Named herein the Richlands channel, the bed of this fluvial channel is as much as 6 mi wide and truncates as much as 125 ft of the underlying strata along a regionally significant disconformity. The channel is at the base of the Dismal sandstone member of the New River Formation and is filled with polymictic conglomerate and conglomeratic subgraywacke consisting mainly of well-rounded quartz pebbles that decrease in size toward the northwest. The northwest end of the channel is at a strandline marked by a well-winnowed orthoquartzite of a northeast-trending, barrier-bar complex. The absence of the characteristic deltaic morphologies, which are typical of fluvial sandstones in the underlying Pocahontas Formation, suggests that sediments at the channel terminus may have been reworked and redeposited by the southeastward-transgressing Appalachian seaway. The Richlands channel and other channels in the New River and Pocahontas Formations in the Richlands area define a major depocenter for Early Pennsylvanian clastics that were prograding from the southeast—a relationship that fits the barrier model applied to these strata rather than a braided, southwestward-flowing river system.

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Exploratory Drilling in Northern Newark Basin, New Jersey

Extensive drilling is in progress along the right-of-way of a proposed flood diversion tunnel in northern New Jersey. This 21.8-km tunnel would cut across the strike of the Newark basin in an area where rock exposures are few because of glacial deposition.

Approximately 2,400 m of the 6,300-m thick northern portion of the Newark basin is represented in rock cores. The uppermost 870 m of Upper Triassic strata has been drilled along with 1,620 m of Lower Jurassic strata. The Jurassic strata include the three Watchung Mountain sheet basalts sandwiched between fluvial and lacustrine sedimentary deposits.

What emerges for the first time is a continuous picture of the previously poorly exposed Jurassic lacustrine deposits. These cyclic deposits containing kerogen-rich layers are some of the youngest strata found in Mesozoic rift basins. These westernmost Newark basin deposits can be correlated to similar age deposits in outer continental shelf drill holes and possibly help the wildcat exploration starting to appear in the Newark basin.

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Upper and Middle Devonian Stratigraphy of Northwestern West Virginia "Devonian Shale" Play

Since 1981, an active oil and gas play has developed in Upper and Middle Devonian fine-grained clastics above the Onondaga Limestone and Huntersville Chert in part of northwestern West Virginia. Activity has been greatest in Ritchie and Pleasants Counties, but Wood, Wirt, Roane, and Calhoun Counties are also involved.

Recent drilling activity has facilitated a more detailed understanding of the Upper and Middle Devonian stratigraphy of the area. The section thickens from west to east, from about 2,000 ft to more than 4,000 ft. To the west, it is composed primarily of interbedded basinal organic dark-brown and gray to black shales and inorganic lighter gray and gray-green shales.

This section is also equivalent to the coarser grained clastic units of the Catskill delta to the east. As the section thickens to the east in the study area, the influence of the delta can be seen in the decrease of organic shale content and the progradation of siltstone bundles into the area. These delta-front siltstones are probably of predominantly turbidite origin and can be correlated with the well-known Upper Devonian drillers' "sands" of central West Virginia.

These facies changes across the area can be used to divide the area into three oil and gas plays: (1) The area west of the Burning Springs anticline, where gas is produced primarily from inorganic and organic shales. (2) The area immediately east of the Burning Springs anticline, where oil and gas are produced from transitional facies including inorganic and organic shales and siltstone. (3) The eastern fringe of the study area, where gas produced primarily from siltstone bundles has been the significant exploration result to date.

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Setting of Early Ordovician (Arenigian) Carbonate Sedimentation in Appalachian Basin: Arid Climatic Epicontinental Seas Interrupted by Intermittent Conditions of Emergence

Epicontinental seas with sea-marginal sabkhas persisted within the tropic zone of what is now the Appalachian basin. The arid climate and hypersaline conditions influenced the accumulation of carbonate sediments. Conditions of intermittent emergence interrupted cycles of carbonate sedimentation.

Evidence of hypersalinity includes calcitic, dolomitic, or siliceous pseudomorphs of former anhydrite nodules; calcite and euhedral quartz infilling solution-enhanced vugs after evaporite nodules; carbonate pseudomorphs after gypsum and halite; euhedral quartz; authigenic K-feldspar; paucity of skeletal debris; preservation of stromatolites; and length-slow chalcedony, including chalcedonic spherulites, half-moon ooids, and dedolomites. Intermittent emergence is inferred from solution-collapse features, desiccation cracks, eroded surfaces, surfaces of induration such as silcrete, and lag concentrates of micrite chips (flat-pebble conglomerate). Angular clasts of dolostone and limestone resulted from collapse and brecciation of overlying strata, when evaporites underlying them dissolved.

