CULTURAL GEOGRAPHY

FIFTH EDITION

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Cultural Geography
Fifth Edition

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PHYSICAL GEOGRAPHY

BIG IDEAS

- What is under the earth's surface?
- How can the earth's interior affect its surface?
- How do mountains and rivers form?

▲ *Fertile farmland along the Nile, Egypt*

▲ *(top) Mount Saint Helens, Washington, USA*

▲ *(middle) Great Barrier Reef, Cairns, Australia*

▲ *(bottom) Antarctica*

RIVERS: GOD'S PROVISION FOR MANKIND

According to Herodotus, "Egypt was the gift of the Nile." In other words, the Nile made the Egyptian civilization possible. The Nile provided Egyptians an abundant supply of fish and fertile land to grow crops. The Egyptians learned to use irrigation ditches to increase production and substantially increase food supplies. This practice became essential to the survival of people in this part of the world, as illustrated by the biblical account of Joseph in the book of Genesis. Today the Nile is still a major provider of fish and crops and remains a vital water route for transportation.

The psalmist reminds us that God created the earth and all that it contains. He stretched out the heavens "like a curtain," and He "laid the foundations of the earth" so that it will remain forever (Ps. 104:1–5). The earth is not unimportant to God. The earth is God's great masterpiece. Whether we look at marvels such as the Grand Canyon, the savanna of Africa, or a powerful volcano, we see God's handiwork. In a fallen world, that handiwork is marred. The creation groans, awaiting its redemption (Rom. 8:21–22). But even this marred creation testifies to the Creator (Rom. 1:20).

A study of the physical earth is obviously relevant to geography. As we study people and cultures of the earth, we must also understand the structure of the physical space those people inhabit. How did the earth's surface features develop? How do they change? How do people interact with the land and water to use and change them?

◀ *Fjadrargljufur Canyon, Iceland*

GUIDING QUESTIONS

- What are the physical systems of the earth?
- What are the elements of the earth's interior?
- What processes are occurring within the earth's interior?

THE EARTH'S STRUCTURE

What is under the earth's surface?

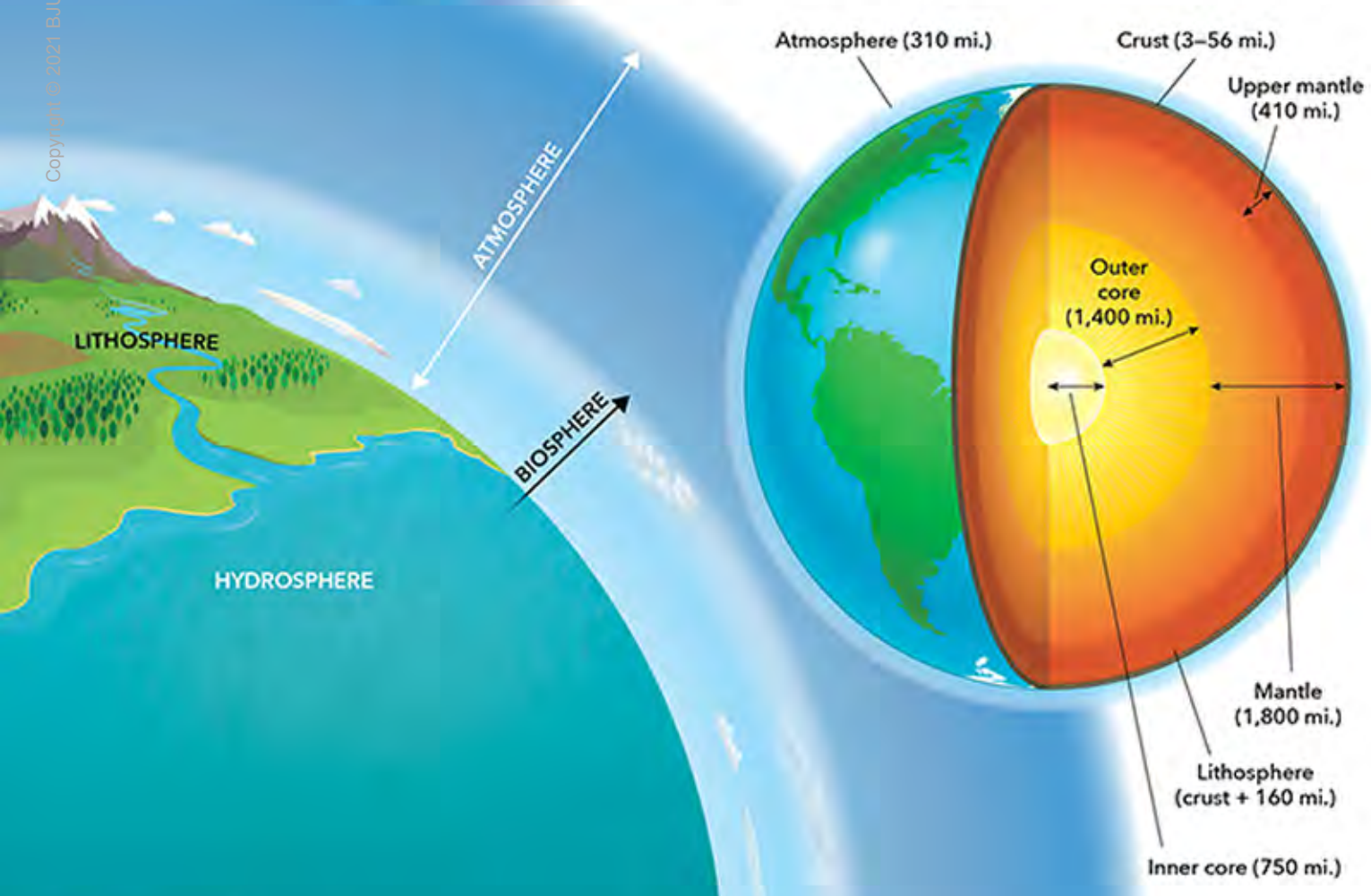
The Earth's Physical Systems

Scientists have developed models that divide the planet into four parts. The covering of air that surrounds our planet is the **atmosphere.** The earth's crust and the section of the upper mantle that moves with the tectonic plates are the **lithosphere.** All the water on the earth's surface, under the ground and in the air is the hydrosphere. The **biosphere** consists of all the different areas on the earth where life can exist and the living organisms that live there.

The earth is nearly eight thousand miles in diameter. We think of the earth's surface as very rough. But when astronauts view it from space, it seems to them as smooth as the surface of an apple.

