

GLD1492



December 30, 1986

Ms. Susan Prestwich
Project Officer
U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 94302

RE: Cost Share Agreement No. DE-FC07-86ID12654
Interim Report - MZI-11A

Dear Susan:

As you know, the MZI-11A temperature gradient core hole has been temporarily abandoned--with plans to re-enter and complete the hole next field season. In the interim, BLM is assessing our request to be allowed to drill without returns of circulating fluids.

The following data are submitted to DOE as an interim report. A Final Technical Report will be submitted following completion of the hole. Interim completion reports were submitted to BLM and DOGAMI earlier this month.

Interim Technical Report - TG Core Hole MZI-11A - List of Enclosures

Well History/Drillers Log Summary (Gollan, CECI)
Possible Lost Circulation Zones and/or Water Entries (La Fleur, CECI)
Lithology of Cuttings and Core to 1354 feet (Al Waibel, Columbia Geoscience)
Core Recovery Log (LaFleur, CECI)

We have received the chemical analyses from the stream sampling program and are preparing an introduction and site maps for this data. These, and results of the noise report are being reviewed and will be transmitted to you within the next two weeks. We trust that this completes our reporting requirements for activities to date.

Very truly yours,

Anna K. Carter
Compliance Manager

AKC:z6141/B4

Enclosures

cc: Ms. Elizabeth M. Bowhan, Contracts Specialist, DOE w/enc.
Mr. Mike Wright, UURI w/enc.
Mr. Bob Fujimoto, BLM

MZI-11A

WELL HISTORY/DRILLER'S LOG SUMMARY

DDDDDIETADY

MAZAMA I-11A
Crater Lake, Oregon

9/12/86 Move in and rig up Buckner Drilling rotary rig. Drill 8" hole to 24' with air foam.

9/13/86 Drilling 8" hole from 24' to 370' with air and foam.

9/14/86 Drill 8" hole from 370' to 575' with air and foam.

9/15/86 Mix mud and condition hole.

9/16/86 Circulate and condition mud for casing job.

9/17/86 to 9/28/86 Run in hole to 575' and circulate--pull out of hole. Rig up and run 18 joints (575') 4-1/2" - 11.6# N-80 casing with 8 round LF & C threads. Land casing at 575' and circulated with mud. Cemented with Halliburton, ran 3 bbls. of H₂O ahead of 272 cubic feet Class G cement with 1:1 Perlite, 3% gel. Displaced top plug to 545' with 8 bbls. of H₂O. Plug in place at 1500 hours 9/17/86. Good returns (100+ cubic feet). Job witnessed by Steve Henderson and Dennis Simontacchi.

9/29/86 to 10/7/86 Weld 6" - 900 series slip on casing head to 4-1/2" casing. Install hydraulic operated annular and blind rams BOP's with dual controls. Install Hydrogen Sulfide detectors and alarm system. Rig up Longyear core rig and work on BOP's.

10/8/86 Tested BOP's 1/2 hr. each at 700 psi, test ok. Witnessed by Dennis Simontacchi.

10/9/86 Drilled cement from 545' to 575'.

10/10/86 to 10/24/86 Coring HQ size (3.50" OD) hole F/575' to 1354'. Fighting lost circulation.

10/25/86 Run temperature survey.

10/26/86 to 10/29/86 Rig down and move off Longyear.

GG:sr:20
Z6132:A5

PROPRIETARY

POSSIBLE LOST CIRCULATION ZONES AND/OR WATER ENTRIES

MZI-11a

It is very difficult to determine exact locations of fluid loss or water entries in the hole during drilling operations. There was no fluid loss reported during the drilling of the surface (0'-575'); however, this was drilled with an air hammer using water and foam mix. There were no water entries in the surface hole which was dry to bottom prior to running casing. There was no observable loss of cement to formation during cementing of the surface casing.

During core drilling (575'-1354') with light mud, a lost circulation zone was reported by the driller at approximately 640'. Upon review of the core, it appears more likely that the fluid loss was between 690' and 693' depth and the standing fluid level while drilling was about 640'.

The attached temperature gradient profile shows a linear gradient in the top 550' of the hole and the bottom 100' or so of the surveyed hole. The thermally perturbed portion of the profile (approximately 550' to 1230') does not suggest cold water entries because the temperature reversals are too minor. These minor reversals probably are reflective of zones where cold drilling fluid was lost to the formation. Since this temperature profile was recorded after only about 20 hours of stabilization, the minor reversals may be the best means of trying to determine where fluid loss actually occurred. Inspection of the core suggests fluid loss zones may occur at the following intervals: significant 690'-693'; major 966'-971'; diffuse 966'-971'; minor 1149'-1152'; minor 1160'-1162'; minor 1263'-1266'; minor 1308'-1314'. These observations on the core do not correspond well to the minor reversals on the temperature log.

