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Characterizing Secondary Seals for Geologic Storage of CO_2 in the Weyburn Field of the Williston Basin, Saskatchewan, Canada

Long-term geological storage of anthropogenic CO_2 associated with EOR within Mississippian carbonates is being investigated in the Williston Basin, Canada, as part of the IEA Weyburn CO_2 Storage and Monitoring Project. Regional geological mapping, from basement to surface, of an area 200 x 200 km centred on the Weyburn Field, Saskatchewan, is delineating features that may have influenced reservoir development and fluid flow characteristics in the basin. Identifying and understanding these basinal characteristics are essential for addressing the potential to securely store CO_2 in the subsurface for thousands of years.

CO_2 injected into limestones and dolostones of the Mississippian Midale beds is contained within the reservoir primarily by sedimentary anhydrite layers and diagenetic anhydrite cements. In the Weyburn Field the Mississippian succession is truncated from less than 1 m to about 25 m above the anhydrite seal by a basin-wide erosional surface that is overlain by a 1.5 km predominantly Mesozoic succession of mainly siliciclastics with minor carbonates and evaporites. These are being examined to develop a three-dimensional model of the distribution of aquitards and aquifers. Significant unconformities are present not only within sandstone, but also within shale dominated successions. Identifying unconformities within these shales relies on the recognition of distinct, yet subtle markers associated with truncation and onlap of strata. Identifying these unconformities is important to risk assessment as the unconformities are commonly associated with porous transgressive bioclastic lags and sandstones with potential as conduits for subsurface fluid movement.