Log Analysis

ARMOUR KANE
Well Log Analyst
18360-6 Cantara St.
Reseda, Ca. 91335
(213) 993-0586

Formation Evaluation
RUN #3
2584-8301'

February 3, 1979

Mr. S. L. Hewitt
Husky Oil/ NPR Operations, Inc.
2525 C Street
Anchorage, AK 99503

Dear Mr. Hewitt:

Schlumberger began logging operations at Tunalik River #1 at 2015 hours on January 24, 1979 and finally finished DLL-MSFL, CNL/FDC, BHC, dipmeter and sidewall cores at 0730 on January 27, 1979. The elapsed time includes 24 hours for a round trip to condition gassy mud. Approximately 10 hours of lost rig-time were caused by tool failure. The logs as obtained are of acceptable quality and 43 of 45 sidewall cores were recovered.

The only formation top was the Torok which was tentatively put at 6015 and was identified from examination of ditch samples. Log responses indicate the possible presence of numerous coal streaks from the casing to about 3500 feet. Five zones totalling 24 feet of sand appear to contain gas although the water saturations are high (55% to 75%), except for one interval 8106-8110 in which Sw is 42%. These quantitative values were computed using an Rw of 0.1 calculated from the positive SP in the shallow (5600) sand and assuming Rw=Rmf=0.08 in the deeper zones. This assumption is based on the fact that the SP is a straight line through the sand intervals and is our only means of estimating Rw.

Engineers on this job were Andy Chaffy and Tom Bruckman who did a creditable job locating and overcoming their several equipment failures and were most cooperative in keeping us informed of their problems.

Very truly yours,

Armour Kane

Mr. Armour Kane

AK/ pab

Log Analysis

COMPANY: HUSKY OIL/NPR OPERATIONS, INC.

WELL: TUNALIK RIVER No 1

FIELD: NORTH SLOPE

COUNTY:

STATE: ALASKA

DEPTH	R_T	ϕ_D	ϕ_N	ΔT	ϕ_S	S_W							REMARKS
5666-74	9	14	22	75	15	75		R_W	0.1				
7966-71	11	15	27	77	16	57		R_W	0.08				
7974-78	18	12	27	75	15	55		"	"				
8106-10	20	15	20	70	11	42		"	"				
8110-13	18	9	21	77	12	74		"	"				

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Formation Evaluation

RUN #4
8298-12,374'

June 6, 1979

Mr. S. L. Hewitt
Husky Oil/NPR Operations, Inc.
2525 C Street
Anchorage, Ak 99503

Dear Mr. Hewitt:

Schlumberger began logging operations on Tunalik Test Well No. 1 on May 31, 1979, at 0230 hours and finished DLL, CNL/FDC, BHC, HRD, Birdwell Velocity Survey and sidewall cores at 0930, June 1, 1979, a total of 31 hours. All logs were of good quality but about two hours of lost rig time were incurred by the failure of an electronic component in the BHC. The engineer recognized the trouble immediately, pulled out of the hole, changed tools and ran a good log. 45 sidewall cores were selected but only 13 were recovered due to the gun being completely covered and packed with lost circulation material from the mud column. Since there was no way of overcoming the problem it was decided not to run another gun.

Correlations with Kugrua, Peard Bay and South Meade wells were very good with the Pebble Shale found in Tunalik at 10,632, Kuparuk River Sand at 10,902 and Kingak at 11,460.

In two intervals, 11,440-50 and 11,517-19, the CNL/FDC response indicated the presence of some gas. Cross-plot porosity in the upper zone is about 10% and Rt averaged at 60 ohm-meters; in the lower zone Rt is 30 ohm-meters and ϕ about 12%. In making quantitative computations Rw was assumed to be the same as R_{mf} (0.15) since the SP is practically a straight line. Based on this assumption, which may or may not be valid but is the only way to approximate Rw, water saturation in both zones is in the 50-55% range. While the sonic response is not the classic "reversal" for a gas sand, it does confirm the porosity values from the CNL/FDC. No other zones of interest were encountered.

