

UURI

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April 16, 1984

Alex Schriener
Area Geologist
Union Geothermal Division
Union Oil Company of California
2099 Range Avenue
Santa Rosa, CA 95406

Dear Alex:

The 34 geochemical pulp samples you submitted earlier this year have been mineralogically analyzed by qualitative X-ray diffraction (XRD). Preliminary results for 13 bulk samples, and for clay fractions extracted from seven of these, were reported to you in my letter of March 5. The present report documents analyses for the entire sample suite, and briefly discusses implications of these analyses for geothermal exploration.

Bulk samples can be grouped broadly into two categories: 1) those dominated by plagioclase and 2) those containing sanidine and cristobalite with minor tridymite and a trace of quartz. These two sample types probably correspond, respectively, to intermediate to mafic volcanic rocks and felsic volcanic rocks.

Plagioclase in type 1 rocks is a variety more calcic than albite, probably andesine or labradorite; it may be accompanied by trace to minor clinopyroxene and apatite, but the X-ray signatures of these phases, if present, are obscured or concealed by the strong, numerous, crowded peaks of the overwhelmingly dominant plagioclase; petrographic examination is suggested for definite identification. Ilmenite, pyrite or marcasite and hematite are other probable trace constituents of many plagioclase-rich samples.

Cristobalite-sanidine rocks are probably rich in devitrified felsic glass. In several of these rocks, such as well no. 3, 750-800', devitrification may not have proceeded to completion; a prominent, broad glass "hump" is apparent between about 18 and 34°2 θ . Alternatively, but less likely, the "hump" could reflect the presence of opal.

Zeolites occur only in wells 1 and 2. In well 1, mordenite is a major constituent of the sample spanning 1900-1950'. In well number 2, zeolites are

zoned with depth; clinoptilolite occurring above 1145' and analcime or wairakite (too little of this phase for a definite identification) below this footage.

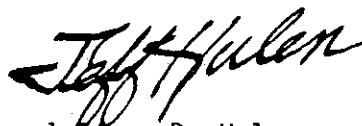
Clay minerals occur in all wells, but are most abundant in wells 1 and (particularly) 2. Smectite, the most common, is found in 16 of the 34 bulk samples; it is a major component of three. With a basal spacing of about 14Å, the smectite probably contains calcium and/or (less likely) magnesium as the principal interlayer cation(s). Illite occurs only in well no. 1; at a depth of 1900' in this well it is accompanied by a trace of randomly-ordered, mixed-layer illite-smectite. Chlorite or kaolinite occur in two samples--one each in wells 2 and 4.

Well number 2 displays a distinct layer silicate zoning which mirrors the zoning of coexisting zeolites. Smectite occurs in the four samples above 1145'; in two of these samples it is accompanied by clinoptilolite. The two samples below 1145' contain conspicuous mixed-layer chlorite-smectite--an ordered variety with about 55% chlorite (Reynolds, 1980). This phase is accompanied in both samples by analcime or wairakite.

Of the five wells investigated, number 2 would appear to be the most encouraging for discovery of a concealed geothermal resource. Its well-developed zeolite and clay mineral zoning may indicate progressively higher-temperature, hydrothermal fluid circulation with increasing depth. Ordered, mixed-layer clays such as those of well 2 almost always develop at relatively high temperatures under conditions of deep diagenesis or hydrothermal alteration (Dunoyer de Segonzac, 1970). Mixed-layer, ordered chlorite-smectites were found in cuttings above productive reservoir at the Tiwi system, Philippines (UURI/ESL reports to Thomas Powell; Nov. 21, 1983 and Feb. 14, 1984), and in cuttings from your Geysers well KC88-24 (UURI/ESL report to Barbara Gallinatti; April 2, 1984), strengthening speculation that an active geothermal system could be present below the sampled depths of well 2. In research well Y-1 at Yellowstone (Honda and Muffler, 1970) clinoptilolite in less altered, high-level rocks gives way to analcime in deeper, more highly altered rocks; this zeolite zoning sequence is very similar to that observed in well 2. Of course, the alteration of well 2 could be entirely paleohydrothermal, so all other downhole data should be compared with the alteration assemblages to determine the probability of a concealed thermal resource at this site.

Thank you very much for submitting these rocks for X-ray analysis. I realize you've had to wait quite a while for the results, and appreciate your patience. The analyses are intriguing; I hope they enable you to bring in a new field.

Sincerely yours,



Jeffrey B. Hulen
Geologist

JBH/jp

REFERENCES

- Dunoyer de Segonzac, 1970, The transformation of clay minerals during diagenesis and low-grade metamorphism--a review: *Sedimentology*, vol. 15, p. 281-346.
- Honda, S., and Muffler, L. J. P., 1970, Hydrothermal alteration in core from research drill hole Y-1, Upper Geyser Basin, Yellowstone National Park, Wyoming: *American Mineralogist*, vol. 55, p. 1714-1737.
- Reynolds, R. C., 1980, Interstratified clay minerals in Brindley, G. W., and Brown, G., eds., *Crystal structures of clay minerals and their X-ray identification*: London, Mineralogical Soc. Mon. 5, p. 411-438.

