



## Brooks Britt

Paleontologist, Brigham Young University (Featured Scientist)

Brooks began looking for fossils on his own at age ten. At age 14, he and his cousin made plans to ride their bicycles on a 900-mile bike trek from Seattle Washington to Vernal Utah to go on their own dinosaur expedition. Although Brooks' parents did not let him ride his bike the whole way, they helped him get to Vernal where Brooks then biked into the desert and discovered the remains of an enormous dinosaur – Diplodocus. Now, Brooks teaches students about ancient life by helping them find and uncover fossils.



## Beth and Jake Hunter

Earth Scientist, Mechanical Engineer  
STEMTaught

We love looking for fossils. You can explore and find fossils too!



## Madelyn Burt

B.S. Biology  
Brigham Young University



You can practice making observations to solve the mysteries of the Earth. The whole Earth is filled with clues to discover! The more questions you ask, the more you learn!



## Anna Doloman

PhD Biological Engineering  
Utah State University



I decided to become a scientist, desiring to explore this amazing world of unknowns.

# Utah's State Fossil

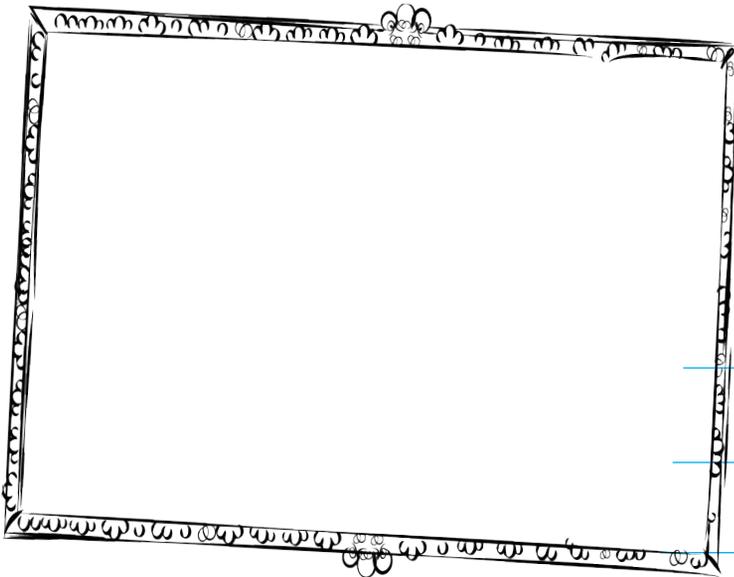
**State: Utah**

**Official Fossil: Allosaurus**

Every state has an official fossil! The fossil of my state, Utah, is a carnivorous dinosaur called the Allosaurus. This great hunter lived in the Jurassic period. It weighed 3,300 pounds and measured 30-40 feet long! It had sharp teeth, strong legs, and used its tail for balance.



## What is Your State or Country's Fossil ?



Where do you live?

Official fossil:

What was that creature like?

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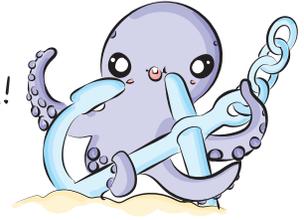
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Engage!

Lesson Anchor

## A Paleontology Expedition In Moab

Explore the  
Phenomenon!



Imagine you're a paleontologist. Today we are going to fly to Moab, Utah and help a paleontology team uncover fossils! Get out of your desks and get on the plane! When we finally land in a small airport we'll go out into the desert to the fossil dig site. Yesterday, the paleontologists discovered a tiny fragment of fossil. What animal is it? Nobody knows. Let's pull out our tools and get to work to uncover more bones. We dig deeper, and by sunset at the end of a hot day, nine bones have been excavated. What are some questions you have about those bones?



Can You Explain It?

**What can we tell about an animal that lived millions of years ago from its fossil remains?**



*Brigham Young University paleontologist, Brooks Britt, digs to uncover the bones from a new and undiscovered dinosaur species.*

What can we tell about this animal from its fossil remains?

