Diamond Shamrock
Thermal Power Company

GL04429_6

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) GOODWIN/MCDANNEL
BASIS BIN. MICROSCOPE/DDATE June 22, 1986

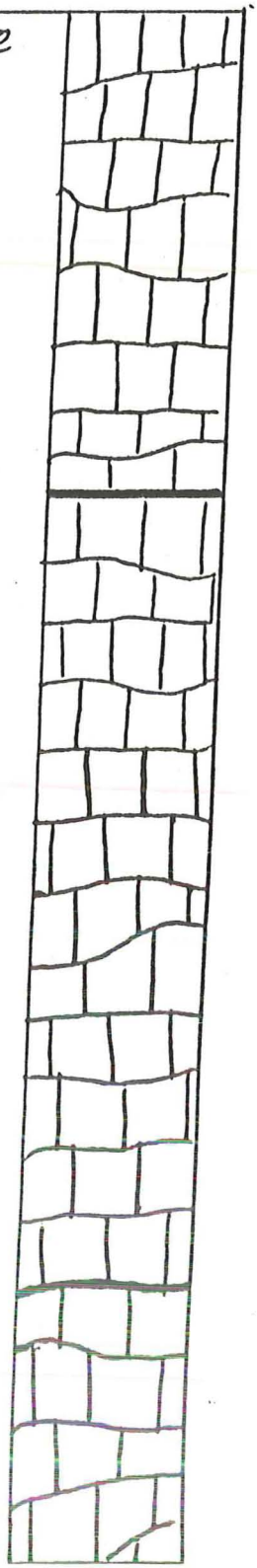
DEPTH INTERVAL	DESCRIPTION	lithology
527'	527' BASALT/BASALTIC ANDESITE Med lt gry to med gry, finely porphyritic <10% phenos, all ≤ 3mm : plag, ol, cpx glomerocrysts of plag, ol, ± cpx vertical to 25° fractures common, fracture surfaces have light to moderate coating of white to yellowish and ponkish clays. @ 540'-545', 548'-549': fracturing intensifies - core pieces 1"-5". @ 549': oxidized to reddish-gry predominately rubble, w/well consolidated intervals. Becomes vesicular. Voids up to 3 cm @ 556': clay increases (lt. yellow & dk red) @560': ashy intervals	
547'		
567'		

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADE / CLACKAMAS

GEOLOGIST (S) McDANNEL / GOODWIN
BASIS BIN. MICROSCOPE DATE 6/22/86

DEPTH INTERVAL	DESCRIPTION
567'	AS ABOVE (rubbly, vesicular basalt/basaltic andesite w/clay & minor ash/scoria)
	579' - approximate flow boundary
580'	BASALT/BASALTIC ANDESITE med gry, finely porphyritic ~8% phenos, ≤ 3mm. glomerocrysts of plag, ol, pyx Fractures common: vertical to 10° & approximately horizontal & coincident with stretched/smeared/elongated vesicles Small vesicles pervasive & decrease w/depth Vesicles & fractures coated w/lt. yellow & pinkish clays
587'	
	604' - approximate flow boundary vesicles pervasive and decrease with depth below oxidized, brick red horizon 1' thick marking rubbly contact
607'	



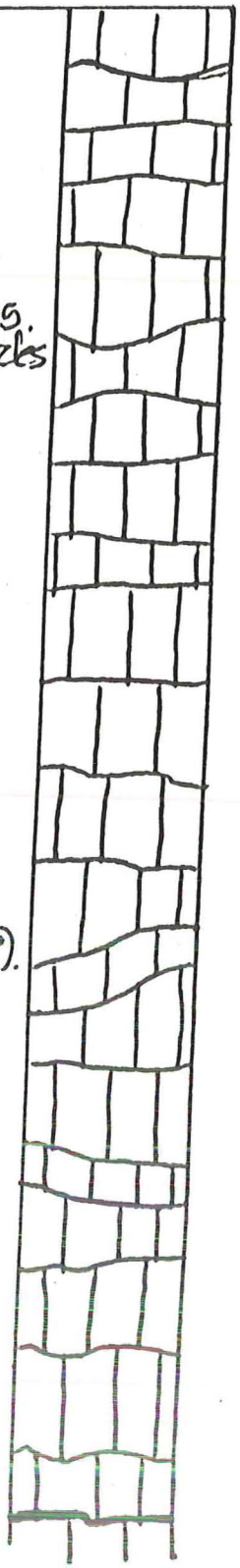
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADE/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS BIN. MICROSCOPE DATE 6/23/86

DEPTH INTERVAL	DESCRIPTION
607'	607' BASALT/BASALTIC ANDESITE med. dk gray, finely porphyritic ~8% phenocrysts, ≤ 5mm glomerocrysts of ol., plag., ± R. pyx.? rubbly, w/ minor red scoria & ash until 616'. Large vesicles 612-615. 616' - consolidated Pinkish clays fill vesicles
627'	629'-634' vesicular interval 632'-639' fractured - predominately small (3") pieces. fractures are vertical to sub-vertical (15°). 2ndary set is horizontal to sub-horizontal
647'	646.5': flow boundary? Marked by ash/cinder/scoria zone (until 648)



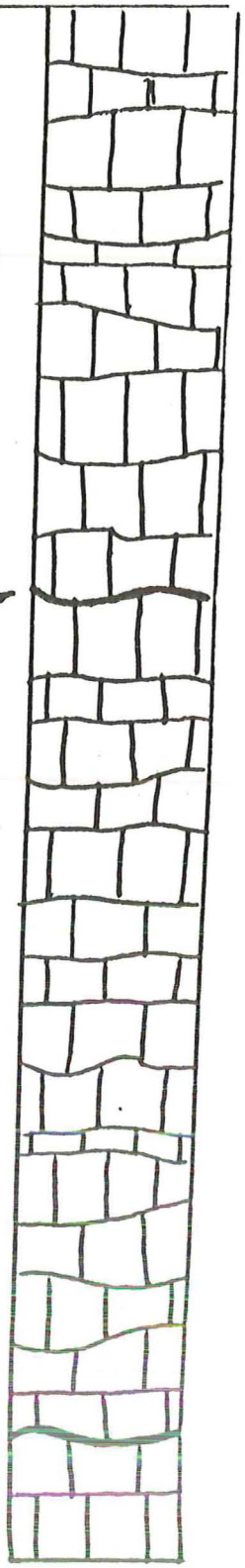
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADE/CLACKAMAS BASIS MICROSCOPE ID DATE 6/23/86

DEPTH INTERVAL	DESCRIPTION
647'	AS ABOVE (BASALT - BASALTIC ANDESITE)
	653': flow becomes denser, less vesicular fractures common — 0-25°, less commonly ~60° — producing 2"-4" pieces of rock
	660': ash & conder zone FLOW BOUNDARY?
	663': rock becomes better consolidated, vesicular zones of rubble persist to 684'
667'	683-687': Well consolidated scoriaceous zone - flow breccia. Flow boundary.
687'	



Diamond Shamrock
Thermal Power Company

Form 2

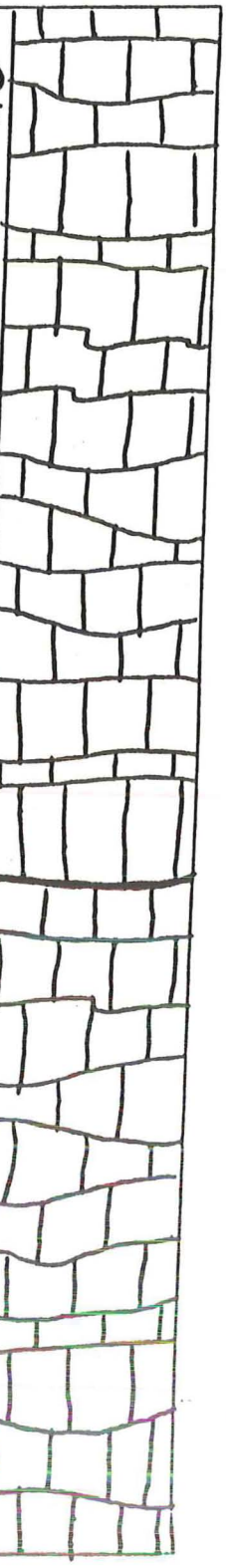
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) MCDANNEL/GOODWIN

FIELD CASCADE/CLACKAMAS BASIS MICROSCOPE ID DATE 6/24/86

DEPTH INTERVAL	DESCRIPTION
687'	687': BASALT/BABALTIC ANDESITE (A/A) MED TO MED DK GRY, PORPHYRITIC (2-5% PHENOS) PHENOS ≤ 2mm: PLAG, OL, PYX. OL→IDDINGSITE fractures 0°-30°, locally vesicular pnk, white, lt. brn. clays on fracture surfaces & filling some vesicles 693'-696': very fractured (A/A) & dense 5-10% vesicles (<1-30mm)
707'	710': brick red, scoriaceous, flow breccia. APPROX. FLOW BOUNDARY ashy & poorly consolidated
	719': BASALTIC ANDESITE. med. dk grey, porphyritic (2-3%) phenos ≤ 2mm: plag, cpx, ol. subtle red tint to groundmass light coating of clays on fracture surfaces fractures 0-30°, (intense fracturing 720'-738') less common horizontal
727'	



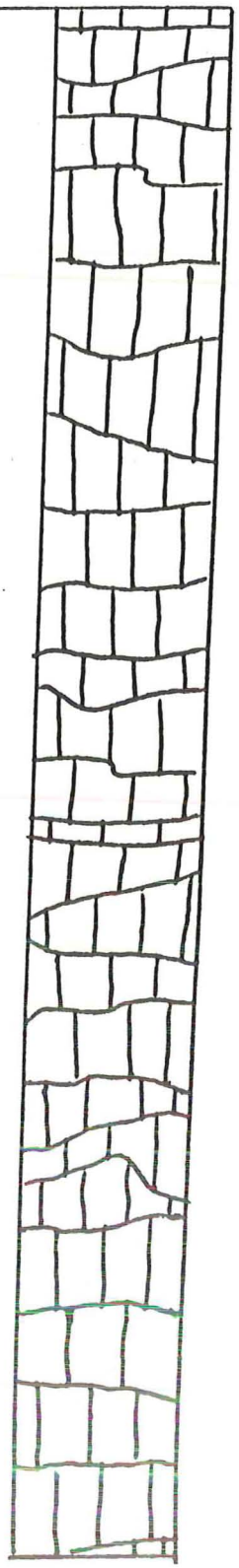
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN / MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS MICROSCOPE ID DATE 6/24/86

DEPTH INTERVAL	DESCRIPTION
727'	BASALTIC ANDESITE A/A
	733'-739': SLIGHTLY SCORIACEOUS/ASHY LT. RED
747'	750': BASALTIC ANDESITE lt. med. gray (unusually lt.) to med. dk. gray, dense, massive, sparsely porphyritic to aphyric, gen'ly <1% plag., ol., pyx., rarely fractured (1x/5' @ 30° ± to ℄) lt. brn clays coat fractures, <1% vesicles
767'	



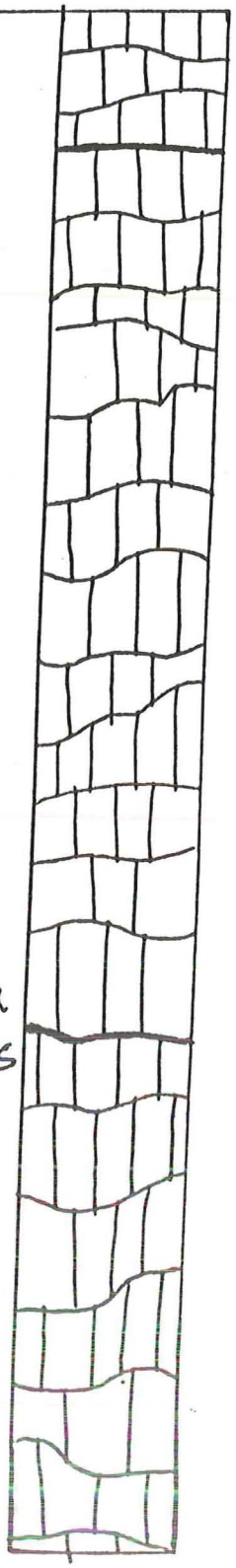
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS BIN. MICROSCOPE DATE 6/25/86

DEPTH INTERVAL	DESCRIPTION
767'	BASALTIC ANDESITE (A/A) 770'-771' increasing vesicularity 771' FLOW BOUNDARY 771'-779' rubble: brick red, vesicular, locally scoriaceous, ashy 779': BASALTIC ANDESITE med. dk. gray, sparsely porphyritic (2-4%) phenos. < 2mm; plag., ol. vesicles 5-15%, decreasing with depth 779'-781' subhorizontal stretching & concentration of vesicles in narrow bands clays: tan, wht, pink in < 20% of vesicles and ptlly. coating fractures
787'	788.5'-792.5' Rubbly 792.5'-795' FLOW BOUNDARY: Rubbly med. dk. gry vesicular basaltic andesite and clayey-ashy flow breccia - common med. brn clay filling interbreccia clast voids - tan & lt. brn clays fill fractures and ~10% of vesicles (i.e. 90% are void) 795'-800' Rubbly, vesicular b.a. 800' Common fractures, often @ 70° to ⊥ heavier clays, thick coatings on fracture surfaces. Lt. pink clay is the predominate clay.
807'	



Diamond Shamrock
Thermal Power Company

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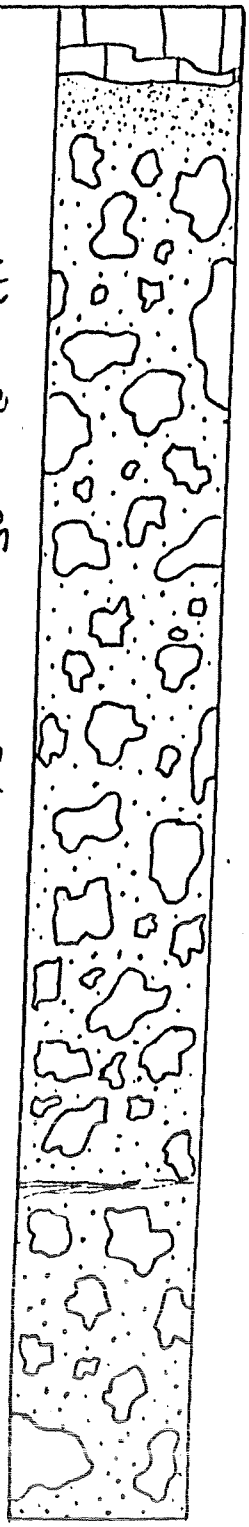
CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/McDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE 6/25/86

DEPTH INTERVAL	DESCRIPTION
807'	BASALTIC ANDESITE (A/A)
	809' VOLCANIC BRECCIA Sub-angular to sub-rounded lapilli & blocks of basaltic to silicic (less common) rock fragments in a yellowish brn matrix of ash, crystals & ash size rock fragments. Silicic fragments are more common near bottom of unit & appear to be of same lithology as underlying unit (@ 854'). Crystals in matrix include biotite, feldspar, opx, cpx, qtz(?). Rock is matrix-supported & moderately to well indurated. Top 18 cm of unit is composed of dk grey ash & ash sz rock fragments. Unit has only minor fracturing & lw/no preferred orientation. Minor limonite stain.
827'	826.5' matrix poorly consolidated – mainly mud & rock fragments collected from core barrel
	839' - ~4 cm of fine laminations which contain v. small scale crossbeds.

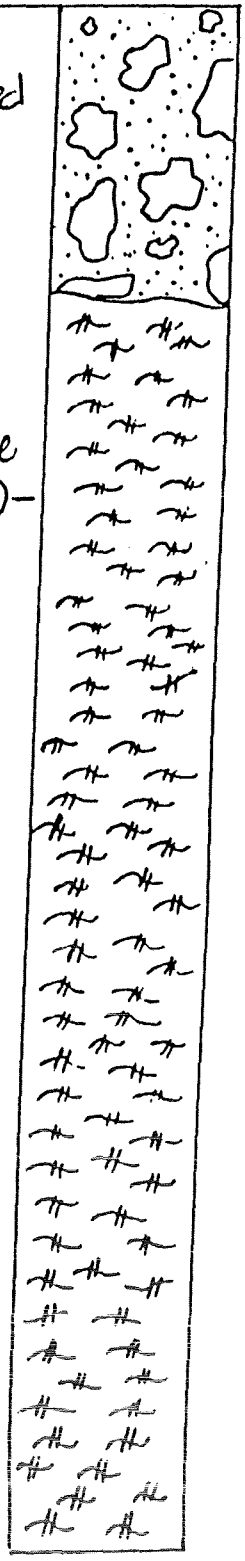


CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) GOODWIN/MCDANNEL
BASIS BINOC. SCOPE DATE 6/26/86

DEPTH INTERVAL	DESCRIPTION
847'	VOLCANIC BRECCIA (A/A) 844'-854' contact w/underlying unit is marked by zone of boulders of underlying unit & less matrix than above. Transition may represent regolith & soil ?
854'	DACITE Med gry, porphyritic. 4-10% phenocrysts of plag, cpx, opx. Slightly "glassy" appearance to fractures. Much of unit is intensely fractured w/ predominate direction 75°-80°; generally closely spaced (1-10cm)-producing platy fracture. Uncommon vertical fractures. Light brn, pinkish clay on fracture surfaces; FeO or MnO? on many fracture surfaces.
867'	
887'	



CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/McDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICRO DATE 6/26/86

DEPTH INTERVAL	DESCRIPTION
887'	DACITE (A/A)
	894'-899' fractured & sheared. Heavy brn. clay (~10°)
	905'-906.5' - intensely fractured
907'	908'-913.5' - intensely fractured, light clays
	917.5'-918.5' - rubble, <1"ϕ fragments
	922'-923' - fractured, w/heavy brn. clay (25%)
971'	

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BINOC. SCOPE DATE 6/27/86

DEPTH INTERVAL	DESCRIPTION
927'	DACITE (A/A @ 854')
	930'-931' - intensely fractured
	934'-935.5' " "
	937'-948' - " "
	939'-939' - breccia, angular to sub-angular rock fragments (½"-6") in matrix of lt. tan (consolidated) clay, sand size rock frags, xtls
947'	
	963'-965': brecciated zone, increase in clay
	960' - slight change in rock texture. Appears less porphyritic, fewer (+smaller) plag phenos. Strongly resorbed hornblende xtls → feldspar, cpx, opx
967'	

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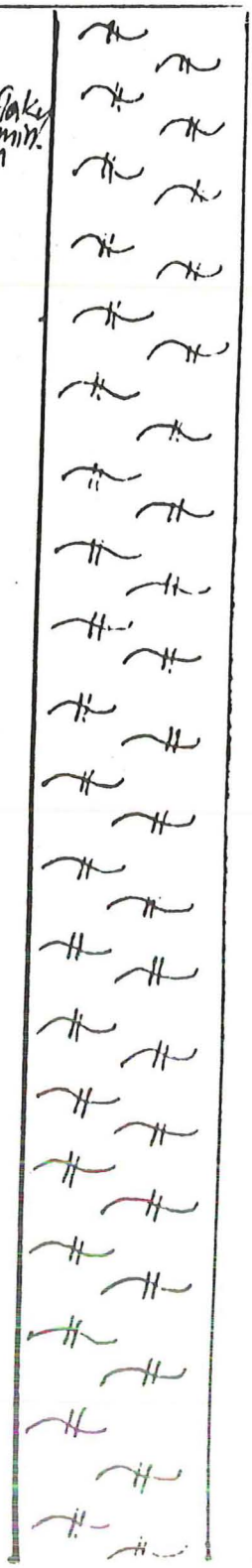
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS _____ DATE 10/28/86

DEPTH INTERVAL	DESCRIPTION
967'	DACITE (A/A @ 854')
	967' - minute aggregates of lt.grn-yel. to clr. flaky min. on frac. surfaces
	972' - clr. flaky min. a/a ; minor cpx & g.mass } oxidation (reddish)
	974' - R. flaky min. & clays have decreased
987'	
	991' - fracturing intensifies, 70°-90°
	1,000' - 6"-8" heavy clay (30%) & breccia
	1,001' - 21" " " " "
1007'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. micro. DATE 6/28/86

DEPTH INTERVAL	DESCRIPTION
1007'	DACITE (A/A @ 854') 1010' - 8-10" fractured zone w/ heavy pinkish tan clay.
	1020'-1022' fractured interval (vertical fractures) heavy clay (pinkish) 1023' green clay on surface w/ reniform texture *groundmass darkening, suggesting changing (i.e. more mafic) composition w/depth, texture is more homogeneous & equigranular
1027'	1028'-1039' fractured interval (vertical to sub-vertical & horizontal to 70° to ℄) w/ heavy brn clay at base of interval
	1040'-1049' Less fractured, less clay and alteration
1047'	1047' lt. coating of grn clay/flaky min. on fracture

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE 6/29/86

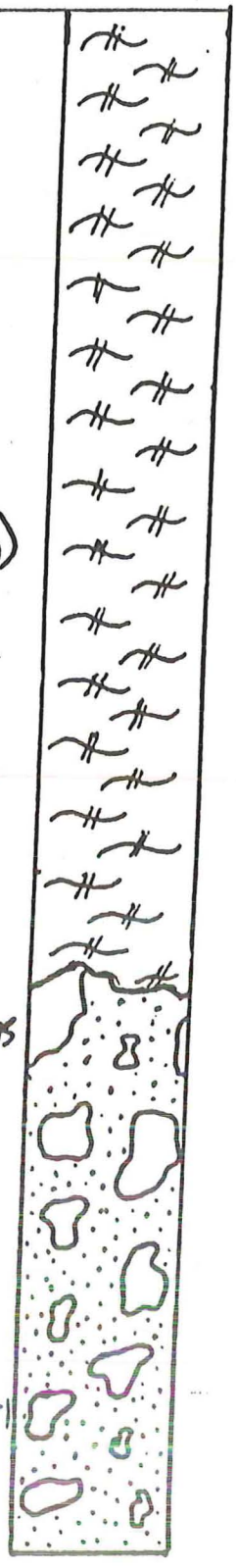
DEPTH INTERVAL	DESCRIPTION
1047'	DACITE (A/A @ 854') 1047' R specks black iron mineral (hematite?), v. fine, scattered through groundmass, rare larger hematite blebs 1049.5' - 1050' intensely fractured 1052' - 1053' heavy clay (med. brn color)
	1057' - 1075' - splintery, high angle fracture
1067'	1066' - 1081' fracturing - moderate to intense, distinctive conjugate joint set @ 15° to ℄ w/ splintery fracture locally lt. limonite to 1109'
	below 1075' subtle increase in phenocryst %: @ 1076' 6-8% → 8-12% (locally) coexisting hematite (metallic) and FeOx (earthy) near fractures
1087'	1081' - 1090' fractures @ 45° to ℄ ± sinuous vertical fracture >> fracture ⊥ to ℄ (90°) darker color than upper part of unit 1081' - 1083' heavy clay, med. - lt. brn & grayish orange pink w/ R+ pyrolusite associated

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE 6/29/86

DEPTH INTERVAL	DESCRIPTION
1087'	DACITE (A/A @ 854') 1087'-1090' fractures @ 45° ∠ to ℄ ± Sinuous vertical fracture, fewer ⊥ to ℄
	1101'-1103' Vertical fractures with heavy clay (lt. brn) 1105'-1109' Small miarolitic voids appearing, irregular shapes, small increase in % pyx.
1107'	1109' Intense clay alteration, 6" inclusion (dark gray) reacting w/ dacite (being digested) 1110' Contact: intense clay alteration but no signs of baking. Lt gry. Appears brecciated & gradational w/ underlying unit, w/ pebbles & boulders of dacite in clay matrix, becoming heterolithologic
1112':	VOLCANIC BRECCIA (SURGE DEPOSIT?) Angular to sub-angular lapilli & block size basalt - basaltic andesite (many from underlying unit) &, less commonly, silicic rock fragments. Clayey matrix (from ash?) of ash sz rock fragments & crystals. 1114' Small lapilli- to ash-size, rounded clay clasts are wht to tan & contain hornblende & biotite, suggestive of devitrified pumice. Discontinuous laminae of v. dark gry - brn gry, thin discontinuous beds w/ small lapilli - ash sz rock frags suggest surge origin. Oxidized slightly disrupted basaltic material near contact with
1127'	



Diamond Shamrock
Thermal Power Company

Form 2

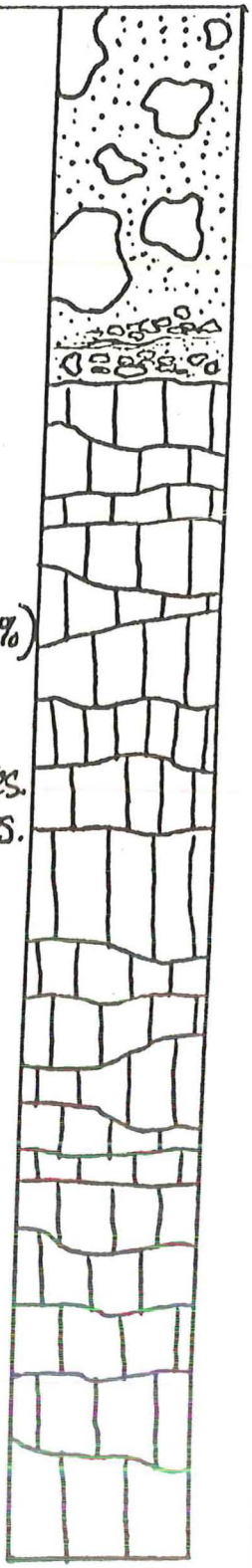
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/McDANNEL

FIELD CASCADES/CLACKAMAS BASIS binocular microscope DATE 6/30/86

DEPTH INTERVAL	DESCRIPTION
1127'	(cont'd) VOLCANIC BRECCIA (A/A) underlying basalt flow suggests deposition while partially molten.
	1137.5' Thin, irregular beds of ash to lapilli-sz, commonly oxidized, rock fragments w/ subtle small scale cross bedding.
	1138': BASALT med-med dk gry to lt brnish gry, porphyritic (~7%-12%) w/ phenos of plag, cpx, ol, w/ rare sieve textured mineral clots 3-15 mm diameter.
1147'	Ol → iddingsite; plag → clay, particularly near fractures. Lt orange & pinkish clay coating on most frac. surfaces. ± rare tenorite, pyrolusite, earthy hematite
	1139'-1142'- horizontal to 40° fracturing
	1143'-1144'- vertical to 15° fracturing - v. fractured. heavier pinkish brn clay.
	1149'-1152'- frac. predom 15° or less, secondary 40°-60° - horizontal
1167'	



Diamond Shamrock
Thermal Power Company

Form 2

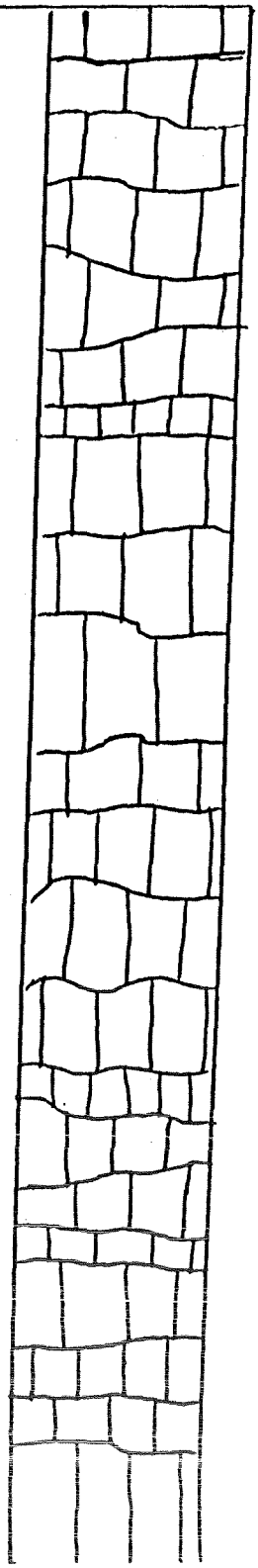
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) GOODWIN/MCDANNEL
BASIS BINOC. MICROSCOPE DATE 6/30/86

DEPTH INTERVAL	DESCRIPTION
1167'	BASALT (A/A)
	1181'-1185' - Three 5"-8" zones of heavy clay w/ brecciated rock
	1186'-1229' - color: med lt gry - lt brnish gry (to 1201')
1187'	1186'-1215' - common fractures: vertical & sinuous, ±45°
	1197'-1200' - hairline incipient fractures, partly dissolved/etched, @ 60°
1207'	



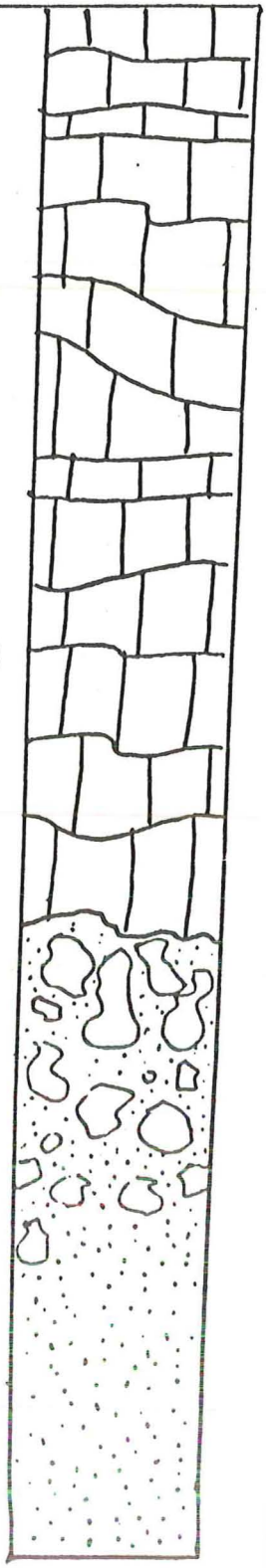
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BINOC. SCOPE DATE 6/30/86

DEPTH INTERVAL	DESCRIPTION
1207'	BASALT (A/A)
	1215'-1229' - ~80° fracture common; continuous vertical fracture
	1223' - black, secondary mineral (MnO?)(FeO?) running phenos on fracture surfaces
1227'	1229' - flow becomes oxidized (brick red) & brecciated but well consolidated. Grades into red clay matrix w/clasts of basalt and cinder & plag xtls. Grades into underlying unit.
1230'	VOLCANIC BRECCIA (surge &/or air-fall origin?) Red-orange-brn. sub-angular to sub-rounded lapilli- & block-sized fragments of dk. gry & red brn (oxidized) basalt & basaltic andesite. [Basaltic frags of above unit at top of volcanic breccia unit] in Matrix of ash (→ clay), ash-size rock fragments, crystals. Unit is not uniform but has sub-units (16cm-1.3m) based on variable clast size, clast to matrix ratio, laminated intervals. Contacts between these units is gradational to abrupt. Unit becomes more uniform @ 1261'. Laminations in matrix are commonly disrupted & drape around lapilli/blocks.
1247'	

