GL02977-5

EG&G Idaho

INTEROFFICE CORRESPONDENCE

date May 1, 1979

to [redacted] Doiron

from D. Goldman

subject SUMMARY OF RRGI-6 DATA - DG-18-79

Objectives

Several reservoir tests have been accomplished at RRGI-6 with apparent changing and/or different reservoir parameters. A clarification of the voluminous data is necessary to determine reservoir constants and/or possible trends.

Summary of Results

The reservoir parameters of Q/s_{10} appear to be relatively constant at ≈ mid 20 gpl (gpm/psi/log cycle) range for early-time data. A discharging type boundary after about 24 hours gives an apparent Q/s_{10} at ≈ mid 40 gpl. Variations in Q/s_{10} values appear to be related to testing techniques and density/viscosity problems.

There does appear to be an improvement in wellbore loss. Early testing was suggestive of over 100 psi well losses, while current testing suggests on the order of 10 psi well loss. This data may be real, due to apparent wellbore enlargement in the upper portion of the open hole, or may be apparent due to density/viscosity problems.

Review of Data

At the completion of drilling operations, with the rig in place, 12 hours of injection testing and 5 hours of air-lift testing were accomplished. It is this early data that was delivered in raw field form to TerraTek. Figures 1-6 are semilogarithmic plots of the data. It should be noted that the drilling report shows no circulation/well cleaning prior to the forementioned testing. The quality of this testing should thus be questioned due to the hole condition and the method of testing. The latter refers to the fact that injection rate was approximated by strokes per minute of the drill rig pumps. Note on Figure 2 that the "steep slope" at about one to three minutes was when a second pump was turned on. There was no control and/or monitoring of fluid temperature/density effects. The Q/s_{10} values for the 800 gpm test were 36 gpl for the pressure rise and 22 gpl for the pressure falloff. Well losses were calculated to be over 100 psi.

A 24-hour flow test in November 1978, at a rate of 170 gpm, was influenced by fluid density changes throughout the test: temperature increased from less than 164°F to greater than 208°F (see Figure 4). The Q/s_{10} value of ≈ 79gpl is most likely due to the low viscosity waters. Pulse testing resulted in similar problems, with resulting Q/s_{10} in the 80 gpl range.

In January 1979 pulse injection testing and 72 hours of injection at 700 gpm were accomplished. The high injection rate and long wellbore heatup resulted in quality data with minimal density-viscosity effects. Resulting Q/s_{10} values were in the 20 gpl range. Early-time data were affected by mechanical startup procedures (see Figure 7). Well losses were calculated to be on the order of 10 psi, while injecting water with temperature in excess of 104°C. During this testing, successive attempts to log RRGI-6 with the INEL truck failed, suggesting that the well may have collapsed below 2000 feet.

Due to the questionable condition of the hole, a commercial caliper log was run in March 1979. The results of the log suggested apparent borehole enlargement between 1698 feet and 2018 feet. There was 204 feet of fill in the bottom of the hole. However, the enlargement may be only apparent due to the limitations of the 4-arm caliper tool and the quality of the logs. In addition, the fill may be residual due to lack of well clean-out after drilling.

During March and April 1979, a 20-day injection test at RRGI-6 was run (see Figure 8). Analysis of the test to date is not complete. The Q/s_{10} values for the early portion of the test were on the order of 20 gpl. A discharging boundary after one day doubled the Q/s_{10} value to 48 gpl. USGS spinner logs during testing suggested that approximately two-thirds of the injected fluid was entering the formation between 1698 and 2018 feet.

Conclusions

The reservoir parameter of Q/s_{10} (directly related to kh or T, dependent on density/viscosity) appears to be relatively constant at ≈ mid 20 gpl range for early-time data. A halving of the s_{10} slope after about 24 hours is due to an apparent discharge-type boundary. The resultant Q/s_{10} is approximately doubled - ≈ mid 40 gpl. Variations in Q/s_{10} values appear to be related to testing technique and density/viscosity problems.

There does appear to be an improvement in wellbore loss. Early testing was suggestive of over 100 psi well losses, while current testing suggests

on the order of 10 psi well loss. This data may be real, due to apparent wellbore enlargement in the upper portion of the open hole, or may be apparent due to density/viscosity problems.

The apparent improvement in well loss will be verified by future planned "cold" water injection testing and additional geophysical logging.

