Christian Kids Explore

Earth&Space

Stephanie L. Redmond

Christian Kids Explore Earth & Space
by Stephanie L. Redmond
A part of the Christian Kids Explore series

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A NOTE FROM THE AUTHOR

I am like you. I am an average homeschool mom, working hard to ensure a sound education for my children and still maintain a respectable home. I have three precious children: Mike (19), Taylor (16), and Rachel (14). My husband, Andy, and I have been married for 23 wonderful years.

My main goal is to glorify God in all that I do. Part of fulfilling that goal is teaching my children to love the Lord their God with all their heart, soul, and might. If I am going to do that, I believe it is essential to teach them from a Christian worldview, using books that honor God.

In our years of homeschooling, I have used several types of study. Some I liked, others I didn't. However, a few years ago, I was introduced to classical education. Now, I'll admit we're not perfect examples of this, but I found it to be a wonderful way to set up our school. We follow the trivium, recognizing the grammar, logic, and rhetoric phases of our children's learning, and we teach history chronologically. We use Latin in our studies and read, read, read! However, for our elementary students, we've had a hard time finding just the right science book. I felt forced, at times, to use books that contained teachings contrary to my beliefs—for instance, books that taught evolution as fact. While I was able to use this as an opportunity to teach my children God's truth, as presented in Scripture, I found that I longed for a homeschool book that would teach the same.

So it was that, through much prayer and encouragement from friends, I found myself writing my first homeschool science book, *Christian Kids Explore Biology*. You must know that

I am not a scientist. My credentials are that I homeschooled myself! I had the manuscript for the book reviewed and edited for science content by qualified people. During this process, I personally learned the joy of studying science. My hope was, and still is, that I will be able to impart that excitement to you and your children. Most of all, I pray that your family is encouraged and God is glorified through the words of the text that seek to exalt God as Creator.

Now I am very excited to bring you another book in the Christian Kids Explore science series, *Christian Kids Explore Earth and Space.* This is an earth science course and again, because I am not a scientist, I had the manuscript reviewed and edited for science content by qualified people. Hopefully, through this book, you can show your child the miracle of God's awesome Creation. Certainly, it won't be any great writing on my part that will do that. Rather, it will be through giving God the credit for the detailed structure and function of this planet. We will spend most of the school year, about 24 weeks, studying our Earth, leaving about 6 weeks to cover outer space.

Because I am much like you, I understand the pressures that homeschooling mothers and fathers face. Time is critical and there is never enough of it. Therefore, this book has been designed taking that into consideration. First and foremost, *Christian Kids Explore Earth and Space* **is written for multiple ages and grades.** While it is geared for 3rd to 6th graders, there are many ideas for younger ones, as well as for those who want to do more. The lessons are complete and concise, but there is room to bring in books from outside sources if you choose. Little advance preparation is needed. A list of the materials you will need is at the beginning of each unit so you can gather once per unit if you choose, instead of every week. Vocabulary lists are included, along with hands-on activities that reinforce learning. There is a gorgeous coloring page with each unit as well as a unit review. Also, there is a very helpful book and resource list in the appendix section. This book seeks to offer you everything you need for a fruitful year of elementary earth science, plus a little more.

~ Stephanie L. Redmond

"Be exalted, O God, above the heavens;
Let your glory be above all the earth."
(Psalm 57:11)

HOW TO USE THIS BOOK

This book contains 24 lessons and six unit reviews. Each lesson and each unit review is designed to be completed in one week. If you teach science twice weekly, you'll need to allow for about 60 to 90 minutes each day. Of course, this will depend on the student and the number of outside resources used.

Each lesson consists of a **Teaching Time** and a **Hands-On Time**. I recommend doing each on a separate day.

Teaching Time

- As each new lesson is begun, the text is read. You may read it to your students or they may read it to themselves. In the case of very young students, you might read it on your own and then discuss the information at their level. They may enjoy completing a Coloring Page while listening to you.

- After this lesson is read, students should complete a "Daily Reading Sheet."

To make the study complete, you will need to do a little more:

- First, review recent lessons, particularly as they apply to your newest lesson.

- Second, if you make flashcards as you go (with vocabulary words, lesson facts, Scripture verses, etc.), you will want to review those.

- Third, have your students list the vocabulary words (any in bold lettering in the lesson, plus any they listed on their Daily Reading Sheet) and define them in their science notebook.

- Last, you'll want to allow time for outside reading and picture perusing and researching topics of interest. I recommend having your students complete additional Daily Reading Sheets for their supplemental reading, even if they use just a few pages from a particular book. (It's quite acceptable to pick and choose pages and chapters to read rather than an entire book!) All completed forms and written work should be kept in their science notebook.

Hands-On Time

Most children love hands-on learning, and it helps keep science exciting for your children (and you!). Although Hands-On Time can be time consuming, try to also make time for a little review as you are working. The "Checking It Out" science experiment form will often be utilized on these days and should be completed and filed in the student's science notebook.

It can be tempting to eliminate these activities to save time; however, I strongly advise otherwise. Science can be so exciting, but it can also be dull. It all depends on how it is taught. Elementary science is about discovery and taking joy in the journey. Have fun with it!

Timeline Activity

Included at the beginning of each unit are timeline entries and dates. These can be used simply to add to your students' knowledge of events. However, I believe your students (and maybe yourself) will be better served by actually completing a timeline, adding information each unit. This activity will help them see major events, inventions, and scientists associated with the subject matter of each unit. The information listed will also give you and your students ideas for additional research. Wall-sized timelines are available from www.brightideaspress.com. We have utilized timeline activities throughout our homeschool studies and find them to be incredibly useful.

Coloring Pages

There is one Coloring Page per unit and all of these are provided again in the appendix section for your convenience. These may be photocopied. Children of all ages will enjoy these beautiful drawings. Some will even benefit from keeping their hands busy with markers or pencils while having lessons read aloud to them.

Unit Wrap-Up and Show What You Know!

The last event for each unit is a unit review and quiz. The "wrap-up" review gives students the opportunity to write a composition summarizing each lesson with the aid of the "Write About It!" worksheet and form (found in the appendix section). This form will help them think through and organize the unit material before they begin writing—all of which will reinforce the main points they studied in the unit. They are also encouraged to create a colorful and fun folderbook for each unit. (Folderbook instructions are simple and are included in the appendix section.)

The wrap-up quiz—"Show What You Know!"—can be used as a test or merely as a unit review; it's your choice. I've made the scoring fun, using thousands of points instead of one hundred. These, too, can be copied for each student and filed in his or her science notebook.

Reproducibles

There are a number of forms in Appendix A that are available for reproducing, according to your needs. The course is designed to be easily used with several children of differing ages at the same time. If you do not have a home copier, make a trip to your favorite copy shop and reproduce several Daily Reading Sheets and Checking It Out forms (along with the Coloring Page, the Write About It! worksheet and form, and the Show What You Know! quiz for each unit). The first two forms mentioned are used frequently, so plan ahead. Is copying difficult for you? Make your own similar forms on the computer or simply use notebook paper. It's the content—not the form—that counts!