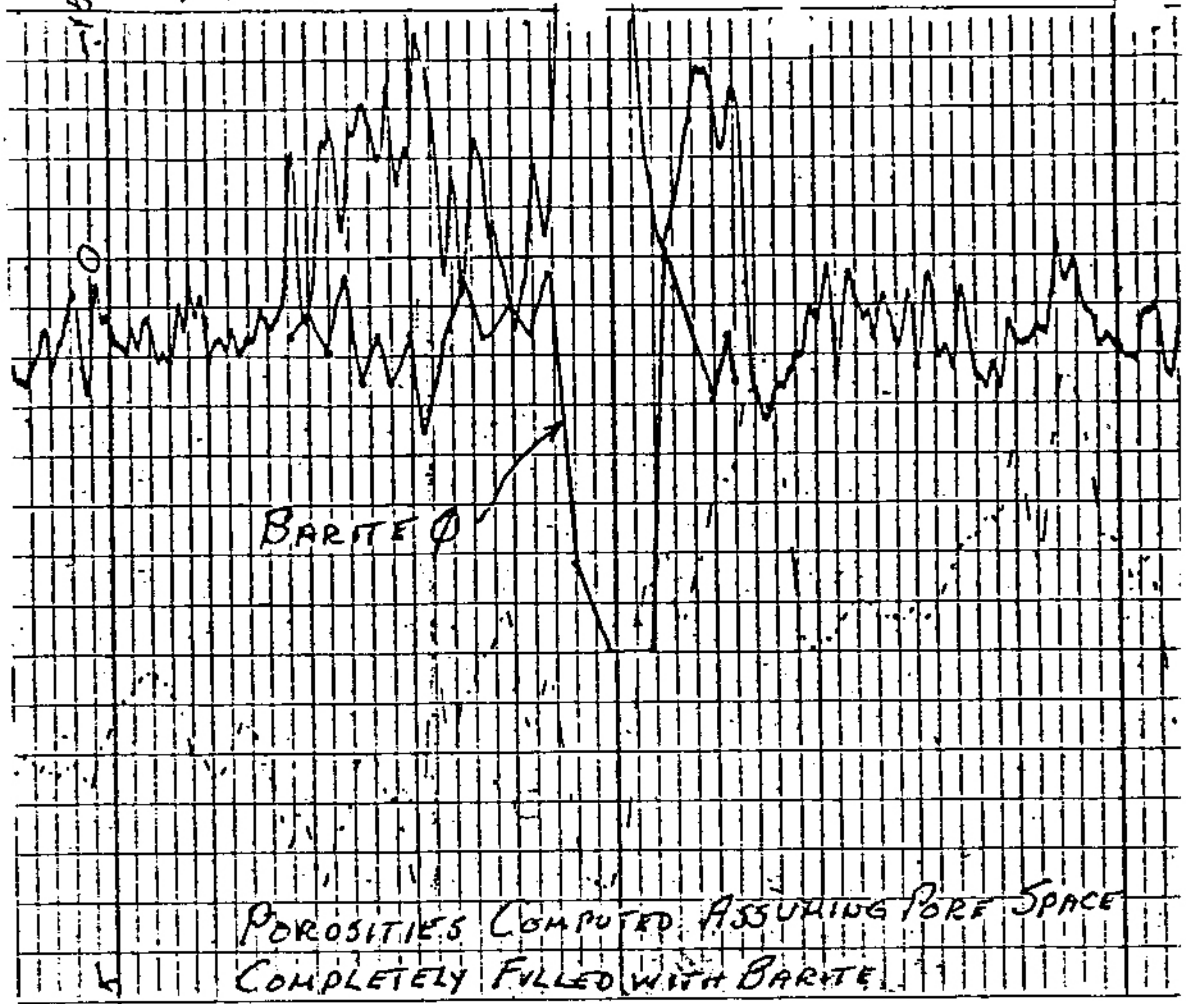
Engineers Tom Bruckman and Dave Barnes are to be commended for a very efficient job and highly cooperative attitude.

