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**INTEROFFICE CORRESPONDENCE**

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date December 10, 1979  
to D. Goldman  
from J. A. Martinez :Am  
subject GEOPHYSICAL LOGGING OF RRGE-1 - JAM-3-79

Schlumberger has run a new cement bond log and a new temperature log at RRGE-1 after approximately 4 years of flow. These have been compared to logs run shortly after the well was drilled in 1975 to see what changes, if any, have occurred over this time period.

#### CEMENT BOND LOG

The casing at RRGE-1, set to 1104.6 m was cemented in two stages. In stage 1, cement was pumped down the casing and forced up the annulus. A part in the casing at the seventh joint stopped work on cementing while repairs were made. During this time the cement in the annulus and 93 barrels of cement slurry in the casing set up. Dresser Atlas ran a cement bond log which generally showed good bonding from the top of the cement plug up to 554.9 m. (figure 1).

Stage 2 cement was pumped from the top directly down the annulus. According to the drillers report, a pumping pressure rise indicated the annulus was filled. Dresser Atlas ran another cement bond log from the surface to 609.8 m which indicates a fair bond with weak intervals. It is possible that cement was not completely set, making this log slightly unreliable.

Schlumberger ran a new CBL on 9/6/79 after approximately 4 years of flow. This log was measured from ground level instead of the Kelly Bushing and is 8.1 m less than the Dresser Atlas logs. A good cement casing bond is indicated from 152.4 m to 484.8 m with weak intervals shown in figure 1.

At 484.8 m there is a sharp change to a bad bond. The bottom of this interval, 548.8 m corresponds to the break between stage 1 and 2 of cementing. This poor bond is possibly a result of pumping cement down the annulus and not filling that area.

Bonding is essentially good to the bottom of the casing(1104.6 m) except for short intervals of weak bonding shown in figure 1.

These short intervals of subsequent bond weakening may be due to several factors. Since the casing was cemented under pressure, a microannulus gap may have been created due to contraction when the pressure was released. Deterioration of bonding may have occurred due to time or thermal effects. Human or mechanical error could cause weak signals on the log, especially

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since they were done by two different logging companies, or it may be a combination of some or all of these possibilities.

#### TEMPERATURE LOG

Schlumberger ran a temperature log on RRGE-1 on 9/6/79. A total of 2,278 lbs. of salt and 407 + barrels of cold water were added to kill the well as needed between 8/24/79 and 9/3/79. The well was shut-in for six days before the temperature log was run. Reliability of data on the log is questionable from 609.8 - 1006.1 m. due to several series of unnatural jerks caused by mechanical failure during logging. Data below the casing (1105.5 m.) appears good and will be closely looked at.

Below the casing there is a shallow temperature gradient to 1310 gpm. where it becomes isothermal for 91.5 m. There is a 18.3 m. temperature reversal of 17.6°C to 1426.8 m. where it then returns to a shallow temperature gradient. This gradient to the bottom of the well is more shallow than that in the casing. (figure 2).

A close look at the lithologies indicate tuff in the isothermal section, schist in the temperature reversal, and quartzite beneath. The cold water injected into the well may have entered the formation at more permeable zones, slowing the rewarming of these areas. This may be the effect seen with impermeable tuff and quartzite sandwiching a permeable schist zone causing this temperature reversal. This explanation does not include the existence of fractures which could also accept cold water and have an effect on the temperature log.

This log was compared to temperature logs run by Schlumberger 2/75, that were run between 3 and 25 hours after the well had been circulated with water. The general trend of the new log resembles those previously run that had the longest wait time after circulation. (figure 3).