Also in Appendix A are labeled and unlabeled versions of the labeled technical art that is in the lessons. When you're at the copy shop, reproduce as many of the unlabeled versions as you'll need for each unit; then have your students test themselves by filling in the labels without looking in the book. When done, they can easily check their labels against the book. This provides another activity to reinforce material they have studied throughout the units.

What a Daily Lesson Could Look Like

Tuesdays

- **Memory Work**—Review flashcards and vocabulary. *5 minutes*
- **Discuss** last lesson. *5 minutes*
- **Teaching Time**—Read or have student read new lesson; ask comprehension questions as you go. *10 minutes*
- **Discuss** new information. *2–3 minutes*
- **Daily Reading Sheet**—Have student complete a Daily Reading Sheet. *10 minutes*
- **Vocabulary**—Have your student fill out (or assist him or her in filling out) a vocabulary sheet, or make flashcards, if you prefer, of the key words in the lesson. *10 minutes*
- **Books**—Outside reading time. This is where students have the opportunity to peruse other sources, perhaps from the library. *30 minutes or more, as necessary*

Thursdays

- **Memory Work**
- **Hands-On Time**—Complete a relevant experiment or activity. Student can also use part of this time for working on folderbooks and discovery (research) activities.

Remember: Younger children do not need as much detail. Give them the facts and HAVE FUN! We are trying to include enough "work" for the older kids, but enough "fun" for the younger ones. If you have only young elementary (K–3) students, then even once a week is enough for science. If they are doing memory work, though, bring out those flashcards two or three times per week. We like to go to the library and get lots of books on the subject at hand.

Instructions for Your Science Notebook

This section is addressed to your students; however, you may need to help them decide the best way to organize their science notebooks.

This year you will need to maintain a science notebook. The purpose of this notebook is to help you organize all your documents from your studies. An important part of good science is good record keeping. It is the only way to accurately track your findings.

I recommend a three-ring, loose-leaf notebook, about 1½ inches thick, with pockets on the inside of the covers. For tabs, I recommend tabs with labels. You have two options in this area:

- **Option 1**—Unit by Unit: For this method you will need six tabs labeled "Unit One," "Unit Two," and so on, through Unit Six. In each section you will file your Daily Reading Sheets, Checking It Out forms, Write About It! composition, and any other written work.

- **Option 2**—Type of Work: For this method you will need at least eight tabs, possibly more, and you will file your work chronologically, that is, in order by date. Your tabs should be labeled:
  - Daily Reading Sheets
  - Vocabulary
  - Checking It Out
  - Write About It!
  - Coloring Pages
  - Field Trips
  - Diagrams (You might sketch some from your readings.)
  - Photos (I highly recommend taking photos throughout the year of your Hands-On activities, field trips, and experiments.)

Your science notebook will provide an excellent record of your studies in earth science!

Unit Two
The Lithosphere

Unit Timeline

79 Mt. Vesuvius erupts, burying and preserving three Roman cities, including Pompeii.

1700s Modern geology (science of Earth's history, composition, and structure) is developed by Jean-Étienne Guettard.

1852 Radanath Sikhdar identifies the highest peak on Earth, which is later named Mt. Everest.

1915 Alfred Wegener publishes his theory that the continents are in constant motion, the "continental drift" theory.

1916 Hawaii Volcanoes National Park is established.

1935 Charles Richter develops a scale for measuring the strength of earthquakes.

1953 Edmund Hillary reaches the top of Mt. Everest.

1960s The plate tectonics theory is developed.

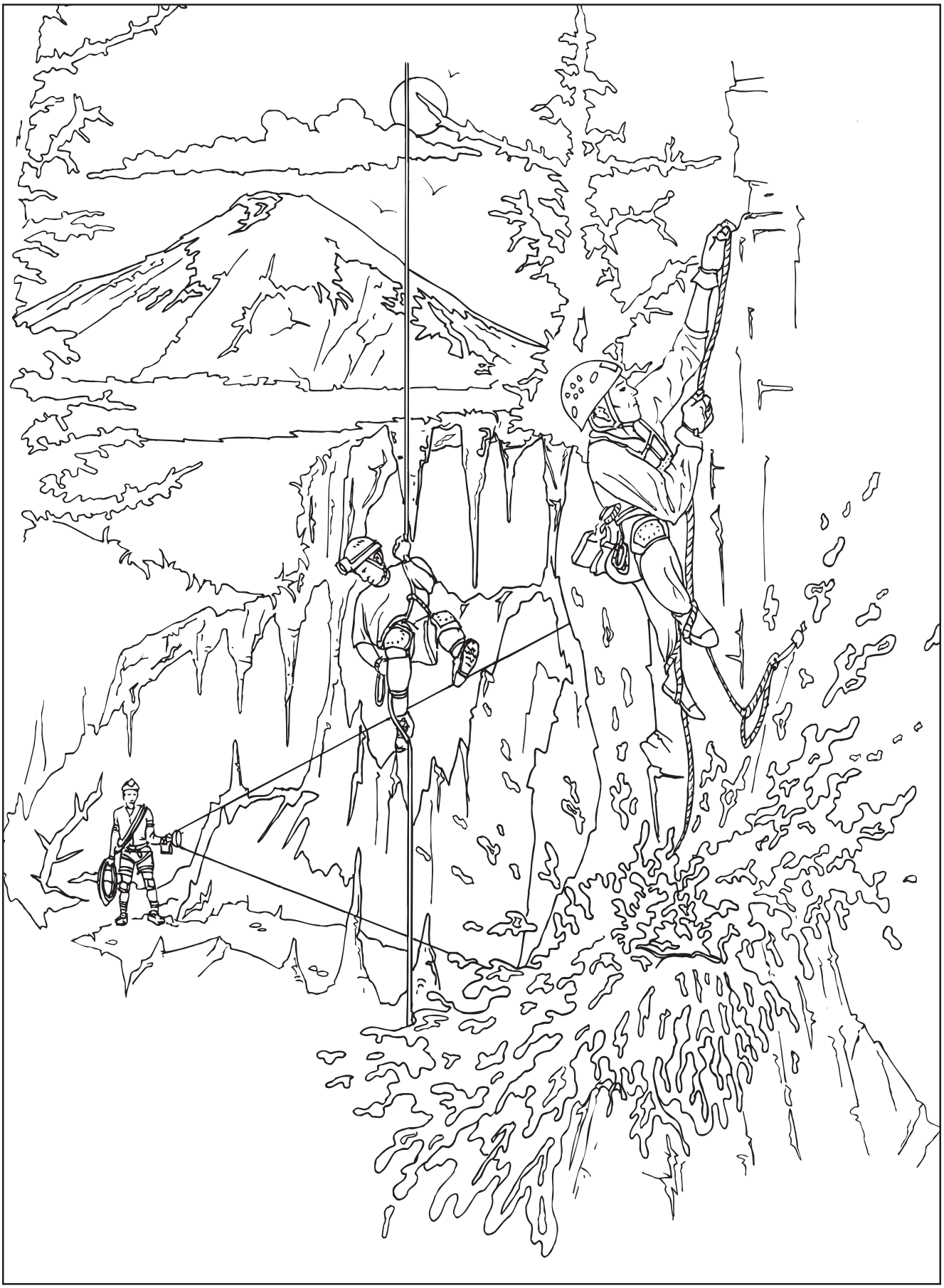
1980 Mount St. Helens erupts.

