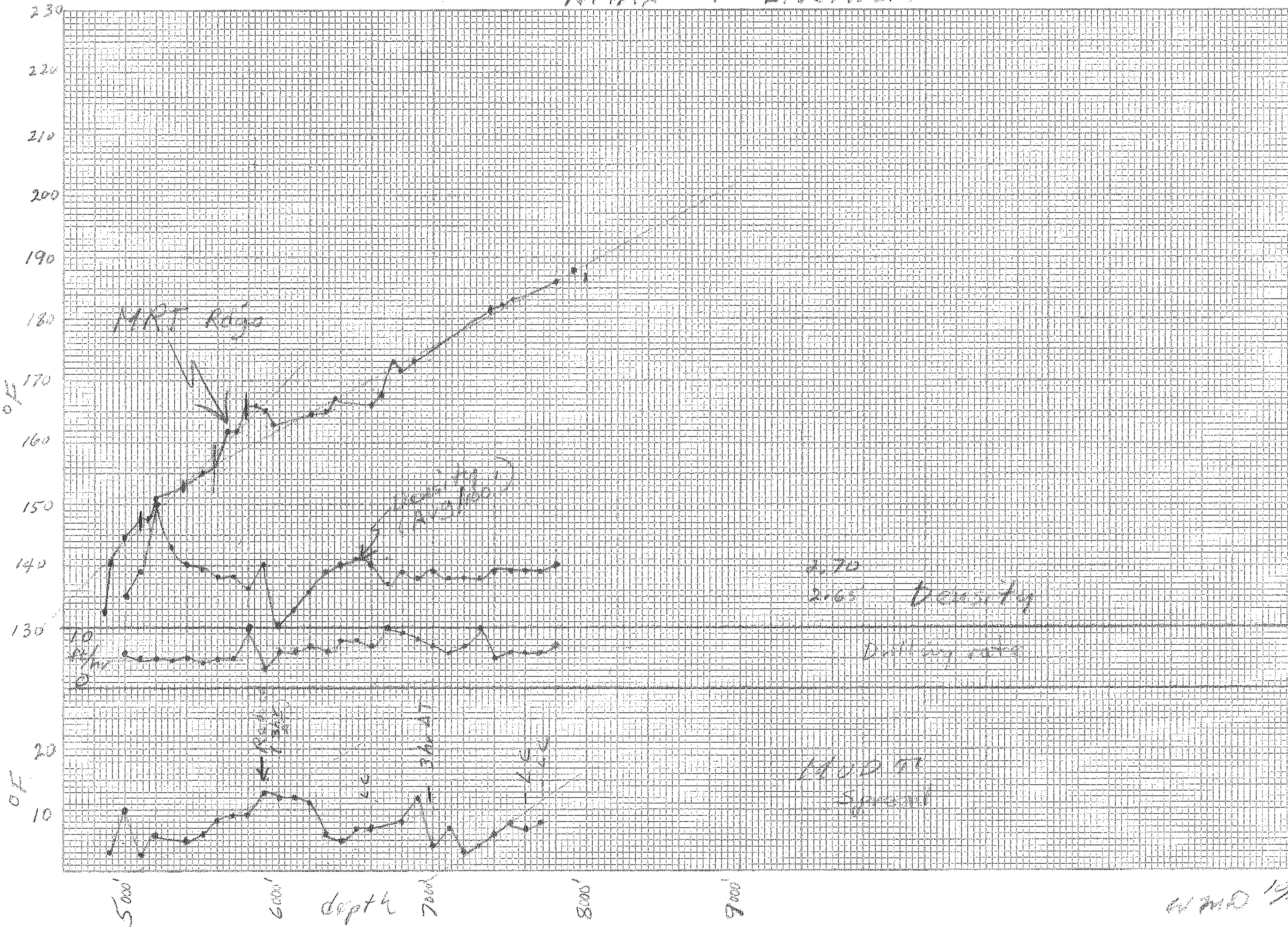
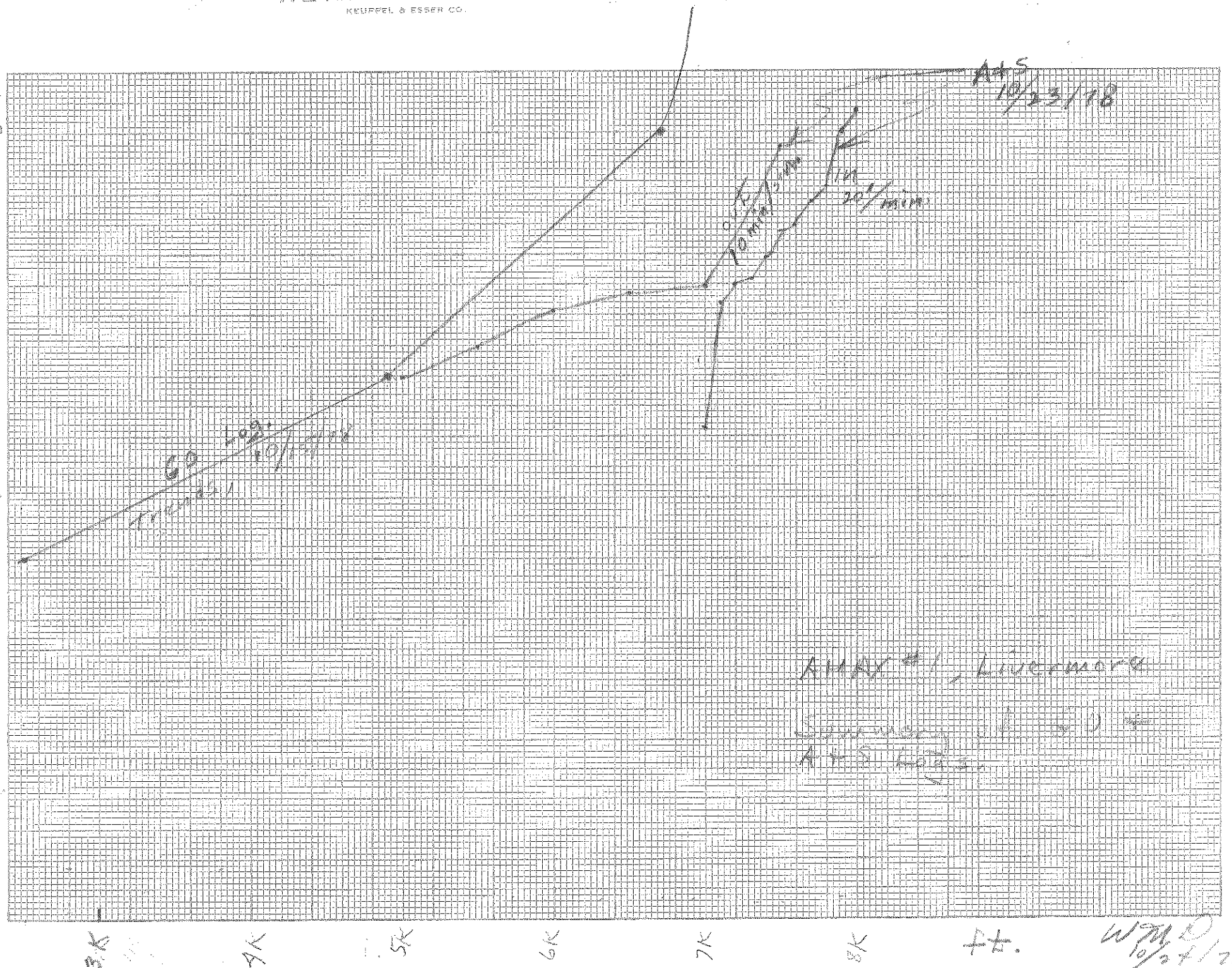
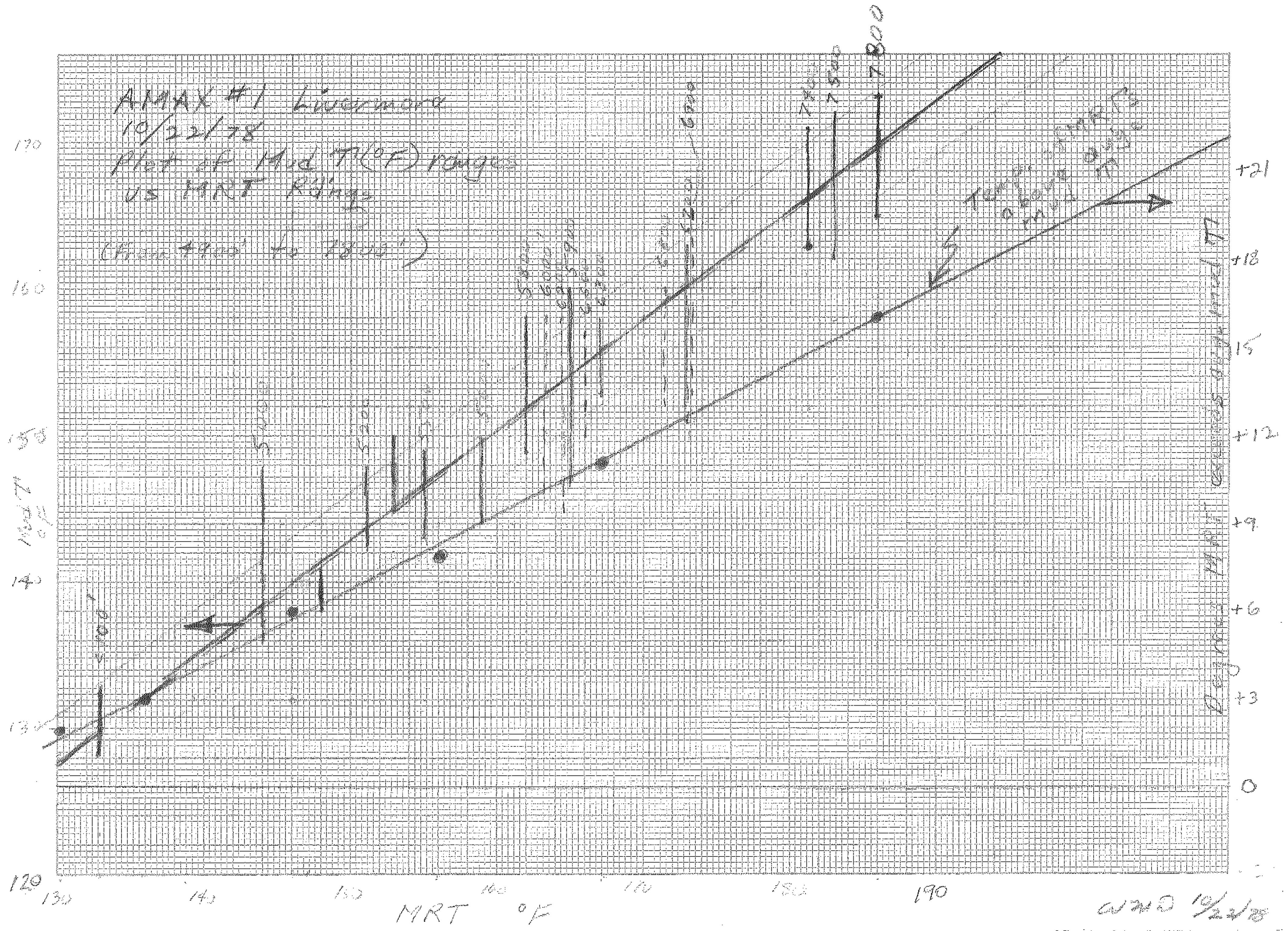
K+E 10 X 10 TO ½ INCH 46 1322
7 X 10 INCHES
KEUFFEL & ESSER CO.

