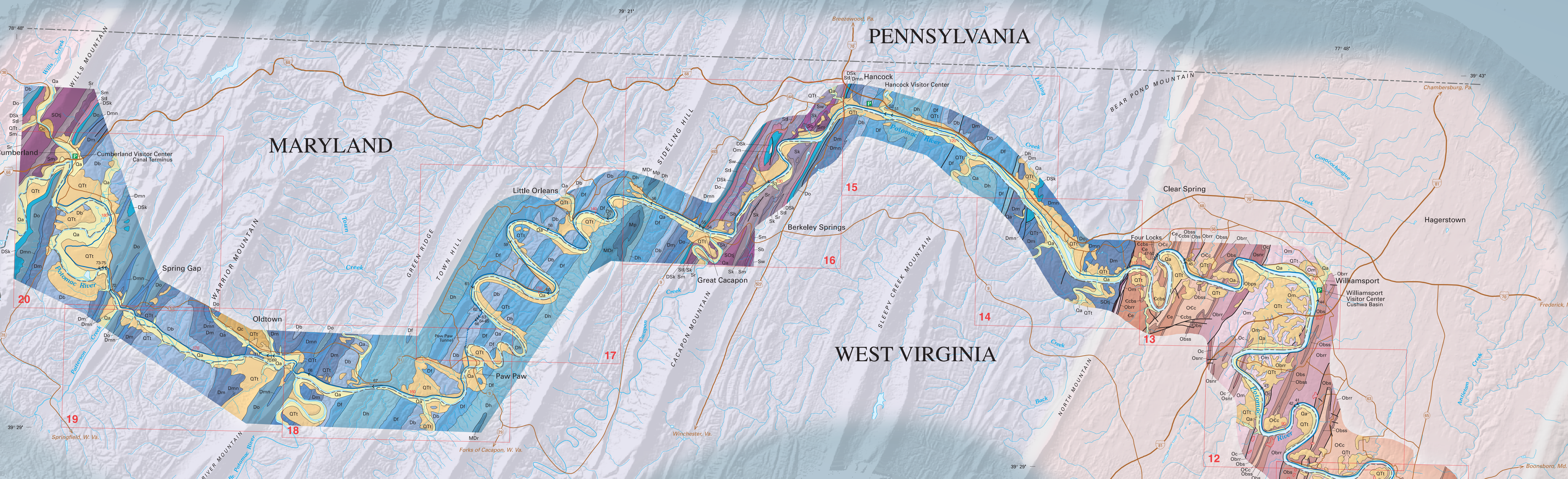
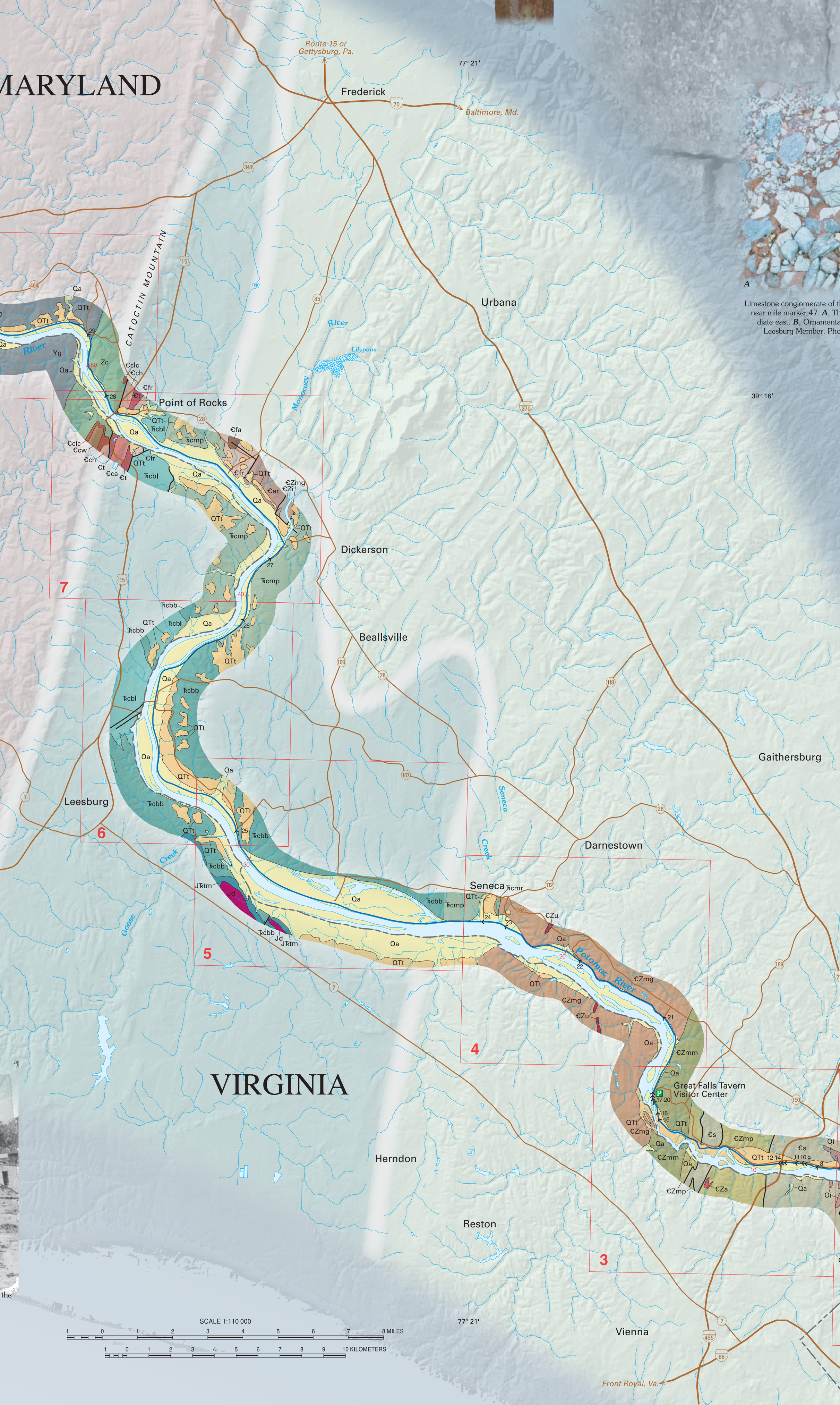
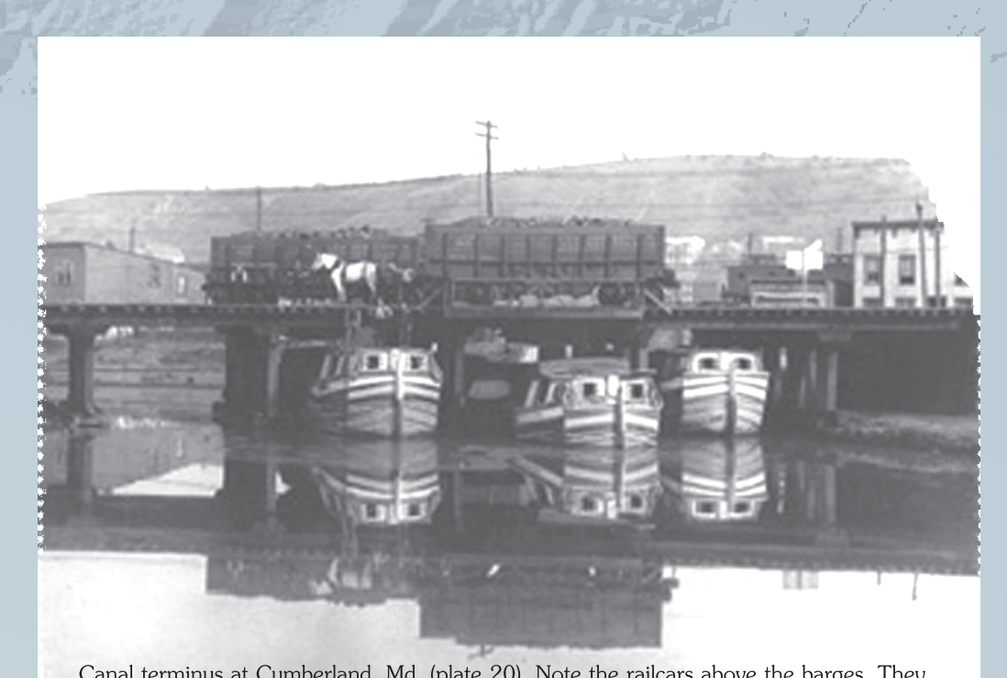
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

