Physiographic Provinces of New Jersey

New Jersey's landscape has formed during more than a billion years of geologic processes such as mountain building, erosion and deposition. This history has given the State distinctive landforms that are divided into four regions (Salisbury, 1898, p. 5), known as physiographic provinces. Beginning in the northwest and proceeding southeast, these regions are called the **Valley and Ridge, Highlands, Piedmont, and Coastal Plain Provinces**. The first three are grouped with the larger classification known as the Appalachian Highland, the last with the Atlantic Slope. Both are major physiographic divisions of the United States.

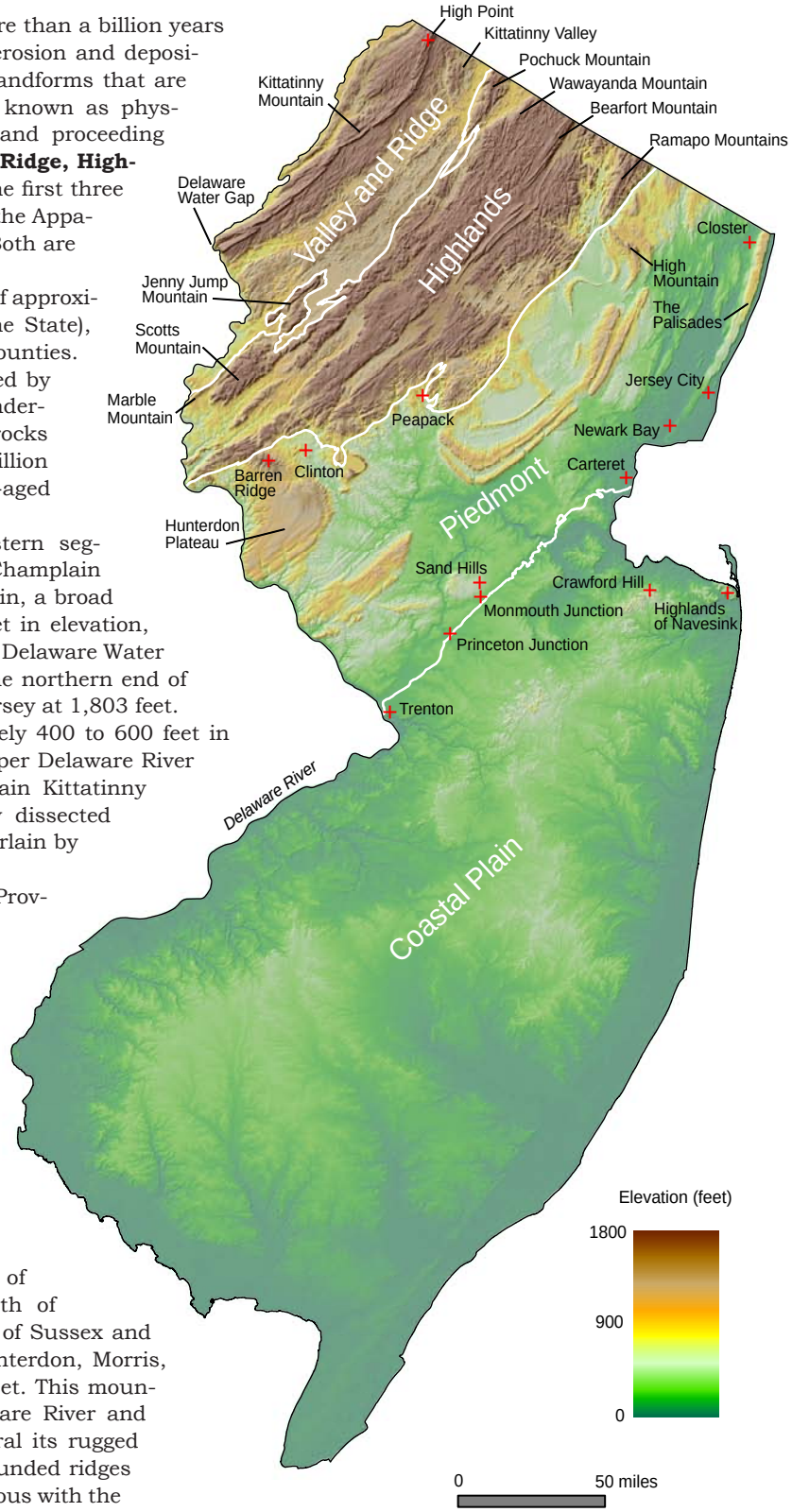
The **Valley and Ridge Province**, with an area of approximately 536 square miles (about one-fifteenth of the State), occupies a major portion of Sussex and Warren Counties. This province, up to 17 miles wide, is characterized by steep-sided, linear ridges and broad valleys. It is underlain by folded and faulted Paleozoic sedimentary rocks of Cambrian to Middle Devonian age (540 to 374 million years old) and minor amount of earliest Silurian-aged igneous rocks.

