



BUILDING STONES OF OUR NATION'S CAPITAL

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The U.S. Geological Survey has prepared this publication as an earth science educational tool and as an aid in understanding the history and physical development of Washington, D.C., the Nation's Capital.

The buildings of our Nation's Capital have been constructed with rocks from quarries throughout the United States and many distant lands. Each building shows important features of various stones and the geologic environment in which they were formed.

This booklet describes the source and appearance of many of the stones used in building Washington, D.C. A map and a walking tour guide are included to help you discover Washington's building stones on your own.

When choosing a building stone, architects and planners use three characteristics to judge a stone's suitability. It should be pleasing to the eye; it should be easy to quarry and work; and it should be durable. Today it is possible to obtain fine building stone from many parts of the world, but the early builders of the city had to rely on materials from nearby sources. It was simply too difficult and expensive to move heavy materials like stone before the development of modern transportation methods like trains and trucks.

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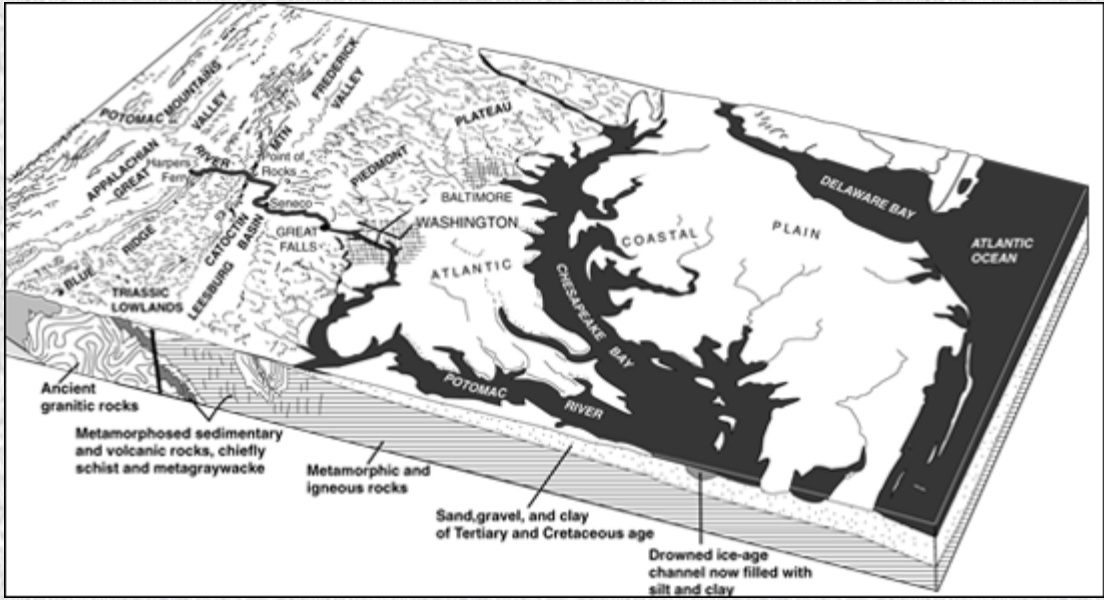
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Washington's Geologic Setting

