GEOLOGY & GLOSSARY
I have a glossary of geologic terms with 7,500 entries within its 545 pages, from **aa** a term for basalt lava flows with a rough, jagged, spinose (spiny), clinker (rough or jagged) surface to **zoophyte** Bryozoan (microscopic aquatic invertabrates) and coralline (microscopic photosynthetic algae) plant-like animal marine life.

John McPhee quotes regarding the vocabulary used by geologist:
With their four-dimensional minds, and in their interdisciplinary ultra verbal way, geologists can wiggle out of almost anything.

The enthusiasm geologists show for adding new words to their conversation is, if anything, exceeded only by their affection for the old. They are not about to drop 'granite.' They say 'granodiorite' when they are in church and 'granite' the rest of the week.

On the geological time scale, a human lifetime is reduced to a brevity that is too inhibiting to think about deep time. ... Geologists ... see the unbelievable swiftness with which one evolving species on the Earth has learned to reach into the dirt of some tropical island and fling 747s across the sky ... Seeing a race unaware of its own instantaneousness in time, they can reel off all the species that have come and gone, with emphasis on those that have specialized themselves to death. **John McPhee on the Geologic Time Scale**

When the climbers in 1953 planted their flags on the world's highest mountain, they set them in snow over the skeletons of creatures that had lived in the warm clear ocean that India, moving north, blanked out. Possibly as much as twenty thousand feet below the seafloor, the skeletal remains had turned into rock. This one fact is a treatise in itself on the movements of the surface of the earth. If by some fiat I had to restrict all this writing to one sentence, this is the one I would choose: The summit of Mt. Everest is marine limestone. **John McPhee summing up what plate tectonics and geology is about**


MESOZOIC ERA
200 M.Y.
251 MILLION YEARS AGO
TRIASSIC PERIOD
JURASSIC PERIOD
CRETACEOUS PERIOD
65 MILLION YEARS AGO
TERTIARY PERIOD
Paleocene Epoch
56 M.Y.
Eocene Epoch
34 M.Y.
Oligocene Epoch
Miocene Epoch
Pliocene Epoch
5 M.Y.
2 M.Y.
11,500 YR.
CENOZOIC ERA
Holocene Epoch
Pleistocene Epoch
QUATERNARY PERIOD
TERTIARY PERIOD
542 M.Y. AGO
CAMBRIAN PERIOD
ORDOVICIAN PERIOD
SILURIAN PERIOD
416 M.Y.
PALEOZOIC ERA
PERMIAN PERIOD
PENNSYLVANIAN PERIOD
MISSISSIPPIAN PERIOD
DEVONIAN PERIOD
PRECAMBRIAN
1 BILLION YEARS AGO
2 BILLION YEARS AGO
3 BILLION YEARS AGO
EARLIEST ORGANIC STRUCTURES
4.5 BILLION YEARS AGO

Eons

Eons are the largest intervals of geologic time and are hundreds of millions of years in duration. In the time scale above you can see the Phanerozoic Eon is the most recent eon and began more than 500 million years ago.

Eras

Eons are divided into smaller time intervals known as **eras**. In the time scale above you can see that the Phanerozoic is divided into three eras: Cenozoic, Mesozoic and Paleozoic. Very significant events in Earth's history are used to determine the boundaries of the eras.

Periods

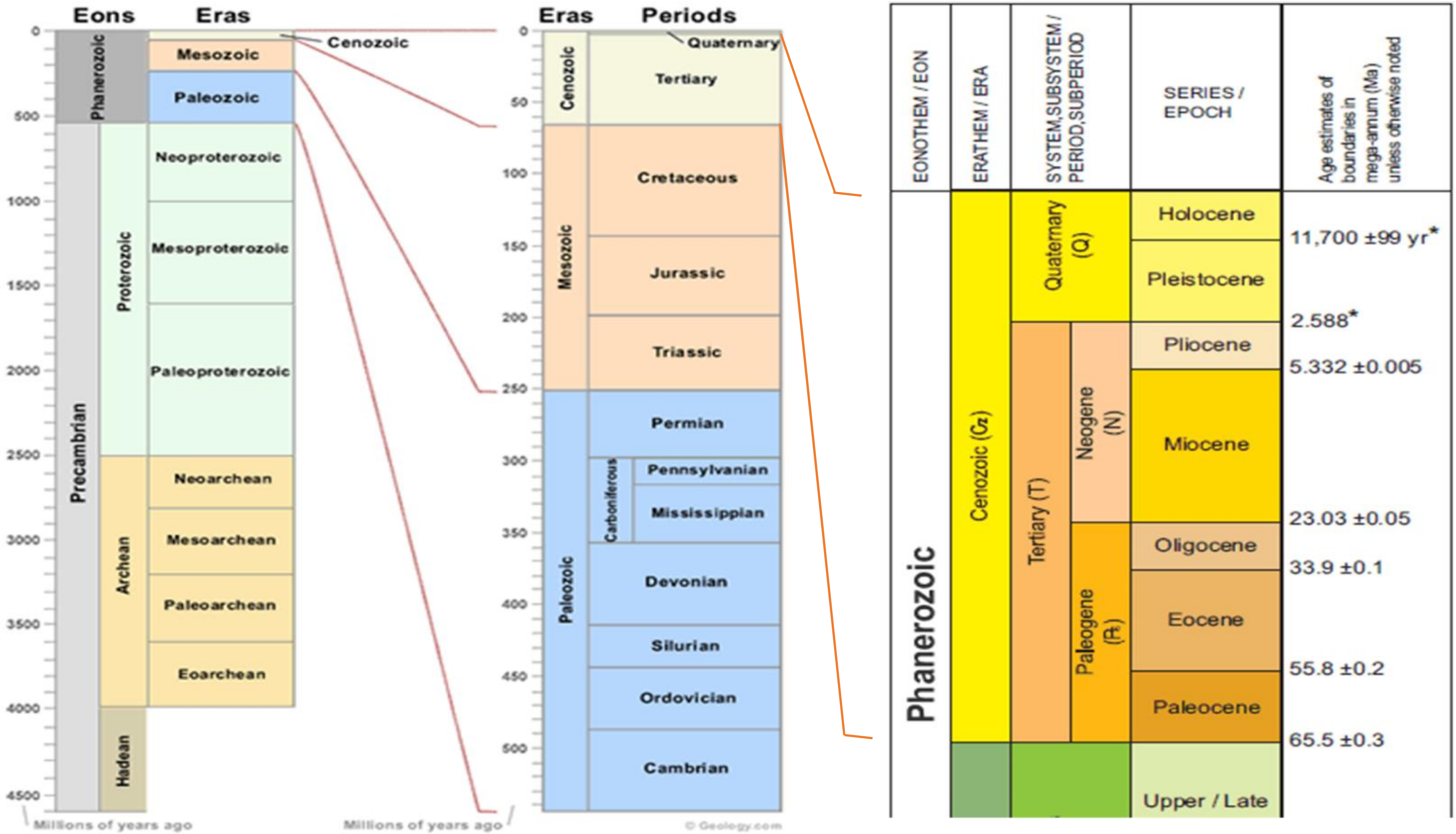
Eras are subdivided into **periods**. The events that bound the periods are widespread in their extent but are not as significant as those which bound the eras. In the time scale above you can see that the Paleozoic is subdivided into the Permian, Pennsylvanian, Mississippian, Devonian, Silurian, Ordovician and Cambrian periods.

