GLD16056-DOC2

R. F. SMITH CORP.

GEOTHERMAL DATA LOG

COMPANY Union Oil Company of California

WELL Cove Fort-Sulphurdale Unit #31-33

FIELD Wildcat **COUNTY** Millard

LOCATION SEC 33 T 25 S R 6 W

STATE Utah **COUNTRY** U.S.A.

LOGGING GEOLOGISTS Dale A. Johnson
James A. Hill John E. Dooley

PRESSURE INST. TYPE Silicon Chip TEMP. TYPE J-Thermocouple

DEPTH LOGGED FROM 52' TO 5221'

DATE LOGGED FROM 5/24/78 TO 7/24/78

ELEVATION 6481.4'(GL)+20' KB ☒ DF ☐ GR ☐

-LITHOLOGY-

Sandstone	Siltstone	Graywacke Type #1	Graywacke Type #4	Solution Deposit	Basalt or Greenstone	Peridotite	Schist	Latite or Andesite
Breccia	Claystone	Graywacke Type #2	Chert	Minerlzd Deposit	Other Volcanic	Igneous Rock	Quartzite	
Conglom.	Shale or Argillite	Graywacke Type #3	Limestone	MELANGE'	Tuff or Tuff Brec	Granitic Rock	Serpentine	

ENGINEERING DATA

HOLE SIZE
17½" to 173½'
12¼" to 5221' T.D.
____ to ____

CASING SIZE
20" to 280'
13 3/8" to 173½'
____ to ____

DRILLING RATE
☒ FT/HR ☐ MIN/FT

ROCK DENSITY - - - -

DEPTH

LITHOLOGY

AIR AND MUD DRILLING DATA

TEMPERATURE (°F)
IN - - - - - - - -
OUT ————

CO_2 ppm ——·——·——
on Air

TOTAL MUD GAIN/LOSS ——·——·——

PRESSURE PSIG
IN - - - - - -
OUT ————

METHANE ppm ——·——·——

ETHANE ppm ——··——··——

H_2S ppm - - - -

% MOISTURE

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REMARKS

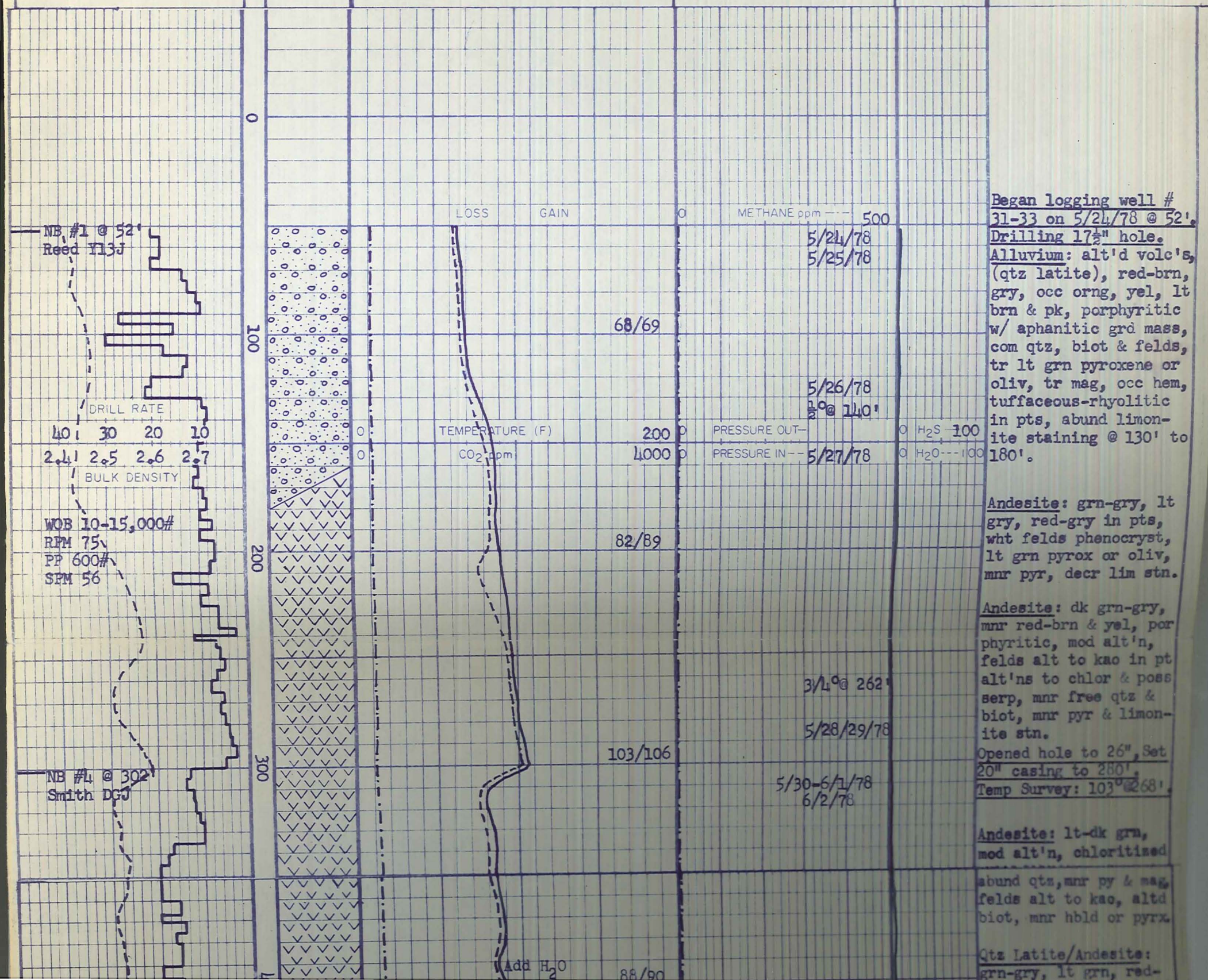
DESCRIPTIONS

CORE RESULTS

SURVEYS

FORMATION TESTS

MUD AGITATOR
ELECTRIC ☐
AIR ☒



Began logging well # 31-33 on 5/24/78 @ 52'. Drilling 17½" hole.
