

INTRODUCTION

Bedrock of the Camden and Philadelphia quadrangles includes unconsolidated Coastal Plain formations that overlie metamorphic basement rocks. The Coastal Plain formations include sand, clay, and glauconitic clay laid down in coastal, nearshore marine, and continental shelf settings between 95 and 75 million years ago. The underlying metamorphic rocks are much older and were originally laid down as sediments between 700 and 550 million years ago, and later compressed and deformed several times. The lithology and age of the formations are provided in the *Description of Map Units*. Age relations are also summarized in the *Correlation of Map Units*. Sections AA' and BB' show the subsurface geometry of the formations along the line of section. Further detail on the regional stratigraphy of the Coastal Plain formations is provided by Owens and others (1998). Surficial deposits of Pleistocene and Quaternary age overlie the Coastal Plain formations in most of the map area. The surficial deposits are mapped by Stanford (2004).

DESCRIPTION OF MAP UNITS

- Kml** MOUNT LAUREL FORMATION—Quartz sand, slightly glauconitic, medium-grained. Yellow to reddish-yellow where unweathered, gray where unweathered. As much as 20 feet thick in map area. Contains traces of feldspar, mica, and phosphate pellets. Late Cretaceous (late Campanian) in age based on nanoplankton (Sugarman and others, 1995). Grades downward into the Wenonah Formation.
- Kw** WENONAH FORMATION—Quartz sand, micaceous, slightly glauconitic, fine to very fine grained. Yellow to very pale brown where weathered, gray to pale-olive where unweathered. As much as 50 feet thick. Contains traces of calcareous material. Late Cretaceous (late Campanian) in age based on pollen (Wolfe, 1976) and ammonite fossils (Kennedy and Cobban, 1994). Grades downward into the Marshallowtown Formation.
- Kmh** MARSHALLOWTOWN FORMATION—Quartz glauconitic clay sand, fine- to medium-grained. Olive to dark gray where unweathered, brown to olive-brown where weathered. As much as 20 feet thick. Contains traces of feldspar, mica, finely disseminated pyrite, and phosphate fragments. Late Cretaceous (middle Campanian) in age, based on nanoplankton (Sugarman and others, 1995). Unconformably overlies the Marshallowtown Formation.
- Ket** ENGLISHTOWN FORMATION—Quartz sand, fine to coarse-grained, with thin beds of clay and silt. Sand is white, yellow, and light-gray where weathered, gray where unweathered. Silt and clay are light-gray to brown where weathered, dark-gray to black where unweathered. As much as 70 feet thick. Sand contains some lignite and mica and minor amounts of glauconitic mica, carbonaceous matter and pyrite are common in the clays. Late Cretaceous (early Campanian) in age, based on pollen (Wolfe, 1976). Grades downward into the Woodbury Formation.
- Kwb** WOODBURY FORMATION—Clay with minor thin beds of very fine quartz sand. Dark gray and black where unweathered, yellowish-brown to brown where weathered. As much as 80 feet thick. Clay is micaceous with some pyrite and carbonaceous matter and traces of glauconitic mica. Late Cretaceous (early Campanian) in age based on pollen (Wolfe, 1976). Grades downward into the Merchantville Formation.
- Kmv** MERCHANTVILLE FORMATION—Glauconitic clay. Olive, dark gray, black where unweathered, olive-brown to yellowish-brown where weathered. As much as 50 feet thick. Glauconitic occurs primarily in soft grains of fine-to-medium sand size. Sand fraction is chiefly quartz, feldspar, mica, and pyrite are minor constituents. Iron cementation is common. Late Cretaceous (early Campanian) in age based on ammonite fossils (Owens and others, 1977). Unconformably overlies the Magoghy Formation.
- Kmg** MAGOGHY FORMATION—Quartz sand, fine to very coarse-grained, and clay and silt, thin-bedded. Sand is white, yellow, light-gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown, reddish-yellow where weathered, gray to black where unweathered. As much as 120 feet thick. Sand includes some lignite, pyrite, and minor feldspar and mica. Silt and clay beds include abundant mica and carbonaceous material. Late Cretaceous (Santonian) in age based on pollen (Wolfe and Pakiser, 1971; Christopher, 1977). Unconformably overlies the Potomac Formation.
- Kp3** POTOMAC FORMATION—Quartz sand, fine to very coarse-grained, and clay and silt, thin- to thick-bedded; minor granule to cobble gravel. Sand is white, yellow, light-gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown, reddish-yellow where weathered, less commonly gray to black where unweathered. Unweathered clay and silt less common than in Magoghy Formation. As much as 280 feet thick. Sand includes some lignite, and minor feldspar and mica. Silt and clay beds include abundant mica and carbonaceous material. The Potomac Formation in the map area is equivalent to the Potomac Formation, unit 3 (Doyle and Robbins, 1977), based on pollen (Wolfe and Pakiser, 1971; Owens and others, 1998), and is of Late Cretaceous (early Cenomanian) age. Unconformably overlies Cambrian and Late Proterozoic bedrock.