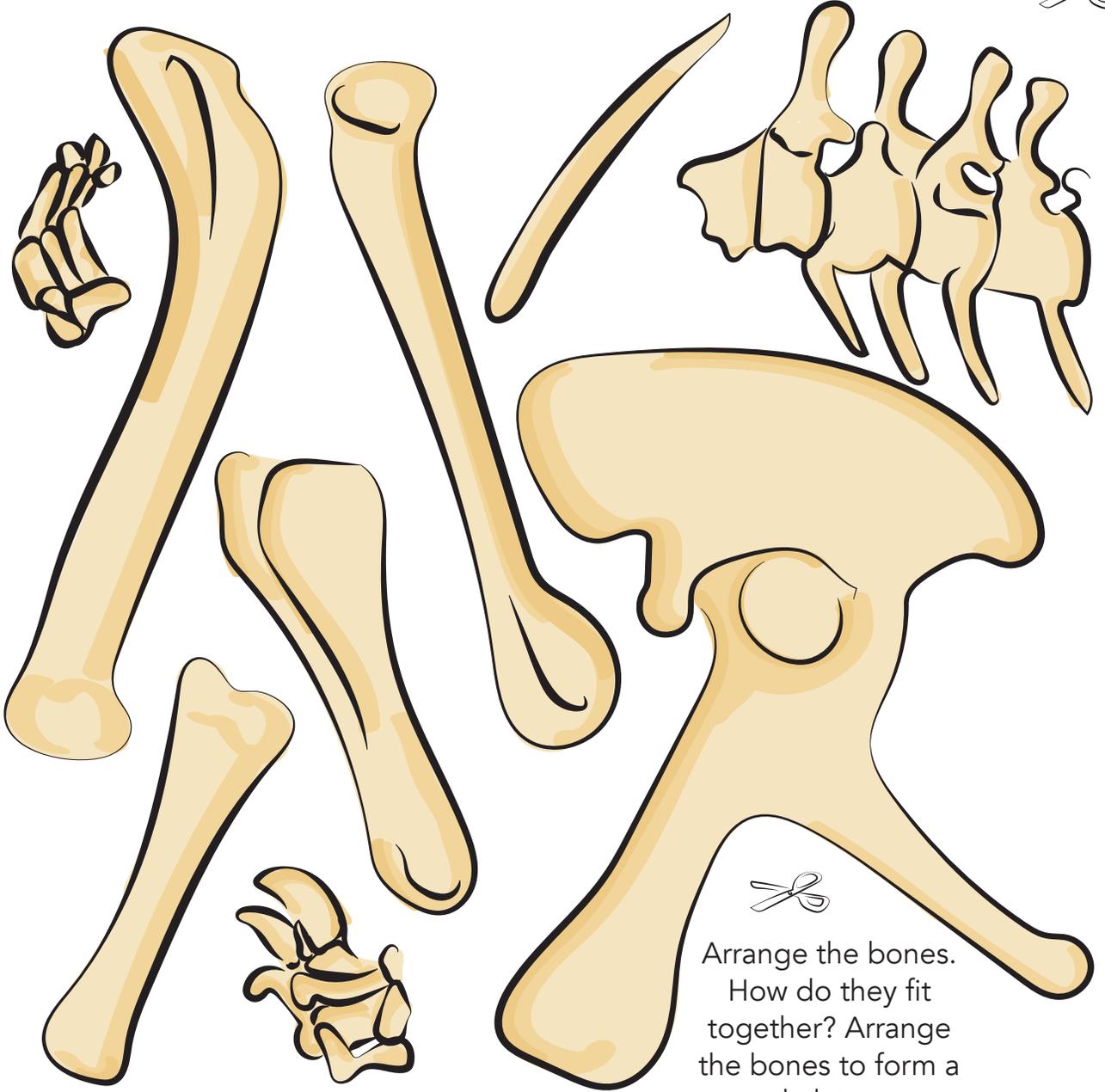
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Arrange the bones.  
How do they fit  
together? Arrange  
the bones to form a  
skeleton.

(Continued) What can we tell about this animal from its fossil remains?

