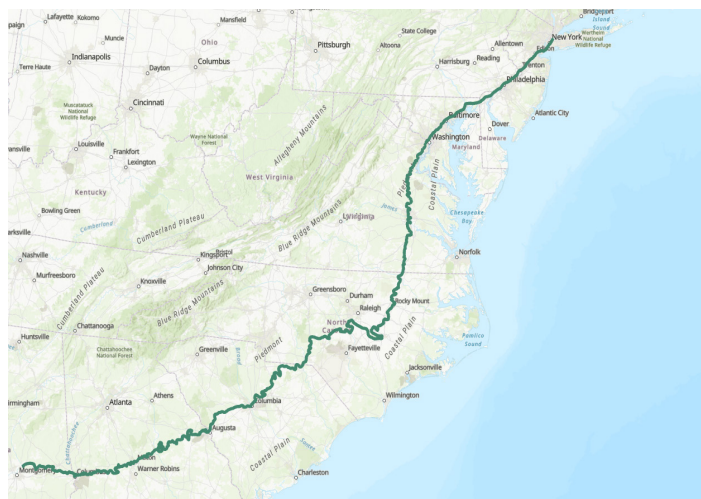




## The Fall Line

### What is the Fall Line?

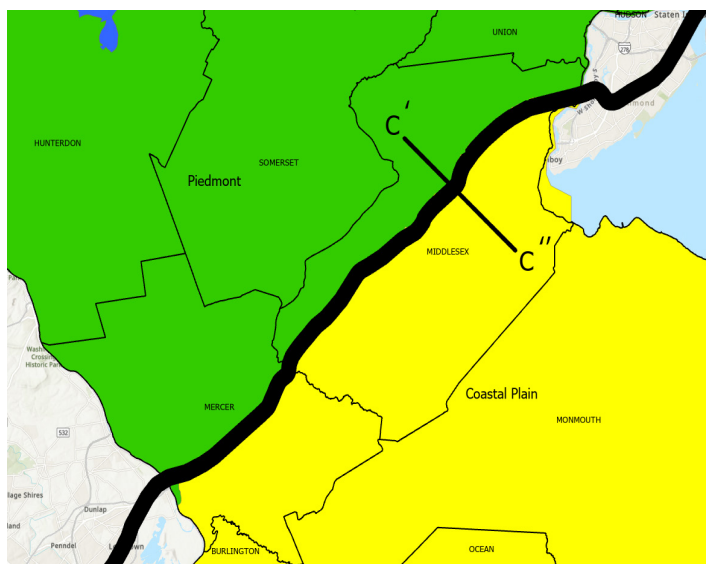
The Fall Line is a geological boundary line in the eastern United States that separates the Piedmont and Coastal Plain physiographic provinces (Monteverde et. al, 2012). It was a well-known natural feature for indigenous peoples and was documented by early European settlements in North America. The entire Fall Line runs from Alabama to New York (fig. 1).



**Figure 1:** Map showing where the Fall Line is along the Atlantic Seaboard.

In New Jersey, the Fall Line divides the state and runs roughly from Carteret to Trenton, following the bedrock contact between the Piedmont and Coastal Plain provinces (fig. 2). Regionally the Piedmont Province mainly consists of deformed, deeply weathered, and eroded Precambrian and lower Paleozoic igneous, metamorphic and sedimentary rocks, but in New Jersey it consists mainly of Triassic to Lower Jurassic (roughly 251 to 174 million years old) sedimentary and igneous rocks of the Newark Basin which have a shallow regional dip to the northwest. However, rocks along the Fall Line exposed in the Trenton area (Trenton Prong) and just northeast of Carteret in Staten Island (Manhattan Prong), Volkert and others (1996), are considerably older; Precambrian, Cambrian and Ordovician (1,000 to 443 million years old) igneous, metamorphic and sedimentary rocks. The province is known for rolling hills and plateaus and typical elevations of up to 400 feet above sea level. The Coastal

Plain Province is made of unconsolidated sediments mainly sand, silt, and clay, derived from Piedmont and older rocks, and is characterized by a regional dip to the southeast. The Coastal Plain tends to be flat land at low elevation, generally ranging from 0 to 250 feet above sea level. The Coastal Plain sediments were eroded away at the Fall Line, thus exposing the Piedmont rocks underneath (Fenneman, 1938, p. 127). Because of the differing strengths of the materials on either side of the Fall Line a series of waterfalls have developed along the contact between these two provinces hence the name “Fall Line.”