AMAX #1 Livermore

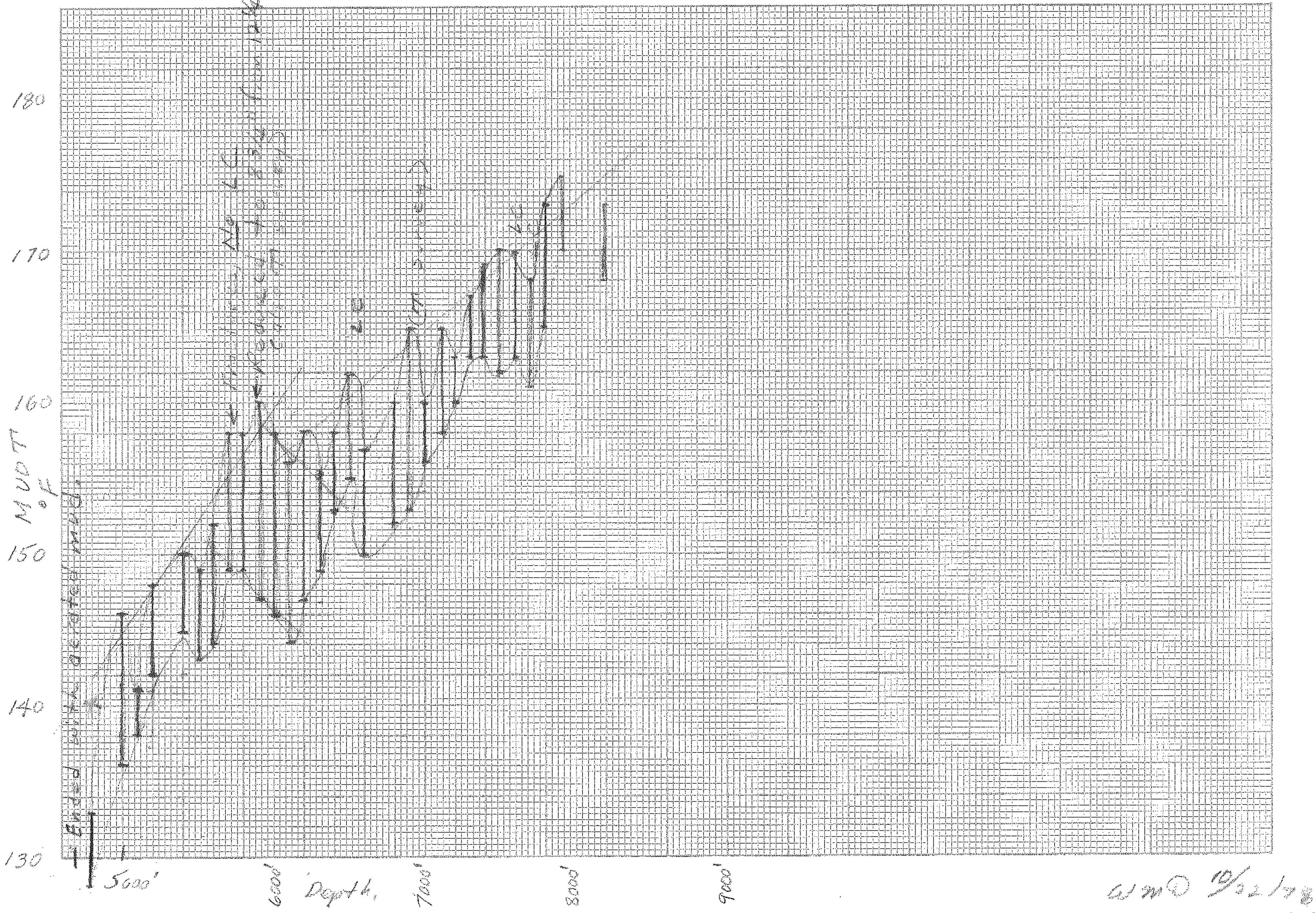


GWMD 10/24/78





AMAX #1 Livermore, Mud Temp. ranges vs. depth



GWD 10/22/78

AMAX EXPLORATION, INC.
Geothermal Group

TIME-TEMPERATURE OBSERVATION FORM

(For use with the Crosby method)

Date 10/27/78

Field

Well AMAX #1 Livermore

Observer [Dreymoney?]