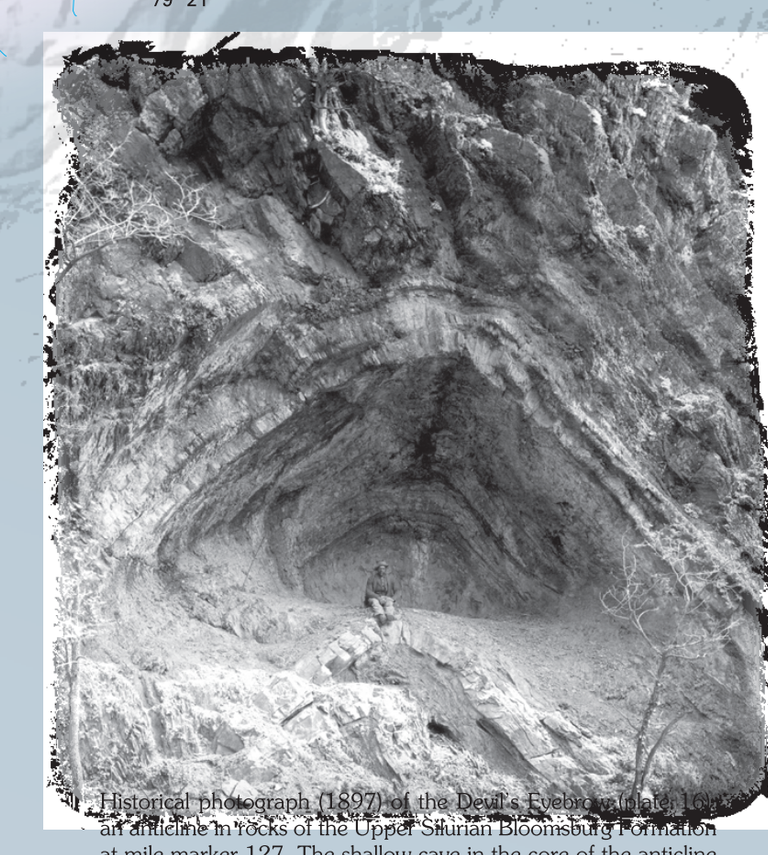
Prepared in cooperation with the
NATIONAL PARK SERVICE, MARYLAND GEOLOGICAL SURVEY, WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY, AND VIRGINIA DIVISION OF MINERAL RESOURCES

