Geology of the National Parks

Evolution of North America with Nicole Myers

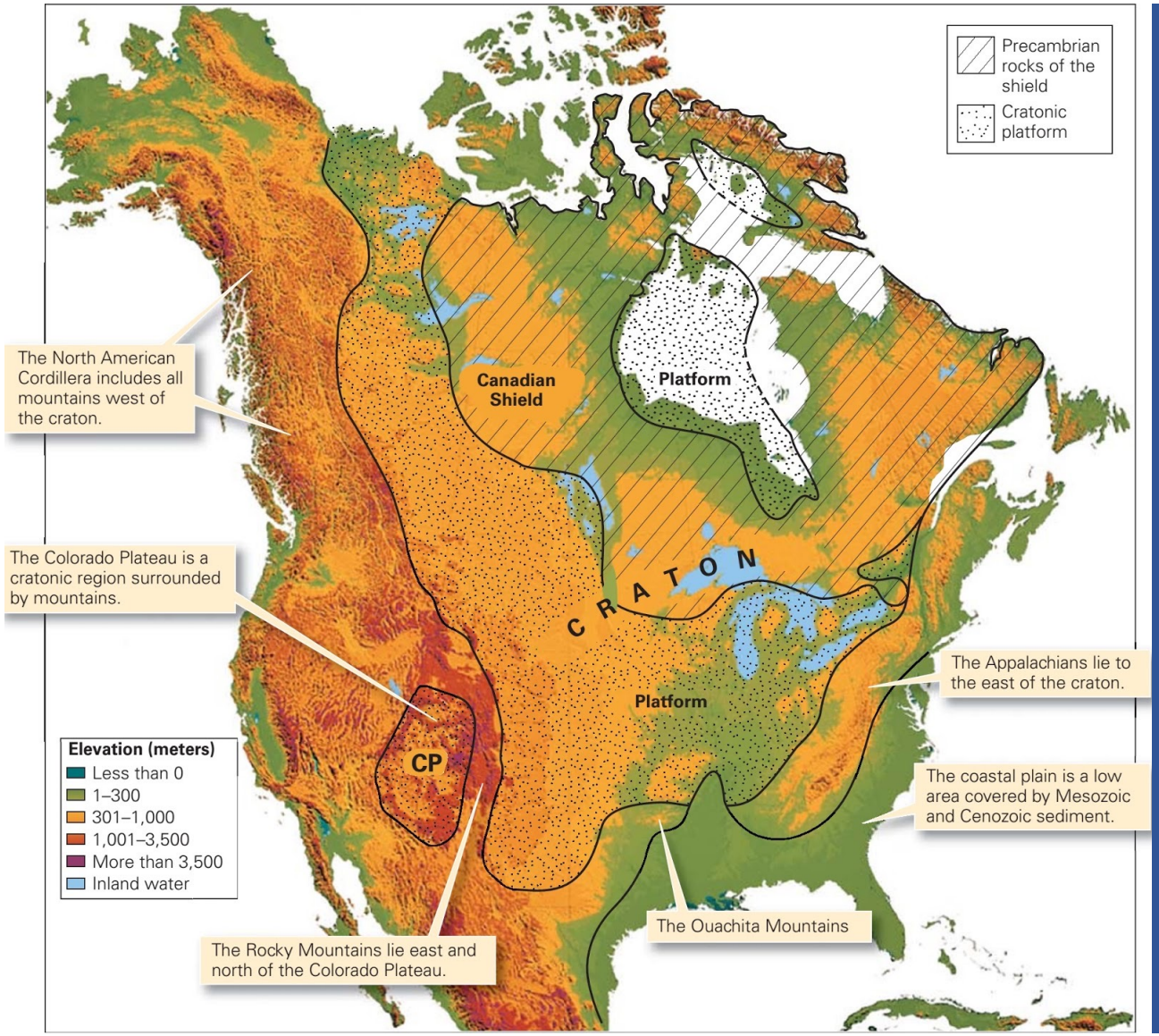
Focus on the green shapes & watch North America slowly form

Video Link:
https://www.youtube.com/watch?v=UwWWuttntio&t=32s

63 US National Parks

- **Earth history**
- **Human history**
- **National history**
- **Conservation**

Video link:
https://www.youtube.com/watch?v=lva1m8cl9-Q

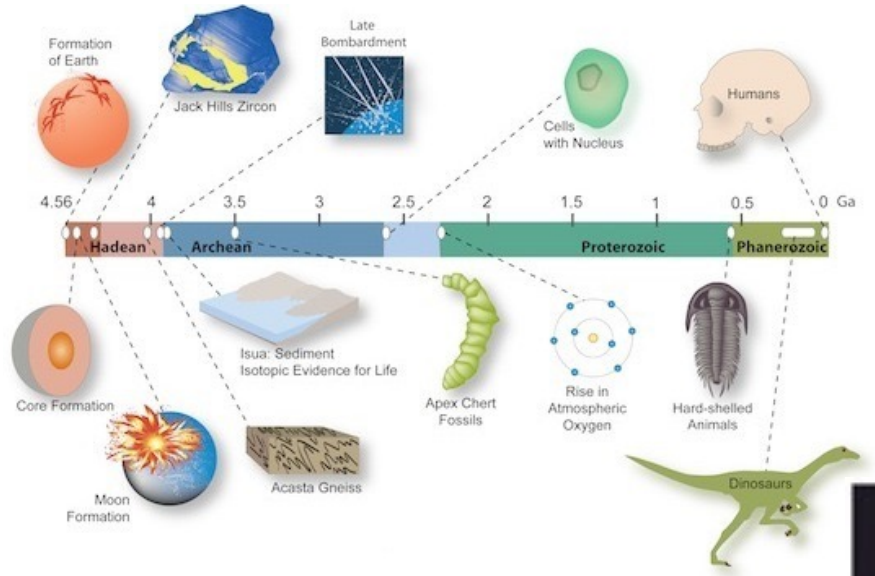


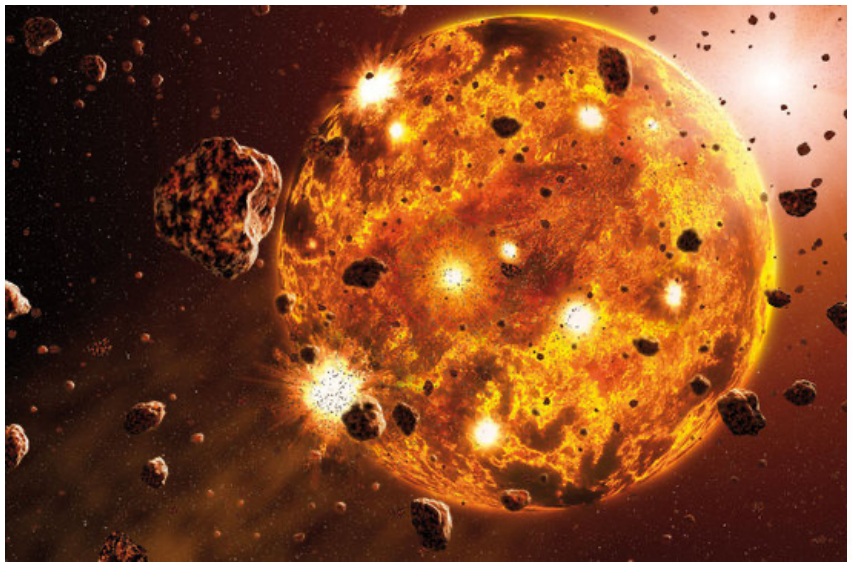
Week 1

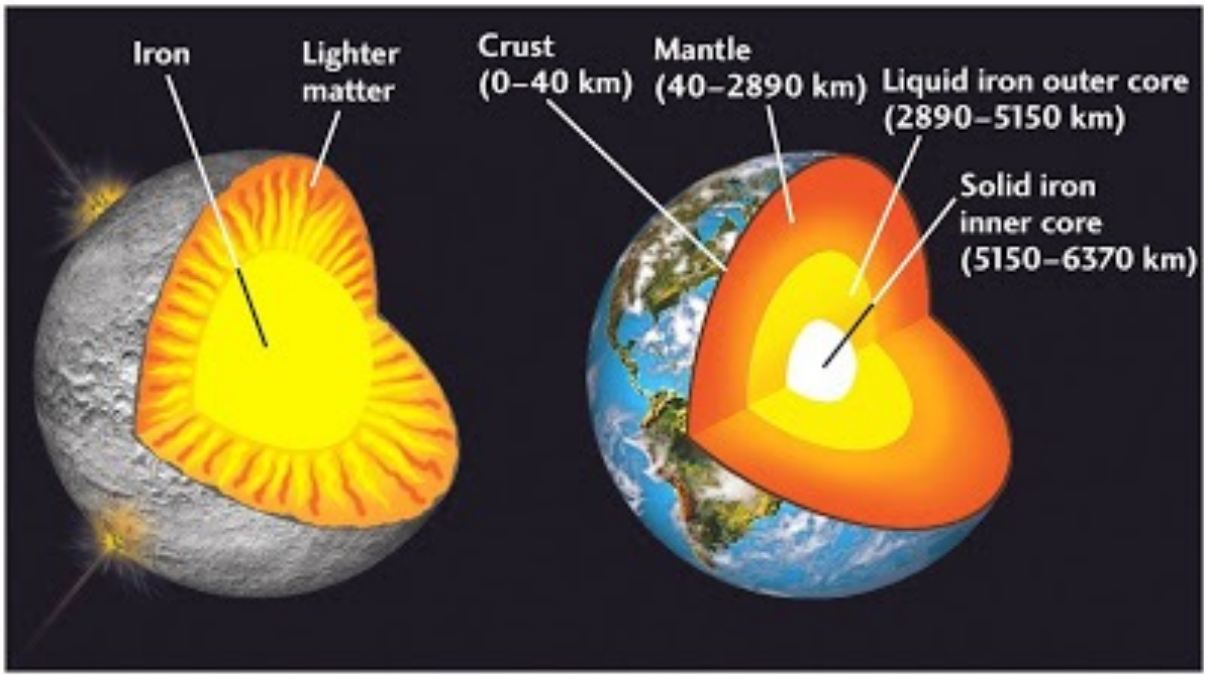
The Formation of Planet Earth, North America & the Geologic Heart of the USA

