Cr. District.
→ *Visit Quarries SE of Waterville - Leaburg 15' map.*

June 12. 2nd Day - Ta & Tr near Dexter & Lowell, *Tmi. on east end of Reservoir*
Then to Bohemia District. *- or Hg District.* *← Anlauf 15'*
Drive to Roseburg.

June 13. Scott Mtn., Call Cr. on N. Umpqua Ri. *Lowell. 15'*
Poss. ~~to Zinc~~ District.
Drive to Lakeview (5 hr. Drive)

Cascades Province - Geol. 1

(McBirney & White, 1982) has generalized map.

- orogenic volcanic system but lacks trench & Benioff zone
Historic volcanic activity at Baker, Saint Helens, Hood and Lassen.

Underlying rock of mid-Miocene Western Cascades:

~14-16 m.y.
mid Miocene — Andesites in west, Flood basalts to east. (Columbian epizode
Late Miocene pulse - 9-10 m.y. small andesite cones, rhyolitic & dacitic ash-flows.
scattered basaltic
→ Andesite to basalt in Cascades, rhy. (silicic ash-flows) to east.

Pliocene - (3-6 m.y.) Oregon - basaltic lavas & rhyolite domes & ash-flows.
Western Cascades to Idaho border -
Andesites subordinate to basalt & rhyolite

Quaternary volcanism - marked narrowing of volcanism to N-S chain.
with time activity localized in to centers from which progressively more differentiated magmas were discharged.
- Western Cascades uplifted & tilted ~~westward~~ ?
- High Cascades subsided to shallow graben -
N-S graben is depressed most in central where volcanism has been strongest.
- Central area - basaltic lavas beneath & between ~~cones~~ andesite cones account for 85% of total Quat. vol. rocks -
Rock types are calc-alkaline, most are strongly porphyritic and rich in plagioclase.

(Kienle et al., 1981) S½ of Oregon Cascades.
linears - majority are in 3 groups: 1. NE strike
2. NW strike
3. north strike

(1) Basin & Range structure in the Klamath Falls - Crater Lake area consist of normal faulting trending NW, then curves to N-S then to NE from south to north.
NW trending dextral slip zones pass throw the normal fault strike curve areas and dextral slip zones continue thru High Cascades.

(2) High Cascades structural trends consist of conjugate set(?) of NW to NE faults and linears and N-S strutures.
→ The eastern part of the High Cascades is said to "overlap" onto the Basin and Range structures.
(3) Western Cascades - NW and NE fault sets
(4) It is evident that the detail of existing fault mapping is very non-uniform in the study area.
(5). Thermal springs in the study area are associated with NW trending faults, both normal and dextral.

(Venkatakrishnan, et al, 1980)

Linears in N½ of Oregon Cascades

① As to the South, the Western Cascades have a NW-NE conjugate set of linears. West of Mt. Hood there is a dominance of NW linears.

②. East of the High Cascades linears are more NNW to NNE particularly south of ~~....~~ 44°37.5' ~~....~~ North Latitude

③ The High Cascades are along the transition between the two patterns of linears, where linear trends and distribution are more irregular.

(Magill and Cox, 1980) Rotation of Western Cascades.

① Coast Range consist of Seamount Province, ~~subaere~~ subaerial basalts over submarine basalts forms 15 to 20 km thick oceanic crust accreted to the continent.

early Eocene "accretion of seamount province to North America."

↳ Paleo subduction zone at South E. end of Range - Roseburg Fm

② Cost Range rotation of 46° clockwise by plate collision and partial subduction, 50 m.y., then 30° more rotation due to extension of the Basin and Range.

③ Western Cascades rotated 25° ~~..~~ clockwise - post 25 m.y. bp

↳ arc volcanic products of subduction!

(Beck, 1984)

Coast Range has moved 350 km north relative to Pole, (Cascades did not) ~~...~~ prior to or during accretion.

Geol. & Geotherm - Central Cascades

(Priest and Vogt, 1983) **Use Abstract for general setting.**

→ ① Western Cascades Uplifted relative to High Cascades accross N-S and NNW faults. ~~4~~ 4 to 5 m.y. B.P.

②. ~~Or~~ Lack of accurate, detailed geologic maps is one of the most important limiting factors for exploration.

③. 10 to 8 m.y. B.P. - narrowing or east shift of activity and change from andesitic to more mafic rocks.

④ Early High Cascades ~9.0 m.y. - Voluminous basalts & basaltic-andesite - cap ridge tops in Western Cascades.

