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Integrated Tectonic and Petrophysical Investigation of the Williston Basin Sediments in and around the Weyburn CO₂ Sequestration Reservoir, Canada (Part II: petrophysical considerations)

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As part of Phase I of the International Weyburn CO₂ Sequestration Project, regional seismic investigations have been conducted around a 100 km radius of the Midale (Mississippian) reservoir in Southern Saskatchewan. The objective was to answer the following question: Do the tectonic, petrophysical and rheological properties of the sedimentary fill guarantee the permanent storage (~10000 years) of CO₂ in the region?

In the Part I of the presentation, the tectonic settings of the investigated volume were analyzed. In this Part II (Petrophysics) further analyses were done to set up a 3 dimensional volumetric model for the Lower Watrous (Triassic) reservoir seal including the seismic inversion of the long regional sections. The Lower Watrous is a vertically and horizontally complex 40 m thick siltstone-sandstone sequence interbedded with nodular anhydrite and anhydritic claystones. Porosity and shale content mappings of this critical unit above the reservoir were carried out on a combined borehole/wireline and seismic datasets. The different 3D stochastic geostatistical models, which can be set up for the Lower Watrous seal, are also included in the study.

Conclusion

Although many small scale structural disturbances (i.e. fault with small offsets/local flexures) have been identified above the reservoir in the Weyburn field, it is presently not possible to know with certainty, if these faults extend through the regional seal, and act as a potential migration path way for CO₂.

The knowledge of the geometry (derived from integrated analysis of the seismic and the borehole data) and the physical/geochemical properties of the rock volume (derived from the well logs and core data) will be required to resolve the above stated uncertainties.

Comment: Some other details of the investigation are presented at the poster session.