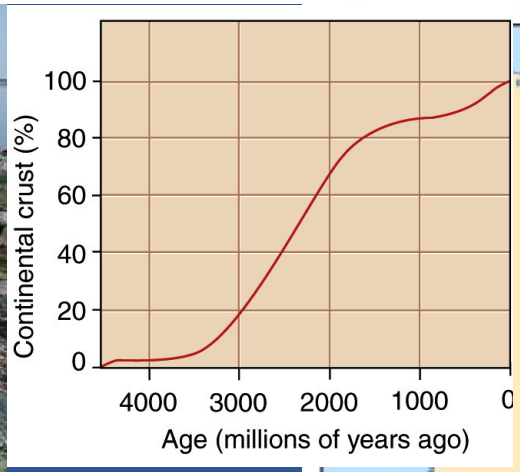
Birth of the Earth

The beginning of a 4.6 billion year history of planetary evolution starts with the formation of the first rocks

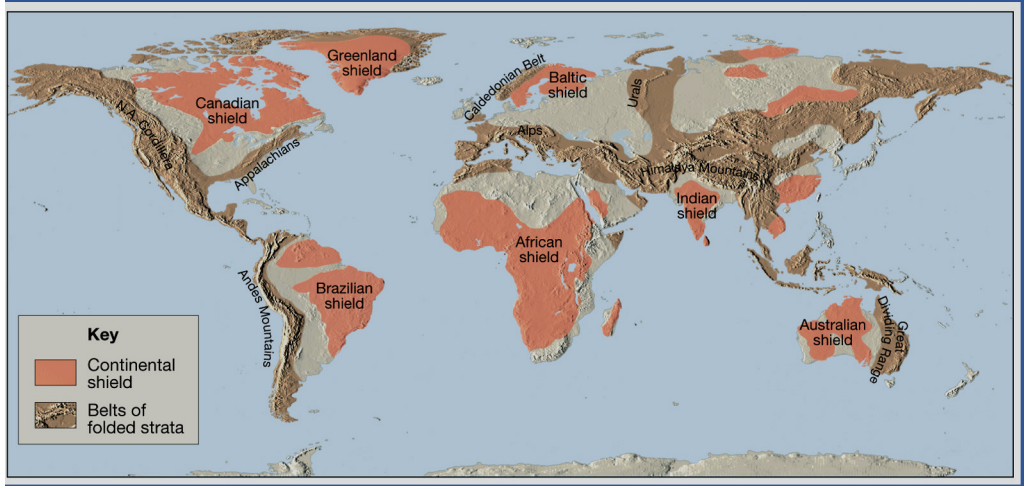


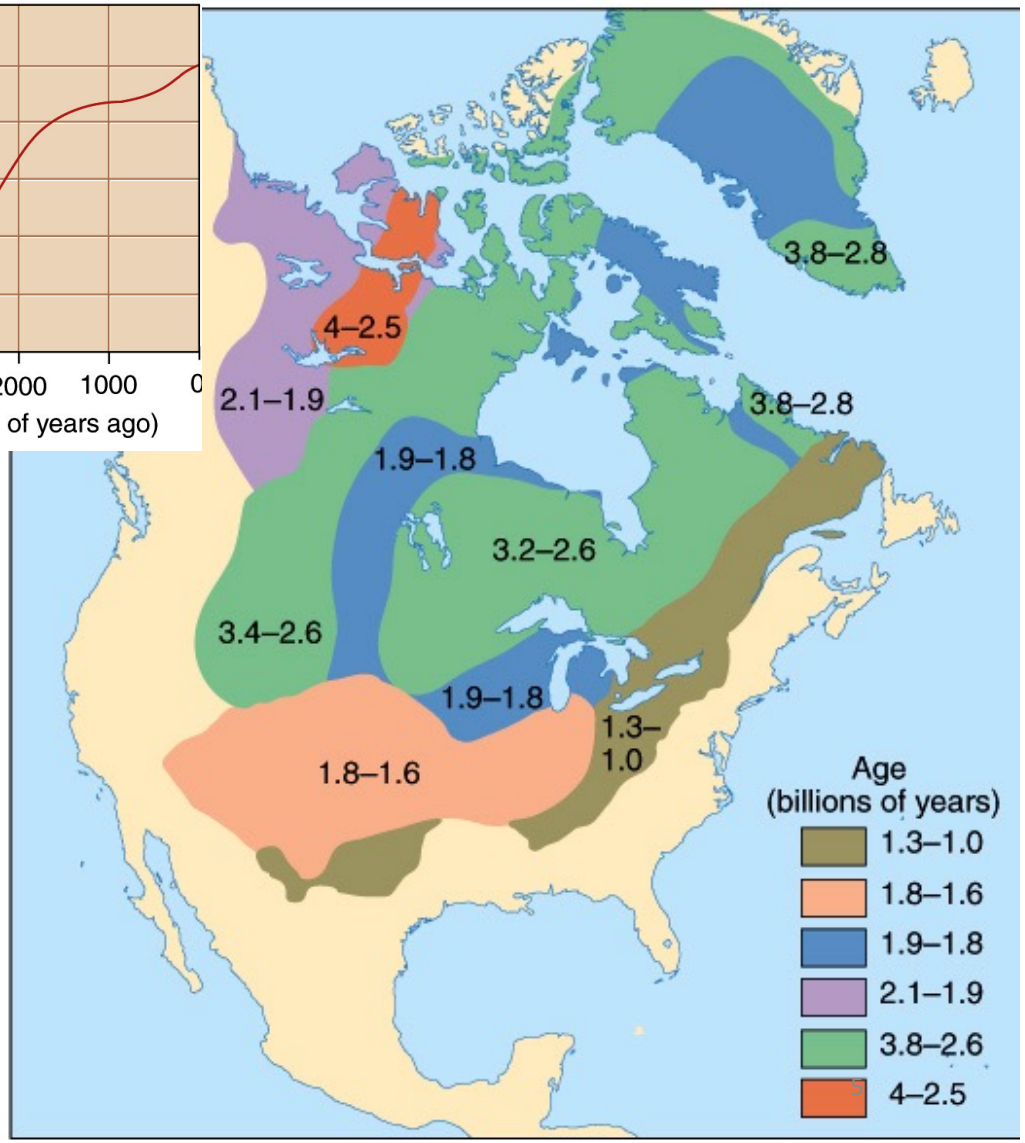


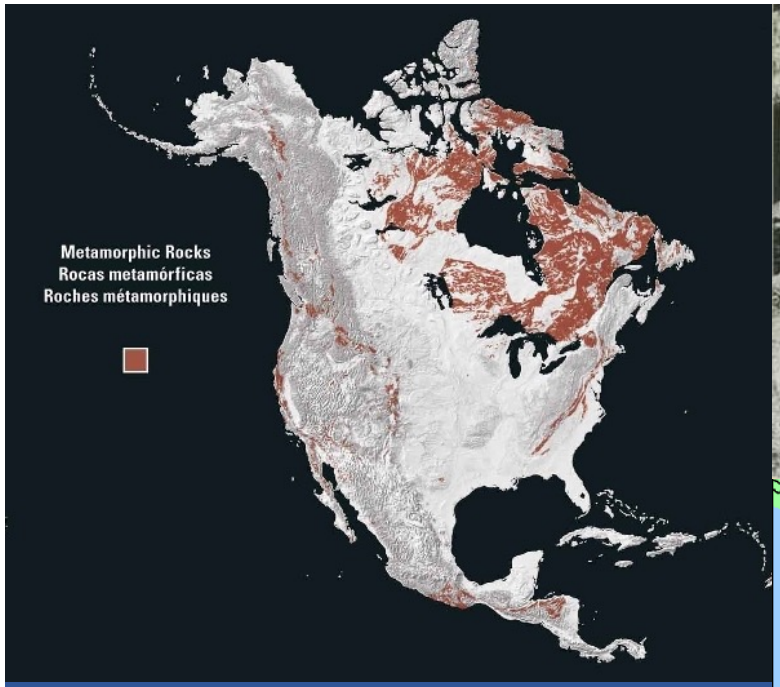




Oldest rock in North America is 4.03Ga
Greenstone, part of the Canadian Shield

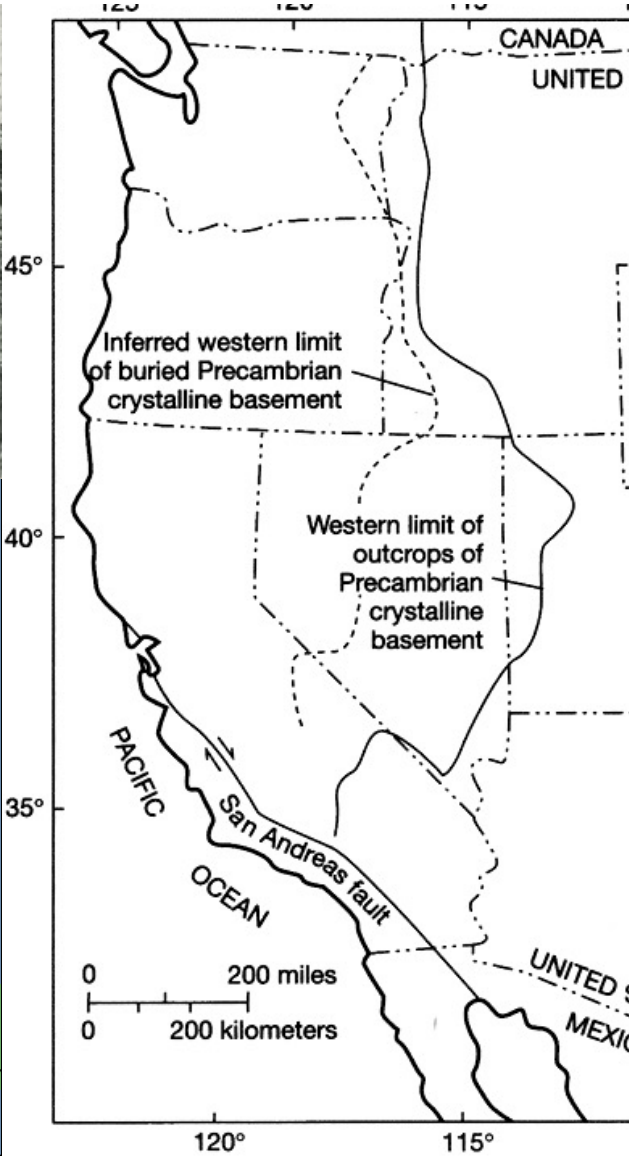






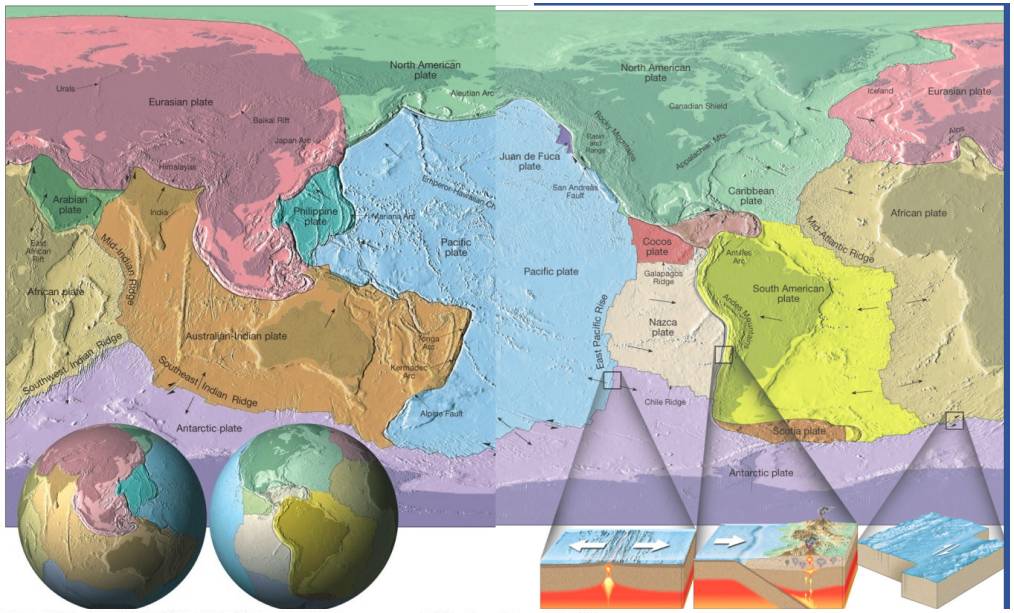
Precambrian Super-Eon Continental Growth

