



**GEORGE P. ZEBAL AND ASSOCIATES**  
INDUSTRIAL UTILIZATION OF GEOLOGY

**GRAPHIC WELL REPORT**

Company: Magma Power Company Well: Magma-USA 88-7  
 Area: East Mesa Location: 500 feet north and 500 feet west of  
 Contractor: H & W Drilling Co. No. 3 SE corner of Sec. 7, T 16 S, R 17 E.  
 Commenced: 1:00 PM 8-20-84 Elevation:  
 Completed: \_\_\_\_\_ Ground Level 30 feet  
 Casing Record: Kelly Bushing 51 feet  
20-inch conductor set at 60 feet  
13 3/8-inch surface set at 1893 feet Remarks: Zone test and injection well  
9 5/8-inch liner landed at 4637 feet  
7-inch liner landed at 7350 feet

Engineering Data

Geological Data

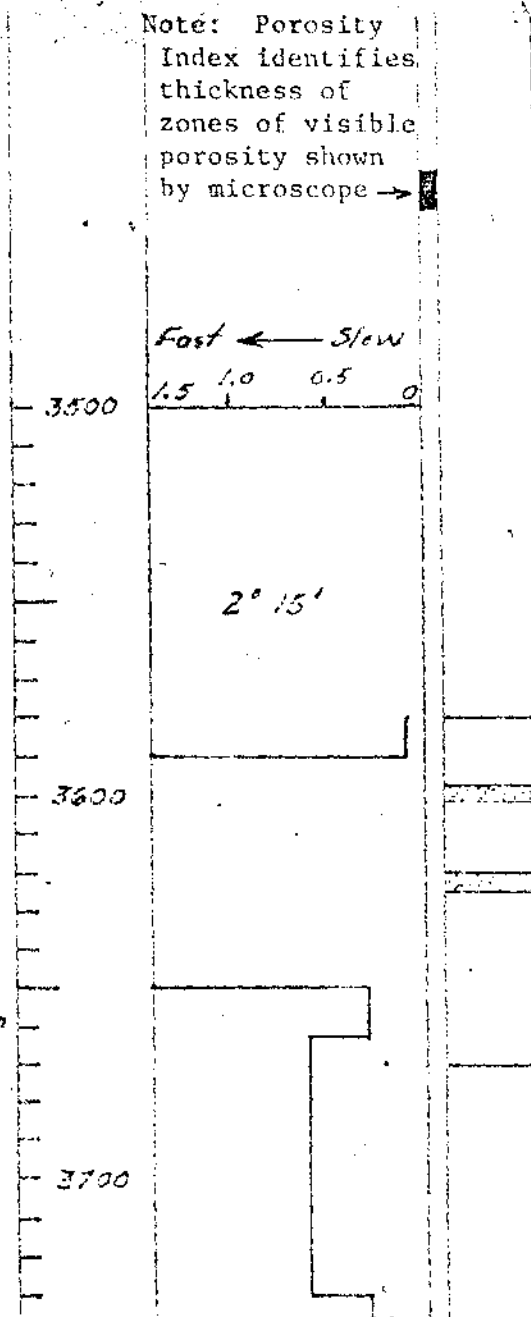
Bit Record	Mud Record	Temp.	Depth	Drilling Time	Sample Log	Sample Description
Make-type	Date	°F	Feet	Ft/min	Porosity Index	
Serial No.	Type	at	below			
Footage:	Weight	flow	KB	Deviation		
In	Viscosity	line		Degrees		
Out	Water loss					
Total	Cake					
Hours	Sand					
Condition	Salinity					
	pH					

4.3 12 1/4"  
Smith FDT  
EA 2256  
2954'  
3585'  
631'  
2 1/2 hours  
Dull

4.4 12 1/4"  
Smith SOGH  
L 7852  
3585'  
4285'  
700'  
1 1/2 hours  
Dull

8-28-84  
Gel-lignite  
Wt. 67  
Vis. 40  
W.L. 15.0  
Cake 2/32  
Sand Trace  
Sal. 1,000  
pH 10.2

Cooling  
tower in  
use  
100°



Grain Size Scale

Particle	Size in mm
Pea gravel	4
Fine gravel	1-2
Coarse sand	1/2-1
Medium sand	1/4-1/2
Fine sand	1/8-1/4
Very fine sand	1/16-1/8
Silt	1/64-1/16

