

GLO1856



CALIFORNIA ENERGY COMPANY, INC.

MAZAMA PROSPECT

KLAMATH COUNTY, OREGON

Well MZI - IIA

Temperature Logs

Lithology of Cuttings and Core

November 1986

November 1989



PRUETT INDUSTRIES, INC.
 8905 ROSEDALE HWY. BAKERSFIELD, CA. 93312
 (805) 589-2768 TELEX 4992440 PRUETT INT.

SUB-SURFACE TEMPERATURE SURVEY = 9/23/89

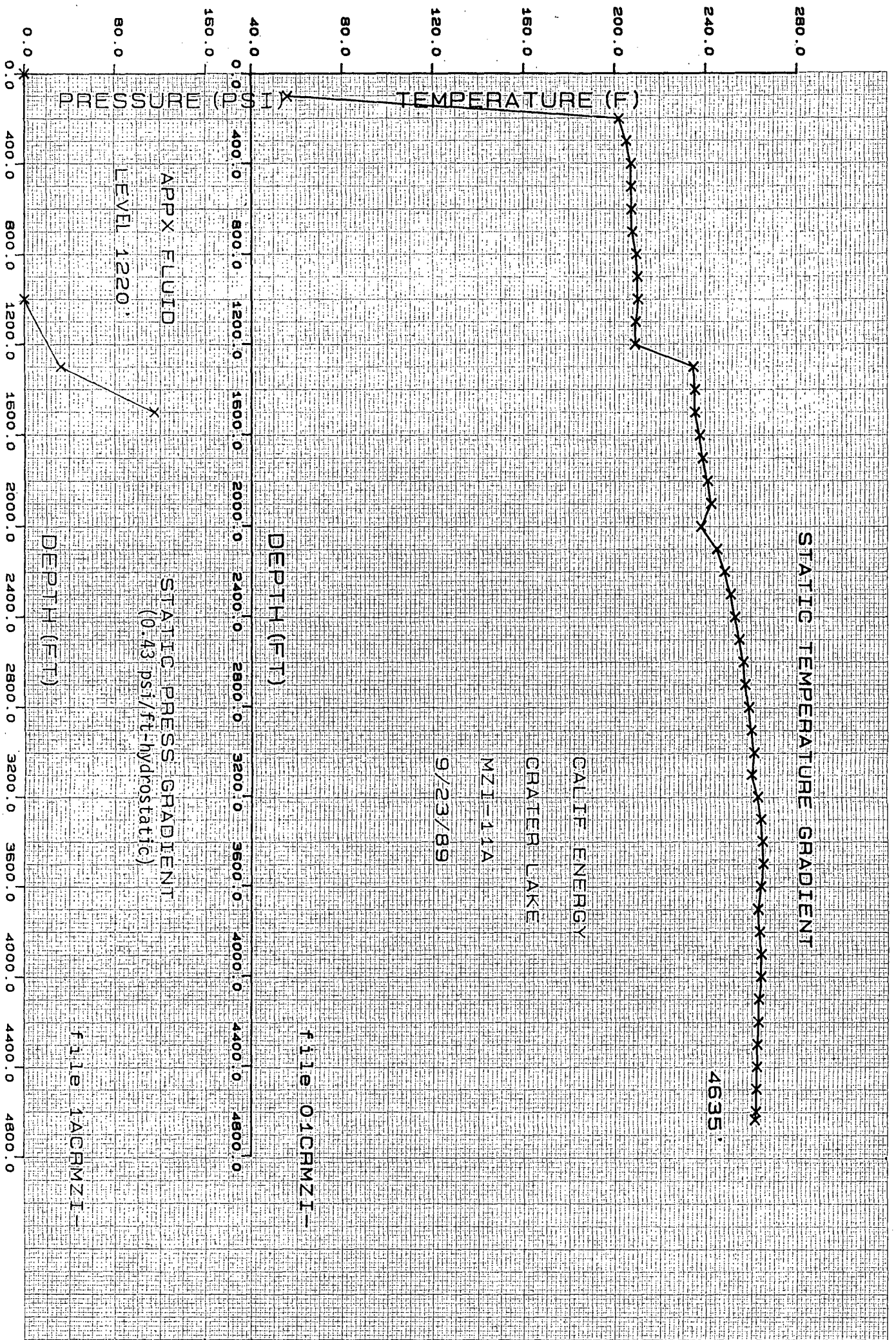
CO. CAL ENERGY		RUN 01 FIELD CRATER LAKE		WELL MZ1-11A
EFF DEPTH 4760'		WELL STAT	STATIC	TOOL HUNG
CASING	-	CASING PRESS		ON BOTTOM 2:21PM
LINER	-	TUBING PRESS		OFF BOTTOM 2:31PM
DATE 092389		ELEMENT RANGE 29 - 440		ZERO POINT 0'
ELEVATION		ZONE		SHUT-IN 8/6/89
MAX TEMP 265.2°F		PICK-UP 4635'		ON-PROD
PERF	-	CAL SER NO. 31		MPP
TUBING 1 1/2" TO -4760'				
UNITS ENGLISH		PURPOSE	STATIC TEMPERATURE	GRADIENT

SURVEY DATA

CO. CAL ENERGY				RUN 01 FIELD CRATER LAKE				WELL MZ1-11A			
TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	100	55.7	0.000	1:00	2500	254.6	.018				
1:00	200	201.8	1.461	1:00	2600	256.4	.018				
1:00	300	205.0	.032	1:00	2700	257.2	.008				
1:00	400	207.0	.020	1:00	2800	258.8	.016				
1:00	500	207.2	.002	1:00	2900	260.0	.012				
1:00	600	207.2	0.000	1:00	3000	261.2	.012				
1:00	700	207.6	.004	1:00	3100	260.2	-.010				
1:00	800	209.4	.018	1:00	3200	263.0	.028				
1:00	900	209.8	.004	1:00	3300	264.2	.012				
1:00	1000	210.0	.002	1:00	3400	264.8	.006				
1:00	1100	209.0	-.010	1:00	3500	265.2	.004				
1:00	1200	208.6	-.004	1:00	3600	264.0	-.012				
1:00	1300	234.4	.259	1:00	3700	262.8	-.012				
1:00	1400	235.1	.006	1:00	3800	263.6	.008				
1:00	1500	235.1	0.000	1:00	3900	264.2	.006				
1:00	1600	237.2	.022	1:00	4000	264.2	0.000				
1:00	1700	238.4	.012	1:00	4100	263.2	-.010				
1:00	1800	240.6	.022	1:00	4200	263.0	-.002				
1:00	1900	242.2	.016	1:00	4300	262.6	-.004				
1:00	2000	237.6	-.046	1:00	4400	262.4	-.002				
1:00	2100	244.8	.072	1:00	4500	262.2	-.002				
1:00	2200	248.2	.034	1:00	4600	262.0	-.002				
1:00	2300	250.8	.026	1:00	4635	261.6	-.011				
1:00	2400	252.8	.020	0:00	0	0.0	0.000				

