

601903

CLACKAMAS THERMAL POWER HOLE

Drilling History

The Clackamas hole is located in the western part of the high Cascade graben, Sec. 28, T8S, R8E, near Detroit, Oregon. The hole was spudded on June 7 and completed on September 7, 1986. Out of 80 days of operation, 59 days were spent actually drilling, and 21 days involved setting casing and rigging up BOP, technical problems, logging the hole and rigging down. During August, drilling was suspended for 13 days due to forest fire danger.

In general, the drilling of the Clackamas thermal gradient hole progressed smoothly and coring averaged 80 feet per day with excellent core recovery. Two significant lost time problems occurred. The first was test failure of the BOP due to a faulty flange. This problem cost 3 days of operation and may have been avoided by pre-assembly and test of the BOP by the supplier, prior to delivery to the drill site.

The second problem was parting of the HX drilling pipe. This probably was caused by a combination of metal fatigue and drag or torque forces in the drill string. Quality inspections of the drill pipe connections during trips out of the hole may have prevented the failure. In any drilling operation, failure of pipe connections is always a possibility however. Of the five down days resulting from the HX rod failure, about 3 were lost to waiting on the NX rods to be transported to the site. These 3 days of down time could have been prevented by having Nx rods on site beforehand as a precaution. However, this would have incurred additional mobilization cost unnecessarily if the Nx had not been needed.

Continual total drilling fluid loss while coring greatly increased the cost of the mud program and may have contributed to problems such as sanding-in the core barrel and parting of the HX rods due to poor hole cleaning. Only minor efforts were made to regain circulation. Lost circulation is a typical problem when drilling volcanic rocks, especially basalt flows. Core drills have very limited ability to control lost circulation because of their small mud system and low pump rate. The most limiting factor is the close tolerance of the coring system does not allow use of coarse matting LCM materials while drilling. However, the cost of the large volumes of LCM and mud, and rig time that would be required to try to cure lost circulation, could equal the cost of continual mud loss without ensuring success.

A brief summary of the events, problems and cost of each segment of the Clackamas hole is given in Appendix I, and a daily list of depth and events during drilling is given in Appendix II. Figures provided by Thermal Power Company of casing completion and the casing head assembly are provided in Appendix III.

APPENDIX I

CTGH-1 Drilling History - Summary

June 7 - 13 Tricone drill to 517', set 35 of 10 3/8" conductor in 12 1/4" hole. Set 519' of 7" K-55 BT & C, 26 lb. casing in 8 3/4" hole and cemented with 181 cu. ft. of cement mix (see Daily Activities).

Main problems were getting conductor set into the 40' of glacial boulders in till, some lost circulation in the basalts, which was overcome, and the 7" casing hung up some in the basalt flows. The 8 3/4" bit cut 482' of hole.

Costs to this point was \$49,390, including mobilization. Drilling cost averaged about \$60 per ft., but costs and drilling time were controlled more by hole problems and setting casing than penetration rate.

June 14-19 Nippling up BOP and rig up for coring. The first test of the BOP failed due to a flange leak, requiring a new flange. Costs for this phase of the project were \$19,030, equipment not included.

June 20-
Aug 18 Cored 4283 feet to a depth of 4800'. Circulation was lost at 540' and never regained while drilling with HX rods to 4203', although LCM efforts brought the water level to within 20' of the surface. Most of the time the static water level was at a depth of about 70'. Core recovery was virtually 100% for the entire hole.

Penetration averaged 80'/day during the 54 days of actual drilling. the cost for this section of the hole was \$316,843 total, or \$74/ft. Six HX core bits cut an average of 600' each, although individual performance was highly variable. For example one bit cut 1385', but the first bit run cut only 61 ft. and was not used for the average above. The short 61' run is probably due to non-lithology factors such as driller's error, junk in the hole after drilling out the casing shoe or a defective bit. Note, also that the first Nx bit run cut only 23' due to milling out the HX bit left in the hole. The second Nx bit cut 574' to T.D. A total of 9 core bits were used.

While drilling the main section of the hole, 10 non-drilling days resulted from technical or equipment problems. These problems were core barrel jammed in defective rods or sanded in,

parted wireline, and the drill pipe broke or twisted off twice. The first time the rods broke while drilling at a depth of 527 feet with a 6" tricone bit. Drill pipe failure was probably due to a combination of stresses from the 6" bit and the HX rods "wipping" around in the 7" casing. After the bit and lost drill pipe were fished out, 4.5" core guide casing was set to 527 feet. Once the casing was in place coring continued to 4203 feet with only minor problems.

The second twist off of the HX drill pipe occurred at a depth of 4203 and may have been caused by general metal fatigue and friction drag in the hole. It was decided at this time that it would be best to switch to Nx⁶ drill pipe, rather than attempt fishing out the HX. Six days were lost waiting on the Nx drill pipe to arrive and retrieving the HX core barrel.

The final T.D. of the hole was determined by the U.S. Forest Service shutting down all operations in the area due to extreme fire danger. After the shut down was over, the hole was conditioned for logging, then geophysical logs were run. Then the drilling company rigged down and moved off site. The discouraging results of a temperature survey run on August 27th (Table II), nine days after drilling ceased, led to the decision not to drill any deeper. All of the HX drill pipe was left in the hole.

APPENDIX II

Daily Drilling Activities

Thermal Power CTGH-1


<u>Date</u> <u>Day/Mo.</u>	<u>Drilled/</u> <u>Depth</u>	<u>Activity</u>
7 June	35'	12 1/4" bit - Spud, used air hammer 12-35' in boulders. 10 3/4 conductor hung up at 12'
8 June	35'	Moved rig 6'-12 1/4 bit to 35', conductor hung up at 28'- 54 vis mud
9 June	-0-	Clean hole to 35', set 35' 10 3/8" conductor and cemented with 32 sacks cement, 3% CaCl
10 June	185-220	8 3/4" bit, 6" D.C. Drilled to 220', deviation 1/2° at 160"
11 June	200-420	61 vis mud, 9.2 wt; 400-410 L.C. 50% 1000 gal.
12 June	97-517	70 vis, 8.8 wt. Lost 60 bbl at 425', Geophy log 517-35'
13 June	-0-	Problems setting 7" casing to 488' 127 ft ³ G cement 1:1 perlite + 40% silica flour, plus 32 ft ³ tail slurry. Good returns
14 June	0-517	Top job cement 4 bbl class G 1:1 perlite, cut off 7" casing, dug cellar
15 June	0-517	Nipple up casing head and BOP
16 June	0-517	Nipple up BOP, test, found leak, ordered new flange
17 June	-0-	Still working on 8 5/8" X 6" flange
18 June	-0-	Install new flange, tested BOP and approved
19 June	0-517	Rig up and align core rig
20 June	10-529	6" tricone bit, drilled out cement, lost bit and 4.5" joint on bottom

Date Drilled/ Activity

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	<u>Depth</u>	
21 June	0-527	Pulled fish out with Bowen overshot, set 4.5" core guide casing with 11 stabilizer 3.937"
22 June	70-597	Started coring with 3 "point" 937", HX rods, lost circulation at 530', bit cut 61'.
23 June	97-694	Coring with no fluid returns, -30 GPM mud in. 45 vis
24 June	80-774	Coring, no fluid returns, tried LCM but no results
25 June	85-859	Replaced bit at 859' it cut 271'
26 June	59-918	Coring, run in hole with new bit, mud 45 vis
27 June	44-962	POH to grease rods, then sanded in core barrel and POH
28 June	121-1083	Coring, no fluid returns, greased rods
29 June	162-1245	100% core recovery, no fluid returns
30 June	71-1316	Replaced bit (412' cut) at 1271' depth
1 July	137-1453	Coring, no fluid returns, 100 % core, water level in hole 45'
2 July	137-1590	Coring
3 July	100-1690	Coring
4 July	75-1765	Coring
5 July	10-1775	POH, replaced bit, RIH, 560-963 interval partially blocked
6 July	53-1828	POH to service coring assembly, bridge at 660' when re-entering hole
7 July	89-1917	Coring
8 July	81-1998	Coring
9 July	85-2083	Coring
10 July	98-2181	100% core recovery, no fluid returns
11 July	105-2286	Coring, mud is 45 vis

<u>Date</u>	<u>Drilled/ Depth</u>	<u>Activity</u>
12 July	50-2336	Wireline parted, POH, fix line, RIH with new bit
13 July	32-2368	Washed from 1000'-2336
14 July	98-2466	Coring
15 July	69-2535	Core barrel jammed in rods at 500', POH bad joint of core tubing, bridge at 1776'
16 July	59-2594	Core barrel jammed in rods again, at 400' bad joint of tubing
17 July	114-2708	Coring
18 July	101-2809	100% core recovery, no fluid returns
19 July	103-2912	Coring
20 July	68-2980	Coring
21 July	89-3069	Coring
22 July	104-3173	Coring, water level 80' in hole
23 July	96-3269	Coring
24 July	86-3355	Coring
25 July	106-3461	Coring
26 July	101-3562	Coring, water level up to 70'
27 July	79-3641	Coring
28 July	80-3721	Coring
29 July	2-3723	POH put on new bit, core barrel latch and reamer shell
30 July	88-3811	Coring
31 July	90-3901	Coring with HX bit
1 Aug	81-3982	Coring
2 Aug	80-4062	Coring
3 Aug	81-4143	Coring

<u>Date</u>	<u>Drilled/ Depth</u>	<u>Activity</u>
4 Aug	60-4203	Coring, HX drilling rods broke in the hole at 823'
5 Aug	0-4203	Waiting on N _x ^{u.c.} rods
6 Aug	-0-	Waiting on N _x rods
7 Aug	-0-	N _x Rods arrived, RIH to locate break at 823'
8 Aug	0-4203	Ran latching assembly on NCC rods to pull HX core barrel, POH without core barrel
9 Aug	0-4203	Modified latching assembly, RIH, POH with core barrel
10 Aug	23-4226	Milled through lost HX bit with new NX bit, cored 23' then POH for new  bit.
11 Aug	53-4279'	Coring with N _x ^{u.f.} bit
12 Aug	92-4371	Coring
13 Aug	79-4450	Coring, torque increase at 4405'
14 Aug	80-4530	Coring
15 Aug	90-4620	Coring
16 Aug	80-4700	Coring
17 Aug	60-4760	Coring-Temp. survey, recover and repair broken wireline
18 Aug	40-4800 TD	Shut down by Forest Service due to dry forest condition
27 Aug	-0-	Temperature-pressure survey ran
2 Sept	-0-	Crew moved on site and run N _x ^{u.c.} rods to bottom
3 Sept	-0-	Condition hole for loggers
4 Sept	-0-	Geophysical logs run
5 Sept	-0-	Completed logging, shipped core to UURI

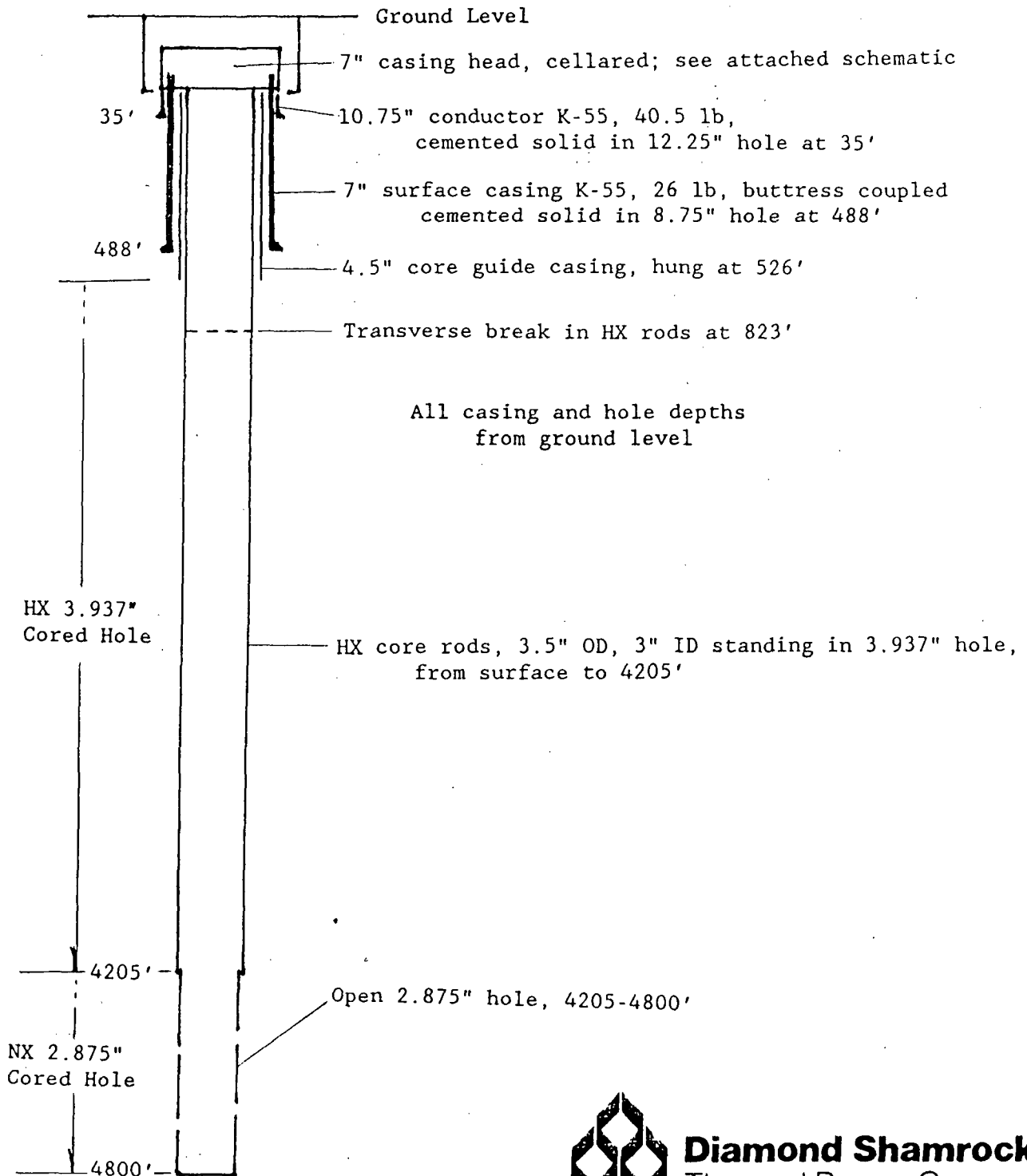
<u>Date</u>	<u>Drilled/ Depth</u>	<u>Activity</u>
6 Sept	-0-	Rigging down
7 Sept	4800 TD	Finished rigging down. Drilling costs to date: \$438,718

