mystery science

Lesson: “What did your town look like 100 million years ago?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hey, it's Esther from the Mystery Science team. Even if you haven't lived in your city or town for very long, I bet you've seen that place go through changes. Maybe you've seen changes in nature, like the seasons changing from summer to fall. Maybe you've seen a building built where there was just an empty lot before, or a road paved where there used to be dirt on the ground. The world around us is full of changes. I have a friend who always says, "The only thing that never changes is change." It's a funny saying. How could the only thing that never changes be change? But it's kind of true. For example, I grew up in the city of Chicago. By the time I was born, Chicago was full of skyscrapers, roads, cars, trains, and many people, but it wasn't always like that. This is a drawing an artist made of Chicago over 100 years before I was born. From this picture, I can see that Chicago has changed a lot. Over 100 years ago this area had more dirt paths and grassy marshes than city skyscrapers and car traffic. Even so, I know there were still people living here back then because people built those buildings. In fact, many different groups of people had been living in this area for hundreds of years already, long before other people moved here to start what's now called the city of Chicago. But what about before then? There was a time before any people lived here. How could I find out what the area that is now Chicago was like then? How could you find out what your city or town was like 1 million years ago? 10 million years ago? 100 million years ago? What do you think?

EXPLORATION VIDEO 2

I don't know how you answered, but maybe you thought about how you usually find more information about something. To learn about a place before humans lived there, maybe you could watch a video online or read a book or visit a museum. But how do the scientists and historians who make those videos or write those books or run those museums know what to put in them? They weren't alive hundreds of years ago either. It might help to think about the kinds of things you can find in a museum exhibit. Like, check this out: This is a museum display of dinosaur fossils. These dinosaurs lived millions of years ago. Fossils like these can give us clues about what the past was like long before humans. But fossils don't just magically appear in museums, of course—scientists have to find them. That often involves digging. Scientists often find fossils buried in the ground or stuck deep inside rock. But why do you think we find fossils buried underground? How come scientists don't usually discover fossils nested in the branches of trees or floating in the ocean? What do you think?

EXPLORATION VIDEO 3

To figure out why scientists discover fossils buried underground, it might help to wonder how a dinosaur became a fossil in the first place. Imagine, long ago, two dinosaurs got in a huge fight. It was a brutal and bloody battle, and when it was over, they both lay dead on the ground. Think about what happened to those dinosaurs' bodies as they sat there for years and years and years. Over time, their bodies started to break down, especially soft parts, like muscles and skin, but other parts like bones and teeth lasted longer, maybe years and years just sitting in the same spot. Have you ever found an object at home or at school that hasn't been used for a long time? Like maybe an old book in a corner where no one usually goes? If you picked it up, the

first thing you probably noticed is that it was covered in dust. The longer something sits in one spot, the more dust it usually collects. Something similar happened to those two dead dinos. Over time, wind and water can move dust, dirt, and tiny pieces of rock long distances. Eventually, dust carried by a breeze or a stream would end up settling on the dinosaur skeletons. The longer the bones lay there, the more they got covered in dust, dirt, rocks, and other stuff. Eventually, they got completely buried. Buried underground, those old dinosaur bones might stay preserved for thousands, even millions of years. These are fossils. Dinosaur bones are the most famous kind of fossils, and for good reason. Many dinosaurs look very different from animals alive today. By studying dino fossils we can find clues to what these strange and amazing creatures were like when they lived millions of years ago. But some fossils actually do look like creatures alive today—like, check these out. These animal fossils are also millions of years old. Do any of these remind you of animals you could find on Earth now? What do they remind you of?

EXPLORATION VIDEO 4

Here's what we noticed. We saw fossils that reminded us of clams and sea stars. Even this odd creature reminded us of a modern-day animal called a horseshoe crab. Studying fossils helps scientists figure out what living things existed long ago. But a fossil doesn't just give us clues to what an animal itself was like. It can also help us understand their environment, what the place they lived in looked like millions of years ago. The fossils we just looked at were all found in the same area and we know many of them looked like modern animals—clams, horseshoe crabs, and sea stars. What kind of environment do you think these ancient creatures lived in long ago? What makes you think this?