Very truly yours,

A. Kane

A. Kane

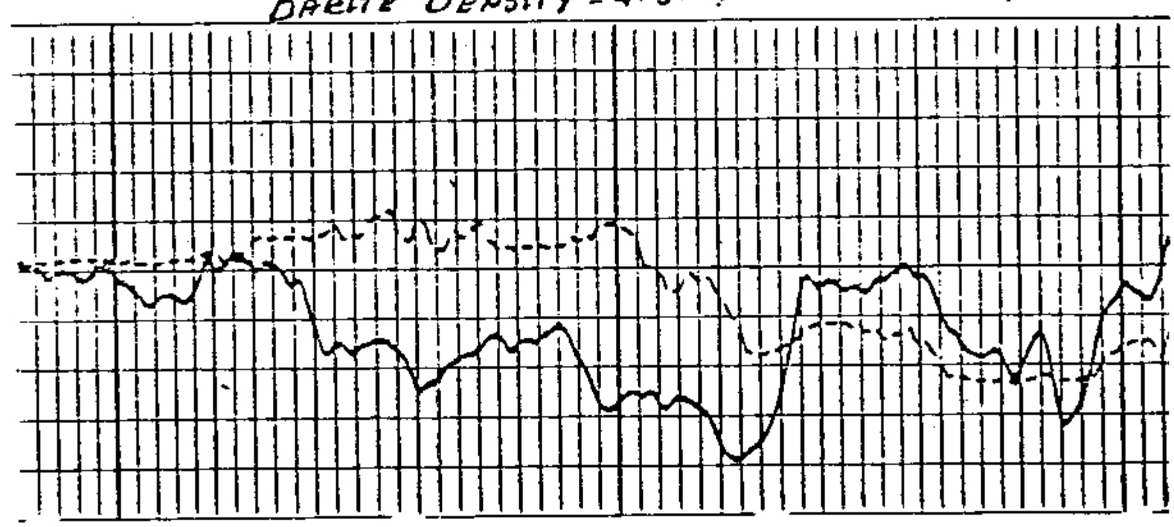
TUNALIK



$$\phi = \frac{2.65 - \rho_B}{2.65 - 4.5}$$

12500 12600

BARITE DENSITY = 4.5



TUNALIK Ø Calc for Barite

Log Analysis

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Formation Evaluation

RUN #6
12,385-14,729'

August 6, 1979

Mr. S. L. Hewitt
Husky Oil/NPR Operations, Inc.
2525 C Street
Anchorage, Ak. 99503

Dear Mr. Hewitt:

Logging operations at Tunalik Test Well No. 1 were begun at 2000 hours on July 26, 1979, and were not completed until 0400 hours on July 31. This total time of 104 hours includes 72 hours of clean-out runs incurred by the extremely rugose and washed out bore hole and the 18.3 pound mud which caused Schlumberger trouble in getting to bottom and which frequently stuck their tools for short periods of time. Finally, DIL, CNL/FDC, BHC, HRD and Velocity Surveys were completed, and, considering the hole conditions, all logs were of good quality except for a few non-critical cycle skips on the BHC. The Schlumberger crews, engineers Bond and Chaffey, are to be commended for their persistent and successful efforts to get to bottom and back out again.

Top of the Shublik was found at 14,350 and correlated well with the Kugrua Well.

No potentially productive zones were seen on the logs. The sands from 12,500 to 12,600 which apparently caused the gas problem have been deeply invaded and obviously contain large amounts of barite within the pore space. I understand that when circulation was lost in this interval, a few hours later the hole would start making mud, but the returning mud was some two pounds lighter than the original. This would indicate that the barite had been "strained" out and left behind which is confirmed by the very high bulk density values of 2.85 to 3.1 g/cc. The bulk density of barite is 4.5 g/cc. An approximation of porosity can be made by substituting the barite density for fluid density in the porosity equation. This assumes the pore space is completely filled with barite which, of course, is not a valid assumption since some fluid must remain in the pores. However, the computations do result in a porosity "index" which is of some value. Attached is a porosity curve calculated using the bulk density of barite in the equation.

