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Technical Category 06 - New Advances in Geological Technology

Use of Real-Time Elemental Chemostratigraphy in Highly-Deviated Wells: Improved Wellbore Positioning and Identification of Sub-seismic Structural Features

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Elemental chemostratigraphy uses whole-rock inorganic geochemistry to characterize and differentiate sedimentary units in both silicilastic and carbonate reservoirs. A high-resolution laboratory chemostratigraphy study of the Middle Cretaceous Wara and Burgan Formations from three cored wells in Minagish Field, Kuwait, established a robust zonation that improved existing petrophysical-log correlations. These results were used to apply chemostratigraphy in real time for improved borehole positioning while drilling, via laser-induced breakdown spectroscopy (LIBS), a portable technology for rapidly measuring elemental abundances from cuttings. When integrated with a dynamic earth model generated from LWD data, wellsite chemostratigraphy proved to be a powerful tool for monitoring ("geomonitoring") and optimizing ("chemosteering") wellbore position in two highly-deviated wells drilled in Minagish Field in 2006.

Analysis of cuttings samples at an approximate 10-foot collection interval allowed precise identification of the stratigraphic position of the wellbore in the Wara Formation as it approached entry into the prime reservoir unit in the Burgan Formation. A geochemically-derived gamma response from LIBS analysis of cuttings was continuously compared to the LWD gamma curve to insure interval sample representivity. Chemostratigraphic identification of sub-seismic faults and their sense of stratigraphic offset was important for two reasons: (1) the well path required adjustment to ensure placement of the 12¼" casing within the reservoir "sweet spot" prior to drilling the 8½" horizontal drain, and (2) faults close to the wellbore entry point into the reservoir were required to be cased off, as they could have acted as potential conduits for early water invasion.

Another high-resolution chemostratigraphy study on four cored wells from the Lower Cretaceous Minagish Oolite was used as the basis for additional wellsite chemostratigraphy work. In addition to aiding in wellbore positioning, elemental data was used to identify the presence of tar mats in the Oolite reservoir while drilling deviated wells in Minagish Field.

Simon Hughes is a Senior Geoscientist with Halliburton – Sperry Drilling Services, and provides global support for their wellsite chemostratigraphy services. He has been involved in the research and development of this new technology, and its application on some 35 wells worldwide in the last six years.

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