GL02970-7

AIR LIFT AND INJECTION TESTING ON RRGI-7 FROM AUGUST 1, 1978, TO AUGUST 3, 1978

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I. OBJECTIVES

Immediately upon reaching total depth on the RRGI-7 well, post-drilling tests were conducted to determine generalized wellbore characteristics and the potential injection capability for planning purposes. Since the rig was still over the well, tests were extremely short. Data must, therefore, be considered as subject to change, pending longer-term testing.

II. DATA EVALUATION

Water level recovery data were collected following a twelve hour air lift. The flow, as measured by the rate of filling the mud tanks, averaged 510 gpm with only relatively small temporal variations throughout the test. The wellhead water temperature reached 172 °F which suggests a reservoir temperature in excess of 180 °F. The recovery data, as measured by chalk and tape, are plotted in Figure 1. An apparent abrupt decrease in slope, Δs, from 11.72 to 5.766 ft/log cycle t/t' occurs after approximately 56.5 minutes of recovery, t'. The slope, after 56.5 minutes, is approximately half the slope of that for the previous data. Assuming an ideal homogeneous isotropic, and infinite aquifer, a linear impermeable barrier boundary results in a halving of the slope during recovery in response to the effects of the second recharging image well. Assuming only one real pumping well and one pumping image well resulted during the 12 hours of air lifting, then during the first 56.5 minutes of recovery there would be the effects of one real pumping well, one pumping image well, and one injection image well. Thus, during the initial recovery segment, there is a net effect of one pumping well. During the second linear segment of recovery, there would be one real pumping well, one pumping image well, and two injection image wells. Thus, during the second linear segment of the recovery curve, there is no net

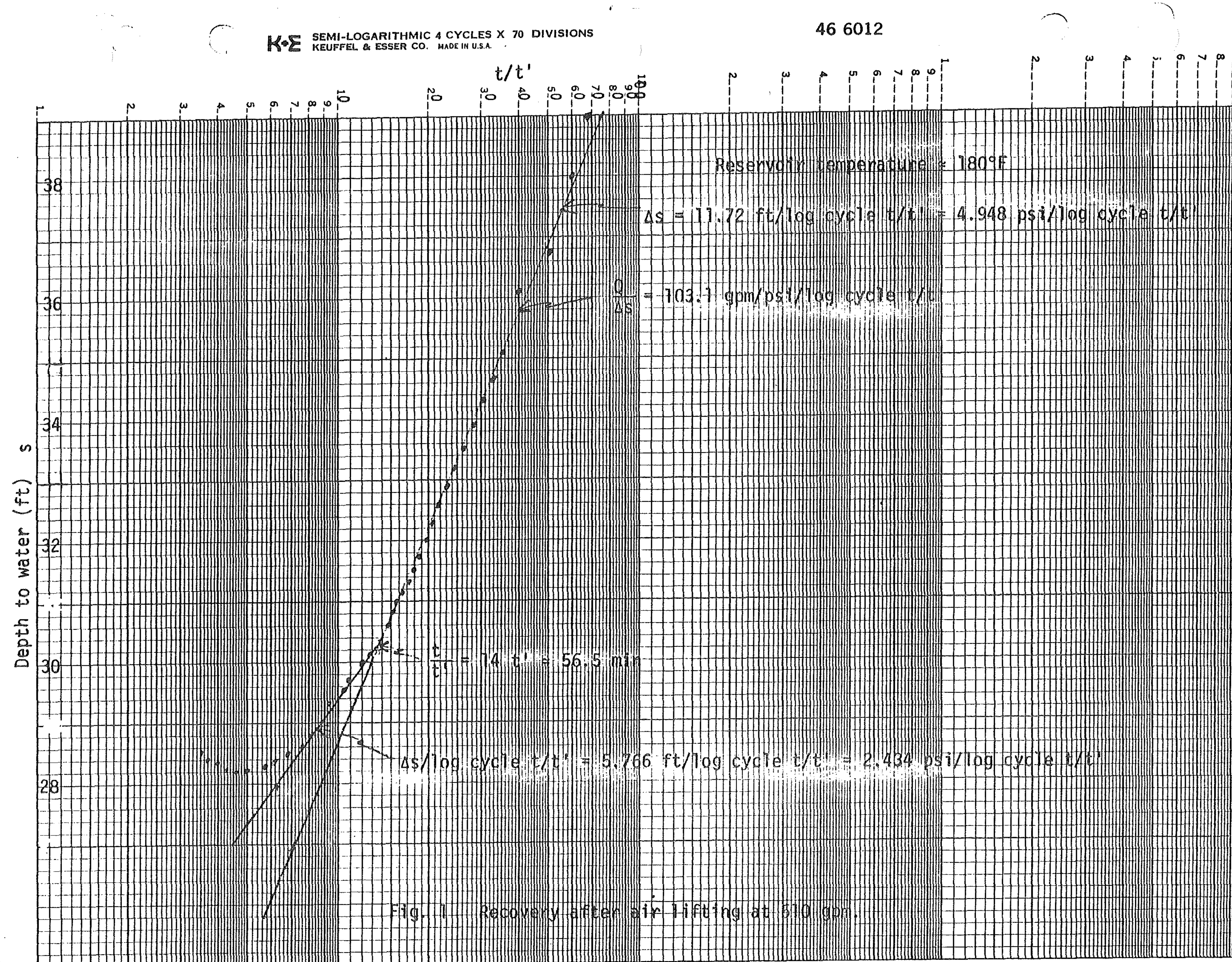

Fig. 1 Recovery after air lifting at 510 gpm.

withdrawal from the well. The decline of the water level in the well when $t/t' < 4.8$ is presumed to be related to increasing density of the water in the borehole as the water cools. The significance of the changing density on the wellhead water level when $t/t' > 4.8$ is not known, but could significantly contribute to the observed change in the slope of the recovery data. The ratio of $Q/\Delta s$ for the linear data segments $t/t' > 14$ is 103.1 gpm/psi/log cycle t/t'. The large value for $Q/\Delta s$ compared to values from subsequent tests suggests a significant effect of changing borehole water density on the observed depth to water during recovery.

Injection testing using the drill rig pumps began on August 2, 1978. The initial injection rate of 840 gpm continued for 56 minutes. The rate was then changed to 675 gpm for an additional 80 minutes. The final injection rate of 450 gpm continued for 154 minutes beyond the end of the 675 gpm injection period. The injected water had a temperature of 125 °F. The injection rates were decreased because of the limited capacity of the temporary water supply line from RRGE-3. Figure 2 is a semilogarithmic plot of the wellhead pressure data, s, versus the time since injection began, t. During the initial stage of the injection of 840 gpm for 56 minutes, approximately 20 minutes of injection were required before the data plotted as a straight line. Assuming a storage coefficient of 0.0005, and a T of 429.61 gpd/ft, approximately 0.31 minutes would be required for steady-shape conditions to develop at the well ($u < 0.01$). The wellhead pressure increased at the rate of 224 psi/log cycle of time, which resulted in a $\Delta Q/\Delta s$/log cycle time of 3.75 gpm/psi/log cycle time. No boundary effects were obvious during the initial 56 minutes of injection.

