

CONFIDENTIAL



GEOHERMAL DIVISION

WELL GLASS MOUNTAIN FEDERAL 31-17
 FIELD GLASS MOUNTAIN UNIT
 COMPANY UNOCAL
 COUNTY SISKIYOU
 STATE CALIFORNIA
 LOCATION T. 43 N R 4 E SEC. 17
6898' E, 5859' S OF NW CORNER SEC. 7. EL. -7000'
 KB EL. 7031' T.D. 8787'
 BHL 1068.84' S AND 1394.61' W OF
SURFACE LOCATION
 SPUD DATE August 7, 1988
 COMPLETION DATE SEPTEMBER 13, 1988
 DRILLING CONTRACTOR Time Drilling #169
 ENGINEERS John Walters, Paul Stroud*
 GEOLOGISTS Glenn Melosh, Dan Carrier,
H. Crecraft, R. Thompson

* + BILL WARREN, DAVE CAMILLE

CASING RECORD

DIA	INTERVAL
30"	0 - 55'
30"	0 - 322'
13 3/4"	0 - 1128'
7 1/2"	911' - 3054'
7" perf	2887 - 8787'

LOGGING RUNS

DATE	INTERVAL	SERVICES	TEMPERATURES	TC
8/11/88	322' - 1128'	DIL, GAMMA, CALIPER	110°F 98°F	2 1/2 hr

RIG TEST

DATE	TIME	SIP/TIME	WHP	FLP	Δ P	FLT	ORIFICE	RATE

EXPLANATION

DRILLING	LITHOLOGY	MINERALS	PHYSICAL-CHEMICAL
NB NEW BIT	[] SHALE, ARGILLITE (MICROGRAYWACKE)	Q QUARTZ	T TEMPERATURE
RRB RERUN BIT	[] MUDSTONE	C CALCITE	BH BOTTOM HOLE
CB CORE BIT	[] GRAYWACKE	E EPIDOTE	DH DOWN HOLE
	[] FELSIC INTRUSIVE		
	[] INTERMEDIATE INTRUSIVE		
	[] MAFIC		

- CB CORE BIT
- DD DIRECTIONAL DRLG.
- BW BIT WEIGHT
- DEV DEVIATION
- KOP KICK OFF POINT
- DST DRILL STEM TEST
- LC LOST CIRCULATION
- PB PLUG BACK
- DP DRILL PIPE
- DC DRILL COLLAR
- KB KELLY BUSHING

- MUDSTONE
- GRAYWACKE SANDSTONE
- CONGLOMERATE
- LIMESTONE
- DOLOMITE
- EVAPORITE
- CHERT
- SERPENTINITE
- GREENSTONE
- METAMORPHIC

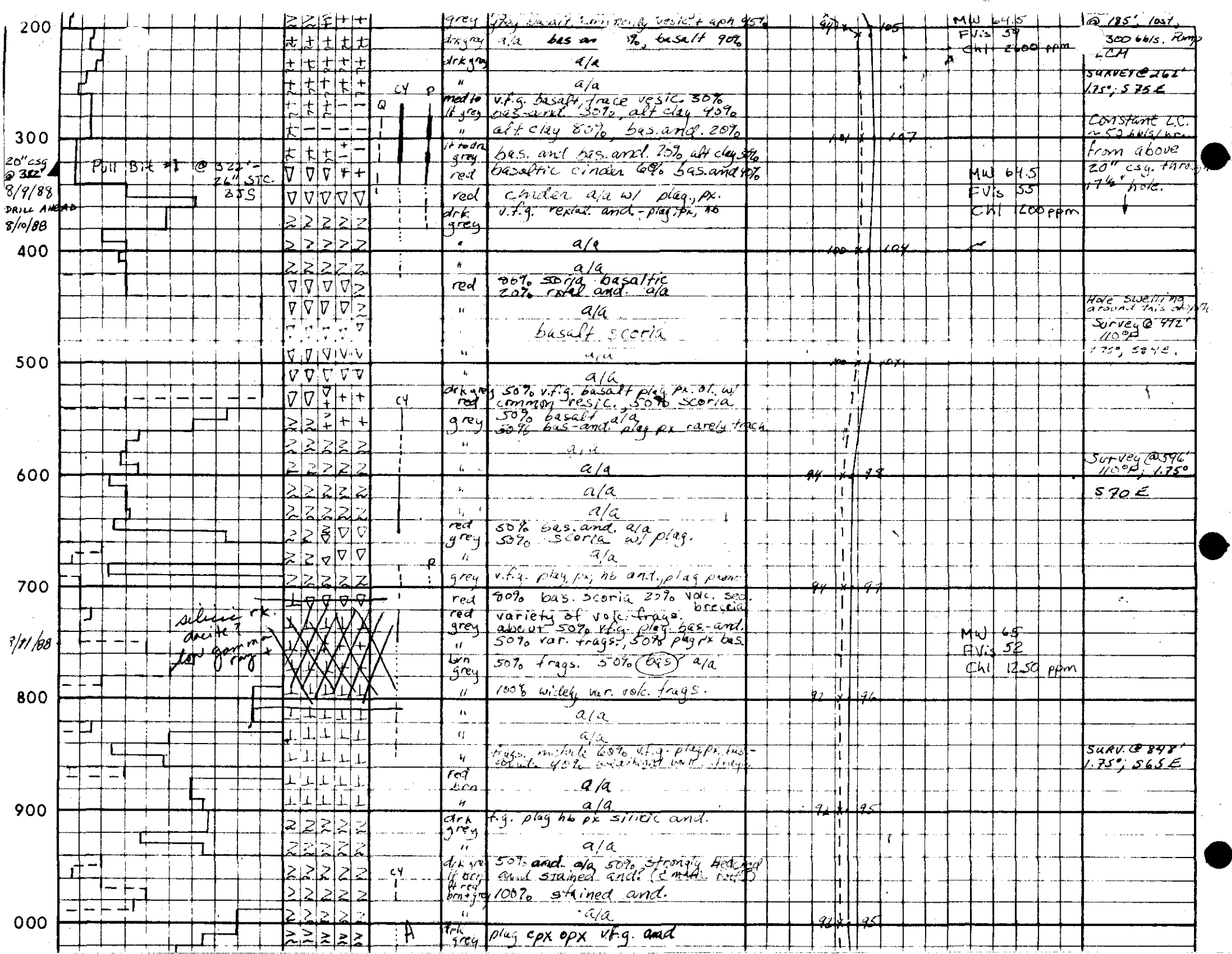
- INTRUSIVE
- FIC TRUSIVE
- FELSIC EXTRUSIVE
- INTERMEDIATE EXTRUSIVE
- MAFIC EXTRUSIVE
- TUFF
- VOLCANIC BRECCIA
- Scoria / Cinder
- Volcanoclastic / detritus

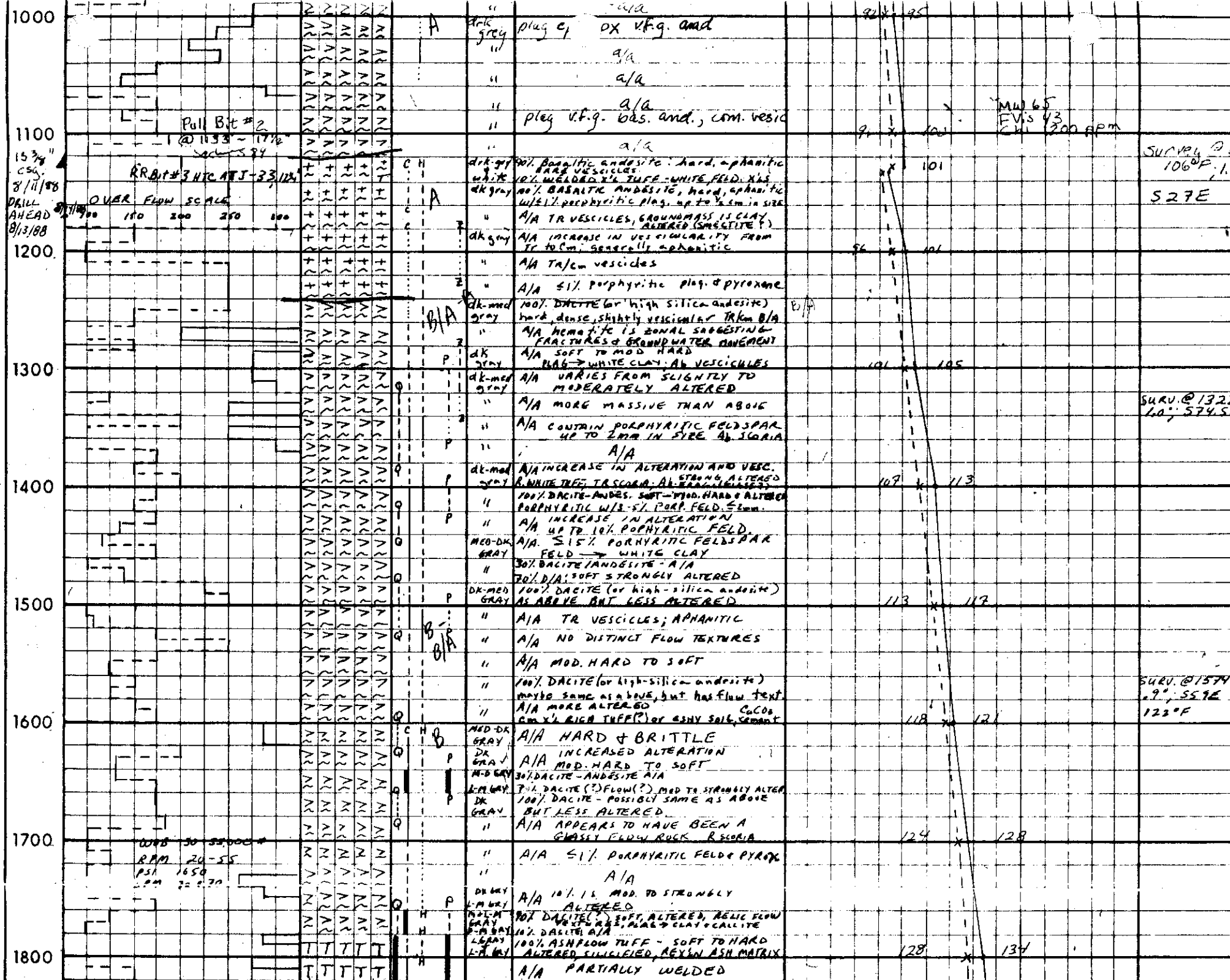
- E EPIDOTE
- CH CHLORITE
- F FELDSPAR
- M MICA
- Z ZEOLITE
- CY CLAY
- O OPAL
- L LIMONITE
- H HEMATITE
- P PYRITE
- S SPHALERITE
- G GALENA
- SP SPHENE
- A ACTINOLITE
- M₃ MAGNETITE