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Attachments:
As stated

cc: C. A. Allen
D. W. Allman
R. R. Stiger
Central File

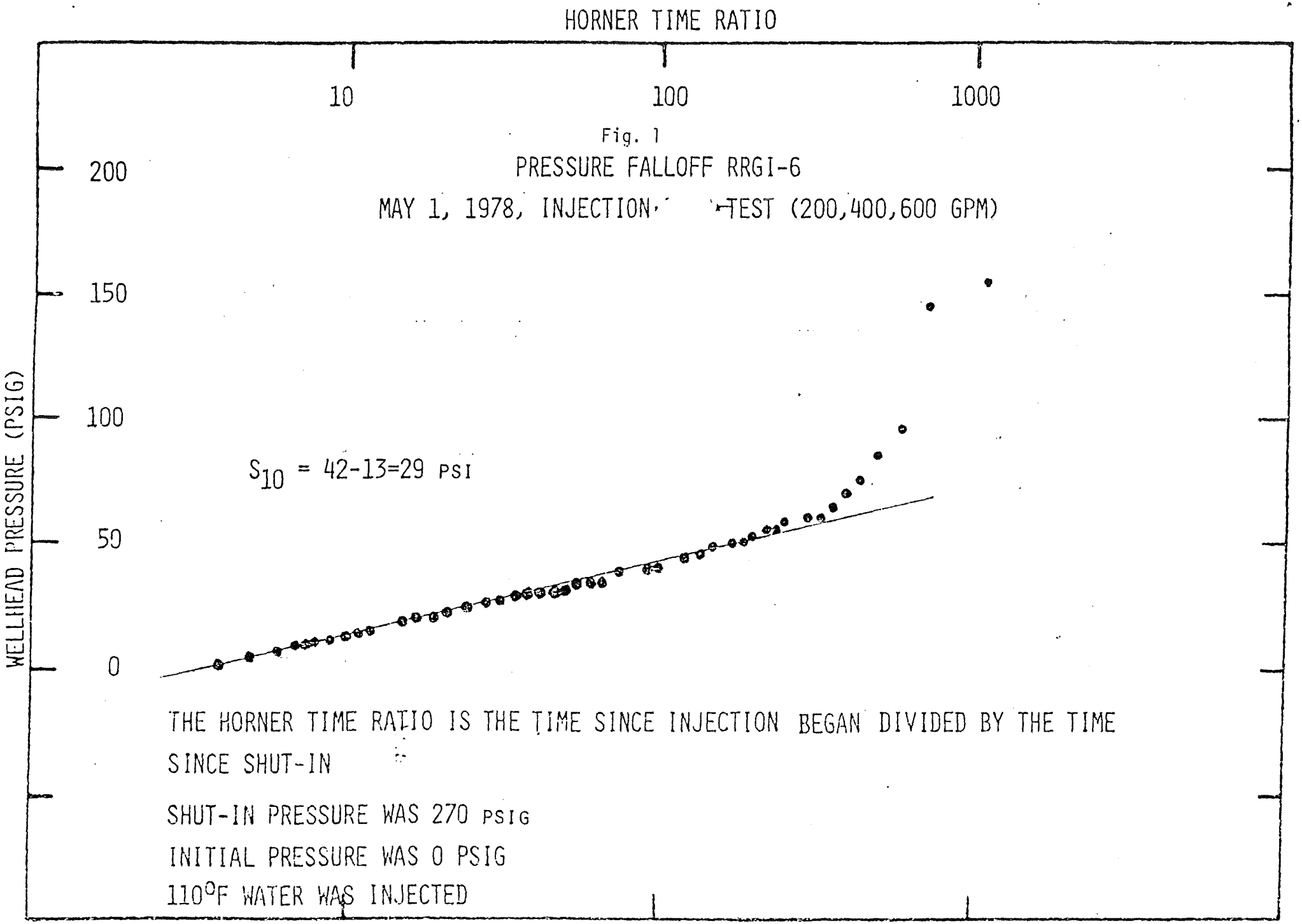


Fig. 1

PRESSURE FALLOFF RRGI-6

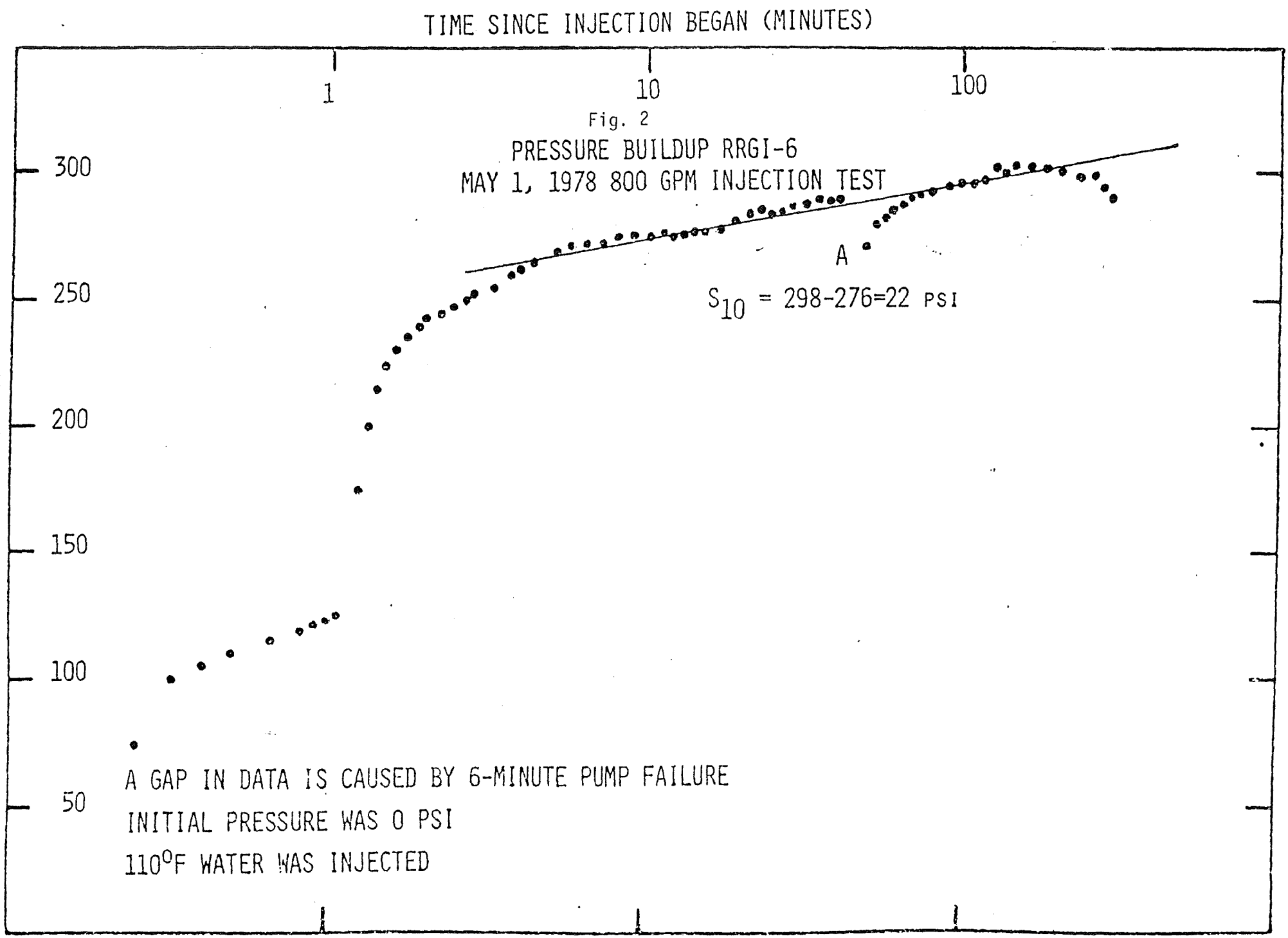
MAY 1, 1978, INJECTION TEST (200,400,600 GPM)

THE HORNER TIME RATIO IS THE TIME SINCE INJECTION BEGAN DIVIDED BY THE TIME SINCE SHUT-IN

SHUT-IN PRESSURE WAS 270 PSIG

INITIAL PRESSURE WAS 0 PSIG

110°F WATER WAS INJECTED


TIME SINCE INJECTION BEGAN (MINUTES)
1
10
100
Fig. 2
PRESSURE BUILDUP RRGI-6
MAY 1, 1978 800 GPM INJECTION TEST
300
250
200
150
100
50
WELLHEAD PRESSURE (PSIG)
A
S_{10} = 298-276=22 PSI
A GAP IN DATA IS CAUSED BY 6-MINUTE PUMP FAILURE
INITIAL PRESSURE WAS 0 PSI
110°F WATER WAS INJECTED

