



Prehistoric Seabed to Modern Day Tributary: The Geologic History of Big Creek

Amanda McGee

Vertebrate Paleontology Collections Manager

Cleveland Museum of Natural History

Geologic Time Scale - Global

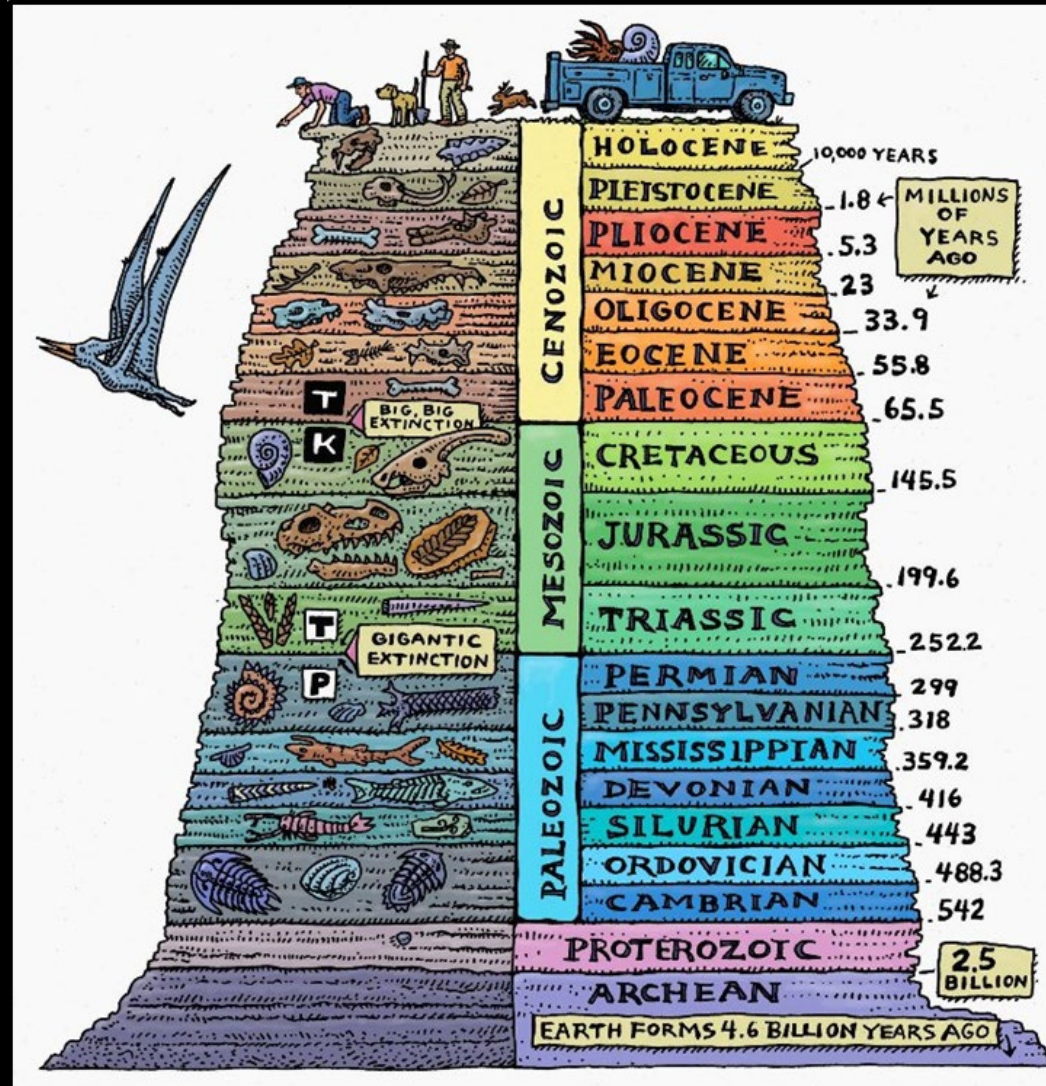
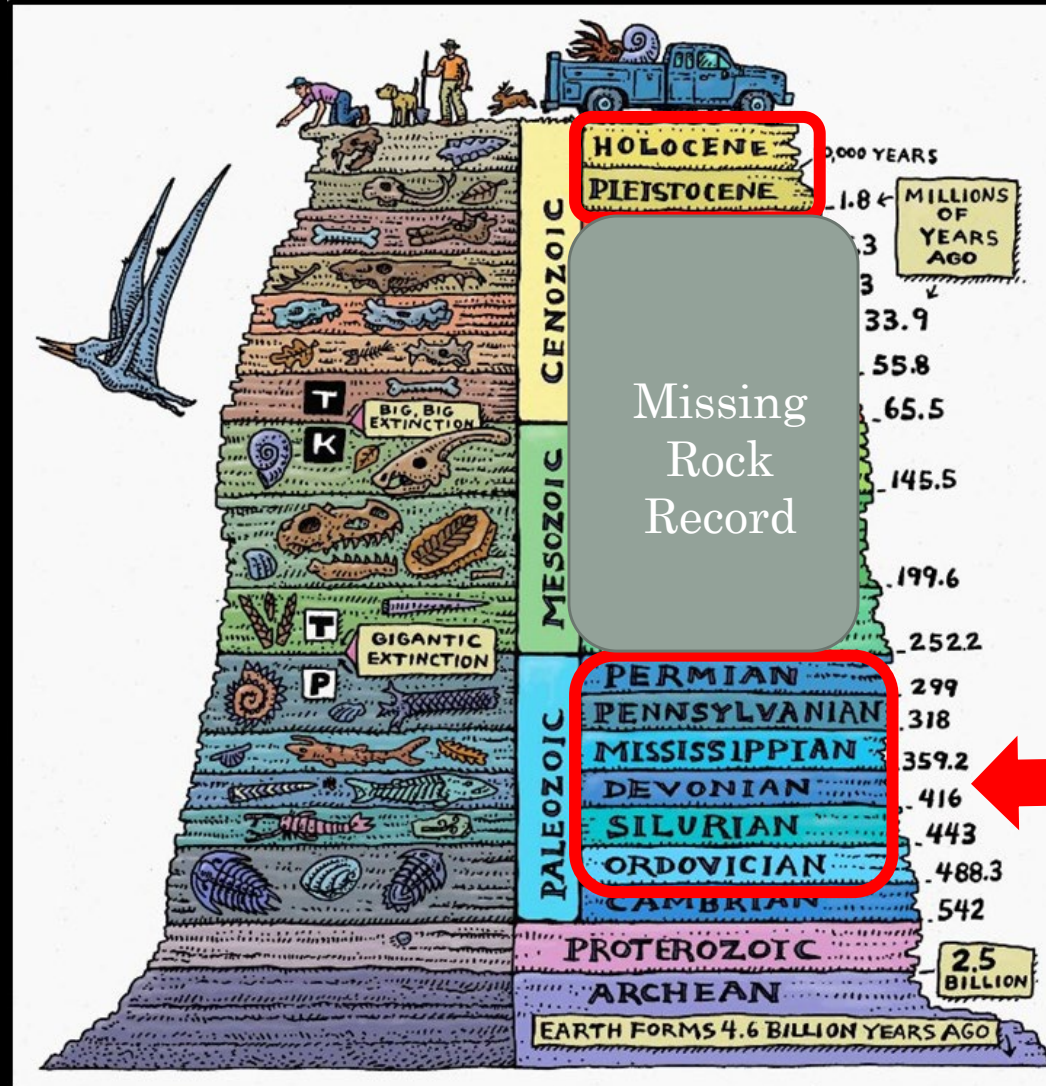


