

THE GEOLOGIC TIME SCALE

Table 1. The development of life through time.

| Million years before present | Era, System, or Event | Relative to a calendar year (date time) |
|------------------------------|--|---|
| | Precambrian | |
| 4600 | Earth formed from planetary nebula | 1/1 0:00 |
| 3900 | Inferred origin of life (first cells) | 2/25 13:02 |
| 3800 | Oldest age-dated rocks on Earth | 3/5 11:28 |
| 3600 | Fossil algae and stromatolites (prokaryotes) | 3/21 8:20 |
| 3250 | Fossil evidence of bacteria | 4/18 2:52 |
| 2100 | Fossil evidence of cells with a nucleus (eukaryotes) | 7/18 8:52 |
| 1500 | First multi-celled organisms (seaweed and algae) | 9/3 23:28 |
| 670 | Oldest marine worms and jellyfish | 11/8 20:05 |
| 600 | Vendian period begins: Ediacarian fossils | 11/14 9:23 |
| | Paleozoic | |
| 544 | Cambrian system begins | 11/18 20:02 |
| 515 | Burgess Shale animals, animals with a notochord | 11/21 3:15 |
| 505 | Ordovician system begins | 11/21 22:18 |
| 505 | First fish | 11/21 22:18 |
| 470 | First fossil evidence of land plants | 11/24 16:57 |
| 438 | Silurian system begins | 11/27 5:53 |
| 430 | First vascular land plants | 11/27 21:07 |
| 414 | Oldest lung fish fossils | 11/29 3:36 |
| 408 | Devonian system begins | 11/29 15:01 |
| 408 | Oldest fossil evidence of mosses | 11/29 15:01 |
| 385 | First insects (beetles), scorpions, and centipedes | 12/1 10:49 |
| 380 | First lobe-finned fish | 12/1 20:20 |
| 375 | First land animals (amphibians) | 12/2 5:52 |
| 370 | First sharks | 12/2 15:23 |
| 365 | First seed plants (ferns) | 12/3 0:54 |
| 360 | Mississippian system begins | 12/3 10:26 |
| 330 | First possible reptiles | 12/5 19:33 |
| 320 | Pennsylvanian system (Kentucky coal) | 12/6 14:36 |
| 286 | Permian system begins | 12/9 7:21 |
| 260 | Sail-backed reptiles (Dimetrodon) | 12/11 8:52 |
| 245 | End of Paleozoic, 96% of all life on Earth perishes | 12/12 13:26 |
| | Mesozoic, the "Age of Reptiles" | |
| 245 | Triassic system begins | 12/12 13:26 |
| 240 | First crocodiles | 12/12 22:57 |
| 228 | First dinosaurs (Eoraptor and Saltoposuchus) | 12/13 21:48 |
| 221 | First mammals (shrew-like) | 12/14 11:08 |
| 210 | First turtles | 12/15 8:05 |
| 208 | Jurassic system begins | 12/15 11:53 |
| 195 | Dilophosaurus, an early Jurassic dinosaur | 12/16 12:39 |
| 155 | First bird, Archeopteryx | 12/19 16:49 |
| 152 | Apatosaurus and Brachiosaurus (long-necked) | 12/19 22:32 |
| 150 | Allosaurus, (meat-eating dinosaur) | 12/20 2:20 |
| 148 | Stegosaurus, (plate-backed dinosaur) | 12/20 6:09 |
| 144 | Cretaceous system begins | 12/20 13:46 |
| 115 | First flowering plants | 12/22 21:00 |
| 82 | Duck-billed dinosaurs (Maiasaurus) | 12/25 11:50 |
| 80 | Protoceratops (first dinosaur eggs discovered) | 12/25 15:39 |
| 75 | Triceratops | 12/26 1:10 |
| 70 | Tyrannosaurus rex and Velociraptor | 12/26 10:41 |
| 65 | End of Mesozoic, probably meteor or comet impact | 12/26 20:13 |
| | Cenozoic, the "Age of Mammals" | |
| 65 | Tertiary system begins | 12/26 20:13 |
| 64 | First ancestors of dogs and cats | 12/26 22:07 |
| 60 | Grasses become widespread | 12/27 5:44 |
| 57 | First ancestors of pigs and deer | 12/27 11:27 |
| 55 | First horses (Eohippus) | 12/27 15:15 |
| 45 | First ancestors of rabbits | 12/28 10:18 |
| 39 | First monkeys | 12/28 21:43 |
| 4 | Oldest human like ancestors (hominids) | 12/31 17:20 |
| 2 | Quaternary system begins | 12/31 20:57 |
| 1 | First of four ice ages | 12/31 22:05 |
| 1 | Oldest direct human-ancestor fossil, Homo habilis | 12/31 23:02 |
| 0.1 | First modern man, Homo sapiens | 12/31 23:48 |
| 0.05 | Mammoth and mastodon bones, Big Bone Lick, KY | 12/31 23:54 |
| 235 years | Revolutionary War | 12/31 23:59 |
| 70 years | World War II | 1/1 0:00 |

The scale of geologic time is vast, currently estimated at nearly 4.6 billion years. During that time, life evolved into the familiar forms we see today. These materials are provided to assist in understanding time relationships and how life on Earth changed through time.

The dates shown were compiled from several available sources. Table 1 shows some important events in Earth history, presented in the order in which they occurred. The data are also shown on the scale of a calendar year. When geologic time is compressed to the scale of a calendar year, 1 second equals about 146 years. At this scale, World War II began about 0.4 second before midnight on December 31; because of rounding, this is shown as midnight of the new year.

On the back of this sheet is a chart showing the geologic eras, systems, and series; the oldest is at the bottom. On the chart, each dot, number, or letter represents 1 million years. The dots get "older" as you read down the chart, or to the right along a row. Thus, they represent millions of years before present ("mybp") and show the ages of the oldest known fossils of selected animals or the time of an event. Not all of the items shown in Table 1 are shown on the chart because of space limitations.

For more information on the geologic time scale, see:

- www.uky.edu/KGS/education/activities.html
- Dinosaurs: Fact & Fiction pubs.usgs.gov/gip/dinosaurs/
- Fossils, Rocks, and Time: pubs.usgs.gov/gip/fossils/
- Geologic Time: pubs.usgs.gov/gip/geotime/
- Teaching About Evolution and the Nature of Science: books.nap.edu/books/0309063647/html/index.html
- Learning from the Fossil Record www.ucmp.berkeley.edu/fosrec/fosrec.html
- Understanding Evolution: evolution.berkeley.edu/
- National Center for Science Education: www.natcensci.org/

The dot scale of geologic time is adapted from an idea by Charly Zuppann of the Indiana Geological Survey, Bloomington, Indiana

The Kentucky Geological Survey is a research and public-service center of the University of Kentucky.



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