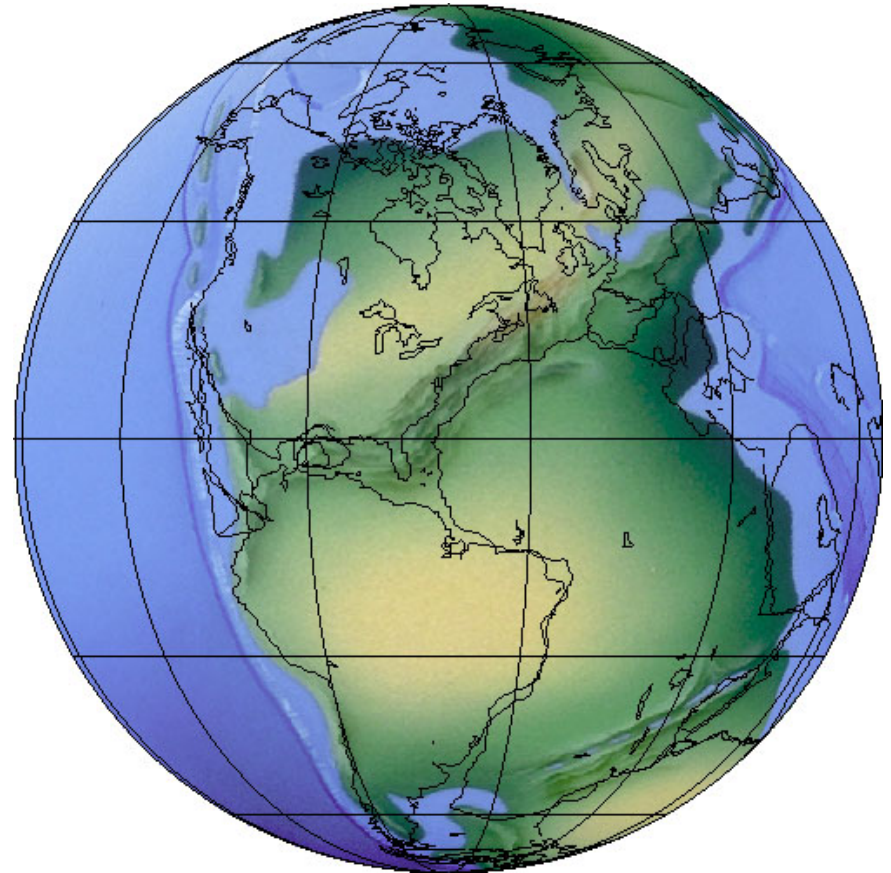


Up and down, round and round: continental and global movements

Textbook Reading
Chapter 8 (again)



The earth 237 million years ago
From PaleoMap Project, C. Scotese

The agenda

- The first continents in the Archean
- Growing continents
- Rodinia
- Gondwana and Laurentia
- Pangea
- Avalonia and terranes
- India
- Influence on climate

Holocene
 Pleistocene
 Pliocene
 Miocene
 Oligocene
 Eocene
 Paleocene
 Cretaceous
 Jurassic
 Triassic
 Permian
 Pennsylvanian
 Mississippian
 Devonian
 Silurian
 Ordovician
 Cambrian

Can Oprah Seek Damages? Maybe Permit Parking Tickets Justify Certain Past Excuses – Oprah May Park Permanently Here.



Era	Period	Epoch	Age (millions of years ago)	
Cenozoic	Quaternary	Holocene	1.8	
		Pleistocene		
	Neogene	Pliocene		24
		Miocene		
	Paleogene	Oligocene		65
		Eocene		
Paleocene				
Mesozoic	Cretaceous		142	
	Jurassic			
	Triassic			
Paleozoic	Permian			
	Pennsylvanian			
	Mississippian			
	Devonian			
	Silurian			
	Ordovician			
	Cambrian			
Proterozoic				
Archean				





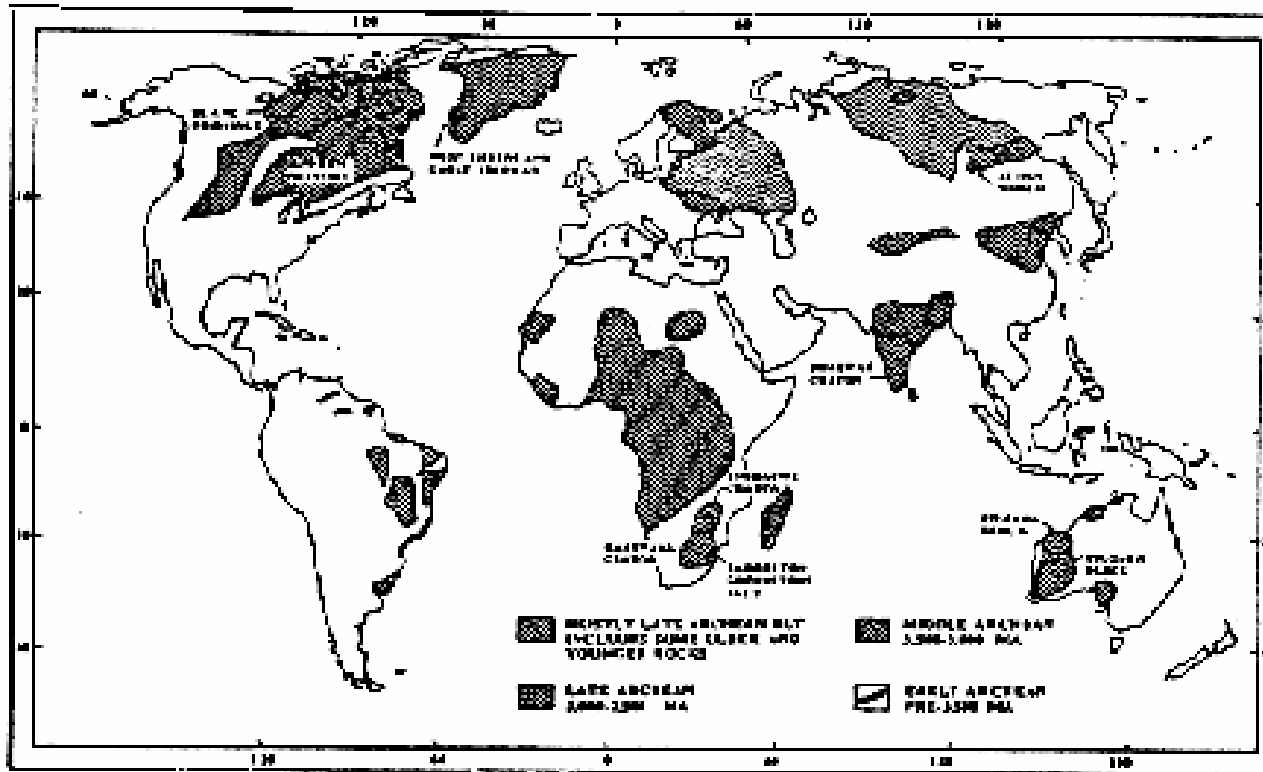
In the beginning, the earth was molten...

