GEOLOGIC HISTORY OF NEW YORK STATE

Billion Years Ago / Era / Precambrian Events / Time Distribution of Fossils

Billion Years Ago	Era	Precambrian Events
.50	.539	Ediacaran Fauna; first multi-cellular organisms (all soft-body and marine) .635-.541
	NEO-PROTEROZOIC	**Cryogenian Period** (Time of Snowball Earth glaciation) ~.720-.635
		First sponges .89
1.0	1.0	**Grenville orogeny:** Metamorphism of exposed bedrock - Adirondacks and Hudson Highlands. 1.2-.98
	MESO-PROTEROZOIC	**Oldest rocks in New York State** 1.3
1.5	1.6	
	PALEO-PROTEROZOIC	First protists 1.9
2.0		First eukaryotes 2.1
		Oxygen Revolution Oxygen from ocean escapes to Earth's atmosphere 2.4-2.1
2.5	2.5	**Oceanic Oxygen** (produced by photosynthesizing cyanobacteria) combined with iron, forming repeated iron-oxide rich layers on ocean floor 2.8-2.5
	NEO-ARCHEAN	
3.0	2.8	
	MESO-ARCHEAN	
	3.2	
3.5	PALEO-ARCHEAN	Oldest undisputed evidence for life (stromatolites) 3.5
	3.6	
	EO-ARCHEAN	Oldest evidence for biological carbon 3.7
4.0	4.0	Oldest known rocks (Acasta Gneiss, Canada) 4.0
		Oldest known zircons (Jack Hills, Australia) 4.4
		Formation of Moon 4.5
4.6		Estimated time of origin of Earth and Solar System

PRECAMBRIAN EON: PROTEROZOIC EON; ARCHEAN EON; HADEAN EON

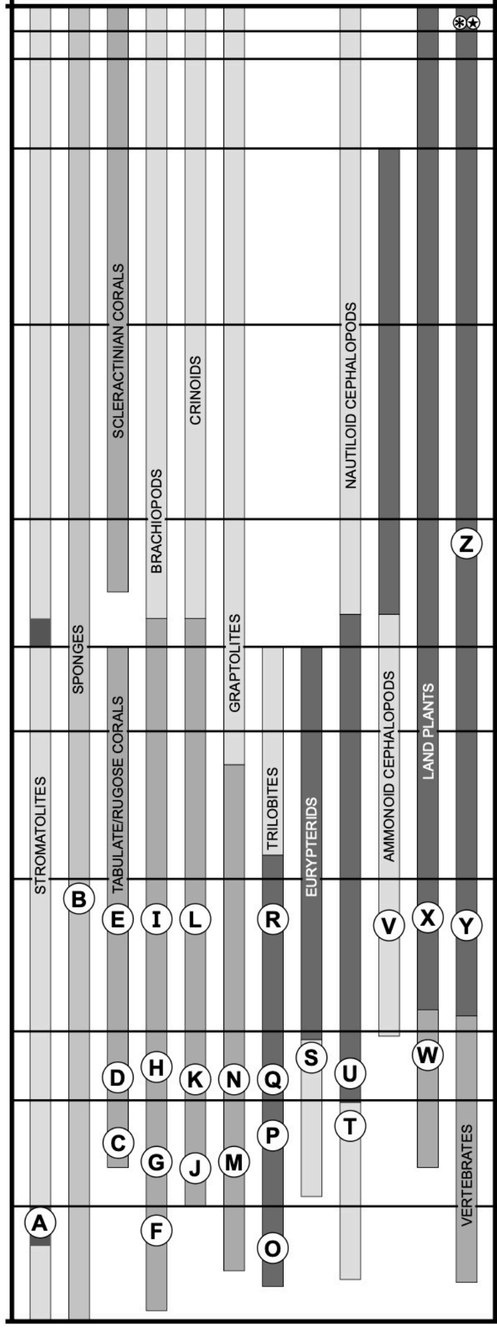
Time Distribution of Fossils: SPONGES; STROMATOLITES

