

## Chapter Menu

### Chapter Introduction

#### Lesson 1

Forces That  
Shape Earth

#### Lesson 2

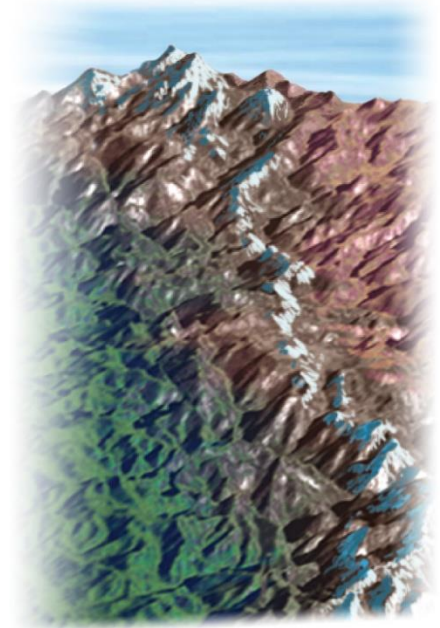
Landforms at  
Plate Boundaries

#### Lesson 3

Mountain  
Building

#### Lesson 4

Continent  
Building



### Chapter Wrap-Up





How is Earth's surface shaped by plate motion?



Get Connected  
[glencoe.com](http://glencoe.com)



**Get Ready****What do you think?**

Before you begin, decide if you agree or disagree with each of these statements. As you view this presentation, see if you change your mind about any of the statements.



Get Connected  
[glencoe.com](http://glencoe.com)



## Get Ready

**Do you agree or disagree?**

1. Forces created by plate motion are small and do not deform or break rocks.
2. Plate motion causes only horizontal motion of continents.
3. New landforms are created only at plate boundaries.



## Get Ready

**Do you agree or disagree?**

4. The tallest and deepest landforms are created at plate boundaries.
5. Metamorphic rocks formed deep below Earth's surface sometimes can be located near the tops of mountains.
6. Mountain ranges can form over long periods of time through repeated collisions between plates.



## Get Ready

**Do you agree or disagree?**

7. The centers of continents are flat and old.
8. Continents are continually shrinking because of erosion.



## Lesson 1

# Forces That Shape Earth

## Key Concepts

- How do continents move?
- What forces can change rocks?
- How does plate motion affect the rock cycle?



## Lesson 1

# Forces That Shape Earth

## Vocabulary

- isostasy
- subsidence
- uplift
- compression
- tension
- shear
- strain





## Plate Motion

- Mountain ranges are produced by plate tectonics.
- The theory of plate tectonics states that Earth's surface is broken into rigid plates that move horizontally on Earth's more fluid upper mantle.
- Mountains and valleys form where plates move away from each other or slide past each other.



## Vertical Motion

Isostasy is the equilibrium between continental crust and the denser mantle below it.

### WORD ORIGIN

**isostasy**

from Greek *iso*, means “equal”;  
and Greek *stasy*, means “standing”



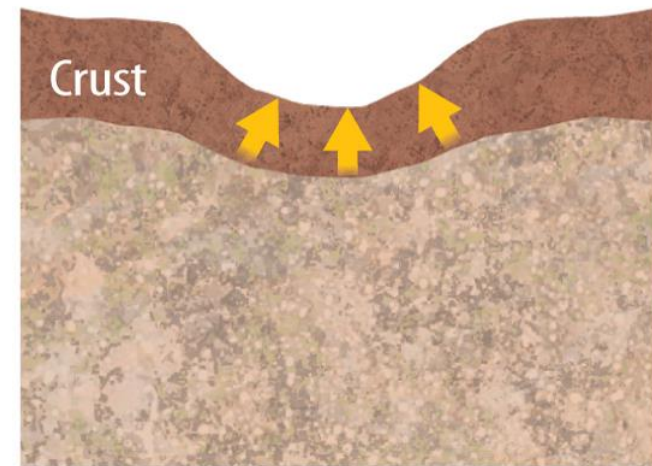
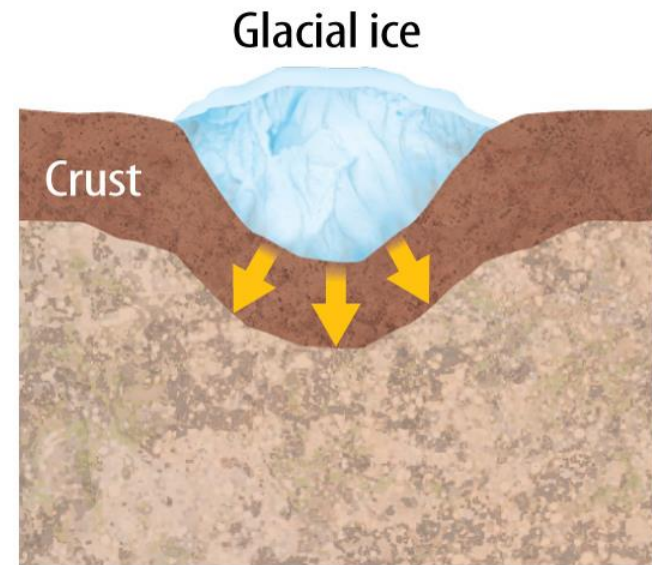
## Vertical Motion (cont.)