RUN BY S WILSON / T DRIVER

*Revised pages 1 & 2
 with added info -
 From Joe LaFleur
 5/25/90*



STATIC TEMPERATURE GRADIENT

4635'

CALIF ENERGY
GRATER LAKE

MZI-11A

9/23/89

file 01CRMZI-

DEPTH (FT)

STATIC PRESS GRADIENT
(0.43 psi/ft-hydrostatic)

APPX FLUID
LEVEL 1220'

DEPTH (FT)

file 1ACRMZI-

TEMPERATURE (F)
PRESSURE (PSI)



PRUETT INDUSTRIES, INC.
 8905 ROSEDALE HWY. BAKERSFIELD, CA. 93312
 (805) 589-2768 TELEX 4992440 PRUETT INT.

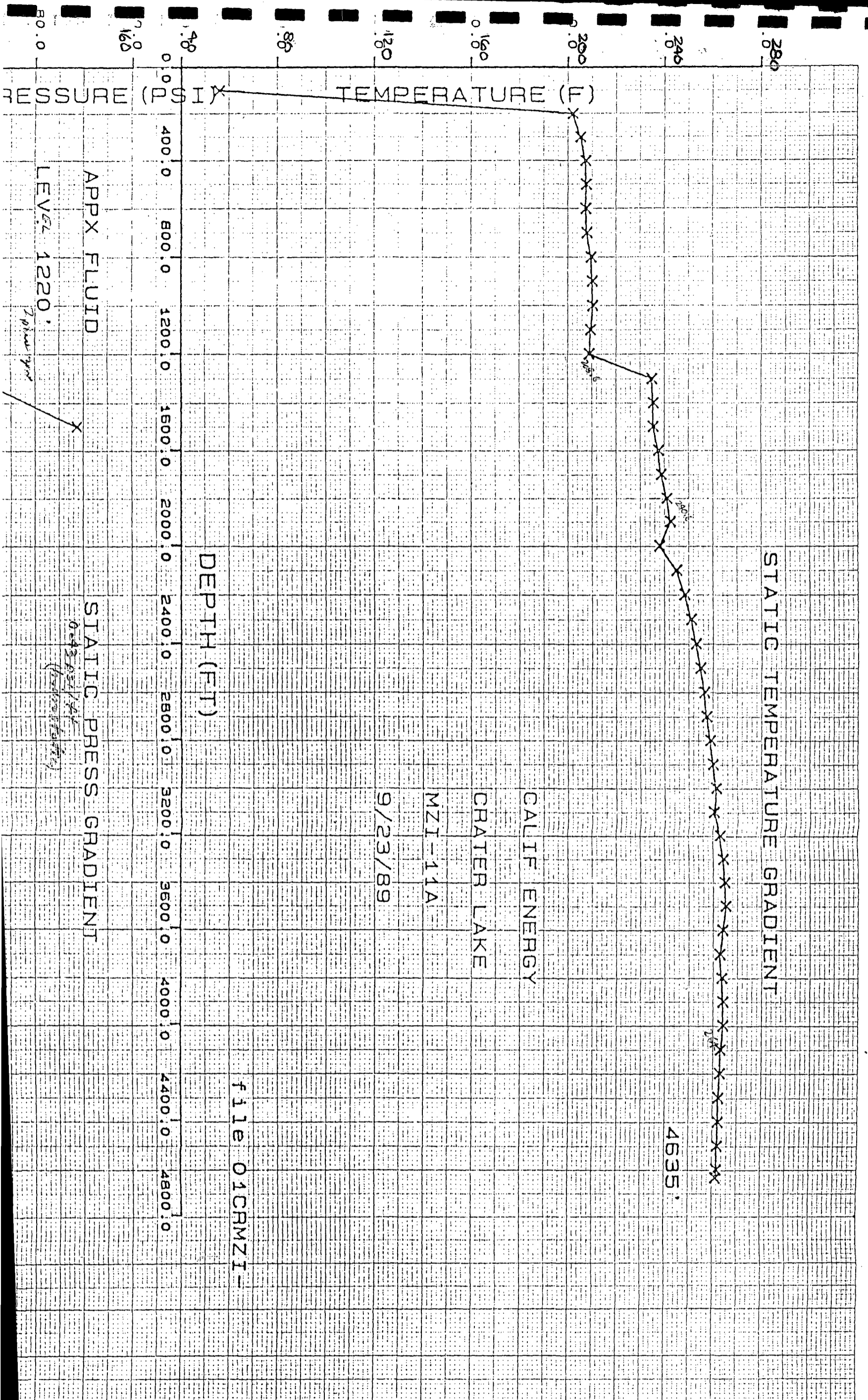
SUB-SURFACE TEMPERATURE SURVEY

CO. CAL ENERGY		RUN 01 FIELD CRATER LAKE	WELL MZ1-11A
EFF DEPTH 4760'		WELL STAT STATIC	TOOL HUNG
CASING -		CASING PRESS	ON BOTTOM 2:21PM
LINER -		TUBING PRESS	OFF BOTTOM 2:31PM
DATE 092389		ELEMENT RANGE 29 - 440	ZERO POINT 0'
ELEVATION		ZONE	SHUT-IN Aug 6. → Sept. 23
MAX TEMP 265.2° F		PICK-UP 4635'	ON-PROD
PERF -		CAL SER NO. 31	MPP
TUBING 1 1/2" TO -4760'			
UNITS ENGLISH		PURPOSE	STATIC TEMPERATURE GRADIENT

