GEOLOGY POSTER 26

# CONTINUOUS ISOTOPE LOGGING IN REAL TIME WHILE DRILLING

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Stable carbon isotope (δ13C) values for light hydrocarbons (HC) are routinely used to characterise both the geochemical and geological systems encountered in the sub-surface; providing information on the HC source, thermal maturity and the occurrence of in-reservoir secondary processes (Whiticar, 1994) . Until now δ13C ratios of light HC's are obtained from spot samples collected at the well site (Isotubes, gas bags, Vaccutainers, etc.) and analyzed off line. Depending on the geographic location of the well the reporting of gas isotope data might occur either weeks or months after samples are collected. In the latter instance the usefulness of the data for field development decisions is significantly reduced. Recent improvements in mud logging techniques now provide a tool for the continuous logging of methane (C1) stable carbon isotope values in real time while drilling. Such data provides a much higher vertical resolution with measurements every second with a typical accuracy of ±1‰. It is anticipated that δ13C measurements of ethane (C2) and propane (C3), as well as δD-C1 in real time will follow in the near future.

Geoservices Isotope Logging is coupled with the Geoservices FLAIR system that provides quantitative analyses of C1 to C5 (HC's from formation) and semi-quantitative analyses of HC's up to octane and light aromatics (Breviere et al., 2002; McKinney et al., 2007) in order to enhance the interpretational potential of stable isotope values .

The extraction of gaseous HC's from the drilling fluid takes



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place as close to the bell nipple as possible under fully controlled conditions, including stable mud and air flows, stable temperature and stable pressure. The compositional analysis (FLAIR) is performed with a gas chromatograph-mass spectrometer (GC-MS), whereas the isotopic analysis is performed simultaneously by near infrared absorption spectroscopy. The application of this technology on a drilling site is new and field tests have shown that this technology is extremely robust and stable and performs well under the harsh conditions on an offshore drilling site.

Field tests have been performed throughout the world in order to test performance for different geological systems and especially different drilling conditions (encompassing variations for both oil and water based drilling muds, as well as differences in drill bit types). Results were compared with both Isotube data and WFT/DST gas samples. Comparison of Isotube and WFT/DST data revealed a good match, within the accuracy limitations of the Isotope Logging equipment.

Further comparison indicated that the continuous character of Isotope Logging data reveals a much higher variability and complexity of δ13C-C1 depth profiles than previously observed with Isotube or Vaccutainer samples. These latter samples are only spot samples with an insufficient depth resolution to detect small scale variations and features. The high resolution of Isotope Logging real time data provides the means for in depth analysis of encountered fluids and their geological habitat, but also represents an interpretational challenge.

Isotope Logging was successfully applied to delineate reservoir connectivity and compartmentalization, provided information about possible biodegradation processes within an oil-column and provided successfully real time information to decipher the nature of HC's encountered in the subsurface. This presentation will provide an overview about this new well site service and discusses case studies focussing on reservoir compartmentalization and fluid separation based on δ13C-C1 where compositional data are inconclusive.

## REFERENCES

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