**Figure 2:** The Fall Line running along the border between the Piedmont and the Coastal Plain Physiographic Provinces. C' to C'' matches cross section in Figure 5.

### Historical Fall Line Geology

Into the 1960s, the concept of peneplains explained the area between the Piedmont and the Coastal Plain. First, the Piedmont had been eroded almost flat to a low level, then, Coastal Plain sediments accumulated upon the Piedmont, finally, the Piedmont was uplifted, causing the Coastal Plain to be eroded away at its highest point and exposing the underlying rock (Johnson, 2004, p. 5). Other geologists theorized that the area of erosion was perhaps the location of a fault or monocline (steep fold) in the Piedmont (Fenneman, 1938, p. 130). As research

and technology progressed, subsurface drilling showed that the Piedmont has a steeper decline toward the ocean than does the Coastal Plain, and that the Piedmont itself has two different sloped surfaces. Using the peneplain concept, geologists determined that multiple episodes of tilting and uplifting caused the different planes and the rolling hills of the Piedmont (Fenneman, 1938, p. 126-127).

### On The Line

As you approach the Fall Line from the Piedmont in a southeasterly direction, there is a gradual drop in land elevation toward the Coastal Plain. The width of this area is somewhat narrow, spanning a few miles in some locations (Fenneman, 1938, p.128). In northeastern Jersey, the zone is covered by glacial drift (Fenneman, 1938, p. 145). However, there are many man-made changes to the topography including roadways and buildings. In fact, a railroad track runs over the geological contact of the Piedmont and Coastal Plain from Princeton Junction to Monmouth Junction.

The Fall Line does not outcrop in many places. One known site is in the Delaware River behind the State House at Trenton (fig. 3). The jagged rocks are visible but only when the water level is low. However, the small rapids they create are regularly discernible in aerial imagery (Stanford, personal correspondence, 14 February 2020) (fig. 4).



**Figure 3:** Outcrop of the Fall Line in the Delaware River with Trenton in the background, Photo, *Ted Pallis*.

The Fall Line is mainly inferred, but it is considered the mapped contact line between the Piedmont and Coastal Plain in New Jersey, as can be seen in (fig. 5), dipping from Line C' on the left to line C'' on the right, in Middlesex County. The term "Fall Zone" can still be used to define the geographical area, but "Fall Line" defines a finer division of the provinces.

### Piedmont and Coastal Plain Geology

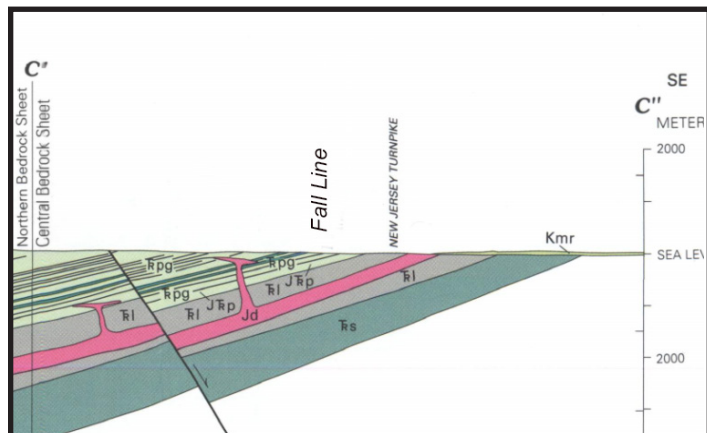
On the northern side of the Fall Line lies the Piedmont Physiographic Province. Volcanic eruptions and deposition



