New Interpretations on Chert Deposition and Porosity Evolution in Mississippian Cherts

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ABSTRACT

Porous chert is common in Mississippian strata in the Mid-Continent. Outcrop studies in northwestern Arkansas provide evidence for a strong depositional control on the alteration potential, and subsequent reservoir quality, of the cherts. Overall shallowing of seas during Osagean time from Reeds Spring to Pineville Tripolite to the Burlington/Keokuk Formation is indicated by a large-scale shoaling upward sequence, from a mudstone-dominated to a grainstone-dominated system. Multiple shoaling upward parasequences 3-8 meters thick are identified in each formation. Porosity development occurs at the tops of parasequences in the Reeds Spring Formation and bases of parasequences in the Burlington/Keokuk Formation, while cyclic variations in porosity are observed in the Pineville Tripolite due to variable facies stacking.

Multiple hypotheses exist describing methods of porosity generation in cherts. Opal to microcrystalline quartz transformation of biogenic silica is inferred to be underrated as a mechanism for porosity development. Dewatering of opal in mixed siliceous and carbonate material results in volume loss, and may result in porosity development. However, continued outcrop studies identified vertical solution pipes within the tripolite, cross-cutting stratigraphy for 3-6 meters, filled with brecciated tripolitic chert. These are inferred to represent subaerial exposure internally within the tripolite and may impart a meteoric influence on the system. Also, differing generations of coarsely crystalline vug and void filling cements have been identified, and may potentially be hydrothermal in origin. These findings illustrate that no single model may explain the complexity associated with chert porosity development, and multiple components are likely driving alteration within the depositional framework.