Unit Two Vocabulary

- active volcano
- calcite
- caldera
- carbonic acid
- caverns
- chemical rock
- cinder cone volcano
- clastic rock
- columns
- composite volcano
- coral caves
- crater
- dormant volcano
- earthquakes
- epicenter
- erosion
- eruption
- extinct volcano
- faults
- focus
- geologists
- geology
- igneous rock
- lava
- lava bombs
- magma
- magnitude
- metamorphic rock
- Milne, John
- organic rock
- Pangea
- plate boundaries
- plates
- plate tectonics
- Richter scale
- rock cycle
- rocks
- San Andreas Fault
- sea caves
- sediment
- sedimentary rock
- seismogram
- seismograph
- seismology
- shield volcano
- soluble
- speleothems
- spelunking
- stalactites
- stalagmites
- sulfuric acid
- vent
- volcanic caves
- volcano
- volcanologist

Materials Needed for This Unit

- Science notebook
- 4 photocopies of the "Checking It Out" form in Appendix A
- Photocopy of the world map in Appendix A
- Photocopy of the "Speleothem Observation Chart" in Lesson 4
- 1 egg (per student)
- Pan for boiling egg
- Salt
- 12-inch length of cotton yarn
- 2 pint-sized jars
- Saucer
- Epsom salts
- Mixing bowl
- 2 paper clips
- Sand
- Large bucket
- Cookie sheet or tray
- Vinyl tablecloth (to protect table or countertop)
- Small piece of cardboard or plywood
- Narrow-neck bottle, such as a16-ounce plastic soft drink bottle, clean and dry
- Modeling clay or dirt, sand, rocks, etc.
- Small funnel
- 3 to 4 tablespoons baking soda
- 3 to 4 drops liquid dishwashing detergent
- 3 to 4 drops red or orange food coloring
- ½ cup vinegar
- Camera
- Student atlas
- Plastic or wooden building blocks
- Cookie sheet
- Ingredients for Chocolate Nut Layer Bars (See the recipe in Appendix E.)
- Materials for Unit Wrap-Up (See page 73.)



Lithosphere Coloring Page

In This Lesson:

Lesson 3

PLATE TECTONICS

Teaching Time:
The Shifting Earth

When God created the universe, including Earth, He created an incredible masterpiece. First, our Earth is beautiful. Second, it is very detailed, right down to the tiniest cell, and everything works perfectly together. God's creation was exactly perfect until Adam and Eve sinned in the Garden of Eden (see the Book of Genesis). This is very important to understand because some scientists disagree tremendously on how things in our world came to be the way they are. Furthermore, not even all Christians agree. Because of these disagreements, not all books you read will teach things in the same way. As we study, we will use the Bible as our guide. We will cover some topics in this unit that are a source of disagreement, but let's remember that scientists are learning more about the world every day. No one but God knows all the answers about our Earth. We will do well to put our trust in God and His Word rather than in man.

Scripture

Then God said, 'Let the waters under the heavens be gathered together into one place, and let the dry land appear'; and it was so. (Genesis 1:9)

Name It!

plate tectonics
A theory that says Earth's crust is made up of several pieces called plates that are in constant motion and sometimes collide, forcing changes on Earth's surface.

plates
In the theory of plate tectonics, large, thin, relatively rigid layers in Earth's crust that constantly move in relation to one another.

Pangea
A theory that says all of Earth's continents were once joined together and have moved apart over time and with the shifting of plates.

Discovery Zone

What Is a Theory?
Scientifically, a theory is a hypothesis (educated guess) that has survived much experimental testing and has been upheld with a significant amount of data. If this theory then survives generations of testing and remains consistent, the theory can become scientific law. This is all called the Scientific Method.

The Plate Tectonics and Pangea Theories

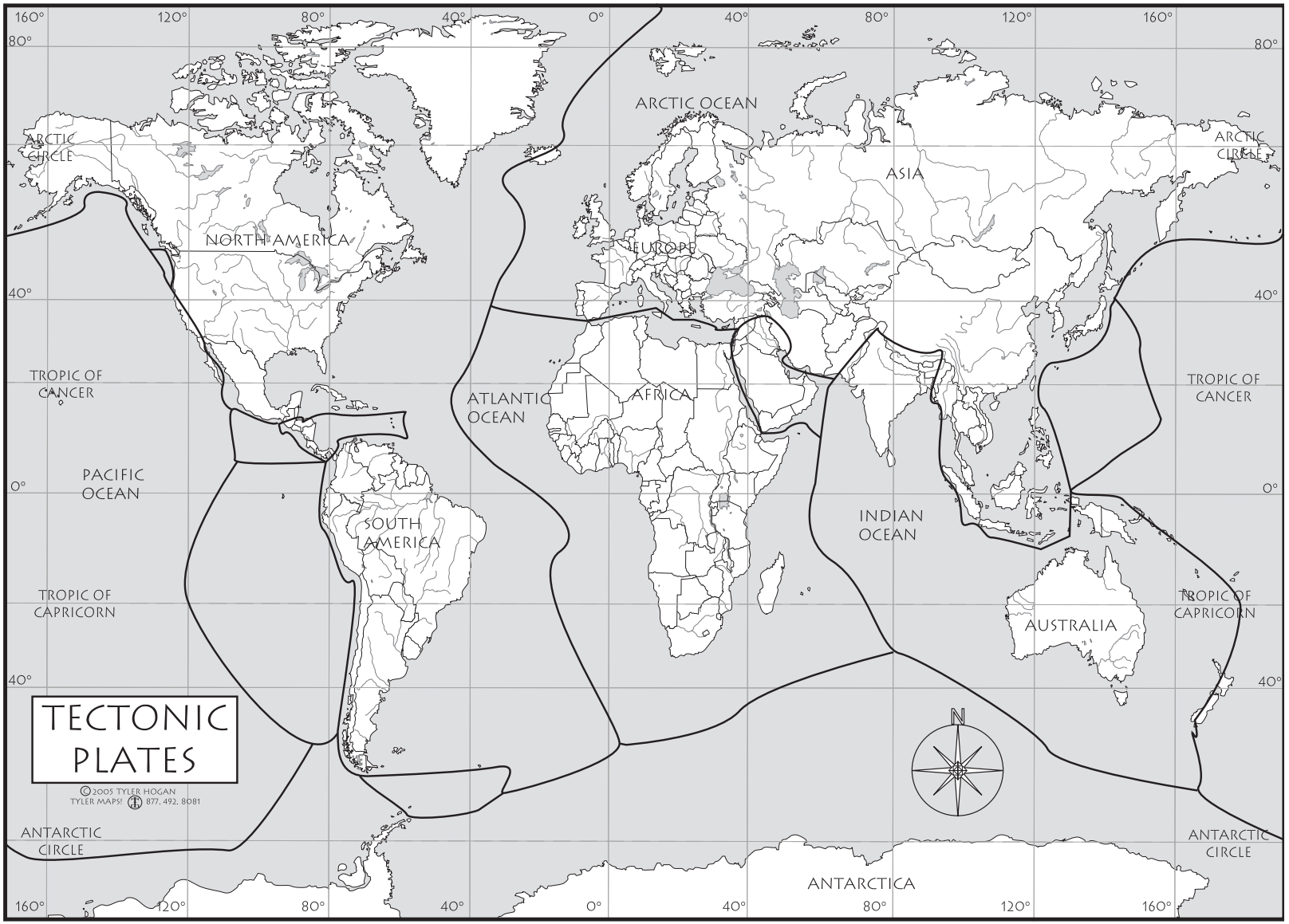
Plate tectonics (tek **tahn** iks) is one topic about which some scientists disagree. We will explore some things about plate tectonics because it affects other matters we need to study. The basic concept of plate tectonics says that Earth's crust is made up of several pieces called **plates** that fit together a bit like a puzzle. In other words, the crust does not appear to be one solid piece but rather, several pieces that are in constant motion. You can look at the "Tectonic Plates" map in this lesson to see where the different plates are.