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## Fossils Explain Earth's Past

A **paleontologist** is a scientist that studies fossils. They are detectives that search for clues to solve mysteries. However, this mystery isn't, "Who drank the milk?" This is the mystery of what the Earth was like a long time ago! The Earth is 4.5 billion years old, and the plants and animals that we see today aren't the same as the ones that lived long ago. To know what these ancient creatures were like, we search in rocks for fossils! Fossils also help us explain what Earth's environments were once like. For example, this tropical plant fossil was found in Antarctica!



Think,  
Pair,  
Share!

# Fossils Are the Remains of Ancient Life

When plants and animals die, sometimes they're buried in the ground by sand and mud and they can be turned into rock and become a **fossil**. Fossils can be found in rocks all over the world, and they help us understand what the world looked like at different time periods.

This is a trilobite fossil. Trilobites lived millions of years ago but are now extinct.



Fossilized trilobites just like this one are found all over western Utah. Trilobites once lived in oceans, but this one was found in the desert, in Utah. Now *that* is a mystery! These little fossils give us a clue that Utah didn't always look like it does now. Trilobites once lived in an ocean that covered western Utah and California around 543 to 248 million years ago!

## Fossils Form When Bones are Buried

When the soft remains of plants and animals (such as skin, scales and leaves) are buried in the ground they can leave **fossil imprints** in the mud that become preserved for us to find millions of years later, sometimes these are called **mold fossils**. When sediment fills in an imprint fossil it can create a **cast fossil**. Hard materials such as bones are gradually replaced by minerals that transform them into rocks so they become **true fossils**. **Trace fossils** are formed when animal tracks, burrows, or nests become preserved in rock. In Utah, there are many dinosaur tracks preserved in sedimentary rocks.



Think,  
Pair,  
Share!



*True fossils are formed when living things die and their bones or shells are buried.*

Do these fossil dinosaur footprints look like any footprints we find today?





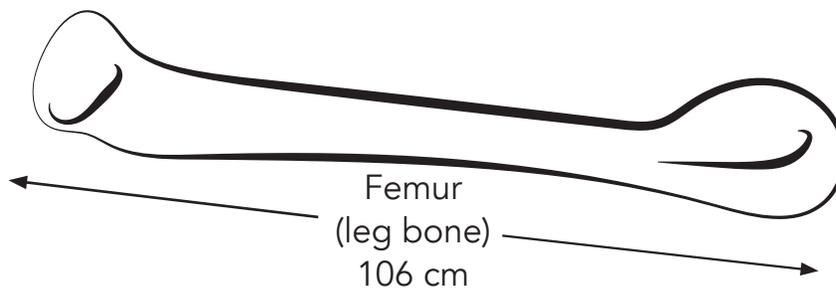
Back to the Moab Dig Site!

## The Length of a Leg Bone

Judging by the footprints in sedimentary rock nearby, the fossilized creature that you are uncovering was a large animal. But how large? Can you estimate the size of this creature by the size of its bones? The longest bone in the body is the femur, which is the bone of the upper leg. Try measuring your upper leg using Mezzie measuring tape to measure the length from your knee to your hip joint. That is the length of your femur.

The length of my (human) femur:

Paleontologists can use the length of the femur to estimate the size of the animal. Use the chart to compare the length of the fossilized femur to the length of the femurs of other animals that live on Earth today.



How does the length of your femur compare to the fossilized femur?

