

## Earth Science

Georgia Performance Standards:

S5E1 Students will identify surface features of the Earth caused by constructive and destructive processes.



What are the surface features of the Earth?

How do constructive forces build up the Earth's surface?

How do destructive forces break down the Earth's surface?

Constructive means to build up

Destructive means to tear down or destroy

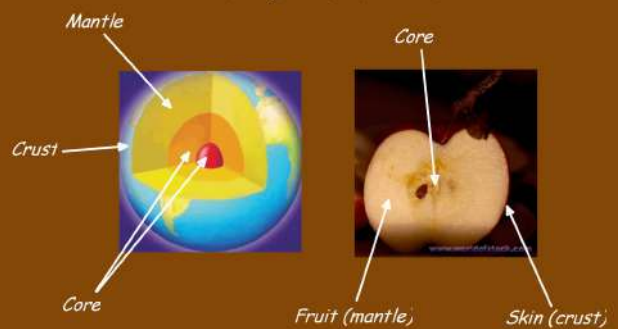
## Lesson 1: The Earth's Structure

Do you know what is below the Earth's surface?

How is the Earth like an apple? What do they have in common?



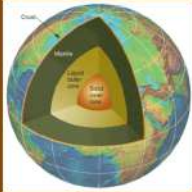
## The Layers of the Earth



[Click here to see how scientists learn about the inside of the Earth.](#)

## The Earth's Layers

### Crust



We live on the crust.

The crust is the outer layer of the Earth. It is the thinnest layer. The crust is made mostly of granite and basalt which contain elements such as silicon, potassium, aluminum, magnesium, calcium, and iron.

Continental crust forms the Earth's landmasses and is about 35 km thick.

Oceanic crust is found below the Earth's oceans and is about 8 km thick.

## The Earth's Layers

### Mantle



The middle area of the Earth is called the mantle. The mantle is the thickest layer of the Earth. Just under the crust, the rock of the mantle is solid. But because the mantle is very hot, part of the mantle is soft. The mantle acts as both a liquid and a solid.

The mantle is about 2,900 km thick with temperatures up to 4000 degrees Celsius.

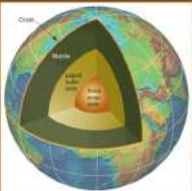
The mantle is probably made of rock called peridotite which is rich in iron and magnesium.



[Click here to see a video about the mantle.](#)

## The Earth's Layers

### Core



[Click here to see a video about the Earth's core.](#)

The core is the center layer of the Earth. It is the hottest layer. It is divided into the outer core which is liquid and the inner core, which is solid.

The outer core is liquid and is about 2,270 km thick.

The inner core is solid iron and is about 1,210 km thick. Intense pressure causes the inner core to be solid.

## A Model World

Materials: modeling clay (2 different colors)  
aluminum foil  
marble  
plastic knife

1. Follow the directions on page 51 in your textbook to make a model of the Earth's layers.
2. In your notebook, draw what the Earth would look like if you could slice it in half.
3. How do you describe the layers that make up the Earth's structure?

REVIEW The Earth's Layers

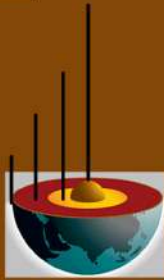
Drag the labels to where they belong on the diagram.

Inner  
Core

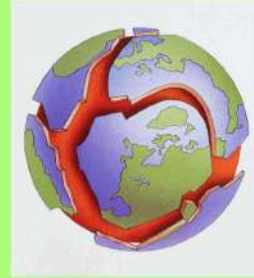
Mantle

Crust

Outer  
Core



Lesson 2: Why does the Earth's crust move?



