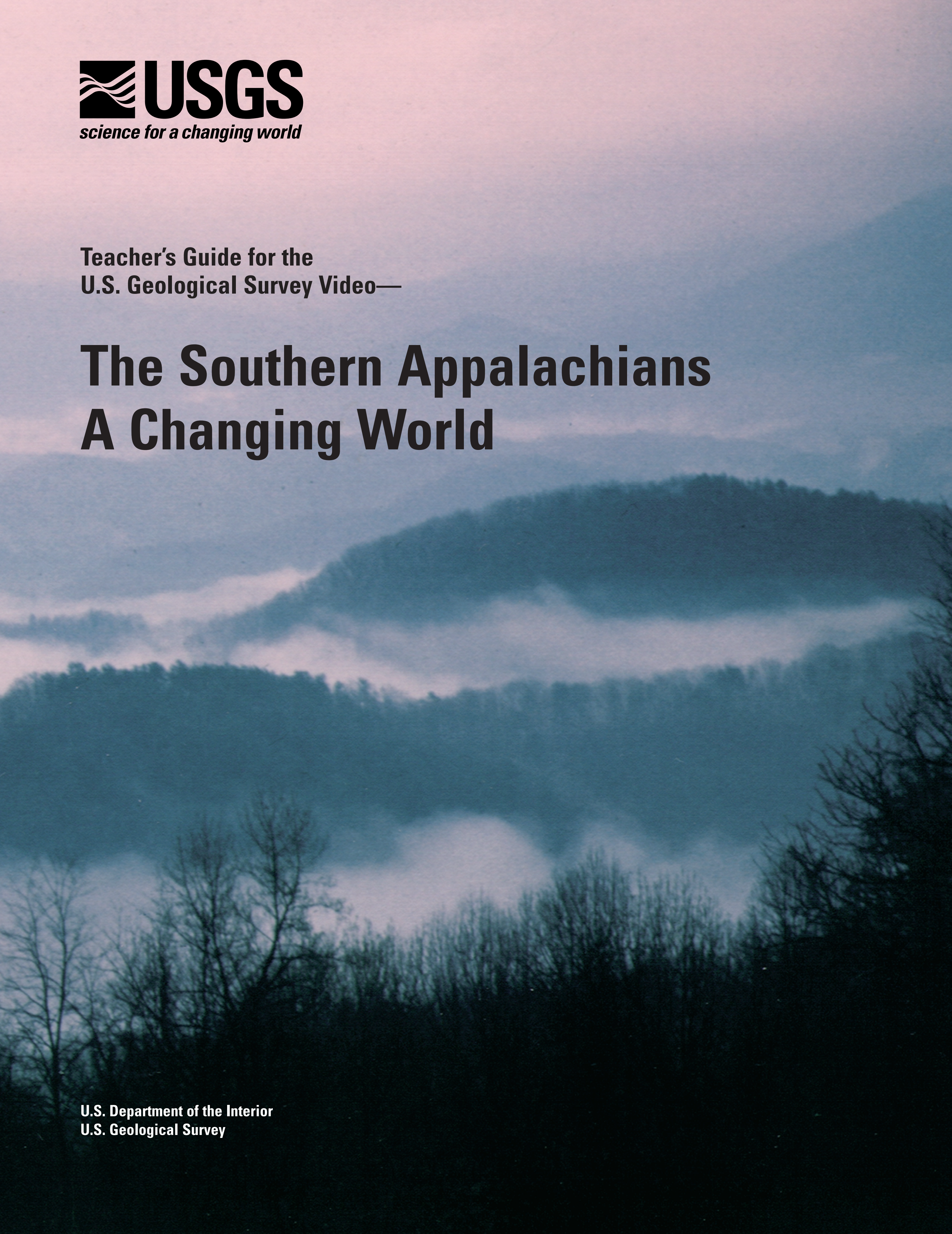
USGS
science for a changing world



Teacher's Guide for the
U.S. Geological Survey Video—

The Southern Appalachians A Changing World

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
U.S. Geological Survey

Teacher's Guide for the U.S. Geological Survey Video—

The Southern Appalachians A Changing World

By Sandra Clark, Elizabeth Romanaux, Dona Brizzi, and Jennifer Thomlin

A synopsis and suggested activities to enhance
the viewing of a U.S. Geological Survey video
about the geology of the Southern Appalachian Mountains

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY
CHARLES G. GROAT, Director

U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA : 2001

Published in the Eastern Region, Reston, Va.
Manuscript approved for publication September 28, 2001.