- BH BOTTOM HOLE
- DH DOWN HOLE
- FL FLOW LINE
- BU BOTTOMS UP
- TC TIME SINCE CIRC
- P PRESSURE
- WH WELL HEAD
- SI SHUT IN
- PPM PARTS PER MILLION
- MW MUD WEIGHT
- CR CIRCULATION RATE
- VIS VISCOSITY
- WL WATER LOSS
- GP GALVANIC PROBE
- CHL CHLORIDES

Comment - SURVEY TEMPERATURES, WITH MUD MOTOR IN THE HOLE, ARE TAKEN 60' OFF BOTTOM; MUD MOTOR TAKEN OFF ASSEMBLY AT 3262'

DEPTH FEET	PENETRATION ■ FT/HR □ MIN/FT	LITHOLOGY				PHYSICAL - CHEMICAL				MISC.
		PRIMARY LITHOLOGY	SECONDARY MINERALS			TEMP ☒ °F ☐ °C	FLOWLINE SUCTION SURVEY (BH) MAX READ THERMO	H ₂ S PPM CO ₂ PPM	---X--- Δ □ ••H•• ---C---	
			ABUNDANT	BULK COLOR	DESCRIPTION					
8/7/88	OVER FLOW SCALE 100 150 200 250 300 PRIMARY SCALE 10 20 30 40 50 60 70 80 90	100 % 0	COMMON TRACE RARE			50 °F	100	150	200	Spud @ 1000 ft 8/7/88
100		∇ ∇ ∇ ∇		black + red 75% Basalt scoria, sph. w/ rare plag. and pt. 5% f.g. r. rd/grey brown sucrose and a/a w/ 70%-80%						
		∇ ∇ ∇ ∇		grey vf. p. and, sucrose texture 1/4 in. p. p. 20% basalt scoria						
		∇ ∇ ∇ ∇		black, 50% basalt scoria, 25% r. rd and p. 25% plag, hb bas-and grey, vf. bas-and, w/ sucrose texture 70%						note: sump water has chl = 1100 ppm
		∇ ∇ ∇ ∇		grey vf. g. bas-and, all w/ plag. r. 50%						
		∇ ∇ ∇ ∇		grey f.g. bas-and, a/a						
200		∇ ∇ ∇ ∇		grey f.g. bas-and, a/a 50%, vf. g. atx						MW 64.5 FV 59 Chl 2600 ppm
		∇ ∇ ∇ ∇		drk grey a/a bas and 10%, basalt 90%						L.C. 100 bbls/m @ 185' lost ~ 300 bbls. Rm LCH
		∇ ∇ ∇ ∇		drk grey a/a						SURVEY @ 262' 175° S 75 E





1000

1100

15 3/4" CSO.

8/11/88

PULL AHEAD 8/13/88

1200

1300

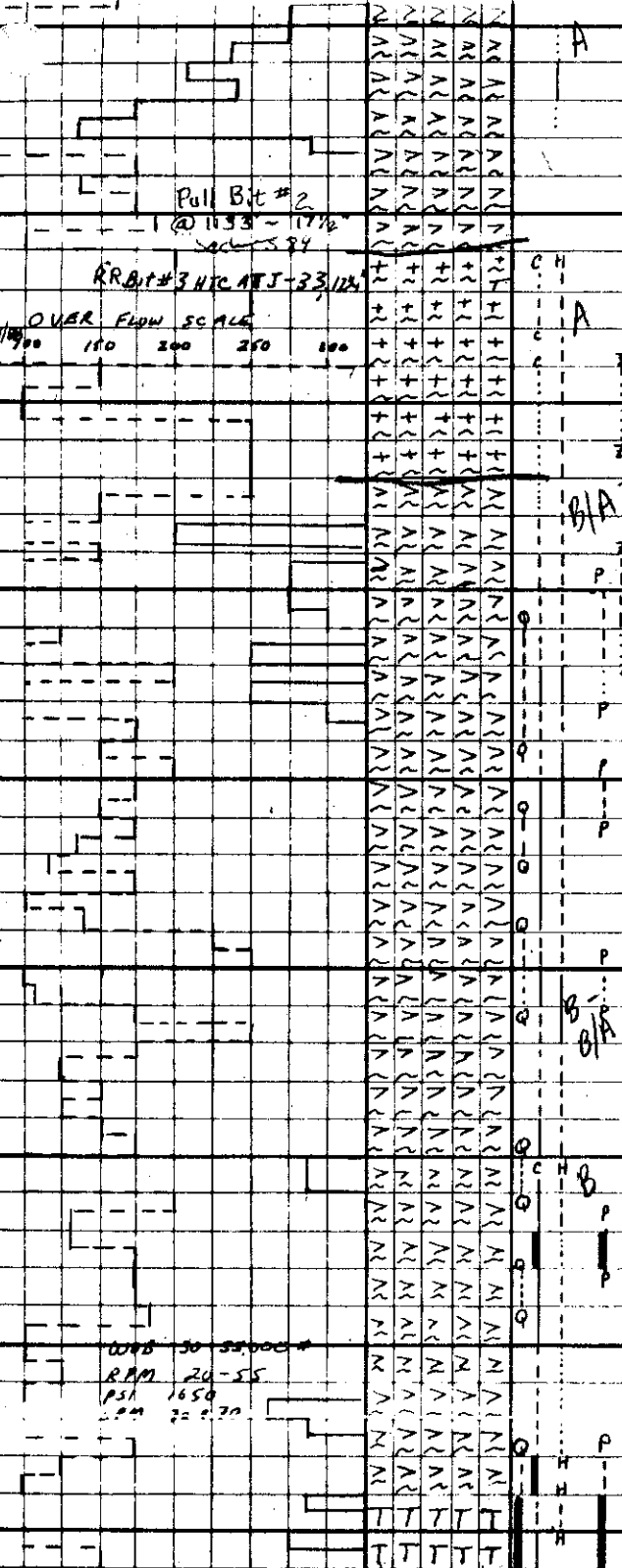
1400

1500

1600

1700

1800



A

Ark grey plug c1

"

"

"

"

dk gray 100% BASALTIC ANDESITE, hard, aphanitic

white 10% WELDED TRUFF - WHITE FELDS. XLS

dk gray 100% BASALTIC ANDESITE, hard, aphanitic

" 100% PORPHYRITIC PLAG. up to 2mm in size

dk gray A/A TR VESICLES, GROUNDMASS IS CLAY, ALTERED (SMECTITE?)