- MAP SYMBOLS**
- Contact—Approximately located. Solid triangle indicates contact observed in outcrop.
 - Formation observed in outcrop, excavation, or hand-auger hole.
 - Formation formerly observed in outcrop or excavation (Woolman, 1897; Bascom and others, 1909; field notes on file at N. J. Geological Survey) but no longer exposed.
 - 7-xxx Well with gamma log—Used to construct section. Numbers of the form 7-xxx are U. S. Geological Survey Ground Water Site Inventory identification numbers. Numbers of the form 31-xxxx are well permit numbers issued by the N. J. Department of Environmental Protection, Bureau of Water Allocation.
 - 31-62 Well or boring penetrating pre-Cretaceous basement—Upper number is identifier, lower number followed by "Czu" is elevation of base of Cretaceous in feet below sea level. Where the Magoghy-Potomac contact is penetrated, the elevation (in feet below sea level) of the contact is indicated between the unit symbols. Identifiers of the form 31-xxxx are well permit numbers issued by the N. J. Department of Environmental Protection, Bureau of Water Allocation. Identifiers prefixed by W, E or B are bridge borings provided by the Delaware River Port Authority. Identifiers prefixed by WM are bridge borings from Woolman (1897). Identifiers prefixed by GH are from Jenço (1999).
 - 31-62 Well with gamma log—On sections. Intensity of gamma radiation increases to right.
 - 31-62 Well with gamma log—On sections. Intensity of gamma radiation increases to right.

REFERENCES

Bascom, F., Clark, W. B., Darton, N. H., Kummel, H. B., Salisbury, R. D., Miller, B. L., and Knapp, G. N., 1909. Description of the Philadelphia district. U. S. Geological Survey Geologic Atlas 192, 23 p.

Christopher, R. A., 1977. Selected Normapollis pollen genera and the age of the Raritan and Magoghy Formations (upper Cretaceous) of northern New Jersey. In Owens, J. P., Sohl, N. F., and Minard, J. P., eds., *A field guide to Cretaceous and lower Tertiary beds of the Raritan and Salisbury embayments, New Jersey, Delaware, and Maryland*. American Association of Petroleum Geologists-Society of Economic Paleontologists and Mineralogists, p. 58-68.

Doyle, J. A., and Robbins, E. I., 1977. Angiosperm pollen zonation of the Cretaceous of the Atlantic Coastal Plain and its application to deep wells in the Salisbury embayment. *Palynology*, v. 1, p. 43-78.

Jenço, J. W., 1999. Hydrostratigraphy of the Cretaceous-age Potomac, Raritan, Magoghy, and Merchantville Formations and Holocene-age Delaware River alluvium, Gloucester County, New Jersey. *Northeastern Geology and Environmental Science*, v. 21, no. 3, p. 148-179.