Free on application to
U.S. Geological Survey
Information Services
Box 25286, Federal Center
Denver, CO 80225

or call the toll-free telephone number
1–888–ASK–USGS

CONTENTS

Teacher's Guide for the
U.S. Geological Survey Video—

The Southern Appalachians
A Changing World

By Sandra Clark, Elizabeth Romanaux, Dona Brizzi, and Jennifer Thomlin

INTRODUCTION

The video "The Southern Appalachians—A Changing World" was created for students who live in the Southern Appalachian Mountain region and for visitors to the region. The video shows how the landscapes that we see today developed over millions of years and how they continue to change. The goal is to help students appreciate the role of geology in their lives by showing the relation between the history of the Earth and life in the Southern Appalachian Mountains. "A Changing World" also shows how knowledge gained through scientific study and research advances our understanding of how to better utilize resources and protect the environment.

The following synopsis and suggested activities and discussion topics are designed to provide guidance and ideas for teachers to expand upon the viewing of the video. Selection or adaptation of activities or topics is the prerogative of the teacher.

SYNOPSIS OF THE VIDEO

GEOLOGIC HISTORY OF THE SOUTHERN APPALACHIANS

The Earth is approximately 4.5 billion years old. In the Southern Appalachians, the history of the last billion years is recorded in the rocks. By reading the rocks, we can trace their incredible history. What are the major stages of development of the Southern Appalachian landscape? What evidence is recorded in the rocks?

BREAK UP OF A SUPERCONTINENT

The rocks at the core of the Appalachian Mountains formed more than a billion years ago. At that time, all of the continents were joined together in a single supercontinent surrounded by a single ocean. About 750 million years ago, the crust of the supercontinent began to thin and pull apart. As the crust expanded, a deep basin—the Ocoee—formed in what is now the western Carolinas, eastern Tennessee, and northern Georgia. Seawater filled the basin.

Sediments formed by the weathering of surrounding hills were transported by water and deposited in layers on the floor of the basin. Over a long period of time, a great thickness of sediments accumulated. These sediments now form the bedrock of the Great Smoky Mountains. Within these sediments, minerals like pyrite and metals like copper were deposited.

At the same time that the sediments were being laid down, volcanoes were erupting in present-day Virginia, the Carolinas, and Georgia. Lava from some volcanoes flowed in slow moving sheets, but some eruptions were explosive.

Then, about 540 million years ago, the supercontinent split into pieces that drifted away from each other. Seawater spread into low areas between crustal plates and, in time, formed new oceans. A shallow sea covered most of what is now the United States.

Evidence recorded in the rocks includes the following:

- We can see fragments of the billion-year-old supercontinent at the surface in many places in the Appalachian Mountains. Examples include Blowing Rock in North Carolina and Red Top Mountain in Georgia.

- Sediments that were deposited in the Ocoee basin can be seen at many places in the Great Smoky Mountains. Look for rocks that reveal layers in which the sediments were deposited on the ancient sea floor. If you look closely, you can see pebbles and grains of sand in the rocks.

- The rocks that formed from coarse sediments, such as pebbles and sand, are very hard and are resistant to weathering and erosion. They form the high peaks and ridges of today. Rocks composed of fine-grained sediments, such as clay and silt, are softer and break down more easily. These rocks can be found in the lower areas. Erosion of the alternating layers of hard and soft rocks makes many of the landforms that we see today. As rivers cut their way through the layers, hard rocks form ledges that make waterfalls, and alternating layers of hard and soft rock make the riverbeds that produce whitewater rapids.