APPENDIX III

Well Completion Diagrams

CLACKAMAS THERMAL GRADIENT HOLE 4800 TD

Schematic: Actual Completion Configuration



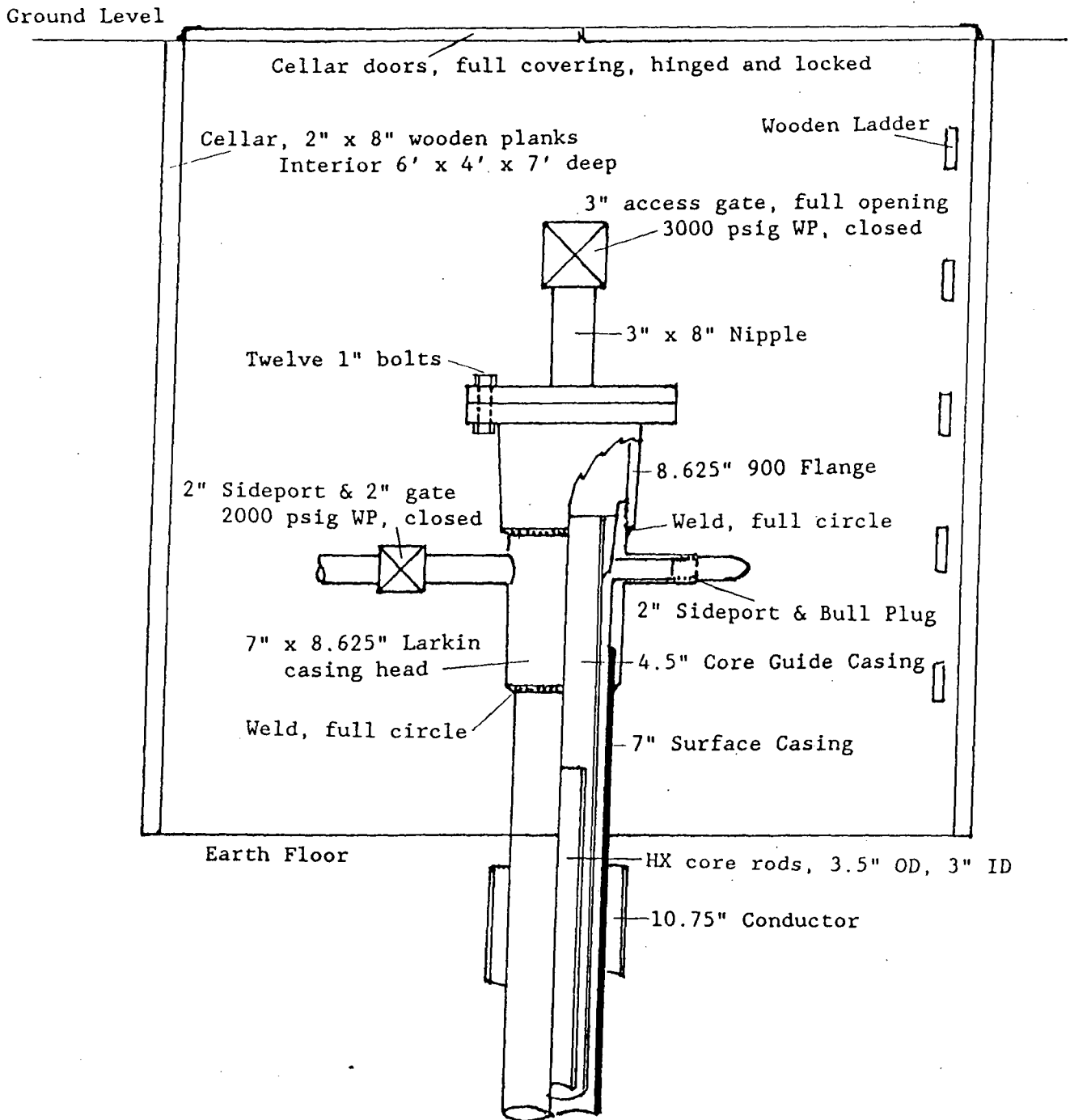
Diamond Shamrock
Thermal Power Company

Completion Date: 7 September 1986

DOE Access Period: 12 months ending 7 September 1987

CLACKAMAS THERMAL GRADIENT HOLE

Schematic: Casing Head, Access Gate and Cellar



Keys to Cellar Lock With:

TPC, Santa Rosa, Calif., 707/576-7022
 Harold Hill, Detroit, Oregon, 503/854-3441



Diamond Shamrock
 Thermal Power Company

Location: Marion Co., Oregon
 T85, R8E, Sec. 28
 Drilled July-Sept., 1986

CLACKAMAS CTGH-1 CORE LOG

Well Head Elevation: 3840 feet
 Logged by: Sibbett, UURI, Nov., 86
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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
1	527-536	74°, 88°, 5°	527-550	<u>Olivine Basalt</u>	2% 2mm Xls. Ol., plag. Xenomor, light gray, 1% ≤ 2mm vesicles, myrolitic cavities.
2	544	mod. to few 45-90°		Basalt con.	3-5% diktytaxitic cavities, med. xl. text Vesicular flow base starts at 549'.
3	552	irregular fract. few 25°, breccia	550-580	<u>Basalt</u>	Vesicular 1/2-2 cm, grayish-red, 10% ≤ 1 mm anh. pheno. Plag. & ol., glommupheric. Matrix fine grain.
4	562	no sign. alt. pk-brn clay	558-580		Diktytaxitic cavities. Flow breccia, vesicular.
5	579				Med.-gray, flow breccia, vesicular.
6	588	few 75°	580-610	<u>Basalt</u>	ves. first 8', ≤ 0.5 cm ves. Med.-dark gray nonporph. Fine grain xenomorphic.
7	595.5	mod. 80-90°			Dense flow, vert. joints, few plag. pheno.
8	606.5	mod. 80-90°			Vesicular base starts at 603'.
9	620	few 80-90°	610-646	<u>Basalt</u>	vesicular top to 618', 1-2 cm ves., Dark gray, fine grain. 2% 1mm plag. xls.
10	629	minor fault 60°	625-628		Flow bands horizontal, 624.5' flow base breccia starts to 628'. Slickenside, minor clay, fault & flow breccia above.
11	639	few 90-85°			1/2 cm 15% vesicles, pink clay wash-in on fract.
12	648	few 65°			Near horiz. Flow-band bubble plan, flow breccia.
13	658	few 65° & 90°	646-661	<u>Basalt flow</u>	dark gray, fine, 1/2 cm ves., 25% vesicular top to 653', Xenomorphic, 2% 1 mm plag.
14	675	few 85°-90°	661-683	<u>Basalt flow</u>	& breccia, vesicular 25%, fine grain dk gray-grayish-brn., 1-3 mm ves. clay matrix in brec.
15	693	mod. 80-90°, few 65°	683-711	<u>Basalt flow</u>	v. fine grain, med.-dk. gray, dusky brn.-grayish brn., flow-top breccia 686', ≤ 1 mm ves.

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
16	701	mod. 60-70° 90° 30° & 65°		2% 1mm plag. pheno. anh, few 1-5 mm ves.	Fractures spaced 2-6 cm.
17	710	few 55-60° and 90°		White clay on vert. fract. 0.5 ft. flow breccia, base recovered.	
18	733	few 70°	711-795	<u>Basalt Flow</u> , ves., fine grain. Grayish red upper flow breccia, gray below 730'.	
19	743	mod. 80-90°		Brnsh-dk. gray, ≤1 mm ves. abundant minor clay on fractures, spaced 3-6 cm.	
20	750	few 60°		V. fine grain, med. gray, clay coat on fractures.	
21	760	2 fractures,		Same as above.	
22	770	45° & 70°		Xenomorphic, non-porphyrific.	
23	785	few 65°	774-795	Flow contact, vesicular basalt above & below.	
24	800	minor clay in ves.	795-815.2	<u>Basalt Flow</u> , vesicular top, dark gray, diktytaxitic.	
25	809	few 80° & 60°		2% 1 mm anh. plag. pheno. yel.-brn. clay on fractures.	
26	817.5	mod. strong 70-90°	815.2-846	<u>Lithic Tuff</u> , yel.-gray to pale yel.-brn. ash.	
27	826.5	crush-zone		Light gray to reddish-brn clast., non-welded weak compaction. Lithic-Lapilli tuff.	
28	838	few 80°		Blocks to 15 cm. dia., water lain (?) ash 3 cm thick at 837'. Andesitic(?) blocks in lapilli tuff.	
29	848.5	broke up	846-1114	<u>Andesite(?) lava-flow</u> , gradual contact 840'-846'. fine grain, dk. grnsh-gray.	
30	863	strong 10°		Non-porphy, clay coating on flow fract. 2-3 cm sp. flow foliation dipping 10°.	
31	883.5	mod.-strong 10° flow joints 80°		<u>Andesite (cont.)</u> dk.-grn.-gray-fine grain. Bimodel xls., 20% 1 mm plag. & pyrox./01., mag.	

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
32	883.5	65° 4 cm sp. strong 0-20°			Black 1 mm min. on fract. Mn.Ox?
33	892	mod. 10° & 30°			As above, fractures 3-6 cm spac.
34	903.5	mod. spec. 10-30° few 80°			Pink-grayish orange clay on 80-90° fract.
35	913	mod. 10-30° & 90°			As above
36	918.5	10-30°			Andesite Flow continued from 846', fine grained
37	928	90° fract.			as above, clay on 90° fractures, MnOx on 10-30° fract.
38	937.5	10-30° strong few 60°			Andesite continued
39	949	strong 0-20°, 90°			Some clay cement breccia, slickensides-20° dip. Increased clay on all fractures
40	960	strong 0-20°, 90°			Minor hem. stain on fract., gray-orange clay in fractures. Andesite cont.
41	964.5	mod. 0-70°			As above, bi-modal andesite ≤ 1 mm plag. xls, in an aphanitic matrix, very uniform texture.
42	974	few 0-20° few 90°			Clay infill on vert. fract., minor hem. coat on fract.
43	984	mod. 10-30° few 80°			As above, 2-20 cm fracture spacing.
44	992.5	mod. 10-30° few 80°			Clay on 80° fract.
45	1000.5	strong 10-30°			Minor breccia zone at 1,000', clay filled fracture spacing 1-3 cm

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CLACKAMAS CTGH-1 CORE LOG

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
46	1010.5	few 70° mod. 0-20°		As above	
47	1021	mod. 0-10° few 80-90°		Clay filling vertical fract.-clay had drying cracks.	
48	1030	mod. 0-10° mod. 70-80°		As above	
49	1039	strong 65° 0-10° few 90°		1038'-39' breccia, clay filled.	
50	1049	mod. 0-20° few 55°		As above, fracture spacing 5-20 cm.	
51	1057.5	mod. 10-20° 60°, few 80°		Clay on high angle fractures.	
52	1057.5- 1066.5	strong 70-80° few 10°, 60°		Andesite Flow continued from 846', dark-grn.-gray, fine grained, 20% 1 mm xls. plag. & pyrox. Fracture spacing 2-3 cm.	
53	1075	Strong 80°		As above, fracture spacing 1 cm.	
54	1082.5	Mod. 75-90° Few 30°		Andesite(?) poss. dacite continued.	
55	1091.5	Mod. 40-60° few 90°		Clay on fractures	
56	1101	few 80-90°		Clay on fractures	
57	1110	Few 80-90° few 60°		Conformable lower contact with underlying pyroclastic. 1109'-1114' basal flow breccia.	
58	1119	V. few 90° Minor slip 1115'	1114-1137.5	<u>Lahar(?)</u> volcaniclastic deposit, crude bedding. Carbon in top 1.5', mix. vol. clasts in tuff-sand-clay matrix.	