26-28

WELL No. 1 BULK CUTTINGS AND CLAY FRACTIONS (< 5μ)	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>															
	QUARTZ	CRISTOBALITE	TRIPYRITE	K-FELDSPAR	PLAGIOCLASE	HEMATITE	ILMENITE	PYRITE OR MARCASITE	GOETHITE	ILLITE	SMECTITE	CHLORITE OK	KAOLINITE	MIXED-LAYER CHLORITE-SMECT	MIXED-LAYER ILLITE-SMECT	MORDENITE
SAMPLE NO.																
353-401' BULK CLAY				MM		TR?		TR?	M							
550-600' BULK CLAY				MM		TR?	TR?									
850-900' BULK CLAY				MM		TR	TR?									
1150-1200' BULK CLAY				MM				TR?	TR?		TR					
1500-1550' BULK CLAY				MM				TR?	TR?		M					
1900-1950' BULK CLAY	M	M?	M?							TR?	M		TR?		M	
2100-2150' BULK CLAY	M	M	M			M?		TR?			TR					

TABLE 1.

SUSPECT GLASS
ALL PROB. KF PKS. OVERLAPPED BY MORD. PKS.

WELL No. 1

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

WELL No. 2
BULK CUTTINGS

MF 56-3

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
ILMENITE
PYRITE OR
MARGARITE
GOETHITE
ILLITE
SMECTITE
CHLORITE OR
KAOLINITE OR
MIXED-LAYER
CHLOR-SMECT.
MIXED-LAYER
ILLITE-SMECT.
CLINOPTILOLITE
ANALCIME OR
VAIRAKITE
CALCITE

205-301'

MM

Tr? Tr? Tr?

m

506-562'

MM

Tr?

M

m

787-886'

MM

Tr?

m

1110-1145'

m

MM

?

m?

M

m

Tr?

1426-1459'

m

MM

?

m?

m

m

m

1727-1760'

m

MM

m

m

m

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE , EARTH SCIENCE LABORATORY

TABLE 2.

WELL NO. 2

WELL No. 3
BULK CUTTINGS
MLF 51-2

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITTE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
IL-MENITE
PYRITE OR
MARCASITE
ILLITE
SMECTITE
CHLORITE
KAOLINITE
MIXED-LAYER
CHLORITE-LAYER
MIXED-LAYER
ILLITE-SMEC.
ILLITE-SMEC.

NOTES / OTHER PHASES

SAMPLE NO.	QUARTZ	CRISTOBALITE	TRIDYMITTE	K-FELDSPAR	PLAGIOCLASE	HEMATITE	IL-MENITE	PYRITE OR MARCASITE	ILLITE	SMECTITE	CHLORITE	KAOLINITE	MIXED-LAYER CHLORITE-LAYER	MIXED-LAYER ILLITE-SMEC.	ILLITE-SMEC.	NOTES / OTHER PHASES
150-200'	TR	M	TR	M												
500-550'	TR	M	M	M												
750-800'		M	TR	M												PROBABLY ABUNDANT GLASS
900-950'	m				MM				M							
1150-1200'					MM	-	TR?									
1500-1550'					MM		TR?	TR?								
1800-1840'					MM		TR?	TR?								

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

TABLE 3

WELL No. 3



WELL No. 4
BULK CUTTINGS

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

52-30

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
ALMENITE
PYRITE OR
MARGASITE
ILLITE
SMECTITE
CHLORITE
KAOLINITE OR
MIXED-LAYER
CHLORITE-LAYER
MIXED-LAYER
ILLITE-SMEC.
SMEC.

NOTES/ OTHER PHASES

DEPTH	QUARTZ	CRISTOBALITE	TRIDYMITE	K-FELDSPAR	PLAGIOCLASE	HEMATITE	ALMENITE	PYRITE OR MARGASITE	ILLITE	SMECTITE	CHLORITE	KAOLINITE OR MIXED-LAYER	CHLORITE-LAYER	MIXED-LAYER	ILLITE-SMEC.	SMEC.	NOTES/ OTHER PHASES
250-300'				MM	m				Tr	Tr							
500-550'				M													PROBABLY ABUNDANT GLASS
800-850'		M		m	M	Tr?											
1100-1150'					MM					m							
1450-1500'	Tr	M	Tr		M	M				m							
1700-1750'		M	Tr		M	Tr?				Tr?							
1900-1950'	Tr	M	m		M												

TABLE 4.

WELL No. 4

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

WELL No. 5
BULK CUTTINGS

54-19

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITE
K-FELDSPAR
PLASIOCLASE
HEMATITE
ALMENITE
PYRITE OR
MARGASITE
ILLITE
SMECTITE
CHLORITE OR
KAOLINITE OR
MIXED-LAYER
CHLORITE-SMEC.
MIXED-LAYER
ILLITE-SMECTITE

NOTES/OTHER PHASES

150-200'

MM

Tr?

500-550'

MM

850-900'

MM

m?

1300-1350'

MM

m

ALSO UNKNOWN T44A
PHASE
PROBABLE ABUNDANT
GLASS

1500-1550'

MM

Tr?

Tr?

1550-1600'

MM

Tr?