→ ⑤ Late High Cascades - 4-0 m.y. B.P. Graben forms. shield volcanoes of basalts & basaltic-andesite compact to diktytaxitic texture - flows follow present drainages into western Cascades.

⑥ Basaltic-andesite and less andesite, dacite and rhyodacite form Quaternary composite cones.

⑦. Belknap Crater eruptions - 1,500 yrs. youngest

⑧ Heat Flow drops of steeply to west of High Cascades, but high heat flow extends to east, especialy in SE part of the state.

⑨. High Cascades graben is down 1000 to 3000 feet, typical 2000' most N-S fault movement late Miocene to early Pliocene N-S Faulting immediately preceeds major eruption episodes.

10. NW trending faults have right-lateral movement - poss.

11. Local Folding in middle Miocene - age control poor -

12. Composition & distribution of rock chem. suggest subduction is occurring.

⑬ - p. 75 - Western Cascade's rock is relatively impermeable.

Heat Flow - Cascades -

(Priest & Vogt, 1983)

① High Cascades mean heat flow 104 ± 9 mW/m²
gradient 66° ± 7° C/km
Need 300 m plus hole to get meaniful data.

②. Western Cascades & Willamette V. - 43 ± 1 mW/m²
30° ± 1 C/km

③ Transition to east over less than ~~10 to~~ 20 km, from ~43 grades to ≥ 100 mW/m²
↳ located about 10 km west of mean physiographic boundary.

4. subduction-zone heat-flow pattern

⑤. Hottest springs N to So. are:

Western Cascades:

	surface	Reservoir Temp. est.
Austin H. Spr.	(86°C)	est-181°C - res. - sulfate - Oxygen
Breitenbush H. Spr.	(92°C)	est 176°-195°C " "
Bigelow H. Spr.	(61°C)	
Belknap H. Spr.	(86.7°C)	148°C
Foley H. Spr.	(80.6°C)	

High Cascades -

Summit Lake Warm Spring.
Crater Lake (warm spring at bottom)
2 km north of Devils Lake.

(Priest and Vogt, 1983)
for (Priest and Others, 1982)

Deep holes in Old Maid Flat - both penetrated Columbia Ri. Basalt
OMF-1 - 3,936' deep (1,200m) into Columbia R. Basalt

OMF-7A - 6,025' deep (1837m) - T.D. 119°C 63°C/km
① Miocene and Older andesite to dacite have v. low permeability
↳ Rocks are self sealing → laumontite-grade metamorphism.

② Tholeiitic basalts of Columbia River Group are permeable but closed in by impermeable andesite-dac.

③ Pleistocene-Holocene fault was also impermeable.

④ Pucci Chairlift site (Timberline Lodge) - Mt Hood (Priest and Vogt, 1983)
drilled to 4,002' (1,220m)
maximum temp. 80°C 88°C/km

⑤ Fracture intrusive rock are more permeable than the volcanics.
holocrystalline lavas retain significant permeability.
⑥ Low-density, high porosity mafic rocks of the High Cascades extend down to 3-km (1.8mi) in western margin of ↑ province
Similar but thinner block- (graben) in Klamath graben - southern ↑

(Priest and Vogt., 1982b)

Mt. Hood - geol. History:
① Composite Cone began within last 700,000 yrs.
Calc-alkaline basaltic andesite to hornblende dacite
② 6 major episodes
1. 700,000 - 29,000 yr B.P. 90% of cone formed by
(Main Stage) ↳ basaltic andesite + pyroxene andesite + hornb. dacite flows & pyroclastic debris flows
- Glaciation -
2. Pollalie eruptive 15,000 to 12,000 yr. BP. - hypersthene dacite plug dome
hot pyroclastic debris flows + lithic ash
3. Timberline eruptive - 1,800 - 1,500 yr. BP. - hornb - hypersthene dacite plug dome ↳ Crater Rock.
hot debris flows, lithic ash fall, mudflows
4. Old Maid eruptive 250 to 175 yr. B.P. Plug-dome - Dacite
hypersthene-hornblende mudflow
5. Crater Rock dome - hyp.-hornb. andesite 62.6% SiO_2
20 fumaroles east & NE of Crater Rock 50-90°C
same time as #4. ~ 200 yr.
6. 1859 & 1865 AD. pumice eruptions - dacite 63.5% SiO_2
hypersthene-hornblende.

Hood continued

(Priest & Vogt, 1982b)

Hood Structures.

① Major graben structure under Mt. Hood, bounded by Hood River fault on east and on west a diffuse zone of faults, some strike N45°W – 400 m (1300') down to east in Old Maid Flat.
NW trending dextral faults.

