## Activity: What can the Fossil Record Tell Us? Instructor Key

Imagine that you are a paleontologist on a team of scientists, working to excavate and interpret a field site in Southwestern Texas. As part of your work, you have already collected several fossils from the location and now want to figure out how these organisms may have interacted when they were alive. What kind of environment did each organism live in? What might they have been doing while alive? Use the information in the power point, and from your teacher, to answer the following questions and create your reconstruction.

**Part 1: Your recovered fossils**
Look at the images of fossils provided by your teacher and answer the following questions about each one.
Optional: draw reconstructions of what some of these fossils might have looked like when they were alive! What colors do you think they were? Did they have any features that you can't see on the fossil?

Note: To extend the activity, students can be asked to create their own reconstructions of the animals and plants that are shown in the activity slides. This can be a moment for creative thinking, and would not have set correct answers. There are reconstructions provided in the slides as well that can be shown either before or after students make their reconstructions. These are made my professional artists in collaboration with scientists, and represent the current thinking on what these organisms looked like.

**Non-vertebrate fossils:**
*Cupressinoxylon* wood (conifer)- This wood was bored by marine bivalves. What type of fossil preservation is this, and how do you think it ended up being bored by marine organisms?

Wood is usually filled in with minerals during fossilization in a process called permineralization, or petrification. Fossil wood is often called "petrified wood". The borings could have been made by insects, or even in some cases by bivalves if the wood ends up in the ocean.

Nelumbonaceae (flowering plants)- What type of environment do you think this flowering plant lived in? What types of animals may have eaten it or pollinated the flowers?

Flowering plants were just starting to emerge during the time of the dinosaurs, and could be found in any terrestrial environment. These plants were ancient lily pads, so were likely found on top of lakes and in wet environments. Herbivorous dinosaurs, early mammals, and insects probably ate them, and they could have been pollinated by insects as well.

*Conlinoceras* (ammonite) - How was this invertebrate animal preserved? What are some of its features and how do you think it protected itself?

This cephalopod's shell has been completely replaced with minerals. The shell itself would have offered protection to the animal, and as a relative of living octopi and squids it may have also ejected ink to distract predators so it could swim away.

*Exogyra* (oyster)- Some invertebrates made up the past reef ecosystems. How do you think this specimen formed a reef and what do you think it ate?

Oysters could cement themselves to each other to make massive reef frameworks. Oysters are filter feeders, and will open their shells to allow water to flow through and then will catch floating food material.

**Vertebrate fossils:**

*Tyrannosaurus rex*- What do you think this dinosaur might have eaten when it was alive? What clues did you use to figure this out?

*Tyrannosaurus* was a carnivorous dinosaur, and is thought to have actively hunted down its prey. It could have hunted several animals, from other dinosaurs (including other *Tyrannosaurs*!) to early mammals, birds, and reptiles. The clues in the fossil are the large, sharp teeth as well as the claws on its forearms.

*Hesperornis*- Looking at the feet of this bird, and knowing that its wings are tiny, where do you think this bird spent most of its time: in the water, or on land? What kind of prey do you think it could catch in its toothy beak?

This bird likely spent most of its time in the water. The duck like feet were probably used to help it dive after fish, which it could catch with its long beak.

*Mosasaurus*- These animals were powerful swimmers; do you think they mostly scavenged for food, or were they active hunters?

The aquatic reptiles are thought to have been pursuit hunters, chasing after their prey. Their large flippers and long, paddle like tail would have helped to propel them through the water as they chased fish, birds, and even smaller marine reptiles. The large sharp teeth would have helped them hold on to their prey.

*Hadrosaur*- Paleontologists think these plant eating animals lived in herds. Do you think this would help them protect themselves from predators? Why or why not?

Living in a group would provide a level of safety for the group from predators. Invite the students to think of large herbivores that are around today: animals like antelope, zebras, and buffalo all depend on herds. The group is better at keeping watch for potential danger, and also can work to intimidate a predator.

For all of your fossils, take a minute and think about what kinds of information may not preserve during the fossilization process. Are there tissues missing (think about skin!)? How might this make reconstructing the environment complicated? Explain below.

There is a lot of information that might not be preserved in a fossil. This can include the skin of an animal, their muscles, any kind of covering (fur, feathers). Soft bodied fossils (such as insects) might also become deformed during the fossilization process. It's also common for only parts of organisms to be preserved, or for bones to be broken and mishappen. All of these can complicate reconstructing extinct organisms.

**Part 2: Interpreting the environment**

Now that you've been able to think about each fossil individually, think about how the organisms you've found in the field site might have interacted with each other. Choose three different pairs of fossils: a pair of non-vertebrate fossils, a pair of vertebrate fossils, and a non-vertebrate and vertebrate pair and describe how they might have interacted when they were alive.

Non-vertebrate pair:

Ammonites could prey on the oysters.

Vertebrate pair:

The *Tyrannosaur* could prey on the Hadrosaur.
The *Mosasaurus* could prey on the *Hesperornis.*
*Tyrannosaurs* could fight each other.
Hadrosaurs could live in a group.

Non-vertebrate and vertebrate pair:

The Hadrosaur could eat *Cupressinoxylon* or Nelumbonaceae.
The *Hesperornis* could eat *Conlinoceras or Exogyra.*
The Mossaurus could eat *Conlinoceras or Exogyra.*

**Part 3: Depict your reconstruction**

Show off your interpretation of this Late Cretaceous environment! You can either write a description of what this environment may have looked like, or draw a picture of the scene. Be sure to include at least two of the pairs you discussed in Part 2.

This part of the activity is a time for the students to be creative! Give them time to incorporate different parts of the environment into their reconstruction. You can also allow students to look up photos of animals that are alive today as inspiration: what kinds of colors do they have? How are they behaving in their environment? They can use whatever resources they would like.

If you haven't already, use this time to show students the reconstructions of the individual fossils. Once everyone is finished with their scenes, you can show the example environmental reconstructions that are also in the power point. There are many ways to depict this interaction, and there is not one particular way. They can even combine the two environments by placing the marsh near the beach, as a way to show both environments at once.