Case Study: Identification of H_2S in tight carbonates

H_2S analysis from cuttings and core chips prior to drilling production wells

GEOROX GEOInterstitial
GEOSource G9+

Client

Kuwait Oil Company
Onshore Development, Kuwait

Challenge

The Makhul formation is a carbonate with low porosity (1-3%) and low permeability (1-2 md). It has been known to produce high amounts of H_2S. Due to the significant quantities of H_2S limited downhole fluid samples are available. Identifying the H_2S zones and avoiding testing/producing from them was the primary challenge.

Solution

An integrated solution was proposed to analyse offset well cuttings and cores and identify residual gases and elemental constituents to correlate any H_2S producing zones ensuring their identification prior to testing and completion.

Results

H_2S was clearly identified in the cuttings ONLY in the upper part of the reservoir. This section corresponded to a limestone interval. This zone also displayed a hydrocarbon content that displayed a lack of light and intermediate components.
Cuttings from the lower zone displayed no presence of H_2S. The lower, H_2S free zone was increasingly dolomitic and displayed higher residual hydrocarbon content, including light and intermediate compounds. This zone also displayed high TOC volumes and high S2 pyrolysis results.

Value

This study of historic cuttings data demonstrated that the presence of H_2S could be clearly identified from cuttings, and corresponded to a zone of poorer productivity.

Services used

GEOROX Mineral & elemental analysis
GEOInterstitial H_2S & light hydrocarbon analysis
GEOSource T.O.C. & pyrolysis
G9+ C9-C27 hydrocarbon analysis

The geochemical analysis of core and cutting samples, identified residual H_2S ONLY in the "upper interval" of X535-X555 ft of the reservoir section. This zone was identified as containing low volumes of elements such as molybdenum and uranium.

The presence of a higher dolomite content in the "lower interval" of X085-X136 ft indicates a possible better reservoir quality. The lower zone did not exhibit the presence of any H_2S. The lower zone also displays a higher residual hydrocarbon gas content and a greater concentration of molybdenum and uranium when compared to that above.

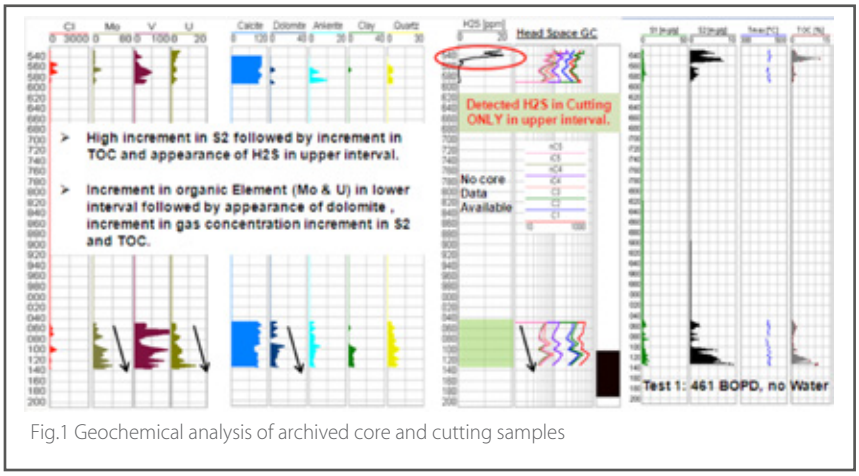

Fig.1 Geochemical analysis of archived core and cutting samples

The presence of heavier molecular weight components in the upper interval, associated with an absence of light and intermediate components, suggests the upper interval comprises a very low gravity fluid. The same interval reported high quantities of S2 and TOC.

The lower interval shows a consistent fluid signature, with increased presence of light and intermediate molecular weight compounds and a reduction in the heavier weight components, indicating a medium API gravity fluid.

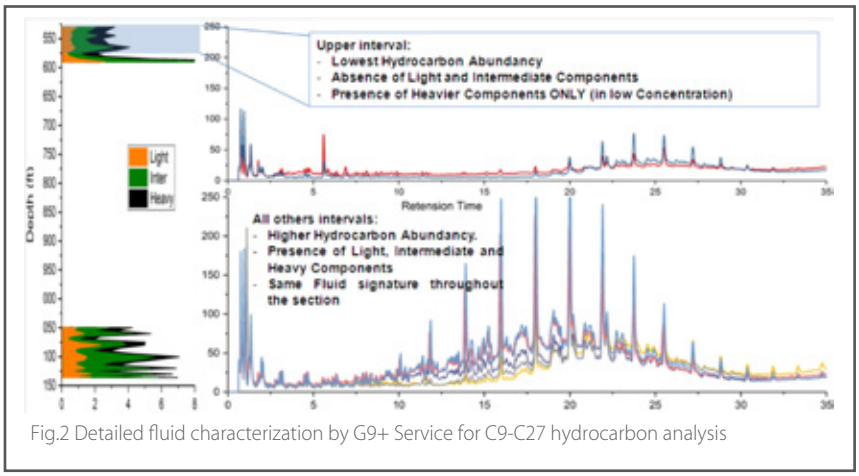

Fig.2 Detailed fluid characterization by G9+ Service for C9-C27 hydrocarbon analysis

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