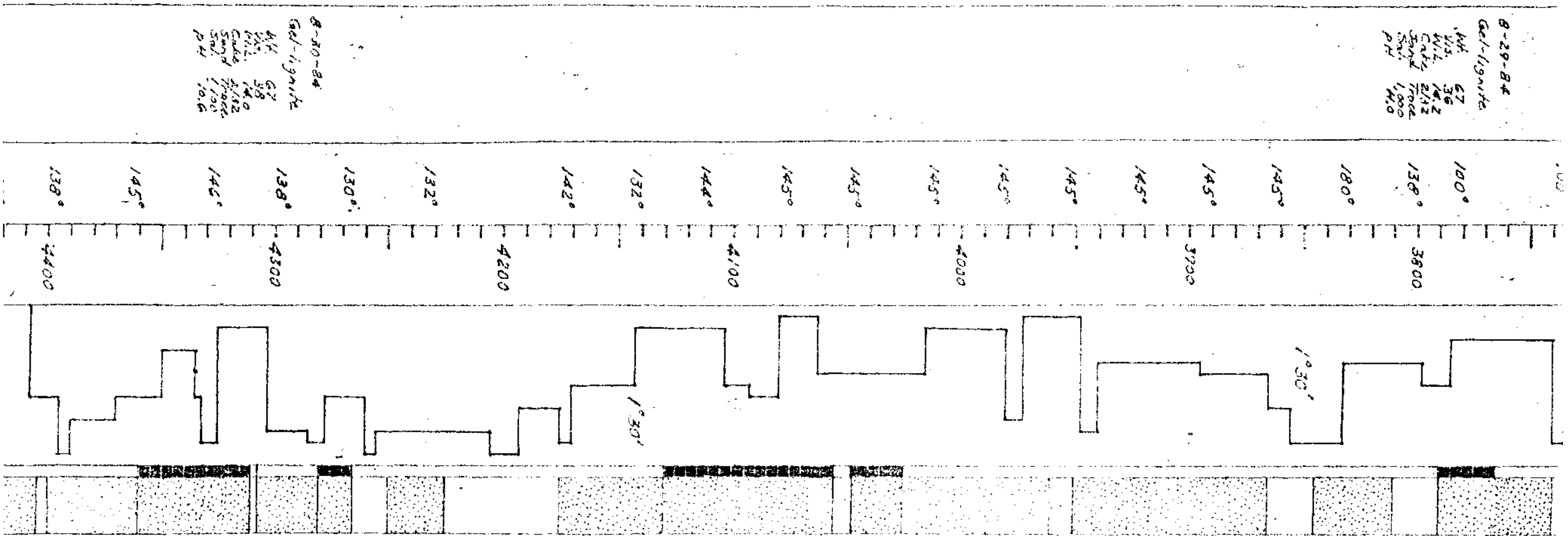
Gray to maroon to brown shale; loose to weakly cemented, med. very fine, silty sand

Hard, light gray to gray sand shale is very calcareous

8-29-84  
Gel-log with  
Wt. 67  
W/L 36  
Calc 2/12  
Sand 1000  
Sul 1000  
PH 14.0

No. 5 12 1/4"  
HUGHES QWV  
(not record)  
311 MM  
4285'  
4235'  
3907'  
15 1/2 hours  
QWV

8-30-84  
Gel-log with  
Wt. 67  
W/L 38  
Calc 14.0  
Sand 1000  
Sul 1000  
PH 10.6



Loose to weakly cemented, fine to very fine sand with some coarse sand grains; trace pyrite.

Loose gray to brown sub-angular to gray, sand.

Loose, weakly to well cemented, arkose, sub-angular, fine to very fine, silty sand.

Loose gray to brown, clay.

Light, white to yellowish, fine to medium, fine to very fine, silty sand; trace pyrite.

Gray to brown, sand.

Dark gray to black, silty sand; calcareous, silty sand; trace pyrite.

White to brown, fine to medium, silty sand; trace pyrite.

Dark gray to black, silty sand; calcareous, silty sand; trace pyrite.

White to brown, fine to medium, silty sand; trace pyrite.

Gray to brown, fine to medium, silty sand; trace pyrite.