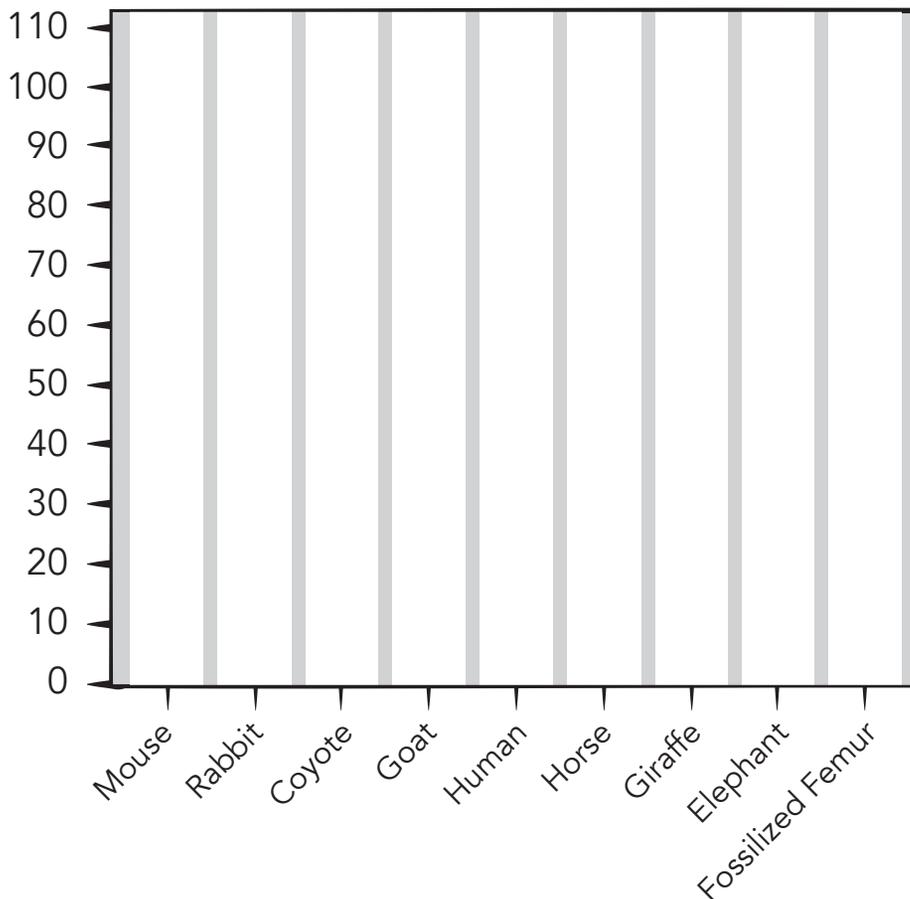
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## Femur Length Data

Femur Type	Length (cm)
Mouse	1.5 cm
Rabbit	10 cm
Coyote	17 cm
Goat	21 cm
Human (You)	cm
Horse	61 cm
Giraffe	66 cm
Elephant	76 cm
Fossil Femur	106 cm

## Animal Femur Length Comparison



*Use the femur length data chart above to make a graph. How does the length of the fossil femur compare to those of other animals in existence today?*

At the Moab Dig Site!



## More Fossils Were Found At the Dig Site!

It's a beautiful, cold, crisp morning. We sit around a campfire to eat our breakfast. It's time to search for fossils again! It can be hard work digging in tough sandstone with your rock hammers and picks. Suddenly, you notice some dark tan spots inside the rock. You look closer and realize that it's another fossil! You and your classmates carefully excavate the fossils. How do the bones fit together?

What do these fossils tell about the animal they came from?