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Attachment: Figure 1 - Cement Bond Log Comparison, RRGE-1  
Figures 2 & 3 - Temperature Logs, RRGE-1

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CEMENT BOND LOG COMPARISON

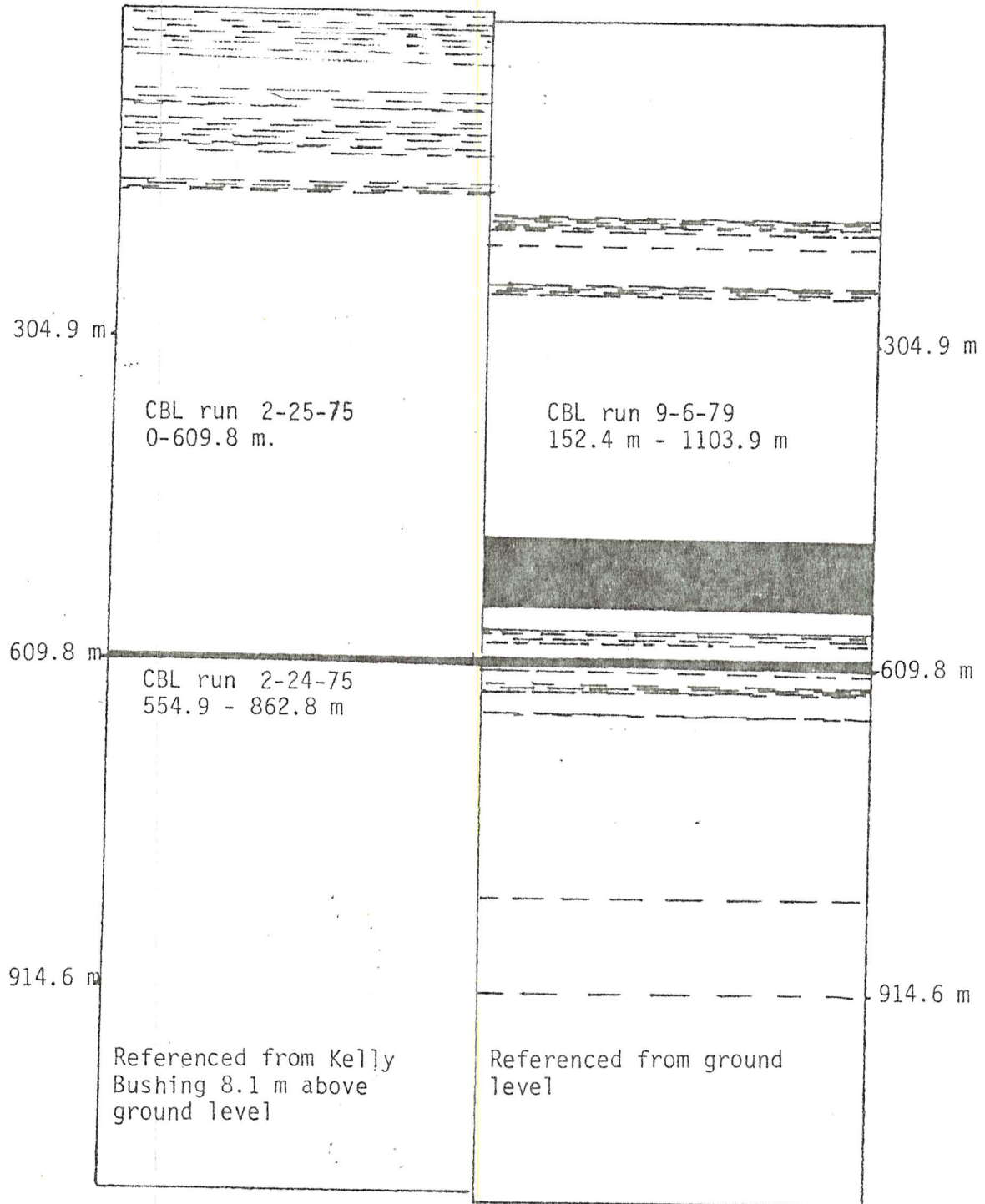


FIGURE 1

RRGE-1 TEMPERATURE LOG 9/6/79

(Temp °C)