Epochs

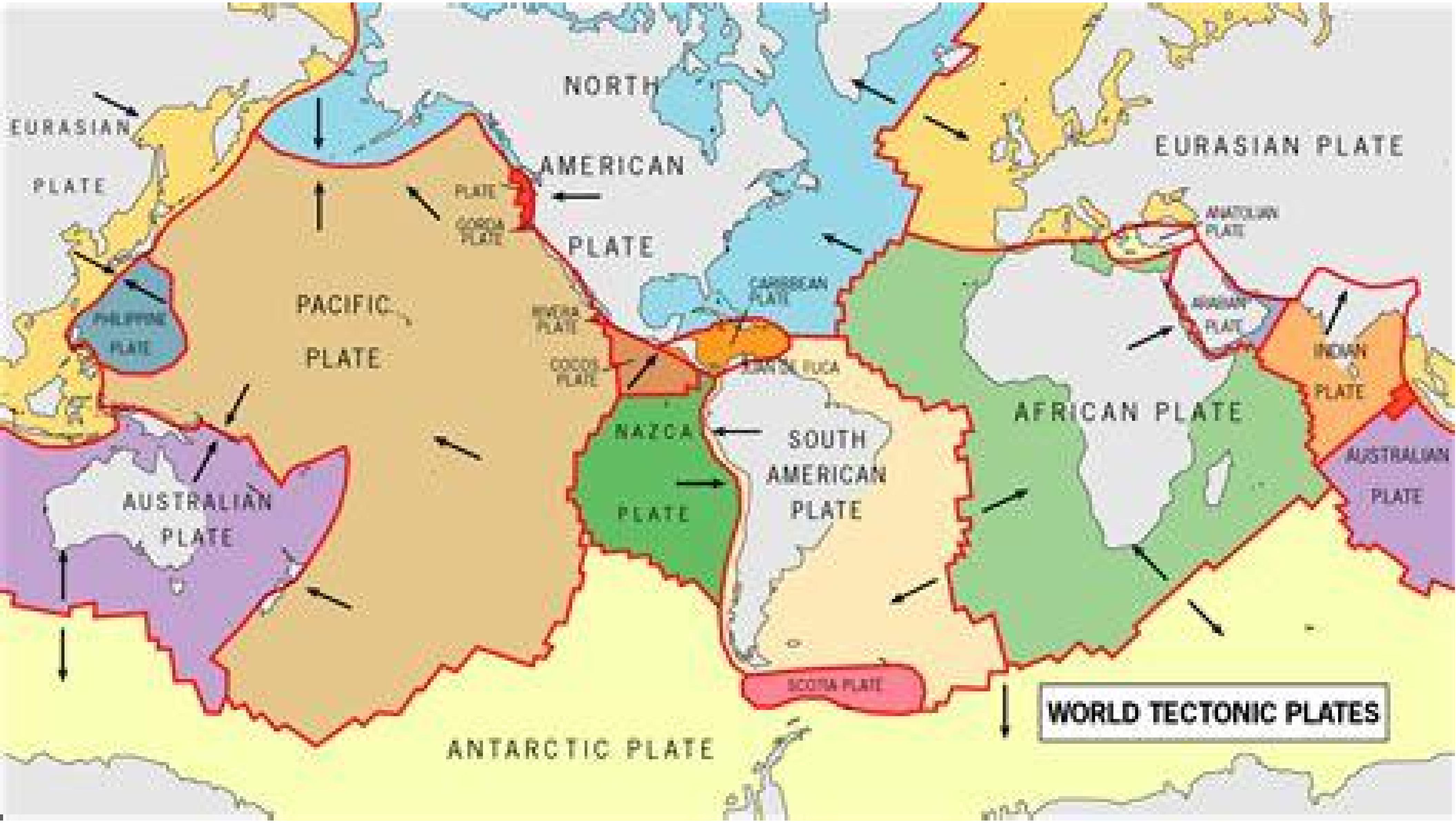
Finer subdivisions of time are possible, and the periods of the Cenozoic are frequently subdivided into **epochs**. Subdivision of periods into epochs can be done only for the most recent portion of the geologic time scale. This is because older rocks have been buried deeply, intensely deformed and severely modified by long-term earth processes. As a result, the history contained within these rocks cannot be as clearly interpreted.

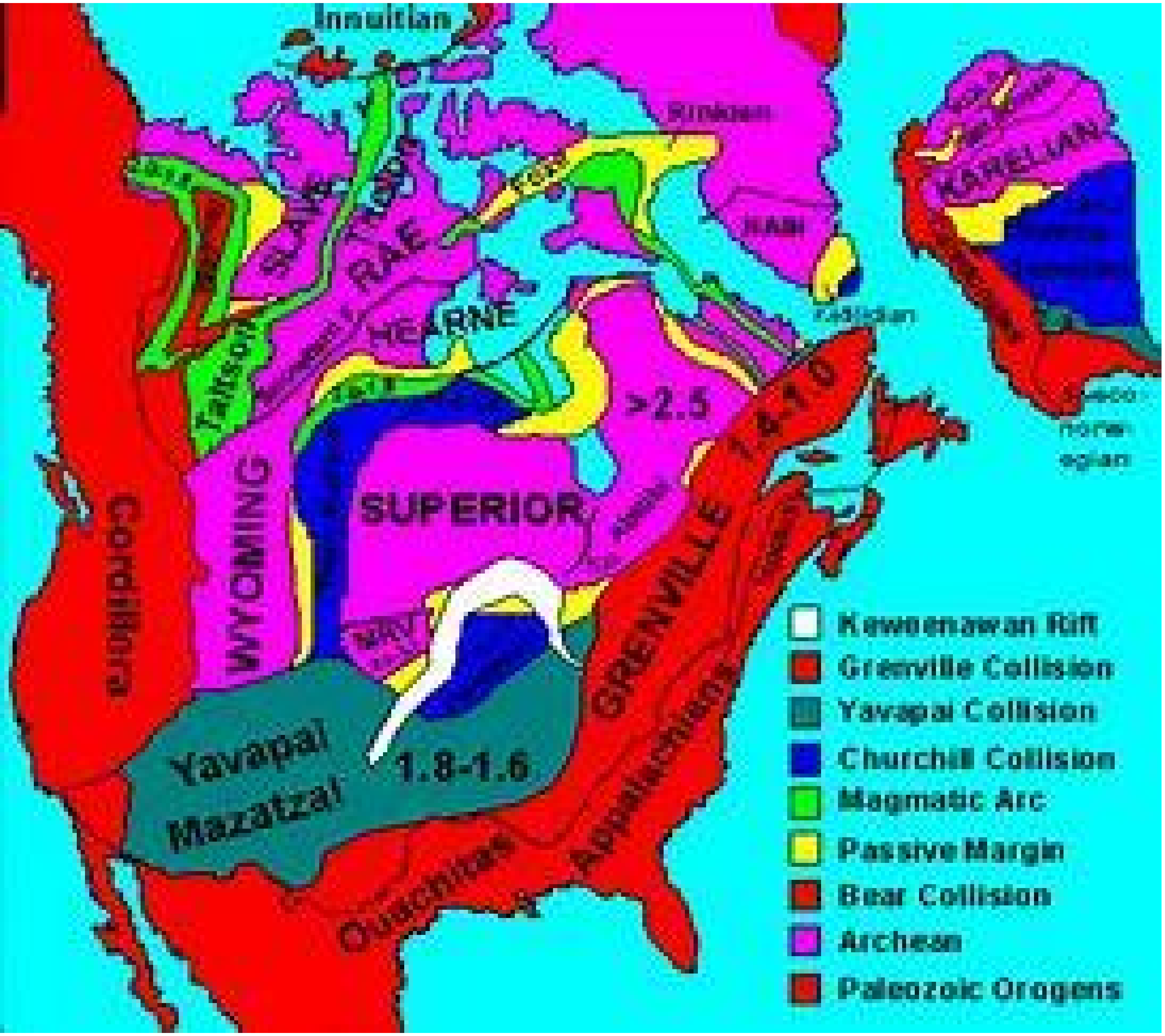
Interestingly all the Ages of Human History are discussed and labeled by the geologic materials used:

The **Paleolithic** (Old Stone Age), The **Neolithic** (New Stone Age), The **Copper Age**, The **Bronze Age**, The **Iron Age**, and The **Atomic Age**. Even the modern period of human history is referred to as **The Silcon Age**