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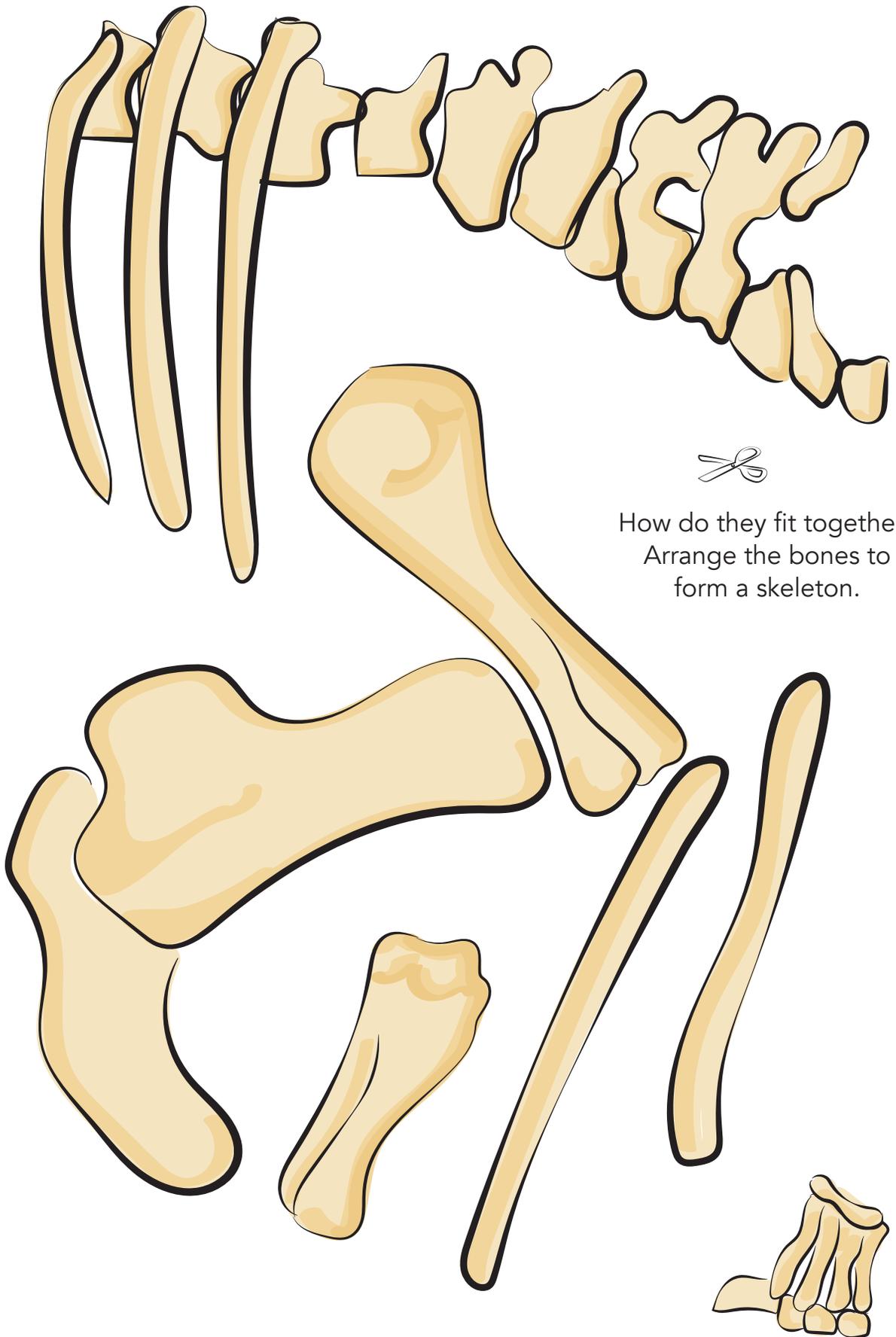
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How do they fit together?  
Arrange the bones to  
form a skeleton.



## Deeper Sands Are Older In Age

Fossils are always found within layers of sedimentary rocks. **Sedimentary rocks** are made of small particles such as mud, sand, gravel, or volcanic ash. These sediments build up over time, forming sedimentary layers. We can order sedimentary layers from the youngest to the oldest, because the layers on the bottom are older than the layers on the top. Finding the age of a fossil can be tricky. The clues within sedimentary layers can help us figure out about how old a fossil is.



*Sedimentary layers containing fossils can be seen in this hill.*



Think,  
Pair,  
Share!

Which are the youngest and oldest  
sedimentary layers pictured here?  
How do you know?

# Volcanic Ash Can Be Dated

A paleontologist calls our class over to show us some gray volcanic ash found in a rock layer above our fossil. Scientists can date volcanic ash by looking at small zircon crystals in the ash.



Think,  
Pair,  
Share!

Is the fossil younger or older than  
the ash above?