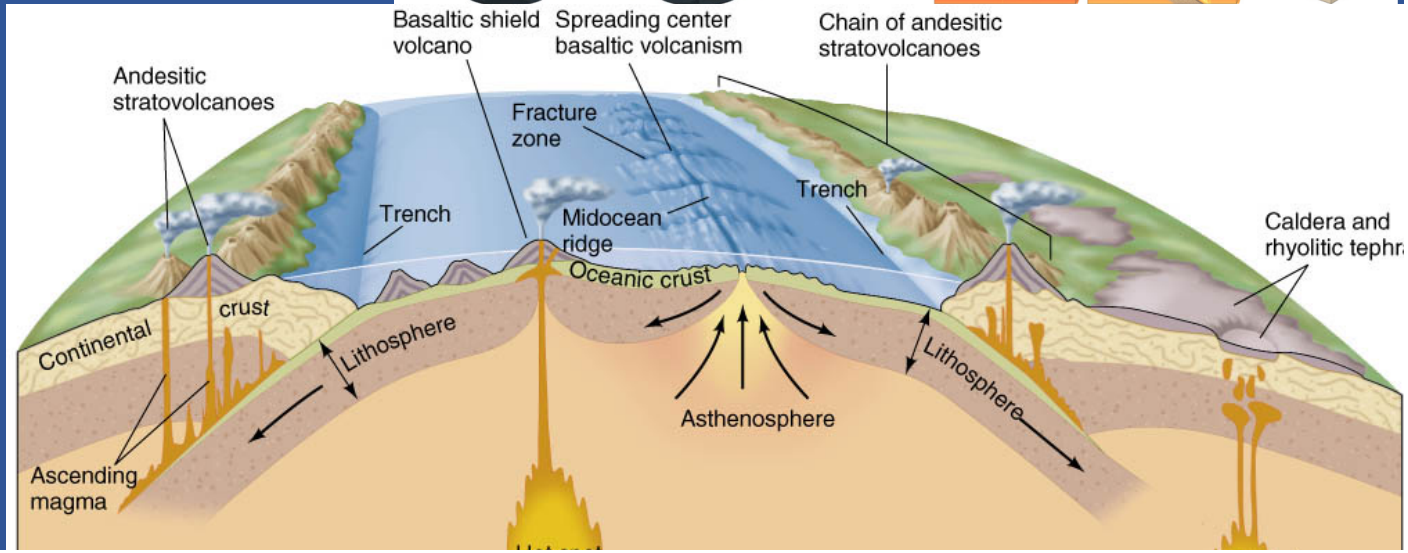
2.8-2.7Ga: oldest USA rocks in Northern Rockies & Western Great Lakes

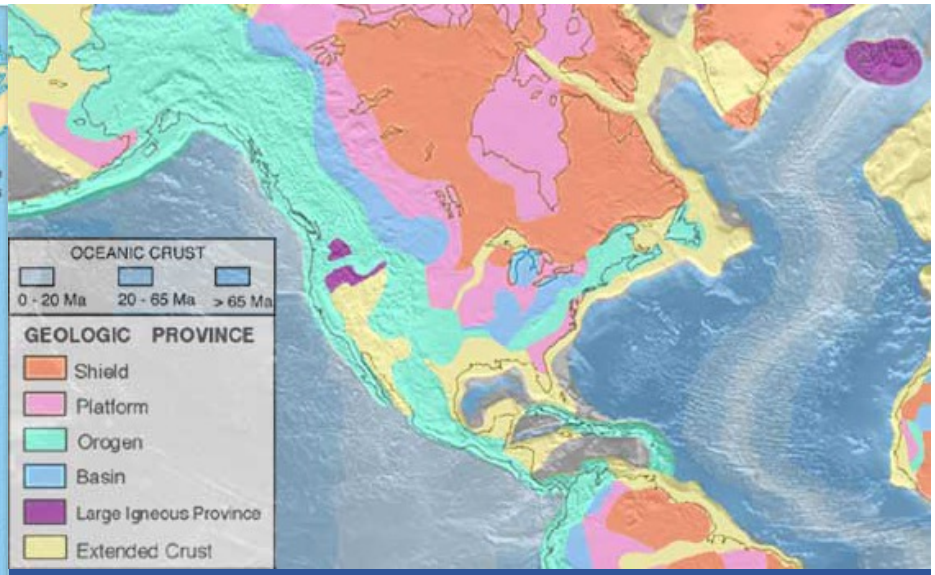


Continents Grow Through Accretion as Plate Tectonics Combines Cratons to Create Larger Landmasses

Video link:
https://www.youtube.com/watch?v=ryrXAGY1dmE







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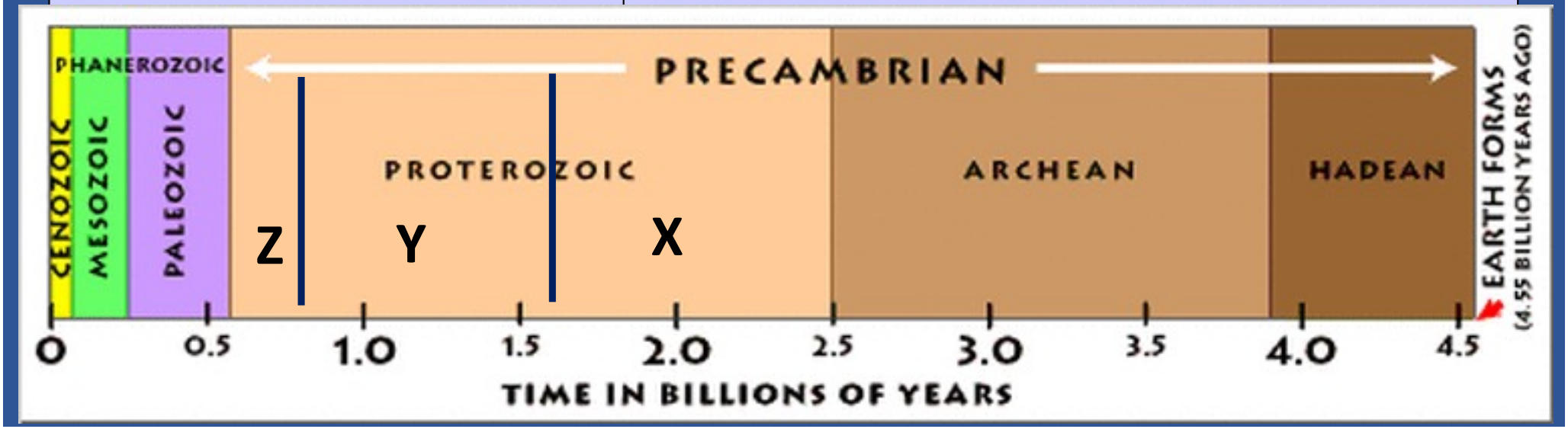
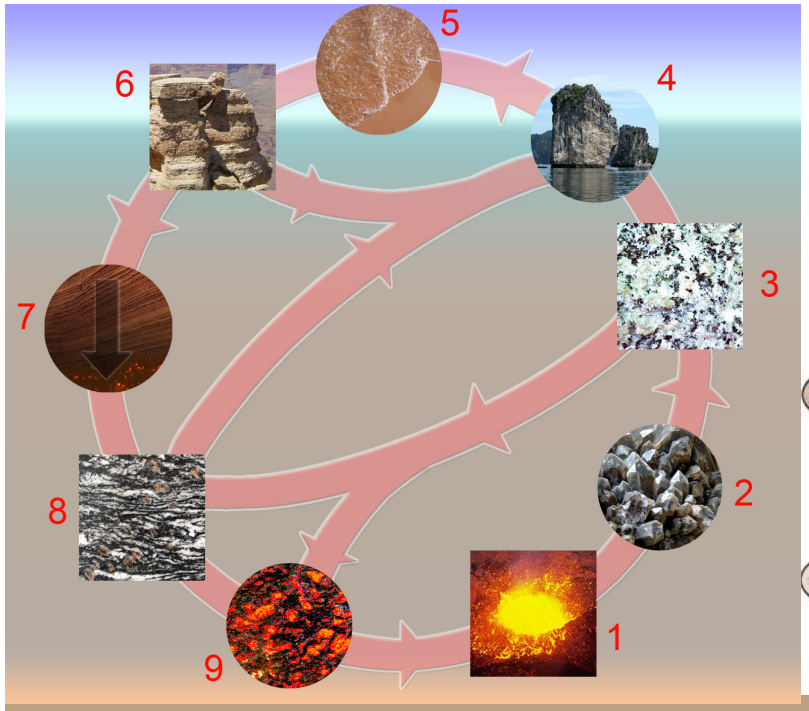
USA National Parks Record the Geologic History of: continental accretion, rock formation & plate tectonics

Geologic Time: Precambrian Super-Eon

January 1	Earth forms
January and early February	Earth organized into core, mantle, and crust
February 21	Life evolves
October 25	Complex organisms, including those with shells and hard parts, evolve