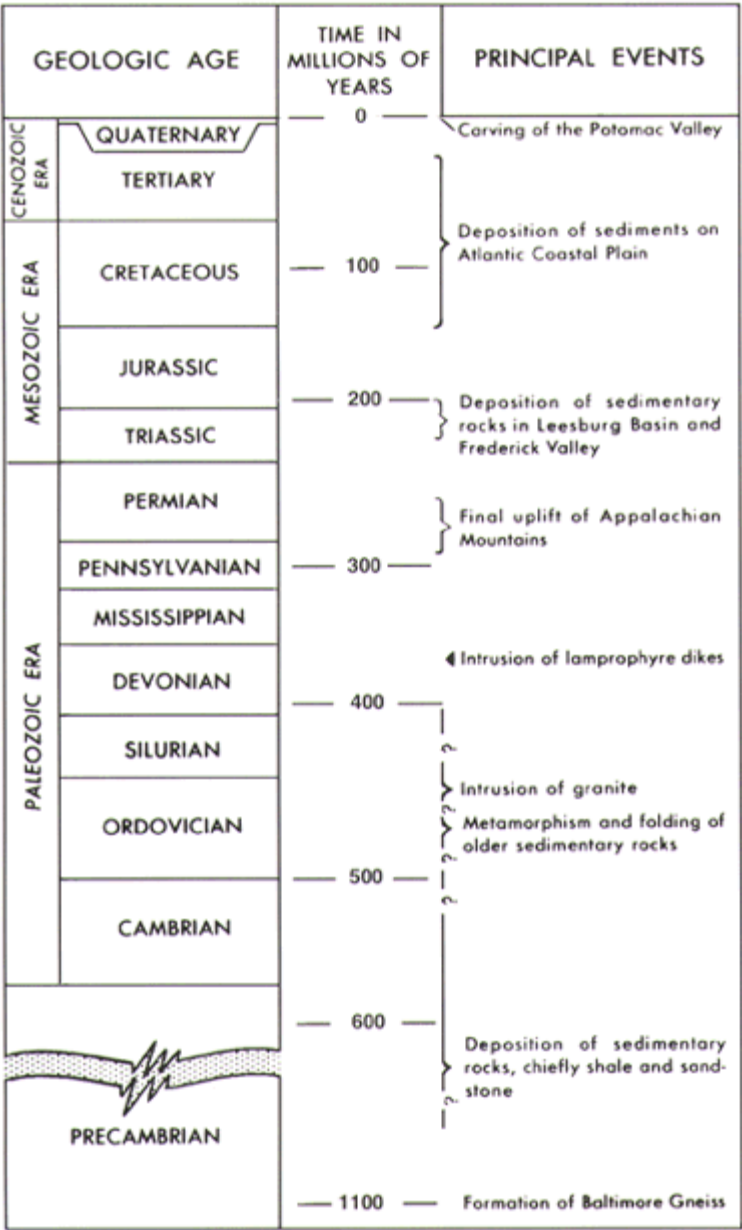
Metropolitan Washington incorporates parts of four physiographic provinces -- areas in which the rocks and topography are similar but differ considerably from those of the neighboring provinces. From east to west, these provinces are the Coastal Plain, the Piedmont, the Triassic Lowland, and the Blue Ridge. In addition, the area on the Mall south of the Lincoln Memorial and Washington Monument to the Potomac River was originally swampland, which was reclaimed by filling it with material dredged from farther down the river.



Physiographic Provinces and Geologic and Geographic Features of the District of Columbia region.

The Atlantic Coastal Plain province borders the Atlantic Ocean and consists of gravel, sand, silt, clay, and marl. Deposition of these sediments began 100 million years ago and continues to the present time. The oldest rocks in the Coastal Plain are poorly consolidated (that is, easily crumbled) gravel, sand, silt, and clay derived from the weathering of rocks to the north and west that were carried to the Coastal Plain by southflowing rivers. Younger rocks consist of sands and clays containing the minerals glauconite and mica, which were deposited in estuaries and on the Continental Shelf at a time when water covered the present Coastal Plain to depths of as much as 200 feet.

The Piedmont Plateau province lies west of the Coastal Plain. The Piedmont rocks in and near Washington, D.C., are crystalline metamorphic rocks that are quite hard and resist weathering; they contain veins of quartz and pegmatite and in many places have been intruded by igneous rock (formed from molten rock from inside the Earth). These crystalline rocks can be seen most easily in valleys where the soil cover has been stripped away by erosion. Most of the crystalline rocks on the uplands were deposited about 550-600 million years ago; over the ages, they have weathered to saprolite, a porous, spongy, red-brown clay-rich material, as much as 200 feet thick. The final product of weathering, seen near the surface throughout much



Geologic time chart

of the Piedmont, is a sticky clay, generally having a reddish color.

The rocks of the Triassic Lowland province, deposited about 200 million years ago, are red shales and red and gray sandstones and conglomerates, which weather to a reddish soil. Near Washington these sedimentary rocks are as much as 5,000 feet thick. In some places, they have been intruded by trap rock (resistant fine-grained igneous rock). At the western edge of the Triassic Lowland is a series of alluvial fans that mark the mouths of ancient rivers. These deposits are made up of rounded to angular masses of limestone, quartz, and quartzite, which range in size from sand grains to boulders as much as 1 foot in diameter, that are cemented by calcite.

