The structural framework of the Gettysburg basin is defined by three parallel, northeast-southwest-trending, southeast-dipping, postdepositional (Sinemurian?) normal faults into which originally horizontal Triassic strata now dip 20°-30° northwest. The faults are controlled by the earlier Alleghanian structural grain. The main portion of the Gettysburg basin extends 120 km from its termination near Frederick, Maryland, to an arbitrary cutoff near Palmyra, Pennsylvania. The basin is bounded on the northwest by a normal fault with a probable maximum displacement of several thousand meters. Inliers of basement, surrounded by Triassic strata, occur adjacent to the border fault, indicating that the deepest part of the basin is not necessarily at the border fault as in a simple half-graben model. At York Springs, Pennsylvania, basement and Triassic strata occur in a fault sliver on the major east-west, older Transylvania fault, which was reactivated with 3.5 km of right-lateral wrenching. Extensive normal faults in the Blue Ridge and Great Valley are associated with development of the Gettysburg basin.

Southeast, near Keymar, Maryland, two normal faults with an aggregate displacement of 1,350 m partially separate a subbasin 20 × 5 km from the main basin. These faults extend 40 km south along the Martic Line into the Triassic Culpeper basin.

Farther southeast, near Tyrone, Maryland, a normal fault with 800 m of displacement totally separates a small (4 × 0.6 km) Triassic basin from the main basin on the northwest.

Dip reversals are rare and develop on a minor scale only adjacent to faults. Therefore, petroleum plays based on surface structural closure are not viable.

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Thermal Maturity of Newark Supergroup Basins from Vitrinite Reflectance and Clay Mineralogy

Thermal maturity estimates from vitrinite reflectance and clay mineralogy point to significant differences between the Newark Supergroup basins in their thermal structure and/or their original depth of burial. The Richmond and Taylorsville basins are relatively immature, with mean vitrinite reflectance values in the range of 0.6 to 1.1%. The clay mineral assemblages are dominated by early diagenetic smectite and mixed-layer clays. Likewise, organics in the Hartford basin have mean vitrinite reflectances between 0.7 and 1.1%. In contrast, the Culpeper, Gettysburg, and Newark basins are thermally more mature. Although a wide range of vitrinite reflectance values is observed in each of the basins, the majority of the mean reflectances are 1.5-3.0%. Well-crystallized illite and chlorite constitute the fine-grained clay fractions.

In general, the lowest degrees of thermal maturity are associated with rocks that either are stratigraphically and structurally highest in the basins or form the updip taper of the half grabens. However, systematic correlations are not observed between stratigraphic/structural position within a basin and the degree of thermal maturity. This may be attributed to a thermal "homogenization" of the basins by circulating hydrothermal fluids. The basins with the highest thermal maturities are those with large volumes of diabase intrusions and that had presumed higher geothermal gradients.

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Schurflingsfensters in Pulaski Thrust Sheet and Their Implications for Hydrocarbon Potential

Highly deformed Cambrian through Devonian rocks are exposed in fensters in the Pulaski thrust sheet of the Virginia Valley and Ridge province. Detailed mapping of these exposures shows a consistency of structural style—namely, faulted, stacked antiforms with duplex geometry and folded roof thrusts. Strain intensity and the style of regional folds and faults suggest that the fensters are schurflingsfensters that expose rootless tectonic slices, or horses, possibly derived from a thrust ramp in the trailing part of the subjacent Saltville thrust sheet. Recent interpretations of the U.S. Geological Survey's central Virginia seismic line place this ramp east of and below the crystalline rocks of the Blue Ridge structural front. Geometric modeling of rocks in the schurflingsfensters suggest the existence of possible Cambrian through Mississippian hydrocarbon-bearing rocks below the Pulaski, Max Meadows, and Blue Ridge thrust sheets. Rock samples from horses are presently being collected to determine thermal maturity and source rock potential. If these rocks were derived from the Saltville thrust sheet, sampling should prove important in evaluating hydrocarbon potential below eastern thrust sheets of the Appalachian Valley and Ridge, and Blue Ridge provinces.

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Stratigraphy and Depositional Environments of Part of Pennsylvanian Pottsville Formation in Black Warrior Basin, Alabama and Mississippi

The upper part of the Pennsylvanian Pottsville Formation of the Black Warrior basin of Alabama and Mississippi is composed of cyclic sequences of conglomerates, sandstones, siltstones, mudstones, and coals, deposited in response to alternate phases of constructive and destructive deltaic sedimentation. The coal-bearing interval has been divided into seven coal groups (Black Creek, Mary Lee, Pratt, Cobb, Gwin, Utley, and Brookwood), each of which contains several coal beds. A detailed study of the three oldest coal groups, the Black Creek, Mary Lee, and Pratt, identified a variety of deltaic facies. These include distributary channel, interdistributary bay, crevasse splay, distributary mouth bar, lagoon/prodelta, and barrier island.

The small, elongate deltas of the Black Creek, Mary Lee, and Pratt coal groups prograded northeastward from an orogenic source southwest of the Black Warrior foreland basin. A possible southeastern source terrain is suggested during deposition of Pratt strata. Distributary channels of the upper Black Creek and Mary Lee coal groups shifted extensively across the lower delta plain. Two general centers of deposition, one in Mississippi and one in Alabama, were maintained. Associated coals, trending northeast, accumulated in bays adjacent to the channels. In contrast, the northwest-trending coals of the lower Black Creek and Pratt coal groups were deposited in back-barrier settings during destructive phases of deltaic sedimentation. A single Pratt depocenter, located in Mississippi, is coincident with the upper Black Creek and Mary Lee depocenter.

Determination of depositional environments is based on the interpretation of geophysical log signatures and the distribution of sandstones and coals. Most of these data have been obtained from dual induction and density logs of wells drilled to underlying Mississippian reservoirs. The Pottsville sediments have not been a major petroleum objective; however, the numerous coal beds are a potential source of methane.

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Structural Geology of Delsignore 1: A Central Eastern Overthrust Well

Located along the Appalachian structural frontal zone of the central Eastern Overthrust, the Robert Delsignore 1 was drilled in early 1984 to a total depth of 9,965 ft after 77 days. The well was spudded within the lower Upper Devonian Chemung Group, and at total depth, the well was in the Lower Devonian Helderberg Group. The well is located less than 1 mi from the nearest Lower Devonian outcrop and approximately 1 mi across strike from the Mastellar discovery wells by Columbia Gas in Mineral County, West Virginia.

The well penetrated only Upper Devonian through Upper Silurian strata and showed the existence of the following: repeated and overturned strata, numerous southeast-dipping thrust faults, a northwest-dipping backthrust, nearly recumbent folds, and a folded, overturned thrust fault. From this "geologic discombobulation," a nearly true stratigraphic penetration of 3,150 ft was made within a 9,965-ft well. Several good hydrocarbon shows were found in the lower portion of the well while drilling.

Data obtained from this well, coupled with local and regional studies, have several implications relevant to development of size, geometry, timing, and emplacement of frontal-zone structures involving Silurian-Devonian rocks. Structural development involving Silurian-Devonian strata near a major decollement step-up can be shown to have generally progressed from east to west, resulting in a frontal-zone "pile-up." The well data also provide insight into the stratigraphy, potential reservoirs, and relative timing of migration and entrapment of hydrocarbons along structurally complex frontal zones.