

Discovering Evolution and Exploring an Ancient Planet

FRAMEWORK

I. Scientific and Engineering Practices <ul style="list-style-type: none"> • 1) Asking Questions • 7) Engaging in argument from evidence
II. Cross-Cutting Concepts <ul style="list-style-type: none"> • 3) Scale, proportion and quantity • 6) Structure and function
III. Life Sciences: LS 4: Biological evolution: Unity and diversity

SKILLS/OBJECTIVES

<ul style="list-style-type: none"> ○ Gain a relative understanding of how old the earth is and what sorts of animals evolved earlier or later relative to each other ○ Understand the three major eras of animal development ○ Learn about how humans have existed for a relatively short amount of time ○ Learn, in brief about paleontology and fossils, and how fossils from living organisms give us clues about evolution
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MATERIALS

<ul style="list-style-type: none"> ○ Butcher Paper ○ Ruler and/or Yard stick ○ Colored Pencils ○ Cards with animal ○ Cheat-Sheet for instructors ○ Colored Pencils ○ A pair of scissors ○ Tape Measure ○ 2 “Excavation sites” ○ Excavation site: <ul style="list-style-type: none"> - Large plastic bin - types of dirt/sand - fossils (pre-made clay molds) - markers to mark off section of bin for different era ○ Spoons ○ small colanders ○ Notebook, “Fossil record book” ○ Fossils from Wesleyan University(if possible!) ○ Activ-Clay Air Dry ○ Leaves collected outside

- Aluminum foil

NOTES

Calculations for timeline can be done by older children or assisted by instructors. Flashcards with ancient animals are to be prepared ahead of time by instructors, the cards need only have pictures on them. The excavation sites must also be prepared ahead of time. To do this, make about 5 fossils with the Activ-Clay Air Dry, for each layer and mark the side of the bin to separate the layers and show when the groups of the different era should dig. The fossils, created by the instructors, should resemble the animals they just learned about in the different eras; for example, a hoof print could represent a hydracotherium and a wing print could represent a meganeura. Clay can be purchased in 3lb quantity at Target. Activity #3 is supplementary, it is to be completed only if time permits.

BACKGROUND

- Begin by asking how old the earth is- it is about 4 billion years old!
- But most animals or living things have only existed on the planet for the past 500 million years (1/8- show them visual with a ruler of what 1/8 looks like!)
- Ask the children whether all of the animals, including humans, which exist today have existed during all of that time.
- If they haven't always existed where did they come from?
- Introduce the idea of evolution and animals evolving from one species to another
- What tools do you think scientists use to learn about how creatures have evolved over millions of years? (fossils, which we will explore today, as well as DNA, which we will explore in other lessons)

Activity # 1	Timeline of the Planet
Materials	<ul style="list-style-type: none"> • Butcher Paper • Ruler and/or Yard stick • Tape Measurer • Colored Pencils • Cards with animal • Cheat-Sheet for instructors • Colored Pencils • Scissors
Worksheet	No

- Tell the children that they are going to make a timeline of the earth's existence!
- Explain that not all of the animals appeared on the planet at the same time, **which do they think emerged first?** Mammals? Reptiles? Insects?
- Explain that for millions of years there was no life on earth, then slowly **unicellular and then multi-cellular organisms evolved until an explosion of living critters occurred about 550 to 600 million years ago**
- **Divide the children into 3 groups:** They will represent the 3 eras of the Paleozoic Era, the Mesozoic era, and the Cenozoic era- assign one or two instructors to each group who are "experts" on the era and use explanations below for each respective group
- **Explain to Paleozoic group that this era, 570-250 million years ago, is one in which many insects, fishes, land reptiles, amphibians and scorpions evolved**
- **Explain to the Mesozoic group that this era lasted from 250-65 million years ago- this was the time of dinosaurs (big reptiles) and some mammals emerged**
- **Explain to the Cenozoic group that this is the era that we live in! It began 65 million years ago and extends to today; it was a time when mammals became more diverse and in about the last 4 million years, ancient man evolved!**
- **Have a couple of children help roll out the butcher paper to 20 feet long (with the use of a tape measurer) and make a cut with the scissors—Use a ruler to explain that each half of an inch represents 1 million years!**

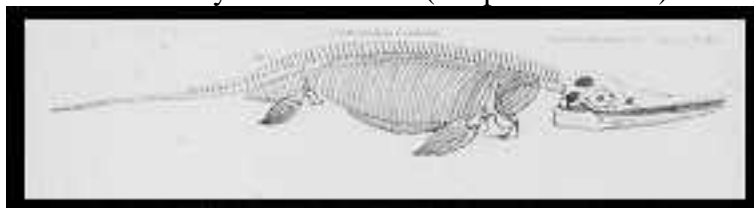
This means we are only showing 500 million years—If we wanted to represent the whole history of the earth the paper would be over 140 feet long (that's about half of a street block long!)