Wow! That's the biggest puzzle I've ever seen!

text page C15

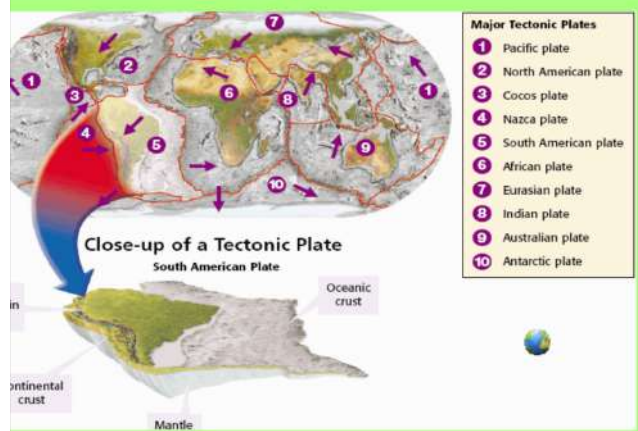
Plate Tectonics 3 min clip

The Earth's crust is broken up into 12 major plates. These plates are slowly drifting on top of the mantle. The plates move both horizontally and vertically. Over billions of years, the location and size of the plates has changed.



It is the movement of these plates that causes earthquakes, volcanoes, and sea floor spreading.

 [Click here to see video about the Earth's crust.](#)





## Plate Tectonics

### I. Continental Drift

A. Developed by Alfred Wegener in 1912.

B. His theory was that 210 million years ago, all land was connected together-PANGAEA, and slowly has drifted apart

C. Scientists didn't accept this theory. Why?

Wegener could not explain HOW the plates had moved.

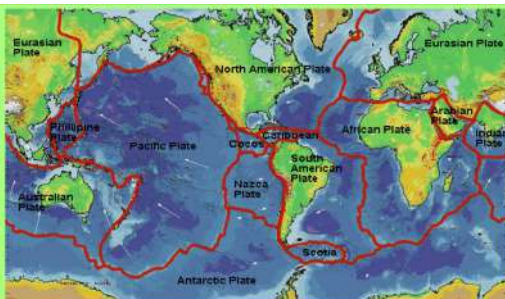
## II. Sea Floor Spreading

A. Discovered in the 1950's using sonar.

B. How does it work?

The sea floor was spreading apart, and as it spread from a crack in the middle, magma oozed from the crack, hardened and formed new rock.

C. This formed an undersea mountain range called the midocean ridge.

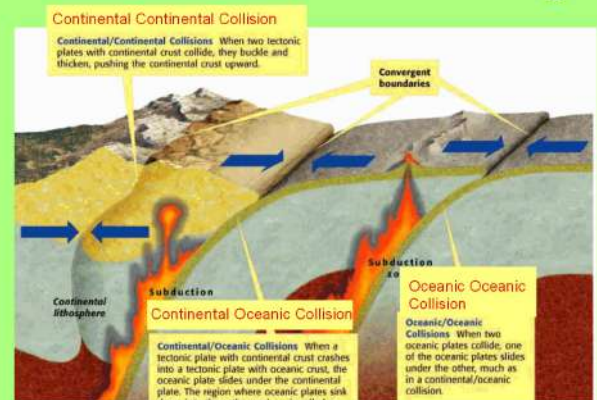


Check out this cool online interactive map

What are some ways that plates can move???????

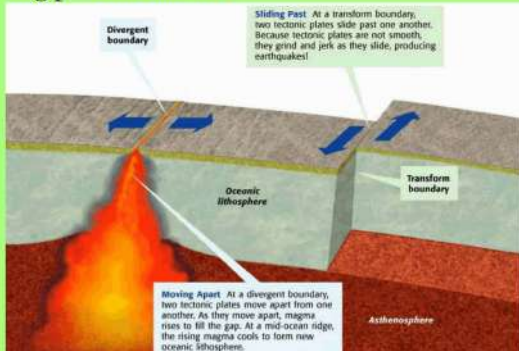


## 1. Convergent Boundaries- two plates push into each other



2. **Divergent Boundaries** form when two plates are moving apart.

3. **Transform Boundaries** form when two plates are sliding past one another.