- Although volcanic activity ended hundreds of millions of years ago, rocks that formed from ancient volcanoes can still be seen at White Top Mountain in southern Virginia. Some rocks in this area contain angular fragments that had cooled and solidified, then later broke up, and were engulfed in lava flow. Others contain small, irregular, mineral-filled holes that formed as gases slowly bubbled up through hot lava.

- The rocks of the Valley and Ridge formed under a vast, shallow, inland sea that covered the area. Shells and other hard parts of ancient marine plants and animals accumulated to form limey deposits that later became limestone. The weathering of limestone, now exposed at the land surface, produces the fertile, lime-rich soils that are so prevalent in the Great Valley.

CONTINENTAL COLLISION

About 470 million years ago, the motion of the crustal plates changed, and the continents began to move toward each other. Eventually, about 270 million years ago, the continents ancestral to North America and Africa collided. Huge masses of rock were pushed westward along the margin of North America and piled up to form the mountains that we know as the Appalachians.

As blocks of continental crust rode across one another, some rocks became so hot that they melted. Some of the molten rock remained deep below ground. There, it cooled slowly and crystallized to form bodies of rock that are called plutons. Granite is an example of an plutonic rock. Some molten rock cooled very slowly and formed coarse-grained veins called pegmatites. Pegmatites have been the source of high-purity minerals (such as feldspar, quartz, and mica) and gemstones (such as emeralds and beryl).

When continental masses collided with the edge of ancestral North America, rocks were subjected to intense pressure and heat. Where the temperature was high but below the melting point of the rocks, the rocks deformed and recrystallized to become metamorphic rocks. The components separated into bands, and some flowed with a consistency like that of toothpaste. During metamorphism, temperatures and pressures can vary. In less extreme conditions, original rock layers may be partly retained. As a result, some minerals recrystallized in sheets, forming rocks (slate or schist) that split easily into thin, smooth layers.

The collision of continental plates is also expressed in the rocks by folds (bends) and faults (breaks). Earthquakes happen because of slippage along a fault. Although earthquakes are now rare in the Southern Appalachians, during the time of continental collision, earthquakes were a common occurrence.

Evidence recorded in the rocks includes the following:

- Plutons are scattered throughout the Southern Appalachians. Some plutons are now exposed at the land surface due to the erosion of overlying rock. They weather to form unusual, smooth-sided domes like Looking Glass Rock, south of Asheville, North Carolina. The plutons are composed of granite and similar rocks. People use granite that has a uniform texture and few fractures, such as the Mount Airy granite, in buildings, bridges, statues, and monuments.
- In many places along the Blue Ridge Parkway, there are metamorphic rocks (gneiss) with folded bands of light- and dark-colored minerals, which sometimes look like the folds and swirls in a marble cake.
- Slate and schist are also common in the Southern Appalachians. The smooth surfaces of slate and schist are excellent slip planes. This characteristic can cause problems, especially when the layers are steeply tilted. Rocks overlying these tilted surfaces are very prone to sliding downhill (landslides), especially when heavy rainfall lubricates the surfaces. Signs along the Blue Ridge Parkway warn motorists of rockfalls.
- Many faults have been identified throughout the Southern Appalachians. Huge masses of rock moved along these faults for distances of 60 miles or more. A major fault area can be seen at Linville Falls, north of Asheville, North Carolina. The rocks that make up the mountains above the falls are older than the resistant ledges that form the falls.
- Another place where the effects of faulting can be seen is in Cades Cove in the Great Smoky Mountains. In a normal sequence of rocks, younger rocks are deposited on top of older ones. However, in Cades Cove, limestone that makes up the floor of the cove is younger than the rocks in the surrounding mountains. The older rocks of the surrounding mountains moved over the limestone along the Great Smoky Mountain fault. Erosion made an opening to expose the younger rocks below the fault, in a feature called a geologic window.