Image Credit: Ray Troll

Geologic Time Scale - OHIO



HOLOCENE
PLEISTOCENE

Missing
Rock
Record

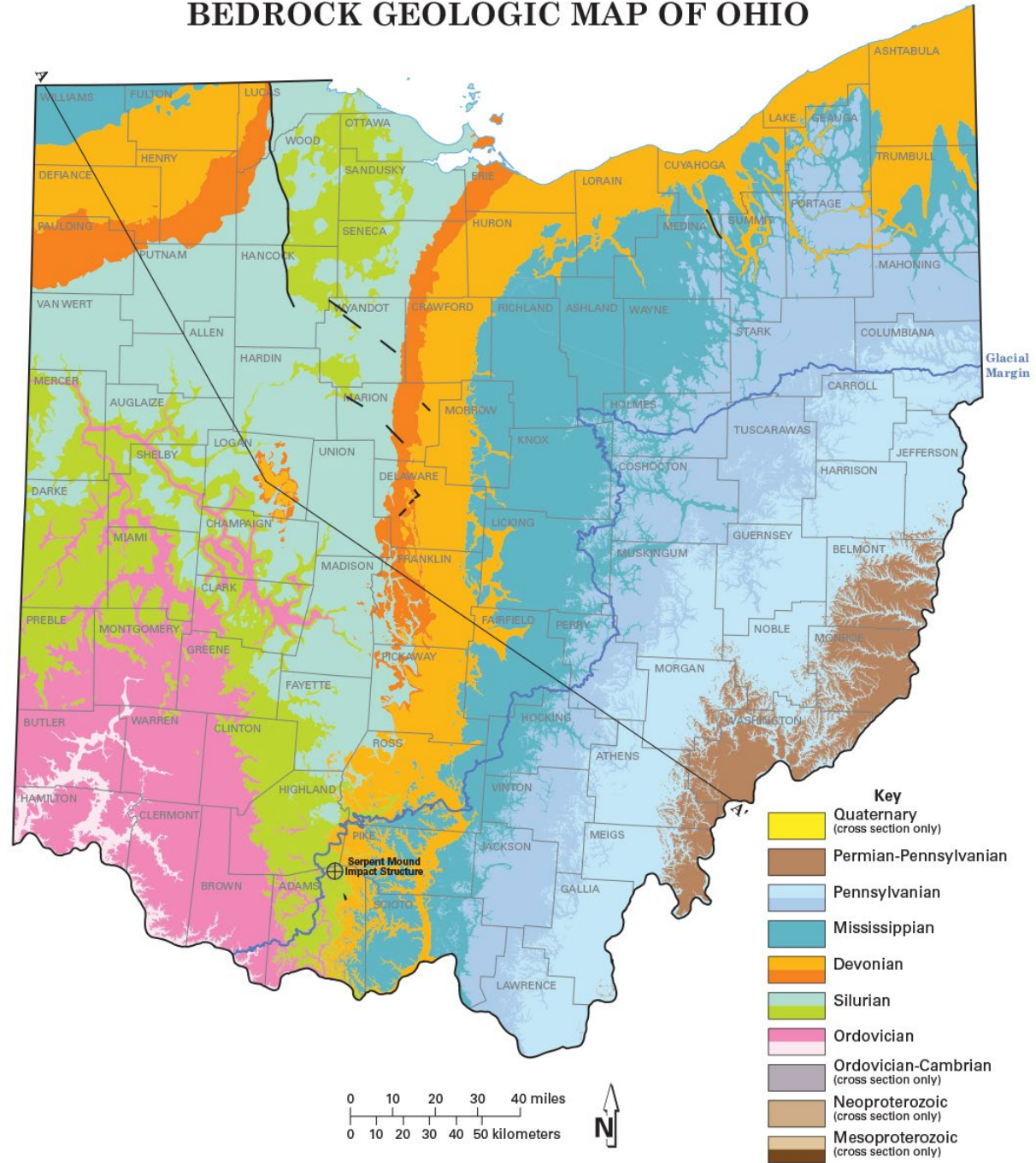
PERMIAN
PENNSYLVANIAN
MISSISSIPPIAN
DEVONIAN
SILURIAN
ORDOVICIAN



Big Creek Rock
Exposure

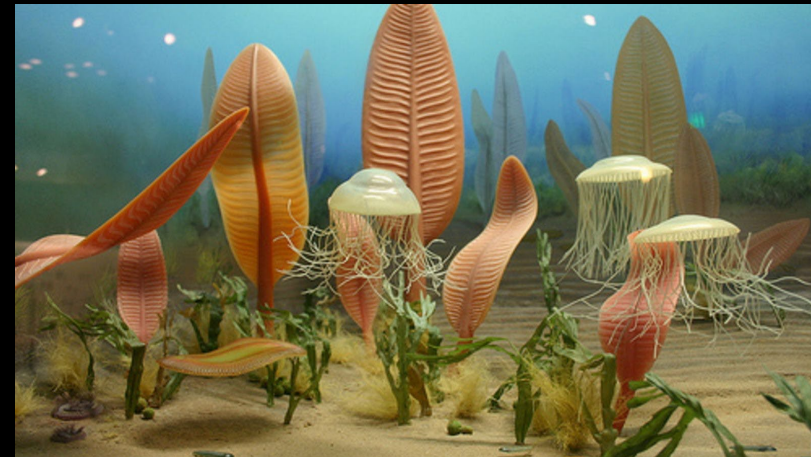
Image Credit: Ray Troll

BEDROCK GEOLOGIC MAP OF OHIO



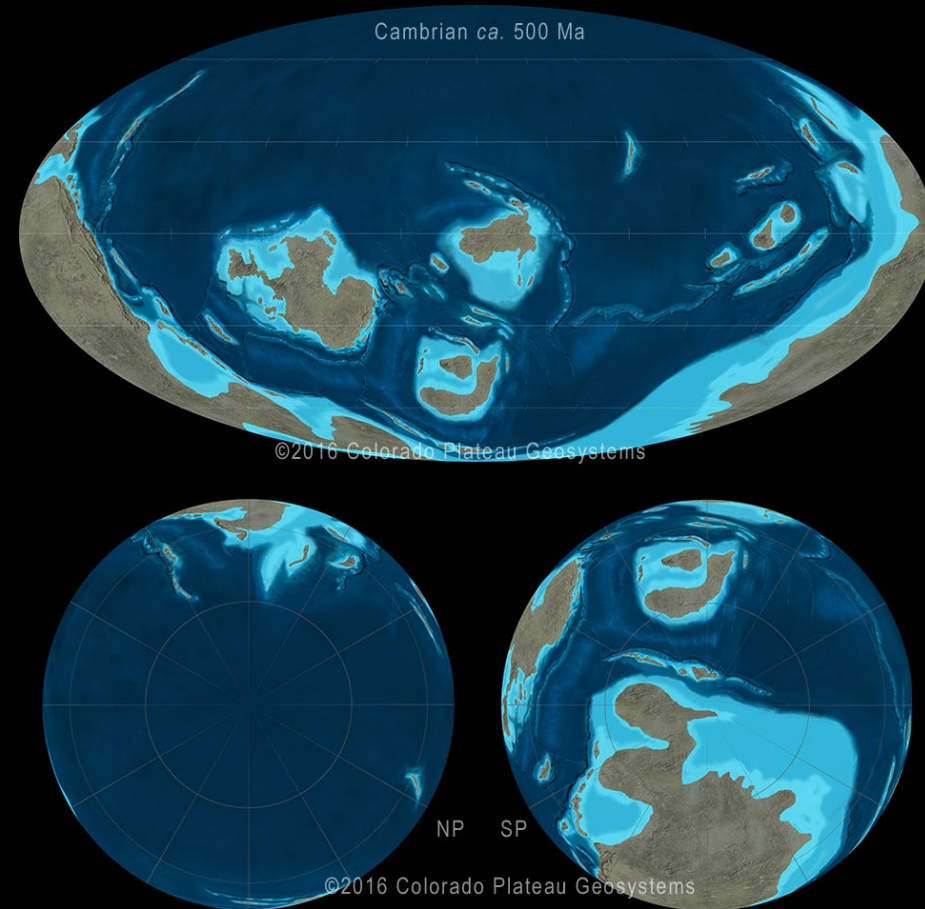
Precambrian (4.6 billion-541 MYA)

- Paleoenvironment – volcanic activity, crustal rifting, mountain building (990-880 MYA), erosion and basin filling (880 – 541 MYA)