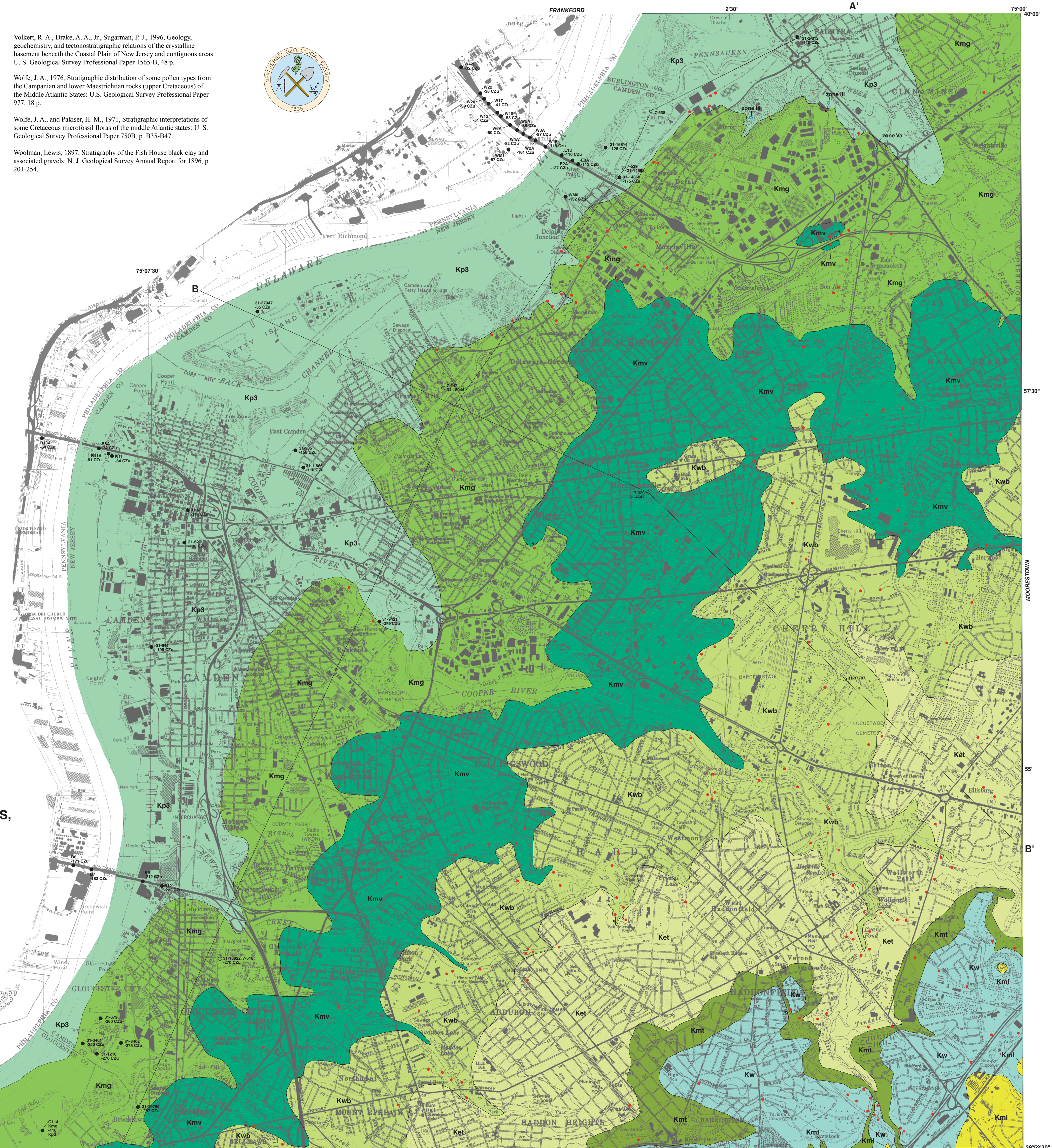
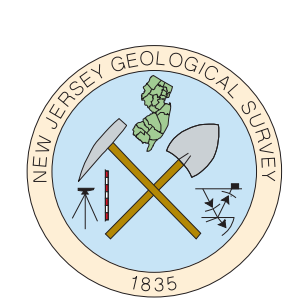
Kennedy, W. J., and Cobban, W. A., 1994. Ammonite fauna from the Wenonah Formation (Upper Cretaceous) of New Jersey. *Journal of Paleontology*, v. 68, no. 1, p. 95-110.