The Earth's Interior

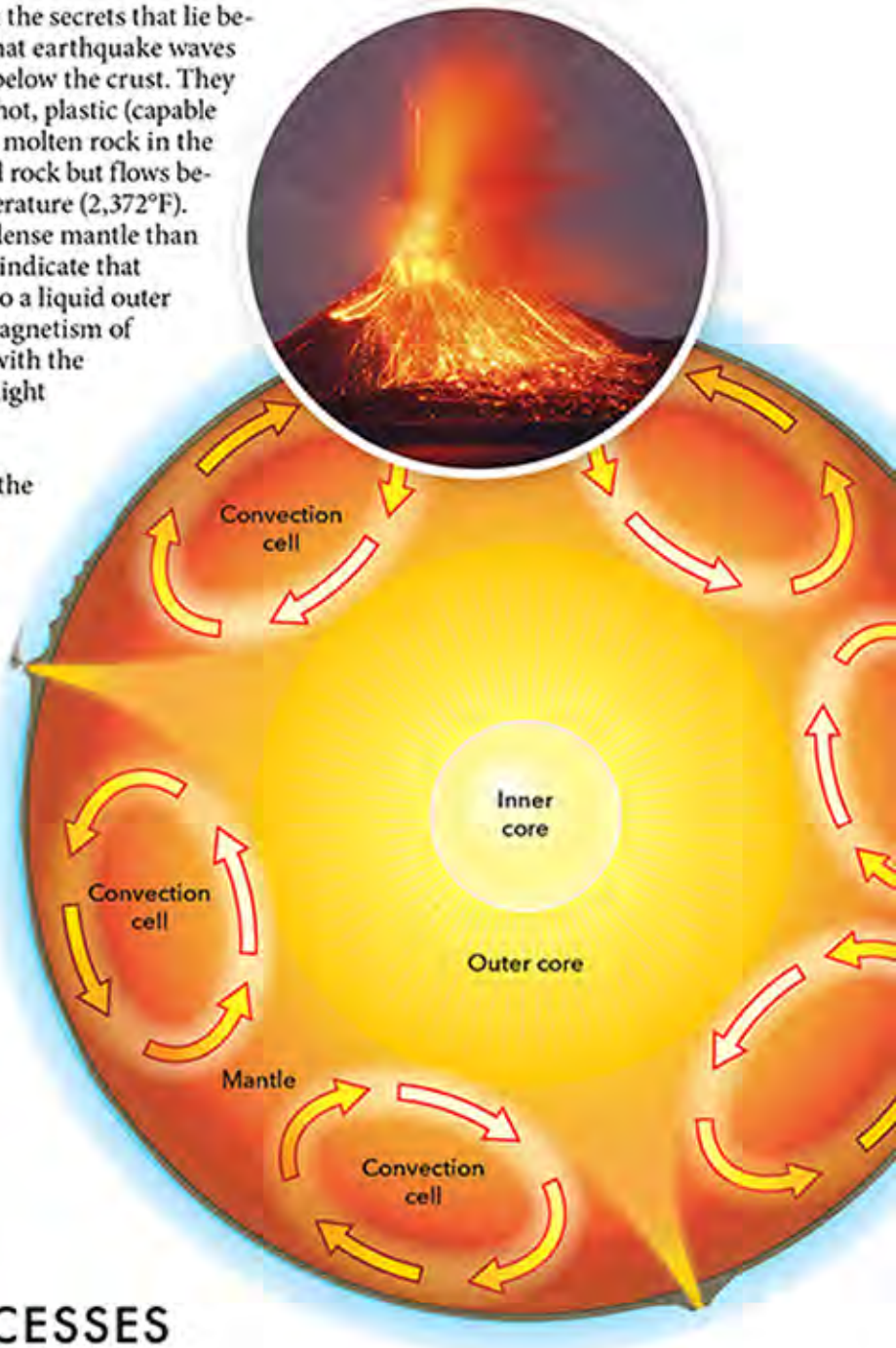
The earth seems to be divided into several layers. The thin outer "skin" is called the **crust** and consists mainly of two layers. The bottom layer of basaltic rock spreads over the entire earth. Above that are the oceans and slabs of granitic rock that are many miles thick. Where these slabs rise above the level of the ocean, they form **continents.**



▾ *A volcano on the island of Anak Krakatau in Indonesia*

Earthquakes provide tantalizing hints about the secrets that lie below the earth's crust. In 1909 scientists noticed that earthquake waves decelerated abruptly and then accelerated again below the crust. They proposed that the waves were entering a layer of hot, plastic (capable of being shaped) material called the **mantle**. The molten rock in the earth's mantle is called **magma**. It is actually solid rock but flows because it is subjected to intense pressure and temperature (2,372°F). Earthquake waves move faster through the hot, dense mantle than through the crust. Waves from earthquakes also indicate that beneath the mantle is a core, which is divided into a liquid outer **core** and a solid inner core. After studying the magnetism of the earth and its powerful gravity as it interacts with the moon, many scientists concluded that the core might be made of two heavy metals, iron and nickel.

Scientists have theorized that a process of convection occurs in the mantle. **Convection** is the heat transfer that occurs when particles carry thermal energy as they move from one place to another. So as heavy rock material sinks it gets closer to the core where it heats up, gaining kinetic energy, and the magma rises, dragging other material with it. As it rises and gets further from the core, it cools, gets heavier, and sinks back down, thus continuing the process.



Heat transport mechanism within the interior of the earth ▸

SECTION REVIEW

1. List the four physical systems of the earth.
2. What are the three layers of the earth's interior?
3. Describe how the process of convection could be happening in the earth's interior.

EARTH-SHAPING PROCESSES

How can the earth's interior affect its surface?

The earth's surface is constantly changing. Since the Flood, two basic processes continue to shape the earth. Internal forces push rocks up, and external forces break rocks down. Both forces help to shape the mountains and other landforms we see today.

GUIDING QUESTIONS

- What are the processes that shape the surface of the earth?
- What does the Bible say about these earth-shaping processes?
- How and where do geologists observe physical processes in the interior of the earth?
- How and where do geologists observe the effects of weathering and erosion?

Internal Forces

Scientists have proposed that the crust is broken into pieces called plates. According to the **plate tectonics theory**, the plates crash into and pull apart from one another, releasing energy from the earth's

▾ *Pangaea*

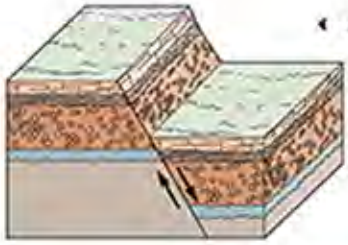
interior and causing earthquakes and volcanoes. This may, in part, explain how God brought about the Flood. The plates continue to move today, resulting in tremors and earthquakes. The engine that moves these giant plates is most likely the process of convection.

If you put the pieces of the earth's crust together like a jigsaw puzzle, especially when the continental shelf is included, you can see how all the continents could have originally been created as one huge landmass. The name Pangaea ("entire earth") is often used to describe this landmass. Some old-earth scientists speculate that the continents must have drifted over millions of years to their present positions. However, the Bible's account of Earth's history does not allow for millions of years. The Bible does teach that the world was once submerged in a worldwide Flood. The evidence seen today can be accounted for by the Flood. The violent upheaval resulting in the shift of tectonic plates during the Flood would have been powerful enough to break apart the supercontinent and set the continents in motion toward their present positions, a process called **continental drift.** This would have occurred over weeks and months rather than millions of years. The plates move today at a speed of two to five centimeters per year. Scientists propose that during the Flood the plates could have had a maximum speed of one meter per second.

