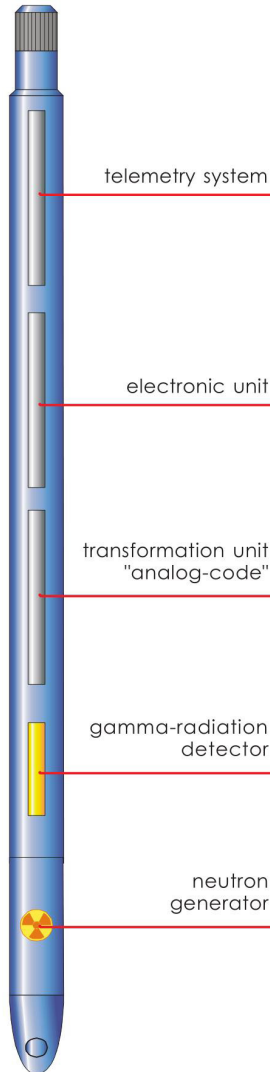


Cased hole

TzSP-C/O-90* Downhole digital carbon-oxygen logging tool



is designed for quick oil saturation estimating and rock ultimate composition due to multichannel registration of inelastic scattering/radiative capture energy spectra but also due to recording an additional time spectrum of induced gamma-ray integral flux within fast neutron pulses interval.

For quantity reduction of round-trip operations and simultaneous recording of several parameters, TzSP-O/C-90 tool can be produced as an integrated tool with the TzSP-GK-S-90 digital downhole gamma-ray spectrometry tool (100 mm diameter in complex) and also be completed with a thermometry channel.

Downhole tool is to be run with the log recorder Hector, Vulcan V3 and with tree-core cable.

SPECIFICATIONS

Terrigenous reservoir oil saturation KH measurements range, %	10-100
Basic relative error limits of KH measurements under normal conditions, %	±7
Scintillation detector BGO (bismuth germanate) size, mm	50x150; 50x120; 50x100
Cs-137 line resolution, %	up to 12
Neutron generation frequency, kHz	10
Tool power supply, V	200
Time analyzer bandwidth, microsec	2.0
Width of the window time analyzer, ms	2
Number of registratable energy spectrum and channels in the spectrum	3x512
Number of registratable time spectrum and channels in the spectrum	1x50
«Dead» time of measuring channel, ms, up to	up to 3
Data transmission rate (through logging cable), kbaud	42
Tool retrieving speed, m/h	50-70
Max. operational temperature, °C	120
Max. hydrostatic pressure, MPa	60
Tool dimensions, mm:	
- diameter	100
- length	3200
Weight, kg	50