Alluvium: alt'd volc's, (qtz latite), red-brn, gry, occ orng, yel, lt brn & pk, porphyritic w/ aphanitic grd mass, com qtz, biot & felds, tr lt grn pyroxene or oliv, tr mag, occ hem, tuffaceous-rhyolitic in pts, abund limonite staining @ 130' to 180'.

Andesite: grn-gry, lt gry, red-gry in pts, wht felds phenocryst, lt grn pyrox or oliv, mnr pyr, decr lim stn.

Andesite: dk grn-gry, mnr red-brn & yel, porphyritic, mod alt'n, felds alt to kao in pt alt'ns to chlor & poss serp, mnr free qtz & biot, mnr pyr & limonite stn.
Opened hole to 26", Set 20" casing to 280'.
Temp Survey: 103°@268'.

Andesite: lt-dk grn, mod alt'n, chloritized abund qtz, mnr py & mag, felds alt to kao, altd biot, mnr hbld or pyrx.

Qtz Latite/Andesite: grn-gry, lt grn, red-

NB #4 @ 302'
Smith DGJ

WOB 30,000#
RPM 60
PP 400#
SPM 50

DRILL RATE
40 30 20 10

2.4 2.5 2.6 2.7
BULK DENSITY

WOB 30,000#
RPM 60
PP 1100#

410'/29 hrs

NB #5 @ 712'
Reed S62J

WOB 30,000#
RPM 60
PP 1100#

WOB 25,000#
RPM 60
PP 1000#
SPM 50/40

DRILL RATE
40 30 20 10

2.4 2.5 2.6 2.7
BULK DENSITY

WOB 25-30,000#
RPM 50-60
PP 1100#

300
400
500
600
700
800
900
1000
1100

103/106

Add H_2O

88/90

LOSS GAIN

Add H_2O

111/116

Add H_2O

TEMPERATURE (F) 0 200
CO_2 ppm 0 4000

Add H_2O

115/118

Add H_2O

122/124

Add H_2O

Add H_2O

117/125

Add H_2O

LOSS GAIN

131/134

Dump Traps
Add H_2O

TEMPERATURE (F) 0 200
CO_2 ppm 0 4000

121/125 Add H_2O

137/142

Add H_2O

5/28/29/78

5/30-6/1/78
6/2/78

1¼°@ 445'