The Blue Ridge province, lying west of the Triassic Lowland, is a region of north- and northeast-trending valleys and ridges underlain by folded metamorphic and igneous rocks that were formed more than 500 million years ago. Near Washington, the rocks consist predominantly of granite, greenstone (metamorphosed by great heat and pressure from basaltic lava flows), and quartzite. Sharp north-trending ridges, formed by steeply dipping quartzite that resists weathering, rise more than 1,000 feet above sea level.

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Washington's Building Stones

The building stones used by the earliest European settlers were the crystalline rocks of the Piedmont, which were quarried from outcrops along the Potomac River and Rock Creek. One type, known to geologists as Sykesville Formation, is still quarried west of the city and used for flagstone.

In colonial days, the first solid ground on the marshy north shore of the Potomac, now just north of the Lincoln Memorial, was an outcrop of Piedmont rocks that jutted into the river. This promontory served as the starting point for surveys establishing property lines for the early settlers. It was called Braddock's Rock, because the British General Edward Braddock and his red-coated soldiers, accompanied by Lt. Col. George Washington, are thought to have landed there in 1755 on their way to Fort Duquesne (now Pittsburgh). In time Braddock's Rock became a quarry, and it may have furnished stone for the foundations of both the White House and the Capitol.



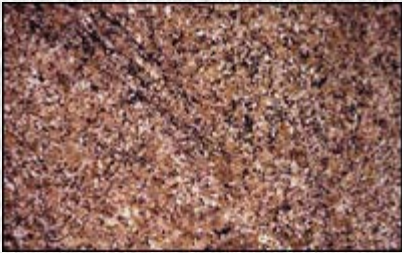
Sandstone



Marble



Limestone



Granite



Many other quarries supplied rocks from the Piedmont province to the young city. One of the most important was the Little Falls Quarry on the Maryland shore of the Potomac, just beyond the District of Columbia. Much of the stone for the foundations and the backing for the marble of the Washington Monument came from this quarry in the Sykesville Formation. An engraved stone from the Little Falls Quarry appears among the various commemorative stones from all over the world that line the interior walls of the monument.

Little Falls Quarry on the Potomac River, [NEXT](#)

Montgomery County, Maryland



Acid Rain in Washington

The problem of urban pollution and acid precipitation (often called acid rain) is of increasing concern in the Washington metropolitan area. Pure, distilled water has a neutral pH of 7. Normal, unpolluted rain is slightly acid, with a pH of 5.6, because the carbon dioxide in air combines with water to form small amounts of a weak acid called carbonic acid. Rainfall in the Washington area has an average pH of 4.2 to 4.4, more than 10 times as acid as unpolluted rain. The main source of pollution here is exhaust from automobiles, trucks, and other forms of transportation. Vehicle exhaust contains nitrogen oxides and sulfur dioxide, which combine with water to form strong acids.

Limestone and marble, the stones that form many of the buildings and monuments in Washington, are especially vulnerable to acid precipitation because they are predominantly made of the mineral calcite (calcium carbonate), which dissolves easily in acid. Many exposed areas on buildings and statues show roughened surfaces and loss of detail in carvings. In other areas, the calcite in the stone may react with sulfur dioxide and moisture in the air to form the mineral gypsum (hydrated calcium sulfate). The gypsum crystals grow into a network of thin blades that traps particles of dirt, resulting in a dark crust on the surface. This gypsum crust dissolves in water, so it accumulates only in sheltered areas protected from rainfall.



The marble balustrade on the west side of the Capitol building shows damage from acid rain dissolving the mineral calcite.

Questions still remain about acid rain and building stone in the Washington area. Weathering (deterioration caused by exposure to the environment) is a natural part of the normal geologic cycle. For example, the process of weathering has turned the hard rocks of the Piedmont Plateau into the soft sediments washed downriver to form the Coastal Plain. Similar weathering processes affect the stones in buildings and monuments. Has this normal process been accelerated by human actions and urban pollution? Geologists at the U.S. Geological Survey are working with scientists at other Federal agencies, including the National Park Service, to learn more about the connections between acid rain and the deterioration of our buildings and monuments through laboratory experiments and studies of the building stones themselves. In order to protect our historically and culturally significant buildings, we need to understand how the various processes of weathering and deterioration can affect the stones from which they were built.