" A/A INCREASE IN VESICULARITY FROM 10 TO 2cm. Generally aphanitic

" A/A TR/cen vesicles

" A/A 5% porphyritic plag. & pyroxene

dk and gray 100% DACITE (or high silica andesite) hard, dense, slightly vesicular TRken D/A

" A/A hematite is zonal suggesting FRACTURES & GROUNDWATER FLOWMENT

dk gray A/A SOFT TO MOD HARD

dk gray PLAG -> WHITE CLAY. Ab VESICLES

dk-med gray A/A VARIES FROM SLIGHTLY TO MODERATELY ALTERED

" A/A MORE MASSIVE THAN ABOVE

" A/A CONTAIN PORPHYRITIC FELDS PAR UP TO 2mm IN SIZE Ab SCORIA

A/A

dk-med gray A/A INCREASE IN ALTERATION AND VESC.

gray R. WHITE TRUFF. TR SCORIA. Ab STRONGLY ALTERED

" 100% DACITE-AND. SOFT-MOD. HARD & ALTERED

" PORPHYRITIC W/ 5% ST. PORP. FELD. 5mm

" INCREASE IN ALTERATION

" A/A UP TO 10% PORPHYRITIC FELD.

med-dk gray A/A 5% PORPHYRITIC FELDS PAR

gray FIELD -> WHITE CLAY

" 30% DACITE/AND. SITE - A/A

" 70% D/A. SOFT & STRONGLY ALTERED

dk-med gray 100% DACITE (or high-silica andesite)

" AS ABOVE BUT LESS ALTERED

" A/A TR VESICLES; APHANITIC

" A/A NO DISTINCT FLOW TEXTURES

" A/A MOD. HARD TO SOFT

" 100% DACITE (or high-silica andesite)

" maybe same as above, but has flow text

" A/A MORE ALTERED

" A/A RICH TRUFF(?) or GSHY SALT, SEMANT

med-dk gray A/A HARD & BRITTLE

gray INCREASED ALTERATION

dk gray A/A MOD. HARD TO SOFT

med-dk gray 30% DACITE-AND. SITE A/A

dk gray 70% DACITE (?) FLOW (?) MOD TO STRONGLY ALTERED

dk gray 100% DACITE - POSSIBLY SAME AS ABOVE

gray BUT LESS ALTERED

" A/A APPEARS TO HAVE BEEN A GLASSY FLOWY ROCK. R SCORIA

" A/A 5% PORPHYRITIC FELDS & PYROX

" A/A

dk gray A/A 10% IS MOD. TO STRONGLY ALTERED

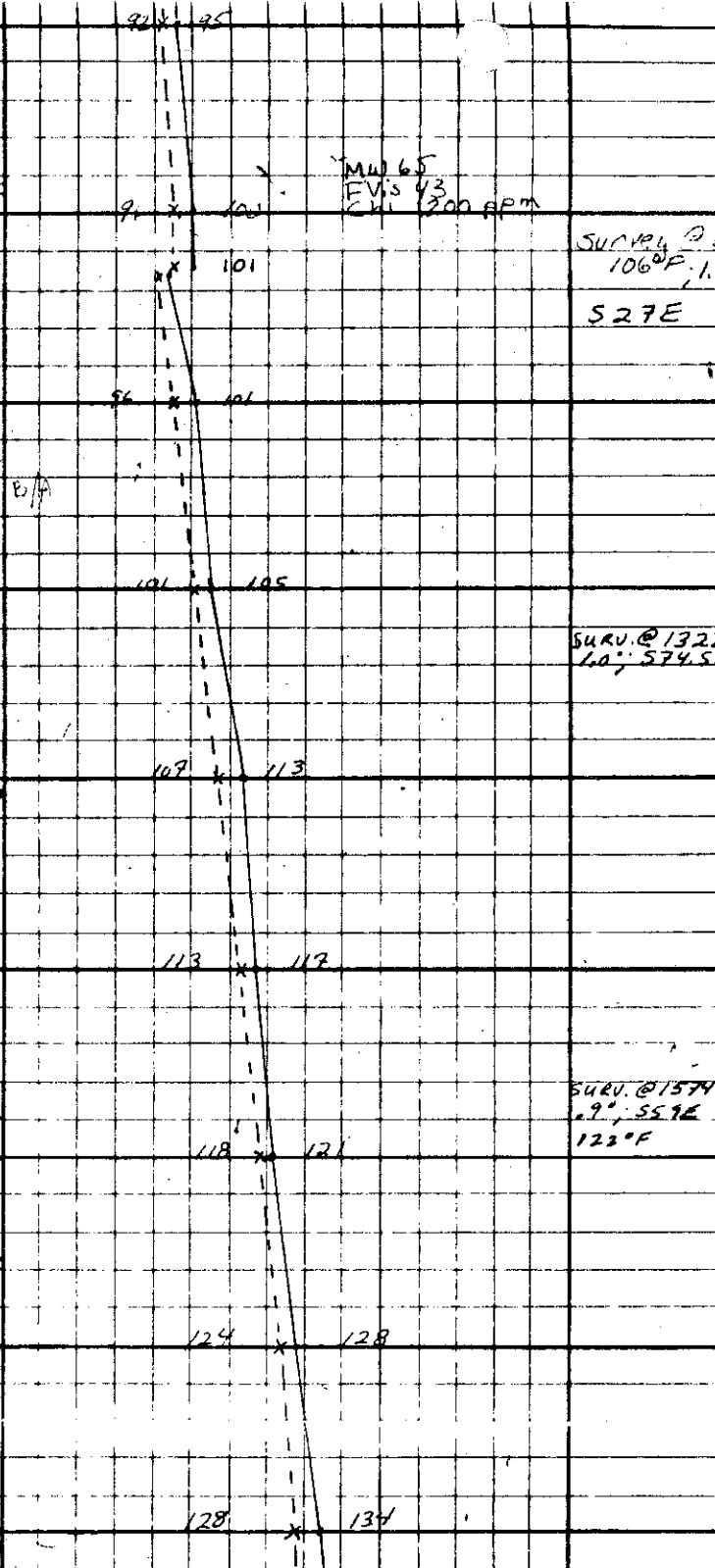
med-dk gray 100% DACITE (or high-silica andesite) SOFT, ALTERED, RELIC FLOW