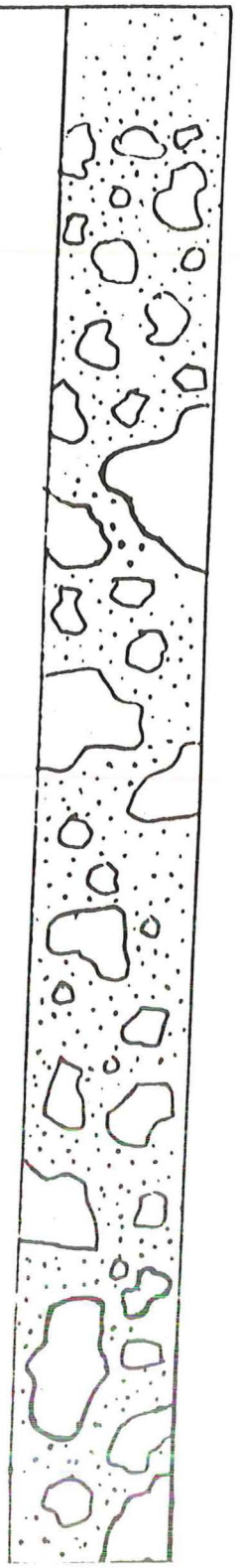


CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE 6/30/86

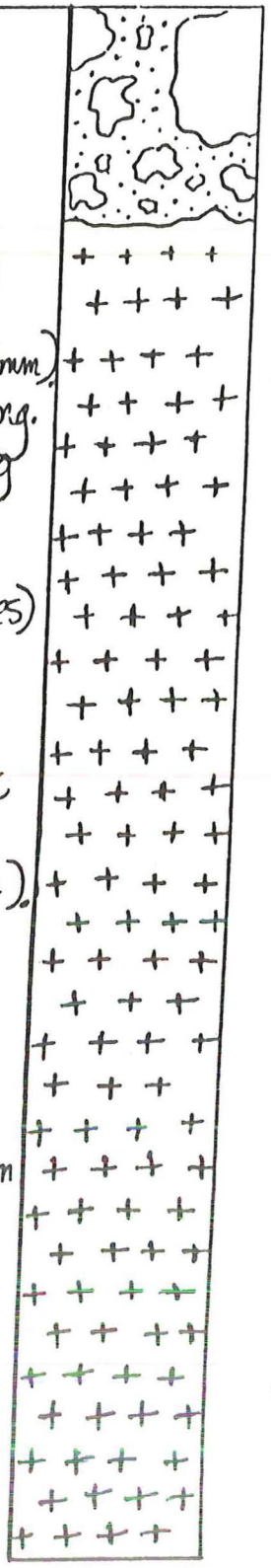
DEPTH INTERVAL	DESCRIPTION
1247'	VOLCANIC BRECCIA (A/A)
	1254.5'-1255.5': Rubbly interval
	1260'-1261' Rubbly interval. First appearance of sheared? clasts from underlying andesite unit.
1267'	
	1270'-1271' Rubbly interval
	1278'-1292' Rubbly interval
	1280'- clasts in breccia are predominately angular lapilli of underlying, sheared andesite.
1287'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL
FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE 7/1/86

DEPTH INTERVAL	DESCRIPTION
1287'	VOLCANIC BRECCIA (A/A)
	1291' ANDESITE
	Pale mod brn (1300-1306) to med dk gry, sparsely porphyritic (3-5%) w/phenos of plag, opx, cpx, hblde, & common open textured crystal clots (≤4mm). Mnr plag alteration → clay; amphibole is resorbing. Common pale orange-pink clay coating & filling fractures. Tr MnO or FeO (black). Clear-white tabular mineral (associated w/small mafic mineral (secondary?) in thin veinlets & coating fracture surfaces) is probably zeolite. Pervasive vertical to 25° anastamosing, thin, closely spaced (≤ 0.5cm) veinlets of yellowish brn clay & zeolite (a/a) appear to be formed along shears(?). Tr dark, platy, metallic mineral on fracture surfaces.
1307'	Top part of flow is very broken & clayey (yel brn, a/a). ~0.3m red brn ash 1297'-1298', may indicate association of top of andesite unit w/VOLCANIC BRECCIA above.
	1312-1315' - rubbly - w/clay containing swell (≤1cm) rock fragments
	1318' - very fractured w/heavy, red brn clay. Fracture has no preferential orientation. Anastamosing yel brn clay veinlets/shear (a/a) not as prominent.
	1325'-1335' - zones of intensely fractured rock interspersed w/consolidated zones. Fracture orientation 35°-45°.
1327'	



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

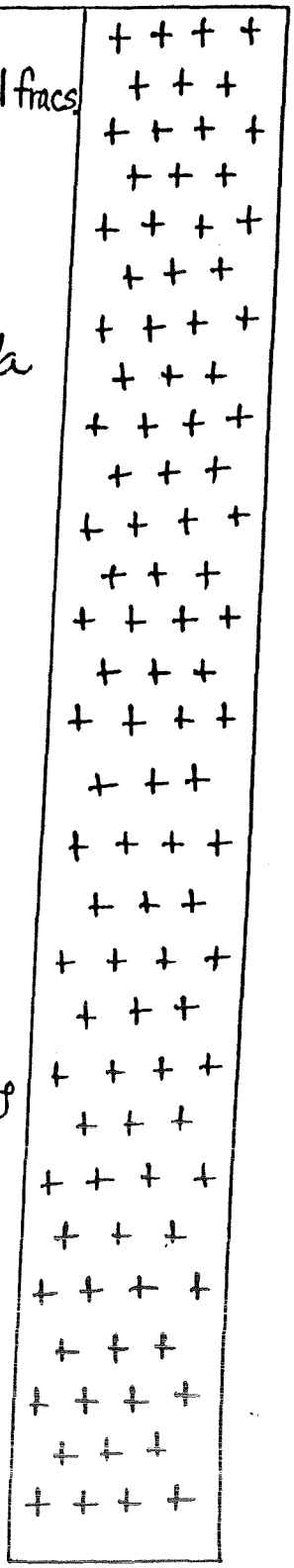
HOLE CTGH 1

FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN

BASIS binoc. microscope DATE 7/2/86

DEPTH INTERVAL	DESCRIPTION
1327'	ANDESITE (A/A) med. dk. gray, sparsely porphyritic, intense pervasive vertical fracs w/ anastomosing v. thin veinlets of yellow-brn clay filling fractures
	1335' - fracturing persists but is not as intense a/a
1347'	
	1352' - 1387' - frac. orientation: predom. ~10°, also 45°-70°
1367'	



Diamond Shamrock
Thermal Power Company

Form 2

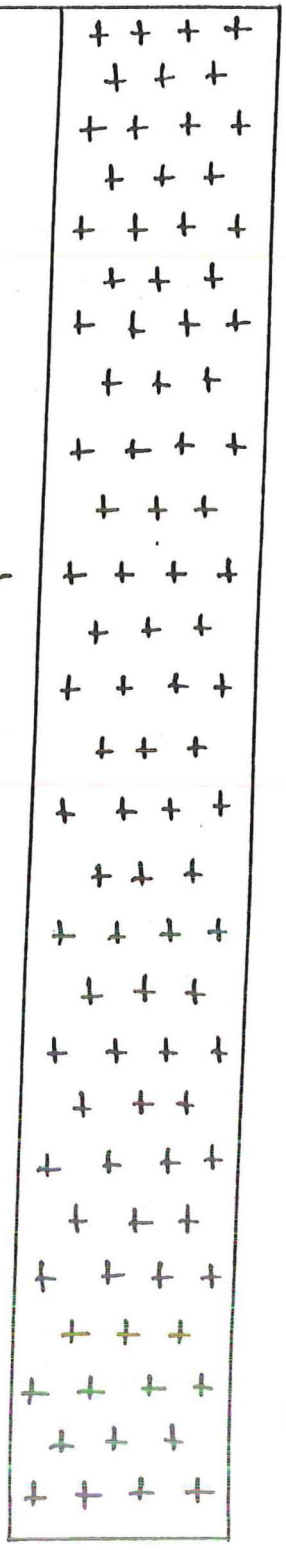
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE C-TGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE 7/2/86

DEPTH INTERVAL	DESCRIPTION
1367'	ANDESITE (A/A)
	1380'-1387' Vertical fractures predominate over horizontal fractures
1387'	1387'-1402' Fractures generally ~45° to ± & less commonly vertical
	1402': frac. orientation most commonly ~45°, less commonly ⊥ vertical. Horizontal Breccia & heavy clay.
	1406': yellowish tint on frac. surf.
1407'	

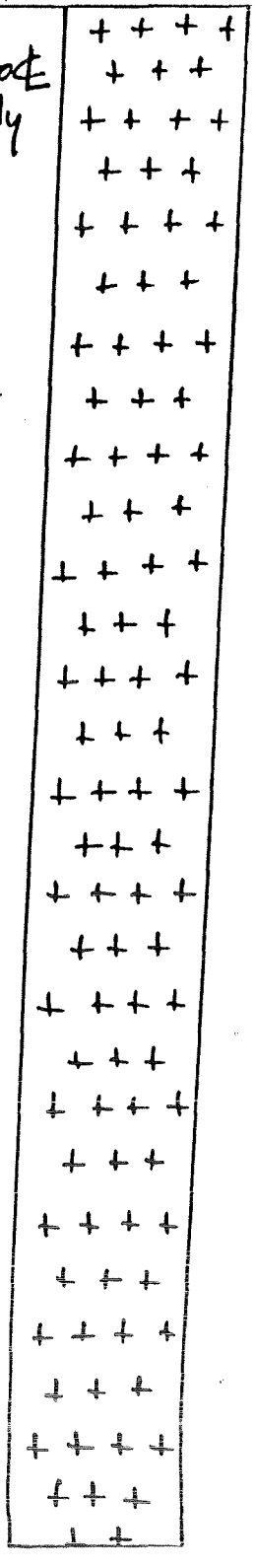


CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE 7/2/86

DEPTH INTERVAL	DESCRIPTION
1407'	ANDESITE (A/A) 1404'-1412' sinuous conjugate fracture set @ 45° ∡ to ℄ 1412'-1418' conjugate fracture set @ 30° ∡ to ℄, rubbly interval w/ heavy clay 1415'-1420' - breccia w/ heavy clay. Prominent yellow stain rims brecciated rock fragments, more subtle stain continues to 1445' adjacent to clay-filled fractures - no mineral observed, just staining 1421'-1438' Intermittent vertical sinuous fractures (≤ 15mm wide) filled w/ clays ± clayey breccia, locally rubbly
1427'	
	1438'-1445' Light fracturing w/ orientation @ 15° ∡ to ℄, often as conjugate joint sets
1447'	below 1445' sinuous vertical fractures w/ clay coating/fracture continue



CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE 7/2/86

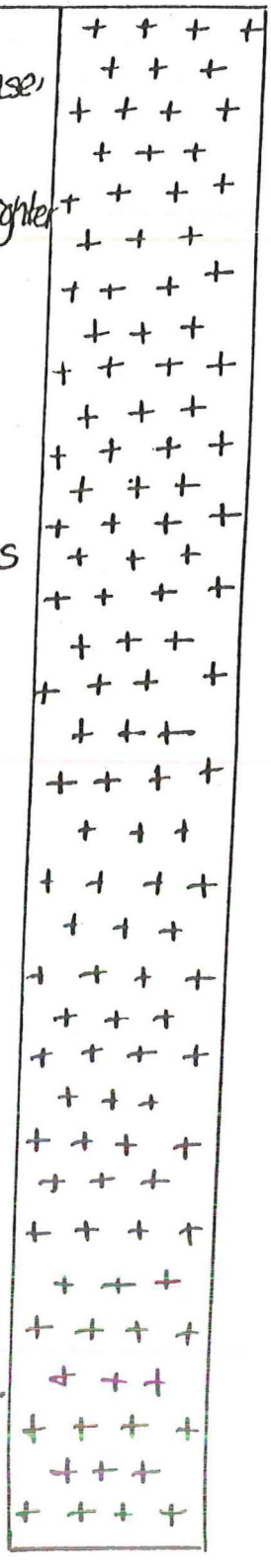
DEPTH INTERVAL	DESCRIPTION
1447'	ANDESITE (A/A) med.gry, locally rubbly & intensely fractured w/ mod.–heavy clay filling fractures, R+ pyrolusite also on clays/fracture surfaces, plag → clay (wht) adjacent to fractures, seams & clays commonly v.pale orange and mod. brn; plag., pyx., and less common hbl phens a/a : 1-3% (sparse) Clear, tabular mineral abundant on frac. surfaces. +R platy dark metallic mineral 1454'-1455' Intraformational breccia zone (30+mm thick) w/ heavy clay (tectonic breccia) @1457' 10mm clay-filled fracture @ 45° to ℄ below 1450' : Subhorizontal banding on scale of 1-5mm continues as subtle mod.grn yellow stain (w/ associated v.lt.clay alteration & R+ pyrolusite) interbanded w/ med.gry unaltered andesite. Milky to clear tabular & acicular zeolites in small voids.
1467'	1462'-1464' Fractured interval w/ heavy clay : seams ≤30mm wide 1466'-1466½' Heavy fracturing w/ lt. clay 1471'-1472' A/A w/ heavy clay 1476½'-1485' Less fractured interval, occasional irregular break ⊥ to & along subhorizontal "incipient platy fracture" partings*, 1476'-1482' : clayey breccia seams w/ mod grn yellow alteration/stain (sim. to that above @1445') no mins. visible * i.e. rock unbroken though partings provide planes of weakness for separation 1485'- fracturing – 4"-8" lengths. Orientation variable but vertical to 10° (sediment) is prominent.
1487'	

Diamond Shamrock
Thermal Power Company

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANIEL
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 7/2/86

DEPTH INTERVAL	DESCRIPTION
1487'	ANDESITE (A/A) w/hornblende becoming more abundant pheno phase
	1491' - 8" vertical clay seam, ~10 mm diam. brecciated appearance: angular clay pieces in lighter clay matrix.
	1494': fracture attitude most commonly 30° & horizontal.
	1500': increase in horizontal "incipient fractures", as marked by thin clay filled joints. ≤2cm - 7cm apart
	1503' - highly fractured. Brecciated. Fracture orientations vertical to 10°, 30°, & ~horizontal. Brecciated rock frags in clay seam ~1.5 cm wide, 12 cm long.
1507'	
	1513': less fractured. Strong horizontal jointing. Thin, 1-6 cm apart. Yellow stain & clay fill emphasize joints.
	1515': Increase in amount of dark, platy, metallic mineral. Found in conjunction w/ previously described clear (to white) tabular mineral (druzy on some frac. surfaces). Yellow stain assoc. w/ this mineral on some fracture surfaces.
1527'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 7/2/86

DEPTH INTERVAL	DESCRIPTION
1527'	ANDESITE (A/A)
	1522'-1524.5': breccia w/clay seams up to 1 cm thick
	1526'-1529': breccia w/clay, A/A
	1530': unit is slightly more porphyritic at this depth than at shallower levels -- largely due to increase in hornblende? Color is med. lt gry
	1530'-1536'- short intermittent fractured & brecciated zones w/heavy clay.
	1536'-1547'- Horizontal clay-filled joints (incipient fractures) become rare & rock is less fractured. Clay diminishes. MnO dendrites prominent.
1547'	1547'-1557'- fracturing resumes. Oriented 30°, 75°, less commonly 45°. Vertical clay seams (1546' 8mm long; 1548' 10 cm long, 4mm wide) contain brecciated rock fragments.
	1557'- intense fracturing resumes
	1561'-1564'- breccia, heavy brown clay
	1560'-1570'- Fine-scale color banding of matrix: 2-15mm bands @ 70° ± to ℄, med. lt gry & med. dk gry, long axes of phenos. also oriented in same plane @ 70° ± to core length, 5cm rounded xenoliths com. @ base of interval
1567'	

Diamond Shamrock
Thermal Power Company

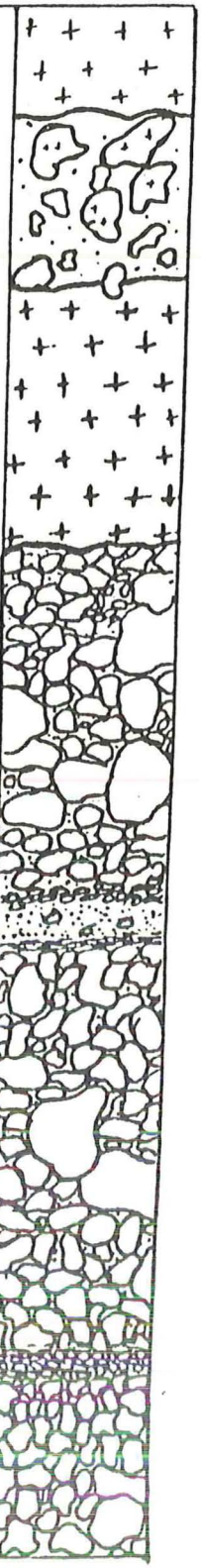
Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1
FIELD CLACKAMAS/CASCADES
GEOLOGIST (S) MCDANNEL / GOODWIN
BASIS BINOC. MICROSCOPE DATE 7/3/86

DEPTH INTERVAL	DESCRIPTION
1567'	ANDESITE (A/A)
1570	VOLCANIC BRECCIA Med dk gry & gry brn. Sub-angular to sub-rounded lapilli and block sz rock fragments of mafic-intermediate lavas in grysh brn matrix of ash sz rock fragments, clay (from ash?), & crystals of plag., pyx, hblde. Unit changes character throughout its thickness: thin, cross-bedded, laminated intervals of ash sz rock fragments, intervals w/palagonite common, intervals w/ disrupted/irregular margins on basaltic andesite clasts suggesting molten deposition. Pyroclastic & surge origin is suggested by much of these characteristics. Generally, unit is clast supported. Voids may occur between small lapilli. Pale blue to med bluish gry clay coats fractured surfaces. Fine, clear, acicular to prismatic (?) mineral on broken surfaces & in voids is probably zeolite. Tr pyrite → FeOx.
1587'	Upper part of unit is transitional w/ andesite unit above 1570'. 1570 - 1573.5 Volcanic breccia contains predominately lapilli & large blocks of andesite (a/a) in ashy matrix w/ mnr clay. 1575' - 1583' return to dense, andesite flow a/a (may be large block in breccia?) 1590' - small lapilli interval grades into thinly bedded - laminated, lt brn interval of ash sz rock frags (~15 cm thick). 1592' - 8 cm of rhythmically thin bedded & laminated ash sz rock fragments & ash (→ clay). Top of this interval marked by erosional contact overlain by small lapilli supported by yel brn palagonitic, ashy matrix. (Suggests surge/hydroclastic deposit.) possible
1607'	



Diamond Shamrock
Thermal Power Company

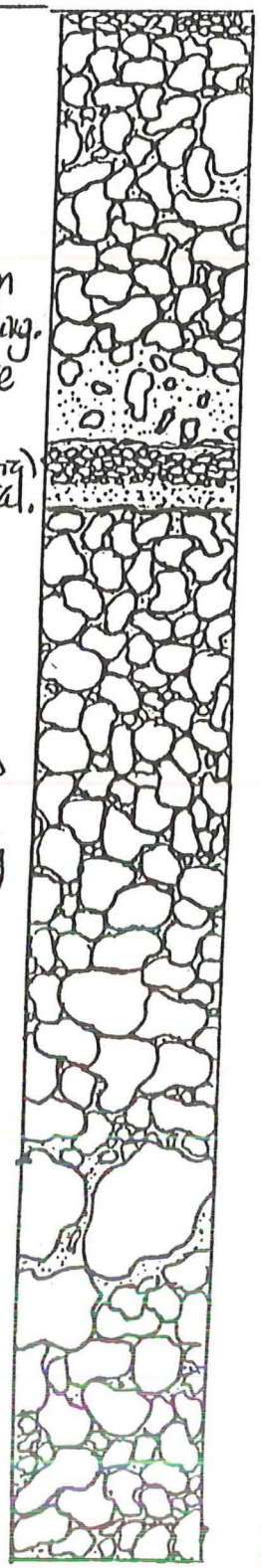
Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1
FIELD CLACKAMAS/CASCADES
GEOLOGIST (S) GOODWIN/MCDANNEL
BASIS BINOC. MICROSCOPE DATE 7/3/86

DEPTH INTERVAL	DESCRIPTION
1607'	VOLCANIC BRECCIA (A/A) 1594'- unit becomes abruptly coarser & darker gry. predom. lapilli size material (rock frags) 1597'- abrupt contact w/interval of ash-sm lapilli sz rock fragments in ash matrix w/palagonite 1522' coarser & darker (gry) a/a @ 1594'. Change in ratio of clasts: matrix, clast size creates subtle bedding. 1610'-1617'- this interval is more "tuffaceous" than above intervals, as there is an increase in ash & pumice. Thin ashy (→ clay)/laminae mark end of this interval @ 1618'. Suggest larger percentage of air-fall (pyroclastic) material. 1619'- clast supported interval of small lapilli to ash sz rock fragments & palagonite. Grades into interval of ash sz fragments & 4 cm of small scale, cross-bedded ash → clay. 1627'-1629'- unit becomes unconsolidated
1627'	1630'-1639'- marked change in character. Dk grey, vesicular to dense blocks &, less commonly, lapilli of basaltic andesite w/irregular margins, some disrupted, suggesting deposition while molten & plastic. Clasts are 60%-90% of interval. Matrix of dk yel brn - brn gry to olive gry, fine ash w/ash size rock frags. Mnr. lamin ations in matrix between clasts. 1644'-1646'- Matrix (Astuy) becomes red brn. Lapilli (no blocks) of grey-red brn - olive rock frags. 1646'-1647'- Vesicular basaltic andesite/andesite boulders w/olive & reddish clays filling vesicles. Grades into andesite unit below.
1647'	

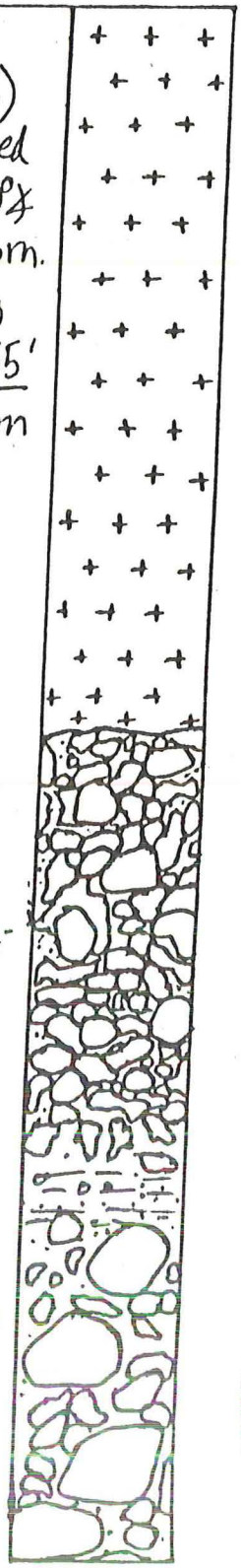


CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH1
FIELD CASCADES / CLACKAMAS

GEOLOGIST (S) McDANNEL / GOODWIN
BASIS binoc. microscope DATE 7-3-86

DEPTH INTERVAL	DESCRIPTION
1647'	1647' - BASALTIC ANDESITE/ANDESITE lt olive gry, lt. med. gry., and lt orn gry; sparsely porphyritic (≤ 1%) phenocrysts: plagioclase, pyroxene (?) altered to clay. Small aligned vesicles 0.5-2.0 cm apart +/- secondary clay define banding @ 60° to ⊥. Fractures are most commonly @ 45°. Clay coatings are lt. brn. dk. grn gry, and mod. orange pink. Minor limonite present adjacent to fractures. Tr. pyrolusite, psilomelane? Moderate amt. fracturing. @1655' clear, elongate tabular secondary mineral/zeolite? forms drusy coating on fracture surface. 1658.5'-1659.5' Intense fracturing @1662' Yellow-staining (FeO_x?) adjacent to clay- and pyrolusite-coated fracture Irregular, sharp basal contact
1667'	1666.5'-1694' VOLCANIC BRECCIA Mottled coloration: dk to mod. red brn, red gry, med. dk gry, olive gry, lt orn gry, pink gry. Angular to subrounded lapilli-sz to sm. block-sz. heterolithologic (aphyric to finely porphyritic dense to vesicular, composition predominately mafic to intermediate but includes v. lt. gry to wht. clasts suggestive of more silicic composition) volcanic rock fragments. Some clasts may have been molten, appear plastically deformed, and have irregular, disrupted margins. Laminations of fine ashy material are typically discontinuous, disrupted, & have small-scale crossbedding. % matrix variable. Comm. fracture clay shearing. Mnr. fracturing with variable attitude. Tr. fine, clr. drusy zeolites on fractures. Lt. amt. 2ndary clay, limonite. @1675' Tr finely disseminated tabular Fe? sulfide in clay 1677'-1682.5' Reddish brn to mod. brn; angular to subrounded lapilli-sz volcanic clasts in ashy (to clayey) matrix, crude thin bedding @ 1681' composed of sm. lapilli-& ash-sz r.f.s., waxy clays, clasts oriented @ 45°. @1682.5' Increase in size & % of andesite blocks from underlying unit.
1687'	



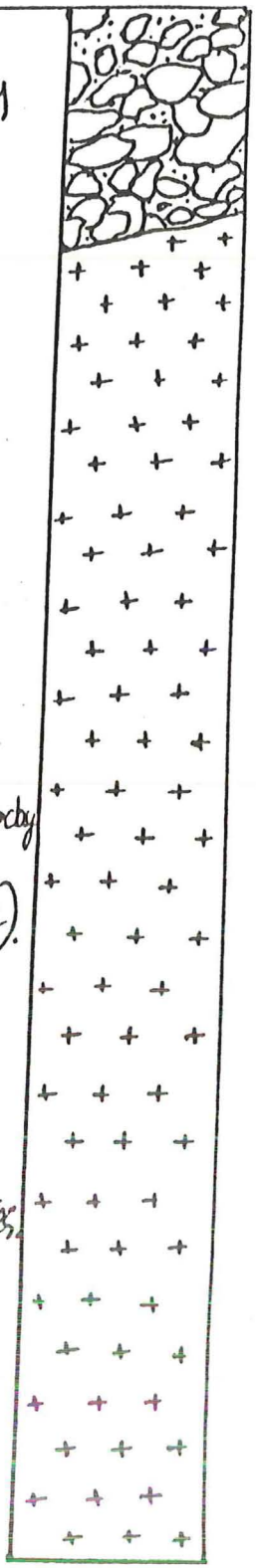
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDannel/Goodwin

FIELD CASCADES/CLACKAMAS BASIS _____ DATE _____

DEPTH INTERVAL	DESCRIPTION
1687'	VOLCANIC BRECCIA (A/A) 1687' soft brn clay partially filling void, sticky core
	1694' sharp 45° ∠ contact w/underlying unit
1694'	ANDESITE Med gry to dk grey to brownish gry. Porphyritic (1-3%) Phenos: plag & pyx. Pyx → clays. Secondary clays coat (lt. to mod.) fracture surfaces: lt brn, lt gru gry, pale blue, reddish brn, minr mod yel. Pyrolusite on frac. surfaces. Groundmass matrix altered to clay. Generally, unit is very fractured w/ zones (~.6m) of consolidated rock. Incipient fracture marked by hairline cracks, which may be filled w/ clays. Most prominent frac. direction ~45°, less prominent 70° ∠ ~ vertical.
1707'	1694'-1702' Intervals (0.5-10cm) of mod or. pink, mod brn, lt. brn gry lams. ash ↗ cby
	1708' abrupt color change to brnish gry. Rock is v. fractured (~1m). Dendritic MnO or FeO (black).
	1716': green clay alteration of matrix changes to reddish yellow clay.
	1721': plag phenos decrease
	1728'-1731': splintery, vertical fracture predominates, pheno content appears to decrease @ 1728
1727'	



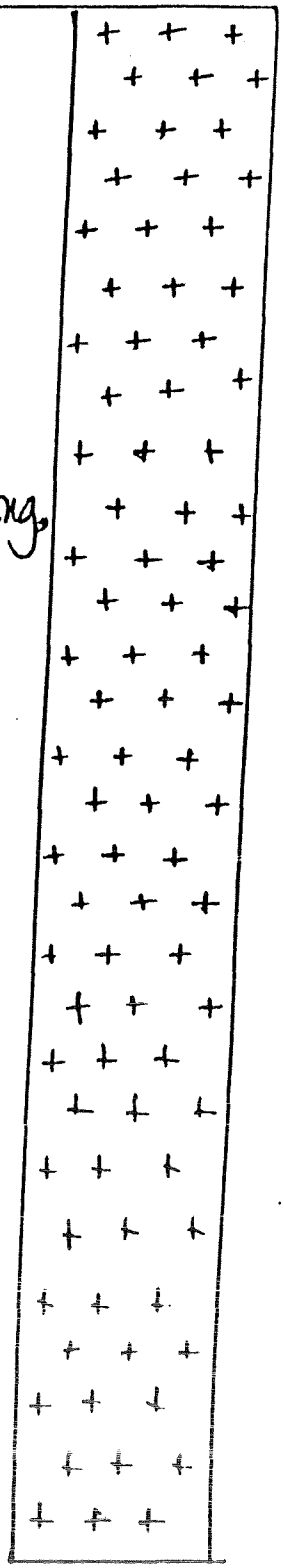
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN / McDANNEL

FIELD CASCADES / CLACKAMAS BASIS binoc. microscope DATE July 4th, 1986

DEPTH INTERVAL	DESCRIPTION
1727'	ANDESITE (a/a)
	1737': mafic phenos (pyx) replaced by green clay rather than reddish yellow clay a/a. Green clay alteration in groundmass, also. Platy, 45° fracturing, rare vertical fractures.
1747'	1745': dk greenish gry & minor pale blue coating on fracture surfaces is most prominent alteration. Other clays are minor.
1767'	

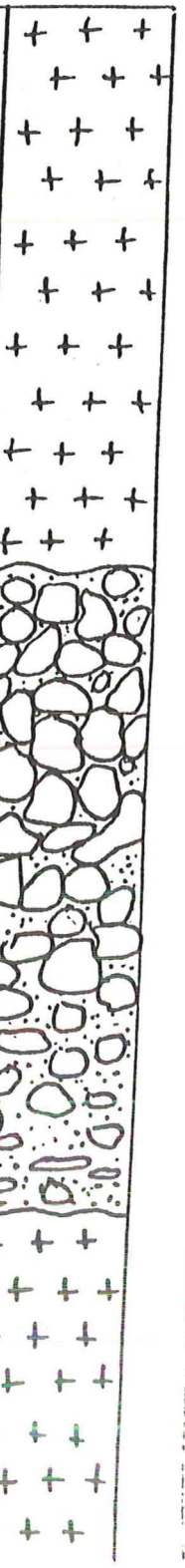


CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscop DATE July 6, 1986

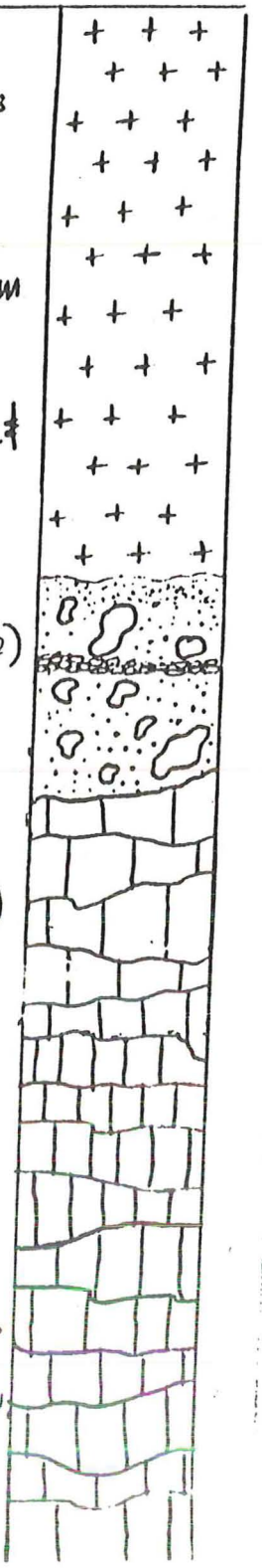
DEPTH INTERVAL	DESCRIPTION
1767'	ANDESITE (A/A)
	1781½' Contact is mod. reddish brn & contains angular rock fragments
1781½'	VOLCANIC BRECCIA (predominately pyroclastic frag.) moderate reddish brn, lapilli-and blocke-sz andesite scoria and, less commonly, med. gry andesite rock fragments in a sparse ashy to clayey matrix. Cmn. shear on fracture surfaces. Matrix ash-sz clasts includes mafics → clay & FeOx & plag. → clay. Frac. clays are ltgrngry +/- lt. to mod. FeOx. Sparse 3-15mm voids have lam's v. pale brn, lt. brn, red brn clays which may drape around clasts. Clr. drusy zeolite also present on fracs. Top of unit has agglomerate appearance. 1796'-1798' color changes to med. dk gry, matrix % increases slightly. Elongated clasts are horizontal 1' above basal contact.
1787'	
1798'	ANDESITE brngry to med gry, v. sparsely porphyritic (≤1%): plag & pyx → clay & FeOx (≤5mm), commonly vesicular w/ gry-grn clay filling=50%, 2ndary wht, lt brn, & gry-grn clays commonly coat fractures, Fe clear prismatic zeolite? occurring A/A
	1803'-1806' Common irregular, elongated vesicles (1-5mm voids) with vuggy/drusy amygdules
1807'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 7/6/86