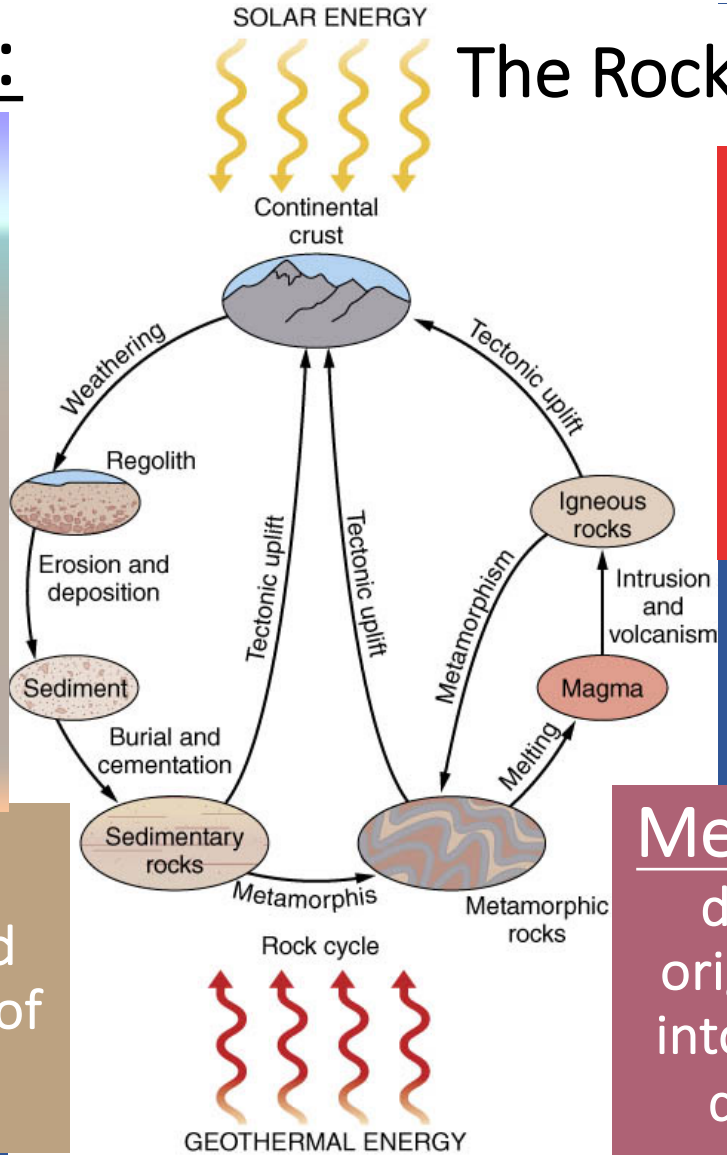
Earth Materials:



Sedimentary Rock:

sediments buried & compacted into solid layers of rock formed of accumulated fragments

The Rock Cycle



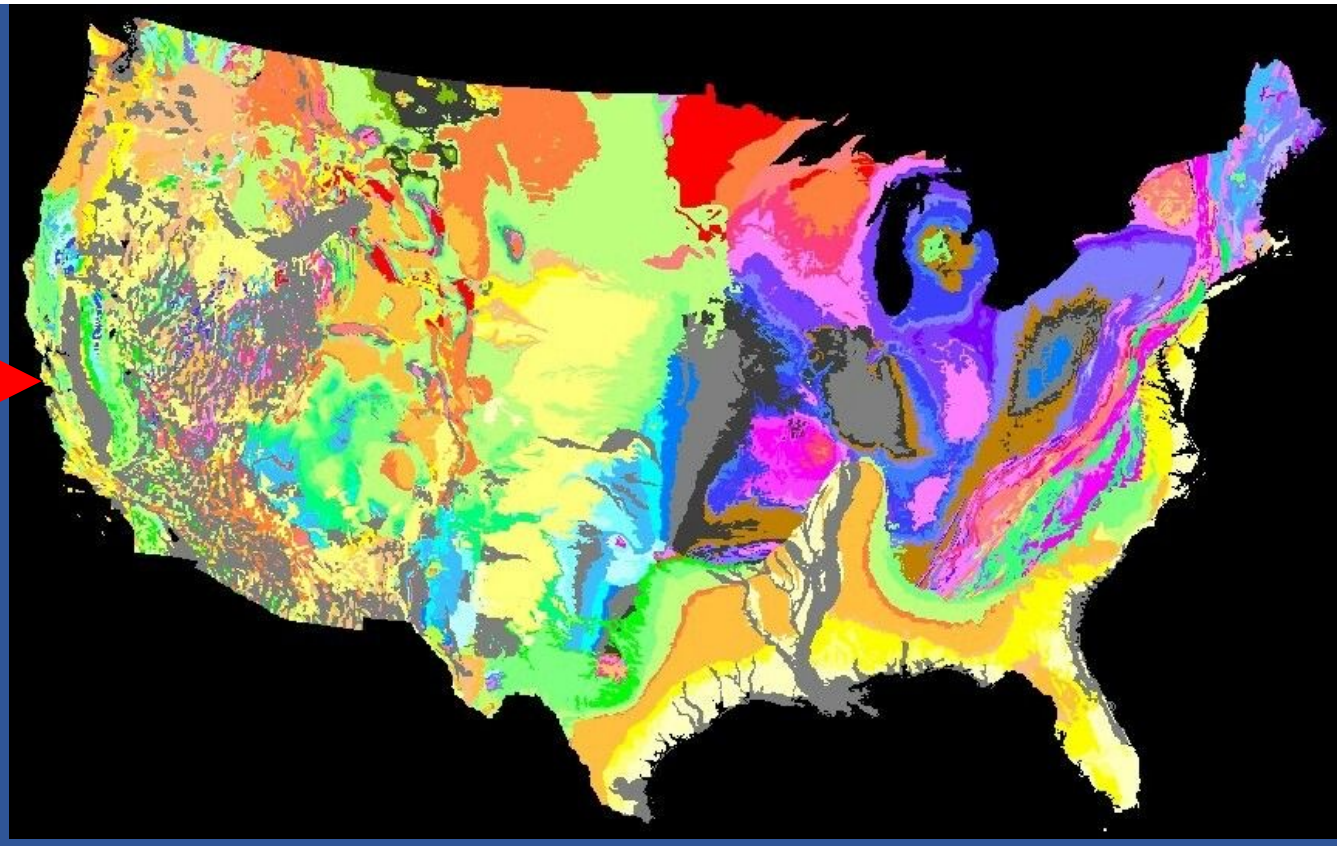
Igneous Rock:

melting forms magma, which cools into a solid rock made of interlocking crystals &/or glass

Metamorphic Rock:

deep burial reforms original rock (protolith) into patterns of crystals deformed by stress

Geologic Maps provide locations of Precambrian rocks, which are mostly within red & dark orange on the geologic map



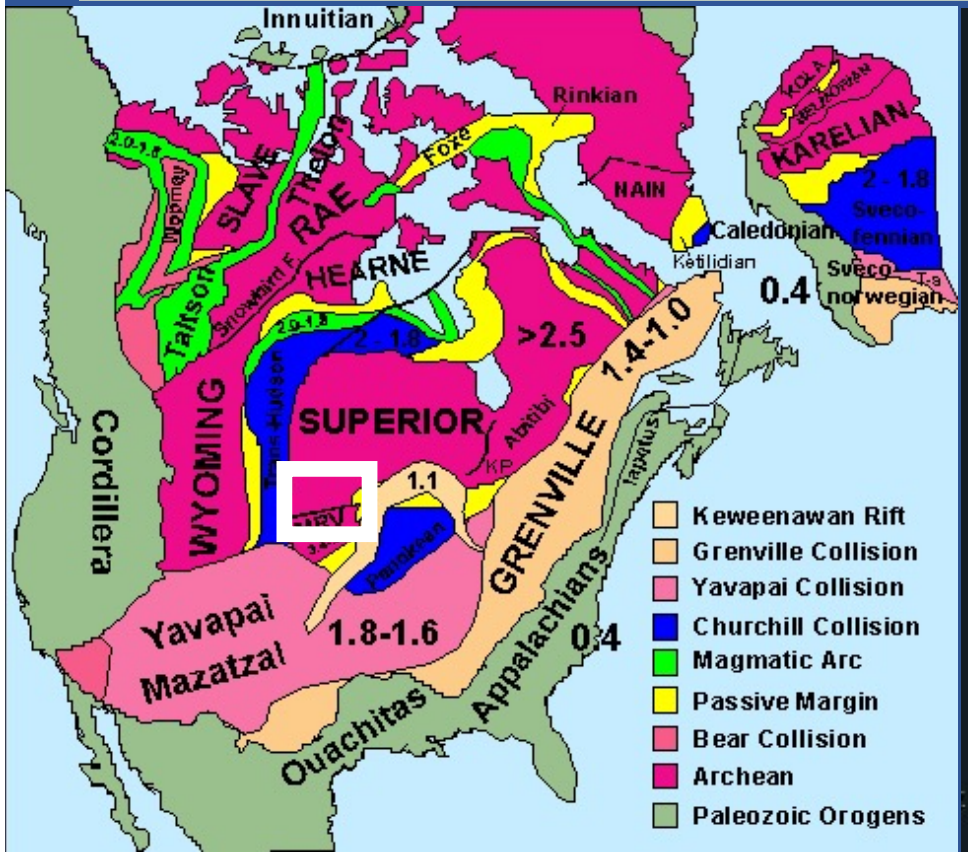
The above geologic map of North America is interactive!

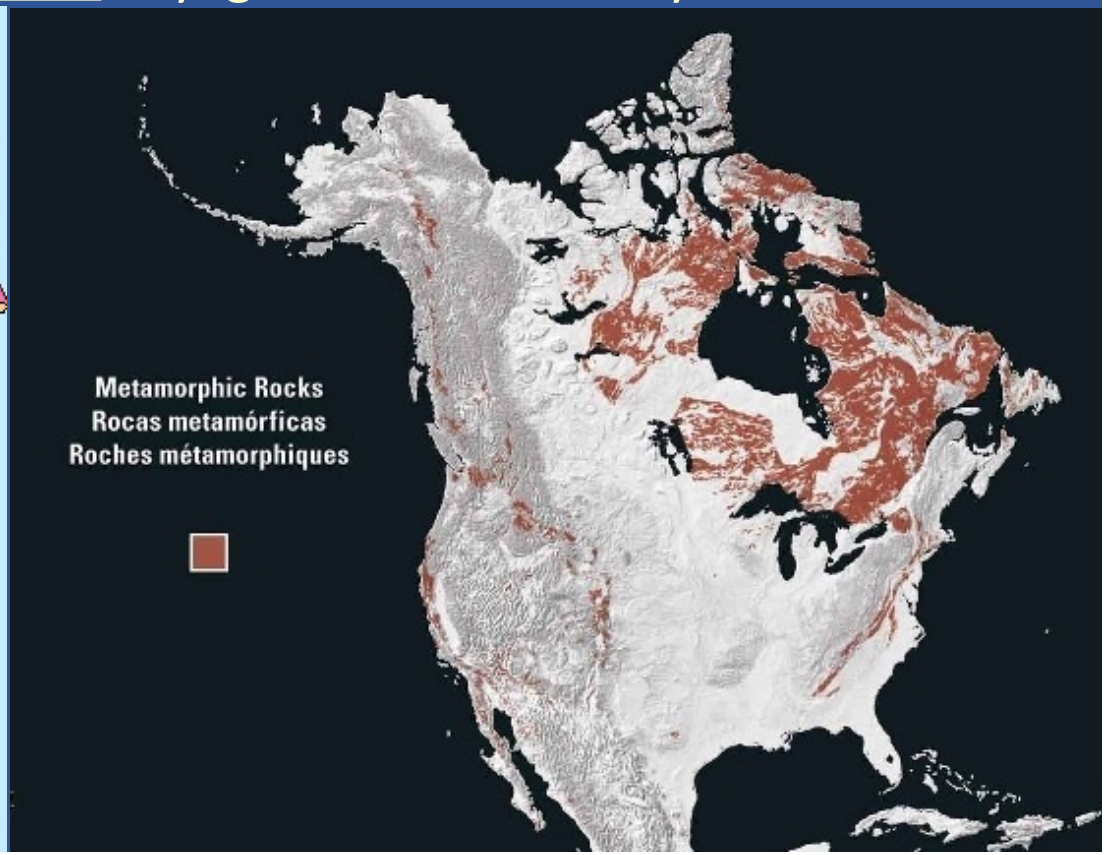
https://www.ldeo.columbia.edu/users/menke/envdata/quality/map/