Light, white, well cemented, very calcareous, fine to very fine, silty sand.

Gray to brown, sand.

Loose to weakly cemented, arkose, calcareous, fine to very fine, silty sand; trace pyrite.

Loose to weakly cemented, arkose, calcareous, fine to very fine, silty sand; trace pyrite.

Light, white, well cemented, very calcareous, fine to very fine, silty sand; trace pyrite.

Gray to brown, fine to medium, silty sand; trace pyrite.

No. 6 8 1/2"  
Reed Y35  
(retipped)  
242955  
4075'  
4817'  
142'  
8 hours Good

9 5/8" liner  
landed at  
4637'

8-31-84  
Gel-lignite

Wt. 67  
Vis. 36  
W.L. 12.0  
Coke 2/32  
Sand Trace  
Sol. 1,000  
pH 11.5

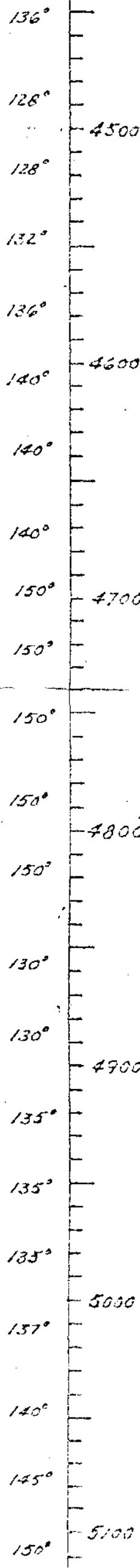
Core No. 1 8 1/2"  
Christensen RC4  
4817'  
4847'  
30'  
hours Good

9-03-84  
Gel-lignite

Wt. 67  
Vis. 39  
W.L. 14.0  
Coke 2/32  
Sand Trace  
Sol. 1,100  
pH 11.0

No. 7 8 1/2"  
with F3  
AD 5390  
4847'  
5254'  
707'  
8 hours Good

9-05-84  
Gel-lignite



Loose to weakly cemented, siliceous, calcareous, fine to very fine sand with some coarse grains  
Light gray, well cemented, calcareous, sandy shale.

Loose to weakly cemented, calcareous, fine to very fine sand; trace pyrite.

Loose, very calcareous, fine to very fine green, silty shale.

Loose to weakly cemented sand & very silty shale.

Loose to weakly cemented sand & shale.

Light to dark gray, calcareous, light gray sandy shale.

White, well cemented, calcareous, medium to very fine sand.

Interbedded white, calcareous, well cemented, silty sand & very fine to medium, light gray, very calcareous, sandy, calcareous, light gray to gray shaly trace pyrite, much iron.

White, well cemented, calcareous, very calcareous, fine to very fine sand; trace pyrite.

Core No. 1 4817'-4850'  
See detailed description below

Interbedded calcareous, calcareous, hard, fine to medium calcareous, silty, fine to very fine sandstone.

Interbedded gray to white, calcareous, shaly, white, well cemented, sandy, calcareous, some hard, white, well cemented, very calcareous, very silty, very fine sandstone.

