ROCKS & MINERALS

BACKYARD WORKBOOK

Hands-on Projects, Quizzes, and Activities For Kids

Dan R. Lynch

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Acknowledgments

Dan would like to thank his wife, Julie, for her endless support and encouragement during this and all his book projects. Dan would also like to thank his parents, Bob and Nancy, for all their help over the years in obtaining specimens, for their guidance, and for being his best PR people.

Dedication

This book is for all the kids who look at a rock twice before skipping it across the pond.

Disclaimer

This book is meant as an introduction to the practice of rock collecting in general. It does not guarantee your safety when rock collecting in any way—when rock collecting, you do so at your own risk. Neither Adventure Publications nor Dan Lynch is liable for property loss or damage or personal injury that may result from rock collecting. Before you go rock collecting, be sure you have permission to collect on the location, ensure that an adult or adults are present, and always avoid potentially dangerous locations, such as cliffs, areas with moving/deep water, deserts, or areas where wildlife (bears, snakes, cacti, insects) may be a concern. Some rocks and minerals (such as those containing lead) can also be potentially hazardous, so you should always be able to recognize such specimens before you go into the field. (You'll likely need to refer to other field guides or experts to do so.) Finally, be aware that many national, state, and local parks do not allow rock collecting, so again, only collect where you are allowed to do so.

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Photo credits on pages 130–131

Rocks & Minerals Backyard Workbook: Hands-on Projects, Quizzes, and Activities For Kids

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Safety Note

How Kids Can Stay Safe When Rock Collecting

Learning about rocks, minerals, and our amazing planet can be even more fun when you head outside to find your own geological wonders! But whether you are in your backyard or at the beach, you always want to stay safe.

Follow these guidelines:

- Never go out alone! Always bring an adult.
- If you're venturing far, bring a map, a smartphone, or a GPS device so that you don't get lost.
- Always bring water to drink. It's dangerous to be out all day with no water.
- Bring a hat and long clothes to protect you from the sun. You may get hot, but at least you won't get burned.
- Never go into rivers, lakes, or oceans because the water may be deeper or faster than your realize.
- Never go near cliffs! Many are unstable and can fall.
- If a rock that you want is out of reach, just leave it. Your safety is more important than the rock.
- Never go onto private property. (Private property means that someone else owns the land.) If you see signs that say "no trespassing," turn around right away.
- A few rocks can be dangerous to collect. Never taste rocks, and always wash your hands after collecting. If your hands are dirty, don't touch your face or eyes.

Table of Contents

What is Geology?

Rocks and minerals are under your feet every day, but do you know what they are or where they come from?

The study of our planet Earth is called **geology**, and someone who studies geology is a type of scientist called a **geologist**. Not only do geologists find out about how rocks formed, they also learn about how Earth itself formed! Geologists study lots of other things, too, like how the Earth changes over time and which rocks are best to look for when you're trying to find valuable gems or metals in the ground.

Geologists and other scientists study things like **rocks**, **minerals**, **crystals**, **fossils**, and **landforms**. All of these things are important for understanding the history of Earth.

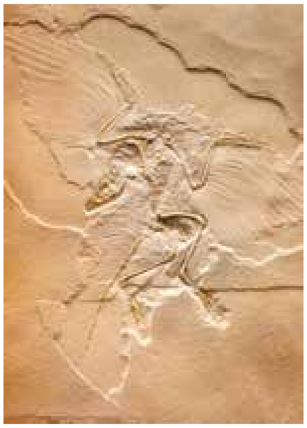
Emerald

Diamond

But if you don't know what some of those things are, that's OK because we'll learn about them in this book.

Geology studies all things about the Earth beneath your feet, from common rocks to amazing landforms, like the colorful hills below, and how they came to be.

When we look at rocks, we can also find and study incredible fossils of ancient life, or even valuable gems.



Archaeopteryx fossil

What are Minerals, Crystals, Rocks, and Fossils?

1. Minerals: *Minerals are special chemicals that usually form in the ground inside rocks.* When minerals harden, they form crystals. There are many different kinds of minerals. Some are shiny and some are dull, and some are very colorful but others are not. Minerals can form in many different ways.

A blocky pyrite crystal

2. Crystals: *Crystals are hardened minerals.* Each mineral forms crystals of a specific shape. For example, the mineral called pyrite usually grows crystals shaped like square blocks. And no matter where in the world you find pyrite, chances are it'll have the same blocky shape.

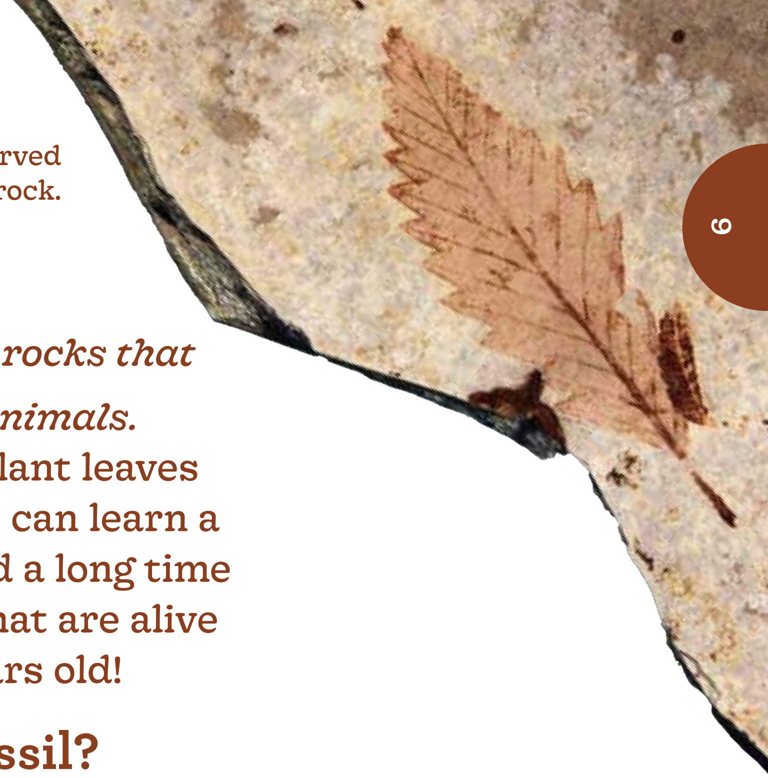
There are many kinds of crystal shapes, such as sharp points, flat plates, and some that even look like little trees!