1900-1950'

MM

Tr?

m

2150-2200'

MM

m

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

TABLE 5

WELL No. 5



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

LK

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

ALEX SCHRIENER
OCT 10 1985

SAMPLE NO.

SAMPLE NO.	QUARTZ	CRISTOBALITE	K-FELDSP.	PLAGIOCLASE	CALCITE	MORPENITE	MAGNETITE	ILMENITE	HEMATITE	PYRITE	CLINOPYROXENE (OR) ORTHOPYROX.	AMPHIBOLE	EPIDOTE	APATITE	SMECTITE	ILLITE *MICA	CHLORITE	KAOLIN	ANALCIME OR WATTSKITE	OTHER *
68-400			82			2?	1	1						1						33
68-800			55				1	2		>10?			1?	6						<25
68-1200			58				1	1		>10?			1?	9						<20
68-1600	8	15	40	12		2		1						10		TR?	TR?			12
68-1900	17		5	48	1		2	3		>5?				5		2				<12
68-2200	40		32	17				1						3	5	2				
68-3000	14		2	45	7			4		>10?				2	2	6				<8
68-3400	10		1?	46	3			4		>10?				5		3				<18
68-3800	8			48			2	2		>10?			1?	14		7				<8
68-4400	8			48	8		1	4		>10?				3		8				<10
68-4800	14		2	53			2	2		? 2				TR		5		TR?		20
68-5000	13		2	48	1			2				3				11				20
68-5200	9			53	1			2				3				9				25
68-5600	11		2	47	3			3				3				4		1?		26
68-6000	11		1	52	3			3				3				5		1?		21
68-6400	12		2	55	4			3			2	3				5		TR?		14

OK

* INCLUDES AMORPHOUS PHASES, THOSE BELOW DETECTION LIMIT, AND THOSE WHOSE REFLECTIONS ARE MASKED BY PLAGIOCLASE PEAKS. MAY INCLUDE SOME LOST CIRCULATION MATERIAL.

IM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY



WELL Nos. 8, 10, 11
BULK CUTTINGS
(WELL NO. 9 ON
FOLLOWING PAGE)

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
ALMENITE
PYRITE
ILLITE
SMECTITE
CHLORITE
MIXED-LAYER
ILLITE-SMEC.
MIXED-LAYER
CHLOR.-SMEC.
CLINOPTILOL.
ANALCIME

NOTES/
OTHER
PHASES

No. 8 242-270'	M		M	m						m									
				M	M					m					m				
				MM	m					M					m				
				MM	m	TR?				M					TR				
No. 10 300-390'				MM	m					m									
		M		M	m			*TR?		TR									PROBABLY ABUNDANT GLASS
					M					TR									"
					M					m									"
		m			TR	M													"
		M	m		M									TR?					
		M	m		M														
		M	m		M				m		m								
No. 11 300-350'				MM															
				MM															
				MM		TR?	TR?			m									
				MM						m									
				MM						m									
				MM						m				TR?					
																			2140-2795 No. calcite calcite, musc. + @ 2795 No qtz veins * OR MARCASITE

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTT. E, EARTH SCIENCE LABORATORY

57-B
 MP
 33
 44-33
 57-11
 ML57H

27-27, 3000': → ± 2.71 Å PEAK (NOT PY OR MARC.) MAY BE IMPURE HEMATITE
 * MAY INCLUDE OTHER AMORPHOUS PHASES SUCH AS OPAL

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>													OTHER PHASES POSSIBLY PRESENT IN TRACE, TO MINOR AM'TS.		
	QUARTZ	CRISTOBALITE	TRIDYMIT	K-FELDSP.	PLAGIOCL.	ILMENITE	HEMATITE	MAGNET.	SMECTITE	ILLITE	MICA #/OR	CHLORITE	KALIN OR SERPENTINE		CALCITE	GLASS*
WELL 14-23																
444'	<M				MM	<M	<M?							M?		CPX, OPX, AP
816'					M	<M								M		AP, GOE
1462'					MM		<M?	M						M?		AP
1903'		M			M									MM		
2325'	<M	M?	M	M	M			<M								
2599'					MM		<M?	<M?	M							AP
2998'					MM		<M?	<M						M?		AP
WELL 18-34																
583'					MM	<M								M?		AP, OLV
1289'														MM		
1983'	M	M	M	M			<M	<M	<M?							
2507'		M		M	M									M?		
2932'					MM	<M	<M		M					M?		AP
3498'					MM	<M	<M?		M					M?		OPX, AP
WELL 27-27																
619'					MM									M?		CPX, AP
1266'					MM		<M?							M?		AP, OLV
1635'					M									M		OLV
2145'					MM	<M	<M?							M?		CPX, AP, OLV
2543'					MM	<M	<M?	<M?						M?		CPX, AP, OLV
3000'					MM		M?	<M						M?		AP, OLV

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5WT% ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

