Pore Morphometrics and Thermal Evolution of Organic-Matter Microporosity, Colorado Group, Western Canada Sedimentary Basin

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Abstract

The physics of flow in conventional oil and gas reservoirs is reasonably well-understood, however, the nature of flow in carbonaceous mudstone reservoirs is unclear due to highly heterogeneous micropore structure. A quantitative model relating micropore morphometrics and matrix permeability, as yet undeveloped, is required to infer the contribution of microporosity to economic flow rates.

Carbonaceous mudstones of the Upper Cretaceous Colorado Group of the Western Canada Sedimentary Basin (WCSB) span a wide spectrum of thermal maturity levels. This affords an opportunity to combine regional scale of investigation with quantitative micropore morphometrics of related carbonaceous mudstones with variable burial and thermal histories. The first phase of this effort requires cataloguing of dominant modes of intrinsic microporosity (Schieber, 2010) and relating these to process dynamics in the depositional and burial domains.

Phyllosilicate framework (PF) and organic matter (OM) pores are the dominant microporosity modes observed in the correlative equivalents of the Second White Specks, Belle Fourche and Fish Scales Formations of the lower Colorado Group in a gamut of samples spanning the foredeep, forebulge and backbulge segments of the WCSB foreland basin. The PF fabric suggests advective transport of mud floccules or fecal pellets as a dominant mechanism for formation of intrinsic PF microporosity. Abundant OM microporosity development in thermally immature organic matter may be indicative of non-catagenic pathways to porosity development and preservation in carbonaceous mudstones.