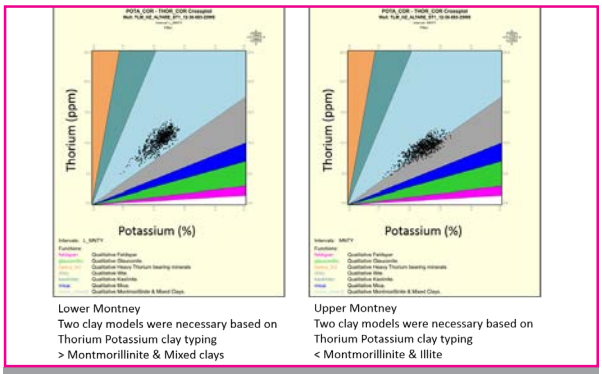
Emerson Geolog Facimage Reveals High-Productivity Areas in an Unconventional Reservoir

RESULTS

- Using the Facimage technology, the customer's asset teams were able to characterize the productivity potential of the Montney formation and locate the best reservoir quality in terms of gas and condensate. This enabled them to focus their drilling program in those zones that will yield the highest return on investment.



Lower Montney
Two clay models were necessary based on Thorium Potassium clay typing
> Montmorillinite & Mixed clays

Upper Montney
Two clay models were necessary based on Thorium Potassium clay typing
< Montmorillinite & Illite

APPLICATION

Emerson Geolog™ Facimage™

CUSTOMER

Major operator in the Montney Formation, Altares area, Northern British Colombia.

CHALLENGE

This was one of the first unconventional hydrocarbon plays undertaken by both companies in this thick stratigraphic interval, so the original focus was to target zones of highest organic content and mud gas response. The results were not satisfactory, however, so another exploration approach was adopted. The focus turned to evaluating reservoir quality, brittleness and permeability, to identify which zones of the Montney would produce gas and condensate at the highest possible rate. Since both the Upper and Lower Montney Formations had potential in terms of mud gas response, it was up to the exploration team to determine the key criteria for enhancing productivity.

The challenge was to determine which parts of this thick stratigraphic unit with varying amounts of organics (including bitumen) had good reservoir quality, were brittle enough for fracking, and had the highest chance of producible liquid hydrocarbons.

SOLUTION

Multi-Resolution Graph-Based Clustering (MRGC) in Emerson's Geolog Facimage electrofacies analysis tool was used to first build a brittle versus ductile electrofacies model. This was then combined with another MRGC model in Facimage to determine intervals of greater oil saturation.

The workflow consisted of integrating core data (permeability, porosity, oil saturation), conventional wire line data, high-end wire line data such as elemental spectroscopy, and NMR data. Using conventional crossplots along with Facimage, the exploration team was able to determine clay types, brittleness, TOC and oil saturation.

"We could not have achieved these results without the Geolog Facimage functionality. MRGC is one of the few clustering techniques that yield facies resembling what we find in nature. No other software currently offers this clustering method."

Jean-Yves Chatellier
Tecto Sedi Integrated Inc.

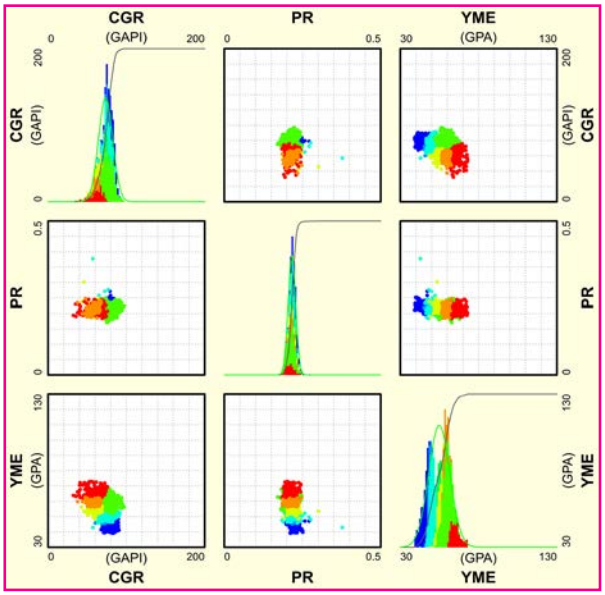


Figure 1 – Montney formation brittleness model developed using Emerson Geolog Facimage

For more information:
www.Emerson.com/EPsoftware

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Whenever possible, core data was used to ground truth the results from the clay models, mineralogy, porosity, permeability, pore throat size distribution and saturation.

