CALIFORNIA ENERGY COMPANY INC.

MAZAMA PROSPECT

KLAMATH COUNTY, OREGON

LITHOLOGY of CORE

from 575 to 1354 feet

November 1986

Columbia Geoscience

DEPTH FT.		LITHOLOGIC DESCRIPTION	RECOVERY % 90 80 70 60 50	FRACTURE ANGLE / FRACTURE DENSITY	COMMENTS
575	769	Rhyodacite: Gray, locally purple-gray, rhyodacite with a macro-texture resembling a very dense welded autobreccia. The rock shows no flow banding, fractures, or vesiculation features that would suggest surface flow dynamics. Occasional irregularly shaped cm-sized vugs are present, lined with a clear tabular zeolite (sub-mm sized crystals, possibly chabazite). Occasional larger irregular cavities and associated fractures are partially to completely filled with calcite and quartz (i.e. at 675 ft.). Calcite also fills irregularly shaped vugs associated with a few of the autobreccia-like fragments. Rarely sub-cm size irregular vugs are observed to be filled with cryptocrystalline silicia. Note that in some vugs a clear plyable material (silicon-like cement ??) has been added; clearly a drilling artifact. The degree and type of rock alteration is somewhat variable. The Fe-bearing minerals are moderately to completely altered to hematite. The groundmass is generally altered to a light green-gray clay, probably smectite. Local hematite alteration has also taken place in the groundmass.	580 590 600 610 620 630 640 650 660	30° 60° <1 10 1 0-15° 3 0-10° <1 0° 50° 2 <1 30° 5° 2 1 <1 40° 5° 20° 2 <1 2 1 5° 4 2 1 60° 0° 3 2	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 compostion. Fractures occasionally follow fragment boundaries, though more often they cut across such boundaries.
		629 ft. The fractures are largely filled with calcite. Fracture surfaces show the same patterns of secondary minerals as observed in the overall rock alteration (mafic minerals altered to reddish hematite, groundmass altered to green-gray clay and trace calcite, clear feldspar [sandine ?] appears to be fresh).			627-628 ft. Predominantly sealed fractures with occasional open cavities.
		666 ft. Green-gray sheared and brecciated zone approximately 8 inches thick. Platy fracture surfaces show dark green slickensides and precipitated calcite. The host rock has a strongly welded crystal-lithic silicic tuff microtexture that grades into a more typical rhyodacite subvolcanic texture within 5 ft. above and below the noted depth.			658 ft. Partially sealed fractures with open cavities.

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					675 ft. Calcite lines vesicles and fractures.
					682-684 ft. Broken and fractured rock.
		691-693 ft. Brecciated rhyodacite with calcite partially filling fractures. Both the pervasive rock alteration and brecciated surfaces show fresh clear feldspar (sandine ?) and mottled red hematite alteration in a greenish groundmass. The groundmass is generally harder than the metal probe point and shows no clear texture with the hand lens. Local small cavities of calcite are present in varying density throughout this section of rock.			692-694 ft. Brecciated with poor fracture cementing.
		756-764 ft. Fractured purple-gray to green-gray rhyodacite. The rock contains variable amounts of red hematite alteration mottled with the a green-gray groundmass. Small irregular vesicles are filled with calcite and silica. The clear feldspar crystals appear to be fresh. Near fracture surfaces the groundmass and feldspar 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 to purple gray, massive. The groundmass conatains variable hematite alteration. Sub-mm feldspars and hornblende crystals are recongnizable.			758-770 ft. Moderately to strongly fractured, including some vertical fracturing.

DEPTH FT.		LITHOLOGIC DESCRIPTION	RECOVERY % 90 80 70 60 50	FRACTURE ANGLE / FRACTURE DENSITY	COMMENTS
		775-780 ft. Broken or crushed zone poorly cemented with a soft white clay, contains many open cavities.			770-784 ft. Fractures lined with thin film of calcite and trace pyrite.
		817-821 ft. Strongly fractured and sheared rock.			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.
		827-828 ft. Strongly fractured and sheared rock.			
		848-850 ft. Cataclastized zone which is poorly cemented. The fracture surfaces are coated with a white clay-like mineral while the center of the fractures are partially filled with coarse calcite crystals.			843.5-844 ft. Single vein of quartz with sub-mm calcite lining. 848-850 ft. Brecciated and poorly cemented. 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.
850	1086	Rhyodacite-Dacite: gray, locally purple gray, massive. The texture varies from a welded autobreccia to a welded crystal-lithic tuff. No flow features or vesiculation are observed. The autobreccia fragments are sub-angular to rounded and range from 1-20 cm. 862-875 ft. Fractures, horizontal to high angle, with no slickensides. No secondary precipitation or alteration minerals are observed.			