METHANE ppm 0 500

6/3/78

PRESSURE OUT- 0 H_2S 100
PRESSURE IN-- 0 H_2O 100

1 3/4°@ 608'

6/4/78

1°@ 733'

1 3/4°@ 899'

1°@ 987'

1½°@ 1080'

6/5/78

METHANE ppm 0 500

ite stn.
Opened hole to 26", Set 20" casing to 280'.
Temp Survey: 103°@268'

Andesite: lt-dk grn, mod alt'n, chloritized

abund qtz, mnr py & mag felds alt to kao, altd biot, mnr hbld or pyrx

Qtz Latite/Andesite: grn-gry, lt grn, red-brn, vf-m gr, qtz 10% clr & wht felds xtl's, mnr mag, biot, chlor, tr py & hem stn, poss propylitic alt'n in pts, tuffaceous in pt.

Temp Survey: 108°@445'
Pumping w/ #1&#2 mud pumps

Qtz Latite/Andesite: lt-dk grn, brn, m gr, some free qtz, altd felds, fracs @ 520' to 550', app of py @ 540' occ hvy tr of py, tr of partially altd biot mafics chloritized.

Temp Survey: 118°@ 608'

Andesite: lt grn-grn, grn-gry, occ red-brn, f-m gr, porphyritic, mod alt'n, wht to clr felds alt in pt, mnr clr qtz, tr biot & py, mnr chlor, occ calc frac fill, app of wht silc frac fill w/abund dism pyr @ 680', chlor itzed, kao, poss chal copyrite, f/680-700' mnr lt red orng welded tuff, mnr calc in pts

Backed off shock sub @ 712', retrieved fis
Temp Survey: 120°@ 73
(broke thermometer@16

Andesite: lt grn-gry to lt gry, mod-hi alt n, abund pyr decr to mod @ 800', mafics ch loritized w/abund red hem, mnr euhed calc x tals in pts, mnr qtz, porphryitic, epidote alt'd hbld, poss frac

Andesite: lt-dk grn, lt gry, m gr, occ f g mod alt'n, alt'd wht felds w/ mnr euhed cl x'tals, rre tr alt'd biot, tr calc fill.
Temp Survey: 139°@ 89

W 8.9 V 35 PV 9 YP 6
pH 10.5 F 21 FC 2
Cl 2100 Ca 100 Sd ½
Slds 4½

Andesite: con't as above, but with incr calc & mag, tr biot.

Temp Survey: 138°@ 98

Siltstone: red-brn, h to frm, p srtd, sdy t v sdy, vf-m sbrd gr's occ clr & smky qtz granules, calc cmt & sugary calcite frac fill, grding in pt t vf gr sandstone, mnr limestone clasts.

Temp Survey: 150°@10
Siltstone: red-brn, gen'ly as above w/ s incr in qtz granules continued sdy in pt clay mtrx, calc cmt.
Circulating mud thro

WOB 25-30,000#
RPM 50-60
PP 1100#

1100

137/112

Add H_2O

$1\frac{1}{2}^{\circ}$@ 1080'

occ clr & smky qtz
granules, calc cmt &
sugary calcite frac
fill, grding in pt t
vf gr sandstone, mnr
limestone clasts.

Temp Survey: 150°@10

Siltstone: red-brn,
gen'ly as above w/ s
incr in qtz granules
continued sdy in pt
clay mtrx, calc cmt.
Circulating mud thro
cooling tower.

1200

120/125

6/6/78

NO RETURNS

LOSS GAIN 0 METHANE ppm ---

NR

Limestone: lt gry,f
grding to lt blu-gry
sltst w/ clasts of a
qtz & dolo in pts, m
clr calc xtals, lt b
chrt, pyr, & euhed q
xtals (vug filling),
dolomitic in pts.
Lost Circulation @ 1
detected 15,000 ppm
10 ppm C_1, & high co
centration H_2S, Set
plugs to regain circ
1257', Lost circ@ 12
Set plug for circ'n.