Modern science teaches that as these plates shift they sometimes collide and force the surface of the land to change. Many believe this is how mountains are formed. The plate tectonics theory also says that all the continents were once joined together in one supercontinent called **Pangea**. The shifting plates are believed by many to have caused Pangea to break apart, forming several continents. Modern science says that this happened over millions and millions of years ago and that the continents moved very slowly to their present locations. Of course, many Christians have a problem with this concept. Many Christians do not believe Earth is nearly that old.

So then, what do we do with these teachings? Who is right, and who is wrong? Do the plate tectonics and Pangea theories disagree with the Bible?

What Does the Bible Say?

The Bible says that Earth was created in six days and that God rested on the seventh day. It also says that "Then God said, 'Let the waters under the heavens be gathered together into one place, and let the dry land appear . . . . ' " (Genesis 1:9) This Scripture does allow room for the idea of Pangea. Many scientists who are Christians agree that the worldwide flood described in the Bible could have caused the separation of the continents. In this case, the world would not have to be millions and



Tectonic Plates

Discovery Zone
Learn more about plate tectonics and earthquakes at The Southern California Integrated GPS Network Education Module: http://scign.jpl.nasa.gov/learn

Discovery Zone
For more information about plate tectonics and the Bible, check out www.answersingenesis.org

millions of years old. Such a flood could have caused the continents to move apart very quickly. This still allows room for the Pangea theory.

There is a lot of scientific evidence to suggest that Earth's continents were once all one supercontinent and that tectonic plates exist. For instance, modern measurements actually show minor change in the distances between the continents. Also, fossils, rocks, and animal life found on the coasts of some of the continents match up with those that, theoretically, were once joined together. Furthermore, studies of the ocean floor show markings and changes that fit in with the theory.

I cannot tell you for a fact whether Earth's crust is actually a series of tectonic plates or not. I cannot tell you for a fact that all the continents were once joined together in a mass called Pangea. I will tell you that Scripture leaves the possibility open for discussion. For your studies, you need to be aware that the theories exist. You might also like to know that they don't necessarily disagree with the Bible.

Review It!

May be done orally or written.

1. What part of Earth's structure is believed to consist of tectonic plates? _____
2. The theory that all the continents were once one super-continent is called _____
3. Name three things that suggest the Pangea theory and the plate tectonics theory might be true.

_____

_____

_____

Additional Notes

Additional Notes

Hands-On Time:

Tectonics Demonstration

Featured Activity

Objective

To demonstrate the concept of plate tectonics.

Materials

- 1 egg per student
- Pan and water for boiling eggs
- 1 teaspoon salt
- Photocopy of "Checking It Out" form in Appendix A

Instructions

Adult supervision required.

1. Place eggs in pan and cover with water.
2. Add salt to the water.
3. Place pan on stove and heat until boiling.
4. Boil for 10 minutes.
5. Have your teacher remove pan from stove and pour off hot water.
6. Refill pan with cold water.

7. Allow eggs to sit in cold water until cool enough to handle.

8. While eggs are cooling, review the lesson on plate tectonics.

9. When eggs can be handled, gently roll each egg on the countertop, cracking the shell.

10. Slide the shell around the egg, allowing the shell to split apart in places.

11. Observe the action. This is a very basic way to view the concept of plate tectonics.

12. Complete a "Checking It Out" form (found in Appendix A) and place it in your science notebook.

Additional Notes

In This Lesson:

Lesson 4

CAVES

Teaching Time:

Spelunking We Will Go!

Have you ever visited a cave? I have, and I loved it! It was dark and damp. There was water seeping down the walls, and there were formations that looked like icicles hanging from the ceiling. Exploring caves as a hobby is called **spelunking**. Spelunking is great fun and can teach you quite a bit about our Earth. I'll admit that when I explored this cave, I had no idea how the cave came to be or what the special features meant. Maybe caves are a mystery to you, too. Let's go spelunking and see what we can learn about God's creation!

Cave Formation

Do you know that there are many different types of caves? Not only are there different types, but caves are also formed in different ways. Some of the different types of caves are coral caves,

Scripture

"So he [Saul] came to the sheepfolds by the road, where there was a cave; and Saul went in to attend to his needs. (David and his men were staying in the recesses of the cave.)" (1 Samuel 24:3)

Caution!

Spelunking can be very dangerous unless you have proper equipment, training, and a guide. Do NOT try this on your own!

volcanic caves, sea caves, and caverns. **Coral caves** are formed by coral colonies joining in shallow water. The wind and waves can enlarge the cave by eroding some of the coral. **Volcanic caves** are formed by flowing lava and volcanic gases. Lava tubes are a type of volcanic cave. **Sea caves** are formed when waves erode sea cliffs. We will look more closely at a more familiar type of cave, the cavern.

Caverns

The surface of Earth is made up of many different types of rocks. Sometimes the rock is soft, other times it is very hard like granite. The softer rocks are often **soluble**, meaning they can be dissolved. Limestone is a common example of a soluble rock. Have you ever dissolved sugar with water? That might give you an idea of what I mean by soluble. Water alone would not be enough to dissolve most rock, however, not even soluble rock like limestone. Water and acids work together to dissolve limestone. **Caverns** are formed by water and acid washing away soluble rock. This process of "washing away" is called **erosion**.