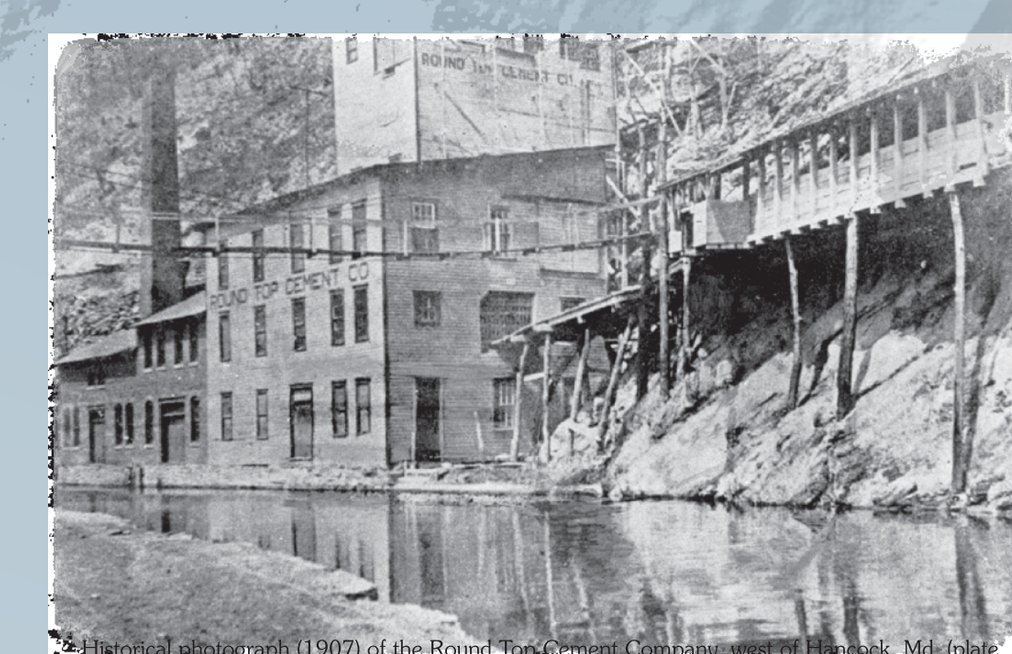
PROFESSIONAL PAPER 1691
PLATE 1

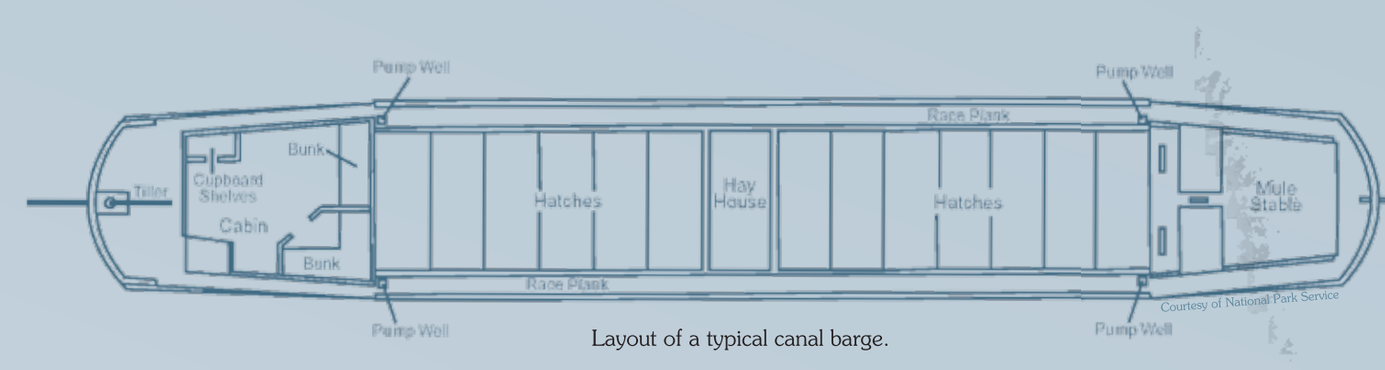





Canal terminus at Cumberland, Md. (plate 20). Note the railcars above the barges. They are filled with coal that was mined in the Appalachian Mountains to the west, brought to Cumberland by train, and loaded on barges to be transported downriver to Washington D.C. Photograph courtesy of National Park Service.


Historical photograph (1897) of the Devil's Eyebrow (plate 16), an anticline in rocks of the Upper Silurian Bloomsburg Formation at mile marker 127. The shallow cave in the core of the anticline was formed from the weathering of limy shale and limestone. Photograph by Charles D. Walcott (U.S. Geological Survey).


Historical photograph (1907) of the Round Top Cement Company, west of Hancock, Md. (plate 16), near mile marker 130, where limestone was quarried ... Photograph courtesy of National Park Service.