SURVEY DATA

CO. CAL ENERGY		T	RUN 01 FIELD CRATER LAKE		WELL MZ1-11A			
TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD	
1:00	100	55.7	0.000	1:00	2500	254.6	.018	
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1:00	300	205.0	.032	1:00	2700	257.2	.008	
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1:00	1600	237.2	.022	1:00	4000	264.2	0.000	
1:00	1700	238.4	.012	1:00	4100	263.2	-.010	
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1:00	2400	252.8	.020	0:00	0	0.0	0.000	

RUN BY S WILSON / T DRIVER



STATIC TEMPERATURE GRADIENT

4635'

CALIF ENERGY

CRATER LAKE

MZI-11A

9/23/89

file 01CRMZI-

DEPTH (FT)

400.0 800.0 1200.0 1500.0 2000.0 2400.0 2800.0 3200.0 3600.0 4000.0 4400.0 4800.0

0.0

APPX FLUID

STATIC PRESS GRADIENT

LEVEL 1220'

2 psi per ft



BAKERFIELD, CA (805) 589-2768

10 x 10 1/2 INCHES

1-88-208

CALIFORNIA ENERGY COMPANY, INC.

MAZAMA PROSPECT

KLAMATH COUNTY, OREGON

Well MZI - IIA

LITHOLOGY OF CUTTINGS

from 0 to 570 feet

November 1986

Hole MZI-11A

Cuttings Review

0-10 ft.

75% Beige, variably devitrified, pumice.
25% Subrounded to rounded mixed lithic igneous fragments.
Tr. sub-mm fragments of feldspar, hornblende and pyroxene are present.

10-20 ft.

a/a.

20-30 ft.

100% Light brown volcanic pebble conglomate. Matrix consists of devitrified pumice, sand size lithic fragments, and feldspar, hornblende, and pyroxene crystal fragments. The coarser fraction consists of angular to subrounded volcanic lithic fragments (rhyodacite?) and rounded devitrified pumice fragments. Note: Traces of dark red to orange red in matrix maybe cinnabar or hematite.

30-40 ft.

a/a

40-50 ft.

100% Mixed volcanic fragments, including angular to subrounded gray rhyodacite (?) and red to orange-brown tuff.

50-60 ft.

90% Gray to dark gray, scoriaceous to dense, hypocrySTALLINE basaltic andesite. The more dense fragments show loss of original texture due to metasomatic alteration. The pyroxene crystals are generally fresh with minor hematite alteration around the edges.
10% Mixed tuffaceous fragments.

60-70 ft.

a/a with minor light colored clay alteration and black hydrous Fe oxide precipitation along occasional fracture surfaces.

70-80 ft. Unwashed Sample

This sample consists of abundant red and gray clay and sand size crystal and lithic fragments. Coarser pebble sized fragments consist of lava and pumice clasts. It is difficult to determine how much of the coarser fraction is slough from up hole or how much of the clay and sand fraction is recycled drilling fluid.

80-90 ft. "Fine mud, driller couldn't catch sample."

Predominantly reddish clay and silt, sand size crystal and lithic fragments, and pebble size mixed volcanic fragments.

90-100 ft.

2% Dark gray scoriaceous basaltic andesite.

98% Red to gray, strongly hematite stained, locally vesicular andesite. Mafic minerals are strongly oxidized, with much of the original crystal morphology lost. The feldspar phenocrysts are variably altered to clay and possibly zeolite, and are often stained red from secondary hematite.

100-110 ft.

20% a/a.

80% Poorly lithified and strongly clay-altered scoriaceous to tuffaceous fragments with abundant secondary reddish hematite.

110-120 ft.

a/a

120-130 ft.

a/a

130-140 ft.

a/a. Note: Possible pipe dope in sample.

140-150 ft.

a/a

150-160 ft.

55% Brown to red devitrified basaltic tephra.

45% Red to gray strongly hematite and clay-altered basaltic lithic fragments.

160-170 ft.

60% red to gray strongly hematite- and clay-altered basaltic lithic fragments.

40% Brown to red devitrified basaltic tephra.

170-180 ft.

100% Red, locally gray, strongly hematite- and clay-altered basaltic lithic fragments.

180-190 ft.

100% Red-brown to gray strongly hematite- and clay-altered basaltic lithic fragments.

190-200 ft.

a/a

200-210 ft.

100% Red to dark gray, locally light green-gray, strongly clay altered basalt(?). Reddish color is due to secondary hematite staining. The green color is due to reduced Fe-bearing secondary clay (smectite?).

210-220 ft.

100% Light green-gray to dark green-gray clay altered dacite(?) with minor local red to orange hematite staining. Fresh sub-mm secondary pyrite crystals are common throughout the green-gray clay-altered rock.

220-230 ft.

100% Light green-gray, locally dark gray, strongly clay-altered dacite(?). Clear to milky precipitated cryptocrystalline silica is common throughout the fragments. Sub-mm black magnetite crystals are present, possibly as a surviving relic of the host rock. Sub-mm secondary pyrite is irregularly distributed through rock fractures, occasionally occurring as mm-size clusters. Minor clear tabular zeolite clusters are present in occasional vesicles and open fractures. Locally fine-crystalline veins of secondary calcite are observed.

230-240 ft.

a/a

240-250 ft.

Similar to above, though the degree of clay alteration in the rock is decreasing. Relict hematite alteration has been preserved in many fragments which have subsequently undergone silicification. Secondary alteration of mafic minerals to pyrite is common. No secondary calcite is observed.

250-260 ft.

a/a

260-270 ft.

a/a with rare traces of white acicular zeolite (natrolite series?). A marked reduction in secondary silicification is observed in this sample.

270-280 ft.

a/a with a continued decrease in the amount of silicification and secondary pyrite. No acicular zeolite observed.

280-290 ft.