② N-S & N20°W faults result of E-W extension – Miocene ~8 m.y.?
Some Boringe-age dikes into the structures

③ ~~Mt~~ Hood River Fault & graben younger than 3 m.y.
N-S alignment of cinder cones N. of Hood.

④ Contact zones of Still Creek and Laurel Hill plutons may be geothermal reservoir sites. (SW of Mt H.)

(Steele and others, 1982, ... in Priest & Vogt.)

Geothermal

Based on 25 wells –

1 - No magma chamber > 4-6km dia. or within 3km of surface

2. small- neck like magma conduit probable.

3. heat flow is 80 mW/m² 12 km from Mt. Hood,
130 to 150 mW/m² 5-8 Km from apex

4 Little vertical permeability below 660', but some lateral permeab.
^ Pucci Chairlift hole → (Timberline Lodge)

5.

Meager Creek

(Fairbanks, et al., 1981)

Geol: south reservoir in crystalline basement rock.
Heat Flow values of 105 - 620 mWm^{-2} (2.5-14.8 HFU) 7 times regional
Thermal anomaly over 3 km^2, not bounded on N & SE
Association with Pliocene to Recent volcanic Complex of andesite, dacite & rhyodacite, flows & breccia, tuff, thermal alt.
Stratovolcano - last event 2550 yr. ago -
Secondary minerals: silica, kaolinite & clays, calcite, dolomite, gypsum and barite. Crude zoning -

Chem: Springs. 59-166°C silica geotherm., 96-250°C Na-K-Ca
Residence time ≥ 25 yrs.
Cl. waters 200-2000 ppm TDS springs
Drill holes 6000-10,400 ppm TDS, 28 ppm boron

Resistivity - 14 Ω·m
Temp - 202.2°C at 367 m depth 330°c/km bottom hole gradient.

Newberry Caldera

(Priest and Vogt, 1983)

860–930m gradient – 505°C/km.

Drill hole – 932m (3,057') T.D. 265°C (Sammel, 1981)
mean gradient – 285°C/km

↳ alt. qt. epidote, sulfides.

them ① Below 758 m encountered basalt & basaltic-andesite
↳ Few permeable zones

② Vertical permeability restricted to faults or intrusion conduits

③ Mg. anomaly parallels ring fracture & on SE Flank, NE Faul

(Priest and others, 1983) OFR 0-83-3

therm ① Caldera – has fumaroles & Hot Spr. rhyolitic rocks.

geol ② Caldera forming eruptions started ~ 510,000 yr. B.P.

③ most recent collapse several 10,000's (or 500,000)

④ -rhyolitic rocks in caldera younger than 6,845 yr – Mazama ash

⑤ most recent eruption – southern margin – 1,350 yr. B.P. obsidian

Flanks of Newberry are basalt, basaltic andesite, & andesite and rhy. domes & flows. (Flows)
↳ aphyric

⑥ Gravity (Williams & Finn, 1981 b) plutonic body 2 km below caldera floor, 10–12 km ~~wide~~ dia.

(Priest, 1983 ch. 2)

6,700–1,350 yr. rhy. dominant on E ⅔ of caldera & SE Flank
circle – 3–4 km dia. post 10,000 yr. part of the 18 km dia. composite silicic pluton. 2–6 km deep.

– Silicic centers extend up 2 4 km away from Caldera on SW, SE, NE,

900 m of flank flows

Hydrology: (Black, G.L., 1983, in Priest et al)

① vertical permeability with Caldera in ~zero
lateral perm. v. limited within the faulted block.

② The permeability on/in the Volcano's flank is good,
water table down 680 m, from Caldera floor –
Regional flow to NNE.

Hot springs 21°C to 80°C – drowned fumaroles.

Washington Cascades

(Beget, 1983)

Glacier Pk is dacitic. – oxyhornblende-dacite ~1,800 yrs.

3 small hot springs around flank
some hydrothermal alt. above glaciers
11,250 yr. B.P. – voluminous pyroclastic-flows

Most recent eruptions have been dominated by Lahars and pyroclastic-flows, domes.

Domes → lahars – pyroclastic flows 1,000 yr. B.P.

Tephra – 200-300 yrs B.P.

(Church and Strotelmeyer, 1984, in Marsh et al.)

① N. Cascades crystalline core complex of pre-Tertiary gneiss, schist & foliated igneous rx.

Porphyry deposits Cu, Mo, Ag, Au.