The Hadean before there were rocks

- In its earliest history, the earth was accreted from material orbiting the sun
- The heat of the objects, plus radioactive decay resulted in a molten planet
- Dense material sank to the center, light material floated to the surface and cooled
- Meteorite impacts were common as junk in orbit continued to hit the earth

The earliest crust

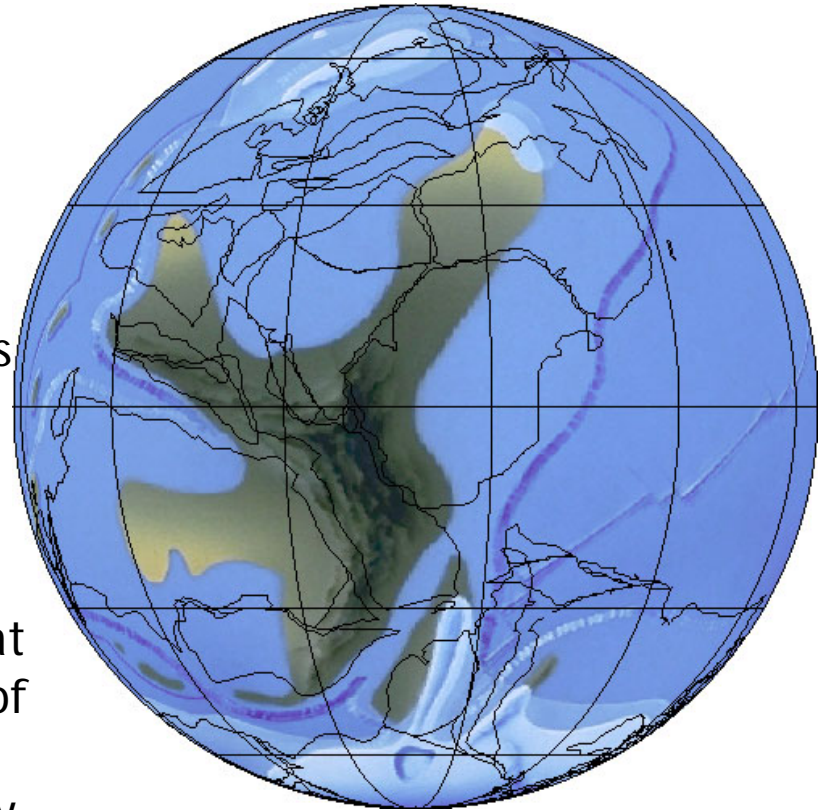
- The original crust was entirely basaltic (mafic), like modern oceanic crust
- Original crustal plates were highly mobile because of intense convections in a mostly molten earth
- Felsic continental crust was sporadically formed by volcanic activity, hot spots, and subduction of mafic plates under one another
- First *protocontinents* were probably small and numerous, like modern Iceland (which is newly formed from a mid-Atlantic hotspot)
- The oldest surviving crust is about 4 billion years old, Archean in age



Where Archean rocks are found today

Proterozoic 'supercontinents'

- In the Proterozoic, small continental fragments lodged together, creating larger continents that subsequently broke apart.
- Best known of these supercontinents was *Rodinia*. It was nearly as large as the largest ever continent, Pangea.
- Other large continents may have formed during this very long period.
- Modern continental *cratons* formed at that time. (cratons = large portions of continental crust that have not been tectonically deformed since the early Paleozoic. Also known as *shields*.)

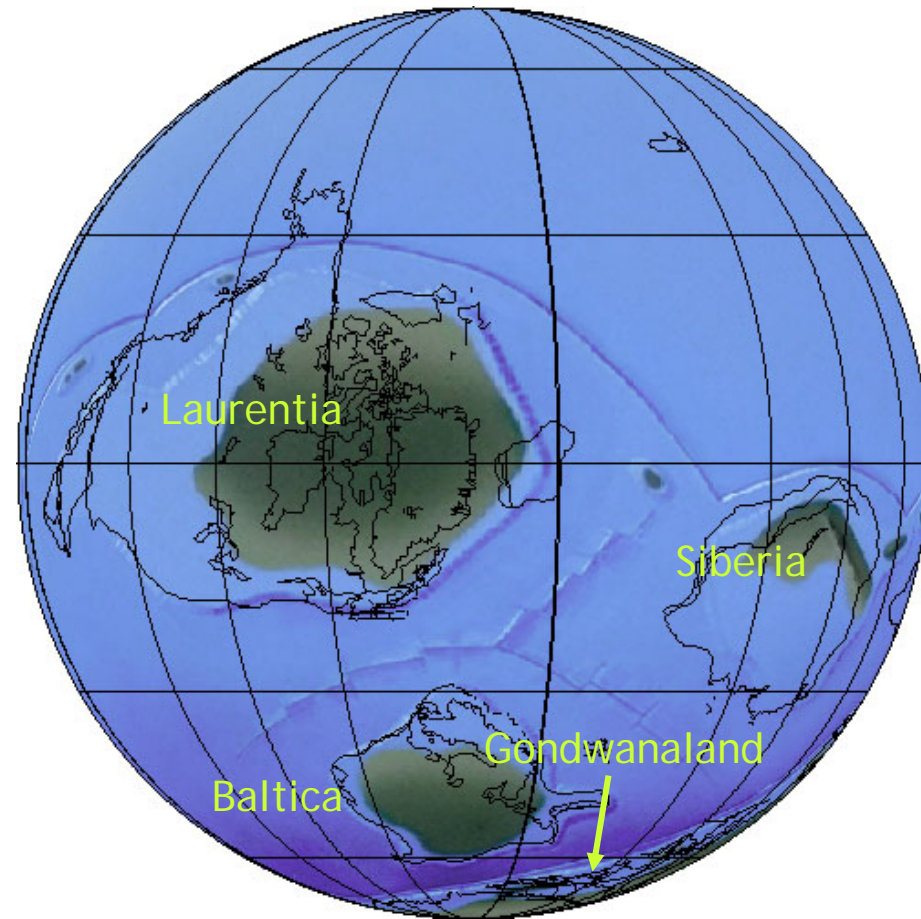


Rodinia
650 Million Years Ago

At the beginning of the Paleozoic...