DEPTH INTERVAL	DESCRIPTION
1807'	ANDESITE (A/A) 1809'-1810': ≥ 30 mm clay seam assoc. w/sinuous frac @ 30° to ℄ @ 1814': microfractures & aligned small voids (@ 0.5-1 cm interval) @ 90° ± 10° to ℄ 20% filled w/thin mod brn or grn gry clay seams 1817'-1820': heavy fracturing & clay above 4" breccia & oxidation horizon (pinkish red)
1820'	VOLCANIC BRECCIA Mod. dk yel, orng brn, red brn. Course ash sz & lapilli sz heterolithologic rock fragments & minor very lt. grey dense pumice (often containing hornblende ± magnetite) Commonly flattened, in a tuffaceous matrix which includes glass, hornblende, ash. Unit has slight changes every 2-6 cm -- i.e. change in color, clast: matrix ratio, clast size -- which gives a crudely bedded appearance. Minor shear visible on fracture surfaces. (Much of unit appears to be pyroclastic airfall matl.) 1826'- ~10 cm of ash & ash sz rock frags w/o clasts 1825'-1826'- reddish orng waxy matrix (from ash?)
1826'	BASALTIC ANDESITE Dk gry to grnish blk, rare microphenos of plag. Pilotaxitic texture, Brecciated (tectonically) intervals are typically consolidated. Dk grnish clay on surfaces of fractures & filling many vesicles. No predominate fracture angle/direction, generally 40° - vertical. Minr white clay in some vesicles. 1826'-1835' volcanic "breccia" is at top of this unit composed of dk gry vesicular blocks of basaltic andesite described above, w/irregular boundaries/margins suggesting fluidal/molten deposition. Matrix (~30%) of lt olive, olive & dk yel brn ashy material.
1827'	
1847'	



Diamond Shamrock
Thermal Power Company

Form 2

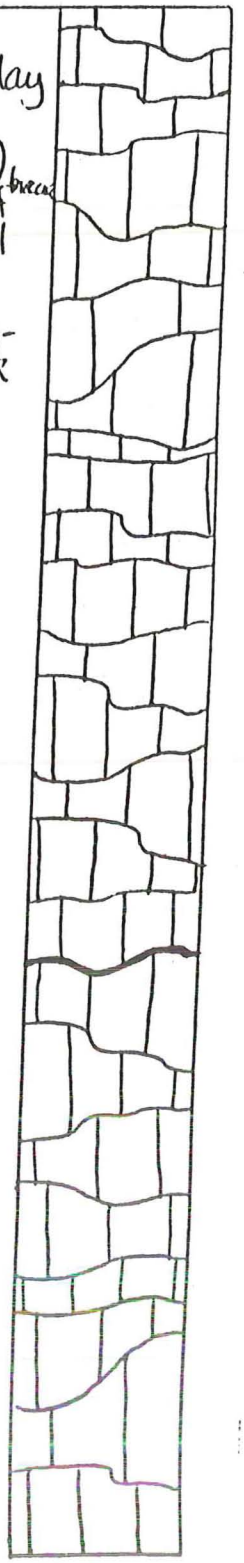
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CT61H-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE 7/7/86

DEPTH INTERVAL	DESCRIPTION
1847'	BASALTIC ANDESITE (A/A) 1836'-1845' (tectonic) Breccia zone, well consolidated. Dk grn clay in fractures. 1851'- increase in vesicularity (1851'-1872' flow transition through pyroclastic breccia) 1853' & 1860' a/a @ 1826', (vesicular to dense blocks & lapilli of basaltic andesite, irregular margins, in minr dk yel brn & olive gry matrix). 1869' Matrix becomes red brn w/ vesicular mafic fragments common & increase in ash component of matrix (suggests pyroclastic origin). Zeolites occur in voids between some fragments.
1867'	
1872'	BASALTIC ANDESITE Dk gry, v. finely & sparsely porphyritic (<1%). Phenos (<2mm): plag., cpx. Mod. amt. dk grnish gry to grnish black ϕ, less common, pale blue clays on fracture surfaces. ± minor, subtle grnish clay in groundmass. Phenos show little to no alteration & rock appears fresh. Fracturing is not pervasive & varies in intensity & fracture angle; 45° & ~ vertical often predominate. 1871½'-1890': minr platy partings @ 45° & 60° ℄, + dk grn clay controls fractures.
1887'	



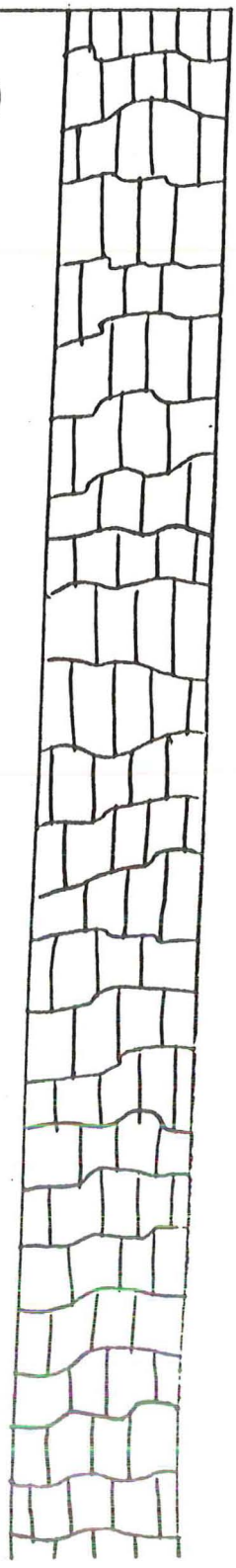
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE July 7, 1986

DEPTH INTERVAL	DESCRIPTION
1887'	BASALTIC ANDESITE dK gry, finely porphyritic (1%), phenos: (<2mm) plag. & cpx., mod. amt gray, green, & lt. blue clays, ± minor subtle greenish clay also in groundmass; phenos. show little to no alteration. Fracturing is light/not widespread, mainly 45°-50° to ℄ & minor subvertical & 30°- often with light coating of brn, blk, dK gry grn clay
1907'	1910'-1917' Common intersecting sinuous vertical fractures with brn & blk clays coating fractures
1917'	



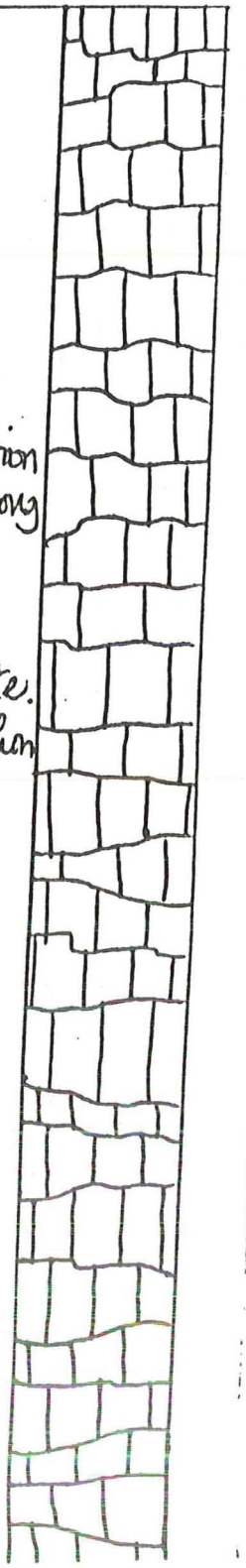
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE July 8, 1986

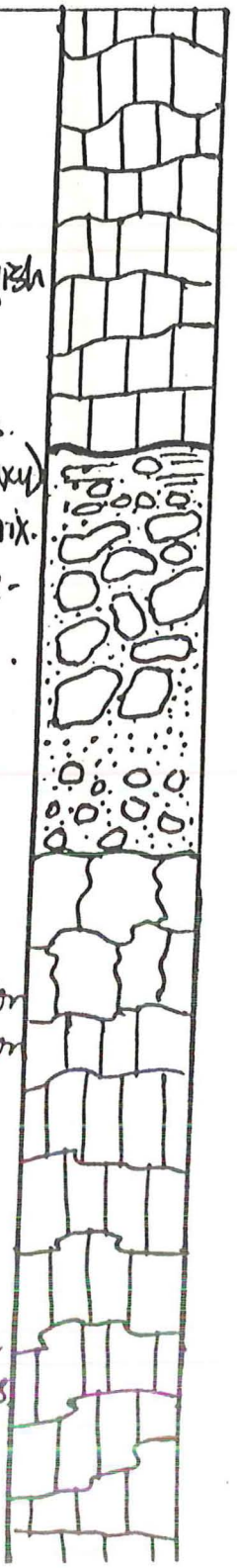
DEPTH INTERVAL	DESCRIPTION
1917'	BASALTIC ANDESITE (A/A) @ 1917' rock fracs. fairly easily along preexisting parting planes @ 30°, 45° & ± sinuous vertical
	1927' 1' zone of intensely fractured/rubbly core
	1928' moderately fractured. Predominate fracture direction is 45°, less commonly ~75° & vertical. Thin dk green clay seam along vertical fracture @ 1936'
	1937' - fracturing increases. Rock somewhat rubbly @ 1940' - 1945'. High angle (~ vertical) & 45° predominate.
1937'	1945-1947' - angular brecciated clasts, in place w/thin clay veinlets.
	1948': rock becomes well consolidated & has few fractures. Fracture tends to be ~horizontal.
1957	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL
FIELD CASCADES/CLACKAMAS BASIS bmoc. microscope DATE July 8, 1986

DEPTH INTERVAL	DESCRIPTION
1957	BASALTIC ANDESITE (A/A)
	1967'-1969' Contact - rock becomes brecciated and color changes to grayish black with minor reddish brown
1969'	VOLCANIC BRECCIA
	1969'-1970.5' Angular to subrounded lapilli- to coarse ash-sized rock frags. of mafic to silicic composition in a fine red brn. matrix of ash→clay (waxy) & mnr. ash-sz r.f.s. Crude bedding defined by clast size & variation in % matrix.
	1970.5'-1979' Lt. med gry to olive gry, commonly vesicular, basaltic andesite blocks (predominate) & lapilli in a sparse matrix of fine yel. brn ash. B.A. blocks may have dark (chilled?) or irregular (disrupted?) margins suggesting deposition in a plastic/molten state. Shear is common on fracture surfaces. Gradational basal contact.
1977	
1979'	BASALTIC ANDESITE
	brngry to gry brn, v. finely & sparsely porphyritic (<1%) hoophyric, phenos: plag, pyx→clays & limonite, ol? →clay, common lt. alteration of matrix to clay (esp. adjacent & within fractured intervals), common brecciation, mod-mod+ clays filling in many vesicles + coating all fracs. & filling all voids (mod brn, dk grn gry, lt gry, pale blue, wht, orange brn...), R clear soft zeolite? occuring as drusy void coating & individual sm. xtals, vesicles to 1986'
	1979'-1984' Vesicular chilled-edged boulders w/ brn secondary? clays @ edges (MAY BE PART OF UPPER V.C. unit) = flowtop breccia
	1979' & below intermittent lt. grn clay in tiny pill-shaped grains irregularly aggregate in fractures & vesicles
	1986'-1990' intense fracturing & brecciation, 50% rubble of smaller than 1"x1" frags.. fracs @ 15° to & filled with thin
1997	



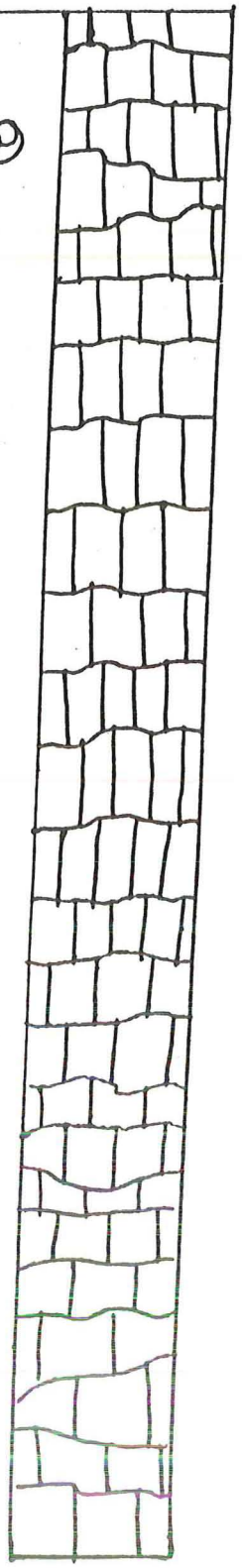
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscop. DATE July 8, 1986

DEPTH INTERVAL	DESCRIPTION
1997'	BASALTIC ANDESITE (A/A) 1990' (cont.) dK brn, mod. brn, dK grn gry clay 1992½'-2000½' Intensely brecciated, 50% rubble, fracs @ 45° to ℄, mostly dK gry grn & brn clays as coatings/fill 2004'-2030' Intensely brecciated, fracs @ 40°, 80° rubbly, overall color is greyish green to dusky green. abundant clay.
2017'	
	2030'-2035'- color changes to dk yel brn. Rock remains rubbly.
	2035' - ~1' mod. red brn clay - CONTACT
2037'	



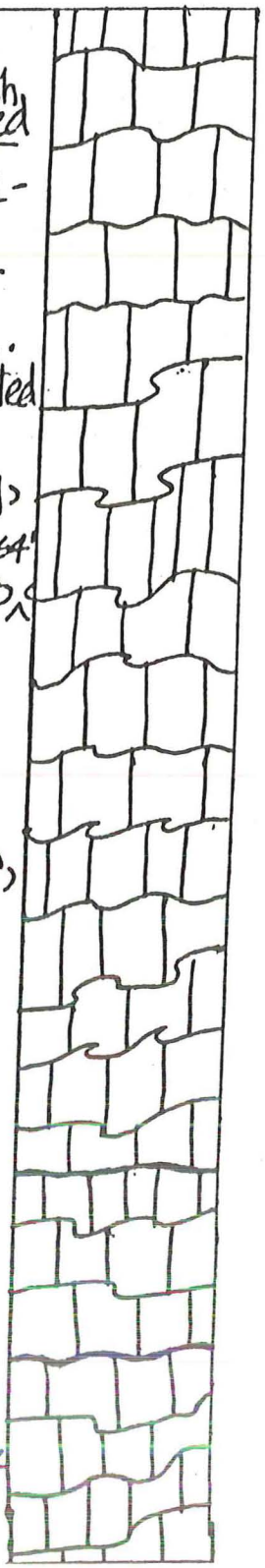
Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE JULY 9, 1986

DEPTH INTERVAL	DESCRIPTION
2037'	2036'- BASALTIC ANDESITE grnish blk to dk grnish gry to gryish brn. Mnr gryish red aphyric. gm. includes plag, pyx. Pervasive dusky grn - dk grn & gryish blk clay alteration. Vesicles (up to 1.5 cm) common but not abundant, lined w/clear drusy mineral (zeolite (vapor phase?) & filled w/clay → pale blue to dk grn. Mnr. veinlets of wht clay. Minor disseminated to drusy coating of clear secondary mineral on fracture surfaces. Heavy fracturing locally, 45° predominate ∠, sinuous vertical to sub-vertical less common. Brecciation common to 2064'
	2040'-2057' well consolidated breccia.
	2055'-2065' Pale brn - clay alteration lt. to mod. w/ clear zeolite? A/A, R earthy hematite & limonite
2057'	clay colors predominately brn & grn gry; wht, red brn, pale blue also present
	2067' Contact: 3" limonite-stained interval between dk. gry vesicular basaltic andesite flows
	2072'-2074' Contact A/A with rock color altered to mod. brn
	2076'-2079' Fracturing @ 15° is sinuous & vertical, increase in zeolite vnlets (≤3mm wide) & clay (brn), mod. brecciation last core consolidation is good, color: mod brn, 40mm drusy vesicle
2077'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH1
FIELD CASCADES/CLACKAMAS

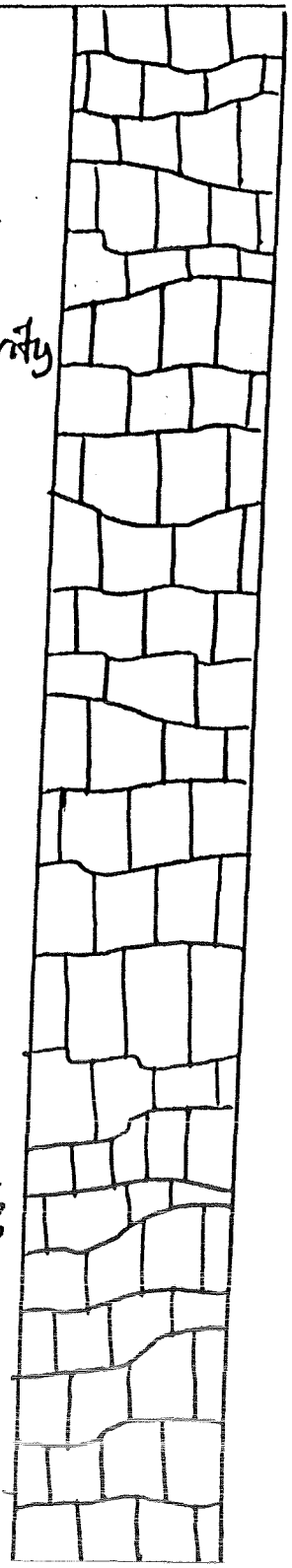
GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE July 9, 1986

DEPTH INTERVAL	DESCRIPTION
2077'	BASALTIC ANDESITE (A/A)
	2083'-2103' unfractured interval w/ fewer zeolites, particularly below 2094' where vesicles become less common, two zeolites present: ¹clr, as drusy fill & finely dissem. xtals in fracs & voids, ²pale yellow (less common) at base of interval as finely dissem xtals
	2088' Contact: red-brn oxidation zone. 3" wide w/ basal leached halo 3" wide
	2091' Contact A/A
2091'	2095'-2101' intermittent coarsening of grainsize, locally w/ appearance of brecciated v. finely porphyritic gabbro in basaltic andesite matrix, sharp to diffuse-edged xenoliths(?) ½" - 2" - 10" across, mild clay alteration (5-15mm wide) adjacent to rare fractures, intermittent fine web of wht zeolite vnlets
	2103' heavy limonite, R+ clr drusy zeolite?, & lt. clay on frac. @ 30° to ℄
	2107'-2111' Increase in clay alteration: rock brnish color
	2111-2116 contact? red brn, increase in vesicularity, one large sinuous vertical crack begins at contact, filled with drusy zeolites (clr), heavy clay, common hematite (earthy)
2117'	

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/McDANNEL
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE July 10, 1986

DEPTH INTERVAL	FRACTURE DENSITY	DESCRIPTION
2117	# fractures per 1' interval (Edges filled w/ secondary mins)	BASALTIC ANDESITE (A/A) 2120' - seam of horizontal brn clay ~6cm thick 2122'-2124' - one 8mm wide ~.03m vertical fracture filled w/ white mineral → clay & numerous smaller veinlets 2124' - rock becomes brn gry. Increase in vesicularity up to ~15% 2126'-2126.5' - rock becomes red brn. Flattened vesicles 2126.5 - return to brn gry color 2127.5-2128 - vertical fracture filled w/ white mineral → clay. Less prominent, thinner, variably oriented veinlets. 2131' - return to homogeneous dk gry color
2137		2137'-2139' - 1 continuous vertical fracture, less prominent (minor) 45° & horizontal fractures
		2148'-2159' grysh red to mod. reddish brn, slt. increase in fracs & wht veinlets (=clay & drusy mineral), vesicles 2-15% mostly filled with wht, lt brn, or pale yel-orange clay, zeolites completely fill vesicles occasionally, common hematite, rare limonite, common clay alteration, (vesicles ≤ 20mm, vns ≤ 5mm)
	0	
	2@15°,F	
	2@subvert,F	
	0	
	0	
	1@70°	
2152	0	



Diamond Shamrock
Thermal Power Company

Form 2

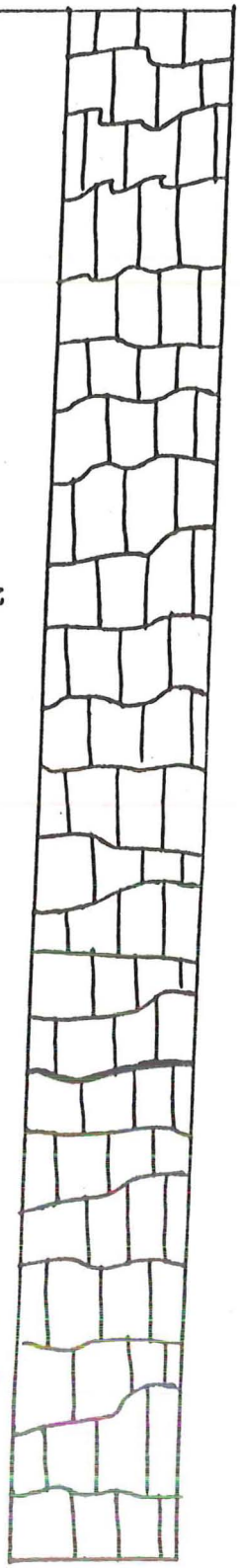
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE July 11, 1986

DEPTH INTERVAL	(fracture indicators)	DESCRIPTION
2151'	0	BASALTIC ANDESITE (A/A)
	2	
	1F	
	1F vert.	
	2F@15°	grayish red to mod. red brn, aphyric, 0-15% (≤20mm) vesicles w/ ± drusy clr min ± clays, mod. to lt. fracture, sparse veinlets w/ zeolites & clay
	1F vert.	2159'-2164' sparse vesicles
	1F@15°	
	2F@15°	
	1F@vert.	
	1F@vert.	
	0	
	0	
	0	2171'-2181' dK grngry color, intermittent coarsening of matrix grain size to v. finely porphyritic with contact between porphyritic & aphyric sharp to diffuse, phenos: plag, ol, pyx (ol → iddingsite), few vesicles, increase in matrix alteration adjacent to fractures in coarser-grained intervals, unfractured exc. tiny veinlets A/A
	0	
	0	
	0	
	0	
	2	
	1@20°	
2177'	0	
	1@70°	
	0	
	0	
	0	
	2F@15° 1@90°	
	0	2184'-2185' Contact: bright orange brn, normally graded volcanic seds./tuff(?): 3" fine clayey ash abruptly changes to poorly-sorted xtal poor lapilli tuff w/ 2-3% plag (euhedral & sparkling) + pyx → clay in clay (devitrified ash?) matrix w/ sparse rounded to subangular red brn (→ clay) mafic to silicic lapilli-sz rock fragments & 1 or 2 pumice clasts → clay
	0	
	0	
	0	
	0	
	0	
	0	
	1@20°	
	>5	
	1	2185'-2200' ~~BASALTIC ANDESITE~~ A/A, consolidated flow top breccia: grngry to lt brn, ± amygdular (w/ zeolites ± clay), local heavy hematite alteration @ 2192' to 2195½' (minor metallic pyrite → hematite in matrix), common fractures with brown clay & fairly coarse-grained drusy zeolites, v. sparse matrix material → lt brn clay ± hematite
	0	
	1@vert.	
	3	
	3@45°	
2197'	1	



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

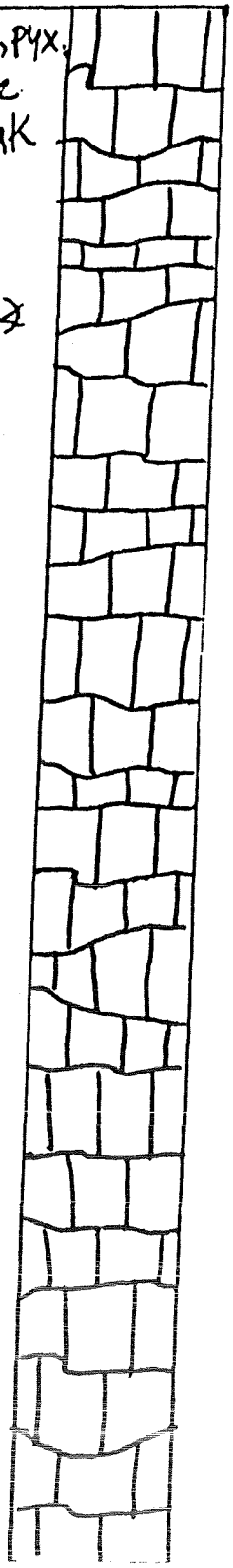
HOLE CTGH1

FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN

BASIS binoc. microscope DATE July 11, 1986

DEPTH INTERVAL	% Recovery	DESCRIPTION
2197'		BASALTIC ANDESITE, aphyric w/g.m. ol → iddingsite, plag, pyx. dk gngry, 2200'-2224' local brecciation but rock well consolidated, fine grygrn clay ± clr zeolite veinlets, unfractured core w/ irreg. break
		2205½' 3cm drusy-lined irreg. cavity & v. lt. wht clay
		2208' fine, wht, acicular zeolite in fractures fracturing remains minor, predom. along 45°-55° ∡
2217'	Lt.	2224'-2230' red brn. Mnr flow? breccia (12cm) passes into vesicular rock (Basaltic Andesite as described above). Vesicles filled w/ clays & wht zeolites(?) White zeolites fill fracture (vein) @ ~20°. Probable contact
		2230' - rock becomes greenish grey with same appearance as described at top of page.
2237'		



Diamond Shamrock
Thermal Power Company

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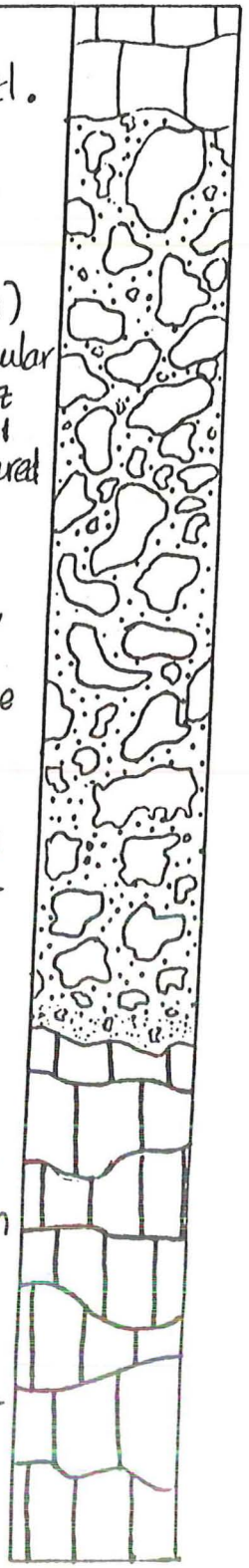
CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN / McDANNEL

FIELD CASCADES / CLACKAMAS BASIS BINOC. SCOPE DATE JULY 11, 1986

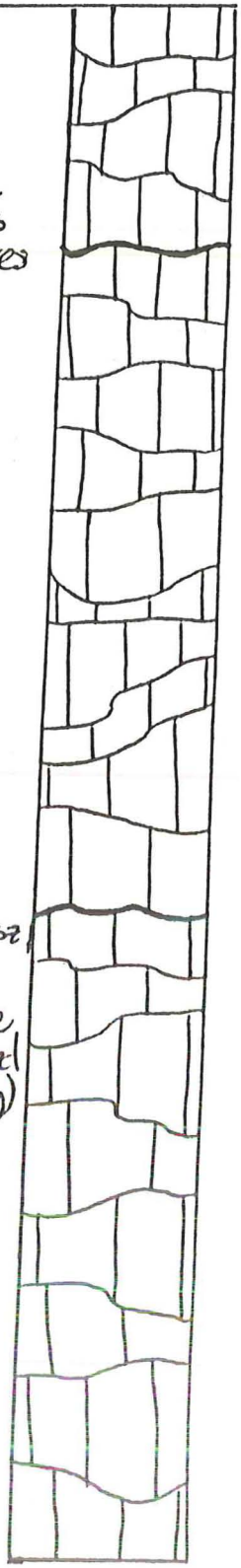
DEPTH INTERVAL	Fracturing intensity ↓ L: light M: moderate H: heavy I: intense A: absent	DESCRIPTION
2237'	L→M→H→M→L	**BASALTIC ANDESITE (A/A)** 2237' rock is brecciated (tectonically) but well consolidated. V. minor matrix of dk grn clay. 2238' increase in vesicles. Clay & wht. zeolite fill vesicles 2239'-2241' very fractured. Waxy shear surfaces.
		2240' - **VOLCANIC BRECCIA** (pyroclastic origin) Lapilli & blocks, rounded to irregularly shaped, dense to vesicular basaltic andesite in a minor matrix of mod brn clay, ash sz rock fragments & crystals (predom. plag.). Numerous small voids & vesicles filled w/ white zeolite & clays (pale blue & dk grn). Sheared waxy fracture surfaces. Predom. fracture direction 20°-35°. 2253' matrix increases; fracturing increases & rock becomes v. broken & rubbly. Shear on surfaces. Larger clasts in breccia have yel brn oxidized rims; other clasts have rims darker than remainder of clasts (chilling?). Fracture remains intense until 2259'.
2257'	H→M→H→M→H→M→H→I→M→H→L→M→L→A→M	2259' angular to sub-rounded lapilli sz rock fragments of med-dk grey mafic lavas in red brn to gry brn matrix of clay (from ash?), ash sz rock fragments, xtls. Some of fragments have convoluted, disrupted margins — suggesting deposition while in a molten/plastic state. 2263' - 7 cm mod rd brn clay w/ predom. ash sz rock frags. (AIRFALL?) 2264' **BASALTIC ANDESITE** Dk grn gry - mod red brn, aphyric. Brecciated (tectonically) but consolidated w/ lt-dk grn gry matrix. Vesicles contain clear drusy zeolite ± white, pale blue clays; uncommon veinlets of same. Short intervals of red brn (oxidized) volcanic breccia of basaltic andesite lapilli — some indicate deposition while molten/plastic. Pyroclastic origin appears most likely. Rare, finely disseminated pyrite → limonite/hematite. Intermittent shear on fracture surfaces.
2277'		



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) MCDANNEL / GOODWIN
FIELD CASCADES / CLACKAMAS BASIS BINOC. SCOPE DATE 7/12/86

DEPTH INTERVAL	DESCRIPTION
2277'	BASALTIC ANDESITE (A/A)
	2277-2280' - hvy brn clay + tr limonite associated w/dk gry vesicular volcanic blocks (flow edge ?)
	2284'-2286' - gry brn - red brn vd. breccia: lapilli sz rock frags in ashy matrix (flow boundary?). Much of matrix is clay. Mnr shearing on fracture surfaces. Zeolites on fractures in trace amnts.
	2286'-2288' - no brecciation of rock a/a (begins @ 2264'). Rock is blue grn color.
	2288' - 7 cm red brn clay seam w/rock frags, offset ~4cm in shear zone. (description similar to 2284' above)
	2294-2295' - vertical fracture w/heavy waxy (clay) shear. + seam of soft clay w/rock frags.
2297'	2298'-2300' - mod brn, brecciated, w/ fractures @ 30°-45°. Clay along fractures, mod. shearing, pervasive clay alteration,
	2301'-2305' volcanic breccia: mod red brn to mod brn: lapilli sz, often vesicular, basaltic andesite(?) clasts in matrix of clay (frm ash), ash sz rock frags, xtls. Lt shear, tr. zeolites. Pyroclastic origin.. Contact?
	2305'-2317.5' - Interval above grades into basaltic andesite as described @ 2264'. Color is blue green. Rock is brecciated (tectonically) but consolidated.
2317'	



