

AUG 30 1994



## Inter-Department Correspondence

TO Steve P Martin August 29, 1994  
Bill Hofer DATE

FROM C.E. Konen *CEK*

SUBJECT Logging Operations: APC Youngren "J" 1-H, Stevens County, Kansas

## SUMMARY

Logging operations were observed on the Youngren "J" 1-H during the period of Aug. 9-12, 1994. The comprehensive logging program was intended to meet multiple objectives in this evaluation well. The well is relatively unique in that approximately 400 feet of core is available for evaluation and comparison with log data in the Chase Group. The objectives of the program were:

1. Evaluate the quick-look potential of micro-resistivity/deep resistivity for detection of hydrocarbons.
2. Evaluate the potential of the new IPL log for the evaluation of the productive formations, and compare with previous methods of evaluation.
3. Compare the results of competing "imaging" systems (FMI vs CBIL) with core and each other for fracture detection and thin bed resolution.
4. Determine the optimum logging program required to detect/evaluate the presence of the productive formations in future wells.

## CONCLUSION

Logging operations were delayed because of the presence of cuttings and hole instability prior to logging. The use of gelled water to minimize fluid loss in this formation was unsatisfactory, and is believed to be responsible for the differential sticking of the logging tool and the resulting bridge in the borehole.

An excellent data set has been obtained to evaluate the use of logs for formation evaluation in the Chase Group. The combination of logs, core, and selective formation tests will allow the determination of the best methods to evaluate these formations for productive potential. A significant amount of effort remains to fully evaluate the acquired information.

## RECOMMENDATION

Mud should be circulated in the borehole to remove solids and stabilize the drilled formations prior to logging.

The data acquired on the remaining evaluation wells in the Hugoton field should be similar to this well and the previously drilled Cornell "C" 1-H. These data sets are unique in their completeness, and add validity to subsequent computer models of reservoir performance. In addition, it is believed that significant savings will result from the development of tools for evaluation and formation stimulation.

## DISCUSSION

### Logging Operations

The logs recorded were the Schlumberger Array Induction, Dipole Sonic, Compensated Neutron/Litho-Density/Microlog, Integrated Porosity Lithology(IPL) log(Spectral Gamma Ray, Accelerator Neutron Porosity, Litho- Density), Dual Laterolog-MSFL, Formation Micro-Imager, and an experimental Micro-SP Imager. Atlas Wireline recorded the Circumferential Borehole Imaging Log(CBIL). NUMAR attempted to record the latest version of the Nuclear Magnetic log, but the tool failed during descent. The chronology of the wireline operations are shown in Table 1.

The operation was relatively uneventful except for the problems with hole conditions prior to adding drilling mud to the borehole, and the delays associated with NUMAR. The Array Induction was stuck in the borehole for nearly 1.5 hours before the tool came free on the initial descent of the Array Induction. After mud and lost circulation material was added to the borehole, a bridge of nearly 100 feet was encountered at approximately 2900 feet. No problems were encountered after reaching total depth at 3230 feet.

The delays associated with NUMAR are partially due to the release of the logging equipment when hole conditions developed and an actual logging time became uncertain. The original time estimates were erroneous because the other client advised that their hole was ready to log, and only 1500 feet was to be surveyed; however, it developed that the other well was not ready, and the survey interval was increased to 5000 feet. Compensation for rig time has been negotiated with NUMAR.

### Quick Look Analysis

The productive formations are characterized by absence of significant quantities of shale, varying porosity, and multiple mineral lithology(i.e. quartz, anhydrite, lime and dolomite). These combinations prevent reliable, routine "ohmology" (i.e. high vs low resistivity)for the detection of productive intervals(i.e. resistivity variation may be related to varying porosity as well as the presence of hydrocarbons or water).

The combination of shallow holes, complicated lithology and large numbers of well completions require the development of a reliable method of quick evaluation. A proven method is the concept of movable hydrocarbons. Movable hydrocarbons involves the comparison of a micro-resistivity and deep resistivity device, after adjustment for the difference in the resistivities of the mud filtrate and formation water. The technique only requires the presence of permeable intervals.

A second approach to quick-look analysis is to obtain reliable indications of porosity for a direct comparison with deep resistivity logs. An increase in porosity and a corresponding increase in resistivity implies a change in water saturation; hence, the presence of hydrocarbons.

A third approach for defining productive intervals is the NUMAR Magnetic Resonance Imaging log; however, this device failed during descent into this well.