The second rate of injection extended from 56 minutes to 136 minutes. The wellhead pressure data for the 675 gpm test are plotted on Figure 2. Figure 3 is a semilogarithmic plot of the pressure difference, $\Delta s'$, between the wellhead pressure that would have resulted had the 840 gpm injection continued and the observed wellhead pressures while injecting at 675 gpm versus the time, t', since injection at 675 gpm began. The data followed a linear trend after 40 minutes of injecting at 675 gpm. The slope, $\Delta\Delta s'$, of the linear trend after 40 minutes is 84.53 psi/log cycle of time, t', which results in a ratio of $\Delta Q'/\Delta\Delta s$ of $(840-675)/84.53 = 1.95$ gpm/psi/log cycle of

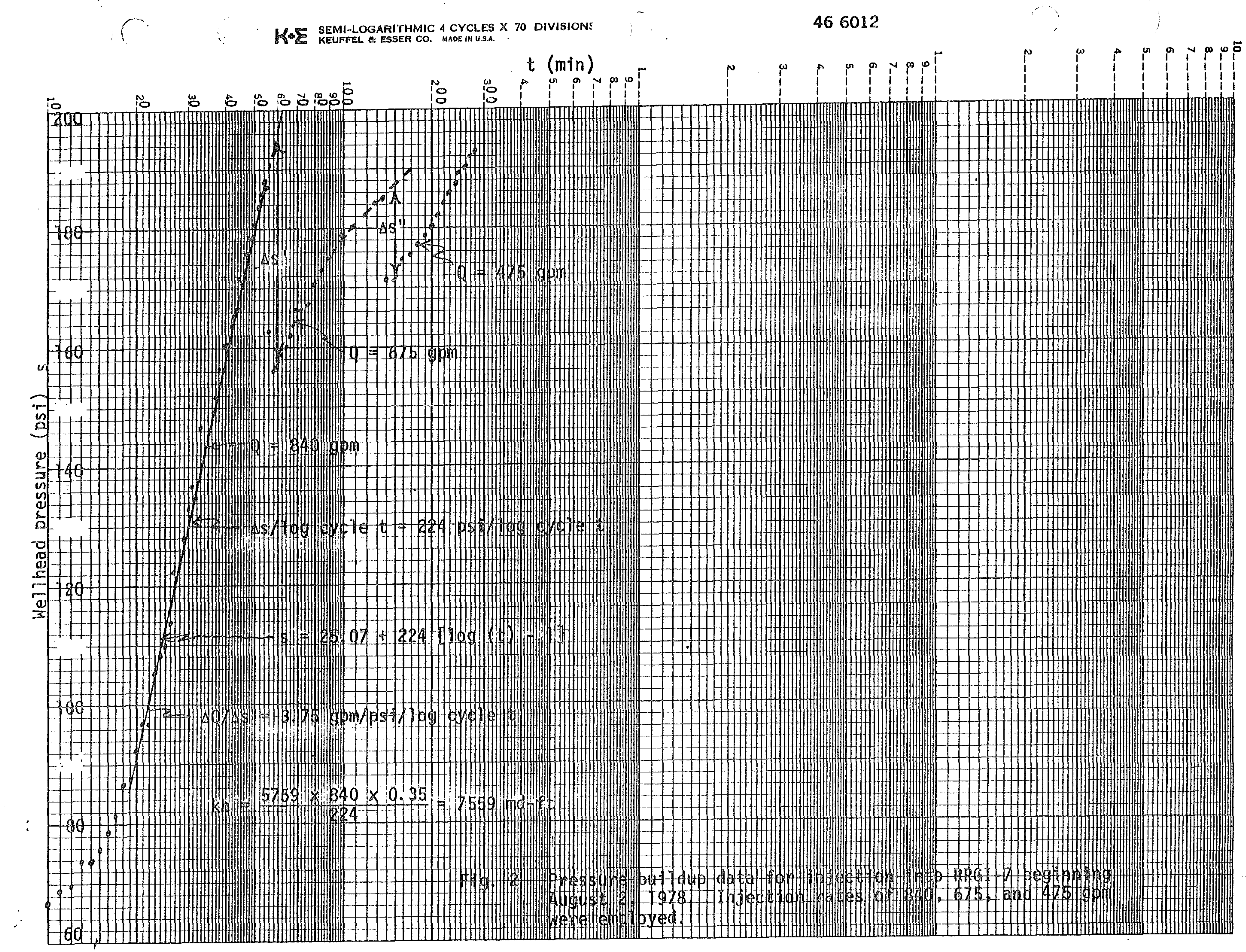

Fig. 2 Pressure buildup data for injection into RRGI-7 beginning August 2, 1978. Injection rates of 840, 675, and 475 gpm were employed.

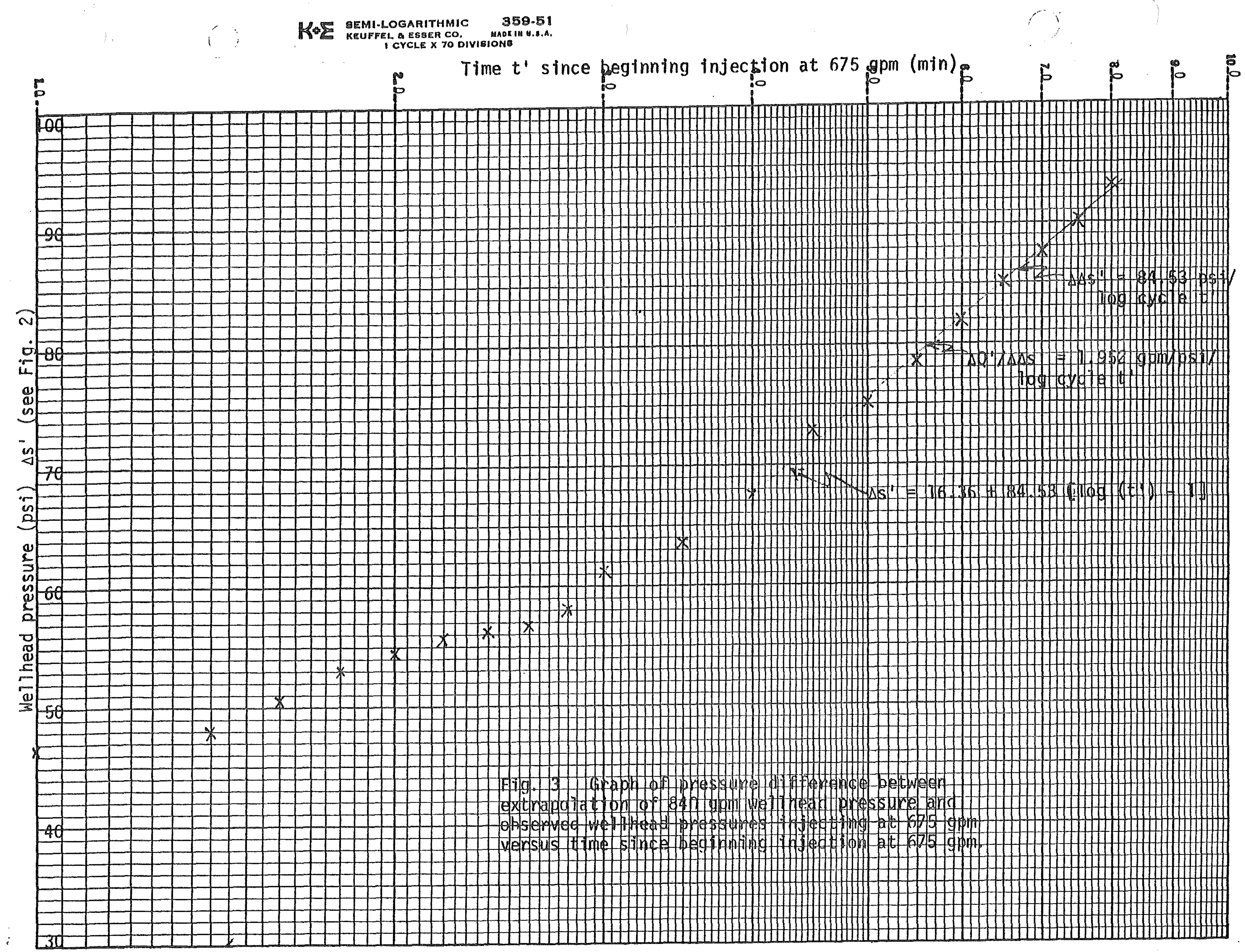

Fig. 3 Graph of pressure difference between extrapolation of 840 gpm wellhead pressure and observed wellhead pressures injecting at 675 gpm versus time since beginning injection at 675 gpm.

time. The near halving of the $\Delta Q'/\Delta\Delta s'$ from the value of 3.75 gpm/psi/log cycle time, $\Delta Q/\Delta s$, obtained during the previous 840 gpm injection period suggests that the calculated $\Delta Q/\Delta s$ and $\Delta Q'/\Delta\Delta s'$ values may be dependent on the injection rate and/or hydrologic boundary effects.

