Ancient Flyers

GRADES 3-5

Notes for Educators

Have students read "Ancient Flyers" and make notes in the right-hand margin. For example, they could underline key passages, paraphrase important information, or write down questions. They may also use this space to draw the pterosaurs and pterosaur body parts described in this reading.

Discussion Questions:

- What is a fossil? How do fossils form?
  (Fossils are the remains of organisms that have been dead for thousands of years. Fossils form when an organism dies and is quickly buried by sediments. Animal bodies, even hard parts like skeletons, are normally destroyed over time, but buried remains are protected. Slowly, minerals can fill the empty spaces within bones or teeth, and even replace the remains entirely. This turns the fossil into rock, allowing it to last for millions of years.)
- How do paleontologists use fossils to learn more about extinct organisms? Give specific examples from the reading.*(Fossils are the remains of dead organisms. They can help paleontologists understand how organisms lived because they preserve features like wings, beaks, and teeth. These contain information about behavior and diet. For example, Pterodaustro had hundreds of thin teeth, which would have been useful for scooping up water and filtering out food.)*
- What have scientists learned about pterosaurs from studying fossils?
  (Scientists learned that pterosaurs had light, hollow bones, had wing membranes, and varied greatly in size.
  Some pterosaurs had teeth and others did not.)

Common Core State Standards:
W.3-5.2, W.3-5.8, W.3-5.9, RI.3-5.1, RI.3-5.2, RI.3-5.4, RI.3-5.10

New York State Science Core Curriculum:
LS3.2c

Next Generation Science Standards:
PE 3-LS4-1
DCI LS4: **Evidence of Common Ancestry and Diversity.** Some kinds of plants and animals that once lived on Earth are no longer found anywhere. Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.

Student Reading
Ancient Flyers


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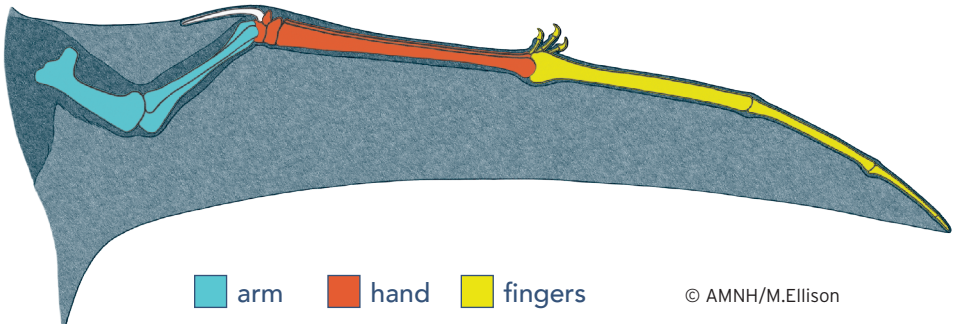
Millions of years ago, pterosaurs ruled the skies. Some of these amazing creatures were the size of a small airplane. Others were as small as a paper airplane. Pterosaurs were not birds. They weren't even dinosaurs. Pterosaurs were flying reptiles that lived alongside dinosaurs from 220 to 66 million years ago. They are all extinct.

Pterosaurs were the first animals with backbones to develop powered flight. They didn't just leap or glide through the air. Rather, they flapped their wings to generate lift, and could travel by air over long distances. Pterosaurs had hollow bones and long forelimbs. All of these features were adaptations for life in the air. Their wings had a strong but flexible membrane that stretched out over a long fourth finger. If you were a pterosaur it would be like using your ring finger to fly!



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How do we know what we know about pterosaurs?

Scientists who study ancient creatures like pterosaurs are called paleontologists. They study fossil remains to learn what pterosaurs looked like and how they behaved.

Fossils show that there were many types of pterosaurs. Paleontologists have discovered more than 150 species. Pterosaur fossils have been found on every continent. But 90% of them come from just five locations. One is in the United States. The others are in Germany, China, England, and Brazil.


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This skeleton of *Rhamphorhynchus muensteri* (ram-fo-RIN-kus MOON-ster-eye) is very well preserved. Wrinkles from its partly folded wings can still be seen.

What are fossils?

Fossils are the remains of ancient organisms. Most formed from the hard parts of organisms such as teeth, shells, and bones. It is very rare to find a fossil that formed from soft tissues like organs, skin, or muscle.

Because fossils only form under certain conditions, they are very rare. Usually when a creature dies its body is quickly destroyed. A predator or scavenger might eat its flesh. A storm or natural disaster could scatter its bones. Decomposers break down the remains. In most cases, there is nothing left of the body to become a fossil.

Not only that, but to become a fossil, a creature must be buried in just the right environment. Bodies of water like lagoons and lakes are perfect places. Sediments such as mud and sand cover the remains of an organism over time. This protects it from scavengers and natural decay.

