# Stratigraphic and Facies Control on Porosity and Pore Types of Mississippian Limestone and Chert Reservoirs: An Example from North-Central Oklahoma

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## ABSTRACT

Mississippian limestone and chert reservoirs in north-central Oklahoma include lithofacies that form upward-shallowing cycles that commonly transition from more mud- to grain-dominated and are typically capped by deposits indicative of subaerial exposure. Mississippian-age rocks in the study area consist of 17 lithofacies that were deposited on a distally steepened ramp. Vertical lithofacies stacking reveals 28 higher order cycles and cycle thickness varies from 1 ft (0.3 m) to 100 ft (30.5 m). Most cycles (22 of 28) are asymmetric, regressive cycles with an average thickness of 21 ft (6.4 m).

Digital-image analysis (DIA) illustrates that most lithofacies exhibit nanopores (1 nm2 < A < 62.5 μm2) and micropores (62.5 μm2 < A < 500 μm2) with five major pore types including interparticle, intraparticle, vuggy, channel, and microfracture. DIA-porosity quantification yields a reliable result to predict porosity with somewhat higher values as compare to core-measured porosity. The discrepancy is likely due to several factors including the internal pore network, diagenetic alteration, unconnected microfracture network, and isolated pores. The combination of thickness and high reservoir quality make most grain-dominated lithofacies the most prospective. Moreover, reservoirs with higher porosity and permeability are commonly associated with the upper intervals of higher order regressive cycles.