

Litho Scanner Service's Accurate TOC Determination for Unconventional Reservoirs

Stand-alone TOC output from new high-definition spectroscopy service

CHALLENGE

Determine total organic carbon (TOC) to define reservoir quality in unconventional plays.

SOLUTION

Run Litho Scanner* high-definition spectroscopy service to directly and accurately determine TOC without introducing variability from other logging services and laboratory analyses.

RESULTS

Accurately and quantitatively determined the TOC weight fraction for numerous organic-rich shale formations in both water- and oil-base muds, as confirmed by measurements on core samples.

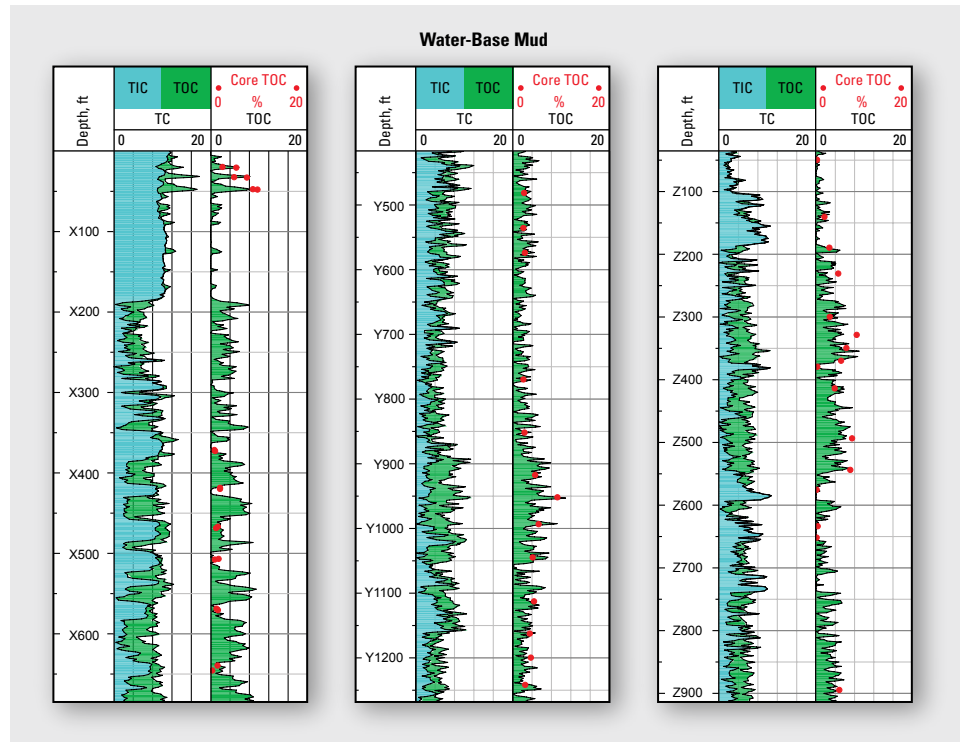
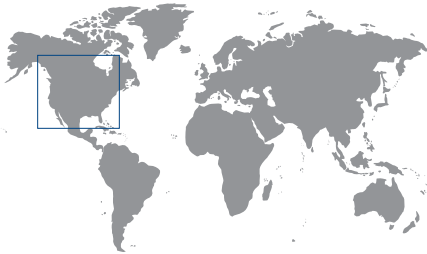
Inconsistent answers in organic-rich formations

Until now, TOC has been determined by using a complex model that requires multiple measurements from different logging and laboratory services. However, the variety of methodologies employed means that interpreters easily come up with different results. This uncontrolled variability in the interpreted results introduces significant ambiguity for one of the most important parameters in defining reservoir quality for unconventional plays.

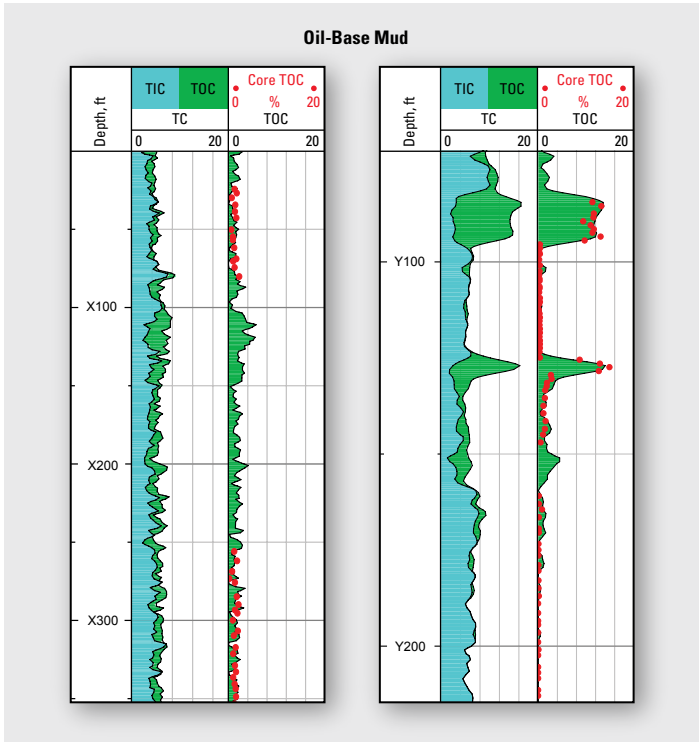
Accurate, quantitative TOC

New Litho Scanner high-definition spectroscopy service revolutionizes gamma ray spectroscopy to enable the detailed description of complex reservoirs. In addition to measuring key elements in a wide variety of rock formations with higher precision and accuracy than previously possible, Litho Scanner service provides a stand-alone quantitative determination of TOC, independent of the environment and the reservoir.

The Litho Scanner service's TOC output is based solely on the tool's direct measurements of both the carbon elemental concentration and accurate quantification of the carbonate minerals in the formation, which determines the carbon content associated with those minerals. The difference between the two is the TOC presented as a continuous log, available at the wellsite instead of waiting for laboratory core analysis.



The accuracy of Litho Scanner service's TOC logs is verified by close agreement with TOC measured from core from different North American shale plays. For each well, the first track shows the total carbon (TC, black curve) derived from the inelastic measurement and the total inorganic carbon (TIC, shaded blue) computed from carbonate minerals using capture spectroscopy elements. The separation between the two curves is the TOC (shaded green), which is repeated in the second track with core data (red) for validation.



Logging by Litho Scanner service accounts for the carbon in the borehole from oil-base mud to accurately determine TOC in these North American shale plays. Core data (red) in the second track of each log validates Litho Scanner service's TOC determination.

Shale TOC in oil- and water-base muds

In both oil- and water-base muds, TOC logs from Litho Scanner service consistently agree well with TOC measured from cores from different shale basins across North America. In oil-base muds, Litho Scanner service avoids biasing the TOC determination by accounting for the contribution to the carbon signal from oil in the borehole.