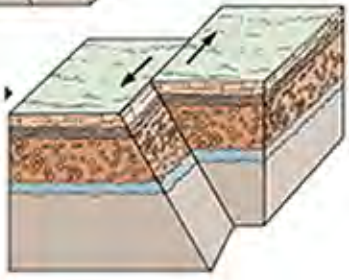
One of the most noticeable evidences of tectonic activity is faulting. **Faults** are deep cracks in the earth's surface where two pieces of land have moved in different directions. Although the movement is rarely more than a few inches, it can devastate life and property. The greatest land displacement ever recorded—nearly fifty feet—took place during the Alaska earthquake of 1964. Faulting is of two types: strike-slip and normal.

The other notable evidence of tectonic activity is folding. Just as a sheet of paper will bend when you push the edges toward the center, so loose sediment can bend upward into a fold when it is pushed from both sides.

◂ *Normal fault*



Strike-slip fault ▸

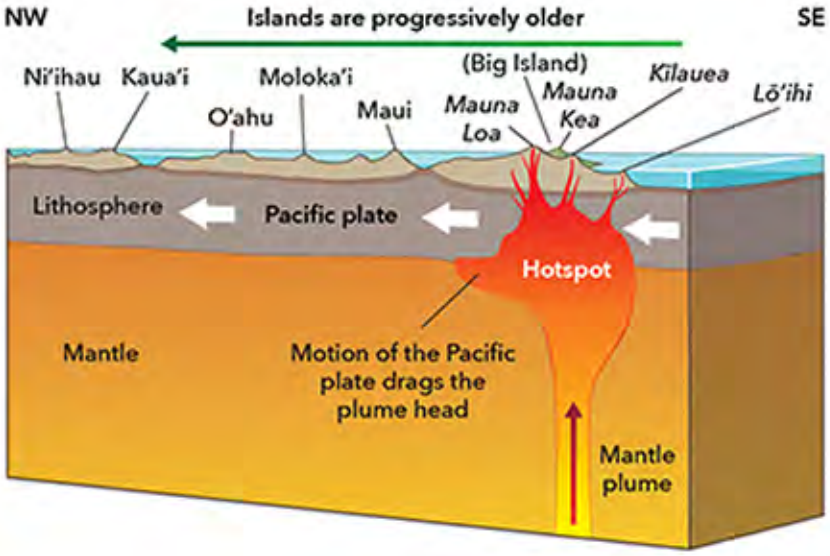


Earthquakes and volcanoes are evidences of powerful forces at work deep within the earth. Although we don't fully understand these internal forces, scientists have some clues. They know that volcanoes and earthquakes are clustered along distinct lines on the earth's surface. Using sonar, scientists discovered that these lines continue under the oceans. The ocean floor is scarred by lines of deep trenches and high ridges.

The Hawaiian Islands are an example of the combined effects of plate tectonics and mantle activity. These islands stretch over 3,600 miles. Moving from east to west they become smaller and smaller. The smallest islands do not even rise above the ocean surface. As the diagram on page 23 shows, there is a hot spot or mantle plume that allows lava from the earth's interior to rise. As the plate moves over the hot spot, an island is created. Since the islands are smaller in the west, the plates must have been moving faster over the hot spot at an

earlier time because the islands were not given as much time to form. The volcanoes on the Big Island of Hawaii have been active throughout recorded history, allowing that island to become the largest. This falls right in line with our understanding that during and following the Flood the earth-shaping forces happened at a much faster rate than they are happening today. If the plates had been moving at a constant rate, all the islands would probably be the same size and possibly all connected.

▾ *Hawaiian Archipelago formation*



External Forces

Landforms do not remain the same. External forces called weathering and erosion wear away the landforms that internal forces have pushed up.

Weathering

Although rocks might seem solid and unmoving, they are constantly weakened by the action of **weathering**. This is the process by which factors or conditions in the environment break rocks into smaller pieces. Weathering can be biological (plants), chemical (water), or physical (formation of ice crystals and temperature changes).

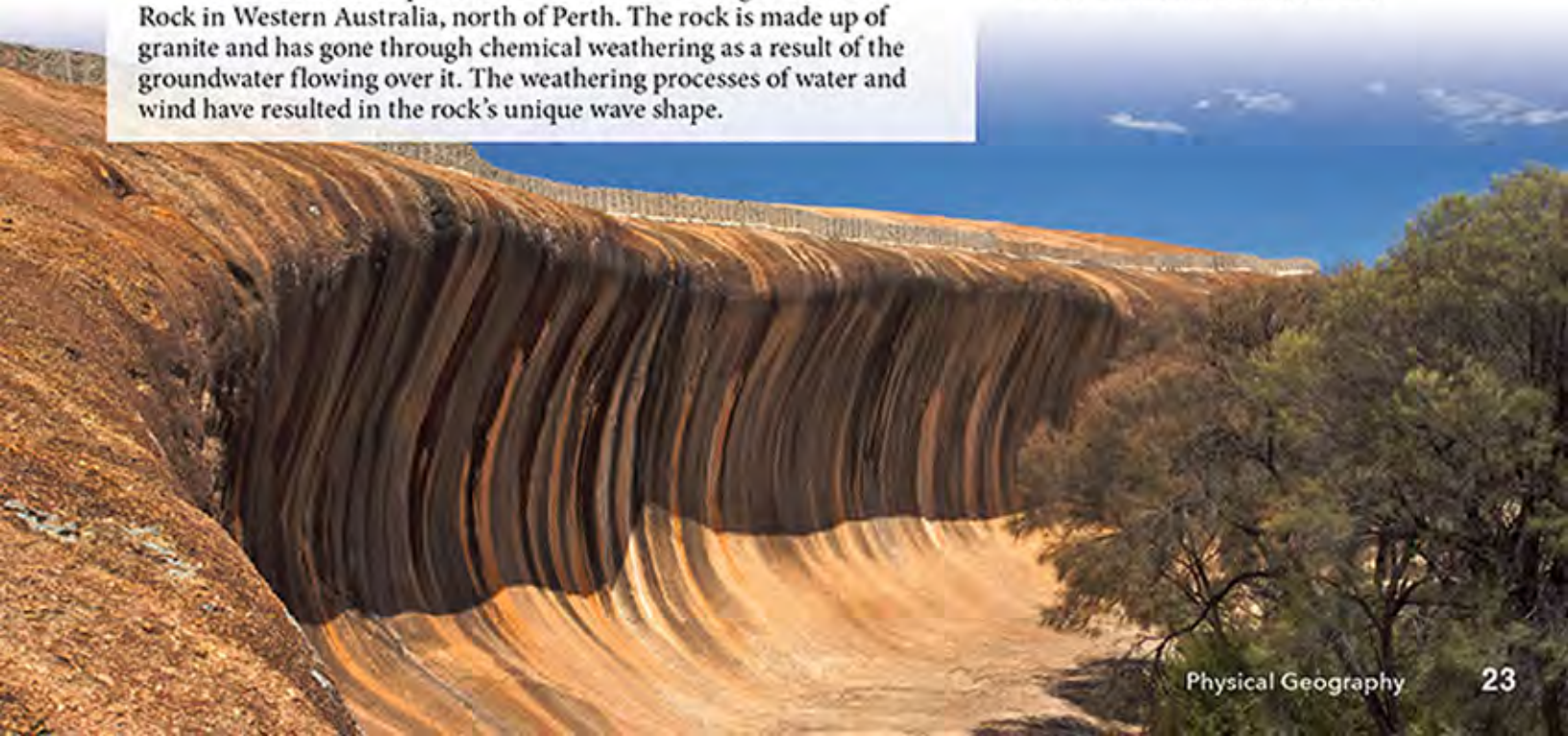
Some kinds of rocks break down more easily than others. Rocks with layers are easily separated. Others shatter under extreme temperature changes. When water collects in pores and freezes, it expands and causes the rock to break. When plants take root and grow, the roots exert tremendous pressure, causing more disintegration. Natural acids from rain, plants, and decaying matter can dissolve some rocks.

