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Pennsylvanian System in Indiana: A Complex Target for CO₂ Sequestration and Coal Bed Methane Recovery

Indiana's Pennsylvanian System is a complex stratigraphic sequence composed of compartmentalized sandstones, largely continuous coal seams, and organic-rich shales. Such diverse facies architecture makes this sequence unique for CO₂ sequestration, enhanced oil and gas recovery, and potential coal bed methane extraction. As energy demand increases, a closer look at this sequence may be attractive both as a source of energy and as a sink for CO₂ formed during power generation. A consortium of five states (Illinois, Indiana, Kansas, Kentucky, and Ohio) has developed the Mid-continent Interactive Digital Carbon Atlas and Relational dataBase (MIDCARB) in order to identify major sources of CO₂ emissions and to determine the most suitable sites for geologic sequestration in the Midwest. This study presents an evaluation of the distribution of selected geological horizons and their characteristics for CO₂ sequestration within the Pennsylvanian rock sequence. The sequestration potential in mature, nearly depleted oil and gas fields, as well as in the relatively thick and widely distributed Seelyville coal, is substantial. Structural and thickness analysis of the Seelyville coal, together with data on the maximum sorption capacity of CH₄ and CO₂/CH₄ ratios, form the basis for calculation of CO₂ sorption capacity of this coal. Subsurface reservoir data including thickness, porosity, permeability, and depth (pressure), were integrated to make a volumetric estimation of the CO₂ sequestration potential of this diverse stratigraphic Pennsylvanian rock sequence in southwest Indiana.