Two common kinds of rocks: granite (top) and basalt (bottom)

3. Rocks: *Rocks are hard materials made up of a mixture of minerals.* The minerals are tightly packed together. And each different kind of rock contains a different mixture of minerals in it. This makes different kinds of rocks look very different from each other. It's kind of like having different types of cookies—a chocolate chip cookie and an oatmeal cookie are both cookies, but they have totally different ingredients.

Rocks can form either deep inside the Earth or on the Earth's surface where we can see them. Rocks come in all kinds of colors, and some have layers or stripes, and others have lots of spots. When you see a speckled rock, look carefully at each different colored spot—those are all different minerals.

A group of quartz crystals



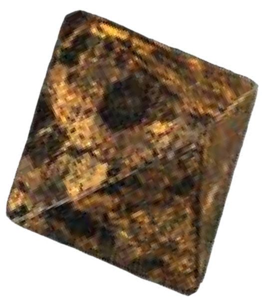
This is a fossil leaf preserved in the surface of a rock.

4. Fossils: *Fossils are special kinds of rocks that contain traces of ancient plants and animals.* Things like animal teeth, bones, and plant leaves can be preserved in certain rocks. We can learn a lot about plants and animals that lived a long time ago by comparing fossils to animals that are alive today. Many fossils are millions of years old!

Matching: Crystal, Rock, or Fossil?

Using what you've learned about minerals, crystals, rocks, and fossils, draw a line from each photo to the label that you think best describes it.

1. Rhyolite



2. Magnetite

3. Granite

4. Wulfenite

5. *Knightia*

6. Scallop

Rock **Crystal** **Fossil**

The most important things to remember:

1. Minerals are natural chemicals in the Earth that have hardened.
2. Hardened minerals make special shapes called crystals.
3. Rocks are hard materials made up of a mixture of minerals all jumbled together.

Answers on page 119! ☞

Our Planet Earth

The Earth beneath your feet may seem solid, but it's always changing! Even mountains and oceans will some day be gone and replaced by something else. That's because deep inside the Earth it is very hot—so hot that even solid rocks can melt! All of that heat makes the inside of the Earth move around very slowly.

The Earth has five main layers. They are:

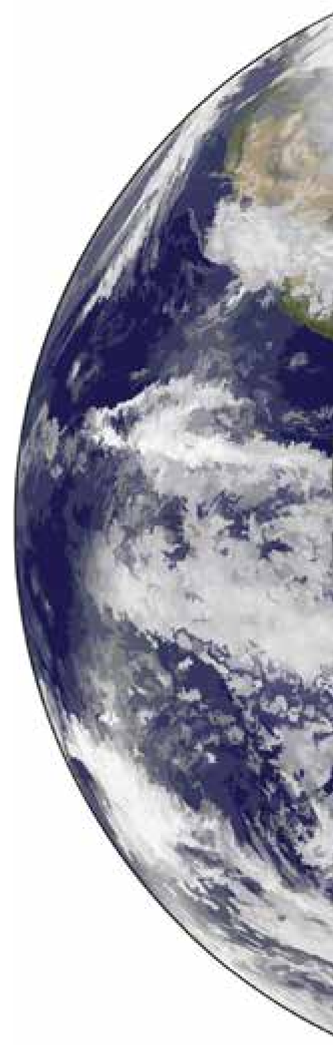
1. The Crust: The outside of the Earth is called the crust. The crust is where all plants and animals live—including you. It is made up of hard rocks, like the ones that you can pick up outside.

2. The Upper Mantle: The next layer down is called the upper mantle. It is heated by the layers below it and is very hot. When rocks from the crust are pushed down into the Earth, they melt in the upper mantle. The molten rocks here are called **magma**. The magma in the upper mantle moves and flows very slowly, a little bit like syrup!

3. The Lower Mantle: Below the upper mantle is the lower mantle, where it is even hotter. But the rocks there are buried so deep (and there's so much pressure) that they can't melt, so the lower mantle is solid.

4. The Outer Core: The outer core is near the center of the planet. It is so hot that all the rocks there are melted and soft.

