

# Timebook, *a guide to Timescale*

<p><b>Cryptic Era</b> 4,570,000,000 years ago 0.00 feet</p>	<p>○ <b>The Earth accreted</b>, its interior differentiated and its molten surface solidified during the Cryptic era.</p> <p>This era is referred to as “Cryptic” because very little geological evidence has survived. Most geological landforms and rocks were probably destroyed in the early bombardment phase, or by the continued effects of plate tectonics. Oldest known minerals are from the Cryptic era.</p> <p><b>4,400,000,000 Years ago: Mars-sized planet impacts Earth, results in Earth-Moon system.</b></p>
<p><b>Basin Groups Era</b> 4,150,000,000 years ago 485.25 feet</p>	<p>○ Oldest rocks on earth date to 4,030,000,000 years ago.</p> <p>Large basins on the Earth’s moon formed by massive impacts.</p> <p>The <b>first lifeforms and self-replicating RNA may have evolved</b> on Earth during this time.</p>
<p><b>Nectarian Era</b> 3,920,000,000 years ago 750.98 feet</p>	<p>○ Nectaris Basin and other major lunar impact basins are formed. <b>Earth’s history relatively unknown.</b></p>
<p><b>Lower Imbrian Era</b> 3,850,000,000 years ago 831.86 feet</p>	<p>○ The Late Heavy Bombardment of the inner solar system saturates the Earth and Moon with impacts, <b>“sterilizing” the planet’s surface and any evidence of life.</b></p>
<p><b>Eoarchean Era</b> 3,800,000,000 years ago 889.63 feet</p>	<p>○ <b>Simple single-celled life (bacteria and possibly archaea) evolves.</b> The oldest probable microfossils date to this Era.</p>
<p><b>Paleoarchean Era</b> 3,600,000,000 years ago 1,120.70 feet</p>	<p>○ Oldest cratons (old and stable interior regions of continents that survived splitting and merging of continents), including the Canadian Shield, are dated to this period.</p> <p><b>First known oxygen-producing bacteria evolve.</b> Oldest definitive microfossils.</p>
<p><b>Mesoarchean Era</b> 3,200,000,000 years ago 1,582.84 feet</p>	<p>○ First stromatolites, layered bacterial “mats” that survive in the fossil record, are dated to this period. <b>Cyanobacteria, aka “blue-green algae” are common</b> in stromatolites.</p>
<p><b>Neoproterozoic Era</b> 2,800,000,000 years ago 2,044.99 feet</p>	<p>○ Stabilization of most modern cratons (old and stable interior regions of continents). From this point onward, <b>plate tectonics leads to considerable geologic upheaval</b> primarily on continental margins.</p>

- Paleo-Proterozoic Era**  
2,500,000,000 years ago  
2,391.60 feet
- **First complex single-cellular life, including protists with nuclei.**  
**Oxygen Catastrophe**, aka Great Oxygenation or Oxygen Revolution, dates to approximately 2,400,000,000 years ago. During this time, an explosion of oxyphotosynthesis by evolving single-cellular life, particularly blue-green algae or cyanobacteria, resulted in a massive buildup of oxygen in the atmosphere (to approximately 21%). **Prior to this time, the level of oxygen in Earth's atmosphere (0.02%) was similar to that on Mars. This buildup was the gateway to widespread biological evolution.** The Oxygen Catastrophe is clearly demarcated in the geological record by the introduction of large amounts of oxygenated iron (rust) called banded iron formations.
- Meso-Proterozoic Era**  
1,600,000,000 years ago  
3,431.42 feet
- Rodinia supercontinent formed. **Green algae colonies spread across the seas.**
- Neo-Proterozoic Era**  
1,000,000,000 years ago  
4,124.64 feet
- **Possible “Snowball Earth” period, from 790,000 to 630,000 MYA (Million Years Ago)**, during which the Earth was entirely covered by ice. A subject of intense debate amongst geologists/climatologists. Supercontinent Pannotia formed.
- Late in the Neo-Proterozoic, around 630,000 to 542,000 MYA, the **first multi-cellular organisms are found in the fossil record.** The Ediacaran biota, including bizarre worm-like creatures and sponges and the Hallucigenia worm, are preserved in fossilized mudslides in Canada. Ediacara wiped out in the extinction event that marks the start of the Cambrian.
- Cambrian Period**  
542,000,000 years ago  
4,653.79 feet
- **Tremendous diversification of life in the “Cambrian Explosion”** facilitated by widespread use of collagen connective tissue. **Animal phyla first appear** in the Early Cambrian. Trilobites, arthropods, brachiopods and crustaceans rule the oceans. The largest Cambrian animals are the Anomalocaridids, shrimp-like carnivores up to 6 feet long.
- Fungi colonize on land, but no significant terrestrial plants are present.
- Agnatha (jawless fish) and the **first Vertebrata** (animals with a braincase and backbone) evolve.
- Supercontinent Gondwana emerges. **Atmospheric carbon dioxide content roughly 25-30 times present day (Holocene).**

**Ordovician Period**

488,300,000 years ago  
4,715.84 feet

The early Ordovician was quite warm, particularly in the tropics. Trilobites' long reign of dominance falls off, giving way to a more mixed ecosystem of molluscs, brachiopods, corals and echinoderms. The first sea stars evolve in the Early Ordovician.