WELL No. 9
BULK CUTTINGS

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

17-6

SAMPLE NO.	QUARTZ	CRISTOBALITE	TRIDYMIT	K-FELDSPAR	PLAGIOCLASE	HEMATITE	ILMENITE	PYRITE	ILLITE	SMECTITE	CHLORITE	MIXED-LAYER ILLITE-SMECT.	MIXED-LAYER CHLOR-SMECT.	CLINOPTILOL.	ANALCIME	NOTES/ OTHER PHASES
270-330'				MM		TR	TR			TR						
420-470'				TR? MM		TR	TR			TR						
720-780'	M	TR	M							TR						
960-1020'				MM		TR				TR						
1260-1380'				MM						m				m	m	
1770-1860'				MM		TR				m						
2280-2300'				MM						m						
2620-2680'				MM		TR				m						
3040-3100'				MM		m	TR			m						
3400-3460'	M			m? MM			TR?			TR	m					
3460-3670'	m			MM						m		m				
3940-3990'	m			MM		TR				m	TR*					

XRD
17-6

MM = PREDOMINANT M = MAJOR m = MINOR TR = TRACE ? = TENTATIVE IDENTIFICATION

* OR MARCASITE
* OR KAOLINITE



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

WELL Nos. 12 & 13
BULK CUTTINGS

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>													OTHER PHASES / NOTES		
	QUARTZ	CRISTOBALITE	TRIDYMITITE	K-FELDSPAR	PLAGIOCLASE	HEMATITE	ILMENITE	PYRITE	ILLITE & MICA	SMECTITE	MIXED-LAYER ILLITE-SMECT.	MIXED-LAYER CHLOR.-SMECT.	STILBITE			
WELL No. 12																
450-500'					MM											
750-800'					MM	m										
1050-1100'					MM		Tr?									
1350-1400'	Tr	M	m		M											
1600-1650'	Tr	M	Tr		M											
1850-1900'		M	m		M				m							
2100-2150'		m	M		M				Tr?							
WELL No. 13																
304-336'					M											PROBABLY ABUNDANT GLASS
564-605'					MM											
829-863'		M			M	M										
1178-1208'					MM				Tr							
1419-1448'					M		m		M				m			
1588-1617'		M			M				m							

1ML 65-26f

17

84-17

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

AUG 15 1985

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>																
	QUARTZ	CRISTOBAL.	TRIDYMIT	K-FELDSP.	PLAGIOCL.	OLIVINE	CLINOPIROXENE	ORTHOPYROXENE	ILMENITE	HEMATITE	APATITE	SMECTITE	ILLITE #/OR	CHLORITE	GOETHITE	GLASS *	MAGNETITE
14-23																	
444'	<M			MM	<M?	<M?	<M	<M?							M?	<M?	
816'				M			<M	<M?						<M?	M		
1462'				MM					<M?	M					M?	<M?	
1903'		M		M											MM		
2325'	<M	M?	M	M	M						<M						
2599'				MM				<M?	<M?	M							<M?
2998'				MM					<M?	<M					M?	<M?	
18-34																	
583'				MM	M			<M		<M?						M?	
1289'								<M?								MM	
1983'	M	M	M	M					<M		<M	<M?					
2507'		M		M	M											M?	
2932'				MM					<M	<M	<M?	M				M?	
3498'				MM					<M?	<M	<M?	<M?	M			M?	
27-27																	
619'				MM		<M?					<M?					M?	
1266'				MM	<M					<M?	<M?					M?	
1635'				M	<M											M	
2145'				MM	<M	<M?		<M	<M?	<M?						M?	
2545'				MM	<M	<M?		<M	<M?	<M?						M?	<M?
3000'				MM	<M					‡	<M?	<M				M?	

* NOTE: "GLASS" CATEGORY MAY INCLUDE OTHER AMORPHOUS PHASES IN MINOR AMOUNTS.

‡ NOTE: UNIDENTIFIED 2.7 Å PEAK (MINOR); NOT PYRITE OR MARCASITE, POSSIBLY IMPURE HEMATITE

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5 WT % ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

* MAY INCLUDE OTHER AMORPHOUS PHASES SUCH AS OPAL.

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>															OTHER PHASES POSSIBLY PRESENT IN TRACE TO MINOR AM'TS.		
	QUARTZ	CRISTOBAL.	TRIDYMITE	K-FELDSP.	PLAGIOCL.	ILMENITE	HEMATITE	MAGNETITE	SMECTITE	ILLITE # OR MICA # OR	CHLORITE	KAOLIN # OR SERPENTINE	CALCITE	GLASS *	ANALCIME OR WAIRAKITE		CLINOPTILOL.	ORAL-CT
WELL 62-21																		
530'					MM	<M	<M		<M					M?				CPX, OPX, AP
1035'					MM		<M		M					M?		<M	<M?	
1700'					MM				M				<M	M?				CPX, AP
1973'					MM		<M	<M?	M				<M?	M?		<M		CPX, AP
2132'					MM		<M?	<M		M				M?				CPX, AP
WELL 68-16																		
508'		M		MM	M		<M											
1039'		M		MM	M		<M		<M?									
1338'					M									MM				
1740'					M				<M					M				CPX,
1857'					M				<M	<M?				MM				
2227'					MM		<M?		M					M?				CPX, AP
2599'		MM	M	M			<M											
2936'		MM		M			<M		<M									
WELL 86-23																		
694'					MM		<M		<M					M?				CPX, AP
1085'					MM		<M		<M					M?				CPX, OPX, AP
1554'					MM		M		M					M?				CPX, AP
2258'					MM		<M		<M					M?				CPX, AP
3157'					MM		<M		M					M?				CPX, OPX, AP
3497'					M				M					M?	<M			CPX, AP

