



601605-DOE I
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	Mineral Deposit	Other Volcanic	Igneous Rock	Quartzite	
Conglom.	Shale or Argillite	Graywacke Type #3	Limestone	MELANGE	Tuff or Tuff Breccia	Granitic Rock	Serpentine	

ENGINEERING DATA

AIR AND MUD DRILLING DATA

REMARKS

HOLE SIZE 17 1/2" to 173 1/4" 12 1/4" to 5221' T.D. to	DEPTH LITHOLOGY	TEMPERATURE (°F) IN ----- OUT -----	PRESSURE PSIG IN ----- OUT -----	H2S ppm % MOISTURE	DESCRIPTIONS CORE RESULTS SURVEYS FORMATION TESTS
CASING SIZE 20" to 280' 13 3/8" to 173 1/4" to		CO2 ppm on Air ----- TOTAL MUD GAIN/LOSS -----	METHANE ppm ----- ETHANE ppm -----		
DRILLING RATE <input checked="" type="checkbox"/> FT/HR <input type="checkbox"/> MIN/FT					
ROCK DENSITY -----					



Began logging well # 31-33 on 5/24/78 @ 52'.
 Drilling 17 1/2" 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 hbl'd or pyr.

NB #1 @ 302
Smith DGJ

WOB 30,000#
RPM 60
PP 100#
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#