EXPLORATION VIDEO 5

These fossils are millions of years old. We can't go back in time and see what this place was like millions of years ago ourselves, but these fossils do look a lot like clams, sea stars, and horseshoe crabs that we see alive today. Those creatures are what we call aquatic animals, animals that live underwater. So even though we can't take a time machine back to the ancient past, these fossils give us clues that when these animals were alive, this place was an ocean. But here's something kind of wild. These fossils were all found in the ground near Chicago, the city where I grew up. Today, Chicago isn't an ocean. In fact, it's nowhere near an ocean. And we know that before Chicago became a city, it wasn't an ocean either; it was a grassy marsh. But the fossils of all these sea creatures buried deep in the ground near Chicago suggested an environment totally different from this or this—maybe more like this. Fossils give us clues about what the environment used to look like. But sometimes fossils give confusing clues. Take a look at an example in a different place. Scientists discovered many fossils in this famous spot, the Grand Canyon in the state of Arizona. Some of those fossils look like aquatic animals, but others look like signs of land animals and even plants. How could we explain this? How can the exact same spot have fossils of land animals and fossils of aquatic animals? What do you think?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to explore all the fossils found in one location. The place you'll be exploring today is called Colossal Canyon. As you might be able to tell by its name, Colossal Canyon is a gigantic canyon. It's so deep you can barely see the bottom. People come from far away to visit and explore Colossal Canyon because the rocks of the canyon are filled with fossils. First, you'll work with a partner to construct a model of Colossal Canyon, then you'll

explore your model canyon and all the kinds of fossils that can be found in the rock layers. You'll begin your journey at the bottom of the canyon and travel up all the way to the top. On each part of your journey, you'll read the story of what kinds of fossils you find in the canyon. What fossils will you find at each step of your journey? What story do the fossils tell about what used to live in this place and what the environment used to look like? We'll show you how to get started, step by step.

ACTIVITY STEP 1

Find a partner. Decide who will be Rock Ranger and who will be Fossil Finder. If you're working alone, that's okay, too. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Get your supplies.

ACTIVITY STEP 3

First, you need to build your model of Colossal Canyon. Lay both pages on your desk so they look like this. Fossil Finder: Add glue to the striped box at the top of this page. Rock Ranger: You're going to lay the bottom edge of this paper along the line here, covering the striped area. Try to keep the corners lined up, like this. It's okay if it's not perfect. Press down along all the edges. It should look like this when you're done.

ACTIVITY STEP 4a

Now that your model of Colossal Canyon is complete, it's time to look at your fossils. Get your fossil cards and discuss with your partner.

ACTIVITY STEP 4b

Here are some things we noticed. We noticed several animal fossils that reminded us of animals alive today, like these fossils that reminded us of fish. And even this one that looks like the skull of an alligator. We also noticed that the fossil plants reminded us of specific plant leaves, like the leaves you might find on a fern. There are lots of other fossils and you may not know exactly what they are just yet, and that's okay. Click the arrow to go to the next step.

ACTIVITY STEP 5

It's time to cut out your fossil cards. Fossil Finder: Cut along the thick black line on the Fossil Cards worksheet. Keep one half and give the other half to your partner. Then you'll both cut along the dotted lines. After you're done, put all six cards together on your desk.

ACTIVITY STEP 6a

You now have six fossil cards and six empty spots where those fossils could be located within Colossal Canyon. Starting at the bottom of the canyon, you and your partner will take turns reading the story aloud. Each part of the story will give you clues about which fossils are found in that layer of the canyon. After you read each section, you'll look at all your fossil cards and decide which one matches most closely with that part of the story. Let's practice one together first. Rock Ranger: Read the story from part one out loud. Fossil Finder: Look at all the fossil cards and decide which fossils match the clues from the story.

ACTIVITY STEP 6b

Here's what we noticed. We noticed the first big clue was that the story mentioned fossil fish. Looking at the fossil cards, these two seem to match that clue. But the story also talked about fossils that are sharp and pointy. We thought these fossils match that clue. So we think this fossil card probably belongs in Layer One of Colossal Canyon. We suggest you write the number 1 here on the card, so you remember that it goes with part one of the story.

ACTIVITY STEP 7

Now that you know what to do, go ahead and take turns reading each part of the Colossal Canyon story aloud. Remember to start at the bottom of the canyon and move up. To help you keep track of where each fossil card belongs, write the number of the story it goes with on each card. This step may take a while. When you're done reading the entire story of Colossal Canyon, go on to the next step.

ACTIVITY STEP 8

In a moment, you'll glue your fossil cards into Colossal Canyon, but before you do, let's check your answers. Go ahead and line up each card next to the part of Colossal Canyon where you think the fossils belong. Review your choices and discuss any changes you may want to make with your partner. If you've changed your mind on where the cards go, you can change the number and then move the fossil cards to the correct section.

ACTIVITY STEP 9

Now let's glue all the fossil cards into your Colossal Canyon model, starting at the bottom. Rock Ranger: First, add glue to the area in the dotted rectangle. Then, Fossil Finder: Lay the fossil card with that number on top, pressing down along all the edges. Repeat this for all six of your fossil cards.

ACTIVITY STEP 10

You started your journey at the very bottom of Colossal Canyon. Let's take a closer look at the fossils there. Use your model to look at the fossils in Layer One. Discuss.