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5wt.% ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

* MAY INCLUDE OTHER AMORPHOUS PHASES SUCH AS OPAL

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>													OTHER PHASES POSSIBLY PRE- SENT IN TRACE, TO MINOR, AMTS.		
	QUARTZ	CRISTOBAL.	TRIDYMITE	K-FELDSP.	PLAGIOCL.	ILMENITE	HEMATITE	MAGNET.	SMECTITE	ILLITE MICA #/OX	CHLORITE	KAOLIN OR SERPENTINE	CALCITE		GLASS*	PYRITE
WELL 45-36																
100'					MM	<M	<M							M?		CPX, OPX, AP
480'	m	M	m	MM				<M								
1000'					MM		<M		M					M?		CPX, OPX, AP
1470'					MM	<M	<M		M					M?		CPX, OPX, AP
1860'					MM	<M	M		M					M?		AP
2390'					MM	<M	<M		M		<M			M?		AP
2780'	M			M	M		<M?			<M				<M		
3100'	M			M	M		<M?			<M						NOTE: PLAGIOCLASE IS PROBABLY ALBITE
3600'	m				MM	<M?			M					M?		CPX, AP
4000'	m			m	MM			<M		M				M?		AMPH
WELL 57-13																
781'														MM		CPX
1423'														MM		
1637'														MM		
2079'	m	<M	M	MM			<M		<M	<M						
2426'										<M				MM		
2929'					MM				M					M?		CPX

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5WT.% ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

AUG 15 1985

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>																					
	QUARTZ	CRISTOBALITE	TRIDYMITE	K-FELDSP.	PLAGIOCL.	OLIVINE	CLINOPYROXENE	ORTHOPYROXENE	IL-MENITE	HEMATITE	MAGNETITE	APATITE	SMECTITE	ILLITE MICA #/OR	CHLORITE	CALCITE	GLASS *	WALLAKITE OR ALAL CLINE	SERPENTINE	EYRITE	AMPHIBOLE	
78-72																						
440'		M	m	MM	<M?					<M												
860'		m	M	m	MM								<M									
1280'			M		M	m							<M									
1500'		m	M		M	m							<M?	<M								
1950'		<M?			<M?	MM	<M?		M		<M?	<M						m?				
2480'			M		M					<M?			M									
2950'		M			MM					<M												
3572'		m			<M?	MM			<M	<M	<M?	<M?	M					m?	<M?			NOTE: SERPENTINE POSSIBLY ± KAOLIN (DISORDERED)
3968'		M			m?	M				M					m	<M						
4500'		m			m?	M							<M	M	<M		<M		M			
29-1																						
467'						MM						<M?										M
1297'			M	m	MM								<M									
1951			m	M	MM								<M									
2375'													<M	<M								MM
2803			<M?			<M?	MM			<M?		<M?	<M?	M								m?
3088'							MM			<M?	<M?		<M?	<M?	M							m?

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5 WT.% ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
 UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

*NOTE: *GLASS CATEGORY MAY INCLUDE OTHER AMORPHOUS PHASES IN MINOR AMOUNTS.

AUG 15 1985

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>																
	QUARTZ	CRISTOBAL.	TRIDYMITE	K-FELDSP.	PLAGIOCL.	OLIVINE	CLINOPYROXENE	ORTHOPYROXENE	ILMENITE	HEMATITE	APATITE	SMECTITE	ILLITE #/OR	CHLORITE	GOETHITE	GLASS *	MAGNETITE
14-23	✓	✓	✓	✓	✓										✓	✓	
444'	<m				MM	<m?	<m??	<m		<m?					m?	<m?	
816'					M			<m		<m?				<m?	M		
1462'					MM					<m?	M				m?	<m?	
1903'		m			m										MM		
2325'	<m	m?	m	M	m						<m						
2599'					MM				<w?	<m?	M					<m?	
2998'					MM					<m?	<m				m?	<m?	
18-34	✓	✓		✓	✓				✓		✓	✓			✓		
583'					MM	m		<m		<m?					m?		
1289'							<m?								MM		
1983'	m	M	m	M					<m		<m	<m?					
2507'		M		M	m										m?		
2932'					MM			<m	<m	<m?	m				m?		
3498'					MM		<m?	<m	<m?	<m?	m				m?		
27-27					✓	✓			✓	✓	✓				✓		
619'					MM		<m?			<m?					m?		
1266'					MM	<m				<m?	<m?				m?		
1635'					M	<m									M		
2145'					MM	<m	<m?	<m	<m?	<m?					m?		
2543'					MM	<m	<m?	<m	<m?	<m?					m?	<m?	
3000					MM	<m			±	<m?	<m				m?		

* NOTE: "GLASS" CATEGORY MAY INCLUDE OTHER AMORPHOUS PHASES IN MINOR AMOUNTS.