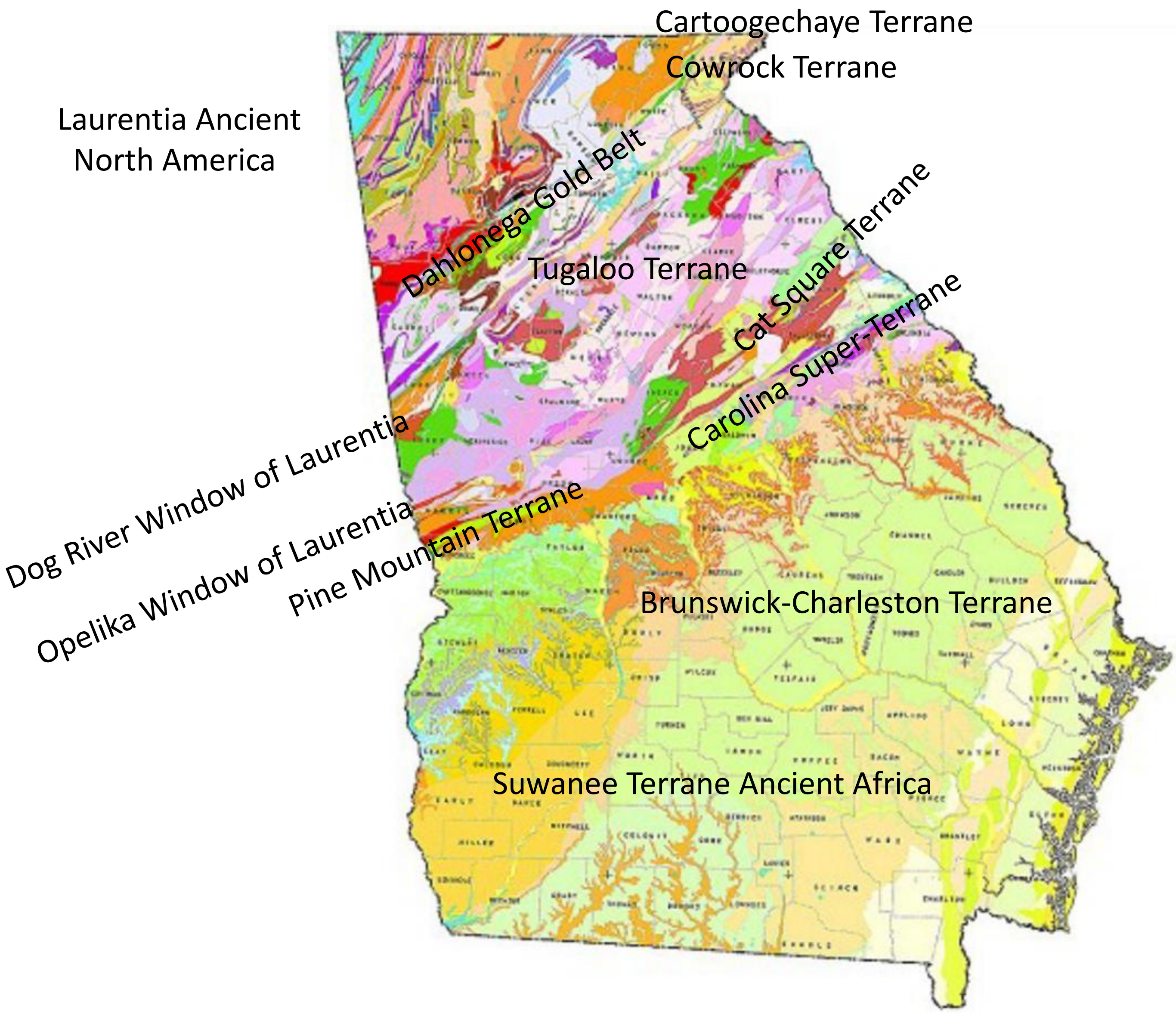
Eons
Eras
Phanerozoic
Precambrian
Proterozoic
Archean
Hadean
Cenozoic
Mesozoic
Paleozoic
Neoproterozoic
Mesoproterozoic
Paleoproterozoic
Neoarchean
Mesoarchean
Paleoarchean
Eoarchean
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Millions of years ago
Eras
Periods
Quaternary
Tertiary
Cretaceous
Jurassic
Triassic
Permian
Carboniferous
Pennsylvanian
Mississippian
Devonian
Silurian
Ordovician
Cambrian
0
50
100
150
200
250
300
350
400
450
500
Millions of years ago
© Geology.com
EONOTHEM / EON
ERATHEM / ERA
SYSTEM,SUBSYSTEM / PERIOD,SUBPERIOD
SERIES / EPOCH
Age estimates of boundaries in mega-annum (Ma) unless otherwise noted
Phanerozoic
Cenozoic (Cz)
Quaternary (Q)
Tertiary (T)
Neogene (N)
Paleogene (Pg)
Holocene
Pleistocene
Pliocene
Miocene
Oligocene
Eocene
Paleocene
Upper / Late
11,700 ±99 yr*
2.588*
5.332 ±0.005
23.03 ±0.05
33.9 ±0.1
55.8 ±0.2
65.5 ±0.3


EURASIAN
PLATE
NORTH
AMERICAN
PLATE
EURASIAN PLATE
PLATE
GORDA PLATE
ANATOLIAN PLATE
PHILIPPINE PLATE
PACIFIC
PLATE
RIVERA PLATE
CARIBBEAN PLATE
ARABIAN PLATE
COCOS PLATE
JUAN DE FUCA
INDIAN PLATE
NAZCA
PLATE
SOUTH
AMERICAN
PLATE
AFRICAN PLATE
AUSTRALIAN
PLATE
AUSTRALIAN
PLATE
SCOTIA PLATE
WORLD TECTONIC PLATES
ANTARCTIC PLATE



GREAT LAKE OROGENIES

Algoman-Kenoran	**2700-2500 MYA**
Hudsonian	**2000-1900 MYA**
Penokean	**1850-1800 MYA**



APPALACHIAN OROGENIES

Greenville 1300-1000 MYA
Larentia fully formed sediments buried in collision intruded by granite (Red Top Mtn)

Taconic 460-430 MYA
Volcanic Island Arc (Dahlonega Gold Belt) collides with Laurentia accreting the sea floor between (Catoogechaye & Cowrock)

Acadian 400-360 MYA
Volcanic Island Arcs (Tugaloo, Cat Square, Carolina Super Terrane-Pine Mountain) Collide with North America

Alleghenian 325-260 MYA
Africa & Europe collide with Laurentia forming Pangaea (Brunswick-Charleston & Suwanee)

PALEO GEOGRAPHY

The past positions of the continents can be determined using the following five lines of evidence: paleomagnetism, linear magnetic anomalies, paleobiogeography, paleoclimatology, and geologic history.

Paleomagnetism. By measuring the remanent magnetic field often preserved in iron-bearing rock formations, paleomagnetic analysis can determine whether a rock was magnetized near the Pole or near the Equator. Paleomagnetism provides direct evidence of a continent's N-S (latitudinal) position, but does not constrain its E-W (longitudinal) position.

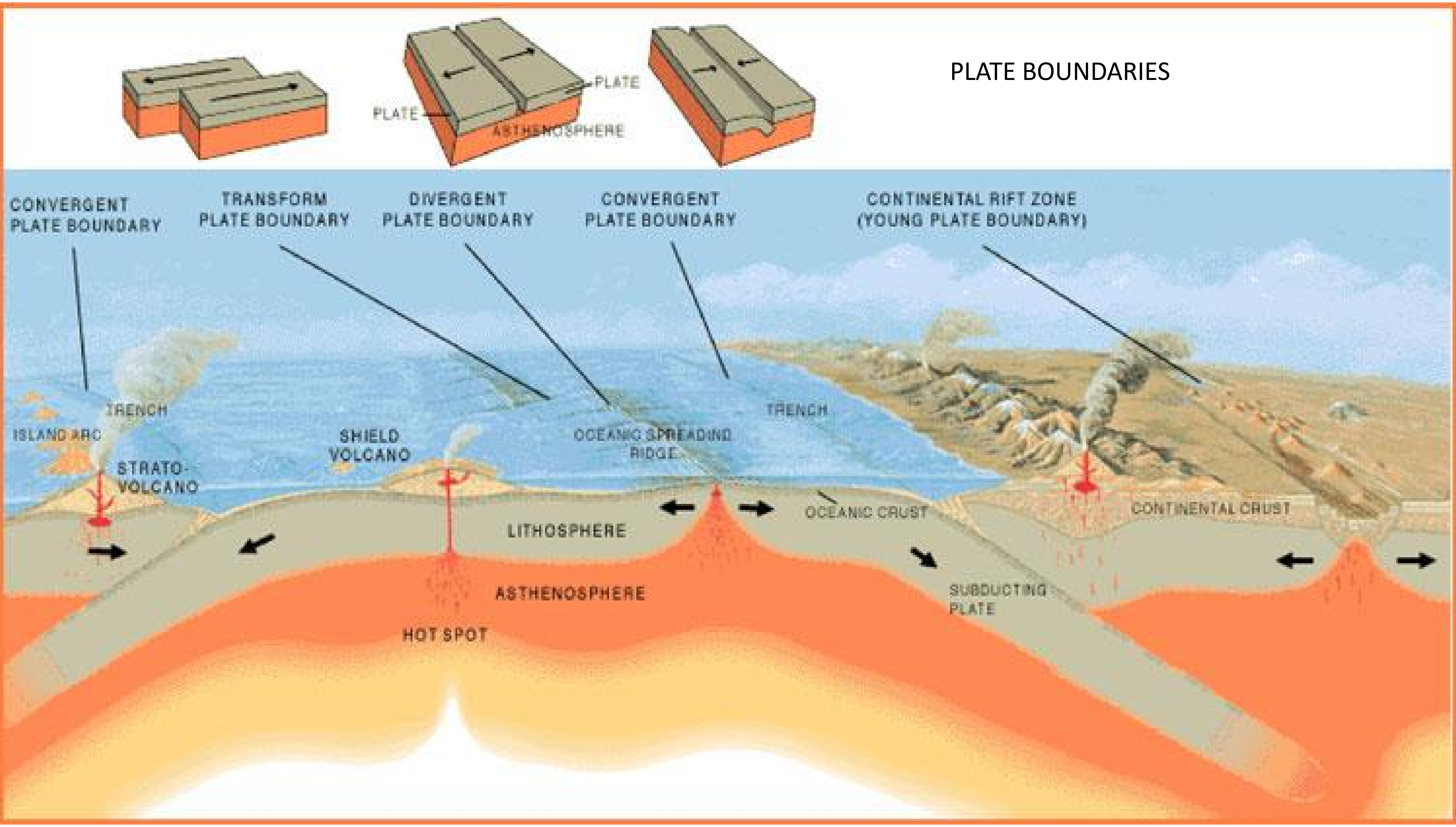
Linear Magnetic Anomalies. The Earth's magnetic field has another important property. Like the Sun's magnetic field, the Earth's magnetic field "flips" or reverses polarity. Fluctuations, or "anomalies", in the intensity of the magnetic field, occur at the boundaries between normally magnetized sea floor, and sea floor magnetized in the "reverse" direction. The age of these linear magnetic anomalies can be determined using fossil evidence and radiometric age determinations. Because these magnetic anomalies form at the mid-ocean ridges, they tend to be long, linear features (hence the name "linear magnetic anomalies") that are symmetrically disposed about the ridges axes. The past positions of the continents during the last 150 million years can be directly reconstructed by superimposing linear magnetic anomalies of the same age.

