Quiz 12-Bonus! (9:30-9:35 AM)
GY 111: Physical Geology

Lecture 31: Mountain Building 2:
The Appalachians

Instructor: Dr. Douglas W. Haywick
Last Time

Mountain Building 1
A) Distribution of mountain belts (the return of plate tectonics)
B) Isostasy and the Rock Cycle (again)
C) Thrust Faults in the Rockies (movie)

Web notes: 30
Mountain Belts

- Northern Appalachian (Newfoundland)
- Undeformed, faulting, folding, blues metamorphism

- Southern Appalachian (Alabama-Georgia)
- Undeformed, faulting, folding, blues metagamphism

Northern Transect

Southern Transect
Isostasy (Isostacy)

The depression of the asthenosphere beneath mountain belts due to loading followed by rebounding as erosion occurs.
Isostasy (Isostacy)

Isostasy will continue as long as continental roots still exist. Once isostasy stops, the mountains will get completely eroded away (it takes about 500 MA for this to occur).
The Rock Cycle

3) Metamorphic

Increasing heat

Regional metamorphism

4) Structural

Reverse faults, Folding

Unfolds, Undefomed
The Movie

There is a special class of reverse fault that is common in mountain belts

Thrust Faults
Today’s Agenda

Mountain Building 2
A) Appalachian “provinces” (Alabama!)
B) Paleozoic time-frame/orogenies
C) How to make a mountain belt

Web notes 31
Appalachian Mountains
Appalachian Mountains

Four geological belts are identified

1) **Plateaus** (undeformed)
2) **Valley and ridge** (folded/faulted)
3) **Piedmont** (Highly metamorphosed)
4) **Blue Ridge** (igneous intrusions)
Appalachian Provinces

Technically only 3 occur in Alabama

1) Plateaus (undeformed)
2) Valley and ridge (folded/faulted)
3) Piedmont (Highly metamorphosed)
Appalachian Provinces

1) Plateaus (undeformed)
2) Valley and ridge (folded/faulted)
3) Piedmont (Highly metamorphosed)

What happened?
When did it happen?
When?

<table>
<thead>
<tr>
<th>Era</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paleozoic</strong></td>
<td></td>
</tr>
<tr>
<td>Permian</td>
<td>(245 to 286 MA)</td>
</tr>
<tr>
<td>Pennsylvanian</td>
<td>(286 to 320 MA)</td>
</tr>
<tr>
<td>Mississippian</td>
<td>(320 to 362 MA)</td>
</tr>
<tr>
<td>Devonian</td>
<td>(362 to 418 MA)</td>
</tr>
<tr>
<td>Silurian</td>
<td>(418 to 441 MA)</td>
</tr>
<tr>
<td>Ordovician</td>
<td>(441 to 505 MA)</td>
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<tr>
<td>Cambrian</td>
<td>(505 to 550 MA)</td>
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<tr>
<td><strong>Neo-Proterozoic</strong></td>
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<tr>
<td>Ediacaran</td>
<td>(600 to 550 Ma)</td>
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Time of origin of the Appalachian Mountains
When?

The Appalachian mountains were produced through the combination of 3 distinct mountain building events (or orogenies)

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<th>Period</th>
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<tbody>
<tr>
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What Happened?

We need to consider Paleozoic paleogeography (ancient distribution of continents, oceans etc).
Paleozoic Paleogeography
Paleozoic Paleogeography

Late Cambrian  514 Ma

Laurentia
Paleozoic Paleogeography

Middle Ordovician 458 Ma

PANTHALASSIC OCEAN

PALEO-TETHYS OCEAN

TAPETUS OCEAN

GONDWANA

Avalonia

New England and Nova Scotia

Sea Floor Spreading Ridge

Subduction Zone (triangles point in the direction of subduction)

Ancient landmass

Modern landmass

North America

Laurentia

North China

India

South America

Africa

Antarctica

Sahara Desert

North Sea

Tornquist Sea

Europe

South China

Siberia

Kazakustania

Sahara Desert

Avalonia

New England and Nova Scotia

Sea Floor Spreading Ridge

Subduction Zone (triangles point in the direction of subduction)

Ancient landmass

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Tornquist Sea

Europe

South China

Siberia

Kazakustania
Paleozoic Paleogeography
Paleozoic Paleogeography

Early Devonian  390 Ma

- Caledonide Mountains
- Siberia
- Kazakhstan
- South China
- North China
- Malaya
- Arabia
- India
- Antarctica
- Africa
- South America
- Australia
- RHEIC OCEAN
- GONDWANA

Legend:
- Ancient Landmass
- Modern Landmass
- Subduction Zone (triangles point in the direction of subduction)
- Sea Floor Spreading Ridge
Paleozoic Paleogeography

Early Carboniferous 356 Ma

- PANTHALASSIC OCEAN
- PALEOTETHYS OCEAN
- RHEIC OCEAN

*Legend*
- Ancient Landmass
- Modern Landmass
- Subduction Zone (triangles point in the direction of subduction)
- Sea Floor Spreading Ridge
Paleozoic Paleogeography

Late Carboniferous 306 Ma

PANTHALASSIC OCEAN

Ancestral Rockies
Ouachita Mts.
Appalachians
Meseta
Ural Mts.

PALEO-TETHYS SEA

North China
South China

GONDWANA

Australia
Indian Ocean
Antarctica

Ancient Landmass
Modern Landmass
Subduction Zone (triangles point in the direction of subduction)
See Floor Spreading Ridge
Paleozoic Paleogeography

Late Permian  255 Ma

PANTHALASSIC OCEAN

PANGAEA

PALEO-TETHYS OCEAN

GONDWANA

TETHYS OCEAN

South China
Indochina

North China

Siberia

Kazakhstan

Central Pangea

South America

Africa

Turkey

Iran

Tibet

India

Australia

Ancient Landmass
Modern Landmass
Subduction Zone (triangles point in the direction of subduction)
Sea Floor Spreading Ridge

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## Paleozoic Tectonics (Taconic Orogeny)

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**Early Cambrian**

**Mid Ordovician**
Paleozoic Tectonics (Taconic Orogeny)

Laurentia

Baltica

Middle Ordovician
Paleozoic Tectonics (Acadian Orogeny)

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Paleozoic Tectonics (Acadian Orogeny)

The next tectonic event (the Acadian Orogeny) was caused by the approach of Baltica (Europe)
Paleozoic Tectonics (Alleghenian Orogeny)

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http://www.jamestown-ri.info/pangaea270.jpg
Lastly, along comes Gondwanna and….

…well you get the idea.
Lastly, along comes Gondwanna and…. 

…well you get the idea.

Pennsylvanian
Lastly, along comes Gondwanna and….

…and you get the idea.

Pennsylvanian

Paleozoic Tectonics (Alleghenian Orogeny)
The End….. For now
Today’s Homework

1. Start Prepping for the Final Exam

Next Time

1. Exam review