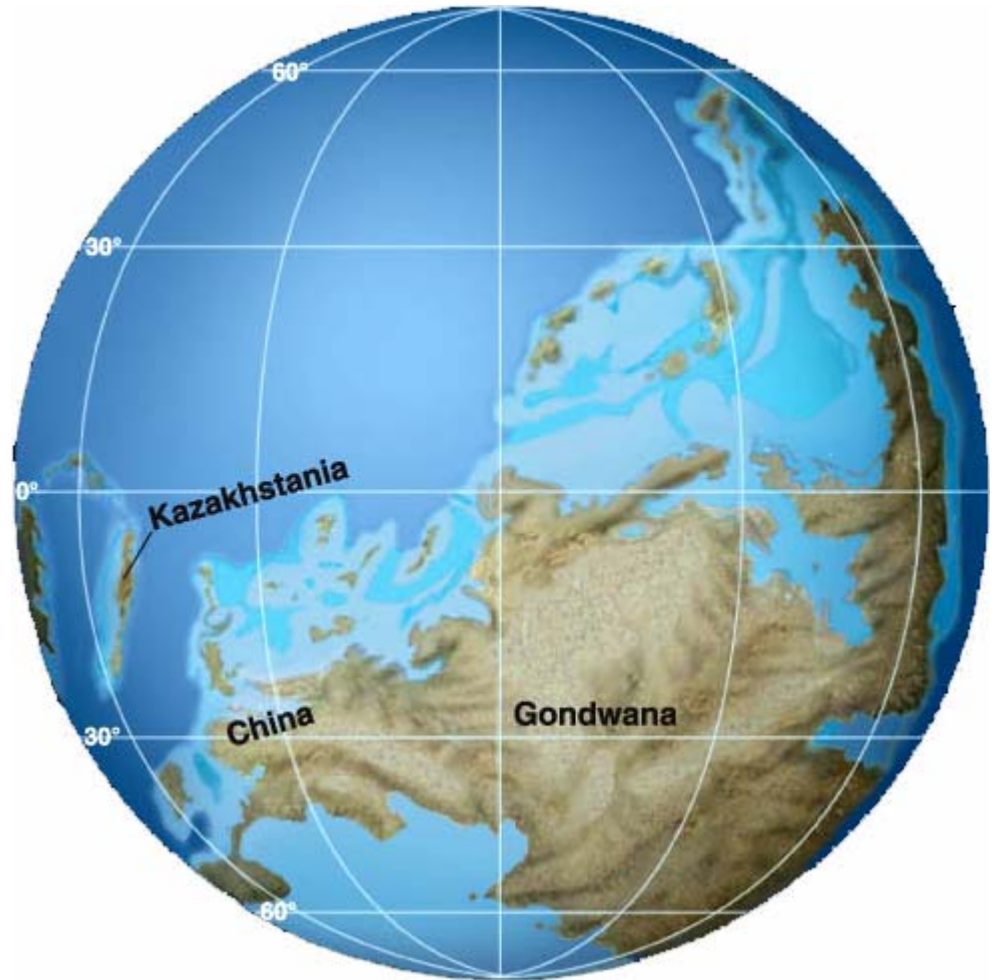
Four major continents:

1. Large, southerly *Gondwanaland*
(includes parts of what are now South America, Africa, India, Australia and Antarctica. The name *Gondwana* comes from a modern province in central India).
2. Large, tropical *Laurentia*
(now forms what is known as the *Canadian shield*. The name *Laurentia* comes from that flat part of NE Canada.)
3. Southerly *Baltica*
(now forms the *Baltic Shield*. Name comes from the *Baltic Sea*.)
4. Tropical *Siberia*
(what is now northern *Siberia*.)