Weathering is crucial to life on the earth because it enriches the soil, the thin layer of the earth's surface where plants grow. Weathering produces particles of sand, silt, and clay that mix with humus to form soil. Farmers carefully study their soils to find out which fertilizers will be most beneficial.

A remarkable example of the effects of weathering is the Wave Rock in Western Australia, north of Perth. The rock is made up of granite and has gone through chemical weathering as a result of the groundwater flowing over it. The weathering processes of water and wind have resulted in the rock's unique wave shape.

◂ *The weathering process, from rock to soil*

▾ *Wave Rock in Western Australia*



▼ A dust storm in Morocco is a kind of wind erosion.

Erosion

After weathering breaks down rock into small pieces, those materials are removed by different types of erosion. **Erosion** is the process of wearing away rock and transporting sediments. So while weathering involves the breaking down of material, erosion is movement of those materials.

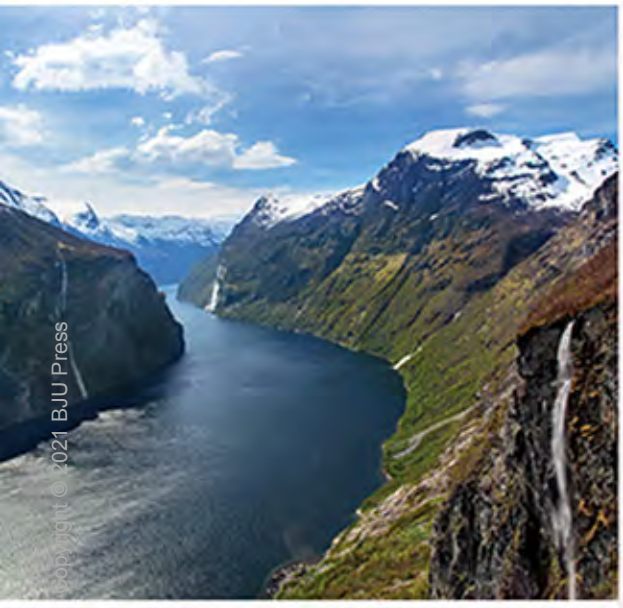
Wind erosion is the most intense in dry areas, particularly deserts. The abrasive action of tiny particles of sand blown by the wind can, over time, do great damage to landforms. The loss of soil through winds can also be destructive. For example, windstorms devastated American farmers on the Great Plains during the Dust Bowl of the 1930s. "Black blizzards" of choking dust darkened the skies as far away as New York.

Wave erosion alters the shore, creating sea caves, sea stacks, and sea arches. Waves also deposit sand offshore, making sandbars or even entire islands. This process formed many of the popular barrier islands along the North American coast.

Glacial erosion occurs when glaciers, large masses of moving ice and snow, flow downhill under the pull of gravity. Like gigantic bulldozers, glaciers push and scrape the earth in their paths. When glaciers receded to their current locations, they left behind hills of debris known as terminal moraines. Two famous moraines extend across the entire length of Long Island, New York.

Running water, however, is the most powerful force of erosion. It quickly flows through soil and soft rocks, carrying away materials as it goes. During floods, water can carve deep gullies quickly. But water's slow action over years can be just as devastating. Farmers are constantly battling to keep water from eroding their topsoil through normal runoff.

Extraordinary examples of erosion are the U-shaped valleys called fjords, created when glaciers receded and swept away material in a process called **glaciation**. The fjords are deepest near the inland, where the glaciation process was strongest.



▲ The Geiranger Fjord in Norway is the result of glacial erosion.

Understanding Earth-Shaping Processes

Other than Creation, the Flood was the most significant physical event in history. Genesis 7–8 provides a glimpse of the process leading to the enormous changes the Flood brought to the earth's surface. The Flood also provided a clear distinction between God's original creation and life after the Flood.

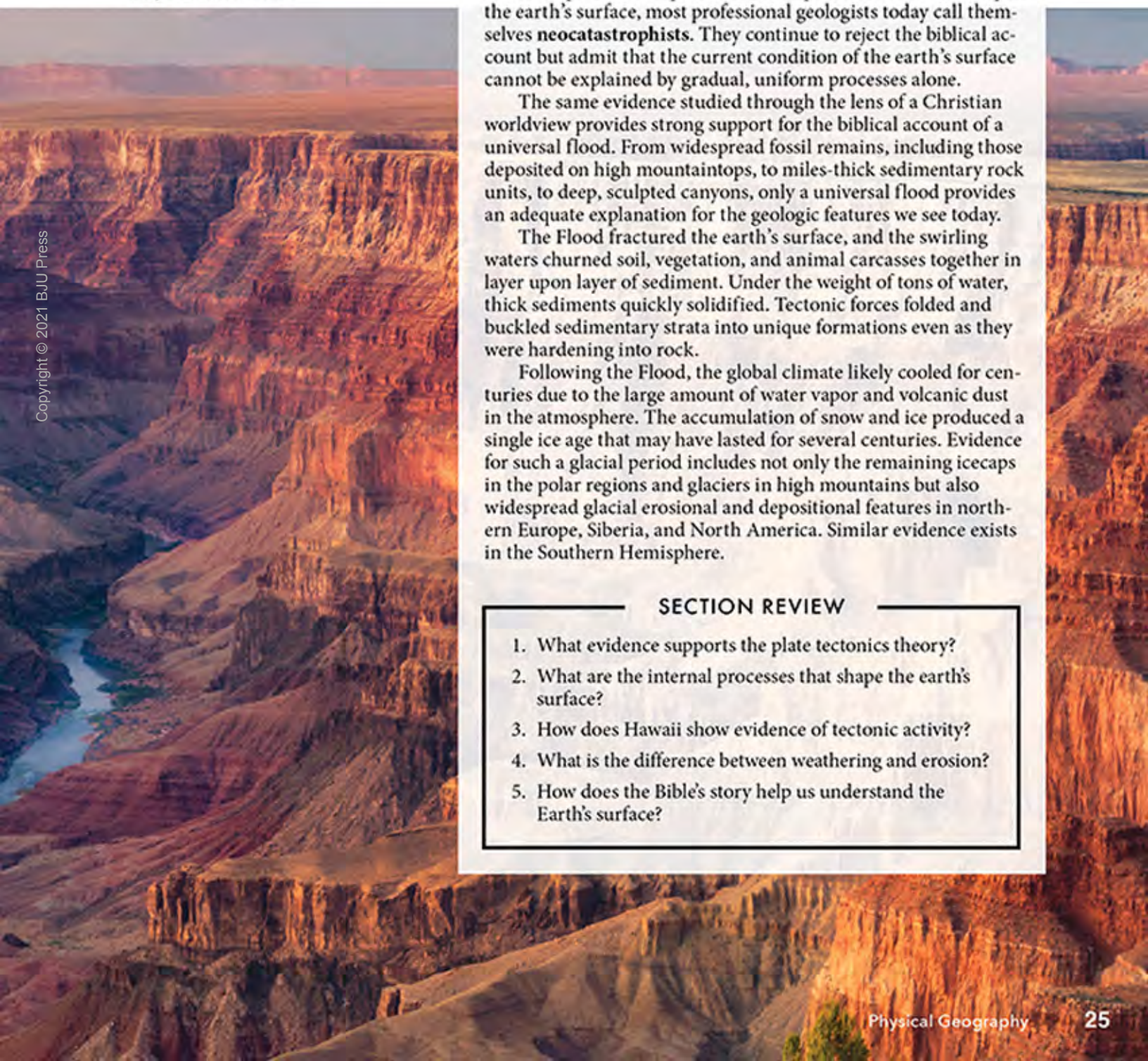
Evidence for a **cataclysm** (a violent upheaval or change in the earth's crust) caused by a flood can be found around the world. How that evidence is interpreted depends on one's worldview. Those with a secular worldview have traditionally believed in **uniformitarianism**, the idea that geologic processes have been relatively uniform in activity and rate. Given the geologic evidence for past catastrophic events and processes that have shaped the earth's surface, most professional geologists today call themselves **neocatastrophists**. They continue to reject the biblical account but admit that the current condition of the earth's surface cannot be explained by gradual, uniform processes alone.

