Faults, Depositional Setting, Sea-Level Change, and Diagenesis Control on Heterogeneous Carbonate-Chert Reservoirs Within Mississippian (Osagean) Strata in South-East Kansas

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Middle Mississippian (Osagean) carbonate and chert form reservoirs in ramp-margin locations bordering the northern Anadarko and Arkoma basins. High-porosity, low-resistivity tripolitic chert, informally termed “chat”, form especially productive reservoirs, but controls on, and timing of, chat formation remain enigmatic. Initial results come from four cores located in northwest Cherokee county, Kansas in a study evaluating the stratigraphic and structural setting, and diagenetic controls on reservoir strata in ramp-margin locations.

Predominant lithofacies include bioclastic wacke-packstone, sponge spicule-rich wacke-packstone, silty dolomitic wackestone, argillaceous mudstone, dense chert, tripolitic chert, and chert breccia. Four cores are used for a ten-mile long northeast-southwest cross section. On the basis of regional facies, the two cores to the northeast were higher on the ramp than the two to the southwest. Correlations show aggradationally stacked southward thinning wedges on a distally steepened ramp-margin. At least three internal packages are each defined by basal argillaceous mudstone and wackestone, overlain by sponge spicule-rich wacke-packstone, and then bioclastic wacke-packstone; indicating shallowing upward into subtidal normal marine environments. The two northeast cores have more chert (55%) than the two southwest cores (37%), indicating a preference for chert facies in the shallower setting.

Although chert overall is less abundant in the southwest, porous chert is more abundant to the southwest (32%) compared to the northeast (25%). That, and molds of calcitic fossils, make up much of the porosity. Petrography reveals some early silicification and chalcedony filling primary intergranular pore space that predates compaction, likely from redistibution of silica from sponge spicules. In addition, there is a stage of post-burial dissolution of calcitic fossil fragments (crinoids), which also affected chert facies. A mapped post-Mississippian fault adjacent to the southwest cores, and fracturing associated with it, may have created preferred conduits for late fluids that enhanced porosity.

These data indicate that reservoir character is a complex interplay of depositional through late diagenetic events. The reservoir sweet spots may be controlled by depositional setting that led to abundant chert and carbonate grains in grain support, combined with a structural setting that led to enhanced fluid flow for later dissolution.