Very truly yours,

A. Kane

A. Kane

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November 13, 1979

Mr. S. L. Hewitt
Husky Oil/NPR Operations, Inc.
2525 C Street
Anchorage, Ak 99503

Dear Mr. Hewitt:

Schlumberger began logging operations on Tunalik Test Well No. 1 at 1700 hours on November 3, 1979, and finished DIL at 2030 hours of the same day. Log quality was very good. They began CNL/FDC at 2100 hours and logged up to 15,560 feet when the weak point in the head parted and the tool was dropped at 2300 hours. The first fishing trip failed and on the second attempt the tool was pushed to bottom and engaged in the overshot surfacing at 2230 hours on November 4. The remainder of the CNL/FDC was begun at 2300 hours November 4 and was completed with the BHC at 0630 hours November 5. Log quality of the CNL/FDC was satisfactory except for a peculiar anomaly on the density log from 14,980-15,150 where bulk density was 2.2 g/cc and the correction curve read -0.20. The BHC was very noisy with many "spikes" and skips possibly due to the sonde dragging on the ha rd, rough, deviated bore hole wall. Numerous tight spots and hard pulls were encountered on the run.

A wiper run was begun at 0730 hours November 5 and was completed at 0330 hours November 6 after which the first temperature log began at 0430 hours November 6. An "O" ring failure was experienced at the casing shoe, was replaced and the survey was continued but the tool stopped at 15,485 and the attempt was finished at 1215 November 6. The HRD was begun at 1300 hours and went to bottom all right but the hole was very bad, grabbing the tool some 25 times. Hole deviation went from 8° to 18° in a few hundred feet. The second temperature survey was then attempted but the tool stopped at 14,772. Birdwell's velocity survey was then begun at 2300 hours November 6 and finished at 0900 hours November 7 after having shorting problems on their tools.

No zones of interest were found and the Sadlerochit was at 14,820, Kavik at 15,560, Echooka at 16,890, Lisburne at 17,100 and volcanics at 17,563. Correlations were good with the Kugrua well.

NOTED
NOV 26 1979
GRYC

Very truly yours,

A. Kane

Armour Kane

RECEIVED
NOV 23 1979
ONPRA
MENLO PARK

Log Analysis

ARMOUR KANE

Formation Evaluation

Well Log Analyst
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January 3, 1980

Mr. S. L. Hewitt
Husky Oil/NPR Operations, Inc.
2525 C Street
Anchorage, Ak 99503

Dear Mr. Hewitt:

Logging operations were begun at Tunalik Test Well No. 1 by Schlumberger at 1400 hours on December 22, 1979, with the sonic log but a bridge was encountered at 15,200 feet. While trying to get through the bridge the weak point broke, just as it did on the previous run in November, and the tools were left in the hole. Waited for fishing tools from Dead Horse and began the fishing run at 2400 hours, December 22, but the driller lost count of the number of stands and had to pull out and re-strap. The fish was engaged in the early morning hours of December 24 and was recovered at 0500 on December 25. A clean-out and mud conditioning run was begun at 0830 hours and was finished at 2200 hours on December 26.

Schlumberger re-entered the hole with the DIL at 2300 hours, December 26 and finished at 0300 on December 27. The log was of poor quality due partly to a bad hole, high temperature and some engineer error. The heat, which reached 371° during the DIL run, burned out first the IL_D, then the IL_m and the gamma ray. The BHC was run next at about 0500 hours and completed at 1000 hours December 27. Again, the log was of poor quality due to the temperature which had reached 405° and burned out another gamma ray. The log was quite valid for the most part but was very hashy in a number of intervals but repeated the hashiness encountered in the previous run in November. Travel times were extremely fast ranging from 47-60 microseconds per foot indicating very hard formation. Birdwell's velocity survey was successfully completed but on the way out of the hole their tool stuck below 15,000 feet, the cable was pulled off, the fishing attempt was unsuccessful and the tool was left in the hole.

No zones of interest were seen and the base of the volcanics appeared to be at 18,278 feet. Incidentally, the bottom hole temperature on the Birdwell run was still at 405°.

Very truly yours,

Armour Kane

Armour Kane