The Kittatinny Valley, which forms the eastern segment, is the southernmost portion of the Hudson-Champlain Valley (Fenneman 1938, p. 203). Kittatinny Mountain, a broad even-crested ridge ranging from 1,600 to 1,800 feet in elevation, separates the upper Delaware River Valley above the Delaware Water Gap from the Kittatinny Valley. High Point, near the northern end of Kittatinny Mountain, is the highest point in New Jersey at 1,803 feet.

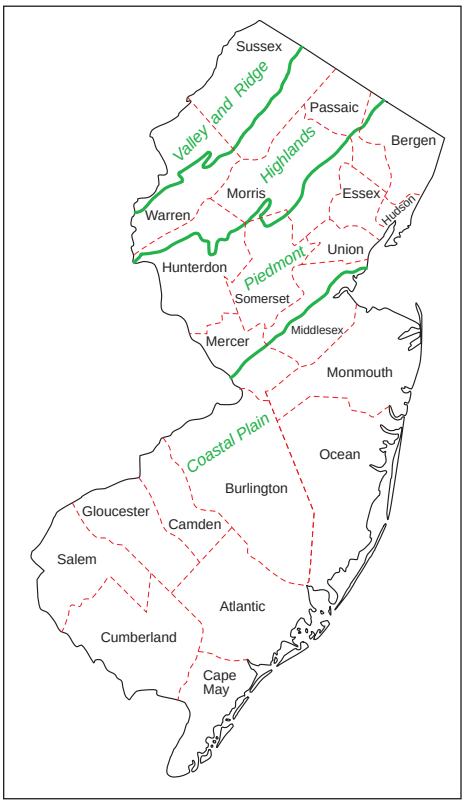
Valley floor elevations range from approximately 400 to 600 feet in the Kittatinny Valley and 300 to 600 feet in the upper Delaware River Valley. Two major sub-valleys, paralleling the main Kittatinny Valley, and numerous tributaries create a highly dissected topography. Karst features are found in areas underlain by limestone and dolomite.

The southeast boundary with the Highlands Province is placed where Cambrian and Ordovician sedimentary rocks are in contact with Precambrian (Proterozoic) crystalline rocks. Generally, this boundary is an unconformity, but in places a fault defines it. Starting at the border of New Jersey and New York, the physiographic province boundary follows the contact south along the western slope of Pochuck Mountain. It continues along the western side of the Highlands around Jenny Jump Mountain, and then continues southwest at the foot of Scotts and Marble Mountains to the Delaware River.

The **Highlands Province** occupies an area of approximately 980 square miles, about one-eighth of the State. It lies within the southeastern portions of Sussex and Warren Counties, as well as major portions of Hunterdon, Morris, and Passaic and small parts of Bergen and Somerset. This mountainous belt is about 10 miles wide at the Delaware River and 25 miles wide near the New York border. In general its rugged topography consists of a series of discontinuous rounded ridges separated by deep narrow valleys. Although contiguous with the Reading Prong in Pennsylvania and the Hudson Highlands in New York, the use of the term "Highlands" (Rogers, 1840) for this region of New Jersey takes precedence.



Color-shaded relief map, and physiographic provinces of New Jersey and location of named features.



Physiographic Provinces and Counties of New Jersey.