- No known life from Ohio, "simple" life elsewhere on Earth
- Rocks – igneous (mainly granite), metamorphic, and metasedimentary. Subsurface only (2,500-13,000 ft beneath surface)



Cambrian (541-485 MYA)

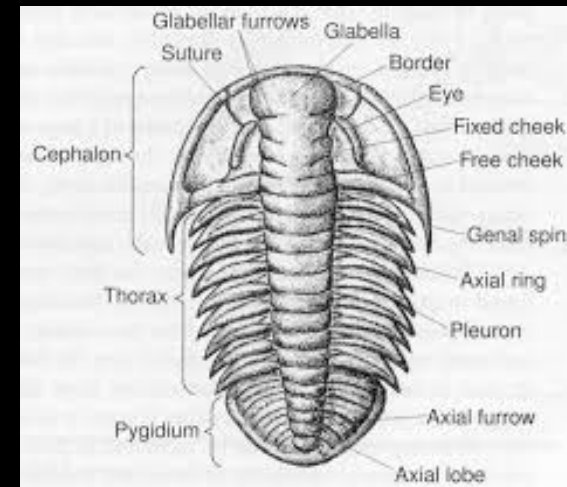
- Seas gradually flooded the land surface and covered Ohio by late Cambrian. Shallow marine sea in arid environment.
- Ohio lay 10° south of the Equator.
- Rocks - sandstone, shale, dolomite (subsurface only). Oil and gas reservoirs!



Cambrian (541-485 MYA)

