

LANDFORMS of NYS

Prof. Anthony Grande

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TOPOGRAPHIC RELIEF MAP of NYS

Landforms

- REMINDER: The basis of present-day landforms (surface features) is the bedrock geology that has been “worked on” by the forces of nature over the millions of years.
- We need to differentiate between the bedrock geology (foundation) and the **surficial geology** (skin).

Physiographic map of NYS and vicinity showing Surface Features

Detail Physiography of NY, NJ and PA

1. Central NYS marks the northern edge of the Appalachian Plateau.
2. The Adirondacks are part of the Canadian Shield of North America.
3. The lowlands of the Lakes Erie and Ontario are part of the Interior Lowlands of N. America.
4. Long Island is part of the Atlantic Coastal Plain.

Exercise 4

- Exercise 4: Physiographic Regions of NYS is active.
- It is an Extra Credit exercise.
- Get it from the Course Home Page.
- It is due no later than the day of the midterm exam.

Creation of NYS Landforms

- Taconic Orogeny 450 mya
- Erosion of mountains
- Filling in of shallow ancient sea (deposits of salt and gypsum)
- Acadian Orogeny 375 mya
- Erosion of mountains

- Creation of the Catskill Delta
- Collision with Africa 285 mya
- Alleghanian Orogeny creates the Appalachian Mts 250 mya
- Erosion of mountains


The doming of the Adirondack region occurred around 50 mya as a hot spot of volcanic activity began to push upward.

Landform Creation

- The landforms were created mainly by forces of folding and faulting during mountain building periods.
- Volcanic activity was present and led to unique features in the eastern part of the state.
- Together the processes were responsible for the creation of the great variety of rocks and minerals found in NYS.

Types of Rocks

- **Sedimentary** – rocks formed by the compaction of eroded material from other rocks and precipitates from dissolved minerals under pressure of the weight of successive layers.



Watkins Glen State Park, Tompkins Co.


- They make up 75% of the earth's surface.

Sedimentary Rocks

Sediments are laid down in **horizontal** layers.

The layers are then **deformed** by folding and faulting and **displaced** by volcanic activity.

They are **eroded** by running water.



In Ausable Chasm, Essex Co.

Helderberg Escarpment

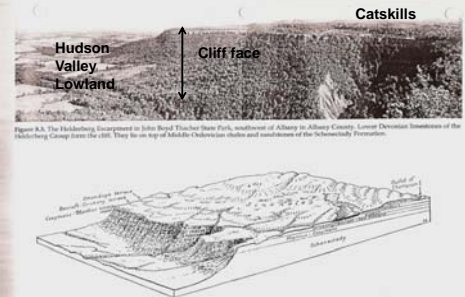


Figure 8.4. The Helderberg Escarpment to John Burg's Taconic Orogenic Belt, westward of Albany in Adirondack. Several Orogenic Orogenies of the Helderberg Group cross the cliff. They lie on top of Middle Ordovician shales and sandstones of the Schenectady Formation.

Figure 8.4. This block diagram of the Helderberg Escarpment shows the relationship between the bedrock units and the land surface. The escarpment exists because the thickness of the Middle and Cambrian formations (part of the Helderberg Group) is more resistant to erosion than the sandstone and shale of the underlying Schenectady Formation. Locate the place on Plate 5 where the Helderberg Group lies directly on top of the Schenectady Formation. There is a large gap in the rock record in this area.

Types of Rocks

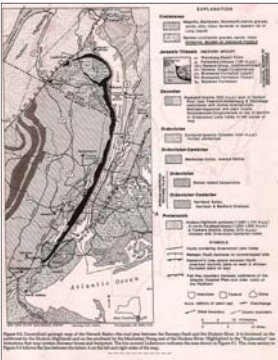
- **Igneous** – rocks formed by the cooling and solidification of molten material.
- The rate of cooling determines its crystalline structure and creation of minerals.

Igneous Rocks

Igneous rocks are found at the surface in (1) southeastern NYS from Staten Island to Rockland County along the Palisades sill (an intrusion of molten rock between layers of sedimentary rock.)

(2) northeastern NYS in the Saratoga Springs area where there are hot springs and pillow lava formations. (Pillow lava is a formation created when molten rock hits cool water.)

(3) The Hudson Highlands and Adirondacks contain PreCambrian igneous rock.



Igneous Rocks

Pillow lava at Stark's Knob, NY >>

Below, recent pillow lava underwater off of Hawaii.