The acid responsible for making caverns usually comes from one of two places. First, there is the acid that is formed by rainwater mixing with carbon dioxide in the air. This forms **carbonic acid**. Carbonic acid is not very strong, so it works slowly. As the rainwater falls, mixing with the carbon dioxide, it soaks into the ground. The acid it forms erodes the limestone, making a hole. Gradually, the path of the rain through the ground forms a type of underground stream, called groundwater, which erodes more and more of the limestone. Eventually, a cavern is formed, and it usually has many winding passages.

Another type of acid that can form caverns is **sulfuric acid**. One way sulfuric acid is formed is when hydrogen sulfide, a gas formed from decomposing leaves and other organic materials, mixes with water that is oxygenated. In the same way as before, limestone is eroded by this mixture and caverns are formed. Because sulfuric acid is much stronger than carbonic

Name It!

spelunking
The hobby of cave exploration.

coral caves
Caves formed by coral colonies joining each other in shallow waters.

volcanic caves
Caves formed by flowing lava and volcanic gases.

sea caves
Caves formed when waves erode sea cliffs.

soluble
Able to be dissolved.

caverns
Caves formed by water and acid that slowly erode soluble rock.

erosion
Process of washing away.

carbonic acid
Acid formed by rainwater mixing with carbon dioxide in the air; responsible for forming caverns slowly.

sulfuric acid
Acid formed by hydrogen sulfide mixing with oxygenated water; stronger than carbonic acid, hence it forms caverns much more quickly.

acid, caverns are created much more quickly by sulfuric acid than by carbonic acid.

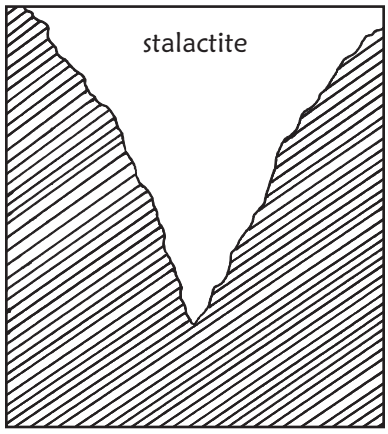
Speleothems

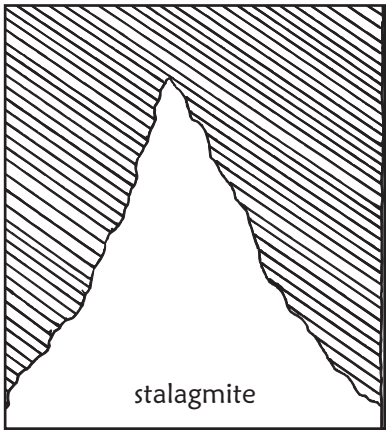
In the first paragraph, I mentioned that I saw things hanging down in the cave that reminded me of icicles. Actually, these formations are not icicles at all. They are **stalactites** (stah **lack** tites). There are also similar features coming up out of the floor of the cave, and they are called **stalagmites** (stah **lag** mites). When stalactites and stalagmites grow together, they form **columns**. All of these are part of a group of formations called **speleothems**. The word *speleothem* comes from the Greek words *spelaion*, which means "cave," and *thema*, which means "deposit." There are other types of speleothems, but these are the most common. Look at the illustrations in this lesson to see some examples of speleothems.

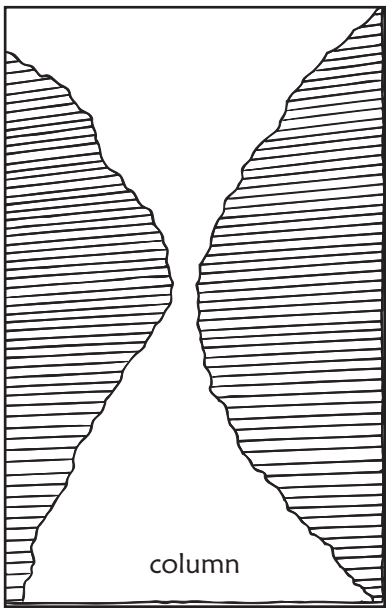
Note: To help remember the difference between stalactites and stalagmites, remember that stala**c**tites grow from the *ceiling* and stala**g**mites grow from the *ground*.

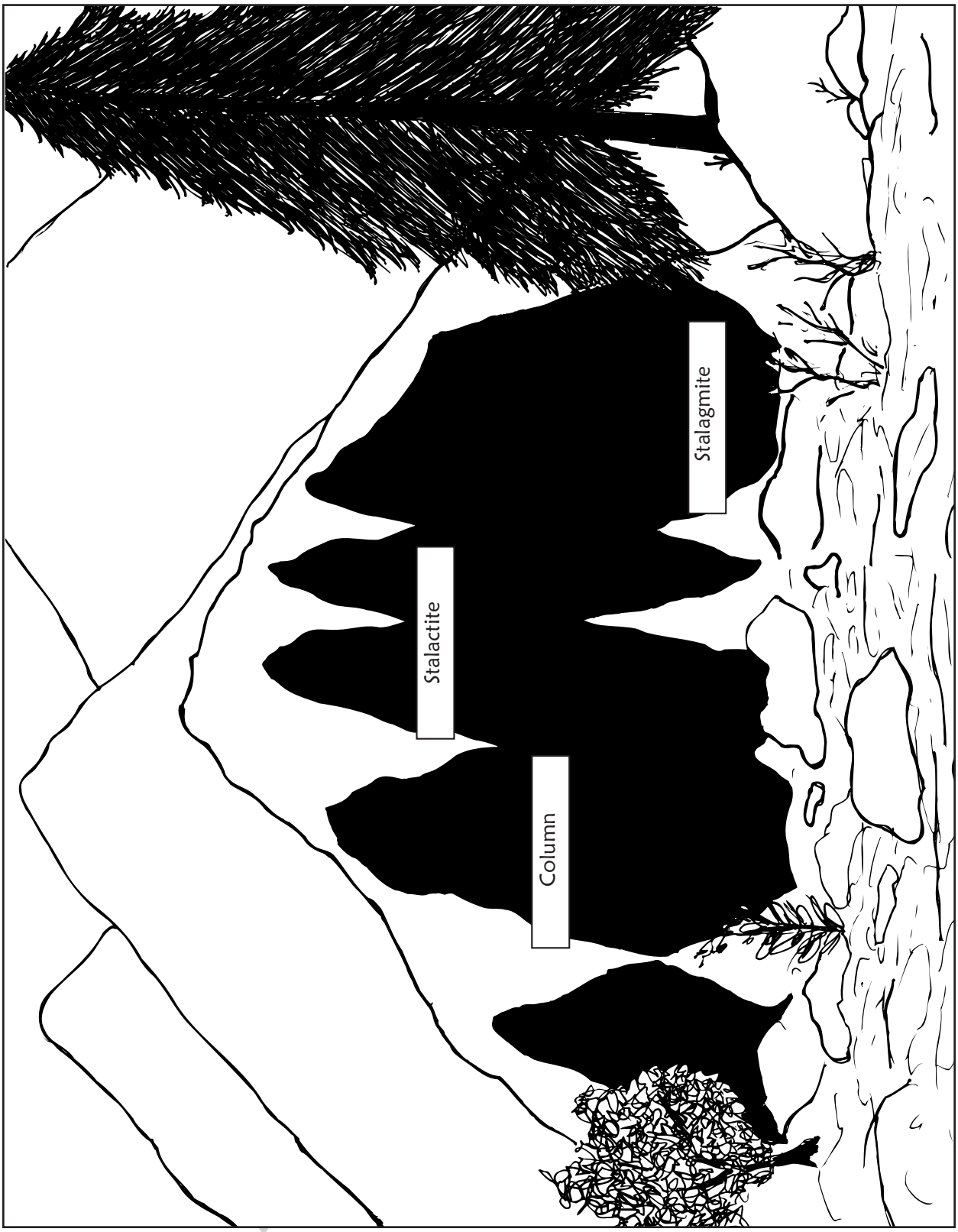
Speleothems are cave formations made from minerals that can no longer be held in the water. The name of the mineral deposited is **calcite**. Calcite is a result of the carbonic acid mixing with the dissolved limestone. As water drips through the ceiling of the cavern, it can land on the floor depositing crystallized calcite, which builds up to form a stalagmite. It can also begin to crystallize on the ceiling and form downward, making a stalactite. Now you should be able to understand why the word *speleothem* so perfectly describes these formations. They are indeed cave deposits.