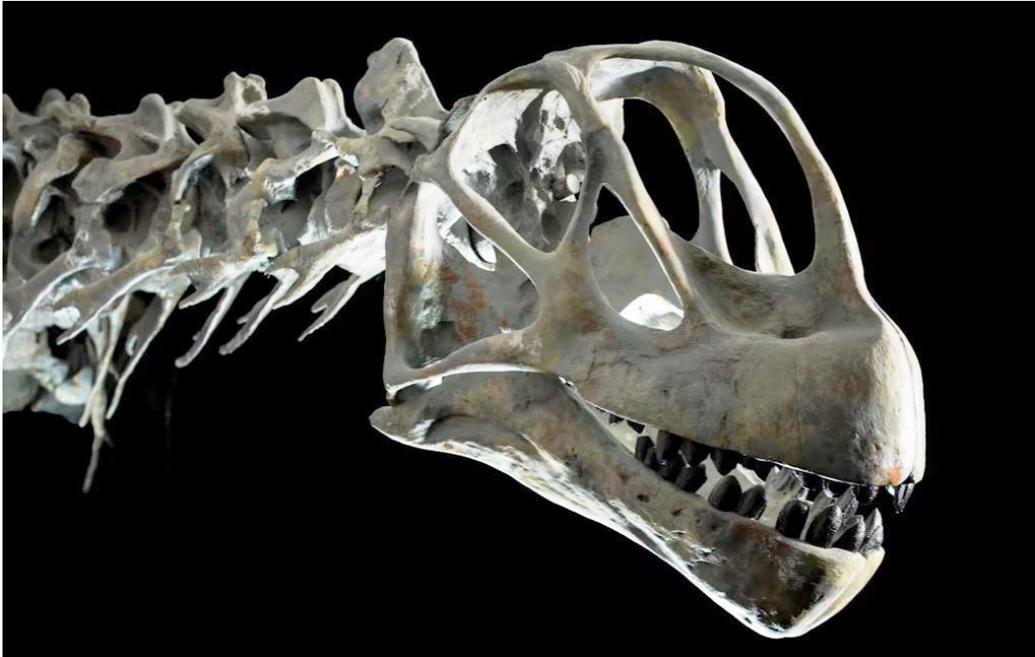
He hopes that we can find more ash in another layer of sediment. This sounds exciting! We finish our trail mix under the umbrella and start to dig again. As our class digs deeper, we get to a new layer of rock just below our fossil's layer and we find some more gray sediment. Wow! It's more volcanic ash!



Think,  
Pair,  
Share!

Is the fossil younger  
or older than the ash  
below?





*This is the skull of the fossil found in Moab by the BYU research team.*

You dig a little more and uncover the animal's skull. Wow! It's amazing!

What can you tell about the animal from the new fossil discovery, the skull?

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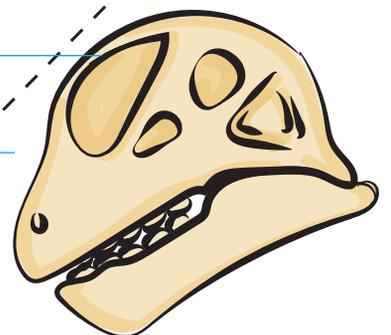
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Cut out the skull.



# Fossils Teach us About Earth's History

We send the ash samples off to a lab to be dated. A few weeks later, the results come in the mail.

The volcanic ash from the layer above our fossil is about 66 million years old.

The volcanic ash from the layer below our fossil is about 150 million years old.



Think,  
Pair,  
Share!

What is the approximate age of the fossil compared to the volcanic ash samples?

Geologists have organized the history of the Earth into different time periods. Scientists have discovered species of plants and animals that have lived in each time period. These fossils give us clues about what the Earth was like long ago. We can observe the fossils to discover what the species ate, what predators it had, and what type of environment it lived in!

What geologic time period is our fossil from? Explain how you know.