The same evidence studied through the lens of a Christian worldview provides strong support for the biblical account of a universal flood. From widespread fossil remains, including those deposited on high mountaintops, to miles-thick sedimentary rock units, to deep, sculpted canyons, only a universal flood provides an adequate explanation for the geologic features we see today.

The Flood fractured the earth's surface, and the swirling waters churned soil, vegetation, and animal carcasses together in layer upon layer of sediment. Under the weight of tons of water, thick sediments quickly solidified. Tectonic forces folded and buckled sedimentary strata into unique formations even as they were hardening into rock.

Following the Flood, the global climate likely cooled for centuries due to the large amount of water vapor and volcanic dust in the atmosphere. The accumulation of snow and ice produced a single ice age that may have lasted for several centuries. Evidence for such a glacial period includes not only the remaining icecaps in the polar regions and glaciers in high mountains but also widespread glacial erosional and depositional features in northern Europe, Siberia, and North America. Similar evidence exists in the Southern Hemisphere.

▾ *The Colorado River and the Grand Canyon, Arizona, USA*



SECTION REVIEW

1. What evidence supports the plate tectonics theory?
2. What are the internal processes that shape the earth's surface?
3. How does Hawaii show evidence of tectonic activity?
4. What is the difference between weathering and erosion?
5. How does the Bible's story help us understand the Earth's surface?

GUIDING QUESTIONS

- How are geology and hydrology relevant to geography?
- What are the different landforms and bodies of water?
- How were particular landforms and bodies of water formed?
- How do people interact with the land and water?
- What does the Bible say about using the earth's resources?

LAND AND WATER

How do mountains and rivers form?

Geography is concerned with the earth's physical features and human activity on the earth. Geology describes what those physical features are and how they change. Hydrology, or a study of the earth's water supply, reveals how human activity has been influenced by bodies of water throughout history and continues to be even today. So both geology and hydrology are important components in a study of cultural geography.

The Major Landforms

God's world is filled with a beautiful variety of land formations. Every variation in the landscape is called a landform. Geographers have classified three major **landforms**—mountains, plains, and plateaus—each of which has played a unique role in human civilization.

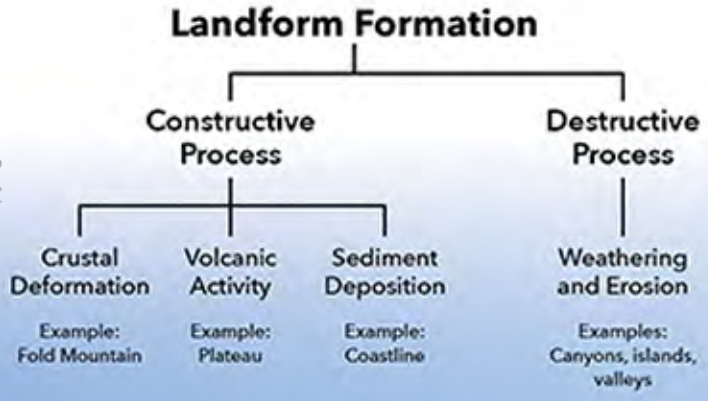
Mountains

Mountains stand high above the surrounding landscape. Geographers distinguish them from hills in that hills are generally smaller than mountains, although no set elevation distinguishes the two. Rather, local usage of the terms is the deciding factor.

Many mountains stand alone above the surrounding landscape. When several mountains appear together, as in the Rocky Mountains, the formation is called a mountain range. The Rocky Mountain range is so large that it actually contains ranges within ranges, which are then called mountain systems.

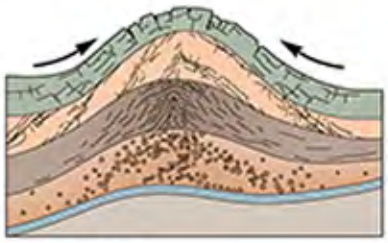
The highest mountain range in the world is the Himalayas. The highest peak is Mount Everest, or Chomolungma in Tibetan. Farmers many miles away depend on the rivers that flow from the melting snows of Mount Everest and other Himalayan peaks.

The Himalayas were formed when the Indian and Asian plates collided during the Flood. If you have ever witnessed the results of a collision involving



Mount Everest, Sagarmatha National Park, Khumbu Valley, Nepal

two large vehicles, you can imagine how much greater would be the result of two large landmasses crashing into each other. The tectonic process by which the relatively thin and dense oceanic crust slowly slides down and under the more massive but less dense continental crust is called **subduction**. Mountains that form in this way are called fold mountains. Other examples include the Rockies, the Alps, and the Appalachians. Fault-block mountains are another type. Fault-block mountains occur when pieces of the earth's crust pull apart, causing some blocks of rock to rise and others to fall. The Sierra Nevada range in the western United States offers a classic example of fault-block mountains. Both fault-block mountains and fold mountains are called deformational mountains because tectonic forces seem to have deformed the rocks that were already on the surface.



▲ *Fold fault*

In addition to influencing weather, climate, and vegetation, mountains have influenced the pattern of human settlement. Many cities arose near mines, which burrow deep into the belly of mountains. Other cities lie in the fertile valleys of mountain ranges, where they are protected from extreme weather. But in most cases, mountains are too cold, rugged, or infertile for extensive human settlement.

Mountain ranges also hinder travel and contact between people. Populations living in the mountains can easily hide from attack, and social changes are slow to reach them. As you study geography, you will notice that cultures, languages, dialects, and national borders are often defined by mountain ranges.