Diamond Shamrock
Thermal Power Company

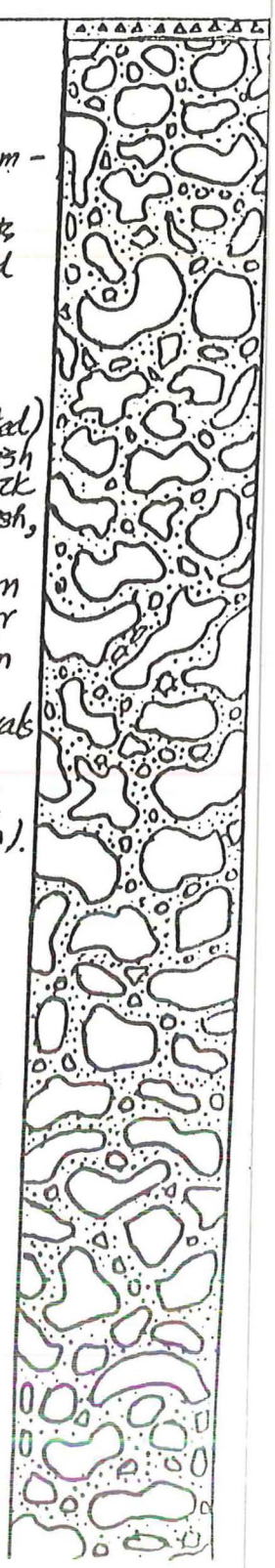
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) MC DANIEL / GOODWIN

FIELD CASCADES / CLACKAMAS BASIS binocular microscope DATE JULY 13, 1986

DEPTH INTERVAL	fracturing (A = abundant, L = light, M = moderate, H = heavy, I = intense)	DESCRIPTION
2317'	L	2317' Minor red brn oxidation marks flow boundary
	M	
	M	2317.5' LAPILLI TUFF
	H	16 cm thick interval: pale yel orng to mod yel brn. <1mm -
	H	5mm elongated clay clasts (appear to have been pumice
	M	lapilli, collapsed) & ≤ 5 cm angular lt. gry rock fragments
	H	of intermediate composition. (Some frags are irregularly shaped
	I	& have oxidized rims). In minor mod yel-dk yel brn clay
	M	matrix w/ xtls of plag & pyx. Percentage of rock fragments in
	M	unit increases w/ depth, grading into unit below:
	M	2318' VOLCANIC BRECCIA (well consolidated)
	H	Dk grn gry, med dk gry, grayish red, mod red brn to brnish
	M	gry. Lt-med gry angular to subangular lapilli to block size rock
	H	frags of mafic to intermediate composition in matrix of ash,
	M	smaller (to ≤ 1mm) rock fragments (l/a), sparse xtls, & dk
	H	grn clay. Frequent, intermittent intervals of mod red brn
	M	& blk flow banded (+ stringers & blebs) lava → clay, ± minor
	H	vesicular / rarely scoriaceous, rounded blk to brn to red brn
	M	lapilli-sz fragments. (Flow banding, stringers & blebs
2337'	L	suggest material was molten at deposition). Also, intervals
	H	of brnish gry basaltic andesite (typically, aphyric) w/
	L	more homogeneous texture & occasional subtle breccia.
	M	(Breccia as described above ~~may be~~ probably of explosive origin).
	H	Minor clay, concentrated on fractured & often waxy,
	M	sheared surfaces of dk grn gry breccia. V. minor
	H	white veinlets & fracture coating of zeolites. (Clays
	L	are predom. dk grn, w/ less pale blue & red brn). Fractures @ ~45°.
	L	2319.5' - rare laminations
		2318' - 2325' - intermittent lt yel brn zones (~15cm - 1m)
		w/ lighter colored (intermed → silicic) lapilli-sz volcanic
		fragments (i.e. rock fragments) + more tuffaceous matrix
		than most of unit.
		2349 - 2351 - breccia has dk grn gry color.
2357'		



Diamond Shamrock
Thermal Power Company

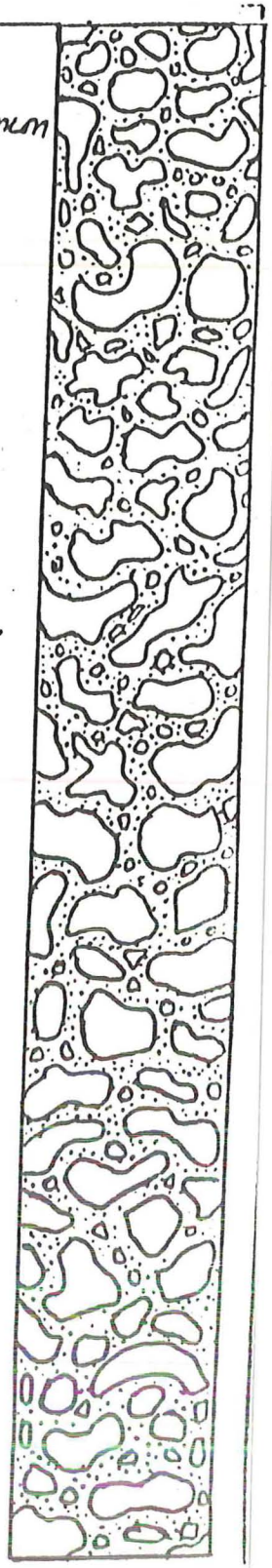
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL / GOODWIN

FIELD CASCADES / CLACKAMAS BASIS BINOC. SCOPE DATE July 14, 1986

DEPTH INTERVAL	Fracturing L=light M=moderate H=heavy A=absent I=intense	DESCRIPTION
2357'	L↓MHIMHI	VOLCANIC BRECCIA (A/A) 2359'-2372' - red brn → blk, brn gry. Flow banding common @ angles of 30°-45°. FeOx (limonite), rare clear zeolite. Much of interval is rubbly.
		2372'-2379' - grn gry breccia (consolidated), less matrix.
2374'	LAMIHLHIHL↓A	2379'-2385' - red brn, med-dk gry. Flow banding 45°-80°. locally rubbly. 2385'-2387' - grn gry breccia (a/a) 2387'-2391' grayish red, rounded, ± vesicles, basaltic and. blebs, minor blends. Sheared frac. surfaces. 2391-2401 brn gry (w/mnr red gry). Texture is subtle: med gry to dk red grey rounded frags. in red gry lava matrix
2401'		



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE July 14, 1986

DEPTH INTERVAL	Fracture	DESCRIPTION
2397'	A L A L H H ↓ M L M L M I L ↓ M	VOLCANIC BRECCIA (A/A) 2401'-2412' - grn grey breccia, as described above, often w/ little matrix between rock fragments. 2412' dk red brn matrix w/ blk, rounded, vesicular rock fragments & irregularly shaped blebs. Zeolites in vesicles. 2416' red color intensifies & flow banding prominent.
2417'	H M ↓ H A M ↓ @45° H ↓ M ↓	2419' grades into red/gry & becomes more homogenous lava by 2422 2425' grn grey breccia, a/a. Pale blue clay & gry grn clay on waxy, sheared, fracture surfaces. 2434'-2438' Brn, blk & red brn breccia "dike" threads its way through it. gry breccia w/ angular blocks & lapilli separated by thin clay seams suggesting little movement relative to "dike" (attitude 15° to // to ⊥). Dike may have been fluid and is composed of ash-sized volcanic fragments with disrupted margins.
2437'		

Diamond Shamrock
Thermal Power Company

Form 2

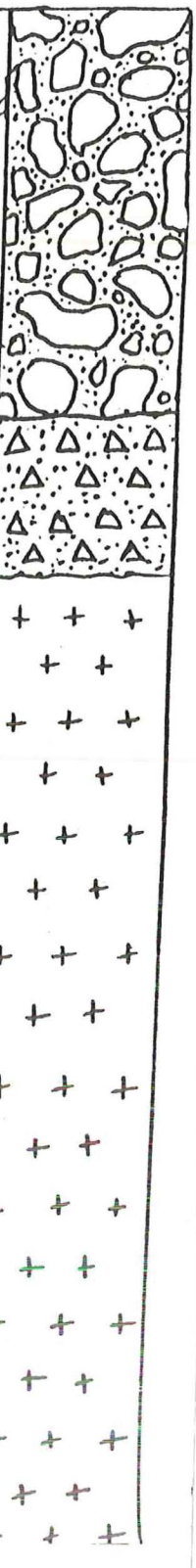
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CLACKAMAS (CASCADES) BASIS hand. microscope DATE 7-15-86

DEPTH INTERVAL	DESCRIPTION
2437'	VOLCANIC BRECCIA (A/A)
	2440'-2441' red brn & dk gry breccia, w/ streaked & convoluted bands (~ flow banding). Red ashy matrix.
	2441'-2448' increase in matrix (dk grn gry), angular to rounded lapilli & small block sz basaltic andesite w/ intermittent intervals (up to 15 cm thick) of red brn & blk banding a/a, w/ sparse lapilli-sz rock. Dk grn waxy shear surfaces (2444'-2448': increase in pale blue clay on fractures)
	2448'-2453' CRYSTAL TUFF? (very ash matrix hyd. altered to clay) Dk yel brn, waxy, sheared clay w/ abundant xtls of plag & pyx → clay. Minor coarse ash-lapilli sz rock fragments (of interm. composition) & porphyritic clay clasts. Unit becomes slightly less waxy & altered w/ depth (~2453') & is marked by disrupted black bands of basaltic material.
2453'	ANDESITE
2457'	med dk gry to v. lt. gry, porphyritic andesite ~10% phenos of plag, cpx & opx → All show clay alteration.
	2453'-2469' bomb- & lapilli-sz gry blk - dk gry porph. andesite commonly flattened/elongated, in dk org brn clayey matrix of coarse ash-sz rock fragments & xtls of plag & pyx. (Flow breccia?)
	2469'-2476.5' above grades into med dk gry porphyritic andesite @ 2469'. Phenos replaced by wht clay w/ minor pale blue cores.
	2476.5 color changes to lt gry - v. lt. gry. Cpx phenos repl. by dk grn clay. Pale blue & pale grn clay pervasive throughout rock.
2477'	



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/McDANNEL

FIELD CASCADES/CLACKAMAS BASIS _____ DATE 7-15-86

DEPTH INTERVAL	DESCRIPTION
2477'	ANDESITE (A/A)
	2485'-2488' rock takes on subtle pinkish cast which becomes pronounced by 2488', Pheno sites have rims of oxidized red brn-mod red iron w/ light blue clay (rather than dk grn clay) repl. phenos.
	2487' ~12 cm zone intense fracturing, increased yel brn clay
	2490' pervasive lt grn gry clay, mnr lt gry brn clay. Veinlets of wht clay (gray zeolite?).
2497'	2495' rock becomes tectonically brecciated w/ minor dk grn gry matrix of finer rock frags & clay. Rock remains well consolidated. Mnr zeolite veinlets. (Brecciation is 2ndary feature)
	2504'-2512' brecciation intensifies. Zeolite veinlets 5°-15° ¢ (acicular zeolite ← natrolite?)
	2512'-2516' Light fracturing. Rock color is lt. brn gray adjacent to fractures, otherwise lt. gry. Light grn clay coats fractures.
	2515' 8 cm drusy cavity with several different zeolites successively coating light grn clay cavity wall (resinous tightly fitting stumpy columns → radiating blades → very fine acicular xtals, all ~clear in color)
2517'	

Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) MCDANNEL/GOODWIN
BASIS binoc. microscope DATE July 16, 1986

DEPTH INTERVAL	Fracturing	DESCRIPTION
2517'	A L A	ANDESITE (A/A)
	L M	2526'-2532½' (2ndary) Brecciation increases. Minor dk grn gray clay vnlets ± clear zeolites coat fractures. Fracture altitude variable, 30°-45° to & most common. Rock remains well consolidated.
	L A	2532½'-2539' Base of flow marked by a change in color: rock is mainly brn gry, w/ pink brn & med. gray-related to incomplete mixing with the lower unit and chilling, respectively.
2537'	L A M A L A	2539'-2552½' Volcanic breccia – (agglomeratic by 2543') Red brn & gray lapilli & blocks of andesite in an orange brn matrix of clay/ash. & common free plag. & pyx. xtals. From 2543' to 2545' lapilli are flattened horizontally. Local fracture @ 15° to & w/ lt. clay shearing. Minor zeolites in vesicles ± clay (± quartz (?) @ 2548'). (Pyroclastic breccia between flows)
		@ 2550' matrix changes color to moderate brn. Amphibole appears. Suggests contact w/ unit below @ 2259'?
		@ 2552½' ½ cm brn clay seam on fracture @ 45° & to & marks contact with breccia of different character
2557'	A L	2552½'-2559' Indistinctly banded, brecciated but consolidated andesite; wispy bands of pale yellowish brn, moderate yellow & red brn xtal-rich matrix (clay, + amphibole ≤5mm), pyx → red brn clay,

Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) MCDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE 7/16/86

DEPTH INTERVAL	DESCRIPTION
2557'	ANDESITE (A/A) (continued from p. 51) ¢ plag) w/med dk gry unaltered blocks. Banding may be a primary flow feature or related to alteration ¢ fracturing.
	2259' ANDESITE (see 2550') finely porphyritic; 2-3% phenos of amphibole, pyx, plag. Med dk gry. Fractures most common @ 20°. ¢ white clay on fracture. Light clay alteration of matrix.
	2566'-2569' - intense shearing, vertical to high angle (15°). Forms rubble.
	2573'-2575' - intense shearing ¢ rubble. Vertical ¢ 45° Waxy shear surfaces.
2577'	2579' - hairline fractures (w/v. lt. clay) @ 45°.
	2580-2586' - volcanic breccia — basal breccia. Lapilli ¢ small blocks of andesite in ashy matrix. Groundmass minerals altering to clays, pyx → hematite ¢ clay. Common gry grn ¢ white clay veinlets.
2586'	CRYSTAL-LAPILLI TUFF (airfall?) Overall color is lt. gry. Lt gry, med gry ¢ red brn fine gr. intermediate to mafic lapilli of volcanic rock fragments in a matrix of ash sz rock fragments, abundant crystals (plag, pyx, amphibole?). Minor flattened pumice → clay. Ash is sparse. Subtle bedding defined by size variations in matrix ¢ lapilli.
	2586'-2589' - orange brn, ashy matrix. Oxidized by overlying andesite flow?
	2594'-2595' - poorly consolidated. Dk green ¢ pale blue secondary clays common.
	2596' - grn clay seam along 30° fracture; below this point is lt. gry/grn rock color to base of unit
2597'	

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Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH1

FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN

BASIS binoc. microscope DATE July 17, 1986

DEPTH INTERVAL	DESCRIPTION
2597'	Crystal-Lapilli Tuff (A/A)
	2602.5 Lapilli Tuff (Ash-flow origin?) Lt gry angular to sub-rounded lapilli sz rock fragments & black glass (FRESH) in med gry to dk med gry matrix of ash sz rock fragments, xtls & glomeroxts of plag, opx & magnetite, glass fragments, minr clay. Rock fragments are predominately porphyritic andesite but include rare gabbroic samples (cumulate?) Elongated, black, fine-textured features are common & are reminiscent of collapsed pumice, but may be depositional feature. Unit is mod. well-consolidated & predominately massive. Bedding & sorting are present but uncommon → suggests possible surge deposition, in part.
	2604 ~0.3 m well sorted thin beds of coarse to fine ash sz material.
2617'	2605 rare blocks & larger lapilli in uppermost part of flow disappear by this interval. Small lapilli only are now present.
	2612' - % decrease in lapilli sz rock fragments to ~ ≤3% throughout remainder of unit
	2624' - lapilli sz frags almost absent
	2630.5' - 2642' unit is poorly consolidated/friable in much of this interval
2637'	

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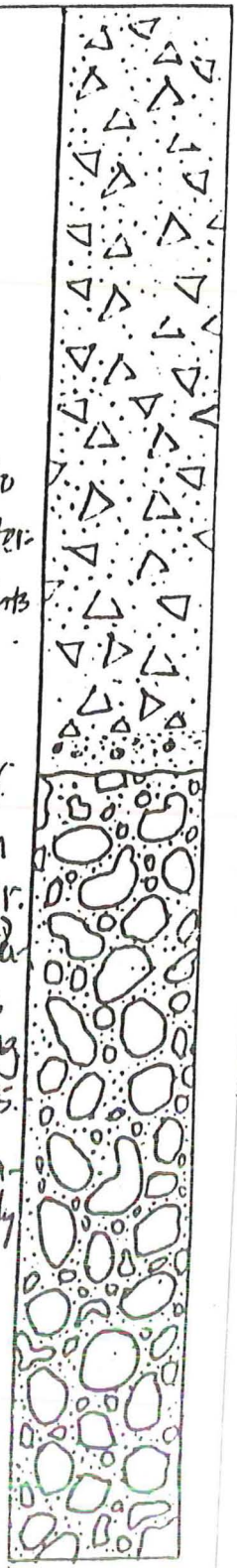
Diamond Shamrock
Thermal Power Company

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH1
FIELD CASCADES/CLACKAMAS
GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE July 17, 1986

DEPTH INTERVAL	Fracturing	DESCRIPTION
2657'	L H M A L I L A M I M L A	LAPILLI TUFF (A/A) 2654½' Unit becomes lt. grey & horizontally-flattened lapilli (v. lt. grey, = fiamme?) increase 2656½' A 6cm thick well-sorted layer of lt. gray coarse ash- to sm. lapilli-sized rock fragments with common wht & grn clay alteration followed by a 14cm thick bed of lt. gry consolidated ash size fragments w/ sparse vesicular andesite lapilli. 2657' ANDESITE BRECCIA med to med dk gry angular to subrounded lapilli & blocks (≤4') of porphyritic andesite (pyx → dk grn gry clay, ± plag. ↑2-4%), in lt. yel brn to lt. olive brn to lt. red brn matrix of ash-size lithics & mnr. xtals w/ common voids. Unit is a series of intervals of primary breccia (i.e. vol. breccia) (with vesicular lapilli & matrix) interspersed w/ blocks (v. thin flows? unvesiculated andesite w/ mnr. secondary/tectonic? fracturing (and may represent a margin sample of thin flows) Mnr wht clay in vesicles. 2651'-2675' Zeolites commonly form drusy linings on intergranular voids & vesicles, cementing the rock together & suggesting laterally extensive interconnected fractures. 2657'-2659' Rapid decrease in matrix fraction. Below top 2' breccia is clast-supported. below 2675' Decrease in matrix voids & zeolites (clr/wht)
2677'		



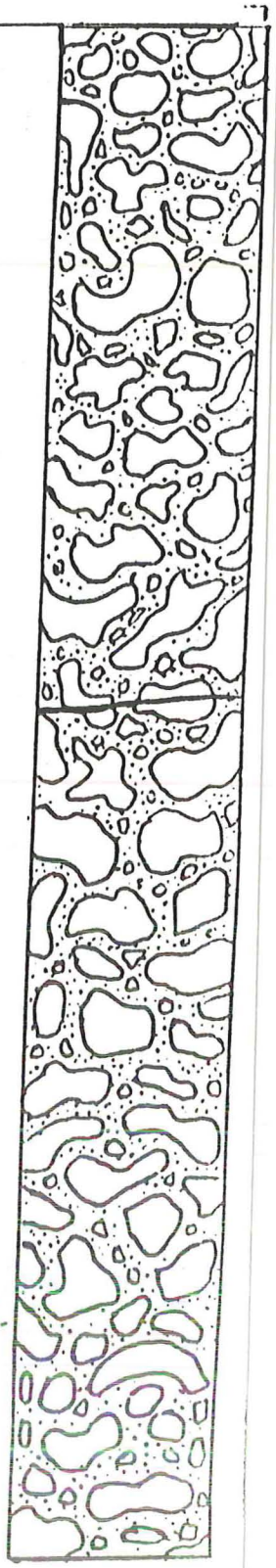
Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTG-H1
FIELD CASCADES/CLACKAMAS
GEOLOGIST (S) McDANIEL / GOODWIN
BASIS binoc. microscope DATE July 19, 1986

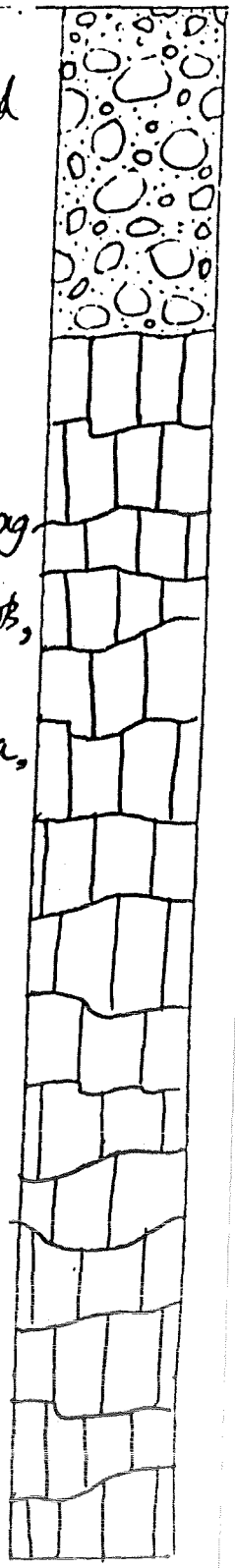
DEPTH INTERVAL	fractures	DESCRIPTION
2677'		ANDESITE BRECCIA (A/A)
		2690'-2694' Notable increase in vesicularity & vesicle size (≤4cm) in scoriaceous blocks. Light amt. drusy zeolites and +/- pale grn gry/wht clay in voids. Contact marked by 23cm of (overall) brn grey coarse ash-size red brn, med gry, & dk. gry rock fragments, xtals & minr. asl(?). Interval is normally graded & crudely bedded/laminated @ 70°.
2694'		2694' VOLCANIC BRECCIA
		Lt. olive gry to dk yellowish brn, lt. to med. gry blocks & lapilli-sz r.f.s. of mafic to intermediate composition in a matrix of ash-sz r.f.s., xtals (minr.), dusky yellow to dk yellow palagonite, & v. fine asl(?). Minor localized crude bedding (thin beds) in matrix. Matrix --> clay
		@ 2694' contact marked by ~23 cm of ash sz rock fragments, lt's & minor ash. Interval is normally graded & crudely bedded & laminated, ~70° angle. (BLAST DEPOSIT?)
		2710' Percentage of rock fragments in unit decreases
		2712'-2718½' Small lapilli-to coarse ash-sz dk gry to dk. gry brn rock fragments in matrix of dk. yellow orange palagonite and minr. xtals. R.f.s often appear elongated & disrupted, as if deposited in a partially molten state. Subtle bedding based on clast size & matrix % variations. Blast deposit origin? Palagonite tuff?
2717		



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE July 15, 1986

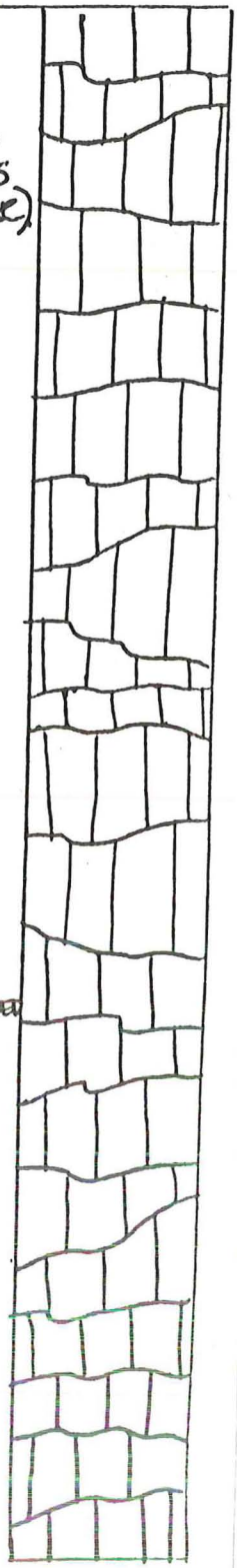
DEPTH INTERVAL	DESCRIPTION
2717'	A ↓ L A ↓ L ↓ A
	VOLCANIC BRECCIA (A/A)
	2718' 12cm of dusky yellow to lt. olive brn v. fine ash-sz. f s and xtals. Palagonitic? Rare lapilli-sz. clasts.
	2718.5' - Volcanic Breccia A/A @ 2694' with slight increase in clasts, mainly from b.a. unit beginning @ 2726'. Matrix color changes from dusky yellow to med. dk gry by 2719'. Rare clr. zeolite veins.
2726'	BASALTIC ANDESITE
	A
	MED DK GRY, V. Finely porphyritic (7-8%). PHENOS: PLAG, PHX → CLAY, OL? LIGHT-MOD fracturing. Long (0.3m+) vertical to 20° fractures coated w/ pale grn & grysh grn, waxy clay. fracture surfaces show minor shearing.
	2726'-2736.5' - flow top breccia: dk gry - gry brn - red brn porphyritic basaltic andesite (25cm - 1cm) fragments, often elongated/banded & disrupted, in mod red brn clayey matrix w/xtls, subtle banding.
2737'	2736.5'-2748' rock becomes pale red brn, less breccia, mnr cavities w/ drusy zeolite. Zeolites also fill hairline fractures.
	H A L A ↓ L A L ↓ A L
	2748' - rock becomes med dk gry as described above.
	M ↓ H
2757'	A



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL
FIELD CASCADES/CLACKAMAS BASIS BINOC. SCOPE DATE JULY 18, 1986

DEPTH INTERVAL	DESCRIPTION
2757'	BASALTIC ANDESITE (A/A) (MED DK GRY, FINELY PORPHYRITIC: PHENOS OF PLAG, PYX, OL? FRACTURING LIGHT TO MODERATE, 20° TO VERTICAL. PALE GRN & DK GRYISH GRN CLAYS ON FRACTURE SURFACES, TYPICALLY SHOWING MNR SHEAR)
2777'	2782'-2786' ROCK BECOMES BRECCIATED (TECTONIC), BUT IS WELL CONSOLIDATED BRECCIA FRAGMENTS ARE ANGULAR, CLOSELY SPACED, & SLIGHTLY ELONGATE (DUE TO FRACTURE DIRECTION) ALONG VERTICAL-SUBVERTICAL AXIS. NOT MUCH MOVEMENT ALONG FRACTURES. MNR CAVITIES W/ ZEOLITE. MNR MATRIX BETWEEN FRAGS OF DK GRYISH GRN CLAY, & LESS COMMONLY, WHT ZEOLITE. FORMING ≤ ½ CM SEAMS ON 30° TO 45° JOINTS WITH WAXY SHEAR (MINOR) TOWARDS BASE OF INTERVAL.
2797'	



Diamond Shamrock
Thermal Power Company

Form 2

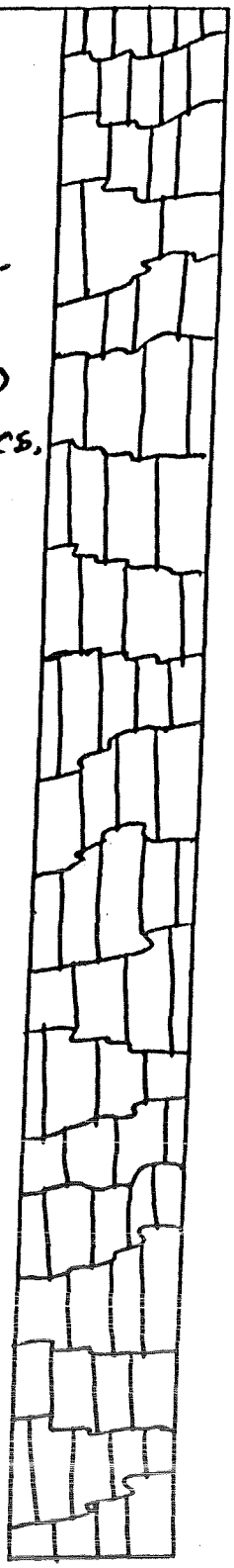
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS Binoc. Microscope DATE JULY 19, 1986

DEPTH INTERVAL	DESCRIPTION
2797'	BASALTIC ANDESITE (A/A) (med dk gry, finely porphyritic, phenos: pyx, plag, & ol.? light to moderate fracturing, most commonly 20° to 45° to ℄ with local sinuous vertical fracture. Pale grn & wht clays on fracture surfaces (often slightly waxy), typically showing minor shearing. V. short intermittent brecciated but consolidated intervals w/ clay vnlets ± rare zeolites (clr).
	2806'-2810' Intensely fractured @ 30° ℄ to ℄ to vertical, splintery rock fragments <1"-6" long, heavy waxy shear ± clear zeolite ± pale grn/wht clay on sinuous to planar fracs.
2817'	
2837'	



Diamond Shamrock
Thermal Power Company

Form 2

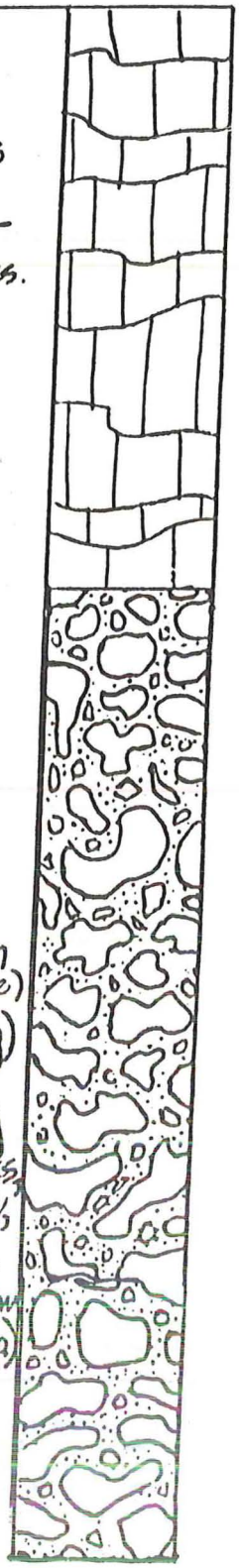
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE July 19, 1986

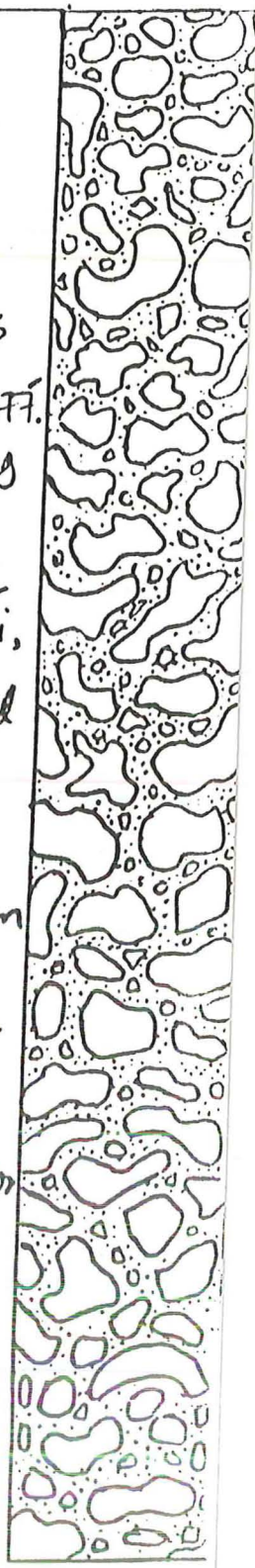
DEPTH INTERVAL	DESCRIPTION
2837'	BASALTIC ANDESITE(A/A) 2838' flow becomes oxidized & grayish red. Flow breccia appears by 2840.5. Decrease in fracturing & clays 2841.25'-2844': very fractured/broken. Vertical to sub-vertical fracture angle predominate. Drusy zeolites.
2857'	2842' VOLCANIC BRECCIA (explosive origin?) Rock changes character often over short intervals, but is predominately composed of angular to sub-rounded lapilli +, less commonly, blocks, of md gry to dk gry mafic-intermediate lavas in a dk gry-brn gry to gry red matrix of smaller rock fragments a/a v. fine material → clay, + xtls. Clasts are typically heterolithologic. Unit varies from clast to matrix supported. Short intervals of dk gry basaltic andesite(?) showing evidence of deposition while still in a plastic, partially molten state (juvenile) (i.e. disrupted margins, flattening, stringers, minr banding) in oxidized (primary) reddish brn matrix. Near top of unit there is crude, subtle, discontinuous bedding in matrix. Rare zeolites filling hairline fractures/cracks, minr drusy coatings on frac. surfaces. Fracture variable, but most often at high angle or ~45°. gen. light. 2860.75'-2863' dk gry porph basaltic andesite, predom lapilli sz, showing plastic deformation (see above descrip) in fine pale brn matrix → clay + smaller basaltic andesite frags. 2863.5' - heterolithologic clasts predom. mafic to interm. composition but include altered porphyritic (? grey, silicic?) lt. grayish green & finely laminated (rextalized?). Some
2877'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTH1-1 GEOLOGIST (S) GOODWIN/MCDANNEL
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE July 19, '86