The Highlands is mainly underlain by highly metamorphosed igneous and sedimentary rocks of Middle Proterozoic age (1.2 billion to about 900 million years old). There are also small areas of Late Proterozoic age metasedimentary rocks and diabase dikes. Many of the elongate northeast trending valleys within the Highlands are underlain with sedimentary rocks similar to those in the Valley and Ridge Province. Middle Paleozoic sandstone and quartzite form some of the higher ridges in the Highlands and Bearfort Mountain is the highest among these at 1,490 feet. In New Jersey, these younger sedimentary rocks are included as part of the Highlands.

At 1,496 feet above sea level, Wawayanda Mountain is the highest point in the Highlands. The maximum elevation of the peaks decreases both toward the southeastern border and southwest to the Delaware River. Ramapo Mountain (1,171 feet) is the highest point on the southeast side of the Highlands while the maximum elevation near the Delaware River is less than 800 feet. The valleys range from less than 400 to over 800 feet above sea level with the lowest elevations located near the Delaware River.

The boundary with the Piedmont Province is placed at the base of the Highlands where the crystalline rocks are in contact with significantly younger sedimentary and igneous rocks. Starting at the New York border the boundary follows the Ramapo Fault southwest to just south of Peapack. It then alternately follows the contact between the Precambrian crystalline rocks and the Cambrian sediments and various segments of the border fault to the Delaware River.

The **Piedmont Province** is an area of about 1,600 square miles and makes up approximately one-fifth of the state. It occupies all of Essex, Hudson, and Union Counties, most of Bergen, Hunterdon, and Somerset, and parts of Mercer, Middlesex, Morris, and Passaic. It is mainly underlain by slightly folded and faulted sedimentary rocks of Triassic and Jurassic age (240 to 140 million years old) and igneous rocks of Jurassic age. Highly folded and faulted lower Paleozoic sedimentary rocks along the northwestern margin in the Clinton and the Peapack areas, as well as at several smaller areas are included as part of the Piedmont. In the Trenton and Jersey City areas, along the southern margin of the province, there are small bands of highly metamorphosed rocks ranging in age from Middle Proterozoic to Cambrian that are also included.

The Piedmont is chiefly a low rolling plain divided by a series of higher ridges. Its width varies from about 16 miles at the New York border to over 30 miles at the Delaware River. Along the foot of the Highlands, the elevation of the Piedmont generally ranges from 300 to 400 feet above sea level. The highest point in the province, at 914 feet, is Barren Ridge on the northern side of the Hunterdon Plateau. The major linear ridges are underlain by igneous rocks (lava flows and diabase intrusive rocks) and have steep front faces with long back slopes. Of these, the tallest is High Mountain at 885 feet. The most prominent feature in the eastern part of the province is The Palisades, which has a maximum elevation of 547 feet near Closter and commands spectacular views of the Hudson River and New York City. The province slopes from the foot of the Highlands toward its southeastern boundary with the Coastal Plain Province. There its elevation is about 100 feet near Trenton and sea level at Newark Bay.

The boundary with the Coastal Plain Province is placed at the contact between the rock units of the Piedmont and the unconsolidated Cretaceous sediments. It is essentially a line from Carteret through Princeton Junction to Trenton. This boundary line is known as the Fall Line because it is marked by a series of waterfalls and rapids all along the East Coast. The Sand Hills are erosional remnants of Coastal Plain sediments that lie within the Piedmont.

By far the largest physiographic province in New Jersey is the **Coastal Plain.** With an area of 4,667 square miles occupying about three-fifths of the state, it includes all of Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Monmouth, Ocean, and Salem Counties and parts of Mercer and Middlesex. The unconsolidated deposits of the Coastal Plain dip gently to the southeast and range in age from the upper Lower Cretaceous to the Miocene (90 to 10 million years old). A broad trough follows the Piedmont boundary from the Raritan Bay to Trenton. Near Monmouth Junction, where the trough floor forms a saddle it reaches an elevation of about 80 feet. East of this depression is the drainage divide between the Delaware River and the Atlantic Ocean. The maximum elevation of the Coastal Plain, located at Crawford Hill, is 391 feet. The streams that flow northwest to the Delaware have narrow valleys, are shorter and have a steeper gradients than the streams that flow southeast. The Highlands of Navesink at 266 feet above sea level is the highest point directly on the coast.

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