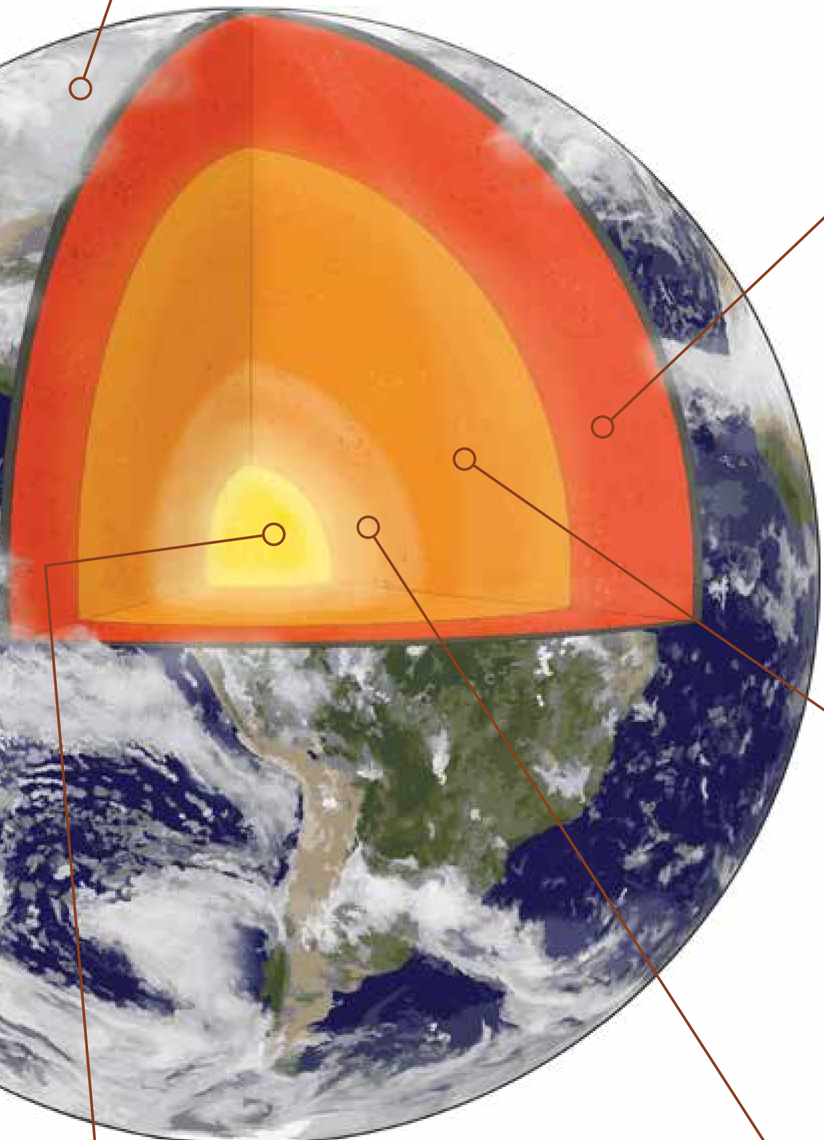
5. The Inner Core: At the very center of the Earth is the inner core, which is a big ball made almost entirely of metal! Specifically, it is composed mostly of iron and nickel. Even though it is very hot, the metals here don't melt, and the inner core is solid.



Labeling: Earth's Layers

We live on the thin outside of the Earth. All of the mountains and oceans are part of it. This layer is called the:

1. ______________________



The next layer down is hot and soft because it is made up of melted rocks. It is always flowing and moving. This layer is called the:

2. ______________________

Even though this layer is also very hot, the rocks there don't melt because they are buried so deep down. This layer is called the:

3. ______________________

This layer is near the center of the Earth. There it is so hot that everything melts. The melted rocks here flow and swirl around. This layer is called the:

4. ______________________

The very hot ball of solid metal at the center of the Earth is called the:

5. ______________________

Answers on page 119! ☞

The Earth's Crust

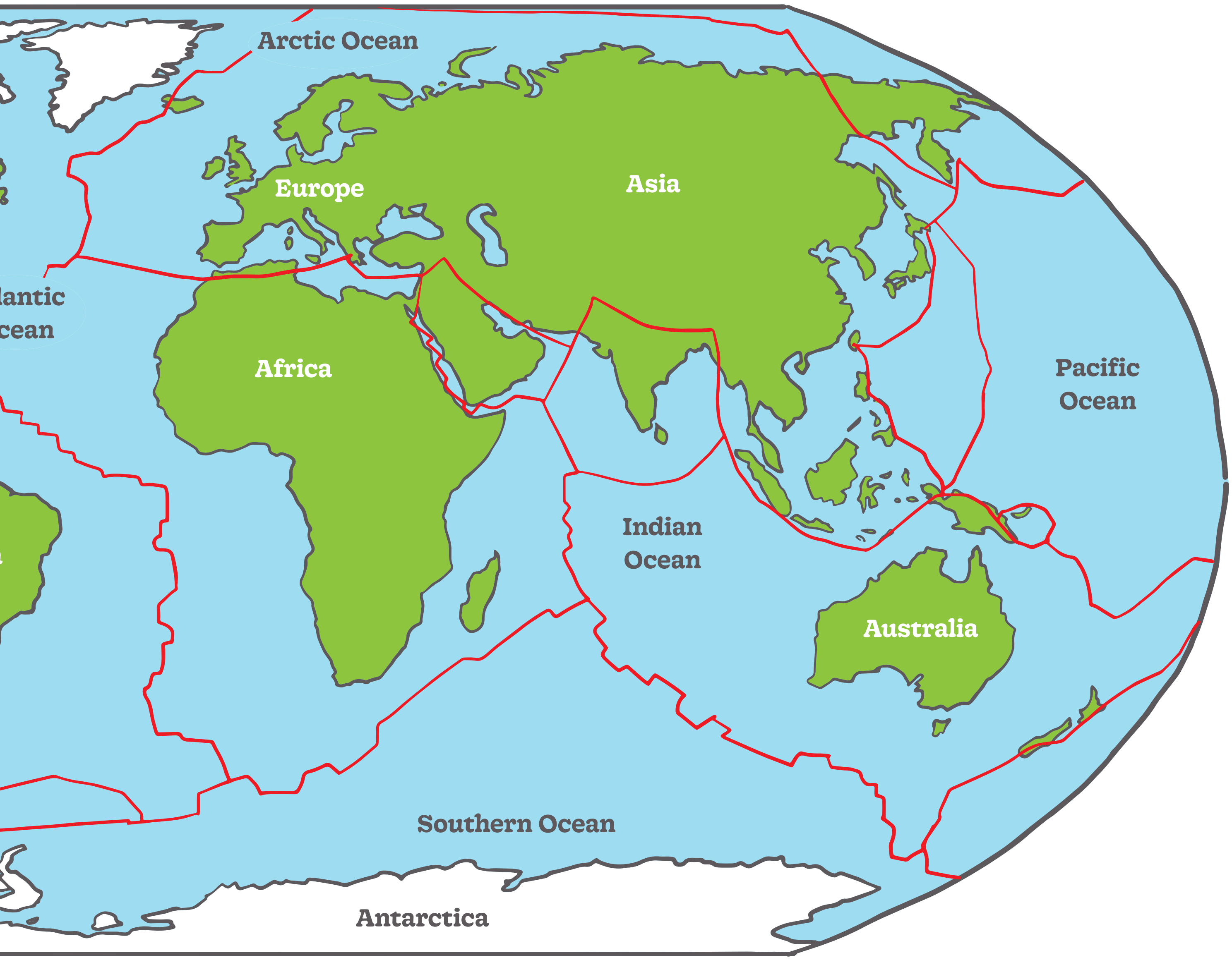
We live on top of the Earth's thin crust. The crust is hard and made of different kinds of rocks. But the crust is not just one solid piece. Instead, the Earth's crust is made up of many separate pieces called **tectonic plates**. The tectonic plates fit together like huge puzzle pieces. But they're always moving slowly because of the hot melted rocks flowing below them in the upper mantle.