ANOTHER CONTINENTAL BREAK UP

Although a collision of continents caused the formation of the Appalachian Mountains, the present-day margin of North America is the result of a reversal in crustal plate movement. After the continents collided, the continental mass began to pull apart. About 240 million years ago, at the beginning of the age of the dinosaurs, a new ocean basin began to form—the present-day Atlantic. The widening of the Atlantic Ocean at the mid-Atlantic Ridge is evidence of this continuing movement.

CARVING THE MOUNTAINS

At the time they formed, the Appalachians were much higher than they are today—more like the present-day Rocky Mountains. While the Atlantic Ocean was still in its infancy, the Appalachians were already being attacked by erosion. For the last 100 million years, erosion has carved away the mountains, leaving only their cores standing. Erosion continues today and is constantly altering the landscape of the Southern Appalachians.

Four times during the past 2 million to 3 million years, great sheets of ice advanced steadily southward from the polar region. The glaciers did not extend as far south as the Southern Appalachians, but they triggered a change in climate that can be seen today in both the rocks and the life of the region.

Evidence recorded in the rocks includes the following:

- The process and agents of erosion can be easily observed in the Southern Appalachians. Mosses and lichens that grow on rocks begin the process of chemically breaking down the rocks. Plants growing in rock fractures slowly widen the fractures, eventually reducing the rock to smaller pieces and finally to soil. These mechanical operations enhance the chemical processes of soil development. Rock layers slip along inclined surfaces, break off, and produce landslides, further altering the landscape. Wind and water continue the process of breaking down the rocks and returning them to the oceans. Millions of years from now, sediments now being deposited on the ocean floor will become layers of rock that might be uplifted into new mountains.

- Effects of the ice ages can be seen in the rocks. When water freezes in cracks or between rock layers, it gradually wedges the rock apart. With repeated freeze and thaw in extremely cold climates, boulders accumulate on treeless slopes and at the bases of cliffs or ledges. Concentrations of boulders can be seen in the present-day forested mountainsides, such as the blockfields along Cove Hardwood Nature Trail at Chimneys Picnic Area, Great Smoky Mountains National Park.
- The great biodiversity of the Southern Appalachians is another remnant of the last ice age. As the climate changed, animals and plants migrated southward. Species more common to northern climates, such as northern spruce, Fraser fir, saw-whet owl, and northern flying squirrel, persist today at higher elevations where seasonal temperatures are more typical of the Northeast.

RELATION OF GEOLOGIC HISTORY TO LIFE TODAY

Geologists map, measure, and sample earth materials to put together a coherent picture of the Earth's history. They try to understand the many ways that geology influences our lives, such as mineral and energy resources, geologic hazards (landslides, earthquakes, and volcanoes), and global climate change. Knowledge gained through scientific study and research advances our understanding of how to better utilize resources while better protecting the environment.

INDUSTRY AND THE ENVIRONMENT

The Southern Appalachians contain many deposits of valuable minerals that have contributed to the growth and development of the region and to the economy of the United States. Among these are the Spruce Pine district in North Carolina, the Mount Airy granite, and the East Tennessee zinc district. One interesting historic mining area is the Copper Basin near Ducktown, Tennessee, which was the largest metal-mining district in the Southeastern United States and the site of one of the most serious environmental problems in the Nation.

When copper mining began near Ducktown, more than a century and a half ago, people did not understand or take measures to prevent the adverse effects that mining and smelting can have on the environment. Metal-bearing rocks were roasted in outdoor heaps to free the metals. The process released harmful sulfur dioxide fumes into the atmosphere. Sulfur dioxide also mixed with the moisture in the air and fell as acid rain, sterilizing the soil and killing whatever vegetation hadn't already been cut for fuel. An area totaling 23,000 acres became a biological desert. Restoration of the vegetation began in the 1930's, but it was not until 40 years later, when updated techniques were used, that trees started to flourish. Millions of trees and shrubs were planted through cooperative efforts of Federal and State agencies, universities, and mining companies, and most of the area has now been revegetated.