40% Gray to very dark gray, locally red-gray dacite.
60% Very light gray, locally red-gray, strongly altered dacite. Mafic minerals are occasionally altered to magnetite, though more commonly to hematite. Alteration of plagioclase to clay ranges from moderate to extreme, occasionally with only casts of plagioclase crystals surviving. The groundmass is altered to white clay, clear tabular zeolite and rare traces of secondary sub-mm pyrite.

290-300 ft.

a/a with a very few soft light green-gray fragments. The texture and degree of alteration is characteristic of a strongly sheared or faulted rock.

300-310 ft.

Similar to above with a general decrease in the degree of alteration. The mafic minerals continue to be strongly altered to hematite. Occasional fracture surfaces contain a light coating of green clay and sub-mm pyrite crystals.

310-320 ft.

a/a with a slight increase in the white clay-zeolite alteration. A few light green-gray fragments have a texture suggesting protomylonite.

320-330 ft.

5% Very dark gray fresh glassy dacite.

85% Gray to light green-gray, locally red-gray, strongly altered dacite.

10% Green-gray cataclastized dacite with many fragments having a mylonite to protomylonite texture.

Vein filling quartz and botryoidal cryptocrystalline silica are present in some of the dacite fragments. A few of the dacite fragments have been indurated with silica, often associated with secondary precipitated sub-mm pyrite crystals. Secondary zeolite alteration is associated with the more strongly altered and brecciated dacite fragments.

This sample consists of fresh glassy subvolcanic dacite, cataclastized rock associated with subvolcanic emplacement, contact metamorphosed rock and hydrothermally altered rock.

330-340 ft.

a/a

340-350 ft.

a/a with only rare traces of fresh glass.

350-360 ft.

30% Light green to green-gray brecciated and sheared dacite. The brecciated fragments contain cryptocrystalline silica and minor pyrite.

70% Gray to light gray altered dacite with variable amounts of secondary hematite.

Tr. dark gray fresh glassy dacite.

360-370 ft.

a/a

370-380 ft.

a/a with a decrease in brecciated fragments to 10%.

380-390 ft.

a/a

390-400 ft.

80% Gray to red-gray variably altered glassy dacite with secondary green-gray clay and pyrite along fracture surfaces.

390-400 ft. (cont.)

20% Light gray to green-gray, strongly sheared, brecciated and clay altered dacite with secondary sub-mm pyrite crystals.

Tr. orange oxidized mylonite fragments.

400-410 ft.

a/a with a marked increase in secondary clear tabular zeolite occurring along fracture surfaces.

410-420 ft.

a/a with 5% orange oxidized mylonite.

420-430 ft.

a/a

430-440 ft.

a/a with 20% orange oxidized mylonite. Note, all Fe appears to occur as hydrous Fe oxides in orange fragments.

440-450 ft.

90% Gray fresh to slightly altered dacite. Very localized reddish zones in the groundmass are the result of hematite alteration. Rare traces of secondary pyrite occur along fracture surfaces has formed subsequent to the hematite alteration.

5% Light green to light green-gray mylonite with secondary sub-mm pyrite and minor clear tabular zeolites.

5% Orange hydrous Fe oxide bearing mylonite. Hydrous oxidation of Fe appears to be the most recent alteration event.

450-460 ft.

a/a

460-470 ft.

a/a with an increase in the amount of clear tabular zeolite along fracture surfaces; continued tr. of orange mylonite.

470-480 ft.

10% Orange mylonite, the result of Fe oxidation in the light green-gray mylonite.

10% Light green-gray mylonite a/a.

80% Gray to dark gray variably altered dacite a/a.

480-490 ft.

a/a with only a trace of the orange oxidized mylonite.

490-500 ft.

a/a with occasional calcite crystals occurring with clear tabular zeolite crystals in fractures.

500-510 ft.

100% Gray to light red-gray hematite altered dacite with up to 5% of rock fragments showing the effect of shearing. Minor sub-mm crystals of pyrite occur along fracture surfaces and disseminated in the dacite, in part forming at the expense of hematite. Minor vein filling quartz and calcite are observed.

510-520 ft.

85% Gray to light gray clay and zeolite altered dacite with variable hematite alteration. Occasional sub-mm fractures are observed to be filled with calcite and zeolite.

15% Light green-gray, rarely orange, protomylonite and brecciated dacite. Secondary fine grained pyrite is observed to be present in unoxidized cataclastic fragments.

520-530 ft.

a/a

530-540 ft.

60% Dacite a/a.

30% Light gray to light green-gray protomylonite and fine breccia

10% Orange oxidized protomylonite.

540-550 ft.

a/a with 10% very dark gray fresh glassy dacite and 1% orange oxidized protomylonite.

550-560 ft.

60% Gray to light gray clay and zeolite altered dacite with variable amounts of hematite alteration. Occasional fractures are observed to be filled with calcite and zeolite.

30% Light green-gray pyrite-bearing protomylonite and brecciated dacite with zeolite and calcite veining.

10% Orange oxidize protomylonite.

560-570 ft.

Note: Many fragments are in excess of 2 cm; this sample may contain slough from up hole.

95% Dark gray to gray altered dacite with local secondary hematite. White secondary clay and pyrite occur along occasional fracture surfaces.

5% Light green-gray, locally orange, protomylonite and brecciated dacite a/a.

End of Rotary Drilled Section.

CALIFORNIA ENERGY COMPANY, INC.

MAZAMA PROSPECT
KLAMATH COUNTY, OREGON

Well MZI - IIA
LITHOLOGY OF CORE
from 575 to 1354 feet

November 1986

DEPTH FT.		LITHOL	COMMENTS
575	764	Rhyodacite: Gray, locally resembling a very dense banding, fractures, of surface flow dynamics. are present, lined w crystals, possibly chab and associated fractu calcite and quartz irregularly shape autobreccia-like fragme observed to be filled some vugs a clear plyab added; clearly a drilli The degree and type of Fe-bearing minerals hematite. The groundma clay, probably smecti place in the groundmass	577-579 ft. Fractured and broken rock. 585-586 ft. a/a 586-760 ft. Autobreccia-like texture with generally subrounded to subangular fragments 1-15 cm in size. Matrix and fragments are made up of the same composition. Fractures occasionally follow fragment boundaries, though more often they cut across such boundaries.
		629 ft. The fractures surfaces show the same the overall rock alter hematite, groundmass a clear feldspar [sandine	627-628 ft. Predominantly sealed fractures with occasional open cavities.
		666 ft. Green-gray s inches thick. Platy and precipitated cal crystal-lithic silic typical rhyodacite sub the noted depth.	658 ft. Partially sealed fractures with open cavities.

