Early Evolution How did everything come to evolve on the Earth?

• 4.6 Billion Years Ago Radioactive decay shows that Earth formed

Early Evolution



During the early formation Earth heated up due to

- 4.5 Billion Years Ago
- radioactive decay of isotopes within the Earth's interior



Oldest Zircon Crystals - 4.4 billion years old Western Australia

- During early Earth's melting, materials separated into zones according to their densities
 - Fe and Ni settled into the core
 - Silicates formed the earliest crust
 - Gaseous compounds made up the atmosphere

4.4 Billion Years Ago

4.2 Billion Years Ago

- Solid crust formed and plate tectonics started
- Gases trapped inside the Earth seeped out in a process called outgassing and created a completely different second atmosphere





Oldest Rocks - 4.28 billion years old Hudson Bay in Northern Quebec

3.9 Billion Years Ago

After the crust had cooled enough, water vapor in the atmosphere began to precipitate and form water on Earth



3.8 Billion Years Ago

Weathering, erosion, and deposition began and the first sedimentary rock was formed





The Mysterious Origins of Life



3.5 Billion Years Ago

- Life forms that used CO₂ and released free oxygen began to evolve
- This allowed for oxygen to start collecting in our atmosphere



3.5 - 2.8 Billion Years Ago

- Oxygen in the atmosphere reacted with iron in the soil to produce rust
- Resembled the surface color of current day Mars



2.8 Billion Years Ago

 Most of the iron compounds that could have reacted with the oxygen had done so, thus oxygen in the atmosphere increased



2.8 - Present Billion Years Ago

Life slowly evolved from single-celled bacteria to multicellular to hard parts on life forms





Multi-Celled

Single-Celled



Shelled



Cambrian Explosion / Burgess Shale



GEOLOGIC HISTORY OF NEW YORK STATE

Eon				Era	Period	Epoch	Life on Earth
Million years ago						Million ye	ears ago
0	ģ		F		QUATERNARY	PLEISTOCENE	.01 Humans, mastodonts, mammoths
	B S			CENOZOIC	NEOGENE	PLIOCENE MIOCENE	5.3 Large carnivorous mammals
	HAN	í				OLIGOCENE 23	Barliest grasses
500	Ъ,	_			PALEOGENE	EOCENE 55	.8 Many modern groups of mammals
			\mathbf{L}			PALEOCENE 65	5.5-(Mass extinction of dinosaurs, ammonoids, and)
			Î	MESOZOIC		LATE	
1000			Е		CRETACEOUS		Forlight flowering plants
		IC	M I	sexually		EARLY	Diverse bony fishes
		0 Z	D	reproducing organisms		146 LATE	Earliest hirds
		02	Ľ		JURASSIC	MIDDLE	Abundant dinosaurs and ammonoids
		EH	Е			EARLY	
		ΟI	F			200	Earliest mammals
2000	3 R I A	PR	Ā		TRIASSIC	LATE	Earliest dinosaurs
			R	Oceanic oxygen		MIDDLE	
			Ŷ	the atmosphere PALEOZOIC		LATE 251	organisms (including trilobites)
					PERMIAN	MIDDLE	Mammal-like reptiles
			_			EARLY	Abundant reptiles
			L A	Oceanic oxygen		299 LATE	
3000	PRE (T E	cyanobacteria	CARBONIF EROUS WISSISSIPPIAN	EARLY 318	Extensive coal-forming forests
		AN	M	iron, forming iron oxide layers on ocean floor		MIDDLE	Large and numerous scale trees and seed ferns
			D			EARLY	(vascular plants); earliest reptiles
			L E				Earliest amphibians and plant seeds
		HE/	Ĩ	Oldest microfossils	DEVONIAN	MIDDLE	Extinction of many marine organisms Earth's first forests
Г	1	ARCI	F	Evidence of biological carbon		EARLY	Earliest ammonoids and sharks Abundant fish
			A		SILURIAN	416	Earliest insects
			R L v			EARLY	Earliest land plants and animals
4000						444	
				Oldest known rocks	ORDOVICIAN	MIDDLE	Invertebrates dominant
					OTTO A TOTALA	EARLY	Earth's first coral reefs
				Estimated time of origin		488	
46 00 L				of Earth and solar system	CAMBRIAN	MIDDLE	Burgess shale fauna (diverse soft-bodied organisms) Earliest fishes Extinction of many primitive marine organisms
						EARLY	
						542	Great diversity of life-forms with shelly parts
				į		580	Ediacaran fauna (first multicellular, soft-bodied marine organisms)
				i.			
(Index fossils not drawn to scale)							Abundant stromatolites
A B C D E F G H I J K L M							
Cryptolithus Valcouroceras Centroceras Eucalyptocrinus Tetragraptus Coelophysis							
Elliptocephala Phacops Hexameroceras Manticoceras Ctenocrinus Dicellograptus Eurypter							



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