Around 150 million years ago, a young *Pterodactylus antiquus* (tair-o-DAK-til-us an-TEEK-wus) died. Its body sank to the bottom of a lagoon. Before the corpse could decay, layers of sediment settled on top. The sediments pressed the pterosaur flat, like a flower pressed between pages of a book. Minerals replaced the bones, so the skeleton turned to stone.

Fossils don't only form where there is water. Some volcanoes eject ash when they explode. The ash can quickly kill and bury plants or animals in the area. This protects the remains from decay or scavenging.

What kinds of fossils are there?

One kind of fossilization is called replacement. Replacement happens when water flows through small channels in a bone. The water carries dissolved minerals. The minerals grow as tiny crystals in the bone. Eventually they replace the original bone with minerals and it becomes a rock. Once it is a rock this fossil will not wear away easily. Most of the fossils we find today formed like this millions of years ago.

Sometimes things that pterosaurs left behind fossilized too. These are called trace fossils. Fossilized dung is called a coprolite. Paleontologists study coprolites to find out what pterosaurs ate. A set of footprints, called trackways, tells paleontologists how pterosaurs walked. They even provide clues about how these flying reptiles took off and landed. Fossilized eggs help paleontologists understand how pterosaurs developed.

Paleontologists can also make inferences about pterosaur behavior by studying fossils. Take a look at these pterosaurs, and what paleontologists have learned about their diet by studying their teeth.

SHELL CRACKER

The rugged skull of *Dsungaripterus weii* (sun-ga-RIP-tor-us way-eye) shows several adaptations for crushing shellfish. The heavy, pointed snout might have been used to dig clams out of the mud. Then the pterosaur may have used its large, rounded back teeth like a nutcracker. It crushed open the clams to get the meat inside.

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FILTER FACE

The teeth of *Pterodaustro guinazui* (tair-o-DOW-stro gee-NA-zoo-eye) were so thin they resembled the bristles of a brush. The animal had about a thousand of these teeth. They lined the entire lower jaw. But these teeth were not for biting. Scientists think the animal likely scooped up water and strained it for food instead. As the water flowed through its teeth, tiny animals would be filtered out and then swallowed. Living animals like flamingos feed in this way today.

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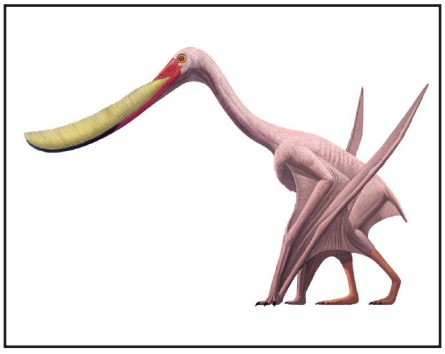

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SOMETHING SWEET

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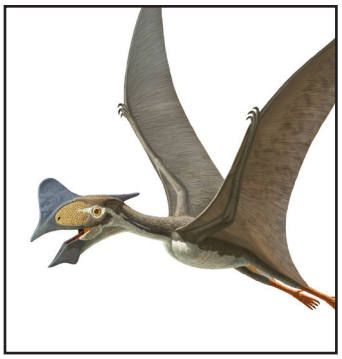

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Tapejara wellnhoferi (ta-pe-JAR-a well-n-HOF-er-eye) had a shortened face and downturned beak. It was also toothless. Toucans have these same features today. Like toucans, these pterosaurs may have moved through branches and leaves to find hidden fruit and seeds. This pterosaur might have helped Cretaceous plants reproduce by spreading fruit seeds in its droppings.

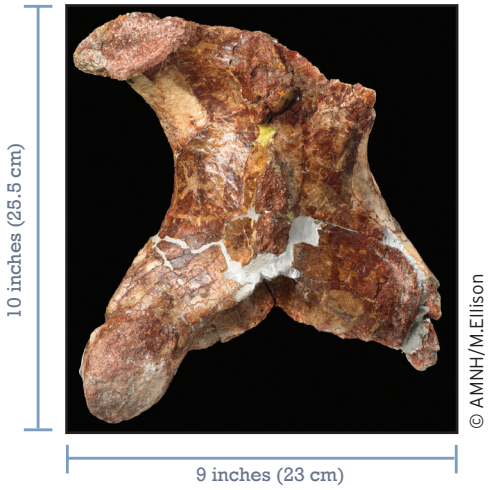
More to Discover

In 2013, paleontologists working with the American Museum of Natural History made an exciting discovery in Transylvania, a region in Romania.

REMAINS OF A GIANT

This fossil was from a species even heavier than *Quetzalcoatlus northropi* (ket-zel-KWAT-a-lus NORTH-rup-eye). *Quetzalcoatlus* was the largest known pterosaur up to this point. This new pterosaur had a thicker build and larger neck.

These are just a few of the many species that have been discovered so far. Paleontologists continue to find new fossils of pterosaurs. These and other fossils form the fossil record of past life on Earth. With each new discovery we increase our understanding of ancient life.



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Pterosaur neck vertebra
Late Cretaceous, Maastrichtian
Around 67 million years ago
Sebes Formation,Hateg Basin, Romania