All in all, I hope that you see how fascinating caves are. The type of cave we learned the most about today is the cavern. There are many places in the United States where you can visit a cavern and see all the interesting things we talked about. Maybe your family can make plans to see one on a vacation, unless one just happens to be nearby. If so, you can see if spelunking is a hobby for you!









Mouth of a cave showing stalactite, stalagmite, and column formations

Review It!

May be done orally or written.

1. What is a speleothem?

   _____

   _____

2. Name the formation that holds tight to the ceiling of a cave.

   _____

3. What two types of acids erode limestone, forming many caves and caverns? _____

   _____

4. Which type of acid erodes limestone more quickly?

   _____

Name It!

stalactites
Cave formations that hang from the ceilings of caves; made from mineral deposits.

stalagmites
Cave formations that build up from the ground or floor of caves; made from mineral deposits.

columns
Cave formations formed when stalagmites and stalactites grow together.

speleothems
Cave formations of various shapes and sizes made from mineral deposits.

calcite
Mineral that results from carbonic acid mixing with dissolved limestone, deposited by water and responsible for many speleothems.

Additional Notes

Hands-On Time:

Make a *Speleothem*

Featured Activity

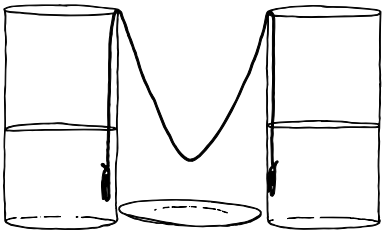
Note: Your speleothem will take several days to form and will require daily observation.

Objective

To see how dripping water can deposit minerals and make a formation.

Materials

- 12-inch length of cotton yarn
- 2 pint-sized jars
- Saucer
- Epsom salts
- Warm water
- Mixing bowl
- 2 paper clips
- Photocopy of "Speleothem Observation Chart" in this lesson
- Photocopy of "Checking It Out" form in Appendix A



Instructions

1. Pour 4 cups of very warm water into a mixing bowl.
2. Add Epsom salts, stirring continuously. Keep adding salts until no more can be dissolved.
3. Divide this solution evenly between the two jars and place in a sunny spot.
4. Place the saucer between the two jars. Add a small amount of Epsom salts to the center of the saucer.
5. Tie a paper clip onto each end of the yarn.
6. Soak the yarn in the solution, saturating it.
7. Place each end of the yarn in a jar so that the yarn is connecting the two jars. (*See the accompanying illustration.*)
8. Make sure the yarn is inside the solution in each jar.
9. Tug slightly on the center of the yarn so that the center dips down lower than the water levels in the jars.
10. Leave for several days. Each day, observe the project and record your observations in the "Speleothem Observation Chart" that follows.
11. Complete a "Checking It Out" form and put it in your science notebook.

Additional Notes

Speleothem Observation Chart

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Water Level (in inches)										
Formation on Saucer? Yes/No										
Changes in Formation? Yes/No										
Sketch of Formation										

Activity for Younger Students: Make a Speleothem With Sand

Materials

- Sand
- Large bucket
- Water
- Cookie sheet or tray

Instructions

1. Begin with a bucket about half full of sand.

2. Add water until you achieve a slightly "drippy" consistency.

3. Scoop up some of this mixture in your fist and hold it over the tray.

4. Open your fist slightly to allow the mixture to drip onto the tray. Your formations will vary, but you can see the idea of water and minerals dripping down and creating formations.

5. Have fun!

Additional Notes

In This Lesson:

Lesson 5

VOLCANOES

Teaching Time:

Hot, Hot, Hot

Do you know what a **volcanologist** is? A volcanologist is a scientist who studies volcanoes. Today, we're going to act like volcanologists and see how much we can learn about volcanoes. Volcanoes are a source of fascination to many people. Their power is more than many of us can comprehend. They are mysterious. Many of us have never visited a volcano and know only what we've seen in pictures or on television. Let's see if we can learn some basic, but interesting, facts about volcanoes and perhaps unravel some of the mystery.

Scripture

"Like one who takes away a garment in cold weather, and like vinegar on soda, is one who sings songs to a heavy heart." (Proverbs 25:20)

Name It!

volcanologist
Scientist who studies volcanoes.

The Structure of a Volcano

First, do you know what a volcano actually is? Can you define it? Most of you probably have some sort of an idea or picture in your mind. I would like you to write out, tell your teacher, or draw a picture of what you think a volcano is. Now, did your description include words like *hot*, *boiling*, *mountain*, or *fire*—or did

Name It!

volcano
Slope or mountain formed by magma.

magma
Combination of molten rock, gas, ash, and rock from inside Earth's crust.

vent
Tube that connects the inside of a volcano to the deeper part of Earth's crust and the molten rock inside.

crater
Sunken area inside a volcano where magma collects.

eruption
A reaction caused by pressure building up inside Earth, forcing magma up through a volcano's vent and out of the volcano.

lava
Magma that has been forced out of a volcano's vent to the outside of the volcano.

lava bombs
Giant clouds of volcanic dust forced out of a volcano by a massive explosion.

active volcano
An erupting volcano.

dormant volcano
Volcano with long periods of inactivity.

extinct volcano
Volcano that no longer erupts.