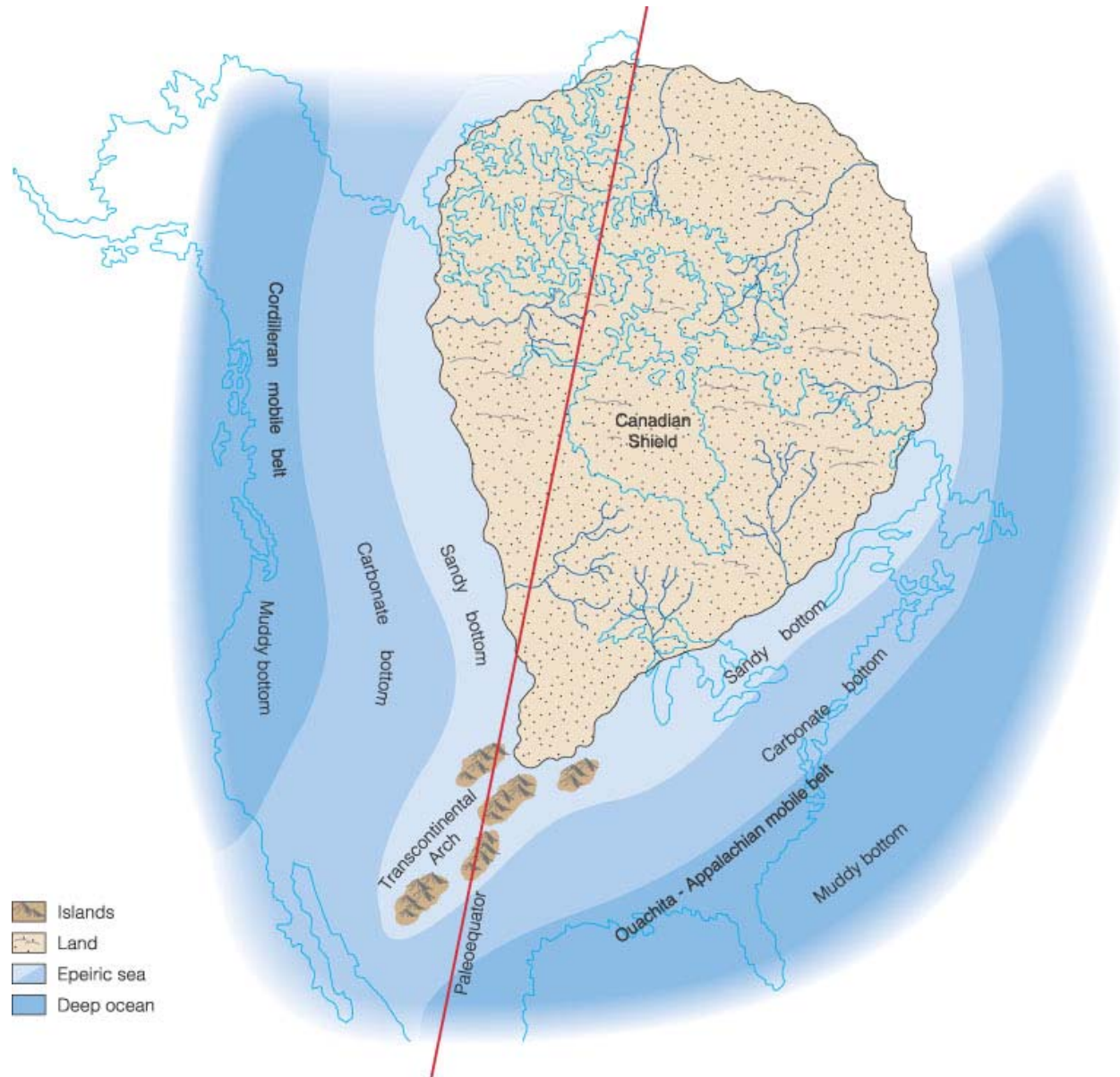


Cambrian Period
514 years ago

A better view of
Gondwanaland in the
Cambrian...

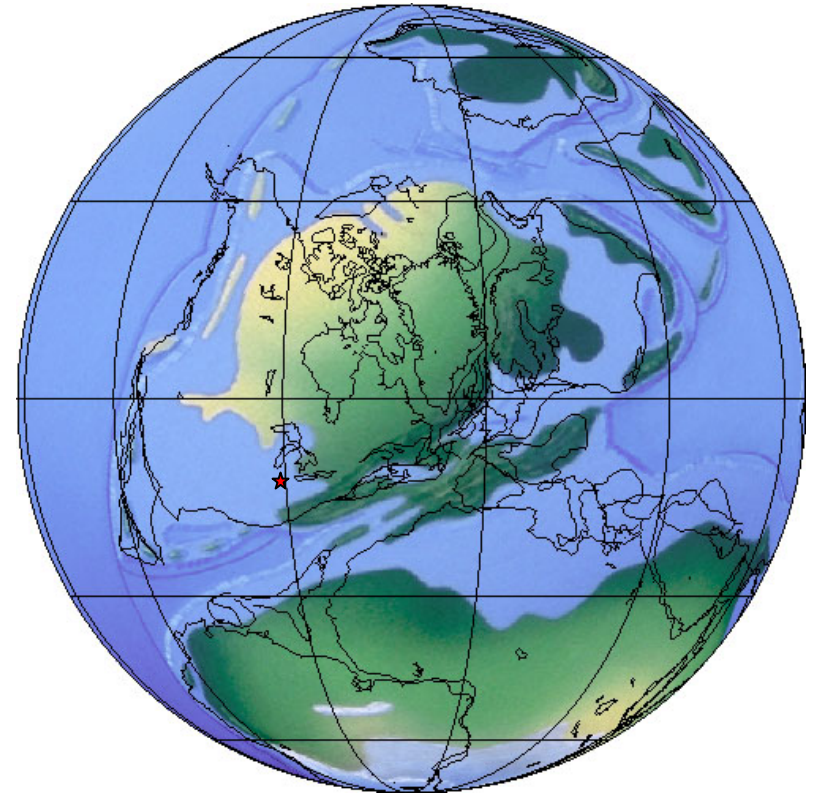


Sedimentary rocks built up around the margins of the early continents as erosion removed material from the land (just as happens now)



Later in the Paleozoic...

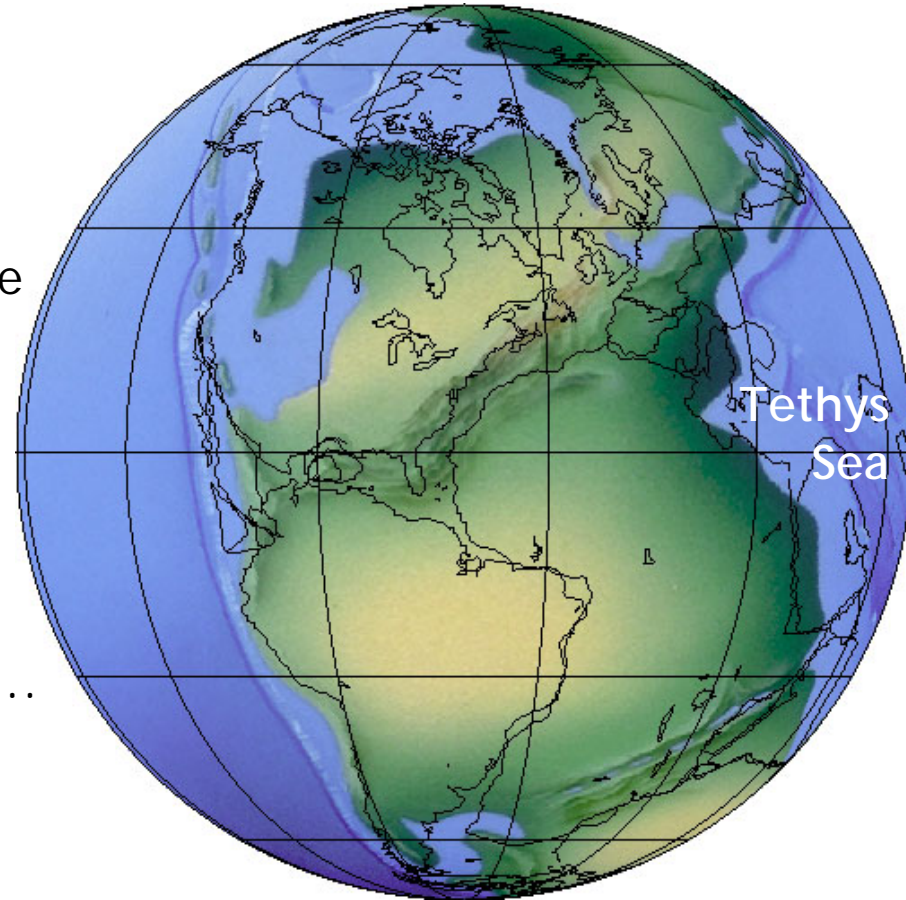
- As the Paleozoic progressed, continents came together.
- North America grew and became joined with Baltica and others.
- The Midwest was a shallow sea, just off the coast and in tropical latitudes.



