Although relatively simple structurally, the Interior Lowland area underlying Ohio and adjacent states constitutes a rich and varied hydrocarbon habitat. Structural style included influences of three subsidence episodes, broadly encompassing the Appalachian orogeny to the east and the Michigan and Illinois basins to the northwest and southwest, respectively. A sedimentary sequence covering the whole Paleozoic succession is variously present and becomes generally younger toward the southeast. Hydrocarbons are produced from numerous reservoir intervals within this Paleozoic section. Prominent among these are the Cambrian-Ordovician Knox Group, Ordovician Trenton Limestone, Silurian Medina Group, Devonian Oriskany and Vanango Sandstones, Mississippian Berea Sandstone, and Pennsylvanian coal measure sands. A variety of petroleum types, implying an equal variation in source rock characteristics, has been recognized. Reservoirs have been charged variously from finely textured organic-rich source beds cosedimented within the same succession. Whether the simplistic case of source charging of syndepositional or directly adjacent reservoir beds is normal or whether more complex long distance lateral and/or vertical emplacement processes are involved has yet to be subject to definitive study. Some of the more prominent source candidate rocks include the Conasauga Shale (Cambrian), Reedville or Utica Shale (Ordovician), Ohio Shale (Devonian), and Bedford or Sunbury Shale (Mississippian), in addition to various Pennsylvanian intervals.

Using kerogen pyrolysis-carbon isotopic source-oil correlation technology, it is possible to match petroleums with their precursor sources.

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Environmental Aspects of Middle Ordovician Limestones in Central Appalachians

Black River and Trenton limestones of the outcrop belts in West Virginia and Maryland were deposited on a gentle carbonate ramp that sloped eastward into a deep-water shale basin. The overwhelming sediment type on the ramp was lime mud, deposited below wave base. Water turbidity and circulation fluctuated, which precluded many epifauna. Burrowing infauna, however, were common. The consistency of the mud varied from soft to firm, and hardgrounds developed locally. The more coherent muds were probably stabilized by early dewatering and cementation. Another common sediment type, fossiliferous lime mud, represents patches of organisms that inhabited the muddy substrate. These communities, dominated by echinoderms, trilobites, and brachiopods, had both low densities and diversities. Patches were initially established by large, flat brachiopod pioneers but did not greatly expand because of the high physiologic stress and the soft consistency of adjacent substrate. Occasionally, bioclastic sands were produced by storms reworking skeletal grains of the patches. These storm deposits cut into underlying sediments, and the bioclastic debris was clearly locally derived. Other skeletal sands, containing abundant calcareous algae and *Tetradium* corals as well as peloids and intraclasts, were deposited above wave base on shallower portions of the ramp. Rare cross-laminated peloid sands were confined to small lenses and channels at various depths, and intermittent bottom currents were probably responsible for their deposition. Into progressively deeper water on the ramp, skeletal sediments decreased in abundance; storm- and current-laid sediments also decreased; and shales increased. Carbonate sedimentation eventually ended when the ramp facies were overstepped by basinal shales.

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Lower Pennsylvania Depositional Environments Reinterpreted

In southeastern Tennessee, northwestern Georgia, and northeastern Alabama, the Cumberland Plateau (Walden Ridge and its southwestern extension, Sand Mountain) is underlain by a relatively small Pennsylvanian basin known as the Raccoon Mountain basin.

Stratigraphic units in this basin, of most interest to our discussion, are the uppermost Mississippian Pennington Formation and lowermost Pennsylvanian Gizzard Group (Signal Point, Warren Point, and Raccoon Mountain formations). The Mississippian-Pennsylvanian boundary (between Pennington and Raccoon Mountain) is transitional, and much of the upper part of the Pennington consists of siliciclastics.

Previous workers have suggested that Mississippian-Pennsylvanian rocks are regionally facies equivalent, with the Pennington Formation representing a shallow marine environment and the Warren Point-Raccoon Mountain formations representing marginal-marine, barrier, and back-barrier environments. This suggestion was based largely on inferences made on observed sedimentary structures, particularly the alleged occurrence of low-angle beach-face beds.

New insight, based on sedimentary structures exposed in roadcuts and stripmine highwalls throughout the Raccoon Mountain basin, has enabled reinterpretation of environments of deposition of Pennsylvanian sandstones and shales. It is suggested that most of these Lower Pennsylvanian rocks accumulated in fluvial and paludal environments.

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Shelf Sedimentation Above Storm Wave Base in Upper Ordovician Reedsville Formation in Central Pennsylvania

Interbedded fine-grained sandstone and shale in a generally coarsening-upward sequence characterize the Reedsville Formation. Data on sedimentary structures, lithology, bedding characteristics, and fossils for eight measured stratigraphic sections indicate that most beds were deposited by occasional storm-generated currents. Storm facies exhibit (1) abundant winnowed shell lags coupled with low-angle cross-stratified finer sediment, (2) abrupt lateral thickness variation in many beds, (3) sharp, erosive upper and lower bed contacts, and (4) well-preserved, unabraded outer sublittoral benthic fauna. Hummocky cross-stratified beds are common, and in many places are associated with wave-rippled sandstones.

A shallow open-shelf environment is inferred. Storms of variable intensity and duration periodically scoured and suspended bottom sediments and deposited individual fining-upward units under conditions of strong but waning bed shear. An overall increase in the sandstone/shale ratio from bottom to top in the progradational sequence suggests gradual shallowing and more frequent storm-wave influence. Uppermost beds contain intertidal fossil communities. Paleocurrent data indicate east- and northeast-directed sediment transport.

These interpretations are not consistent with the common assumption that the Reedsville is simply the deep-basin, distal equivalent of the adjacent Martinsburg Formation. The present data suggest that Reedsville sediments accumulated on a shelf west of a structural hinge line that comprised the western margin of the thicker, deeper water Martinsburg sequence. Differential subsidence across this shelf-edge hinge line may account for the significant differences in paleobathymetry of the two formations.

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Six Types of Trap or Reservoir-Producing Configurations in Trenton Limestone Reservoir, Northwestern Ohio

Six types of petroleum-producing configurations are recognizable in the oil and gas fields of the Lima-Indiana trend whose reservoirs are the Trenton Limestone of Ordovician age. The data that support recognition of these six structural, structural-stratigraphic, and possibly stratigraphic-permeability trapping configurations are mixed, but involve consideration of the pattern of 34 fields or pools on the main anticlinal trend of the Findlay arch as well as 12 smaller fields or pools to the northwest in the Michigan basin and 20 fields to the southeast at the updip edge of the Appalachian basin.

The reservoir is mainly dolomite and the producing portion of the reservoir generally occurs near the top of the Trenton Limestone. The more porous dolomite has been analyzed chemically for Ca/Mg ratios, Na, Sr, Fe, and other elements in cores to supplement petrographic studies off the main oil field trend in Wyandot County.

The six play configurations are the following. (1) An anticlinal trap along the crest of the Findlay arch. Here, as elsewhere, the seal and presumably the source are the overlying Utica Shale. (2) A faulted anticlinal trap on the western side of the Findlay arch. The fault, the Bowling Green fault, generally limits production to the upthrown eastern side. (3) An updip facies change from the Trenton Limestone into the overlying Utica