State CA

Analysis WMD

County NAPA

Depth 8195

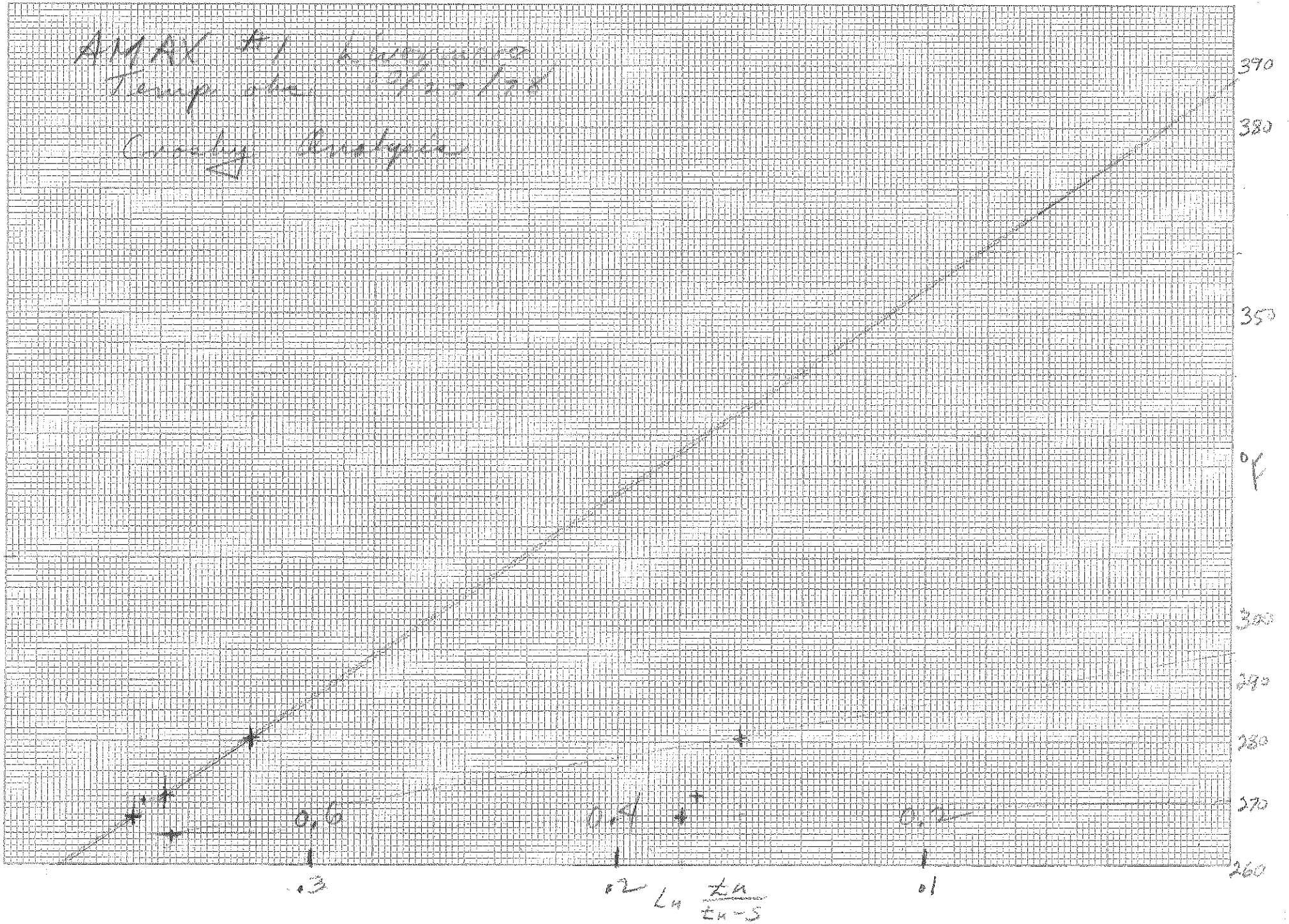
Comments: Results of 2-1.5 hr Kuster Bomb runs + 1 HRT (t_3) phoned in to Denver by Dreymoney.

true time		t	event	temp. °C	temp. °F	$\frac{tn}{tn-s}$	Ln $\frac{tn}{tn-s}$	
	t_o	0	bit arrival					
	s	10.07	circulation ceases					
	t_1	33.58	observation	130.74	267.58	1.428	.358	.3562
37 HRS →	t_2	34.42	"	132.77	271.23	1.414	.348	.3464
	t_3	~~36.75~~	"	~~137.92~~	~~280.50~~	1.377	~~.320~~	.3199
	t_4	~~37.00~~	"		280.5	1.373		.317
Sch. Log →	t_5	20.2	"		264.9	1.994	.690	.690
	t_6	33.83	"		270.34	1.424	.355	.353
▷	t_7	~~40.11~~	"		~~355~~		~~.09[illegible]~~	

(in 168
Mud out 177)

@ 8195 in 168
out 173

~~By implication~~



AMAX EXPLORATION, INC.
Geothermal Group

TIME-TEMPERATURE OBSERVATION FORM

(For use with the Crosby method)

Date 10/27/78 Field

Well AMAX #1 Livermore Observer Deymonaz

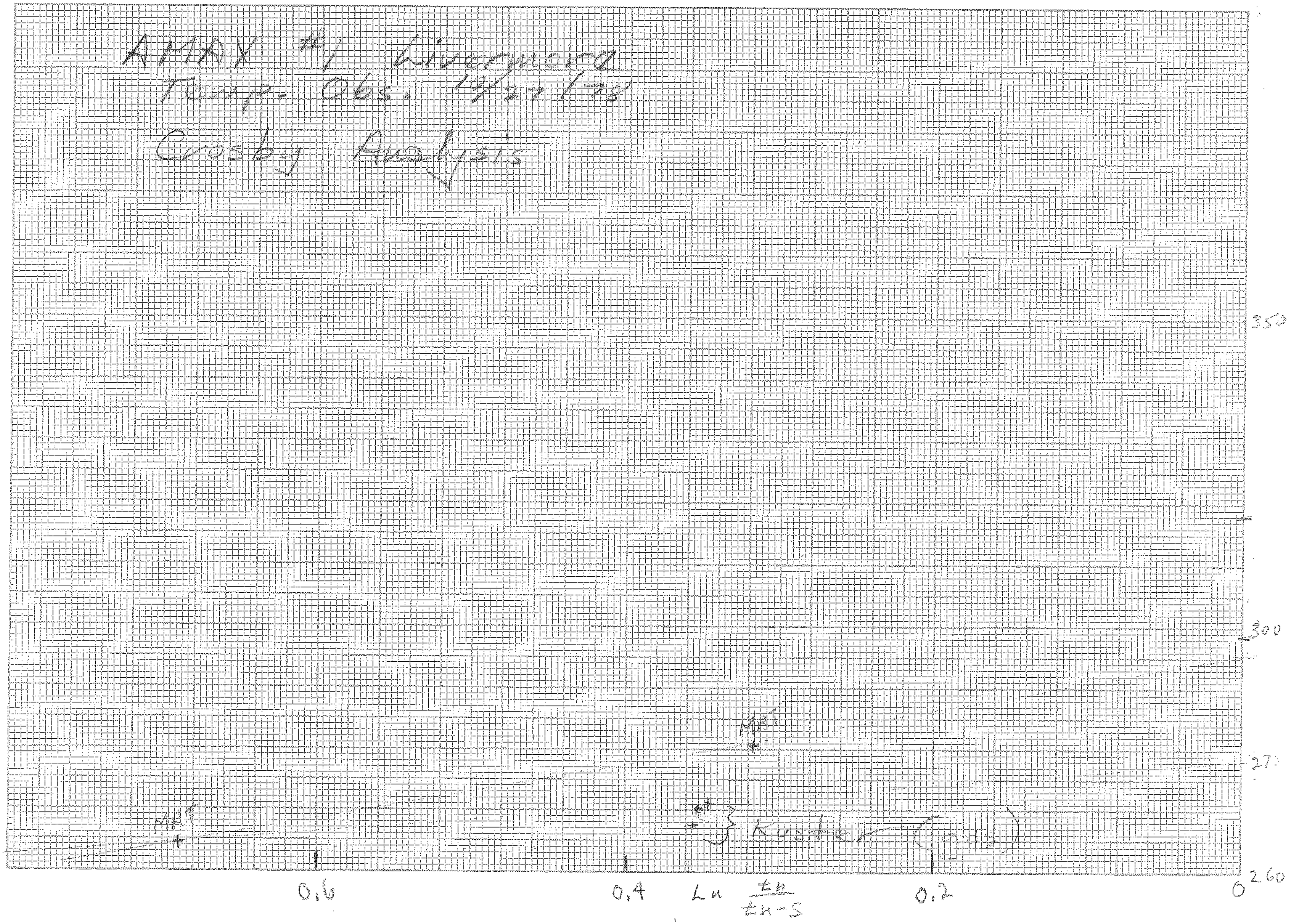
State CA Analysis WMD

County NAPA Depth 8195

Comments: Results of 2 - 1.5 hr. Kuster runs (t_2, t_3, t_4); the Schlumberger MRT adjusted by their Log (t_1), and the AMAX MRT (t_5)

true time		t	event	temp. °C	temp. °F	$\frac{tn}{tn-s}$	Ln $\frac{tn}{tn-s}$
	t_o	0	bit arrival				
	s	10.07	circulation ceases				
MRT	t_1	20.2	observation		264.9	1.994	0.690
	t_2	33.58	"		267.58	1.728	0.3562
	t_3	33.83	"		270.34	1.724	0.353
	t_4	34.42	"		271.23	1.414	0.346
MRT	t_5	37.00	"		280.50	1.373	0.317
	t_6		"				
	t_7		"				

K+E 10 X 10 TO ½ INCH 46 1322
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.