The third rate of injection extends from 136 minutes to 290 minutes. The wellhead pressure as a function of time since injection was first initiated is plotted in Figure 2. Figure 4 is a semilogarithmic plot of the pressure difference, $\Delta s''$, between the wellhead pressure that would have resulted had the 675 gpm injection continued and the observed wellhead pressures while injecting at 450 gpm versus the time, t'', since injection at 450 gpm began. The wellhead pressure that would have resulted had injection continued at 675 gpm was calculated using the equation predicting the pressure buildup, s, that would have resulted had injection continued at 840 gpm (Figure 2) minus the pressure difference equation for $\Delta s'$ (Figure 3) resulting from injection at 675 gpm. The pressure buildup data, $\Delta s''$, followed a linear trend beginning at approximately 25 minutes and ending at approximately 110 minutes. The abrupt decline in pressure at 20 minutes is caused by a decline in injection rate. The reason for the deviation from the linear trend beyond 110 minutes is not known. The slope of the pressure data is only 8.90 psi/log cycle time which results in a $\Delta Q''/\Delta\Delta s''$ ratio of (675-450)/2.90 = 25.3 gpm/psi/log cycle time.

This ratio of $\Delta Q''\Delta\Delta s''$ is considerably larger than the preceding values of 3.75 and 1.95 gpm/psi/log cycle time (Figure 2 and 3) for $\Delta Q/\Delta s$ and $\Delta Q'/\Delta\Delta s'$. The classical method of step test analysis (Jacob, C. E., "Drawdown Test to Determine Effective Radius of Artesian Well," Trans. ASCE, CXII (1947) pp 1047-1064) assumes the ratio of $\Delta Q/\Delta s$ and $\Delta Q/\Delta\Delta s$ to be a constant for each step. Since this is obviously not the case, an analysis for well loss coefficients was not undertaken. The reliability of the calculated values for $\Delta Q/\Delta s$ and $\Delta Q/\Delta\Delta s$ decreases as the number of steps increase. The data obtained for the third step are probably unreliable with the second step data being much less questionable. The first step (840 gpm) data are presumed to be reliable.

Wellhead pressures after five years of injection at a constant rate were calculated by extrapolation of the data procured during injection testing and by assuming an initial wellhead pressure of 0 psi. Based on the 840 gpm data,

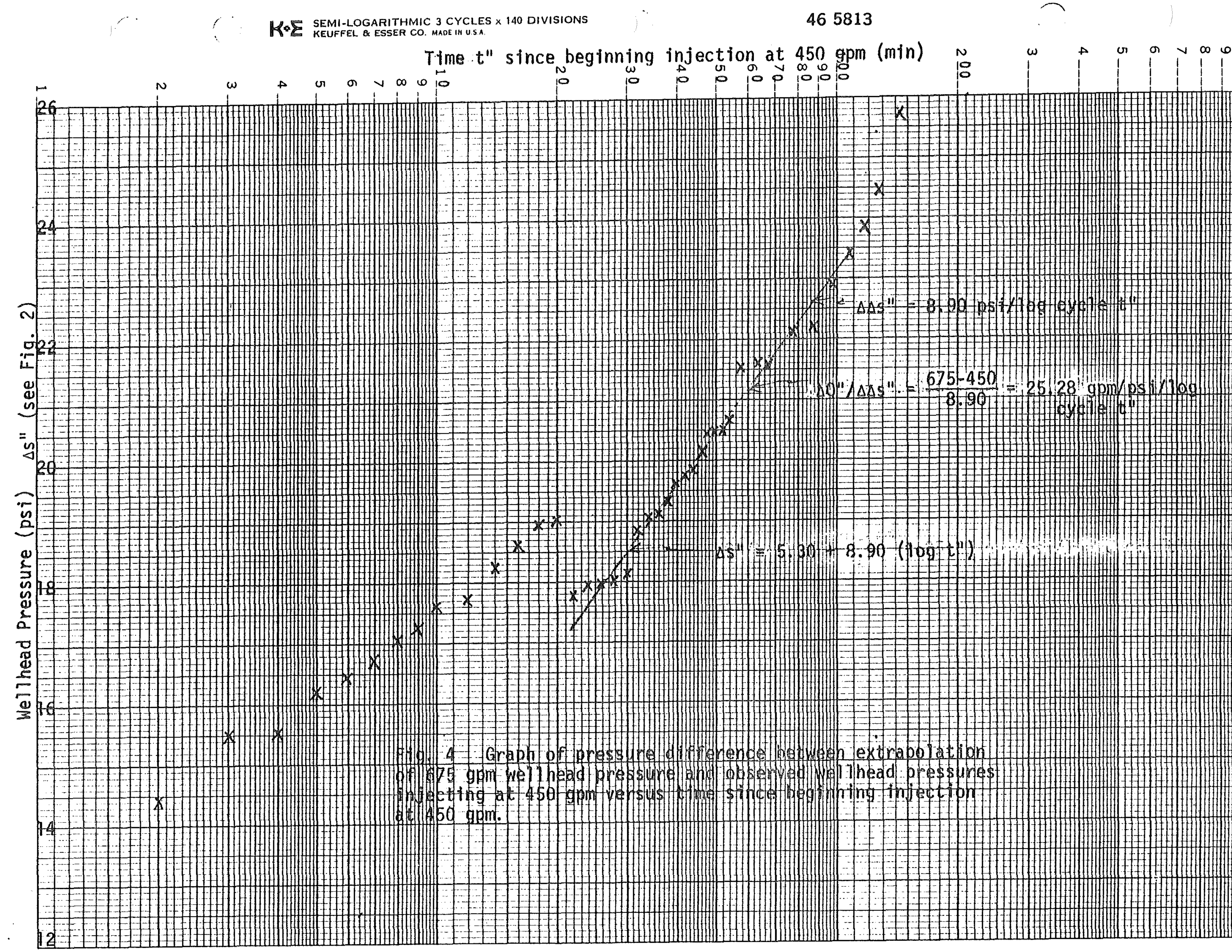

Fig. 4 Graph of pressure difference between extrapolation of 675 gpm wellhead pressure and observed wellhead pressures injecting at 450 gpm versus time since beginning injection at 450 gpm.

the equation s = 25.07 + 224 [log (t) - 1] was used to calculate a wellhead pressure of 1239 psi with no interference after injecting five years at 840 gpm. Figure 5 depicts the predicted wellhead pressures after five years, assuming no interference as per the left scale and an estimated 100 psi of interference as per the right scale. In the absence of data to the contrary, a linear relationship was assumed to exist between wellhead pressures and the injection rate. The data from the 675 gpm test was used to calculate a wellhead pressure buildup s, using the following equation: $s = 25.07 + 224 [\log (t) - 1] - 16.36 - 84.53 [\log (t') - 1] \approx 8.71 + 139.47 [\log (t) - 1]$. This equation predicts a wellhead pressure of 765 psi after five years. Similarly, using the 450 gpm data, the calculated wellhead pressure buildup was obtained using the following equation: $s \approx 8.71 + 139.47 [\log (t) - 1] - 14.20 - 8.90 [\log (t'') - 1] \approx 5.49 + 130.57 [\log (t) - 1]$, which resulted in a predicted wellhead pressure of 750 psi after five years of injection at 450 gpm. These predicted wellhead injection rate relationships are plotted in Figure 5. The most reliable prediction results from using the 840 gpm data.