- Have each group mark off their respective era (if there are older children in the group ask them to estimate where this would be!)
Paleozoic: about 9 feet at early end
Mesozoic: about 7.5 feet in middle
Cenozoic: about 3 feet long
- **Distribute a card with an animal on it to each child that correlate to the era of the group and do not tell them how old their animal is!**
- **Have this children place on the butcher paper** where they think there animal belongs relative to the other animals- the "experts" can give them clues based on how developed the animal is
- **When helping the children try to hint at trends.** For example, mammals didn't emerge until later, and insects and reptiles (including aquatic reptiles) are more primitive
- **After the kids have solved the mystery (found the right temporal spot for their animal) have them sketch their animal in the right spot on the paper.** (This butcher paper might be able to be displayed in the classroom)
- **Elect a kid from each group to be an expert about the era and talk to the group about the different animals that existed during that time.**

- **Make note of the emergence of mammals**, humans don't look very much like a starfish, but they have many more similarities to a horse-like animals!

Activity # 2	Dig through Time
Materials	<ul style="list-style-type: none"> • 2 "Excavation sites" • Excavation site: <ul style="list-style-type: none"> -Large plastic bin -2 types of dirt/sand -fossils (pre-made clay molds) • Spoons • small colanders • Notebook, "Fossil record book"
Worksheet	Yes

- **Explain that now since the children are experts on the 3 eras they are going to go on a fossil dig!**
- **Fossils don't just exist in museums**; they exist all around us! Maybe even in our backyards.
- Fossils give us clues about the past and what lived here before, as well as the kinds of species that once existed relative to the species that exist now (clues relating to evolution!)
- In fact, kids like you have made some pretty important discoveries about fossils. About 200 years ago, 12 year old, Mary Anning of Great Britain discovered some of the first Ichthyosaurus fossils (see picture below)



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- But what are fossils really? What are they made out of?
- Some fossils have been found **trapped in ice like woolly mammoths**, just like your freezer can preserve food, freezing an animal can preserve its fur and other parts from decomposing.
- A lot of time we see fossil bones, but what are they really? Are they really the same bone that used to be in the animal? No! They are fossilized bones, which means that **when the bones were buried in sediment or a sand storm, water-infused minerals seeped into the bones and replaced the bones with minerals that are rock-like**; this means that the original material was actually replaced!

- There are also **print fossils**, which we are about to see in this activity! Print fossils, also **called molds and casts, are not part of the original animal or plant**. During fossilization the original material sometimes dissolves away, leaving a cavity, this is a mold. Casts are hollowed impressions of the original fossil; common casts are footprints and animal trails.
 - Have 2 pre-prepared excavation sites with three layers each containing about 5 fossils (created ahead of time and inserted at appropriate marked layer) for each era (see Notes)
 - **Ask the children where the oldest and newest fossils will appear in the excavation site in terms of depth.**
 - **Ask the children** what they expect to find on top of the dig sight and what do they expect to find on the bottom, tell them that this is there **hypothesis**
 - **Divide the children into 3 groups with equal representation of experts on the 3 eras**
 - **Have the Cenozoic experts dig first** using spoons as “shovels” and small colanders as “sieves”
 - When they unearth a fossil ask one person from the group **to draw a diagram in the fossil record book-** encourage the kids to talk about what it might be from. They can take the fossil over to the time line to compare the fossil to the picture, to understand which fossil correlates with which animal.
 - **Repeat** for Mesozoic and Paleozoic era

Activity # 3	Discovering the Fossil
Materials	<ul style="list-style-type: none"> • Fossils from Wesleyan University • Activ-Clay Air Dry • Leaves, feathers...etc collected outside
Worksheet	No

- Now, we are going to make some of our own print fossils! They can be like clues that we leave behind to tell future scientists about the different things that lived on our planet today.
- Have the children **go outside and find leaves or feathers**. Leaves are living things like animals and thus their species has the potential to evolve, kids should not make fossils out of manufactured things that cannot evolve.
- Fossilize the living materials! Press the feather or leaf into the clay and it should air dry for the kids to take home. When the clay is dry remove the object to reveal the fossil!

CONCLUSIONS

Have all animals always existed? What are some of the characteristics of the animals that first existed on the planet? Can we make some inferences about how some of the animals evolved from other animals?

It is hard to believe that all of the animals that we are used to seeing today have been around for such a relatively short period of time, including us humans! Insects, and reptiles developed long before mammal (that's us!).

Why are fossils important? What clues do they give us about animals and species that may have existed before us?