

Some Characteristics of Rocks

Rock Elements:

Oxygen Silicon

Magnesium Iron

High Silica Content (SiO₂) → Low Silica Content

Light Weight (low density) → Heavy (dense)

Low Melt Point (600°F) → High Melt Point (2000°F)

Minerals:

Quartz

Amphibole

Pyroxene

Rocks:

Granite

Basalt

Peridotite

Evolutionary Themes

1. Increasing complexity 2. Goldilocks conditions 3. Emergence—new phenomena appear that did not previously exist (e.g. stars, elements, life) 4. There are major thresholds surpassed on the evolutionary journey—new phenomena appear:

1. creation of the universe
2. creation of the first stars
3. the creation of chemical elements in the center of stars
4. the appearance of planets
5. the emergence of life
6. photosynthesis
7. eukaryotes
8. Homo sapiens

Plant Kingdom

Plants seem to have first appeared about 425 million years ago, having evolved from algae. Over time they diversified into 12 distinct groups within the Plant Kingdom, known as phyla or divisions, including:

1. Chlorophyta- Green Algae- ~4300 species
2. Charophyta- Stoneworts, Desmids & Spirogyra- ~7000 species
3. Marchantiophyta- Liverworts- ~9000 species
4. Anthocerotophyta- Hornworts- ~250 species
3. Bryophyta- Mosses ~12,500 species
4. Lycopodiophyta- Clubmosses- ~1000 species
5. Pteridophyta- Ferns & Horsetails- ~12,000 species
6. Pinophyta- Conifers- ~650 species
7. Cycadophyta- Cycads- ~100 species
8. Ginkgophyta- Ginkgo- 1 species
9. Gnetophyta- Ephedra, Gnetum & Welwitschia- ~96 species
10. Magnoliophyta (or Anthophyta, or Angiosperms)- Flowering Plants- ~300,000 species

Animal Kingdom

The first animals appeared on Earth is about 800 million years ago (mya), when there is evidence of 'sea sponges living in an ancient ocean. The first animals on land appeared about 500 mya. There are currently about 35 different phyla of animals, including the following:

1. Porifera- Sponges- 10,000 species, mostly marine with only 150 species in fresh water.
2. Cnidaria- Jellyfish, sea anemones and coral- 10,000+ species
3. Platyhelminthes- Flatworms, 15,000 species.
4. Nematoda- Nematode worms- 25,000 described, estimated to be over 1 million
5. Annelida- Annelids- ~17,000 species known, including the earthworms
6. Tardigrada- Water Bears, 1000+ species
7. Mollusca- Mollusks, including clams, mussels, snails, slugs, oysters and octopi.
8. Arthropoda- Arthropods- well over a million species, includes insects, spiders, crabs, shrimp, krill.
9. Echinodermata- Starfish, sea urchins, sea cucumbers- ~7000 species
10. Chordata- Chordates (everything with a dorsal, hollow nerve chord)- 65,000 species. There are 3 subphyla, one of

Evolutionary Characteristics of Plants

Plant Division	Scientific Name	Appearance Millions of Years Ago	# of Species Worldwide	# of Species Methow	Flagellated (tailed) Gamete	Cuticle	Vascular System	Pollen	Seeds	Lignin	Flowers
Stoneworts (Green Algae)	Charophyta (Chlorophyta)	1000 mya	400	?	X						
Liverworts	Hepatophyta	450 mya	9000	150 (75 IDed)	X	X					
Horworts	Anthocerophyta	400 mya?	100	?	X	X					
Mosses	Bryophyta	300 mya?	26,000	250 (150 IDed)	X	X					
Clubmosses	Lycophyta	428 mya	1200	8	X	X	X				
Horsetails	Sphenophyta (now with Pterophyta)	400 mya	40	7	X	X	X				
Ferns	Pterophyta	400 mya	12,000	22	X	X	X				
Cycads	Cycadophyta	300 mya	130	0	X	X	X	X	X		
Ginkgo	Ginkgophyta	270 mya	1	0	X	X	X	X	X	X	
Conifers	Coniferophyta	300 mya	630	14		X	X	X	X	X	
Ephedra & Allies	Gnetophyta	250 mya	75	0		X	X	X	X	X	
Flowering Plants	Anthophyta	150 mya	300,000	1250		X	X	X	X	X	X

Evolutionary Characteristics of Vertebrates

	Fish	Amphibians	Reptiles	Birds	Mammals
# of Species in World	32,000	4000	6800	10,000	4260
# of Species in Methow	26	7	11	265	72
Bony Skeleton	X	X	X	X	X
External Fertilization	X	X			
Internal Fertilization			X	X	X
3-chambered Heart	X	X	X		
4-chambered Heart				X	X
Paired Limbs		X	X	X	X
Lungs		X	X	X	X
Shelled Egg			X	X	
Warm-blooded				X	X
Bipedal				X	X
Parental Care				X	X
Hair					X
Live Birth					X
Secretes Milk for Newborn					X