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Descriptions and Origins of Selected Principal Building Stones of Washington

SANDSTONE

Maryland - Seneca Creek, Montgomery County. Red, reddish - brown, and gray. Coarse - to fine-grained angular quartz; some fragments of feldspar and mica. Fine - grained. Durable building stone. Triassic age.

Example: Original Smithsonian Institution Building.

Virginia - Aquia Creek, Stafford County. Brown to light-gray. Rounded, coarse to fine grains of quartz. Cemented with silica and containing scattered pellets of clay as much as 1 inch in diameter. Cretaceous age.

Example: Crypt and Rotunda of the U.S. Capitol Building.

LIMESTONE

Alabama - Colbert County. Similar to Indiana limestone. Has large isolated shells and other fossils. Mississippian age.

Example: Interior gallery walls of the National Gallery of Art.

Indiana - Bedford, Lawrence County. Light tan buff to nearly white. Rounded grains of calcite. Shell fragments also present. Firm and compact. Mississippian age.

Example: Washington National Cathedral, Department of the Interior Building, and all Federal buildings in Federal Triangle along north side of Constitution Avenue from Department of Labor at 14th Street NW to Federal Trade Commission Building.

GRANITE

Connecticut - Stony Creek, New Haven County. Coarse - grained, with large pink feldspar crystals in a gray mass of smaller crystals. Precambrian age.

Example: Exterior of Commerce Department.

Massachusetts - Milford, Worcester County. Light pinkish to greenish gray, with spots of black biotite mica that may form bands. Medium to coarse textured. Precambrian age.

Example: Zero Milestone.

Minnesota - Redwood and Renville Counties. Greenish-gray medium-grained biotite gneiss; pale-pink biotite granite or quartz diorite; and a granite gneiss with distinct banding, black knots of biotite, and large isolated feldspar crystals. Precambrian age.

Example: Fountains on the Ellipse at Constitution Avenue.

North Carolina - Mount Airy, Surry County. Very light gray. Medium textured. Biotite granite. Biotite is unequally distributed; some rock contains almost no biotite. Probably Paleozoic age.

Example: Arlington Memorial Bridge.

Vermont - Barre, Washington County. Gray to white. Medium to fine grained. Contains about 65 percent feldspar, 27 percent quartz, and 8 percent biotite mica. Ordovician age. **Example:** Steps to the west front of the Capitol.

MARBLE

Colorado - West Elk Mountains, Gunnison County. White with gray markings. Fine grained. Contains scattered grains

of pyrite. Excellent building stone. Mississippian age.

Example: Exterior of the Lincoln Memorial.

Georgia - Pickens County. White, blotched with black and gray. Coarser grained than Vermont white marble. Called "White Cherokee marble." Precambrian age.

Example: East-central front of the Capitol.

Maryland - Texas and Cockeysville, Baltimore County. White to light gray. Medium to coarse textured. Precambrian age.

Example: Bottom 152 feet and upper 390 feet of the Washington Monument.

Massachusetts - Lee, Berkshire County. White to light gray. Medium fine textured. Ordovician age.

Example: Exterior of Senate and House wings of the Capitol.

Missouri - Carthage district, Jasper County. White to light gray with bluish-gray tint. Coarse grained. Some stylolites (wavy, thin, dark lines formed when minerals in the rock dissolve under pressure). Mississippian age.

Example: Interior of Commerce Department Building.

Tennessee - Knox and Blount Counties. Pink, light pink, and gray. Fine textured. Stylolites, known locally as crowfeet, in beds. Ordovician age.

Example: National Gallery of Art.

Tennessee - Hawkins County. Dark chocolate to red with white streaks and masses. Coarse. Has some fossils. Ordovician age.

Example: Stairways in the Senate and House wings of the Capitol, Tennessee Memorial Stone.

Vermont - Rutland County. Snowy white. Fine grained. Other types light-blue-gray and black with highly contorted stylolites. Ordovician age.

Example: Jefferson Memorial.

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Building Stones of Washington Walking Tour

The following section is a guidebook for a walking tour of some of the building stones used in the Nation's Capital. The tour covers an area roughly bounded by Pennsylvania Avenue on the north, the Jefferson Memorial on the south, the U.S. Capitol on the east, and the Lincoln Memorial on the west, with some side trips to describe especially interesting buildings outside the area. The numbers are keyed to the locations on the accompanying map.



WEST



EAST

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About This Publication



As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering sound use of our lands and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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