† NOTE: UNIDENTIFIED 2.7 Å PEAK (MINOR); NOT PYRITE OR MARCASITE, POSSIBLY IMPURE HEMATITE

MM = PREDOMINANT M = MAJOR m = MINOR <m = <5 wt % ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

WELL Nos. 6 & 7
BULK CUTTINGS

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITTE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
IL-MENITE
PYRITE
ILLITE
SMECTITE
SHLORITE
KAOLINITE OR
MIXED-LAYER
SHLOR-ILM
MIXED-LAYER
ILLITE-SMECT.
ILLITE-LAYER
SMECT.

NOTES/OTHER PHASES

ML 75-6

WELL No. 6

350-400'

MM TR?

600-650'

MM TR?

800-850'

MM M TR

1050-1100'

MM TR? TR M

1450-1500'

M TR? M M

ABUNDANT GLASS

1750-1800'

TR MM M

1950-2000'

MM M

2-81

WELL No. 7

700-730'

TR M M? MM TR

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

* MAY INCLUDE OTHER AMORPHOUS PHASES SUCH AS OPAL

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>													OTHER PHASES POSSIBLY PRESENT IN TRACE TO MINOR AMTS.		
	QUARTZ	CRISTOBAL.	TRIDYMITE	K-FELDSP.	PLAGIOCL.	ILMENITE	HEMATITE	MAGNET.	SMECTITE	ILLITE #/OX	CHLORITE	KAOLIN OR SERPENTINE	CALCITE		GLASS*	PYRITE
WELL 45-36																
100'					MM	<M	<M							M?		
480'	m	M	m	MM				<M								
1000'					MM		<M	M						M?		
1470'					MM	<M	<M	M						M?		
1860'					MM	<M	M	M						M?		
2390'					MM	<M	<M	M			<M			M?		
2780'	M			M	M			<M?			<M				<M	
3100'	M			M	M			<M?			<M					
3600'	m				MM	<M?		M						M?		
4000'	m			m	MM			<M			M			M?		
WELL 57-13																
781'														MM		
1423'														MM		
1637'														MM		
2079'	m	<M	M	MM				<M			<M	<M				
2426'														MM		
2929'														M?		

NOTE: PLAGIOCLASE IS PROBABLY ALBITE

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5wt.% ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INS TUTE , EARTH SCIENCE LABORATORY

AUG 15 1985

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>																
	QUARTZ	CRISTOBAL.	TRIDYMIT	X-FELDSP.	PLAGIOCL.	OLIVINE	CLINOPYROXENE	ORTHOPYROXENE	ILMENITE	HEMATITE	APATITE	SMECTITE	MICA #/OR	CHLORITE	GOETHITE	GLASS *	MAGNETITE
14-23	✓	✓	✓	✓	✓				✓	✓					✓	✓	
444'	<m				MM	<m?	Am?	<m		<m?					m?	Am?	
816'					M			<m		<m?				Am?	M		
1462'					MM					<m?	m				m?	<m?	
1903'		m			m										MM		
2325'	<m	m?	m	M	m							<m					
2599'					MM				<m?	<m?	M					Am?	
2998'					MM					<m?	<m				m?	<m?	
18-34	✓	✓		✓	✓				✓		✓	✓			✓		
583'					MM	m		<m		<m?					m?		
1289'							Am?								MM		
1983'	m	M	m	M					<m	<m	Am?						
2507'		M		M	m										m?		
2932'					MM			<m	<m	<m?	m				m?		
3498'					MM		Am?	<m	Am?	<m?	m				m?		
27-27				✓	✓				✓	✓	✓				✓		
619'					MM		Am?			<m?					m?		
1266'					MM	<m			<m?	<m?					m?		
1635'					M	<m									M		
2145'					MM	<m	<m?	<m	<m?	<m?					m?		
2545'					MM	<m	<m?	<m	Am?	<m?					m?	Am?	
3000					MM	<m			±	<m?	<m				m?		

* NOTE: "GLASS" CATEGORY MAY INCLUDE OTHER AMORPHOUS PHASES IN MINOR AMOUNTS.
 * NOTE: UNIDENTIFIED 2.7 Å PEAK (MINOR); NOT PYRITE OR MARCASITE; POSSIBLY IMPLIES HEMATITE

MM = PREDOMINANT M = MAJOR m = MINOR <m = <5 wt % ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
 UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

ML 36-28

WELL No. 1
BULK CUTTINGS
AND CLAY FRACTIONS (< 5µ)

ML 36-28

SAMPLE NO.

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

QUARTZ
CRISTOBALITE
TRIPYMITITE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
ILMENITE
PYRITE OR MARCASITE
GOETHITE
ILLITE
SMECTITE
CHLORITE OR KAOLINITE OR MIXED-LAYER
CALORITE
MIXED-LAYER ILLITE-SMEC.
MORDENITE

TABLE 1.