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
59	1130.5				Gray-brns. to pale red near base -- base contact conformible, pebbles to 20 cm blocks, upper contact dips 15°, lower contact 20°
60	1139		1137.5-1243.5	<u>Dacite (?)</u>	Porphyritic 10% 1-3 mm anhedral feld. plag?. pyx, bio. Matrix is grnish.-black, aphanitic, even text, minor ves. upper 6'.
61	1149	Few 75-90°			Porphyritic 10% 1-3 mm pheno. plag, prox. bio. grn.-black matrix, clay on fract. is pale-brn. w/ red flakes, clay filled breccia 1143'-1145'.
62	1158	Few 50-60° & 80° & 30°			Clay coating on fract. ≤1 mm to 3 mm, tuffac. Banded clay washed into fractures.
63	1167	Few 90-80° & 60°			Minor slip surface on clay joint 1160'.
64	1177	Few 90°			Dacite cont., joints clay coated.
65	1186	Mod. 70° 90° few 55°			Pink clay in joints, washed in.
66	1196	Mod. 50-60° few 80° & 40°			Color grades to dark-olive gray. 40° flow-parting with clay & mica on fractures.
67	1205	Few 50° & 30° flow parting			Few andesitic(?) xenoliths. 2 cm.
68	1215	few 90-80° & 30°			Dark brn. coating-MnOx(?) on 30° fractures.
69	1223.5	mod. 20° few 90°			Dacite continued, 4-8 cm fracture spacing.
70	1232.5	few 20°, 70°			Basal flow breccia starts at 1230', greenish-blk. blocks with ash & minor clay filling breccia, vesicular, red oxidized matrix.

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Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
71	1242				Ves. in blocks increase, blocks red-oxidized also. Minor pale-brn. clay injected. Prob. flow emplacement fault at base.
72	1251.5	fault	1243.5-1587		<u>Volcaniclastic</u> -2% porphy., pale-brn., Dacitic dome. Lapilli to block size brn. andesitic(?) clasts 2% xls.
73	1261	v. few 70°			Pale red baked upper contact to 1251', pale brn. Clasts in a light brn. to pink tuffac. clay matrix, clast supported.
74	1270.5				Pink to brn. laminated swelling clay infills between clasts.
75	1280	few 70°			Probable rubble flow or dome spree apron.
76	1288	few 40°			Volcaniclastic or flow breccia continued, core breaks around clasts.
77	1297.5	few 70°			Dacitic(?) flow or dome with upper breccia 1243'-1292',
78	1306.5	few 70°			change to flow banded & sheared 70° to vertical.
79	1315.5	mod 90°			Vertical flow banded, probably a dome or thick flow.
80	1325.5	mod 70°			Dark grnish.-gray, some flow brecciation continued,
81	1335	mod 50-60°			clay along fractures.
82	1344	mod 70° few 30°			As above
83	1352.5	mod 90° & 70° few 30°			
84	1362	mod 90° to 50° few 0-20°			Dacitic dome or flow continued from 1243'.
85	1370	prod 0-30° few 80°			
86	1379	mod 10-30°			2% 1 mm plag. pheno's., fracture spacing 3-7 cm.

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87	1387.5	& 55-70° mod. 80-90°, 10°			As above, fracture spacing 1-5 cm.
88	1395	mod 80-90°, 10°			Fracture density increased.
89	1404	mod 60-70° & 80°, few 20°			As above
90	1412	strong 30-40° 80°, few			Dacite or poss. Andesite continued.
91	1420	strong 80°, 10- 20			Andesitic-Dacite dome, continued 2%. 1 mm pheno, in a dk. grnish.-gray matrix.
92	1428	strong 0- 20° & 80°			Pink clay wash-in along fractures, 1-5 cm spacing.
93	1438	mod 30°, 60°, 80°			Viscosity as indicated by thick flow breccias suggest dacite.
94	1447	80-90° & 10-20°			Flow shear appears to be about 10° dip.
95	1456	mod 90° few 5°			Gray-pink clay up to cm thick in vert. fract.
96	1466	mod 80° & 10°			Dacite continued.
97	1475.5	few 80° 10, 60°			Flow shear planes about 10° dip.
98	1485	strong 100 80-90°			Dacite continued.
99	1494.5	mod 50°,			2 cm thick clay wash-in on vertical fractures.

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Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
100	1503	90°, 10° mod 80°, 60°, 10°			White mineral, plag? along flow shear planes.
101	1512	mod 80 & 10°, few 60°			Dacite continued from 1243'.
102	1521.5	few 10°			Fracts. along flow shears.
103	1530	mod 10° & 75°			Dacite continued.
104	1539	mod 80° 10° & 30°			Dacite continued.
105	1548	few 20° & 50°			Dacite continued.
106	1557	few fract. 60°, 20°, & 90°			Dacite continued.
107	1565	80-90° & 55°			Fracturing moderate to strong frequency.
108	1574	few 30° & 70° 70°	1570-1587'		Basal flow breccia.
109	1583	few 50° & 90°			Basal flow breccia.
110	1592	few 40° 75-90°	1587-1629		<u>Lahar(?) Volcaniclastic</u> , lapilli & few blocks in an ash & clay matrix, non-sorted, dark-med. gray
111	1601	few 55°			2' beds of ash, 40 cm blocks. Andesite to basaltic clasts, also few pumice clasts.
112	1610.5	no fract			Some clasts have fairly rounded-smoothed surfaces, few clasts irregular to angular, no alteration

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Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
113	1621	none			4 cm thick laminated bed at 1620.5'.
114	1630	few zone			Broke up with 80-90° fractures 1626'-1629'.
115	1639	few 50°	1629-1673.5		<u>Basalt flow</u> , vesicular, to 1648', 2% 2 mm plag xl., upper flow breccia 1624'-1644' in filled with ash & clay from lahar.
116	1648	V. few 70°			Brown and white clay layers half filling vesicles, Basalt med.-gray, fill surfaces 4° off normal to core.
117	1656.5	few 50° 90°, 20°			Brownish-gray, flow-shear planes dip 20°, with clay & ves. along planes.
118	1666	mod. 20° 90°-70°			Clay in-filling along fractures. Basal flow breccia starts at 1666.5'.
119	1675.5	minor faults 50-60°	1673.5-1694		<u>Lahar or Volcaniclastic</u> 10 cm clasts in banded clay and ash matrix, mostly clast supported.
120	1684.5	mod 60- 90° 20°			Clay slicken surf. on fract., probably minor movement. Most are gry. brns. & reds, mod.-red. brn. matrix supported clay zone with gray lapilli.
121	1693.5	none			Vol. Breccia-Volcaniclastics continued. dk. gray dacitic blocks with pale red-gray ash-lapilli matrix.
122	1704	few 55- 60°	1694-1784		<u>Basalt or Andesite</u> -olive-black, fine grain. Pink clay-ash in-filling, non-porphyrific, plag, pyroxene-ol.?
123	1711	mod. 60° 32°, 90°			Top flow breccia to 1702' breaking along flow shear planes.
124	1721	mod. 70- 90°, 20°			Pale green clay coating or hem. on fractures.
125	1728.5	strong 80°, 45°			Few 2 mm vesicles.
126	1737.7	mod 90°-			MnOx & clay on fract.
127	1745.5	mod-strong			Strong MnOx coat on high angle fract. minor hem. stain

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128	1755	55°, 90° mod. 50-60°		on 55° fract. MnOx & blue-grn clay coat on 2-15 cm spaced fract.	
129	1764.5	strong 50-60°		Rock type & alt. continued, fracture spacing 1-5 cm.	
130	1779.5	mod 45-60°		Fracture spacing 2-9 cm.	
131	1788.5	few 70-90°	1784-1798	<u>Intra-flow breccias and cinders</u> , red, non-vesicular.	
132	1798	few 60° 10°		Clay matrix in-filling flow breccias.	
133	1807.5	few 70-80°	1798-1820	<u>Basalt Flow</u> , med.-dk. gray, 25% 1-3 cm vesicles filled with blk.-waxy clay, non-porphy.	
134	1817	mod 90-70°, 60° 10°		Grn.-blk. clay&poss. chlor. on frac. minor flow breccia at base, but also slicken surface in clay alt. tuff.	
135	1825	mod 70° 45 & 90°	1820-1826.5	<u>Lapilli Tuff</u> , clay alt. waxy, cracking clays, lapilli alt. also, mod. reddish brn. to orange. mod. sorting.	
136	1834.5	few 70°	1826.5-1969	<u>Basalt Flow</u> , vesicular, black, non-porphy., upper flow breccia to 1836' in-filled with olive-brn. ash.	
137	1845	few 75°		Vesicles & fractures filled with black-waxy clay	
138	1854	few 90-70°		Curving irregular fractures.	
139	1963	none		Basalt Flow cont., color varies to dk. olive grn, Basal flow breccia starts 1857'.	
140	1872	none		Flow breccia-gray to gray-red.	
141	1882	few 90-80°, 60° & 20°		As above, dark gray.	

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142	1891	few 50°			Flow shear planes at 50°.
143	1900	V. few 70°			Flow shear 10-20°.
144	1909	few 70-80°			Flow shear 20°, brnsh. blk. clay on fractures.
145	1919	mod 70°-80°			Basalt flow continued.
146	1928	mod 75° 30°, 90°			
147	1937	mod 65° 30°, 90°			Basalt flow continued.
148	1946.5	strong 50-70°			Rock crushed, abundant black-waxy clay on fract.
149	1956	strong			Dark gray basalt continued, strong fractures.
150	1964.6	V. few 50°			Basalt continued.
151	1974	few 80°, 70 & 30°	1969-1970.5		<u>Lapilli tuff</u> red, clay alt., compact, slicken surfaces.
152	1984	few 55- 70°	1970.5-2037		<u>Basalt flow</u> vesicular top w/flow breccia, dark gray, nonporphy, clay & chlor. alt. along fract.
153	1992	mod 80- 90°			Few olivine pheno. 1-2 mm, partly alt., rock is grayish black.
154	2001	breccia fault			Rock is strongly crushed & recemented by clay & chlorite, poss. zeo.
155	2010	strong 60-70°			Fractures of all angles, brecciated and cemented.
156	2019	brecciated			Breccia
157	2030				Basal flow breccia, also crushed. red basal oxidized zone 2035'-2037'.
158	2039.5	few 65°	2037-2240		<u>Basalt flows</u> greenish-blk., vesicular, non-porphy.

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Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
		& 80°			Strongly chloritized, ves. & fract. filled with white clay.
159	2049	mod 60°, 45°, 80°			Flow-breccia to 2039', poss. zeo. in vesicle, chloritized.
160	2057	few 45°			Grnish., blk. chloritized, white lined vesicles.
161	2067	few 50- 75°			Basalt Flows cont. white xl. min. in ves. and fract., prob. zeo. cubic xls. and few euh. qtz. xls.
162	2076	few 20°, 65°			Zeolite in vesicles and fractures.
163	2085	few 80° 90°, 55°			Fract. healed with chlor. & zeo.
164	2095	V. few 75°			Vesicles continue thru entire flow
165	2105	V. few 65°			As above
166	2114	few 65°			As above
167	2124	few 90° 75°			As above-few zones alt. to red-brn
168	2133	few 65- 80°			Vesicle filling level 4° off normal to core axis, abundant 0.5 to 2 cm vesicles, zeo. lined
169	2142	few 40°			fewer vesicles.
170	2151.5	few 65°			Grnish.-blk. grading to dk. red-brn.
171	2161	few 90° 10° & 70°			Dark red brn., dark yellowish-orange zeo., on 90° fract.
172	2170	few 90- 85°			As above. about 1/2 grnish. black.
173	2179.5	few 60°			As above, grnish. black.
174	2189	few 65°			Some breccia healed with chlorite. Intra-flow ash clay alt., compact at 2184'.
175	2198	few 90°			Fault zone(?)-crush breccia recemented by chlorite, clay slickenside & open space zeo. on vertical fract.

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176	2208	none			Totally chloritized, rock crushed and chl _r . cemented, vesicles with zeo. & clay amygdules in some clasts, as above, grnish.-black, zeolite and chlorite.
177	2218	few 65-50°, 40°			
178	2228	few 60°			Chl _r , zeo. alt., color grades to dk.-red-brn.
179	2231	few 30°, 60°			intra flow ash, brn.-clay alt. compacted at 2240'. Basalt grades back to grn. black.
180	2247	few 65° 85°	2240-2318		<u>Basaltic flow Breccia & Ash</u> , vesicular upper flow breccia, zeo. amygdules, clay in-filling.
181	2257	fault 40-60°			Grn.-black blocks, brn. to olive-brn. clay matrix, minor movement.
182	2265	few 60-70°			Red brn. to gray flow breccia, chlor.-clay alt., some tectonic crushing.
183	2273	few 70-80°			As above
184	2284	few 50-60°			Basaltic(?) flow breccia cont.
185	2292.5	90-70°			Extensive clay alt., chloritized, zeo. in fract.
186	2301.5	strong-50-90°			As above
187	2310.5	few 90° 50-60°			Basaltic flow breccia and ash. cont.
188	2319	few 35°	2318-2419		<u>Lahar(?)</u> w/minor ash & vol. breccia zones. Grnish.-blk. to red. ol. brn. chlor., clay alteration mixed vol. litho. in clasts.
189	2327.5	few 40°			
190	2337.5	few 10° 45°			Increased gray-red ash.
191	2348	few 50° & 20°			Dk. gray brn. to red Lahar/vol. breccia.