AMAX EXPLORATION, INC.
Geothermal Group

TIME-TEMPERATURE OBSERVATION FORM

(For use with the Crosby method)

Date 10/23/78 Field NAPA

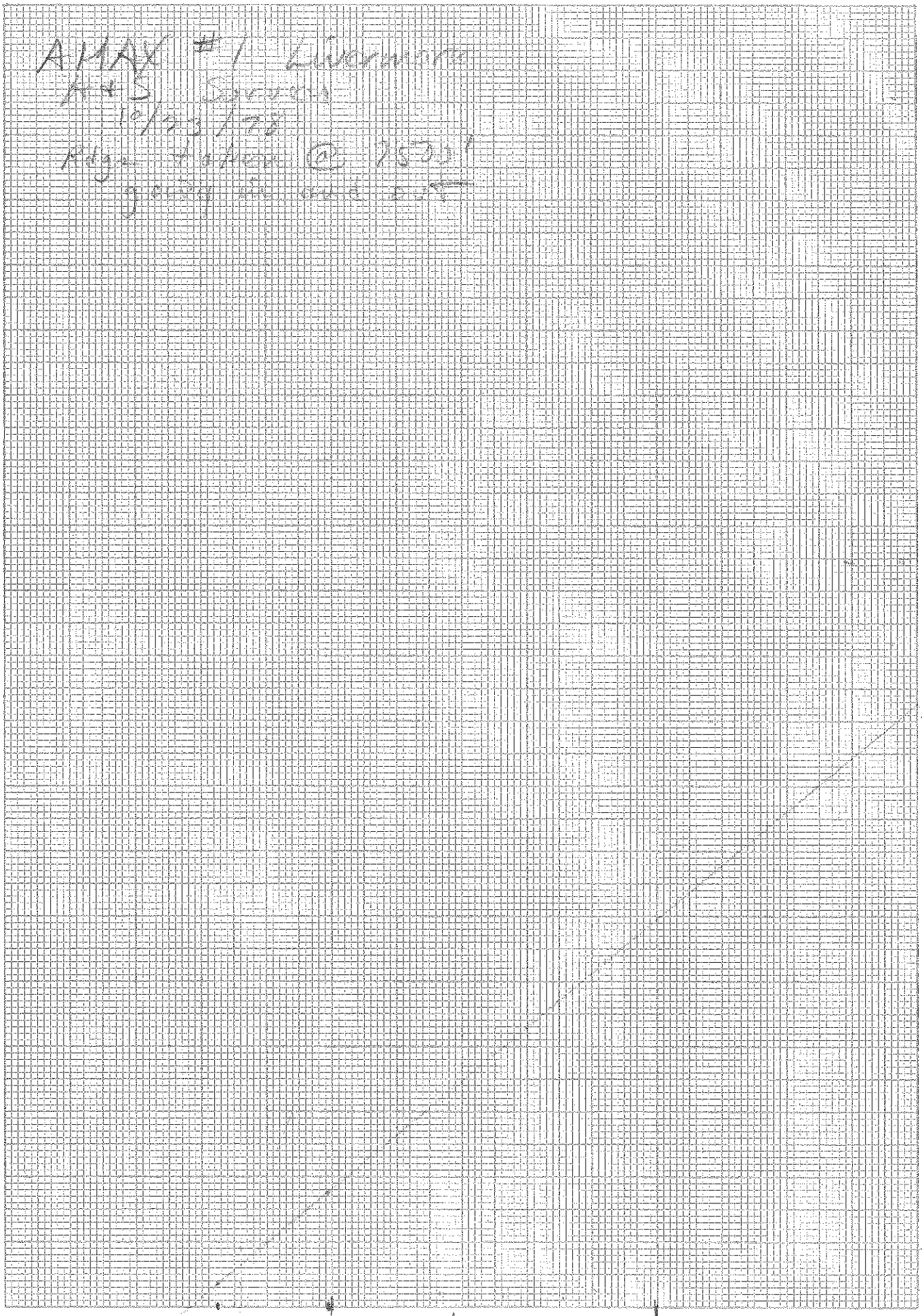
Well AMAX #1 Livermore Observer WMD

State CA Analysis WMD

County NAPA Depth 7500'

Comments: A+S survey, deductions from readings taken going in and out

true time		t	event	temp. °C	temp. °F	$\frac{tn}{tn-s}$	Ln $\frac{tn}{tn-s}$
	t_o	0	bit arrival				
	s	~~76.33~~	circulation ceases				
	t_1	~~84~~ 18	observation		~~213.6~~	~~10.724~~	~~2.372~~
	t_2	~~87.83~~	"		~~217.8~~	~~7.637~~	~~2.033~~
	t_3		"				
S	~~t_4~~ 3	74.33	"				
	t_5	82.18	"		213.4	10.469	2.348
	t_6	85.83	"		222.8	7.463	2.010
	t_7		"				



AMAX EXPLORATION, INC.
Geothermal Group

TIME-TEMPERATURE OBSERVATION FORM

(For use with the Crosby method)

