Integrating Advanced Seismic Analysis with Rock Physical Modeling to Refine Stratigraphy and Predict Reservoir Characteristics for the Norwegian Finnmark Carbonate Platform

Arnout Colpaert¹, Juergen Mienert¹, Gregor P. Eberli², L. B. Henriksen³, and Gregor T. Baechle²

¹ University of Tromsø, Tromsø, Norway
² University of Miami, Miami, FL
³ Statoil, Harstad, Norway

Upper Paleozoic carbonates of the Norwegian Barents Sea have been subject of increasing exploration but a good understanding of potential reservoir distribution is paramount for success in this area. This study is an example of reservoir characterization for the Finnmark Carbonate Platform using 3 exploration wells and several 3D seismic cubes. This complex platform succession contains a range of carbonate rocks, including dolostone, limestone and evaporites with highly variable porosities. Combining advanced seismic techniques such as seismic inversion, rock physical modeling from well logs and core plugs, and multi-attribute analysis provided a better understanding of the sequence stratigraphy and carbonate platform evolution. As a result, we achieved an integrated geological model that included estimations of porosity and lithology distribution from the inner to outer carbonate platform settings.

Detailed 3D seismic imaging provided the subsurface morphology, but the use of inverted P-impedance data proved to be important for the recognition of platform geometry, the different lithological bodies, and the development of a solid stratigraphic framework. Hence, quantitative seismic interpretation (QSI) demonstrates how rock physics can be applied to predict reservoir properties. QSI combines seismic attributes and inversion with fundamental rock physics to quantify the geophysical signature of rocks and fluid properties. Rock physical modeling with the effective medium theory was applied on the well log to extract porosity-impedance-relations within the individual stratigraphic intervals, where petrophysical measurements on core-plugs are used to calibrate these models. The results of the QSI increased the understanding of the Finnmark Platform potential reservoir and porosity distribution.