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192	2358	irregular		Mixed vol. clasts types, andesitic, hornblendes,	
193	2366	few 20-30°		chlorite and clay alt. continued.	
194	2374.5	strong 90°; 20-30°		Core broke up - Lahar cont.	
195	2383.5	mod 80°, 30°		Poss. lithic rich pyroclastic flows, slip on fractures.	
196	2393	mod 20-30, 70-90°		As above	
197	2402.5	few 90° 45°, 70°		Chlor. as above. Poss. lava flow or dike 2400'-2412'.	
198	2411	strong		As above, fractures of all angles.	
199	2420	few 50°		Grn.-black to red, Vol. breccia-Lahar.	
200	2430	mod 20° 30-50°	2419-2448	<u>Andesitic Breccia</u> , dk.-grn.-gray to gray-red.	Uncertain as to brecciation pre-dates emplacement or post dates chloritization. Strong chl., clast-matrix ratio variable.
201	2440	strong 50-75°			
202	2449	strong 50° few 80°			Minor movement on these fract. surfaces.
203	2458	mod-strong 68-70°, 25-45°	2448-2454	<u>Crystal Ash Flow Tuff</u> , clay alt. 15% 1-2 mm plag. xls., compact, abund. bio., brn.	
204	2467.5	few 70° & 75°	2454-2546	<u>Andesite Flow</u> , 15% 1-2 mm plag. xls. alt. to chlor, clay, minor calcite. Flow is brecciated.	
205	2466.5	few 70°, 50°		Brec. mostly flow emplacement, gray-red-brn. to grn.-black.	
206	2486	V. few		Flow grades to dk. grnish.-gray, w/hornb./bio.	

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		irreg.			1-3 mm and mottled appearance, magnetite still present.
207	2495	few 80° 20°			Strong chloritization, fractures zeolite filled.
208	2504	few 70-80°			Chor. veinlets along crush surfaces, zeolite
209	2512.4	few 25°, 90°			rock is more crushed, extensive tectonic breccia and chl. matrix.
210	2512.5	few 80°			As above
211	2533	strong 75-80°			Andesite flow continued dark grn.-gray, 15% porphy- strong, chloritized, clay(?) grn. schist?
212	2543	V. few			Basal flow breccia with red matrix ash 2535'-2546'
213	2552.5	V. few 50°	2546-2586		<u>Andesite(?) flow</u> , 15% 1-2 mm pyx. xls. pyx. are little alt. hem. coating, dark gray.
214	2561.5	V. few 20-50°			Upper flow top breccia 2546'-2553', poss. port. alt. pyx. to hornb.
215	2570	mod. 80°			Minor zeo. along 80° fract., much less chlor. alt.
216	2579	strong 70-90°			
		few 20°			Pale grn. clay along fractures.
217	2589	few 45° 75-80°	2586-2602.5		<u>Lithic-lapilli tuff</u> red to pale grnish.-gray, 60% lapilli sand to 3 cm size mixed vol. litho.
218	2598	few 45° & 65°			Few V. pale grn. fiamme, compacted strong chlori- tization of matrix, mod. clay alt.
219	2606	none			Lapilli reduced to 30%, more fiamme.
			2602.5-2657		<u>Crystal Lithic Tuff</u> . grayish-blk., 10% 2 mm plag.
220	2615	1 fract 25°			≤cm lapilli 5% mix vol. litho, black-fiamme, vol. brecc. at top of unit 2602'-2604'.
221	2624.5	V. few 40°			Tuff appears little altered.

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222	2633.75	none		Vitric ash.	
223	2643	none		Compact, pumice flattened, but not strongly welded. Obsidian lapilli, matrix unaltered.	
224	2652.5	none		Minor clay & chlorite alt. near base 2656'. Tuff lightens to brnish.-gray below 2654'.	
225	2662	none	2657-2694	<u>Olivine Basalt</u> , ves. near top, 10% 1-2 mm olivine 3% plag, amygdules of zeo.(?) 12 flow breccia on top.	
226	2671	few irreg.		Black to brnish.-gray, minor chlor. alt., zeo. filled fract.	
227	2680	few 50°			
228	2690			> cm size open space left in breccia, zeo. cement & coat. basal flow breccia starts 2684', soft, white zeo.	
229	2699	none	2694-2713	<u>Lahar</u> , mixed vol. lapilli to blocks in a clay + sand matrix, dk. red-brn. to olive black, mixed colors & non-to porphy. clasts.	
230	2708.5	few irreg.			
231	2717.5	few 45° w/slicken	2713-2719	<u>Lapilli ash</u> 1-3 mm clasts, well sort. yel.-brn. to dk. yel.-brn., 3 cm clast near base	
232	2727	none	2719-2726	<u>Lahar or volcaniclastic</u> , light gray blocks-lapilli in an olive-black matrix, clasts are rounded, non-sort.	
233	2736.5	none	2726-2842	<u>Andesite Flow</u> , 5% 2 mm pyrox, 2% plag. blk-red-pale brn.-to gray black, hem clay alt. zeo. on fract. minor alt.	
234	2745	few 80°		Pale grn. clay or celadonite on fract.	
235	2754.5	few 80°		Black MnOx(?) coat and waxy clay on fract.	
236	2765.5	mod. 70-90°		Chlor. alt. increases.	

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237	2775	mod. 70-90°, few 30°		Clay & chlor. on fractures, andesite or poss. basalt cont.	
238	2784.5	mod 70-90°, few 30°		Minor movement on high angle joints, chlor-+ zeo. cement fractures	
239	2794	mod 70-30°, few 90°		Crush and chlor. alt.	
240	2804	mod. 70-80°		Clay on joints as above.	
241	2814	mod. 70-90°, 40°		Andesite Flow-cont. grnish.-black, 5% 2 mm prox., 2% plag. strong chlor. alt.	
242	2823	mod. 80-90°, 50-60°		Chlor. on fract.	
243	2832	mod. 60° few 45°		Andesite flow continued.	
244	2842	few 60-75°		Color changes to gray-red in basal flow breccia at 2837.	
245	2851.6	few-mod. 80-90°	2842-2935	<u>Volcaniclastic</u> or <u>Lahar</u> Mixed litho. of lapilli to blocks, non-sort., fine matrix of ash to clay, red-olive blk.	
246	2861	irreg. breaks		Zeolite filling fractures.	
247	2870	few 70°		Brown clay alt. matrix, minor slicken surfaces	
248	2880	few 10°	2877-2879	Well sorted lapilli, zone-dk. brn. to yel.-brn. clay alt. ash-cinders?, 75° slip surfaces.	
249	2889	60°-45°	2885-2891	Lapilli-clay alt, compact, few slip surfaces	

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250	2899	75°, 90° & 45°		As above,	yel.-brn. & pale grn.
251	2909	few 75°		Lapilli cinders,	minor ash, few blocks,
252	2918	few 80°		grn., dk.-gray & dk. red lapilli	few light gray, grnish. gray to brn.
253	2928	few 80°		Olive black.	
254	2937	few 45° 70° & 90°	2935-2952	<u>Ash or tuff</u> ,	trace plag. xls., dk. gray to gray-red.
255	2945	few 75°		Rare lapilli in ash,	few slip surfaces.
256	2955	few 65-90°	2952-2966	<u>Volcaniclastic</u>	lapilli pyroclastic, mix litho, dark grnish. gray, slip surfaces on clay.
257	2964	strong 90-60°		Few blocks & thin sand bed.	clay alt. matrix. Basal contact is a fault.
258	2973.5	mod. 45° 80-90°	2966-4800 TD	<u>Olivine Basalt flows</u> .	fine grain few mm xls. olivine, grnish. blk. to blk. mod. chlor-alt., 2% mm plag. xls., upper contact is a minor fault at 2966'.
259	2983	mod. 65°		Flow breccia,	small irreg. vesicles, minor zeo.
260	2992	minor-irreg.			
261	3001	few 65°		Multi-colored flow breccia,	mono-litho, zeo. and clay alt.
262	3010	few 45°		Vesicular,	1-3 mm, irreg.
263	3018.6	irreg.		As above.	
264	3028	none		Dunite zenoliths?	
265	3037.5	few 80°		Basalt Flows continued,	light blue clay alt.
266	3047.5	few 60°		As above.	
267	2057	few 90°		As above,	flow breccia-cinders.
268	3066.5	strong 90°, 70°, 50°		More solid flow rock,	white, blue & grn. coating on fract.

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269	3076	few 80°			Flow breccia, vesicular.
270	3085	few 50°			Vesicular, vesicles open, coated w/blue clay.
271	3084	none			Continued dk. gray-brnish gray, vesicular, irregular vesicles, 2% plag.
272	3103	none			As above, clay coating vesicles.
273	3113	few 60-90°			Med. gray - as above.
274	3123	strong 50-90°			Open fractures, clay and chlorite.
275	3131	mod 60			As above.
276	3140.5	few 60-70°			Open irreg. ves. flow breccia-cinders.
277	3150	mod. 70-90°			Chalcedony coating on open fract.-space.
278	3159.5	mod. 90-70°			
279	3168.5	mod. 60-70°			As above, open irreg. ves.
280	3177.5	few 10° & 70°			As above.
281	3187	few 70-80°, 100			Chlor. on fract.
282	3196	few 80°, 40°			Some open breccia at 3196'.
283	3205.5	few 45° 65°			As above.
284	3214.5	few 50-40°			Clay in filling breccia & fract. chlor-alt.
285	3223.5	few			Vesicular, as above.

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286	3233	irreg. few 30°		As above.	
287	3242	irreg. breaks		Vesicular.	
288	3252	few 80° 30°		Basalt Flows continued from 2966'.	
289	3261	few 90° & 60-70°		As above.	
290	3270	few 90- 80° & 60°		As above.	
291	3279.5	few 70°		As above.	
292	3289	few 60°			
293	3299	few 90°		Flow centers & breccia, mod. chlor. alt. in flow breccia.	
294	3308	few 25° & 90°			
295	3318	V. few 65°		As above, clay and zeolite along fract. cont.	
296	3328	85° few		Vesicular flow breccia, minor chalcedony.	
297	3337	few 80°, 60°		As above.	
298	3346	mod- strong 90°, 10°, 60°		As above, flow center.	
299	3355	mod. 80- 90°, 55°			

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300	3364	few 10° few irreg.			As above, flow breccia.
301	3373.5	55° few			Basalt-Andesite Flows continued, dark red-gray to grnish. black, 3% 1-2 mm plag. xls.
302	3383	mod. 90° 60-75°, 10°			Chlor. on fract. about 2/3 flow breccias & 1/3 solid flow center, Flow brec. consolidated. 2 mm irreg. vesicles.
303	3392	mod. 80- 90°, few 20-30°			Chlor. on fractures.
304	3401	mod. 70- 90°, few 30°	3396-3421		Flow breccia vesicular, dk. olive grn.
305	3411	none			Fract. joints not present in flow breccia, flow breccia cont.
306	3421	none			Vesicular flow breccia, grn.-gray shades.
307	3430	mod. fract. 55°, 90° 20°	3421-3434'		Flow center, open space 2nd minerals chlor-white zeo., poss. clay blue-grn. Basalt Flows continued from 2966'.
308	3440	mod. 80° 10-20°			Flow breccia starts 3434', vesicular.
309	3439.5	few 80° 20°, 45°			Flow breccia to 3444' then flow center.
310	3458.5	few 90- 80°, 45° 10°			Flow-breccia 3 feet thick.
311	3468	one 90° 2-20°			All flow breccia.

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CLACKAMAS CTGH-1 CORE LOG

Well Head Elevation: 3840 feet
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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
312	3477	irreg.		Dk.-gray-grn. to grnish. black.	Vesicular flow breccia, consolidated.
313	3487	mod. 70-75°, 30°		Grn. chelcedony(?)	on fractures, flow center.
314	3497	few 75-90°		Flow breccia,	empty vesicles.
315	3507	few 80°		As above.	
316	3517	irreg. 50°		As above.	
317	3526	mod. 75-80°, few 45°		Flow center.	
318	3535	mod. 80, 70°, few 10°		Flow center to 3531'	then flow breccia chlor. on fract.
319	3544.5	strong 60-70°		Flow breccia zeo. along fract. & coat open space breccia.	
320	3553.5	mod. 70° irreg.		Flow breccia,	vesicular.
321	3563	few 30°		Vesicular flow breccia,	as above.
322	3572.5	2-55°		As above.	
323	3582	few 65-90°		Clear to pale grn. zeolite	on fractures.
324	3592	V. few 57°		Flow breccia-open vesicles.	
325	3601.5	V. few 70°		As above.	

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
326	3611.5	mod. 35°, 45°, 90°		Basalt	Flows continued from 2966'. 5' thick flow center vesicular.
327	3620	few 45° 75°		Basalt	4' flow center - 6' flow breccias.
328	3629	V. few 10-20° & 50°		Basalt	Calcite coating on one fracture.
329	3638.5	V. few fract. 55° & 20°		Basalt	Matrix of flow breccia strong alt. to chlor or celadonite(?)
330	3648.5	V. few 80°		Basalt	As above.
331	3658	irreg. breaks		Basalt-Andesite(?)	Flows continued, dk.-gray, brn., gray-grn. 3% 1-2 mm plag. vesicular 2 mm, vesicles -1/2 filled w/zeo.
332	3669.5	irreg. break		Basalt	Flow breccia as above.
333	3677	none		Basalt	Zeo. & clay as above.
334	3687			Basalt	As above.
335	3696			Basalt	As above.
336	3706	none		Basalt	At 3703', 3 cm vesicle-zeo. coat, amygdules of chalcedony, celadonite.
337	3715	none		Basalt	Qtz & celadonite amygdules.
338	3723.5	few 8° & 50°		Basalt	As above.
339	3733	mod. 75° 40°		Basalt	Flow breccia.
340	3242.5	V. few 60°		Basalt	As above.