Date 10/23/78 Field Napa

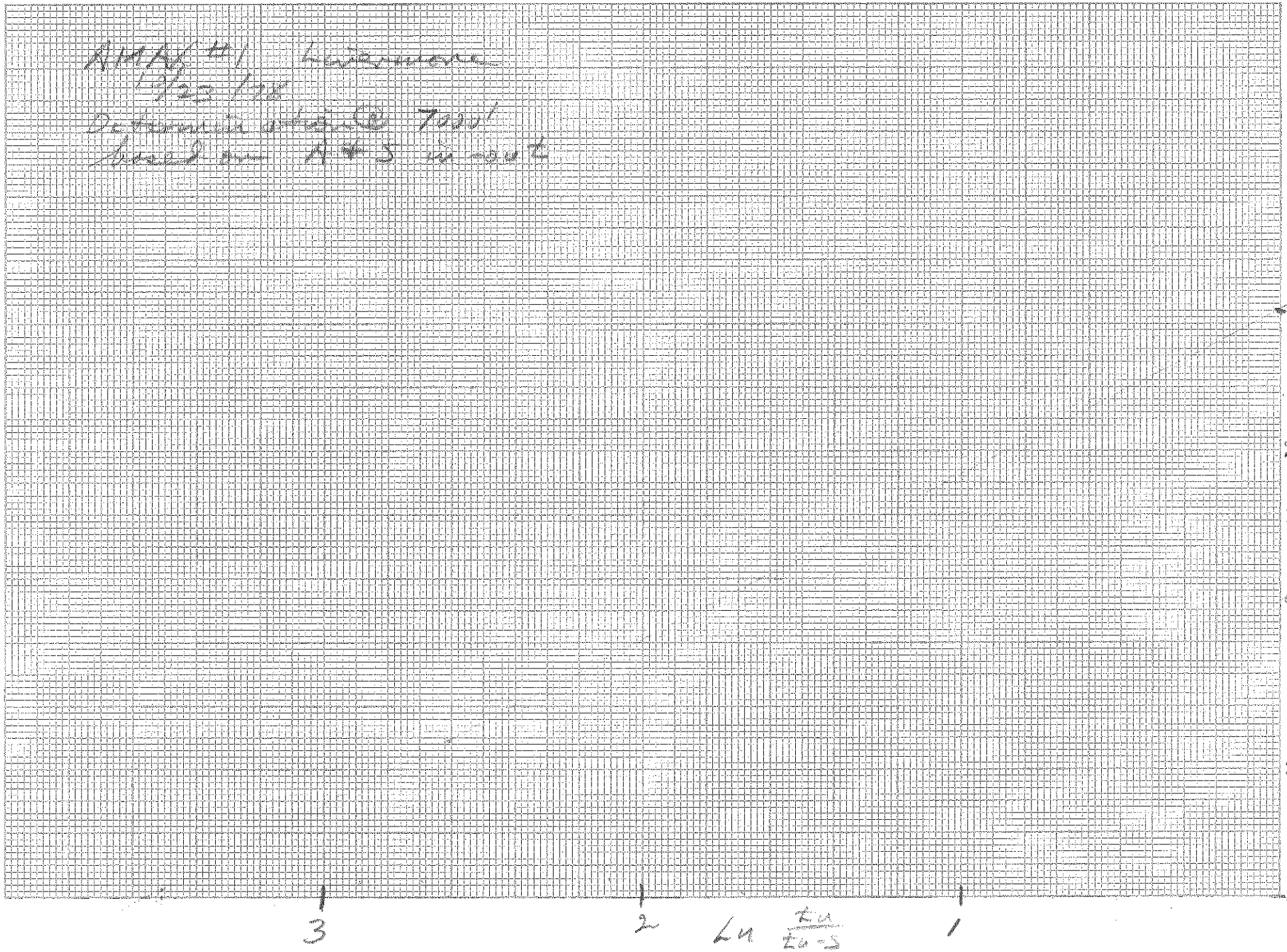
Well AMAX #1 Livermore Observer WHD

State CA Analysis "

County Napa Depth 7000'

Comments: R+S survey; deductions from ridgs taken going in and out

true time		t	event	temp. °C	temp. °F	$\frac{tn}{tn-s}$	Ln $\frac{tn}{tn-s}$
	t_o	0	bit arrival				
	s	147.30	circulation ceases				
	t_1	151.86	observation		181.4	33.303	3.506
	t_2	159.05	"		204.5	13.536	2.605
	t_3		"				
	t_4		"				
	t_5		"				
	t_6		"				
	t_7		"				



AMAX EXPLORATION, INC.
Geothermal Group

TIME-TEMPERATURE OBSERVATION FORM

(For use with the Crosby method)

Date 10/15/78 Field Napa

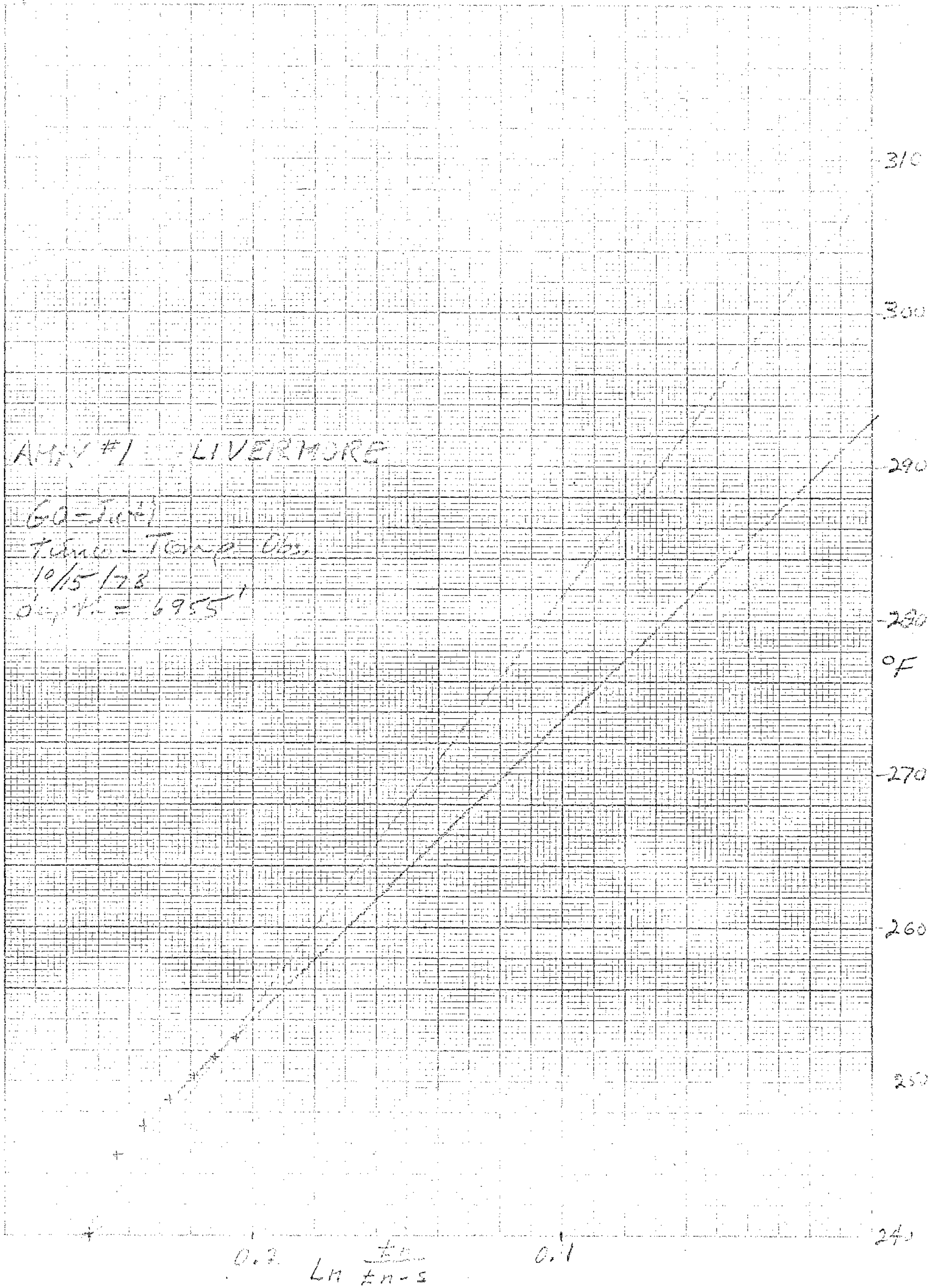
Well AMAX #1 Lawrence Observer Demmons

State CA Analysis WHD

County Napa Depth 6955'

Comments: Kuster bomb failed, employed 60-hr #1, could not log open hole, went down thru drill pipe.

true time		t	event	temp. °C	temp. °F	$\frac{tn}{tn-s}$	Ln $\frac{tn}{tn-s}$
1855	t_o	0	bit arrival				
2215	s	3.33	circulation ceases				
0950	t_1	14.91	observation	240		1.2875	0.2526
1020	t_2	15.41	"	245.2		1.2756	0.2434
1050	t_3	15.91	"	247.1		1.2647	0.2348
1120	t_4	16.41	"	248.8		1.2545	0.2267
1150	t_5	16.91	"	250.4		1.2452	0.21929
1220	t_6	17.41	"	251.6		1.2365	0.2122
1250	t_7	17.91	"	252.8		1.2283	0.20562


LIVERMORE
Time - Temp Obs.
10/15/78
6955'
310
300
290
280
°F
270
260
250
240
0.2
0.1

AMAX EXPLORATION, INC.
Geothermal Group

TIME-TEMPERATURE OBSERVATION FORM

(For use with the Crosby method)