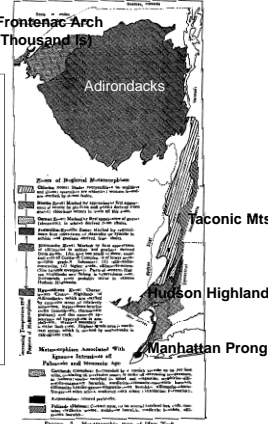
<<Volcanic sill, Haverstraw, NY (Rockland Co.)

Types of Rocks

- **Metamorphic** – rocks formed by the addition of great heat and pressure to existing sedimentary, igneous and metamorphic rocks.
- Shale becomes slate; limestone becomes marble.

Metamorphic Rocks

Metamorphic rocks are found in eastern NYS (Taconic Mts., Hudson Highlands and the Manhattan Prong), the Adirondack Mts. and in the Thousand Island region (Frontenac Arch).

Frontenac Arch (Thousand Is)
Adirondacks
Taconic Mts
Hudson Highlands
Manhattan Prong

Resistance of Rocks

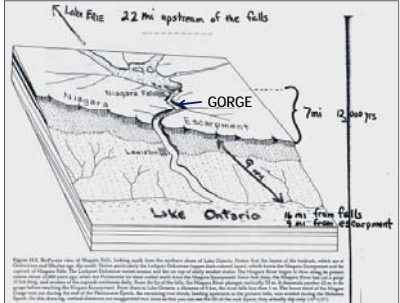
- The composition of the rocks give them the ability to resist forces of erosion.
- Igneous and metamorphic rocks are generally stronger. They are resistant to erosion and form highlands.
- Sedimentary rocks tend to be weaker. They are found in lowlands.
- Together they result in a variety of surface features and slope angles.

Setting of Niagara Falls

The Niagara River drains Lake Erie.

It flows over the Niagara Escarpment to reach Lake Ontario.

In doing so for 12,000 yrs, it has created a 7 mile long gorge as the falling water eroded weak layers of rock.

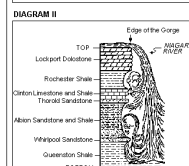
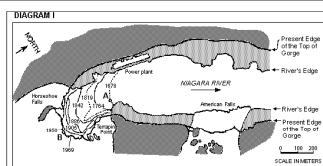


Lake Erie 22 mi upstream of the falls
Niagara Falls
GORGE
Escarpment
7 mi
Lake Ontario 4 mi from falls from escarpment

Niagara Escarpment



Retreat of Niagara Falls



At the present rate of erosion it will take the Niagara River 75,000 years to reach Lake Erie.

Niagara Falls

American Falls



1969



2011

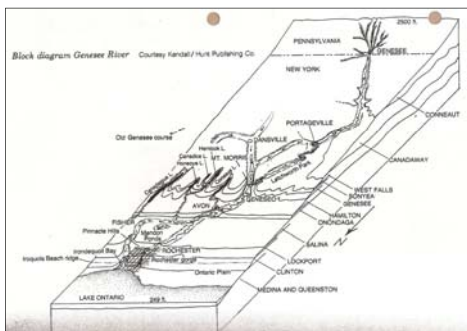
Niagara Falls



Horseshoe or Canadian Falls



Genesee River



Letchworth State Park



Genesee River in the "Grand Canyon of the East."



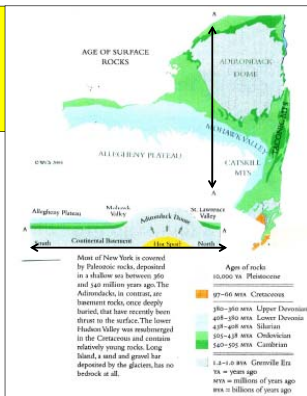
High Falls on the Genesee River at Rochester



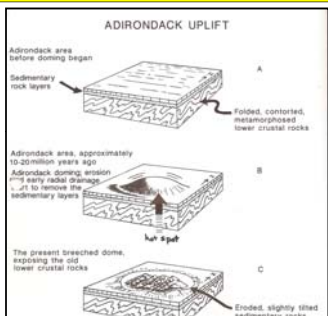
Age of the Surface Rocks of NYS

Surface rocks are exposed by geologic activity and elements of weather.

Some surface rocks may be older than surrounding rocks because of uplift and other tectonic processes.



Creation of Adirondack Mts.