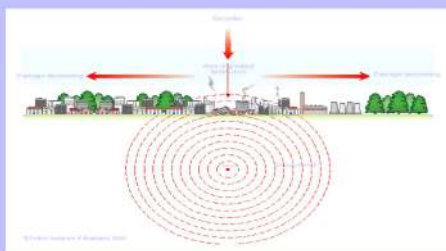


The Great Rift Valley in Eastern Africa occurs as a result of divergent boundaries between the Indian and the African plates



BrainPop-Plate Tectonics

### Lesson 3: How Do Earthquakes Happen???



Learn online about recent earthquakes: One could be happening right now somewhere in the world.

Earthquake Video Clip 2 minutes

Discovery Channel: Earthquake Simulator

Japan Quake Map



### All about Earthquakes



Earthquakes are caused by the movement of plates along **faults**.

**Pressure** builds up as the plates press against each other, and then is suddenly released.

This releases energy in the form of **seismic waves**.

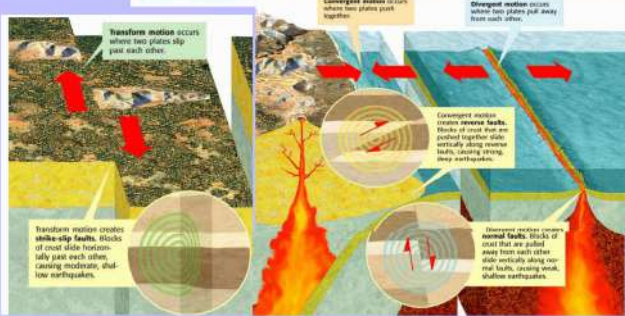
Scientists can detect earthquakes using a machine called a **seismograph**.

A **focus** is the point deep underground where the earthquake begins.

The **epicenter** is the point on the surface of the earth directly above the focus.


## Earthquakes occur along plate boundaries in areas called FAULT lines

Plate motion	Prominent fault type	Earthquake characteristics
Transform	strike-slip fault	moderate, shallow
Convergent	reverse fault	strong, deep
Divergent	normal fault	weak, shallow

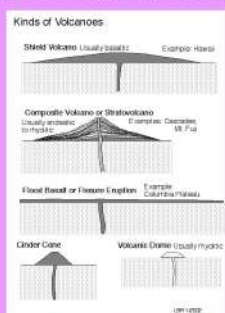


## Discussion Questions/Ticket out the door:

1. What are plate boundaries?
2. What are three types of plate boundaries? How do they move?
3. What occurs at these boundaries when plates move?
4. Are earthquakes a destructive or a constructive force? Explain your answer.

 BrainPop-Earthquakes

## Lesson 4: How Do Volcanoes Form??



3 minute clip on Mountains/Volcanoes  
 Forces of Nature: Select Volcanoes Cool Site  
 Interactive site: Form Volcanoes and Mountains  
 What is the Ring of Fire? Clip

Volcanoes are mountains that form when lava, ash, rocks, and melted rock material pile up and harden.

Magma - hot, melted (molten) rock below Earth's surface

Lava - hot, melted (molten) rock above Earth's surface

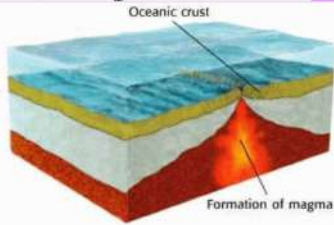
What's the only difference?



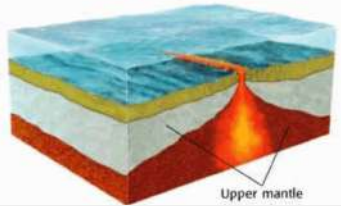


## Volcanoes can form at divergent boundaries.

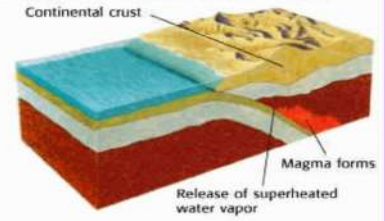
1 Mantle material rises to fill the space opened by separating tectonic plates. As the pressure decreases, the mantle begins to melt.