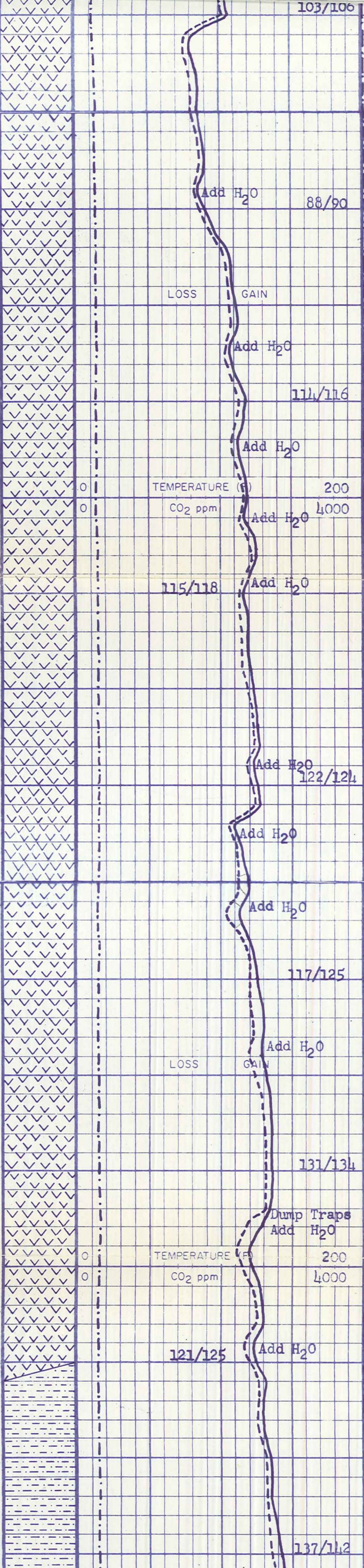
410'/29 hrs
NB #5 @ 712
Reed 362J

WOB 30,000#
RPM 60
PP 1100#

WOB 25,000#
RPM 60
PP 1000#
SEM 50
DRILL RATE
40 30 20 10
2.4 2.5 2.6 2.7
BULK DENSITY

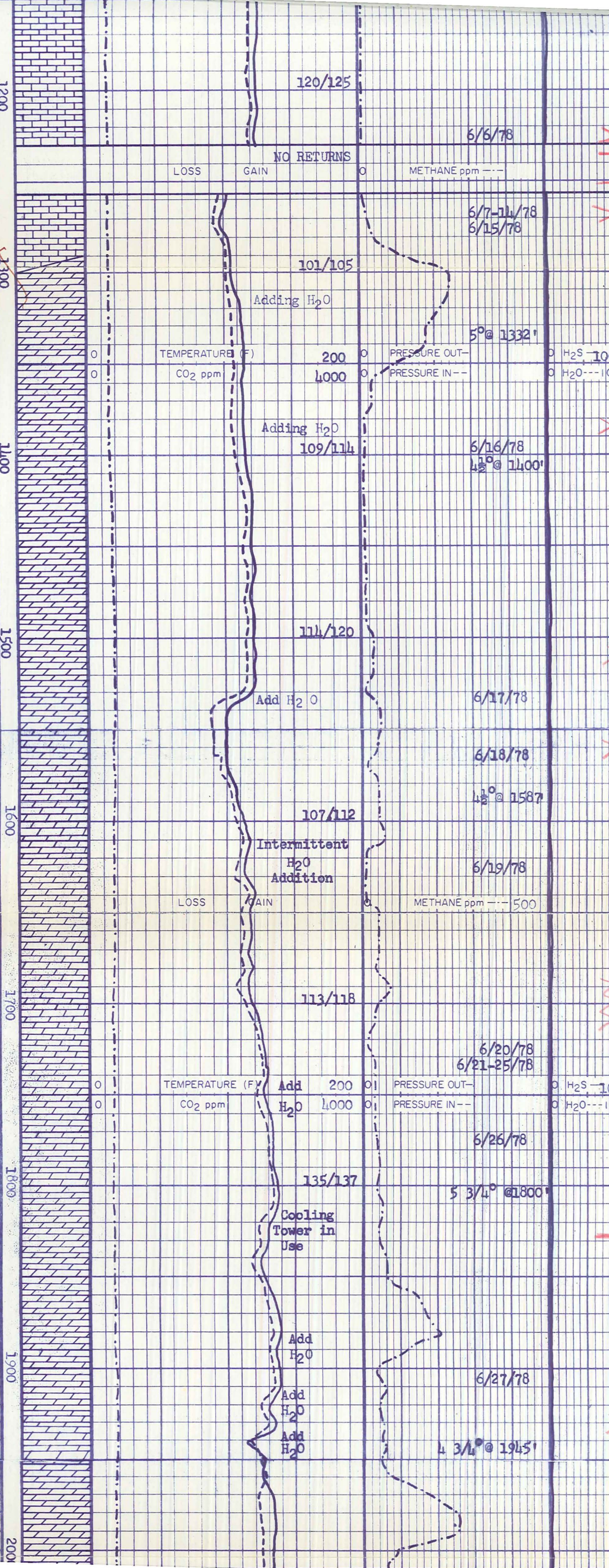
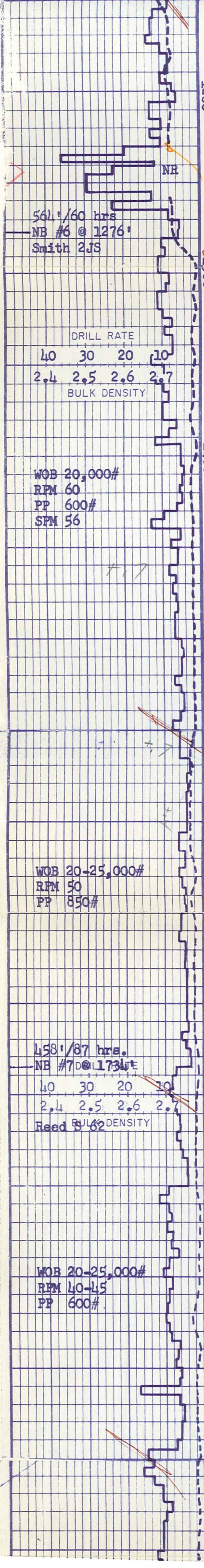
WOB 25-30,000#
RPM 50-60
PP 1100#

300
1000
500
600
700
800
900
1000
1100



103/106
5/30-6/1/78
6/2/78
88/90
111/116
115/118
122/124
117/125
131/134
121/125
137/142
TEMPERATURE (F) 200
CO2 ppm 4000
PRESSURE OUT--
PRESSURE IN--
METHANE ppm --- 500
H2S ---100
H2O ---100
Dump Traps
Add H2O
LOSS GAIN
1 3/4 @ 608'
1° @ 733'
6/5/78
1 3/4 @ 899'
1° @ 987'
1 3/4 @ 1080'