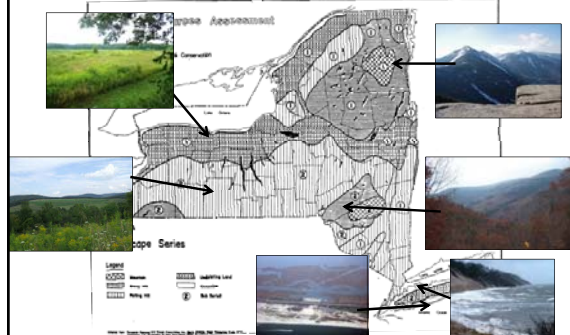
Adirondack Mts.

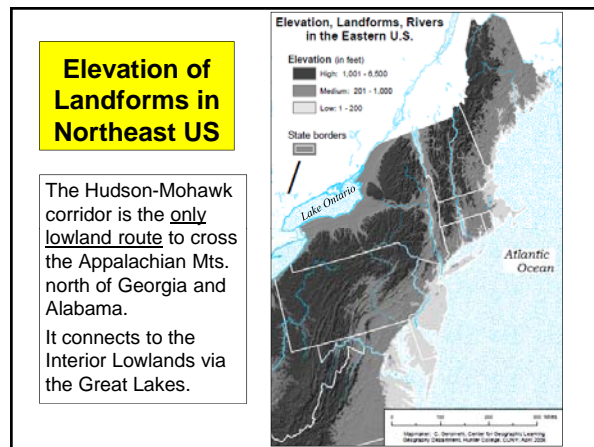
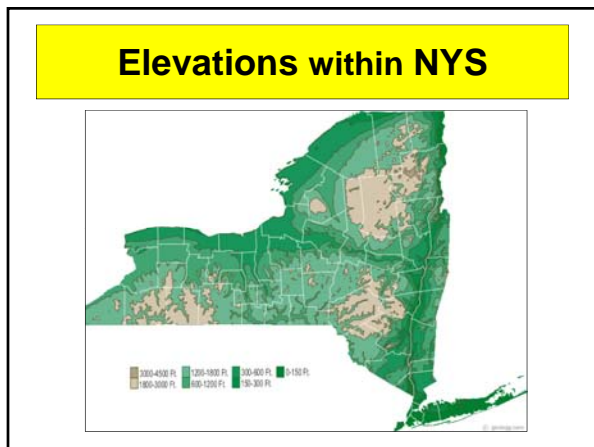
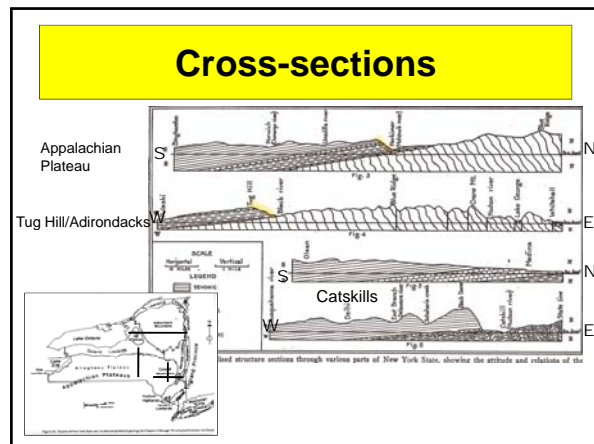
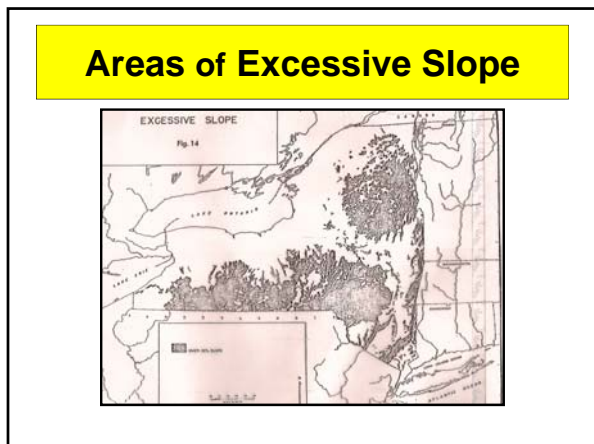