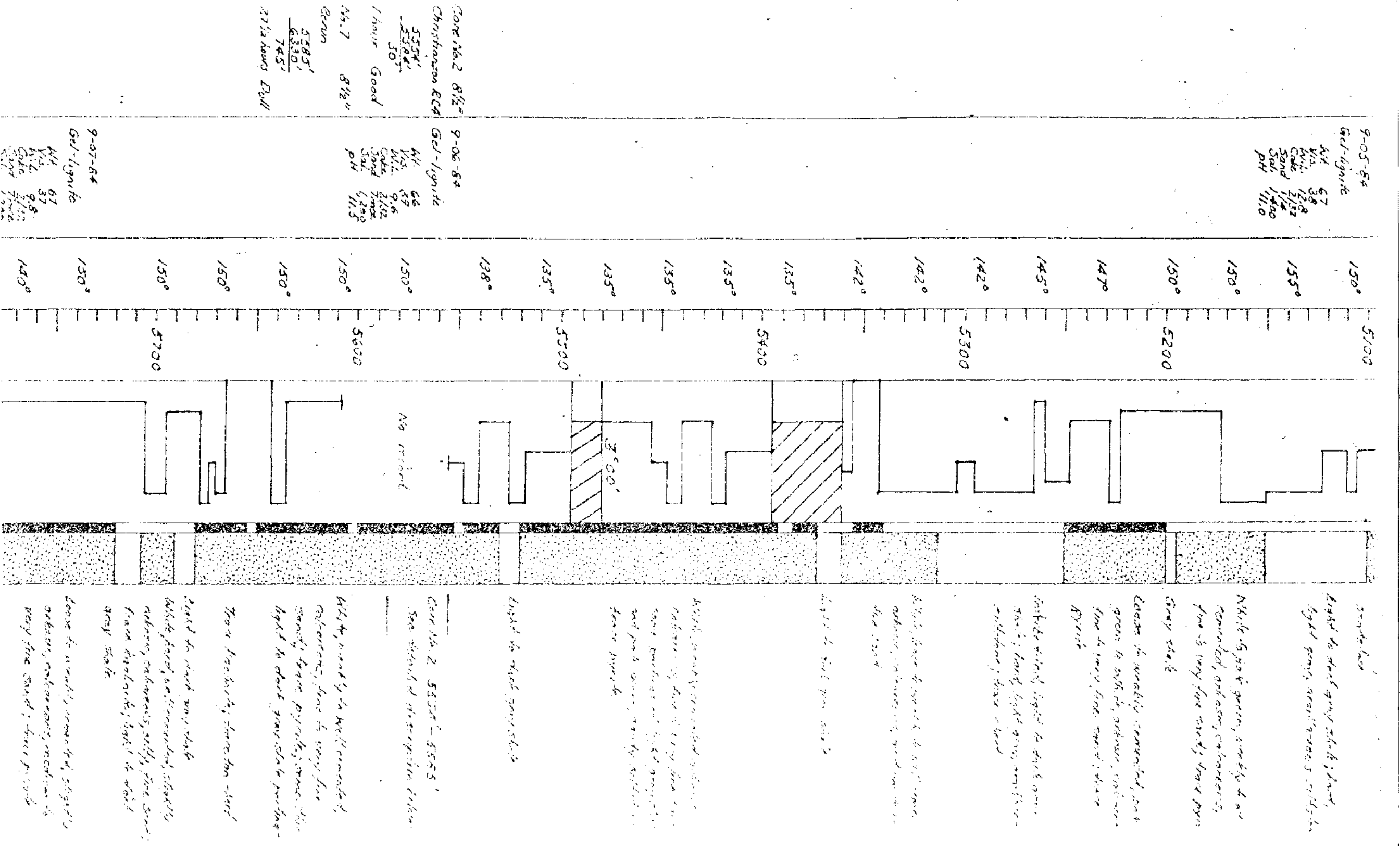
Loose to weakly cemented, pale green to white, siliceous, calcareous, fine to very fine sand; trace pyrite; some thin, dark gray shale partings.

Gray shale.

Loose to weakly cemented sand & shale; well cemented at base of sand body; trace pyrite.

Light gray to green shale.

White, well cemented, calcareous, very calcareous, silty, fine to very fine sandstone.



9-05-84  
red-lignite  
Wt 67  
Vol. 38  
Calc 12.8  
Sand 7 1/2  
Silt 14.00  
PH 11.0

9-06-84  
red-lignite  
Wt 66  
Vol. 39  
Calc 9.6  
Sand 21.72  
Silt 12.50  
PH 11.5

8 1/2"  
Bern  
5585'  
6330'  
745'  
27 1/2 hours Drill

9-07-84  
red-lignite  
Wt 67  
Vol. 37  
Calc 9.8  
Sand 21.17  
Silt 12.22

Sample box

Light to dark gray shale, hard, light gray, weathering reddish

White to pale green, sandy & unconsolidated, calcareous, fine to very fine sandy, heavy pyrite  
Gray shale

Loose to sandy, unconsolidated, not green to white, calcareous, calcareous fine to very fine, sandy, heavy pyrite  
Pyrite

White to light gray, sandy, unconsolidated, heavy pyrite, calcareous, calcareous, heavy pyrite

White to gray, sandy, unconsolidated, heavy pyrite, calcareous, calcareous, heavy pyrite

