Upper Cretaceous (Campanian) Ozan and Annona Chalks in Caddo–Pine Island Field, Northwestern Louisiana: Depositional Setting, Lithofacies, and Nanopore/Micropore Network

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ABSTRACT

The Caddo–Pine Island Field is a very old, shallowly buried (<2000 ft; <600 m) producing field that was discovered in 1905. One of its main reservoirs is the tight Annona Chalk, which is presently produced by the fracking of horizontal wells. A long (~200 ft [~60 m]), vertical core recovered from the Ozan Chalk and Annona Chalk sections has been analyzed to understand under what conditions the chalks were deposited and what mineralogic and diagenetic processes produced chalks with fair to very good porosity (Ozan arithmetic mean = 17.4%; Annona arithmetic mean = 23.8%) but poor permeability (Ozan arithmetic mean = 0.18 md; Annona arithmetic mean = 0.42 md). The chalks are classified as chalky marls having more than 5% clay. The Campanian Annona Chalk and Ozan Chalk were deposited during a second-order sea-level rise on the drowned Lower Cretaceous constructed platform. Depositional setting for these chalks is interpreted as deeper shelf, distal from any siliciclastic source, below storm-wave base, and in a low-energy and well-oxygenated bottom environment. Several cycles of covariant calcite and clay-mineral content suggest changes in either sea level or climate or a combination of both. The relatively small amount of clay is important because it enhanced compaction and cementation, which are the two main diagenetic processes reducing reservoir quality. The pore network is composed of interparticle and intraparticle nano- to micropores. The sub-micron pore throats between the coccolith platelets and clay are responsible for the low permeabilities. With advanced drilling and completion technologies and an estimated 94% of in-place reserves remaining, the shallowly buried Annona Chalk will be of continued economic interest. With a future increase in oil prices, even the Ozan Chalk may become of interest as an oil target.

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