Integration of Electromagnetic Data for Use in Characterization of Reservoir Prospects in the Hoop Area of the Barents Sea

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ABSTRACT

In this case study, we consider the quantitative integrated interpretation of seismic and CSEM data within a rock physics framework to characterise the Realgrunnen subgroup in PL723 located in the Northern Barents Sea. Since the discovery of the nearby Wisting field in 2013, and the subsequent Hanssen discovery in 2014, there has been increasing interest in the region. Whilst the Wisting and Hanssen discoveries have proven the presence of hydrocarbons in the northern Barents Sea there are also several examples of wells drilled based upon seismic analysis alone that have proven to be low saturation pay. In this area and at the shallow depth of interest, the focus is on high oil saturations. The goal of the study presented here was to provide a robust assessment of its prospectivity and improve the confidence as to whether high saturation hydrocarbons may be present. Sensitivity analysis conducted for both the CSEM and seismic data showed that the integration of the datasets could resolve ambiguities that exist if the data are considered separately. During seismic analysis, which included both statistical and attribute analysis, potential hydrocarbon-bearing sands were identified, however, the saturation remained uncertain. The analysis of the CSEM data focussed both on imaging the subsurface but also on understanding the limits of the data and how this translated to estimating reservoir properties such as hydrocarbon saturation. The analysis concluded that for a hydrocarbon accumulation to be clearly imaged by the CSEM data, the saturation must be 60% or greater. Therefore, adding the CSEM data in this setting allows us to distinguish between high saturations (>70%), and low and medium saturations (<50%). To enable the quantitative integration of the seismic and CSEM data a common domain is required. Here we converted the seismically-derived results to the electrical domain by applying Archie's law to the seismically-derived porosity. The results of this integration in combination with the results of a litho-fluid facies classification incorporating both seismic and CSEM results made it clear that saturations similar to those observed at the nearby Wisting well (>90%) are not present in this area. However, because of limitations on the sensitivity/recoverability of the CSEM data in this high resistivity environment, it is less clear whether the saturation is very low (<20%) or higher (potentially up to 40-50%). This remains an uncertainty in the analysis.