#### Integrated Porosity Lithology Log(IPL)

The Integrated Porosity Lithology log consists of a new spectral gamma ray, accelerator neutron porosity and a new density system. The most significant change has occurred in the new neutron log(APS) portion of the instrument.

The accelerator neutron porosity is an epithermal neutron measurement which means a minimal influence from formation lithology components as compared to the convention compensated neutron(CNT). This characteristic is both good and bad. The log porosity is minimally influenced by formation components and provides a good approximation of porosity directly except when gas is present. Thus, a basis for quick look analysis exists(i.e. porosity vs resistivity). The downside is that the measurement provides minimal lithological information about the formation(e.g. shale, sand, lime dolomite etc.). Lithological information is derived almost exclusively from the density log data, and gamma ray information with this new system.

The IPL system is very new and we have negligible experience with the instrument. As a result we are attempting to gain familiarity with both the system and its interpretation. The presence of all of the core on this well, in addition to the Cornell "C" 1-H, affords an excellent opportunity to evaluate the accuracy and limitations of the measurement.

#### Imaging Logs

The Schlumberger FMI and Atlas Wireline CBIL logs were recorded on this well. The Schlumberger UBI was unavailable. Imaging logs consist of two types: conductivity and acoustic. These devices are marketed as if one replaces the other; however, the devices are complimentary.

The Schlumberger conductivity device is the Formation Micro Imager(FMI), and the acoustic device(borehole televiewer) is the Ultrasonic Borehole Imager(UBI). The equivalent acoustic devices for Atlas Wireline and Halliburton are the Circumferential

Borehole Imaging Log(CBIL), and Circumferential Acoustic Scanning Tool(CAST) respectively.

Numerous discussions have occurred regarding the applicability of each of these devices for the definition of bed boundaries and fractures. The Youngren well afforded the opportunity to study the resolution of this devices in conjunction with significant core data. The cores indicated very little fracturing, and similar results were observed on the imaging logs; however, additional processing will be required to fully evaluate the differences in the data.

An experimental Micro-SP Imager was recorded also, but Schlumberger has not provided a final product. Field observations indicated that the FMI and CBIL were both superior to the new device.

Dipole Shear Sonic Imager

The Dipole Shear Sonic Imager(DSI) was recorded to provide information for use in the preparation for the fracture stimulation. Shear transit time allows the calculation of Poisson's ratio for use in the FRAC HITE computer program. The principal advantage of the DSI is the direct measurement of shear transit time rather than relying upon correlation's with the Stonely wave. This device can also be used in computer programs to assist in the calculation of formation lithology.

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Table 1: Logging Operations Anadarko Youngren "J" 1-H (8/9/94-8/12/94)

<u>DATE</u>	<u>TIME</u>	<u>REMARKS</u>
8-9-94	0645	Arrive location, SWS present
	0830	Receive call from NUMAR. Logging equipment in Liberal. Advised that we would be ready August 10 at 0500 AM
	1030-1330	Log with AIT. AIT tool stuck @ 2880 feet, work cable and pull AIT tool free at 1305 hours. Log to casing shoe at 2433 feet. Examine AIT at surface. No apparent damage to standoffs, centralizers or tool.
	1330-2030	Change mud system and blowout preventers.
	2030	Received call from NUMAR. They have another job in east Texas waiting and ready to log 1500 feet. Expect to return in 24-30 hours. NUMAR released.
	2030-2340	Trip into hole with drill pipe. Hit bridge at 2920 feet. Drill and circulate to 3230 feet.
8-10-94	0100	Trip out of hole with drill pipe.
	0205-0340	Rig up to log with AIT
	0340-0820	Record GR/CNL/LDT . Three high resolution passes over interval
	0820-1215	Record Dipole Sonic
	1215-1500	Record DLL-MSFL(DST)
	1500-2345	Record Integrated Porosity Log(IPL)
8-11-94	0010-0230	Record Formation Micro Imager(FMI)
	0230-0505	Record experimental Micro SP Imager(MSP)
	0530	Schlumberger finished
	0530-1000	Record Atlas Circumferential Borehole Image Log(CBIL)
	1000-2400	Waiting on NUMAR
8-12-94	0100	NUMAR arrives location
	0100-0200	Trip out of hole with drill pipe
	0200-0240	Attempt to connect NUMAR logging unit to Schlumberger cable without success.
	0240-0600	Release SWS unit to travel to Liberal shop to obtain modifications to allow use of NUMAR logging tool, and return location.
	0600-0725	Check out wiring modifications and tool operation.
	0745-0900	NUMAR tool fails at 400 feet during descent into borehole. Come out of hole to check wiring and tool performance.
	0900	Operation canceled.