

THE GEOLOGIC TIME SCALE

Table 1. The development of life through time.

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

*Calculated on the basis of a 365-day year even though 2000 is a leap year.

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 and 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** (www.nap.edu/readingroom/books/evolution98/)
- **Learning from the Fossil Record** (www.ucmp.berkeley.edu/fosrec/fosrec.html)

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 institute within the Research and Graduate Studies division of the University of Kentucky. Contact the Survey:

Kentucky Geological Survey
228 MMRB, University of Kentucky
Lexington, Kentucky 40506-0107
Phone: (606) 257-5500
On the Web: www.uky.edu/KGS



THE GEOLOGIC TIME SCALE

Era	System and Series		Began mybp	Relative Time (1 dot or character = 1 million years)
Cenozoic	Quaternary	Holocene	0.01	
		Pleistocene	1.8	X•
	Tertiary	Pliocene	5	•••
		Miocene	23	••••••••••••••••••
		Oligocene	34	••••••••••
		Eocene	57	W•••V••••••••••••••••••U•T
Paleocene	65	••S•••RQ		
Mesozoic	Cretaceous		144	••••P•••••O••••N••••••••••••••••••••••••••••••M••••••••••••••••••
	Jurassic		208	•••L•K•J•••I•••
	Triassic		245	•H••••••••••G•••••F•••
Paleozoic	Permian		286	E••
	Carboniferous Systems	Pennsylvanian	320	••
		Mississippian	360	••
	Devonian		408	••••C•••••B••••A•••••••••••9•••••••••••••••••••••••••••••••••••••
	Silurian		438	•••~••••••••••••••••
	Ordovician		505	••
Cambrian		544	••••••••••~••••••••••••~••••••••••••••••••••••••••~••••••••••••	

Events

- 0 Earth formed
- 1 Life originates
- 2 Oldest age-dated rocks
- 3 Blue-green algae
- 4 Bacteria
- 5 Cells with a nucleus
- 6 Multicellular life
- 7 Fish
- 8 Land plants
- 9 Insects
- A Amphibians
- B Sharks
- C Plants with seeds (ferns)
- D Reptiles
- E End-Permian extinction
- F Early dinosaurs (such as *Eoraptor*)
- G Mammals (shrew-like)
- H Turtles
- I *Archeopteryx*
- J *Apatosaurus*
- K *Allosaurus*
- L *Stegosaurus*
- M Flowering plants
- N Duck-billed dinosaurs
- O *Tricerotops*
- P *Tyrannosaurus rex*
- Q End-Cretaceous extinction
- R Dogs and cats
- S Grasses widespread
- T Pigs and deer
- U Horses (*Eohippus*)
- V Monkeys
- W Hominids
- X First of four ice ages