**Figure 4:** Rapids on the Delaware River at the Fall Line. Yellow box is the statehouse.

of crustal fragments and soft sediments were pushed up from the ocean floor resurfacing on the North American plate resulting in various metamorphic and igneous formations (Grymes, 1998). The Piedmont region mostly contains metamorphic rocks such as schist, gneiss, granite, and marble. However, the Piedmont region in New Jersey consists mostly of sedimentary rock formations (U.S. National Park Service, 2018). This occurred through a series of mountain building events that helped form the Appalachian Mountains (Grymes, 1998).

At for the southern side of the Fall Line, the Piedmont meets the Coastal Plain Physiographic Province. The Coastal Plain consists of soft sediments that are desirable to farmers and many farms can be found here. Its flatter geography also makes it easier to farm.



**Figure 5:** Part of Cross Section C to C'' of the Northern and Central Bedrock Sheet (Herman and others, 1996).

### Rapids and Falls

Falls and small rapids occur at the Fall Line because of the slopes and composition of the geologic material in conjunction with the flow direction of the water (Smock and Clark, 1897, p. 174). This causes deeper, uneven cutting and the tendency to create small falls and rougher waterways.

The falls made an impression on the Native Americans as well as Europeans new to the land. In 1608, Captain John Smith, the English explorer who helped establish the Jamestown, Virginia colony was given a tour inland by the Indian chief Powhatan, whose name means “waterfall” (Smith and Deane, 1866/2023, p. 7). Smith subsequently noted the falls as a place to return to and depart from (Smith and Deane, 1866/2023, p. 7). This area characterized by falls, rapids, and streams running to the Coastal Plain became known as the Fall Zone (Johnson, 2004, p. 14).

### The Fall Line Road

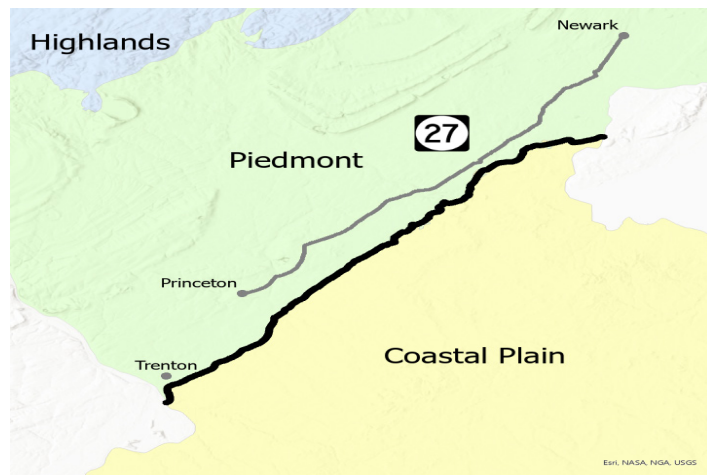
The Fall Line was a popular place to settle for the Native Americans before European settlement. It is most likely that the Native Americans may have followed the Fall Line to get from settlement to settlement.

In the 1700s, the portion of the King’s Highway from Fredericksburg, Virginia to Philadelphia followed the Fall Line. This stretch is referred to as the Fall Line Road (Lewis, 2007). In New Jersey, part of the King’s Highway ran along or no more than a few miles away from the Fall Line, from what is now Route 206 from Trenton to Princeton and Route 27 from Princeton to Newark (fig. 6). The development of certain cities and commerce are due in great part to the Fall Line. Colonists settled where the inland rivers became impassable like Trenton and where fresh water was in ample supply. Captain Smith noted the difficult navigability of the Fall Line: “...we were intercepted with great craggy stones in midst of the river, where the water falleth so rudely, and with such a violence, as not any boat can possibly passe...” (Smith and Deane, 1866/2023, p. 7).

