Petrologic and Petrophysical Evaluation of the Lockport Dolomite (Middle Silurian) for Geological Sequestration of CO_2 in the Central Appalachian Basin, Christopher D. Laughrey, Jaime Kostelnik, Kristin M. Carter, and John A. Harper, Pennsylvania Geological Survey, Pittsburgh, PA 15221, claughrey@state.pa.us

The Middle Silurian Lockport Dolomite is a potential target for geological sequestration of carbon dioxide (CO_2) in the Central Appalachian Basin. Lockport sediments were deposited as shallowing upwards facies on a broad carbonate platform across this region. Porous, permeable intervals mostly occur within thicker (> 4.5m) biohermal and biostromal lithofacies. Carbonate textures and fabrics indicate episodes of marine and freshwater phreatic diagenesis, syngenetic replacement of micrite by finely crystalline dolomite, evaporite mineralization, burial dolomitization, and late diagenetic formation of iron sulfides, galena, fluorite, saddle dolomite, calcite, quartz, bitumen, and hydrogen sulfide during thermochemical sulfate reduction. Anhydrite cement might increase CO_2 fugacity.

Vuggy, moldic, and intercrystalline voids dominate the Lockport reservoirs, yielding a dual porosity-permeability distribution. Dense crystalline dolostones have an average porosity of 3.4 percent and average horizontal and vertical permeabilities of <0.10 md and 0.88 md, respectively. Intervals with vuggy and moldic pores have an average porosity of 9.6 percent and respective horizontal and vertical permeabilities of 50.0 md and <0.10 md. Irreducible saturations in the vuggy and moldic intervals average 7 to 9 percent at water pressures of 97 to 284 psi. Resistivities for Lockport brines range from 0.032 to 0.045 ohm-m, with a mean R_w = 0.04 ohm-m. S_w calculated using the Archie formula is unreliable due to variability in the cementation exponent. Combined use of S_w as measured by the movable hydrocarbon index, the ratio method, and the Archie equation, in conjunction with estimates of bulk volume water, provide accurate calculations of fluid saturations in these rocks.