SCIENCE FUSION Life Science

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PowerNotes

Unit 1 **Lesson 4** The History of Life on Earth

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Uncovering Clues

How do we learn about ancient life?

- Paleontologists use fossils to reconstruct the history of life.
- A **fossil** is a trace or an imprint of a living thing that is preserved by geological processes.
- Fossils of single-celled organisms date as far back as 3.8 billion years.

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What can we learn from fossils?

- All of the fossils that have been discovered worldwide make up the **fossil record**.
- Examining the fossil record helps scientists identify when different species lived and died.
- There are two ways to describe the ages of fossils.

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What can we learn from fossils?

- *Relative dating* determines whether a fossil formed before or after another fossil formed. Newer fossils are found in layers of rock that are above older fossils.
- *Absolute dating* estimates the age of a fossil in years.
- Estimations are based on information from radioactive elements in certain rocks near the fossil.

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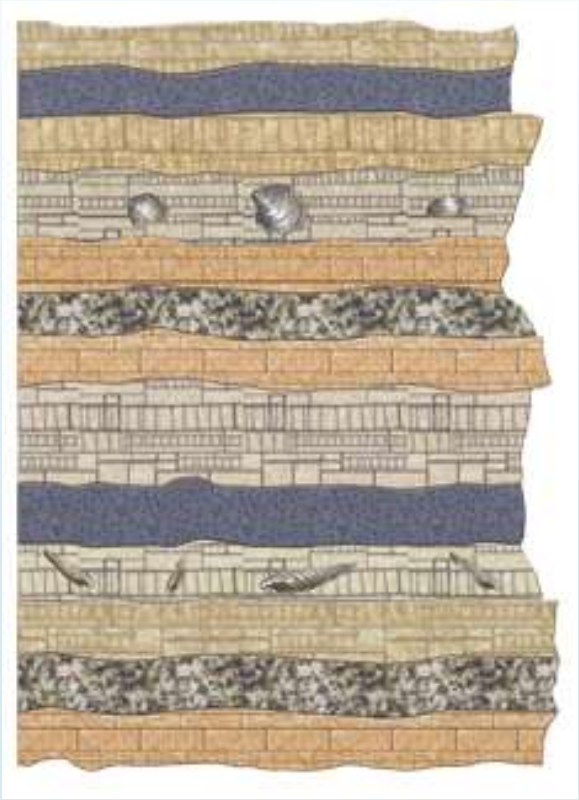
What can we learn from fossils?

- What can relative dating and absolute dating tell us about these fossils?



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What can we learn from fossils?

- The fossil record gives evidence of many of the different organisms that have lived during Earth's long history.
- Changes in population can be preserved in fossils over many generations.
- Some species are present in the fossil record for a short period of time, while others survive for long time spans without much change.

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What can we learn from fossils?

- An **extinction** happens when every individual of a species dies.
- A mass extinction occurs when a large number of species go extinct during a relatively short amount of time.
- Gradual environmental changes and catastrophic events, such as the impact of an asteroid, can cause mass extinctions.

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What can we learn from fossils?

- Extinctions and mass extinctions are documented in the fossil record.
- Fossils that were common in certain rock layers may decrease in frequency and eventually disappear altogether.
- Evidence in the fossil record helps scientists form hypotheses about how and when species went extinct.

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Way Back When

What is the geologic time scale?

- The **geologic time scale** is the standard method used to divide Earth's 4.6-billion-year natural history into manageable parts.
- Paleontologists adjust and add details to the geologic time scale when new evidence is found.
- The early history of Earth has been poorly understood, because fossils from this time span are rare.

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What is the geologic time scale?

- Boundaries between geologic time intervals correspond to significant changes in Earth's history.
- Some major boundaries are defined by mass extinctions or significant changes in the number of species.
- Some boundaries are defined by major changes in Earth's surface or climate.

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What is the geologic time scale?

- The largest divisions of the geologic time scale are eons, which are divided into eras.
- Eras are characterized by the type of organism that dominated Earth at the time.
- Eras are further divided into periods, and periods are divided into epochs.

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What is the geologic time scale?

- The four major divisions that make up the history of life on Earth are Precambrian time and the Paleozoic, Mesozoic, and Cenozoic eras.

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Ancient Wisdom

What defined Precambrian time?

- Precambrian time started 4.6 billion years ago, when Earth formed, and is made up of the first three eons of Earth's history.
- *Prokaryotes*—single-celled organisms without a nucleus—were the dominant life form.
- They lived in the ocean, and the earliest prokaryotes lived without oxygen.

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What defined Precambrian time?

- Fossil evidence suggests that prokaryotes called *cyanobacteria* appeared over 3 billion years ago.
- Cyanobacteria use sunlight to make their own food. This process releases oxygen, which did not exist in Earth's atmosphere at this time.
- Eventually, oxygen built up in the ocean and air and formed ozone, a gas layer in the upper atmosphere.

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What defined Precambrian time?

- Increased oxygen allowed for the evolution of new species that used oxygen to live. After about 1 billion years, new types of organisms evolved.
- These organisms, called *eukaryotes*, have cells with a nucleus and other complex structures.
- Later, eukaryotic organisms evolved that were multicellular, or made up of more than one cell.

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What defined Precambrian time?

- For some organisms, oxygen is toxic. Therefore, increased oxygen was also followed by the extinction of some organisms.
- Less is known about Precambrian life because microscopic organisms did not preserve well in the fossil record.

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What defined the Paleozoic era?

- The Paleozoic era began about 542 million years ago.
- Rocks from this era are rich in fossils of animals such as sponges, corals, snails, and trilobites.
- Fish and sharks, the earliest animals with backbones, appeared during this era.