There is no evidence to suggest that there were any water entries at all in the hole. The regional water table was not encountered but lies within 200' below the bottom of the hole. The bottom hole elevation is approximately 4700' above sea level and Klamath Marsh is about 4500' above sea level. A cold regional groundwater table, as normally conceptualized, may not be present beneath the site as evidenced by the high heat flow observed in the lower portion of the hole.

Attachment

JLF:sm:42:12:19:86:6138

PROPRIETARY

PROPRIETARY

CALIFORNIA ENERGY COMPANY INC.

MAZAMA PROSPECT

KLAMATH COUNTY, OREGON

LITHOLOGY

OF CUTTINGS and CORE

to 1354 feet

November 1986

Columbia Geoscience

PROPRIETARY

CALIFORNIA ENERGY COMPANY INC.

MAZAMA PROSPECT

KLAMATH COUNTY, OREGON

LITHOLOGY of CUTTINGS

from 0 to 570 feet

November 1986

Columbia Geoscience

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 vary 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

LITHOLOGY OF CORE

from 575 to 1354 feet

November 1986

Columbia Geoscience

DEPTH FT.	LITHOLOGIC DESCRIPTION	RECOVERY %	FRACTURE ANGLE		COMMENTS					
			90	80		70	60	50		
575-764	<p>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 silica. Note that in some vugs a clear pliable material (silicon-like cement ??) has been added; clearly a drilling artifact.</p> <p>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.</p> <p>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).</p> <p>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.</p>					<p>577-579 ft. Fractured and broken rock.</p> <p>585-586 ft. a/a</p> <p>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.</p> <p>627-628 ft. Predominantly sealed fractures with occasional open cavities.</p> <p>658 ft. Partially sealed fractures with open cavities.</p>				

DEPTH FT.	LITHOLOGIC DESCRIPTION		RECOVERY %	FRACTURE ANGLE	FRACTURE DENSITY	COMMENTS
			90 80 70 60 50			
					1	675 ft. Calcite lines vesicles and fractures.
		680			2	
					1	
					2	682-684 ft. Broken and fractured rock.
					3	
		690			>10	692-694 ft. Brecciated with poor fracture cementing.
	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.				2	
					3	
		700			3	
					5	
					2	
		710			2	
					3	
					3	
		720			3	
					1	
		730			1	
					5	
		740			1	
					3	
		750			<1	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.
					1	
764	Rhyodacite to Dacite: Gray to purple gray, massive. The groundmass contains variable hematite alteration. Sub-mm feldspars and hornblende crystals are recognizable.	760			7	758-770 ft. Moderately to strongly fractured, including some vertical fracturing.
850					>10	
					4	

DEPTH FT.	LITHOLOGIC DESCRIPTION		RECOVERY %		FRACTURE ANGLE		FRACTURE DENSITY	COMMENTS
			90	80	70	60		
	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.
		780						
		790						
		800						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.
		810						
	817-821 ft. Strongly fractured and sheared rock.							
		820						
	827-828 ft. Strongly fractured and sheared rock.							
		830						
		840						
	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.
		850						848-850 ft. Brecciated and poorly cemented.
850	10%							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.
	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.							
		960						

DEPTH FT.	LITHOLOGIC DESCRIPTION	RECOVERY %	FRACTURE ANGLE		COMMENTS
				FRACTURE DENSITY	
		90 80 70 60 50			
	875-882 ft. Predominately vertical fractures coated with thin dark green sheared clay. The fractures cross-cut calcite veins.			3 8 >10 3 5 3 2	** 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.
	890-892.5 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 <1	897 ft. Probable drilling artifact, see comment at 871 ft.
	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.			1 3 <1 5 2 50 50 1 <1 2 1 >10	910-1002 ft. General increase in pervasive alteration of dacite to light green-gray clay and dark green clay, chlorite, and calcite.
	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.				

