Scientific core drilling of the Lower Palaeozoic succession in the Swedish sector of the Baltic Sea – investigation of the CO₂ storage potential

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With an aggregated thickness of c.100 m, a porosity of up to 15 % and a permeability above hundred millidarcy, previous studies have assessed the three widely distributed Cambrian sandstone members in the Swedish sector of the Baltic Sea as the most potential CO₂-storage candidates in Sweden. Existing models indicate an effective storage capacity between 450–1500 Mt CO₂. However, these rough numbers are uncertain as they are related to vintage and partly inadequate data sets, especially regarding physical property values needed for a more certain evaluation of the storage capacity. Hence, as part of a larger screening and evaluation programme, launched by the Swedish government to identify and quantify potential storage sites in Sweden, two scientific core drillings were completed in 2023 on the southernmost part of the island of Gotland in the Baltic Sea. The primary aim was to collect complementary and missing data on the Lower Palaeozoic succession including both caprocks and reservoirs. The scientific evaluations and results of the core drillings on south Gotland will together with geophysical logging of the boreholes, new seismic data and 3D models constitute an essential part in improving the models of the effective storage capacity of the Cambrian reservoirs in the Swedish sector of the Baltic Sea. The coring, monitoring and investigations were managed by the Geological Survey of Sweden and the Swedish national research infrastructure for scientific drilling, “Riksriggen”, operated by the department of Engineering Geology at Lund university. H-dimension triple tube coring (96/61 mm hole/core diameter) was successfully performed with an Atlas Copco CT20C rig. The two wells, Nore-1 and Nore-2, penetrate 470 m of Silurian marlstone and claystone, 85 m of Ordovician argillaceous limestone and 225 m of Cambrian sandstone, siltstone and shale before finishing in the Precambrian crystalline basement of potassium porphyritic granite at 791.5 m and 787.7 m, respectively. The operation managed to reach the set goals despite challenges of over pressured formations and up to metre-thick bentonites. Initial results show a thick, tight, and homogenous caprock and that the Faludden Sandstone, one of the three Cambrian sandstone members, have hydraulic properties that qualifies it as a possible storage reservoir. The preliminary results from the two wells are here presented together with evaluations of drilling performance, monitoring
programme, logging and test operations.