When tectonic plates move, some move away from each other, others crash into each other, and some plates can slide past each other.

These different kinds of movements can form valleys, mountains, and oceans, as well as cause earthquakes and volcanic eruptions.

Earth's Tectonic Plates

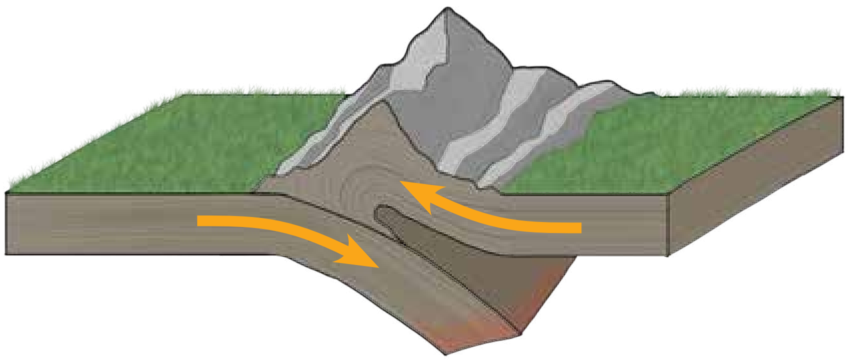
This map shows the locations of Earth's tectonic plates. Each of these plates is a huge sheet of rock that moves slowly. Notice how the continents usually sit on one plate, but the oceans sit upon several plates.


Arctic Ocean
Europe
Asia
Africa
Pacific Ocean
Indian Ocean
Australia
Southern Ocean
Antarctica

Tectonic Plate Movement

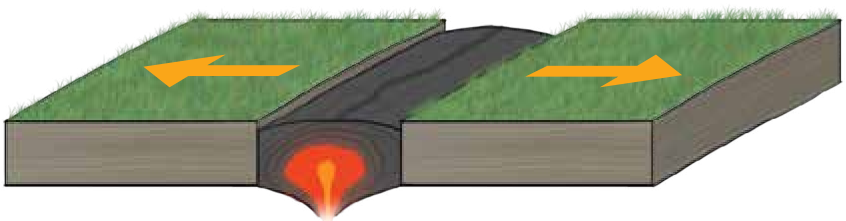
Here are a few of the ways tectonic plates move:

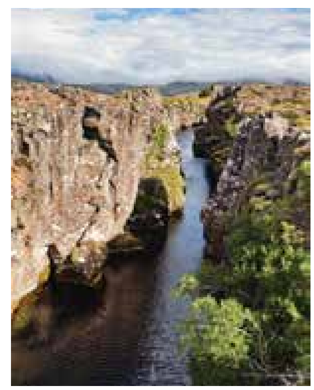
1. When tectonic plates push into each other, one is often pushed down into the Earth while the other is pushed up to form mountains.



Mount Everest, the tallest mountain in the world, was formed when two tectonic plates pushed rock upward.

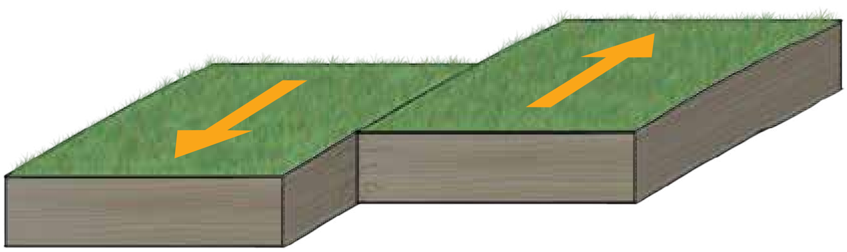
2. Some tectonic plates are pushed apart when melted rocks from deep in the Earth rise between them. Lots of times, the space between the plates becomes filled with water.





This canyon in Iceland gets wider every year because each side of the canyon is a different tectonic plate, and they are slowly moving apart.

3. And some tectonic plates slide past each other. This can cause earthquakes.

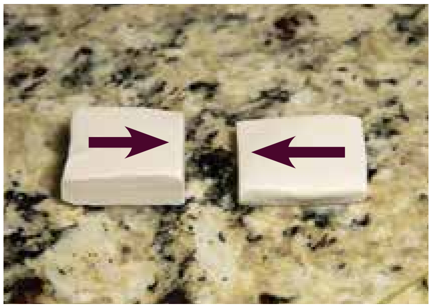


When two tectonic plates slide past each other, it can cause earthquakes that can cause major disasters.