Ancient Cratons

Oldest North American rocks are ancient cratons that have been metamorphosed:

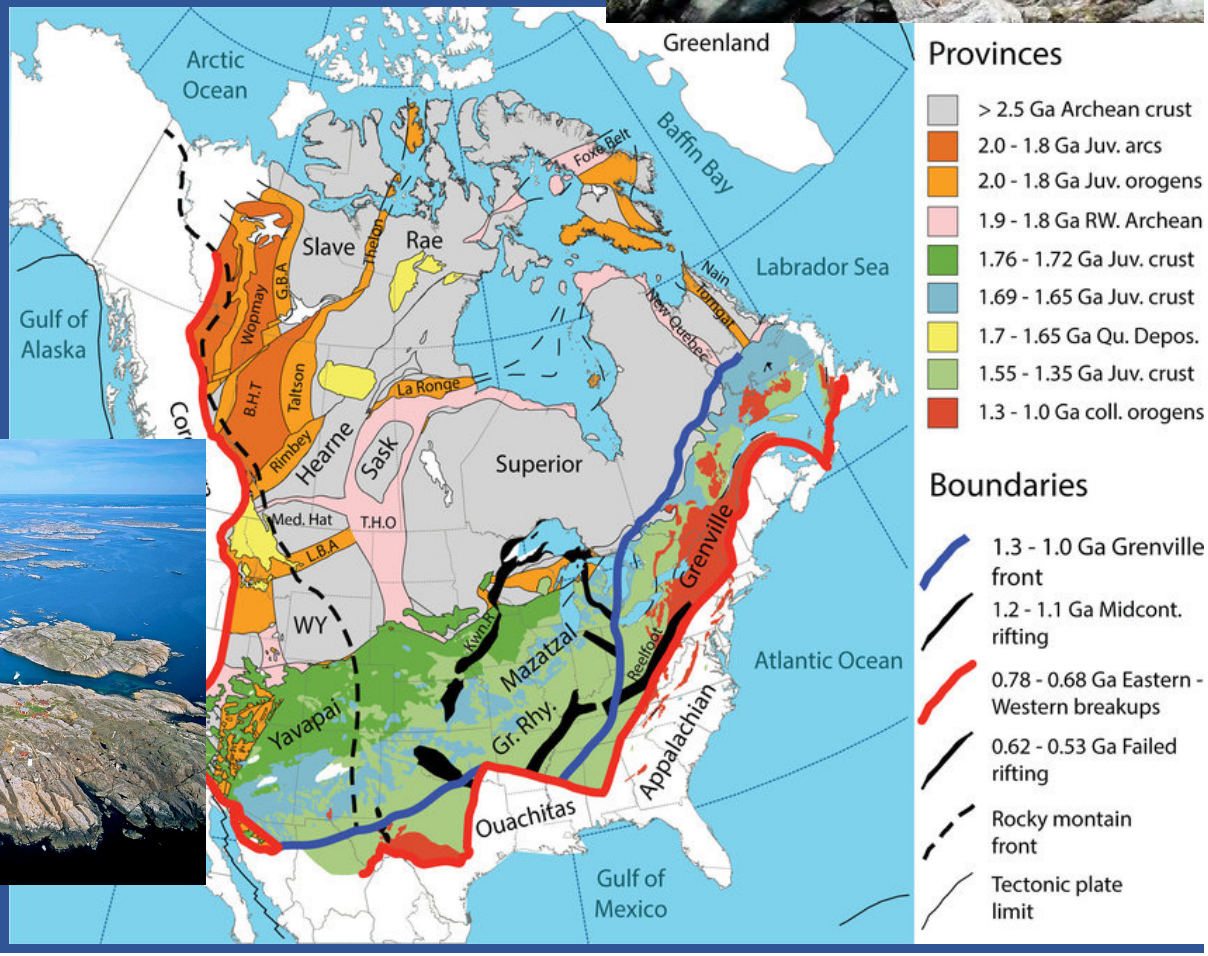
- Archean Eon 2.8-2.7Ga: Grand Teton NP & Yellowstone NP
- Archean & Proterozoic Eons 2.75-1.1Ga: Voyageurs NP & Isle Royale NP

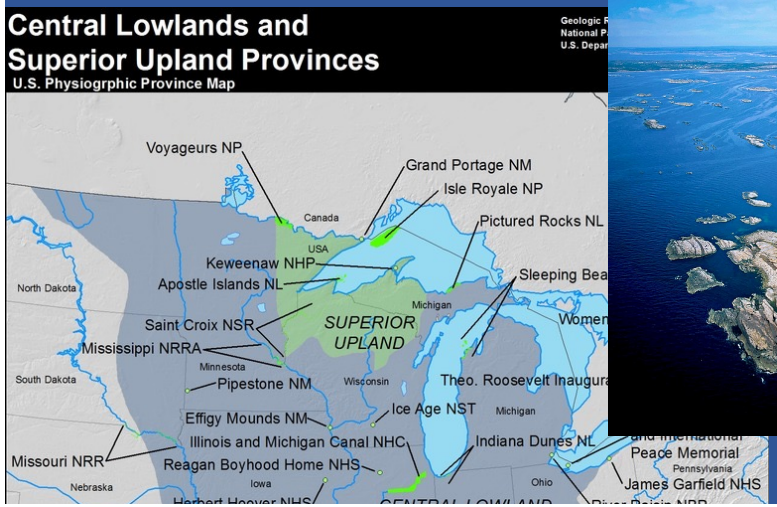


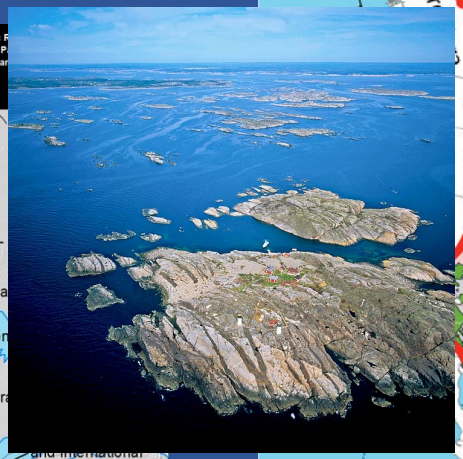


Superior Uplands: Voyageurs National Park, MN

- Archean Eon:
  - –Oldest bedrock: 2.75Ga
  - –Kenoran Orogeny
  - –Metamorphosed batholith of greenstone with gold
  - –1893-1898 **gold mining boom**







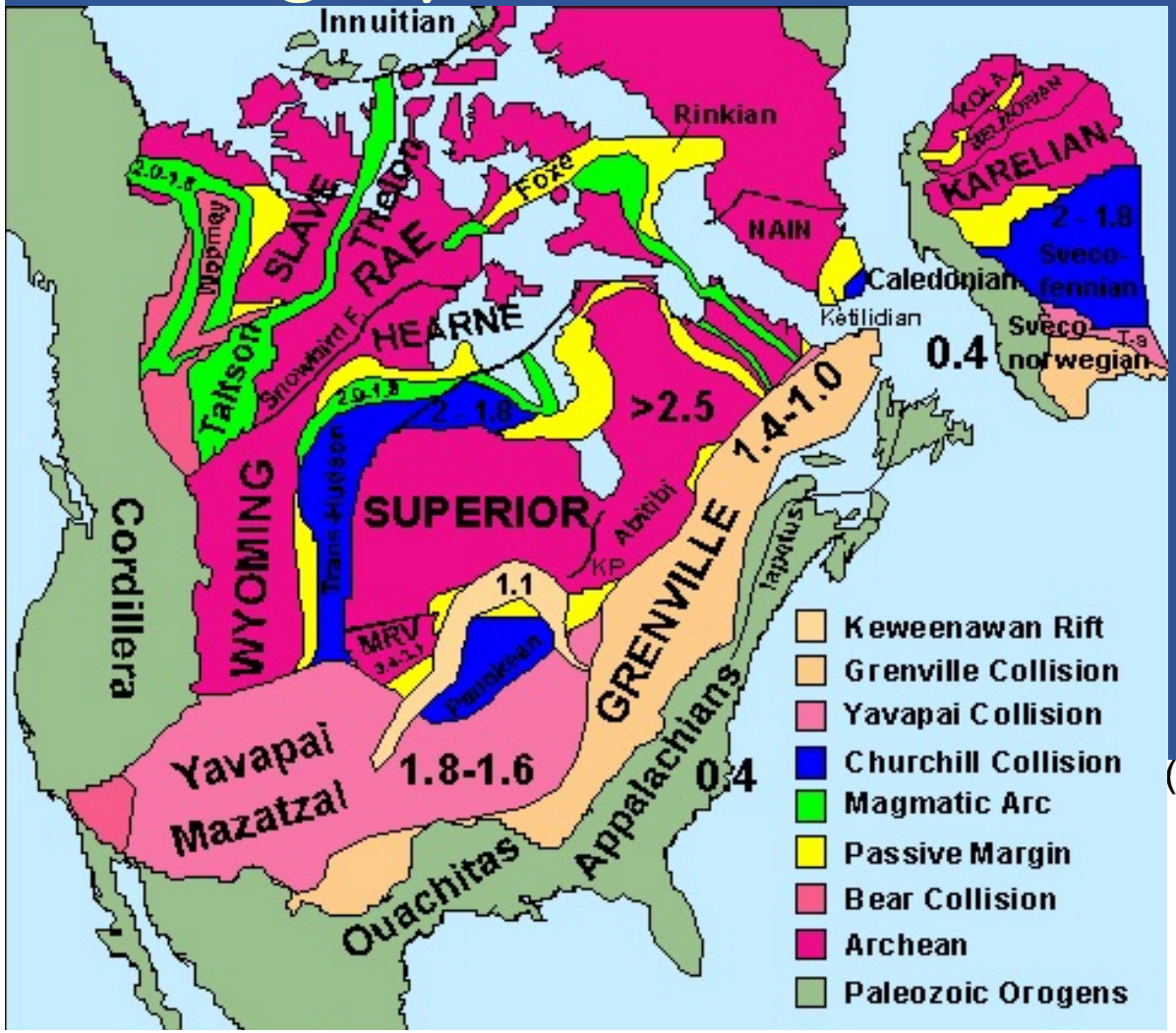
Superior Uplands: Voyageurs NP

- Proterozoic Eon:
  - –2.1Ga mafic dikes
- Pleistocene Epoch:
  - –Glacial deposits: lakes, outwash, peat
  - –Lake Superior disorganized hydrology
  - –Park Est.: April 8, 1975