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Applications of Surface Geochemical Prospecting for Shale Gas Exploration in Western Appalachian Basin

Results of a regional radiometric survey in northeastern Ohio revealed several sites where anomalous values of radon, hydrocarbons, and associated gases were found. Laboratory analysis of soil-gas samples and comparisons between radon activities at anomalous sites and scintillometer readings at the same sites indicate that the anomalous gas components are of bedrock origin.

Deeper soil-gas hydrocarbon sampling techniques and various film cups and electronic detectors were used to interpret the significance of radon-hydrocarbon relationship. Highly sensitive FID and TCD gas chromatographs were used to separate and measure soil-gas light hydrocarbons (C_1-C_4) and associated gases.

Results were consistent with earlier anomalous values for total hydrocarbons, C_2/C_1, and C_2/C_3 ratios in areas of higher radon activities, supporting the hypothesis of gases leaking from depth. Gas components considered to be particularly significant in this regard are the light (C_2-C_4) hydrocarbons, He, H_2, H_2S, and CO_2, because the presence of high CH_4 may partly result from microbial or chemical reactions in the soil or subsurface bed rock. Deeper soil-gas hydrocarbon compositions, as measured by ratios of C_1/C_2, C_1/C_n, and $C_3/C_1 \times 1,000$, were found to be more consistent with known samples of Devonian shale gas than with Clinton or other gases in Ohio. This compositional relationship offers support for the viability of radon/hydrocarbon soil-gas prospecting. Recent blowouts in eastern Ohio where soil-gas anomalies were discovered prior to actual drillings also support this conclusion.

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Carolina Slate Belt: A Review of Thoughts of Its Age and Position in Appalachian Orogene

The Carolina slate belt (CSB) is located in the southeastern Appalachian Piedmont, cropping out as a narrow continuous zone extending from central Virginia southwestward to central Georgia. Geologic investigations of the CSB began in the 1820s, shortly after discovery of gold in Cabarrus County, North Carolina. Early workers established the general distribution and character of the CSB relative to adjacent belts, and more recently, mappable units have been delineated. Present interest in the CSB is in part due to recognition of similarities between slate-belt rocks and those associated with sulfide deposits in New Brunswick, and in part to the recent recognition of sedimentary features in the relatively undeformed slate-belt rocks.

Early workers in the CSB recognized the volcanic origin of slate-belt rocks, as well as subsequent metamorphic alteration. More recently, the sedimentologic-stratigraphic aspects of the CSB have been investigated. Interpretations of tectono-sedimentary environments have been made, based on petrologic, geochemical, and stratigraphic relationships, in light of the articulation of the concepts of plate tectonics and accreted terranes.

Age interpretations of the CSB have been based on degree of metamorphism, radiochronology, and sparse fossil evidence. Age interpretations in the late 1800s and early 1900s suggested a Precambrian age for the CSB. This was modified in the 1960s by the discovery of a purported Middle Cambrian trilobite and a lead-alpha date of 440 to 470 ± 60 Ma. Post-1960s radiometric dates for the CSB range from 705 ± 15 Ma to 511 ± 14 Ma, representing various postdepositional intrusion and cooling events. The discovery of a mid-Cambrian Atlantic province trilobite fauna and upper Precambrian Ediacarian fossils not only unequivocally date the southern part of the CSB, but also support the accreted terrane concept and Euro-African origin of sedimentary units of CSB.

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Early Mesozoic Lacustrine Sedimentation in Culpeper Basin, Virginia, and in Deep River Basin, North Carolina: A Comparative Study

Lacustrine rocks in the Culpeper basin were deposited in open lacustrine, marginal lacustrine, and mud-flat environments. Lateral and vertical facies relationships suggest that lacustrine deposition was controlled by a complex interplay of tectonic movement and climatic change. Lacustrine units thicken stratigraphically upward and toward the fault zone that bounds the basin on the west, suggesting tectonic control on lake formation. Some lacustrine sequences show an asymmetric arrangement of facies consisting of a diastem overlain by open lacustrine black shale, followed by marginal lacustrine and mud-flat deposits. This pattern suggests rapid deepening, possibly tectonic in origin, followed by gradual shallowing. Other lacustrine sequences consist of a symmetrical arrangement of facies representing gradual deepening followed by gradual shallowing, possibly as a result of climatic change.

Preliminary work in the Deep River basin (Durham and Sanford subbasins) has shown that, at several localities, lacustrine units are present at the tops of fluvial fining-upward cycles. The lacustrine rocks include both shallow-water and mud-flat deposits. The lacustrine shales are overlain by massive, mottled units interpreted as paleosols, they coarsen upward into ripple cross-laminated and wavy-laminated siltstone and very fine-grained sandstone, or they are truncated at the top by fluvial channel scour.

Lacustrine units in the Culpeper and Deep River basins contain shallow-water and mud-flat deposits. Facies relationships show that, in Culpeper basin, relatively large lakes were present, whereas in Deep River basin, many lacustrine units were deposited in shallow flood-plain lakes.