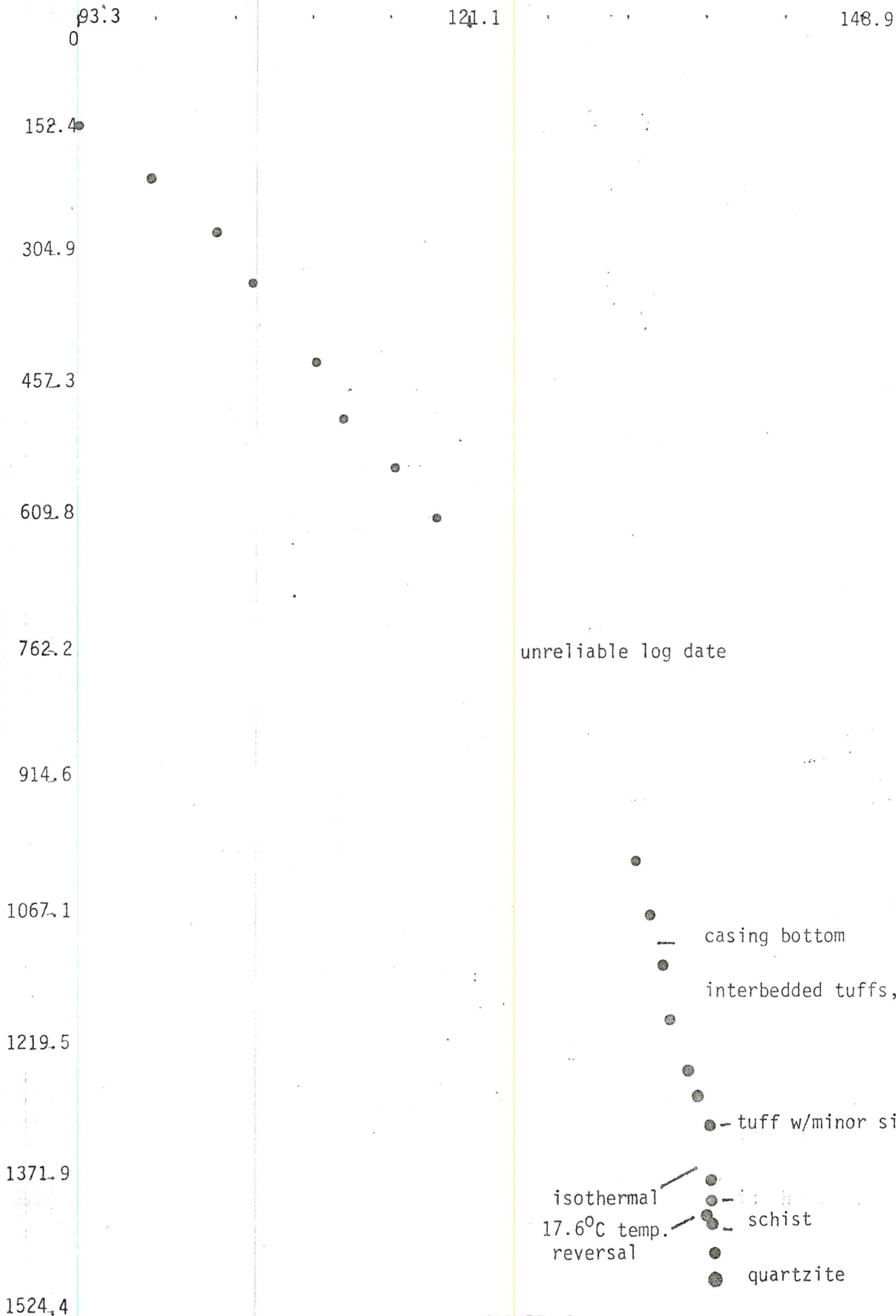


FIGURE 2

RRGE-1 TEMPERATURE LOGS

Temperature ( $^{\circ}\text{C}$ )

37.8

93.3

148.9

Depth (m)

0  
152.4  
301.9  
457.3  
609.8  
762.2  
914.6  
1067.1  
1219.6  
1371.9  
1524.4

- Time After Circulation
- 14 hours
  - △ 10 hours
  - ▲ 25 hours
  - 7 hours
  - new log

1 Bridge Fault

FIGURE 3