Date 12/6/78 Field Napa

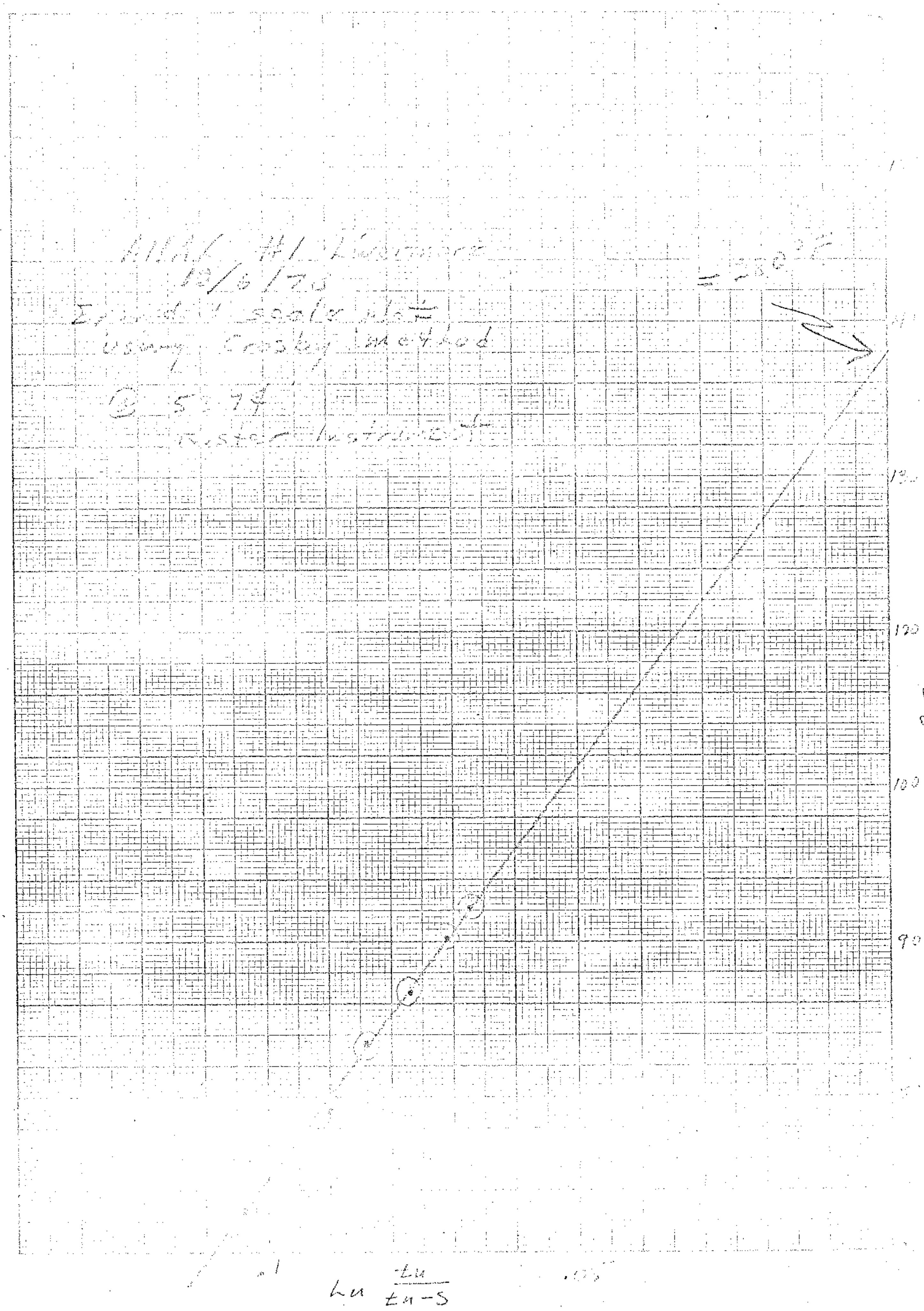
Well AMAX #1 Livermore Observer Deymonaz

State CA Analysis Dolan

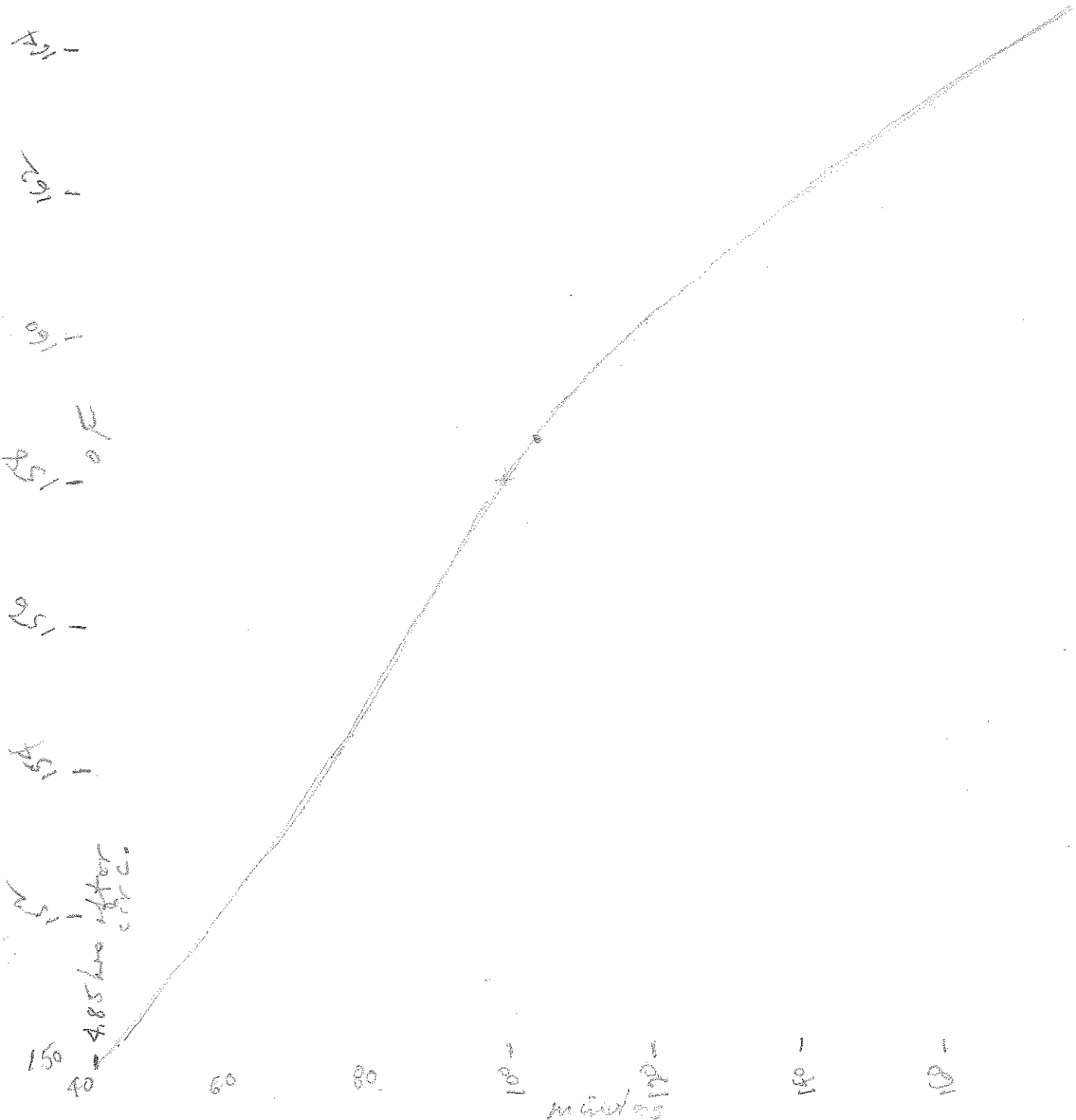
County Napa Depth 5874'