DEPTH FT.		LITHOLOGIC	COMMENTS
			675 ft. Calcite lines vesicles and fractures.
			682-684 ft. Broken and fractured rock.
		691-693 ft. Brecciated r fractures. Both the perv surfaces show fresh clea hematite alteration in a g generally harder than th texture with the hand lens present in varying density	692-694 ft. Brecciated with poor fracture cementing.
		756-764 ft. Fractured pur rock contains variable with the a green-gray g filled with calcite and to be fresh. Near fractu show clay alteration.	756-764 ft. The texture suggests silica metasomatization. The fractures are filled with calcite and pyrite. Occasional fracture surfaces have a red-orange staining, associated with partial oxidation of secondary pyrite. Secondary pyrite is present locally in the rock, usually away from fractures.
764	850	Rhyodacite to Dacite: Gray conatains variable hema hornblende crystals are r	758-770 ft. Moderately to strongly fractured, including some vertical fracturing.

DEPTH FT.		COMMENTS
	775-780 ft. Broken clay, contains m	770-784 ft. Fractures lined with thin film of calcite and trace pyrite.
		792-843 ft. Fractures filled with calcite and varying amounts of pyrite. Pyrite precipitation both preceded and is cogenetic with calcite. Reddish stained fractures both cross-cut and are cross-cut by some calcite veinlets.
	817-821 ft. Str	
	827-828 ft. Str	
	848-850 ft. fracture surface the center of crystals.	843.5-844 ft. Single vein of quartz with sub-mm calcite lining.
		848-850 ft. Brecciated and poorly cemented.
850	10% Rhyodacite-Dacite varies from No flow features fragments are 862-875 ft slickensides observed.	850-903 ft. Calcite seams and veins up to 3 mm wide. The groundmass of the rock-both adjacent to and away from fractures, has been pervasively altered to a gray-green clay with local small areas of orange hematite and secondary calcite.

DEPTH FT.

875-882 ft.
green sheared

890-892.5 ft.
clay, calci
fractures cr
rock surrou

900-967 ft
contain a
Occasional
alteration

967-97
altera

COMMENTS

** 871 ft. The core contains an 8 inch thick section of soft dark gray clay-like material with sharp upper and lower boundaries. This appears to be an artifact of drilling. When viewed through a microscope it appears to be made up of finely ground rock containing fine fresh feldspar fragments.

897 ft. Probable drilling artifact, see comment at 871 ft.

910-1002 ft. General increase in pervasive alteration of dacite to light green-gray clay and dark green clay, chlorite, and calcite.

DEPTH FT.	COMMENTS
971-983 ft. General vesicles filled with	984 ft. Fractures and vesicles are filled with calcite. 986 ft. a/a 989 ft. a/a
1003-1039 ft. E hematite alteration intensity of secondary fragments.	995-1039 ft. Vein and vesicle filling calcite is common. 1004 ft. Probable drilling artifact, see comment at 871 ft.
1035-1086 ft. T generally strong surfaces have a precipitation mineral	1024 ft. Probable drilling artifact, see comment at 871 ft. 1039-1042 ft. Secondary pyrite is associated both with dark green slickensides and with traces of calcite and clay. 1042-1059 ft. Rare traces of pyrite are present.
	1059-1062 ft. An older fracture event has resulted in a fracture and breccia zone with veins of a soft clear mineral with boxwork morphology. Replacement pyrite is present in the the brecciated fragments.

DEPTH FT.			COMMENTS
1086	1125	Dacite: Gray to purple features. The purple color is prominent. The stable Fe chlorite. Minor clay are usually pronounced sheared vesicles.	1074-1079 ft. Minor to trace of pyrite occurs. Note that the pyrite occurrence may predate the intense brecciation of this zone.
1125	1180	Dacite: Gradual development of calcite veins. 1131-1135 ft. of calcite. The 1141-1151 ft. No pronounced minerals appear. calcite veins. 1159.5-1162 ft. calcite veins. 1164 ft. The background alteration preferential to the groundmass.	1106 ft. Probable drilling artifact, see comment at 871 ft. 1128 ft. Probable drilling artifact, see comment at 871 ft. 1149 ft. Probable drilling artifact, see comment at 871 ft. 1164 ft. Local sub-mm zones of hematite which may be possible pseudomorphs of mafic minerals. Secondary calcite is common, occurring both in vesicles and plagioclase sites. Green clay alteration appears to be subsequent to hematite alteration.

DEPTH FT.

COMMENTS

1169-1178 ft. present, mainly partial oxidation or chlorite. The crystal-rich groundmass throughout the dacite: Gray to light dacite. A few Many feldspar The groundmass clay/chlorite a

1200 ft. The rock the rock to be 1208 ft. The alteration. Many suggesting vesicular minerals included does not effectively present as a vein 1211-1217 ft. alteration of calcite or chlorite common

1229-1232 ft. chlorite foliation phenocrysts appear to have undergone by a clay or located near calcite common

1263-1266 ft. A bluish clay alteration (chabazite?) the rock is fracture surface

1174 ft. Occasional vesicles show green clay or chlorite alteration along the edges, followed by calcite, and rarely with quartz following calcite. More commonly vesicles and fractures are filled with calcite, and occasionally with calcite and mordenite. A few of the the vesicles contain only an acicular zeolite (mordenite?). One vesicle contains massive calcite, followed by mordenite, which in turn is followed by bladed calcite. Pervasive rock alteration includes green clay or chlorite and secondary calcite. Plagioclase laths have altered to clay, possible zeolite, and calcite.