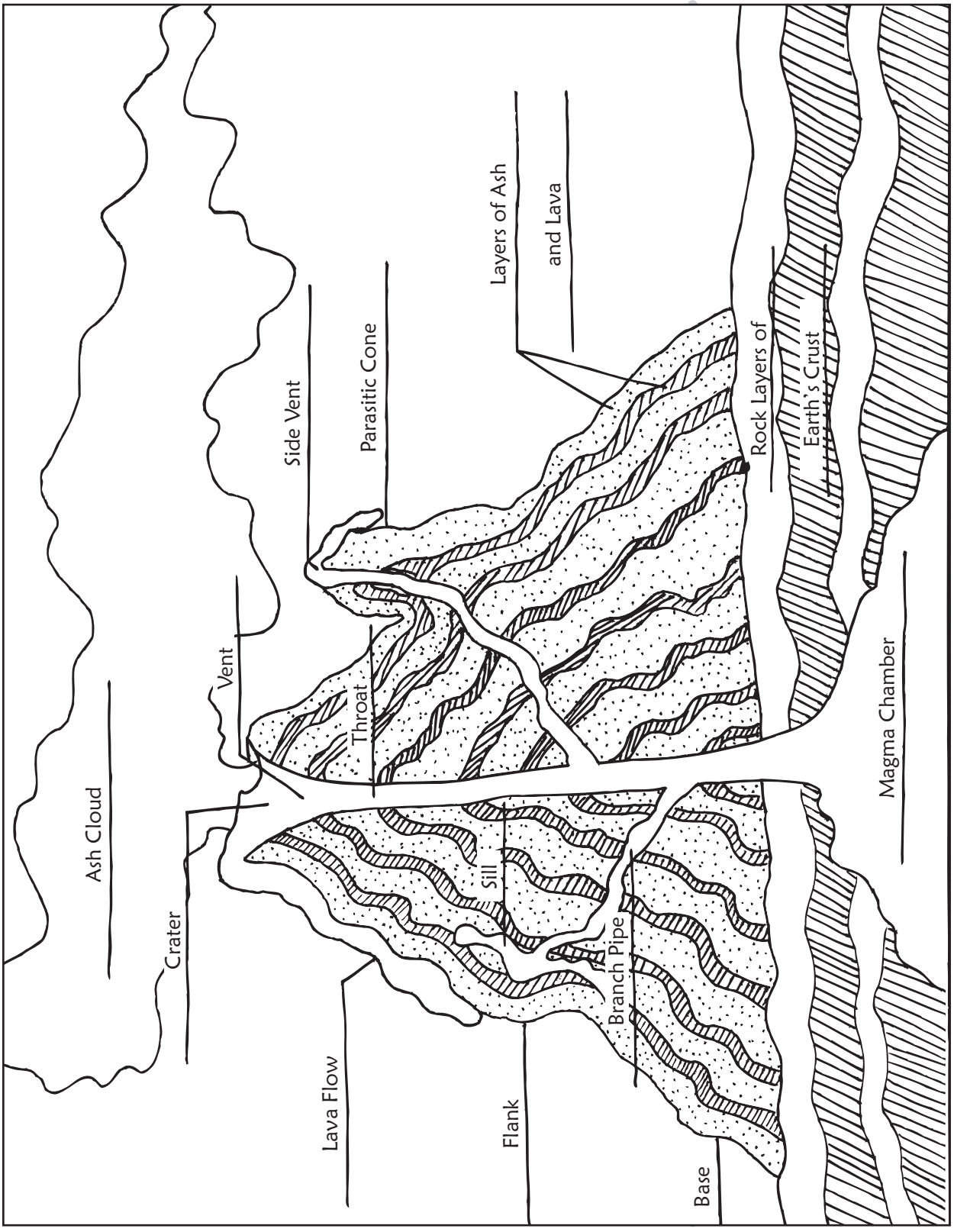
your picture illustrate these words? More than likely it did. A **volcano** is a slope or mountain formed by **magma**. Magma is a combination of molten rock, gas, ash, and rock from inside Earth's crust. A **vent**, or tube, connects the inside of the formation to the deeper part of the crust. The top of a volcano has a **crater**. A crater is a sunken area where the magma can collect. As pressure inside Earth builds up, magma is forced up through the vent and can rise to the crater. With enough energy, the magma can be forced out. This is called an **eruption**. If the magma spills out, it is called **lava**. The cooled lava hardens. Repeated eruptions cause a buildup of lava that eventually forms the land formations we know as volcanoes. This is not the only way volcanoes erupt, however. Sometimes there is a massive explosion that releases giant clouds of dust called **lava bombs**. Other times, the walls of a volcano can collapse in. Either way a volcano erupts, you can be sure it's hot!

Notice the diagram of a volcano in this lesson. Can you see the path magma would take as it rises and forces its way out of the volcano?

Types of Volcanoes

Volcanoes can be **active, dormant**, or **extinct**. Volcanoes are described as active when they are erupting. They are dormant when they have a long period of inactivity. Extinct volcanoes no longer erupt.

As we have talked, have you been picturing a volcano in your mind? You might be picturing a mountain with a hole in the top and that would make perfect sense because many volcanoes look just that way. However, that is not the only form volcanoes can take. As a matter of fact, volcanoes come in several different shapes and vary in size. Let's discuss the different categories of volcanoes. First, there are two categories that are basically in a cone shape, like we were just describing. These are called **cinder cone volcanoes** and **composite volcanoes**. Both types are usually the result of explosive eruptions. However, they are different



The Inside of a Volcano

Name It!

cinder cone volcano
Volcano caused by an explosive eruption, cone-shaped and relatively small in size.

composite volcano
Volcano caused by an explosive eruption, cone-shaped and large in size due to repeated eruptions over a long period of time.

shield volcano
Nonexplosive volcanic mound with gentle, sloping sides, known to vary greatly in size.

caldera
Volcano formed low to the ground, caused by the ground's collapsing after an explosive eruption.