The lack of established roads kept settlers by the water for some time. This proved worthwhile: mills were powered by the rapid waters thus increasing economic development. Shipping was easy, the goods and their method of delivery were in one place. Over time, these once-incident establishments became important “Fall Line Cities” with industrial centers (Delaware Geological Survey, 2020). Though we see them today simply as large cities, their emergence is truly due to geology.

### Conclusion

Society, industry, and geology all come together over the matter of the Fall Line. Native Americans relied on the falls for water and a recognizable place to live. Colonists also settled near the Fall Line, first out of necessity and then out of commercial advantage. In modern history, the Fall Line has remained a marked feature for roadways and an important geographical landmark. It has provided valuable geologic studies that answer questions about New Jersey geology. This interesting, historical piece of geology continues to gain our interest.



**Figure 6:** King’s Highway (Rt. 27) follows the route of the Fall Line from Princeton to Newark.

### References

- Delaware Geological Survey (2020), A Summary of the Geologic History of Delaware.
- Herman, G.C., Monteverde, D.H., Volkert, R.A., Houghton, H.F., Parker, R.A., Drake, A.A., and Dalton, R.F., (1996), Cross Sections of the Valley and Ridge, Highlands and Piedmont Physiographic Provinces, Northern and Central Bedrock Sheets, *in* Bedrock Geologic Map of Northern New Jersey, U.S. Geological Survey Miscellaneous Investigations Series Map I-2540A (Sheet 2 of 2).
- Fenneman, N.M., (2023), Physiography of eastern United States. Retrieved from Internet Archive website: <https://archive.org/details/physiographyofea0000nevi>
- Grymes, C., (1998), Virginia Places, Geology of the Fall Line
- Johnson, Douglas, (2004), Stream Sculpture on the Atlantic Slope, Retrieved from Internet Archive website: <https://archive.org/details/in.ernet.dli.2015.150757>
- Lewis, J.D., (2007), Carolina - The Fall Line Road.
- Monteverde, D.H., Herman, G.C., Volkert, R.A. and Stanford, S.D., (2012), Bedrock map of the Princeton quadrangle, Mercer and Middlesex counties, New Jersey, New Jersey Geological and Water Survey, Open File Map, OFM - 93.
- Smith, J., Deane, C., (2023), A True Relation of Virginia (p. 7) HathiTrust (Original work published 1866).
- Smock, J.C., Clark, W.B., (1897), Annual Report for the State Geologist for the Year, New Jersey Geological Survey (p. 174),
- U.S. National Park Service (2018, May 8), Piedmont Province, (U.S. National Park Service), <https://home.nps.gov/articles/piedmontprovince.htm>.
- Volkert, R.A., Drake, A.A. Jr., and Sugarman, P.J. (1996), Geology, geochemistry, and tectonostratigraphic relations of the crystalline basement beneath the coastal plain of New Jersey and contiguous areas; US Geological Survey, Professional Paper 1565-B.

Volkert, R.A. and Stanford, S.D., (2018), Bedrock geologic map of the New Jersey part of the Trenton West and Trenton East quadrangles, Mercer and Burlington Counties, New Jersey, New Jersey Geological and Water Survey, Open File Map, OFM-122.

**STATE OF NEW JERSEY**

Philip D. Murphy, *Governor*

Tahesha Way, *Lieutenant Governor*

**Department of Environmental Protection**

Shawn LaTourette, *Commissioner*

**New Jersey Geological and Water Survey**

Steven Domber, *State Geologist*



*Prepared by Derek Tyson and Corinne Kosar*

Comments or requests for information are welcome

Mail: New Jersey Geological and Water Survey  
P.O. Box 420, Mail Code 29-01  
Trenton, NJ 08625-0420

Phone: 609-292-1185

On-line: <http://www.njgeology.org/comments.html>