DEPTH FT	LITHOLOGIC DESCRIPTION	RECOVERY % (90 80 70 60 50)	FRACTURE ANGLE / FRACTURE DENSITY	COMMENTS
880	875-882 ft. Predominately vertical fractures coated with thin dark green sheared clay. The fractures cross-cut calcite veins.		5° 60° 45° 5° 75° 10°	** 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.
890	890-892.5 ft. Fractured and brecciated zone containing minor white clay, calcite, and clear tabular zeolite (chabazite ?). These fractures cross-cut earlier formed veins of calcite and pyrite. The rock surrounding this brecciated zone is strongly altered to clay.		10° 60° 10° 10°	
900	900-967 ft. Calcite bearing fractures. A few fracture surfaces contain a very thin zone of slickenside-like sheared rock. Occasional calcite bearing fractures show a dark green clay alteration adjacent to the rock.			897 ft. Probable drilling artifact, see comment at 871 ft.
910				
920			5° 50° 5° 50°	910-1002 ft. General increase in pervasive alteration of dacite to light green-gray clay and dark green clay, chlorite, and calcite.
930				
940			5°	
950				
960	967-971 ft. Brecciated zone with a pervasive light green-gray clay alteration of the rock. Minor white clay and traces of a clear tabular zeolite (chabazite ?) have formed on some of the fracture surfaces.		5° 45°	

FRACTURE DENSITY: 3, 8, >10, 3, 5, 3, 2, >10, <1, 1, 3, <1, 5, 2, 1, <1, 2, 1, >10

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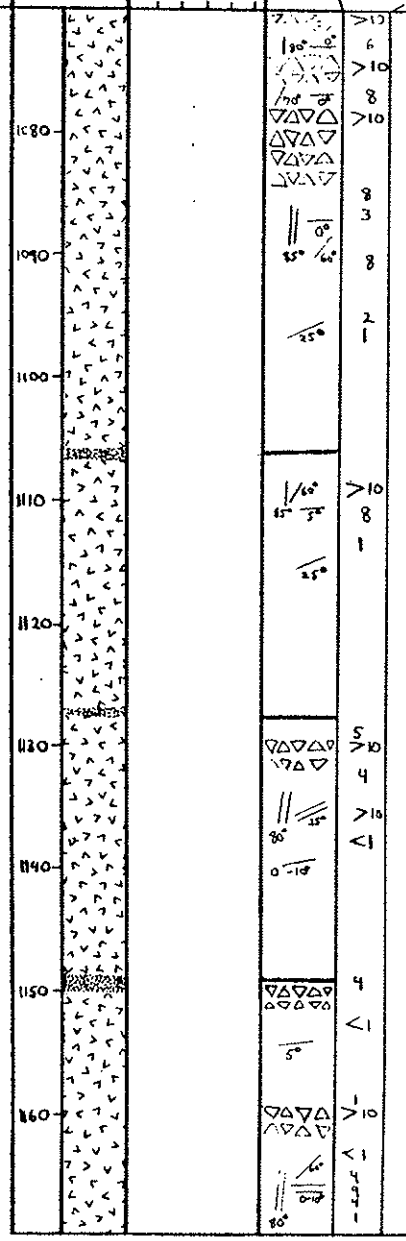
	971-983 ft. Generally unfractured rock with only occasional vesicles filled with calcite.			984 ft. Fractures and vesicles are filled with calcite. 986 ft. a/a 989 ft. a/a
				995-1039 ft. Vein and vesicle filling calcite is common.
				1004 ft. Probable drilling artifact, see comment at 871 ft.
	1003-1039 ft. Dacite autobreccia showing variable secondary hematite alteration in the groundmass. Often the variations in the intensity of secondary hematite accent the autobreccia-like fragments.			
				1024 ft. Probable drilling artifact, see comment at 871 ft.
	1035-1086 ft. The rock is strongly brecciated and variably, but generally strongly, altered to clay. Many of the breccia fragment surfaces have a sheared slickenside texture. No obvious secondary precipitation minerals are observed in this zone.			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.		LITHOLOGIC DESCRIPTION
1086	1125	Dacite: Gray to purple-gray dacite with pronounced autobreccia-like features. The secondary hematite alteration accounting for the purple color is most pronouced in the matrix of the autobreccia. The stable Fe mineral in much of the rock is secondary clay/ chlorite. Minor veins and vesicles of secondary quartz and white clay are usually under 5 mm thick. Near vertical fractures with pronounced sheared faces postdate the mineral filled fractures and vesicles.
1125	1190	Dacite: Gradual decrease in the autobreccia-like features. 1131-1135 ft. Coarsely brecciated dacite with minor mm-thick veins of calcite. The brecciation appeare to postdate the calcite seams. 1141-1151 ft. Brecciated dacite with abundant vertical fractures. No pronounced secondary alteration is observed. No precipitation minerals appear to be associated with the brecciation. Minor calcite veins appear to predate the brecciation. 1159.5-1162 ft. A/a, with some of the fractures following earlier calcite veins. 1164 ft. The dacite contains abundant microcrystalline vesicles. Background alteration appears to include green clay or chlorite, preferentially located around vesicles. Secondary hematite occurs in the groundmass away from the vesicles. The only recognizable primary minerals are mm to sub-mm sized plagioclase laths.



