Preliminary Classification of Matrix Pores in Mudrocks

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ABSTRACT

Investigation of pore networks in mudrocks is important because shale gas has become a major exploration target and understanding pore networks of these very fine grained rocks is essential to an understanding of production rates and reserves. However, identifying and characterizing mudrock pores are difficult because of their nanometer to micron scale. With development of argon-milling surface-preparation techniques and use of field-emission scanning-electron microscopes, we can now image pores as small as 5 nanometers (nm). A number of different pore types have been identified, and combinations of pore types that constitute pore networks in different mudrock suites are variable. Basic pore types are divided into those associated with organic matter and those that are not. Pores within organic matter appear to be related to thermal maturation of organic matter. Nonorganic-matter pores can be divided into interparticle and intraparticle types and are strongly affected by mechanical and chemical diagenesis. Interparticle pores occur between grains and crystals, whereas intraparticle pores are found within the boundaries of grains. The latter include dissolution molds in fossils and particles, intercrystalline pores within framboids of pyrite, fluid inclusions in crystals, and pores within phosphate grains. Pore types vary in variety and abundance within differing shale-gas reservoir systems. Mississippian Barnett mudrock pores are dominantly associated with organic matter, Jurassic Haynesville/Bossier mudrocks contain mostly interparticle pores, and Cretaceous Pearsall mudrocks contain primarily intraparticle pores. Mudrock pore networks can be overprinted by fractures, producing a dual pore system.

Loucks, R. G., R. M. Reed, S. C. Ruppel, and U. Hammes, 2010, Preliminary classification of matrix pores in mudrocks: Gulf Coast Association of Geological Societies Transactions, v. 60, p. 435-441.