564'/60 hrs
NB #6 @ 1276'
Smith 2JS

1300

6/7-11/78
6/15/78

101/105

Adding H_2O

5°@ 1332'

Dolomite(calcareous)
lt-dk gry, occ lt br
f-m gr, suc, hd-frm,
calc & silc veining,
tr pyr, lam in pts.
Temp Survey:122°@ 13

DRILL RATE
40 30 20 10

0 TEMPERATURE (F) 200 0 PRESSURE OUT- 0 H_2S 100

0 CO_2 ppm 4000 0 PRESSURE IN-- 0 H_2O 100

2.4 2.5 2.6 2.7
BULK DENSITY

Dolomite: lt brn-lt
aphanitic, hd, massi
tr pyr.

Lost 30bbls mud @138

Adding H_2O

109/114

6/16/78

$4\frac{1}{2}^{\circ}$@ 1400'

Temp Survey:118°@ 1

WOB 20,000#
RPM 60
PP 600#
SPM 56

1400

Dolomite: lt gry-brn
f gr, hd, silc & pos
galena frac fill, ap
of pyr @ 1440' on f
surfaces, mnr calc
frac fill, tr sphal
ite.

W 8.5 V 36 PV 6 YP
pH 11.5 F 41 FC 2 S
Slds 1.28 Cl 1000

Lost 60bbls mud @ 1

114/120

Lost 135bbls @ 1532
Dolomite: lt-dk gry
m gr, hd, calc frac
fill, tr pyr, sdy i
wht, lt brn, gry ch

Add H_2O

6/17/78

Lost 250bbl mud f/1
to 1564'. Lost circ
L564', set plug.

6/18/78

1500

$4\frac{1}{2}^{\circ}$@ 1587

107/112

Intermittent
H_2O
Addition

6/19/78

Dolomite: brn to br
gry, hd, crinoid fr
@ 1560-70', occ abu
silc fill, tr py, s
calc, rre tr galena
tr wht chert.
Lost 60bbl mud @ 16
Lost 25bbl mud @ 16

LOSS GAIN 0 METHANE ppm --- 500

WOB 20-25,000#
RPM 50
PP 850#

1600

Dolomite: lt brn gr
f gr, massive, wht
veining, tr pyr.
Lost 150bbl mud @ 1

113/118

Lost 300bbl mud @ 1
Lost circ @ 1734'.
plug to regain circ
Set 13 3/8" casing
1734'. Drlg 12¼" ho

6/20/78
6/21-25/78

458'/87 hrs.
NB #7 DD @ 1734'

1700

Dolomite: brn-lt br
f-m gr, hd, silc ve
ing, sl calc in pt,
pyr, tr drk brn chr
tr calc vein fillin

0 TEMPERATURE (F) Add 200 0 PRESSURE OUT- 0 H_2S 100

0 CO_2 ppm H_2O 4000 0 PRESSURE IN-- 0 H_2O 100

40 30 20 10
DRILL RATE

2.4 2.5 2.6 2.7
BULK DENSITY

Reed 5-62

6/26/78

W 8.5 V 30 PV 3 YP
pH 12.5 F 55 FC 2
Sd 3/4 Slds 1¼ Cl

Gained 50 bbl of m
at 1815'.

1800

135/137

5 3/4° @1800'

Cooling
Tower in
Use

Dolomite: lt-dk br
f-mgr, occ silc ve
tr pyr, mnr brecci
veins, occ calcite
form'n darker w/ d

WOB 20-25,000#
RPM 40-45
PP 600#

Add

WOB 20-25,000#
RPM 40-45
PP 600#

1900

Tower in Use

Add H_2O

Add H_2O

Add H_2O

6/27/78

4 3/4° @ 1945'