10 Minute Break!

Video Link:
https://www.youtube.com/watch?v=UwWWuttntio&t=32s

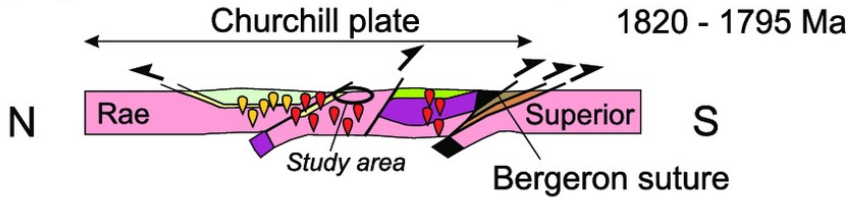
Orogeny = Mountain Building = Metamorphism



Proterozoic Eon ~1.8-1.7Ga:

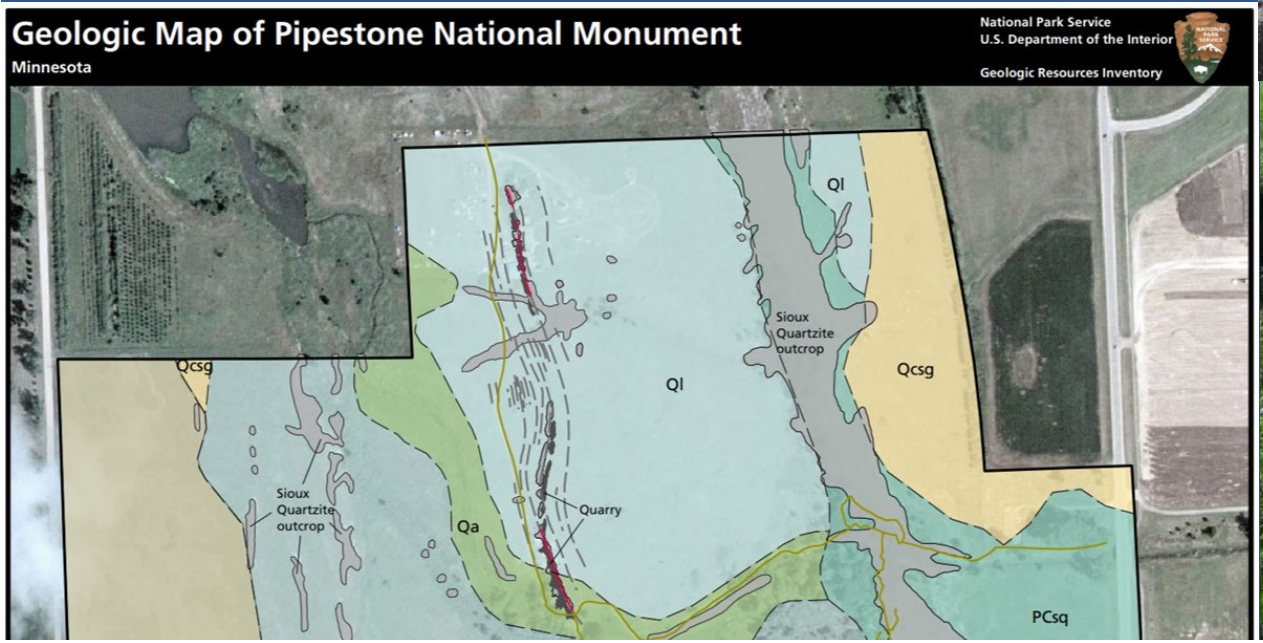
- Wyoming & Superior Cratons accreted on to NA
- **Penokean Mountains** (blue) = Churchill Craton accreted

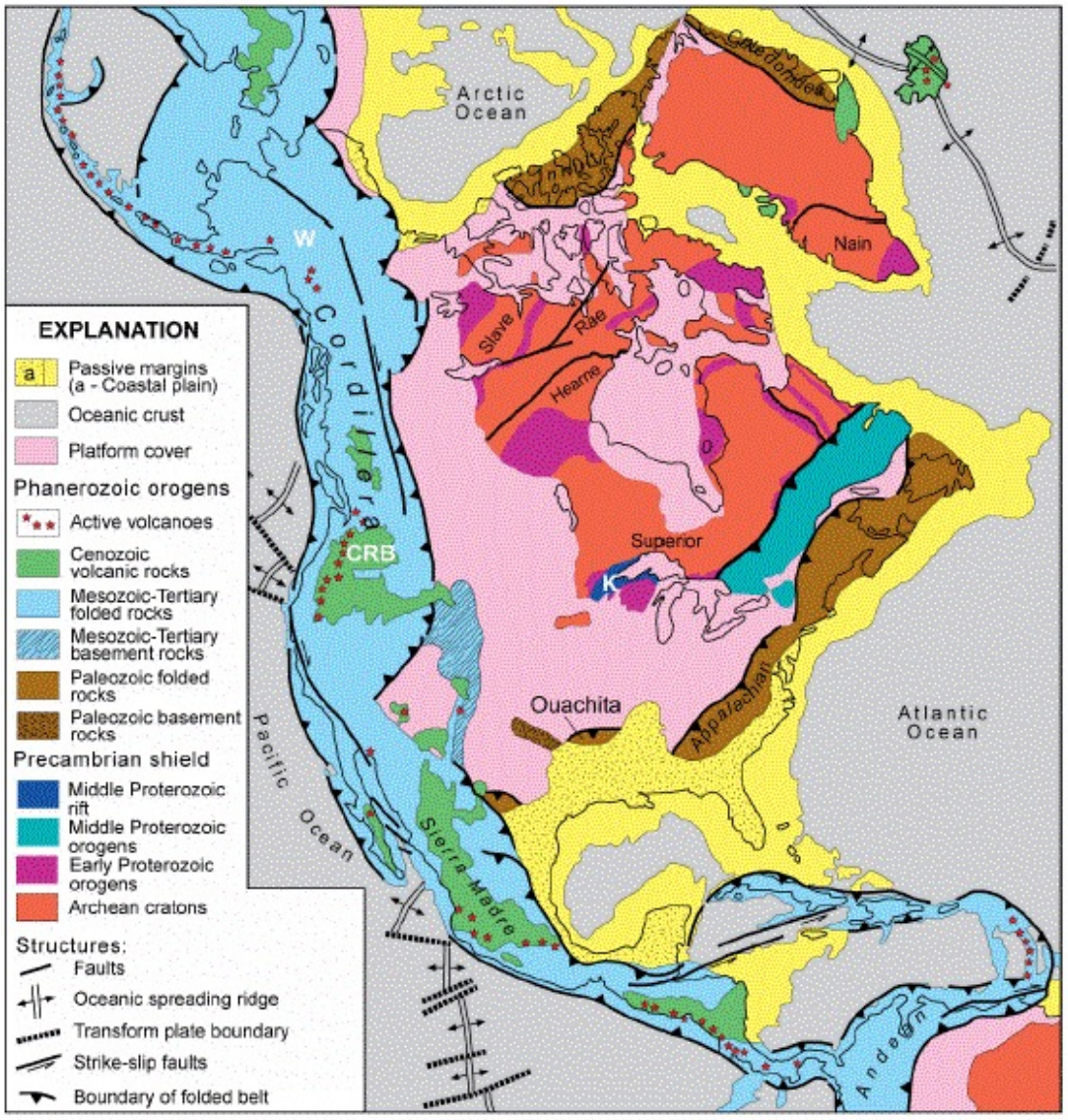
(e) D_2: Collision of Churchill plate & Superior craton:



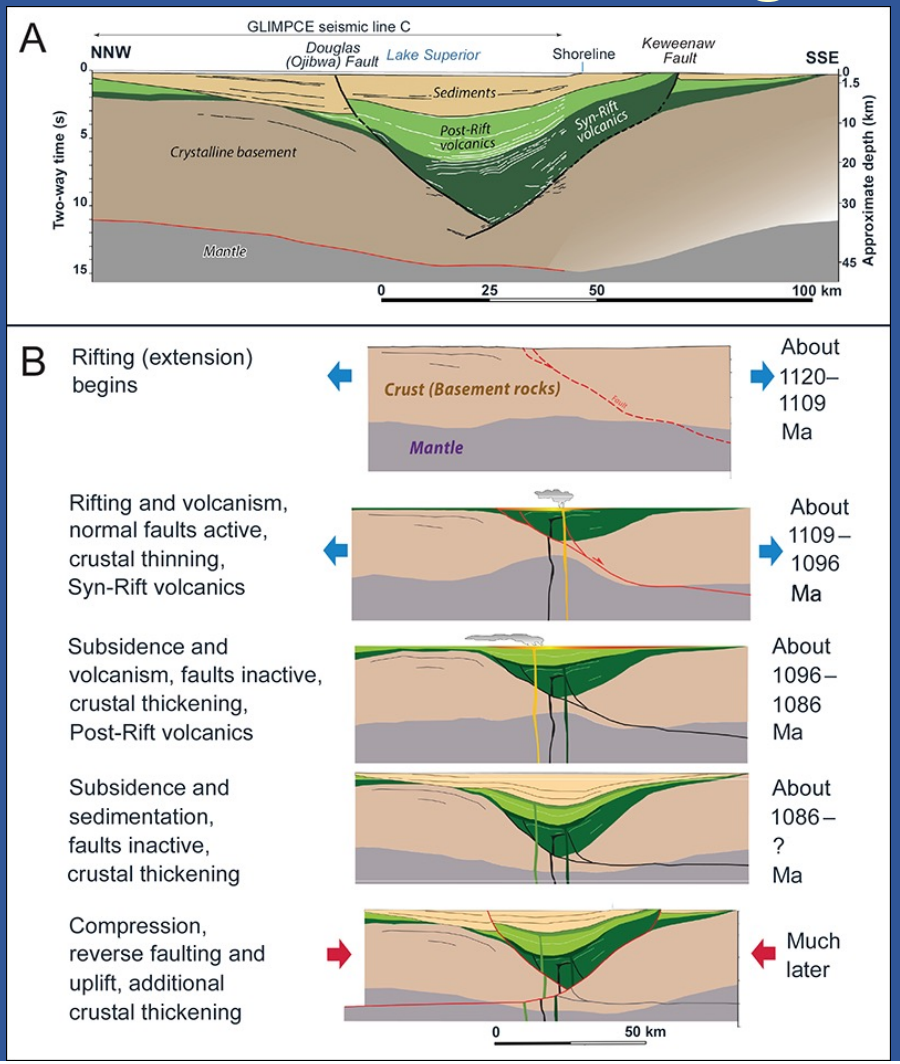
Pipestone National Monument, MN

- Proterozoic Eon 1.75-1.63Ga: Sioux Quartzite
  - –Contains Quartz-poor Catlinite (pipestone)
  - –Erosion of Penokean Mtns
- Mined by Native Americans
- Monument Est. 8/25/1937