DEPTH INTERVAL	Fracturing	DESCRIPTION
2877'	I	VOLCANIC BRECCIA (A/A)
	↓	2863.5' contd: Clasts show plastic deformation. Oxidized reddish matrix shows minr banding (as if deposited in molten state)
	L	2876' - sheared & broken. Sheared, waxy surfaces. Variable shear/fracture angles.
		2877.5'-2879' small lapilli sz gry & dk red brn rock frags (heterolithologic) in minor matrix of dusky yel-dk yel org clay (palagonitic?). Thin bedding, laminations @ 2876-2877.
		2878'-2880' unit v. sheared & broken, predominately along short high angle fractures. waxy, sheared surfaces
	A	2880'-2897' dk yel brn to dk yel orange matrix, interval characterized by two interbedded units grading into one another repeatedly: (1) a lapilli-rich interval w/ 2-25 mm rounded lapilli, mainly dk. yel. brn & altered to clay & (2) larger more angular lapilli of mafic & intermed. comp. in a matrix of v. fine ± palagonitized rfs & clay (wht) w/ minr xtals pyx, plag., FeOx (blk min). Rare frac @ 30° to & w/ lt. shearing of clays & v. rare zeolites
2897'	L	
	H	
	M	
	L	
	I	
	↓	
	H	2896'-2903' Sinuous subvertical fracture & poorly developed 30° conjugate fractureset (locally), lower ½ is rubbly, common shearing on fractures, v. lt. wht & grn gry clay
	M	
	I	Below 2897'-2955': matrix color dusky yellow grn, change in Fe oxidation state?
	A	
	L	
	↓	
	M	
	I	2906'-2907' thin interval with characteristics of hot deposition: blk & reddish gry matrix w/ v.f. palagonitized rfs & smaller lapilli among larger basaltic andesite lapilli/blocks
	M	
	H	
	I	
	L	2909'-2916½' Several rubble zones (≤ 2' thick) in interval, matrix color: dirty brn, rock has v. irreg. break & is sometimes friable, probably shear-related condition y. lt. clays & zeolites in fracs (v. rough conj. fracset @ 35°)
	↓	
2917'	A	



Diamond Shamrock
Thermal Power Company

Form 2

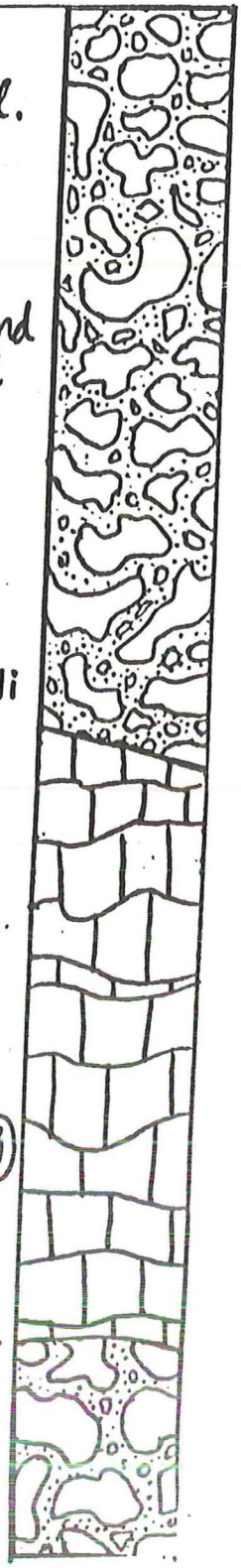
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc microscope DATE July 29, 1986

DEPTH INTERVAL	fracturing	DESCRIPTION
2917'	LALLAMHMIHHLIAMHIHMLILALAIAALM I	VOLCANIC BRECCIA (A/A) 2916½' matrix color varying from dusky yel. grn to dk yel. brn w/ both matrix & clast-supported intervals 2925' matrix color: dk yel. brn, matrix appears to flow around larger constituents in matrix-supported interval; hot ↑ fluid deposition suggested 2930'-2933' Vertical fracture present w/ rubble at base of interval 2935' reverse graded base of breccia unit: ash-sized & lapilli n.f.s, lightly sheared @ 45° to ℄ w/ brn clay vn along shear (= fault contact?), crudely bedded @ 90° to ℄ 2934'-3936' laminae & thin beds of predominately ash sized rock fragments. Bedding is horizontal to ~45° to ℄. 2935' BASALTIC ANDESITE Md gry to dk md gry, finely & sparsely porphyritic (≤1%), phenos: plag, pyx. Rock has mottled grey appearance. Grades into oxidized mod (@2939') red & med gry: flattened, elongated, irregular disrupted margins of dk gry basaltic andesite in oxidized basaltic andesite. (Pyroclastic mat.) 2951.5' VOLCANIC BRECCIA (see following page)
2937'		
2957'		

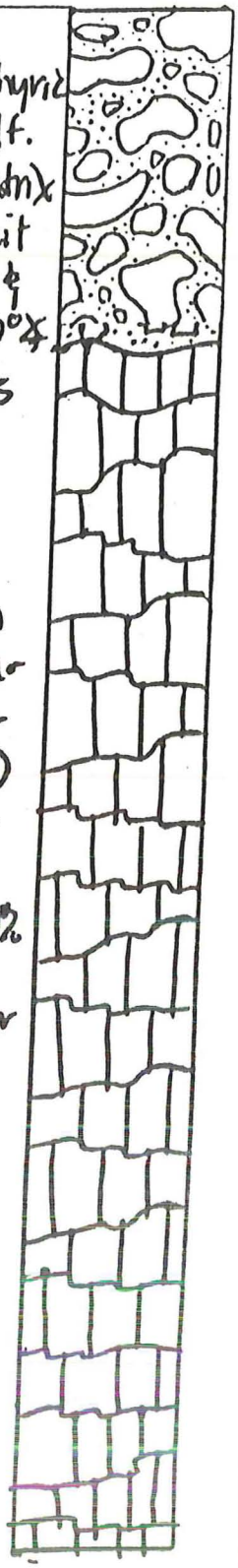


CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE July 20, 1986

DEPTH INTERVAL	fracturing	DESCRIPTION
2957'	I	VOLCANIC BRECCIA (A/A) Angular to sub-angular lapilli sz clasts of porphyritic-aphyric mafic to intermediate lavas ⅘, less commonly, lt gry to v. lt. gry clasts (some now clay) which may be more silicic. Mtrx is greenish blk coarse to fine ash sz rock frags. a/a. Unit is predominately clast supported. Graded bedding at 2954' & 2956'. Unit is v. fractured, usually along subvertical to 30° & Polished, sheared surfaces. Minor pale grn & pale blue clays on frac. surfaces.
	M	
	H	
	I	
2965.5'		BASALTIC ANDESITE med gry to dk gry to brn gry, finely & commonly sparsely porphyritic (2-5%), phenos: plag ⅘ wht clay, pyx → grn clay, common mottled appearance, due to brecciated but consolidated rock: dk gry to brnish gry sm. blocks & lapilli-sized B.A. frags. (w/ generally disaggregating boundaries) blend into matrix of ash sz B.A. frags, xtals plag & pyx, & bright orange, wht, & red brn clays. Mottling is more subtle and matrix is sparse above 2979'. Below 2979' matrix increases to 20%-50% and fine fracturing of lapilli w/ sm. valets wht clay is common. Pervasive mod. matrix clay alteration. Fractured intervals w/ shear surfaces, typically 30°-45° &. V. Mnr gry grn clay on surfaces. 2979½'-2984' intermittent rubble, 30°-45° fracs most common w/ irreg breaks ⊥ to &
	L	
2977'	M	
	H	
	I	
	M	
	L	
2997'		2994'-2998½' basaltic andesite interval, unbrecciated - w/ soft lt. gry clay in vertical fracture at 2994', mod. clr drusy (& coating) zeolite on fractures



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE July 20, '86

DEPTH INTERVAL	Fracturing	DESCRIPTION
2991'	L M L M L A L H M H L	BASALTIC ANDESITE (A/A) below 2998½' mottled appearance, brn gry & dk gry B.A. lapilli sized frags. in orange brn to red brn matrix a/a, sparsely porphyritic (fewer pyx.) (This feature ends ~3001', when flow becomes med. dk grey.) (Pyroclastic breccia) 3003' rock appears more open textured. Increase in vesicles. Clays (grn gry, white, pale blue, gry grn) fill vesicles & intergranular voids. 3014' - began to find yellowish grn - gry grn inclusions (2-4 cm) composed of pyroxene & minor plagioclase + clay (green). 3016' rock becomes slightly scoriaceous & becomes increasingly scoriaceous by 3018', showing red brn oxidation. Rock is slightly less consolidated & breaks easily. (Pyroclastic breccia interval)
3017'		
3037'		

Diamond Shamrock
Thermal Power Company

Form 2

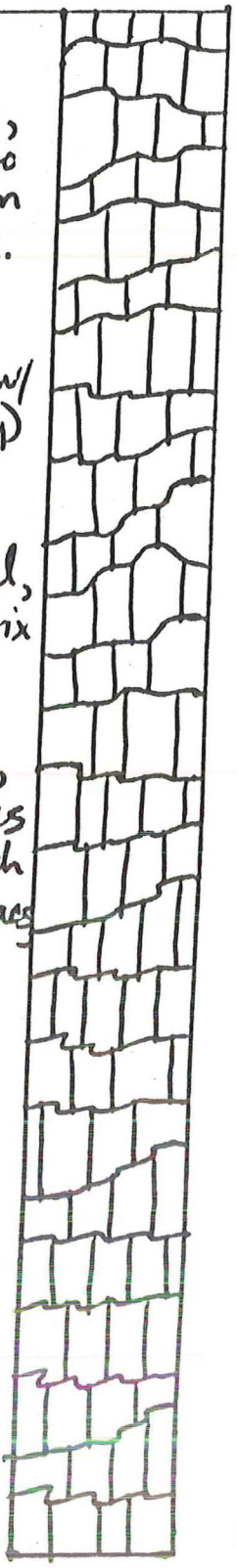
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) GOODWIN/MCDANNEL
BASIS binoc. microscope/ DATE JULY 21, 1986

DEPTH INTERVAL	Fracturing	DESCRIPTION
3037'	ML↓ML	**BASALTIC ANDESITE (A/A)** rock fragments commonly porous & scoriaceous, fractures easily, brecciated but consolidated, most common frac. @ 45° w/ no shearing, v. lt. pale blue & dk grygrn clay in frac's., common unfilled vesicles (≤≤ 1.5cm) overall v. little alteration exc. lt. clay alteration of matrix & pyx → clay
		3047½'-3048½' Rubbly interval, several vertical fracs. w/ one continuing to 3051', mod. brn clay (easily washed away)
		3054'-3069' Scoriaceous rock absent through interval, @ 3054' rock becomes matrix-supported w/ increase matrix
3057'	I↓MLA↓LLHI↓H↓I↓HML↓AM↓AL↓	3057'-3067' unbrecciated med. gry basaltic andesite, commonly rubbly w/ sinuous vertical - subvertical fractures & frac @ 40°, light clay (pale blue, dk grygrn) on fracs which often have irreg. break, v. light drusy zeolite in voids/fracs pervasive light matrix clay alteration (grygrn)
		@ 3067' return to brecciated but consolidated blocks & lapilli-sz b.a. in red brn matrix (A/A), commonly scoriaceous, little alteration exc. light clay alteration of matrix, frac @ subvertical & 45° w/ no or v. light pale blue & grygrn clay
3077'	F↓	3068½'-3072½' 8" intensely oxidized red brn scoria followed by brn gry → med gry unbrecciated b.a. A/A (contact?)



Diamond Shamrock
Thermal Power Company

Form 2

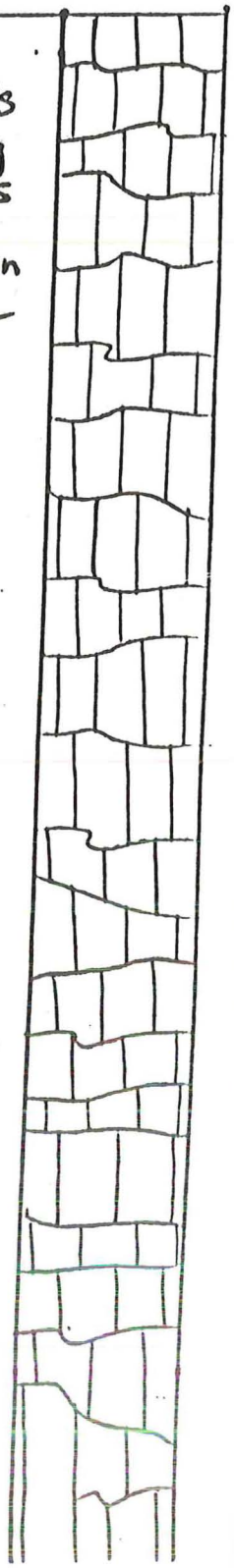
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE JULY 22, 1986

DEPTH INTERVAL	Fracturing	DESCRIPTION
3077'	ILLALLILILILIL ALLAALIMALILILILMLMH	BASALTIC ANDESITE (A/A) brecciated but consolidated ba. blocks (less common muds) & lapilli-sz r.f.s in mod brn to red brn matrix a/a, generally light fracturing (often irregular), light pale blue & dk gry grn clays in vesicles and coating fractures, common scoriaceous texture locally rubbly & light clr zeolite in vesicles, pervasive lt. matrix clay alteration 3076½-3079' : rubbly, vertical frac intersecting irreg breaks ⊥ to ¢ in fragile/scoriaceous interval, slt. increase brn clay 3087'-3088' rubbly
3097'		3107' - ROCK BECOMES LT-MED GRY, DENSE — i.e. NO LONGER SCORIACEOUS. FRACTURING PREDOMINATELY VERTICAL, LESS COMMONLY 45°
3117'		3114' - FRACTURING INTENSIFIES. GRAYISH GREEN CLAY V. COMMON ON FRACTURE SURFACES & IN CRACKS & SMALL VOIDS. FRACTURING PREDOMINATELY VERTICAL TO SUB-VERTICAL, LESS COMMONLY 45°.



Diamond Shamrock
Thermal Power Company

Form 2

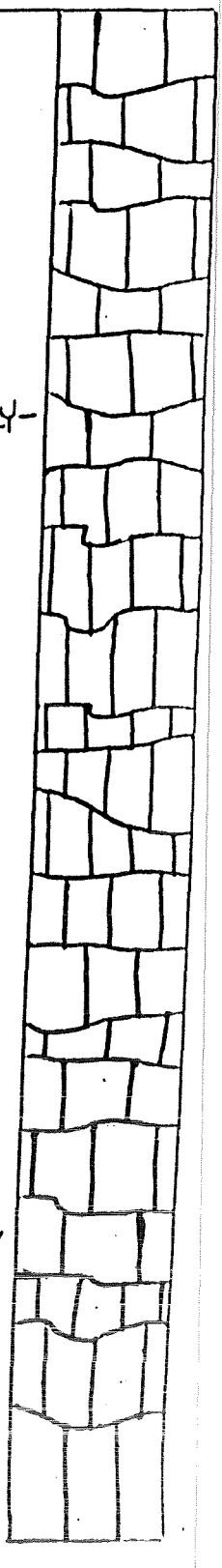
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) GOODWIN/MCDANNEL
BASIS BINOC SCOPE DATE JULY 22nd, '86

DEPTH INTERVAL	DESCRIPTION
3117'	BASALTIC ANDESITE (A/A)
	3122'- FRACTURING & CLAY DECREASE
	3126'- VOLCANIC BRECCIA ROCK RESUMES PREVIOUS COLOR (MED DK GRY-DK GRY) & BECOMES SCORIACEOUS AGAIN - MNR RD BRN SCORIA IN BASALTIC ANDESITE LAVA. MNR PALE BLUE CLAY.
3137'	3140'- ROCK BECOMES LT-MED GRY, DENSE; INTENSIFIED FRACTURING W/GRNISH GRN & GREENISH GRY CLAYS (AS ABOVE @ 3114-3126).
	3146'- AS ABOVE @ 3126'
	3148'- COATING OF BOTRYOIDAL SILICA ON FRACTURE/VOID WITH WHT CLAY INTERLAM'S PTLLY FILLING VOID
3157'	@ 3154' conjugate fracture set @ 15°± to ℄ & sinuous vertical fracture, slt. increase clay, consolidated v. poorly



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. scope DATE JULY 23, '86

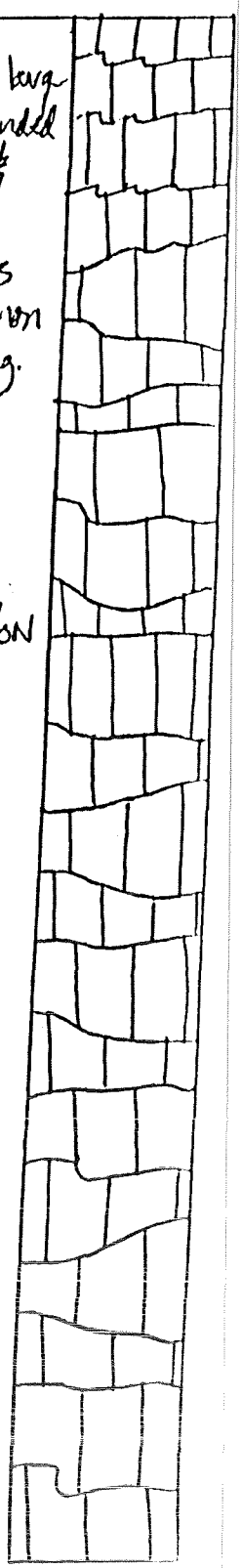
DEPTH INTERVAL	*Fracturing	DESCRIPTION
3157'	LMI↓HML↓ALA↓LMLA↓LMI↓ALA↓LAL↓MH	**BASALTIC ANDESITE (A/A)** 3157'-3161.5' med dk gry, unbrecciated, dense, sparsely porphyritic (plag & pyx phenos.), pilotaxitic g.m., often intensely frac'd., common lt. coating pale blue gry (dry) & wht (& dk gry grn (wet)) clay on fracs & coating vesicles, rare vn lets clay + quartz, clay commonly botryoidal, most common fracs @ 30° & ~vertical 3161.5'-3173' brecciated & consolidated lapilli- & blk-sz ± scoriaceous b.a. in or- to red-brn matrix a/a, clast-supported except at boundaries of interval where matrix% exceeds 50%, decrease in fracturing & clays 3173'-3177' dense & unbrecciated, frothy top w/ decrease in vesicles w/ depth, lt. frac. w/ predom. fracs @ 30° & 60°, lt. clays a/a (@ 3157'), 2cm breccia seam in middle of unit, rare plag-pyx clots (≤0.5cm) Unit may represent a single thin flow.
3177'		3177'-3181.5' brecciated but consolidated (same as 3161.5') finely scoriaceous lfs 3181.5'-3184.5' dense basaltic andesite, fracs @ 15°-45° near basal rubbly zone 3184.5'-3189.5' brecciated but consolidated, no scoria, botryoidal pale blue clay in voids (light), rare vertical veinlets w/ clr zeolites, increase in gry grn matrix clay in basal ½ of unit, lt. shearing of 1-45° frac 3189.5'-3197' dense, generally unbrecciated, local alignment of sm pits filled w/ clay @ ~45° = incipient platy parting?, fracs variable: sinuous sb vertical most common w/ lt. amt. wht/pale blue clay (botryoidal), large (≤2") angular voids basal 1½' of unit, partially filled w/ wht botryoidal silica (= clay + silica), minr silica vnlets
3197'		

*Fracturing: A=absent L=light M=moderate H=heavy I=intense

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH1 GEOLOGIST (S) MCDANNEL/GOODWIN
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 7/23/86

DEPTH INTERVAL	fractures	DESCRIPTION
3197'	HMA↓LAML↓M↓LML	BASALTIC ANDESITE (A/A) a series of thin (3'-15') layers of massive med gry porphyritic lava & brecciated but consolidated intervals of commonly med gry subrounded lapilli-sz r.f.s of b.a. in a red brn to mod brn matrix of ash sz r.fs & xtals of plag & pyx. 3197' Subtly brecciated but cons. b.a. a/a, common scoriaceous r.fs, v. lt. amt. pale blue/wht (dry) clay on fracs & in voids, common lt. matrix clay alt., frac. & most common = vertical (sinuous & irreg. break)
		3205.5' ZEOLITES COMMON AS DRUSY COATING OVER/ON BLUISH GREY CLAY ON FRACTURE SURFACES & IN VOIDS
3217'		
		3214'-3240' VOIDS UP TO 5 CM COMMONLY THIN CLAY COATINGS, ± ZEOLITES.
	L↓A↓L	
3237'	M	



CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1

FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) GOODWIN/MCDANNEL

BASIS BINOC. MICROSCOPE DATE 7/23/86

DEPTH INTERVAL	DESCRIPTION
3237'	BASALTIC ANDESITE (A/A)
	3244' - 1 vein opalescent pale blue qtz in frac previously coated w/ clay s/a
	3246' - 3248.5' ~VERTICAL TO 45° FRACTURE
	3248' - TR DISSEMINATED V. FINE, THIN, SOFT, GOLD-COLORED MINERAL ON FRACTURE W/ ZEOLITE & BLUISH GRY CLAY
	3252.5' - 3257.5' irregular sub-vertical & 30° fractures w/ sub-conchoidal ltgry to ltbluegry to pale grn clay (± v.lt. zeolite - less common), rubbly @ 3254' - 3255' (in dense lava unit)
3257'	3257.5' - 3263' : consolidated breccia w/ finely scoriaceous r.f.s. (≤ 1.5 cm voids) w/ v. light amt. clay (exc. pervasive matrix clay alteration - mod. amt.)
	3263' - 3267' dense lava, common fracturing w/ increased amt. clays (but still slight): wht & pale grn & pale blue (± pale grn/clear zeolite) coating fractures, ₹ opalescent quartz in vn @ 3265', vesicles & pits intermittently partly to completely filled w/ clay s/a
	3274' - 3279' dense lava, commonly frac'd @ 30°-45°, very light amt. clay for dense lava interval; no intense fracturing
3277'	

LAVA LAKE MEMBER

Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 7/24/86

DEPTH INTERVAL	DESCRIPTION
3277'	**BASALTIC ANDESITE (A/A)**

A series of thin (3'-15') layers of massive dense porphyritic lava and consolidated breccia intervals (breccia intervals (pyroclastic) commonly consist of med gry subrounded lapilli sz lava rock fragments in a red brn to mod. brn matrix of ash sz r.f.s and xtals of pyx & plag). Brecciated intervals are commonly thicker, less fractured, & often have less secondary mineral deposition in available voids. The breccia is commonly porous but pervasive lt. to mod. matrix clay alteration may result in less permeability than the dense lava which has less porosity (though it is commonly vesicular at borders) but is usually lightly to moderately fractured. Apparently the interconnection of these fractures is fairly good. Light amounts of clay (a/a) & zeolites & rare quartz veins are found in the unbrecciated but fractured dense lava intervals.

3279'-3289' breccia a/a, unfrac'd w/common scoriaceous r.f.s, lt-mod. lt. gry to mod brn clay, intermittent ptl to complete filling of vesicles by clay.

3289'-3293' dense lava w/lt. amt lt. gry to lt. blue gray clay ± v. lt. amt lt. grn/clr botryoidal zeolite on clay

3297'

3293'-3302' same as 3279'-3289' - volcanic breccia

3302'-3308' dense lava, platy frac. @ 75° to ℄ and less common vertical fracture with lt. amt. lt. blue gry & gry grn clays

3308'-3334½' Volcanic Breccia

3317'

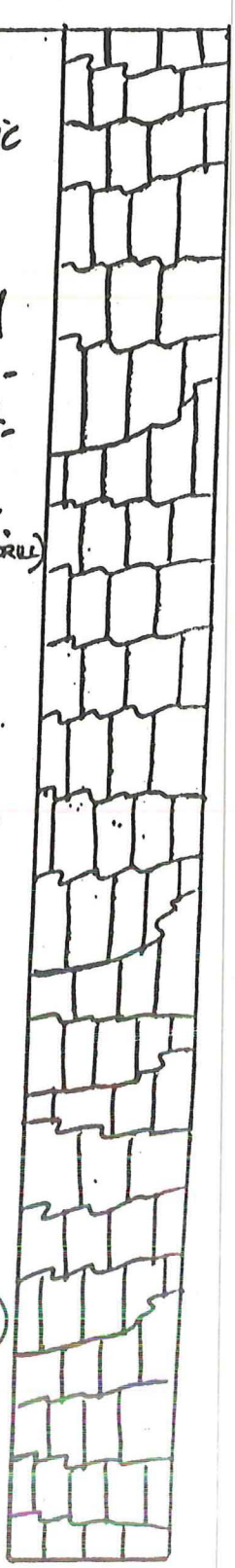
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. 'scope DATE 7/24/86

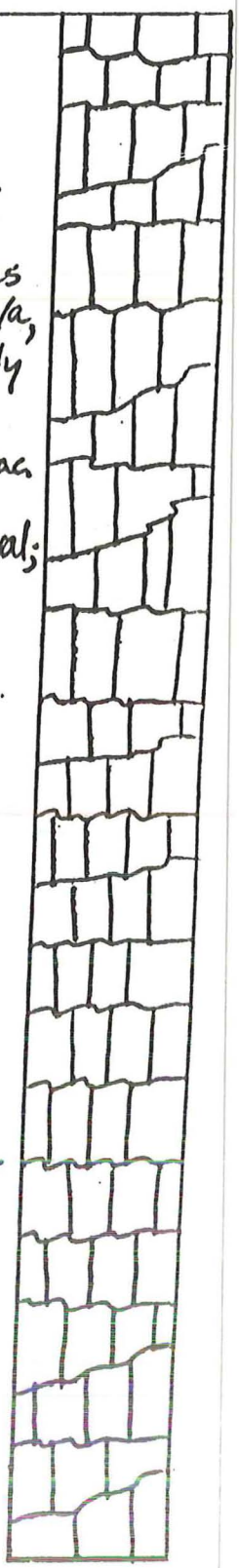
DEPTH INTERVAL	DESCRIPTION
3317'	BASALTIC ANDESITE (A/A)
	3319' microscopic, thin, malleable plates of copper-colored metallic mineral
	3324' ℟ botryoidal silica in void w/ lorn gry clay, vertical fracture at this interval w/ coating of botryoidal dusky yellowish grn clay overlain(?) by dusky grn clay w/ drusy coating of soft, clr, microxtalline (zeolite?) mineral. common pale blue clay. ℟ v. fine disseminated phyllosilicate - dk. grn to dk grey ... chlorite?? (SUPERFICIAL MATERIAL WASHED INTO DRILL HOLE, ACCOMPANIED BY FINE SAND.)
	3329' ℟ copper-colored mineral occurring as @ 3319', lt. shear of fracs @ 15°-30° w/ lt. to mod. amt ltgry to lt. bluegry clay
3331'	3335'-3337.5' dense lava, @ 3335' (≤ 2cm voids) w/ clr. silica ptlly filling voids on top of botryoidal gry-grn clay (+ zeolite?)
	3337.5'-3339' brecciated a/a, no unusual mineralization
	3339'-3352' dense lava w/ pilotaxitic grn texture, plag & pyx phenos., unit v. frac'd to 3347' w/ fracs @ subvert. to 75°, lt. blk to gry-grn clay (℟ w/ shear) on fracs, orange & yellow oxides form films on & on fracs. and (≤ 6") halos in unfrac'd rock below 3345'
	3350' microscopic, thin, irregular golden flecks (tarnished w/ lt. grn) ⌐ unidentified metallic min. occurring as v. finely disseminated grains on fracture surface w/ clays. (NATIVE COPPER)
3357'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN
FIELD CASCADES/CLACKAMAS BASIS binoc. scope DATE 7/24/86

DEPTH INTERVAL	DESCRIPTION
3357'	**BASALTIC ANDESITE (A/A)**
	3356.5'-3360' dense flow w/ local platey parting, vesicular top, frac. variable, most common subvert. & irreg., lt. gmt. botryoidal pale blue gry to v. lt. gry zeolite? and clay on fracs. (v. soft coating)
	3360'-3373' brecciated but consolidated, common scoriaceous r.f.s, v. lt. amt clay-zeolite botryoidal frac./vesicle coating a/a, v.f. clr drusy zeolite coating frac. @ 3373', vesicles commonly filled ptlly w/ mod. brn to gry grn clays
	3373'-3379.5 gry-grn clay coating fracs., rarely sheared, frac. attitude commonly subvert to 75°, local yellow and orange oxide forms films adjacent to fracs & on fracs. in this dense flow interval; @ 3379.5' silica vn in assoc. w/ pale blue gry to wht clay in subvertical fracture
3377'	
	3383'-3395' dense lava, rare v.f. disseminated copper-colored metallic flakes on botryoidal frac. coating of zeolite? + pale blue clay. Grayish blue grn, waxy clay & v. pale blue clay coat fracture surfaces, fill fractures & small voids. Mnr dusky yel grn clay, also. Mnr dusky yel "limonitic" & red brn oxidation stains follow hairline fractures. Microscopic, irridescent spots on fracture surface appear to be metallic, but are soft & break easily into small, thin plates of yel org color. Vertical-sub-vertical &, less commonly, 60-70° fractures pervasive.
3391'	



Diamond Shamrock
Thermal Power Company

Form 2

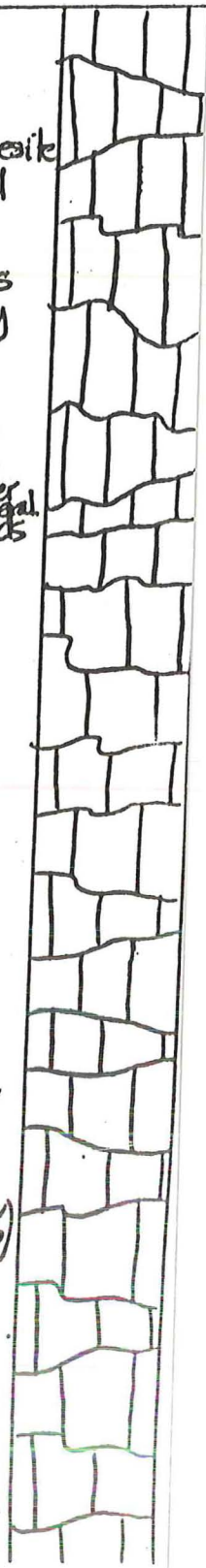
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANIEL

FIELD CLACKAMAS/CASCADES BASIS BINOC SCOPE DATE JULY 25, '86

DEPTH INTERVAL	fracturing	DESCRIPTION
3397'	L A L A L A L A L I A L M A L M M L A	**BASALTIC ANDESITE (A/A)** (pyroclastic) 3395'-3421'- Return to volcanic breccia- lapilli & blocks of scoriaceous/vesicular/dense basaltic andesite in basaltic andesite matrix. Vertical to sub-vertical fracture persists, w/lesser 60°-70°, but is not as intense as above. Common pale blue to v. pale blue clays on fracture surfaces & lining intergran voids. Less common grayish blue grn clay (a/a), & gry blu grn & gry grn. Clays(?) often have fine botryoidal form & may or may not be coated by v. fine, drusy coating of soft clear mineral (zeolite?). Also, clear botryoidal mineral on frac. surfaces. Mnr silica. Sequence of clays lining voids: lt blue, green, clear mineral (a/a). Mnr copper mineral. 3399.5'- very soft, clear foliated mineral in small voids on cut surface of core = gypsum? Trace amounts. ↓ (zeolite)
3417'		3421'-3434.6'- return to dense, med gry, b.a. lava. Plag, pyx, ol? Most of mafic minerals → clay. Mnr flow banding produces fracture ~75°-80°. Silica veinlets ~ horizontal. Silica appears to be increasing on fracture surfaces, in voids & ≤1cm veins, often in botryoidal-mammillary form. Lt. blue & gry blue grn on fracs & in vessicles, voids. Less common gry grn clay. Trace copper colored mineral as described above (3365'-3395') occurs as thin, malleable flakes & as flat wire-like form.
3437'		



CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CLACKAMAS/CASCADES BASIS BINOC SCOPE DATE 7/25/86

DEPTH INTERVAL	DESCRIPTION
3437'	BASALTIC ANDESITE (A/A)

3434'-3443' Return to volcanic breccia a/a, common pale yellow gry and very pale grn clay ptlly to completely filling 50-70% of sm. vesicles, larger vesicles (3-15mm) often contain clr zeolites as drusy coatings on lt. blue gry to lt gry botryoidal clay, opalescent silica is less common except in the largest cavities (≤2½cm) where it is selectively deposited, often in close association w/ wht clay eg. 3438' & 3441'. At 3438' silica fills a 1½cm cavity and 6" away a 2½cm cavity contains only botryoidal clay & the clr drusy zeolite.