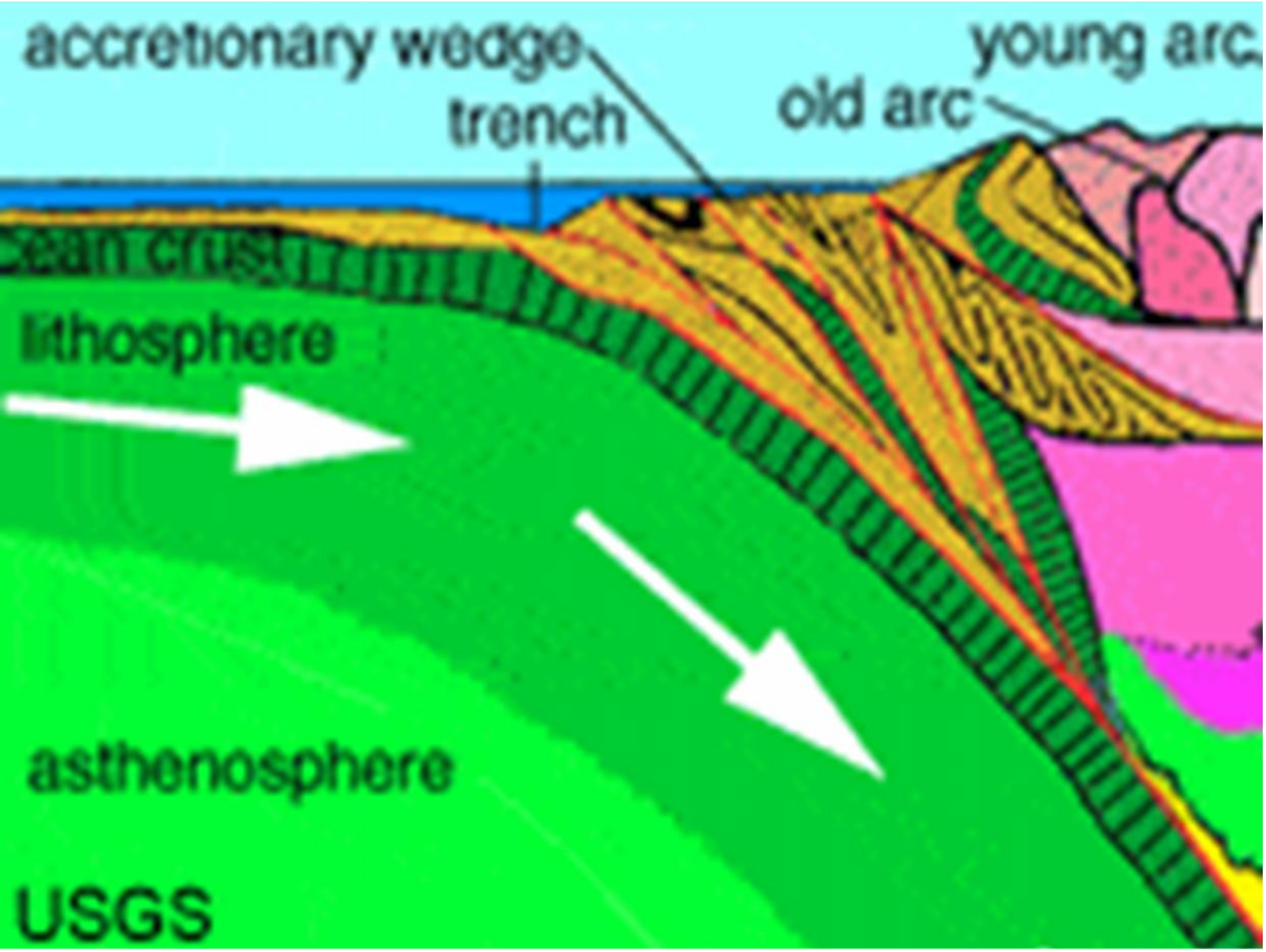
Paleobiogeography. The past distribution of plants and animals can give important clues concerning the latitudinal position of the continents as well as their relative positions. Cold-water faunas can aften be distinguished from warm-water faunas, and ancient floras both reflect paleo-temperature and paleo-rainfall. The similarity or dissimilarity of faunas and floras on different continents can be used to estimate their geographic proximity. In addition, the evolutionary history of groups of plants and animals on different continents can reveal when these continents were connected or isolated from each other.

Paleoclimatology. The Earth's climate is primarily a result of the redistribution of the Sun's energy across the surface of the globe. It is warm near the Equator and cool near the Poles. Wetness, or rainfall, also varies systematically from the equator to the pole. It is wet near the equator, dry in the subtropics, wet in the temperate belts and dry near the poles. Certain kinds of rocks form under specific climatic conditions. For example coals occur where it is wet, bauxite occurs where it is warm and wet, evaporites and calcretes occur where it is warm and dry, and tillites occur where it is wet and cool. The ancient distribution of these, and other, rock types can tell us how the global climate has changed through time and how the continents have travelled across climatic belts.

Geologic and Tectonic History. In order to reconstruct the past positions of the continents it is necessary to understand the development of the plate tectonic boundaries that separate continents and bring them back together again. Only by understanding the regional geological and tectonic evolution of an area can you determine the location and timing of rifting, subduction, continental collision and other major plate tectonic events.