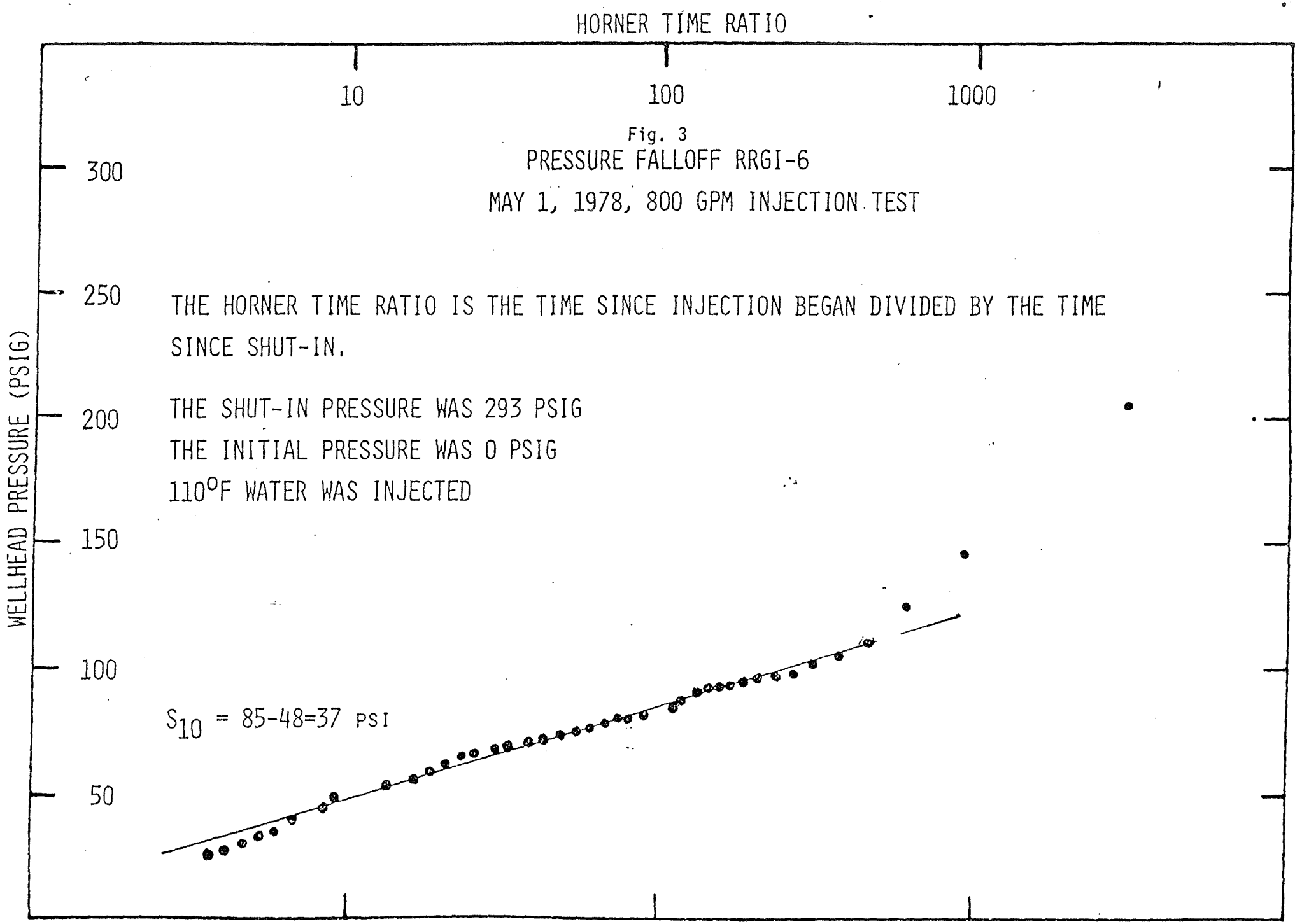


Fig. 3

PRESSURE FALLOFF RRGI-6

MAY 1, 1978, 800 GPM INJECTION TEST

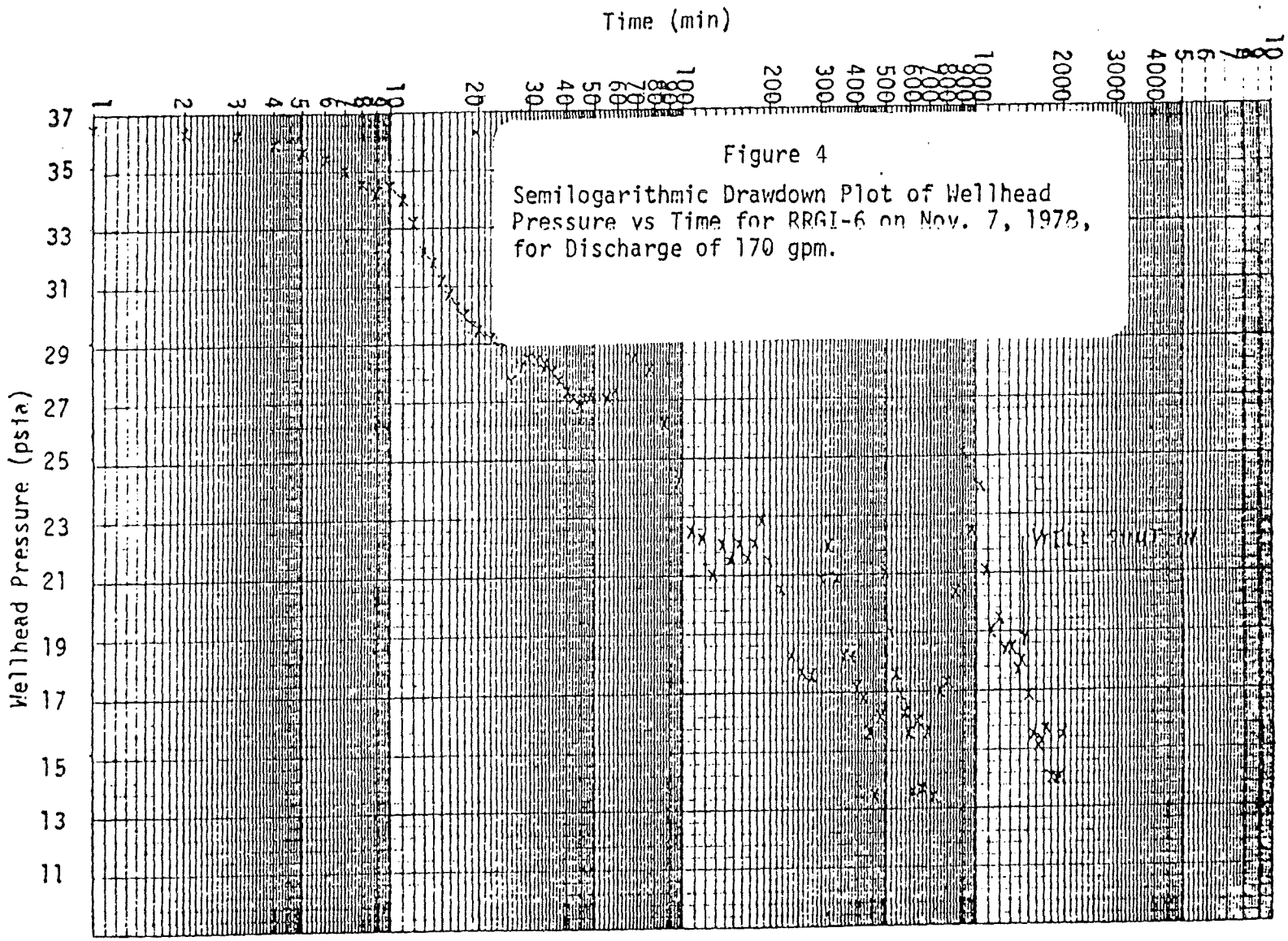


Figure 4

Semilogarithmic Drawdown Plot of Wellhead Pressure vs Time for RRGI-6 on Nov. 7, 1978, for Discharge of 170 gpm.