Plains

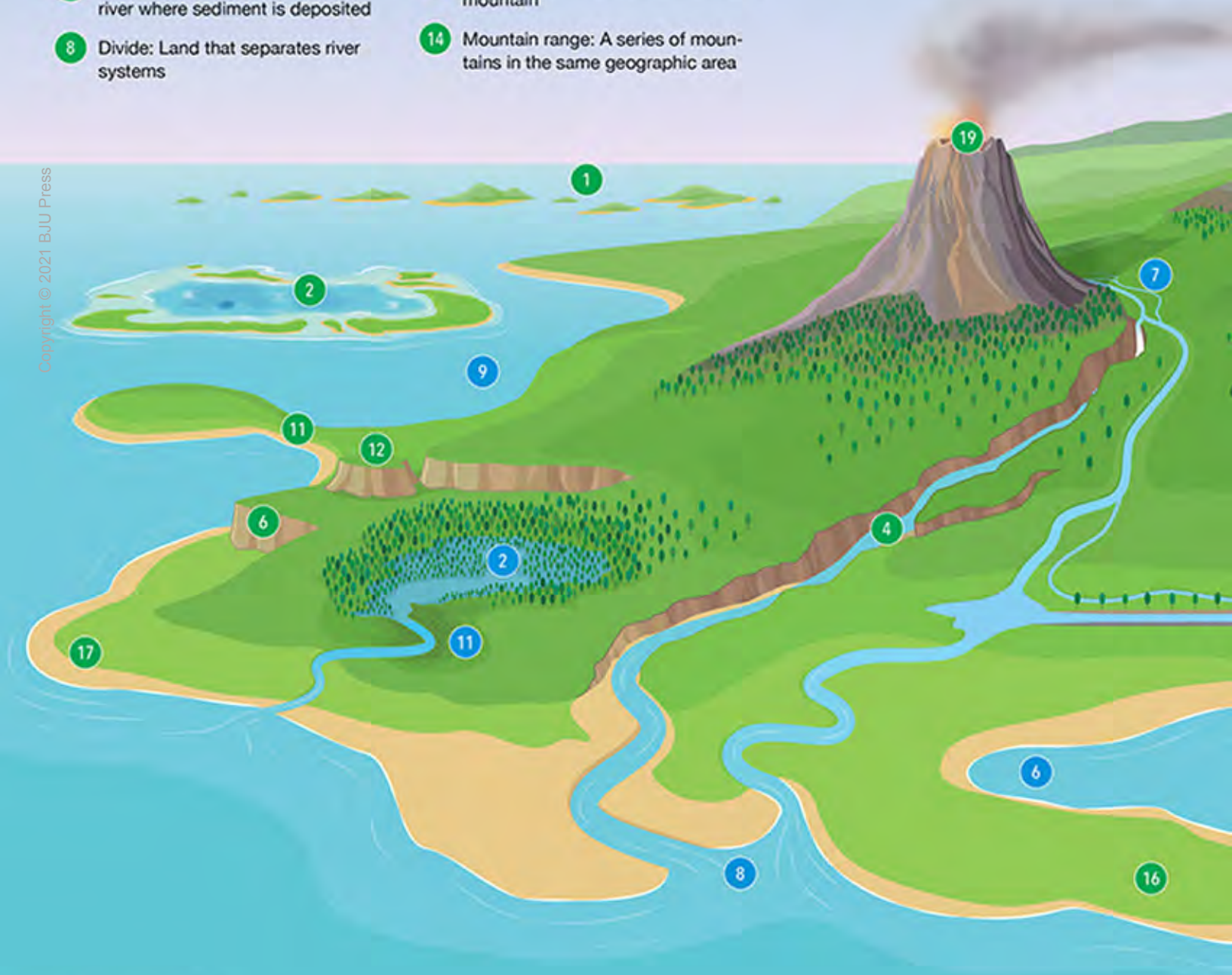
In contrast to mountains, **plains** are wide areas of flat land. Some plains that lie in coastal areas, such as the land along the Gulf of Mexico, are called coastal plains. But low elevation does not define plains; plains can also be found at high elevation. For example, nestled among the Andes Mountains of South America is the Altiplano, which averages twelve thousand feet above sea level. Nor are plains always completely flat. For instance, the Great Plains region of North America has many rolling hills.

▲ *The Uyuni Salt Flat in southwest Bolivia is part of the Altiplano Plain.*

Plains are the most valuable landform for farmers. Rivers bring water and sediments from the mountains, and deposits called alluvium settle in the flat plains. Alluvium is often rich in nutrients that enable farms to produce large quantities of food. Therefore, such alluvial plains are the "breadbaskets" of many nations. They are often named after the river that flows through them. For example, the Congo Basin is an alluvial plain named for the mighty Congo River.

Landforms

1. Archipelago: A group of islands
2. Atoll: A ring of low coral islands and reefs surrounding a central lagoon
3. Basin: Area of land drained by a river and its tributaries
4. Canyon: A deep valley with steep sides usually carved by a river
5. Cave: A naturally occurring underground hollow in earth, rock, or ice
6. Cliff: Steep face of rock and soil
7. Delta: The area at the mouth of a river where sediment is deposited
8. Divide: Land that separates river systems
9. Dune: A depositional landform resulting from wind-deposited sand and soil
10. Hill: A natural elevation of the earth's surface rising to a summit; lower than a mountain
11. Isthmus: A strip of land with water on two sides connecting two larger areas to each other
12. Mesa: A flat-topped hill with steep sides
13. Mountain peak: The pointed top of a mountain
14. Mountain range: A series of mountains in the same geographic area
15. Oasis: An area of land in a desert where water and plants are found
16. Peninsula: A piece of land jutting out into water
17. Seacoast: The part of the land adjoining the sea
18. Valley: An area of land between hills or mountains
19. Volcano: A crack in the earth's crust through which molten rock comes to the surface



Bodies of Water

1. Bay: An area of water bordered by land on three sides; smaller than a gulf
2. Bayou: A slow-moving stream or a marshy lake
3. River: A large stream
4. Canal: An artificial waterway, usually connected to existing bodies of water
5. Channel: The physical confinement of a river, slough, or ocean strait
6. Cove: A circular or round inlet with a narrow entrance
7. Creek: A small stream
8. Estuary: A semi-enclosed coastal body of water with one or more rivers or streams flowing into it and with a free connection to the open sea
9. Gulf: A part of a lake or ocean that extends so that it is surrounded by land on three sides; larger than a bay
10. Mouth: The point at which a stream empties into another body of water
11. Wetland: Land that is almost always wet; usually classified as a marsh, swamp, or bog

▲ *The Tibetan Plateau is one of the largest in the world.*

Plateaus

Plateaus, a third landform, are wide areas of relatively flat land, like plains, but they rise abruptly above surrounding lands. They resulted from the erosion of soft sedimentary material by the massive movement of the Flood waters. Steep cliffs or slopes mark at least one edge of a plateau. Plateaus are often called tablelands because their surface is sometimes elevated like a tabletop.

The surfaces of plateaus are much more varied than plains, often including hills, mountains, and deep canyons. For example, the Grand Canyon cuts through one of North America's largest plateaus. The most rugged plateaus of the world are often called highlands. Plateaus can occur at almost any elevation. The highest is the Tibetan Plateau, which lies on the northern border of the Himalayan range in Asia.

Plateaus generally have poor soils and few resources other than grass for grazing animals. Many of the world's deserts are located on plateaus.

