

PLATE TECTONICS, ETC.

- 4.54 BY Age of the earth. The Hadean Eon: 4.54-3.8 BYA.
- 4.4 BYA Theia collides with earth. The Earth became molten again. Part of it formed the Moon and the earth was changed afterward. Surface solidified, water had begun forming on the surface. Ancient zircons contain water molecules. One idea is that most of our water came from meteorites and comets.
- 4.0 BYA Water vapor and CO² filled the atmosphere. It began raining and continued for millions of years. 90% of the surface was water with some volcanic islands. Temperatures were greater than 200°F. Volcanic activity began and granite began to be made from basalt mixed with super-heated water. Granite could withstand ocean erosion.
- 3.8 BYA Archaean Eon: 3.8-2.5 BYA. Precambrian Era. Bacteria and algae.
- 3.4 BYA Huge green (from minerals- ie: iron, etc) oceans dominated. Present-day southern Africa was a pluton of granite. Granite proto-continents grew.
- 2.5 BYA Proterozoic Eon: 2.5 BYA- 542 MYA. By this time, stromatolites had appeared and the algae began putting oxygen into the atmosphere. We still have stromatolites today (ie: off of Australia's Shark Bay). In these, algae causes growth layer by layer. Photosynthesis turns sunlight into oxygen. As iron left the green oceans, they turned blue. With iron deposition, banded iron formations became the source for most of our iron ores.
- 1.85 BYA Sudbury impact crater, named after the nearby Canadian city, occurred in the ocean and may have affected the concentrations of dissolved oxygen in the deep sea and stopped the deposition of the banded iron formations.

- 1.5 BYA The continents were on the move. Identical fresh water Trilobites are found in the eastern United States and in Britain. Wegener proposed continental drift- plate movement. U. S. Navy sea floor mapping showed mid-ocean rifts. Plate tectonics. Oceanic plates drag the continents with them. Iceland has “fissure eruptions”, surface manifestations of plate rifts. Plates move @2.5 cm/year.
- 1.0 BYA Rodinia- super continent formed. Probably the US and Canada were the heart with other segments bunched around. The surface was bare. No animals or plants on land yet. Rodinia blocked ocean circulation.
- 800 MYA Breakup of Rodinia.
- 710 MYA Southern half of planet was landmass, northern half was ocean. This limited ocean currents, causing ice sheets. Polar regions froze- “Snowball earth”. Glaciers were 1 mile deep. Whole planet covered, caused extinction of most species (90%). Life forms left at this time: stromatolites and other bacteria.
- 650 MYA Volcanic eruptions beneath the ice caused breakup of the ice and increase of oxygen.
- 640 MYA Another snowball Earth.
- 630 MYA Rodinia broke into fragments. Greenhouse effect. Shallow seas opened and marine life became more diverse.
- 550 MYA The continents possibly joined together again to form Pannotia (Vendia).
- 545 MYA Phanerozoic Eon: 542 MYA- today. Cambrian Period: 542-495/* MYA (Paleozoic Era).
- 500 MYA Cambrian life explosion- ie: fossils in Burgess Shale found in Canadian Rockies by Walcott. Modern animals had arrived. Over next 100 MY, oxygen increased to present day levels and ozone layer formed for first time.
- 495 MYA Ordovician Period.

- 450 (mid-Ordovician)- 350 (late Devonian) MYA Appalachians grew from a vanished ocean.
- 440 MYA Silurian Period.
- 415 MYA Devonian Period.
- 400 MYA First plants moved onto land but only along waterways (water dependent). Had spores. Gymnosperm- wind blown pollen from cones to female pistils. Conifers. Ozone layer formed, allowing animals to move onto land.
- 380 MYA Europe and Africa collided with eastern North America.
- 360 MYA Oxygen 20% lower than today.
- 355 MYA Mississippian Period (Carboniferous). Large plants occupied the land surface. Swamp land dominated for the next 60 MY. Results: coal. Fresh water swamps prevented plants from decaying.
- 325 MYA Pennsylvanian Period.
- 310 MYA Late Mississippian, ancestral Rockies began uplift. Trees began.
- 300 MYA Fresh water decomposition let plant debris be preserved to turn into coal with pressure and heat. Twice as much oxygen in air as today. Helped species of ant grow big, queen had 5" wing span.
- 290 MYA Permian Period.
- 270 MYA Late Permian. Plates have formed Pangea. The center is a vast desert (pre-Sahara). Panthalassa Ocean (Pacific), Tethys Sea (pre-Mediterranean Sea) Volcanic activity heats the atmosphere. Oxygen-rich environment.
- 251 MYA What is now Siberia had massive volcanic eruptions, lasted @1 MY. Poison gasses released, 95% of species died out.
- 245 MYA Triassic Period (Mesozoic Era).