2000

NO RETURNS

6/28-29/78

WOB 25,000#
RPM 60
SPM 27
PP 200

LOSS GAIN

METHANE ppm --- 0 500

53/62

DRILL RATE
40 30 20 10

0 TEMPERATURE (F) 200
0 CO_2 ppm 4000

PRESSURE OUT— 500 0 H_2S 100
PRESSURE IN-- 500 0 H_2O--- 100

2100

64/79

2200

WOB 20-25,000#
RPM
SPM 25

60/64

6/30/78

2300

No returns

6° @ 2354'

Change of CO_2 Scale to 0-20,000

Change of pressure out scale to 0-5

57/73

LOSS GAIN

METHANE ppm --- 0 500

2400

65/99

DRILL RATE
40 30 20 10
2.4 2.5 2.6 2.7
BULK DENSITY

0 TEMPERATURE (F) 200
0 CO_2 ppm 20000

PRESSURE OUT— 5 0 H_2S 100
PRESSURE IN-- 500 0 H_2O--- 100

2500

Change of CO_2 Scale to 0-40,000

2600

7/1/78

Gained 50 bbl of mud at 1815'.

Dolomite: lt-dk brn, f-mgr, occ silc veins, tr pyr, mnr brecciated veins, occ calcite, form'n darker w/ depth

Dolomite: con't as above, but with incr lt gry calc dolo @1920.

Lost circ @ 1913, regained after 80bbl mud.

Temp Survey: 133° @1945'

Dolomite: dk brn, dk gry @ 1980', m gr, silicic veining common, tr pyr, sl calc in pts, rre breccia veins.

Lost circ @ 2016', losing all mud in tanks.

Began drilling with aerated H_2O @ 2021'. No returns.

Injecting 27bbl H_2O/hr. mixed with unisteam

Detected mnr amounts of H_2S @ 2080'.

No Returns

Intermittent water returns for a duration of 1-2 minutes, no formation returns.

No returns

Intermittent returns for a duration of 2-3 minutes with no formation returns.

No Returns

Temp. Survey: 138° @2351'

Dolomite: lt brn, f-m gr, common calc xtals, tr pyr & hem stn.

Dolomite: lt-dk gry-brn f-m gr, mod calc frac filling, brecciated veins in pts, tr pyr. Gain in water volume due to formation water

No Returns @ 2470

Dolomite: dk gry, lt-dk brn, silc frac fill w/ mnr qtz xtals, sl calc in pt, tr pyr.

No Returns

Injecting 250bbl H_2O/hr.

Detected tr H_2S @2675

WOB 20,000#
RPM 60
SPM 29

1186'/10 2hrs.
NB #8 @ 2920'
Smith 3Js

DRILL RATE
40 30 20 10

2.4 2.5 2.6 2.7
BULK DENSITY

2700
2800
2900
3000
3100
3200
3300
3400

LOSS GAIN

0 TEMPERATURE (F) 200
0 CO_2 ppm 40000

V Poor Return
Poor Return
V Poor Return

60/63
52/74
70/86
63/72
68/70
69/85
65/70
66/74

7/1/78
6° @ 2731'
7/2-3/78
7/4/78
8° @ 3250'.

METHANE ppm 0 — 500

PRESSURE OUT 0 — 5
PRESSURE IN 0 — 500

H_2S 0 — 100
H_2O 0 — 100

DRILL RATE
40 30 20 10

2.4 2.5 2.6 2.7
BULK DENSITY

WOB 25,000#
RPM 60
SPM 30

No Returns

Injecting 250bbl H_2O/hr.

Detected tr H_2S @2675'

No Returns

No Returns

Dolomite: lt-dk brn, dk gry, brecciated, calc & silc fill, tr pyr

Injecting 200bbl H_2O/hr mixed with unisteam & ammonia.

Rare cold water returns with no formation cuttings returning.

No Returns

Put 2 compressors on hole @ 2945'.

Rare Cold water returns with no formation cuttings returning.

Siltstone: red-brn, w/ vf gr sd clasts, mod srtd, sl-v calc.

Sandstone: wht-gry, varicol grns, p srtd, tr pyr

Siltstone: red-brn as above, tr pyr, tr calcite, sdy in pt.