Million Years Ago / Era / Period / Epoch (million years ago) / Life on Earth

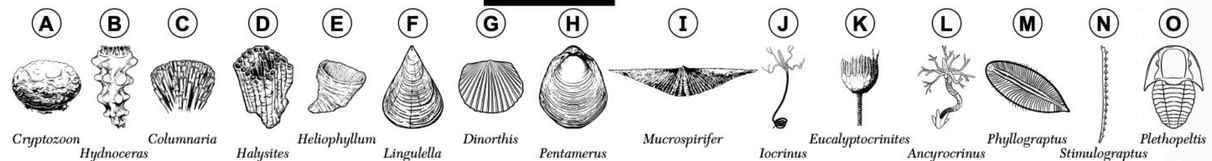
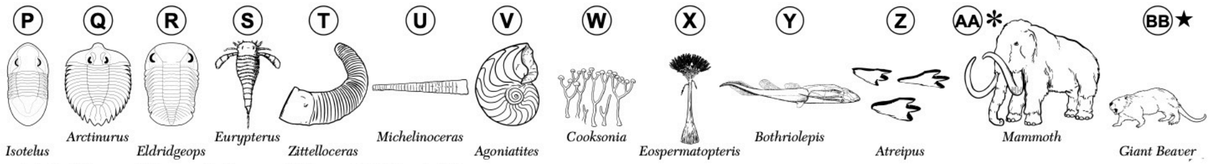
Million Years Ago	Era	Period	Epoch (million years ago)	Life on Earth
			⟨Holocene (.012- present)⟩	End of Ice Ages; human populations grow
	CENOZOIC 66.0-present	QUATERNARY	Pleistocene 2.6-.012	**Humans, mammoths, giant beaver**
		NEOGENE	2.6 Pliocene 5.3	Large carnivorous mammals; diverse human ancestors
			Miocene 23	Abundant grazing mammals; giant crocodiles
		PALEOGENE	Oligocene 34	Grasslands become widespread
			Eocene 56	First horses and whales
			Paleocene 66	Many modern groups of mammals evolve
	MESOZOIC 252-66.0	CRETACEOUS	Late Cretaceous	Mass extinction of all non-avian dinosaurs, many land plants, ammonoids, and other marine organisms Grasses first evolve. Earliest placental mammals
			101	Giant marine reptiles (ichthyosaurs, plesiosaurs)
			Early Cretaceous 145	Rays and modern sharks become common Earliest flowering plants Diverse bony fishes
		JURASSIC	Late Jurassic	Earliest birds; peak of sauropods and ammonoids
			162 Middle Jurassic	Abundant dinosaurs and ammonoids
			175 Early Jurassic	Oldest sauropods
		TRIASSIC	201 Late Triassic	Fifth largest extinction event **Dinosaur tracks in NY (Rockland County)** Earliest mammals
			237 Middle Triassic	Earliest dinosaurs
			247 Early Triassic	
	PALEOZOIC 539-252	PERMIAN	252 Late Permian	Largest mass extinction of many land and marine plants and animals
			260 Middle Permian	Ancestors to mammals were diverse
			273 Early Permian	Reptiles more common than amphibians for first time
		CARBONIFEROUS: PENNSYLVANIAN	299 Early 323-315 / Middle 315-307 / Late 307-299	Extensive coal-forming vegetation in swamps
		CARBONIFEROUS: MISSISSIPPIAN	323 Late Mississippian	Abundant amphibians
			331 Middle Mississippian	Large and numerous vascular plants
			347 Early Mississippian	Earliest reptiles
		DEVONIAN	359 Late Devonian	Extinction of many marine organisms, possibly caused by climate change due to spread of forests
			383 Middle Devonian	Earliest amphibians and seed plants **Earth's earliest forests - Gilboa and Cairo, NY**
			393 Early Devonian	Abundant **fishes and brachiopods** Earliest ammonoids
		SILURIAN	419 Pridoli	Abundant **eurypterids in NY;** earliest sharks
			423 Ludlow	Earliest land animals (arthropods)
			427 Wenlock	Earliest fish with jaws; first vascular plants
			433 Llandovery	Widespread reefs; rising global temperatures
		ORDOVICIAN	444 Late Ordovician	Mass extinction affecting all major groups of marine organisms
			458 Middle Ordovician	**Earth's first reef-containing corals,** first land plants
			470 Early Ordovician	Rapid diversification of Paleozoic animals
		CAMBRIAN	485 Furongian	Extinction of many early life forms
			497 Miaolingian	Peak **trilobite** diversity
			509 Epoch 2	Earliest trilobites; earliest fishes
			521 Terreneuvian	First life forms with hard shells
			539	

PHANEROZOIC EON

Time Distribution of Fossils and Index Fossils



NY Rock Record / Important Geologic Events in New York / Inferred Positions of Earth's Landmasses

NY Rock Record: Sediment; Bedrock

Important Geologic Events in New York	Inferred Positions of Earth's Landmasses
Advance and retreat of last continental ice	
Sands and clays underlying Long Island and Staten Island deposited on margin of Atlantic Ocean	50 million years ago
Dome-like uplift of Adirondack region begins	125 million years ago
Initial opening of Atlantic Ocean North America and Africa separate	
⟨Intrusion of Palisades sill Pangaea begins to break up⟩	220 million years ago
Alleghenian orogeny caused by collision of Proto-North America and Africa along transform margin, forming Pangaea	
Catskill delta forms Erosion of Acadian Mountains **Acadian orogeny** caused by collision of Proto-North America and Avalon and closing of remaining part of Iapetus Ocean	359 million years ago
Salt and gypsum deposited in evaporite basins **Salinic orogeny** caused new subduction to the east of Proto-North America	
Erosion of Taconic Mountains; Queenston delta forms **Taconian orogeny** caused by closing of western part of Iapetus Ocean and collision between Proto-North America and volcanic island arc	458 million years ago
Widespread deposition over most of New York along edge of Iapetus Ocean