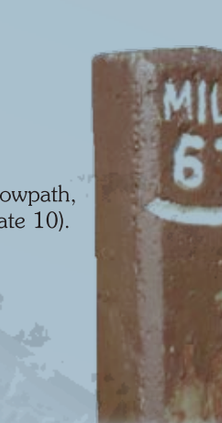


Layout of a typical canal barge.

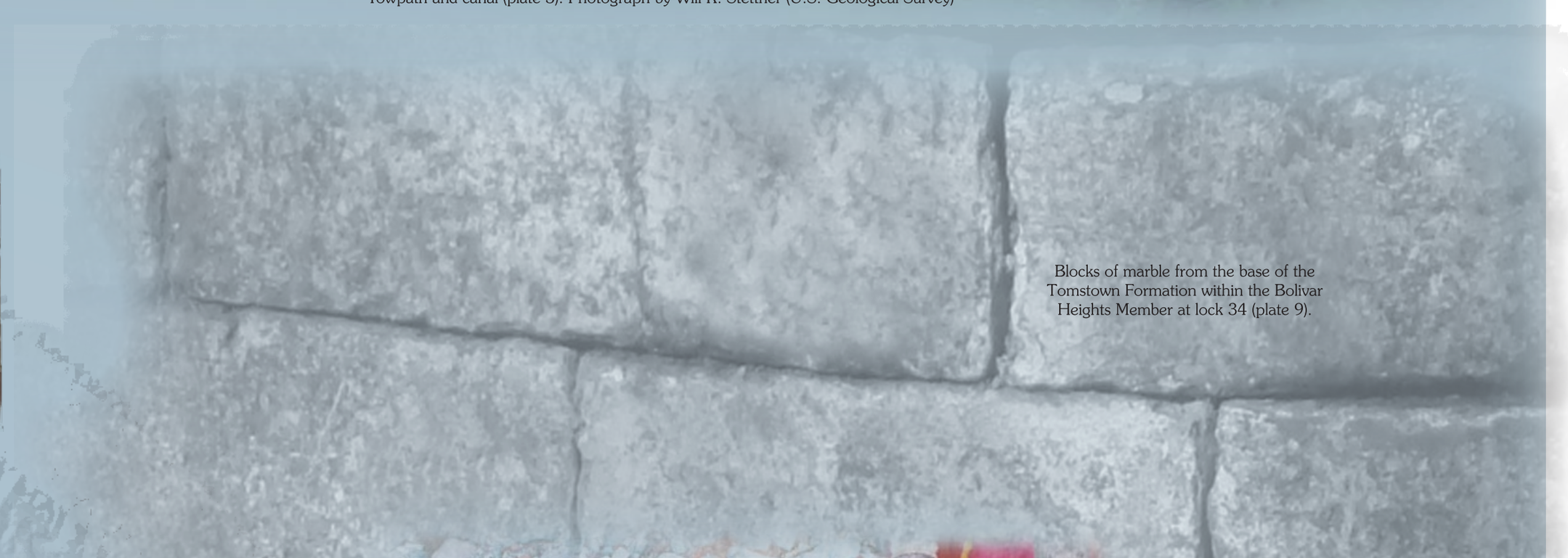

Historical photograph (date unknown, probably late 19th century) of workers and mules scraping the floor of Big Pool (plate 14) after it was drained to remove silt. Photograph courtesy of National Park Service.


Historical photograph (around 1920) of Cushwa basin at Williamsport, Md. (plate 13), at mile marker 100, showing coal being loaded into horse-drawn wagons. The coal was transported down the canal from Cumberland. Photograph by Consolidated Coal Co.; courtesy of National Park Service.