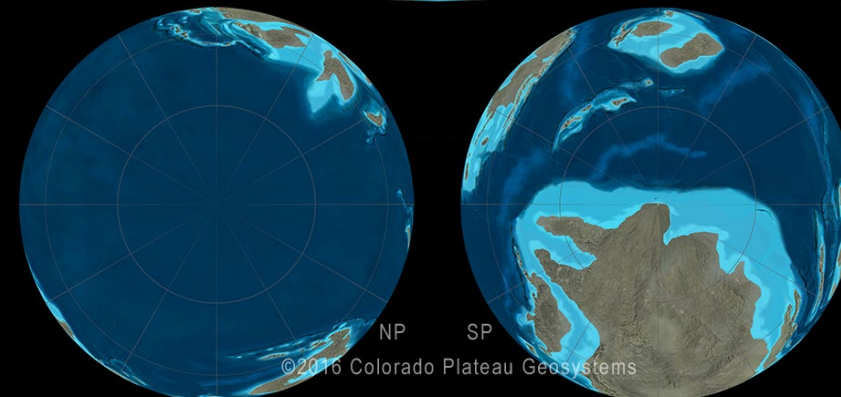
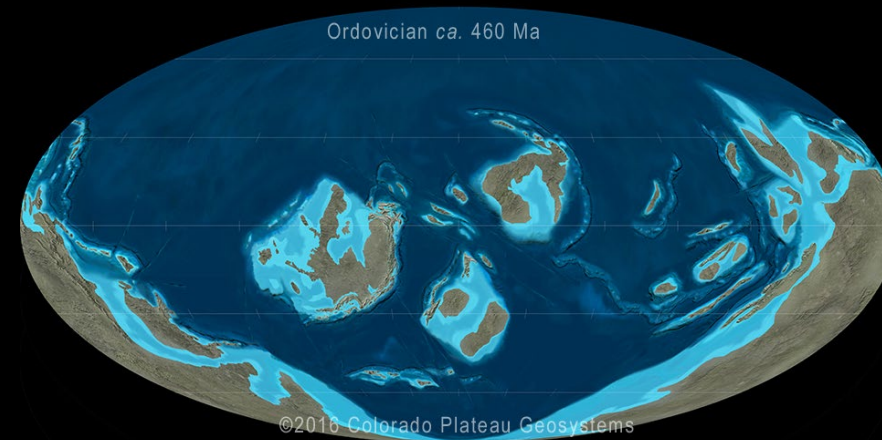
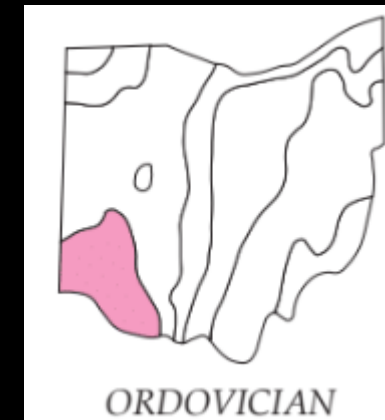


- Marine life abundant, but few fossils known from Ohio. Limited to core samples.
- Trilobites reached their peak diversity during the late Cambrian.

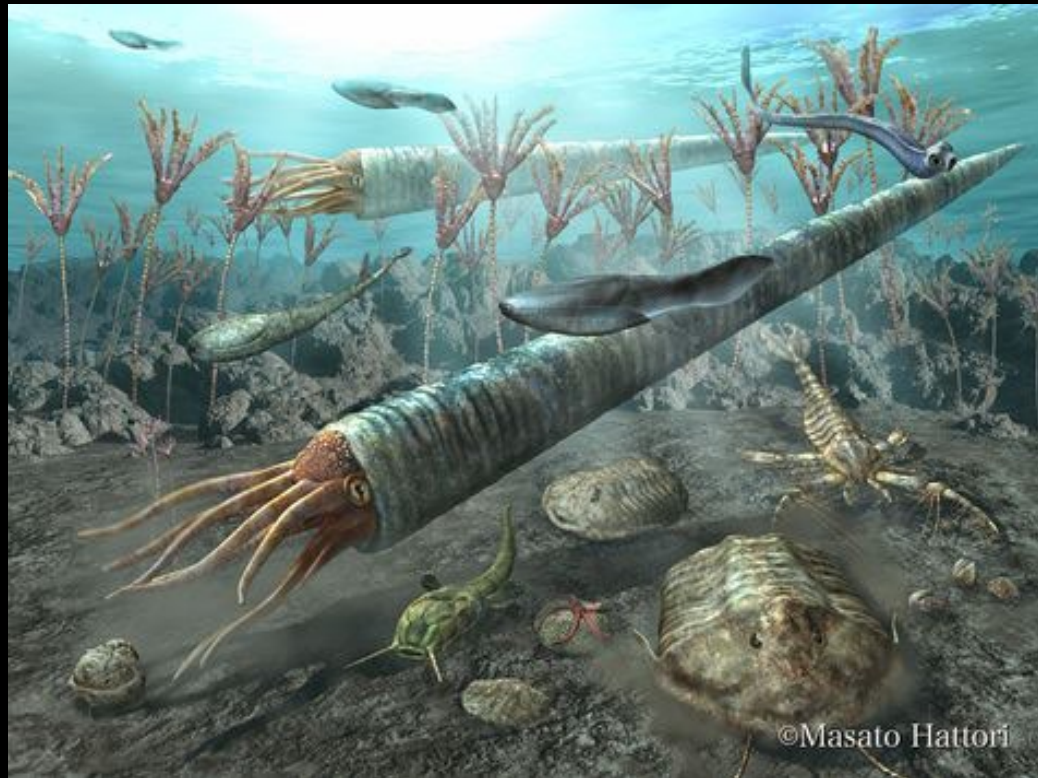


Ordovician (485-443 MYA)

- Oldest rocks exposed in the state!
- A warm, shallow sea similar to the Bahamas covered Ohio which lay 20° south of the Equator.
- Taconic Orogeny – mountains start to form to east
- At the end of Ordovician time glaciation in the southern hemisphere lowered sea level.
- Rocks – Limestone and shale. Oil and gas, and quarried for building stone.
- In 1884 the first giant U.S. oil field was discovered in Ordovician rocks in northwestern Ohio (Wood Co.)



Ordovician (485-443 MYA)



- Fossil animals – diverse invertebrate taxa (bryozoans, brachiopods, cephalopods, trilobites, horn corals, snails, clams, echinoderms, graptolites).