ACTIVITY STEP 11

Your journey ended at the very top of Colossal Canyon. Let's take a closer look at the fossils in that top layer. Use your model to look at the fossils in Layer 6. Discuss.

ACTIVITY STEP 12

Take a look at these different environments. Discuss.

ACTIVITY STEP 13

Discuss.

WRAP-UP VIDEO 1

Fossils give us clues about how a place changed over time. At the bottom of the canyon, you saw fossils of aquatic creatures—animals that lived underwater. This gives you a clue that when these animals lived, this place was covered with water, maybe an ocean. At the top of the canyon, you saw fossils of leaves and land animals. These fossils give you clues that when these plants and animals lived, this environment was dry land dense with life, maybe a forest. And the fossils weren't just different between the top and the bottom of the canyon. They went through several changes between the top and the bottom as well. These different layers give us evidence that this environment changed not just once or twice but many, many times. But how do we know in what order those changes happened? Suppose you wanted to tell the story of Colossal Canyon from millions and millions of years ago until now. You could use the fossils in the canyon layers to help you tell the story. But where should you start the story? How do we know which layer is oldest? I wonder what you think.

WRAP-UP VIDEO 2

To figure out which layer of fossils is the oldest, it might help to think back to how these fossils became fossils in the first place. Remember those two dead dinosaurs we talked about earlier that eventually became fossils? Over the years, wind and water carried bits of dust, dirt, and rock long distances to the area where the dead dinos lay and completely buried them. Scientists call these tiny pieces of rock, dust, and dirt *sediment*. Now, what if, hundreds of years later, another living thing—say, this fern—started to grow in the ground in that same spot right over the buried dino skeletons? Just like the dinosaurs, that fern might eventually get covered in sediment. Once that plant was buried in a layer of dust, another animal might scuttle over the

ground on top of it, die on the dirt there, and also end up getting buried. By this point, there would be many layers of fossils and dirt, and more fossils and more dirt, piled one on top of the other. This is exactly how the layers in Colossal Canyon were formed too. But hang on. We've been talking about fossils buried in sediment, dust, and dirt, and tiny grains of sand, but the fossils in Colossal Canyon aren't buried in dirt. They're in solid rock. How did they get inside solid rock?

WRAP-UP VIDEO 3

Maybe you wondered: What if the rock around a fossil wasn't always rock? We know that as layers of sediment pile up in one spot over time, plants and animals can get buried in it and eventually become fossils. But what happens to the sediment itself over time? Well, imagine what it would feel like if you piled a layer of sand on top of your hand, and then another layer, and then another, and then another—eventually it would get uncomfortable. All those layers would get heavy and press down on your hand at the bottom. A similar thing happens to sediment over time. As more and more sediment builds up, the top layers press down heavier and heavier on the layers below. Over thousands or even millions of years, the sediment in those squeezed layers stops being lots of tiny pieces and becomes something else: solid rock. Because it's made from sediment, scientists call this *sedimentary rock*. Some things buried in sediment hold their original shape while the layers of sediment press together and become sedimentary rock; this is how we get fossils like the plants and animals you spotted in Colossal Canyon. But things buried in sediment don't always hold their shape. Take a look at Colossal Canyon again. Can you spot any part of the canyon that looks like it has no fossils in it at all?

WRAP-UP VIDEO 4

This dark layer in the rocks seems like it has no fossils in it, right? And it's true that not every layer of sedimentary rock has fossils inside it to begin with. But this layer does have fossils in it. In fact, this entire layer is both rock and fossil. Sometimes, when an environment is really thick with plants, like a dense swamp, pieces of plants pile up on the ground in a layer. Under the right conditions, layers of sediment build up on top of that preserved plant layer, squeezing it together until it becomes a special kind of sedimentary rock. So even though we can't see the shapes of the plants in the rock anymore, those plants give this rock a unique property. Because this rock is made of plants, which can burn when lit on fire, this rock can burn too. You may have heard of this kind of rock before. It's called coal. It's often easy to spot a layer of coal in a canyon wall, like this one. Its dark gray color stands out, but coal or not, each stripe of sedimentary rock shows how this land formed, bit by bit, layer by layer. Each layer of rock and fossil shows a little bit about what the place was like at the time it formed. What lived there, what the environment was like, and what changes were taking place. One single layer of sedimentary rock might take longer than a hundred human lifetimes to form. That's so much time, so much change one place has witnessed, and it doesn't stop. Even now, the wind is blowing dust and dirt and pieces of rock this way. Even now, a human might be making a boot print in the dirt, which might get filled with more sediment and become a fossil over the next 10 million years. Who knows what this place will look like then? After all, the only thing that never changes is change. Have fun, and stay curious.