Wellhead pressure recovery data were collected following the cessation of injection using the digiquartz recorder and, later when well water levels fell below land surface, a tape was used. Figure 6 is a plot of the recovery data using the digiquartz pressure sensor. The slope of the data, Δs, when $t/t' > 12$ is 18.38 psi/log cycle t/t'. The ratio $Q/\Delta s$ has a value of 31.28 gpm/psi/log cycle t/t', assuming an effective injection rate of 575 gpm. When $t/t' < 12$, the slope is believed to have changed from the 18.38 psi/log cycle t/t' because of operations involved in disconnecting the kelly, in addition to errors that would result due to trapped gases in the pressure line from the wellhead to the digiquartz pressure transducer. Figure 7 is a graph of the recovery data collected using a tape, after the kelly was removed. The slope of the data when $t/t' > 4.5$ is 42.85 feet of water per log cycle which, assuming a borehole fluid temperature of 120 °F, is equivalent to 18.37 psi/log cycle t/t'. The values for the recovery slope per log cycle t/t' are essentially identical using the digiquartz data collected when $t/t' > 12$ and for the tape data when $t/t' > 4.5$. This agreement supports the contention that the digiquartz data collected when $t/t' < 12$ did not accurately represent aquifer pressures. In addition, since no observable change in slope occurred

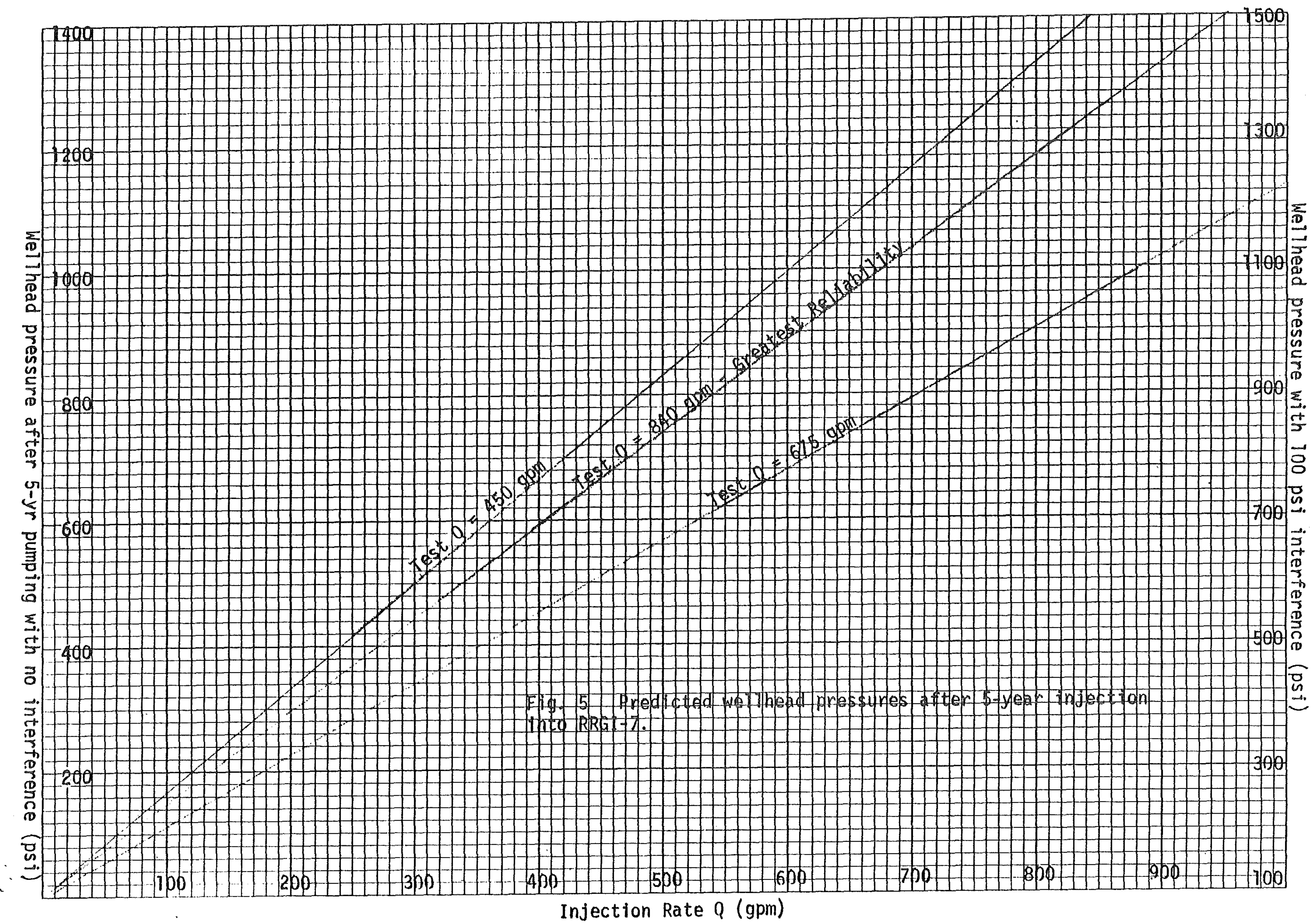

Fig. 5 Predicted wellhead pressures after 5-year injection into RRGI-7.