	QUARTZ	CRISTOBALITE	TRIPYMITITE	K-FELDSPAR	PLAGIOCLASE	HEMATITE	ILMENITE	PYRITE OR MARCASITE	GOETHITE	ILLITE	SMECTITE	CHLORITE OR KAOLINITE OR MIXED-LAYER	CALORITE	MIXED-LAYER ILLITE-SMEC.	MORDENITE
353-401' BULK CLAY				MM		TR?		TR?		m					
				M				m		m					
550-600' BULK CLAY				MM		TR?	TR?								
				M							m				
850-900' BULK CLAY				MM		TR	TR?								
				M							m				
1150-1200' BULK CLAY				MM				TR?	TR?						
				M											
1500-1550' BULK CLAY				MM				TR?	TR?						
				M					TR?		m				
1900-1950' BULK CLAY		m	m?	m?						TR?	m		TR?		M
		m	m?	m?						m	M		m		M
2100-2150' BULK CLAY	M	M		M		m?	TR?				TR				
	m	M		M		m?					m				

SUSPECT GLASS
ALL PROB. KF PKGS. OVERLAPPED BY MORD PKGS.

Quartz at 2084'

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

WELL NO. 1

R. P. GUNDER:

AUG 15 1985

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>																					
	QUARTZ	CRISTOBALITE	TRIDYMITE	K-FELDSP.	PLAGIOCL.	OLIVINE	CLINOPYROXENE	ORTHOPIROXENE	IL-MENITE	HEMATITE	MAGNETITE	APATITE	SMECTITE	ILLITE MICEL #/OR	CHLORITE	CALCITE	GLASS *	WAIKAKITE OR ANALCIME OR	SERPENTINE	PYRITE	AMPHIBOLE	
78-32																						
440'		M	m	MM	<M?					<M												
860'	m	M	m	MM									<M									
1280'		M		M	m								<M									
1500'	m	M		M	m								<M?	<M								
1950'	<M?			<M?	MM	<M?			M		<M?	<M					m?					
2480'		M		M						<M?			M									
2950'	M			MM						<M												
3572'	m			<M?	MM				<M	<M	<M?	<M?	M				m?		<M?			NOTE: SERPENTINE POSSIBLY ± KAOLIN (DISORDERED)
3968'	M			m?	M					M				m	<M							
4500'	m			m?	M								<M	M	<M		<M		m			
29-1																						
467'					MM								<M?								M	
1297'		M	m	MM										<M								
1951'		m	M	MM										<M								
2375'													<M	<M							MM	
2803'	<M?			<M?	MM				<M?				<M?	<M?	M						m?	<M?
3088'					MM				<M?	<M?				<M?	<M?	M					m?	

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5 WT.% ? = TENTATIVE IDENTIFICATION

* NOTE: "GLASS" CATEGORY MAY INCLUDE OTHER AMORPHOUS PHASES IN MINOR AMOUNTS.



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE , EARTH SCIENCE LABORATORY

ML 51-2

WELL No. 3 BULK CUTTINGS	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>																		SAMPLE NO.	NOTES / OTHER PHASES		
	QUARTZ	CRISTOBALITE	TRIDYMITITE	K-FELDSPAR	PLAGIOCLASE	HEMATITE	ILMENITE	PYRITE OR MARGASITE	ILLITE	SMECTITE	CHLORITE OR KAOLINITE OR MIXED-LAYER CHLORITE-LAYER	MIXED-LAYER ILLITE-SMEC.	ILLITE-SMEC.									
	Tr	M	Tr		M																	
	Tr	M	M		M																	
		M	Tr		M																	PROBABLY ABUNDANT GLASS
	m				MM				M													
					MM	-		Tr?														
					MM			Tr?	Tr?													
					MM			Tr?	Tr?													no 913

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

TABLE 3

WELL No. 3



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
 UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

ML 52-30

WELL No. 4
BULK CUTTINGS

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

ML 52-30

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
ALMENITE
PYRITE OR
MARGASITE
ILLITE
SMECTITE
CHLORITE OR
KAOLINITE OR
MIXED-LAYER
CHLORITE
MIKIP-LAYER
ILLITE-SMEC.
SMECT.

NOTES/ OTHER PHASES

250-300'

MM m Tr Tr

500-550'

M

PROBABLY ABUNDANT GLASS

800-850'

M m M Tr?

1100-1150'

MM m

1450-1500'

Tr M Tr M M m

1700-1750'

M Tr M Tr? Tr?

1900-1950'

Tr M m M

qtz, but in clay

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

TABLE 4.

WELL No. 4



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

* MAY INCLUDE OTHER AMORPHOUS PHASES SUCH AS OPAL.

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>														OTHER PHASES POSSIBLY PRE- SENT IN TRACE TO MINOR AM'TS.				
	QUARTZ	CRISTOBAL.	TRIDYMITE	K-FELDSP.	PLAGIOCL.	ILMENITE	HEMATITE	MAGNETITE	SMECTITE	ILLITE #/OX	MICA #/OX	CHLORITE	KAOLIN #/OR SERPENTINE	CALCITE		GLASS *	ANALCIME OR VAIRAKITE	CLINOPTILOL.	OPAL-CT
WELL 62-21																			
530'				MM	<m	<m		<m						m?					Cpx, Opx, Ap
1035'				MM		<m		M						m?		<m	<m?		
1700'				MM				M					<m	m?					Cpx, Ap
1973'				MM		<m	<m?	M					<m?	m?		<m			Cpx, Ap
2132'				MM	<m?	<m		M						m?					Cpx, Ap
WELL 68-16																			
508'	M		MM	m		<m													
1039'	M		MM	m		<m		<m?											
1338'				m											MM				
1740'				M				<m							M				Cpx,
1857'				m				<m	<m?						MM				
2227'				MM		<m?		m							m?				Cpx, Ap
2599'	MM	m	M			<m													
2936'	MM		M			<m		<m											
WELL 86-23																			
694'				MM		<m		<m							m?				Cpx, Ap
1085'				MM		<m		<m							m?				Cpx, Opx, Ap
1554'				MM		m		m							m?				Cpx, Ap
2258'				MM		<m		<m							m?				Cpx, Ap
3157'				MM		<m		M							m?				Cpx, Opx, Ap
3497'				M				M							m?	<m			Cpx, Ap