PLATE BOUNDARIES

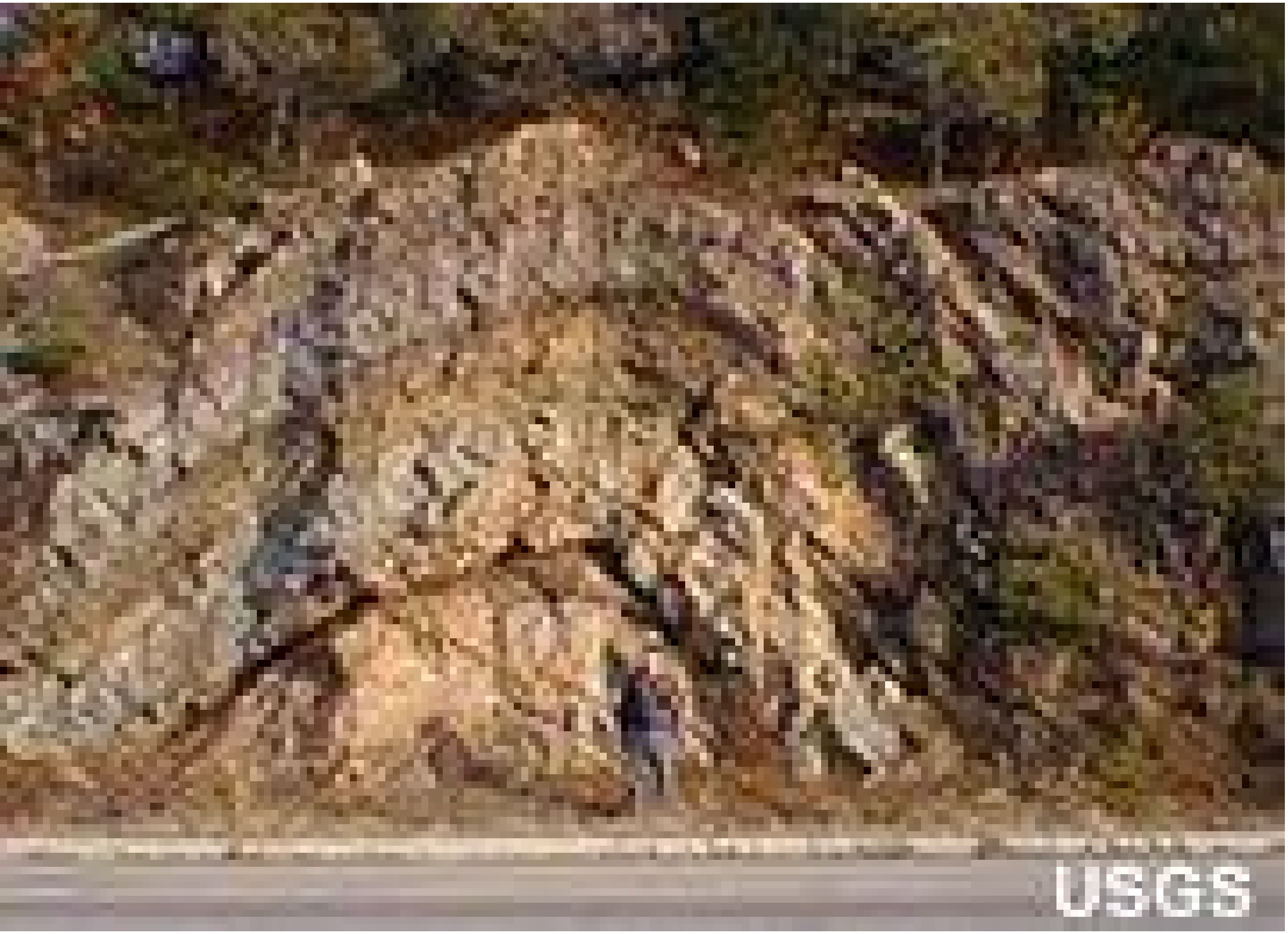




Accretionary Wedge

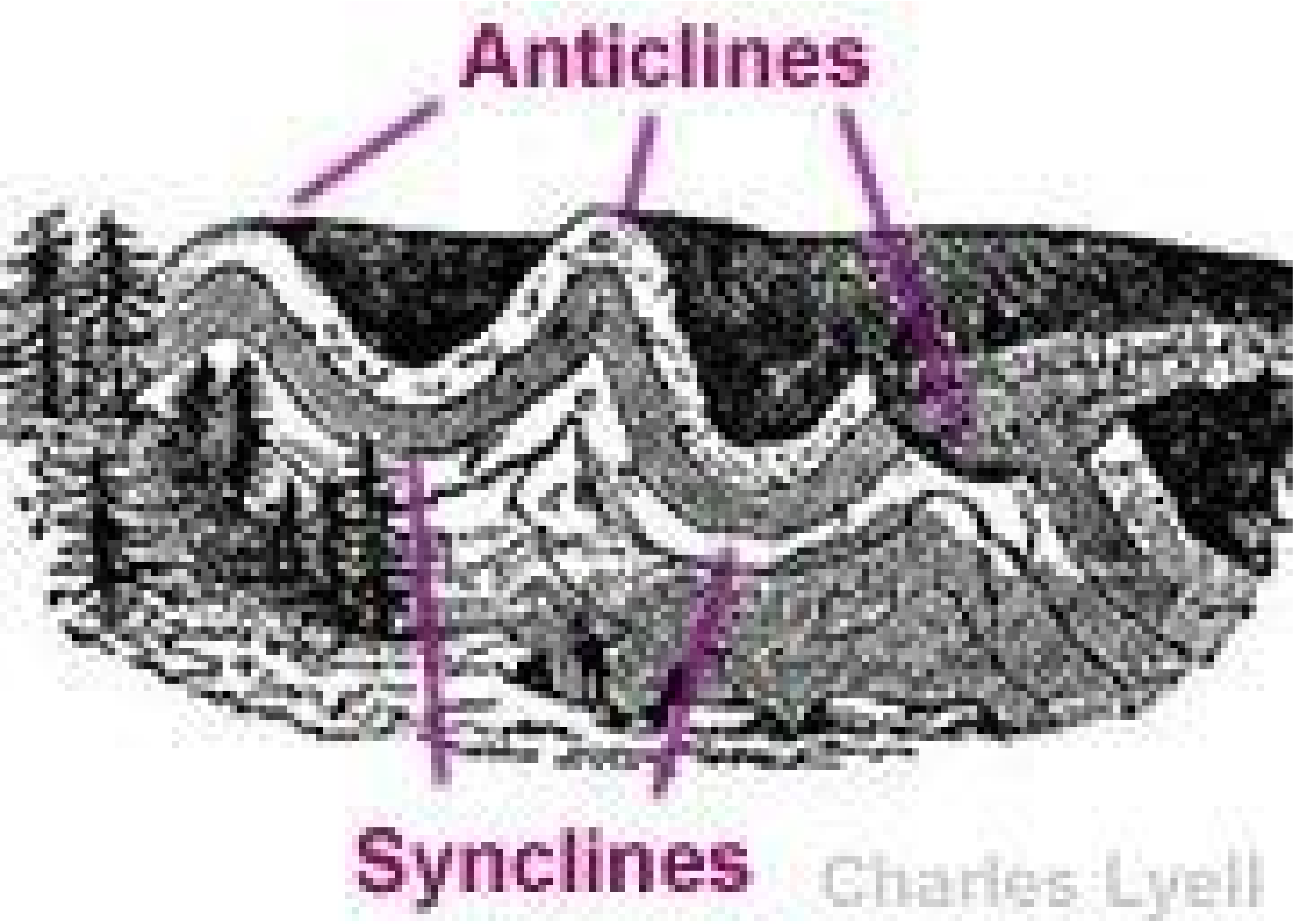
A mass of sea floor sediment that accumulates at the boundary between a converging oceanic plate and continental plate. This sediment is being scraped off the top of the oceanic plate as it is forced under the continental plate. It "accretes" at the point of plate collision, and that is where the name originates.

OLYMPIC PENINSULA



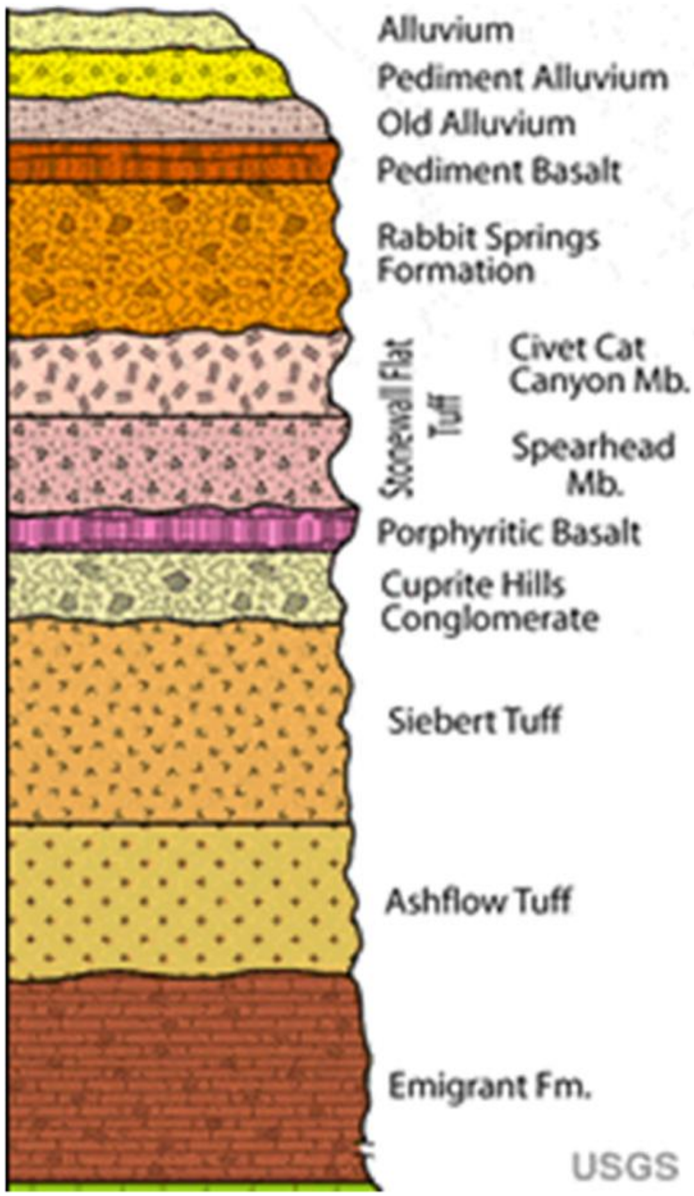
Anticline
A fold in rock strata with a convex upward shape. The rocks in the core of an anticline are the oldest. The anticline in the photo is along New Jersey Route 23 near Butler, NJ.

