Building models of the earth: merging methods, rock physics and geostatistics

Lucy MacGregor[1,2]
[1] *Edinburgh Geoscience Advisors*
[2] *Cognitive Geology*
lucy@edinburghgeo.co.uk
ORCID:orcid.org/0000-0001-8034-3203

Creating a robust image of the earth is a key step that enables the interpretation of geological processes, characterisation of sub-surface resources or prediction of sub-surface behaviour.   Combining multiple geophysical approaches in the imaging and characterisation steps can lead to a more robust interpretation than if a single method is applied. For example, the integration of seismic attributes with controlled source electromagnetic (CSEM) data has been shown to dramatically improve the certainty with which commercial hydrocarbons can be distinguished from residual saturations (figure 1, [1],[2]), a problem that is hard to address with seismic alone. There are many approaches to multi-physics analysis and the choice depends on the data available, and the geological and/or geophysical goal of the analysis. A careful approach tailored to the study objectives and making use of a range of algorithmic approaches is required to ensure the best result.
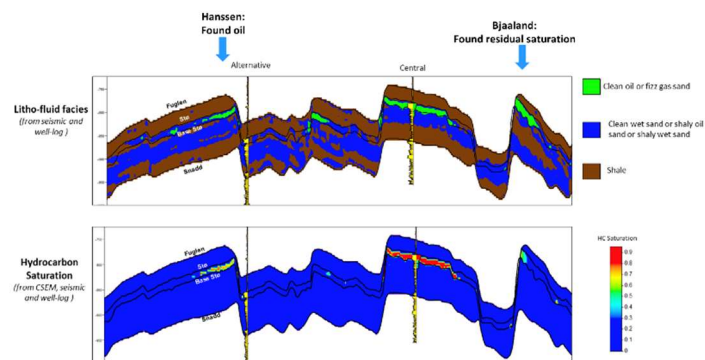

Figure 1. Multi-physics characterisation of a reservoir in the Northern Barents Sea (further details see [1]). Whereas seismically defined lithofluid facies can identify the presence of hydrocarbon, no distinction can be drawn between commercial and residual saturations. A multi-physics approach including EM data resolves this ambiguity.

References
Alvarez, P, Alvarez, A., MacGregor, L., Bolivar, F., Keirstead, R. & Martin, T., 2017. Reservoir property prediction integrating CSEM, prestack seismic and well log data using a rock physics framework: Case study in the Hoop area, Barents Sea, Norway.
Alvarez, P., Marcy, F., Vrijlandt, M., Skinnamoen, O., MacGregor, L., Nichols, K., Keirstead, R., Bolivar, F., Bouchrara, S., Smith, M., Tseng, H-W & Rappke, J., 2018. Multi-physics characterisation of reservoir prospects in the Hoop area of the Barents Sea.