The Major Bodies of Water

Like landforms, bodies of water play a major role in human life. The three main bodies of water—oceans or seas, lakes, and rivers—are at the heart of a great deal of human activity.

Without a ready supply of fresh water, we would quickly die; therefore, human settlements develop near sources of fresh water. Less than 3 percent of the earth's water is fresh, and more than two-thirds of that water is in polar icecaps and glaciers or is underground. The remaining water, in lakes and rivers, is a precious resource, essential to our growth and survival.

Large bodies of water often provide means for travel and trade. When settlers first arrived in America, they clustered along the coast and rivers rather than moving into the mountains. It was much less expensive to ship food by water than to transport it overland. Ships could carry ten wagonloads of goods for the same price as one cart pulled over the mountains. Food on ships arrived at the marketplace much sooner; the food cost less and was fresher. Even today, water transportation is by far the least expensive way for most nations to ship products to each other, especially if they do not share a land border.

Oceans

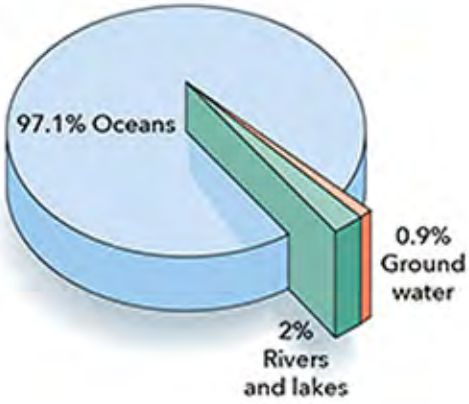
The earth is unique in the solar system. To date, scientists have not found liquid water on any other planet or moon, yet water covers 71 percent of the earth's surface, amounting to more than three hundred million cubic miles. Although 97 percent of the water is in the oceans, traces of water can be found on almost every square inch of land.

There are four principal ocean basins in the world: the Pacific, the Atlantic, the Indian, and the Arctic. In the year 2000 the International Hydrographic Organization decided to recognize a fifth ocean. The Southern Ocean, while not a true ocean basin, surrounds Antarctica and extends to 60 degrees latitude. All of the world's seas, gulfs, and bays belong to one of these oceans. Continents generally mark the borders of each ocean. If you look at the world map, however, you will see that the divisions are not always clear. The oceans flow into each other. For this reason, the whole system is sometimes called the **world ocean**.

The oceans provide humans with many blessings—distributing thermal energy from the sun, providing water for rain clouds, and guarding nations from foreign invasion. Ocean waters teem with fish and pearl-producing clams. One often overlooked gift of the sea, however, is its salt. Salt is essential for human health. It has hundreds of uses, from preserving food to being an essential ingredient in many manufactured goods and chemicals.

If we could drink ocean water and pump it into our parched fields, it would solve many of our worst problems. But the high concentration of salt—about 3.5 percent of the total mass of seawater—is harmful to crops and land animals.

▾ *Earth's Fresh and Salt Water*



▾ *With waves averaging thirty to forty feet, the Southern Ocean is no place for the amateur sailor.*

Rivers

Water is in constant motion. Unless something gets in its way, water will eventually flow to the ocean. Small streams flow into rivers, which in turn flow into even larger rivers. Rivers that feed other rivers are called **tributaries**. The main river and all its tributaries are called a **river system**. Many of the world's great river systems flow more than two thousand miles from their headwaters (source) to their mouth. Geographers rank river systems by comparing various features, such as length, discharge, drainage area, and navigability.

▾ *Mississippi River Basin*

The most obvious comparison is length. The Nile is considered the longest river, an impressive 4,160 miles. But depending on which tributary one designates as the headwaters, the Amazon might be longer. The longest rivers in the United States—the Missouri River (2,540 miles) and the Mississippi (2,340 miles), which it flows into—are not among the top ten longest rivers. But considered as a river system, the Mississippi-Missouri River (including tributaries of the Missouri) measures 3,735 miles long, giving it a rank of fourth place in the world.

▾ *The Amazon River*

Another feature of comparison is discharge, the amount of water flowing into the ocean. It would take about sixty-three rivers the size of the Nile to match the volume of water that flows from the Amazon. The volume is so large that the water from the Amazon remains fresh and drinkable two hundred miles out into the Atlantic Ocean.

A third feature for comparison is the size of the **drainage basin**, the total land area drained by the main river and its tributaries. The Nile's drainage basin is small and mostly dry and has few tributaries. In contrast, the Amazon River drains a rainforest that covers 40 percent of the continent of South America. The Missouri River has the fifth largest drainage basin (1,244,000 sq. mi.).

A fourth feature of comparison is navigability, or how far up a river oceangoing vessels can travel. Steamboats used to ply the Missouri River more than one thousand miles from the ocean. Barges rely on deep, navigable rivers for carrying goods from their distant sources to coastal cities. The Mississippi River and its tributaries include more than fifteen thousand miles of navigable water, making it the second largest inland water route in the world. The Amazon is the only river system that has more navigable miles than the Mississippi.

Rivers have played a central role in the history of almost every nation. Historically, explorers have used these waters as roads to the interior. Many pioneers who followed the explorers settled near these rivers, and most cities were founded beside rivers. For example, St. Louis sprang up at the point where boats floating down the Missouri entered the Mississippi River. Even where rivers are too shallow for travel, they provide drinking water, irrigation, fish, game, power generation, and recreation. The birthplace of almost every great civilization was somewhere along a river.

Lakes

Bodies of water fully enclosed by land are called lakes and are remnants of the Flood and the Ice Age. Many cities are located on the shores of lakes because lakes provide fish, drinking water, transportation, and recreation. Lakes make it possible for some cities to be built deep in the interior of continents. Lakes can form in many different ways. Some formed where glaciers cut out valleys and built up dams that kept the meltwater from flowing into the sea. Other lakes formed in basins that were created by tectonic activity. After the basin was formed, it filled with water. Some lakes form in volcanoes. When a volcano becomes inactive, water can collect in the crater, as in the case of Crater Lake in Oregon. When a river changes directions, it can leave a lake behind. Landslides can also cause the formation of a lake when the land dams up a river. Some very large lakes or reservoirs are created when people dam a river. Lake Volta in Ghana is the world's largest reservoir, containing 144 billion cubic meters of water.

The Great Lakes of North America are the largest system of freshwater lakes in the world. This system includes the world's largest freshwater lake (by area)—Lake Superior. The Great Lakes support many large cities, including Chicago and Detroit.

Other continents also have important freshwater lakes. Lake Titicaca, high in the Andes Mountains, is the largest lake in South America (by volume) and the highest navigable lake in the world. Africa's Lake Chad has been the heart of great empires in central Africa. In east Africa is Lake Victoria, the largest lake on the continent (by area) and the second largest freshwater lake in the world.

Lake Baikal, located in Asia, is both the deepest lake and the largest freshwater lake (by volume). More than a mile deep, it holds almost as much fresh water as all of the Great Lakes combined, although its surface area is relatively small.

