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Diverse Origins and Facies of Carbonate Microporosity

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Carbonate microporosity has reached new significance with the modern focus on the exploration for natural gas reservoirs. Because microporosity does not permit good fluid flow, microporous carbonate facies and diagenetic systems received limited study in the oil-focused exploration programs of the 20th century. However, because microporosity is effective for gas flow, there is growing interest in the distribution and origins of microporous carbonate facies as potential gas reservoirs. Microporous carbonate reservoir rocks occur throughout the geologic column, and vary greatly in both their facies distributions and origins. Microporous carbonate reservoir examples given here vary from peritidal dolomites, to shallow-water packstone-grainstone banks, to deeper water mud-rich and cherty carbonate facies.

Ordovician peritidal facies of the updip Bromide dolomite reservoirs in the Arkoma Basin of Oklahoma are dominated by micro-intercrystalline dolomite porosity resulting from rapid early diagenetic reflux dolomitization. Lower Devonian mid-to-lower slope gas reservoirs in the Thirtyone Formation in the Permian Basin of west Texas rely on cherty microporosity in spiculitic packstones, accompanied by spicule-moldic porosity, and sometimes fracture porosity. Middle Pennsylvanian (Strawn, Desmoinesian) gas reservoirs in Komia packstone-grainstone banks of the Val Verde basin in west Texas are characterized by intraskeletal microporosity within the small branching fossils. And Late Jurassic Cotton Valley deep-water microbial-sponge mound gas reservoirs of the East Texas Basin have microporosity developed in the recrystallized originally high-Mg calcite microbialites.

Microporous carbonate rocks commonly require an associated macroporosity type in order to be good primary exploration targets, but carbonate rocks with only microporosity can be good secondary producing horizons. The growing interest in tight carbonate gas reservoirs, and the increased exploration into deeper and higher temperature horizons, provides impetus to learn more about microporous carbonate facies and diagenetic systems, which should enable better predictability.

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