

Hydrothermal Dolomite (HTD) in the Michigan Basin, USA, David A. Barnes, William B. Harrison III, G. Michael Grammer, Michigan Geological Repository for Research and Education and Department of Geosciences, Western Michigan University, Kalamazoo, MI 49008, barnes@wmich.edu; T.M. Parris, Kentucky Geological Survey, University of Kentucky, Lexington, KY 40506

Previous investigations and new data from the St. Peter Sandstone, Trenton/Black River (T/Br), Niagaran, and Dundee formations in the Michigan Basin (> 1,600 MMBOE combined cumulative production) suggest that genetically related, hydrothermal diagenesis was important in the origin of many petroleum reservoirs. Saddle dolomite occurs in all of these units as replacive intergranular cement, fracture/vug fill, and/or primary carbonate matrix replacement. Other important hydrothermal phases include pyrite; bitumen; quartz; fracture filling, sparry calcite; anhydrite; and rare fluorite. Petroleum reservoirs in the Ordovician T/Br Group have long been recognized as classic, fracture related, hydrothermal dolostone reservoirs. Stable isotope and fluid inclusion data indicate that fracture fill and replacive dolomite and late, sparry calcite fracture fill were formed from saline, $\delta^{18}\text{O}$ enriched (+5–+12 $\delta^{18}\text{O}$) hydrothermal fluids at between 100°–160°C in T/Br reservoirs. The subjacent, Ordovician St. Peter Sandstone and related strata (AKA “PDC” Sands) contains a complex diagenetic mineral suite including intergranular, replacive, saddle dolomite formed from saline, $\delta^{18}\text{O}$ enriched (+9–+10 $\delta^{18}\text{O}$) hydrothermal fluids at between 120°–170°C. Although complex early diagenesis dominates secondary mineral assemblages in many Silurian Niagaran Reef reservoirs, a regionally significant suite of hydrothermal mineral cements also occurs. Saddle dolomite and late sparry calcite formed from saline, $\delta^{18}\text{O}$ enriched (+2–+9 $\delta^{18}\text{O}$) hydrothermal fluids at between 85°–125°C. The Devonian Dundee Limestone formation contains numerous dolostone reservoirs with matrix replacive and fracture/vug filling saddle dolomite and late sparry calcite formed from saline, $\delta^{18}\text{O}$ enriched (+4–+8 $\delta^{18}\text{O}$) hydrothermal fluids at between 120°–145°C. Each of these important hydrocarbon reservoirs as well as other, less productive formations share at least one and, in most cases, several important diagenetic mineral components resulting from at least one episode of fracture related, hydrothermal mineralization in the Michigan Basin.