DEPTH FT.	LITHOLOGIC DESCRIPTION	RECOVERY %	FRACTURE ANGLE		FRACTURE DENSITY	COMMENTS
			90	80		
971-983	Generally unfractured rock with only occasional vesicles filled with calcite.					
980						984 ft. Fractures and vesicles are filled with calcite. 986 ft. a/a 989 ft. a/a
990						995-1039 ft. Vein and vesicle filling calcite is common.
1000						1004 ft. Probable drilling artifact, see comment at 871 ft.
1003-1039	Dacite autobreccia showing variable secondary hematite alteration in the groundmass. Often the variations in the intensity of secondary hematite accent the autobreccia-like fragments.					
1010						
1020						1024 ft. Probable drilling artifact, see comment at 871 ft.
1030						
1035-1086	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.					
1040						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.
1050						
1060						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	RECOVERY %	FRACTURE ANGLE		COMMENTS
				FRACTURE DENSITY	
		90 80 70 60 50			
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.		0-10°	< 1	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.
	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.		5°		
			45°		
1200 ft.	The rock is becoming increasingly altered to clay, causing the rock to become softer.		10-15°	4	
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.		10-15°	< 1	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.
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.		15-18°	> 10	1217-1218 ft. Only minor amounts of calcite in fractures and vesicles.
			75°	8	
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.		30°	< 1	1232-1254 ft. The intensity of fracture and vesicle filling is variable.
			10°	3	
			30°	1	
			55°	3	
			70°	2	
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.		70°	2	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.
			70°	1	
			70°	> 10	
			70°	1	

MZI-11A
CORE RECOVERY

<u>Depth Interval</u>	<u>Cut</u>	<u>Recovered</u>	<u>% Recovered</u>
575'-579'	4	4	100%
579'-585'	6	6	"
585'-589'	4	4	"
589'-594'	5	5	"
594'-596'	2	2	"
596'-604'	8	8	"
604'-614'	10	10	"
614'-624'	10	10	"
624'-634'	10	10	"
634'-644'	10	10	"
644'-654'	10	10	"
654'-663'	9	9	"
663'-673'	10	10	"
673'-683'	10	10	"
683'-693'	10	10	"
693'-694'	1	1	"
694'-704'	10	10	"
704'-714'	10	10	"
714'-724'	10	10	"
724'-734'	10	10	"
734'-744'	10	10	"
744'-754'	10	10	"
754'-764'	10	10	"
764'-772'	8	8	"
772'-782'	10	10	"
782'-792'	10	10	"
792'-801'	9	9	"
801'-811'	10	10	"
811'-820'	9	9	"
820'-830'	10	10	"
830'-840'	10	10	"
840'-850'	10	10	"
850'-856'	6	6	"
856'-861'	5	5	"
861'-871'	10	10	"
871'-873'	3	2	67%
873'-882'	9	9	100%
882'-892'	10	10	"
892'-897'	5	5	"
897'-907'	10	10	"
907'-914'	7	7	"
914'-924'	10	10	"
924'-934'	10	10	"
934'-944'	10	10	"
944'-954'	10	10	"
954'-964'	10	10	"

PROPRIETARY

<u>Depth Interval</u>	<u>Cut</u>	<u>Recovered</u>	<u>% Recovered</u>
964'-974'	10	10	100%
974'-984'	10	10	"
984'-994'	10	10	"
994'-1004'	10	10	"
1004'-1006'	2	2	"
1006'-1014'	8	8	"
1014'-1024'	10	10	"
1024'-1032'	8	8	"
1032'-1042'	10	10	"
1042'-1052'	10	10	"
1052'-1058'	6	6	"
1058'-1061'	3	3	"
1061'-1069'	8	8	"
1069'-1079'	10	10	"
1079'-1084'	5	5	"
1084'-1086'	2	2	"
1086'-1096'	10	10	"
1096'-1106'	10	10	"
1106'-1108'	2	2	"
1108'-1118'	10	10	"
1118'-1128'	10	10	"
1128'-1138'	10	10	"
1138'-1147	9	9	"
1147'-1150'	3	3	"
1150'-1154'	4	4	"
1154'-1162'	8	8	"
1162'-1164	2	2	"
1164'-1174'	10	10	"
1174'-1184'	10	10	"
1184'-1194'	10	10	"
1194'-1204'	10	10	"
1204'-1209	5	5	"
1209'-1219'	10	10	"
1219'-1225'	6	6	"
1225'-1234'	9	9	"
1234'-1244'	10	10	"
1244'-1250'	6	6	"
1250'-1259'	9	9	"
1259'-1263'	4	3	75%
1263'-1268'	5	4	80%
1268'-1278'	10	10	100%
1278'-1287'	9	9	"
1287'-1297'	10	10	"
1297'-1307	10	10	"
1307'-1315'	8	8	"
1315'-1324'	9	9	"
1324'-1334'	10	10	"
1334'-1344'	10	10	"
1344'-1354'	10	10	"