GY 112: Earth History
Lecture 24: Paleozoic 1: Laurentia
Instructor: Dr. Douglas W. Haywick
Last Time (before the exam)

The Cambrian Explosion

A) Why a Cambrian “explosion”
B) Introducing our ancestors (recap…. kind of)

(web notes 23)
The Cambrian Explosion

Not so much an explosion…

…more of a shift… to hard body parts
The Cambrian Explosion
The Cambrian Explosion

What we know about the early development of all of the current phyla is limited to sites where we have lots of beasties preserved.

http://arjournals.annualreviews.org/na101/home/literatum/publisher/
The Burgess Shale
Today’s Agenda

The Paleozoic of North America

1) Laurentian passive continental margin sedimentation
2) Central North America

(web notes 24)

The next few lectures includes several detailed diagrams that may require a bit more discussion than usual. If you don’t understand a diagram, ASK QUESTIONS!
Laurentia (Paleozoic North America)
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In the early Paleozoic (Cambrian to Middle Ordovician) North America was pretty isolated.
Laurentia (Paleozoic North America)

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- Convergent boundary well to the north.
Laurentia (Paleozoic North America)

In the early Paleozoic (Cambrian to Middle Ordovician) North America was pretty isolated.

- Convergent boundary well to the north.
- Divergent plate boundary well to the south.
Laurentia (Paleozoic North America)

Consider:
Laurentia (Paleozoic North America)

Consider:

1) passive continental margin
Laurentia (Paleozoic North America)

Consider:

1) passive continental margin
2) shallow marine water (shelf)
Laurentia (Paleozoic North America)

Consider:
1) passive continental margin
2) shallow marine water (shelf)
3) tropical climate
Laurentia (Paleozoic North America)

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All the way from Labrador to Alabama
Laurentia (Paleozoic North America)

Consider:

1) passive continental margin
2) shallow marine water (shelf)
3) tropical climate

All the way from Labrador to Alabama

1+2+3 = Fossil. Limestone, oolite, quartz arenite etc.
Laurentia (Paleozoic North America)

Passive continental margins are sites where thick sequences of coastal and shallow marine sedimentary rocks are deposited.

Bahamas oolite shoals

http://www.scgltd.com/scgbahamascourse.html
Laurentia (Paleozoic North America)

Passive continental margins are sites where thick sequences of coastal and shallow marine sedimentary rocks are deposited.

And these rocks were deposited all the way from Labrador to Alabama.

Cahaba River near Montevallo, AL
Laurentia (Paleozoic North America)

Passive continental margins are sites where thick sequences of coastal and shallow marine sedimentary rocks are deposited.

And these rocks were deposited all the way from Labrador to Alabama.

We could choose any site between them to discuss....
Laurentia (Paleozoic North America)

Passive continental margins are sites where thick sequences of coastal and shallow marine sedimentary rocks are deposited.

And these rocks were deposited all the way from Labrador to Alabama.

We could choose any site between them to discuss....

... I choose Newfoundland

Northwestern Newfoundland
Laurentia (Paleozoic North America)

Newfoundland is at the northern end of the Appalachian Mountains and is an important geological location

http://iz.carnegiemnh.org/crayfish/country_pages/newfoundland.htm
Laurentia (Paleozoic North America)

The island is divisible into several geological zones

http://iz.carnegiemnh.org/crayfish/country_pages/newfoundland.htm
The Humber zone is a region of undeformed, passive continental margin rocks.

Laurentia (Paleozoic North America)

http://iz.carnegiemnh.org/crayfish/country_pages/newfoundland.htm
Laurentia (Paleozoic North America)

This is a section of the Paleozoic stratigraphy of the Humber Zone in Newfoundland.
Laurentia (Paleozoic North America)

Cambrian rocks contain shallow marine limestones, dolostones and quartz arenite sandstones.

Dolostone
Laurentia (Paleozoic North America)

Early Ordovician rocks contain dolostones and limestones, some with good reefs (stromatolites, rugose and tabulate corals).

Stromatolite reef
Laurentia (Paleozoic North America)

All are mostly flat lying (non-deformed); they escaped the Paleozoic orogenies

Stromatolite reef
Laurentia (Paleozoic North America)

But something happens as you go up sequence. Shallow marine rocks are overlain by deep marine shale.
Laurentia (Paleozoic North America)

A sudden (localized) deepening occurred (transgression) and above that....
Laurentia (Paleozoic North America)

Thrust faulting…
Laurentia (Paleozoic North America)

Even though this coastline of Laurentia was a passive continental margin, a plate tectonic boundary was rapidly approaching…
Laurentia (Paleozoic North America)

The resulting Taconic Orogeny first depressed the seafloor (localized transgression) and then pushed previously deposited passive continental margin sediments up into thrust fault mountains.

More on the Appalachians next time.
Ignoring tectonics for a moment and you’ll see that sea water covers much of the craton in these 2 paleogeographic images, but not always to the same extent…
Cratonic Sequences

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Middle Ordovician

Early Devonian
Cratonic Sequences

When continents flood during transgressions, sediment is deposited.

When regressions occur, erosion takes place producing unconformities (disconformities)
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When regressions occur, erosion takes place producing unconformities (disconformities).

Thick sedimentary packages between disconformities are called cratonic (depositional) sequences.
Cratonic Sequences

When continents flood during transgressions, sediment is deposited.

When regressions occur, erosion takes place producing unconformities (disconformities)

Thick sedimentary packages between disconformities are called cratonic (depositional sequences).

- **Basins** have thick sequences (shorter disconformities)
- **Arches/domes** have thin sequences (longer disconformities)
And every depositional sequence is named (e.g., Sauk, Tippecanoe, Kaskaskia etc.)
And every depositional sequence is named (e.g., Sauk, Tippecanoe, Kaskaskia etc.)

Why the variation in thickness from the center of the craton to the edge?
Cratonic Sequences

<table>
<thead>
<tr>
<th>Geologic Time</th>
<th>Cratonic Sequences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CENOZOIC</strong></td>
<td></td>
</tr>
<tr>
<td>Cretaceous</td>
<td>65 m.y.a.</td>
</tr>
<tr>
<td>Jurassic</td>
<td></td>
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<tr>
<td><strong>MESOZOIC</strong></td>
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</tr>
<tr>
<td>Permian</td>
<td>251 m.y.a.</td>
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<tr>
<td>Pennsylvanian</td>
<td>Absaroka</td>
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<tr>
<td><strong>LATE PALEOZOIC</strong></td>
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</tr>
<tr>
<td>Mississippian</td>
<td>Kaskaskia</td>
</tr>
<tr>
<td>Devonian</td>
<td></td>
</tr>
<tr>
<td><strong>EARLY PALEOZOIC</strong></td>
<td></td>
</tr>
<tr>
<td>Silurian</td>
<td>Tippecanoe</td>
</tr>
<tr>
<td>Ordovician</td>
<td>Sauk</td>
</tr>
<tr>
<td>Cambrian</td>
<td></td>
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</tbody>
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Today’s Homework

1. Time Chart 2 Now due Thursday April 6th

Next Time

1. Special Lecture: Diane Palmore
2. Quiz 9 postponed until Tuesday April 4th
GY 112: Earth History

Lecture 24: Laurentia

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