Mississippian Period
342 Million Years Ago
("Monroe County Time")

Pangea: The Supercontinent

- At the end of the Paleozoic, in the Permian, all of the continents lodged together to form *Pangea*
- Centered on the tropics with a C-shape that encircled the Tethys Sea
- The coming together of Pangea happened near the same time as history's largest extinction
- Pangea remained intact into the Jurassic Period, 180 million years ago...

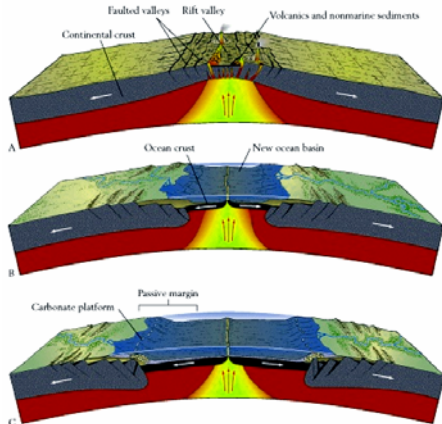


Dimetrodon, a Permian pangean species

Early Triassic Period
237 Million Years Ago

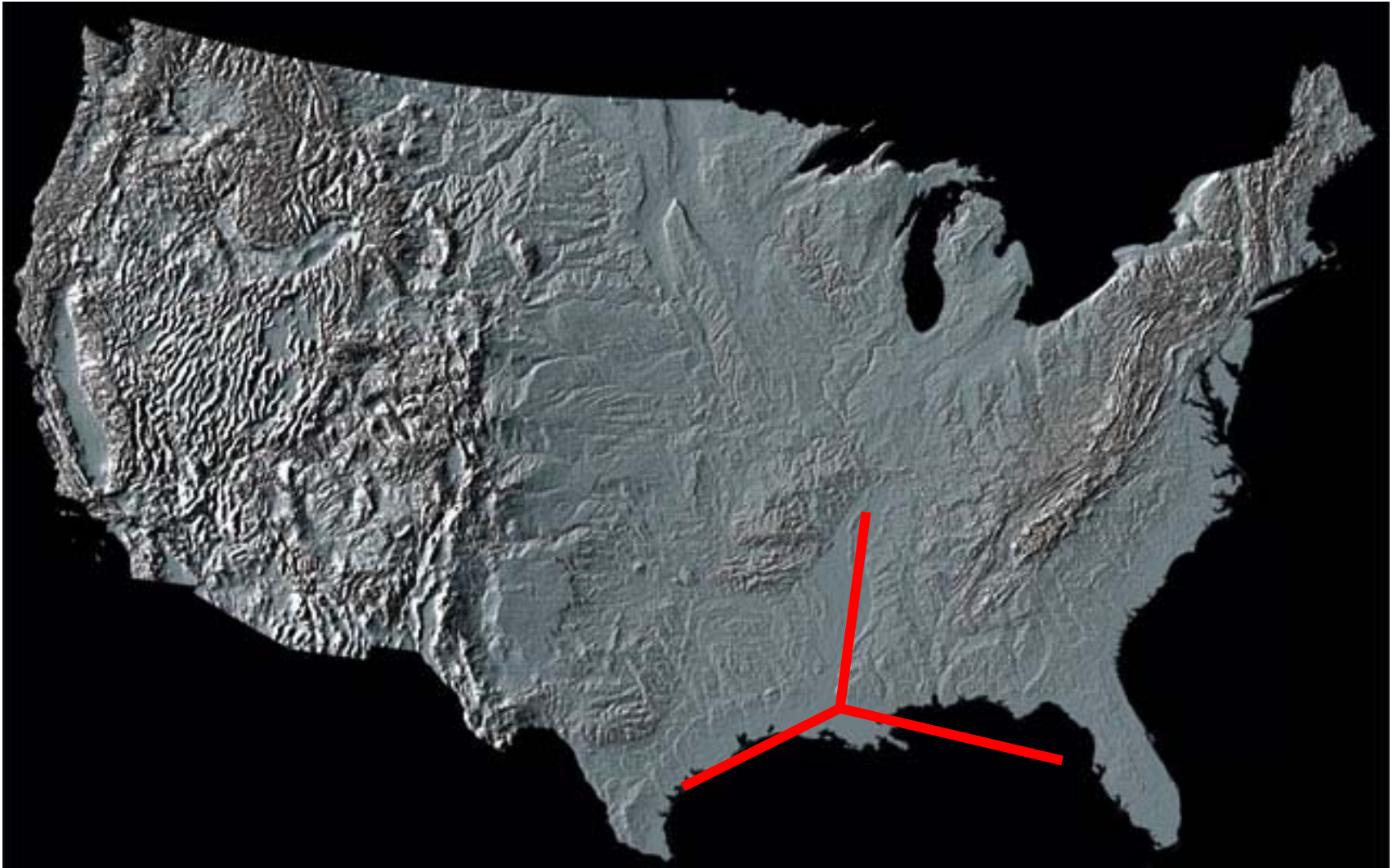
Pangea began to split apart in the Jurassic as a three-armed rift...