Pyrite (fool's gold) was another mineral mined in the Copper Basin, and pyrite can be seen in rocks at many other places in the Southern Appalachians. When pyrite is exposed to air and water, the rocks break down into iron and sulfur. The sulfur mixes with rainwater to form sulfuric acid. This acid-generating process can happen naturally, or when roadcuts are made to build highways, or when pyrite-rich rocks are piled up as waste rock tailings from metal or coal mining. Any disturbance that exposes more pyrite-rich rock surfaces to air and water can generate acid runoff. The acid runoff from construction or mining sites can kill aquatic life in streams. However, by using our scientific knowledge, acid drainage can be mitigated. Limestone, which neutralizes acid, can be used to counteract acid runoff. For example, limestone was added to the pyrite-bearing rocks of the streambed of the Ocoee whitewater course used in the 1996 Olympic Games.

BIODIVERSITY AND CULTURE

Differential erosion rates and chemical characteristics of different rock types result in different landforms and soil characteristics, which, in turn create diversity in habitat. During the continental collision, rocks that had formed in diverse environments were brought together. This juxtaposition set the stage for the rich diversity of landscape, habitat, and life forms that characterizes the Southern Appalachians today.

The patterns of elongate ridges and valleys that resulted from folding and faulting of contrasting rock types during the continental collision also determined the main routes of transportation and communication and the settlement patterns of the region. Settlement patterns were also influenced by soil characteristics and by the availability of mineral resources.

Faults also acted as channels of migration for fluids and were a key factor in localizing gold in certain zones. Gold occurred in veins and along fault zones and was concentrated in gravels of the streambeds. The Cherokee people, who had settled in the region about a thousand years ago, knew about the gold, but it did not have the same significance to them as to white settlers. In 1829, newspaper articles described great riches in gold in North Georgia, and thousands of people rushed to the area. The resulting frenzy hastened the removal of most of the Cherokees to Oklahoma by a forced march during the winter of 1837–38. More than one-third of the Cherokee people who started the march died along the way on what is now known as the Trail of Tears.

CONCLUSION

Geologic processes acting over millions of years produced and continue to change the landscape of the Southern Appalachians. The geology of this region affects the lives of those who live and visit here, but people also affect the landscape. By increasing our knowledge and appreciation of Earth history and processes, we will be better able to sustain the quality of life in this beautiful and multifaceted region of the United States.

ACTIVITIES AND DISCUSSION TOPICS

GEOLOGIC TIME

Have students make a timeline, showing the process of the creation of mountains and their eventual return to the sea. Experiment with timelines drawn as a spiral to illustrate a continual process.

PLATE TECTONICS

Have students create a continental drift puzzle to show how the pieces may have moved in the past and how they may move in the future.

OBSERVATION OF LOCAL ROCKS

1. Have students bring in interesting rocks that they have found. Arrange rocks on a tabletop. Teacher should examine selections and point out manmade “rocks”—cement, brick, asphalt. Have substitute rocks on hand for students inadvertently bringing manmade rocks to class. Have students work in pairs to examine rocks and give general descriptions—for example, heavy, black, layered.

2. Discuss rock types and how they formed. Write down the three groups into which rocks are classified—igneous, sedimentary, and metamorphic—and the characteristics of each on the board. Have students write down clues that they see in their rocks that would help a geologist decide into which group each rock sample may fit. Then have them decide whether their rocks are igneous, sedimentary, or metamorphic. Ask students to arrange rocks into groups of the same type. Tell students that all the landforms that they see are composed of the three main rock types.

THE LIFE OF A ROCK

Collect different kinds of rocks (such as sandstone, shale, limestone, granite, gneiss) and ask children make up histories for each one, telling the story from the rock’s point of view.

DELTA IN A JAR (Teacher demonstration)

Demonstrate how waterborne sediments sort into layers, mimicking what happened as the Ocoee basin filled. This sorting or layering can be seen in rocks today.