2 Because magma is less dense than the surrounding rock, it rises toward the surface, where it forms new crust on the ocean floor.



1 As the oceanic plate moves downward, some of the rock melts and forms magma.



Volcanoes can form at convergent boundaries.

2 When magma is less dense than the surrounding rock, it rises toward the surface.



The Pacific Ring of Fire is an area of frequent volcanoes and earthquakes. 90% of the world's earthquakes occur along the Ring of Fire. More than half of the world's active, above sea level volcanoes are in the Ring of Fire.

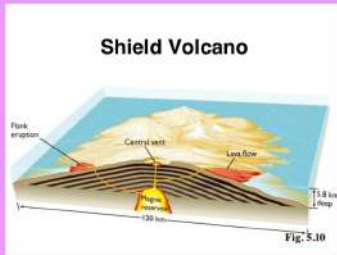


## Three Types of Volcanoes

Cinder cones are the simplest type of volcano. These volcanoes have steep sides. Cinder cones are not usually very tall, only about a few hundred meters. Cinder cones erupt with explosive force, throwing out ash and cinders, which are lava fragments. Krakatau, in Indonesia, is an example of a cinder cone volcano.



Shield volcanoes are gently sloped volcanic mountains. Shield volcanoes usually erupt quietly without much force. They are made mostly of igneous basalt. Examples of shield volcanoes are the five volcanoes that formed the Hawaiian Islands. In fact, the Hawaiian Islands are the largest volcanoes on Earth!



Shield volcanoes tend to be very large and gently sloping. They often produce fountain like eruptions.



Another type of volcano is a **composite cone**, also called stratovolcanoes. These volcanoes are made of alternating layers of volcanic rock fragments, lava, and ash. The volcanic rock and ash are ejected with great force. The lava escapes during quiet eruptions. These volcanoes are usually very steep and large. Examples of composite cones are Mt. Vesuvius in Italy, Mt. Rainier in Washington, Mt. Hood in Oregon, and Mt. Fuji in Japan.



BrainPop-Volcanoes

How do people try to control all these forces of nature?

#### Seismological studies

Seismologists (scientists that study earthquakes) have been able to study earthquake data and even predict when and where earthquakes will occur

Volcanologists are scientists that study volcanoes. They can use data that they observe to predict whether a volcano will erupt and when it might happen.

[Video: Earthquakes and Volcanoes \(15 min total\)](#)



## Lesson 5: Mountain Formation

1. Most mountains form near plate boundaries.
2. When plates crash into each other (converge), they push up layers of rocks.
3. These are called FOLD MOUNTAINS

The Himalayan Mountains

The Himalayas: Website



2. Fault-Block mountains can form where ever there are fault lines.

They form when rocks break into blocks as the fault slips up, down, or sideways.



Let's try an activity where we make folds and faults!



## Folding and Faulting Lab

**Objective:** To investigate how the movement of plates effects geological features such as mountains.

**Materials:** Modeling clay of 3 different colors, plastic knife, index card

1. Cut a 1 inch cube of modeling clay, or use the clay at your table and roll it into a tube about 4 inches long. Flatten the tube with your hands.

2. Repeat this step with each color.

3. Layer each color on top of each other.

4. Hold the clay by the ends, and press together, forming a clay "mountain".

5. Draw a picture of this on your paper. You have used a type of rock stress called COMPRESSION.

6. Pull your mountain apart so that the clay stretches. It should be thin in the middle. You have used a type of rock stress called TENSION.

7. Now use your plastic knife to cut the clay layers at an angle. This is called a fault line.

8. Place the index card at an angle between the pieces. When you push the layers together, they may slide up. This is called a normal fault.