* The TzSP-C/O-90 tool is certified

FEATURES AND ADVANTAGES

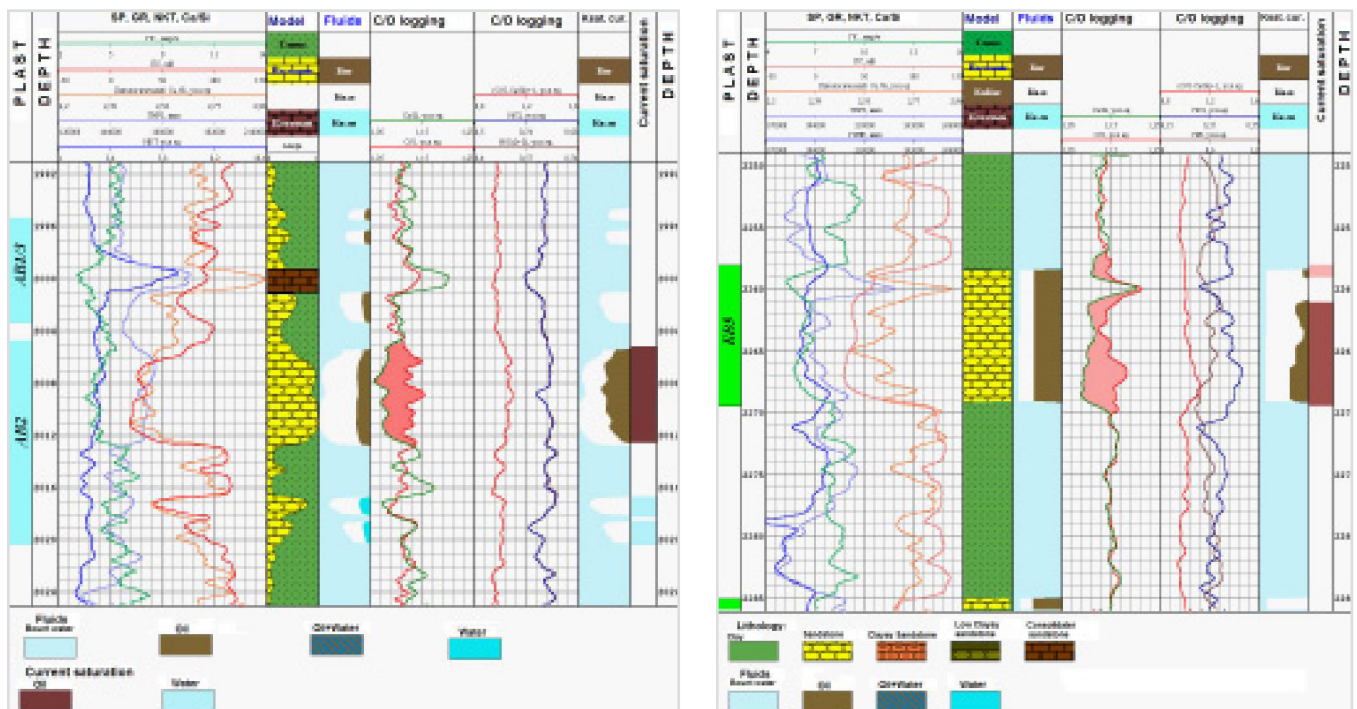
- simultaneously-consecutive registration of 3 energy spectrums according to 512 quantization signal levels according to amplitude and summary gamma-radiation temporal spectrum according to 50 channels;
- the use of high-frequency impulsive (10 khz) fast neutron ING-06 radiator of increased power (more 108 n/sec) and operation resource more 200 hours;
- technological program package for measurements process control and application program package for primary C/O logging data processing

APPLICATION FIELD

Estimation of oil-and-gas saturation coefficient on value of the relative amplitude of C/O and Ca/Si anomalies taking into account layers lithology, neutron and effective porosity of the investigated collectors.

Measurement of inelastic scattering gamma-ray, radiation capture gamma-ray and epithermal neutron spacetime and energy distributions provides the principle conditions for calculating of partial contributions from the basic oil-, water- and rock-forming element nuclei (C, O, H, Si, Ca, Fe, Cl, etc.) as well as for calculating different relations associated by the correlation dependences with the filtration-capacity parameters, rock lithology and fluids (oil, water) which saturates them.

Examples of oil-saturated reservoir identifying by C/O logging diagrams



Case Study No.1

Search for Oil-saturated Intervals Using Hardware-Software System of Pulsed Neutron Spectrometry and Spectral Gamma-ray Logging

Challenge

As part of oil zones search in a prospecting and appraisal well in the West Siberian region of Russia, the reservoir properties of terrigenous deposits behind a 7-inch casing had to be evaluated. In addition, the operator needed to correct lithological model and determine an extended elemental composition for saturation analysis in potential reservoirs. The client made a request to perform a standard pulsed neutron spectrometry and spectral gamma ray logging service to locate and comprehensively evaluate the reservoirs behind the casing. The evaluation was to be completed in one trip. The client provided the openhole log data required to make a conclusion: neutron, induction and lateral logs.

Solution

System of pulsed neutron spectrometry (TsSP-INGK-S) and spectral gamma-ray logging was applied to display average values of current oil saturation at a given depth interval. Then a continuous lithological model was built from deep logs and a quantitative estimation of oil saturation within the reservoir was made.

Results

1. According to data processing, 2 oil-saturated intervals (1 and 1.5 m thick) were identified. At the bottom of open hole, according to the methods of EL, Sonic Log, DensityLog, these intervals are water-saturated.
2. The operator decided to perform additional perforation of these intervals. The result was oil flowing.