- Rifts are part of divergent margins
- Rifts often begin with three arms, one of which fails to continue

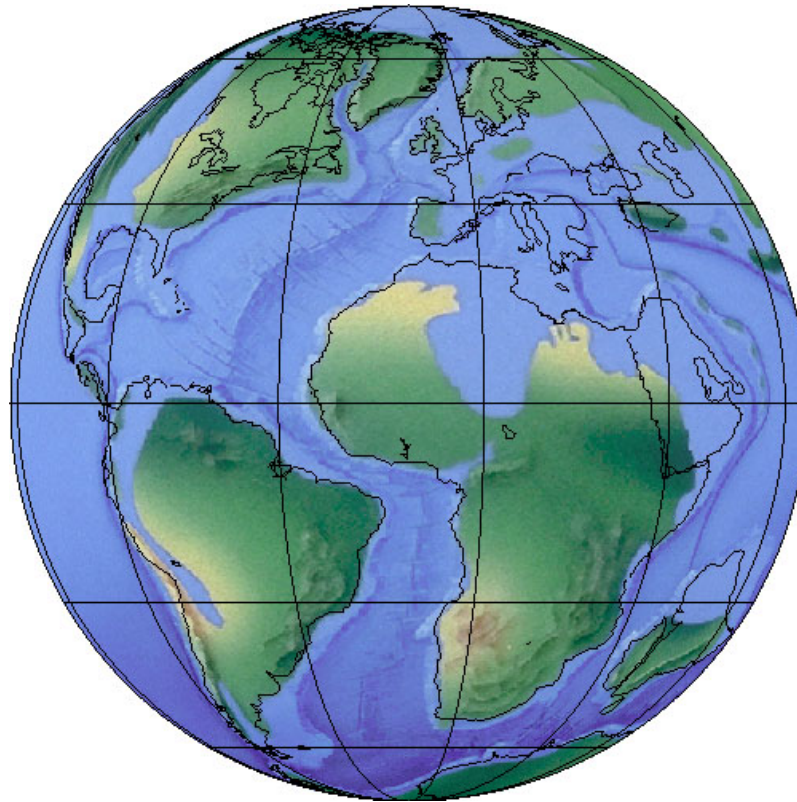


©2004 Thomson - Brooks/Cole

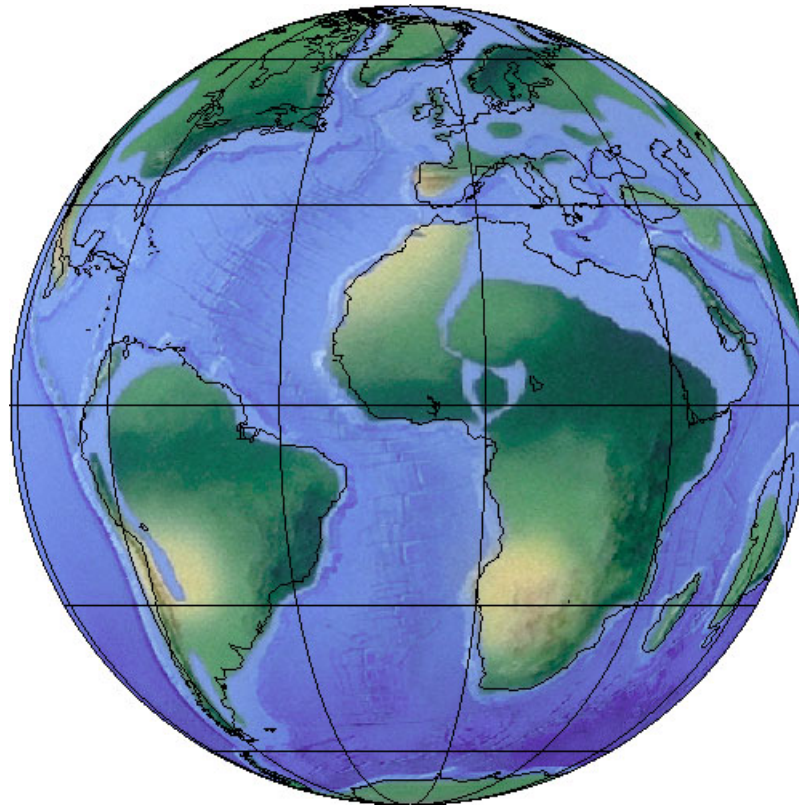
The lower Mississippi Valley began as a failed rift