Opened hole to 280',
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 hbl'd or pyr.
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 mud
pumps
Qtz Latite/Andesite:
lt-dk grn, brn, m gr,
some free qtz, altd
felds, frac @ 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
itized, kao, poss chal-
copyrite, f/680-700'
mnr lt red org welded
tuff, mnr calc in pts
Backed off shock sub
@ 712', retrieved fish
Temp Survey: 120°@ 733'
(broke thermometer@160'
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,
porphyritic, epidote &
alt'd hbl'd, poss frac.
Andesite: lt-dk grn,
lt gry, m gr, occ f gr
mod alt'n, alt'd wht
felds w/ mnr euhed cal-
x'tals, rre tr alt'd
biot, tr calc fill.
Temp Survey: 139°@ 899'
W 8.9 V 35 PV 9 YP 6
pH 10.5 F 21 FC 2
Cl 2100 Ca 100 Sd 1/2
Slids 4 1/2
Andesite: con't as
above, but with incr
calc & mag, tr biot.
Temp Survey: 138°@ 987'
Siltstone: red-brn,
to frm, p srt'd, sdy t
v sdy, vf-m sbrd gr's
occ clr & smky qtz
granules, calc cmt &
sugary calcite frac
fill, grding in pt to
vf gr sandstone, mnr
limestone clasts.
Temp Survey: 150°@108
Siltstone: red-brn,
gen'ly as above w/ sl
incr in qtz granules,
continued sdy in pt &
clay mtrx, calc cmt.
Circulating mud thro
cooling tower.



grading to lt blu-
slst w/ clasts of
qtz & dolo in pts,
clr calc xtals, lt
chrt, pyr, & euhed
xtals (vug filling
dolomitic in pts.)
Lost Circulation @
detected 15,000 pp
10 ppm C₁, & high
concentration H₂S, Se
plugs to regain ci
1257', Lost circ@
Set plug for circ'

Dolomite (calcareou
lt-dk gry, occ lt
f-m gr, suc, hd-fr
calc & silc veinin
tr pyr, lam in pts
Temp Survey: 122° @

Dolomite: lt brn-l
aphanitic, hd, mas
tr pyr.

Lost 30bbls mud @

Temp Survey: 118° @

Dolomite: lt gry-b
f gr, hd, silc & p
galena frac fill,
of pyr @ 1440' on
surfaces, mnr calc
frac fill, tr spha
ite.
W 8.5 V 36 PV 6 Y
pH 11.5 F 41 FC 2
Slids 1.28 Cl 1000

Lost 60bbls mud @
Lost 135bbls @ 15
Dolomite: lt-dk gr
m gr, hd, calc fra
fill, tr pyr, sdy
wht. lt brn, gry

Lost 250bbl mud f
to 1564'. Lost cir
1564', set plug.

Dolomite: brn to l
gry, hd, crinoid
@ 1560-70', occ al
silc fill, tr py,
calc, rre tr gale
tr wht chert.

Lost 60bbl mud @
Lost 25bbl mud @

Dolomite: lt brn
f gr, massive, wh
veining, tr pyr.

Lost 150bbl mud @
Lost 300bbl mud @
Lost circ @ 1734'
plug to regain ci
Set 13 3/8" casing
1734'. Drlg 12 1/4"

Dolomite: brn-lt
f-m gr, hd, silc
ing, sl calc in
pyr, tr drk brn
tr calc vein fill.

W 8.5 V 30 PV 3
pH 12.5 F 55 FC
Sd 3/4 Slids 1 1/2 C

Gained 50 bbl of
at 1815'.