Activity: Make Your Own Tectonic Plates

Using flat pieces of clay, try to recreate these tectonic plate motions. For example, see what happens when you push two sheets of modeling clay together. One of them might rise up to make a hill or mountain! Experiment with differently shaped pieces of clay, or try making one sheet thicker than the other.

1. These two pieces of clay can act like tectonic plates. See how one is much thinner than the other? This represents the different kinds of tectonic plates.



Hint: If your clay is too sticky to easily slide along a table, try putting a little piece of paper towel under each piece to help it slide more easily.

2. When pushed together, the top of the thicker one starts to roll over the thinner one, while the thinner one starts to push underneath.

3. Keep pushing them together and the thicker one may rise up into a shape that looks like a hill or mountain—a lot like how tectonic plates form mountains.

Timeline of Earth's History

The Earth is very old—around 4.6 billion years old!—and lots of different plants and animals have lived on our planet throughout that time. Some that appeared long ago are still around today, like fish, but others went extinct (died out), like the dinosaurs. At first, there was no life that lived on dry land—not even plants! All life on Earth began in the oceans and slowly moved onto land over millions of years.

Scientists organize the Earth's lifetime into chunks called periods. Each period saw different kinds of life appearing and disappearing. Let's look at the timeline of Earth and when different plants and animals first appeared.

After studying the timeline, answer these questions:

1. Trilobites first appeared in the Cambrian Period, around 521 million years ago. But they went extinct 252 million years later at the end of another period. Which period was their last?

____

2. Stromatolites are rounded structures made by what kinds of organisms?

____

☜ *Formation of the **Earth** 4.6 billion years ago.*

Answers on page 119! ☞

Trilobites were sea creatures that lived in the oceans. They were around for a long time. They lived from 521 million years ago to 252 million years ago, but they are extinct now.

The **first fish** started to appear in the oceans around 530 million years ago. The very earliest fish were different from most fish we know now—they didn't have jaws, just like lamprey (a weird, eel-like sort of fish) today.

Precambrian Period
Began: 4.6 billion years ago
Ended: 541 million years ago

Cambrian Period
Began: 541 million years ago
Ended: 485 million years ago

One of the earliest kinds of life on earth was tiny bacteria. Cyanobacteria, also called blue-green algae, has been living in the oceans for about 3.6 billion years (and maybe earlier), and are still around today! These bacteria live grouped together in round, mushroom-shaped rocky structures called **stromatolites**.

Mollusks first appeared in the oceans around the beginning of the Cambrian Period, 541 million years ago. Mollusks are soft, boneless animals that often have a shell. Clams, snails, and octopuses are mollusks.

Timeline of Earth's History

They may look like ocean plants, but **crinoids** are animals. They appeared 480 million years ago and are still around today.

Sharks first appeared in the oceans around 425 million years ago.

Ordovician Period
Began: 485 million years ago
Ended: 443 million years ago

Silurian Period
Began: 443 million years ago
Ended: 419 million years ago

This strange fossil is from a group of animals known as Orthoceras. They were squid-like animals with a long shell and lived around 470 to 442 million years ago.

The **first animals appeared on land** around 419 million years ago at the end of the Silurian Period—they were tiny animals with no backbones, and were a lot like millipedes and spiders we have today.

Ferns were some of the first leafy land plants and appeared around 380 million years ago.

Conifer trees (trees with seed cones) appeared around 310 million years ago.

Quiz Time

After studying the timeline, answer these questions:

1. When did the first fish appear?

____

2. The first animals with backbones that lived only on dry land appeared in what period?

____

3. What were the first animals with backbones to walk on land?

____

Devonian Period
Began: 419 million years ago
Ended: 359 million years ago

Carboniferous Period
Began: 359 million years ago
Ended: 299 million years ago

Some of the first animals with backbones to walk on land were **amphibians**, around 370 million years ago. They were major predators back then. They lived mostly in the water but could come on land.

Reptiles, like lizards, appeared 312 million years ago. They were the first animals with backbones that only lived on land and not partially in the water.

Answers on page 119! ☞

Timeline of Earth's History

Giant insects, such as giant relatives of dragonflies called *Meganeura* (which had a wingspan over two feet!), lived around 305 million years ago.

Around 275 million years ago, a group of animals called **therapsids** appeared. They were a little bit like half-reptile, half-mammal animals! They are the distant relatives of all mammals.

Carboniferous Period

Permian Period
Began: 299 million years ago
Ended: 252 million years ago

Dimetrodon were animals that lived during the Permian Period. They may have looked like dinosaurs, but they were actually more closely related to mammals than to reptiles.

Quiz Time

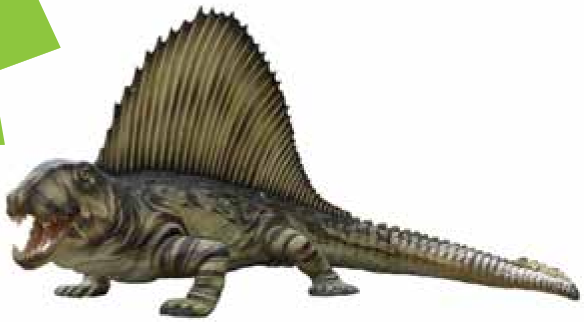
After studying the timeline, answer these questions:

1. Both dinosaurs and mammals appeared during which period?

______

2. Mammals became the dominant species in the Paleogene Period, after the dinosaurs went extinct. Without the dinosaurs around to eat them, what happened to many kinds of mammals?

