Robert G. Hickman, Structural Solutions, W. Norman Kent, Kent Geoscience, Jeff Martin, and Mark E. Odegard, Getech

Exploring the Appalachian Basin for Hydrocarbons Trapped in Hydrothermally Altered Reservoirs

Trenton-Black River exploration has focused attention on hydrothermal dolomite reservoirs. Understanding these reservoirs and the fluids that produced them suggests additional exploration opportunities and strategies. The fluids that formed these reservoirs were brines with temperatures of 50° to 200° C, which are higher than formation temperatures produced by the geothermal gradient. The sources of the large flux of water required for dolomitization are deep, basin-wide regional aquifers such as the Mt Simon/Potsdam and Knox. Hot brines moved laterally in these aquifers and then upward through faults or across unconformities into shallower aquifers. Their high salt content increased calcite solubility and facilitated dolomite replacement. Upward cooling of the brines further increased calcite dissolution. In contrast, cooling reduced silica solubility. Consequently, deep sandstone aquifers and sandstones in the areas of upflow may have enhanced secondary porosity while peripheral sandstones are silica cemented. Integrated regional mapping of aquifers, seals and faults using logs, potential fields data and seismic can identify potential fluid pathways and prospective trends. Sandstone and carbonate aquifers have enhanced porosities of regional extent, but require four-way closures or updip truncations for trapping. Sandstones adjacent to carrier faults may have abnormally good reservoir properties. Hydrothermal dolomite reservoirs occur along faults that tap a deep aquifer at a favorable position such as the erosional truncation of the aquifer. Typically, the faults were reactivated over Precambrian terrane boundaries, faults, and contacts and may have a small component of strike-slip displacement. Fluid flow and dolomitization is focused at releasing fault bends and interaction zones.