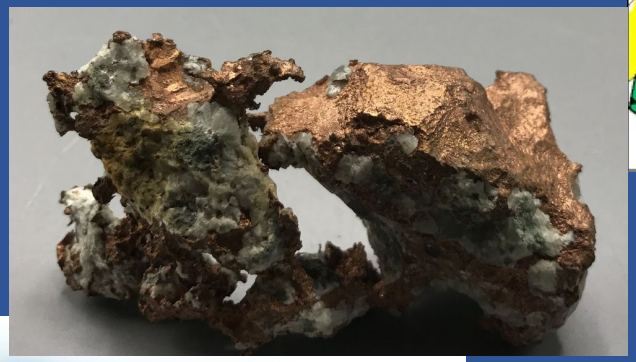


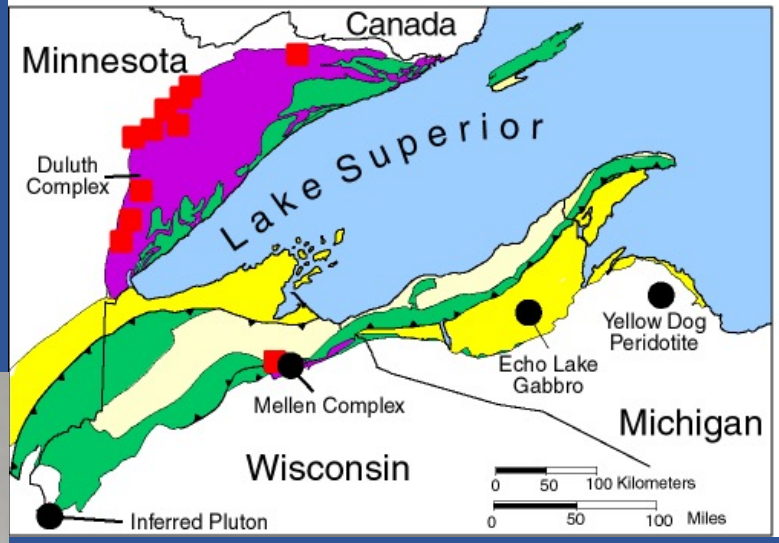
Precambrian Rifting

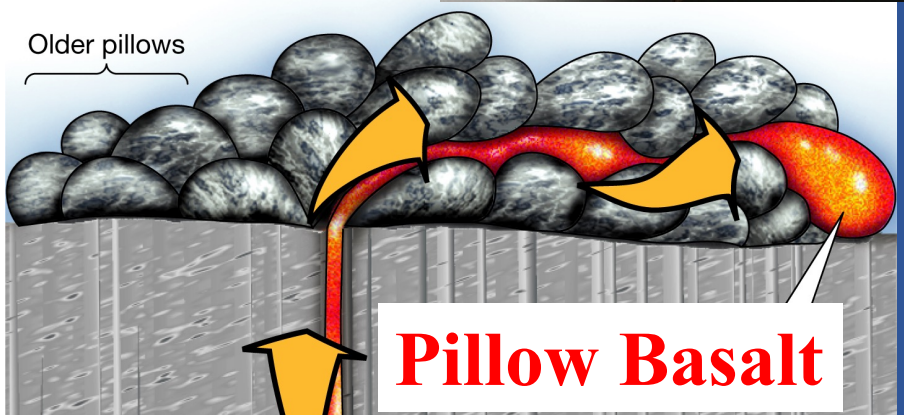


Isle Royale NP Continental Rifting

Proterozoic Eon 1.1Ga: continental rifting of NA for 24 million years = basalt flows, pyroclastic eruptions & hydrothermal metamorphism





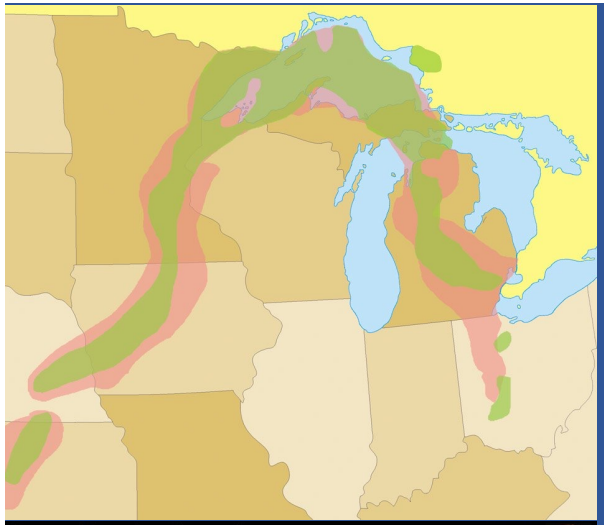


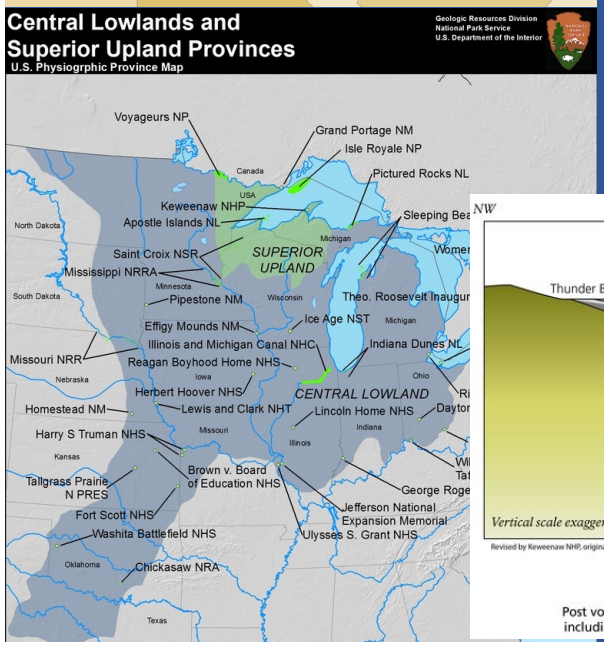
Video Link: https://www.youtube.com/watch?v=0yWYlv3xG-c

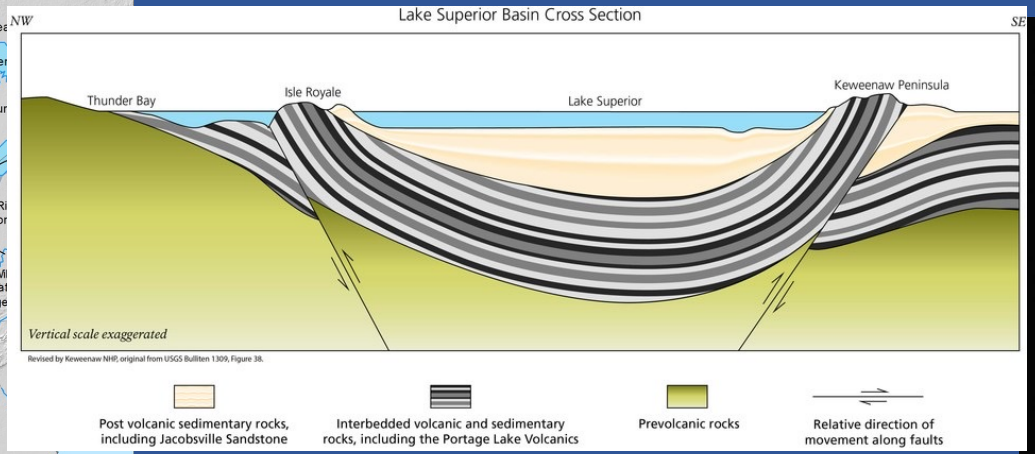
Isle Royale National Park, MI

- End of Precambrian: Lake Superior syncline + faulting
- Pleistocene Epoch: glaciation formed Lake Superior Basin

- 3800BC: Native copper mined by Native Americans
- Michigan State Gem = Chlorastrolite found in amygdules with pink agates
- Est. 4/3/1940 + UN International Biosphere Reserve 1980



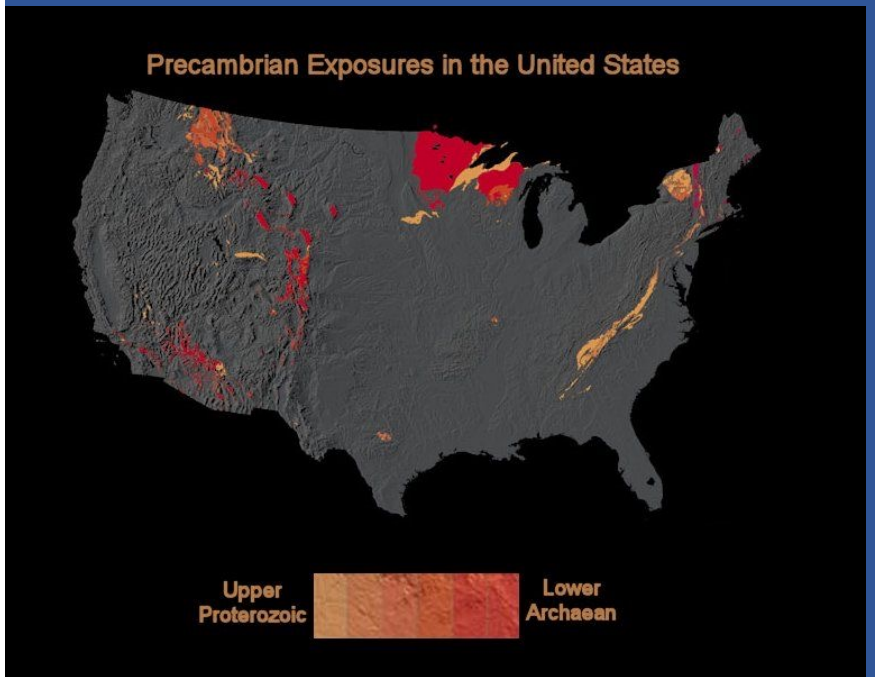




Precambrian Mountains Rose & Fell as NA Assembled

- Grand Canyon NP 2.0-1.7Ga
- Rocky Mountains NP 1.8-1.45Ga
- Glacier NP 1.6-0.8Ga
- Joshua Tree NP 1.7-1.65Ga
- Death Valley NP 1.7-1.4Ga
- North Cascades NP 1.65Ga
- Gates of the Arctic NP ~0.6Ga