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
341	3751.5	irreg.		As above.	
342	3760.5	few 90, 70°		As above.	
343	3770	few 70° 80°		Ves. 2/3 filled. as amygdules.	
344	3779	few 90- 60 irreg.		Flow breccia as above.	
345	3788	irreg.		As above.	
346	3797	few 90- 80, 65°		As above.	
347	3805.5	mod. 80°, 60, 30°		Basalt Flows continued from 2966'. Qtz. filled 7` flow center amygdules	
348	3815	none		flow breccia-as above.	
349	3824	few mod. 45°, 90°		As above.	
350	3833	few 75- 80°		As above.	
351	3842	few 65°		As above flow breccia, qtz amygdules,	
352	3852	few 65°		vesicular, few celadonite filled, some open	
353	3861	strong 75-80°, few 30°, 60°		chlor & qtz. along fract.	
354	3871	few 80- 90°		As above, flow breccia.	
355	3880	few 80- 90°		Most vesicles empty.	
356	3889	none		Flow breccia.	
357	3998	few 65°		As above.	

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
358	3907	80°, 90° mod. 65-75°			Celadonite amygdules, but most ves. empty. Flow breccia as above & qtz. amygdules.
359	3916	none			As above, breccia.
360	3924.5	mod. 80-90°, few 75°			Flow center. 8' thick.
361	3434	none			Basalt-Andesite flows cont. 2 mm vesicular, 5-10% 3% 1-2 mm plag. xls, grnsh.-blk, to dk. gray flow breccia cont.
362	3943.5	none			As above.
363	3953	few irreg. 75°			
364	3962	few 20-25°			As above.
365	3972.5	few 90° & 70°-80°			Fract. qtz. rock more crushed below 3970', qtz. cemented.
366	3982	strong 50-90°			Chlorite & qtz. cement.
367	3991.5	few 20-30°			Basalt Flows continued from 2966', qtz. amygdules.
368	4000	mod. 90° 55-65°			As above.
369	4009.5	few 70°			As above.
370	4019	mod. 80-90°			Fract. in flow center, qtz in celadonite-chlor. on fract.
371	4028	strong			Qtz. vein/fract. fill increasing flow center.

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
		70-90° 50°			
372	4037	few 70°		Flow breccia, less qtz.	
373	4047	few 75°		As above, less qtz.	
374	4055.5	strong 70-80° 55°		Flow center.	
375	4065	strong 70-80° few 55°		Flow center as above.	
376	4074.5	mod. 80° & 20°		As above, center to breccia at 4069'.	
377	4084	strong 90°, few 65°		As above, flow center 4089'-4103'.	
378	4094	strong 80° & 70°		Flow breccia to 4099'.	
379	4102	strong 90°, 70- 80°		As above, flow center 4099'-4103'.	
380	4112	few 60° & 80°		As above, flow breccia.	
381	4121	none		As above.	
382	4030.5	few 50°		As above.	
383	4140	none		Celadonite amygdules.	
384	4149.5	none		As above.	
385	4158.5			As above, flow breccia.	
386	4168			Flow breccia.	
387	4177.5			As above.	

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
388	4186	mod. fract. 70-80° & 50°		As above, Basalt Flows.	
389	4195	few 40°		Chlor. on fract., qtz. amygdules.	
390	4206	mod. 85-90°, few 45°		As above.	
391	4216	few 25 & 70°		Basalt flows & breccia-cont. from 2966' 2 mm vesicular 5-10%, 3% plag. 1-2 mm, grnish.-black vesicles to 1 cm.	
392	4226	strong 90°, 50° 75°			
393	4235	mod. 90° 35-30°		As above.	
394	4245	trace py.		Qtz. & celadonite amygdules, zeo.	
395	4255	no fract.		As above, breccia.	
396	4284.5	strong 75-80° 25°		Flow center.	
397	4274	mod. 80-90°, few 20°		Flow breccia.	
398	4283.5	few 65-70°, 30°		Most ves. open/unfilled.	
399	4293	mod. 90° few 85°		As above.	

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
400	4301.5	few 85-90°, few < 10°		As above.	
401	4311	few 60°-45°		As above-flow center, upper part vesicular.	
402	4321	few 50°, 90°		As above, center-breccia-ves. top.	
403	4330	few 90°-40°		As above.	
404	4339.5	strong 90°-80°-10°		Basalt Flows and intra-flow breccias continued from 2699'.	
405	4349	few 90°		Flow breccia.	
406	4359	few 80°-50°		As above.	
407	4368	none		As above.	
408	4377	few 70°-90°, 25°		Thin qtz. coat on fract.	
409	4387.5	mod. 90°-50°		Flow center, as above.	
410	4397	few 55° & 25°		As above, flow center to 4391', breccia	
411	4406.5	mod. 40°-80°		As above, flow center.	
407	4368	none		As above.	
408	4377	few 70°-90°, 25°		Thin qtz. coat on fract.	
409	4387.5	mod. 90°		Flow center, as above.	

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GEOLOGIC DESCRIPTIONS

Box #	Bottom Depth Of Box	Fractures (90°=vert.)	Unit Interval (feet)	Lithology	Description
410	4397	few 55° & 25°			As above; flow center to 4391', breccia
411	4406.5	mod. 40° 80°			As above, flow center.
412	4415	mod.			Crushed rock with fractures at all angles.
413	4423.5	strong 30° & 60°			As above.
414	4433	mod. 30° & 60°			Minor fault 30°, flow center over breccia.
415	4442	irreg.			As above, ves. breccia.
416	4451.5	few 55°			Basalt cont.
417	4461	V. few 60°			Qtz. amygdules.
418	4471	few irreg.			As above.
419	4480.5	few 90°			As above.
420	4489.5	mod. 10°, 30°, 80°			Flow center.

Box 421 to 453, Interval 4536-4800 T.D. Basalt Flows and breccia continued from 2966'

CORE LOG

Marion Co., Oregon

PROJECT Clackamas/Cascades WELL NUMBER CTGH-1 LOCATION T8S, R8E, Sec. 28

WELL HEAD ELEV. ~3840' LOGGED BY Sibbett DATE Nov. 11, 86 PAGE 1

BOX #	Recovery Run Depth Interval	Core 90° Vert. FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
1	9/527-536	Light Clay - Drill 74°, 88°, 5°		527-590'	Olivine Basalt, ~2% 2mm pheno. ol + plag. Xenomorph	6 cm 2.4"	
2	8/536-544	Mod. to few 45-90°			Light gray, ~1% ± 2mm vesicles, myralitic cavities. Basalt. con. 3-5% dikty taxitic cavities - med. xl. text. Vesicular flow base starts at 549'		
3	8/544-552	Irregular fract. few 25°, breccia		550-580	Basalt vesicular 1/2-2cm, Grayish-red 5R-6/2 ~10% ± 1m anh. pheno. Plag. & ol., glom. pheric, matrix fine grain dikty taxitic cavities.		
4	10/-562	No sign. alt. PK-brn clay in Bre			558-580 Flow breccia, vesicular. med. gray		
5	10/15/-579				flow breccia, vesicular		
6	9/-588	few 75°		580-610	Basalt, ves. first 8', ± 0.5cm ves. med-dark gray non-porph. Fine grain Xenomorph.		
7	7.5/-595.5	mod. 80-90°			dense flow, vert. joints, few plag. pheno.		
8	11/-606.5	mod. 80-90°			Vesicular base starts at 603		
9	19/3.5-620	Few 80°-90°		610-646	Basalt, vesicular top to 618, 1-2cm ves., Dark gray fine grain. ~2% 1m pho. plag.		
10	9/-629	Minor Fault 60° ~625-628			flow bands horizontal, 624.5 flow base breccia starts to 628 slickenside, minor clay, fault & flow breccia above-		
11	10/-639	Few 90-85° To mod. fract.			1/2 cm 15% vesicles, pink clay wash-in on fract. (drilling mud?)		
12	9/-648	Few 65°			Near horiz. flow-band bubble plane. Flow breccia base 645-646		
13	10/-658	few 65° & 90°		646-661	Basalt flow, dark gray, fine, 1/2 cm ves, 25% vesicular top to ~653', xenomorph, ~2% 1mm plag.		
14	10/17-675	Few 85°-90° PK clay wash in		661-683	Basalt Flows & breccia, vesicular, 25% fine grain, dk gray - grayish-brn. 1-3mm ves.		
15	10/18-693	mod. 3-12cm sp. 80-90°, few 65°		683-711	Basalt flow, v. fine grain, med-dk gray, dusky brn-grayish brn flow top breccia - 686, ± 2mm ves.		
16	8/-701	mod. 2-6cm sp. 60-75°, 90°			~2% 1mm plag. pheno, anh, few 1-5mm ves.		
17	9/-710	few 55-60° & 90°			white clay on vert. fract. 0.5 ft. flow breccia base recovered.		
18	8/23-733	Few 70° Flow breccia		711-795	Basalt. Flow, ves. fine grain, grayish red. 5R top - 718 Flow breccia, gray below 730'		
19	10/-743	Mod. 80-90° 3-6cm spac.			brnsh-dk gray, ± 1mm ves. abundant minor clay on fractures		
20	7/-750	Few 60° - clay coat			v. fine grain, med gray.		
21	10/10-760	2 fractures. 30° & 65°			Same		
22	10/-770	1 of 45° & 70°			Xenomorph, non-porphyrific.		
23	9/15-788	Few ~65°		774-	Flow contact vesicular basalt above & below.		
24	8/13-800	minor clay in ves. & on fract.		795-815.2	Basalt Flow, vesicular top, dark gray, dikty taxitic ~2% 1mm anh plag. pheno. yel-brn clay on fractures		
25	9/809	Few 80° & 60° & strong, broke up			as above.		
26	8/8.5-817.5	mod. 1 strong- 70-90°, crush zone			Fault breccia at 811' - flow breccia 814-815.2'		
27	9/9-826.8			815.2-846	Lithic Tuff, yel-gray to pale-yel-brn ash, Light gray to reddish-brn clast, non-welded, weak compaction, Lithic-lapilli tuff		
28	9/12-838	broke up. & 80° in block			block to 15 cm. dia. water laid(?) ash 3cm thick at 837		
29	~9/10.5-848.5	Broke up.			Many andesitic? blocks in lapilli tuff - gradual contact 840-846 846-1114' Andesite? lava flow, fine grain, dk grnsh-gray.		
30	9/14.5-863	abund. flow foliat at 10° 2-3cm sp.			non-porph, clay coating on flow fract.		

CORE LOG

PROJECT Clackamas/Cascades WELL NUMBER CTGH-1 LOCATION Oregon, T85, R8E, Sec 22

WELL HEAD ELEV. ~3840 LOGGED BY Sibbett DATE Nov. 11 PAGE 2

BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
31	9/13.5 863-876.5	mod. strong, 10° flow joints 20° joints		846-1114	Andesite Flow, dk-grn-gray- fine grain, bimodal xls. ~20% ~1mm plag. & pyrox or ol. ? abu. mag.	6 cm 2.4"	
32	8.5 -883.5	strong 0-20° & ~65°-2cm sp.			black 1mm min. on fract. Mn. Ox.?		
33	8.5 -892	mod. 3-6cm sp. ~10° & 30°			as above.		
34	~9/11.5 903.5	mod. 2-7cm spac. 10-30°, few 80°			pink-grayish orange clay on 80-90° fract.		
35	~9/11.5 -913	mod. 2-7cm 10-30° & 90°			as above.		
36	5.5 918.5	as above			" "		
37	9.5 928	clay on 90° fract. Mn Ox on 10-30°			as above.		
38	9.5 937.5	10-30° strong. few 60°			Andesite continued		
39	~9/11.5 949	strong fract 0-20°, ~90°	✓		some clay cement breccia, slickensides - 20° dip. increased clay on all fractures.		
40	~9/11 -960	strong 0-10° 2-15cm few 75-90°			minor, hem. stain on fract. gray-orange clay in fractures Andesite cont.		
41	7/4.5 964.5	mod. 0-70° & brake up zone			as above - bimodal andesite - ≤ 1mm plag. xls. in a aphanitic matrix, very uniform texture		
42	9.5 974	few 0-20° 5-20cm, few 90°			clay infill on vert. fract., minor hem. coat on fract.		
43	10 -984	mod. 10-30° 2-20cm sp. few 80°			as above		
44	9.5 992.5	mod. 10-30° few ~80°			clay on 80° fract.		
45	8.5 -1000.5	strong 10-30° 1-3cm few 70°	no		minor breccia zone at ~1000', clay filled		
46	10 1010.5	mod. 0-20° 2-15cm,			" as above		
47	10/10.5 1021	mod. 0-10° few 80-90°			clay filling vertical fract. - clay had drying cracks.		
48	9/9 1030	mod. 0-10° mod. 70-80°			as above		
49	9/9 -1039	strong 65° 0-70° few 90°			1038-39 breccia, clay filled		
50	10 -1049	mod. 0-20° few 55° 5-20cm.			as above.		
51	8.5 1057.5	mod. 10-20° ~60°, few 80°			clay on high angle fractures		
52	9/9 1066.5	strong 70-80° 2-3cm spac. few 10° 60°			as above.		
53	8.5 1075	strong 80° ~1cm sp.			"		
54	7.5 1082.5	mod. 75-90° few 30°			Andesite(?) poss. dacite continued		
55	9/9 1091.5	mod. 40-60° few 90°			clay on fractures.		
56	9.5 1101	few 80-90° few			clay on fractures		
57	9/9 -1110	few 80-90° few 60°	+		- Conformable lower contact with underlying pyroclastic. as above to 1109-1114 basal flow breccia.		
58	9/9 -1119	v. few 90° above contact minor s/lpe 1115'	+		1114-1137.5 Lahar(?) volcanoclastic deposit, crude bedding. carbon in top 1.5', mix. Vol. clasts in tuff-sand-clay matrix		
59	10/11.5 1130.5		0.0- 10.0- 20.0- 30.0- 40.0- 50.0- 60.0- 70.0- 80.0- 90.0- 100.0-		gray-brns to pale-red near base - base contact conformable. pebbles to 20cm blocks, upper contact dips ~15° lower contact ~20°		
60	8.5 1139		10.0- 20.0- 30.0- 40.0- 50.0- 60.0- 70.0- 80.0- 90.0- 100.0-		1137.5-1243.5 Dacite(?) Porphyritic 10% 1-3mm anhedral feld.-plag? pyx bio, matrix is greenish-black, aphanitic, even text, minor ves. upper 6', mn.		