NW GEORGIA
Anticlines are the valleys

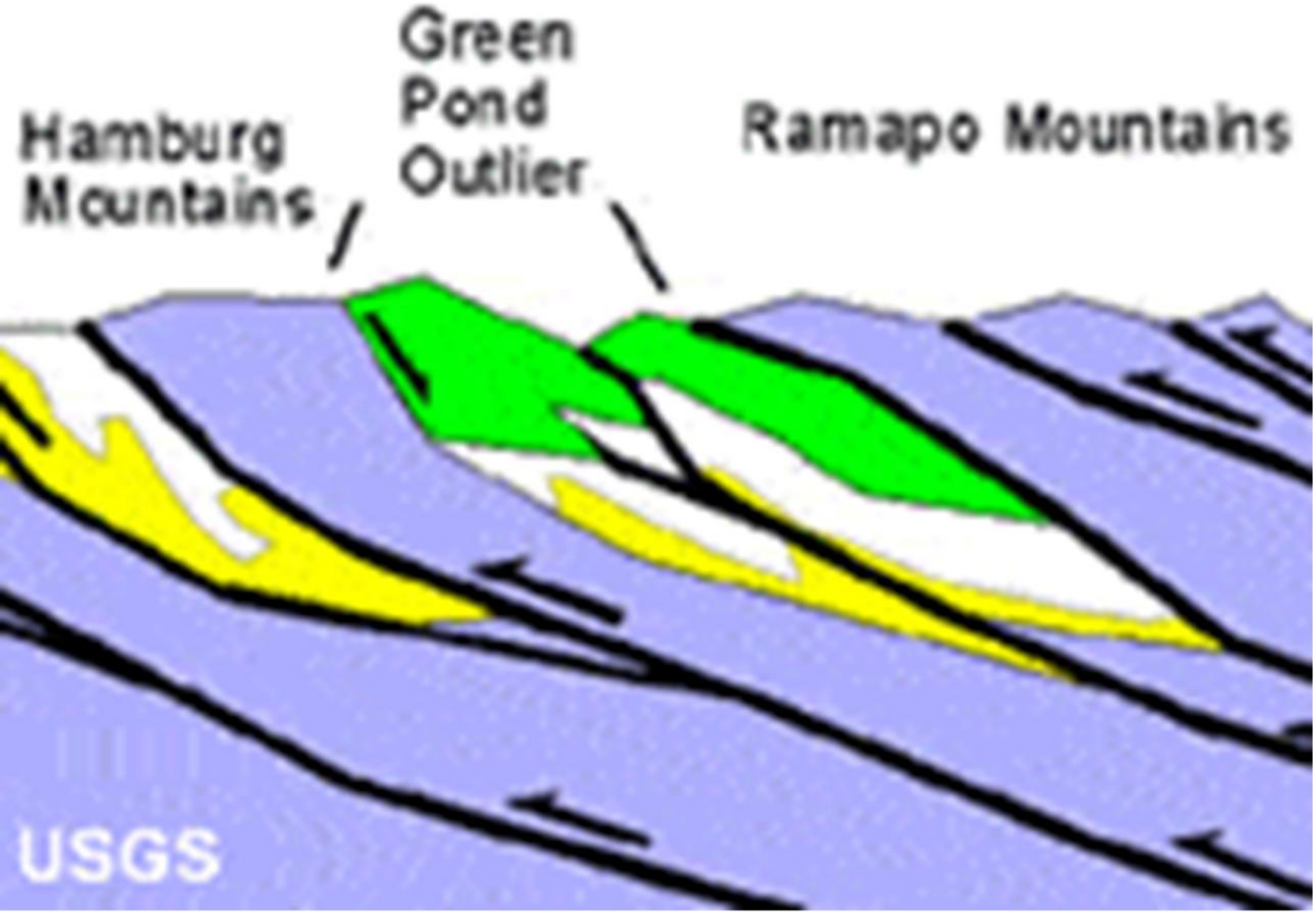


Syncline
A trough-shaped fold with youngest strata in the center. Sketch by Sir Charles Lyell.

NW GEORGIA
Synclines are the mountains



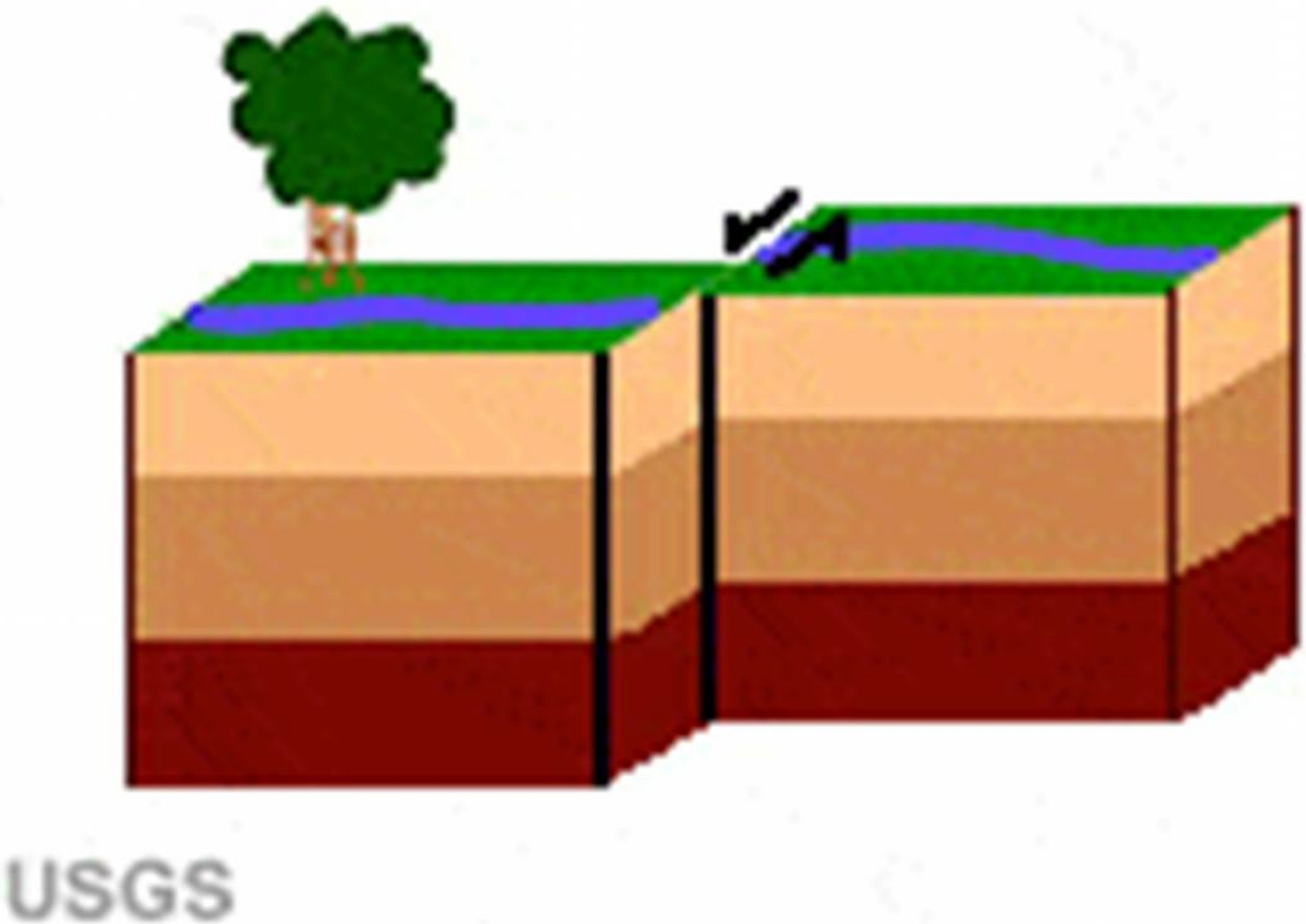
Stratigraphic Column
A diagram that shows the vertical sequence of rock units present beneath a given location with the oldest at the bottom and youngest at the top. They are typically drawn to approximate scale with proportional rock unit thicknesses. Colors and standardized symbols are usually added to graphically communicate rock types and some of their more important features. Geologic columns prepared for regions will have generalized thicknesses and rock unit features that show relationships that change over distance.



Thrust Fault
A reverse fault that has a dip of less than 45 degrees. A reverse fault is a fault with vertical movement and an inclined fault plane. The block above the fault has moved upwards relative to the block below the fault. Thrust and reverse faults are the typical structural style of convergent plate boundaries and portions of the crust that are under compression.

