FMI* Based Sedimentary Facies Modelling, Surmont Lease (Athabasca, Canada)

J.P. Leduc, V. Delhaye-Prat, P. Zaugg, B. Mathis
TOTALFINAELF

and

A. Lejay
Conoco Canada

In the Surmont lease (Athabasca, Canada), the recognition of sedimentary lithofacies using FMI* data in replacement of core description is of first importance considering the reduction of the uncertainties for the geological model of the field. Using core data description as a reference and both FMI and conventional well logs as a model input, a continuous description of the well-bore is obtain in term of geological facies with a good rate of success.

In a first step, a log typing model is build using raw wireline logs such as Gamma ray, density, neutron and density-neutron separation. The resulting log types curve does not match confidently the facies from the reservoir model. This mismatch, experienced with any model attempted, is partly due to the impossibility to directly get the textural information to define some of the sedimentological facies with conventional wireline logs (mudstone breccia vs sandy or muddy heterolithic stratification). Despite this mismatch, the log typing model serves as a lithological reference as far it is simple to build and to propagate and thus particularly well adapted to the huge quantity of data available on the Athabasca oil sands. Then the FMI* images are analysed using bedding calculation and bed boundaries determination. Bedding takes into account all significant events which are automatically picked on the image. Bed boundaries additionally takes into account specific image attributes. This process well identifies the lithological and/or the texture changes and are accompanied by different quality indices : continuity and contrast of the sedimentary events. Additional curves were calculated as bedding index (abundance of bedding surfaces in a given depth interval), stratification index (abundance of bed boundaries in a given depth interval), and image activity (Is the image homogeneous or not?).

Because FMI* features and dip determinations are too thin in term of vertical resolution, all these curves were up-scaled (i.e. smoothed and interpolated from high frequency irregular sampling rate to wireline log sampling rate) in order to provide a geological facies prognosis every 0.1 meter.

Integrating images in conventional log analysis strongly improves the sedimentary facies recognition and permit to discriminate between muddy/sandy incline heterolithic sandstones and mudstones breccia. The detailed calculated dip succession gives the opportunity to assess the sedimentary patterns analysis, to improve the correlation between wells and to made a link with the 2D/3D analysis (seismic).

In this Heavy Oil context, the FMI* analysis is of high accuracy due to a strong conductivity contrast between claystones and heavy oil bearing sandstones. An important gain is expected in term of reservoir understanding and core storage cost thorough the FMI modelling of a great number of wells.

FMI* for Formation Microscanner Imaging trade mark from Schlumberger.