

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  $440 \pm 470 \pm 60$  Ma. Post-1960s radiometric dates for the CSB range from  $705 \pm 15$  Ma to  $511 \pm 14$  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 sub-basins) 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  $10^\circ$  S,  $20^\circ$  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  $N40^\circ$  E and dip approximately  $70^\circ$  to the northwest or southeast. These faults appear to define a conjugate set, and as such would require  $\sigma_1$  to be nearly vertical,  $\sigma_2$  to be horizontal and trending  $N40^\circ$  E, and  $\sigma_3$  to be horizontal and trending  $S50^\circ$  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