**The ice age at the end of the Late Ordovician was one of the coldest times on planet earth in the last 600,000,000 years.** Gondwana was located at the South Pole. Mass extinction events at the end of the Late Ordovician wipe out many species of planktonic life and other more complex species.

**Silurian Period**

443,700,000 years ago  
4,767.37 feet

Glaciers retreated and the Earth entered a relatively warm period. Sea levels dropped, resulting in evaporite formations throughout what is now North America. The first bony fish, Osteichthyes, swim in the warmer oceans. Diverse fauna of Eurypterids, also known as sea scorpions, related to modern-day horseshoe crabs, prowled the shallow seas of North America.

**The oldest known vascular plants grow on land.**

**Devonian Period**

416,000,000 years ago  
4,799.37 feet

The continent Euroamerica forms between Gondwana and Siberia, resulting in considerable uplift of the Appalachian mountains.

Seed bearing plants spread on land. The development of soils and plant root systems probably led to changes in the speed and pattern of erosion and sediment deposition.

Armored jawless fish decline, jawed fish thrive. Shallow, warm, oxygen-depleted Devonian inland lakes allow fish to form lungs and make their first short forays onto land. **In the late Devonian, lobe-finned fish evolve into well documented land-walking amphibians.** Tall dense forests spread across the land.

A recently discovered fossil of a fish embryo attached to its mother by an umbilical cord in 380 million year old Devonian strata provides the **earliest fossil evidence of vertebrates giving live birth to their young.**

The Late Devonian extinction event, possibly caused by widespread vegetation reducing CO2 content in the atmosphere, was one of the five largest extinction events in the Earth's history, impacting primarily marine life.

**Carboniferous Period**

359,200,000 years ago  
4,864.99 feet

**Highest atmospheric oxygen levels in the Earth's history.** Large primitive trees, first land vertebrates, and amphibious sea-scorpions live amid **coal-forming coastal swamps.** In the oceans, early sharks are common and quite diverse.

**Winged insects radiate suddenly, including species related to modern dragonflies with wingspans of over two feet.** It is often theorized that such creatures were able to survive due to increased oxygen levels in the atmosphere.

**Permian Period**

299,000,000 years ago  
4,934.55 feet

Landmasses have fully united into the **supercontinent Pangaea**, the most well-known of several supercontinents in the Earth's history.

Synapsid (mammal-like) reptiles become abundant, including pelycosaurs, giant carnivores up to 15 feet in length, and **therapsids from which mammals evolve**. Beetles and flies evolve.

**Permian-Triassic extinction event occurs 251 MYA: 95% of life on Earth becomes extinct. This “mother of all mass extinctions” is also known as the Great Dying.** Causes are unknown, but may include impact events, increased volcanism, or a sudden release of methane hydrates from the sea-floor.

**Triassic Period**

251,000,000 years ago  
4,990.00 feet

**Archosaurs, a group of reptiles, are dominant on land as dinosaurs, in the oceans as Ichthyosaurs and nothosaurs, and in the air as pterosaurs (pterodactyls).** Cynodonts, a sub-group of therapsids, become smaller and more mammal-like. Modern insect clades appear.

**Jurassic Period**

199,600,000 years ago  
5,049.39 feet

**Many types of dinosaurs**, such as sauropods, carnosaurs, and stegosaurus. Mammals common but quite small. **First distinct birds** and lizards.

Breakup of Pangaea into Gondwana and Laurasia. Nevadan orogeny in North America creates the granites seen today in the nearby Sierra Mountains. Atmospheric Carbon Dioxide levels 4-5 times the present day levels.

**Cretaceous Period**

145,500,000 years ago  
5,111.89 feet

**Flowering plants proliferate**, along with new types of insects. Many new types of dinosaurs (e.g. Tyrannosaurs, Titanosaurs, duck bills, and horned dinosaurs) evolve on land. Mosasaurs and modern sharks appear in the sea. Primitive birds gradually replace pterosaurs. Monotremes, marsupials and placental mammals appear.

Continued tectonic activity in Western North America forms the granites of Yosemite National Park and the Sierras. Break up of Gondwana. Beginning of Laramide and Sevier Orogenies which build the Rocky Mountains. Atmospheric Carbon Dioxide close to present-day levels.

