

The Importance of Geological Variability on Petrophysical Properties When Estimating Geologic Storage Capacity in the Middle Devonian Dundee Limestone (Sensu Lato), Michigan Basin, USA

J.P. Kirschner, D.A. Barnes, Western Michigan University & MGRRE

The Middle Devonian Dundee Limestone (sensu lato) has substantial Geological Storage Capacity (GSC), estimated at 1.4-5.6 billion metric tons, in the Michigan Basin. Historically, the Dundee Limestone (s.l.) was separated into the Rogers City and Dundee (sensu stricto) Limestones only in outcrop. However, separation is also possible in much of the subsurface on the basis of wireline logs. The Dundee Limestone (s.s.) consists of evaporate prone peritidal facies in the western part of the basin, and predominantly shallow open marine patch reef, grainstone/packstone, and other facies in the east. The Rogers City Limestone is a mostly homogeneous, open marine, fossiliferous mudstone/wackestone that overlies the Dundee Limestone (s.s.). Localized fracture related dolomitization has significantly improved reservoir quality in both units. The petrophysical properties of the Rogers City and Dundee (s.s.) Limestones are intrinsically influenced by stark differences in lithology. Using statewide averages for porosity and thickness obscures GSC estimates even on the county scale. High end estimated GSC per unit area using statewide averages is 1,361 tons/ha for the Dundee (s.l.), 1,089 tons/ha for the Dundee (s.s.), and 139 tons/ha for the Rogers City. Estimated GSC per unit area using county averages for the respective units are 2,285 tons/ha, 2,080 tons/ha, and 12 tons/ha in Arenac county, and 575 tons/ha, 367 tons/ha, and 86 tons/ha in Osceola county. Thus, statewide GSC estimates misrepresent known lithologic and petrophysical variability, which must be taken into account for any geologically sound GSC estimate.