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Making geologic sense of pore-system characterizations in carbonate-rich mudrocks: an examples from the Niobrara Formation, DJ Basin

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ABSTRACT:

Carbonate-rich mudrocks are deposited as biogenic sediments, and their mineralogy means they should have different pore-system characteristics - pore types, sizes, and connectivities - relative to argillaceous and siliceous mudrocks. But not all carbonate mudstones are deposited alike or with the same initial mineralogies. Secular changes in ocean chemistry mean geologic intervals characterized by originally calcitic mudstones and other intervals characterized by originally aragonitic mudstones. Biological evolution has meant time intervals of only benthic-sourced mud (Paleozoic) and intervals of both benthic-and pelagic-sourced muds (post-Jurassic). How these differences translate to pore systems in carbonate mudstones hosting unconventional resources is not well documented. Scanning electron pore imaging of one example, the Niobrara Formation, reveals three key points. An intercrystalline pore network associated with the calcite dominates. Pore associated with clay minerals in the matrix of marls and marly shales, as well as pores within organic matter, are secondary. The intercrystalline pores are bigger, less elongate, have large pore throats, and are better connected than all other pore types. Lithology matters. However, vertical lithologic heterogeneity occurs over three spatial scales (cm to decameter), which means the lithologic control creates tremendous challenges for upscaling.

Speaker Biography:

David Budd received BA, MS, and PhD degrees in geology from the College of Wooster (1976), Duke University (1978), and University of Texas, Austin (1984). After three years in ARCO's geologic research group, he joined the Department of Geological Sciences at the University of Colorado in 1987. David's primary research interests are in the diagenesis of carbonate rocks, and the application of carbonate geology to petroleum reservoirs and aquifers. Current research relates to the evolution of nanopore systems in unconventional carbonate reservoirs, reaction-transport modeling of diagenetic patterns, dolomitization, and self-organizing phenomena in carbonates.

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