**The Cretaceous ends with the Cretaceous–Tertiary extinction event (aka K-T Extinction Event) approximately 65.5 MYA (Million Years Ago). Many species, including the dinosaurs, pterosaurs, and large marine reptiles, disappeared.** Several impact craters and massive volcanic activity in the Deccan traps of India have been dated to the approximate time of the extinction event.

**Paleogene Period,  
Paleocene Epoch**  
66,500,000 years ago  
5,204.32 feet

○ Climate tropical. Modern plants appear; Mammals diversify into a number of primitive lineages following the extinction of the dinosaurs. **First large mammals (up to bear or small hippo size)**. Marsupials and Placentals migrate from North America to South America, and Marsupials continue on to Antarctica and Australia.

The Indian Subcontinent collides with Asia beginning uplift of the Himalayas.

**Paleogene Period,  
Eocene Epoch**  
55,800,000 years ago  
5,215.53 feet

○ Archaic **mammals flourish** and continue to develop. Appearance of several “modern” mammal families. **Primitive whales diversify, evolving from small hoofed land animals similar to deer**. First grasses.

Reglaciation of Antarctica and formation of its ice cap. Rocky Mountains are well-formed, Alps begin to form in Europe.

**Paleogene Period,  
Oligocene Epoch**  
33,900,000 years ago  
5,240.83 feet

○ Rapid evolution and diversification of fauna, especially mammals. Horses, entelodonts, rhinoceroses, oreodonts, and camels flourish. The largest land mammal ever known, an herbivorous rhino relative called the Paraceratherium aka Indricotherium, loomed up to 25 feet tall and 28 feet long.

**Apes split from Old World monkeys around 25 MYA**, towards the end of the Oligocene.

During this period, the continents continued to drift toward their present positions. Antarctica continued to become more isolated and finally developed a permanent ice cap.

**Neogene Period,  
Miocene Epoch**  
23,030,000 years ago  
5,253.39 feet

○ The plants and animals of the Miocene were fairly modern, with recognizable dogs, raccoons, horses, beaver, deer, camels, and whales. Mammals and birds were well-established. Whales, seals, and kelp spread. Grasslands expanded while forests fell victim to a generally cooler and drier climate overall.

Approximately 100 species of apes lived during this time. Due to scanty fossil evidence **it is unclear which ape or apes is the “ancestor” to modern hominids, but molecular evidence indicates this ape lived from between 15 to 12 MYA.**

**Neogene Period,  
Pliocene Epoch**  
5,332,000 years ago  
5,273.84 feet

According to the best estimates, **chimpanzees humans split from humans chimpanzees around 5 to 6 MYA.** (Wouldn't humans have to split from chimpanzees since they came later?) Fossilized footprints in volcanic ash in Tanzania indicate early ancestors of modern humans (**Australopithecines**) **began to walk upright 3.6 MYA.**

The **oldest known formed stone tools date to circa 2.6 MYA.** Homo habilis is arguably the first species of the Homo genus to appear, arriving approximately 2.5 MYA. Homo erectus evolved around 2.0 MYA, alongside homo habilis.

Present (Quaternary) ice age begins roughly 2.58 MYA; cool and dry climate.

**Neogene Period,  
Pleistocene Epoch**  
1,806,000 years ago  
5,277.91 feet

Homo erectus originally migrated from Africa during the Early Pleistocene, around 2.0 MYA, and dispersed throughout most of the Old World.

Homo Sapiens diverge from Homo Neanderthalis approximately 500,000 years ago. The exact evolution of Homo Sapiens is a matter of debate, but the most widely accepted view among current anthropologists is that **Homo sapiens originated in the African savanna around 200,000 years ago.**

Indonesian Lake Toba supervolcano erupts 75,000 years before present, causing a volcanic winter and pushing humanity to the brink of extinction.

**Neogene Period,  
Holocene Epoch**  
11,800 years ago  
5,279.99 feet

**The last glacial period ends. Rise of human civilization.** Quaternary Ice Age recedes, and the current interglacial begins.

**Agriculture begins, allowing humans to build cities.** Paleolithic/Neolithic (Stone Age) cultures begin around 10,000 BC, giving way to Copper Age (3500 BC) and Bronze Age (2500 BC). Cultures continue to grow in complexity and technical advancement through the Iron Age (1200 BC), giving rise to many pre-historic cultures throughout the world, eventually leading into Classical Antiquity, such as Ancient Rome and even to the Middle Ages and present day.

**Note: On the final project scale of 4.57 billion years to 5280 feet, the Holocene Epoch is 4.16 millimeters (just under 1/6 inch) long. On the scale of the 52.8 ft rope you are holding, the Holocene is half the width of a single human hair.**