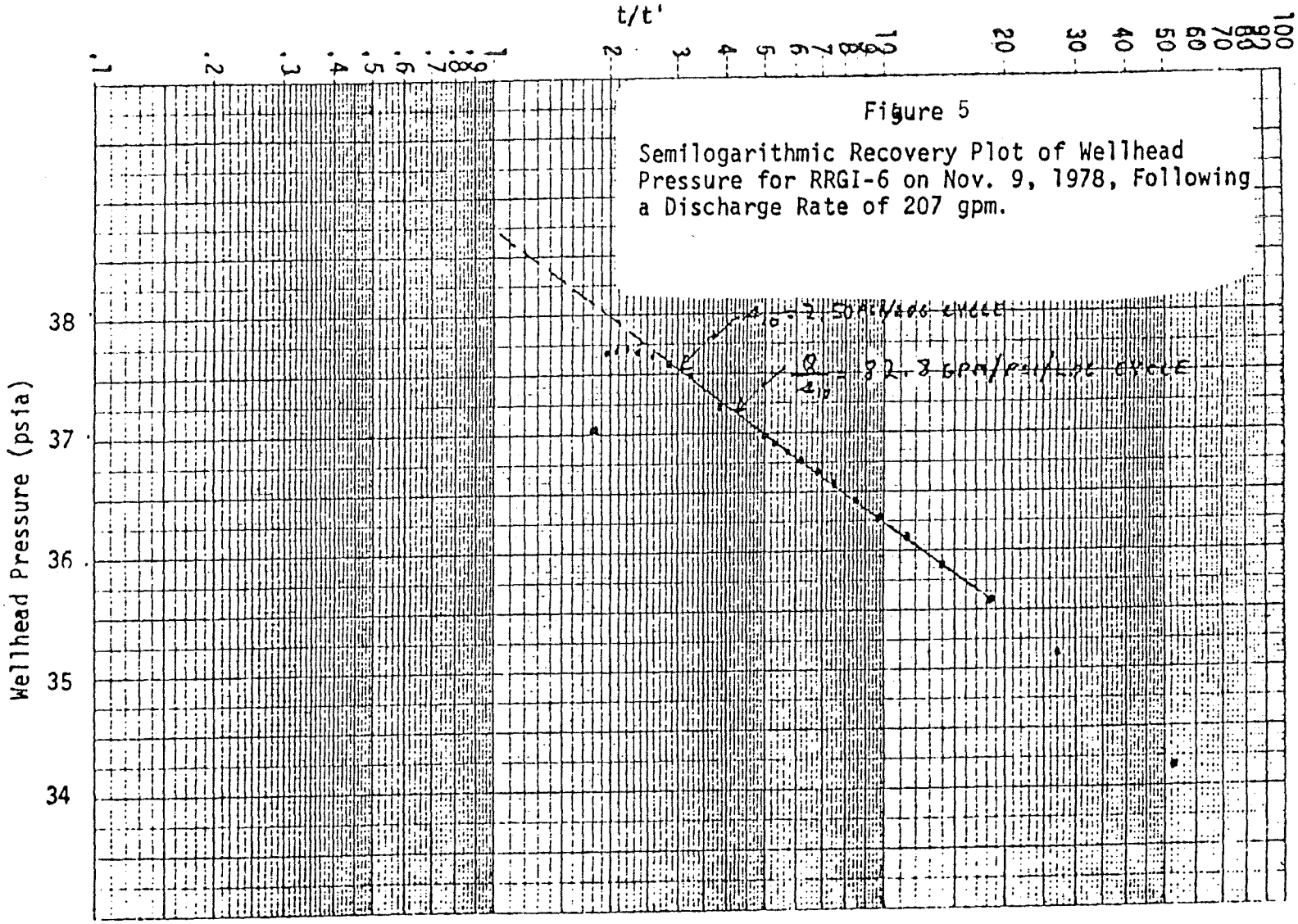


Figure 5

Semilogarithmic Recovery Plot of Wellhead Pressure for RRGI-6 on Nov. 9, 1978, Following a Discharge Rate of 207 gpm.