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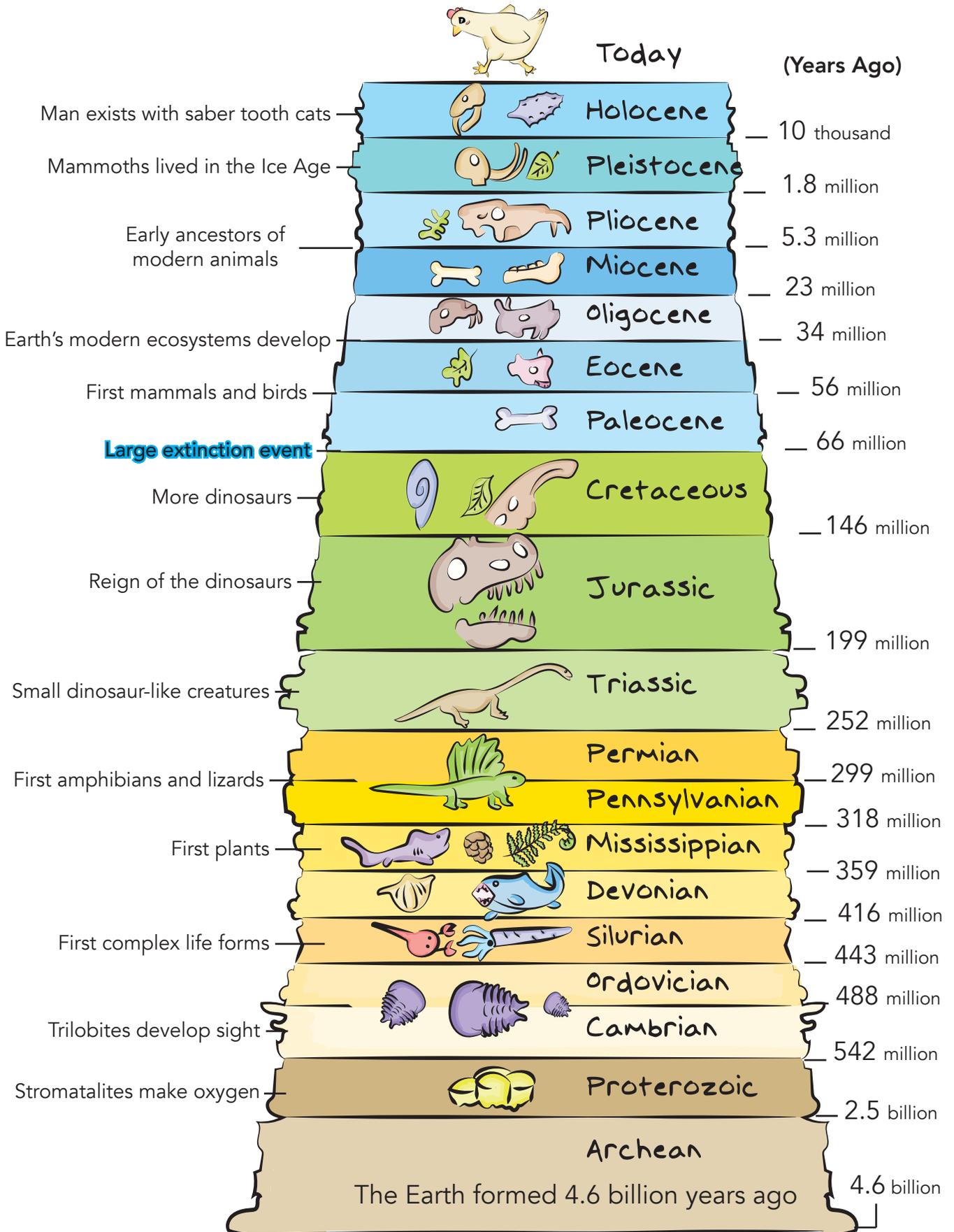
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# Geologic History of the Earth