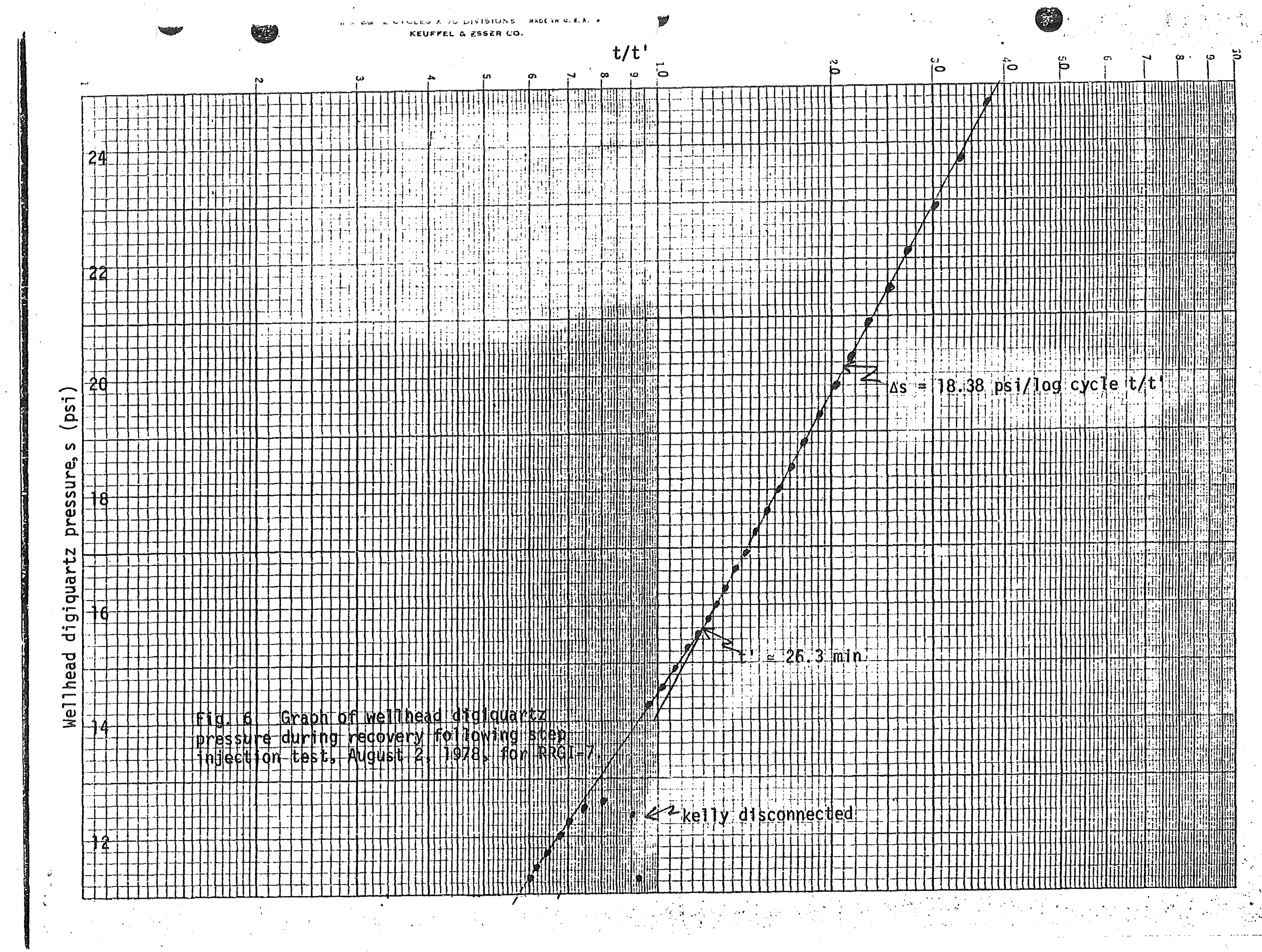

Fig. 6 Graph of wellhead digiquartz pressure during recovery following step injection test, August 2, 1978, for RRGI-7.

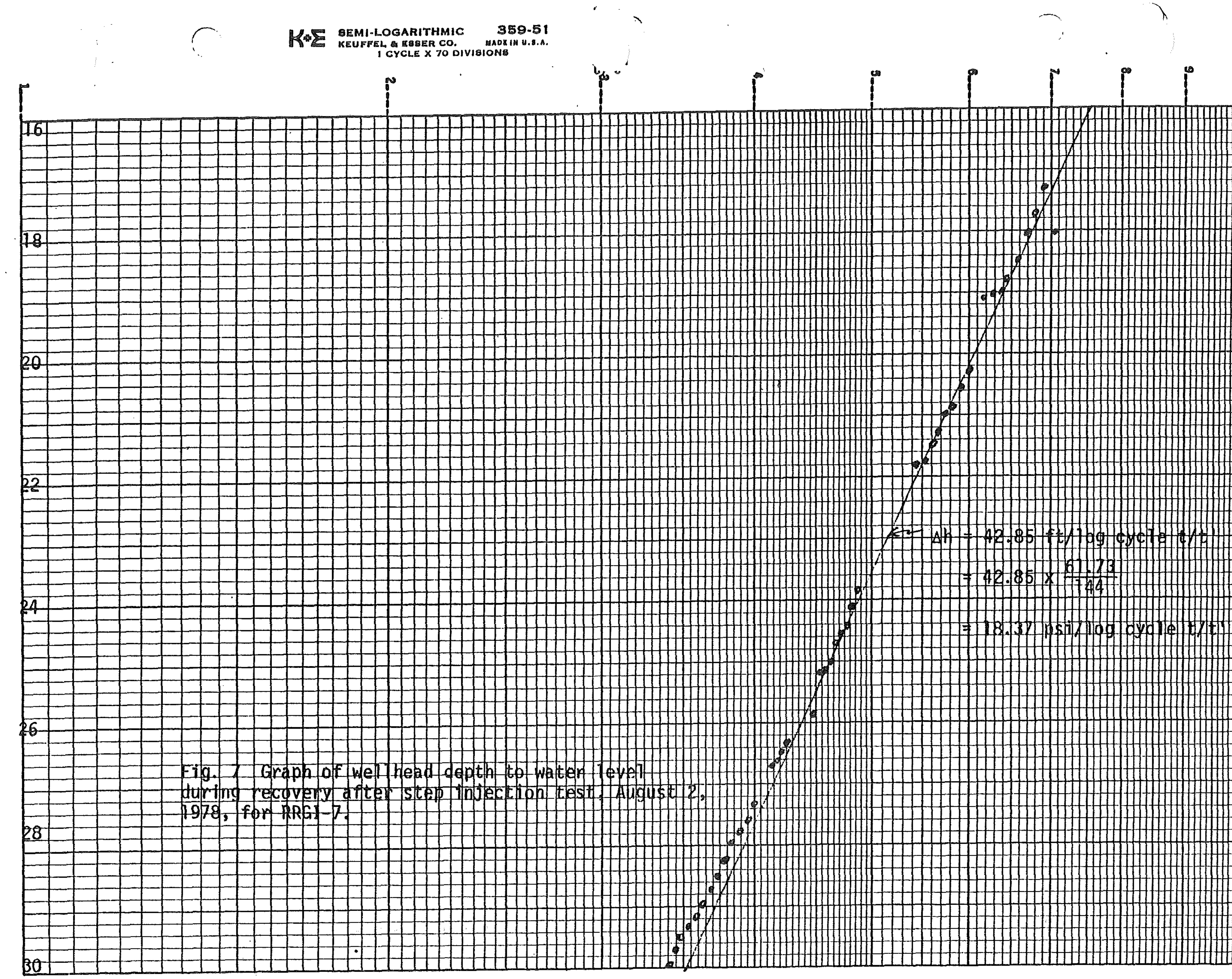

Fig. 7 Graph of well head depth to water level during recovery after step injection test, August 2, 1978, for RRGI-7.

after 56 minutes of recovery (which corresponds to a t/t' of 6.18), the boundary or other pressure effects occurring at 56.5 minutes of the 510 gpm recovery data (Figure 1) were probably due to extraneous effects unique to the data collected following air lifting. The upward drift in the recovery data plotted in Figure 7, when t/t' < 4.5, is probably due to a gradually increasing temperature of the borehole fluid.

Assuming an effective injection rate of 575 gpm, a recovery rate of 18.38 psi/log cycle t/t' for the recovery following injection suggests a reservoir kh of 63,057 md-ft. This compares to a calculated kh of 208,527 md-ft obtained for the recovery data collected following air lifting (Figure 1) and a kh of 7559 md-ft for the 840 gpm injection test (Figure 2). Since RRGI-7 will be used for injection, conditions during injection testing are presumed to have a greater similarity to conditions that will be encountered while injecting into the well than the conditions during recovery. Thus, greater reliability should be placed on the injection test data than on the recovery data for the prediction of wellhead pressures.

