C. Appendix III: Geology of New Jersey

New Jersey's Geology

The foundation of the New Jersey's diverse landforms was built over the course of millions of years of expanding and receding glaciers, extending and deepening rivers, rising and falling sea levels, eroding beach sand, geologic faults, and volcanoes. Present-day New Jersey reflects geologic processes that began more than 500 million years ago, with the deposition of sand, mud, and lime sediment from Paleozoic seas and floodplains, and continues today with the erosion and movement of sand to shape and reshape the barrier islands.

The New Jersey Geological Survey divides New Jersey into four distinctive physiographic provinces: Valley and Ridge, Highlands, Piedmont, and Coastal Plain.

Valley and Ridge Province

Ancient seas and floodplains during the Cambrian to Devonian, deposited sand, mud, and lime sediment on the landform that is now northwestern New Jersey. In the 570 to 345 million years since initially deposited, sedimentary layers of sandstone, shale, and limestone formed and have compressed into folds and thrust along faults to form linear belts. These belts of erosion-resistant sandstone and easily-eroded shale and limestone underlie the long, parallel ridges and valleys of northwestern New Jersey, that include the Kittatinny Ridge, the Walpack Ridge, and Flat Brook Valley.

Highlands Province

An escarpment divides the Highlands from the Valley and Ridge Provinces from Franklin to the Delaware River, north of Phillipsburg. The Highlands have the oldest rocks in New Jersey – granite, gneiss, and marble that were formed in the Precambrian, between 1.3 billion and 750 million years ago. Granite and gneiss are resistant to erosion and have persisted while streams and rivers have created the deep, steep-sided valleys. The long, parallel ridges and valleys that extend through the Highlands include Bearfort Mountain, Long Valley, and the Musconetcong Valley.

Piedmont Province

The Piedmont is separated from the Highlands by a series of major faults, including the Ramapo Fault. A prominent escarpment on the northwest side of the faults marks the extent of the Highlands. Below the faults, sandstone, shale, conglomerate, basalt, and diabase are the foundation of the broad lowland and intermittent ridges of the Piedmont. These rocks are of the Late Triassic and Early Jurassic age, 230 to 90 million years old. The rocks reside on a crustal block that dropped during the initial stages of the opening of the Atlantic Ocean. Volcanic activity created erosion-resistant basalt and diabase substrates. Basalt and diabase underlie the Palisades, Rocky Hill, Sourland Mountain, and Cushetunk Mountain and shale and sandstone-lined valleys and lowlands between them.

(**Appendix III continued)**

Coastal Plain Province

The unconsolidated sand, silt, and clay sediments of the Coastal Plain Province coincide with the rocks of the Piedmont Plains between Carteret and Trenton. These sediments were deposited in ancient river deltas and marine conditions from Cretaceous to Miocene, 135 to 5.3 million years ago, and extend past the coastline to the edge of the Continental Shelf. Late Tertiary and Quaternary rivers deposited sand and gravel that cover much of the Coastal Plain. The New Jersey coastline is the result of a rapid post-glacial rise in sea level that slowed 6,000 years ago.

Recent Glaciations

During the past two million years there have been three glaciations. The most recent glacier, the late Wisconsinian advance, began to recede approximately 20,000 years ago from Harmony across to Morristown and to the mouth of the Raritan River. Glacial deposits cover much of the substrate north of the extent of the glacier. Till, an unsorted mixture of sand, clay and boulders, covers much of the uplands. Sand and gravel from glacial meltwater and silt and clay fill the valleys and lowlands. Patches of till from older glaciations dot the landscape beyond extent of the late Wisconsinian advance.

Geologic Activities Today

The dynamic barrier islands have been formed by erosion and deposition of beach sand by waves and currents, while rivers deposit mud and sand in the bays and estuaries, expanding New Jersey's extensive brackish wetlands.

More information about the geology of New Jersey is available from the New Jersey Geological Survey Web site:

www.state.nj.us/dep/njgs

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