______



Answers on page 119! ☞

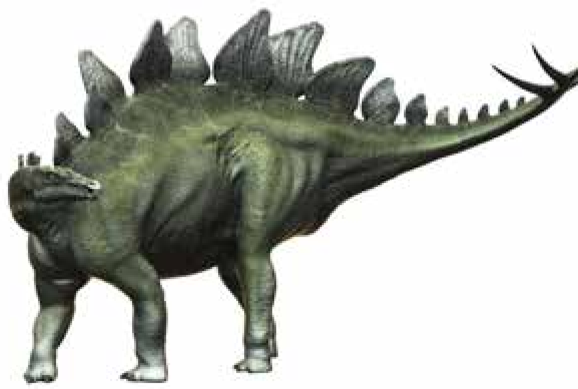
Not long after dinosaurs appeared, so did mammals! The **first furry, warm-blooded mammals** were very small so that they could hide from predators, like dinosaurs. They appeared around 220 million years ago.

Some of the biggest dinosaurs started to appear in the Jurassic Period. *Brontosaurus* first appeared around 156 million years ago and lived until about 147 million years ago.

Triassic Period
Began: 252 million years ago
Ended: 201 million years ago

Jurassic Period
Began: 201 million years ago
Ended: 145 million years ago

Many of the strangest dinosaurs began to appear in the Jurassic too. *Stegosaurus,* with their spiked tails, lived from about 155 to 150 million years ago.



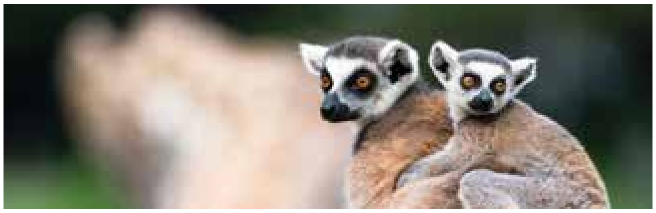
The first dinosaurs were small, like this *Coelophysis (say it "see-lo-fy-sis").* Dinosaurs began to appear around 233 million years ago.

Timeline of Earth's History

The **first birds** began to appear around 121 million years ago. Back then, they had teeth! All birds evolved from dinosaurs, which means that all birds today are directly related to dinosaurs, like *Tyrannosaurus rex!*

***Dinosaurs** went extinct 66 million years ago.*

The first **primates**, like monkeys, appeared around 55 million years ago. Primates are very smart and are the distant relatives of humans like you and me!



Cretaceous Period
Began: 145 million years ago
Ended: 66 million years ago

Paleogene Period
Began: 66 million years ago
Ended: 23 million years ago

The mighty *Tyrannosaurus rex* and stout *Triceratops* appeared around the same time, 68 million years ago. *Tyrannosaurus rex* likely hunted the *Triceratops.*

After the dinosaurs went extinct, **mammals** could grow to much bigger sizes, like this giant ground sloth that lived around 35 million years ago. Some ground sloths were nearly 20 feet long!

The largest shark ever, the *megalodon,* was as big as a bus! It ate whales and appeared about 23 million years ago, surviving until about 3.6 million years ago.

Saber-toothed cats were large and had enormous fangs; they lived from around 2.5 million years ago to as recently as 10,000 years ago.

Quiz Time

After studying the timeline, answer these questions:

1. What animals are still alive today that are directly related to dinosaurs?

____

2. Dinosaurs lived in three time periods. Which periods were they?

____

3. Did *T. rex* ever fight a *Stegosaurus?*

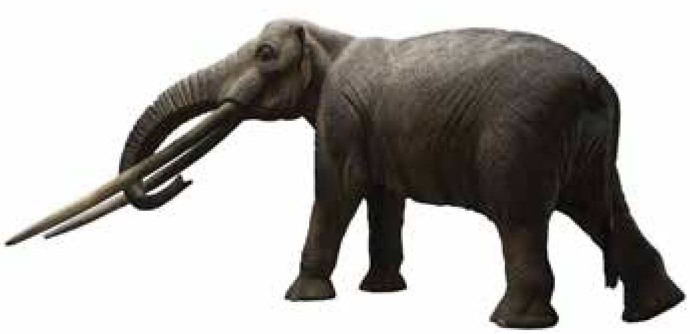
____

Neogene Period
Began: 23 million years ago
Ended: 2.6 million years ago

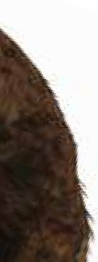
Quaternary Period
Began: 2.6 million years ago
Still continues today.

Today, *you're reading this book!* ☞

Mastodons were large muscular animals like elephants. They first appeared 5 million years ago and lived until about 10,000 years ago.



We are a very young species. **Humans** appeared around 300,000 years ago.



Answers on page 119! ☞

Rock Layers

The Earth's crust has lots of rocks in it that we can find and study. Some rocks are much older than others and formed a very long time ago. But how do we know which rocks are older?

One way that we can learn about the age of rocks is by looking at **rock strata**. Strata is a scientific word that means "layers," so when we study rock strata, what we're studying are the layers of rock that make up the Earth's crust. It's like looking at the different layers in a fancy cake.

The most important thing to know about rock layers is that younger layers form on top of older layers. Each layer can be a completely different kind of rock, but the oldest ones are at the bottom.

Activity: Create Your Own Layers

What you'll need:

- A clear jar or bowl
- Different-colored sand, gravel, and/or dirt

---

1. Put some dirt or sand in a clear container so that it forms a layer that covers the bottom. Then, take a different color of sand or a different kind of dirt and make another layer above the bottom layer. Keep repeating this with different sand or dirt until the jar is filled. Then take a look at the layers you made.

2. The layers you made are a lot like rock layers. Since you put the bottom layer in the jar first, it is older than the top layer, which you put in last. And if some of your layers weren't perfectly flat, look how they affected the shape of the layers above them.

---

3. Try this activity again and place some small toys or stones in the various layers to represent fossils!

Quiz Time

Answer these questions using the image on the left:

1. Which layer is the oldest?

____

2. Do you think that the *T. rex* and the *Triceratops* (shown in the fossils in the rocks at left) lived at the same time?