During injection step testing, the wellhead pressure increased at RRGE-3, but declined slightly at RRGI-6. Background wellhead pressure data were collected for approximately 150 minutes prior to the initiation of injection. During this period, the wellhead pressure at RRGE-3 declined 0.2 psi, whereas no change occurred at RRGI-6. The long-term trends in wellhead pressures at these two wells are not known. An apparent wellhead pressure buildup at RRGE-3 during step injection, assuming a constant temporally independent reference pressure, is plotted in Figure 8. The apparent pressure increase was 1.17 psi/log cycle time, but could be as great as 1.67 psi/log cycle time (assuming a 0.2 psi decline in the reference pressure per 150 minutes). Effects of this magnitude would result in < 10 psi interference while injecting at approximately 575 gpm. The temporally dependent injection rate technically invalidates the estimated interference of < 10 psi, but probably still provides a reasonable estimate. The lack of response at RRGI-6, which is approximately 100 feet closer to RRGI-7 than RRGE-3, indicates reservoir heterogeneity.

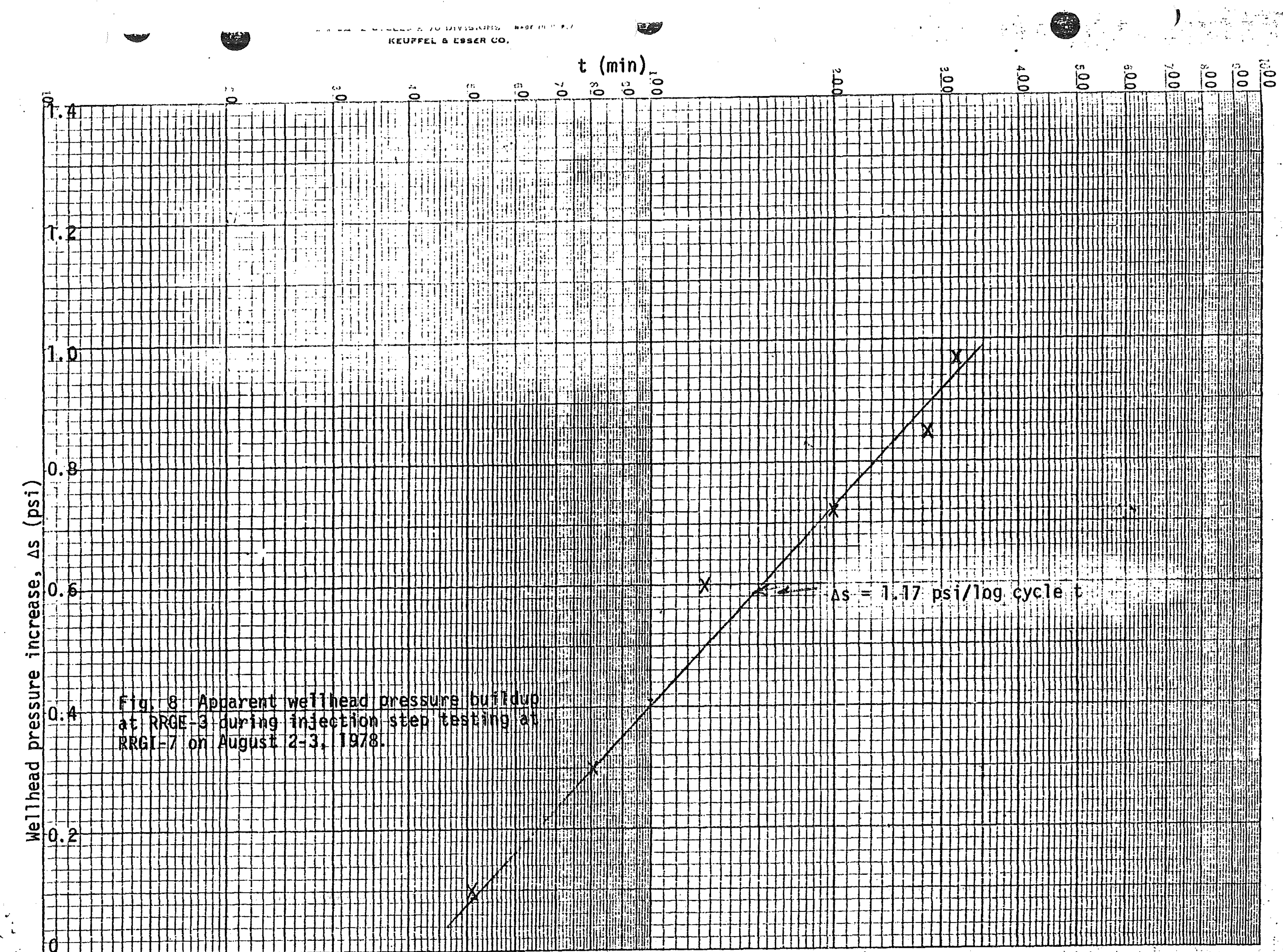

Fig. 8 Apparent wellhead pressure buildup at RRGE-3 during injection step testing at RRGI-7 on August 2-3, 1978.

III. CONCLUSIONS

1. The best prediction of wellhead pressure buildup results using the 840 gpm data as presented in Figure 5.

2. The wellhead recovery data suggest a much larger kh than that obtained from the 840 gpm injection test.

3. Step testing of a well results in calculated values of questionable reliability, especially for the third and any other subsequent steps.

4. Apparent responses occurred in the wellhead pressure at RRGE-3 during injection, with no response being observed at RRGI-6. This unequal pressure response indicates a heterogeneous reservoir.

TABLE I

TEST DATA SUMMARY FOR RRGI-7

	ΔQ (gpm)	Duration (min)	Slope of Data on Semilog Plot (psi/log cycle)	ΔQ/Slope of Data on Semilog Plot (gpm/psi/log cycle)
Airlift Recovery	510	--	4.948	103.1
1st Step	840	56	224.0	3.75
2nd Step	165	80	84.53	1.952
3rd Step	225	154	8.90	25.28
Step Recovery	575	--	18.38	31.28

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RRGE 1 0-1020 FEET

Date	Type	Depth	Company	No. of Back Stock
1-9-75	Caliper	18-898	Schlumberger	1
11-13/14-75	Casing Collar Log	0-1020	Schlumberger	1
1-9-75	Borehole Volume Integration	890-4614	Schlumberger	8

RRGE 1 800-4620

Date	Type	Depth	Company	No. of Back Stock
1-20/2-4-75	Mudlog	918-4650	Corelab	30
2-24-75	Cement Bond	1200-2830	Dresser-Atlas	2
1-9-75	Borehole	30-900	Schlumberger	3
2-2-75	Compensated	880-4620	Schlumberger	
4-6-75	Sonic	3592-5000	Schlumberger	
2-2-75		350-4620	Schlumberger	
2-2-75	Temperature	500-4620	Schlumberger	6
2-3-75		800-4620	Schlumberger	
2-9-75		850-4610		
2-9-75	Temperature	875-4610	Schlumberger	0
2-9-75		20-3050		
1-9-78	Dual Induction	33-900	Schlumberger	3
2-2-75		888-4618		
1-19-75		18-900		
2-2-75		870-4620		
2-9-75	Caliper	900-4617	Schlumberger	4
4-6-75		3000-5002		
4-6-75	Cement Bond	2700-3650	Schlumberger	16
2-2-75	Compensated Neutron	880-4619	Schlumberger	2
4-6-75	+ Formation Density	2692-4992		
4-6-75	Temperature	920-5000	Schlumberger	2
4-6-75		0-5000		
4-6-75	Compensated Neutron Formation Density	3623-4992	Schlumberger	1
5-6-75	Borehole Volume Integration	890-4614	Schlumberger	10