CORE LOG

PROJECT Claskamas/Cascades WELL NUMBER CTGH-1 LOCATION Oregon
 WELL HEAD ELEV. 3840 LOGGED BY Sibbett DATE Nov. 11, 86 PAGE 3

BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
61	9.5/9.5 1139.5-1149	few 75°-90° Clay fill brecc. 1143-1145		1137.5-1243.5	Dacite(?) porphyritic -10%, 1-3 mm pheno. plag, pyrox, bio.	6 cm 2.4"	
62	9/9 -1158	few 50-60° 80°, 30°			grn-black matrix, clay on fract. is. pale-brn w/ red flakes Clay coating on fract ± 1mm to 3mm, tuffaceous banded clay washed into fractures.		
63	9/9 -1167	few 90-80° 60°			minor slip surface on clay joint 1160'		
64	10/10 -1177	few 90° Joints clay coated			Dacite cont.		
65	9/9 -1186	mod. 70° 90° few 55°			pink clay in joints, washed in.		
66	10/10 -1196	mod. 50-60° few 80° ± 40°			Color grades to dark-olive gray. 40° flow-parting with clay & mica on fracture.		
67	9/9 -1205	few 50° 30° flow parting			few andesitic? xenoliths. 2cm.		
68	10/10 -1215	few 80-80° 30°			Dark brn coating-MnOx? on 30° fractures		
69	8.5/8.5 1223.5	Mod. 20° 4-8cm few 90° irreg.			Dacite cont.		
70	9/9 -1232.5	few 20° 5-15cm few 70°			Basal flow breccia starts at 1230' greenish-bk blocks with ash & minor clay filling breccia, vesicular, red oxidized matrix		
71	9.5/9.5 1242	flow base oxid.			Ves. of blocks increase, blocks red-oxidized also. Minor pale-brn clay injected, - Prob. flow emplacement fault, at base.		
72	9.5/9.5 -1251.5	minor fault surfaces 1244'			1243.5-1587 Volcano-clastic - 2% porphy. Andesite, Pale Brn, Lapilli to block size brn andesitic? clasts, ~2% xls.		
73	9.5/9.5 -1261	few 70°			Pale red baked upper contact to ~1251, Pale brn clasts in a light brn to pink tuffaceous-clay matrix, clast supported.		
74	9.5/9.5 -1270.5				Pink to brn. laminated swelling clay infills between clasts.		
75	9.5/9.5 -1280	few ~70° brakes around			Probable rubble flow or dome spire approx.		
76	8/8 -1288	few ~40°			Volcano clastic or flow breccia continued.		
77	9.5/9.5 1297.5	few ~70° brakes around blocks.			Andesitic? flow or dome with upper breccia 1243-1292		
78	9/9 1306.5	few 70° along flow bands			Change to flow banded & sheared 70° to vertical		
79	9/9 1315.5	mod. ~90° to strong 90°			Vertical flow banded Probably a dome- or thick flow.		
80	9/10 1325.5	mod. 70° flow breccia			dark greenish-gray.		
81	9.5/9.5 -1335.	mod. 50-60° 70° to strong			clay along fractures		
82	9/9 -1344	mod. 70° few 30°			as above.		
83	8.5/8.5 1352.5	mod. 90° ± 70° few ~30°					
84	8.5/9.5 -1362	mod. 90° to 50° few 0-20°					
85	8/8 1370	mod. 0-30° few 80°					
86	9/9 1379	mod. 10-30° 55-70° 3-7cm			~2% 1mm plag, pheno's.		
87	8.5/8.5 1387.5	mod. 80-90 1-5cm few 10°			as above		
88	7.5/9.5 1395	mod. strong 80-90°, 10°			"		
89	9/9 1404	mod. strong 60-70° 80° few 20°					
90	8/8 1412	strong. 30-40° 80°, few 70°			Andesite or poss. Dacite Continued.		

CORE LOG

PROJECT Clackamas/Cascades WELL NUMBER CTGH-1 LOCATION _____

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BOX #	Recovery / Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
91	8/8 1412-1420	Strong Fract. ~80° 1-3cm 10-20 ~25cm		1243.5-1587	Andesitic-Dacite	Flow or Dome, ~2% -1mm phenos, in a dk greenish-gray matrix.	
92	8/8 -1428	Strong fract 0-20° & ~80°				clay-pink wash in along fract.	
93	14/10 -1438	mod. fract. ~30°, 60° & 80°				Viscosity as indicated by thick flow breccias → Dacite	
94	9/9 1447	M. fract 80-90° & 10-20°				Shear flow banding appears to be ~10° dip.	
95	9/9 -1456	Mod ~80° few ~5°				gray-pink clay up to cm thick in vert. fract.	
96	14/10 -1466	Mod. Fract. 80°, & 10°					
97	9.5/9.5 1475.5	Few Fract. 80°, 10° 60°				Flow shear planes ~10°	
98	9.5/9.5 -1485	Strong Fract. 10° 80-90°					
99	9.5/9.5 1494.5	M. fractured 50°, 90° 10°				~2cm thick clay wash in on vertical fracture	
100	8.5/8.5 1503	M. Fract. ~80°, 60°, 10°				white mineral, plug? along flow shear planes	
101	9/9 -1512	M. Fract. 80° & 10° Few 60°				as above	
102	9.5/9.5 -1521.5	Few 10° fract along				fract. along flow shears.	
103	8.5/8.5 1530	Mod. Fract. 10° & 75°					
104	9/9 1539	mod. fract. 80° & 10° 30°					
105	8/8 1548	Few 20° & 50°				as above.	
106	9/9 -1557	few fract. 60° 20° & 90°					
107	8/8 -1565	Mod-Strong Fract. 80-90° & ~55°					
108	9/9 -1574	Few Fract. ~30° & 70°				Basal Flow breccia starts at ~1570' and to 1587'	
109	9/9 1583	few fract. ~50°, 90°				Basal flow breccia	
110	9/9 -1592	Few-m. Fract. ~40°, 75-90°		1587-1629	Lahar? Volcanoclastic, lapilli & few blocks in an ash & clay matrix, non-sorted, dark-med. gray.		
111	9/9 1601	few fract. 55°			2' beds of just ash, 40cm blocks Andesite to basaltic clasts, also few pumice clasts		
112	9.5/9.5 -1610.5	NO. Fractures NO. alteration			Some clasts are fairly rounded - smoothed surfaces. few clast irregular to angular.		
113	10/10.5 1621	none			4cm thick laminated bed at 1620.5'		
114	9/9 1630	mod. fract. in 2' zone			Possible contact at 1629', below upper flow breccia of basalt. ~1626-1629 broke up with 80-90° fractures		
115	9/9 -1639	few Fract. 50°		1629-1673.5	Basalt? Flow, vesicular, to 1648, 2% 2mm plug		
116	9/9 1648	V. few - 70°			upper flow breccia 1629-1644 in filled with ash & clay from lahar. Brown and white clay layers half filling vesicles, 4° off level suggesting hole deviation of ~4°; basalt med. gray, top breccia darker.		
117	8.5/8.5 1656.5	few fract. 50° 90°, 20°			Brownish gray, flow-shear planes dip ~20°, with clay & ves. along plane		
118	9.5/9.5 1666	mod. Fract. 20°, 90°-70°			Clay in-filling along fractures. Basal flow breccia starts at 1666.5		
119	9.5/9.5 1675.5	Few minor fault 50°-60°		1673.5-1694	Lahar or Volcanoclastic. -10cm clasts in banded clay and ash matrix, mostly clast supported		
120	9/10 1684.5	Mod. Fract. 60-90° & 20°			clay slicken surfaces on fracture, probably minor movement. Most is gray brns & reds, 1679-1681 mod-reddish-brn. matrix supported clay zone with gray lapilli.		

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
121	9.5 1684.5-1893.5	none	1684.5-1893.5	Vol. Breccia or Volcano clastics.			
122	9.5 1704	few fract-fault 55-60°	1694-1784	Basalt? or Andesite.	Olive-black, fine grain		
123	7.9 -1711	mod. 60°, 32° 90°		pink clay-ash infilling - non-porphyrific, clay, pyroxene-ol.?			
124	9.5 -1721	mod. strong fract 70-90° 25° pale-grn clay-fr		top flow breccia to ~1702'			
125	7.5 -1728.5	strong fract. 80°, 45°		Breaking along flow shear planes.			
126	9.9 -1737.7	mod. 90°-70°		Pale green clay coating or hem. on fractures			
127	8.8 -1745.5	mod. strong fract. 55° ~90°		few 2mm vesicles			
128	9.5 1755	mod. fract. 50-60° 2-15cm		MnOx & clay on fract.			
129	9.5 -1764.5	strong fract. 50-60° 1-5cm		strong MnOx coat on high angle fract. minor hem. stain on 55° fract. MnOx & blue-grn clay coat.			
130	9.5 1774.5	mod. fract. 45-60° 2-9cm		as above.			
131	9.9 1788.5	few in flow base ~70°-90°		1784-1798 Intra-flow breccias and cinders. Red, non-vesicular			
132	9.5 -1788.5	few 60° 10°		Clay matrix infilling flow breccias			
133	9.5 1807.5	few fract. 70-80°		1798-1820 Basalt flow, med-blk gray, ~25% 1-3mm vesicles non-porph., vesicles filled with blk-waxy clay.			
134	9.5 1817	mod. fract. 90-70°, 60°, 10°		grn-blk clay & pass chert on fract. minor flow breccia at base, but also slicken surface in clay alt. tuff			
135	8.8 -1825	mod. fract. 70°, 45° & 90°		1820-1826.5 Lapilli Tuff, clay alt. waxy, cracking clays, lapilli alt. also mod. reddish brn. to orange. mod. sorting.			
136	9.5 -1834.5	few 70°		1826.5-1869 Basalt flow, vesicular, black, non-porph. upper flow breccia - 1836 in filled with ol. brn ash, vesicles & fractures filled with black-waxy clay			
137	10.5 1845	few fract. 75° blk clay alt.					
138	9.9 -1854	few 90-70° curving-irreg.					
139	9.9 1863			Color varies to dk. olive grn, basal flow breccia starts ~1857-			
140	9.9 1872	none		flow breccia - gray to gray-red.			
141	10.0 1882	few 90-80° 60° & 20°		as above Dark gray			
142	9.9 1891	few fract. 50°		Flow shear planes at 50°			
143	9.9 1900	W. few 70° & 10° flow shear		flow shear ~10-20°			
144	9.9 1909	few 70-80° & 20°		flow shear 20° Brnish blk clay on fractures			
145	9.5 1919	mod. fract. ~70° 80°					
146	9.9 1928	mod. fract. 75°, 30°, 90°		as above			
147	9.9 1937	mod. fract. 65°, 30°, 90°					
148	9.5 1946.5	strong fract. 50-70°		rock crushed, abundant black-waxy clay? on fract.			
149	9.5 1956	strong. fract. ends at 1948'		Dark Gray Basalt cont.			
150	8.5 1964.6	V. few ~50°		as above.			