1187 ft. Rock alteration shows an early episode of hematite alteration of Fe minerals, both phenocrysts and groundmass, to hematite, followed by a later stage green clay or chlorite, preferentially occurring near vesicles and fractures. Larger vesicles and fractures contain secondary calcite and mordenite. 1217-1218 ft. Only minor amounts of calcite in fractures and vesicles.

1232-1254 ft. The intensity of fracture and vesicle filling is variable.

1259 ft. Late stage calcite is present in a few of the vesicles. Mordenite also occurs with the calcite. The latest stage of calcite, formed subsequent to the mordenite, has a bladed morphology.

DEPTH FT.

COMMENTS

1267-1276 ft
groundmass, fo
Vesicle-filli
calcite.

1276-1277 ft. Fractures show both
massive calcite and quartz
filling.

1278-1280 ft. The fracture surfaces
show very minor calcite mainly in
open fractures. No secondary
quartz is observed.

1280-1294 ft. Generally unfractured
rock with minor calcite filled
vesicles.

1294 ft. A s
filled with c
sub-mm Fe su
other unident
the bulk of s
1296 ft. Occ
followed by
alteration
alteration.
silica. Mi
groundmass.
By 1298 ft
appears to
are filled
of a crysta
may be th
alteration.

A clear to white zeolite with a
tablet-like morphology occurs in
fractures, associated with a rare
trace of pyrite (?), 1319 ft.
(see 1322 ft. away from main
fracture veining). The degree of
secondary green clay-chlorite
increases below 1315 ft.,
especially in areas of
fracturing. In addition to an
increase of clay-chlorite, a rare
trace of drusy quartz occurs,
cogenetic with mordenite. Minor
secondary pyrite also occurs as a
vein-filling mineral. The
precipitation of quartz appears
to represent the most recent,
perhaps ongoing, activity.

1301-TD (C
calcite and
calcite b
fractured
Many of t
Much of th
or chlorit
earlier he
from inte
trace vein
occurs mos

1350 ft. Thick calcite-mordenite
veins observed.

1351 ft. A very fine clear white
vein filling zeolite, possibly
mordenite with a more tabular
morphology is observed.

1352 ft. Veining of calcite-
mordenite-quartz-pyrite.

CALIFORNIA ENERGY COMPANY, INC.

MAZAMA PROSPECT

KLAMATH COUNTY, OREGON

Well MZI - IIA

LITHOLOGY OF CORE

from 1354 to 4670 feet

November 1989

DEPTH FT.

TO From

LITH

COMMENTS

areas containing white

illings of zeolite and
te is present in the
on mineral in the rock
. The rock adjacent to
to a light gray-green

The core is generally
mafic minerals are alter
minor pyrite.

contain sparse calcite
ite. Alteration along
green clay/chlorite and

Flow breccia, generally be

sent along some of the
pears to pre-date the
alteration.

DEPTH FT.		LITH	COMMENTS
TO	From		
		Scoriaceous basal flow	contains calcite. Trace calcite are observed.
	1513 ft.	Base of the	rich zone are filled
	1513-1513.5 ft.	Purple clay	with calcite.
	1513.5-1575 ft.	Gray to purple	
		are crystal-rich. Many	
		Other alteration minerals	
			common in the groundmass cryst sites.
			contain thin coatings of
	1575-1722 ft.	Purple-gray lithic tuff.	
			netic calcite and white
			ly contain calcite.

DEPTH FT.		LITHOLOGY	COMMENTS
TO	From		
		Purple-gray to green tuff.	
			calcite followed by zeolite. The center of acicular zeolite.
			e and minor zeolite.
		Ash-rich zone of cemente	
			e and minor calcite.
		Lithic-rich tuff.	
		Scoriaceous-bearing lithi	

DEPTH FT.		LITH	COMMENTS
TO	From		
			in both calcite and
	1719-1720'	Ash-rich horizon.	contain an outer layer the centers.
	1722-1755 ft.	Welded flow breccia in	, blocky zeolite and end to be irregularly
	1739'	Small brecciated zone.	tain zeolite and minor
	1755-1784 ft.	Lithic tuff.	
			s of calcite with local onal vesicles contain
	1784-1809 ft.	Gray to g plagioclase porphyritic	

DEPTH FT.

TO From

LITHOLOGY COMMENTS

1809-1814 ft. Green-gray

1814-2165 ft. Gray-green
porphyritic dacite with
from fresh to strong
alteration.

generation of quartz,
occasional druse quartz
to 1 cm long.

Flow brecciation.

with calcite and zeolite.

with calcite and acicular
contain central zones
of zeolite.

with a green-gray to black
with zeolite or zeolite and

DEPTH FT.		LITH	COMMENTS
TO	From		
			calcite, druse quartz
			in traces of pyrite and eral that visually appears to be quite a
			ky calcite and minor
		Flow brecciation.	
		1952-1970' Sheared zone, rock has ur	z and calcite.
		1953-56; 1960-63; Zones of shearing and alts	ky calcite and minor of pyrite are present cent to the fractures.
			e and acicular zeolite. blocky to tabular. s as thin blades.
		Gray to purple-gray pyrox alteration of the ground from light to moderately	quartz, calcite and tend to be filled with
		1978-1988 ft. Shearing w/ Fractured to brecciated zc to a clay-like consistency	
		Flow brecciation.	

DEPTH FT.

LITHO COMMENTS

TO

From

2006-2012,
Flow banding.

Gray to purple-gray, contain clacite, local
porphyritic dacite. The
secondary hematite.

es are lined with a
ain quartz and zeolite.

2068-76'
Zone of fractures and br

agments are coated with
d contain aciclular

2097-98'
Scoriaceous and poorly li

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

2220-2230'

Flow banding associated with matrix are filled with
of calcite.

2260-2276'

Welded flow breccia with a 1.5 ft. matrix of calcite zeolite, minor
at 2268 ft. tz.2276-2298 ft. Gray to green cementation (dark green alteration
following small
lithified, the result of compacted celadonite?).
horizons are present at 2278,
The lower 5 ft. contain abundant and thin fractures

DEPTH FT.