gray 10% DACTE A/A

med-dk gray 100% ASH FLOW TRUFF - SOFT TO HARD

gray ALTERED, SILICIFIED, RELIC ASH MATRIX

dk gray A/A PARTIALLY WELDED



92 x 95

9 x 100

101

101

105

107 x 113

113 x 117

118 x 121

124 x 128

128 x 134

MWD 65

FV 13

CHI 200 RPM

SURV @ 1322

106°F

527E

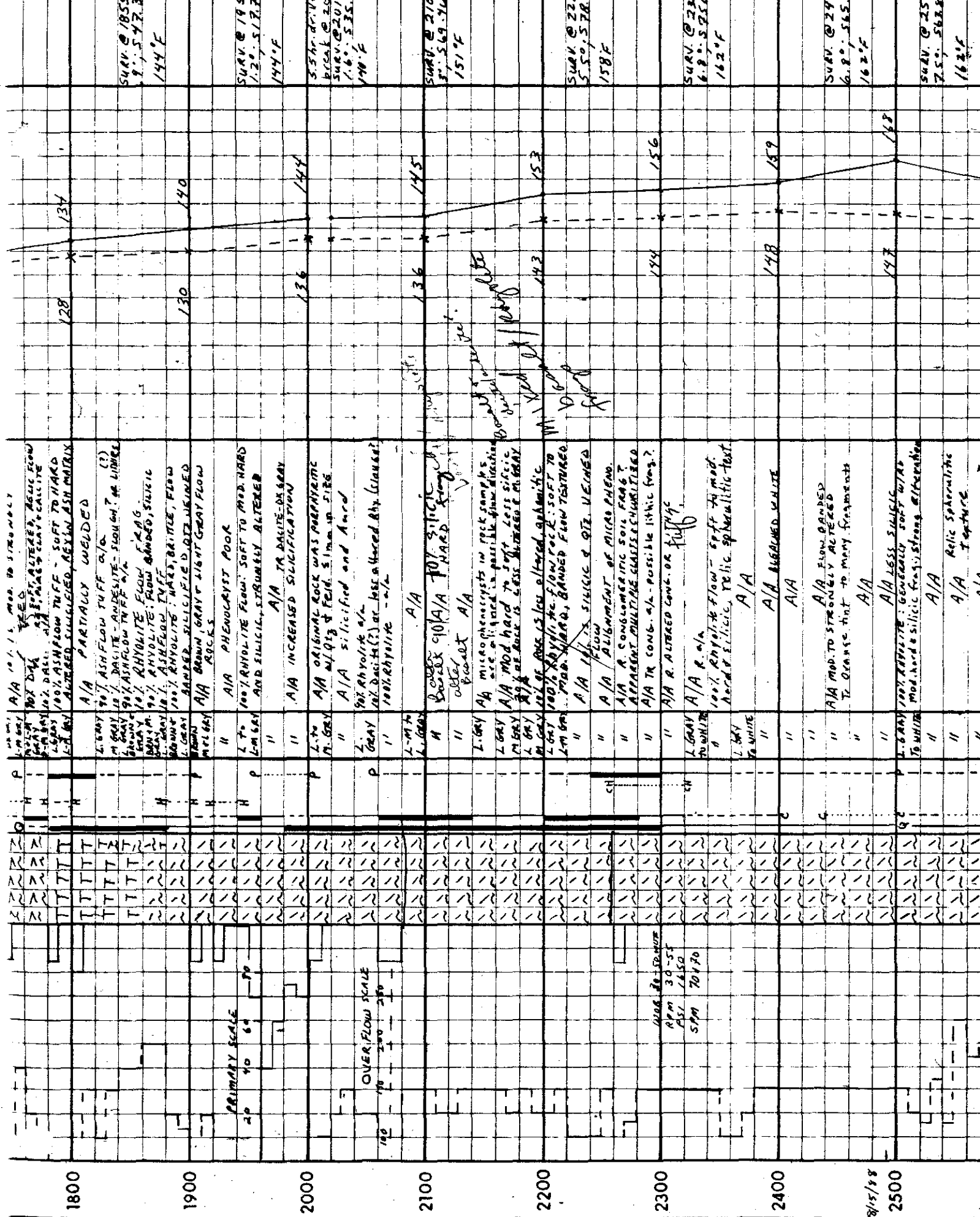
SURV @ 1322

107° 574.5A

SURV @ 1574

129° 557E

123°F



SURV. @ 1855
 129.577.3
 144°F

SURV. @ 195
 129.517.22
 144°F

SURV. @ 2010
 160.535.5
 140°F

SURV. @ 2103
 151.569.761
 151°F

SURV. @ 222
 150.578.9
 158°F

SURV. @ 2321
 162.525.6
 162°F

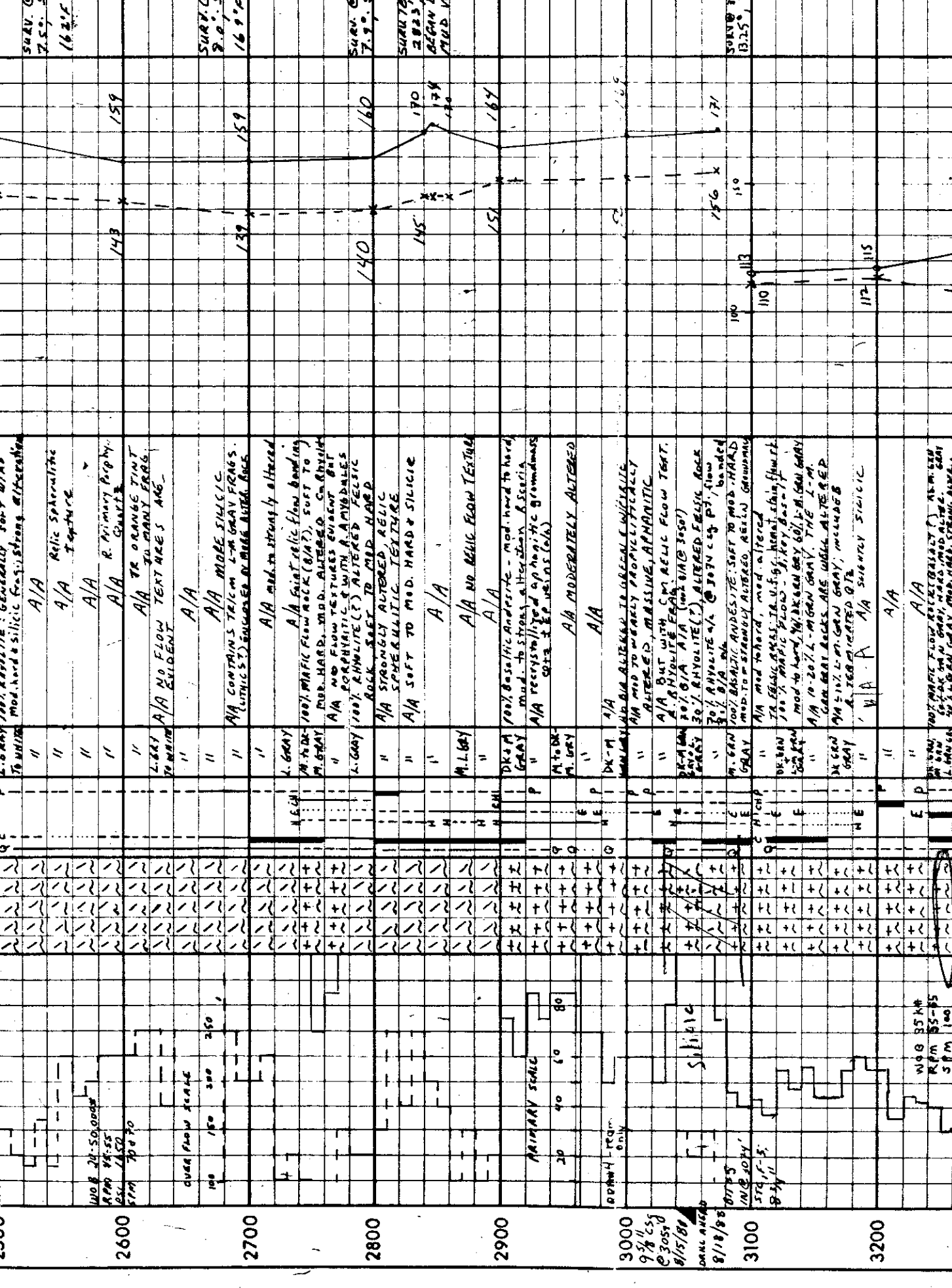
SURV. @ 2449
 162.565.9
 162°F

SURV. @ 2549
 162.563.8
 162°F

8/15/98

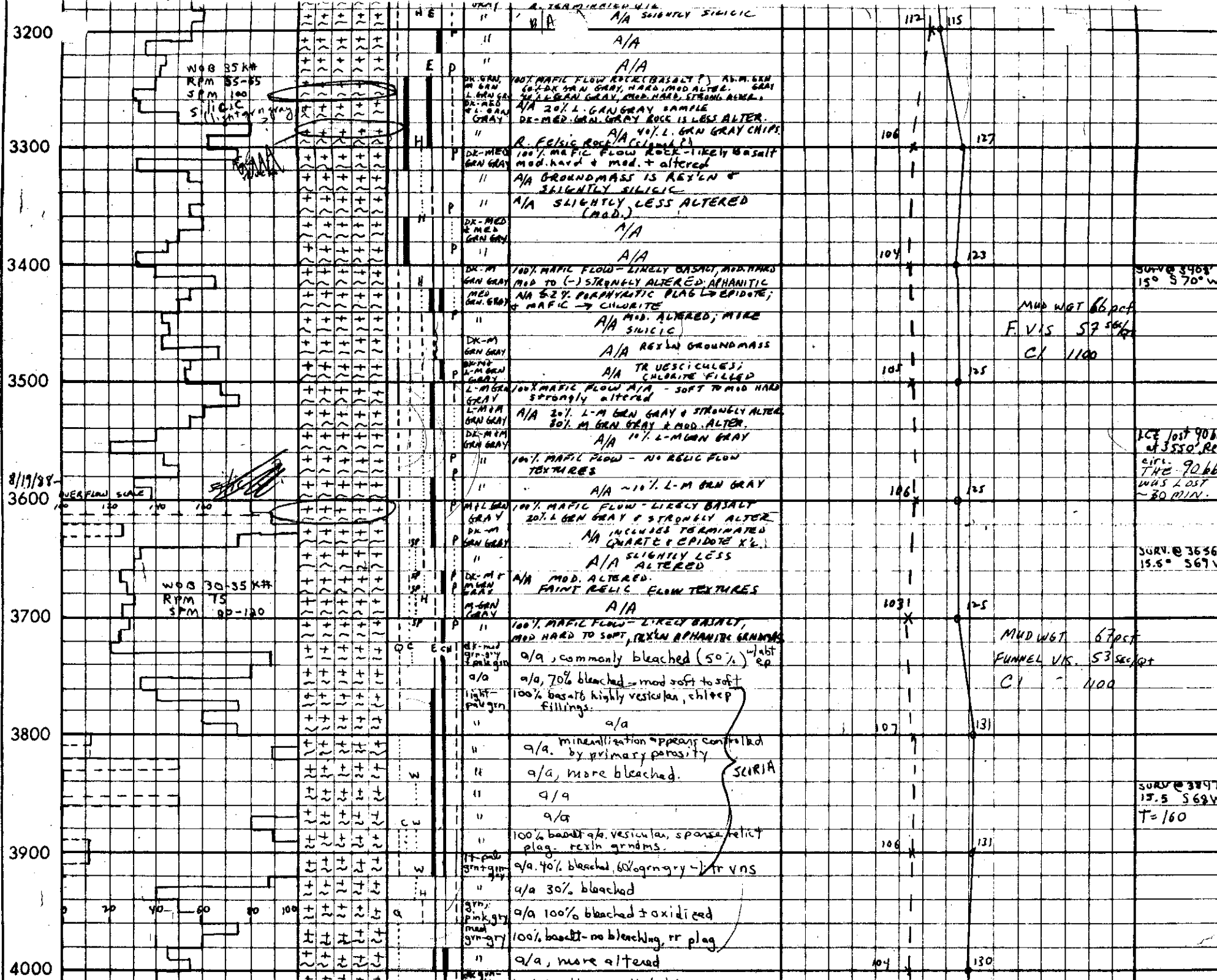
1106 88-50-50-50

162
 168
 159
 159
 160
 170
 174
 140
 145
 151
 167
 171
 100
 110
 115
 127



162
 168
 159
 159
 160
 170
 174
 140
 145
 151
 167
 171
 100
 110
 115
 127

162
 168
 159
 159
 160
 170
 174
 140
 145
 151
 167
 171
 100
 110
 115
 127



MUD WGT 66 pcf
 F.VIS 57 sec/ft
 CI 1100

SURV @ 3468
 15° S 70° W

ICE lost 90 lb
 of 3550 Rev
 circ. THE 90 lb
 WAS LOST
 ~ 30 MIN.