Dolomite: lt-dk
f-mgr, occ silc
tr pyr, mnr bre
veins, occ calc
form'n darker w

Dolomite: con't
above, but with
lt gry calc dol
Lost circ @ 191
gained after 80

Temp Survey: 13
Dolomite: dk br
gry @ 1980', m
icic veining ca
tr pyr, sl calc
rre breccia ve
Lost circ @ 20
ing all mud in

2000
2100
2200
2300
2400
2500
2600
2700

WOB 25,000#
RPM 60
SPM 27
PP 200

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

WOB 20-25,000#
RPM 60
SPM 25

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

H₂O
Add
H₂O

4 3/4" @ 1945'

NO RETURNS

6/28-29/78

LOSS GAIN

METHANE ppm --- 500

53/62

TEMPERATURE (F) 200
CO₂ ppm 4000

PRESSURE OUT- 500
PRESSURE IN-- 500
H₂S --- 100
H₂O---100

64/79

60/61

6/30/78

No returns

6" @ 2351'

Change of CO₂ Scale to 0-20,000

Change of pressure out scale to 0-5

57/73

LOSS GAIN

METHANE ppm --- 500

65/99

TEMPERATURE (F) 200
CO₂ ppm 20000

PRESSURE OUT- 5
PRESSURE IN-- 500
H₂S --- 100
H₂O---100

Change of CO₂ Scale to 0-40,000

60/63

7/1/78

6" @ 2731'

Lost circ @ 1913, re-gained after 80bbl mu

Temp Survey: 133° @ 1913
Dolomite: dk brn, dk gry @ 1980', m gr, silicic veining common, tr pyr, sl calc in pt rre breccia veins. Lost circ @ 2016', losing all mud in tanks.

Began drilling with aerated H₂O @ 2021', No returns.

Injecting 271bbl H₂O/hr, mixed with unisite

Detected mnr amounts of H₂S @ 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-gr, common calc xtal tr pyr & hem stn.

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

No Returns @ 247

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

No Returns

Injecting 250bbl H₂O/hr.

Detected tr H₂S @ 267

No Returns

WOB 20,000#
RPM 60
SPM 29

1186' / 102hr
NB #8 @ 2920'
Smith 3Js
DRILL RATE

10 30 20 10
2.4 2.5 2.6 2.7
BULK DENSITY

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

WOB 25,000#
RPM 60
SPM 30

2800
2900
3000
3100
3200
3300
3400
3500
3600

TEMPERATURE (F)
CO2 ppm

TEMPERATURE (F)
CO2 ppm

PRESSURE OUT
PRESSURE IN

PRESSURE OUT
PRESSURE IN

METHANE ppm --- 500

METHANE ppm --- 500

LOSS GAIN

LOSS GAIN

52/74

70/86

63/72

68/70

69/85

65/70

66/74

104/171

65/63

7/2-3/78

7/4/78

8° @ 3250'

7/5/78

No Returns

Dolomite: lt-dk brn, dk gry, brecciated, calc & silc fill, tr pyr
Injecting 200bbl H₂O/hr mixed with unisteam & ammonia.

Rare cold water return with no formation cuttings returning.

No Returns

Put 2 compressors on hole @ 2945'.

Rare Cold water return with no formation cuttings returning.

Siltstone: red-brn, w/ vf gr sd clasts, mod s srted, sl-v calc.
Sandstone: wht-gry, varicol grns, p srted, 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, p sorted, pred mica is biot, the sltst is silic, tr gyp
Temp Survey: 234° @ 3250'
Injecting 200bbl H₂O/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 srted, 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 grn in pts, mod micaceous & calcareous, tr chlor
Temp Survey: 260° @ 3625'

805 1/16 hrs
 NB #9 @ 3725'
 Smith 20's RATE
 40 30 20 10
 2.4 2.5 2.6 2.7
 BULK DENSITY