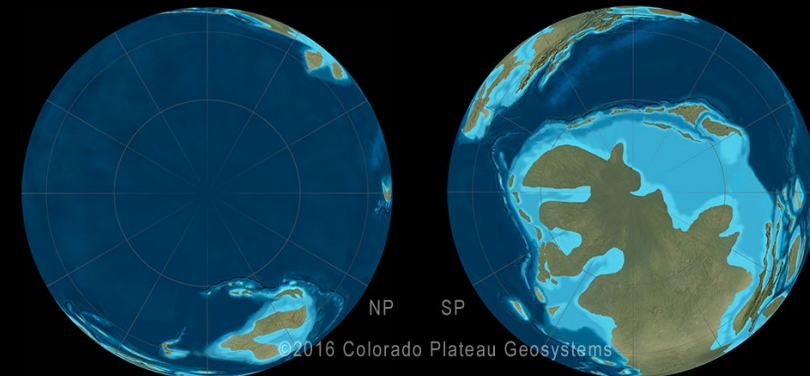
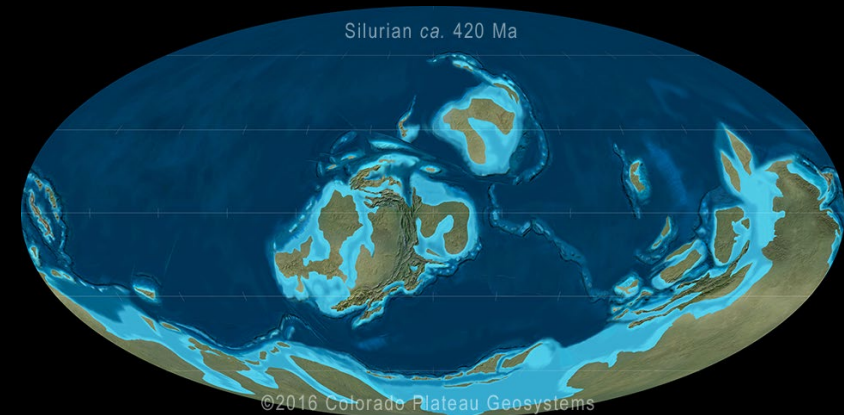
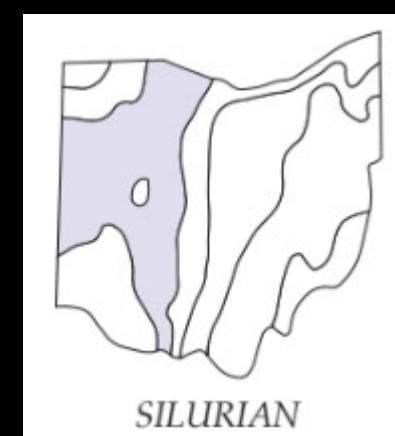
- Ohio is world famous for its fossiliferous Ordovician rocks in the Cincinnati area.

- *Isotelus* (state fossil) found in Late Ordovician rocks



Silurian (443-419 MYA)

- In early Silurian Ohio was dry land subject to erosion. Then warm, shallow seas returned, crating reef environments (low clastic input).
- Late Silurian sea level dropped and reefs formed barriers for water flow. Massive evaporite basins formed in arid environment. Ohio lay 20° south of the equator.
- Rock Types - limestone, dolomite, shale, gypsum, and salt.
- Salt beds are mined more than 500 meters under lake Erie here in Cleveland, and in Lake County.



Silurian (443-419 MYA)

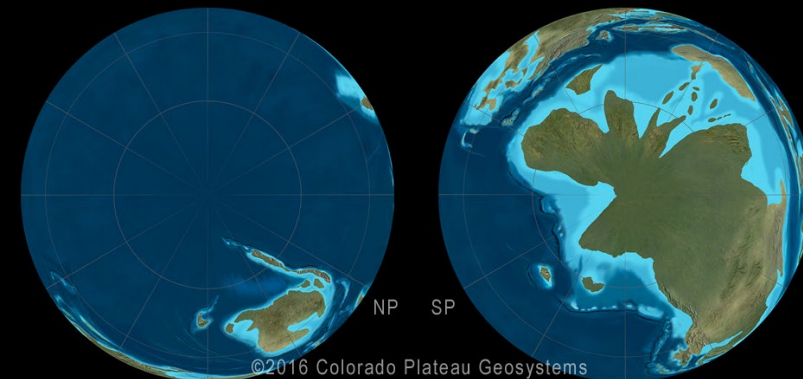
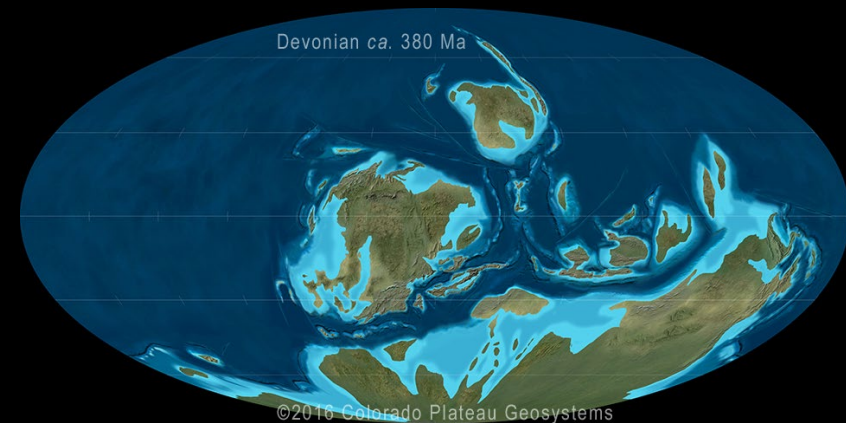
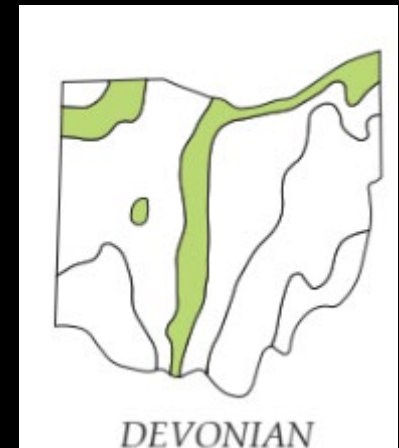
- Coral reefs abundant ("Age of the Corals"), also echinoderms, clams, brachiopods, cephalopods. Fishes starting to diversify, and plants start to colonize land.



