Hunting Potential Sites for Carbon Storage in The Upper Cenozoic Glacimarine Deposits, Continental Passive Margin of Norway: Seismic Sequence Stratigraphy Approach

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Abstract

The application of seismic sequence stratigraphy plays a crucial role in the initial screening and evaluation of carbon capture and storage (CCS) potential in the continental passive margin environments. Previous petroleum activities in the last century have revealed the presence of potential reservoirs with hydrocarbon shows along the continental passive margin of Norway. However, the carbon storage potential of these reservoirs remains largely unexplored. Hence, this study focuses on a comprehensive examination of seismic sequence stratigraphy, specifically the seismic architecture and depositional sequences, to characterize the CCS reservoirs within the Upper Cenozoic glacimarine clastic deposits of the Sørvestnaget Basin in Norway. The interpretation of 2D seismic reflections and well logs was performed, along with the identification of seismic facies associated with diverse depositional processes and environments. These analyses included assessing seismic reflection termination and configuration, mapping seismic facies, identifying seismic sequence boundaries, and generating Wheeler diagrams. Furthermore, well-log data were utilized for the purpose of interpreting lithological characteristics and fluid properties. The study identifies at least four seismic sequences within the interval. Three of these sequences exhibit progradation geometry with distinct shelf-edge configurations, including descending, flat, and ascending trajectories formed during the Lowstand system tract. Additionally, one sequence developed under the Transgressive system track which demonstrates a transgression and flooding event that overlays and encompasses the preceding sequences. The study also explores the influence of relative eustatic sea-level changes and sediment supply on the formation and preservation of potential CCS reservoirs. In general, the Upper Cenozoic interval exhibits relatively thin reservoirs with a low net-to-gross (NTG) ratio, as indicated by the well-log information. However, promising CCS sites can still be found, particularly within submarine fan environments where the clastic reservoirs display relatively widespread distribution characteristics. Additionally, it is noteworthy that thicker sandstone reservoirs are identified within older strata units, specifically in the Oligocene interval. These findings enhance our understanding of the
stratigraphic framework of glacimarine passive margin deposits in Norway, providing valuable insights for CCS exploration and development. The application of seismic sequence stratigraphy in assessing CCS potential aids in identifying optimal target areas for future CCS projects, essential for reducing greenhouse gas emissions and advancing sustainable energy practices. The outcomes of this study will be instrumental in guiding CCS exploration efforts and facilitating the implementation of efficient and effective carbon capture and storage initiatives.

Keywords: Seismic; Sequence; CCS; Cenozoic; Norway