Brief Introduction to the Geology of Flat Rock Brook Nature Center and Bergen County

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The Rock Cycle

Rock Cycle in Earth’s Crust

SEDIMENTARY ROCK
- Heat and/or Pressure Metamorphism
- Weathering & Erosion
- Compaction and/or Cementation
- Deposition and Burial

SEDIMENTS
- Erosion
- Weathering & Erosion
- Uplift

METAMORPHIC ROCK
- Melting
- Heat and/or Pressure Metamorphism
- Weathering & Erosion

IGNEOUS ROCK
- Melting
- Solidification

MAGMA
Sedimentary Rocks

- Sandstones
- Shales
Basalts (Diabase)

https://en.wikipedia.org/wiki/Diabase
Geologic Origins of Our Area

Oldest rocks form more than 1 billion years ago when early land masses collided to form the Grenville Belt.

- Skipping over hundreds of millions of years, ancient North America and Africa collided to form Pangaea.
Origins of Our Area – Triassic/Jurassic

- As Pangaea split and the Atlantic Ocean began to form, sediments and lava flows were deposited.

- Faulting and tilted affected the region, as evidenced in the rock outcrops and features visible today.
Erosion over the past 150 my

• Day-to-day weathering and erosion wore down the vast mountains to the west and. Sediments were deposited along the Atlantic Coastal Plain. Resistant basalts and diabases stood up as the Palisades and Watchungs

• Ice Sheets covered the land as recently as 10,000 years ago
“Upper Contact” between Palisades Diabase and Sedimentary Layers
“Trace Fossils” from the Shallow Freshwater Lakes

- “Worm Burrows”
- “Raindrop impressions”
Worm burrows in FRB Quarry specimen
Triassic reptile fossil from Edgewater

http://www.njpalisades.org/triassicPark.html
The Last Ice Age

[Southern New England and Eastern New York at the Last Glacial Maximum: 26,000 yBP map]

Map generated by B.A. Oakley and J.C. Boothroyd, URI Dept. of Geosciences
Basemap: NOAA Coastal Relief Model
Sea level from ICE 5G model of Peltier and Fairbanks (2006).
Ice Margin modified from Dyke and Prest (1987) and Ridge (2010)

http://www.easternct.edu/oakleyb/files/2014/01/LIS_LGM_Oakleyt.jpg
Glacial Striations
Striations on FRB path
Glacial Erratics


http://www.landforms.eu/Central%20Park/images/perched1.jpg
Quarrying on the Palisades – “Carpenter Brothers’s Quarry”

http://www.njpalisades.org/images/quarryConveyer.jpg
Carpenter’s Trail

http://www.njpalisades.org/images/carpenterTrail.jpg
Beginning around 1900, the Womens Clubs of NY & NJ mounted campaigns in the State Legislatures leading to establishment of the Palisades Interstate Park. This is Carpenters’ Boathouse in 1931
Through the 1890s, quarries blasted the Palisades for stone to make gravel and cement. The largest of these, Carpenter Brothers’ quarry, was just south of here (background photograph and D). Many thousands of tons of broken rock were taken from this quarry.

Public outrage at this “desecration” of the landscape was captured in newspaper articles such as this one (A) from the New York Times in 1895.

In New Jersey, the fight to preserve the Palisades was led by the New Jersey State Federation of Women’s Clubs. In 1897, club women voted the quarries by boat (C), making a stop here at Carpenter’s quarry. Could a handful of women—a generation before suffrage—succeed in such an ambitious effort?

In 1900, New Jersey and New York, spurred by the women’s clubs and with the backing of several prominent individuals and families, including New York governor Theodore Roosevelt, formed an Interstate Park Commission whose purpose was to close down the quarries and preserve the Palisades. John Pierpont Morgan would donate the funds to close Carpenter’s quarry. The last blasting at this spot occurred on Christmas Eve, 1900.

The Palisades Interstate Park was formally dedicated in 1909 at Alpine Landing (D).
Englewood Crushed Stone Co.

• c. 1900, the Englewood Crushed Stone Company started operations on the back side of the Palisades
• Blasted the diabase under the sandstone/shale
• Brought slabs to crushing house for reduction in size for use in road construction
• Transported by wagons and trucks to forerunner of Route 4 and other roads
Quarry Operations at FRB

• Continued into late-20s
• Closed due to complaints from neighbors
• Englewood Crushed Rock Company → Englewood Lumber Company → ELCO
• Remains of two-room office (razed in 1970s) and crushing building part of my childhood
Cliff walls in the FRB Quarry
Drill Holes in Quarry Rock
Remains of Crusher Building
Selected References to Learn More

More information about the area’s geology:

• “Bedrocks of the Newark Basin—Sediments and Volcanoes”

• The Teacher-Friendly Guide to the Earth Science of the Northeastern United States
  http://geology.teacherfriendlyguide.org/index.php/over-ne

• Geology of Bergen County in Brief
  http://www.state.nj.us/dep/njgs/enviroed/county-series/Bergen_County.pdf

Slideshow available at: https://earth2class.org/site/?page_id=4969
• “Triassic Park”
http://www.njpalisades.org/triassicPark.html

• “The Story of Our Valley—The Cold Facts”

• “Life in the Mesozoic “Hackensack River Basin”

“The real classroom is outside: Get into it!”