9. When you pull the layers apart, they may slide down. This is called a reverse fault.

10. Try this several times, then draw a picture of what you see in your notes.



<i>Convergent Boundaries</i>	<i>Divergent Boundaries</i>	<i>Transform Boundaries</i>
INSIDE		
PICTURES OF LANDFORMS THAT ARE CREATED BY THESE TYPES OF PLATE BOUNDARIES		
<i>Plates move...</i>	<i>Plates move...</i>	<i>Plates move...</i>
<i>This movement creates.</i>	<i>This movement creates.</i>	<i>This movement creates.</i>

## Lesson 6: Wearing Down Earth's Surface

Weathering—The process by which rocks are broken down into smaller and smaller pieces.



Eventually, the rock is so small it is called  
**SEDIMENT** (like sand, dirt, clay, or silt)

- b. Identify and find examples of surface features caused by destructive processes.
- Erosion (water—rivers and oceans, wind)
  - Weathering
  - Impact of organisms
  - Earthquakes
  - Volcanoes

## Two Types of Weathering

### **Mechanical Weathering**

Objects are broken down into small pieces, but their chemical makeup **stays the same.**

How does it happen?

**Wind** blows across rocks

**Water** washes over rocks



**When water gets into cracks and freezes, it expands and breaks rock apart.**



At home: Take a disposable PLASTIC (not glass) water bottle and fill it up to the top. Put it in the freezer and leave it in there all night. Take it out in the morning and observe. Be ready to share what you saw.

## IMPACT OF LIVING ORGANISMS

Did you know that plants can cause weathering?

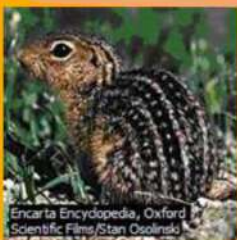


**Plant roots grow between rocks and break them apart....**



Even in the sidewalk!

**Animals can cause weathering too! Seriously!**



Animals that burrow in the ground can push against rocks and allow water to move deeper into them.

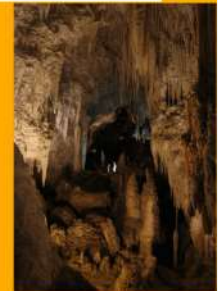


## Chemical Weathering

**This happens when the chemicals that make up the rocks react with other substances and change their chemical structure.**

**Water can chemically change some rock. This usually happens very slowly.**

*This is how caves form.*





### Chalk and Vinegar Experiment

Use either a piece of chalk or sea shells for this.

1. Place them into a cup of white vinegar. Vinegar is a weak acid that chemically erodes materials made of calcium carbonate, the main chemical in chalk, shells, and limestone.
2. Observe what happens to the chalk after 10 minutes in the vinegar.
3. Write down your observations. How is this demonstration similar to the formation of Georgia's limestone caves ( see the next page for pictures)

Ellison's Cave

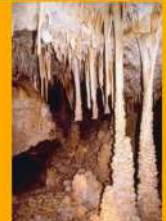


### Caves in Georgia

Pettijohn's Cave



Climax Caverns



Byer's Cave



### Lesson 7: Erosion

Erosion is a **DESTRUCTIVE** force  
It breaks down land features  
of the Earth

Deposition is a **CONSTRUCTIVE** force  
It builds up land features on the  
Earth



### Erosion

*Erosion is the carrying away of sediments by water, wind or moving ice.*



### What Can Cause Erosion?

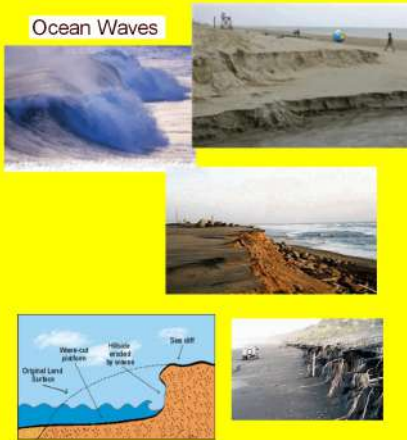
Wind can move sand from one place to another to build beautiful sand dunes on a beach or in a desert.