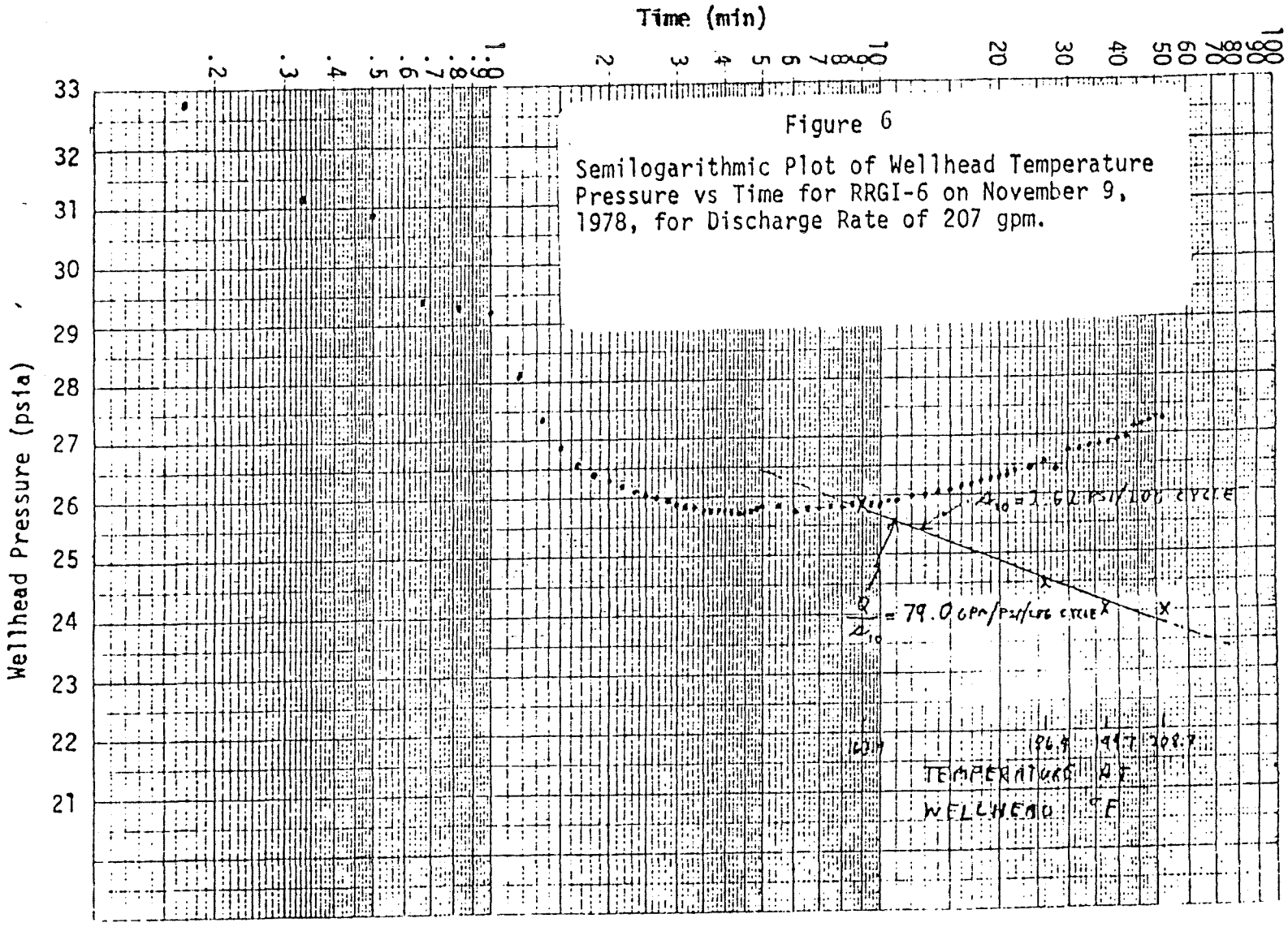
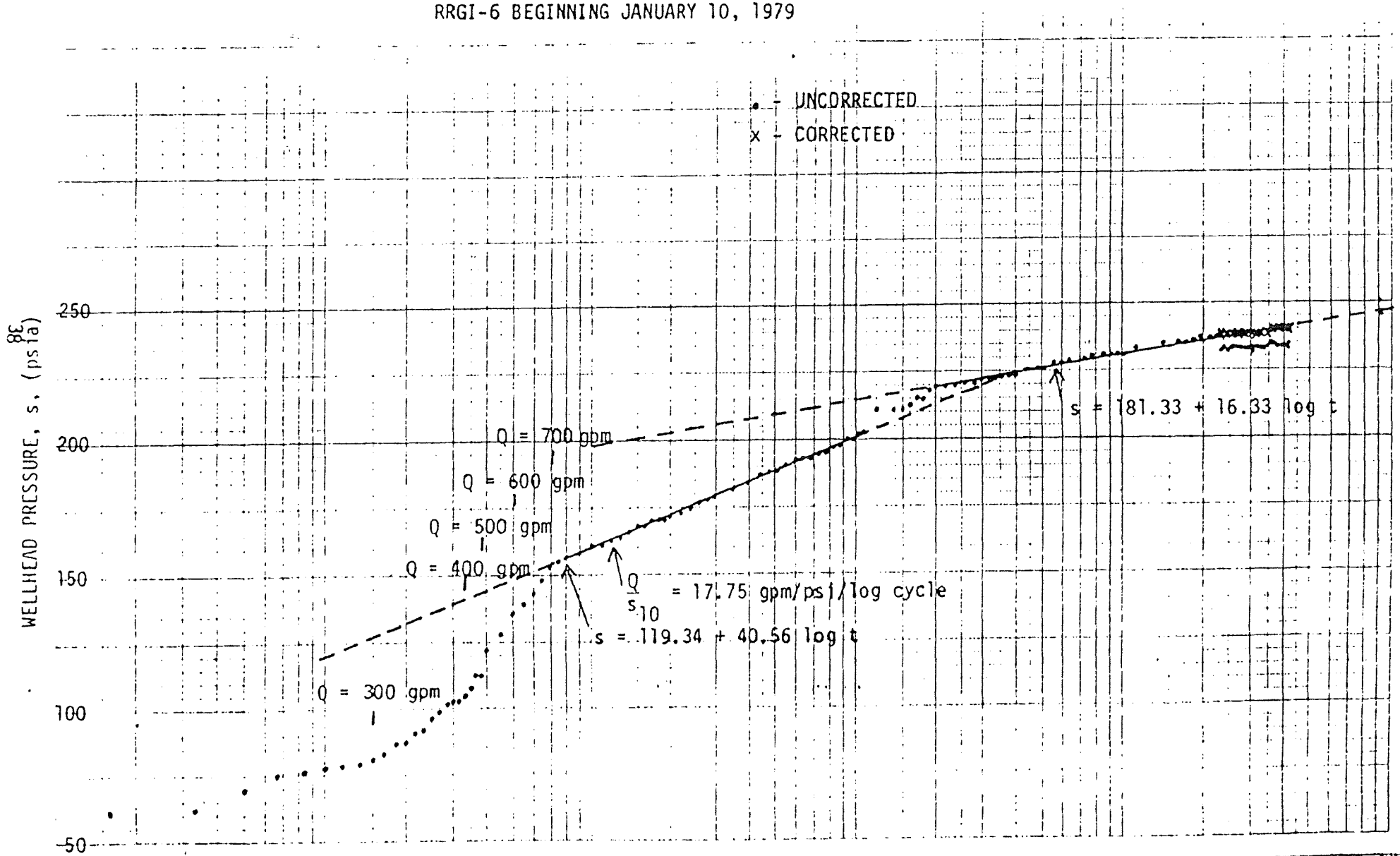


Figure 6

Semilogarithmic Plot of Wellhead Temperature Pressure vs Time for RRGI-6 on November 9, 1978, for Discharge Rate of 207 gpm.