TO From

LITHOLOGIC DESCRIPTIONS

2298-2366 ft. Gray to dark gray porphyritic dacite. The texture is vesicular and vug-rich to boundaries separate areas of material is a common, though irregular phenocryst sites often contain

white zeolite.

aces contain purple horizontal fractures

icles and some vugs. cavities. Calcite s and locally in the

and vesicles up to 2 zeolite.

Flow breccia zone, the rock is clay.

2366-2370 ft. Vesicular to scori possibly a flow-breccia.

te zeolite.

2367' Gray to purple-gray, augite(?) plagioclase porphy breccia are common. The groundm scratched with a needle probe. altered.

d with a green-gray tures and stretched ite.

2370-2629.5 ft.

Strongly vesicular zones rewelded flow breccia features rather abruptly, between purple gray and gray-green zones with boundaries are part of what appears difficult to tell if these are dynamic features or if some are features.

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

2405' scoriaceous zone.

2405-2430' flow breccia

lined with secondary
vesicles contain zeolite.
larger vesicles contain
calcite.

lined with a green
in white acicular
calcite.

2444-2446' Flow breccia with some

minated hematite.
with a gray-green
calcite and zeolite.

2464-2467' Very scoriaceous.

to 7 cm, are lined
clay/chlorite and
calcite up to 2.5 cm
contain calcite.

2478-2485' Purple-gray dacite
fragments.

vesicles contain white

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

lined with a dark
and are filled with
minor calcite.

d with hematite,
and dark green clay,
layer.

Sub-horizontal vesicle pat
ures and stretched
of dark gray-green
verlain with a thin
any contain quartz

condary hematite and
so observed as an
acite.

ite and zeolite.

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

2613-2629.5' Red-gray to purple breccia, possibly including some

2629.5-2630 ft. Orange-brown ash.

2630-2739 ft. Gray-green to gray-purple contain a soft waxy
- of dense dacite, strongly ve
exhibiting plastic deformation,

2630-2641' Red-gray scoriaceous zeolite. Fractures
ar zeolite. One thin
cite.

2641-2655' Gray-purple vesic
concentrated in sub-horizontal
en mineral has the
eems to be too soft.

2655-2662' Vesicular to sc
green-gray, including a 3-inch
light blue-gray and
microcrystalline pyrite
clay. Zeolite and
is present in the
or druse quartz is
of the fractures.

a gray-green clay
ite. Some smaller

fractures lined with
clay and contain

DEPTH FT.

LITHOLOGIC ELEMENTS

TO From

ain gray-green clay.
y plus zeolite and

green-gray clay and
nd calcite.

gly fractured to

2729-2739' Scoriaceous flow bre

fragments filled with
terial, possibly

2739-2792 ft. Gray-green to purple
flow breccias and vesicular zo
boundaries are not clearly iden

2792-2823 ft. Gray-green to dark
to andesite. Sparse mafic ph
hematite and/or green clay.
clay.

coated with clay and
calcite and minor
pyrite?).
-green clay, often
Some vesicles contain
als and some contain
mineral.

DEPTH FT.

LITHOLOGIC ELEMENTS

TO From

2792-2823 ft. Gray-green to dark
to andesite. Sparse mafic phe
hematite and/or green clay. T
clay.

d with clay.

2823-2889 ft. Devitrified lithic tu
clay-altered.

ated in the tuff and
eral. Fractures also
icular zeolite and

icular zeolite and

2889-2974 ft. Strongly devitrified
clay-altered rhyodacite with li

TO From

Gray to dark gray devitrified
occasional sub-mm to mm size hor-
sites. Vugs and vesicles are in
section.

en clay or chlorite
pistachio-green
groundmass and in some
epidote.

2965-2974' Zone of brecciation, part fractures.

2974-3134 ft. Gray to purple-gray
basaltic andesite. Phenocrysts
mafic mineral sites now containing
clay.

DEPTH FT.

LITHOLOGIC DESENTS

TO From

coated with a dark
contain zeolite.
with zeolite in some

th a dark green
eolite. Occasional
calcite.

clay/chlorite and
minor calcite. A
is present that
identification is

Very dark gray (fresh) aphanitic g
plagioclase phenocrysts.

a dark gray to black

undant calcite and

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

Very vesicular dark purple-gray

lined with a green
and locally zeolite.
commonly near the
toward the center.

3114-3117' Breccia.

calcite and druse
by white acicular

3132-3134' Scoriaceous flow breccia with dark green
calcite and zeolite.
3134-3213 ft. Gray and purple-gray plagioclase porphyritic andesite in one generation of

lined with green
contain zeolite. A
epidote?) occurs near

Abundant blocky plagioclase phenocrysts
to 4 mm wide.

3177-3189' Flow banding.

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

3213-3219 ft. Purple to purple-gray d

ite.

3219-3243 ft. Volcanic conglomerate,
ash.

3243-3243.7 ft. Glassy dacite, possib

3243.7-3244.3 ft. Volcanic conglomerate

3244.3-3247 ft. Glassy dacite, possib

3247-3248 ft. Volcanic conglomerate.

3248-3334 ft. Gray to green-gra

plagioclase porphyritic dacite

alteration product of plagioclases or fills small

contains areas of volcanic conglomerate also present in some

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

Gray to green-gray, locally porphyritic dacite. Minor calc product of plagioclase phenocrysts areas of volcanic conglomerate.

3334-3339 ft. Volcanic conglomerate.

gularly distributed
een mineral is also

3339-3527 ft. Gray to green-gray, local pyroxene plagioclase porphyritic discrete internal zones show where autobrecciation with plastic deformation these features may indicate subvolcanic always clear which features represent which represent internal flow deformation

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

Gray to green-gray, locally purple-gray, plagioclase porphyritic dacite. The internal zones show what appear to be auto-brecciation with plastic deformation. These features may indicate subvolcanic activity. It is not always clear which features represent cooling and which represent internal flow deformation.

a light gray-green
and zeolite are
als.

Dark gray aphanitic dacite with plagioclase and a thin layer forming microphenocrysts. The plagioclase mineral similar to degrees of clay alteration. The mafic mineral though appears to be alteration.