Owens, J. P., Sohl, N. F., and Minard, J. P., 1977. A field guide to Cretaceous and lower Tertiary beds of the Raritan and Salisbury embayments, New Jersey, Delaware, and Maryland. American Association of Petroleum Geologists-Society of Economic Paleontologists and Mineralogists, 113 p.

Owens, J. P., Sugarman, P. J., Sohl, N. F., Parker, R. A., Houghton, H. F., Volkert, R. A., Drake, A. A., Jr., Ondorff, R. C., 1998. Bedrock geologic map of central and southern New Jersey. U. S. Geological Survey Miscellaneous Investigations Series Map 1-2540-B, scale 1:100,000.

Stanford, S. D., 2004. Surficial geology of the Camden and Philadelphia quadrangles, Camden, Gloucester, and Burlington counties, New Jersey. N. J. Geological Survey Open-File Map OFM 60, scale 1:24,000.

Sugarman, P. J., Miller, K. G., Burky, D., and Feigenson, M. D., 1995. Uppermost Campanian-Maestrichtian strontium isotopic, biostratigraphic, and sequence stratigraphic framework of the New Jersey Coastal Plain. *Geological Society of America Bulletin*, v. 107, p. 19-37.

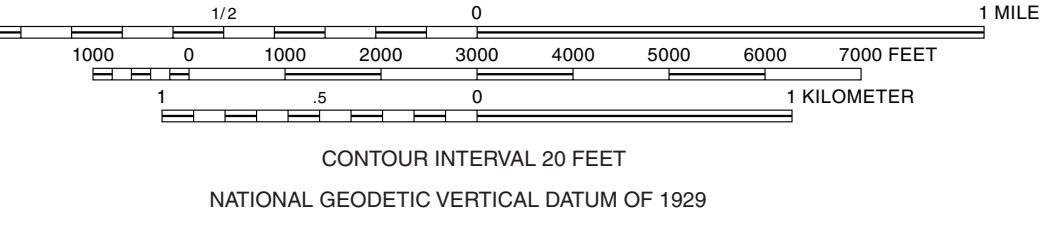


BEDROCK GEOLOGY OF THE CAMDEN AND PHILADELPHIA QUADRANGLES,
CAMDEN, GLOUCESTER, AND BURLINGTON COUNTIES, NEW JERSEY

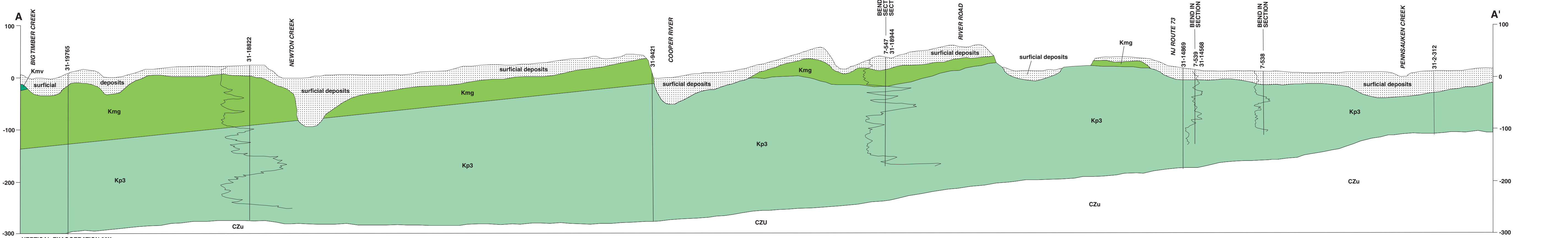
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2004

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SCALE 1:24 000



Base from U. S. Geological Survey Camden and Philadelphia quadrangles, 1967, photorevised 1973



CORRELATION OF MAP UNITS