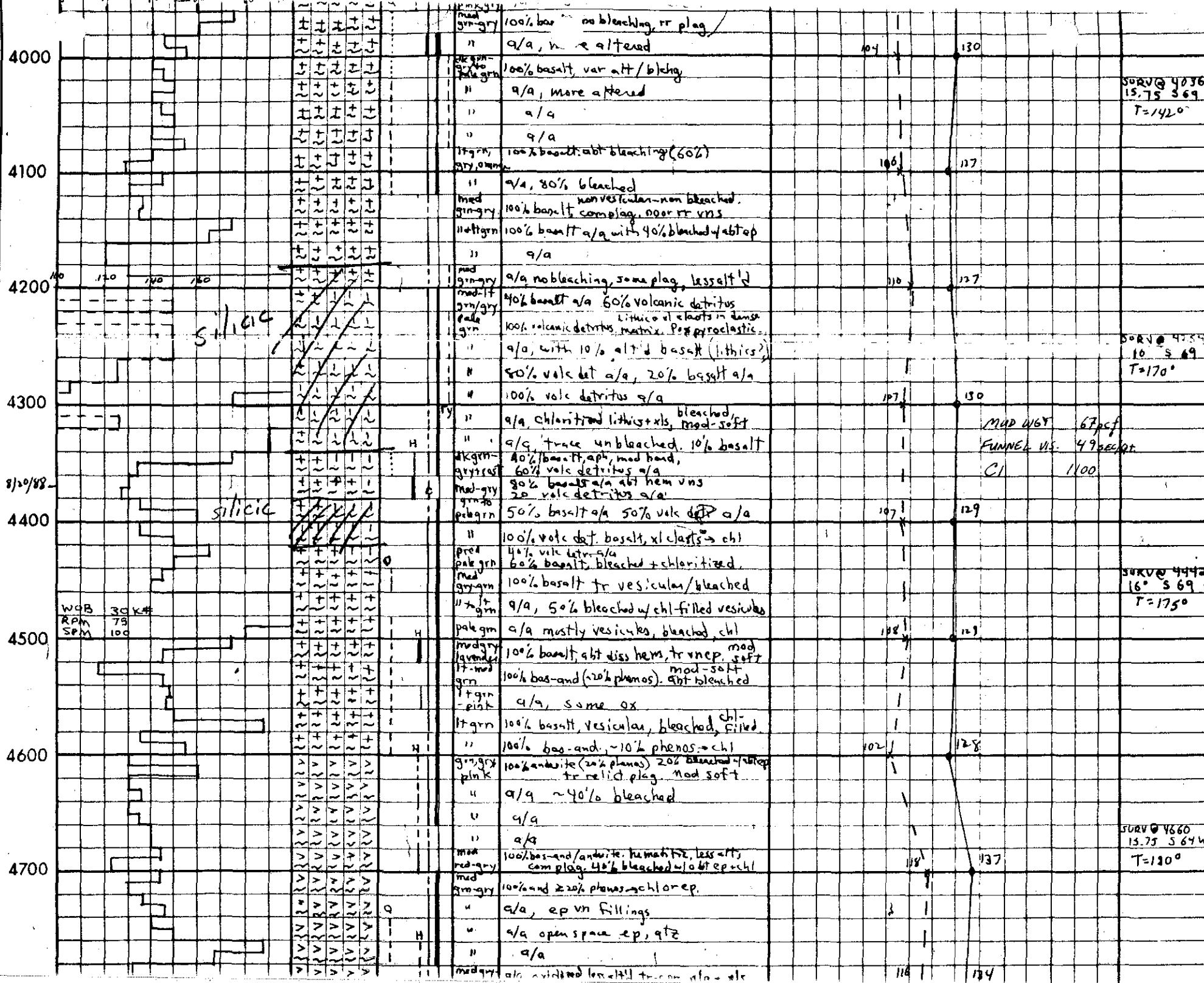
SURV @ 3636
 15.5° S 69° W

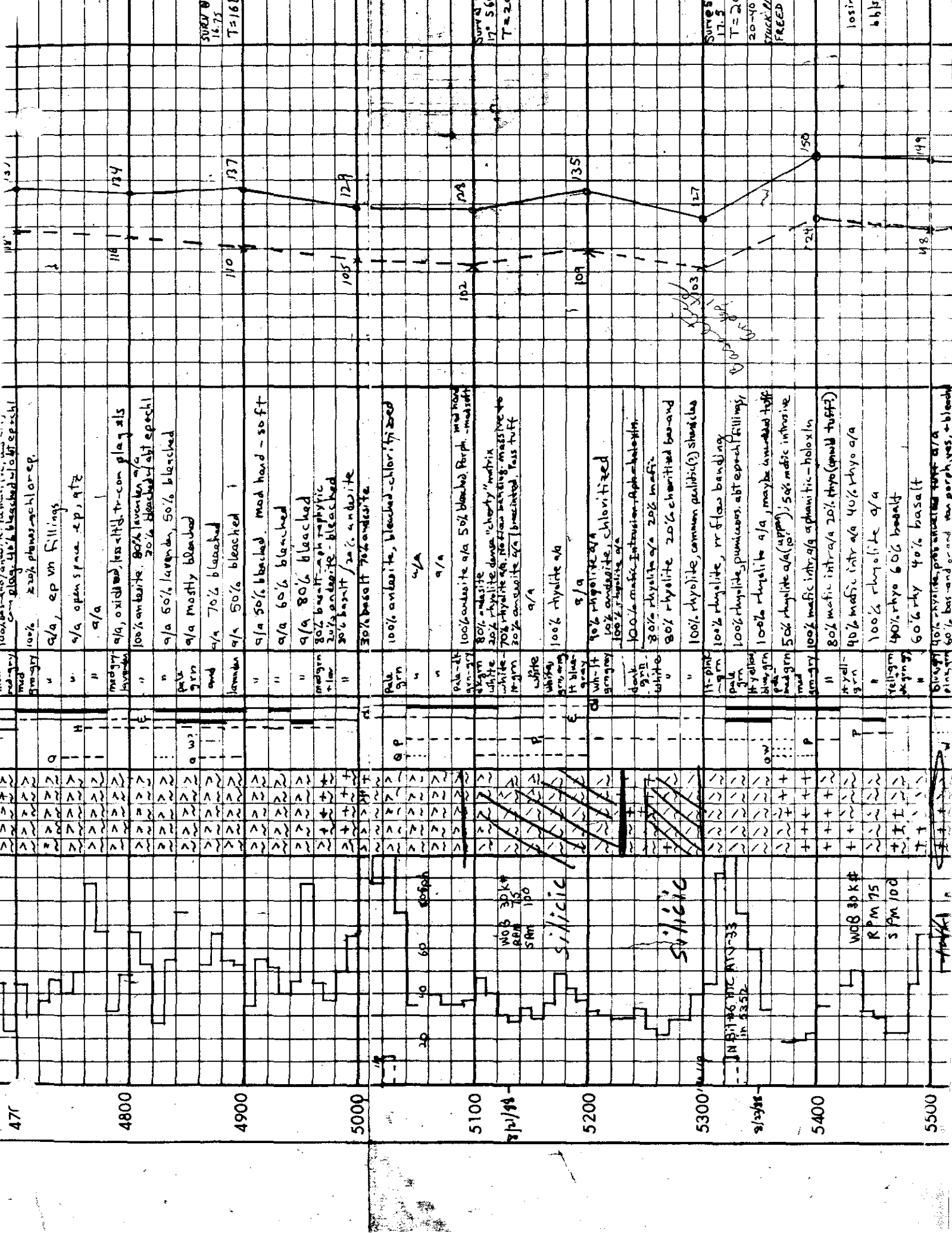
MUD WGT 67 pcf
 FUNNEL VIS. 53 sec/ft
 CI 1100

SURV @ 3897
 15.5° S 68° W
 T=160

SCORIA

8/19/88
 MUDFLOW SCALE





477

4800

4900

5000

5100

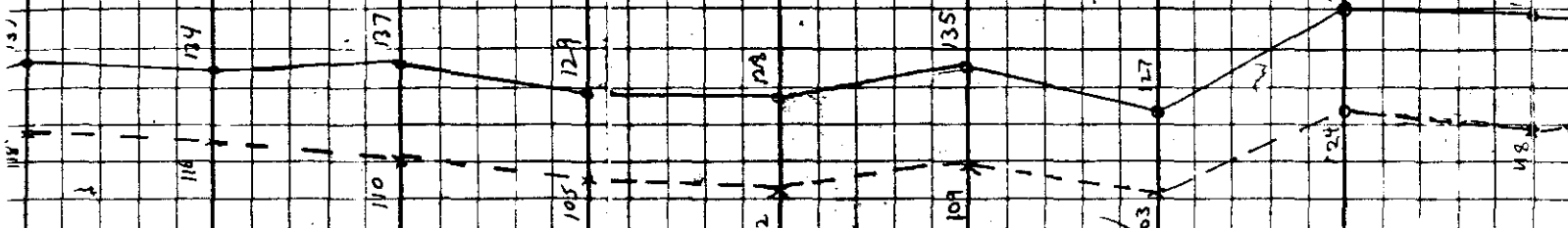
5200

5300

5400

5500

100% quartzite, bleached, light ep. ch
com. plagi. 40% bleached, light ep. ch
100% 20% plagioclase, op.
q/a, ep. in fillings
q/a open space, ep., qtz
q/a
q/a, oxidized, less lit. tr-con. plagi. als
100% quartzite, 80% quartzite, 20%
30% bleached, light ep. ch
q/a 50% lavender, 50% bleached
q/a mostly bleached
q/a 70% bleached
q/a 50% bleached
q/a 50% bleached, mod. hard - soft
q/a 60% bleached
q/a 80% bleached
80% quartzite, rhyolite
20% quartzite - bleached
30% basalt / 20% andesite
30% basalt / 20% andesite
100% andesite, bleached - chloritized
q/a
q/a
100% andesite q/a 50% bleached, Porph. matrix
80% andesite
20% rhyolite, dense "cherty" matrix
White - 70% rhyolite q/a, porous, silty, massive to
10-grm 30% andesite q/a bleached, less tuft
q/a
100% rhyolite q/a
q/a
90% rhyolite q/a
10% andesite, chloritized
100% mafic intrusions - aphanitic
80% rhyolite q/a 20% mafic
80% rhyolite 20% chloritized basalt
100% rhyolite, common aphanitic(?) structures
100% rhyolite, rr flow banding
100% rhyolite, pumiceous, abt. ep. ch fillings,
100% rhyolite q/a, maybe unweathered tuft
50% rhyolite q/a (appx), 50% mafic intrusive
100% mafic intr. q/a aphanitic - holox. in
80% mafic intr. q/a 20% rhyo (small tuft)
90% mafic intr. q/a 40% rhyo q/a
100% rhyolite q/a
40% rhyo 60% basalt
60% rhy 40% basalt
90% quartzite, porous, bleached tuft q/a
60% basalt and 40% porous, - bleached