DEPTH FT.		LITHOLOGIC DESCRIPTIONS
TO	From	
		<p>Gray to green-gray, locally purple-gray plagioclase porphyritic dacite. The internal zones show what appear to be auto-brecciation with plastic deformation. These features may indicate subvolcanic origin. Always clear which features represent cooling which represent internal flow deformation.</p> <p>3524-3527' Flow banding and brecciation fragments. This may be a subvolcanic body.</p> <p>3527-3586 ft. Green-gray strongly clay altered rhyodacite or dacite with plagioclase crystals.</p> <p>3550' Light gray-green strongly clay altered. The plagioclase phenocrysts are various sizes range from elongated to stubby green clay-chlorite and minor pyrite.</p> <p>3586-3910 ft. Intercalated aphanitic microphyritic clay altered porphyritic rhyodacite to</p>
		<p>sites altered to a or sulfides. Near irregularly dis- ay/chlorite, and</p> <p>ay/chlorite, fine te.</p> <p>/ chlorite, fine calcite (less than</p>

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

Intercalated aphanitic micropophyritic altered porphyritic rhyodacite to dacite.

3607-3614' Mottled purple and gray-green boundary with some plastic deformation ev

breccia are lined d often contain contain acicular

green clay/chlorite s commonly contain

3623-3628' Mottled purple and gray-green boundary.

ite. Fractures are contain calcite

dark green clay/

3664-3787' Mottled dark gray-green aph gray-green clay altered porphyritic rhyod the components are welded together, an plastic deformation. This may be a section contact.

calcite.

coated with a dark te which contains precipitated vein zone of calcite and

DEPTH FT.

LITHOLOGIC DESCRIPTIONS

TO From

Intercalated dark gray-green aphanitic d
clay altered rhyodacite to dacite porphyry

alcite alteration is
are lined with very
and microcrystalline

microcrystalline pyrite
ts as an alteration

Intercalated dark gray-green aphanitic d
clay altered rhyodacite to dacite porphyry

ed with dark green to
d contain zeolite.

DEPTH FT.		LITHOLOGIC DESCRIPTION	TESTS
TO	From		
		Intercalated dark gray-green aphanitic da clay altered rhyodacite to dacite porphyry.	clay/chlorite and e, some acicular laded calcite.
			ed with green n calcite.
			surfaces. Minor in the rock as an
			etely filled with e vesicles contain
		Intercalated dark gray-green aphanitic d clay altered rhyodacite to dacite porphyry	

DEPTH FT.

TO From

LITHOLOGICAL COMMENTS

3910-3923 ft. Gray to gray
welding and some plastic
contact.

... varying colored soft
contain calcite and

3923-3945 ft. Dark gray aph
subvolcanic feature.

... green clay/chlorite
crystalline pyrite is
zone.

3945-4172 ft. Predominantly
rhyodacite to dacite with
andesite to dacite. The light
alteration. Plastic deformation
between the two rock types
been intruded by the dark
conglomerate-like zones
welded and often plasticly
The lighter gray-green rock
chlorite-epidote grade of
throughout this section. M
as an alteration mineral.

... is present as an

... with a very dark green-
and contain calcite,
line pyrite. The rock
chlorite and locally
silicified. The most
is little precipita-

... of chlorite and pyrite
coated with a dark
and contain zeolite.

DEPTH FT.

LITHOLOGICAL DESCRIPTIONS

TO From

...e?) is observed as a

Light gray-green, strong porphyry with local zones of

Chlorite to chlorite-epidote, rhyodacite to dacite. Microfractures commonly filled with distributed in the rock. Fractures associated mm across, with indistinct albization with a very dark gray

...rite, calcite and genetic calcite and occurring along the vug. ...ite is observed in ... have been vesicles. ... appear to have been ...tz and epidote.

Light gray-green, strong porphyry with local zones of

... with calcite.

DEPTH FT.

LITHOLOGICAL UNITS

TO From

Light gray-green, strong
porphyry with local zones

crystalline pyrite is
on minerals. Minor
also present.

to an epidote chlorite

with a dark green to dark
and locally contain a
Minor secondary calcite
ration of plagioclase

4172-4401 ft. Mottled and
gray-green and purple to p
the result of subvolcanic
from rounded to subangular; vein minerals include
to gradational transitionite and two morphologies
showing plastic deformation; tentatively identified as
mineral associated with

contain chlorite and
quartz.

DEPTH FT.

LITHOLOGICAL
ELEMENTS

TO From

chlorite alteration
epidote and pyrite

rite and contain clear
ed zeolite, acicular
ts of calcite.

Mottled and varied light g
purple to purple-gray welded
subvolcanic activity. Ident
subangular, from sharp and ic
transitions, and are welded
deformation.

se epidote, acicular
zeolite. Some vugs are
and some vugs are
contain druse epidote

DEPTH FT.

LITHOLOGIC
MENTS

TO From

and pyrite.

epidote.

Mottled and varied light
purple to purple-gray welde
subvolcanic activity. Ide
subangular, from sharp and
transitions, and are welde
deformation.

calcite.

t in small vugs.

DEPTH FT.

LITHOLOGICAL UNITS

TO From

4401-4484 ft. Gray, locally gray-green, chlorite-epidote alteration of the ground irregularly by chlorite in is also observed in the ground accentuated by irregular ground with chlorite and suggesting fluid flow along epidote.

contain calcite and

and zeolite.

4484-4552 ft. Mottled and various gray-green and purple to the result of subvolcanic from rounded to subangular to gradational transitions showing plastic deformation often vesicular. The gray porphyritic to aphanitic chlorite-epidote grade alteration

DEPTH FT.

LITHOLOGIC COMMENTS

TO From

Mottled and varied light purple to purple-gray welded subvolcanic activity. Id subangular, from sharp and transitions, and are welded deformation. The more purple The gray to green fragments aphanitic and now display alteration.

ite and zeolite.

4552-4670 ft. Light gray-green appearing to have almost no deformation along boundaries indistinct due to the high boundaries are sharply defined the rock appears to be highly texture. Both rock types chlorite-epidote grade. May be, in part, specular hematite.

ular zeolite and

idote, calcite and