Erosional debris of ancient mountains flowed into oceans & metamorphosed as cratons combined



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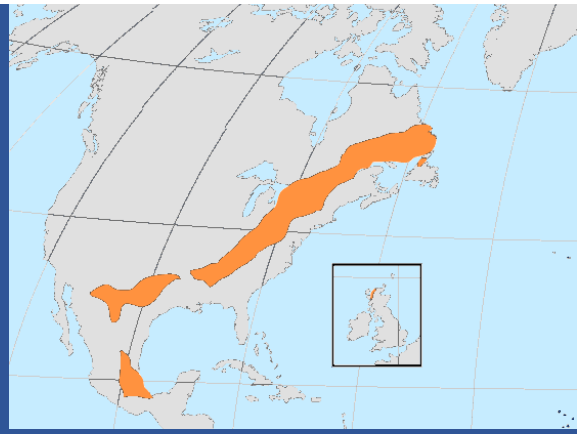
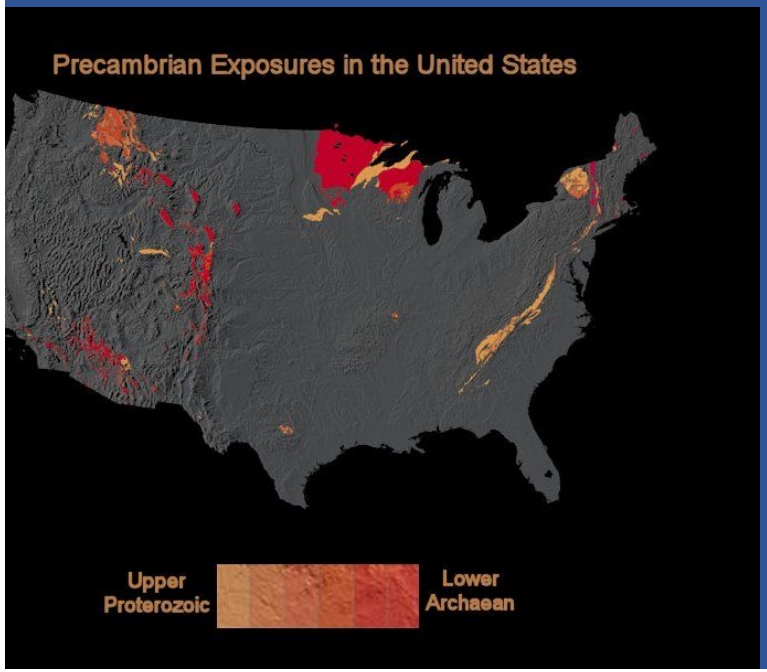
Formation of Supercontinent Rodinia

Grenville Orogeny formed Rodinia 1.4-1.1Ga

- Great Smokey Mountains 1.1Ga
- Shenandoah 1.1Ga
- Mountains eroded into sediments that metamorphosed during orogenesis





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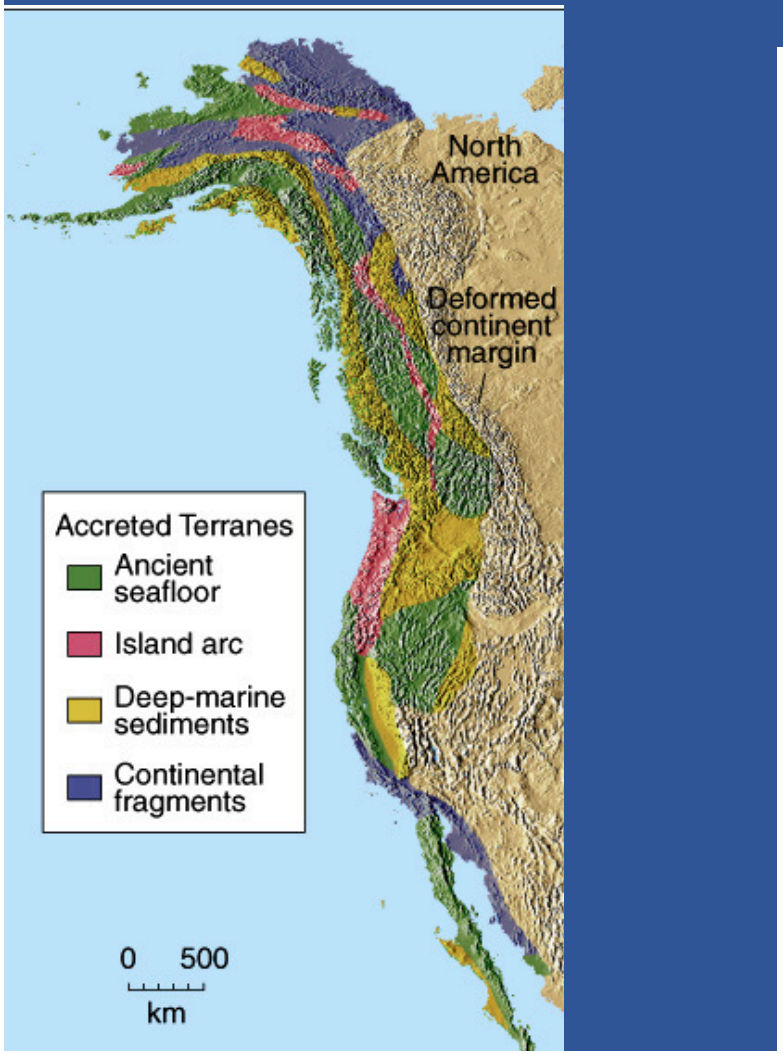
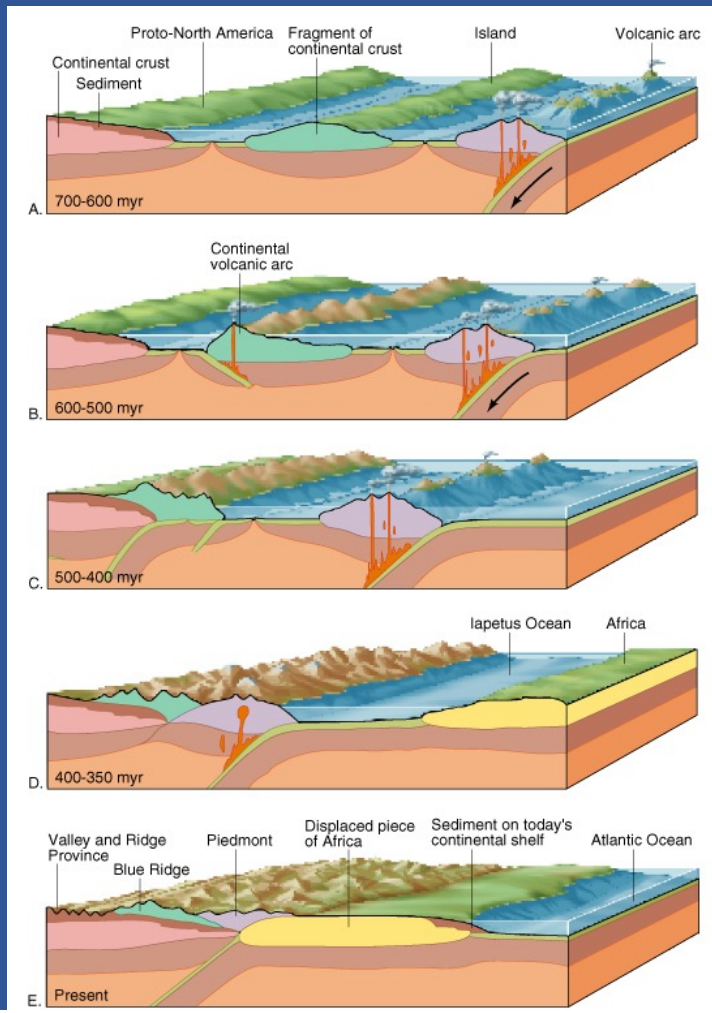
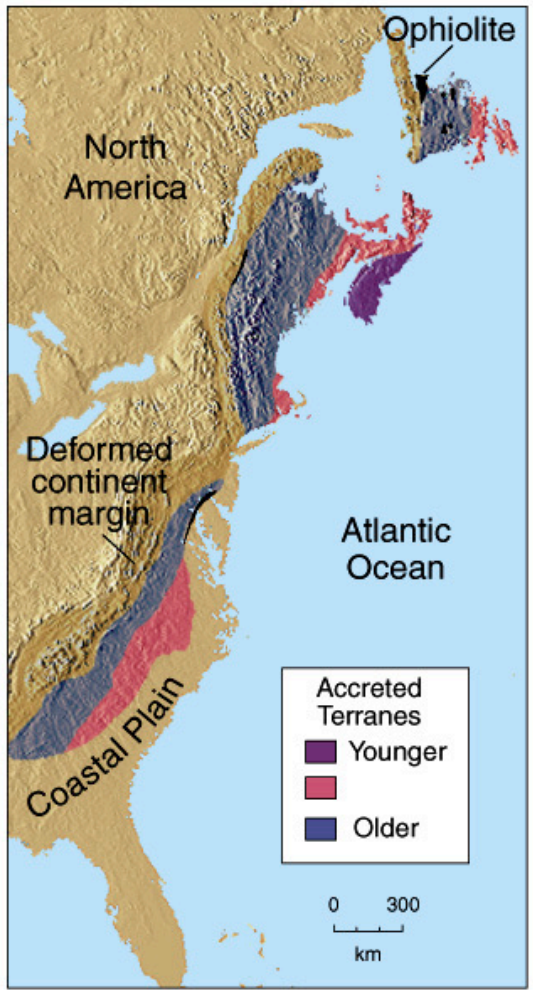
Weeks 5 & 6: Cordillera Belt ← Week 2: Appalachians







Next week…

The Appalachians & Pangaea Supercontinent