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A Modern Digital Solution for Regional Screening Purposes and Play Fairway Analysis

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Summary

This study presents a regional sequence stratigraphic framework for the offshore basins of NW Europe, covering the Carboniferous to present day. By analyzing over 5,800 wells and integrating seismic data, the research provides a consistent framework for understanding basin evolution and petroleum systems. The study uses detailed lithological, depositional environment, and facies interpretations, along with seismic correlations, to create reliable fairway maps that support conventional exploration and carbon capture storage (CCS) applications. The Facies Map Browser (FMB), accessible via a cloud-based platform, allows for dynamic updates and easy access, providing valuable insights into the characteristics and performance of potential reservoirs. This tool is crucial for minimizing risk, understanding reservoir quality, and identifying potential CCS aquifers. Key petroleum system parameters, such as porosity, permeability are integrated to refine prospectivity analysis.

Examples in the study illustrate the importance of combining legacy exploration data with this framework, enhancing the understanding of reservoir evolution and risks. The integration of multiple datasets aids in CCS screening, providing a fast-track approach for evaluating potential sites, understanding reservoir/aquifer properties, and assessing overburden characteristics. This approach offers a powerful tool for both exploration and renewable applications, ultimately reducing geological risk and accelerating the exploration cycle

Introduction

Regional mapping of key petroleum system components is a crucial step in the exploration process. Gaining insight into the tectonic and sedimentary history of a basin is essential for identifying and prioritizing potential prospects. When coupled with the structural variability across the offshore region, this complexity makes it challenging to extrapolate a regional geological model from limited calibration data and to select the most suitable analogue for a prospect.

A regionally consistent sequence stratigraphic framework for the entire Norwegian and UK North Sea is provided in the form of a Facies Map Browser (FMB) and is critical to constraining fairways and de-risking prospects in each basin.

This digital FMB study provides that consistency via interpretation and calibration to a vast well database. Supplementing regional facies mapping and prospect delineation with key petroleum system parameters from analogues at the well level are important to minimize risk in geological models and fully understand the potential characteristics and performance of a prospect.

Examples shown highlight the importance of integrating exploration results with a robust sequence stratigraphic framework to understand the key risks, evolution and variation within a reservoir system or potential CCS aquifer.

Now for the first time this study will be accessible via a cloud based solution, allowing dynamic updates of the data as wells are released and easy user access on any device.

Method

The sequence stratigraphic framework presented forms part of a wider study from the Carboniferous to the present day across the offshore basins of NW Europe. The analysis of >5800 wells are integrated seismic data to provide a regionally consistent basin framework across each of the offshore basins (Figure 1).

Detailed interpretation of wireline, core and biostratigraphy, together with regional seismic interpretation has allowed the development of a sequence stratigraphic model. This includes detailed well-based lithological, gross depositional environment (GDE) and associated facies interpretations. Seismic data is used to correlate and extend the GDE maps away from the well control. The result is a reliable sequence stratigraphic framework and consistent fairway maps across the entire region.

Depositional environment and related facies distributions are a key control on reservoir quality and mapping provides a predictive method for conventional exploration and for CCS applications. This study provides many key petroleum system parameters including those used to evaluate reservoirs/aquifers (i.e. lithology and thickness, average porosity and permeability (Figure 2), net-to-gross, temperature, pressure, production test rates and hydrocarbon shows). These analogues are combined with the regional GDE mapping to identify, characterize several targets allowing geoscientists/explorationists to high and low grade areas for prospectivity.

Examples

Selected examples discussed in this study will be the application of FMB data for use in regional CCS screening, through the integration of multiple datasets and the ability to cross reference large volumes of data and view it in a meaningful way that enables a fast track understanding and an instant overview in order to high and low grade areas for potential CCS sites, including aquifer mapping, understanding

reservoir/aquifer property variance observed within altering depositional facies and a detailed understanding of the overburden.

