Stratal Architecture, Lithofacies, Environmental Setting, Depositional Processes, and Associated Geological Characteristics of the Upper Cretaceous Austin Chalk in Louisiana

Robert G. Loucks[1], Christopher K. Zahm[1], Toti E. Larson[1], Laura C. Zahm[2], and Peng Zeng[1]

[1]Bureau of Economic Geology, University of Texas at Austin,
Box X, University Station, Austin, Texas 78713–8924, U.S.A.

[2]No affiliation, U.S.A.

ABSTRACT

The Austin Chalk in Louisiana is an active petroleum exploration and production trend. For this siliciclastic-rich chalk to be exploited efficiently, knowledge of the stratal architecture, lithofacies and their distribution, environmental setting, depositional processes, and associated geological characteristics is required. Integration of wireline-log and core data is an excellent method for characterizing this fractured, low-porosity-matrix reservoir system. In the producing trend in Louisiana, the Austin Chalk was deposited in an open-marine, outer shelf setting below storm wave base. Four major lithofacies can be defined that allow analysis of the stratal architecture and stacking patterns within the Austin Chalk. Lithofacies 1 is a highly bioturbated, organic-matter-poor, marly chalk and rarer pure chalk. Lithofacies 2 is a highly bioturbated, organic-matter-poor to -rich, marly chalk to chalky marl. Lithofacies 3 is a slightly burrowed, organic-matter-rich, laminated marly chalk to lesser chalky marl. Lithofacies 4 is an organic-matter-rich, well-laminated marly chalk to chalky marl. Lithofacies 1 was deposited under oxic conditions, lithofacies 2 under oxic to dysoxic conditions, lithofacies 3 under dysoxic to anoxic conditions, and lithofacies 4 under anoxic conditions. Numerous small-scale cycles composed of organic-matter-poor, burrowed units alternating with organic-matter-rich, laminated units are similar to Milankovitch cycles as seen in age-equivalent Niobrara Chalk in the Western Interior Seaway and chalks in the North Sea region in Europe. These cycles are most pronounced in deeper-water, outer-shelf areas away from the regions of uplift. The Austin Chalk pore network is composed of interparticle nanopores between coccolith elements and fewer intraparticle

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nanopores in clay platelets and inoceramid fragments. Some organic-matter nanopores are within solid bitumen. Organic matter in the chalk is generally type II and III kerogen depending on lithofacies, and some of the chalk has >2 wt% total organic carbon.

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