COMMENTS
1074-1079 ft. Minor to trace of pyrite occurs. Note that the pyrite occurrence may predate the intense brecciation of this zone.
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	LITHOLOGIC DESCRIPTION	RECOVERY % 90 80 70 60 50	FRACTURE ANGLE / FRACTURE DENSITY	COMMENTS
	1169-1178 ft. Only minor vesicle and fracture filling minerals are present, mainly calcite. Background rock alteration suggests a partial oxidation of iron minerals followed by secondary green clay or chlorite. The rock contains abundant microvesicles in a crystal-rich groundmass. Minor secondary calcite is ubiquitous throughout the rock. Dacite: Gray to light gray, pervasive though variable clay altered dacite. A few sub-mm clear feldspar crystals appear to be fresh. Many feldspar phenocrysts appear to be altered to clay and calcite. The groundmass contains variable zones of secondary dark green clay/chlorite and minor zones of secondary purple hematite.		<1 0-10° 5° 45° 1190 4 85° 10° <1 0-10°	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.
	1200 ft. The rock is becoming increasingly altered to clay, causing the rock to become softer. 1208 ft. The rock is more brittle due to a decrease in clay alteration. Many of the fracture surfaces show slickenside effects suggesting vertical to oblique high angle movement. Vein filling minerals include calcite and unidentified soft white mineral which does not effervesce in HCl. Traces of mordenite needles may be present as a vein filling mineral. 1211-1217 ft. Highly fractured rock with veins a/a. The background alteration of early stage hematite followed by subsequent green clay or chlorite continues.	1200 1210 1220	>10 85° 10° <1 8 75° <1 0°	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.
	1229-1232 ft. Fractures and vesicles show linings of green clay or chlorite followed by massive calcite. At a hand lens scale no phenocrysts are readily identifiable in the rock. The rock appears to have undergone a mild but pervasive hematite alteration followed by a clay or chlorite alteration. The latter is preferentially located near vesicles and plagioclase sites. Minor secondary calcite commonly occurs in feldspar sites.	1230 1240	~30° 70° 30° 3 55° 1 15° 3	1232-1254 ft. The intensity of fracture and vesicle filling is variable.
	1263-1266 ft. A brecciated zone. The rock shows a pervasive background clay alteration. A clear zeolite with a tabular morphology (chabazite ?) and pervasive purple to orange hematite alteration of the rock is present. Very minor secondary calcite is present along fracture surfaces.	1250 1260	90° 2 >10 1	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.	LITHOLOGIC DESCRIPTION	RECOVERY % (90 80 70 60 50)	FRACTURE ANGLE / FRACTURE DENSITY	COMMENTS
	1267-1276 ft. Dacite with secondary hematite occurring in the groundmass, followed by subsequent secondary green clay or chlorite. Vesicle-filling minerals include green clay followed by massive 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.
1280				
1290				
	1294 ft. A strongly fractured zone. The fractures are partially filled with chlorite (or green clay), minor calcite, mordenite, and sub-mm Fe sulfide (pyrite ?). Soft white areas probably include other unidentified secondary minerals. Mordenite appears to make up the bulk of secondary mineralization in these fractures. 1296 ft. Occasional fractures containing minor secondary quartz, followed by calcite and mordenite. The rock shows somewhat less alteration than up-hole, with only minor early stage hematite alteration. Small sub-mm fractures are predominately filled with silica. Minor localized secondary calcite is limited to the groundmass. By 1298 ft. The secondary mineralization associated with fractures appears to be limited to calcite and a zeolite. Sealed fractures are filled with calcite. Open fracture surfaces have a fine coating of a crystalline zeolite (mordenite ?). Rare sub-mm silica veins may be the result of nothing more than localized metasomatic 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.
1300				
1310				
1320				
1330				
	1301-TD (1354 ft.) The dominant fracture filling minerals are calcite and mordenite with the most recent morphology consisting of calcite blades forming on mordenite needles. The most intensely fractured zones occur at 1331 ft., 1334-1340 ft., and 1347-TD ft. Many of these fractures show a lining of green clay or chlorite. Much of the more recent alteration is dominated by light green clay or chlorite which tends to obscure earlier hematite alteration. The earlier hematite alteration is best preserved in those areas away from intense fracturing. Microscopic sized Fe sulfide occurs as a trace vein mineral and as an alteration mineral below 1319 ft. It occurs most commonly in the intensely fractured areas.			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.
1340				
1350				
	TD 1354			