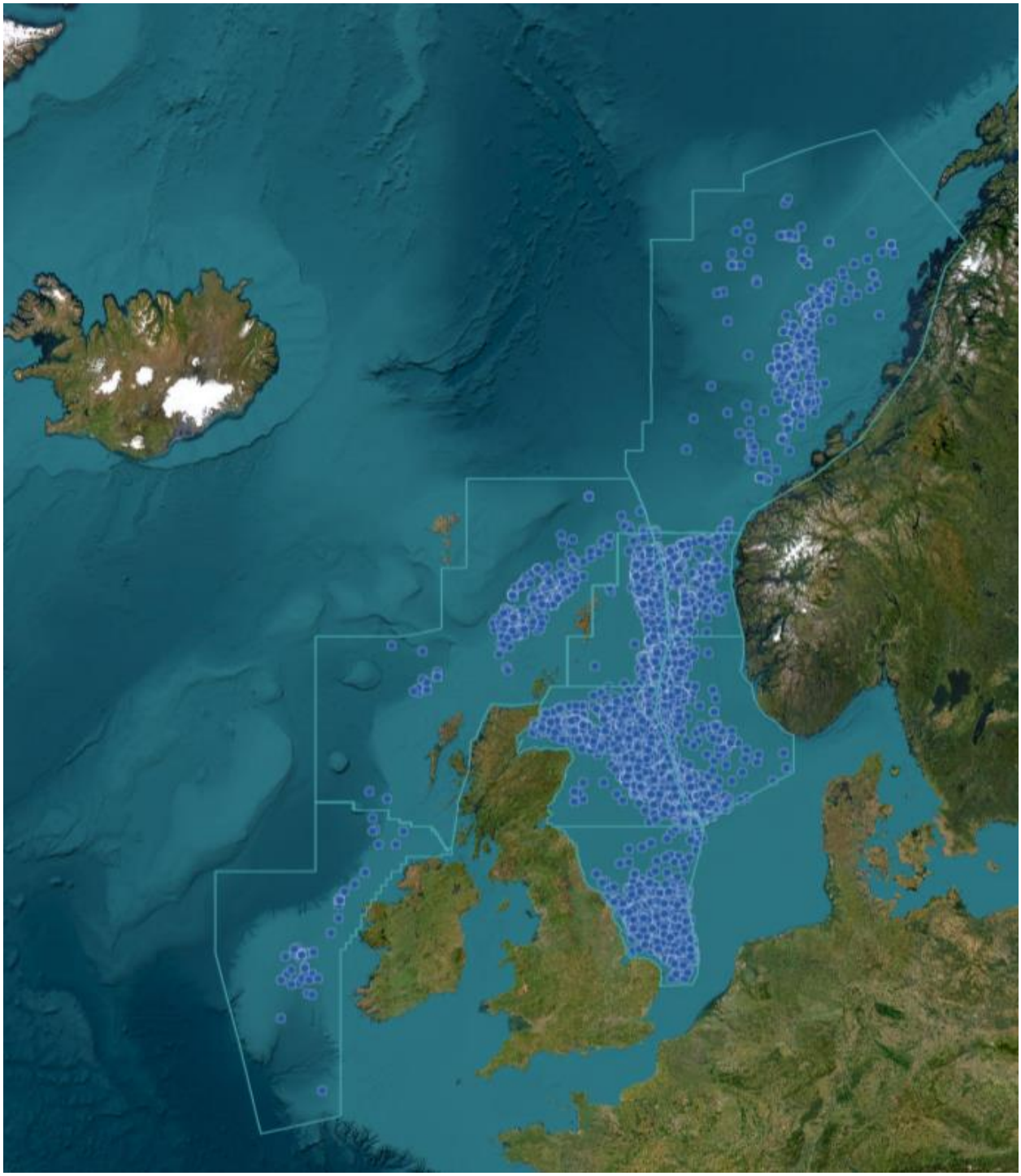

Figure 1 *Map of NW Europe FMB showing seismic and wells used to generate regional sequence stratigraphic model*

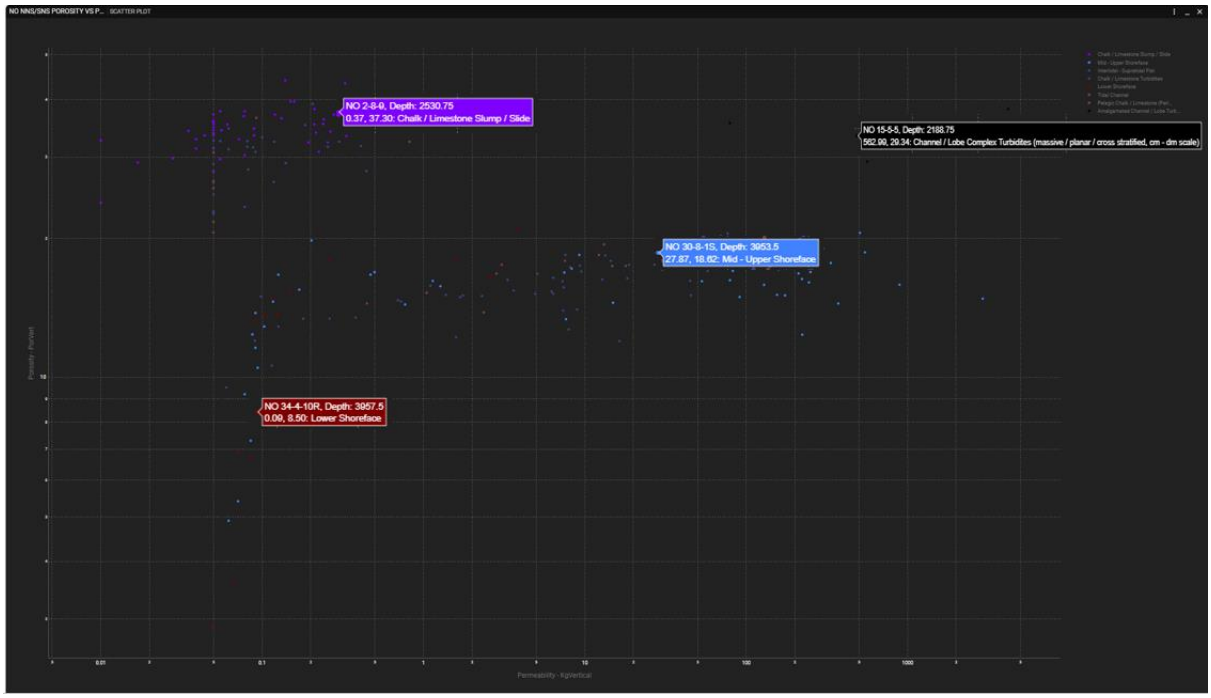

Figure 2 *Porosity vs Permeability plot with data points colored by interpreted depositional facies*

Conclusions

The examples discussed will emphasize the importance of integrating legacy exploration data with a strong sequence stratigraphic framework to gain a deeper understanding of the key risks, evolution, and sometimes subtle variations within a reservoir system, all of which are influenced by various factors. This study analyzes several of these factors on a regional scale, and when paired with detailed, high-resolution seismic interpretation, they can become a powerful tool for both exploration and renewable energy applications.

Now for the first time this study will be accessible via a cloud based solution, allowing geoscientists to dynamically query the database and extrapolate meaningful data in a way that will help fast track exploration cycle times and delineate geological risk.