Heterogeneity of Miocene Deepwater Heterozoan Carbonates and Reservoir Potential

Walters, Lindsay A.[1]; Franseen, Evan [1]; Goldstein, Robert [2]; Byrnes, Alan [3] (1) Kansas Geological Survey, Lawrence, KS. (2) Department of Geology, University of Kansas, Lawrence, KS. (3) Chesapeake Energy Corporation, Oklahoma City, OK.

Miocene outcrops in southeast Spain expose 3D heterogeneity of cyclic deep-water heterozoan carbonates. Variable substrate paleotopography resulted in a point-sourced system that focused loose heterozoan grains into deeper water. Strata are primarily composed of coarse and moderate grained intraclastic units interpreted as debris flows, graded facies indicating turbidites, trough cross-bedded packstones indicating tractive currents, and fine-grained hemipelagic deposits. Depositional mechanisms are similar to point-sourced, deep-water siliciclastic reservoirs. Previous studies have documented seven to ten cycles that were deposited in flooded paleovalleys as a function of high-frequency relative sea-level fluctuations. New observations confirm that cycles typically fine upward, occur in roughly 75% of the study area, and are either not preserved due to erosion at the base of the next overlying cycle or were not deposited above areas of onlap against the paleotopography. New results indicate deposition was primarily by sediment gravity flows down steep valley flanks into low-lying areas as a result of fluctuating sea-level interacting with paleotopography. Deposits consist of hundreds of flows that lap out against underlying substrate. Amalgamation of flow deposits is preferentially found in areas of erosion, such as paleovalley centers and less in flank areas. Within the paleovalleys flow deposits typically are laterally continuous, until the point of lap out.

Analysis for porosity and permeability data was performed on 493 samples as a step in developing a reservoir analog model for this relatively unstudied point-sourced deep-water heterozoan carbonate system. Good reservoir-analog facies, with associated average porosity and permeability values, include coarse- and moderate-grained intraclastic packstone, 38% and 375 mD, graded units, 37% and 550mD, and cross-bedded packstones, 35% and 340 mD. Fine grained units, mostly hemipelagic material, tend to have porosities similar to the reservoir-analog facies, 40%, but with markedly lower permeabilities, 175 mD. Therefore, they may be lower permeability reservoir facies, or even potential baffles to flow units in the subsurface. The mapped facies distribution and porosity and permeability data demonstrate that a point sourced deepwater heterozoan carbonate reservoir could be a viable one, with higher degrees of heterogeneity along the flanks than along the axis of the deposit.