Heterogeneity of Microscale Lithology and Pore Systems in an Upper Cretaceous Eagle Ford Group Horizontal Core, South Texas, U.S.A.

Robert M. Reed, J. Evan Sivil, Xun Sun, and Stephen C. Ruppel

Bureau of Economic Geology, Jackson School of Geosciences, University of Texas at Austin, University Station, Box X, Austin, Texas 78713, U.S.A.

ABSTRACT

A horizontal core from the Upper Cretaceous Eagle Ford Group of South Texas provides a rare opportunity to study lateral heterogeneity of lithology, total organic carbon (TOC), and pore systems in a calcareous-argillaceous mudstone from the subsurface. The core is 182 ft (55.5 m) long and spans between 2 and 4 ft (0.6 and 1.2 m) of stratigraphic section. True vertical depth is ~10,970 ft (~3343.7 m). Calculated vitrinite reflectance (Ro) is ~1.1%. Macroscopic variations in lithology are related primarily to foraminiferal abundance. Millimeter-scale grainstone laminae with numerous foraminifera are common but generally discontinuous.

On a microscopic scale, the rock can be divided into three major domains or lithologic components: coccolith-rich pellets, siliceous-argillaceous seams, and foraminifera. Pellets contain intraparticle pore spaces filled with organic matter interpreted to be migrated bitumen. Siliceous-argillaceous seams anastomose around the pellets and are predominantly clay minerals with quartz, albite, and minor organic matter. The ratio of siliceous-argillaceous seams to pellets varies between laminae and between samples. Macroscopically, there is variation in the abundance of foraminifera from sparse to abundant. Scanning electron microscope (SEM) examination shows chambers filled with calcite, kaolinite, and bitumen, along with minor pyrite, dolomite, and quartz. From sample to sample and from foraminifera to foraminifera, the proportion of fill material differs—some samples have more calcite, some more kaolinite, and some more bitumen. Chamber fill in grainstone laminae is dominantly calcite, and calcite cement is also present between foraminifera.

Variation also occurs in minor components of the samples. For example, differences in the abundance of originally siliceous, now pyritized radiolarians suggests local differences in the amount of dissolved silica available

Reed, R. M., J. E. Sivil, X. Sun, and S. C. Ruppel, 2019, Heterogeneity of microscale lithology and pore systems in an Upper Cretaceous Eagle Ford Group horizontal core, south Texas, U.S.A.: GeoGulf Transactions, v. 69, p. 593–594.

for quartz cement. Significant variations in the amounts of silt-size albite and dolomite occur between samples (e.g., some samples have twice the albite of others).

These rocks have a complex pore system. Within bitumen in pellets and foraminifera chambers there are typically two sizes of organic-matter pores: submicrometer-scale spherical to slightly elongate pores and more numerous nanometer-scale pores. The larger pores appear to be connected by the smaller, more numerous pores. Also a few early micrometer-scale pores were developed during initial migration of bitumen. Within the siliceous-argillaceous seams surrounding the pellets are nanometer-scale interparticle pores. As pore abundance is influenced primarily by the local ratio of pellets to siliceous-argillaceous seams, lateral variations in this ratio drive variations in the pore system.

Ed. Note: This abstract was extracted from a full paper published in the 2019 volume of the *GCAGS Journal*. The *Journal* papers are currently available in open-access format online at www.gcags.org.