____

3. Which is older: the *T. rex* fossil or the *Triceratops* fossil?

____

Answers on page 119! ☞

Weathering

Rocks may seem so solid that nothing could hurt them, but all it takes is some water! When water, like rain and waves, hits a rock for many years, it can wash away little pieces of the rock and change its shape. This can even happen to huge rock layers! Other things like wind, ice, and even plants can also change and break rocks. This is called **weathering**, and it is a powerful force that shapes the Earth's crust.

Here are some of the different ways that weathering can change rocks.

When **water** hits rock over and over, it slowly washes away tiny pieces of it. Over many years, this can eventually wear away the whole rock. This huge hole in the cliff was made by **waves.**

Wind can blow around little pieces of sand, and when that sand hits a rock, it can chip tiny pieces off of it. These huge rock arches were carved by the wind blowing sand against the rock for many years.

When water freezes to become **ice**, it expands, which means it gets bigger. If a crack in a rock has some water in it and then the water gets cold enough to freeze, the expanding ice can split the rock! These cracks were made by ice.

Glaciers are enormous sheets of ice that flow very slowly, like a river of ice. They are very heavy and can crush rocks beneath them. This glacier is carving a whole valley into these mountains.

Sometimes natural **acids** in the ground can **dissolve** soft rocks. This means that the rocks are slowly absorbed into water. This can happen underground, which makes sinkholes open up, like this one.

Plants may seem weaker than rocks, but when their roots get into the cracks in rocks and grow bigger, they can split the rock. Cliffs can form when plants break up the rocks and make them fall.

Landforms

The rocks and rock layers in Earth's crust take all kinds of shapes! These are called landforms, and they include things like mountains and valleys. Some landforms are formed by the moving tectonic plates and others are formed when wind, water, and ice shape and carve rocks (that's called weathering). Read more about landforms on pages 92–105.

Rivers are paths that water makes as it flows downhill. Rivers wash away rocks and are a form of weathering.

Oceans are huge bodies of water that form when two tectonic plates spread apart and water fills in between them.

Lakes are bodies of water that form in low spots made by weathering, like rain and ice.

Deserts are very dry areas that don't get much rain, sometimes because nearby mountains stop the rain clouds from getting there.

Tall **mountains** can form a few different ways, but they usually form when tectonic plates crash into each other and one is pushed upward! Young mountains are sharp and jagged, but older mountains are lower and more rounded from weathering.

Volcanoes are places where melted rock is pushed out of the Earth and onto the surface. These are often the result of tectonic plate movements.

Plateaus *(say it "plah-tohs")* are like hills with flat tops. They can form by tectonic plate movements or by weathering or often by both.

Valleys are low areas between mountains. They can be formed by tectonic plate movements or by weathering or often by both.

Canyons are like a deep valley with steep sides. They were formed by weathering, when rivers washed away the rock.

Quiz Time: Name the Landform

Using what you've learned about different landforms, answer these questions:

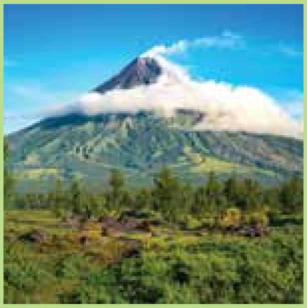
1. Which landform from this list is usually formed by the movement of tectonic plates?

A. Canyon

B. Mountain

C. River

2. Which landform from this list is usually formed by weathering?

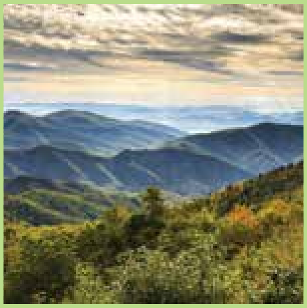


A. Volcano

B. Ocean

C. Canyon

3. Which of these mountain ranges is oldest?

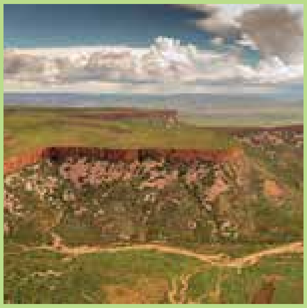


A.

B.

4. Which landform blocks rain clouds from getting to deserts?

A. Mountain



B. Plateau

C. Lake

5. Which of these landforms can form by both tectonic plate movements and by weathering?

A. Valleys

B. Volcanoes

C. Plateaus

6. Which of these landforms is formed when tectonic plates spread apart?

A. Mountain

B. River

C. Ocean

Answers on page 119! ☞

Minerals

Minerals from when special chemicals in or on the Earth come together and harden to form crystals. There are thousands of different minerals. Each mineral has a specific set of "ingredients" that doesn't change, no matter where in the world you find it. These ingredients are called **elements**, which can be thought of as "building blocks" that make up everything, including minerals!

For example, table salt is actually a mineral called halite. The "ingredients" that make up halite are the elements sodium and chlorine. No matter where in the world you find halite, it is always formed from the same combination of sodium and chlorine.

The most exciting thing about minerals is their crystals! **Crystals** are the shapes minerals take when they harden. They form when a mineral is pure and has enough room to grow. Each mineral forms crystals of a specific shape.

For example, halite forms as cubes, sometimes in groups that are stuck together. No matter where in the world you find halite, it will form as cube crystals. If you look at table salt under a magnifying glass, you might even see some cube crystals there too.

There are lots of different possible crystal shapes. From blocky shapes to pointy shapes, or flat shapes to lumpy shapes.

Naturally formed halite crystals, also known as table salt

A nice cube-shaped crystal of halite

With a magnifying glass or microscope, you may find cube-shaped halite crystals in common table salt!

Matching: Crystals

Different minerals can have different crystal shapes, and there are a lot of them! Get to know a few of the common shapes and appearances of minerals by matching these mineral photos to the label that best describes them.