Credit: Alena Hovorkova

Devonian (419-359 MYA)

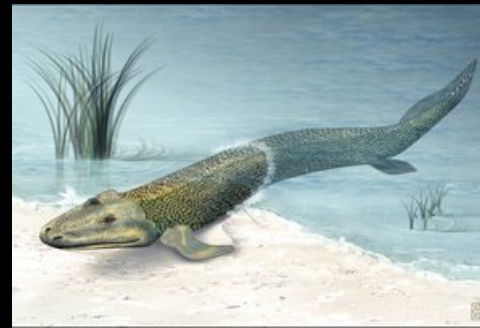
- Most of Ohio was dry land during early Devonian. Ohio was in near equator. Shallow seas flood continent in Mid Devonian – coral reefs.
- Acadian Orogeny – Appalachians start to form to east. Renewed mountain building and erosion.
- During late Devonian the sea became stagnant and anoxic (lacking oxygen). Poorly fossiliferous, but great preservation!
- Rocks - limestone, dolomite, shale, sandstone (natural gas reserves)



Devonian (419-359 MYA)



- "Age of the Fishes"
- Numerous invertebrate in Mid Devonian, near Columbus. Also, first major appearance of sharks and bony fishes during Middle Devonian.
- Fossils of Big Creek are Late Devonian, and include placoderms, sharks, bony fishes.
- Also, vertebrates colonize land.

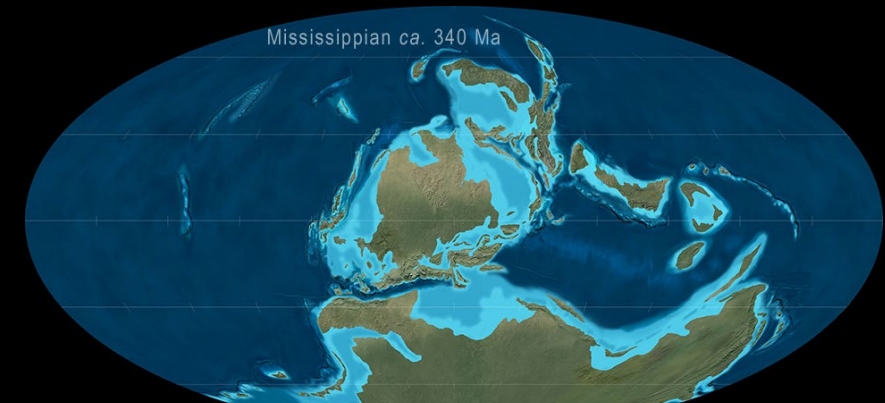
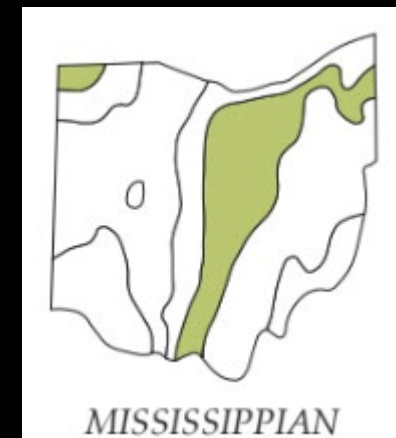


Big Creek Exposure

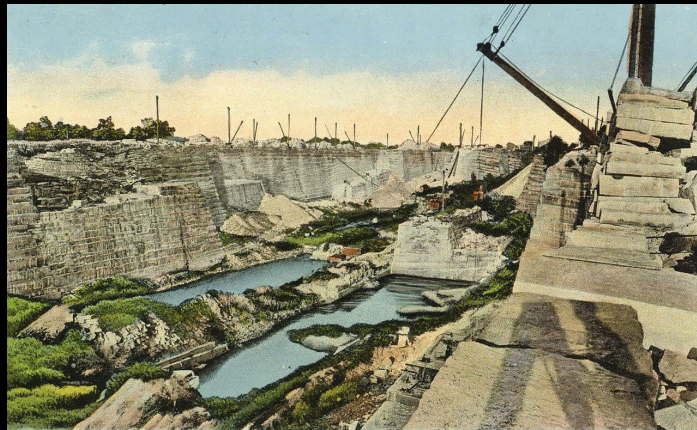


Mississippian (359-323 MYA)

- In early Mississippian dark organic muds gave way to fluvial and deltaic silts and sands (inland basin filling). Ohio lay in equatorial latitudes.
- During latest Mississippian time the seas retreated, leaving a sparse rock record.
- Rocks - Sandstone, siltstone, conglomerate, shale, and limestone. Ohio has been a major producer of building (Berea Sandstone) for over 150 years. Also, sandstones of Hocking Hills deposited during Mississippian.



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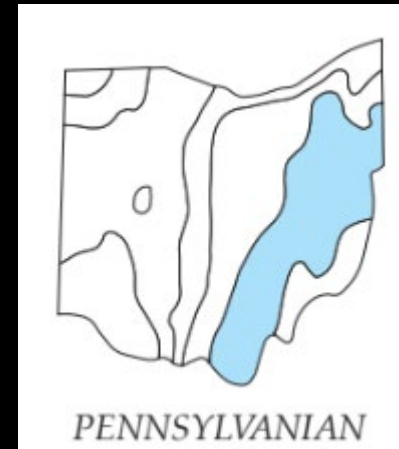
Mississippian (359-323 MYA)

- Fossils include brachiopods, clams, crinoids, and fishes. Land plants increasingly abundant.

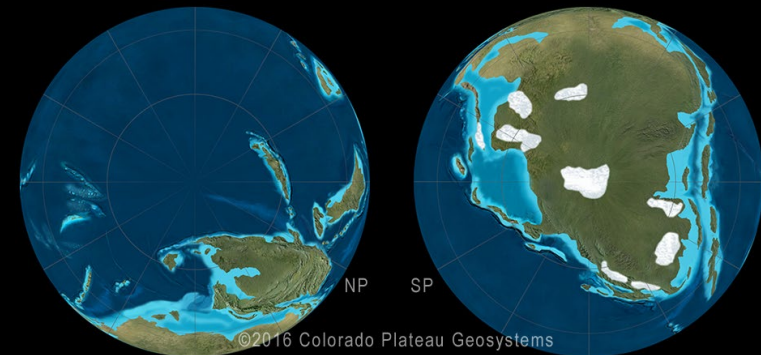
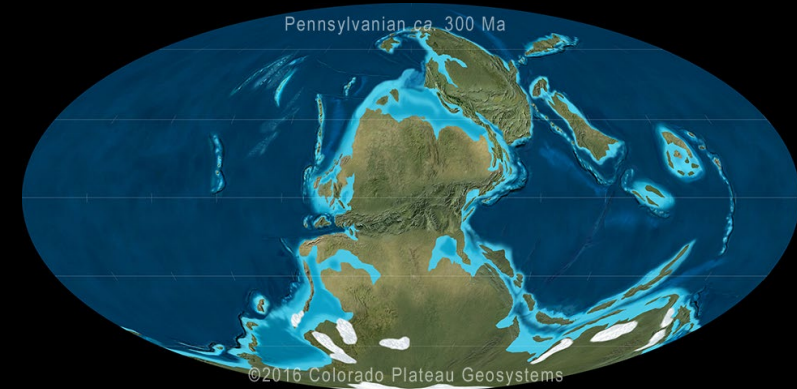


by Mary Parrish

Pennsylvanian (323-299 MYA)