FIGURE 7

GRAPH OF WELLHEAD PRESSURE, s, AT RRGI-6 DURING PRESSURE BUILDUP FOR 700 GPM INJECTION TEST ON RRGI-6 BEGINNING JANUARY 10, 1979



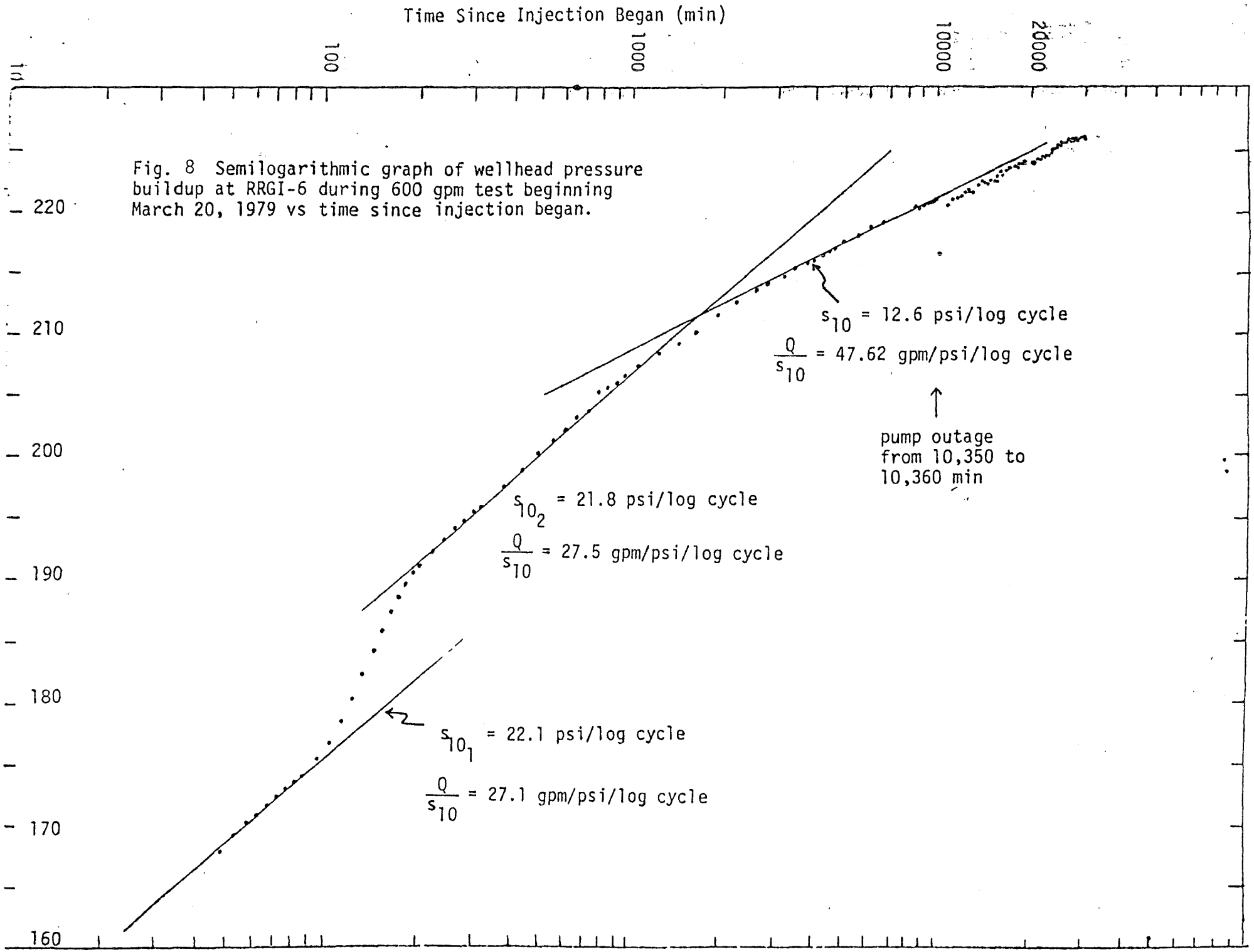


Fig. 8 Semilogarithmic graph of wellhead pressure buildup at RRGI-6 during 600 gpm test beginning March 20, 1979 vs time since injection began.