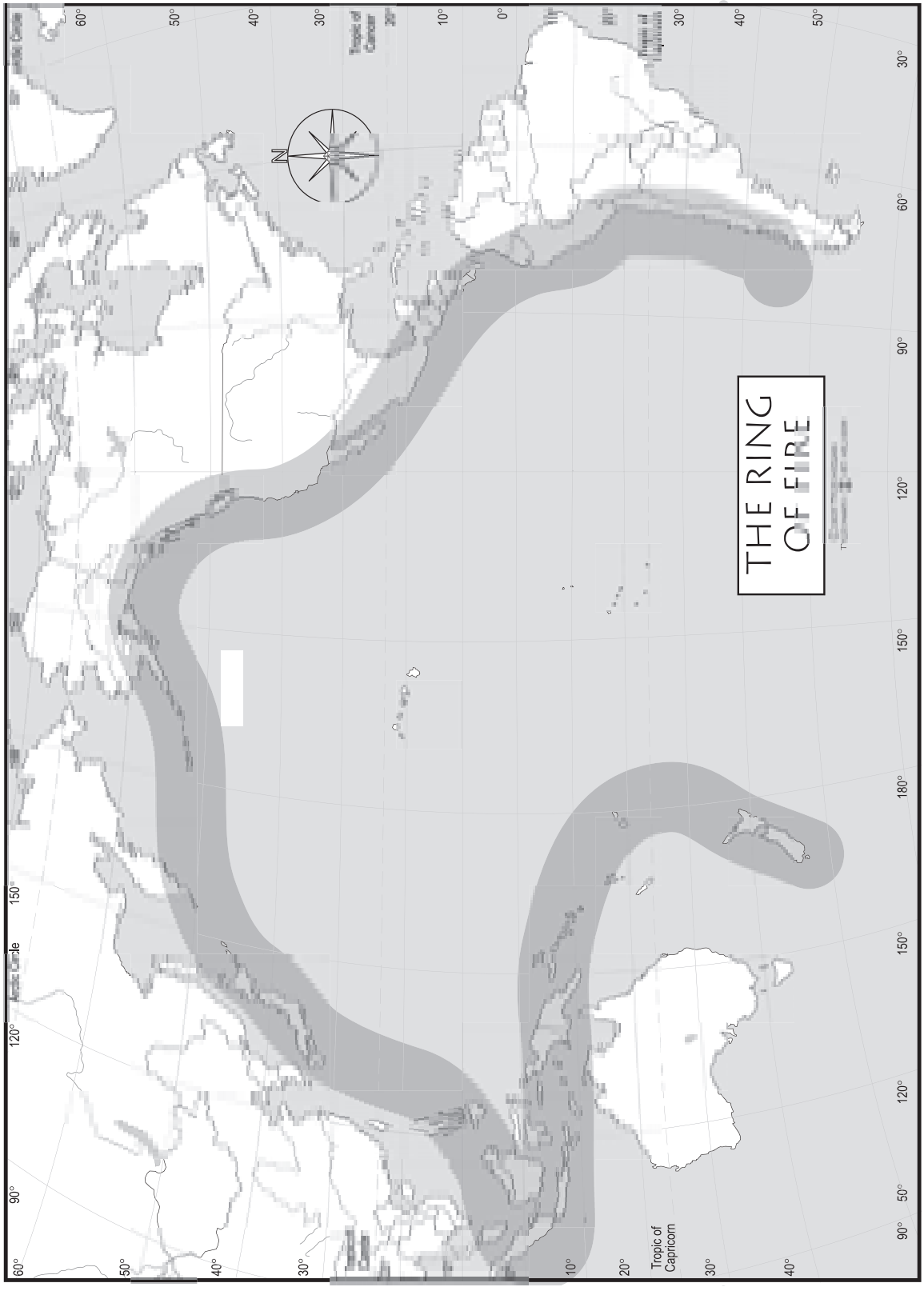
in size and makeup from each other. Cinder cones are almost always smaller than composite volcanoes. One reason is that cinder cones are not known to be in existence as long as composites usually are. Composite volcanoes usually have repeated eruptions over a long period of time. The material that comes out of the volcano builds up, increasing the overall size of the volcano. Mount St. Helens in the state of Washington is a good example of a composite volcano.

Next, there are **shield volcanoes**. Shield volcanoes are mounds with gentle, sloping sides. They are nonexplosive. The lava usually travels far from the vent, rather like pouring syrup on a pancake, especially if the syrup is hot. Shield volcanoes can be large or small. The largest shield volcanoes are much larger than even the very largest composite volcano. Two examples of shield volcanoes are found in Hawaii; they are called Mauna Loa (**maw** na **lo** ah) and Kilauea (kill oo **ay** ah).

A fourth type of volcano is the **caldera**. Calderas are round and lower to the ground than the other types. They form when there is an explosive eruption and the ground collapses.

There is a geographical area called "The Ring of Fire" that surrounds the Pacific Ocean. This area is famous for its many volcanoes. Look at the map provided in this lesson to see this hot spot. The coastal areas of all the countries are lined with volcanoes. Many earthquakes happen here as well.

Today we have really covered a lot of ground, so to speak. I hope you have learned some things about volcanoes. Mostly, though, I hope you have developed a greater interest in volcanoes. They truly are fascinating and give me an idea of how powerful God must be if He could create something as powerful as a volcano.



The Ring of Fire

Additional Notes

Hands-On Time:

Simulate a Volcanic Eruption

Featured Activity

Note to Teacher: This experiment really shows more about chemistry than volcanoes. However, it's fun and memorable. To make it more applicable, you can try to make your volcano look like a specific volcano, and have your student read about that particular one.

Objective

To visualize "lava" spewing out of a "volcano."

Note: If you make a mound around your bottle with modeling clay or play dough, you will need to allow a day or two for it to harden before performing the demonstration.

Materials

- Vinyl tablecloth (to protect table or countertop from the eruption!)
- Small piece of cardboard or plywood
- Narrow-neck bottle, such as a16-ounce plastic soft drink bottle, clean and dry
- Modeling clay or dirt, sand, rocks, etc.
- Small funnel

- 3 to 4 tablespoons baking soda
- 3 to 4 drops liquid dishwashing detergent
- 3 to 4 drops red or orange food coloring
- ½ cup water
- ½ cup vinegar
- Photocopy of "Checking It Out" form in Appendix A
- Camera

Instructions

Adult supervision required.

1. Cover your table or countertop with the tablecloth, then place the bottle on a piece of cardboard or plywood. This is a good outdoor project as it is very messy.
2. Cover the bottle with modeling clay, or mounded dirt or sand, creating the shape of a volcano. (Do not cover the mouth of the bottle.)
3. Use a funnel and add 3 to 4 tablespoons of baking soda to the bottle.
4. Add detergent to the bottle.
5. Slowly add water to the bottle.
6. In a separate container, mix the food coloring and vinegar.
7. Slowly add the vinegar mixture to the bottle. The chemical reaction should cause your volcano to erupt.

Additional Notes

Additional Notes

8. In your science notebook, record your demonstration and what happened. You can use a "Checking It Out" form (found in Appendix A). Add this to your science notebook. If you take a picture, add it to your science notebook as well.

9. Now, consider again the Bible verse: Proverbs 25:20. Having completed your demonstration, what do you think this Bible verse means? Write out the verse in your science notebook, then also write out your answer to this question.

Appendix C

SCRIPTURE MEMORY

Scripture taken from New King James

Unit Two

"Like one who takes away a
garment in cold weather,
And like vinegar on soda,
Is one who sings songs
to a heavy heart."
(Proverbs 25:20)

Unit Two

"Then, behold, the veil of the
temple was torn in two from
top to bottom; and the earth
quaked, and the rocks
were split . . . "
(Matthew 27:51)

Unit Two

"Some fell on stony places,
where they did not have much
earth; and they immediately
sprang up because they had
no depth of earth."
(Matthew 13:5)

Unit Three

"In the six hundredth year of
Noah's life, in the second
month, the seventeenth day of
the month, on that day all the
fountains of the great deep
were broken up, and the
windows of heaven were
opened. And the rain was on
the earth forty days
and forty nights."
(Genesis 7:11–12)