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Evidence for Dominance of Normal Dip-Slip Motion on Segment of Flemington Fault in Newark Basin of New Jersey

A fracture study conducted on a series of outcrops along U.S. Route 202, beginning approximately 1.5 km east of the Delaware River and extending eastward for a distance of approximately 1.5 km, provides ample evidence for normal dip-slip faulting and virtually no evidence of strike-slip faulting. The study area is located approximately 1 km south of the Dilt's Corner fault, the southern splay of the Flemington fault, and along a line nearly perpendicular to the axis of a broad, open anticline plunging approximately 10°S, 20°E. This anticline is one of several transverse folds on the hanging-wall side of the Flemington–Dilt's Corner fault system.

Measurement of more than 150 small faults revealed fewer than 10 with a significant strike-slip component of motion. Most of the small faults in the area strike northeasterly and dip steeply either to the northwest or to the southeast. Of particular interest are faults that strike N40°E and dip approximately 70° to the northwest or southeast. These faults appear to define a conjugate set, and as such would require σ_1 to be nearly vertical, σ_2 to be horizontal and trending N40°E, and σ_3 to be horizontal and trending S50°E.

In 1962, Sanders suggested that in addition to considerable dip-slip displacement, the Flemington fault might have a major right-lateral strike-slip component of motion. Manspeizer used right-lateral strike-slip motion on the Flemington fault as part of his rhomb-graben model for the Newark basin. Recently, Burton and Ratcliffe have suggested that the Flemington fault has both right-lateral and normal components of motion on it. Strike-slip motion, at least on the Dilt's Corner splay of the Flemington fault, is not compatible with the observed field data.

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Petrology, Porosity, and Permeability of Berea Sandstone (Mississippian), Perry Township, Ashland County, Ohio

Thin sections and SEM studies of 46 porosity and permeability plugs taken from a core of Berea Sandstone from Perry Township, Ashland County, Ohio were conducted to ascertain the relationship between porosity and permeability and 16 petrographic variables. Statistical analysis indicates that these properties are significantly related with four petrographic variables. Porosity and permeability are positively correlated with maximum pore size (partly resulting from early but incomplete quartz cementation) and grain size. They are negatively correlated with total cement and matrix.

Petrographic studies identified 3 diagenetic zones on the basis of diagenetic cementation. Patchy dolomite and minor quartz are the most common cements occurring throughout the sandstone portion of the core between 692 and 742 ft. This zone exhibits the highest average porosity (15.6%) and permeability (15.2 md). These high values are in part the result of initially large pores and potash feldspar dissolution. Between 697 and 717 ft, siderite cement replaces patchy dolomite and minor quartz and framework grains. Siderite cement is most prevalent at the top of the zone and becomes less abundant with depth. In this zone average porosity and permeability measurements are 13.1% and 7.7 md, respectively. The lowest porosity and permeability measurements are between 719 and 737 ft, where there is a zone of alternating tight quartz-cemented sandstones and patchy dolomite and minor quartz cement. Average values of 12.5% for porosity and 2.0 md for permeability in this zone reflect the interpenetration of framework grains, numerous microstylolites, and complete cementation.

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Stratigraphy of Yorktown (Lower and Middle Pliocene) and Chowan River (Upper Pliocene) Formations in Southeastern Virginia

The Yorktown and Chowan River formations exhibit vertical and lateral variations in lithology and fauna. The Yorktown, which rests disconformably on the Eastover Formation (upper Miocene), is comprised of a fossiliferous shallow marine sand with a discontinuous basal pebbly sand (Sunken Meadow Member). The upper Yorktown consists of intertonguing and intergrading shelf, shoal, and restricted marine deposits (Rushmere, Mogarts Beach, Moore House, and a possible unnamed uppermost member). The shelf deposits are principally fossiliferous, marine silty fine sand, and the shoal sediments are planar and cross-bedded biofragmental sands. The restricted marine sediments range from silty fine sand to silty clay and contain a limited fauna. Near the Fall Zone, the Yorktown is comprised of nonfossiliferous quartz-rich sand. Differential upward movement of the outer Atlantic coastal plain created an offshore shoal, west of which were embayed conditions. The Bacons Castle, Windsor, and higher formations rest with a regional angular unconformity on the Yorktown.

The Chowan River formation is restricted to the outermost coastal plain in Virginia and is composed of planar and cross-bedded shelly fine sand. The basal Chowan River contains scattered allochthonous pebbles and boulders, sideritic nodules, and brackish to marine fossil assemblages. The Yorktown and Chowan River formations represent the last incursions of relatively warm seas into southeastern Virginia during the late Tertiary.

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Tectonic Influence on Late Devonian Sedimentation near Cincinnati Arch, Kentucky