MM = PREDOMINANT M = MAJOR m = MINOR <m = <5wt% ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

ML 54-19

WELL No. 5
BULK CUTTINGS

ML-54-19

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITITE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
ALMENITE
PYRITE OR
MARCASITE
ILLITE
SMECTITE
CHLORITE OR
KAOLINITE OR
MIXED-LAYER
CHLORITE-LAYER
MIXED-LAYER
ILLITE-SMECTITE

NOTES/OTHER PHASES

150-200'

MM

Tr?

500-550'

MM

850-900'

MM

m?

1300-1350'

MM

m

1500-1550'

MM

Tr?

Tr?

1550-1600'

MM

Tr?

1900-1950'

MM

Tr?

m

2150-2200'

MM

m

no g/b
ALSO UNKNOWN 744A
PHASE
PROBABLE ABUNDANT
GLASS

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

TABLE 5

WELL NO. 5



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

GMF 56-3

WELL No. 2
BULK CUTTINGS

MINERALOGY, APPROX. WT.% (or) RELATIVE ABUNDANCE

SAMPLE NO.

QUARTZ
CRISTOBALITE
TRIDYMITE
K-FELDSPAR
PLAGIOCLASE
HEMATITE
ILMENITE
PYRITE OR
MARCASITE
GOETHITE
ILLITE
SMECTITE
CHLORITE OR
KAOLINITE OR
MIXED-LAYER
CLAY OR-SMEC.
MIXED-LAYER
ILLITE-SMEC.
CLINOPTILOLITE
ANALCIME OR
VAIRAKITE
CALCITE

Qtz
1058 - unoriented
1058 - oriented
1113 - calcite

205-301'

MM

TR? TR? TR?

m

506-562'

MM

TR?

M

m

787-886'

MM

TR?

m

1110-1145'

m

MM

?

m?

M

m

TR?

1031 + calcite, 1058 Qtz + calcite
unoriented

1426-1459'

m

MM

?

m?

m

m

m

1727-1760'

m

MM

m

m

m

TABLE 2.

MM = PREDOMINANT M = MAJOR m = MINOR Tr = TRACE ? = TENTATIVE IDENTIFICATION

WELL No. 2



SUMMARY OF X-RAY DIFFRACTION ANALYSIS
UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

* MAY INCLUDE OTHER AMORPHOUS PHASES SUCH AS OPAL.

SAMPLE NO.	MINERALOGY, APPROX. WT.% <input type="checkbox"/> (or) RELATIVE ABUNDANCE <input checked="" type="checkbox"/>														OTHER PHASES POSSIBLY PRESENT IN TRACE TO MINOR AM'TS.			
	QUARTZ	CRISTOBAL.	TRIDYMITE	K-FELDSP.	PLAGIOCL.	ILMENITE	HEMATITE	MAGNETITE	SMECTITE	ILLITE #/OR MICA #/OR	CHLORITE	KAOLIN #/OR PERRENTINE	CALCITE	GLASS *		ANALCIME OR HAIRAKITE	CLINOPTILOL.	OPAL - CT
WELL 62-21																		
530'				MM	<M	<M		<M						m?				CPX, OPX, AP
1035'				MM		<M		M						m?	<M	<M?		
1700'				MM				M				<M	m?					CPX, AP
1973'				MM		<M	<M?	M				<M?	m?		<M			CPX, AP
2132'				MM	<M?	<M		M						m?				CPX, AP
WELL 68-16																		
508'	M		MM	m		<M												
1039'	M		MM	m		<M		<M?										
1338'				m										MM				
1740'				M				<M						M				CPX,
1857'				m				<M	<M?					MM				
2227'				MM		<M?		m						m?				CPX, AP
2599'	MM	m	M			<M												
2936'	MM		M			<M		<M										
WELL 86-23																		
694'				MM		<M		<M						m?				CPX, AP
1085'				MM		<M		<M						m?				CPX, OPX, AP
1554'				MM		m		m						m?				CPX, AP
2258'				MM		<M		<M						m?				CPX, AP
3157'				MM		<M		M						m?				CPX, OPX, AP
3497'				M				M						m?	<M			CPX, AP

MM = PREDOMINANT M = MAJOR m = MINOR <M = <5wt.% ? = TENTATIVE IDENTIFICATION



SUMMARY OF X-RAY DIFFRACTION ANALYSIS

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