Case Study: Geosteering in a clastic reservoir

GEOLOG SURFACE LOGGING

High resolution chemo steering improves drilling and increases productivity in horizontal wells

GEOROX

Client

Kuwait Oil Company
Onshore Development, Kuwait

Challenge

The Burgan reservoir consists of vertically stacked channel sands connected to an underlying aquifer by a network of faults. Setting completions across the faulted zones leads to premature and sever water breakthrough. Many of the fault zones are sand against sand, and therefor not obviously identified by conventional electric log methods.

Solution

GEOLOG proposed to evaluate offset well cores and cuttings using X-ray fluorescence elemental analysis to identify key elemental markers for identification of the fault zones. This model was then used in real-time during drilling of horizontal wells to identify the fault zones.

Results

The pre-drill study identified a range of elemental signatures that clearly identified the fault zones. By evaluating cuttings samples during drilling, the well was kept in the optimal producing zone and the completion strategy modified to avoid the potential high-water flow zones associated with the faults.

The improved drilling in the reservoir resulted in a longer producing section being exposed in the horizontal leg of the well. The well was produced with zero water cut.

Value

The well was geo-steered with the aid of real-time elemental analysis. The length of producing section was increased and water production avoided completely in the initial production of a well in one of the highest producing areas in Kuwait.

Services used

GEOROX Elemental (XRF) analysis

Technical Paper References

IPTC

Drilling of Multilateral Wells Aided with Geochemical Analysis Kuwait_ IPTC-16617

Estimated cost savings: $200k USD + increased production

The seismic image shows the horizontal well section, superimposed with abundance of main elemental markers obtained through XRF analysis. The markers chosen are those which provided the best contrast during the pre-well study: Al, Zr, Ti, K. Clear changes in the abundance of these elements are associated with the main features of the well section, i.e. the landing point at approximately 7300 ft, the faulted sections at 7940 ft and 8450 ft in particular. "Al" also provided an early indication of the approaching fault as it started showing an increase at the start of the "disturbed section" at 7836 ft.

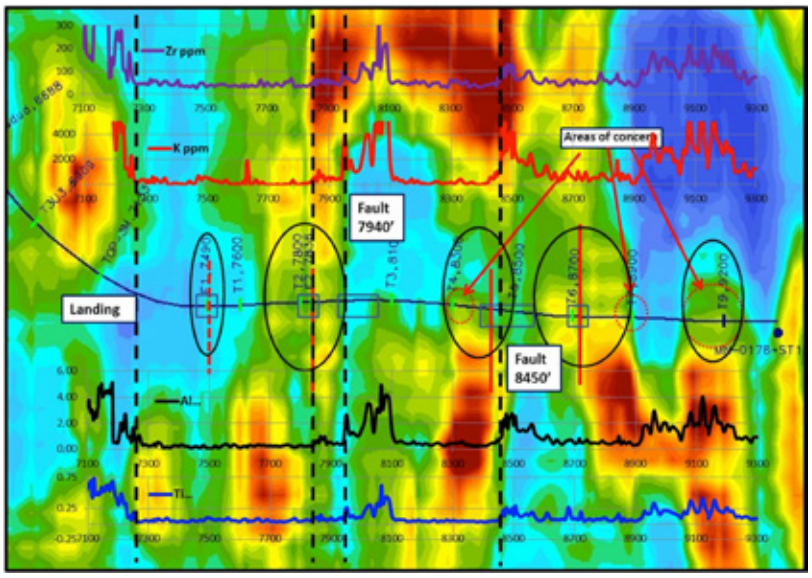

Fig.1 XRF Vs Seismic Data

XRF data utilized during the production phase to isolate the faulted interval. In our case "Al" concentration, which had a significant increase across the faulted sections was used as a proxy along with permeability measurements to mark and isolate these zones of potential trouble; which would be very detrimental for water production.

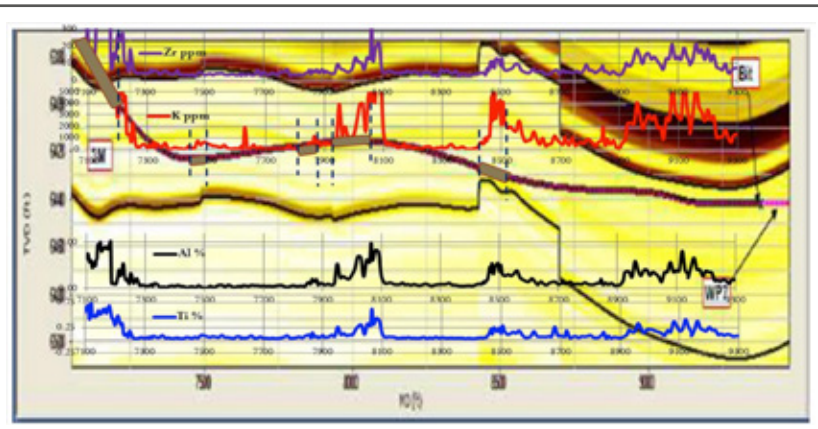

Fig.2 XRF data utilized for improving well completion