5067 @ 98
16.75
T=168°

5100 @ 98
17.56W
T=202°

5300 @ 98
17.5
T=204°
20-40 W
STUCK IN
FRED W

losing
6/10/1

WOB 30k
ROM 75
SAM 100

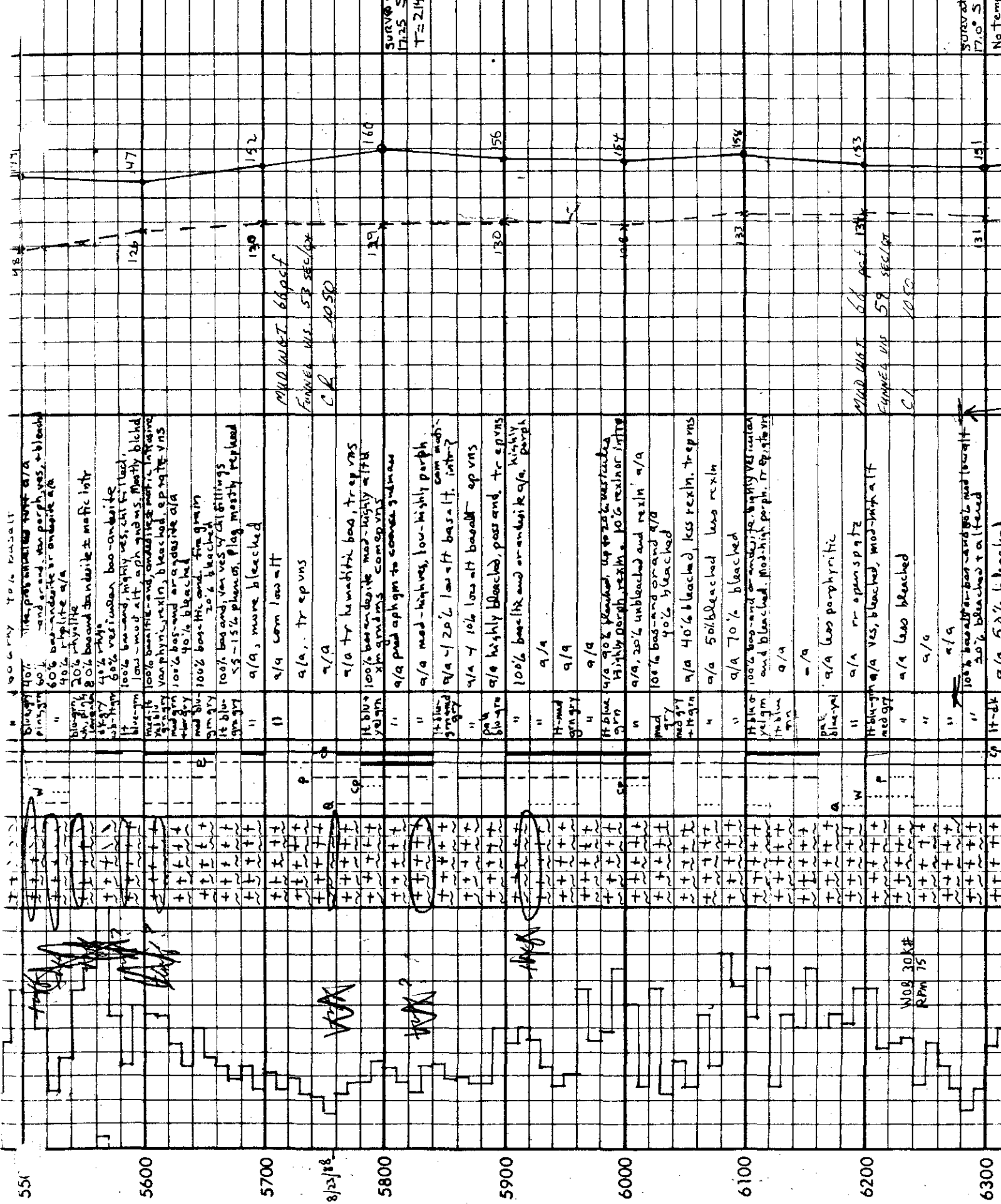
silicic

silicic

JN B176 TIC RTU-33
in 3352

WOB 30k #
RPM 75
SAM 100

WOB 30k



5500
5600
5700
5800
5900
6000
6100
6200
6300

Bluish gray
60% and and. and porph. ves. + bleached
60% bas-andesite or andesite a/a
40% rhyolite a/a
Bluish gray
80% rhyolite a/a
4 1/2 rhyolite
65% vesicular bas-andesite
100% bas-and. highly ves. and fr. tuff.
low mod alt. a/a and ves. mostly bleached
100% basitic and andesite a/a. In ves.
van. phyl. r. xln, bleached, ep. r. r. vns
100% bas-and a/a andesite a/a
40% bleached
100% basitic and. fr. grain
70% bleached
100% bas. and. van. ves. w/ fillings
SS - 15% plenum. Plag. mostly replaced
a/a, more bleached
a/a com low alt
a/a, tr ep vns
a/a
a/a tr hematite bas, tr ep vns
100% bas-andite mod-highly a/a
xln grains com ep vns
a/a mod a/a to com. granular
a/a mod-highves, low-highly porph.
com mod.
a/a - 20% low alt basalt. inter?
a/a - 10% low alt basalt ep vns
a/a highly bleached, pass and. tr ep vns
100% basitic and or-andesite a/a. highly porph.
a/a
a/a
a/a
a/a 90% bleached, up to 20% vesicular
Highly porph. r. xln. 10% resin. inter?
a/a, 20% unbleached and resin a/a
100% bas-and or and a/a
40% bleached
a/a 40% bleached, less resin. tr ep vns
a/a 50% bleached less resin
a/a 70% bleached
100% bas-and. com. highly vesicular
and bleached. Mod-high porph. tr ep, r. xln
a/a
a/a
a/a low porphyritic
a/a r. opans p a/z
a/a ves, bleached, mod-high alt
a/a less bleached
a/a
a/a
a/a
100% bas-and. and 80% mod low alt
20% bleached + altered
a/a 50% bleached

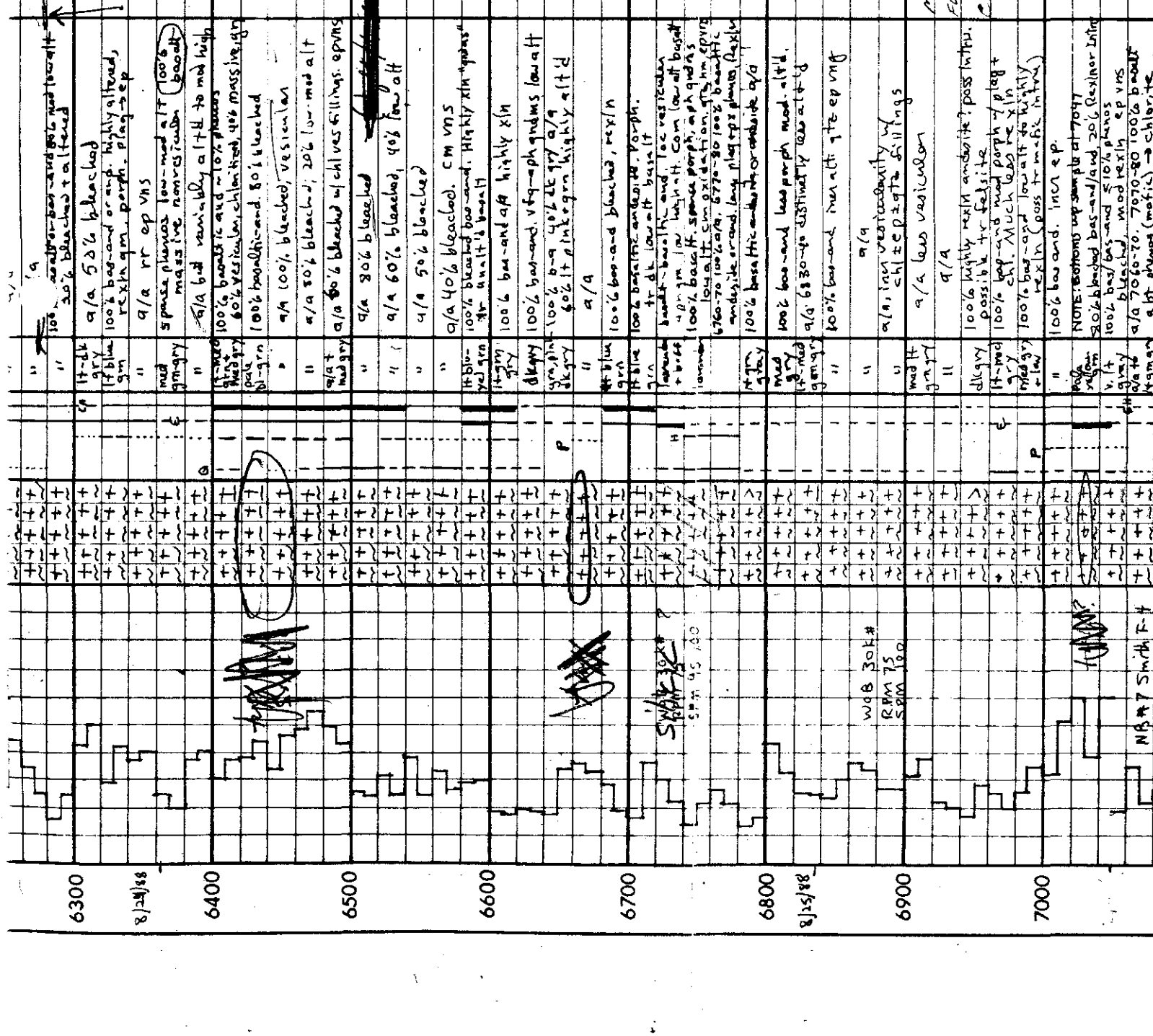
126
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158