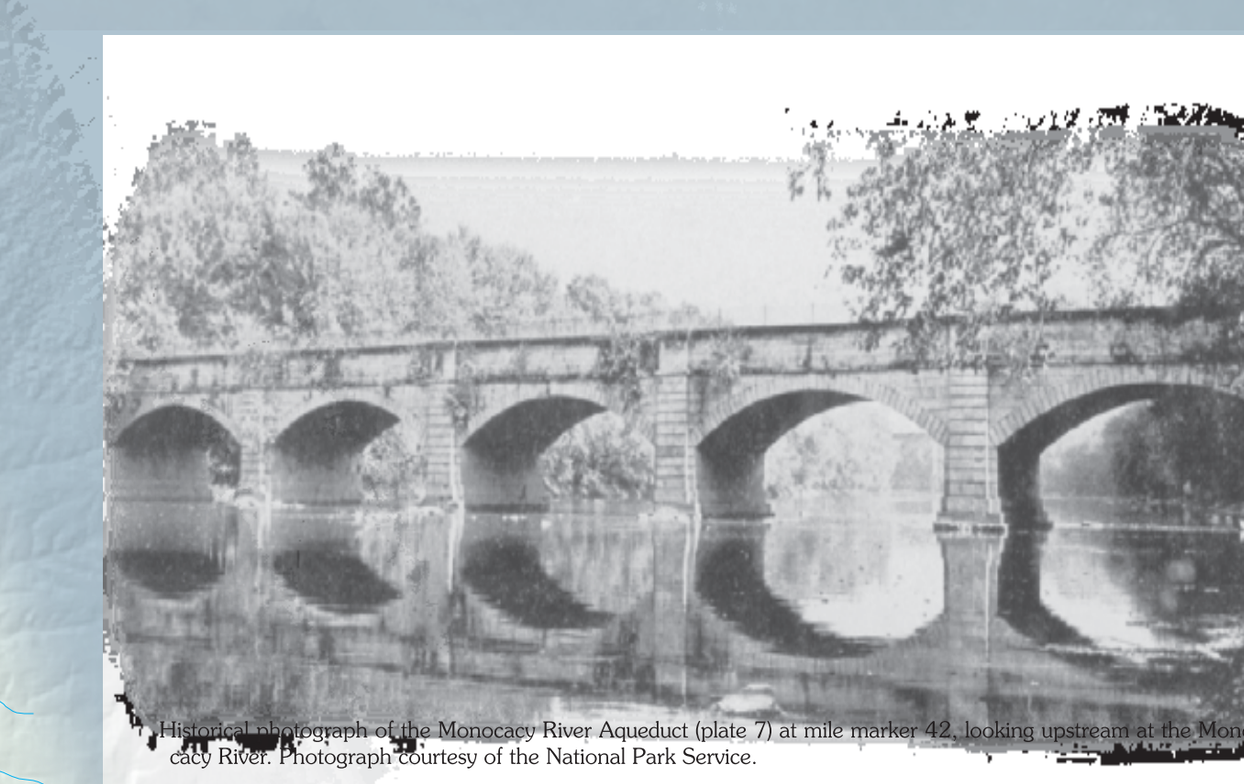

Towpath and canal (plate 3). Photograph by Will R. Stettner (U.S. Geological Survey)

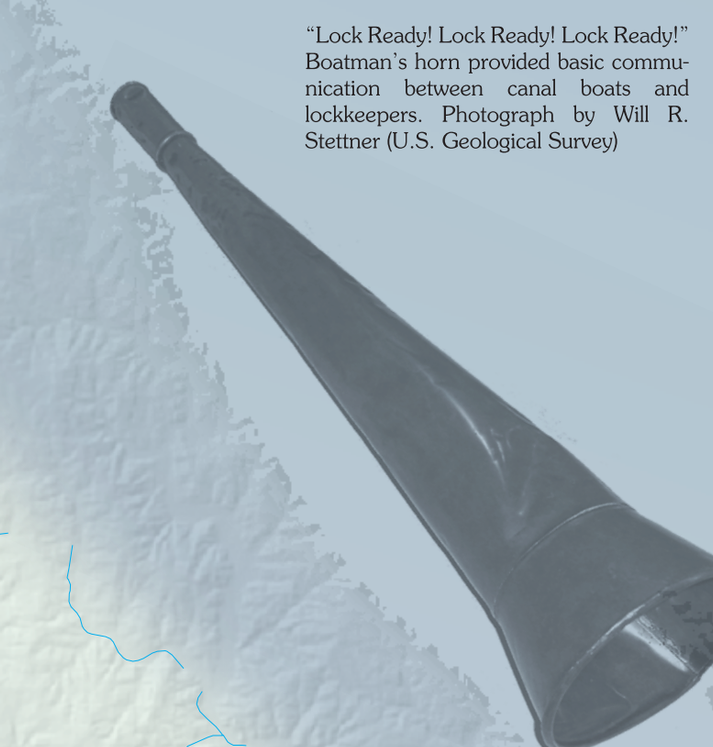


Mile marker along towpath, near lock 37 (plate 10).


Blocks of marble from the base of the Tomstown Formation within the Bolivar Heights Member at lock 34 (plate 9).


Limestone conglomerate of the Upper Triassic Leesburg Member of the Bull Run Formation (plate 7), near mile marker 47. ***A***, The canal was excavated through this unit, and it was quarried to the immediate east. ***B***, Ornamental columns of Statuary Hall in the U.S. Capitol Building formed from the Leesburg Member. Photograph courtesy of the National Park Service.


Historical photograph of the Monocacy River Aqueduct (plate 7) at mile marker 42, looking upstream at the Monocacy River. Photograph courtesy of the National Park Service.


"Lock Ready! Lock Ready! Lock Ready!" Boatman's horn provided basic communication between canal boats and lockkeepers. Photograph by Will R. Stettner (U.S. Geological Survey)

DESCRIPTION OF MAP UNITS

CENOZOIC SURFICIAL DEPOSITS

- **af** — **Artificial fill**
- **Qa** — **Alluvium (Holocene)**—Unconsolidated clay, silt, sand, and gravel underlying flood plains
- **Qc** — **Colluvium (Holocene and Pleistocene)**—Cobbles, boulders, and blocks on mountain slopes
- **QTt** — **Terrace deposits (Holocene, Pleistocene, and Tertiary?)**—Sand, gravel, and boulders underlying flat benches and isolated hills; includes some colluvium