Siltstone: red-brn, w/ mnr lt wht-gry & lt grn-gry s gr ss, free calc xtals (prob vein filling), matrix calc & micaceous, red color due to FeO, sp sorted, pred mica is biot, the sltst is silic, tr gyp

Temp Survey: 234° @3250'

Injecting 200bbl H_2O/hr mixed with unisteam & ammonia.

All formation returns are of minor extent.

Siltstone: red-brn, w/ mnr lt wht-gry & lt grn-gry ss, mod calc vein filling, mnr biot

Intermittent cold water returns w/ no formation cuttings returning.

Sandstone: lt gry-wht, f-m gr, mod srtd, sl-v calc, tr pyr cubes, tr red sltst slough.

WOB 25,000#
RPM 60
SPM 30

3400

3500

66/74

104/171

7/5/78

65/63

3600

9 3/4° @ 3625'

LOSS GAIN

METHANE ppm ---- 500

3700

805' / 16½ hrs
NB #9 @ 3725'
Smith 2Js

81/120

DRILL RATE
40 30 20 10

0 TEMPERATURE (F) 200

0 CO_2 ppm 40000

0 PRESSURE OUT— 5 0 H_2S —100

0 PRESSURE IN— 500 0 H_2O ---100

7/6/78

2.4 2.5 2.6 2.7
BULK DENSITY

3800

83/87

3900

66/80

WOB 20,000#
RPM 60-75
SPM 31

4000

93/175

1 Compressor

LOSS GAIN

METHANE ppm ---- 500

7/7/78

10 1/4° @4090'

4100

103/108

DRILL RATE
40 30 20 10

0 TEMPERATURE (F) 200

0 CO_2 ppm 40000

0 PRESSURE OUT— 5 0 H_2S —100

0 PRESSURE IN— 500 0 H_2O ---100

2.4 2.5 2.6 2.7
BULK DENSITY

4200

109/110

Sandstone: lt gry-wht, f-m gr, mod srtd, sl-v calc, tr pyr cubes, tr red sltst slough.

Sandstone: lt gry-lt grn, f gr grding to lt grn sltst in pts, tr pyr, sl calc, hvy tr biot in pts

1 Compressor on Hole at 3515'.

2 Compressors on Hole at 3553'.

Siltstone: pred lt tan-red w/ lt grn & lt gry in pts, mod micaceous & calcareous, tr chlor.

Temp Survey: 260° @ 3625'

Injecting 250bbl H_2O/hr mixed with unisteam & ammonia.

Siltstone: lt gry, mnr biot, tr chlor, mnr calc xtal's & calc matrix.

Sandstone: wht-lt gry, m gr, mod srtd, v calc, mnr varicol grns, tr biot.

Siltstone: red-brn, grding to lt gry f gr ss in pts, calc vein filling, mod srtd, micaceous.

Injecting 250bbl H_2O/hr mixed with unisteam & ammonia.

No Returns

Sandstone: red-brn(FeO stain), f gr, mod calc mtrx, tr biot.

No Returns

Siltstone: red-brn(FeO stain), tr gry, mod calc, mod srtd, v sdy, grding to f gr, red-brn sandstone, tr silc frac fill, micaceous in pts, tr lt grn, wht-gry sandstone @ 4030' w/ hvy tr pyr.

Siltstone: red-brn as above in gen'l, tr gyp, w/ inc gry sltst & calc w/ depth.

Temp Survey: 285° 290° 325° @ 4090' 7/8/78

Added 2nd Compressor To Hole @ 4105' To clean cutting from btm.

Siltstone: gry to gry-grn, grding from red sltst above, mod srtd, v calc lt gry to wht ss in pts.

Siltstone: lt-dk gry, tr lt grn, w srtd, sl sdy in pts, gry sltst is v limy while grn sltst is rarely calc.