MUD MATT 66 p. 131
FUNNEL VNS 59 SEC/MT
C/ 1050
MUD MATT 66 p. 131
FUNNEL VNS 59 SEC/MT
C/ 1050

8/23/88

W08 30k#
RPM 75

SURFACE
17.0° S
No Temp.



lossing ±

surveys 17.0° 55
No Temp

surveys 16.75° 54
T = 190° F

surveys 16.75° S
T = 210

31
151
131
132
133
117
24
125
116
148

159
154
166
44
184
153
148

MUD. MET. 67pcf

FLUEN. U.S. 50.556/21

10.50

WB 304#

RBM 75

50M 100

NB 7 Smith F-4

SMITH F-4

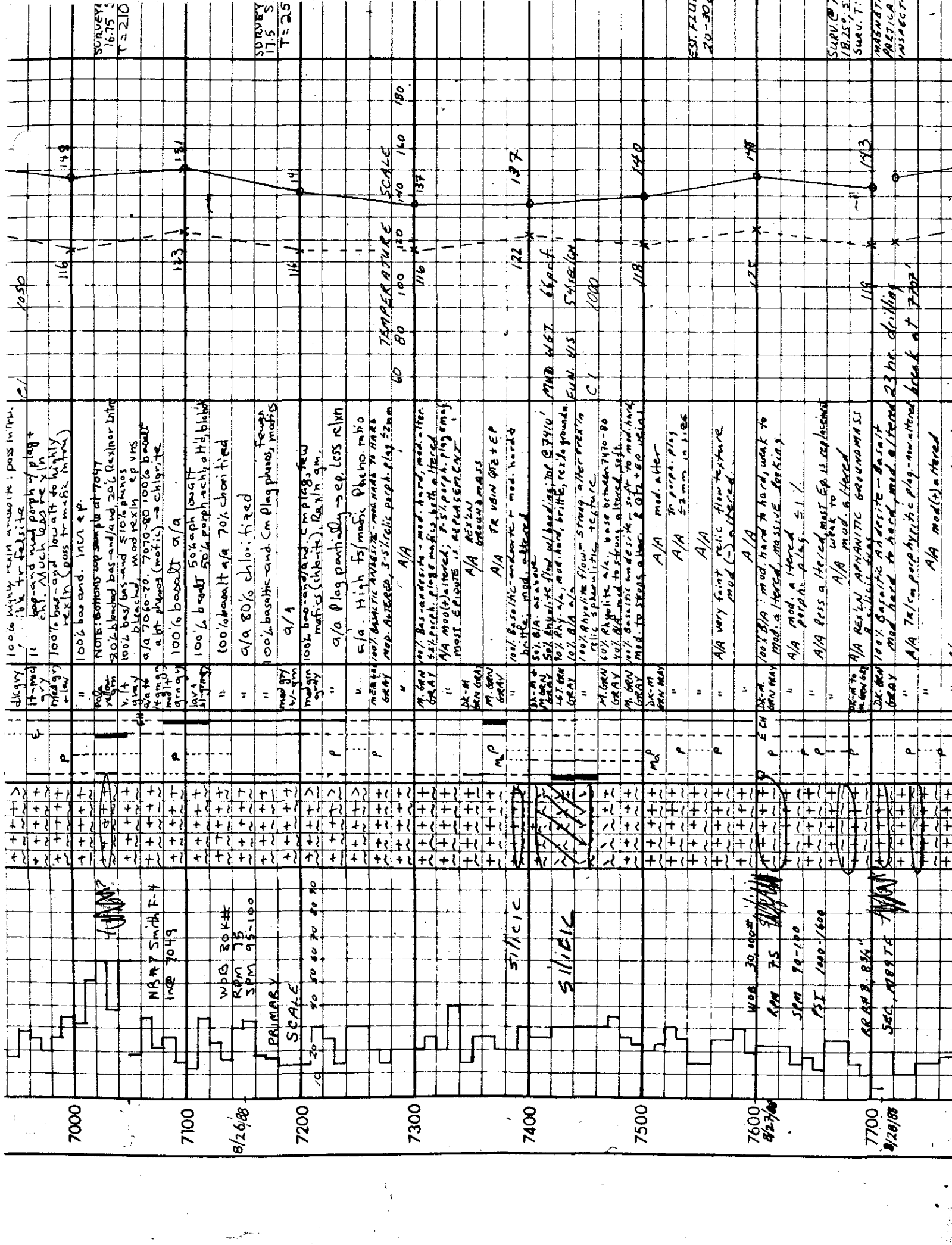
57° 45' 180

NOTE: Bottoms up sample at 7017

100% bas-and 50% phenos

v. t. v. t.

9/a 70-80% to 70-80% 100% basaltic



NOTE: bottom up sample at 7047
80% basalt basal and 20% REXLIN INTER
100% basalt and 50% phos
bleached, mod rexin ep vns
a/a 70-80, 70-80 100% basalt
abt phos (matrix) - chlorite

NOTE: bottom up sample at 7047
80% basalt basal and 20% REXLIN INTER
100% basalt and 50% phos
bleached, mod rexin ep vns
a/a 70-80, 70-80 100% basalt
abt phos (matrix) - chlorite

100% highly resin cement: pass in HCl
100% basalt a/a
100% basalt 50% chlo. sized
100% basalt 50% porph. mod, a Hcl bleed
a/a 80% chlo. sized
100% basaltic and. Cm flag phos. few
a/a
100% basaltic and. Cm flag phos. few
mat. (abund). REXLIN gm.
a/a flag partially - ep. less rexin
a/a High f+mod. Pheno. ratio
mod. ALTERED. 3-5% porph. flag 5mm
A/A
100% Bas. and phos - mod. hard, med. alter
50% B/A. as above
50% Basaltic flow w/ banding. Top 2740'
90% B/A. a/a. mod. hard, brittle, rexin ground
100% B/A a/a
100% Basaltic flow - strong after rexin
rel. spherulitic texture
60% Phos. a/a. base between 7470-80
80% B/A. a/a. mod. to strong, altered soft
100% Basaltic and phos. soft to med. hard
mod. to strong, alter. & OTE + EP below
A/A mod. alter
A/A in prep. plug
A/A 5-3 mm in size
A/A
A/A very faint relic flow texture
A/A
100% B/A: mod. hard to hard, weak to
mod. a. altered, massive looking
A/A mod. a. altered
A/A porph. plug 5-1"
A/A Res. a. altered, most EP is replacing
A/A weak to
A/A mod. a. altered
A/A REXLIN AMPHIBOLITE GROUND MASS
& chlorite
100% Basaltic and phos - Basalt
mod. hard to hard, med. altered
A/A 7x/cm porph. phos. - mod. altered
A/A mod (+) a. altered