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
151	9.5/9.5 1964.6-1974	Few fract. 80°, 70° & 70°	5	1826.5-1969	Basalt flow (cont)	Dark gray, non-porph.	2.4" or 6cm
152	10 -1984	few 5.5-70°	4.5	1969-1970.5	lapilli tuff.	red, clay alt, compact, slicken surfaces	
153	9/8 -1992	few 80-90° mod. fract.		1970.5-2037	Basalt flow	vesicular top w/ flow breccias, Dark gray, nonporphy, clay & chlor. alt. along fract.	
154	9/9 2001	strong crush breccia, fault				Few olivene phen. 1-2mm, partly alt. grayish black.	
155	9/9 -2010	brecciated & cemented				rock is crushed & recemented by clay & chlorite, poss. Zeo.	
156	9/9 2019	Brecciated				Fractures of all angles, but prominent 60-70° fract.	
157	9/11 -2030					Breccia - ~ 2029-2037 basal flow breccia, also crushed 2035-37 red basal oxidized zone.	
158	9.5/9.5 -2039.5	Few 65° & 80° - chlor.	6.5	2037-2240	Basalt flows	Greenish-blk, vesicular, non-porph. strongly chloritized, ves. & fract. filled white clay.	
159	9.5/9.5 2049	mod. fract. 60°, 45°, 80°				flow breccia to 2039' Poss. zeo. in vesicle, chloritized.	
160	9/8 2057	mod. few ~45°				grnish blk chloritized, white lined vesicles.	
161	10 -2067	Few 50-75 zeo. cement fract				white xl. min. in ves. and fract, prob. Zeo. cubic xls. and few euh. qtz xls	
162	9/9 -2076	Few. 20° & 65 zeo. in ves. & fract.				as above	
163	9/9 -2085	Few fract. 80° 90°, 55°				Fract. healed with chlor. & zeo.	
164	10/10 -2095	1/2 few 75°				Vesicles continue thru entire flow	
165	10/10 -2105	1/2 few 85°				as above	
166	9/9 2114	Few at 65°				as above.	
167	10/10 -2124	few - 90° 75°				as above - few zones alt. to red-brn.	
168	9/9 2133	Few 65-80°				Vesicle filling level 4" off normal to core axis. abundant 0.5 to 2.0cm Vesicles, zeo. lined.	
169	9/9 2142	Few -40°				fewer vesicles.	
170	9.5/9.5 2151.5	Few fract. ~65°				dark grnish blk grading to dk redd-brn Zeo. on 90° fract.	
171	9.5/9.5 2161	Few irreg. 90° few 10° & 70°				dark redd brn. dark yellowish orange Zeo. on fract.	
172	9/9 -2170	Few Fract. 90-85°				as above - about 1/2 grnish black	
173	9.5/9.5 -2179.5	Few ~60°				as above, grnish black	
174	9.5/9.5 -2189	Few -65°				some breccia healed with chlorite. Intra-flow as 2184-2185 clay alt, compact.	
175	9/9 2198	Few fract. 90° slicken	5			Fault zone? - crush breccia recemented by chlorite, clay? slicken side & open space Zeo. on vertical fract.	
176	10/10 -2208	none				Totally chloritized, rock crushed and chr. cemented Vesicles with zeo. & clay amygdaloids in some clasts.	
177	10/10 -2218	Few 65-50° 40° zeo, chr.				as above, grnish-black.	
178	10 -2228	Few open 80° Many healed. chr.				chr, zeo. grades to dk-red-brn	
179	9/9 -2237	Few, 30°, 60°				2240-41 intra flow ash, brn. - clay alt, compacted. grades back to grn. black.	
180	2247	Few 65°, 85° chr, zeo, clay	6.5	2240-2318	Basaltic flow Breccia	ash, vesicular upper flow breccia, zeo amygdaloids, clay in filling	

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
181	10 2247-2257	Fault surfaces 40-60°	△	2241-2318	Basalt Flow-Breccia,	ves. blk. in clay matrix grn-black blocks, brn to olive brn clay matrix, minor movement.	2.4" 6cm.
182	8.5 -2265	few 60-70°	△			red brn to gray base. Flow breccia, chlor.-clay alt. some tectonic crushing.	HQ
183	8.5 -2273.5	few 70-80°	△			as above	
184	10 -2284	Few 50-60°	△			basaltic? flow breccia cont.	
185	8.5 -2292.5	90° - 70°	△			extensive clay alt., chloritized, zec. in fract.	
186	9 2301.5	strong-irreg. 50°-70°	△			as above	
187	9 -2310.5	Few Fract. 90° & 50-60°	△			basaltic flow breccia and ash. cont.	
188	9.5 -2319	Few 35°	△	2318-2419	Lahar? w/ minor ash & vol. breccia zones.	Greenish-blk. to red. ol. brn. chlor. clay.	
189	8.5 -2327.5	Few ~40°	△			mixed vol. litho. in clasts.	
190	10 -2337.5	Few -10° 45°	△			increased gray-red ash,	
191	10.5 2348	few 50°, & 20°	△			dk gray brn to red. Lahar/vol. breccia	
192	10 -2358	irregular breaks chr. & clay	△			mixed vol. clasts types, andesitic, hornblende	
193	8.5 -2366	Few fract. 20-30°	△			as above.	
194	8.5 2374.5	strong. 90° 20-30°	△			core broke up. - Lahar cont.	
195	9 -2383.5	mod. 80°, 30° slicken on fract.	△			poss. lithic rich pyroclastic flows, thin zone	
196	7.5 2393	Mod. Fract. 20-30° 70-90°	△			as above	
197	9.5 2402.5	Few Fract. 90°, ~45°, 70°	△			chloritized. as above. 2400-2412 poss. lava flow or dike?	
198	8.5 2411	Strong - all angles	△			as above	
199	9 2420	Few ~50°	△			grn-black to red. Vol. breccia-Lahar	
200	10 -2430	Few-mod. 20° 30-50°	△	2419-2448	Andesitic breccia, dk-grn-gray to gray-red.	uncertain as to brecciation pre-dates emplacement or	
201	10 2440	strong 50-75°	△			Post dates chloritization. strong chr. clast-matrix ratio variable.	
202	9 -2449	Strong 50° few 80°	△			as above, minor movement, on these fract. surfaces.	
203	9 -2458	mod-strong Fract. 68-70°, 35-45°	△	2448-2454	Crystal Ash Flow tuff, clay alt, 15% 1-2mm frag, xls.	compact. abund. bio, mod. brn.	
204	9.5 2467.5	Few Fract. 70° & 25°	△	2454-2546	Andesite flow, porphyritic, 15% 1-2mm frag. xls	alt to chlor. clay, minor calcite. flow is brecciated	
205	9 -2476.5	Few 70°, 50°	△			brec. mostly flow emplacement, gray-red-brn to grn-black.	
206	8.5 -2486	v. few irreg. breaks	△			flow grades to dk. grnish-gray, w/ hornb/bio 1-3mm and mottled appearance - magnetite still present.	
207	9 2495	few 80° zec filled, few 20°	△			strong chloritization	
208	9 -2504	Few 70-80° zec	△			chlor. veinlets along crush surfaces.	
209	8.5 2512.5	Few 25° 90°	△			rock is more crushed, extensive breccia & chr. matrix	
210	8.5 2522.5	Few 80°	△			as above.	

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BOX #	Recovery / Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
211	19/1 2522-2533	Strong 75-80 Chlr. cemented		2454-2546	Andesite flow dark grn-gray, 15% porphy- strong chloritized, clay? grn schist?	15% H Q	
212	1/10 -2543	V. few		Basal flow breccia ~2535-2546. red matrix ash.			
213	9.5/9.5 -2552.5	v. few 50° 65°		2546-2586	Andesite? flow, porphy. ~15% 1-2 mm pyrox. pyx. are little alt. hem. coating, dark gray.	x15.	
214	9/9 -2561.5	v. few fract. 20-50°		Upper flow top breccia 2546-53. poss. part. alt. pyx to hornb.			
215	8.5/8.5 2570	Mod. 80°		Minor zeo. along 80° fract. Much less chlor. alt.			
216	9/9 -2579	Strong 70-90° few 20°		pale grn. clay along fractures.			
217	10/10 2589	few 45° 75-80°		2586-2602.5 Lithic-lapilli tuff - red to pale grnish-gray ~60% lapilli-sand to 3cm size typical of mixed vol. litho.			
218	9/9 -2598	few 45° & 65° chlor-clay		few v. pale grn. fiamme-compacted strong chloritization of matrix, mod. clay alt.			
219	8/8 2606	none		lapilli reduced to ~30% more fiamme			
220	9/9 2615	1. fract 25°		2602.5-2657 Crystal-Lithic Tuff, grayish-blk, 10% 2 mm plag- 4 cm lapilli ~5% mix. vol. litho, black-Fiamme, Vol. brecc. at top 2602.5-2604.			
221	9.5/9.5 -2624.5	v. few 40°		Tuff appears little altered.			
222	9.5/9.5 -2639.75	none		vitric ash.			
223	9.5/9.5 2643	none		compact, pumice flattened, but not strongly welded. obsidian lapilli, matrix unaltered			
224	9.5/9.5 2652.5	none		minor clay & chlorite alt. near base >2656' as above - tuff lightens to brnsh-gray below 265'			
225	9.5/9.5 2662	none		2657-2694 Olivine Basalt, ves. near top, ~10% 1-2mm olivine ~3% plag, amygdules of zeo? ~12' flow breccia on top			
226	9/9 -2671	few irreg. zeo. filled fract		Black to brnsh-gray, minor chlor. alt.			
227	9/9 -2680	few ~50° zeo. cement.		as above.			
228	10/10 -2690			> cm. size open space left. in breccia, zeo. cement & coat. basal flow breccia starts ~2684' - soft, white zeo.			
229	9/9 -2699	none		2694-2713 Lahar, mixed vol. lapilli, to blocks. in a clay sand matrix dk red-brn to olive black.			
230	9.5/9.5 -2708.5	few irreg.		mixed colors & non-to porphy. clasts.			
231	9/9 2717.5	few 45° w/ sliken.		2713-2719' Lapilli ash 1-3mm clasts, well sort. yel-brn to dk yel-brn, 3cm clast near base.			
232	9.5/9.5 -2727	none		2719-2726 Lahar or volcano clastic, light gray blocks-lapilli in an olive-black matrix, clasts are rounded, non-sort.			
233	9.5/9.5 -2736.5	none		2726-2842 Andesite? Flow, 5% 2mm pyrox, ~2% plag. blk-red-pale brn-to gray black.	Fr. olive.		
234	8.5/8.5 2745	few fract. 80° zeo. cement.		zeo. on fract, minor alt.			
235	9.5/9.5 -2754.5	few 80°		pale grn clay or celadonite on fract.			
236	10/10.5 2765.5	mod. 70-90° waxy clay on fr.		Black MnOx? coat on fract, Chlor. alt, increases.			
237	10/10 -2775	mod. 70-90° few 30°		clay & chlor. on fractures Andesite or poss. basalt cont.			
238	9.5/9.5 2784.5	mod. 70-90° few 30°		minor movement on high angle joints chlor.+zeo. cement fractures			
239	9.5/9.5 -2794	mod- strong 70-70° few 90°		crush and chlor. alt.			
240	10/10 2804	mod. 70-80°		clay or poss. talc on joints as above.			

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
241	10/10 2804-2814	Mod. Fract. 70-90°, 40°		2726-2842	Andesite? Flow	- cont. Grnish-black, ~5% 2mm prox., 2% plag. Strong chlor. alt.	
242	9/9 -2823	mod. F 80-90, 50-60°			chlor on fract,	as above,	
243	9/9 2832	Mod. 60° few 45°					
244	9/9 2842	Few 60-75°				Color changes to gray-red in basal flow breccia 2837	
245	9.5/9.5 2856.6	Few-mod. 80-90°-Zeo. Fr.	40 20 20	2842-2935	Volcano-clastic or Lahar	Mixed litho. of blocks, non-sort., fine matrix of ash to clay, red-olive	lapilli to blk.
246	9.5/9.5 2861	Irreg. breaks	20 20			as above.	
247	9/9 2870	Few ~70° slick with minor				brown clay alt. matrix zone	
248	19/10 2880	Few 10° & 75° slicken				a well sorted lapilli zone - 2877-79 dk brn to yel-brn clay alt. ash-cinders?	
249	9/9 2889	Few slicken. 60°, 45°				Lapilli-clay alt, compact 2885-2891'	
250	19/10 2899	Few slicken. 75°-90° & 45°				as above, yel-brn & pale grn.	
251	14/10 -2909	Few 75° irreg. breaks				Lapilli cinders, minor ash. few blocks.	
252	9/9 -2918	Few 80°				grn, dk gray & dk red lapill', few light gray grnish gray to brn.	
253	19/10 -2928	Few 80°	20 20 20			olive black	
254	9/9 2937	Few, 45°, 70° & 90°	20 20 20	2935-2952	Ash or tuff.	Trace plag, xls dk. gray to gray-red.	
255	8/8 2945	Few ~75° Slicken.	20 20 20			rare lapilli in ash.	
256	19/10 -2955	Few 65-90° Slicken on clay	20 20 20	2952-2966	Volcanoclastic	- lapilli pyroclastic, mix litho, dark grnish gray	
257	9/9 -2964	Strong 90°-60° clay alt.	20 20			Few blocks & thin sand beds. clay alt. matrix. Basal contact is a fault.	
258	9.5/9.5 2973.5	mod. slicken. 45°, 80-90°	20 20	2966-4800 TO	Olivine Basalt Flow.	Fine gray. few mm xls. olivine. grnish blk to black. mod. chlor. alt., ~2% mm plag. xls	
259	9.5/9.5 2983	mod. fract. 65°				Upper contact is a minor fault. as above	
260	9/9 2992	minor-irreg. minor-zeo.				flow breccia, small irreg. vesicles.	
261	9/9 -3001	Few 65° zeo + clay				muddy colored flow breccia, mono-litho.	
262	9/9 -3010	Few 45°				Vesicular 1-3mm irreg	
263	8.5/8.5 3018.6	irreg.				as above	
264	9.5/9.5 3028	none				Oxide xenoliths?	
265	9.5/9.5 -3037.9	Few 80° li. blue clay				as above, poss cinders.	
266	10/10 -3047.5	Few 60°				as above	
267	9.5/9.5 3057	Few 90°				as above. flow breccia-cinders	
268	9.5/9.5 -3066.5	Strong Fract. 90°, 70°, ~50°				more solid flow rock - white, blue & grn coating on fract.	
269	9.5/9.5 3076	Few 80°				Flow breccia, Vesicular.	
270	9/9 3085	broke up few 50°				Vesicular, vesicles open, coated w/ blue clay	