Breccia pipes in area

② Hot spring reservoir temp. Gamma H.S. 350–410°F (177–210°C)

(Korosec, et al, 1983)

① Volcano is part of Glacier Peak Wilderness Area
High temp. reservoir within upper cone – solfataric areas.

Hot springs on NE and W sides.

② Kennedy H. Spr. (38°C) 5 km W. of Pk in Wilderness A.
↳ equib. T. 170–220°C

③ Gamma H. Spr. (65°C) 5 km NE of Pk – 200–215°C
↳ NaCl type

④ cold seeps 11 Km NE sodium chloride – 170–225°C equi. T°

⑤ Sulphur Cr. H. Spr. (37°C) 17 Km N. -Pk not related to Glacier Pk.

Newberry Caldera

(Priest & others, 1983)

A ring of gravity high ~~around~~ along ring fracture.

(Caldera subsidence ~ 500,000 yr.)

Crater Lake

(Williams & von Herzen, 1983)

① Heat Flow - ave - 138 ± 121 mW/m² (3.3 ± 2.9 HFU)
② 2 thermal springs - Water convects in lake
③ based on thermal anomally size & spacing they est. Geothermal reservoir is 1-2 km below lake bottoms & 1.5-2 km thick x 1.5-2 km wide - 100-200°C Heat Flow est. convective 16 to 33 HFU

* (However, note Chan Swanberg's Remark, Geol. and basaltic cone in crater)

Silicic Volanism

Washington -

White Pass Area - Spiral Butte - Dacitic, youngest → hornblende andesite Late Pleistocene volcanism ~0.79 m.y.
(Clayton, G.A., 1983, in Korosec and others)
(p. 232) - 550 m high lava dome grades into 5 km long lava flow.
64-66% SiO_2

Spiral Butte is 2 km^3

Clear Fork Dacite (Clayton, 1983; p. 234 Ellingson, 1972) ~~p. 232~~ 59-62% SiO_2

Simcoe Mtns - near Indian Rock, (Korosec and others, 1983, p. 286)
minor volume of dacite domes and rhyolite flows
occur atop and on flanks of very large shield volcano,
undated but volcanic area ~ Pleistocene?

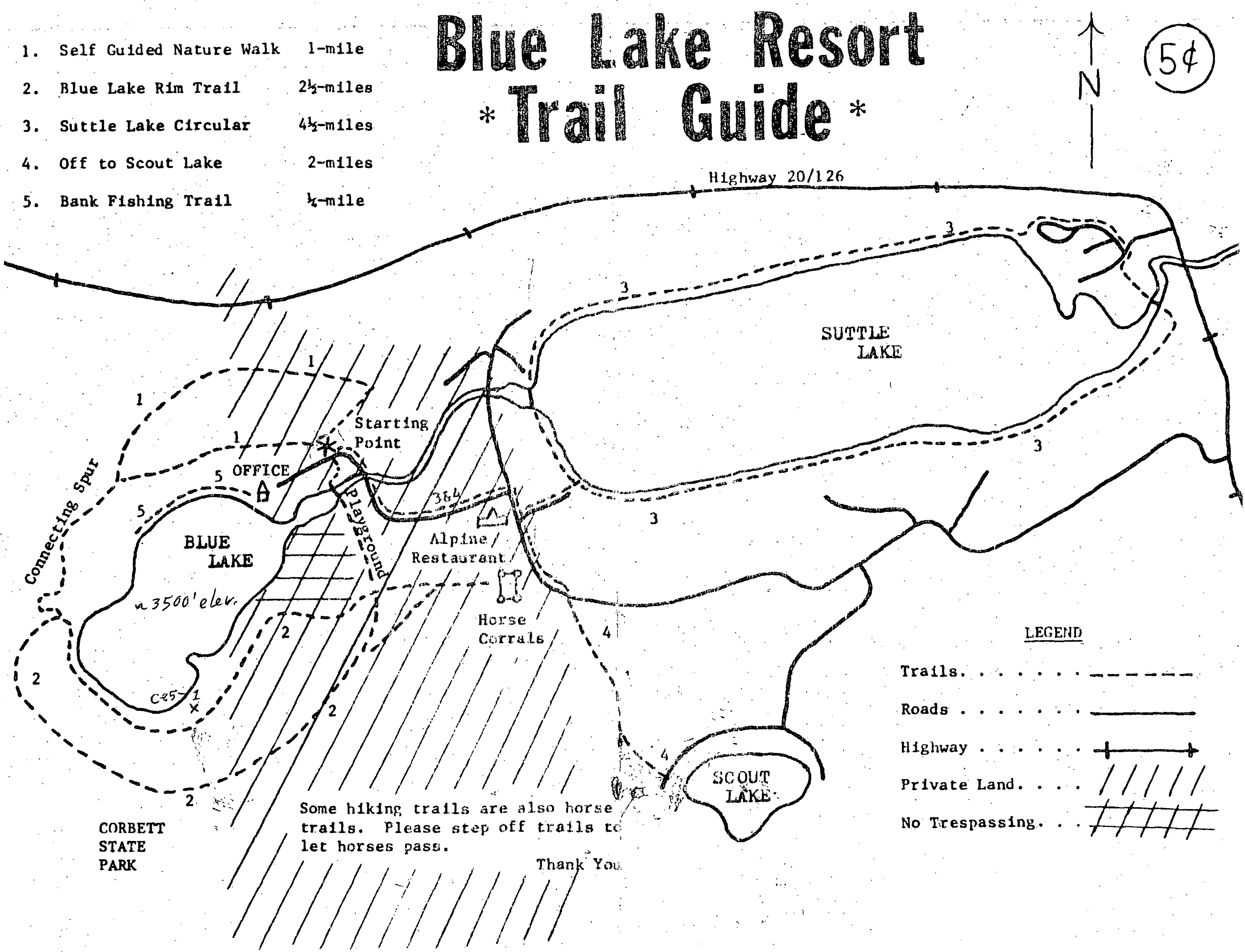
Burney Mountain Dacite, Calif., dated 240,000 yr. B.P.
(Muffler, and Campbell, 1984)