- 240MYA Pangea was dominated by dinosaurs.
- 230 MYA Pangea began breaking up.
- 225 MYA A meteor hit the pre-Sahara desert, fusing a lot of sand into glass.
- 205 MYA Jurassic Period. N. America and Greenland split. Angiosperms developed- flowering plants. Pollen to female pistils.
- 200 MYA Breakup of Pangea continuing- 2 rifts: east to west- Laurasia (N. America and Eurasia) and Gondwana; north to south- S. America and Africa split from Antarctica, Australia and India. New York and Monaco were neighbors- have same basalt rocks. This was the beginning of the north Atlantic. Slightly later, India split away.
- 180 MYA The split-up of Pangea was accompanied by increased volcanic activity, greenhouse gasses (CO²) promoted rain forests. The break-up split the pre-Sahara desert between Africa and South America.
- 140 MYA Cretaceous Period.
- 100 MYA Volcanism coincided the breakup with diamond-bearing volcanic pipes, originating @100 miles below surface. Kimberlite mineral from Kimberly Mine in Africa.
- 95 MYA Tropical climate, vegetation lush. Inland sea (Tethys) began due to separation of Africa and S. America. Then, due to uplift, Tethys flowed into Mediterranean Sea.
- 90 MYA Land south of Albuquerque was a swamp. Cretaceous seaway started forming. Zuni Ceratops first appeared.
- 68 MYA Tyranasaurus Rex arrived.

- 65 MYA Paleocene Epoch- Tertiary Period (Cenozoic Era). End of Cretaceous Period. Asteroid ,@6 mile wide (bigger than Mt. Everest) hitting at @30°, impact caused mass extinction, 70% of species perished, including the dinosaurs. Iridium concentrated in KT boundary. Luis and Walter Alvarez discovered the increased presence of iridium in this “tombstone” layer. At same time, massive lava eruptions in western India. The rupture between S. America and Africa is complete. Greenland detached from Europe. Inland sea retreated and seaway dried up. Climate was hot. Triceratops are giants now. S. Dakota is a primeval forest.
- 57 MYA Eocene Epoch. Ancestral Rocky Mountains was a vast highland of bold mountains and deep structural basins.
- 50 MYA Mammals began to flourish. Collision of Africa and Europe caused Alps (now 3 miles above sea level). Evidence: quartz grains stretched from deformation. Matterhorn is a child of two continents- top is a piece of Africa, the base is European.
- 35 MYA Oligocene Epoch. Ancestral Rockies were largely peneplained with a few monadnocks to mark the highest parts of the old ranges. The earth was hotter, pre-polar ice caps.
- 23 MYA Miocene Epoch. Ancestral Rockies region began to rise as a broad, gentle arch.
- 6 MYA Grand Canyon began due to Colorado Plateau uplift and erosion by the Colorado River. The uplift was caused by the Pacific Plate pushing against the North American Plate.
- 5 MYA Pliocene Epoch.
- 2 MYA Man appeared. Volcanoes in today’s Panama completed the land bridge between north and south America. Tectonics had changed the ocean currents and the ice ages began. Carved the Great Lakes. New York City Central Park shows glacial scars. The ice was twice as thick as the Empire State Building is tall.

1.6 MYA Pleistocene Epoch- Quaternary Period.

.1 MYA A 1° shift in the earth's axis caused the Sahara to green up.

.01 MYA Holocene Epoch.

.005 MYA The earth shifted back and the desert re-formed.

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