- Ohio was a relatively flat coastal-plain swamp in equatorial latitudes. Fluctuations in sea level resulted in alternating terrestrial, freshwater, and marine deposits. Mountain building continued to east, glaciation in southern hemisphere.
- Rocks - sandstone, conglomerate, shale, clay, limestone, coal, flint, and ironstone. Rocks used for building stone, crushed stone for construction and industrial uses, oil and gas, and electric power (coal).
- During the 1800s Ohio was a major iron-producing state.



Pennsylvanian (323-299 MYA)

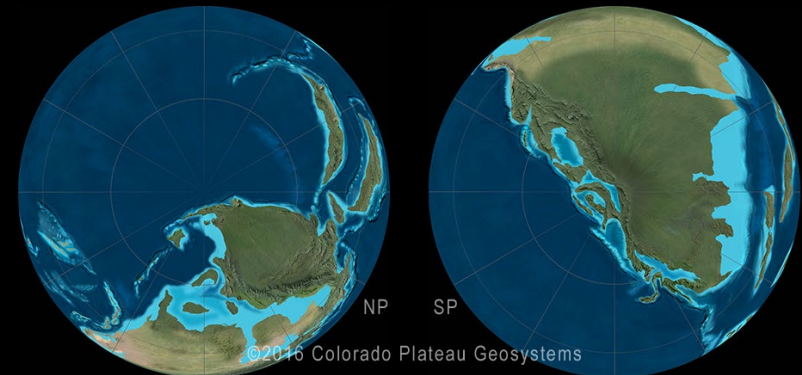
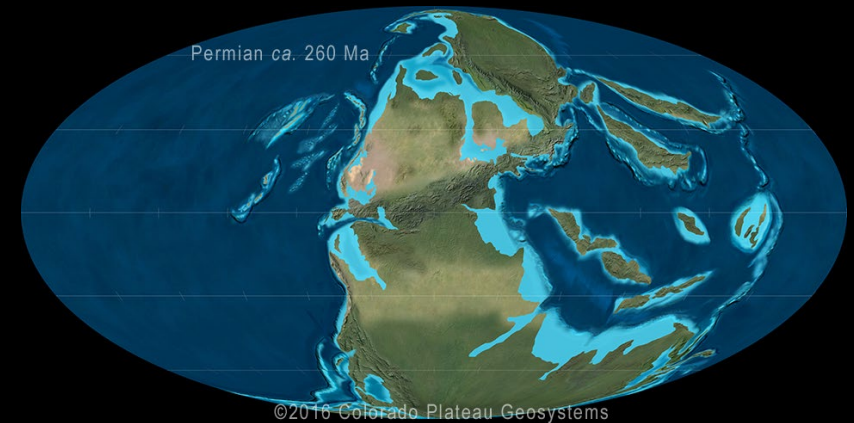
- Abundant plants (tree ferns, early conifers, lycopods, reeds and horsetail rushes). Extensive coal deposits!
- Terrestrial and freshwater life included amphibians, reptiles, and freshwater clams.



Credit: *Treena Joi*

Permian (299-251 MYA)

- During early Permian southeastern Ohio was a coastal plain swamp, about 5° north of the Equator.
- The swamp eventually filled with deltaic sand and mud. By late Permian, uplift and erosion.
- Rocks - sandstone, shale, freshwater limestone, coal,



Permian (299-251 MYA)

- Fossils are sparse in general. Freshwater and terrestrial fossils include snails, clams, fishes, plants, amphibians, and reptiles.



Credit: Spencer Sutton/Science Source

The Lost Interval (251-2.6 MYA)