3443'-3451' Return to dense med gry b.a. lava, fracs. commonly @ ~75° & subvertical (& sinuous), clays occur a/a, silica restricted to 1 vein @ 3448' (2mm x 40mm, sinuous & subhorizontal), rare microscopic copper-colored metallic min. occurs as v.f. disseminated flakes on clays in fractures. Limonite mnr @ 3451'.

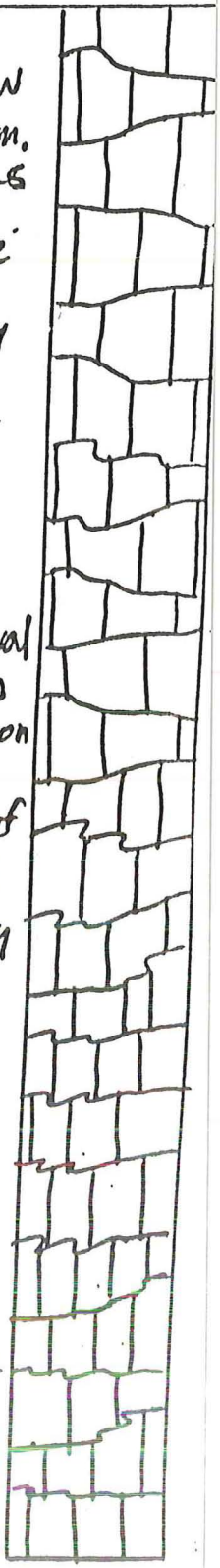
3451'-3455' volcanic breccia w/ clays a/a, @ base of interval silica occurs in fracture above a 1mm layer of grn gry clay & below a 3mm layer of wht clay. Silica is 1mm layer & all are horizontal in partially-filled void.

3457'

3455'-3459' dense lava; platy partings @ 60° in middle of interval, lt. clay on fractures a/a, rare v. finely disseminated microscopic copper-colored min. occurring a/a; blue gry to milky silica as short veins (≤1½cm x ≤2mm) & filling vesicles & associated w/ lt. blue gry and grn gry clays on fractures. Common botryoidal clr zeolite on dk gry grn clay in other vesicles. Clays >> silica > zeolite. Silica assted w/ subvertical fracture through this thin unit.

3459'-3480½ Return to breccia; mod brn & gry grn clays in vesicles a/a, to 3471' intermittent v. lt. blue botryoidal silica assoc. w/ wht clay on frac & in larger (≤2cm) vesicles on top of gry grn clay, milky & pale blue varieties are commonly horizontally banded (1-5mm bands) in ptlly filled cavities, many voids remain v. lightly mineralized w/ gry-grn clays & drusy clr zeolite w/o silica, below 3469' subtle increase in clay content of matrix (gry grn) & in zeolites

3477'



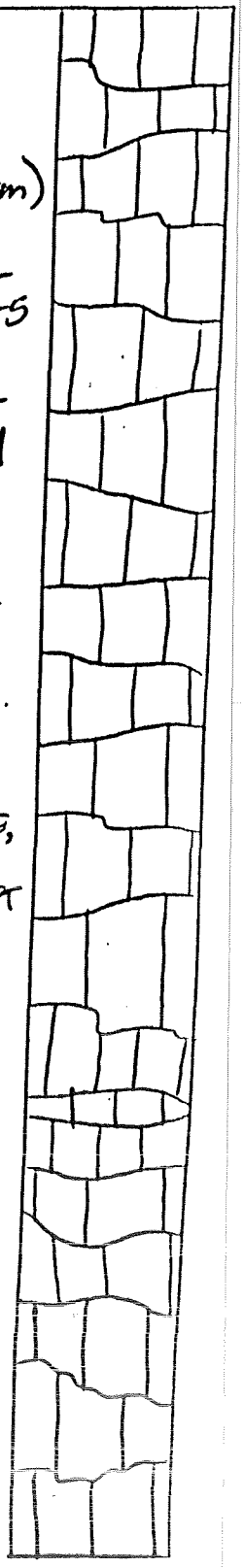
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) GOODWIN/McDANNEL

FIELD CLACKAMAS/CASCADES BASIS binoc. 'scope DATE 7/26/86

DEPTH INTERVAL	DESCRIPTION
3477'	BASALTIC ANDESITE (A/A)
	3480½' - 3492' Return to dense lava (finely porphyritic ba. w/ 5% plag & pyx → gry grn clay, pilotaxitic g.m.) increasing silica (pale blue & milky) in voids and as (≤ 5mm thick x ≤ 30cm) vns filling common sinuous subvertical fractures, some of pale blue silica has botryoidal/mammillary texture and is hydrated/opalescent. Clay adjacent to silica in large (≤ 3-5 mm) vesicles is silicified (pthly).
	@ 3481' clr zeolite forms microstalactites in void above silica pooled at base of narrow 5" fracture, both form on top of grn clay
	3492' - 3517' Return to VOLCANIC BRECCIA
	3488' ROCK BECOMES VESICULAR & PASSES INTO VOLCANIC BRECCIA ~ 3492. (VOLCANIC BRECCIA COMPOSED OF LAPILLI & BLOCKS OF BASALTIC ANDESITE, COMMONLY SCORIACEOUS OR VESICULAR & MAY SHOW SUBTLE RED BRN OXIDATION, IN MATRIX OF BASALTIC ANDESITE), VESICLES FILLED W/ GRY BLUE GRN CLAY & PALE BLUE CLAY*, MNR WHITE CLAY. BLUE & GRN CLAYS MAY BE BOTRYOIDAL (NOT AS COMMON IN THIS INTERVAL AS ABOVE) & COATED W/ CLEAR, FINE, ZEOLITE*(PALE BLUE CLAY OFTEN COATS GRY BLUE GRY). MNR SILICA IN VOIDS & SUB-VERTICAL VEINLETS. TR. V. SOFT FOLIATED MINERAL. TR COPPER.
3497'	CLAYS IN THIS INTERVAL APPEAR TO BE LESS THAN INTERVALS ABOVE (i.e. ~3385')
3517'	



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1

FIELD CLACKAMAS/CASCADES

GEOLOGIST (S) GOODWIN/MCDANNEL

BASIS BINOC. SCOPE (20x MAX) DATE 7/26/86

DEPTH INTERVAL	Fracturing	DESCRIPTION
3517'	ALHL ↓ AMLM ↓ HML ↓ ALA ↓ LAL ↓ ALMLA ↓ LAL ↓ A ↓ L	**BASALTIC ANDESITE** 3517'-3532' RETURN TO DENSE BABALTIC ANDESITE LAVA: FINELY & SPARSELY PORPHYRITIC. PHENOS OF PLAG, PYX, OL? (IDENTICAL TO PREVIOUS LAVAS-SINCE 2965.6). INCREASE IN FRACTURING & CLAY OVER PREVIOUS INTERVAL (3438-3517'). FRACTURING PREDOM. SUB-VERTICAL & LESS COMMONLY, 45°. FRACTURE SURFACES HAVE LIGHT CLAY COATING: GRY BLU GRN, GRY GRN, PALE BLUE, WHT. PALE BLUE USUALLY COATS UNDERLYING GRY BLU GRN & MAY IN TURN HAVE A DRUSY COATING OF FINE ZEOLITES. CLAYS MAY EXHIBIT BOTRYOIDAL FORM. SiO_2 FORMS SHORT VEINLETS & OCCURS AS/ BLUE GRN IN VOIDS. V. RARE COPPER. MINOR SHEAR ON FRAC. SURFACES. 3532'- 3538' VOLCANIC BRECCIA AS ABOVE IN 3438'-3517'. THIS INTERVAL CONTAINS GREATER RED BRN OXIDATION (PRIMARY). RARE FRACTURES @ 45° to ⊥ W/ LT. SHEARING OF CLAY. COMMON PALE GRY GRN.
3537'		CLAY in FINE VESICLES W/ CLR, DRUSY, SLIGHTLY BOTRYOIDAL ZEOLITE ON TOP OF CLAY (Both < 1mm thick coatings), est. 10% of ROCK is VOIDSPACE W/ ~80% filled W/ CLAY & ZEOLITES in this interval. This is well above the average % of filled VOIDS. 3538'-3546' VOLCANIC BRECCIA changes character: fractured dense dk gry b.a. (pilotaxitic g.m., sparse & finely porphyritic W/ plag >> pyx + ol? phenos) with gry-grn clay ± ptlly silicified wht to blush gry clay filling in the irreg, angular (≤1") cavities between r.f.s (that often fit together across the frac's - indicating less relative movement of r.f.s than upper unit @ 3532'). Inter r.f. material commonly is 2ndary. Irregular frac. attitudes W/ cmn. sinuous break. Drusy zeolites on clay a/a. Rare microscopic copper colored min. a/a. @ 3542' grn clay is covered by pale blue clay which is covered by a platy clr zeolite & an opaque wht spherulitic? or botryoidal zeolite in a ±1cm vesicle. Uncommon 2-3mm wht silica vnlets. Overall lt. silica < zeolites < clays (which are v. lt on fracs. & lt to mod. as void fillings)
3557'		

Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES / CLACKAMAS BASIS BIN. MICROSCOPE DATE JULY 21, 1986

DEPTH INTERVAL	DESCRIPTION
3557'	BASALTIC ANDESITE (A/A)

3546'-3559' Return to Volcanic Breccia w/ 3532' character except red-brn matrix is less abundant. Above 3549' interval is matrix-supported w/ common gry grn coloration (due to ≤3" thick layers of fineash-s2 rfs (altering) → grn gry clay more commonly); light amt clr platy zeolite on fracs, botryoidal pale gry blue to lt gry clay ± zeolite? in cavities (<2cm). Intermittent wht silica in ≤2mm vesicles (less common than clays, zeolites).

3559'-3561½' Amygdular b.a. w/ gry-grn clay >> wht silica as vesicle filling material. Silica clearly postdates clay.

3561½'-3571' consolidated breccia a/a, relatively unfracd w/ fracs @ 45°-75° w/ lt. clay shear locally, increase in clr zeolite abundance in available sm. vesicles (≤1mm) but still light amt. rare silica (5mm vn) @ base of interval. Fracs occurring w/ or w/o clay a/a. This is notably lighter than clay occurrence 100' uphole.

3571'-3576½' dense b.a. flow, fracs @ 30°-45° w/ lt. to no clay a/a. Lt. gry clay ± zeol? in vesicles are common. Localized lt. to mod. wht silica (up to 30% of vesicles in one 1' interval). Common gry grn clay filling vesicles & v. light amt. on fracs. Local mild clay silicification. V. Rare microscopic v.f. dissem. copper min.

3576½'-3577½' breccia w/ v. common clr zeol. & local sm silica vnlets

3577½'-3580' dense flow, lg. subvert. frac. (8" long) in mid-interval w/ lams grn-gry clay below turquoise colored clay below clr drusy zeol. below opalescent to wht silica. Zeolite most abundant & lt. coatings of all overall (<<1mm).

3580'-3600.5 consolidated breccia a/a, lt. frac w/ most common @ 45°. Cmn. lt. amt. lt. gry botryoidal zeol/clay coating ≤4cm vesicles. @ 3581': start 1' rubbly interval. @ 3586' wht 1mm spheroidal silica w/ clay or fairly hard zeolite in frac. Local pH. clay silicification (grn-gry & mod brn in vesicles). Overall zeolites more abundant (lt-mod) on fracs than clays. Rock still has plenty of open pore space for fluid movement (5-8% = ½ of available space before any 2ndary min deposition).

3577'

3597'

Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CLACKAMAS/CASCADES
FIELD CTGH-1

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS BINOC. SCOPE DATE JULY 27, 1986

DEPTH INTERVAL

DESCRIPTION

3597'

BASALTIC ANDESITE (A/A)

3600.5'-3609.5' breccia grades into Basaltic andesite lava [lava is v. similar to those lavas described between volcanic breccias since 2965.6': med to med dk gry, finely & sparsely porphyritic, w/phenos of plag, pyx, ol?] fracture increases over that of previous interval. Dominant direction is vertical/sub-vertical, w/ less common 45°-75° fractures. Pale blue, gry grn, gry blue grn clays thinly coat fracture surfaces, form thin veinlets, fill vesicles & voids. Gry brn & wht clays are less common & are found in vesicles & voids. Gry brn is the last clay to fill voids & is softer than the others. SiO_2 also fills vesicles, voids, & forms veinlets — color ranges from wht to the blues of the above described clays, & may replace some of the clays. Fine, clear zeolites may coat clays in voids. Clay may be botryoidal

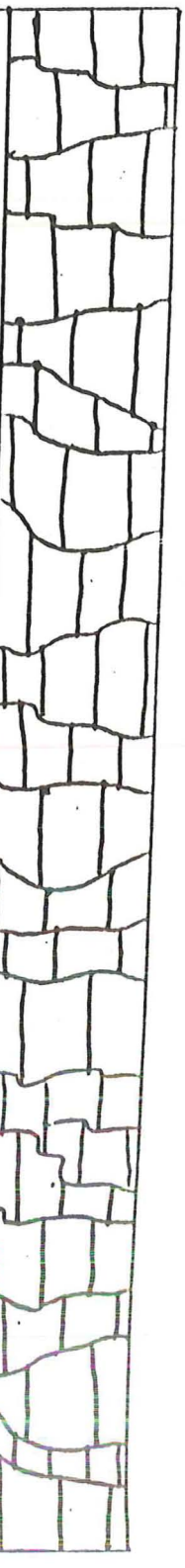
3609.5'-3723' Volcanic breccia (a/a @ 3546'). Intergrain voids are small (generally ≤ 2mm) & are filled w/gry blue grn & gry grn clays, typically botryoidal. Clays may be silicified; white & blue silica common. Wht clay coats blue grn when both are present. Tr clear zeolite, typically as drusy coatings on clays, rare on fracture surfaces. 3 cm void filled w/: grn clay at bottom, overlain by lt. blue clay, & topped w/silica (white-v. pale blue). Short interval (3613'-3615') of dense basaltic andesite lava (a/a @ 3600') is more fractured than breccia & has more vesicles/voids & has more 2ndary silica than does breccia. Rare, fine plate of copper. Fracturing is minor, most commonly @ 30°-45°. Irregular break ⊥ to & is more common and occasionally has soft lt gry clay seams. Silica occurs intermittently - usually in intermed. sz vesicles (1-8mm) in a 6" to 18" thick band (assoc. w/clays or lay itself). Intermittent = every 2' to 10' for silica occurrence.

3617'

3630' 2cm thick brn gry clay seam (soft) & 2mm coating on opposite fracture wall of clr zeolite and wht clay; surface of zeolite disturbed/resorbed

3636½'-3638½' matrix color becomes gry grn as clays of same color increase in voids of r.f.s & vesicles, clr zeolite remains common [illegible]

3637'



Diamond Shamrock
Thermal Power Company

Form 2

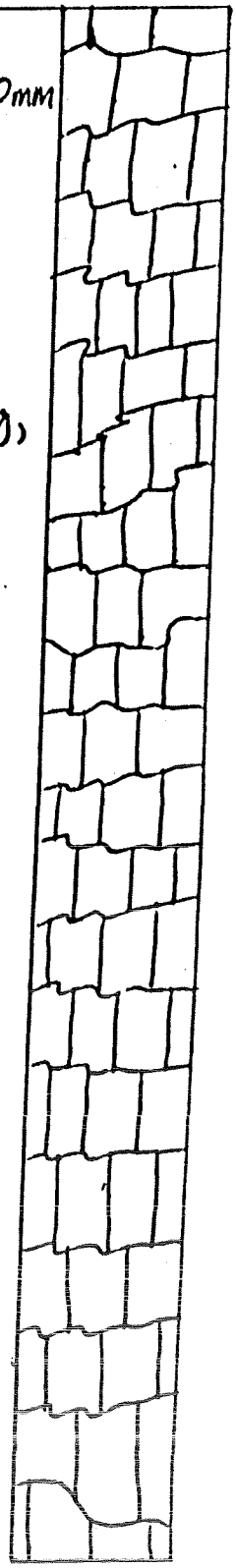
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BNDC. SCOPE DATE JULY 28, 1986

DEPTH INTERVAL	DESCRIPTION
3637'	BASALTIC ANDESITE (A/A)
	3639' Wht botryoidal zeolite coats grngry clay in 5-10mm vesicles. Soft ltgray brn clay partially fills void interior.
	3646' grngry clay less common over 1'-2' interval, lt. blue clay is predominate with vulets, vesicles filling, & sm. frac. coating occurrence. Occasionally lt. blue clay is coated w/ very thin film of clr zeolite? / wht clay.
3657'	
3677'	



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC, SCOPE DATE JULY 28, 1986

DEPTH INTERVAL	DESCRIPTION
3677'	BASALTIC ANDESITE (A/A) Volcanic breccia continues. Rock is well indurated & generally dense with smaller & fewer intergran voids than observed @ 3600'. Small (≤2 cm) pervasive vesicles & vugs filled w/ waxy "clays" of variable hardness & include gry grn, gry blue grn (to turquoise), pale blue. Soft brn gry to gry brn also common. Clays typically fill vugs from rim to interior in this order: gry grn → pale blue, and may have drusy coating of fine clear zeolite or silica. Cross section of this sequence is microscopically banded w/ fine crenulations. Soft brn gry-gry brn clay is the most recent. Botryoidal form in clay is common. Clay & silica occur also, as short veinlets. Silica commonly fills vugs/vesicles. Rock has a tendency to break horizontally.
3697'	3690' - increase in fracturing?/breaking, forming discs (horizontal break) of variable thickness. 3687' - slight increase in gry brn clay, coating break/fracture surfaces @ 3693.6'-3695' forming clay seams ≤ 1 cm. 3699' several ≤10 mm vesicles w/ from rim to interior: pale gry grn clay, lt. blue gry botryoidal clay/zeolite?, clustered wht radiating 1 mm fibers (open into void interior) = zeolite
	3701' clr zeolite microstalactites drip from top of ≤15 mm vesicles w/ lt. blue gry botryoidal & drusy zeolite coating & pool @ bottom
	3703' 30 mm cavity w/ sparse ≤1 mm copper flakes on top of clr drusy zeolite
	3704' heavy soft gry brn clay in narrow wobbly zone (3")
	3714' >60 mm cavity lined w/ gry grn clay, clr drusy zeolite,
3717'	

Form 2

Diamond Shamrock
Thermal Power Company

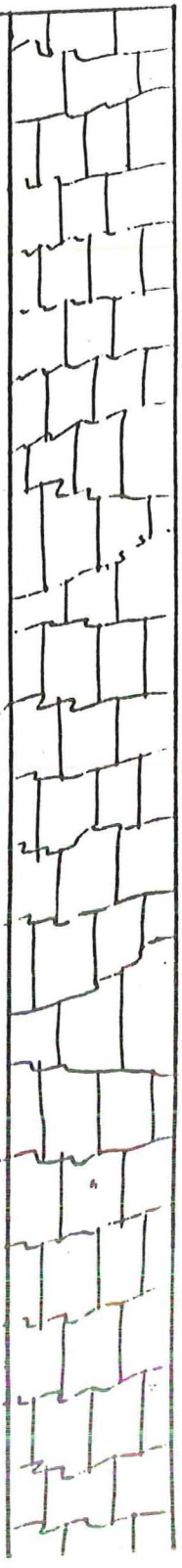
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) MCDANNEL/GOODWIN
BASIS Binoc Scope DATE JULY 29, 1986

DEPTH INTERVAL	DESCRIPTION
3717'	BASALTIC ANDESITE (A/A) lt. blue clay is predominate in small (≤2mm) vesicles, silica and silicification of clays is sporadic (10' between occurrences) and diminishes with depth. Silica occurs in (≤10mm) larger vesicles only and no veins. Otherwise rock is as described @ 3677'. Soft brn clay occurs fairly commonly in ≈2mm vesicles and in seams where the rock has broken irregularly, often @ 90° to ∠.
	3715'-3721' slight increase in size & # of vesicles. wht, lt. blue grn gry clay & clr drusy zeolite in vesicles, as @ 3677'. Clays are commonly laminated in larger vesicles w/ the zeolite occurring at the top of the void on occasion (last in the sequence).
	3721'-3723½' ruddy, many fractures barren or v. lt. amt. lt. gry/clr zeolite & gry grn clay, silica rare/absent below 3720'
	3723'-3727½' med gray dense, vesicular b.a. lava, fracs. @ subvert & 45°, lt. amt clays & lt. gry zeolite on fracs & in vesicles
3731'	3727½'-3743' Volcanic breccia continues as @ 3677', overall v. light amt grn gry clay & clr. drusy zeolite in vesicles & fractures, lt. blue clay becomes rare & overall alteration is decreasing.
	3743'-3745½' dense b.a. lava w/ mod. amt. wht clay in ≤1mm vesicles. Lesser amt. waxy lt. blue & gry grn clays & clr. zeolite
	3745½'-3760' Volcanic breccia, a/a @ 3727½. microscopic copper (@ 3757) in vugs w/ botryoidal - mammillary lt blue to milky opaline (?) material that forms v. small stalagtites. Clay coating on broken surfaces is very light.
3757'	



Diamond Shamrock
Thermal Power Company

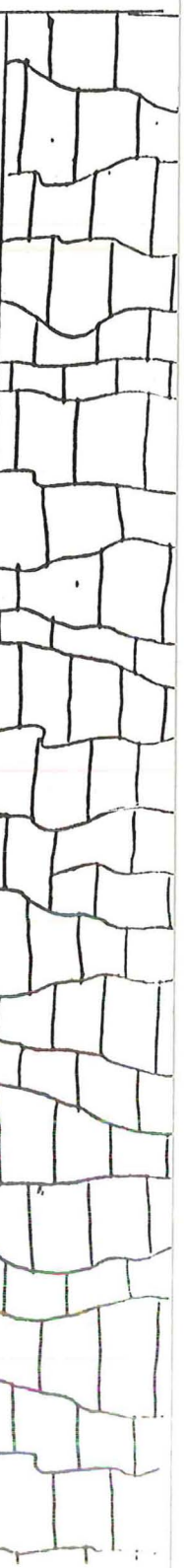
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDONNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. SCOPE DATE JULY 30, 1986

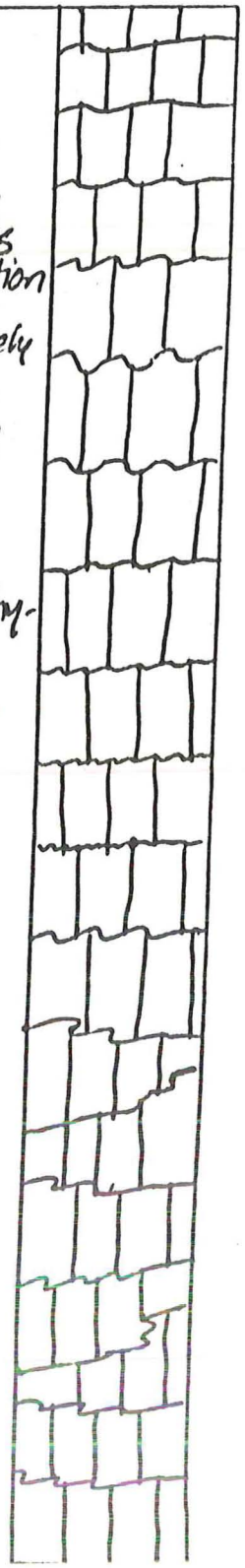
DEPTH INTERVAL	DESCRIPTION
3757'	BASALTIC ANDESITE (A/A)
	3758.5 ~35° fracture w/minor shear on frac. surface
	3761'-3763' denser interval = basaltic andesite lava, fewer voids ∴ there is less clay than in breccia interval(s). Minor silica as void filling & forming thin (~2mm) vertical veinlet in green clay-lined fracture (3763').
	3763'-3796' return to volcanic breccia per above description @ 3745'; white clays in vesicles & voids. Green clays less common
	3769' - 30-40° fracture (1) w/ 0.5 cm gry clay on frac. surface
	3772'-3773' - broken, less consolidated (slightly) interval.
3777'	
	3782'-3783' - rubble zone
	3783' - 3787.5' - many of vesicles & voids are not lined or filled w/clay
	3789'-3790' - rubble zone - predom. vertical - sub-vertical fracturing
	3792'-3796' - matrix of breccia is red brn due to primary oxidation.
	3796'-3803' rock is denser, not oxidized a/a @ 3792'. Basaltic andesite lava a/a @ 3761' (& numerous preceding flows) near vertical fracture @ 3796.5' is coated w/green & white ~~unidentified~~ hard, brittle (film) deposit - silicious?
3797'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS
GEOLOGIST (S) GOODWIN/MCDANNEL
BASIS BINDI SLOPE DATE JULY 30, '86

DEPTH INTERVAL	DESCRIPTION
3797'	HIMLALLIHLMLALMHALAILA — BASALTIC ANDESITE (A/A)
	3796'-3803' (cont.) mod. to intense fracturing w/ fracs @ subvertical, 30° & 70°; light amt. secondary mins on fracs: discontinuous film admixed blue & gry grn clay ± clear drusy/film zeolite on top of clays or by itself; sparse vesicle filling by clays of same color + mnr. wht clay on interior of vesicles lined w/ gry grn clay; sparse lt gry silica & local clay silicification
	3803'-3813½' return to volcanic breccia as @ 3745', finely scoriaceous lapilli sz rf.s to 3806, locally matrix clay alteration increases (gry grn clay & coloration of rock), intermittent very fine white acicular zeolite in voids on clr zeolite, radiating needles suggests natrolite eg 3807½' & 3814½', mnr soft brn clay in larger (>10mm) vesicles
	3813½'-3819' return to dense med. gray finely & sparsely porphyritic basaltic andesite lava, mod. frac. @ 45° & 70° w/ frac. alt. a/a @ 3803', mnr local silica vns (2x25mm max.), zeolites including natrolite as @ 3803'
3817'	
	3819'-3826½' return to volcanic breccia as @ 3745' common open voids w/ light amt. secondary clays & zeolite: vesicles >2mm generally have a rim of grn gry clay & an interior of clr drusy zeolite (no natrolite), smaller vesicles are empty or filled w/ gry grn clay, silica, &/or soft brn clay
	3826½'-3829' return to dense basaltic andesite lava, vesicles filled w/ wht, gry grn clays, &/or silica. Clays locally/adjacent to vns silicified, mnr natrolite? as @ 3803'
	3829'-3835' return to volcanic breccia, very lt. amt. secondary mins. as @ 3817'
3837'	



Diamond Shamrock
Thermal Power Company

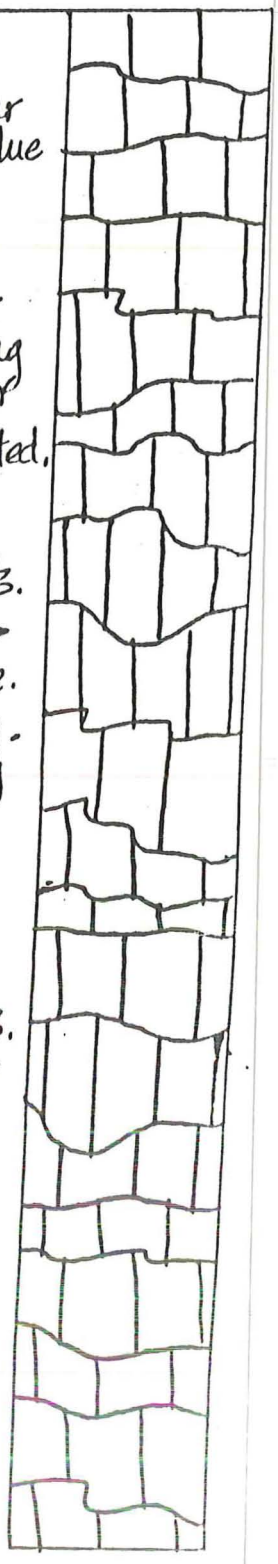
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE JULY 31, 1986

DEPTH INTERVAL	DESCRIPTION
3837'	BASALTIC ANDESITE (A/A)
	3835'-3839' Basaltic andesite lava. Top 1.5' vesicular w/silica the predominate vesicle fill. Silica is white ± blue & typically fills upper part of vesicle & is underlain by lt blue grn clay which typically has been silicified. In other vesicles byrn clay overlies grn gry clay. Less common, soft, brn gry clay may fill vesicle or be at center of vesicle lined by other clays. V. light coating of blue grn & gry grn clays on frac. surfaces. V. minor fracture ~15°, 180°. 3838' is (tectonically) brecciated but consolidated.
	3839'-3852' Volcanic breccia a/a @ 3829' blue grn, pale grn, gry grn, white fill vesicles & voids. Minr. brn gry (soft) clay, also. Clays form minor veinlets. Vesicles are often layered from bottom to top: dk grn gry grn → blue grn → lt blue/white. (No silica found). Fe zeolite. 3848-3850 - Rock is fractured & broken = mod. rubbly. Sheared surfaces. Fracture direction most commonly ~25°-30°.
3857'	3851' silica fills vugs
	3852'-3860' Basaltic andesite lava a/a @ 3835' Brecciated (2ndary - i.e. tectonic) but consolidated. Little to no movement occured between breccia fragments. Gry grn & dk blue grn clay fill narrow spaces between breccia fragments. Brecciation decreases by 3857' Broken frac. surfaces show minor shearing. Clays appear more abundant in this interval over the above vol. breccia interval. Grn clays (as described numerous times above), white clays, & minor silica occur as vein & void fill. Clays v. common on fracture surfaces. Red brn - orange red & dusky yellow Fe oxide stains(?) are common in this interval.
3860'	3860'-3867' Volcanic breccia, a/a @ 3839'. Clays as described above + zeolite.
2077'	



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) MCDANNEL/GOODWIN
BASIS BINOC. MICROSCOPE DATE JULY 31, 1986

DEPTH INTERVAL	DESCRIPTION
3877'	BASALTIC ANDESITE (A/A)

3860'-3873' Return to Basaltic andesite lava [a/a @ 3852']. Increased fracturing, typically at high angle 0-15°, less commonly ~45° & 80°. Mnr shear on fracture surfaces. Abundant blue grn (waxy) clay on frac. surfaces, mnr pale blue. V. common red brn-orange red & dusky yellow oxidation -- usually follow small cracks/fractures.