Supplies needed:

Clear 1- liter plastic soda bottle with neck and top cut off
Large wide-mouthed jar with lid
2-1/2 cups water
Spoon
Strainer
1/2 cup coarse gravel (size of miniature marshmallows) or dry kidney beans
1/2 cup fine gravel (aquarium gravel) or uncooked white rice
1/4 cup artist's modeling clay (NOT dough-based clay) or flour

Pour 1 cup water into soda bottle. Place clay or flour in the jar, add 1/2 cup water. Stir with spoon until dissolved (about 5 minutes). Strain and discard any remaining clay or lumps of flour. Pour EITHER flour mixture, beans, and rice OR clay mixture and coarse and fine gravel into the jar, add 1 cup of water and shake vigorously. Pour into soda bottle. Observe every 1/2 hour for 2 hours. Write down observations. Observe again in 24 hours. What has happened?

Rivers carry a mixture of rocks, gravel, sand, and clay to the sea, represented by the mixture poured into the soda bottle. Once these elements sink to the bottom of the ocean, they settle into layers based on size and weight. Great thicknesses of these deposits formed in the Ocoee basin and were changed into rock through metamorphism.

MAKING A SEDIMENTARY ROCK SHORELINE SEQUENCE

Sedimentary rocks form from eroded remains of other rocks, such as gravel, sandstone, clay, or mud, or sometimes they form from animal remains such as limestone. By examining sequences, or layers of rock, geologists can tell what the area was like at certain time periods. Students can make their own layered sedimentary rocks.

Supplies needed:

Plaster of paris
Large Styrofoam cup (12-16 oz.) for each student
Broken gravel (size of miniature marshmallows)
Aquarium gravel (rounded and smaller than broken gravel)
Food coloring
Coffee stirring sticks

STEP 1:

Teacher mixes up enough plaster of paris for each student to get approximately 1/4 cup.

Have students pour broken gravel into their cups.

Teacher adds 1/4 cup of plaster of paris to each student's cup; students stir once or twice with coffee stirrer.

Allow to set.

STEP 2:

Teacher mixes up enough plaster of paris for each student to get approxi mately 1/4 cup.

Teacher adds one drop blue, red, and yellow food coloring to the plaster of paris and stirs to make brown plaster.

Teacher pours 1/4 cup of brown plaster into each student's cup on top of the first layer. Do not stir.

Allow to set.

STEP 3:

Teacher mixes up enough plaster of paris for each student to get approxi mately 1/4 cup.

Have students pour aquarium gravel into their cups on top of the brown plaster layer.

Teacher pours 1/4 cup plaster of paris into each student's cup over the aquarium gravel; students stir once or twice with coffee stirrer.

Allow to set.

STEP 4:

Teacher mixes up enough plaster of paris for each student to get approxi mately 1/4 cup.

Do not add food coloring.

Teacher pours 1/4 cup of plaster of pair into each student's cup on top of the aquarium gravel layer.

Do not stir. Allow to set.

After 24 hours, have students place a piece of newspaper on their desks. Students should break off the cup surrounding the plaster of paris, leaving a series of "sedimentary deposits." Have students gently wipe sides of their "deposits" with a damp paper towel to better show the deposit layers. Call the layers I, II, III, and IV, with I being the bottom (oldest) deposit. These deposits represent a section of sea floor along a changing coastline.

The oldest plaster layer, layer I, shows a time when this area was near a rocky coastline, with rocks broken off and deposited before erosion could round off their sharp edges. This type of deposit is called breccia.

Layer II shows a time when the coastline had retreated far from this area and only fine sediments (clay and mud) carried by streams and rivers were deposited (brown plaster). These deposits formed shale or mudstone.

Layer III shows that a time when the coastline had moved toward the deposit area again (to a location between those represented by layers I and II) and rounded rocks were deposited. These rocks were rounded by erosion as they were transported by streams and rivers to the deposition site. This type of deposit is called a conglomerate.