VALLEY AND RIDGE PROVINCE

- **Mp** — **Purslane Formation (Lower Mississippian)**—Red and brown sandstone
- **MDr** — **Rockwell Formation (Lower Mississippian and Upper Devonian)**—Green to gray sandstone, siltstone, and shale
- **Dh** — **Hampshire Formation (Upper Devonian)**—Gray to red sandstone, siltstone, and shale
- **Df** — **Foreknobs Formation (Upper Devonian)**—Greenish- to reddish-gray sandstone, siltstone, and shale
- **Db** — **Brallier Shale (Upper Devonian)**—Dark-gray sandstone, siltstone, and shale.
- **Dm** — **Mahantango Formation (Middle Devonian)**—Light-gray siltstone, sandstone, and shale
- **Dmn** — **Marcellus and Needmore Shales, undivided (Middle and Lower Devonian)**—Grayish-black shale, calcitic shale, and limestone
- **Do** — **Oriskany Sandstone (Lower Devonian)**—Light-gray sandstone and pebble conglomerate
- **DSk** — **Keyser Limestone (Lower Devonian and Upper Silurian)**—Gray limestone, shale, and cherty limestone
- **Stl** — **Tonoloway Limestone (Upper Silurian)**—Gray limestone, dolostone, calcareous shale, and thin sandstone
- **Sw** — **Wills Creek Formation (Upper Silurian)**—Gray shale, limestone, claystone, and sandstone
- **Sb** — **Bloomsburg Formation (Upper Silurian)**—Red sandstone, siltstone, shale, and mud rock
- **Sm** — **McKenzie Formation (Upper and Middle Silurian)**—Gray shale, calcareous shale, and limestone
- **Sk** — **Keefer Sandstone (Middle Silurian)**—Tan sandstone with *Skolithos linearis*
- **Sr** — **Rose Hill Formation (Middle Silurian)**—Tan and red siltstone, hematite sandstone, and tan sandstone
- **SOtj** — **Tuscarora Quartzite and Juniata Formation, undivided (Lower Silurian and Upper Ordovician)**—White and gray sandstone and quartz-pebble conglomerate; and maroon sandstone and siltstone

Great Valley Section

- **Om** — **Martinsburg Formation (Upper and Middle Ordovician)**—Brown and green shale, siltstone, and sandstone; and gray, shaly limestone
- **Oc** — **Chambersburg Limestone (Middle Ordovician)**—Gray, argillaceous, nodular limestone
- **Osnr** — **St. Paul Group (New Market and Row Park Limestones, undivided) (Middle Ordovician)**—Gray, thick-bedded limestone
- **Obps** — **Pinesburg Station Dolomite (Middle Ordovician)**—Gray, cherty, fractured dolostone
- **Obrr** — **Rockdale Run Formation (Middle and Lower Ordovician)**—Interbedded gray limestone and dolostone
- **Obs** — **Stonehenge Limestone (Lower Ordovician)**—Gray limestone
- **Obss** — Stoufferstown Member—Gray silty, laminated limestone with shale partings
- **O€c** — **Conococheague Limestone (Lower Ordovician and Upper Cambrian)**—Interbedded gray limestone, dolostone, and sandstone
- **€cbs** — Big Spring Station Member (Upper Cambrian)—Light-gray dolostone and dolomitic sandstone
- **€e** — **Elbrook Limestone (Upper and Middle Cambrian)**—Interbedded gray limestone and dolostone
- **Waynesboro Formation (Lower Cambrian)**
  - **€wac** — Chewsville Member—Red siltstone and shale
  - **€wak** — Cavetown Member—Interbedded light-gray limestone and dolostone
  - **€war** — Red Run Member—Tan sandstone and green shale
- **€t** — **Tomstown Formation (Lower Cambrian)**—Interbedded light-gray limestone and dolostone

BLUE RIDGE PROVINCE

- **€t** — **Tomstown Formation (Lower Cambrian)**—Gray dolostone
- **€ca** — **Antietam Formation (Lower Cambrian)**—Gray, ferruginous sandstone
- **€ch** — **Harpers Formation (Lower Cambrian)**—Greenish-brownish-gray, phyllitic metasiltstone; and light-gray metagraywacke and metasiltstone
- **€cw** — **Weverton Formation (Lower Cambrian)**—Dark-gray quartzite and pebble conglomerate; and light-gray to brown, thin-bedded metasandstone
- **€clc** — **Loudoun Formation (Lower Cambrian)**—Polymictic cobble and pebble conglomerate, and variegated phyllite
- **Zc** — **Catoctin Formation (Neoproterozoic)**—Green metabasalt, phyllite, and sandstone
- **Zs** — **Swift Run Formation (Neoproterozoic)**—Tan, medium-grained metasandstone with quartz cobbles and pebbles; and tan quartz-sericite schist and sandy phyllite and marble
- **Yg** — **Granitic gneiss (Mesoproterozoic)**—Biotite-rich granite, light-colored granite with or without garnet, quartz-plagioclase gneiss, hornblende monzonite gneiss, and small bodies of garnet-graphite paragneiss

PIEDMONT PROVINCE
Culpeper Basin Section

- **Jd** — **Diabase dikes and sills (Early Jurassic)**—Black crystalline diabase
- **J₹tm** — **Hornfels (Early Jurassic to Late Triassic)**—Gray hornfels resulting from contact metamorphism of shale and siltstone
- **Bull Run Formation (Upper Triassic)**
  - **₹cbb** — Balls Bluff Member—Red shale and siltstone
  - **₹cbl** — Leesburg Member—Variegated carbonate conglomerate and red siltstone
- **Manassas Sandstone (Upper Triassic)**
  - **₹cmp** — Poolesville Member—Red arkosic sandstone
  - **₹cmr** — Reston Member—Tan quartz-pebble conglomerate