3873'-3896' Volcanic breccia, a/a @ 3839'. secondary minerals/clays a/a w/ gry grn & mod blue most common, sequence from rim to interior on vesicles is typically gry grn → mod. blue → lt. blue → soft gry brn clay, a lt. amount of clr drusy zeolite commonly occurs on clay in cavities; rubbley @ 3889'-3891' & 6" interval at base of unit, v. minor fracturing, core breaks irregularly @ 90°

3896'-3902' Return to basaltic andesite lava [a/a 3852'] fracturing increases w/ common fracs @ subvert & 30°, clays on fracs are lt. w/ waxy wht & gry grn colors predom. over mod blue & pale blue & pale blue grn, rare limonite? yellow & orange oxides as @ 3873'

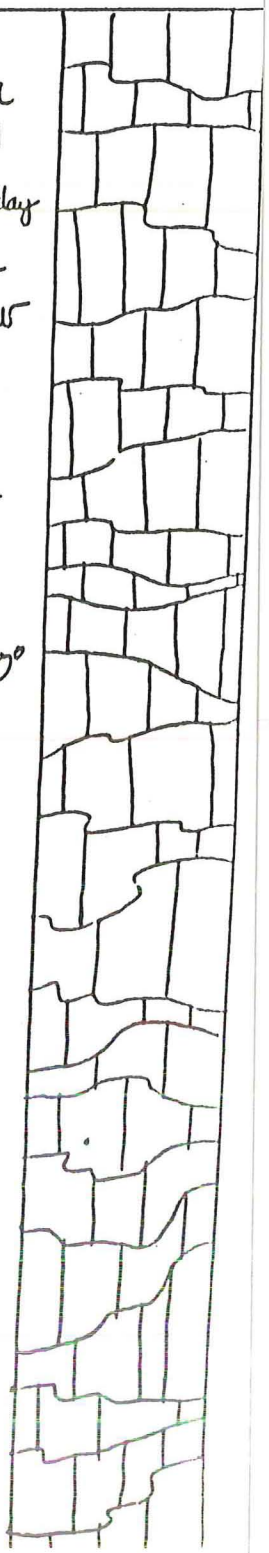
3897'

3902'-3915' Volcanic breccia, a/a @ 3839'

from 3903' to 3907' a notable increase in the variety of clays & zeolites occurs, a common sequence rimming vesicles towards the interior are blk, gry grn, mod blue, grayish olive grn & wht clays followed by a clear zeolite w/ rare matted or acicular v. fine wht zeolites last deposited. All clays are <<1mm laminations.

pale blue silica vns (<65mm) & vesicle fill occurs intermittently w/ overall lt. amt., > microscopic round plates of copper also occur on fracs. (rare concentration)

ALTERATION LEVEL



Diamond Shamrock
Thermal Power Company

Form 2

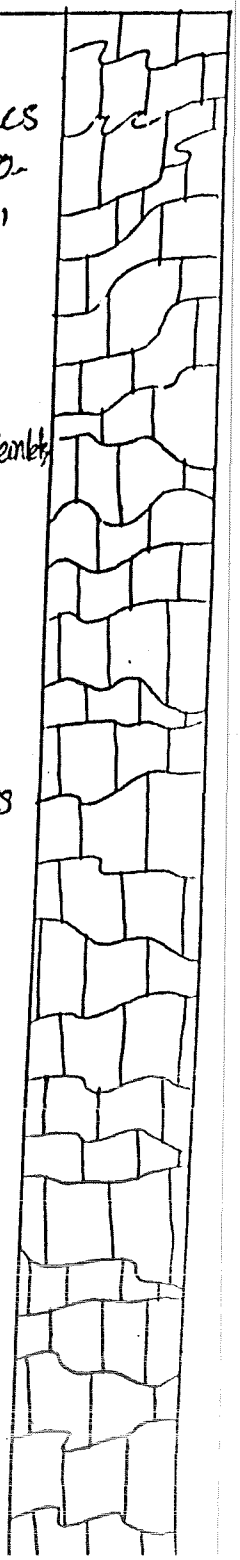
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binocular microscope DATE August 1, 1986

DEPTH INTERVAL	DESCRIPTION
3917'	BASALTIC ANDESITE (A/A)
	3915'-3922½' Return to basaltic andesite lava, most common fracs @ 30° & 90° in mod. frac. interval, rock commonly frac'd but unbroken w/thin vnlets wht & grngry clay & clr. zeolites. Lt. brn clay also present but less common in vnlets & fracs., local lt. clay ptl. silicification.
	3922½'-3959' Volcanic breccia (a/a @ 3902). Fracturing decreases from above lava. Light amt of clays fill voids & mnr vnlets. Blue grn, gry grn clays commonly overlain by pale blue clay & may be coated by drusy zeolite (v. fine). Blue clay in vods is often botryoidal. Soft, gry brn clay common in voids. Minor white clay. V. fine acicular to fibrous zeolite(s) (natrolite?) also in vugs/voids ± clay. Small amt. of foliated, clear mineral cleaves into v. thin sheets (@ 3924.5'). No silica. Thin med brn coating of FeOx(?) common on many fracture surfaces & predates clays. Mnr org oxidation (local).
3937'	



Diamond Shamrock
Thermal Power Company

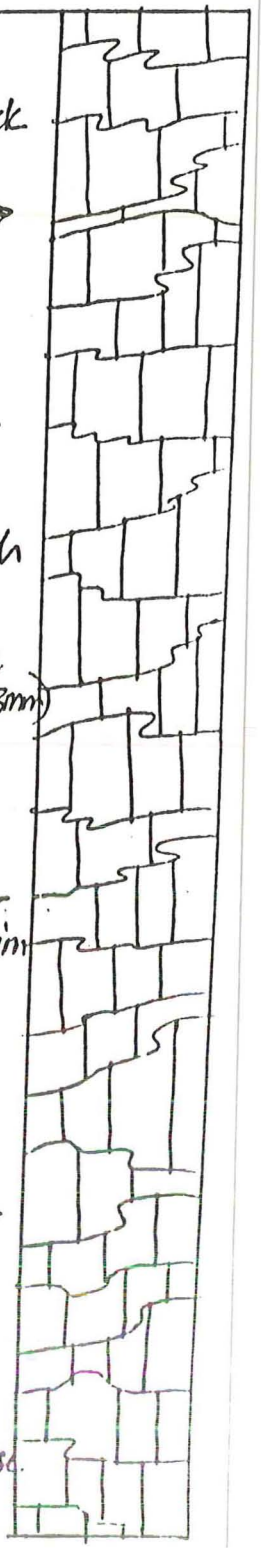
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CLACKAMAS/CASCADES BASIS BINOC. CORE DATE AUG. 1, 1986

DEPTH INTERVAL		DESCRIPTION
3957'	LILL A LMIL A L HM	BASALTIC ANDESITE cont'd VOLCANIC BRECCIA, A/A. 3958'-3959' subtle change in matrix character: med. ash size rock fragments are equigranular with a v. minor fraction of smaller material. Color is gry grn due to common alteration of v. f.s → clay of same color. 3959'-3961' dense b.a. lava, light amt. vesicle filling clays a/a @ 3922½', clr silica also fills vesicles 3961'-3965' Return to Volcanic Breccia with matrix character as @ 3958' 3965'-3982' Dense b.a. lava, commonly fracd @ 50°-70° with very lt. amt grn gry & lt. blue clays ± pale blue (botryoidal) silica on clays (below 3972' rock is finely fracd by tectonic brecciation @ 45° to subvert. most commonly, thin vns (<3mm) & vnlets are common through 3982'). lt. amt. vesicle filling med blue grn, olive grn & gry grn clays above 3972' (base of zone of horizontally flattened (<8mm) vesicles which also contain lt. amt. pale blue/wht silica & or a white zeolite which is occasionally acicular & v. finely fibrous (natrolite?) on rim clays) 3977' 3982'-3984' Return to Volcanic Breccia, no fracs, lt. blue & gry grn clays in vesicles & cavities (± wht zeolite) 3984'-3999.5' Dense basaltic andesite lava, vesicular to 3989½' with gry grn, pale blue clays & clr silica & white zeolite (natrolite?) in cavities & vesicles, local v. lt. FeOx staining adjacent to fractures, minr clays a/a (in vesicles) on fracs plus v. lt. amt soft brn gry clay, fracs. commonly @ 60° & 20°. From 3991'-3997.5': fine (tectonic) fracturing w/ vn & vnlets silica & gry grn clay. From 3997.5'-3999.5': increase in zeolites with increase in vesicles aligned @ 45° (stretched) at unit base



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES / CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS binoc. microscope DATE August 2, 1986

DEPTH INTERVAL	DESCRIPTION
3997'	BASALTIC ANDESITE (A/A)

3999.5'-4010' Return to basaltic andesite breccia, matrix appears finer & denser than most preceding breccias of this kind. Small voids (≤1mm) are filled w/ clays (greens, wht, grn) & zeolites. Clay is common but not abundant. Wht clay & zeolites precipitated after the dk green & blue grn clays. Foliated, clear mineral also in voids (zeolite? gypsum?). (Fibrous & acicular zeolites, less commonly fine, rectangular? form)

4010'- 4029' BASALTIC ANDESITE LAVA (a/a @ 3984')
Generally v. fractured — subvertical, ~40° & 75°-80°. Fracture surfaces show shear. Thin green & blue green "clays" on surface are harder & more brittle than most clays but have no form (i.e. amorphous) are accompanied by thin brittle, clear coating of unidentified material. When scratched the coatings (green & clear) effervesce slightly w/HCl. Silica fills in voids & forms veins in fractures. Veins/voids may be lined w/ blue grn or dk grn "clay," which may have become silicified? (Veins are most often vertical → sub-vertical in orientation). Other veins show green "clays" layered w/ silica in fractures.

4017'

4029'-4044.5 volcanic breccia a/a @ 3995'. Same features & secondary mineralogy a/a. (see following page, also).

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Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICRO. DATE AUG 2, '86

DEPTH INTERVAL	DESCRIPTION
4037'	BASALTIC ANDESITE (AVA)

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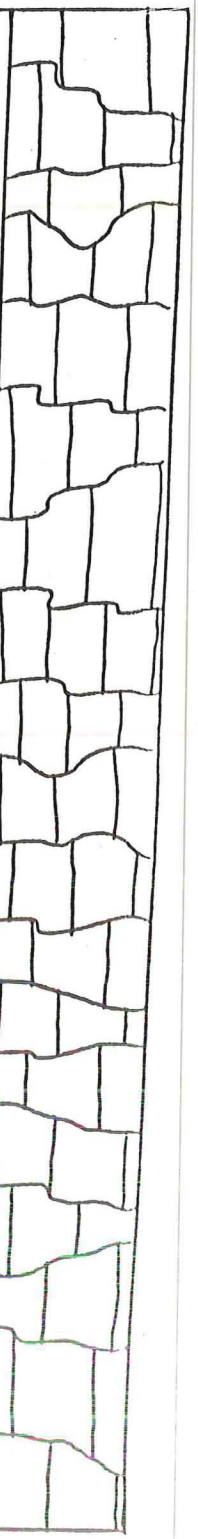
Cont'd VOLCANIC BRECCIA from 4029' to 4044.5
voids, vesicles filled w/ grn clays, zeolites, wht clay & brn gry clay. Voids are often thinly lined w/med grn clay & then coated w/ very fine zeolite(s). DK gry grn "waxy" clay in matrix. Less blue grn clay in this interval than previous ones.

4044.5 - 4068' BASALTIC ANDESITE LAVA
dk-gry, v. sparsely porphyritic with 1% plag & (pyx → clay), dense, fine grained & brittle, moderate & locally heavy fracturing, most commonly at 45° & vertical with lt. to v. lt. dmt 2ndary mins. deposited as thin surface films & less commonly seams. From rim to interior of fracture, a common sequence is gry grn clay (most common) → lt. blue (rare) → wht bacicular radiating fiber clusters (a zeolite = Natrolite?). From 4058'-4062.5' grn gry clays decrease & a thin coat of wht clay ± pale blue clay is predominate. At 4058' a waxy brn clay appears & continues to base of interval. Vesicles are uncommon & v. small (< 1mm) with gry grn clay fillings. Clr silica vns are rare & also intermittent yel. & orange FeOx/limonite is rare adjacent to fracs. Mn clay shear is intermittent. Red clay is sparse & begins @ 4063' as vesicle fill & frac. coating material. @ unit base a film of pale blue botryoidal silica on gry grn clay is present as fracture filling material.

4057'

4068'-4072' Return to Volcanic Breccia, dense & unfractured, vesicles (< 2mm) ptlly filled w/ thin lam gry grn clay covered w/ drusy clr zeolite ± wht fibrous (Natrolite?) zeolite

4072'-4081' BASALTIC ANDESITE LAVA
same as @ 4044.5' w/ less fractures & vesicular top 3', 4072'-4073' has common vert.-subvert. fracs w/ silica vns, lower fracs are @ 45° & vertical, silica ≥ = or > gry grn clay in common vns (< 4mm



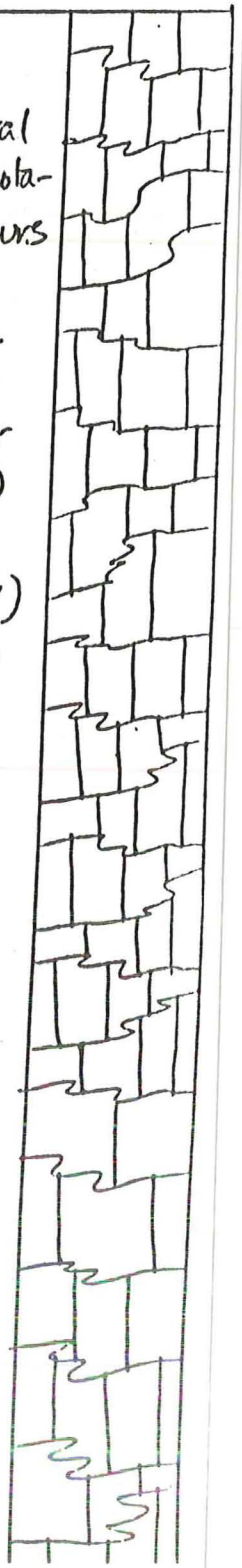
Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 8/2/86

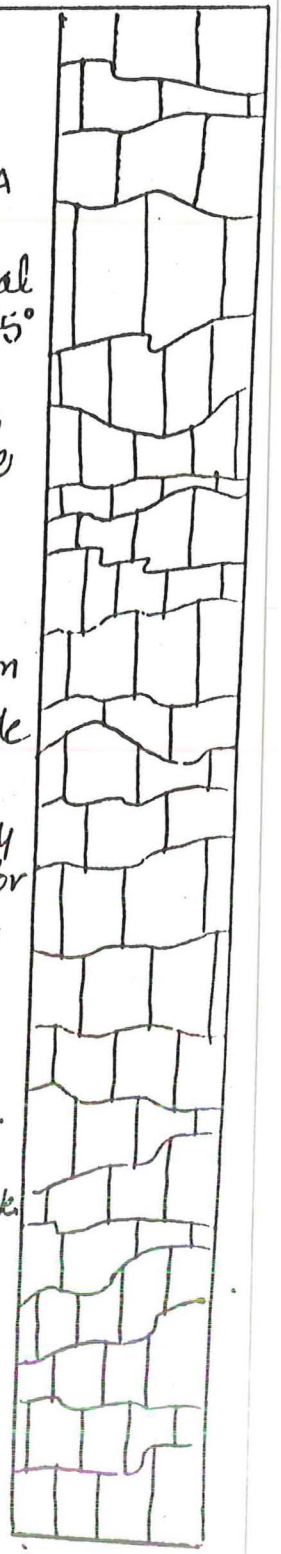
DEPTH INTERVAL	DESCRIPTION
4077'	BASALTIC ANDESITE (A/A)
	4072'-4081' (cont.) BASALTIC ANDESITE LAVA silicified gry grn and rarer lt. blue clays. Vesicles @ top of interval also contain a finely acicular wht fibrous zeolite (natrolite?). A notable increase in vn/fracture coating silica & decrease in clay occurs in this interval.
	4081'-4089' Return to Volcanic Breccia a/a @ 4068', very lt. or no fracture, lt. amt. 2ndary mins in vesicles, gry grn clay in small (< 1mm) more common vesicles & clr fibrous zeolite in larger (2-5mm) relatively sparse vesicles on ± gry grn clay (thin coating)
	4089'- 4105' BASALTIC ANDESITE LAVA (a/a @ 4072') Rock is fractured but generally consolidated, with broken/fractured intervals. Fractures are commonly filled w/ grn blue "clay" & gry grn "clay" or silica, & are oriented in vertical to sub-vertical direction (i.e. high angle to core length). Clays & silica are also in small voids & silica appears to replace some clay. Fracture surfaces have thin coating of above grn clays, plus a translucent whitish coating that is relatively soft, thin & brittle. HCl causes weak effervescence of green/blue grn "clays." Darker gry clays were deposited first, followed by blue green, then silica or translucent whitish material described above. Mnr. shear on fracture surfaces. (wht clay also present on frac. surf.)
4097'	
	4105'- 4122' BASALTIC ANDESITE VOLCANIC BRECCIA (A/A @ 4081') Rare fractures: 0-20°, & ~75°. Vesicles & small voids filled predominately w/ white zeolites & wht clay. Lesser blue grn, gry brn clays. Gry Grn also v. common. Veins filling fractures are commonly dry green clay (thin coating) along walls, w/a drusy lining of very fine zeolites, & filled w/ white clay (from zeolites). Wht clay dissolves
4117'	



CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/McDANNEL
FIELD CASCADES/CLACKAMAS BASIS BINOC. MICRO. DATE AUG. 3, '86

DEPTH INTERVAL	DESCRIPTION
4117'	BASALTIC ANDESITE (A/A) 4105'- 4122' VOLCANIC BRECCIA (cont'd) 4122'-4125.5' - BASALTIC ANDESITE LAVA [A/A @ 4072'] Clays & silica form small veins following fracture. Fracture predominately vertical & sub-vertical, but includes near horizontal & 45° orientations. Clays are predom. blue grn. White clay less common. Clays & silica also fill voids (vesicles). Some clay appears to have been silicified/replaced by silica. 4125.5'-4137' VOLCANIC BRECCIA [A/A @ 4105'] med gray to dk gray, ± vesicular (<1cm in w/common 2mm voids) r.f.s. in basaltic andesite matrix of grayish shade
4137'	± red brn matrix a/a, irreg-break ⊥ to & w/ v. few fracs, v. lt. amt 2ndary mins w/ many empty vesicles, vesicles (larger (>2mm) commonly rimmed by gry grn clay then either clr/lt gry drusy zeolites & or wht acicular radiating fibers in spheroidal clusters (natrolite) = a zeolite, smaller vesicles commonly filled w/ clay of one color or horizontally laminated sequence of clays. eg: med brn - blk - blue grn - lt blue (chert) & clr/wht drusy zeolite & - soft brn gry clay. Clays are locally silicified though no silica was observed. Rare microscopic copper flakes on zeolites or clays in larger open vesicles. The rare fracs have gry grn clay & wht fibrous zeolite. 4139'-4143' BASALTIC ANDESITE LAVA [A/A @ 4122'] relatively unfrac'd w/ irreg ⊥ break, rare fracs w/ coatings gry grn clay ± clr/lt gry drusy zeo. ± wht fibrous zeo., vesicles coated w/ same materials as fracs + lt blue clay & soft brn gry clay, sparse silica vns (+ vesicle fillings) also are present (<5mm x <30mm, pale blue)



Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES / CLACKAMAS

GEOLOGIST (S) McDANNEL/GOODWIN
BASIS ~~binocular microscope~~ DATE 8/4/86

DEPTH INTERVAL		DESCRIPTION
4157'	LALMLA	BASALTIC ANDESITE (A/A) 4143'-4175' continued Volcanic Breccia: common red-brn & lt. brn as well as grayish matrix, unfrac'd exc. irreg. break @0°+90°, soft brn gry clay common in larger vesicles & break zones, Endary material in cavities & sm. (<2mm) vesicles is v. lt. amt. Many cavities have only v. thin coatings. The most common vesicle rim → interior sequence is: gry grn clay → ± clr drusy zeolite → ± wht fibrous zeolite → ± soft brn clay. Also present are pale grn yel, olive grn, & blue grn clays as vesicle fill in mnr amts. Mnr amt gry grn botryoidal drusy zeolite is also present in larger vesicles.
4177'	L	4175'-4210' BASALTIC ANDESITE LAVA Breccia (above) passes into vesicular top (~4') of basaltic andesite lava. Vesicles filled w/ blue grn clay, dk gry grn clay (which underlies blue grn clay in some vesicles), silica, &/or zeolites. Dk gry grn to dusky blue grn clay most common & is pervasive throughout rock. Silica is wht to lt. blue & may replace blue grn clays. Zeolites include v. fine drusy crystal coating, acicular & radiating fibrous habits. (Medium hard botryoidal coating may also be silica). Zeolite may coat silica (which coats clays) in some vesicles. Fracture is generally light & 55° or 75°-80° ∠. 4183'-4187' rock is brecciated (tectonically) slightly, w/ dusky blue grn clay & less commonly, silica filling fractures. 4185'-4188' ~50° fracture angle common, 30° less common. slight shearing on fracture surfaces 4188'-4190.5' increase in vesicularity = increase in clay & silica

Diamond Shamrock
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Form 2

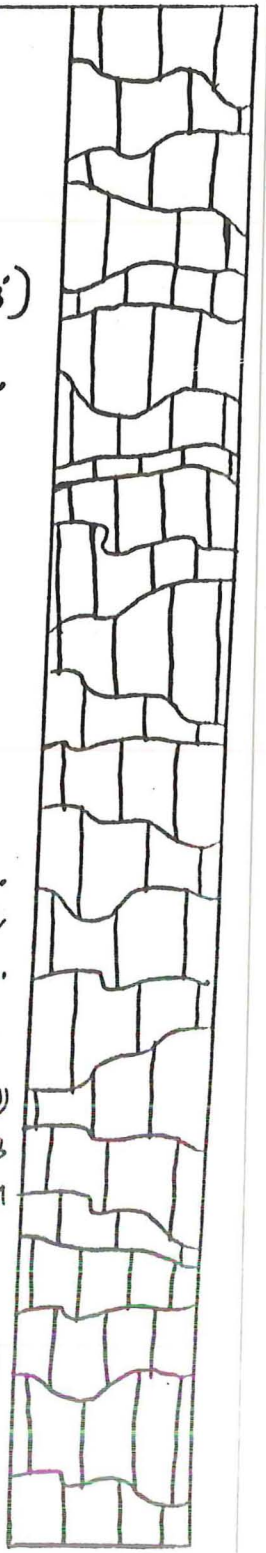
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN / MCDANNEL

FIELD CASCADES / CLACKAMAS BASIS binoc. microscope DATE 8/10/86

DEPTH INTERVAL	DESCRIPTION
4197'	BASALTIC ANDESITE (A/A) 4193'-4201' - silica fills increased void space
4212	
4207	4210'- 4217.5' (BASALTIC ANDESITE) VOLCANIC BRECCIA (a/a @ 4148') Voids are generally only coated/filled w/clays, mnr zeolite. Silica is present only in trace amounts. This is in contrast to above lava unit.
4212	
4217'	4217.5'- 4232' BASALTIC ANDESITE (LAVA FLOW) Med gray - med dk gry - med bluish gry. Sparsely porphyritic w/ phenos of plag, mafic phenos ox. ⇒ red clay. Unit is brecciated (tectonic/secondary brecciation) between 4217.5'- 4224', but consolidated. Unit is lightly to mod. fractured w/ most common direction 30°, less commonly vertical. Mnr shear on fracture surfaces. Grayish blue grn to dusky blue grn "clay" is pervasive throughout rock, most noticeably on fracture surfaces & between breccia fragments. Wht clay is common & typically overlies grn clays. Secondary FeOx (± hydrous FeOx?) yel brn & red brn common on fracture surfaces & as wispy stains throughout core, typically following hairline fractures. No silica found in this unit.
4222	
4227	
4232	
4237'	



CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 8/11/86

DEPTH INTERVAL	DESCRIPTION
4237'	BASALTIC ANDESITE (cont'd)
	4232'–4255' VOLCANIC BRECCIA
	Dk gry to dk grnish gry, vesicular to dense blocks & lapilli of basaltic andesite in basaltic andesite matrix (which is v. ashy from 4232'–4236'). At 4236' breccia becomes mottled dk gry–med gry & red brn & less ashy. Dusky gry grn clay common in small voids/vesicles. Blue grn clays less common, generally. Zeolites commonly fill voids lined by clays & have drusy, fibrous (± radiating) & foliated habits; clear to white in color. Tr silica
	4231'–4241' increase in vesicles w/lava (a/a @ 4217.5) common. Vesicles may be as high as 10–15% of the rock. This interval is marked by an increase in clays a/a, zeolites, & silica. Also dk yellowish grn clay common as vesicle coating in this interval. Rare pyrite.
4257'	4251'–4255' increase in red brn ashy matrix
	4255'–4267' BASALTIC ANDESITE LAVA
	dense, med gry to med dk gry, v. sparsely porphyritic, 1% phenos plag & pyx → gry grn clay (≤1mm); lt. amt. matrix alt → gry grn clay & FeOx (red brn) mixed w/clay; lt. to mod. fracturing most commonly @ 20°–55°, common micro frac/unbroken fracs. @ subvertical with clay seams/coatings (<1mm thick); fracs commonly coated w/ v.f. amt. gry grn clay (& lt. waxy shear) ± gry yellow soft clay ± yel. & red limonite stain ± wht powdery or botryoidal zeolite (latest 2ndary min. deposited); v. few vesicles
	4267'–4271' VOLCANIC BRECCIA
	same a/a @ 4232'
	4271'–4282' BASALTIC ANDESITE LAVA
4277'	med gry, sparsely porphyritic, vesicular to 4274', dense to 4277', vesicular

Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH1 GEOLOGIST (S) McDANNEL/GOODWIN
FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 8/12/86

DEPTH INTERVAL | DESCRIPTION

4277'

BASALTIC ANDESITE (continued)

4271'-4282' BASALTIC ANDESITE LAVA
basal 2' with mnr 2ndary alt. relative to top of unit, fracs lt. @ 30°-45° w/ v.lt. gry/gry clay, 2ndary material common in vesicles: a common sequence includes (anus. (horizontal) or rim → interior of 2-3 of the following: gry/grn clay → mod. blue/grn clay → pale blue botryoidal silica → clr foliated drusy zeolite → gry/yellow soft clay → wht fibrous zeolite +/- soft brn gry clay. These materials fill (most common) or completely fill the ≤20 mm vesicles. Towards the center of unit silica vns increase. (≤8 mm x 40 mm).

4282'-4287' VOLCANIC BRECCIA
same as above at 4232', unfractured, v.lt. amt. 2ndary material in v.f. vesicles: gry/grn clay +/- pale blue silica +/- wht fibrous zeolite

4287'-4298' BASALTIC ANDESITE LAVA
same as above at 4271', common fractures at subvertical & 60° w/ v.lt. amt. secondary mins: grn/gry clay ± orange & yellow FeOx stain (in clay mixed) ± botryoidal pale blue silica (also present in mnr vns); clay locally yel/gry & waxy

4297'

4298'-4300' VOLCANIC BRECCIA a/a @ 4282'
v.lt./No matrix, v.lt. amt 2ndary mins in vesicular v.fs.: (rim → interior) yel/gry clay +- clr/pale blue silica +- wht fibrous (-radiating) zeolite

4300'-4305' BASALTIC ANDESITE LAVA
a/a @ 4287', vesicular to 4302½', v.lt. 2ndary material in vesicles (≤5 mm): pale blue botryoidal silica +- gry/grn clay ± wht fibrous zeolite; mnr blue/gry & olive/gry clays also present.

4305'-4309' VOLCANIC BRECCIA
a/a @ 4298', unfrac'd, com. vesicles w/ v.lt. amt 2ndary material: rim → gingry clay ± pale blue botryoidal zeolite ± foliated clr drusy zeolite ± wht fibrous zeolite, common 10 mm cavities at base of unit w/ only film of zeolite on walls

4309'-4314' BASALTIC ANDESITE LAVA

4317'

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Form 2

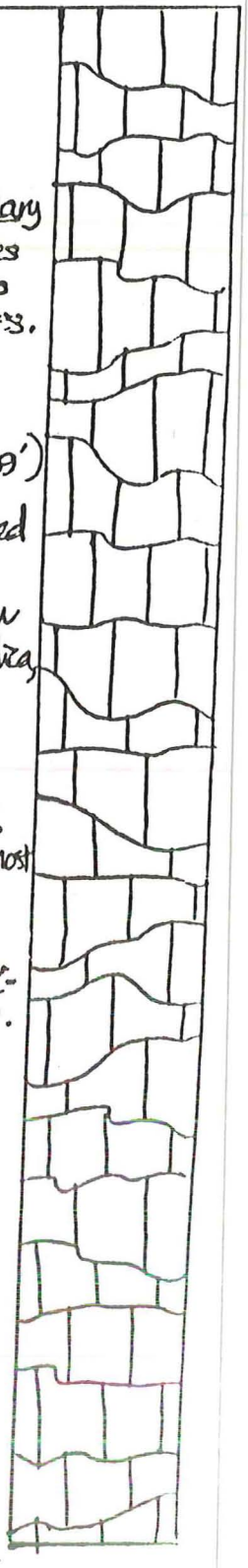
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE 8/12/86

DEPTH INTERVAL	DESCRIPTION
4317'	BASALTIC ANDESITE (A/A)
	4309'-4314' (cont'd) BASALTIC ANDESITE LAVA Moderately fractured. Brecciated (tectonically) but breccia is consolidated. Fracture direction predominately vertical-subvertical; less commonly 45°. Grn clays (as described above @ 4300') are predominate 2ndary alteration/mineralization. Clay & silica & zeolites form veinlets & fill small voids. (Botryoidal & fibrous zeolites). Shear is common on fracture surfaces.
	4314'-4315.5' VOLCANIC BRECCIA (A/A, @ 4305') gry to red brn matrix & lapilli.
	4315'-4321½ BASALTIC ANDESITE LAVA (A/A @ 4309') (all lavas & breccias in this unit (4 thick units) are sparsely & finely porphyritic w/ plag. & mafics which have altered to clay → commonly dusky green) Lava is very vesicular (25%) to 4318.5'. Vesicles filled w/ green clays (as described @ 4300' & previously...) & zeolites, silica, with clays deposited prior to silica &/or zeolites.
4337'	4321½'-4330' VOLCANIC BRECCIA med dk gry & minor red brn. Unit is relatively dense. Grn clays (blue) predominate as 2ndary mineral. (Still have slight effervescence w/ HCl). White zeolite, most commonly fibrous. Trace of small yel brn-orng FeOx, often at site of magnetic sulfide. Habit is tabular to thin sliver; bronze color (On fracture surfaces. May be superficial material washed into hole).
	4330'-4338' BASALTIC ANDESITE LAVA (A/A) Secondary mineralization: grn & blue clays/zeolites/silica/trace of metallic % @ 4325. Unit is very fractured, predominately vertical to sub-vertical; less commonly horizontal. V. minor shear on surfaces.
	4338'-4379' VOLCANIC BRECCIA med. dk gry & minor red brn. Dense & few fractures. Most common frac. is irregular subvertical break with very light or no 2ndary mineralization, most commonly dusky grn clay. Small (≤ 6mm) vesicles have lt. amt. to mod. amt. 2ndary material - most commonly dusky grn clay and/or fibrous zeolite (± radiating). 2ndary material in vesicles
4357'	



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Form 2

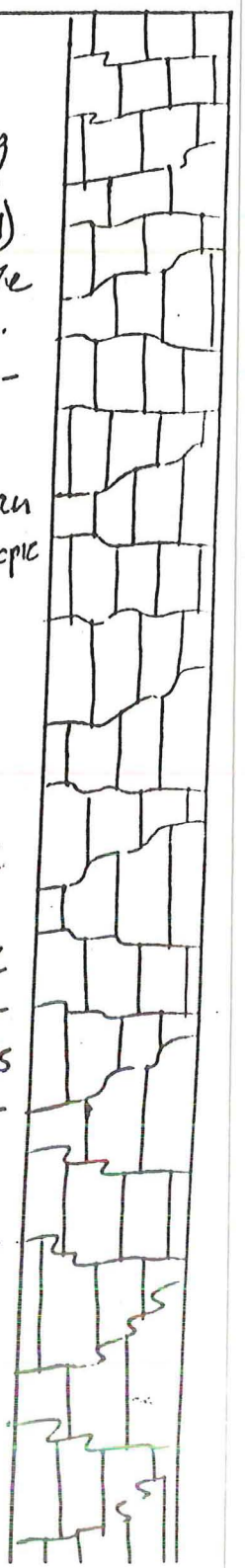
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 8/13/86