1. Feldspar

2. Mica

3. Quartz

4. Garnet

5. Pyrite

6. Beryl

7. Hematite

8. Copper

A. Barrel-Shaped: Some minerals form crystals that are short with flat ends.

B. Ball-Shaped: Some minerals form crystals that look a bit like a soccer ball.

C. Pointy: Some minerals can form crystals that have sharp tips.

D. Cube-Shaped: Some minerals form crystals shaped like perfect cubes.

E. Grape-Like: Many minerals form lumpy masses that look a bit like bunches of grapes.

F. Blocky: Many minerals form crystals that are big and blocky with no sharp tips, but they are not perfect cubes, either.

G. Tree-Like: Some minerals can form complex crystals that branch out like a tree.

H. Flaky: Lots of minerals form thin, flaky crystals that grow together in layers.

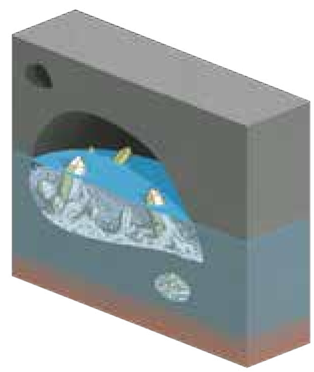
Answers on page 119! ☞

Minerals

Minerals can form in many different ways. In fact, some geologists specialize in studying the different ways minerals can form—they're called **mineralogists**. Just one of the many ways nice crystals form is when hot water from deep inside the Earth rises up into the holes inside hard rocks. The hot water has lots of minerals dissolved in it. That means that it has lots of tiny particles of minerals in the water. When the water begins to cool, it leaves those particles behind inside the spaces in rocks. Eventually, those particles can combine to form minerals and crystals.

Most minerals form inside rocks, usually inside a space or hole where they can grow. Sometimes they can fill the space completely, and other times they may only form a crust around the inside of the hole.

This photo shows holes in a rock that were partially filled with little quartz crystals.



This illustration shows us how hot water from deep in the Earth can rise up into a hole in a rock and leave crystals behind.

Activity: Dissolving Minerals

With an adult's help, you can test how minerals dissolve in warm water. Heat a small amount of water in a cup, and then add some table salt (halite) to it and stir it. Eventually, the salt will dissolve, or disappear into the water—now the water has a mineral in it! If you leave the cup alone for a few days and let the water dry up, then you'll see that the salt was left behind as a crust of tiny crystals on the bottom of the cup. This is similar to how hot water in the Earth moves minerals around and the way that crystals grow inside the holes in rocks as the water dries up.

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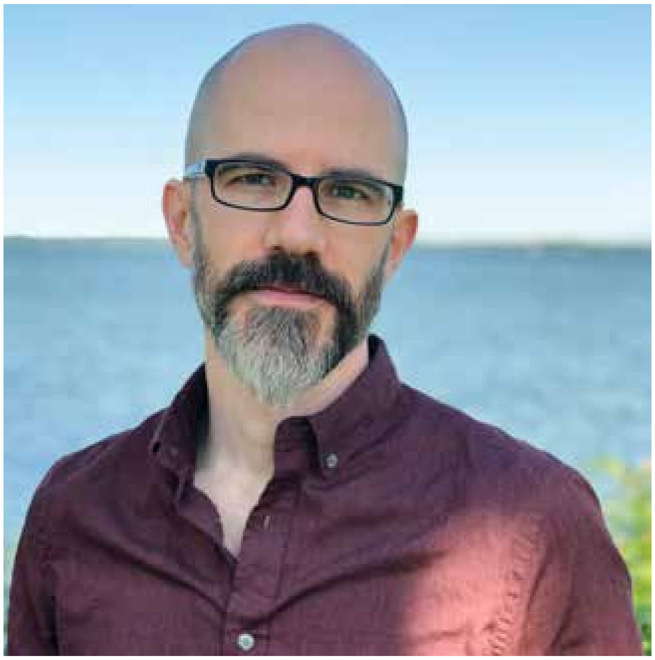
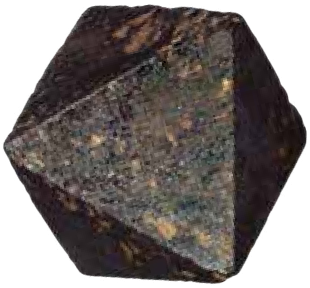


Dan R. Lynch grew up in his parents' rock shop, learning to identify rocks and minerals from a young age. Always an artist and writer, he combined his graphic design degree with his background in rocks to write more than 20 books about rocks and minerals. With his books, he strives to help novices "decode" the complex terms and concepts in geology by writing in an easy-to-understand way and approaching every topic with a "from the ground up" approach. He has always been fascinated by the natural world and all of its little details that most people don't pay any attention to, and he hopes his books can spark curiosity in his readers young and old. Dan currently lives in Madison, Wisconsin, with his wife, Julie, and their cat, Daisy.



Crystallized magnetite—
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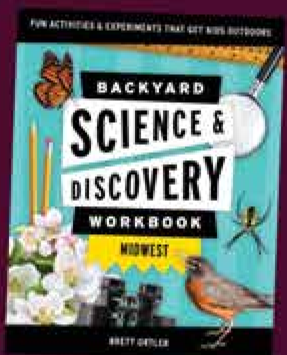

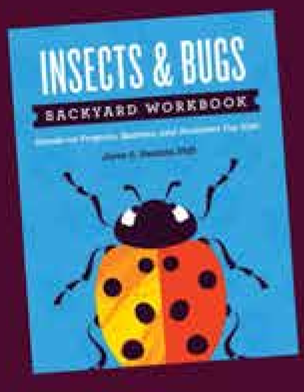

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