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Characterization of the Lower Cambrian sandstone aquifer in the Swedish Baltic Sea area – assessment regarding its potential suitability for storage of CO_2

M Erlström and U Sivhed

Geological Survey of Sweden, Kiliansgatan 10, S-223 50 Lund, Sweden, mikael.erlstrom@sgu.se, ulf.sivhed@sgu.se

In the Baltic region the Cambrian sandstone is considered to have great economic value concerning its aquifer and reservoir properties. Its potential as petroleum reservoir is well known, especially from the Polish, Lithuanian and Russian sectors of the Baltic Sea where oil and gas has been found in anticline traps in the sandstone sequence. Offshore exploration in the Swedish sector has so far not encountered any significant findings of oil and gas. However, the extensive exploration has generated data, which is now being used for assessing the overall properties regarding suitability for storage of CO_2. The Swedish primary industry has a great interest in finding potential sites for storage of CO_2. A suitable site in the Baltic Sea would be a most favourable alternative in comparison to more remote alternatives such as deep saline aquifers in the North Sea. The Lower Cambrian is in the Swedish sector of the Baltic Sea composed of three main sandstone units varying in thickness between 5 and 50 m occurring within an up to 250 m thick Cambrian sequence dominated by fine-grained terriclastic sediments. The limit of Lower Palaeozoic sequence in the Baltic area is today defined by erosional truncation because of the gently dipping Lower Palaeozoic sequence. To the north and northwest, the limit is found in the Pre-Quaternary, whereas the erosional limit is deeply buried beneath Permian and Mesozoic sediments to the south. Here the Lower Palaeozoic limit is buried to depths reaching more than 2 km. The Cambrian sequence in the distal parts of the Swedish sector occurs at depths of c. 1300 m while it constitutes the bedrock surface in a narrow zone trending from Öland to the north of of Gotland. Sandstone beds constitute 40–60% of the total Cambrian sequence. The main sandstone units have a regional distribution of several thousands of square kilometres. The up to 50 m thick Faludden sandstone member exhibits the best reservoir properties including porosities in the range of 10–16% and permeabilities of 200–400 mD. Wire line logs indicate uniform physical properties of the member. The Faludden sandstone is in addition interpreted as a closed aquifer since it wedges out updip and is overlain by alum shale and several hundred metres of Ordovician–Silurian argillaceous limestone with bentonite clays acting as a significant seal. The regional distribution in combination with the satisfactory physical properties makes it an interesting candidate for CO_2 storage. Investigations of the hydraulic properties of the aquifer as well as properties of the seal, in combination with numeric modelling have to be performed as to achieve a reliable assessment of the storage capacity. Research projects regarding this are now being launched by the Geological Survey of Sweden, Uppsala University, Lund University and the industry. Existing data regarding the Lower Cambrian sandstone in the Baltic Sea will also be included in the Nordic CCS GIS Atlas and data base within the recently launched Nordiccs-project.