Date	Type	Depth	Company	No. of Back Stock
1-9-75	Borehole Volume Integration	18-898	Schlumberger	8
5-6-75	*Coriband	900-4600	Schlumberger	3
2-3-75	Temperature Logs Miscellaneous Worksheets	0-TD	EG&G	0
2-2-75	Temperature	0-TD	EG&G	0
2-25-75	Squeeze Job	0-TD	EG&G	0

RRGE 2 0-1550

Date	Type	Depth	Company	No. of Back Stock
4-30-75	Caliper	15-899	Birdwell	10
4-30-75	Caliper	17-904	Birdwell	0
4-30-75	Temperature	30-899	Birdwell	5
6-12-75	Cement Bond	0-1532	Dresser-Atlas	9

RRGE 2 800-4250

Date	Type	Depth	Company	No. of Back Stock
5-19-78	Continuous Dipmeter	926-4142	Schlumberger	1
5-21-78	Caliper	850-4232	Birdwell	1
5-21-75	3-Dimensional Velocity Log	30-4232	Birdwell	14
6-3-75	Cement Bond	0-4200	Schlumberger	12
5-12-75	Compensated Sonic	870-4228	Schlumberger	0
5-13-75	Compensated Neutron Formation Density	870-4247	Schlumberger	1
9-22-78	Temperature	0-3000	McCullough	0
9-22-78	Caliper	1900-2640	McCullough	0
9-22-78	Gamma	0-3000	McCullough	0
5-12-75	Temperature	780-4228	Schlumberger	1

RRGE 2 4200-6000

Date	Type	Depth	Company	No. of Back Stock
6-4/9-75	Cement Bond	0-4806	Dresser-Atlas	0
6-27-75	Compensated Sonic	4219-5997	Schlumberger	2
6-27-75	Compensated Neutron Formation Density	4220-6003	Schlumberger	1
5-3/6-26-75	Mudlog	925-6000	Rocky Mountain Geo-Engineering	3
6-27-75	Temperature	4220-6004	Schlumberger	4
6-27-75	Dual Induction	4215-5998	Dresser-Atlas	1
	Temperature	0-TD	EG&G	0

RRGE 3 0-1500

Date	Type	Depth	Company	No. of Back Stock
3-30-76	Dual Induction Focused	140-1410	Dresser-Atlas	0
3-30-76	Caliper	54-1412	Dresser-Atlas	0
3-30-76	Temperature	25-1412	Dresser-Atlas	0

RRGE 3 1100-4300

Date	Type	Depth	Company	No. of Back Stock
3-30-76	Caliper	54-1412	Dresser-Atlas	0
4-17-76		1382-4212		
4-20-76	Cement Bond	1193-2399	Dresser-Atlas	1
4-23-76	Cement Bond	1150-4232	Dresser-Atlas	5
4-18-76	Acoustilog	1385-4201	Dresser-Atlas	4
4-17-76	Dual Induction Focused	1400-4211	Dresser-Atlas	0
4-17-76	Densilog	1384-4211	Dresser-Atlas	1
4-20-76	Cement Bond	1206-2393	Dresser-Atlas	3

RRGE 3 4100-6000

Date	Type	Depth	Company	No. of Back Stock
4-15-77	Δ Temperature	4100-5917	Dresser-Atlas	3
4-17-77	*Spectralog	8-5929	Dresser-Atlas	0
4-17-77	Acoustilog	4244-5932	Dresser-Atlas	10
3-30-76		25-1412		
5-1-76	Temperature	0-5868	Dresser-Atlas	4
5-3-76		0-5865		
4-18-76	Acoustilog	1385-4201	Dresser-Atlas	0
5-1-76		4247-5856		
3-30-76		140-1410		
4-17-76	Dual Induction	1400-4211	Dresser-Atlas	0
5-2-76	Focused	4247-5865		
4-17-76	Densilog	1384-4211	Dresser-Atlas	1
5-3-76		4247-5863		
4-18-77	Compensated Neutron	4244-5932	Dresser-Atlas	0
5-16/22-76	Mudlog	4415-5520	Rocky Mountain Geo-Engineering	0
4-18-77	(Offset) Densilog	4245-5933	Dresser-Atlas	10
4-17-77	(Offset) Dual Induction Focused	4245-5953	Dresser-Atlas	12
4-17-76	Compensated Neutron	1385-4208	Dresser-Atlas	3
5-1-76		4200-5865		

RRGP 4 0-1900

Date	Type	Depth	Company	No. of Back Stock
4-17-77	Compensated Neutron	401-1909	Dresser-Atlas	11
4-6-77	Densilog	400-1908	Dresser-Atlas	13
4-15-77	Dual Induction	403-1886	Dresser-Atlas	9
4-16-77	Acoustilog	401-1901	Dresser-Atlas	12

RRGP 4 1800-3500

Date	Type	Depth	Company	No. of Back Stock
9-28-78	Dual Induction Focused	1824-3460	Dresser-Atlas	12
9-27-78	Caliper	1815-3464	Dresser-Atlas	12
9-29-78	Acoustilog	1820-3448	Dresser-Atlas	12
9-28-78	Densilog	1820-3456	Dresser-Atlas	13
9-28-78	Densilog-Neutron	1820-3456	Dresser-Atlas	13
9-28-78	Δ Temperature	0-3463	Dresser-Atlas	12
10-5-78	Cement Bond	1450-3118	Dresser-Atlas	0
10-2-78	Cement Bond	1450-3247	Dresser-Atlas	0

RRGP 4 3350-5420

Date	Type	Depth	Company	No. of Back Stock
10-20-78	Densilog	3471-5221	Dresser-Atlas	15
10-20-78	Caliper	3459-5200	Dresser-Atlas	15
10-20-78	Compensated Neutron	3474-5220	Dresser-Atlas	15
10-20-78	Dual Induction Focused	3450-5218	Dresser-Atlas	15
10-19-78	Temperature	3420-5230	Dresser-Atlas	1
	ΔT	5220	Dresser-Atlas	15
10-20-78	*Diplog	3467-5186	Dresser-Atlas	6
10-20-78	Acoustilog	3467-5208	Dresser-Atlas	14
10-31/ 11-13-78	Mudlog, Leg B	3555-5115	Rocky Mountain Geo-Engineering	7
10-18/ 10-30-78	Mudlog, Leg A	1970-5420	Rocky Mountain Geo-Engineering	11
11-13-78	High Resolution Temperature	32-5128	Schlumberger	4
11-13-78	Dual Induction	3471-5120	Schlumberger	3
11-13-78	Compensated Sonic	3421-5113	Schlumberger	1
11-13-78	F.B. Spinner	3376-4200	Schlumberger	5
11-13-78	*Fracture I.D. Log	3470-5124	Schlumberger	12