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What defined the Paleozoic era?

- Plants, fungi, and air-breathing animals colonized land during the Paleozoic era.
- Land dwellers had adaptations that allowed them to survive in a drier environment, and plant groups appeared.
- Crawling insects were among the first animals to live on land, followed by large, salamander-like animals.

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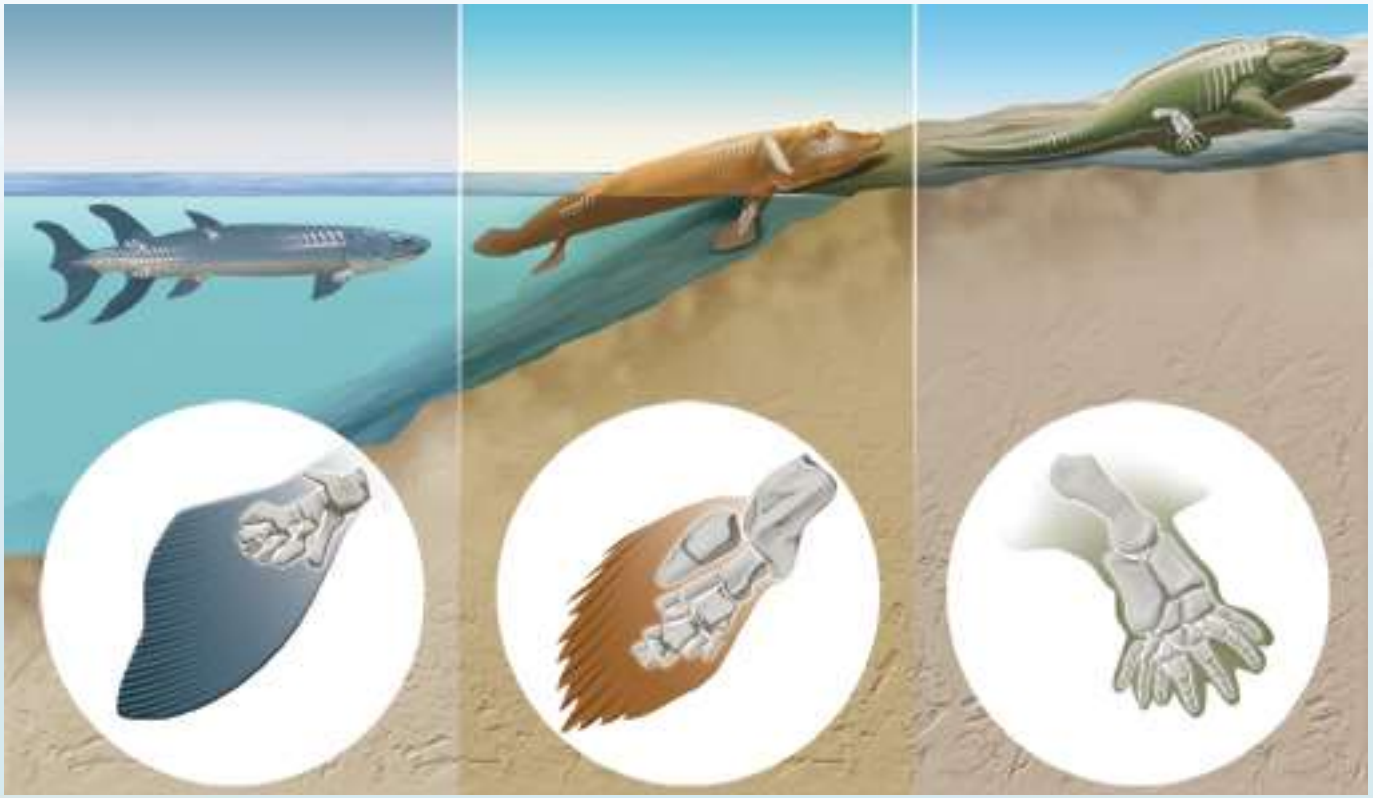
What defined the Paleozoic era?

- What adaptations would have allowed organisms to migrate from oceans to land?



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What defined the Paleozoic era?

- The Permian mass extinction took place at the end of the Paleozoic era and is the largest known mass extinction.
- By 251 million years ago, as many as 96% of marine species had become extinct.
- The mass extinction wiped out entire groups of marine organisms, oceans were completely changed, and many species became extinct.

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Time Marches On

What defined the Mesozoic era?

- Scientists think the reptiles that survived the Paleozoic era evolved into many different species during the Mesozoic era.
- Dinosaurs are the best-known reptiles that evolved during the Mesozoic era.
- The first birds and mammals also appeared.
- The most important plants of this era were conifers, or cone-bearing plants, which formed large forests. Flowering plants appeared later.

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What defined the Mesozoic era?

- Evidence shows that an asteroid hit Earth around the Mesozoic era. The impact caused giant dust clouds and worldwide fires.
- With sunlight blocked by dust, many plants would have died.
- Without plants, plant-eating dinosaurs also would have died, along with meat-eating dinosaurs that ate the other dinosaurs.

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What defines the Cenozoic era?

- The Cenozoic era, in which mammals dominate, began 65 million years ago and continues today.
- Humans appeared during this era.
- The climate has changed many times during the Cenozoic. Organisms migrated toward the equator, adapted to the cold, or became extinct.

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What defines the Cenozoic era?

- Primates are a group of mammals that includes humans, apes, and monkeys.
- Primates have eyes that are in the front of the head. Most primates have five flexible fingers, one of which is an opposable thumb.
- Primates' ancestors were probably nocturnal, mouse-like mammals. Millions of years after dinosaurs died out, primates with larger brains appeared.

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