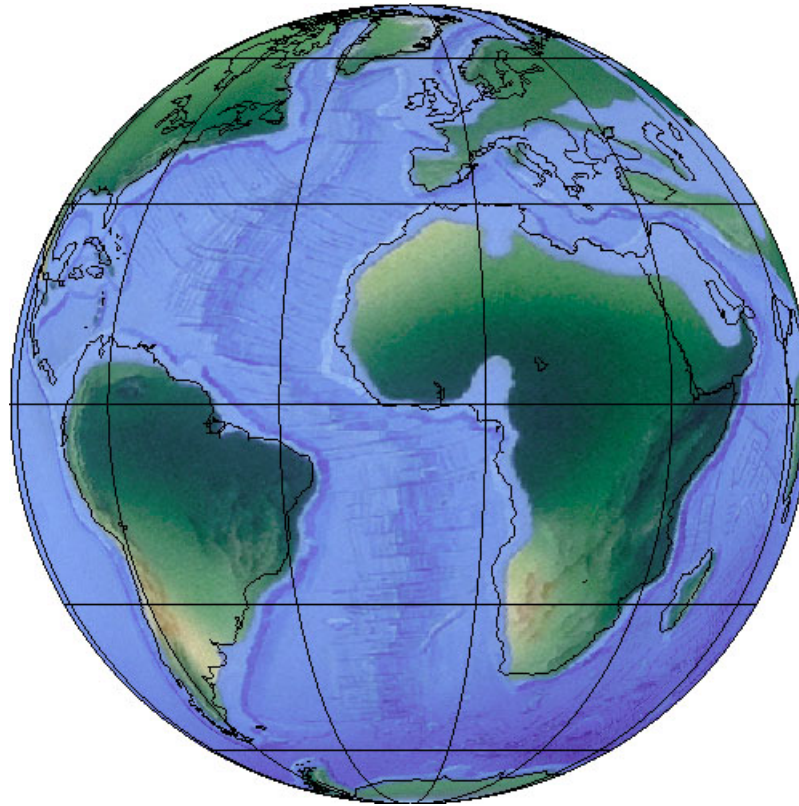
94 Million Years Ago
Cretaceous Period



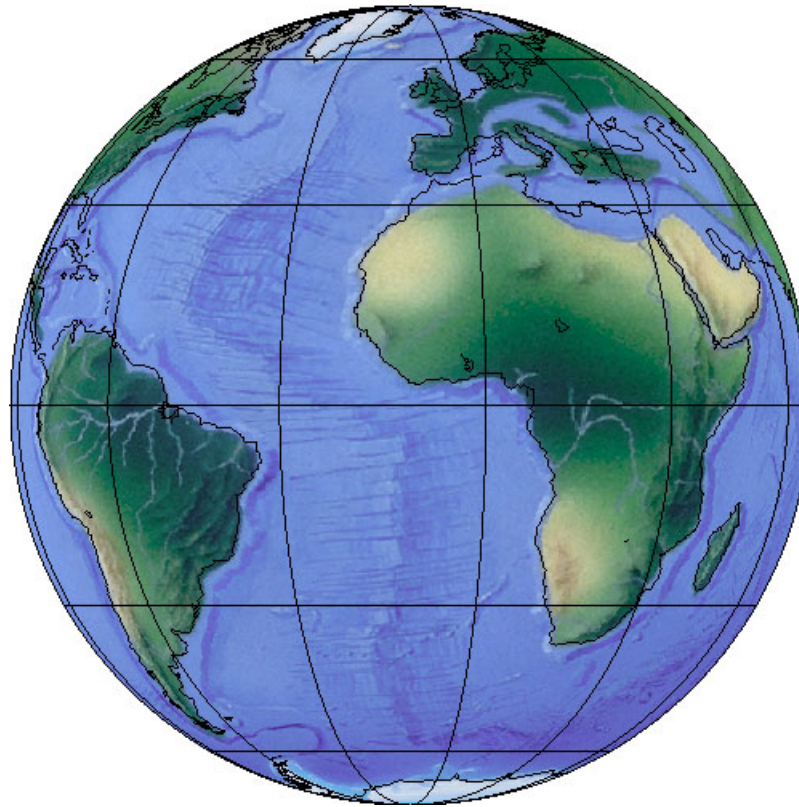
64 Million Years Ago
Cretaceous Period



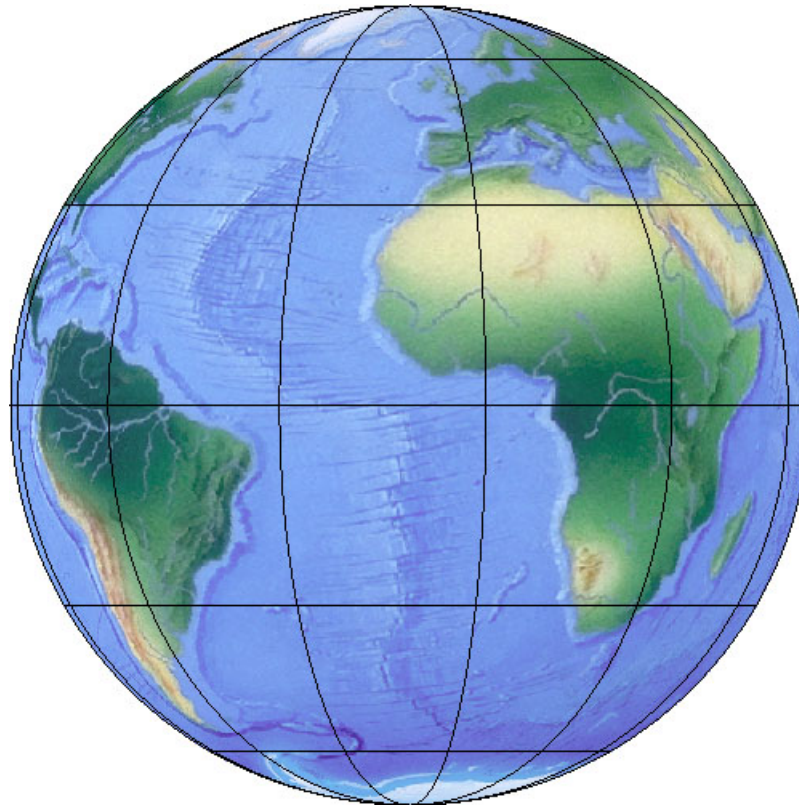
50 Million Years Ago
Eocene

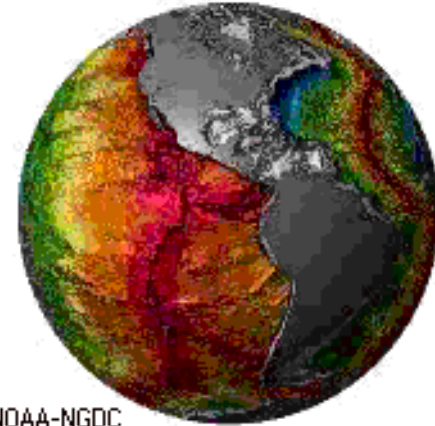


14 Million Years Ago
Miocene



0 Million Years Ago
Present Time





Q: How old are the world's oldest ocean floors?

A: Approximately 180 my, Jurassic.

