

The sealing units of the Weyburn Field: continued evaluation of carbon dioxide sequestration potential in a carbonate reservoir

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ABSTRACT

Geological storage of CO₂ is being evaluated in Mississippian carbonate and evaporite strata of the Weyburn Field, SE Saskatchewan. The Weyburn reservoir is a microcrystalline dolomite commonly referred to as the “Marly” dolomite of the Midale Beds. Understanding CO₂ sequestration potential requires detailed knowledge of the seal characteristics. The sealing units for the Weyburn reservoir are the overlying Midale Evaporite, the underlying Frobisher Evaporite, and an updip diagenetic anhydrite. These strata all were progressively truncated in a north to northeastward direction by a pre-Mesozoic unconformity surface. The Triassic aged Lower Watrous formation overlies the unconformity and consists primarily of siltstones and shales. The diagenetic anhydrite cap was formed when sulphate-rich fluids from deeper within the basin were trapped by the Lower Watrous siltstones at the unconformity.

Detailed mapping of the sealing units has shown that: 1) the southern edge of the Frobisher Evaporite is more irregular than previously shown in the literature, 2) an additional evaporite is present in the northern portion of the map area, immediately above the Frobisher Evaporite and, 3) an algal grainstone occurs between the newly identified evaporite above, and the Frobisher Evaporite. The irregular southern extent of the evaporites is likely due in part to erosion of the seaward edge of the sabkha, leaving erosional remnants of anhydrite. The algal grainstone on top of the Frobisher Evaporite was likely formed by a brief transgression of the Frobisher seas, allowing carbonates to form over the evaporitic sabkha. Following this transgression, the seas retreated, allowing for further evaporite deposition and anhydritization to occur, forming the third evaporite.