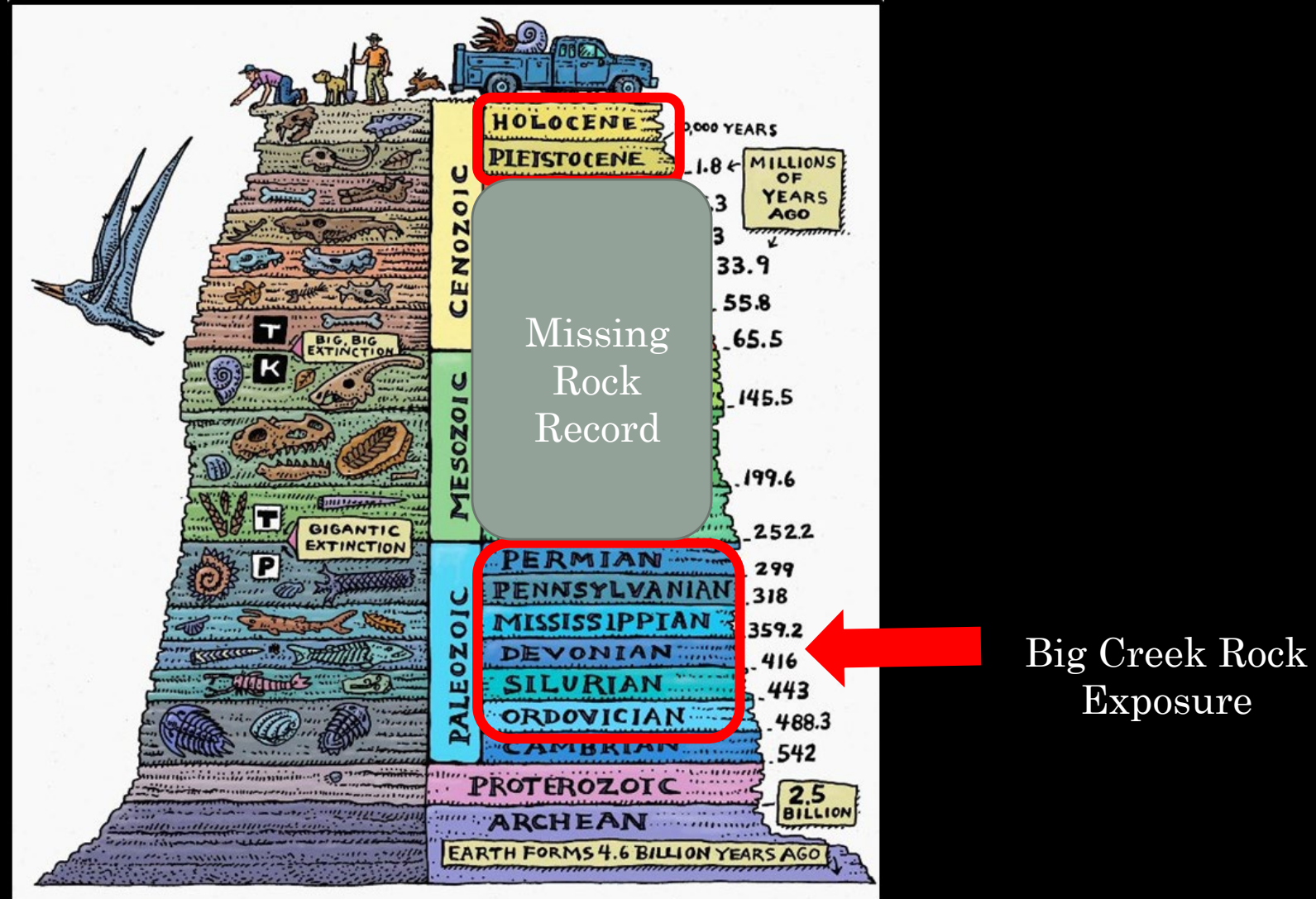
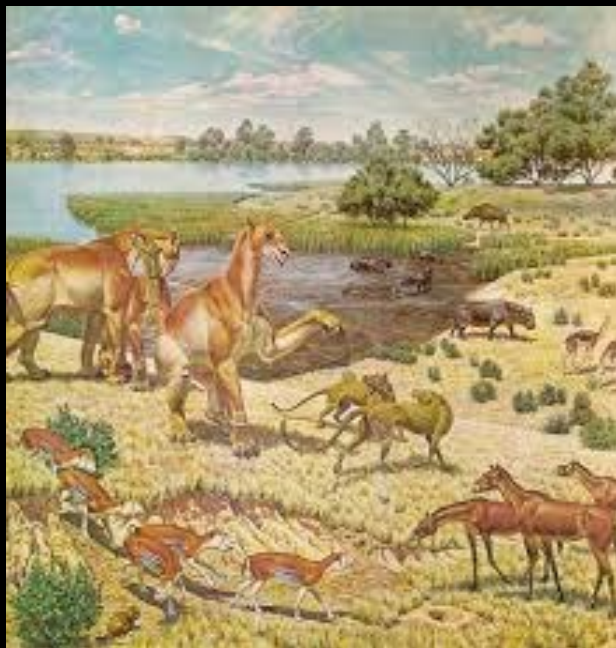


Image Credit: Ray Troll

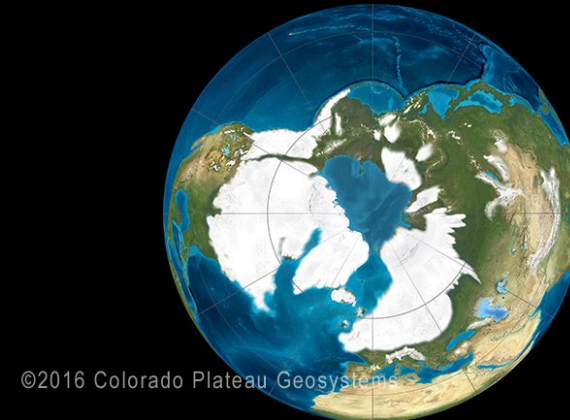
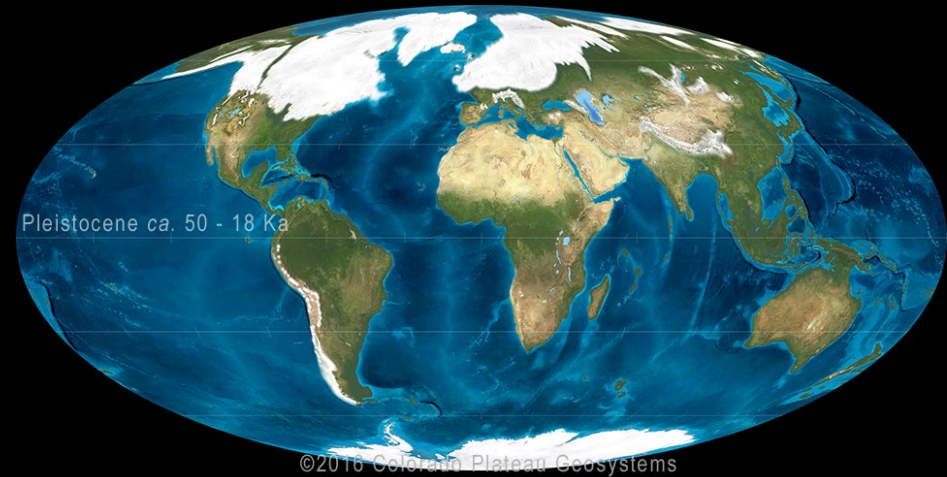
The Lost Interval (295 -2.6 MYA)

- Ohio is missing almost 290 million years of rock record!
- The state was above sea level = lots of weathering, erosion, and non-deposition.



Quaternary (2.6 MYA - Present)

- Glaciation began about 1.8 MYA and ended 14,000 years ago. Four major glacial periods.
- Two-thirds of Ohio was covered by mile-thick ice during maximum glacial periods.
- Rocks - glacial till, clay, silt, sand, gravel, glacial erratics.



Quaternary (2.6 MYA - Present)