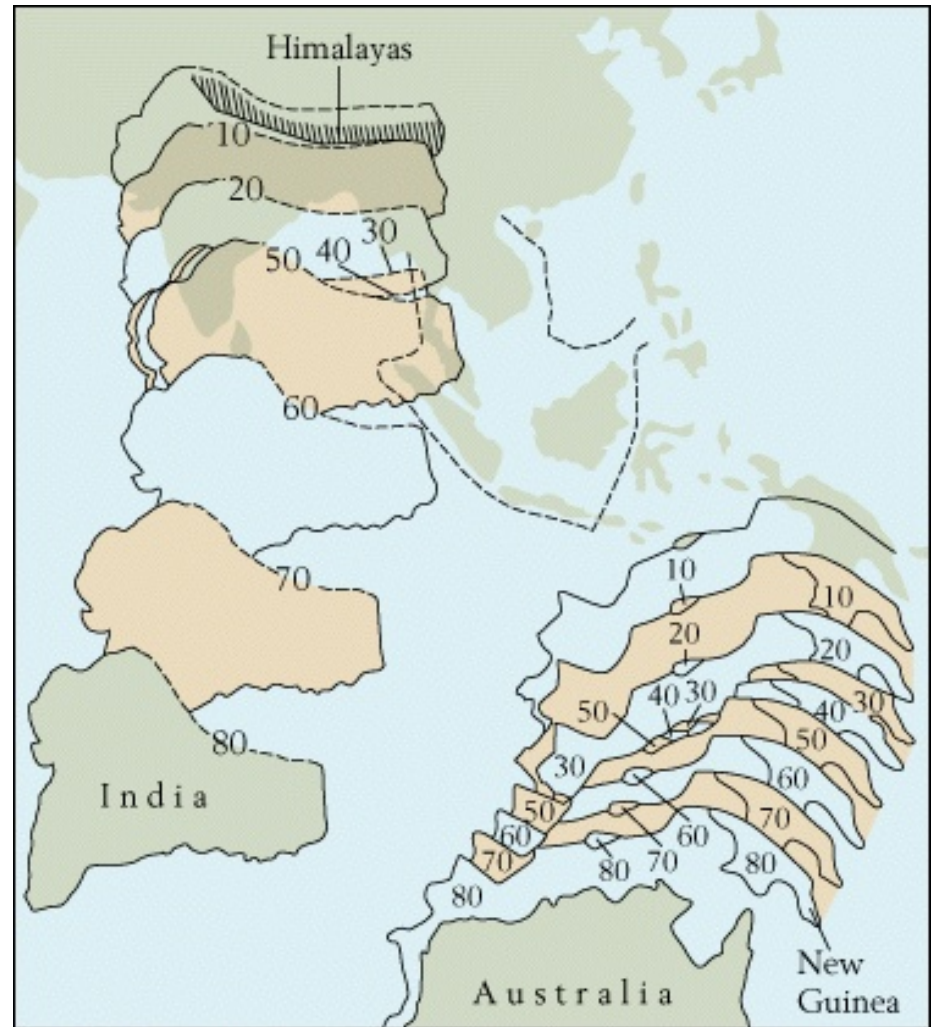
Q: Where are the oldest ocean floors?

A: The Pacific, which existed at the time of Pangea

Collision of India with Asia

First docking
approx. 40 m.y.a.

Himalaya Mts. are
the result

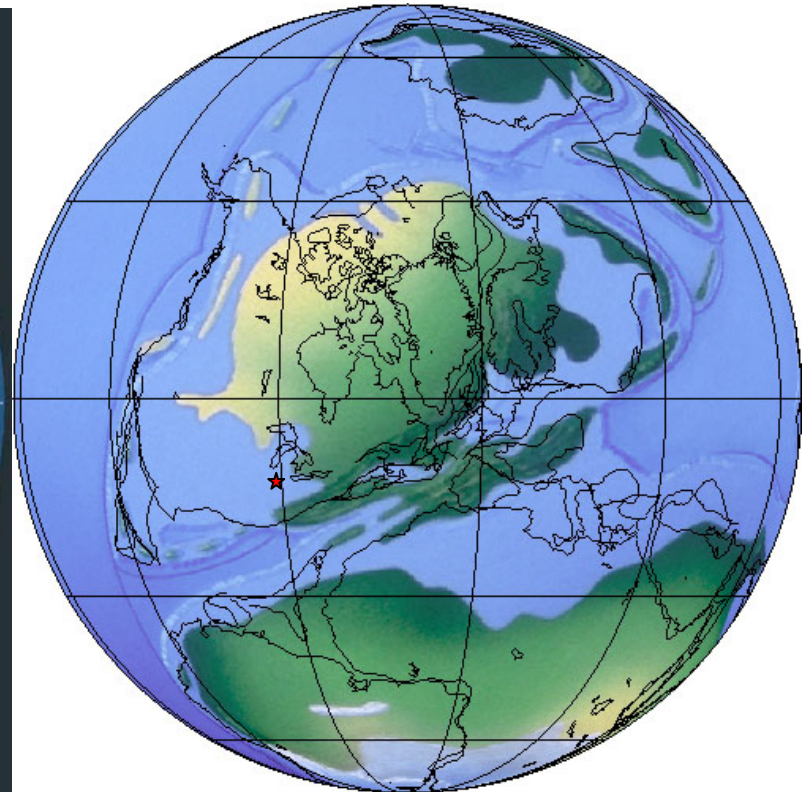


Terranes

Continental crust that has been added as large continents bulldoze over small land masses



Silurian

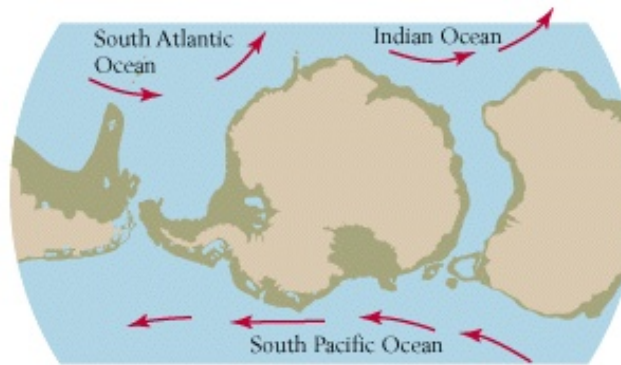


Mississippian

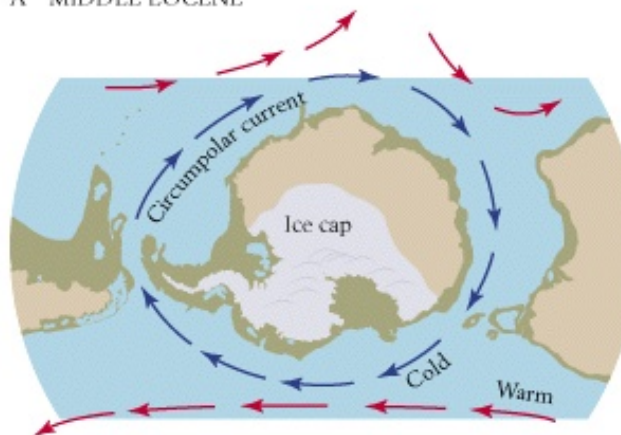
Avalonia is an example. Its rocks are now found in New England and Great Britain, both.

Effects of Continent Positions on Climate

As Gondwana split, the ocean currents changed. In the Oligocene, South America finally split from Antarctica, allowing circumpolar current to form, which allowed ice caps to form.



A MIDDLE EOCENE



B EARLY OLIGOCENE