Date	Type	Depth	Company	No. of Back Stock
11-13-78	Compensated Neutron Formation Density	3470-5120	Schlumberger	2
11-14-78	4-Arm Caliper	3470-5124	Schlumberger	3
11-13-78	Directional	3470-5124	Schlumberger	7
10-29-78	Differential Temperature	3400-5420	Dressler-Atlas	8
10-20-78	Diplog	3490-5184	Dressler-Atlas	10
6-9-78	Flowmeter	0-TD	EG&G	0
7-5-78	Pressure	0-TD	EG&G	0
	Temperature	0-TD	EG&G	0
		RRGP 5 0-1500		
5-15-78	Temperature	50-1453	Petro Log	0
5-13-78	Temperature	40-1514	Schlumberger	0
5-15-78	Cement Bond	50-1453	Petro Log	3
5-13-78	Caliper	120-1514	Schlumberger	0
		RRGP 5 1250-3800		
5-28-78	Dual Induction Focused	1510-3743	Dressler-Atlas	7
6-27-78	Dual Induction	3160-3320	Dressler-Atlas	0
6-22-78	Δ Temperature	70-3370	Dressler-Atlas	0
5-29-78	Densilog-Neutron	1508-3744	Dressler-Atlas	13
5-28-78	Caliper	1509-3742	Dressler-Atlas	12
5-28-78	Densilog	1508-3742	Dressler-Atlas	14
5-29-78	Acoustilog	1508-3744	Dressler-Atlas	17
9-2-78	Gamma	1250-1950	McCullough	10
8-30-78	Gamma	1250-3350	McCullough	1
5-28-78	Δ Temperature	10-3740	Dressler-Atlas	0
5-28-78	Dual Induction Focused	1510-3743	Dressler-Atlas	9
6-2-78	Epilog	1500-3750	Dressler-Atlas	0
5-28-78		10-3740		
5-28-78	Δ Temperature	26-3740	Dressler-Atlas	14
5-29-78		74-3740		
6-2-78	*Library Tape Most Logs	1508-3750	Dressler-Atlas	2

RRGP 5 3380-4950

Date	Type	Depth	Company	No. of Back Stock
5-10/6-22-78	Mudlog	70-4911	Rocky Mountain Geo-Engineering	2
9-13-78	BGT Caliper	3394-4924	Schlumberger	3
9-14-78	High Resolution Temperature	30-4934	Schlumberger	1
11-14-78	High Resolution Temperature	3300-4936	Schlumberger	0
7-6-78	Caliper	1500-4908	Gebhart-Owens	0
7-8-78	Full Bore Spinner	1330-4900	Schlumberger	0
9-14-78	Full Bore Spinner	3380-4936	Schlumberger	6
7-30-78	*High Resolution Temperature Engineering Production Log	80-4908	Schlumberger	0
7-8-78	Temperature	300-4916	Schlumberger	0
9-13-78	Dual Induction	3360-4930	Schlumberger	2
9-13-78	Compensated Sonic	3370-4934	Schlumberger	3
9-15-78	Compensated Neutron Formation Density	3396-4934	Schlumberger	1
7-7-78	Dual Induction	1513-4919	Schlumberger	0
7-7-78	Compensated Neutron Formation Density	1513-4919	Schlumberger	0
7-8-78	Compensation Sonic	2903-4919	Schlumberger	0
7-23-78	Dual Induction Focused	1515-4920	Dressler-Atlas	0
5-10/6-22-78	Mudlog	70-4911	Rocky Mountain Geo-Engineering	0
11-14-78	High Resolution Temperature	3300-4936	Schlumberger	0
7-6-78	Temperature	1500-4908	Gebhart-Owens	0
	*Multi-Shot Deviation Survey	3400-4924	Eastman Whipstock	0
7-6-78	X-Y Caliper	1500-4908	Gebhart-Owens	0
5-19-78	Absolute Temperature	1510-TD	EG&G	0

RRGI 6 0-2020

Date	Type	Depth	Company	No. of Back Stock
4-16-78	Compensated Neutron	100-2017	Dresser-Atlas	11
4-16-78	Dual Induction Focused	90-2020	Dresser-Atlas	17
4-17-78	Acoustilog	100-2011	Dresser-Atlas	13
4-17-78	Temperature	4-2016	Schlumberger	16
4-17-78	Caliper	38-2018	Schlumberger	18
4-28-78	*Epilog	120-2020	Dresser-Atlas	10

RRGP 6 1660-3800

4-30-78	Δ Temperature	1660-3782	Dresser-Atlas	14
{4-30-78	Acoustilog	1700-3773	Dresser-Atlas	5
{4-17-78		100-2011		
5-8-78	*Epilog	2000-3790	Dresser-Atlas	7
4-29-78	Mudlog	810-3888	Rocky Mountain Geo-Engineering	7
{4-16-78	Dual Induction	90-2020	Dresser-Atlas	15
{4-30-78	Focused	1700-3784		
4-30-78	Densilog, Neutron	1700-3789	Dresser-Atlas	14
4-30-78	Densilog	1700-3789	Dresser-Atlas	14
6-16-78	Combined Library Tape	100-3784		0
12-5/13-78	Temperature	0-TD	EG&G	2

RRGI 7 0-2060

8-3-78	*Epilog	150-2050	Dresser-Atlas	3
7-23-78	Acoustilog	160-2055	Dresser-Atlas	11
7-24-78	Δ Temperature	100-2054	Dresser-Atlas	11
7-25-78	Caliper	10-2016	Dresser-Atlas	3
7-23-78	Compensated Neutron	160-2050	Dresser-Atlas	5
7-23-78	Dual Induction Focused	150-2052	Dresser-Atlas	0

RRGI 7 2050-3900

Date	Type	Depth	Company	No. of Back Stock
8-2-78	Densilog	2049-3798	Dresser-Atlas	11
8-17-78	*Epilog	2050-3800	Dresser-Atlas	2
7-23-78	Acoustilog	160-2055	Dresser-Atlas	0
7-31-78		2050-3800		
7-23-78	Compensated Neutron	160-2050	Dresser-Atlas	0
8-1-78		2050-3789		
7-24-78	Δ Temperature	100-2054	Dresser-Atlas	11
7-31-78		2050-3800		
7-15/31-78	Mudlog	540-3858	Rocky Mountain Geo-Engineering	4
11-14-78	High Resolution Temperature	34-3808	Schlumberger	4
7-23-78	Dual Induction	150-2052		
8-1-78		2050-3789	Dresser-Atlas	0

MISCELLANEOUS LOGS

Nielson #1			
9-22/10-22-73	Mudlog	600-6981	Continental
Mesa 8-1			
3-25-74	Dual Induction Laterlog	1000-6199	Schlumberger
	Simple Total Field & Schlumberger Soundings Near Sugar City, Idaho		USGS
5-25-74	Dual Induction Laterlog	1000-6199	Schlumberger
5-27-74	Continuous Dipmeter	1000-6091	Schlumberger
5-25-74	Compensated Sonic	100-6070	Schlumberger
5-25-74	Compensated Neutron Formation Density	100-6204	Schlumberger
5-25-74	Compensated Formation Density	100-6204	Schlumberger
6-16-74	*Saraband	1000-6186	Schlumberger
Utah State Penitentiary - Forestry #1			
7-28-78	Fluid Temperature		EG&G (2)
7-28-78	Gamma		
7-28-78	Flowmeter Calibration		
White Sulphur Springs, Montana			
7-24-78	Temperature Logs		EG&G (4)
7-17-78	SP/Resistance		EG&G
7-17-78	Gamma		EG&G
7-17-78	Absolute Temperature		EG&G
7-17-78	Caliper		EG&G
Griffith - Wight Well			
11-22/12-7-73	Mudlog	635-6787	Continental

*Computer Processed Interpretation

COMBINED

Sugar City Well			
8-7-78	#1 Absolute Temperature	50-2290	EG&G
8-12-78	#2 Absolute Temperature	0-2290	EG&G
Harold Smith Well			
11-19-75	Temperature	0-630	EG&G
Boise Wells			
	Temperature		EG&G
Raft River Monitor Wells			
10-10-78	Temperatures		EG&G (4)

Stratigraphy of Lava Flows in Drill Holes at Argonne National Laboratory West - INEL: CH-C7, CH-E7.9, CH-G4-8.05, CH-F11.25, CH-G12

Weiser Hot Springs — Temperature Logs & Other Information