Frederick Valley

- **Frederick Formation (Upper Cambrian)**
  - **€fa** — Adamstown Member—Argillaceous limestone and silty dolostone
  - **€fr** — Rocky Springs Station Member—Dolomitic limestone, polymictic breccia, and sandstone with grayish-black shale interbed (€frs)
- **€ar** — **Araby Formation (Middle and Lower Cambrian)**—Light-brownish-gray, sandy, mottled metasiltstone
- **€t** — **Tomstown Formation (Lower Cambrian)**—Light-gray dolostone

Westminster Terrane

- **€Zi** — **Ijamsville Phyllite (Lower Cambrian? and Neoproterozoic?)**—Bluish-purple phyllite, slate, and phyllonite with vein quartz, metabasalt, and metalimestone

Potomac Terrane

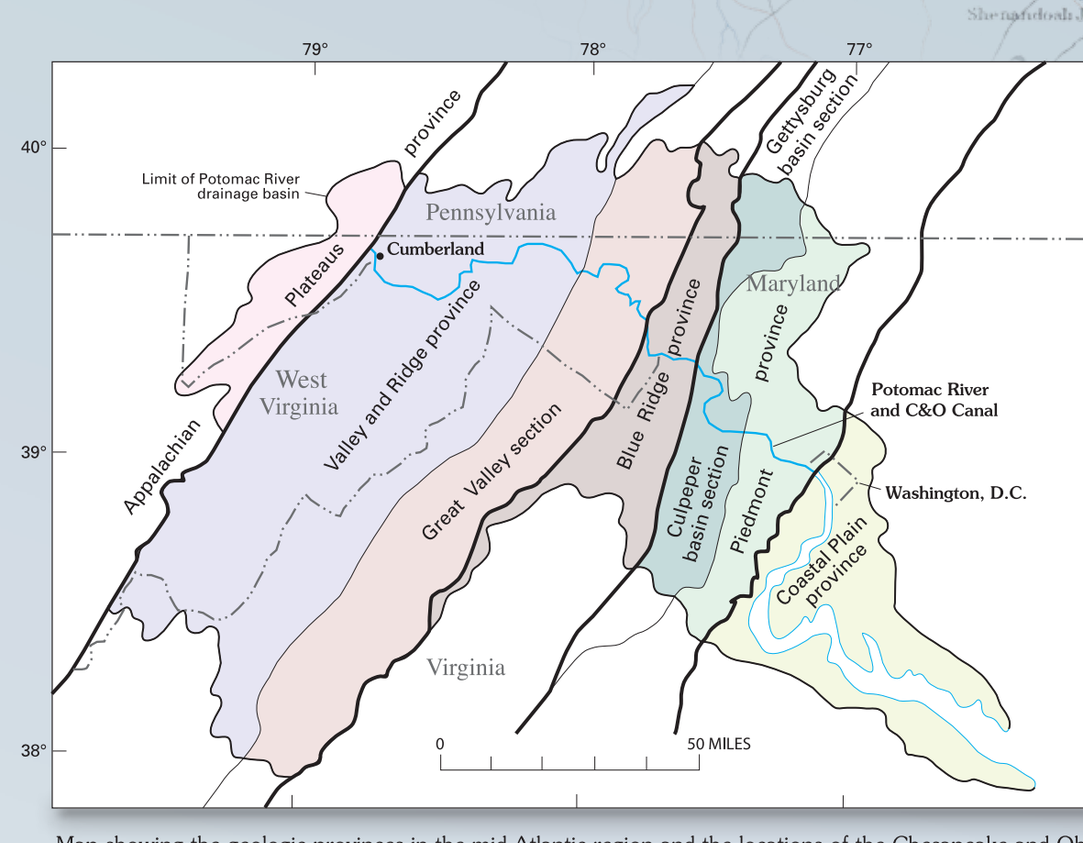
- **Oi** — **Intrusive rocks (Middle to Early Ordovician)**—Includes Kensington Tonalite, Georgetown Intrusive Suite (biotite-hornblende tonalite, biotite tonalite, quartz gabbro, quartz diorite, serpentinite, soapstone, and talc schist), Dalecarlia Intrusive Suite (biotite monzogranite, granodiorite, and muscovite trondhjemite), and Clarendon Granite
- **€s** — **Sykesville Formation (Lower Cambrian)**—Gray sedimentary mixture of fragments and bodies of metamorphosed sedimentary, volcanic, and igneous rocks in a quartzofeldspathic matrix
- **€l** — **Laurel Formation (Lower Cambrian)**—Gray sedimentary mixture of meta-arenite and muscovite-biotite schist in quartzofeldspathic matrix
- **Mather Gorge Formation (Lower Cambrian and (or) Neoproterozoic)**
  - **€Zmg** — Metagraywacke and schist—Gray, well-bedded metagraywacke and dark-gray, quartz-rich schist containing interbedded mica gneiss, metagraywacke, and calc-silicate rock
  - **€Zmm** — Migmatite—Mixture of quartz-plagioclase leucosome and quartzose schist paleosome
  - **€Zmp** — Chlorite-sericite phyllonite—Greenish-gray, containing white vein quartz
- **€Za** — **Amphibolite (Cambrian to Late Proterozoic)**—Green, foliated epidote-plagioclase-hornblende amphibolite
- **€Zu** — **Ultramafic rock (Lower Cambrian and Neoproterozoic)**—Serpentinite, soapstone, and talc schist