Advantages

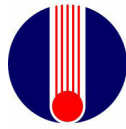
- Determination of current oil saturation in one trip
- Rapid, accurate result for targeted extraction

Key Benefits

- Quickly, accurately, clearly and completely detects reservoirs
- Evaluates oil saturation in low-porosity formations through the casing
- Calculates spectral ratios, elemental composition of the matrix and liquid, and uranium, thorium, and potassium content

Location: Russia, West Siberian province

Well type: prospecting and appraisal



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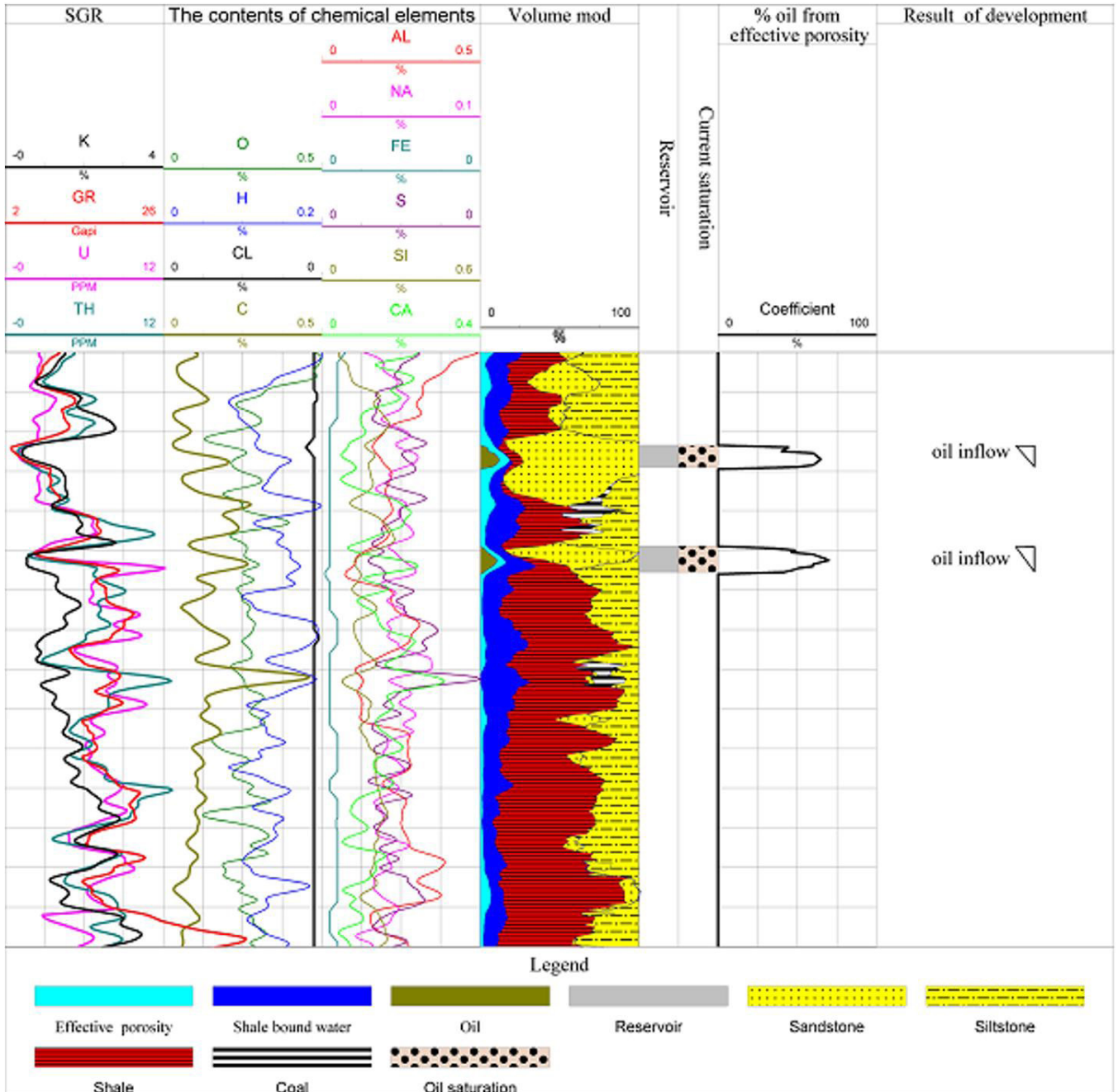
DEVELOPMENT

TECHNOLOGY

WELLS METHODS

PURPOSES

ACHIEVEMENTS



The fourth track shows the lithologic model based on the logging results. The elemental composition is calculated from spectral analysis of the data and used to build the lithologic model represented above.

Tracks 5-7 show reservoir intervals, saturation (The nature of current saturation was determined based on the Client requirements for conditional gradations of effective porosity (n_e) in pore space volume), average values of current oil saturation.

Track 8 is the final formation properties confirmed by perforation.



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