PRIMARY
SCALE

TEMPERATURE SCALE

DEPTH

SURVEY
16.75
T=210

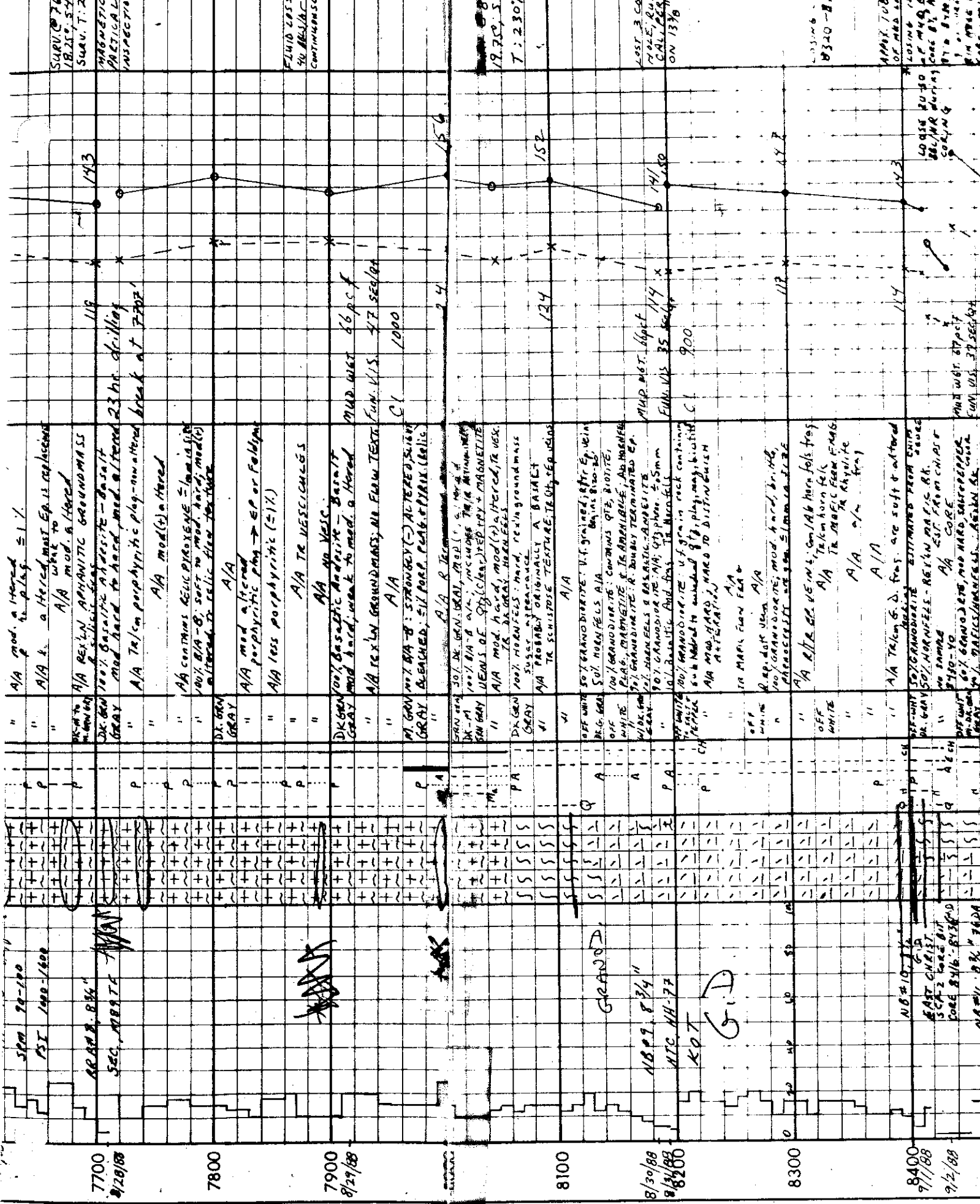
SURVEY
17.5
S
T=2.5

SURVEY
17.5
S
T=2.5

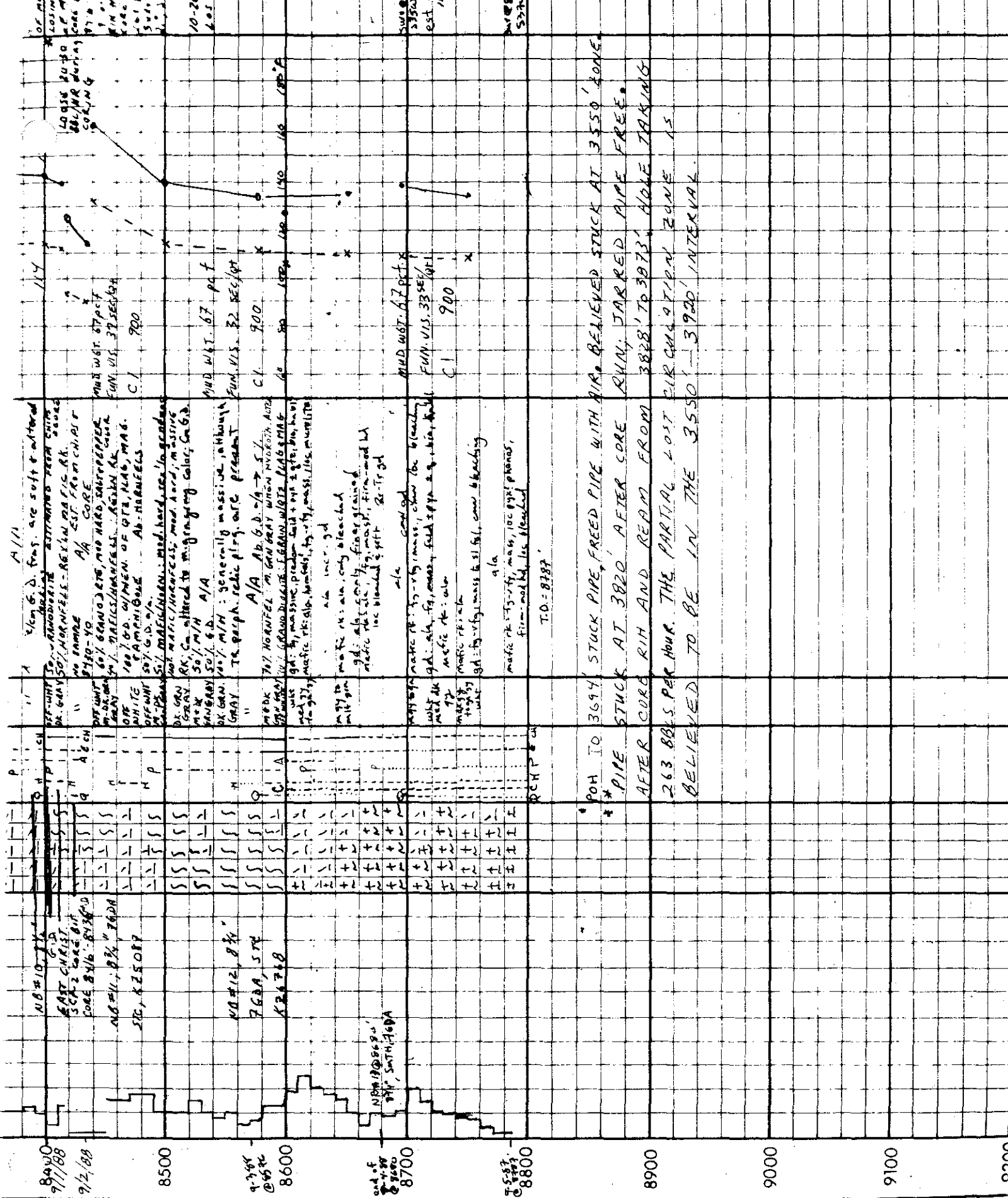
SURVEY
17.5
S
T=2.5

SURVEY
17.5
S
T=2.5

SURVEY
17.5
S
T=2.5



SURV. 767
 18.2.5.20
 SURV. T. 25
 MAGNETIC
 PALEONTOLOGICAL
 INSPECTION
 FLUID LOSS
 50 MSL/A
 CONTINUOUSLY
 800
 19.2.5.20
 T: 2.30F
 LOST 3 CARDS
 FOLEY, RUN
 CALLER
 ON 13.7.80
 8320-8350
 APPROX. 7080
 OF HARD MASS
 LOSING 100
 OF 144, 145
 CORE BY MOUNTAIN
 147 & 148
 149
 150
 151
 152
 153
 154
 7700
 8/28/88
 7800
 7900
 8/29/88
 8100
 8/30/88
 8/31/88
 8200
 8300
 8400
 9/1/88
 9/2/88
 SPN 90-100
 PSI 1000-1600
 AR 80.8, 8.8%
 SEC. AB9TA
 NB #10, 11, 12
 EAST CHIST
 SEC 2 core bit
 CORE 8/16 - 8/26
 NB #11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100



3/4 inch G.D. frags. are soft & altered
 Tuffaceous... alternating thin beds
 10-20 lb LIME
 PURE...
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900

POH TO 3694 STUCK PIPE, FREED PIPE WITH AIR, BELIEVED STUCK AT 3550' ZONE.
 * PIPE STUCK AT 3820' AFTER CORE RUN; JARRED PIPE FREE.
 AFTER CORE RIN AND REAM FROM 3828' TO 3873' MORE TAKING
 263.805 PER HOUR. THE PARTIAL LOST CIR CHS 47' PAZ ZONE IS
 BELIEVED TO BE IN THE 3550' - 3920' INTERVAL.
 T.D. = 8783'

8400
 7/1/88
 9/2/88
 8500
 9-2-88
 8600
 out of
 8700
 8800
 8900
 9000
 9100
 9200

114
 80
 120
 140
 160
 180
 200
 220
 240
 260
 280
 300
 320
 340
 360
 380
 400
 420
 440
 460
 480
 500
 520
 540
 560
 580
 600
 620
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 960
 980
 1000

10-20 lb LIME
 PURE...
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900
 MUD WGT. 67 pcf
 PURE... 32 sec/ft
 CI 900

9/2-88
 8950
 9000
 9050
 9100