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
271	9/9 3085-3094	none		2966-4800 T.D.	Basalt Andesite Flow E	dk gray - brnish gray, vesicular, irregular vesicles, ~2% plag.	gray,
272	9/9 -3103	none				as above.	
273	19/6 -3113	clay coat. ves. Few 60-90°				med. gray - as above	
274	10/10 2123	strong 50-90° clay + chlor.				open fractures,	
275	8/8 -3131	mod. irreg. ~60°				as above	H Q
276	9.5/9.5 3140.5	Few 60-70°				open, irreg. ves. flow breccia - cinders.	
277	9.5/9.5 -3150	mod. 70-90° cha. (Si)				chalcedony coating on open fract. space.	
278	9.5/9.5 3158.5	Few - strong 90° - 70°					
279	9/9 -3168.5	mod. 60-70°				as above, open irreg. ves.	
280	9/9 -3177.5	Few 10° & 70°				as above.	
281	9.5/9.5 3187	few 70-80° few 100°				chlor. on fract.	
282	9/9 -3196	few 80° 40°				some open breccia at 3196'	
283	9.5/9.5 3205.5	few ~45° to 65°				as above	
284	9/9 -3214.5	few 50-40° chlor. + clay				clay infilling breccia & fract. chlor. alt. along clay & rind	
285	9/9 -3223.5	few irreg. br.				vesicular, as above	
286	9.5/9.5 -3233	few 30°				as above.	
287	9/9 -3242	irreg. breaks				vesicular	
288	10/10 3252	few 80°, 30° grn clay coat.				as above	
289	9/9 3261	Few 90° # 60-70°				as above	
290	9/9 3270	few 90-80° # 60°				as above.	
291	9.5/9.5 -3279.5	few 70°				"	
292	9.5/9.5 3289	few 60°					
293	10/10 -3299	few 90°				Flow centers & breccia, mod. chlor. alt. in flow brecc.	
294	9/9 3308	Few 25° # 90°					
295	10/10 3318	v.f. 65° 200, clay				as above	
296	10/10 -3328	85° few minor chalc.				Vesicular flow breccia.	
297	9/9 -3337	few 80°, 60°				as above	
298	9/9 -3346	mod - strong 90°, 10°, 60°				as above, flow center	
299	9/9 -3355	mod. 80-90° 55° few 10°					
300	9/9 3364	few - irreg.				as above - flow brecc.	

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
301	9.5 / 3364-3373.5	F. Fract. ~55°		2966-4800-T.D. Basalt-Andesite Flows	Dark redd-gray to greenish black, ~3% 1-2mm plag. xls	to	
302	9.5 / -3383	mod. 90° 60-75°, 10°		Chlor. on fract. about 2/3 flow breccias & 1/3 solid flow center	flow brecc. consolidated, ~2mm irreg. vesicles.		
303	9.9 / -3392	mod. 80-90° few 20-30°		chlor on fract.			
304	9.9 / 3401	mod. 70-90° few 30°		3396 → flow breccia to 3421	vesicular, flow brecc. dk olive grn.		
305	10 / -3411	none.		fract. joints not present in flow breccia	Flow breccia cont.		
306	10 / -3421	none.					
307	9.9 / -3430	mod. fract. 55°, 90°, 20°		Vesicular flow breccia, grn-gray shades.	flow center to 3434'		
308	10 / -3440	mod. 80° 10-20°		Open space 2nd. minerals chlor, ^{white} zeo, ^{blu-grn.} poss. clay.		H Q.	
309	9.5 / -3439.5	few 80° 20°, 45°		3434 - flow breccia, vesicular	flow breccia to 3444 then flow center		
310	9 / 3458.5	few 90-80° 45°, 10°		3 rd flow breccia	as above		
311	9.5 / 3468	one - 90° 2 - 20°		all flow breccia			
312	9.9 / -3477	irreg.		dk. gray-grn to greenish black.	as above, vesicular flow breccia, consolidated.		
313	10 / 3487	mod. 20-75° ~30°		grn. celadonite? on fractures.	flow center		
314	10 / -3497	few 75-90°		flow breccia, empty vesicles.			
315	10 / -3507	few 80°		as above.			
316	10 / -3517	irreg. ~50°		as above.			
317	9.9 / -3526	mod. 75-80° few 45°		flow center			
318	9.9 / 3535	mod. 80, 70° few 10°		flow center to 3531 then flow breccia	chlor on fract.		
319	9.5 / -3544.5	strong 60-70° zeo & chlor.		flow breccia as above to	zeo along fract. & coat open space breccia.		
320	9.9 / -3553.5	mod. ~70° irreg.		flow breccia, vesicular.			
321	9.5 / -3563	few ~30°		vesicular flow breccia, as above.			
322	9.5 / 3572.5	2 - 55°		as above			
323	9.5 / 3582	few 65-90°		as above			
324	10 / 3592	v. few ~57°		clear to pale grn. zeolite on fract.			
325	9.5 / 3601.5	v. few 70°		flow breccia - open vesicles			
326	10 / 3611.5	mod. 35°, 45° 90°		as above			
327	8.5 / 3620	few - 45° 75°		5' thick flow center	vesicular		
328	9 / 3629	v. few 10-20° & 50°		~4' flow center	6' flow breccia s.		
329	9.5 / 3638.5	v. f. fract. 55°, E. 20°		Flow breccia.	Calcite coating on one fract.		
330	10 / 3648.5	v. few 80°		matrix of flow breccia strong alt to chlor-celadonite?			
				as above			

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
331	9.5 3642.5-3657	irreg breaks across core.		2966-4800	Basalt-Andesite? Flows	DK. gray, brn, gray-grn- ~3% 1-2mm plag. Vesicular ~2mm, Vesicles ~1/2 filled w/ zeo.	
332	9.5 - 3667.5	irreg. break.			flow breccia as above.		
333	9.5 - 3677	none.			zeo. & clay as above,		
334	10 - 3687				as above.		
335	9.9 3696				as above		
336	10 - 3706	none			at 3703, - 3cm vesicle - zeo. coat. & native copper? in zeo. or qtz. as above amygdules of chalcedony, celadonite,		
337	9 - 3715	none.			as above. qtz & celadonite amygdules -		
338	8.5 - 3723.5	few 80° & 50°			as above.		H-Q
339	9.5 - 3733	mod. 75°, 40°			flow breccia		
340	9.5 - 3742.5	v.f. 60°			as above		
341	9.9 3751.5	irreg.			as above.		
342	9.9 3760.5	few 90, 70			as above		
343	9.5 3770	few 70°-80°			ves. ~2/3 filled,		
344	9 3779	Few 90-60 irreg.			flow breccia as above.		
345	9 - 3788	irreg.			as above		
346	9 - 3797	Few 90-80 65°			as above		
347	8.5 - 3805.5	mod. strong 80°, 60, 30°			~7' flow center qtz filled amygdules.		
348	9.5 - 3815	non -			flow breccia - as above.		
349	9 - 3824	Few-Mod. 45°, 90°			as above.		
350	9.9 - 3833	Few 75-80°			as above.		
351	9.9 3842	Few 65°			as above flow breccia, qtz amygdules -		
352	10 - 3852	Few 65°			vesicular ^{few} celadonite filled, some open		
353	9 - 3861	strong 75-80 few 30°, 60°			chlor. & qtz along fract.		
354	10 - 3871	Few 80-80°			as above flow breccia		
355	9 3880	Few 80-90			most vesicles empty		
356	9 - 3889	none			flow breccia		
357	9 - 3898	Few 65° 80°, 90			as above.		
358	9 - 3907	mod. fract. 65-75°			celadonite amygdules but most ves. empty ves. flow breccia as above. & qtz amygdules		
359	9 - 3916	none.			as above breccia		
360	8.5 3924.5	mod. 80-90 Few 75°			flow center, 8' thick.		

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
361	9.5 3924.5-3934	none - fract. alt. cel. qtz none		2966-4800	Basalt-Andesite Flows	Cont. ~2mm vesicular, 5-10% ~3% 1-2mm Plag. xls, grnish-blk. to dk gray.	
362	9.5 - 3948.5	1			Flow breccia cont.		
363	7.5 3953	Few irreg. 75°			as above		
364	9 - 3962	few 20-25°			as above		
365	9.5 - 3972.5	Few 90° & 70°-80°			rock more crushed below 3970- Fract. qtz cement.		
366	9.5 - 3982	Strong, fract. 50-90			chlorite & qtz cement.		
367	9.5 3991.5	Few 20-30°			qtz amygdules	H-Q	
368	8.5 - 4000	mod. 90° 55-65°			as above		
369	9.5 - 4009.5	Few ~70°			as above		
370	9.5 4019	mod. 80-90			fract. in flow center qtz + cel celadonite - chlor. in fract.		
371	9.5 4028	strong 70-90 50°			qtz vein/fract. fill increasing Flow center		
372	9 - 4037	Few 70°			flow breccia, less qtz		
373	10 - 4047	Few 75°			as above less qtz		
374	8.5 4055.5	strong 70-80° also 55°			Flow center		
375	9.5 - 4065	strong 70-80 few 55			flow center as above.		
376	9.5 - 4074.5	mod. 80° & ~20°			as above center to breccia at 4069'		
377	9.5 4084	strong 90° few 65°			as above Flow center 4073-4081		
378	10 - 4094	strong in center 80° & 70°			flow breccia to 4089';		
379	8 4102	strong 90° 70-80			as above. Flow center 4089-4103		
380	10 - 4112	few 60° & 80			as above, flow breccia		
381	9 - 4121	none.			as above		
382	9.5 4030.5	Few 50°			as above.		
383	9.5 - 4140	none.			celadonite amygdules		
384	9.5 4149.5	none			as above.		
385	9 - 4158.5				as above flow breccia		
386	9.5 - 4168				Flow breccia		
387	9.5 4177.5				as above.		
388	8.5 - 4186	mod. fract. 70-80° & ~50°			as above.		
389	9 - 4195	Few 40°			chlor. on fract. qtz amygdules	H-Q or 2.4"	
390	9 - 4206	mod. 85-90° few 45°			as above.	6 CM End HQ	

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BOX #	Recovery Run Depth Interval	FRACTURES & ALTERATION	Graphic Symbol	GEOLOGIC DESCRIPTIONS			CORE SIZE Drilling Fluid Samples
				Unit Interval	Lithology	Description	
391	10 - 4216	few 25 & 70		2966 -	Basalt? flows & breccia - cont.	2mm vesicular	5-10%
392	10 4226	Strong - 90° 50°, 75°			~3% plag. 1-2mm, greenish-black	vesicles to 1cm.	4.7cm or 1 7/8"
393	9 4235	mod - 90° 35-30°			as above		N-Q or NX
394	10 4245	Trace Py. none - fract.			qtz & celadonite amygdules, zeo.		
395	10 4255	no fract.			as above breccia		
396	9.5 - 4284.5	Strong 75-90° 25°			Flow center.		
397	9.5 4274	Mod - 80-90° few 20°			Flow breccia,		
398	9.5 4283.5	few 65-70° 30°			most ves. open/unfilled.		
399	9.5 4293	mod. 90° few 85°			as above.		
400	8.5 4308.5	few 85-90° few ≤ 10°			as above.		
401	9.5 - 4311	Few 60°, 45°			as above - flow center, upper part vesicular		
402	10 4321	few 50°, 90°			as above, center - breccia - ves. top.		
403	9 4330	few 90° 40°			as above		
404	9.5 4339.5	Strong - 90°-80° 10°			as above		
405	9.5 - 4349	few 90°.			as above - Flow breccia		
406	10 4359	few 80° 50°			as above		
407	9 4368	none			as above		
408	9 4377	few 20-90° ~25°			thin qtz coat on fract.		
409	10.5 4387.5	Mod-Strong fract 80°, 40° ~ 50°			Flow center, as above		
410	9.5 4397	Few 55° & 25°			as above, flow center to 4391 → breccia		
411	9.5 4406.5	mod. 40° 80°			as above - flow center		
412	8.5 4415	mod - all angle gen. crush			as above.		
413	8.5 4423.5	Strong - 80-90° & 20°			as above.		
414	9.5 4433	mod - 30° & 60°			minor fault 30° flow center over breccia		
415	9 4442	irreg.			as above - ves. breccia		
416	9.5 - 4451.5	few 55°			basalt cont.		
417	9.5 4461	v. few 60°			qtz amygdules		
418	10 - 4471	few irreg.			as above		
419	9.5 4480.5	mod few 90°			as above.		
420	9 4489.5	mod-Strong fract 10°, 30°, 80°			Flow center		