Bedrock Geology and associated Landform Features of NYS



Landscape Characteristics





Physiographic Regions of NYS

NAME	LOCATION	PRINCIPAL ROCK TYPE	SLOPE	SPECIAL CHARACTERISTICS
N. Lawrence Lowland	North, between the Adirondacks and Laurentian Highlands of Canada	Sedimentary (sandstone and siltstone)	Level to gentle	Part of the lowland corridor from the Great Lakes to the Atlantic Ocean. The St. Lawrence River traverses it. The Thousand Islands are a remnant of the old (Proterozoic) Arch between the Adirondacks and the Laurentians.
Adirondack Highlands	Northeast	igneous and metamorphic	Moderate to very steep	A large structure of igneous country. Highest elevations. Related to the Canadian Shield, the same area of North America.
Champlain Lowland	Northeast, between the Adirondacks and the New England Upland (west of this section)	Sedimentary (sandstone)	Level	Occupied mainly by Lake Champlain. Drains the Hudson Lowland to the St. Lawrence Lowland.
New England Upland	East	igneous and metamorphic	Steep	Many extends into eastern NY in the Adirons. The Wadsworth High is some SE NY in the Hudson Highlands, forms the gorge of Hudson at West Point. Southern part forms Montauk Island.
Black River Valley Lowland	North central, between the Adirondacks and Tug Hill	Sedimentary (sandstone)	Level to gentle	This area was once occupied by a glacial lake.
Tug Hill Upland	North central between the Black River Valley and the Ontario Lake plain	Sedimentary (sandstone, shale and siltstone)	Moderate	Clipped by resistant sandstone, forms a cuestas that is sloped from east to west. Area of poor drainage.
St. Lawrence Plain Lowland	Northeast (containing Lake Erie and Lake Ontario)	Sedimentary (sandstone, shale and siltstone)	Level to gentle	Part of the Interior Plain of North America. Characterized by weak rock formations with some resistant outcrops (as the Niagara escarpment). Covered by thin glacial drift, some poor drainage. Divides between Rochester and Syracuse.
Mohawk Valley Lowland	East central, between the Adirondack and the Appalachian uplands	Sedimentary (shale)	Level to moderate	Drained by the Mohawk River. Waterfall at Little Falls is where the glacial melt water broke through the pre-glacial drainage divide.
Appalachian Upland	South central	Sedimentary (sandstone, shale and siltstone)	Gentle to moderate	Largest physiographic region of NYS. Northern end of the Great Appalachian Plateau that extends north from Alabama. Resistant beds on north and east (as the Allegheny). The Finger Lake basin, deeply incised by glaciers, are the lowest parts of the plateau. The Catskills are not mountains but a severely eroded (dissected) raised portion of the plateau. The Allegheny Hills region in the southwest is the only part of the upland that was not glaciated.
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Allegheny Plateau and the Catskill Mountains	South central	Sedimentary (sandstone, shale and siltstone)	Gentle to moderate	Largest physiographic region of NYS. Northern end of the Great Appalachian Plateau that extends north from Alabama. Resistant beds on north and east (as the Allegheny). The Finger Lake basin, deeply incised by glaciers, are the lowest parts of the plateau. The Catskills are not mountains but a severely eroded (dissected) raised portion of the plateau. The Allegheny Hills region in the southwest is the only part of the upland that was not glaciated.
Hudson Valley Lowland	East, between the Appalachian and New England Uplands	Sedimentary (sandstone and shale)	Level to moderate	Part of the Ridge and Valley Province of North America (called Appalachian) that extends north from Alabama. The Hudson River is at sea level until Troy. Southern section is drained by the Wallkill River.
Triassic Lowland or Newark Basin	Southeast, between the Palisades and the Reading Prong of New England Upland	Sedimentary (sandstone)	Gentle	Smallest region of NYS, was once occupied by a glacial lake.
Long Island Coastal Lowland	Southeast	Unconsolidated material	Level to gentle	Northern portion of the Atlantic Coastal Plain that extends from Cape Cod to Florida. Terminal moraine and outwash plain features are present.

Landforms and Land Use

Physical Characteristics

- Elevation** – height above sea level
- Relief** – vertical difference between a high and low point
- Slope** – horizontal distance between a high and low point
- Valley Shape and Stream Flow** – work of water and gravity.
 - $Slope\ angle + volume\ of\ water + geologic\ setting = Rate\ of\ erosion$
- Vertical Zonation of Climate** – 3.5°F/1,000 ft. of change in elevation (related to #1 above)

Influence on People

- Barrier or Unifier** – fosters isolation or interaction
- Distinction or Assimilation** – separation or mixing
- Transportation/Communication** – ease and cost
- Population Density**
- Economic Activities**
- Hazards** – natural and man-made

Geologic Map of NYS

Hot link to fold out map in *Geology of New York State* textbook:

http://geology.about.com/library/bl/maps/n_statemap_NY3100.htm



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