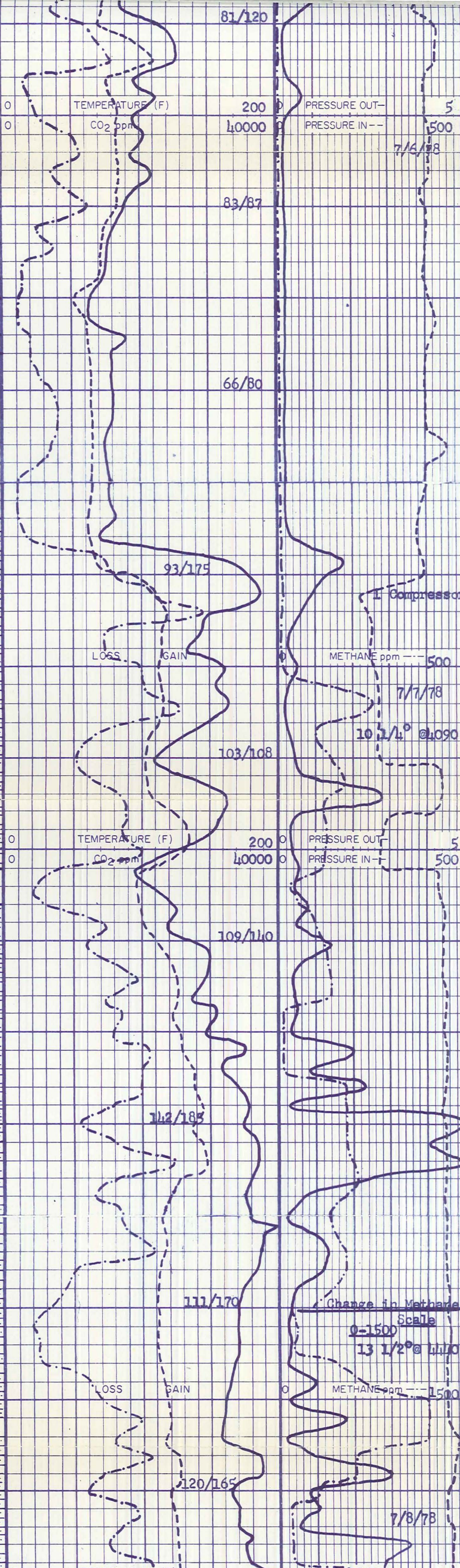
WOB 20,000#
 RPM 60-75
 SPM 31

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

WOB 25,000
 RPM 65
 SPM 30

819 1/17 hrs
 NB #10 @ 4540'
 SEC 586
 DRILL RATE

3700
3800
3900
4000
4100
4200
4300
4400
4500



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

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

Injecting 250bbl H₂O/hr mixed with unisteam & ammonia.

No Returns

Sandstone: red-brn(FeO stain), f gr, mod calc mtr, 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 str pyr.

Siltstone: red-brn as above in gen'l, tr gyp w/ inc gry siltst & cal 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 siltst 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 siltst is v limy while grn siltst is rarely calc.

Siltstone: lt-dk gry, mtr grn, mtr 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.

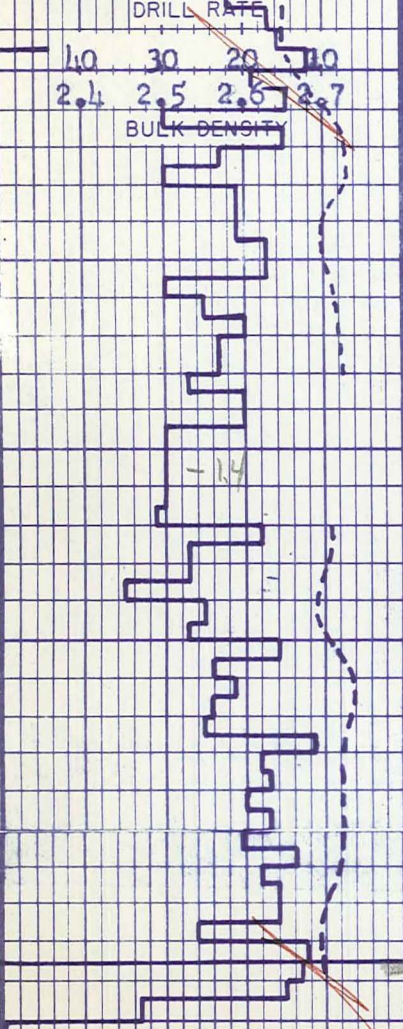
Siltstone: dk-m gry, tr lt gry, w srtd, v limy rre tr silc frac fill, tr oxidized pyr, poss fossil frags @ 4410'.