The sand dunes themselves can be moved from one place to another by wind erosion.



### Ocean Waves

During storms, like hurricanes, waves breaking on the shore can wear it away. The larger the waves, the faster the beach erosion will be. The sand doesn't vanish. It moves out to sea or is carried to nearby beaches.



Look at these photos taken of Seagrove Beach, FL

The first is before Hurricane Ivan hit it.

The second is after the hurricane.

The third is after a second hurricane hit the beach in the same year.



### Glaciers

Rivers of ice called glaciers very slowly slip down over the land. As they do so, they scrape rocks off the land and move them downhill. Eventually, the glacier will stop moving and even retreat. A pile of rocks is left behind, and a steep U-shaped valley it had cut into the land.



### Moving Water/Rivers

- The most common method of erosion
- Gravity pulls the water downhill. As it flows, it erodes the ground
- Over time, the river channel becomes deeper and wider.

Valleys formed by rivers are V-Shaped



The Colorado River ran through and carved out rock, weathering it into sediment. The river also carried sediments downstream, leaving behind this.....



The Grand Canyon!!

### Lesson 8: Deposition

Think of the word "Deposit"

What does that mean?

Deposition is when sediments are dropped or released after they have been moved (eroded)

Land features formed by deposition include:

- Alluvial Fans
- Deltas
- Sand Dunes
- Barrier Islands

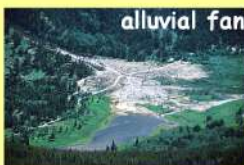
Rivers carry sediments downstream.



When they reach a flat plain area or the ocean the water flows more slowly.



The sediments they carry are dropped or DEPOSITED, and a landform builds up.



alluvial fan



delta

### Sand Dunes and Barrier Islands

Sand along beaches often comes from rivers that have carried it downstream.

Ocean waves wash sand off of beaches and redeposit it on other parts of the beach



Beaches and shore lines are constantly changing because of erosion and deposition of sand!!!



### Georgia's Coastal Islands

The islands along Georgia's coast were formed during the last Ice Age!

They were created as sea levels rose and fell and as sand was deposited just off shore.

They also constantly change shape because of erosion and deposition of sand!



### Lesson 9: The Role of Humans in Controlling Forces of Nature

#### I. Flood Control

Rivers can rise with too much rainfall or snow melt.

When hurricanes reach the shore, there is often a storm surge, which can flood the coastline.

Here are some ways that humans try to control flooding....

**Storm Drains** - pipes or channels that carry away storm water from streets and parking lots.



**Dam** - a wall across a river. Behind a dam, the river water collects into an artificial lake called a **reservoir**.

**Levees** - a wall along a river channel or other body of water. It keeps the water behind it.



**LEVEES ALONG THE MISSISSIPPI RIVER**  
More than 2,000 miles of levees    Height: 15 ft. to 30 ft.    Width: 8 ft. on top    More than 100 ft. at the base



#### **Beach Reclamation**

Sometimes beaches can erode away faster than sand is deposited back onto them. This is sometimes caused by rising ocean levels.

**Beach nourishment** - sand is dredged up from underwater, then re-deposited onto an eroded beach.

**Sea walls** are built along the edge of the beach to keep waves from washing away the beach.

**Sea grasses** are planted along sand dunes to help hold sand in place so that it is harder to blow or wash away.



At Home Project:

Make a travel brochure for a Georgia beach. Discuss the constructive forces that build it up and the destructive forces that erode it. Include a section explaining how "beach nourishment" helps rebuild the beaches that have eroded away.

### Soil Conservation

I. Humans cause 10-15 times more erosion than all other natural forces.

A. We are eroding the surface of the earth faster than it can be replaced.

II. Soil Conservation-what can we do to stop this?

A. Contour Plowing

Make rows that act like a series of little dams that block water from washing away soil.

B. Terrace Farming

Terracing changes a hill into a series of flat fields. Water collects on the fields and doesn't run off.

