Upper Cambrian Hoyt Limestone, Saratoga Springs, New York

Stromatolites

Middle Ordovician Limestone, Watertown, New York
Cambrian-Ordovician Stratigraphy
Eastern NY

Key
- Cambrian-Ordovician Sedimentary
- Proterozoic Sedimentary
- Lower Proterozoic Metamorphic
- Proterozoic (Precambrian) Metamorphic

Proterozoic nonconformity - southeastern NY

Lower Ordovician Wappinger Group dolostones, S.E. New York

Lower Cambrian quartzite

Grenville Gneiss
Upper Ordovician Normanskill Greywackes, Wallkill Valley, New York

Simplified Stratigraphy of Western New York

- Proterozoic
- Cambrian
- Lower Ordovician
- Middle to Upper Ordovician

- Deep Basin
- Shallow Shelf
- Beach
- Normanskill Shale and Greywacke
- Wappinger Group Dolostones and Limestones
- Poughquag Quartzite unconformity
- Grenville metamorphic rock

Cambrian-Ordovician Stratigraphy Southeastern NY

Key:
- Cambrian - Ordovician Sedimentary
- Cambrian - Ordovician Metamorphic, Igneous
- Proterozoic (Precambrian) Metamorphic, Igneous

High Grade Metamorphism
Manhattan Prong - high grade metamorphism

- Manhattan schist, Inwood marble, Hartland gneiss
- Deeply buried during metamorphism.
- Roots of a high mountain range.

Inwood Marble (450 million years old)
Fordham Gneiss (1 billion years old)

Metamorphic Rocks of Manhattan

Inwood Marble
East bank of the Hudson R.
Manhattan Schist / Hartland Gneiss (450 my)
Inwood Marble (450 million years old)
Fordham Gneiss (1 billion years old)

Metamorphic Rocks of Manhattan
Hartland Gneiss and igneous intrusion
Orchard Beach, Bronx

Low Grade Metamorphism

Cambrian-Ordovician Stratigraphy
Southeastern NY

- Taconic Mountains - low grade metamorphism
- Slates and phyllites
- Thick pile of sediments shoved westward.
- Taconic rocks are allochthonous (out of place).
- Klippe - large region of allochthonous rock.
Evidence for the Upper Ordovician Taconic Orogeny

- Collision of North America with a volcanic island arc.
- Middle to Late Ordovician
- First orogeny caused by the closing of the Iapetus Ocean basin (also called “protoAtlantic”).
Taconic Mountain Building Event
(450 million years ago)

Bedrock geology of the southern Manhattan Prong.

Cameron’s Line - the suture line between metamorphosed rocks of ancient North America and metamorphosed rocks of the Taconic volcanic arc.

Modern Geologic Time Scale

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<thead>
<tr>
<th>Time (Ma)</th>
<th>Period</th>
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<tr>
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Taconic Orogeny
Passive margin
Silurian Geology

Appalachian Fold Belt

Shawangunk Ridge

Key
- Cambrian - Ordovician Sedimentary
- Mississippian - Carboniferous Sedimentary, Igneous
- Devonian Sedimentary
- Silurian Sedimentary
- Carboniferous - Ordovician Sedimentary
- Cambrian - Ordovician Metamorphic, Igneous
- Precambrian (Preatlasian) Metamorphic, Igneous

Wallkill Valley and the Gunks, New York

Shawangunk Ridge, near New Paltz, NY
Shawangunk Conglomerate, New York

Cement mine in Upper Silurian carbonates, eastern New York

Taconic Angular Unconformity

Lower Devonian

Upper Ordovician

Upper Silurian
After the Taconic Orogeny

- Taconic Mountains erode.
- Collision uplifts previously deposited strata.
- Angular Unconformity is created.
- Silurian - sea level rise floods unconformity surface.
- Shawangunk conglomerate and sandstone deposited.
- Upper Silurian carbonates (limestones and dolostones) deposited.
- Lower Devonian carbonates deposited.
Late Silurian limestones and shales

Niagara Gorge

Horseshoe Fall, Niagara NY
American Falls and view up-river (south)

Canadian Falls