GEOLOGIC TIME

PALEONTOLOGY AND TIME

To understand paleontology, it is necessary to gain an appreciation for the immensity of time that has passed throughout the history of our planet, and the relative occurrence of events. This section focuses on the relative and absolute timeframe for dinosaurs relative to other extinct and extant (not extinct) animals.

GEOLOGIC TIME BASICS

The Earth's history has spanned a very long time (4.6 billion years!). Geologists break down the Earth's history into parts of time according to relative time and radiometric dating.

Relative time is the order of major events that have occurred during Earth's natural history based on the position of rock layers.

Radiometric dating is a science that uses minerals that contain naturally occurring radioactive elements to calculate the numeric age of a rock in years.

GEOLOGIC TIME SCALE

EON	ERA	PERIOD
Phanerozoic (542 mya to present)	Cenozoic [LINK TO BELOW] (65.5 mya to present)	Quaternary (2.6 mya to present)
		Neogene (23 to 5.3 mya)
		Paleogene (65.5 to 23 mya)
	Mesozoic [LINK TO BELOW] (251 to 65.5 mya)	Cretaceous (145.5 to 65.5 mya)
		Jurassic (199.6 to 145.5 mya)
		Triassic (251 to 199.6 mya)
	Paleozoic [LINK TO BELOW] (251 to 65.5 mya)	Permian (145.5 to 65.5 mya)
		Carboniferous (199.6 to 145.5 mya)
		Devonian (416 to 359.2

		mya)
		Silurian (443.7 to 416 mya)
		Ordovician (488.3 to 443.7 mya)
		Cambrian (542 to 488.3 mya)
Precambrian [LINK TO BELOW] (4600 to 542 mya)	Proterozoic (2500 to 542 mya)	Neoproterozoic (1000 to 542 mya)
		Mesoproterozoic (1600 to 1000 mya)
		Paleoproterozoic (2500 to 1600 mya)
	Archean (4000 to 2500 mya)	Neoarchean (2800 to 2500 mya)
		Mesoarchean (3200 to 2800 mya)
		Paleoarchean (3600 to 3200 mya)
		Eoarchean (4000 to 3600 mya)
	Hadean (4600 to 4000 mya)	

PRECAMBRIAN EON (4.6 billion years – 540 million years)

Earth formed during this time and primitive life forms arose. The Precambrian Eon encompasses over ¾ of Earth's entire history and is known primarily as the Age of Microbes because of the simple life forms that evolved and spread worldwide during this time. It was also a time of building the basement rock of the continent.

EVENTS:

4.6 billion – Earth forms
4.2 billion – Oceans and primitive non-oxygen atmosphere form
3.96 billion – Oldest rock in North America
3.5 billion – Oldest known fossil; first direct evidence of life on Earth
2.2 billion – Oxygen atmosphere develops
1.4 billion – Sediments deposited in a large, shallow lake in the area of Glacier National Park
600 million – First multi-celled organisms

PALEOZOIC ERA (540 million years – 345 million years)

The Paleozoic Era was a time when seas periodically flooded and receded from the Northern Rocky Mountain region, depositing thousands of feet of sedimentary rocks such as sandstone, shale, and limestone. The predacessors of all modern animals have evolved and were aquatic. Invertebrate animals were abundant in the early Paleozoic.

EVENTS:

530 million – Primitive ancestors of most modern animals lived in oceans worldwide.
425 million – The first land plants appear

375 million – The earliest mountain building event on west coast of North America happens
370 million – Corals and stromatoporoids built reefs in the tropical waters covering the region.
360 million – Pangea begins to assemble.
350 million – The first amphibians appear.
245 million – All landmasses assemble into one supercontinent called Pangea. Earth's most massive extinction occurs.

MESOZOIC ERA (245 million years – 65 million years)

The Mesozoic Era was a time of mountain building as the Rocky Mountains began to form about 100 million years ago. Terrestrial animals such as dinosaurs flourished here, making Montana and Alberta some of the richest areas in the world for dinosaur fossils. Mammals, birds, and flowering plants also evolved during the Mesozoic Era.

EVENTS:

208 million – Land accreting on the west coast of North America.
150-110 million – The Rocky Mountains begin to form along the west coast of North America. To the east, rising sea levels create the Cretaceous Interior Seaway.
56 million – Non-avian dinosaurs die out in another major extinction.

CENOZOIC ERA (65 million years – present)

The Cenozoic Era was a time of continued mountain building, volcanism, and glaciation. Mammals radiated into niches left vacant by the extinct dinosaurs. Fossils of horses, camels, mammoths, and saber-toothed cats among others tell us about life in the Northern Rockies during this time, just as the rocks and landforms tell us of the forces the planet was undergoing.

EVENTS:

55 million – Mammals diversify after dinosaurs die off.
15 million – Insects, plants, and prairie grasses evolve.
15 million – Migration of the North American plate over a fixed "hot spot" creates volcanic activity from western Idaho to Yellowstone.
5 million – Wyoming's Teton Range, like many other ranges, forms.

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Visit the USGS Online Edition of "Geologic Time"

- Visit the "Understanding Geologic Time" Education Module developed by the University of California Museum of Paleontology and sponsored by the National Science Foundation.
- Visit the "Tour of Geologic Time" developed by the University of California Museum of Paleontology.
- Book: Digging up Dinosaurs, Jack Horner