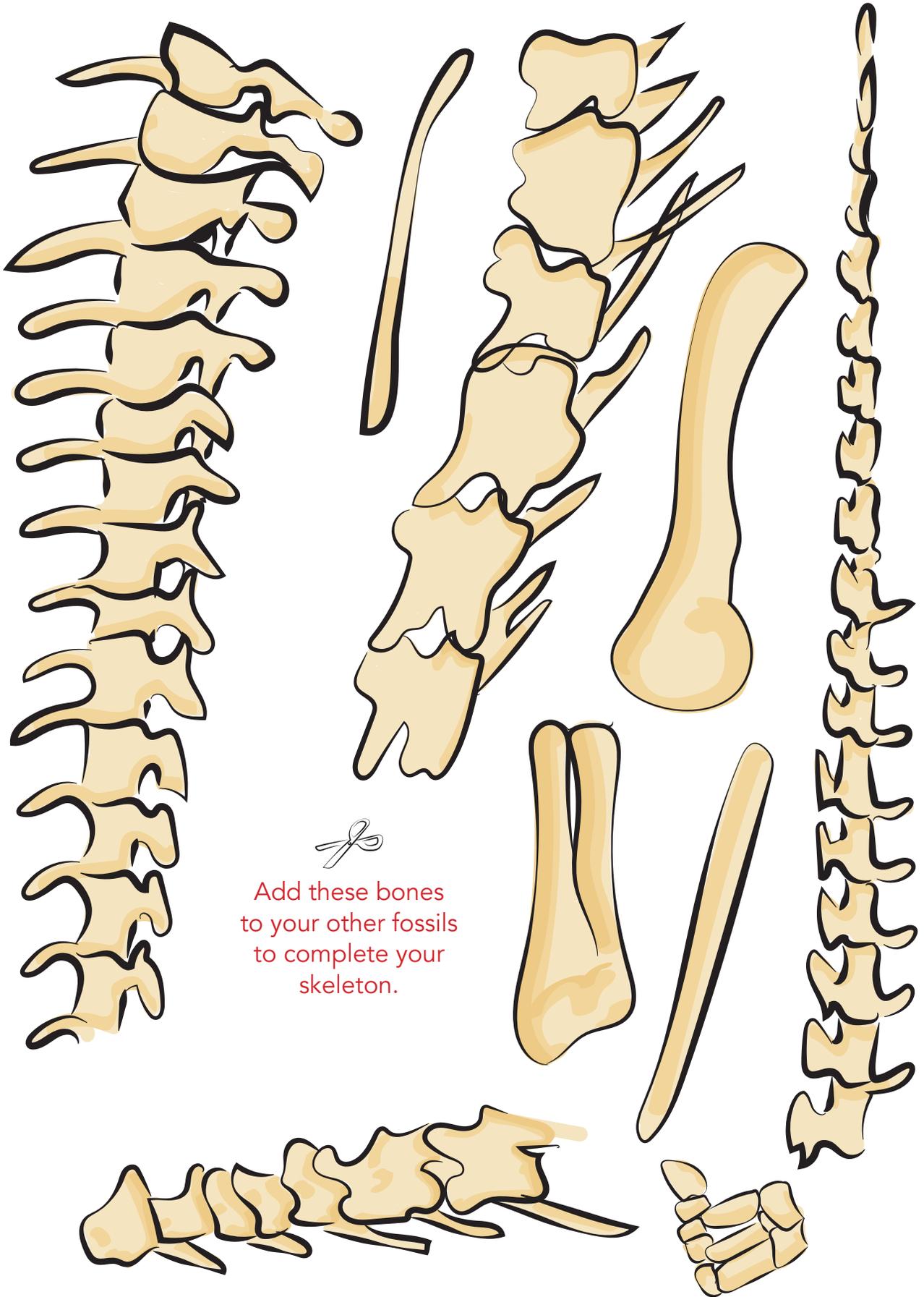
## The Final Fossils Are Uncovered

A BYU paleontologist, Brooks Britt, has been traveling to Moab with students for years and he's uncovered lots of fossils. It takes a long time to collect, prepare, sort and describe all the bones. In order to assemble one museum quality specimen of the animal, over 5,500 bones were excavated!



*Paleontologist, Brooks Britt, works on assembling the fossil skeleton of a new dinosaur species which he named, Moabasaurus. (Credit: Jarren Wilkey/BYU)*

The bones from over 18 different members of the same dinosaur had been brought to their resting place by an ancient stream. The fossilized bones in the rock were all mixed up and broken. Brooks and his student used all the best fossil pieces they found to reconstruct the animal. They named the new species Moabasaurus.



Add these bones  
to your other fossils  
to complete your  
skeleton.