DRILL RATE
40 30 20 10
2.4 2.5 2.6 2.7
BULK DENSITY

4200
4300
4400
4500
4600
4700
4800
4900

WOB 25,000
RPM 65
SPM 30

819'/17½hrs
MB #10 @ 4540'
SEC S86

DRILL RATE
40 30 20 10
2.4 2.5 2.6 2.7
BULK DENSITY

Drill Rate 4785' to 4980'
150 120 90 60 30 0

DRILL RATE
120 90 60 30
2.4 2.5 2.6 2.7
BULK DENSITY

Drill Rate Scale Change

0 TEMPERATURE (F) 200
0 CO_2 ppm 40000

109/110
142/185
111/170
120/165
107/149
58/100
68/72

0 PRESSURE OUT 5
0 PRESSURE IN 500
0 H_2S 100
0 H_2O 100

Change in Methane Scale
0-1500
13 1/2° @ 4440'

LOSS GAIN
0 METHANE ppm 1500

7/8/78
7/9/78
7/10/78
7/11/78
7/12/78

Siltstone: gry to gry-grn, grding from red sltst above, mod srtd, v calc lt gry to wht ms in pts.

Siltstone: lt-dk gry, tr lt grn, w srtd, sl sdy in pts, gry sltst is v limy while grn sltst is rarely calc.

Siltstone: lt-dk gry, mnr grn, mnr red, w srtd, v limy & poss grding to silty lime-stone

Siltstone: pred dk gry, w srtd, sdy(f gr) in pts, v limy, tr oxidized pyrite.

Siltstone: dk-m gry, tr lt gry, w srtd, v limy, rre tr silc frac fill, tr oxidized pyr, poss fossil frags @ 4410'.

Temp Survey: 283° @ 4440'

Siltstone: dk gry, tr lt gry & lt grn-gry, mod srtd, sdy in pts, v limy w/ tr wht calc frac fill, tr oxidized pyrite, cont fossil fragments.

Siltstone: m-dk gry, mod srtd, occ v sdy, common foss frags (mollusks & shell frags), tr gry limestone frags.

Siltstone: lt gry, calc cement, abund fossil frags & minute blk gastropods or forams, mnr qtz, & mica, tr pyr, & gyp, inc calc w/depth.

Detected mnr H_2S @ 4635'

Injecting 250bbl H_2O/hr mixed with ammonia

No Returns

Siltstone: red-brn w/ lt-dk gry & lt grn, sl calc mtrx w/ mnr silc frac fill, mnr f gr lt gry ss, tr foss frags, tr oxidized pyr

Siltstone: red-brn, lt grn, gen'ly as above.

2 Slugs of return after 4790'. Dolomitic Siltstone.

Began drilling w/ H_2O only @ 4796'.

Temp Survey: 294° @ 4675'
Temp Survey: 294° @ 4700'
Temp Survey: 293° @ 4727'
Temp Survey: 293° @ 4735'

No Returns

No Returns

DRILL RATE
120 90 60 30
2.4 2.5 2.6 2.7
BULK DENSITY
Drill Rate Scale Change
40 30 20 10

NB #12 @ 5021'
Smith 4Js

T.D. 5221'

5000
5100
5200
5300
5400
5500

0 TEMPERATURE (F) 200 0 PRESSURE OUT— 5 0 H_2S —100
0 CO_2 ppm 40000 0 PRESSURE IN-- 500 0 H_2O---100

69/70

69/71

LOSS GAIN 0 METHANE ppm --- 500

DRILL RATE
40 30 20 10
2.4 2.5 2.6 2.7
BULK DENSITY

0 TEMPERATURE (F) 200 0 PRESSURE OUT— 5 0 H_2S —100
0 CO_2 ppm 20000 0 PRESSURE IN-- 500 0 H_2O---100

7/13-15/78
7/16/78

13¼°

7/17/78

7/18/78

7/19-21/78

7/21-24/78
Released 7/24/78

No Returns

CB #1 from 5015 to5018'
Dolomite: 8 inch recovery, dk gry, brecciated.
CB #2 From 5018 to5021'
No recovery

Temp Survey:249° @5035'

No Returns

No Returns

Ran Schlumberger Logs
T.D. 5221'.
Plugged hole at various depths to end well.

Cove Fort-Sulphurdale
31-33

Depth | LITHOLOGY | TEMPERATURE (F) OUT — IN - - - CO_2 ppm —·——·——·— | PRESSURE psi OUT — IN - - - METHANE ppm ——·——·—— | H_2S ppm % MOISTURE | REMARKS. R F SMITH CORP

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