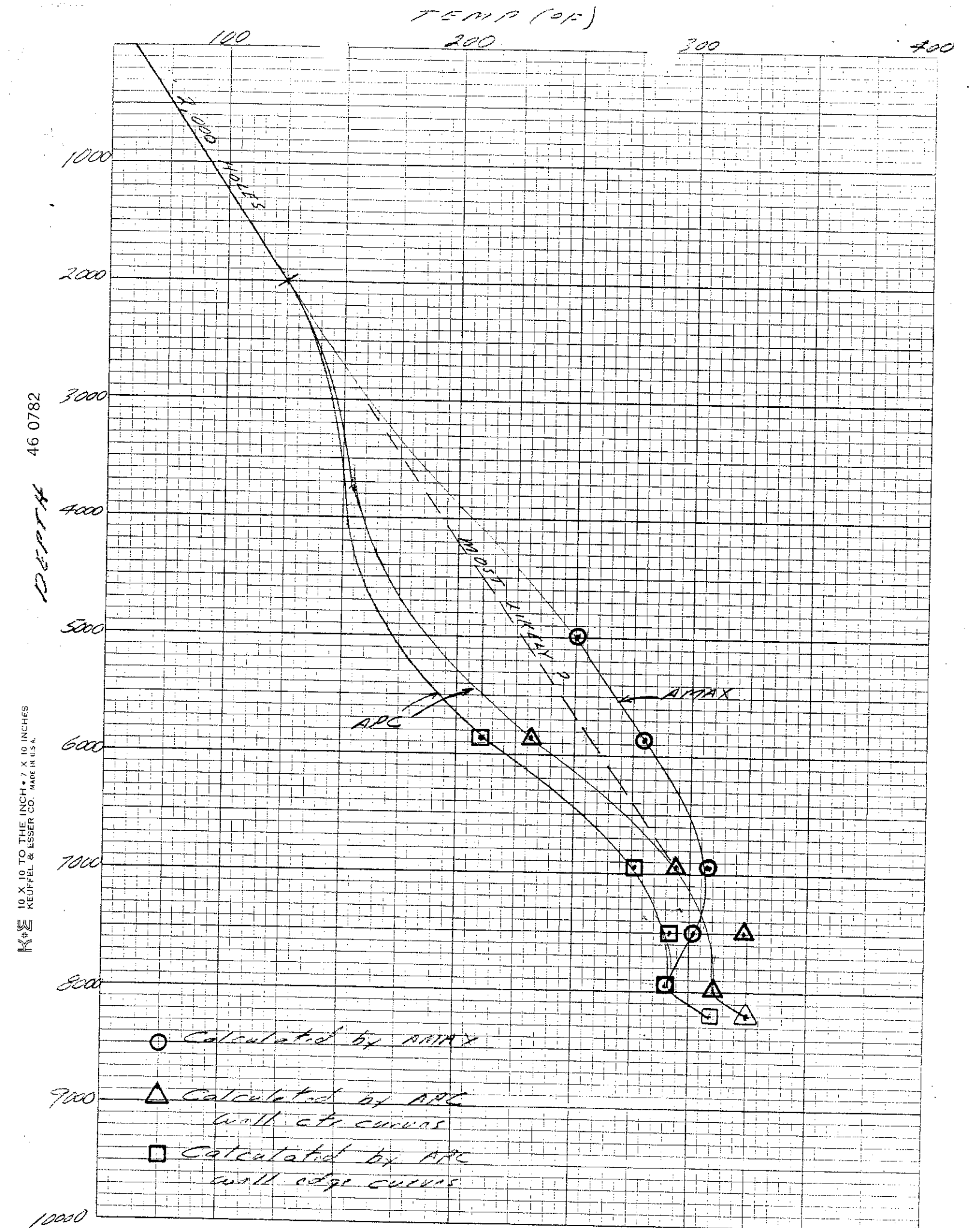
Comments: About 4' off bottom; circ. time approximate; Kuster instrument went down drill pipe; actual observation about 81 below end of drill pipe.

true time		t	event	temp. °C	temp. °F	$\frac{tn}{tn-s}$	Ln $\frac{tn}{tn-s}$
	t_o	0	bit arrival				
	s	0.5	circulation ceases				
	t_1	5.23	observation	72.73		1.11	0.104
	t_2	5.73	"	79.06		1.095	0.090
	t_3	6.23	"	83.58		1.087	0.084
	t_4	6.73	"	86.70		1.080	0.769
	t_5	7.23	"	90.03		1.074	0.710
	t_6	7.63	"	92.09		1.070	0.677
	t_7		"				


MHF #1 Livermore
12/8/78
Expanded scale plot
using Crosby method
@ 5279
Foster Instrument
= 280°F
130
120
100
90
°C
.1
.15
Ln tu/(tu-S)

Amoco #1 Livermore
Temp Bomb @ 5000'
on 10/2/78
(well depth = 5500')





AMAX - LIVERMORE AL SHOWING ALTERNATE TEMPERATURE INTERPRETATIONS. RCE 10/27/78

Example: (using 10/27/78 data)

t_c = time of circ. = 10.07 hrs

t_n = time of observation = 23.51 hrs after circulation ceased

T_m = mud temp. = 174°F

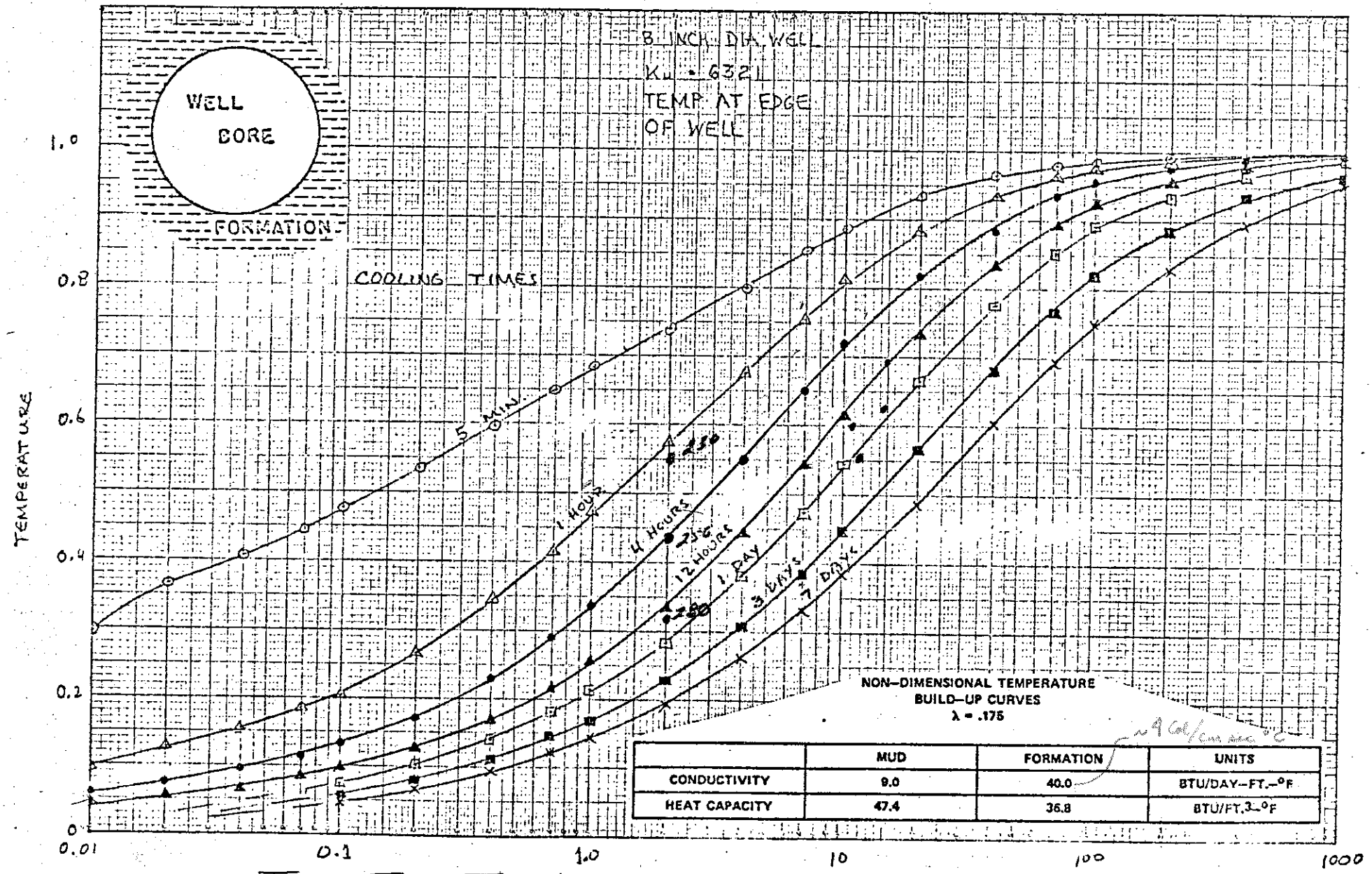
T_n = normalized temp. from chart (i.e. use t_n on abscissa, t_c is cooling time)
= 0.78