Layer IV represents a period when the coastline retreated farthest from this deposition site. Shells and other hard parts of ancient marine plants and animals accumulated to form limey deposits that later became limestone.

HOW DID THAT SHELL GET WAY UP THERE?

When ocean basin sediments are compressed by colliding continents, they often move great distances and can be shoved high up, forming mountains, by the incredible forces.

<u>Supplies needed:</u>

1-foot-square piece of foil per student
One white sticker (such as mailing labels) per student
Pens or pencils
Scissors

Have students draw 4 to 6 little fish and (or) shells on their stickers.
Cut up stickers into squares, each with one drawing.
Have students stick squares on the central area of the foil. The foil represents ocean sediments in the ancient Ocoee basin, and the stickers represent animal remains (fossils) in those sediments.

With foil flat on the desk, have students place a hand on each side of the foil, palm down, and slowly slide hands together. Note that the "sediments" are uplifted into mountains, carrying the "fossils" with them. This uplifting is why we find fossil remains of ancient sea creatures on mountaintops in the Appalachians.

THRUST FAULTS AND GEOLOGIC WINDOWS (Teacher demonstration)

When the Appalachian Mountains were formed, huge thick layers of rocks were shoved against one another, thrusting some rocks up into mountains and placing older layers on top of younger layers.

<u>Supplies needed:</u>

10 pieces of thick cardboard (cut from boxes), about 1 foot x 6 inches each
Pens
Masking tape

Divide the 10 pieces into two stacks. Number the pieces in the first stack 1 through 5. These are the African rock layers. Number 1 (on the bottom) is the oldest, and number 5 (on the top) is the youngest. Mark the pieces in the second stack A through E, with A (on the bottom) representing the oldest rocks, and E (on the top) representing the youngest. These are the North American rock layers.

Place the two stacks on a smooth tabletop, with short sides facing each other. Gently push the stacks toward each other. Allow the layers to rise up and interleave naturally. Then use masking tape to hold the outer layers in place by taping the outer edges to the table. Note the order in which the layers now rest.

With the pieces in their new random order, cut a 3-inch-square hole through the top two layers. Let the students look through the hole to the layers underneath. Are the layers in the hole older or younger than the top layers? This structure is known as a geologic window, and several can be found in the Southern Appalachians.

MAKING METAMORPHIC ROCK

Metamorphic rocks are formed by compressing and heating other types of rock. Here we will make models of sand grains (representing sandstone) and compress the grains so that the sandstone is transformed (metamorphosed) into quartzite.

<u>Supplies needed:</u>

Two colors of clay
Rolling pin or smooth-sided soda bottle filled with sand or aquarium gravel for weight
2 pieces of notebook paper for each student

Have each student place one piece of paper on a desktop. Give each student a small lump of clay (golf-ball-sized) of each of the colors. Have the students divide each lump into six pieces and roll each piece into a ball. The balls of clay should be approximately the same size. The balls represent grains of sand. Students should set the balls down on the sheet of paper in two rows of six each, alternating colors (for example, a row of green-yellow-green-yellow-green yellow and a row of yellow-green-yellow-green-yellow-green).

Students should press all clay balls together until they stick. Note that the shape of each ball changes somewhat but is not eliminated completely. Have students place a second piece of paper on the clay and use the rolling pin or soda bottle filled with sand to gently flatten the clay balls to about half their original height. After the students remove the paper, they should note how the shape of each ball (sand grain) has been altered (metamorphosed) by pressure.

PERMEABILITY OF SANDSTONE VS. QUARTZITE (Teacher demonstration)

Supplies needed:

Clay
Large sieve or strainer
Rolling pin
1 cup water

Teacher makes clay balls about 1 inch in diameter and sets them in a sieve. The clay balls represent the sand grains in sandstone. Pour 1/2 cup of water through the sieve. Observe how quickly the water passes through the "sandstone" layer.