DEPTH INTERVAL	DESCRIPTION
4357'	BASALTIC ANDESITE (continued) (BA)
	4338'-4397' VOLCANIC BRECCIA (continued) include many possible combinations from rim to interior of the following material/minerals: dusky grn clay (less common are dusky blue grn & yellow gry clays) +/- pale blue botryoidal zeolite +/- clr drusy (+/- botryoidal) zeolite +/- wht radiating v.f. acicular fibrous zeolite --> wht clay. The fibrous zeolite is intermittently very common over 6" to 12" intervals. Less common is intermittent fracture & vesicle fill of pale blue (+/- botryoidal) silica (eg. of occurrence in vesicles within dense lava blocle from 4349' to 4353'). 4369' to 4396' is gradational to lower lava flow with common vesicular blocks with larger (≤1cm) cavities than upper unit, most of which have v. minr 2ndary mins. @4348.5' microscopic native copper flakes are present on zeolites/clays coating fracture.
4377'	4376'-4390½' BASALTIC ANDESITE LAVA med. dk gry, aphyric to v. sparsely porphyritic (<1% phenos plag, +/- pyx → FeOx and/or gry grn clay), v. lt. amt 2ndary mins. in dense unit w/ lt. (generally) fracturing @ variable attitude (15°, 45°, 80°). Vesicles absent. Fracture fill/veinlets include gry grn clay rims +/- pale blue (+/- botryoidal) silica (consolidated), 4376'-4384' lt. amt. tectonic brecciation (but rock remains unbroken) with clay-silica in v. thin inlets with sub-vertical attitude. Lt. amt. FeOx (lt. olive brn & med. red) mixed w/ clay near base of interval adjacent to fractures.
	4390½'-4397½' VOLCANIC BRECCIA same as above @ 4338', med. dk gray, dense with sparse to moderate small (≤5mm) vesicles, vesicles filled v. to completely w/ lt. amt. +/- gry grn clay +/- gry grn clay +/- wht/v. pale blue botryoidal zeolite +/- soft moderate brn clay, unit is unfractured.
4397'	



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Form 2

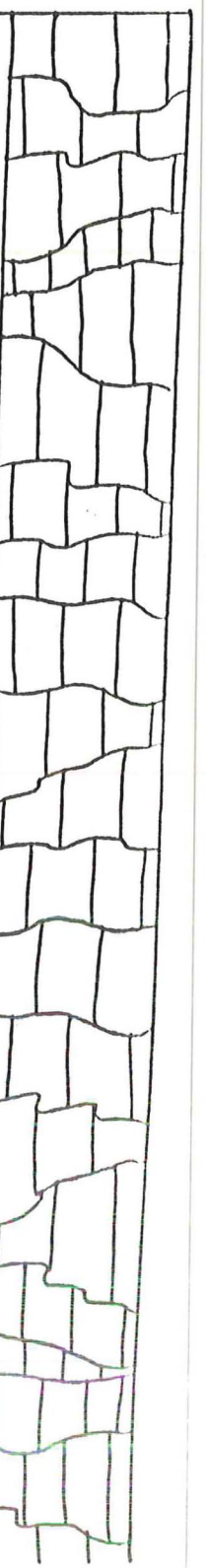
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE 8/13/86

DEPTH INTERVAL	DESCRIPTION
4317'	BASALTIC ANDESITE (A/A)
	4349.5' - 4426' BASALTIC ANDESITE LAVA
	Med - med dk gry dense basaltic andesite. Sparsely porphyritic. Phenos ≤ 2mm of plag, pyx? → clay. Light to moderate and locally heavy fracturing; variably oriented fracture. Unit is brecciated (tectonically) with short (1'-2') unbrecciated intervals (rare). Blue grn & dusky grn "clay" is predominate 2ndary mineral/alteration. Clay, silica & fibrous zeolites fill fractures & voids. Clay common on fracture surfaces.
4417'	4426-4442' VOLCANIC BRECCIA. (ABRUPT CONTACT)
	DK gry - med gry w/ Red brn. VESICULAR TO DENSE (HUNKS SCORIA) LAPILLI & LESS COMMONLY, BLOCKS OF BASALTIC ANDESITE IN MINOR ASHY MATRIX. WELL INDURATED. VOIDS & VESICLES LINED OR FILLED BY LT BLUE TO LT BLUE GRN CLAY, BOTRYOIDAL WHT ZEOLITE, FOLIATED WHT-CLEAR ZEOLITE. DUSKY GREEN & GRY GREEN "CLAY" (BRITTLE) ON FRACTURE SURFACES; WHT ZEOLITE (FOLIATED). WITH DEPTH A FINELY ACICULAR RADIATING ZEOLITE ALSO APPEARS IN VESICLES. THE PREDOMINATE 2ndary material in INTERVAL are GRY GREEN CLAY & FOLIATED WHT-CLEAR ZEOLITE. VESICLES are rarely 10mm and commonly ≤ 2mm. FRACTURING is v. lt. through interval with irregular breakage @ 15°-30° & 70°-90°. 6" rubble zone occurs at base of unit.
4437'	



CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH1 GEOLOGIST (S) MCDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE 8/14/86

DEPTH INTERVAL	DESCRIPTION
4437'	BASALTIC ANDESITE (A/A)
	4426'-4442' VOLCANIC BRECCIA
	4442'-4445½' BASALTIC ANDESITE LAVA med. dk gry, dense, aphyric, 8-15% 5-30mm commonly horizontally stretched vesicles with lt. to mod. 2ndary mins. Cavities & vesicles commonly lined with gry olive grn clay (less commonly gry yel. grn or dusky yel. brn), ± aclr foliated zeolite ± pale blue (± botryoidal) silica. Core breaks commonly with irregular surface @ 45°-70°. A film of dk brn ± grn gry clay is often present on break surface.
	4445½'-4449' VOLCANIC BRECCIA A/A @ 4426' with 2ndary vesicle-filling material consisting of gry grn clay ± clr drusy zeolite ± pale blue botryoidal silica
	4449'-4451½' BASALTIC ANDESITE LAVA A/A @ 4442' with rubbly top 1'. 2ndary mins in vesicles and veins are dominated by pale blue botryoidal silica & include gry grn & pale blue clays ± opalescent pale blue silica ± wht acicular radiating zeolite.
4457'	
	4451½'-4454' VOLCANIC BRECCIA A/A @ 4445½' with 2ndary mins commonly lining vesicles in the following sequence: gry grn clay ± lt. blue clay ± pale blue botryoidal silica ± wht radiating acicular zeolite (a good example is @ 4451½' in a large cavity)
	4454'-4463.5' BASALTIC ANDESITE LAVA A/A @ 4449', irreg. fracture @ 45° to 70°, 2ndary material confined to vesicles & consists of dusky grn (less com. brn) clay ± pale blue botryoidal silica (predominate material) ± wht radiating acicular zeolite (also v. common) ± (less common) soft mod. brn clay. Interval is 8-10% ≤ 10 mm vesicles with common ptl. to complete 2ndary fill. Silica vns also present but less common.
	4463.5'-4477.5' VOLCANIC BRECCIA gradational contact into volcanic breccia from above unit. Med dk gry w/ mor red brn near contact. Unit is generally
4477'	

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Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN/MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. SCOPE DATE 8/14/86

DEPTH INTERVAL	DESCRIPTION
4477'	BASALTIC ANDESITE (A/A) (cont'd from pg. 99) & less commonly, clear druzy zeolites fill voids & vesicles 4477'-4490' BASALTIC ANDESITE FLOW gradational with above unit. Med gry. dense. Sparse flattened vesicles near top of flow are filled w/clays & silica. Dusky green & blue grn clays line vesicles, or fill bottom of vesicles, and are overlain by silica. Minor fractures (vertical) filled w/ grn clays & silica. Fracture surfaces may have Fe_2O_3 red brn stain or minor red brn clay. Yell brn "limonite" stain less common. Lt grn clay less common than above clays. Predom. frac. direction 250-30°.
4490'	4490'-4495' VOLCANIC BRECCIA med dk gry & v. minor red brn. Lt/pale blue clays (may be bentonitic) & green clays fill vesicles & voids. Zeolites also fill vesicles/voids & include clear druzy, clear foliated, & white fibrous habits. Fibrous are coats or covers others & silica, when present. Silica common.
4497'	4495'-4503.5' BASALTIC ANDESITE FLOW Gradational contact into vesicular, med dk gry-med gry basaltic andesite flow. Stretched/flattened vesicles filled w/ blue grn & gry grn clay, zeolites (c/a). No predom. fracture direction. Shear is visible along most fracture surfaces, forming hard brittle coating from above clays. Red brn Fe_2O_3 stains common on fractures. Rare orange Fe_2O_3 specks on fracture surf. suggesting oxidation of iron mineral.
	4503.5'-4515' VOLCANIC BRECCIA Dk gry, blk, red brn. More grey textured than previous vol. breccia. Lt blue & bluish white clays predominate as void & vesicle fill.
4517'	

Diamond Shamrock
Thermal Power Company

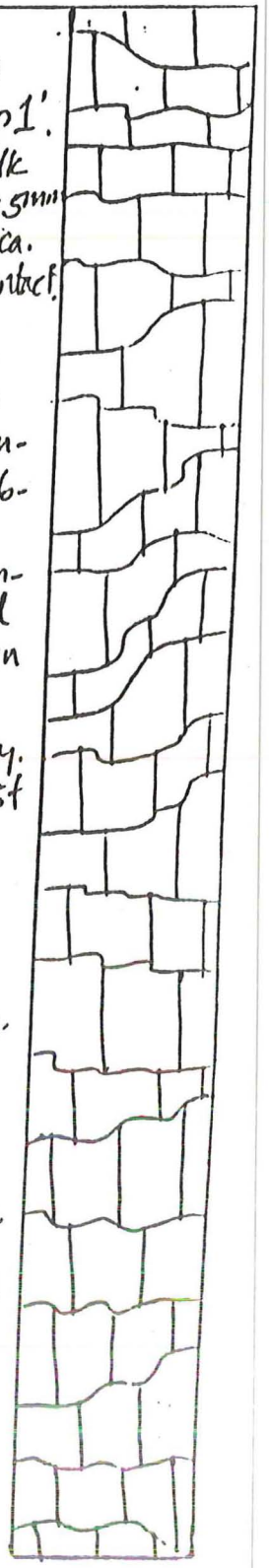
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) McDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROFORE DATE Aug. 14, '86

DEPTH INTERVAL	DESCRIPTION
4517'	4515'–4519' BASALTIC ANDESITE FLOW Dk gry–med gry, dense. Gradational contact with above unit. aphyric. Sparse ≤20mm vesicles (stretched @ 0° to 45°) in top 1'. Lt. to mod. frac.–irreg. @ 45° to 90° w/ lt. shear film of red brn FeOx +/– dk gry grn clay. Parting @ 90° + 0° w/ vnlets of frac.-fill material. In ≥5mm cavities pale blue silica predominate. In smaller vesicles lt. grn clay +/– silica. Base is sparsely porphyritic w/ 2-3% plag. phenos. Sharp brecciated contact! 4519'–4529' VOLCANIC BRECCIA (BASALTIC ANDESITE) brn gry & med gry b.a. lava lapilli- and less commonly, block-sized r.f. in mod. red brn ash-sized matrix of b.a. r.f.s, common grn tinge due to abundant gry grn clay in common sm. (≤1mm) irreg. matrix vesicles. Fracs. lt. to absent with most common at 45°–70° with red brn FeOx stain. Vesicles are commonly ≤5mm and lined with clay, zeolites, and silica. Partial to complete vesicle fillings from rim → interior include: v. lt. gry/clr botryoidal (+/– drusy) zeolite +/– dk olive grn/blue grn/gry gry clays +/– v. fine disseminated grn stumpy zeolite w/ prismatic habit +/– clr (locally brn stain) foliated zeolite +/– rare wht acicular zeolite +/– pale blue (+/– botryoidal) silica +/– yel gry clay. Clays → foliated zeolite + wht acicular zeolite, or clays → silica are most common linings/fillings. 4529'–4553' BASALTIC ANDESITE LAVA med dk gry, aphyric. Top 13' is transitional with intermittent narrow breccia intervals. Commonly vesicular to 4548' (2–15%, commonly hor. elongate, 2–15%) with increase in zeolitic minerals due to available pore-space increasing. Pt. to complete vesicle and cavity fillings of gry gry clay + pale blue silica + wht acicular zeolite are most common. Zeolitic material in linings & horizontal bands includes: clays (gry gry, blue gry, olive gry, yel gry, blk) +/– clr foliated zeolite +/– pale blue botryoidal silica +/– wht radiating fine needle zeolite. Silica is most abundant zeolitic material. Rare limonite (yellow to r. red) oxidation bands (2mm wide) in matrix adjacent to fracs. Fracs. v. lt. with variable ∠ but 45° most common. Mnr film FeOx'ed brn +/– gry grn clay w/ lt. shear on fracs @ 4532': mic silica stalactites. @ 4540'–4542' mic acicular & foliated zeolites w/ 2mm xtals (big!).
4537'	
4557'	4553'–4565' VOLCANIC BRECCIA (BASALTIC ANDESITE)



Diamond Shamrock
Thermal Power Company

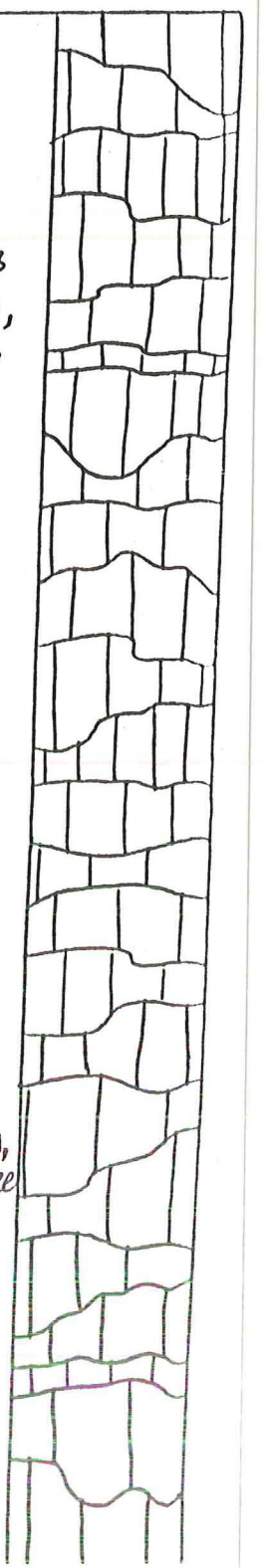
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH-1 GEOLOGIST (S) GOODWIN / MCDANNEL

FIELD CASCADES/CLACKAMAS BASIS BINOC. MICROSCOPE DATE Aug. 15, '86

DEPTH INTERVAL	DESCRIPTION
4557'	BASALTIC ANDESITE (A/A) 4553'-4565' VOLCANIC BRECCIA (contd) Dense med to dk gry. Blocks & lapilli of aphyric - sparsely porphyritic basaltic andesite (dense to vesicular) in minor matrix of basaltic andesite lava. Green & blue green clays commonly line vesicle walls & are overlain by zeolites (clear druzy, v. pale blue botryoidal, fibrous). Fibrous, white zeolite is last 2nd mineral to be deposited. Silica fills vesicles locally. Black (actually v. deep green when disaggregated) clay fills vesicles lined by green clay beginning @ 4559'. 4565'-4571' BASALTIC ANDESITE (LAVA FLOW) Gradational contact w/above unit. Lava is aphyric, med to med dk gry. Vesicular near top but quickly becomes dense. Vesicles are lined or filled w/grn & blue grn clays, & commonly may be overlain by zeolite (druzy, fibrous) or silica. Lt. coating of blue grn clay on fracture surfaces. Fracturing generally is light & is oriented vertically, horizontally & rarely 30°. ("Black" clay, a/a, also common). 4571'-4591.5' VOLCANIC BRECCIA a/a @ 4553', but w/ larger number of vesicles/void spaces. Grn clays, a/a, fill or coat vesicle walls. Clay generally is light in this interval. Zeolites common, particularly white fibrous one (is dominate). Appearance of grn clay & grey blue clay, typically thin brittle coating. Grey blue may be botryoidal. Fracture is horizontal ± sub-horizontal. 4591'-4596' - BASALTIC ANDESITE (LAVA FLOW) Gradational contact w/above unit. Flow is dense, aphyric. Sparse vesicles lined/filled w/green & "black" clay; typically accompanied by white zeolite or silica
4577'	
4597'	



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Thermal Power Company

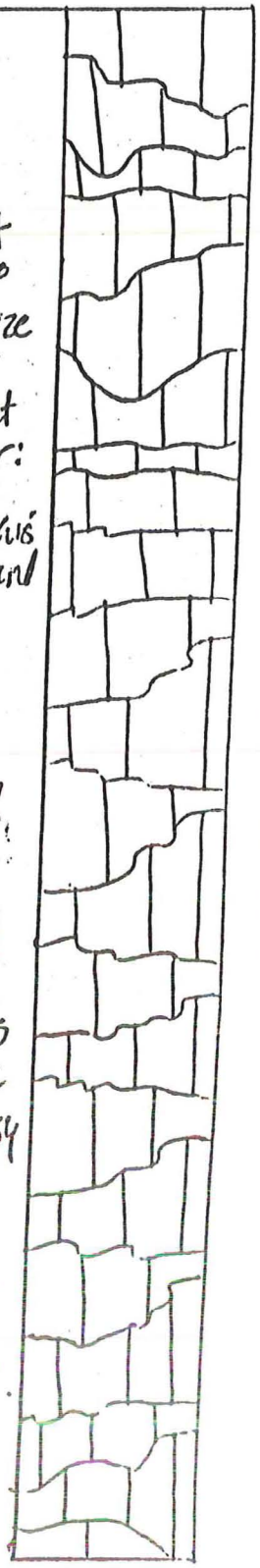
Form 2

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTG11-1 GEOLOGIST (S) MCDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BINOC. SCOPE DATE Aug 15, 1986

DEPTH INTERVAL	DESCRIPTION
4597'	**BASALTIC ANDESITE (A/A)**
	4596'-4616' VOLCANIC BRECCIA
4602'	Med-dk gry, red brn. Breccia is vesicular & has a more open texture than breccia @ 4553'. Secondary mineralization light & includes grn & blue grn clays, wht zeolite (fibrous). Fracturing is uncommon with mvr and (@ ~45° (sinuous) without 2ndary min. deposition. Vesicles are ≤ 6mm in size and commonly ≤ 3mm and rarely completely filled except when silica is the most recent cavity filling. All vesicles/cavities generally have a light coating of gry grn clay +/- the following materials toward the interior: +/- lt. tanned. blue clay +/- gry botryoidal zeolite +/- clr drusy zeolite +/- wht radiating acicular zeolite. The wht zeolite is predominate in this sequence. Silica rarely occurs with any zeolite except the wht acicular zeolite and is also common.
	4616' - 4620' BASALTIC ANDESITE LAVA
4617'	med dk gry, dense, aphyric to v. sparsely porphyritic with plag & pyx. phenos., Rare fracturing is @ 45° and irregular. No 2ndary material is present on fractures. Vesicles are ≤ 10 mm in size and commonly < 1mm. Again clays initially rim vesicles followed by zeolites and/or silica. Silica and the wht acicular zeolite (natrolite?) are predominate and overall 2ndary mineralization is greater than preceding breccia, though still light. A common rim → interior sequence of vesicle filling materials is: gry grn clay +/- lt. blue clay +/- pale blue botryoidal zeolite (more opaque than the commonly opalescent silica) +/- pale blue botryoidal silica +/- clr drusy zeolite +/- wht acicular (radiating) zeolite (locally chalky).
	4620'-4630' VOLCANIC BRECCIA
	A/A @ 4596'. Fract's virtually absent w/ mvr FeOx red brn stain. Cavities, as in the preceding lava, are ≤ 10mm with < 2mm vesicles more common. Cavities and vesicles are commonly partially filled w/ lining or bands of 2ndary mins as described above @ 4616'. Silica may completely fill vesicles but zeolites rarely do. Clays include gry grn, blue gry, blk, & yel. gry varieties. Alteration remains light.
4637'	4630'-4636' BASALTIC ANDESITE LAVA



Diamond Shamrock
Thermal Power Company

Form 2

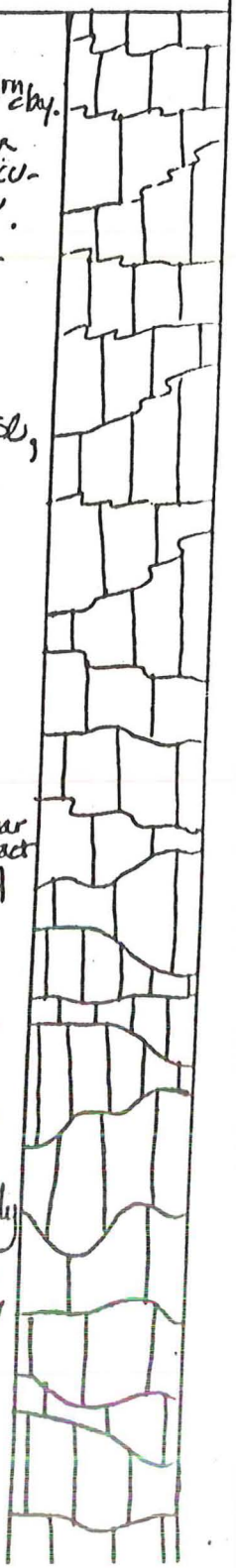
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) MCDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS binoc. microscope DATE 8/16/84

DEPTH INTERVAL	DESCRIPTION
4637'	A BASALTIC ANDESITE (A/A)
	4638'-4646' BASALTIC ANDESITE LAVA (continued) ±3grn/bby. med. dk gry, aphyric, dense, lt. frac. @ 70° w/ dk red brn film/stain, frac less common @ 30° & 45°. 2ndary mins. concentrated in top 1½', vesiculated lava. Vesicles rarely 10mm, commonly ≤ 3mm, 4-10% above 4632'. Silica is predominate. Linings include yel. gry, gry grn, & blue gry clays, clr drusy zeolite & pale blue (& botryoidal) silica.
	4636'-4649' VOLCANIC BRECCIA Gradational contact w/ above unit. Med-dk gry. Dense, few lapilli w/ vesicles. Alteration is pervasive but light. Clays & zeolites fill small (<2mm) voids. Clays are predominate & include grn, blue grn & lt blue (may be botryoidal) & black (actually is very dark grn). Most common zeolite is white, fibrous
	4649'-4658.5 BASALTIC ANDESITE (FLOW) Gradational contact. Lava is dense, aphyric. Green clays common throughout rock & often replace mafic minerals. Sparse, small (≤5mm) vesicles are lined with clay, which may be coated with silica. ~3cm void near contact filled w/ V. pale blue silica. Unit, sometimes brittle, grn & blue "clay" on fracture surfaces, & may show minor shear. Dusky red hematitic "clay" also on fracture surfaces & becomes common by 4652', accompanying blue & grn clays. Lt. green, soft clay on shear surface. Fracturing is low angle (horizontal to 75°) &, less commonly, vertical.
4657'	
	4658.5-4694.5' VOLCANIC BRECCIA Gradational w/ above unit. Med gry-red brn. Generally dense (minor vesicular lapilli). Lt blue clay appears most common secondary mineral but is not abundant. Alteration light. Grn clays, blue grn clays; foliated drusy, & fibrous zeolites. Vesicles commonly lined/filled in this order (vesicle wall → interior): dk grn or blue grn clay / lt green / drusy or foliated zeolite / fibrous zeolite. Minor black, blue, unit silica (more common with depth) min
4677'	



Diamond Shamrock
Thermal Power Company

Form 2

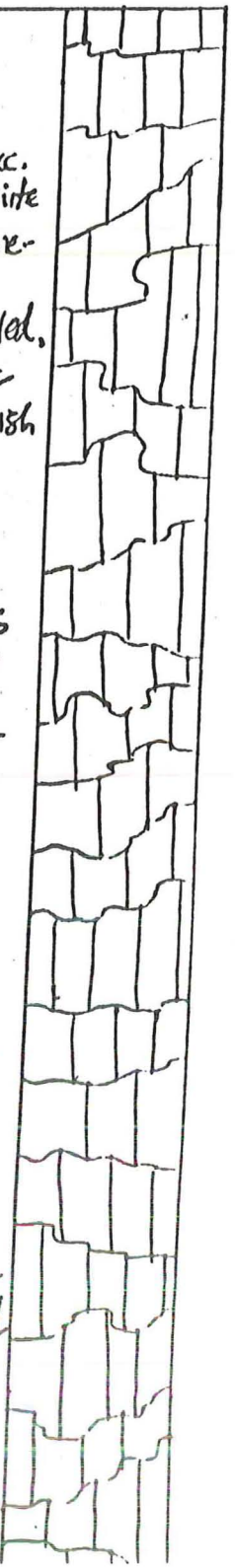
CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH 1 GEOLOGIST (S) MCDANNEL/GOODWIN

FIELD CASCADES/CLACKAMAS BASIS BINGC. MICROSCOPE DATE 8/17/86

DEPTH INTERVAL	DESCRIPTION
4677'	BASALTIC ANDESITE (A/A)
	4658.5'-4694.5' VOLCANIC BRECCIA (continued) soft brngry clay. Vesicles are commonly ≤ 2mm. Cavities are intermittent and ≤ 20mm. Cavity filling is similar to vesicles exc. pale blue (± botryoidal) silica is common on clays lining voids. The white fibrous (radiating) zeolite is the most common cavity fill material and generally occurs on the interior except @ 4688' where a dusky yel. grn v. fine spheroidal clay?/zeolite? is present. While cavities are partially filled, vesicles (≤ 2mm) range from completely filled to barren & often are partially filled - most commonly with gry grn clay, giving the rock a grnish tinge. Basal contact is gradational.
	4694.5'-4707' BASALTIC ANDESITE LAVA med. dk. gry, aphyric to v. finely phaneritic, dense, intermittent vesicles (0-15%, ≤ 25mm & commonly < 2mm) above 4703', below 4703' rock is dense w/ incipient partings @ 45° @ 4704' and platey fracture @ 4704½' for 6" interval. Below platey fracture @ 90°, common fracture attitude is @ 15° to 45°. In the fractured interval FeOx-stained, lightly-sheared clays (mod. red brn, lt. olive brn + intermittently waxy) are present in v. lt. amts on fracs. (& in matrix/grdmass same color clays are present in v. lt. amts, unsheared). In upper unit fracs. are less common and irregular, most commonly @ vertical (sinuous) & 45°. These fracs. have v. lt to mod. amts. v. pale grn clay or dk gry gry clay ± pale blue silica (as inlets & vns to 6 x 60 mm max.) vesicles contain pale grn, dk gry grn, lt blue, gry olive grn clays ± clr to pale blue silica ± clr drusy zeolite ± wht fibrous (locally chalky) zeolite ± gry grn botryoidal clay?, Silica and clays are the predominate cavity/vesicle fillings. Contact is gradational in frac'd interval and overall 2ndary material is light.
4697'	
	4707'-4730.5' VOLCANIC BRECCIA A/A @ 4658.5', fractures are rare @ 60°-80° with v. dk red brn stain ± gry grn clay. Rock is dense with fine (< ½mm) matrix voids and commonly vesicular r.f.s. Vesicles/cavities are filled
4717'	



CORE DESCRIPTION

40 FOOT INTERVAL

HOLE CTGH1
FIELD CASCADES/CLACKAMAS
GEOLOGIST (S) McDANNEL / GOODWIN
BASIS Binoc. Microscope DATE 8/17/86

DEPTH INTERVAL

DESCRIPTION

4717'

BASALTIC ANDESITE (A/A)

4707' - 4730.5' VOLCANIC BRECCIA

partially to completely with clays, zeolites and silica. Clays are predominate in the < 2mm voids and silica & the white fibrous zeolite in the cavities. A common rim → interior cavity lining sequence is: dusky bluegrn +/- grngry +/- lt.blue +/- dk.olivegry clays → clr. foliated zeolite or pale blue tetragonal silica (opalescent) → wht radiating fibrous zeolite. 2ndary mineralization is commonly light and rock alteration very minor. Silica is much less common than zeolites.

4730.5' - 4732' BASALTIC ANDESITE (LAVA FLOW)

Gradational contact w/above unit. Lava flow is thin & very vesicular. Typically voids are lined w/ lt blue grn clay; w/dusky grn filling bottom of void (vesicle) & zeolite or silica overlying clays.

4731'

4732' - 4738' VOLCANIC BRECCIA (A/A @ 4707')

Gradational contact. Dense. Secondary mineralogy same as breccia @ 4707'

4738' - 3742' BASALTIC ANDESITE (FLOW)

Gradational contact. Upper 3' of unit are vesicular. Vesicles filled w/dusky green clays. Blue grn clay less common & may thinly line vesicle walls. Clays are typically overlain by wht zeolite or silica, with silica predominate. Minor v. fine clear druzy zeolite lines some vesicle walls. Unit is fractured but consolidated w/silica filling fractures & voids. Less commonly, grn clay in fractures.

3742' - 3767½' VOLCANIC BRECCIA.

· med to dk gry lapilli-sz r.f.s (with rare blocks) in red brn-weathered r.f. matrix - all basaltic andesite. Local common grn tinge from grngry clays filling common sm. vesicles in r.f.s & sm. matrix voids (< 1mm). Rare fractures (eg. @ 4758' with frac's @ 0° to 15° & lt. and. 2mm) coatings of grngry clay +/- med blue gry botry-

4757'

Form 2

Diamond Shamrock
Thermal Power Company

CORE DESCRIPTION
40 FOOT INTERVAL

HOLE CTGH 1
FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) MCDANNEL/GOODWIN
BASIS BINOC. MICROSCOPE DATE 8/18/86

DEPTH INTERVAL	DESCRIPTION
4757'	BASALTIC ANDESITE (A/A)
	4742'-4767½' VOLCANIC BRECCIA (continued) and 2ndary min. deposition in fracs & voids light. Clays are predominate material in <1mm voids (vesicles & matrix) & wht fibrous radiating zeolite is most abundant in >1mm vesicles & cavities. Cavities (≤40mm) contain clays (gry grn, lt. blue, med olive grn, blue gry) +/- mnr. pale blue silica +/- med. blue gry finely spheroidal zeolite?/clay? +/- clr drusy zeolite +/- wht brittle film (=silica+ clay?) +/- wht fibrous zeolite +/- soft bn gry clay. From 4763'-4765½': dense b-a. block w/ mnr. breccia texture, 5mm. frac @ 45° w/ grn+brn clays +/- wht brittle film. Contact is gradational.
	4767½'-4784' BASALTIC ANDESITE LAVA Dk gry to med. dk gry, aphyric, dense, & brittle. Top 2' has vesicles & cavities stretched along sinuous subvertical planes (≤50mm, commonly <5mm, 5-15%). These voids are ptlly lined or completely filled (smaller voids only) with gry grn clay +/- clr (or stained yellow by FeOx) drusy zeolite +/- mnr. pale blue silica +/- soft bn gry clay. Below 4769½', unit is dense & brittle w/o vesicles. Fracs. are common w/ a variable & but most commonly @ 40°-70° (+ local sinuous subvertical frac.). Fracs. are stained by red brn FeOx and coated w/ gry grn & mod. yel. brn (waxy) clays. FeOx stains in bands (≤40mm) and spots (mod red brn, dusky yellow, dusky red) become common below 4775' and may also color clays. Sharp irregular contact @ base.
4777'	
	4784'-4790' VOLCANIC BRECCIA Dk gry-red brn. Abrupt, but transitional contact w/ above unit. Breccia is slightly scoriaceous. Secondary mineralization is light. Green & blue green clays are most common secondary material. Light amt of zeolites (as described above). Silica is present in v. light amounts & rarely forms well terminated quartz crystals as fine drusy lining on voids. Clays & zeolites occur in small (commonly ≤1mm, but up to 5mm) voids.
	4790'-4796' BASALTIC ANDESITE (LAVA FLOW) Med gry, aphyric, vesicular. Vesicles are typically flattened & may be as large as 5cm. Smaller vesicles filled w/ clay & commonly silica or zeolites is above clay. (Clays are grn, blue grn a/a). Larger voids filled by silica. Rare botryoidal silica fills fractures also. Alteration decreases w/ depth as unit becomes denser @ 4794.5'
11797'	

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Diamond Shamrock
Thermal Power Company

Form 2

CORE DESCRIPTION

40 FOOT INTERVAL

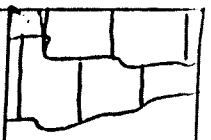
HOLE CTGH-1

FIELD CASCADES/CLACKAMAS

GEOLOGIST (S) GOODWIN/MCDANIEL

BASIS BINOCULAR MICROSCOPE DATE 8/18/86

DEPTH INTERVAL	DESCRIPTION
4797	BASALTIC ANDESITE (A/A)
	4796- VOLCANIC BRECCIA (a/a @ 4784') Med gry – med dk gry. V. light Zn clay mineralization Green clays & zeolites a/a.
4817	



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