Light to dark gray shale

Light to dark gray shale

Light to dark gray shale

Core No. 2 5335' - 5385'  
See detailed description below

White, sandy to well cemented, calcareous, fine to very fine sandy, heavy pyrite, calcareous, heavy pyrite, light to dark gray shale, weathering gray shale

Thin, horizontally laminated, sand

Sand to mud, gray shale  
White, fine to medium, calcareous, calcareous, sandy, fine sand, heavy pyrite, light to dark gray shale, weathering gray shale

Loose to sandy, unconsolidated, slightly calcareous, calcareous, medium to very fine sand, heavy pyrite

9-07-84

Get-lignite

Wt.	67
Vis.	37
W.L.	9.8
Coke	2/32
Sand	Trace
Sal.	1,200
pH	10.5

150°

140°

138°

5800

132°

No record

150°

150°

5900

149°

149°

142°

2°00'

134°

6000

138°

136°

136°

6100

136°

138°

140°

6200

135°

130°

135°

6300

139°

2°00'

No record

150°

6400

Loose to weakly cemented, slightly calcareous, medium to very fine sand; trace pyrite

Interbedded hard, white, well cemented, very calcareous, fine to very fine sandstone; light to dark gray shale; trace pyrite; trace kaolinite with chlorite

Interbedded sand as above and light to dark gray shale  
White, weakly cemented, slightly calcareous, fine to very fine sand; trace pyrite

White, weakly cemented, slightly calcareous, fine to very fine sand; trace pyrite

Light to dark gray shale; white, calcareous, very sandstone; hard, white, well cemented, very fine sandstone; trace pyrite  
White, weakly cemented, very fine sand; trace pyrite  
Light to dark gray shale

White, weakly to well cemented, slightly calcareous, fine to very fine sand; trace pyrite

Dark gray shale  
Sand as above

White, weakly to well cemented, calcareous, medium to very fine sand

Interbedded hard, light to dark gray shale; hard, white, well cemented, fine sand; trace pyrite; trace kaolinite

White, weakly to well cemented, calcareous, fine to very fine sand

Interbedded hard, white, well cemented, very calcareous, silty, very fine sandstone and hard, light to dark gray shale

Core No. 3 6300'-6350'  
See detailed description below

Interbedded white to light gray, well cemented, silty calcareous, very fine sand and hard, gray shale

9-08-84

Get-lignite

Wt.	67
Vis.	38
W.L.	9.8
Coke	2/32
Sand	Trace
Sal.	1,100
pH	11.5

Core No. 3 8 1/2"  
Christiansen RCA  
6330'  
6360'  
30'  
3 1/2 hours Good

9-09-84

Get-lignite

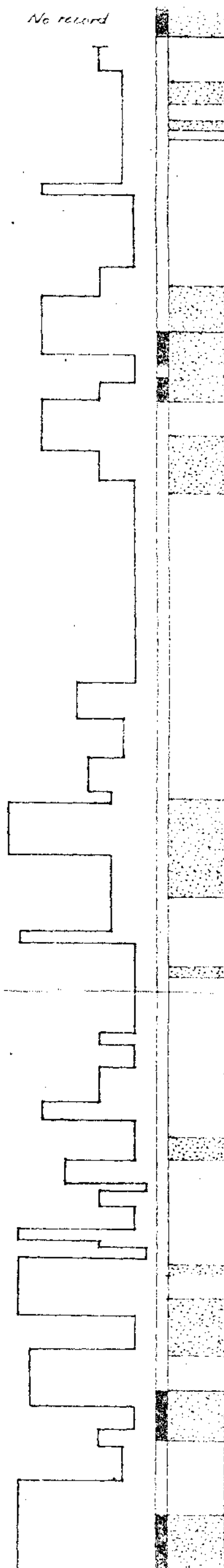
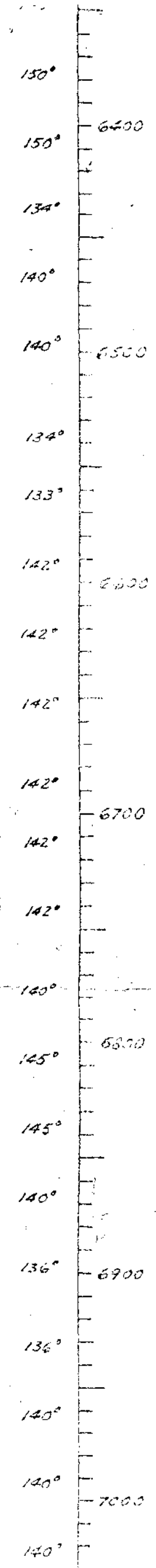
Wt.	67
Vis.	38

