AAPG Datapages/Search and Discovery Article #90308 ©2017 AAPG Eastern Section 46th Annual Meeting, Morgantown, West Virginia, September 24-27, 2017

Importance of Basin Tectonics in Alleviating Uncertainty in Carbon Storage Projects

Hannes E. Leetaru[1], Jared T. Freiburg[1], Robert A. Bauer[1], and John H. McBride[1]

[1]Illinois State Geological Survey

ABSTRACT

Carbon Capture and Storage (CCS) is on a cusp of moving from small volume CO2 injection test sites to large-scale commercial projects. The increased rate of injection will raise both the reservoir pressure and the volumetric (lateral and vertical) extent of the plume. A combined regional and site-specific approach to geologic characterization will be necessary to understand the uncertainty and potential risks, including microseismicity, involved with any injection program. The Cambrian Mt. Simon Sandstone is one of the most important formations for CO2 storage in the Continental United States. The sediments of the lower Mt. Simon were deposited in a Precambrian failed rift basin that formed during the breakup of the supercontinent of Rodinia in what is now the Illinois Basin. This rifting event accommodated deposition of over 2,600 ft (792 m) thick Mt. Simon siliciclastic sediments. Examination of 2D and 3D seismic data integrated with well and log data are leading to better understanding of the geologic risks for CCS. In the Illinois Basin, these data suggest that accommodation of Mt Simon sediments was accompanied by contemporaneous faulting in the lowermost Mt. Simon and Precambrian rocks. The preservation and architecture of Mt. Simon reservoir rocks may, in some areas, be controlled by Precambrian topography that was formed by faulting and by erosion into the underlying rhyolite basement. One million tonnes of CO2 have been injected into the Mt. Simon Sandstone at the Illinois Basin – Decatur Project (IBDP). Continuous seismic monitoring before, during, and after injection, shows that microseismicity increased during injection, tends to occur in spatial clusters, and occurs not only in the Mt. Simon, but also in underlying (Argenta) clastics and Precambrian igneous rocks. The 3D seismic data at this area suggests that much of the microseismicity is proximal to interpreted faults that extend from the basement up into the lowermost Mt. Simon strata. The faults near clusters of microseismic activity are critically oriented with respect to the maximum stress direction. Addressing uncertainty around the potential for microseismic activity associated with commercial-scale CCS requires not only identification of a suitable reservoir and its petrophysical characteristics, but also the extent and orientation of existing local faults and their relation to regional stress orientation.