Water Saturation from Resistivity Images

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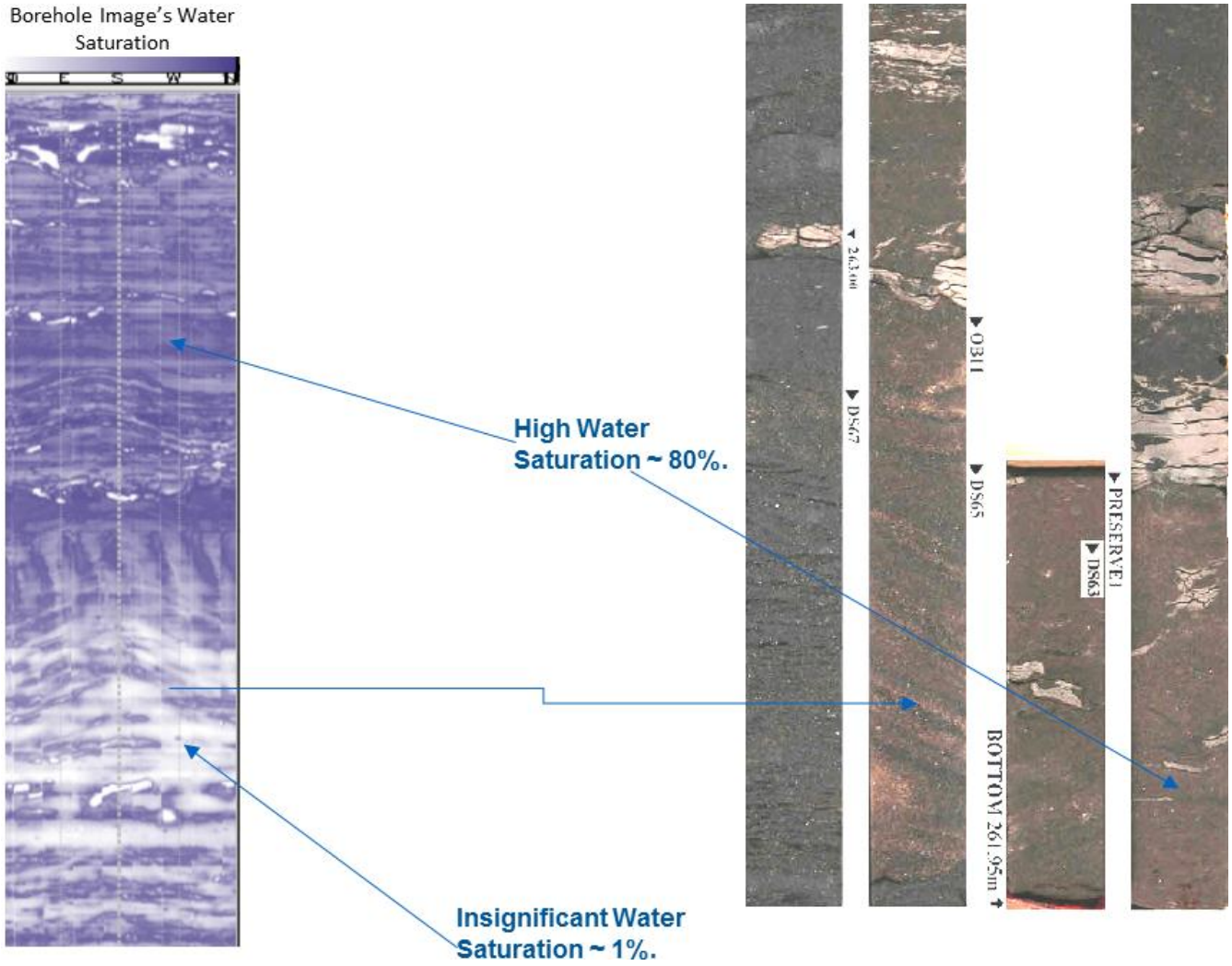
Summary

The grain size of the early Cretaceous McMurray Formation varies from very fine to conglomeratic sand. The clay minerals content varies as well, and it forms silty to muddy layers. The typical grain cementing material is negligible.

The McMurray formation is an example of fluvial to estuarine sedimentation. It contains large deposits of bitumen of millions of centipoise viscosities. In this environment, the laminated layers thickness is less than the resolution of the conventional logging tools.

The borehole resistivity images are used to enhance the resolution of clay, porosity and saturation analyses. The method applied in converting the borehole images into clay content will be presented. The resulting analysis is compared with the core photo derived mud content.

Once the clay content estimation is completed, the porosity values are correlated to the resistivity values. The data mapping is based on assumption that the McMurray Formation particles can be modeled as a binary system composed of clay size and larger clean sand grains. Then; a new shaly Archie (Nabil Al Adani, “McMurray, Dean-Stark and Archie”, September 2012, Canadian Well Logging Society Luncheon) is applied on each button to estimate the water saturation.



This method assumes that the borehole resistivity measurement responds mainly to clay and water content. The grain size, shape and sorting effects are assumed negligible. The comparison between the Dean-Stark tests and the borehole image derived water saturation will be presented.

This work has concluded that the water saturation resolution can be enhanced through the borehole resistivity image. However, its application should be restricted within the boundaries of assumptions made during the analysis.