Topography of the Northeastern US: *a brief review*

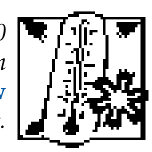
Does your region have rolling hills? Mountainous areas? Flat land where you never have to bike up a hill? Topography is the change in elevation over an area. The topography of the Northeast is intimately tied to weathering and erosional forces, and the type and structure of the underlying bedrock.

Weathering includes both mechanical and chemical processes that break down a rock. Wind and water in all forms, including streams, the ocean, and ice, are all media by which physical weathering and ***erosion*** occur. Streams are constantly trying to erode their way down through bedrock to sea level, creating valleys in the process. With sufficient time, streams can cut deeply and develop wide flat floodplains on the valley floor.

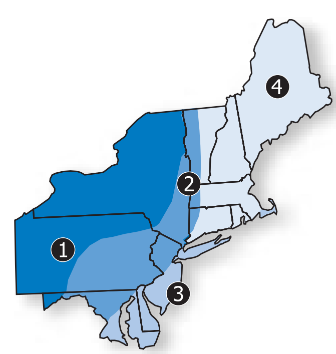
Weathering *is the break down of rocks;* **erosion** *is the transport of weathered materials.*

The pounding action of ocean waves on the coastline contributes to the erosion of coastal rocks and sediments. Ice plays a major role in the weathering and erosion of the Northeast landscape because of the frequent episodes of ***freezing*** and ***thawing*** in temperate latitudes. On a small scale, as water trapped in fractures within the rock freezes and thaws, the fractures widen further and further. This alone can induce significant break down of large rock bodies. On a larger scale, ice in the form of glaciers in mountain valleys and continental ice sheets can reshape the surface of a continent.

see Glaciers, p.60 for more on **freeze-thaw** *fracturing.*



Working in conjunction with mechanical weathering, chemical weathering also helps to break down rocks. Some minerals of igneous and metamorphic rocks that are formed at high temperatures and pressures, far below the surface of the Earth, become unstable when they are exposed at the surface where the temperature and pressure are considerably lower, especially in contact with water. Unstable minerals are altered to more stable minerals, which in the process results in the breakup of rock. Weak acids, such as carbonic acid found in rainwater, promote the disintegration of certain types of rocks. Limestone and marble may be rapidly broken down chemically as carbonic acid reacts with the carbonate mineral composition of these rocks, forming cavities and caverns in the rock. Other sedimentary rocks held together by carbonate cement are also particularly sensitive.

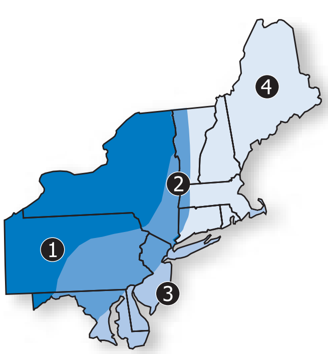


Rock type at the surface has an important influence on the topography of a region. Certain rocks are able to resist weathering and erosion more easily than others; resistant rocks that overlie weaker layers act as caps and form ridges. The inland ocean basins of the Ordovician Taconic and the Devonian Acadian mountain-building events collected and preserved sediments that became sedimentary rocks. Sedimentary rocks weather and erode differently than crystalline, generally harder igneous and metamorphic rocks that are more common in the Exotic Terrane and Appalachian/Piedmont region. Silica-rich igneous rocks have a crystalline nature and mineral composition that resists weathering far better than the cemented grains of a sedimentary rock. The metamorphic equivalents of sedimentary and igneous rocks are often more resistant due to ***recrystallization***. However, there are exceptions, such as schist, which is much weaker than its pre-metamorphism limestone or sandstone state. The unconsolidated sediments of the Coastal Plain region, which are not even yet considered rocks, are the least resistant to erosion. The Coastal Plain sediments have little cement, compaction, or interlocking crystals to stand up to the effects of wind, oxygen, and water.

Recrystallization *refers to the change in mineral crystals that make up rocks. When rocks are metamorphosed, recrystallization often occurs as the pressure allows crystals to grow larger into a tighter, interlocking arrangement.*

The underlying structure of the rock layers also plays an important role in the topography at the surface. Sedimentary rocks are originally deposited in flat-lying layers on top of each other. Movement of the plates creates stress and tension within the crust, especially at plate boundaries, which often deform the flat layers by folding, faulting, intruding or overturning. These terms are collectively used to describe rock structure and can be used to interpret what forces have affected rocks in the past. The folding of horizontal rock beds followed by erosion and uplift expose layers of rock to the surface. Faulting likewise exposes layers at the surface to erosion, due to movement and tilting of blocks of crust along the fault plane. Tilted rocks expose underlying layers. Resistant layers stick out and remain as ridges, while surrounding layers of less resistant rock erode away.

The glacial ice sheet of the most recent ice age covered part of the region, leaving its mark on the topography of the Northeast. Glaciers carved away at the land's surface as they advanced generally southward, creating many classic glacial U-shaped valleys and characteristic glacial depositional features such as drumlins and moraines. Mountains were sculpted, leaving high peaks and bowl-like cirques. As the ice sheet melted, other characteristic glacial features were left



behind to mark its former presence, including glacial lakes and eskers.

Just as we were able to make sense of the type of rocks in an area by knowing the geologic history of the region, we are able to make sense of the topography of the Northeast based on the rocks and structures resulting from past geologic events.

see Glaciers, p.60, for more on the scouring and deposits of glaciers.

Topography of the Inland Basin

Region 1

The Inland Basin has three main topographic divisions: the ***Allegheny*** Plateau, the Adirondacks and the Lowlands *(Figure 5.1)*. The existence of the basin itself is due to the downward buckling of the crust at the onset of the Taconic and Acadian mountain-building events. What makes the Inland Basin distinct from the other regions of the Northeast are the structure and nature of the sedimentary rocks that fill the basin. Unlike the Appalachian/Piedmont region or the complexly deformed Exotic Terrane region, the surface rocks of the Inland Basin have been gently tilted and folded, and were far enough removed from the mountain-building events to have escaped being metamorphosed. The exception to this pattern is the ***Adirondack region***, where uplift independent of the Paleozoic mountain-building events raised bedrock metamorphosed during the late Precambrian to the surface as erosion removed the overlying Inland Basin sedimentary layers.

***'Allegheny'** refers to the plateau or front; 'Alleghanian' refers to the mountain-building event.*

*see Rocks, p.32 for more on the rocks of the **Adirondack region**.*

Figure 5.1: Generalized topographic divisions of the Inland Basin.

Allegheny Plateau

The Allegheny Plateau dominates much of the Inland Basin region, extending from the southern tier of New York through Pennsylvania and Maryland to Alabama *(Figure 5.1)*. The layers of rock within the plateau have been only gently folded and tilted slightly to the south during the final mountain-building event during the Permian. A drive through the Allegheny Plateau region reveals a landscape contrary to the common concept of a plateau as an