DEEP WATER

CASE STUDY

Top of Cement Identification in Deepwater Well Supports Cement Lift Pressure Calculations

XBAT™ SERVICE ACCURATELY DETERMINES TOP OF CEMENT BY RECORDING AND ANALYZING RAW WAVEFORM DATA

GULF OF MEXICO

CHALLENGE

- Accurately identify TOC in deepwater drilling operation
- Eliminate significant mud losses typically observed while running, cementing, and displacing the plug during a 13⅝-in. intermediate casing string

SOLUTION

- XBAT™ azimuthal sonic and ultrasonic LWD service, programmed for openhole logging applications, to acquire waveform data for predicting accurate TOC

RESULTS

- Successfully confirmed TOC depth through raw waveform data supporting calculations based on cement lift pressure
- Confirm TOC from memory analysis

OVERVIEW

While drilling wells in the relatively young formations of the deepwater Gulf of Mexico (GOM), zonal isolation of the intermediate casing strings can be a major challenge. When mud losses are observed in the weaker formations during cementing, there can be uncertainty as to the placement of cement, with top of cement (TOC) estimated using the cementing lift pressures. Acoustic logging-while-drilling (LWD) tools can be used to provide an assessment of TOC while tripping in hole to drill out cement ahead of the next hole section by analyzing the raw waveforms, which can show the contrast of free-ringing casing and casing that is bonded to the formation.

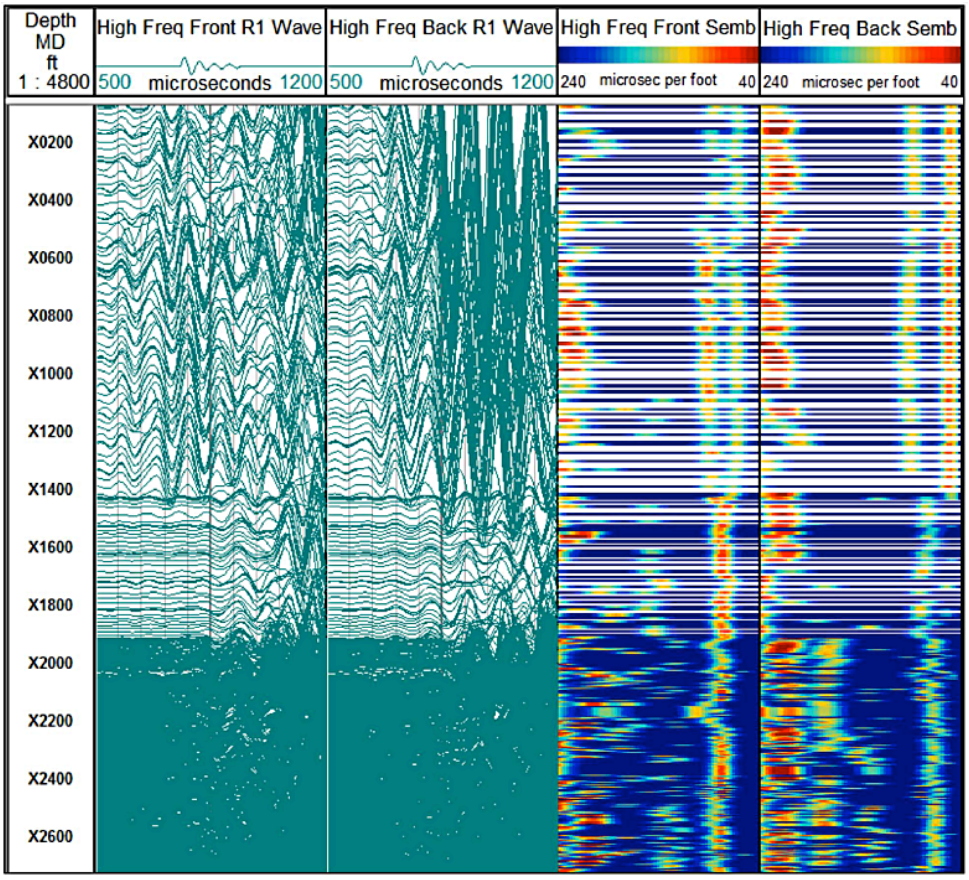
XBAT™ SERVICE IDENTIFIES TOC IN WEAK FORMATIONS, REDUCING WELL TIME

Running, cementing and displacing the plug of a 13⅝-inch intermediate casing job on a deepwater GOM well, the operator observed significant mud losses at each stage of the operation. While the planned lift pressure was 700 psi, the observed final differential pressure of 650 psi put the calculated TOC at X1,430 feet.

The XBAT azimuthal sonic and ultrasonic LWD service was included in the bottomhole assembly (BHA) and was programmed to perform real-time pore pressure analysis and seismic tie-in. While tripping in hole, waveform data inside the 13⅝-inch casing were recorded and analyzed once the tool was at surface.

WAVEFORMS AND CASING ARRIVAL ANALYSIS CONFIRM TOC

The TOC analysis plot on the next page illustrates the downloaded acoustic data, while tripping in hole shows the raw waveform data during the high-frequency monopole firing for the receivers nearest to the transmitter, and the processed semblances using the waveforms from all of the receivers. A change in the waveforms is clearly seen at approximately X1,420 feet—representing the TOC. Despite the depth resolution being limited by the 12-second sample rate and the fact that regular tripping speeds were used, the TOC analysis from the XBAT service supported the calculations made from the final differential pressure. This confirmation clearly supports the potential value of using the XBAT service in future applications to identify TOC, especially if the tool is programmed specifically for the application, and trip-in or trip-out speeds are selected to optimize depth resolution.



The TOC analysis plot shows raw memory waveforms acquired during a trip-in hole pass. The clear contrast observed at approximately X1,420 feet on the front and back raw waveform tracks is interpreted as the TOC.

This case study includes data from a technical paper prepared for presentation at the SPE/IADC Drilling Conference and Exhibition held in The Hague, The Netherlands, March 14–16, 2017.

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