GEORGIA

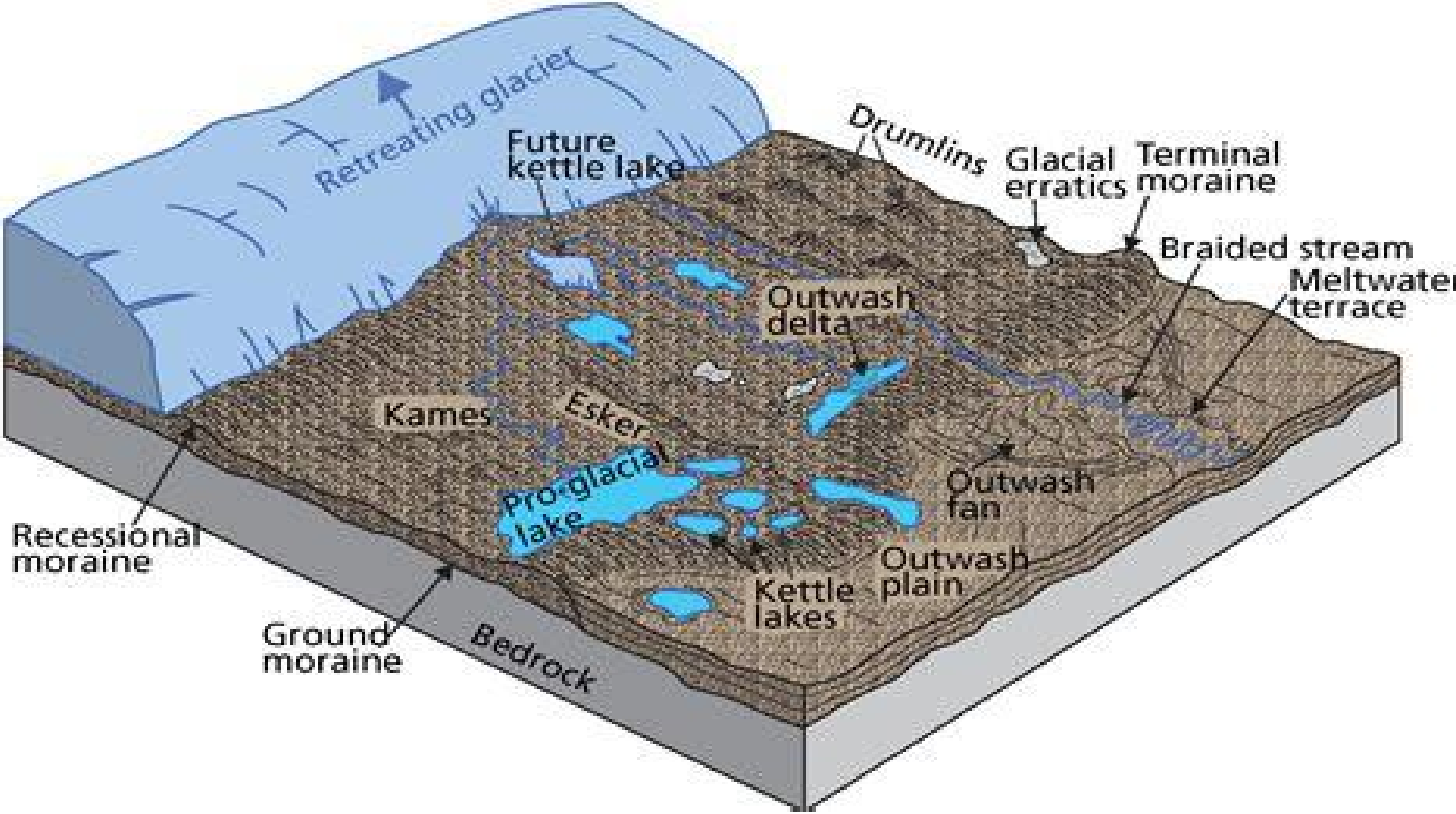
Blue Ridge Thrust Fault



Strike-Slip Fault
A fault with horizontal displacement. Strike-slip faults are typically vertical or near vertical and are typically caused by shear stress. They are the typical fault of transform plate boundaries. The **San Andreas Fault** is the world's most famous example of a strike-slip fault.

GEORGIA

Brevard Fault
Goat Rock Fault
Others



Retreating glacier
Future kettle lake
Drumlins
Glacial erratics
Terminal moraine
Braided stream
Meltwater terrace
Outwash delta
Kames
Esker
Pro-glacial lake
Outwash fan
Recessional moraine
Kettle lakes
Outwash plain
Ground moraine
Bedrock

Terminal Moraine
A mound of unsorted glacial till that usually crosses a valley and marks the furthest advance of a **glacier**. Also called an "end moraine." The photo shows the terminal moraine of the Nellie Juan Glacier near Prince William Sound, Alaska. The two-mile-long lagoon between the terminal moraine and the glacier's terminus is filled with seawater.

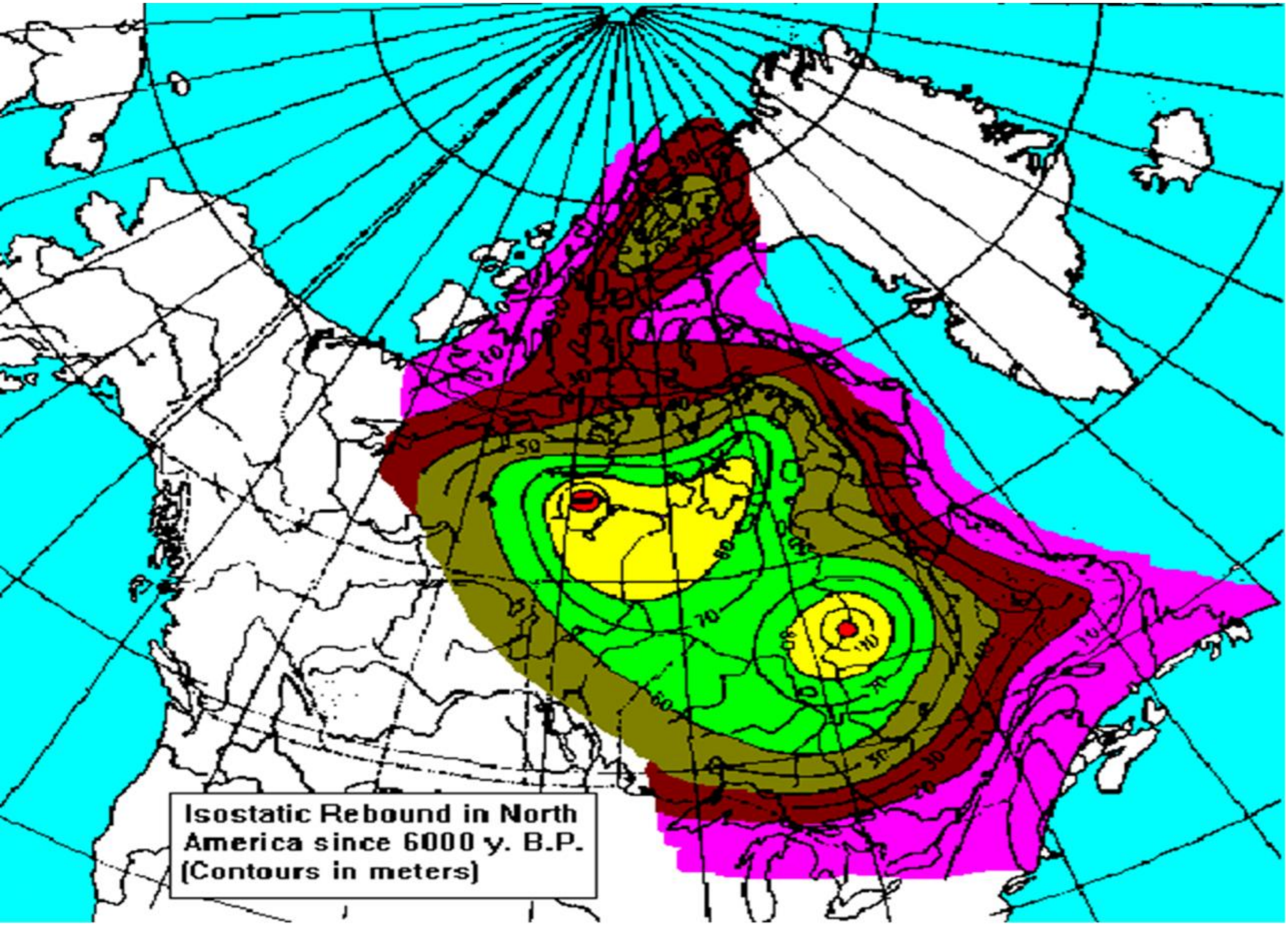
USA

Long Island
Cape Cod

Esker
A long winding ridge of sorted **sands** and gravel. Thought to be formed from sediment deposited by a stream flowing within or beneath a **glacier**.

Drumlin

A low, smoothly rounded, elongate hill. Drumlins are deposits of compacted till that are sculpted beneath the ice of a flowing **glacier**. The long axis of a drumlin parallels the flow direction of the ice.