The Caspian Sea, also in Asia, is the world's largest lake (by both area and volume). Unlike Lake Superior, however, its water is salty. While the water in freshwater lakes is kept clean by rivers or other outlets that carry dissolved minerals downstream, a few drainage basins of the world have no outlet to the ocean. Water collects at the lowest spot, called a depression. The Caspian Sea is actually below sea level. As the water evaporates, minerals are left behind. Though rare, such salt lakes are often large and famous. For example, the Dead Sea, which is nearly 37 percent salt, is the saltiest lake in the world. (Utah's Great Salt Lake is 10–25 percent salt, and ocean water is typically 3 percent salt.)

▲ *North Shore of Lake Superior, Minnesota, USA*

The frozen surface of Lake Baikal, Russia ▶

Seas

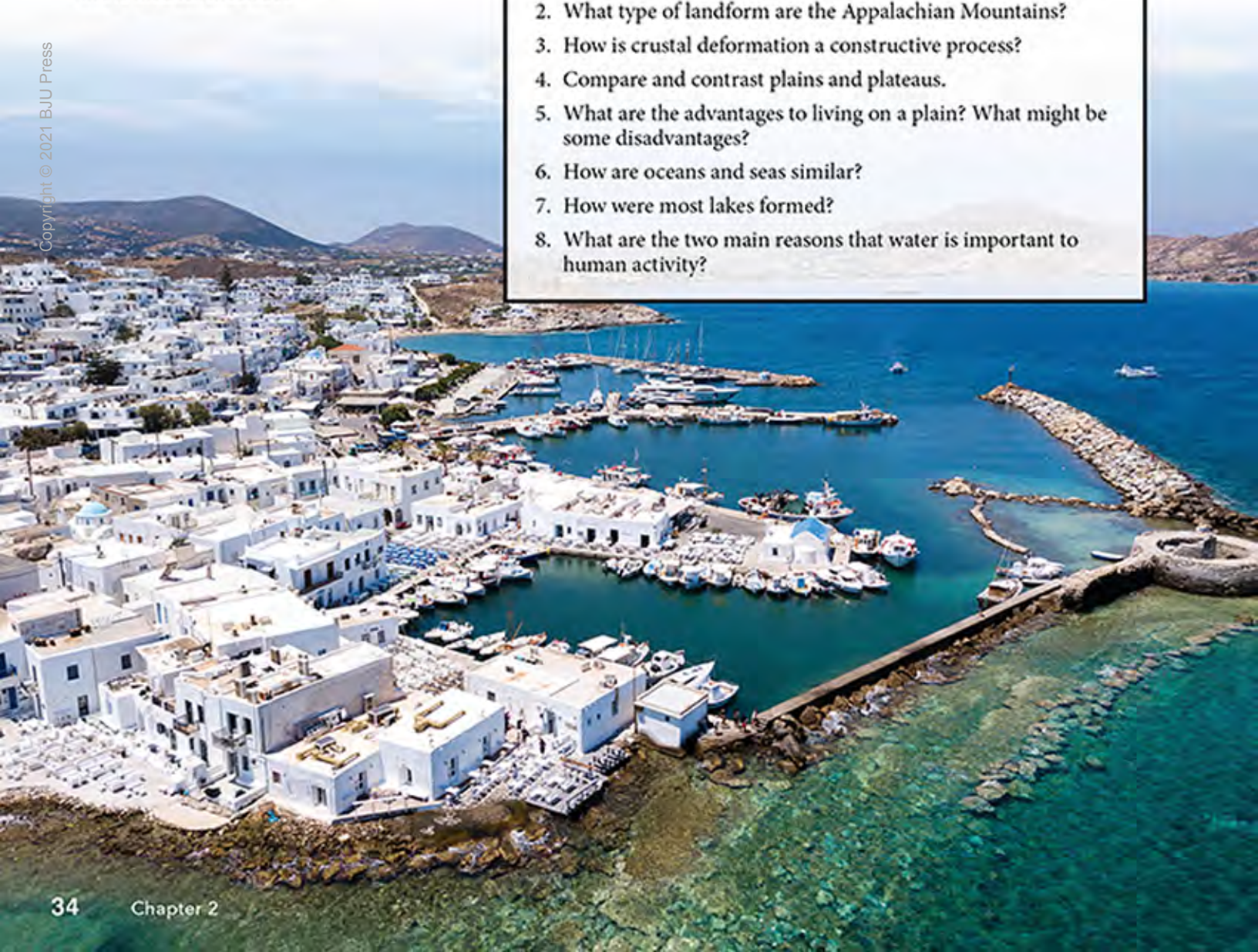
Seas are arms of the ocean partially enclosed by land. Seas can vary greatly in size, and some even have seas within seas. For example, a map of the Mediterranean Sea reveals seven arms in the north that ancient peoples called the "seven seas." The Greek and Roman civilizations arose along their shores. Sailors prefer carrying people and goods on the smaller seas because they normally have smaller waves. The shores blunt the blows of the violent storms that batter ships on the open seas, such as the Mediterranean.

Ships need safe places to anchor while they load and unload their cargo. A sheltered body of deep water next to the shore is called a harbor. Good harbors are rare. The water must be deep enough that the ships do not run aground. The shore must encircle enough of the sea to shelter ships from winds and waves that might otherwise drive them into the rocks or sand. A key to the success of America's original colonies was their harbors. Boston, New York, Philadelphia, and Charleston quickly became major port cities because of their great harbors.

SECTION REVIEW

1. What are the three basic landforms on the earth?
2. What type of landform are the Appalachian Mountains?
3. How is crustal deformation a constructive process?
4. Compare and contrast plains and plateaus.
5. What are the advantages to living on a plain? What might be some disadvantages?
6. How are oceans and seas similar?
7. How were most lakes formed?
8. What are the two main reasons that water is important to human activity?

▼ *The fishing village of Naousa on the island of Paros, Greece, in the Mediterranean Sea*



Interacting with Land and Water

As never before, people living today see the world transformed around them. This progress is what we should expect in a world in which God has given humans the abilities to subdue and make use of the creation.

The word *industry* is often used to describe people's hard work to make a living. Although there are many types of jobs, or industries, the basic categories have been around since God made man to exercise dominion over His earth. All industries are primary, secondary, or tertiary. Primary industries are the most basic, which means they relate directly to interacting with land and water. In primary industries people take from the earth materials that are needed for food, clothes, and shelter. There are four types of primary industries: agriculture, fishing, forestry, and mining.

Part of God's Creation Mandate to Adam was dominion over the created world. God intended for Adam to be His steward, or caretaker, of the environment that He had created. The Lord Himself planted the first garden, filling it with plants and foods for Adam and Eve's use. In addition to using the earth to meet basic needs, we should endeavor to make the earth both more productive and more beautiful. This requires us to be careful about how we treat the earth.

Christians should take care of God's creation. It is important to note what God did not say in Genesis 2:15. He did not say, "You are just a part of My creation and are to leave everything the way it is." Today, many believe that people should be viewed as a type of virus on the earth. This contradicts Genesis 1:28–29, where we learn that God has given humanity a special role. The three verbs that exemplify man's job and relation to creation are *tend*, *care*, and *rule*. Sinful humans who damage the creation through pollution and resource depletion are failing to manage the creation wisely. Often these actions stem from prioritizing short-term benefits over long-term flourishing.

▾ *The Grand Coulee Dam on the Columbia River, Washington, USA*

The three industry sectors