

Maturation for potential CO₂ storage in Denmark – The Stenlille and Havnsø structures

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Geological storage of CO₂ has become important in relation to capture and thus to reduce emission of large quantities of greenhouse gases affecting the climate. Subsurface storage of CO₂ is part of the Danish political 2021 CCS-strategy. Eight geological structures are investigated and matured with seismic acquisition (e.g. Papadopoulou et al. 2023) and mapping (Gregersen et al. 2023). Two of these structures investigated are the Stenlille and Havnsø structures in western Zealand, Denmark, not far from the cities of Kalundborg and Holbæk. Results of the mapping of this project are presented with focus on the main reservoir sandstones of the Gassum Formation and the thick overlying Fjerritslev Formation mudstone seal. The Gassum Formation of the Stenlille structure has been used for safe storage of natural gas to consumers for more than 30 years. The Stenlille area has the most extensive data base onshore Denmark with 20 wells, a 3D seismic survey and 2D seismic surveys. It is therefore a key area for understanding the nearby Havnsø structure with less data coverage. The areas can be connected using seismic correlation and both structures are structural 4-way closure traps at the reservoir levels and are formed by the growth of an underlying salt pillow during mainly the Jurassic time (Gregersen et al. 2023). The Gassum Formation and deeper sandstone successions could potentially provide reservoirs for storage of CO₂, and key horizons and successions are mapped and the storage potential of the Gassum Formation has been estimated for both structures.

The regional mapping shows that the Gassum and Fjerritslev formations are widely distributed across the region. In the Stenlille structure, details of the Gassum Formation sedimentary systems with channels and progradation are revealed in 2D and 3D seismic data and wells. Such features are also observed in 2D seismic data at the Havnsø structure, where these also support the presence of sand-prone sedimentary systems.

References

- Gregersen, U., Hjelm, L., Vosgerau, H., Smit, F.W.H., Nielsen, C.M., Rasmussen, R., Bredesen, K., Lorentzen, M., Mørk, F., Lauridsen, B.W., Pedersen, G.K., Nielsen, L.H., Mathiesen, A., Laghari, S., Kristensen, L., Sheldon, E., Dahl-Jensen, T., Dybkjær, K., Hidalgo, C.A. & Rasmussen, L.M., 2023: CCS2022-2024 WP1: The Stenlille structure. Seismic data and interpretation to mature potential geological storage of CO₂. GEUS, Copenhagen. Danmarks og Grønlands Geologiske Undersøgelse Rapport 2022/26, 164 pp. <https://doi.org/10.22008/gpub/34661>
- Papadopoulou, M., Zappalá, Malehmir, A., Gregersen, U., Hjelm, L., Nielsen, L. & Haspang, M.P. 2023: Innovative land seismic investigations for CO₂ geological storage in Denmark. *Geophysics*, 88 (5): B251-B266. <https://doi.org/10.1190/geo2022-0693.1>