Temp Survey: 263° @ 4410'

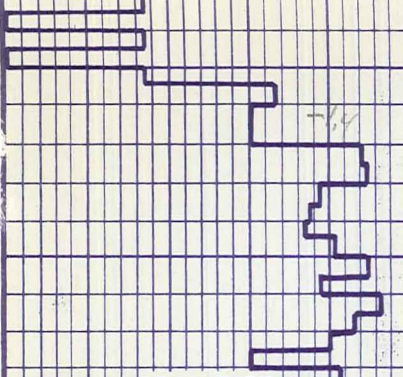
Siltstone: dk gry, tr lt gry & lt grn-gry, mod srtd, sdy in pts, v limy w/ tr wht calc frac fill, tr oxidized pyrite, cont fossil fr agments.

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

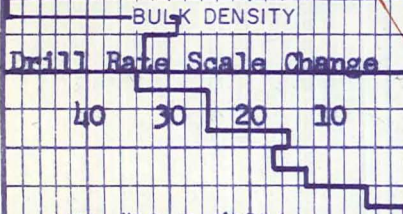
819' / 1.7 hrs
 NB #10 @ 4549'
 SEC 886



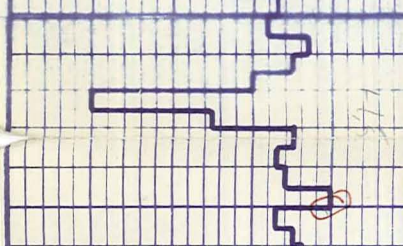
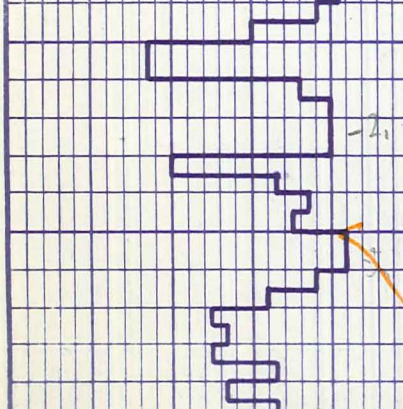
Drill Rate 4785' to 4980'
 150 120 90 60 30 0