T_t = observed temp. at time t_n = 267.58°F

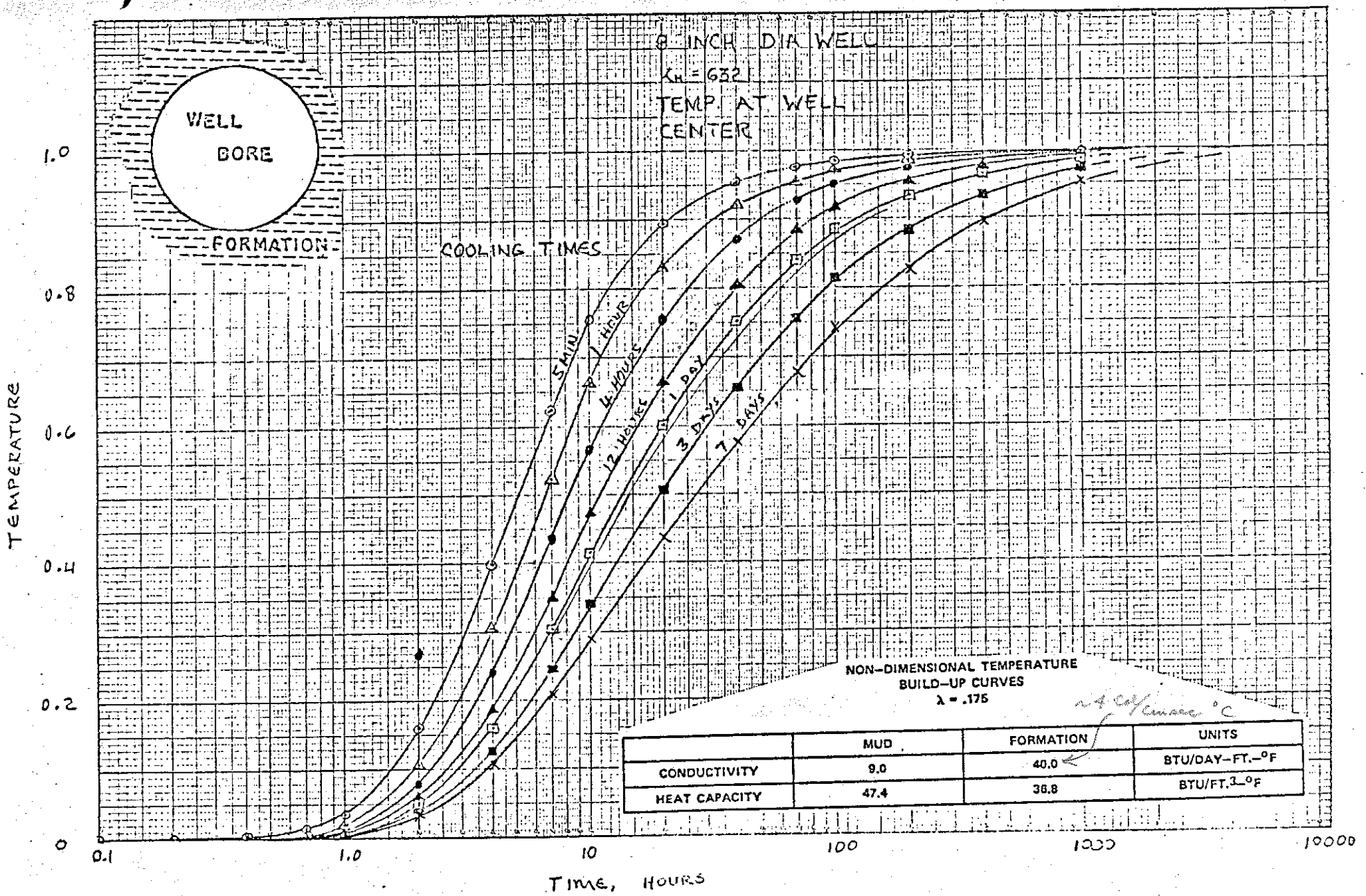
∴ T_f = equil. temp. = $\frac{267.58 - 174}{0.71} + 174$ [93 written above]

= 305

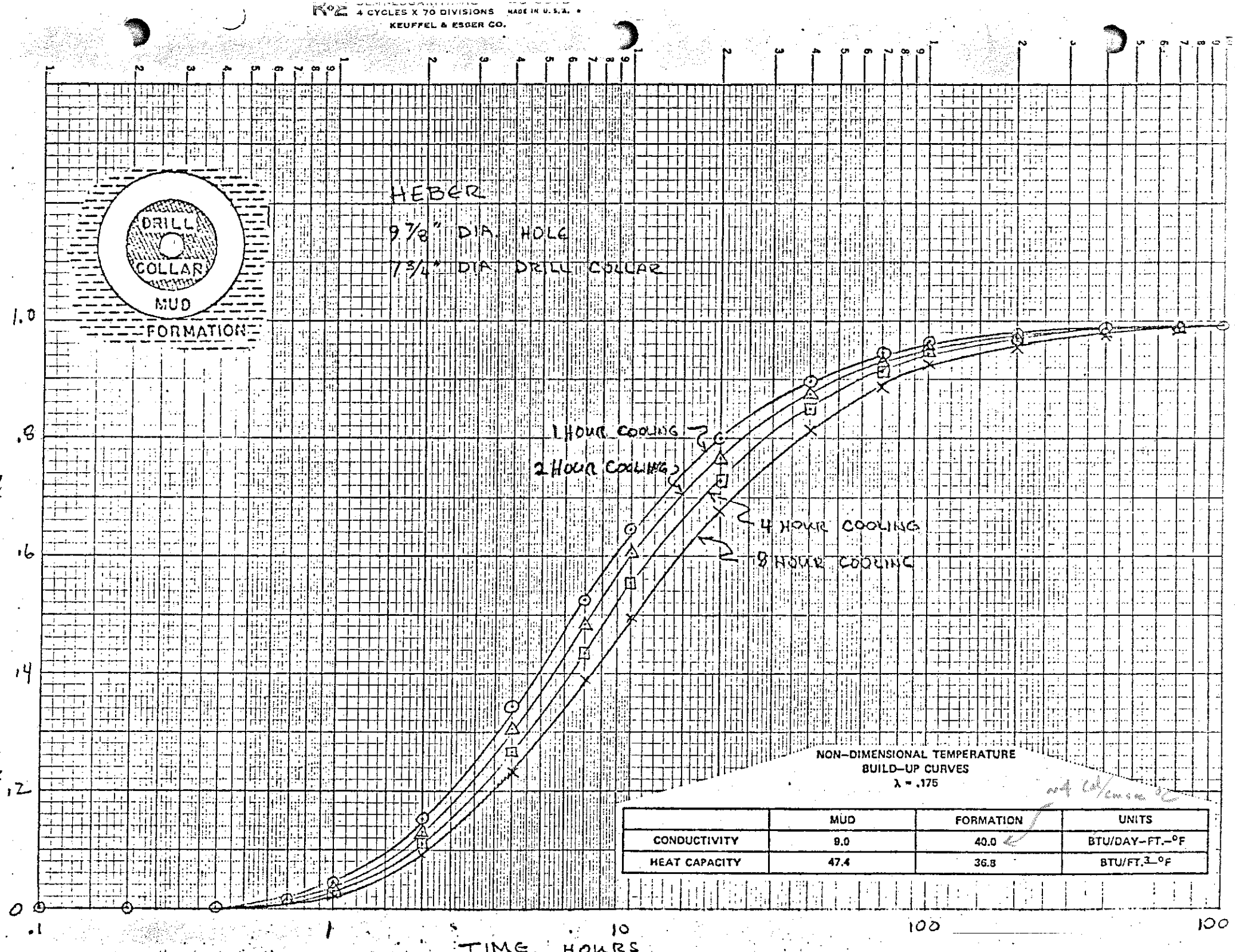
$T_{f_2} = \frac{271.23 - 174}{.75} + 174 = 303.23$



$$T_f = \frac{T_t - T_m}{T_N} + T_m$$



	MUD	FORMATION	UNITS
CONDUCTIVITY	9.0	40.0	BTU/DAY–FT.–°F
HEAT CAPACITY	47.4	36.8	BTU/FT.^{3}–°F



NON–DIMENSIONAL TEMPERATURE
BUILD–UP CURVES
$\lambda = .175$

	MUD	FORMATION	UNITS
CONDUCTIVITY	9.0	40.0	BTU/DAY–FT.–°F
HEAT CAPACITY	47.4	36.8	BTU/FT.^{3}–°F