COASTAL PLAIN PROVINCE

- **Kp** — **Potomac Formation (Lower Cretaceous)**—Sand and clay with plant leaves, stems, and trunks

EXPLANATION OF MAP SYMBOLS

- **Contact**
- **Fault**
- **Sinkhole**
- **Roads**
  - Interstate highway
  - State highway
  - Local road
- **State boundary**
- **Plate outline and number**—See report
- **Chesapeake and Ohio Canal**
  - National Park Service Visitor Center
  - Canal
  - Lock
  - Mile marker
  - Paw Paw Tunnel

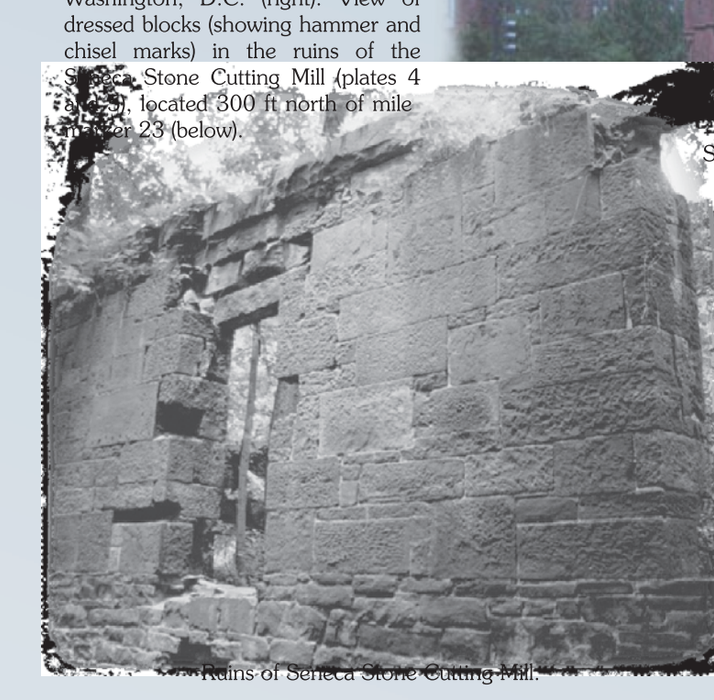


Map showing the geologic provinces in the mid-Atlantic region and the locations of the Chesapeake and Ohio (C&O) Canal, the Potomac River, and the Potomac River basin.

Portion of an historical U.S. Geological Survey topographic map (1893) of the Harpers Ferry, W. Va., area.

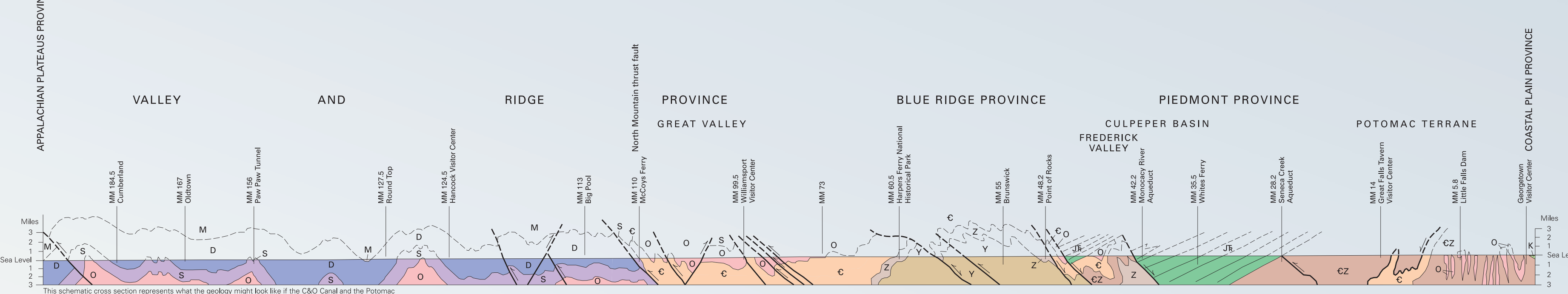
The Upper Triassic Poolesville Member of the Manassas Sandstone (informally called "Seneca Red Sandstone") was drilled and quarried for dimension stone along the bluffs west of Seneca, Md. This sandstone was used in constructing the main building of the Smithsonian Institution in Washington, D.C. (right). View of dressed blocks (showing hammer and chisel marks) in the ruins of the Seneca Stone Cutting Mill (plates 4 and 5), located 300 ft north of mile marker 23 (below).


Smithsonian Institution Main Building


Ruins of Seneca Stone Cutting Mill.


Seneca Creek Aqueduct (plate 4), just east of mile marker 23. Historical photograph (undated) showing the water-filled aqueduct. Photograph courtesy of the National Park Service.

EXPLANATION



GEOLOGY OF THE CHESAPEAKE AND OHIO CANAL NATIONAL HISTORICAL PARK AND POTOMAC RIVER CORRIDOR, DISTRICT OF COLUMBIA, MARYLAND, WEST VIRGINIA, AND VIRGINIA

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2008

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