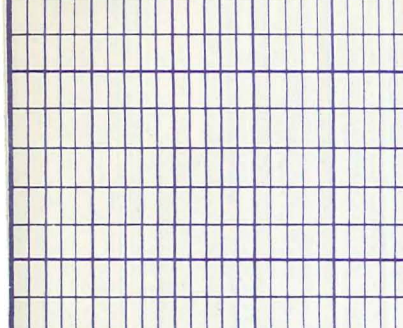
Drill Rate Scale Change
 40 30 20 10



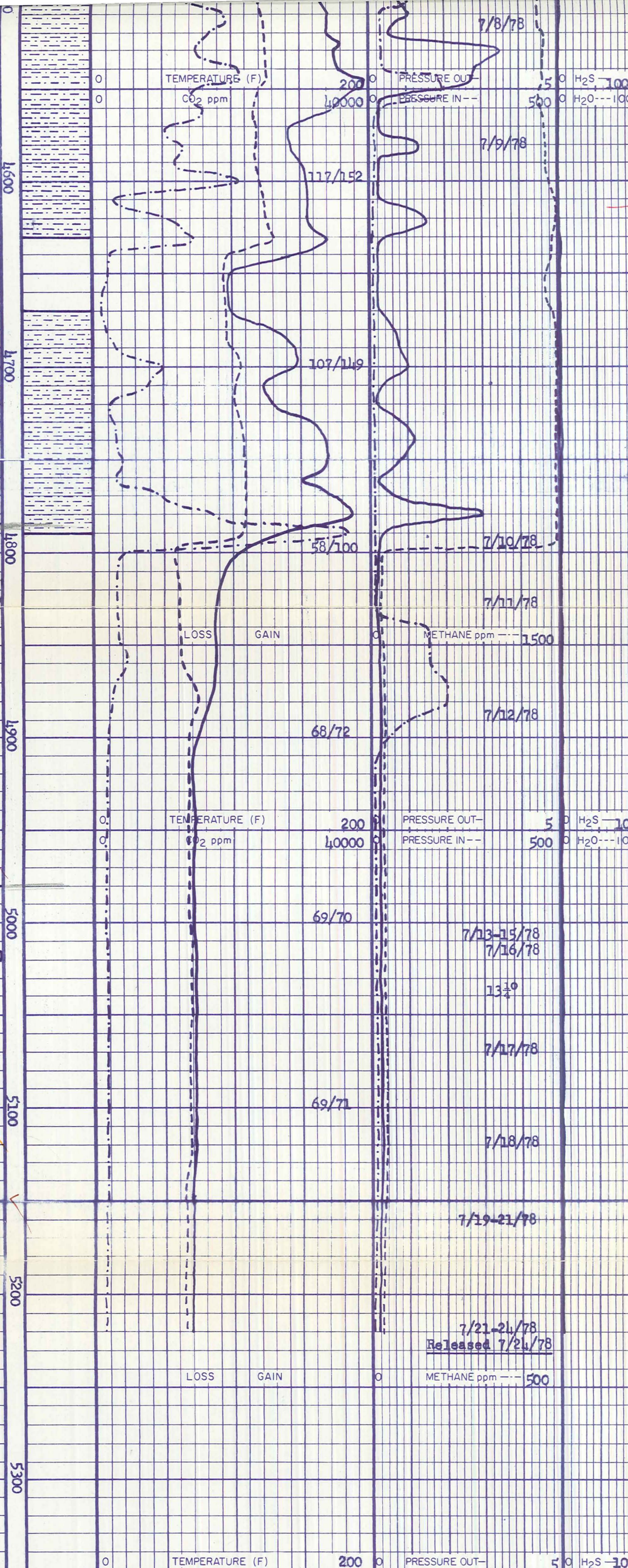
NB #12 @ 5021'
 Smith 4Js



T.D. 5221'



DRILL RATE
 40 30 20 10
 2.4 2.5 2.6 2.7



Siltstone: m-dk gry, mod srt'd, 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 H₂S @ 4635' Injecting 250bbl H₂O/hr mixed with ammonia

No Returns

Siltstone: red-brn w/ lt-dk gry & lt grn, sl calc mtrix w/ mnr silic frac fill, mnr fgr 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/ H₂O only @ 4796'.

Temp Survey: 294° @ 4672'
 Temp Survey: 294° @ 4700'
 Temp Survey: 293° @ 4727'
 Temp Survey: 293° @ 4735'

No Returns

No Returns

CB #1 from 5015 to 5018' Dolomite: 8 inch recovery, dk gry, brecciated.