No. 5 8 1/2"  
Central YHP3  
07

6360'  
 30'  
 60 hours Good  
 No. 5 8 1/2"  
 Central YHP3  
 E 7,  
 6360'  
 7223'  
 863'  
 60 hours Dull

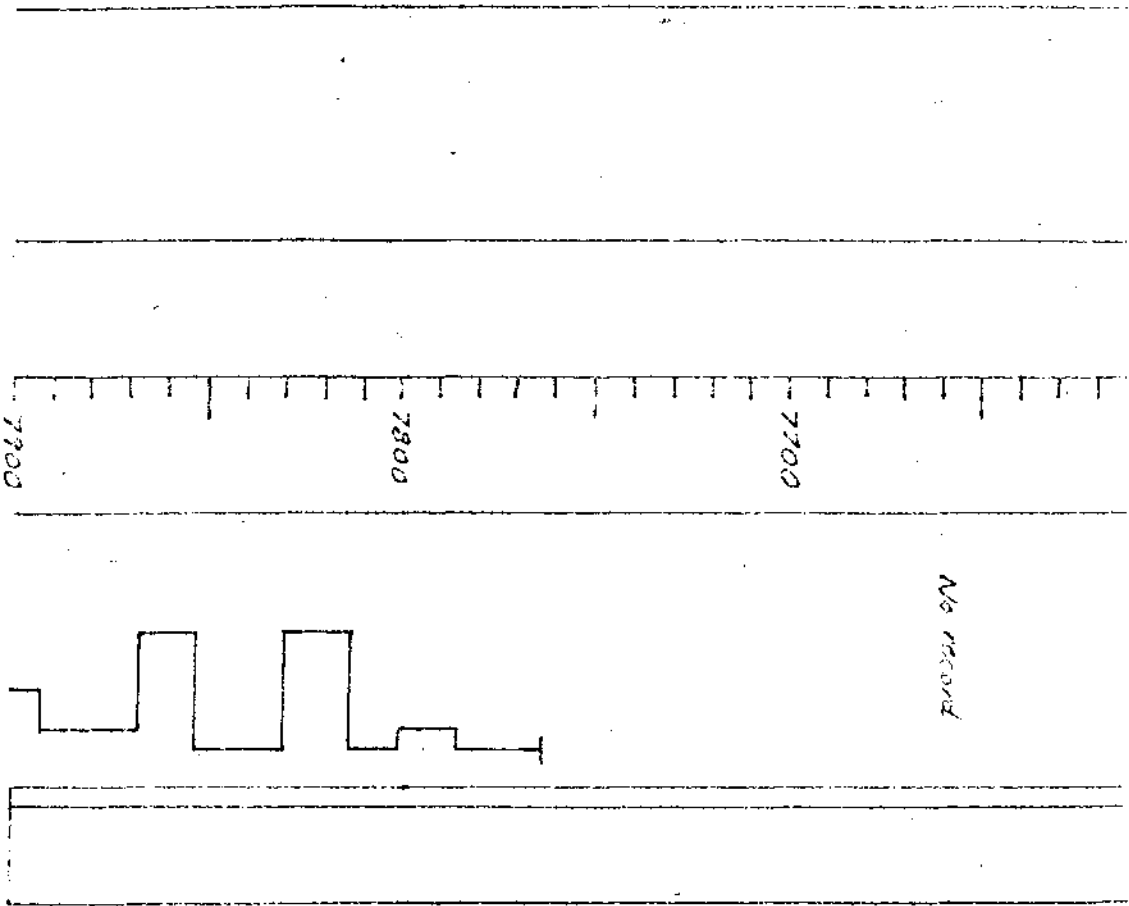
W.L. 9.8  
 Coke 2/52  
 Sand Trace  
 Sol. 1,100  
 pH 11.5  
 9-09-84  
 Gel-lignite  
 Wt. 67  
 Vis. 38  
 W.L. 4.8  
 Coke 2/82  
 Sand Trace  
 Sol. 1,000  
 pH 10.5