Then remove balls from the sieve and use a rolling pin to press the balls into a sheet of clay. The sheet of clay represents metamorphic quartzite. In nature, this change (metamorphism) from sandstone to quartzite is the result of intense pressure created when masses of rock collide.

Lay the sheet of clay in the sieve. Pour 1/2 cup of water on top of the sheet. How has compression of the sandstone grains into metamorphic quartzite altered the ability of the rock to let water pass through (that is, its permeability)? Discuss why the permeability of rocks is important (for example, allowing fluids such as water or petroleum to flow through layers of permeable rock and be trapped below impermeable layers).

BEDROCK, EROSION, AND LANDFORMS

Supplies needed:

Dustpan
Clay
Dry sand
Watering can filled with water

Use a dustpan. Let students create two strips of clay, each about 2 inches wide, 2 inches tall, and 6 inches long. Press the strips of clay inside the dustpan, perpendicular to the two sides. Explain that the clay represents bands of hard bedrock. Fill the dustpan completely with dry sand. Explain that the sand represents soft rock.

Now let students pour water from a small watering can into the dustpan, washing the sand away into a trash can. All that will be left are ridges of "hard bedrock," similar to the ridges of bedrock that underlie the white-water rapids in many Southern Appalachian streams.

Many modern landforms are the result of a similar process, where softer rocks were eroded away to reveal the harder rocks beneath.

BIODIVERSITY

The collision of continents hundreds of millions of years ago set the stage for the development of a richly diverse landscape. Assign students to research how the diversity of rock types (for example, limestone, sandstone, and volcanic rocks) and landscape gave rise to the great variety of life forms in the Southern Appalachians.

EFFECTS OF ACID ON PLANTS

Supplies needed:

Two disposable aluminum pie pans, marked 1 and 2
Large, flat baking pan
Gravel
Grass seed
One plant mister (marked A), filled with plain water
One plant mister (marked B), filled with 1/2 cup of vinegar plus enough water to fill the mister
Soil
pH-testing strips

Poke 20 to 30 holes in the bottom of the two pie pans and set the pie pans in a large, flat baking pan lined with gravel. Fill the pie pans with soil. Sprinkle grass seed over the soil. Press the grass seed into the soil surface with the palm of the hand. Water both pie pans gently with plant mister A until the soil surface is damp. Place the large pan on a sunny windowsill (but out of intense heat, such as full sun all day or on a radiator). Mist daily, keeping soil damp but not wet.

When grass has sprouted and is thick, have students describe the condition of the plants (such as, green, soft, flexible).
Have students spray a piece of pH-testing paper with plain water and a second piece with the vinegar mixture. Record the pH of each.

Mist the grass in tray 1 with the vinegar mixture daily (mister B); mist the grass in tray 2 with plain water (mister A). Record the condition of the plants. The vinegar will quickly kill the grass in tray 1, showing that some plants cannot live in an acidic environment.

LESSONS FROM THE PAST

Discuss why copper mining was conducted so carelessly in the 19th century. What lessons have been learned from the past? Discuss why it was important to repair the destruction.

APPLICATIONS TO THE PRESENT

Ask students why it is important to be able to predict where pyritic layers occur below the surface before construction can begin in an area. Guide students in a discussion of other types of research being conducted in the Southern Appalachian region. Can they suggest research ideas of their own?

THE CHEROKEE REMOVAL

Let students research the Cherokee removal and discuss it from different points of view. Why were the Cherokee people removed from their land? Was it legal to do this at the time? How do the Cherokees tell this story? What would it have been like to come to the area in search of gold? What role did newspaper reporters, politicians, and others play in this tragedy?

GEOLOGY IN THE NEWS

Discuss recent news stories about geology. Have the students collect newspaper or magazine stories or summarize TV, radio, and Internet news stories about geology. For example, a scientist recently theorized that a landslide under the Atlantic Ocean could cause a tidal wave to hit the East Coast. Discuss how the theories and principles of geology help us comprehend the dynamic nature of the Earth.