~~#~~ Lassen Peak - Dacite to rhyolite domes
(Muffler, and others, 1982)
Hornblende Dacite pyroclastic deposits - Chaos Crags (Crandell and others, 1974)

Blue Lake Resort *Trail Guide*

5¢

1. Self Guided Nature Walk 1-mile
2. Blue Lake Rim Trail 2½-miles
3. Suttle Lake Circular 4½-miles
4. Off to Scout Lake 2-miles
5. Bank Fishing Trail ¼-mile



VOLCANO MODEL

Research Problems and Objectives

It is evident from available literature and the U. S. Geological Survey's Cascades Geothermal Workshop (Menlo Park, May 22-23) that a concise model of the feeder system of a Cascades stratovolcano is lacking, particularly as structures and lithologies relate to geophysical properties and hydrothermal systems. To formulate a volcano model the distribution and character of dikes, plugs and large intrusions in the volcanic pile and underlying rocks should be determined. The density, magnetic susceptibility, permeability and alteration of these intrusions and the rocks between intrusions should be determined to relate the model to geophysical data and geothermal system models. Also, the mineralization, fluid inclusions and structures should be studied to determine temperature, depth, chemistry and plumbing of associated hydrothermal systems.

Data Collection

A regional study of deeply eroded volcanoes and exposed vents and intrusions in the High Cascades, such as Mount Jefferson, Mount Washington, older volcanic centers around Lassen Peak, and in the Western Cascades will be carried out to develop a general model of volcanic structures at different levels. During field examination the size, distribution, alteration and magnetic susceptibility of intrusions will be studied. The jointing, fracturing, faulting and alteration along these structures will be studied to determine the control they provided for circulating fluids. Samples will be collected for study of alteration minerals, vein minerals, and fluid inclusions to determine temperature, depth and chemistry of thermal fluids.

Data Synthesis and Model Formulation

The data gained from the regional study will be integrated with the drilling program results, published studies of volcanic vent in other areas and the data from studies of Cascades volcanoes to develop a volcano model which will correlate geology with the geophysical characteristics and provide a framework for geothermal systems. The model will attempt to define the typical structure, composition, density, alteration and permeability of a stratovolcano at several levels under the cone. The model will be useful in interpreting data from a specific volcano and formulating a geothermal exploration strategy.

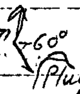
Subvolcanic Structures: Notes -

<u>Quartzville District</u>

- open joints in alt. tuffs
  Faults are clay filled but open

Detroit Dam stock - open joints, permeable but clay alt. fault breccia.

3 Fingered Jack - many dikes.



~~(Priest and others, 1982)~~

1. Fractured intrusives more permeable than volcanics
2. lavas retain sign. permeability

<u>West Spanish Peak</u> (Johnson, 1968) has radial dikes from ~~(a 4.4 km by 2.8 km stock)~~ several stocks, but no evidence of doming.

cone fractures at Medicine Lake (Heiken, 1978)