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Petrology and Petroleum Geochemistry of Trenton - Black River Carbonates and Shales, Central and Northwestern Pennsylvania

Limestones and dolostones in the Trenton and Black River formations of central and northwestern Pennsylvania were deposited on a gently sloping carbonate ramp under normal marine conditions. Black River carbonates comprise skeletal grainstones, packstones, and wackestones, mudstones, and dolostones deposited in intertidal, lagoonal, and shallow subtidal environments. Trenton rocks include skeletal grainstones, packstones, and wackestones, laminated and nodular mudstones, and black calcareous shales deposited in relatively deep-water environments. Centimeter-scale cyclic patterns, induced by storms, suggest various sedimentary processes that were active during deposition of the Trenton and Black River formations. Diagenetic features in the Trenton and Black River formations reflect mostly marine and burial environments of cementation and alteration. Evidence for marine diagenesis includes micritization, isopachous cements, sparry calcite cement, and hardgrounds. Compaction features, fractures, silicification fabrics, idiotopic and xenotopic dolomite textures, and MVT mineral assemblages all denote burial diagenesis. Trenton and Black River rocks in northwestern Pennsylvania contain as much as 2.95 % Total Organic Carbon (TOC). These rocks are at peak thermal maturity and are gas-prone. TOC in the Trenton and Black River formations of central Pennsylvania also reflect good petroleum potential (up to 1.72%), but the rocks here are over mature and their kerogens are exhausted. Nevertheless, these rocks appear to be generating low-molecular weight hydrocarbons at a rate that might result in commercial gas accumulations. Low and high temperature pyrolysis data reveal the presence of bitumen sorbed on the mineral matrix of Trenton and Black River carbonates. This bitumen is cracking to gas today.