9-10-84  
 Gel-lignite  
 Wt. 67  
 Vis. 39  
 W.L. 8.5  
 Coke 2/32  
 Sand Trace  
 Sol. 1,800  
 pH 10.5



Interbedded white to light gray,  
 well cemented, shaly calcareous,  
 calcareous, very silty, very fine  
 sand and hard, gray shale.  
 Hard, light to dark gray shale,  
 gray, silty shale; light gray,  
 argillaceous silt; trace  
 kaolinite  
 White, hard, well cemented, shaly  
 calcareous, very calcareous, very fine  
 sandstone  
 White, weakly cemented, calcareous  
 fine to very fine sand  
 Hard, light to dark gray shale  
 White, hard, well cemented, very  
 calcareous, silty, very fine sand  
 Interbedded, hard, light to dark  
 gray shale and hard, calcareous,  
 argillaceous siltstone; trace  
 kaolinite  
 Hard, light to dark gray shale; arg.  
 argillaceous siltstone  
 Sand as above  
 Hard, light to dark gray shale; arg.  
 argillaceous siltstone  
 Sand as above  
 Dark gray shale  
 White, well cemented, shaly  
 calcareous, calcareous, fine to very  
 fine sandstone; trace kaolinite;  
 trace kaolinite; hard, gray shale  
 White, weakly cemented, shaly  
 calcareous, calcareous, fine to very  
 fine sand; trace kaolinite; trace  
 kaolinite  
 Hard, light to dark gray shale  
 White, weakly cemented, shaly  
 calcareous, calcareous, fine to very  
 fine sand; trace kaolinite; trace





hard, unbedded, gray, hard, light to dark gray, fine hard, white, well cemented, slightly calcareous, calcareous to siliceous, silty, fine to very fine sandstone, hard, but has granularities to sandstone. How fine sand or gravel throughout.

Core No. 1 4819'-4850' Pressure 20 feet Drilling time 29 min.

- 4819-4823 Lost interval (probably loose sand)
- 4823-4825 White, weakly cemented, siliceous, calcareous, fine to very fine sand
- 4825-4826 Interbedded white sandstone, calcareous, siliceous, fine to very fine sand
- 4826-4828 Hard, white, well cemented, calcareous, very calcareous, very silty, very fine sandstone
- 4828-4830 White, weakly cemented, siliceous, calcareous, fine to very fine sand
- 4830-4835 Interbedded white, well cemented, calcareous, siliceous, sandstone and gray shale
- 4835-4845 Hard, white, well cemented, calcareous, very calcareous, very silty, very fine sandstone
- 4845-4850 Gray to dark gray shale

No evidence of high angle fractures in core

Core No. 2 5534'-5585' Recovered 25 feet Drilling time 49 min.

- 5534-5542 Lost interval (probably loose sand)
- 5542-5544 White, weakly cemented, calcareous, calcareous, fine to very fine sand
- 5544-5577 White, finely laminated, calcareous, calcareous, fine to very fine sand calcareous, fine to very fine sand, pyrite (in situ); minor pyrite as dark mineral grains
- 5577-5578 Dark gray shale
- 5578-5584 White, weakly to well cemented, calcareous, calcareous, fine to very fine sand
- 5584-5585 White, weakly cemented, calcareous, calcareous, fine to very fine sand

No evidence of high angle fractures in core

Core No. 3 6330'-6381' Recovered 38 feet Drilling time 101 min.

- 6330-6338 Lost interval (probably weakly cemented sand)
- 6338-6339 Hard, white, well cemented, slightly calcareous, fine to very fine sandstone
- 6339-6350 Hard, dark gray shale
- 6350-6358 Hard, white to dark greenish gray, well cemented, calcareous, fine to very fine sandstone
- 6358-6359 Laminated, hard, calcareous, gray, very calcareous, very silty, fine to very fine sandstone and hard, dark gray, calcareous, very silty shale (thin bedded 1/2")
- 6359-6360 Hard, gray shale with random whorls of hard, calcareous to light gray, well cemented calcareous, very silty, fine to very fine sandstone
- 6360-6361 Hard, dark gray, slightly calcareous shale

No evidence of high angle fractures in core