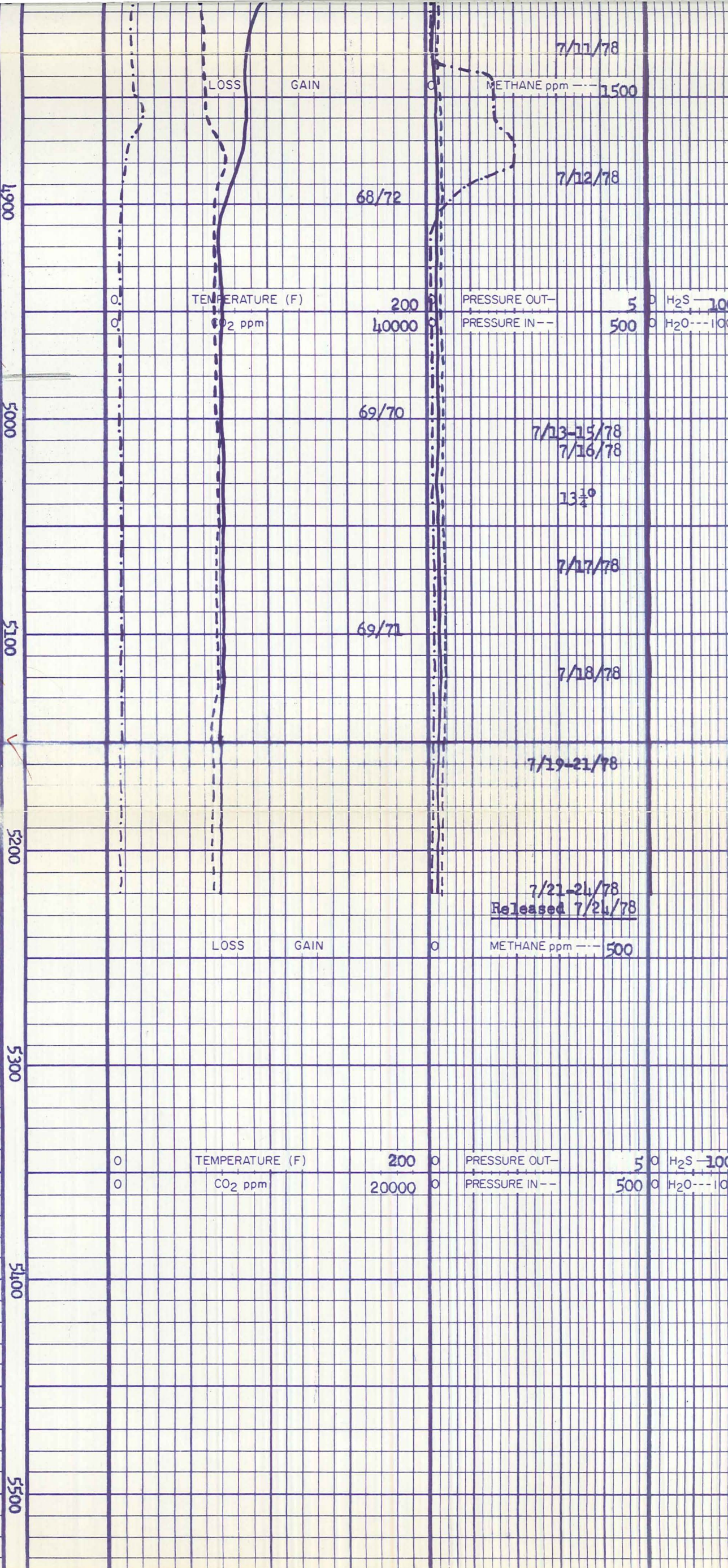
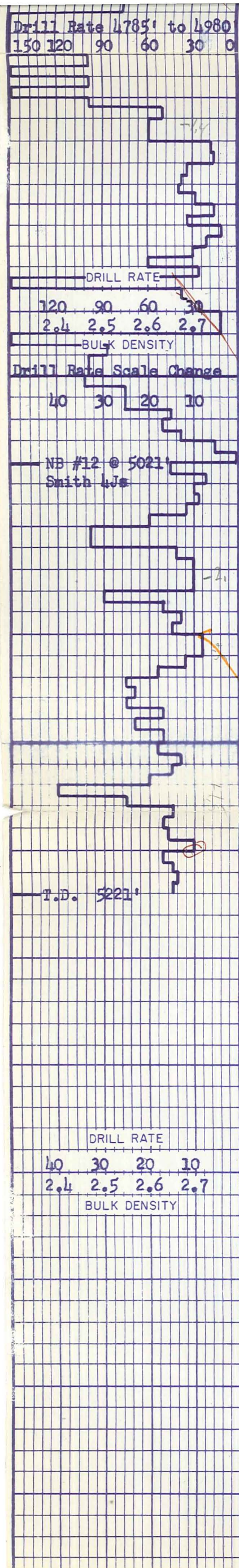
CB #2 From 5018 to 5021' No recovery

Temp Survey: 249° @ 5035'

No Returns

No Returns

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



only @ 4796'.
Temp Survey: 294° @ 467'
Temp Survey: 294° @ 4700'
Temp Survey: 293° @ 4727'
Temp Survey: 293° @ 4735'

No Returns

No Returns

CB #1 from 5015 to 5018'
Dolomite: 8 inch re-
covery, dk gry, breccia-
tated.
CB #2 From 5018 to 5021'
No recovery
Temp Survey: 249° @ 5035'

No Returns

No Returns

Ran Schlumberger Logs
T.D. 5221'.
Plugged hole at var-
ious depths to end
well.