Following the integration of core XRD clay measurements into elemental spectroscopy logs, it was found that the Lower Montney FM had more clay than the Upper Montney. As there was a reasonable fit of XRD clay measurements from a variety of data sources (both core and cuttings) and from different labs, along with their fit to wireline elemental spectroscopy, they now felt confident in determining the amounts of clay going forward using wireline data.

A Brittleness Facimage Model was generated, along with a Moveable Oil Plot (MOP) Facimage model. Track 9 on the layout (figure 3) shows the Brittleness facies, while track 10 shows the MOP Facies. The combination of higher MOP Facies (green) and the greatest brittleness (green facies on Track 9), indicates the best reservoir quality in terms of producibility.

The red facies in the hydrocarbon saturation facies model in Track 10 shows the highest resistivity and highest TOC (2179 to 2194 meters). These are usually great hydrocarbon indicators, but the hydrocarbon facies are non-moveable due to bitumen plugging. The brittleness facies model (Track 9) shows the highest core oil saturation, mainly in the green facies.

RESULTS

The final interpretation shows that when green facies are present in both Facimage models (brittleness and hydrocarbon saturation) along with appropriate permeability - the most productive capability is associated with the highest moveable oil. The red striped track (Track 13) shows the apparent zones where both thresholds have been met, along with permeability – mainly in the Upper Montney Formation. Although completion intervals are not available, the horizontal wells on this pad produced both gas and condensate.

BENEFITS

This approach avoids the pitfalls of just focusing on high TOC/high gas show intervals/high apparent porosity zones as they may have poor production due to bitumen effects. Based on this information, the exploration team was able to locate the best reservoir quality in terms of gas and condensate. This enabled them to focus their drilling program in those zones, and characterize the productivity potential of the Montney formation.

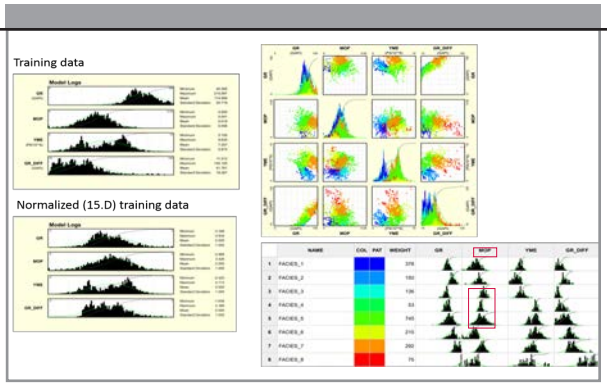

Figure 2 - Hydrocarbon saturation Facimage model

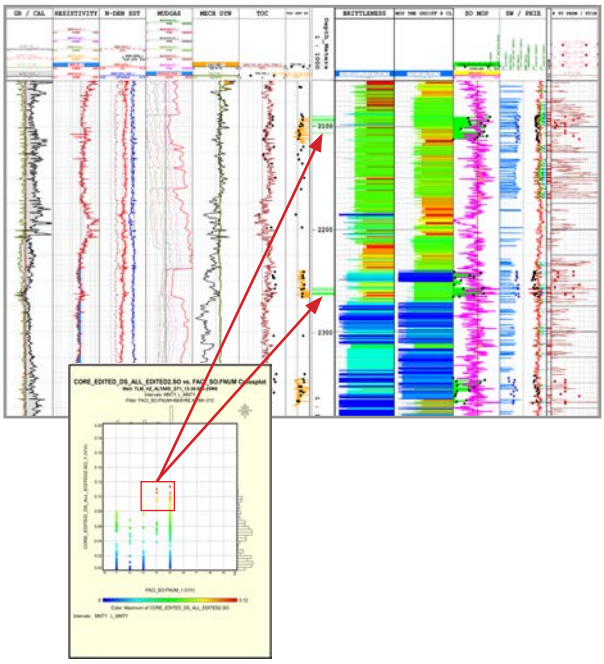

Figure 3 – High oil saturation from Facimage facies and higher permeability

RESOURCES

www.pdgm.com/products/geolog/facimage

Based on an article, "Geochemically focused integrated approach to reveal reservoir characteristics linked to better Montney productivity potential", co-authored by J-Y Chatellier, K. Simpson, R. Perez and N. Tribovillard, Bulletin of Canadian Petroleum Geology, Vol. 66, No. 2, June 2018.

Emerson E&P Software
Two Memorial Plaza
820 Gessner, Suite 400
Houston, TX 77024
T +1 713 393 4800