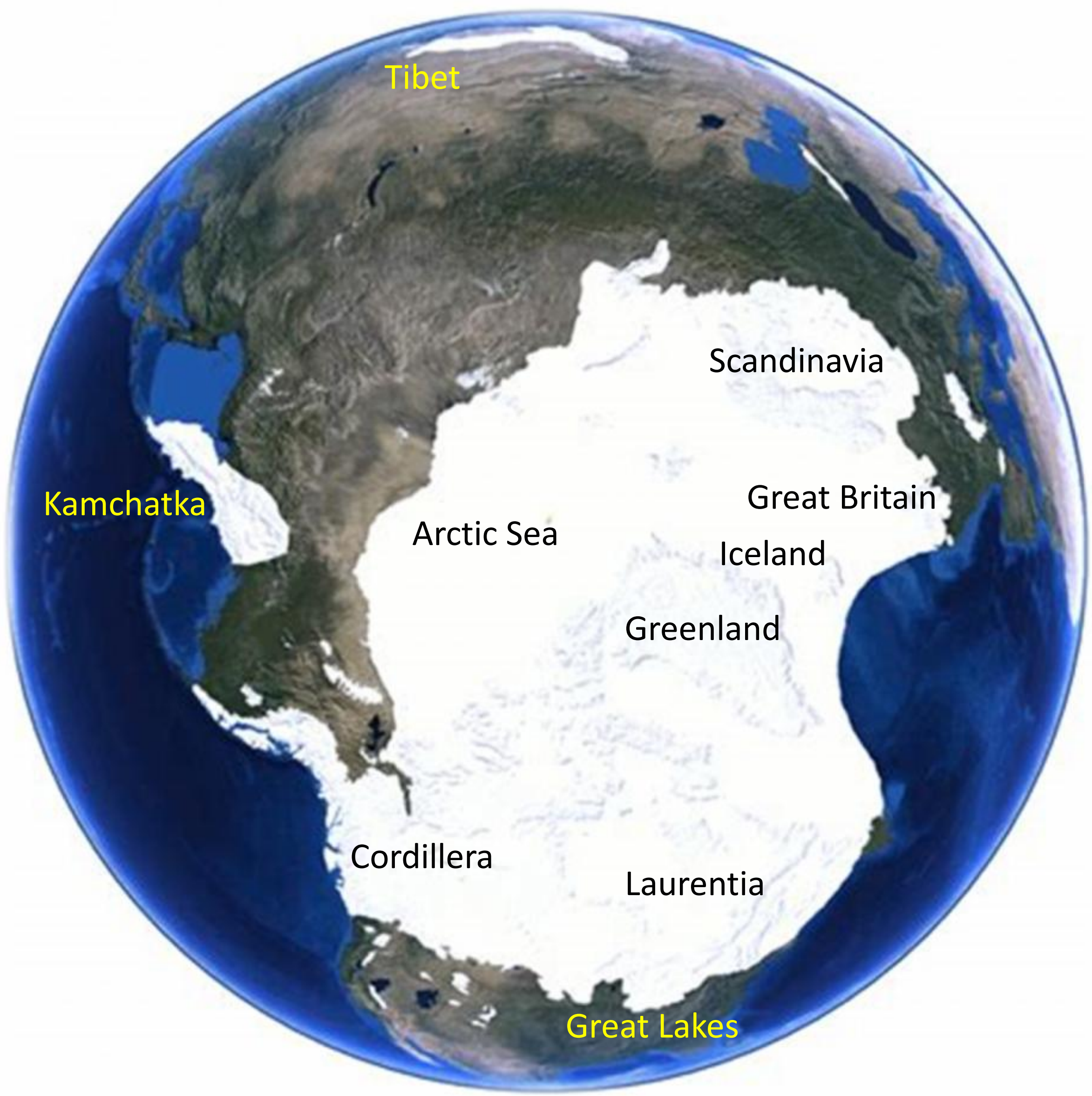
Glacial Rebound
A very gradual uplift of Earth's crust that occurs after the weight of a thick continental ice sheet (which produced subsidence) has melted away.

Eustatic Sea Level Change

A rise or fall in sea level that affects the entire earth. Thought to be caused by an increase/decrease in the amount of available water or a change in the capacity of ocean basins. At the present time glacial and polar melting is causing a slow but steady **sea level rise** which is having an impact on coastal communities.

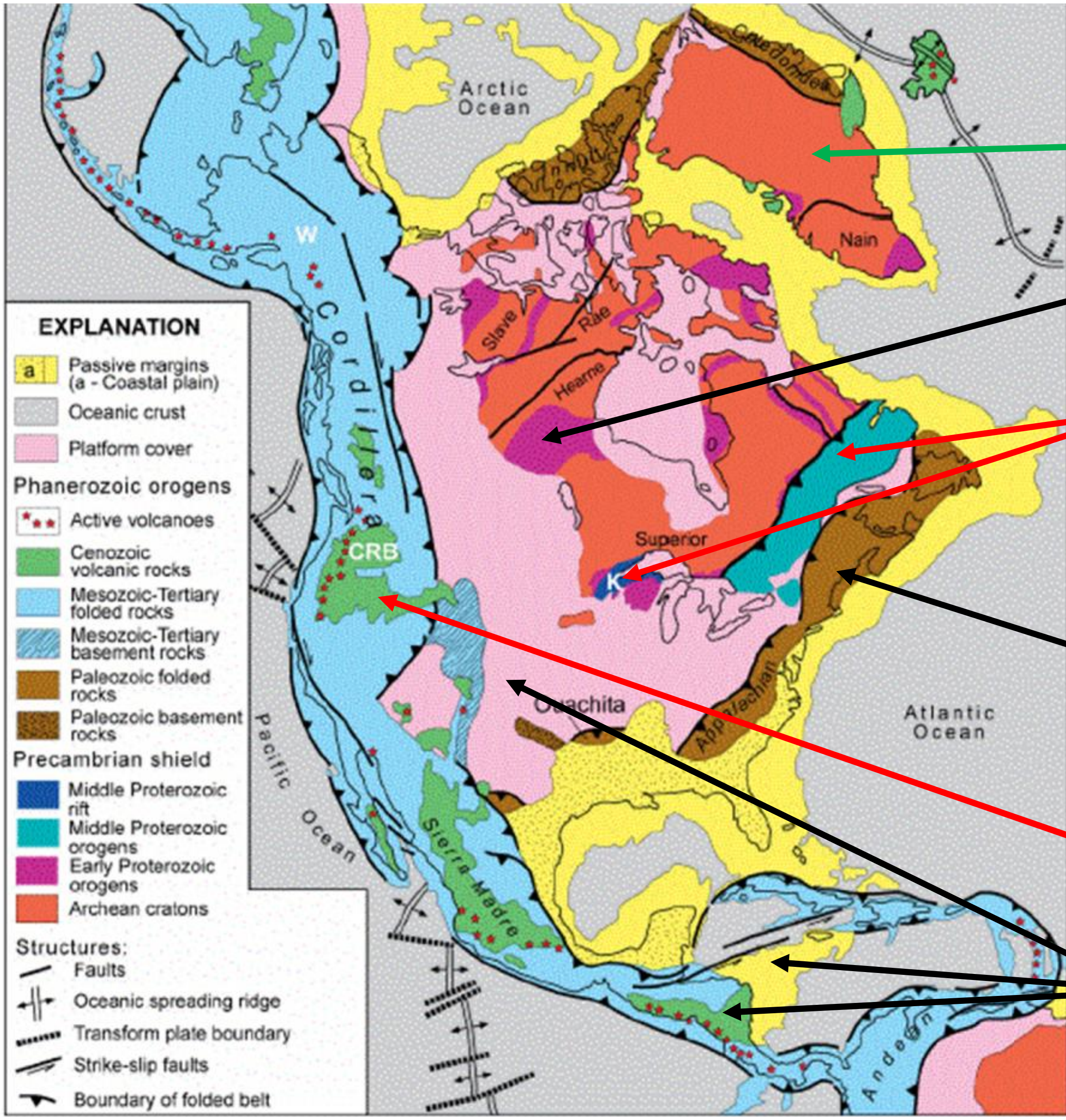
OTHER TYPE OF SEA LEVEL RISE

RELATIVE



GLACIAL MAXIMUM

The Laurentian, Greenland, and Scandinavian Ice Caps Merged to create a huge continuous ice sheet covering from 26 to more than 30 million square kilometers or 10-12 million square miles.



GEOLOGIC MAP of NORTH AMERICA

ARCHEAN
4,000 MYA to 2,500 MYA

PALEOPROTEROZOIC
2,500 MYA to 1,600 MYA

MESOPROTEROZOIC (Greenvile Orogen)
1,600 MYA to 1,000 MYA

NEOPROTEROZOIC
1,000 MYA to 542 MYA

PALEOZOIC (Taconic, Acadian-NeoAcadian-Alleghany)

542 MYA to 251 MYA

MESOZOIC
251 MYA to 65.5 MYA

CENOZOIC
65.5 MYA to Present

GEOLOGIC MAP of KENTUCKY