- A continent floats on top of the mantle because the mass of the continent is equal to the mass of the mantle it displaces.
- The crust will sink and rise as its mass changes, in order to reach equilibrium. If a part of the continental crust becomes thicker, it sinks deeper into the mantle. The crust can also rise higher if it becomes lighter.



## Vertical Motion (cont.)

- The downward vertical motion of Earth's surface is called subsidence.
- The upward vertical motion of Earth's surface is called uplift.



## Vertical Motion (cont.)

- Much of North America was covered by glaciers more than 1 km thick 20,000 years ago.
- The weight of the ice pushed the crust downward into the mantle.
- When the ice melted and the water ran off, the isostatic balance was upset. In response, the crust moved upward.



# Vertical Motion (cont.)



## KEY CONCEPT CHECK

What can cause Earth's surface to move up or down?



Get Connected  
[glencoe.com](http://glencoe.com)



## Horizontal Motion

- Horizontal motion at plate boundaries applies much greater forces to rocks than vertical motion does.
- Forces at plate boundaries are strong enough to break rocks or change the shape of rocks.



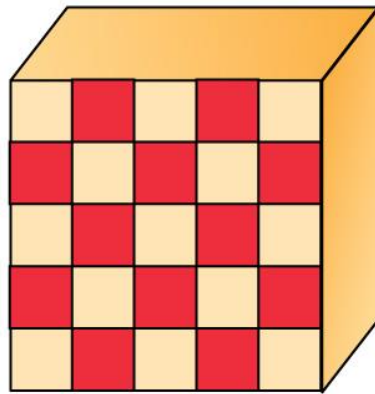
## Horizontal Motion (cont.)

- Stress is the force acting on a surface.
- Squeezing stress is compression.
- Stress that pulls something apart is tension.
- Parallel forces acting in opposite directions are shear.

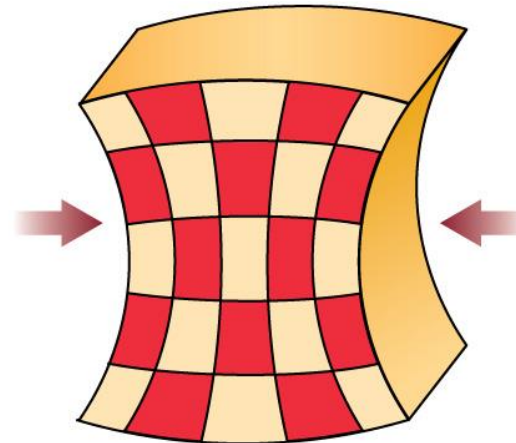




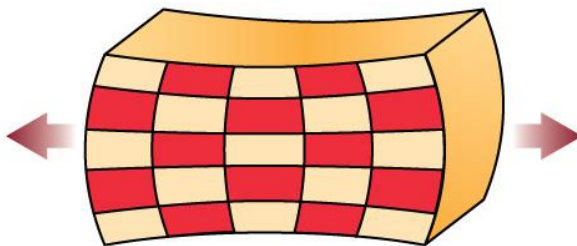
Compression, tension, and shear can all cause rocks to change shape.



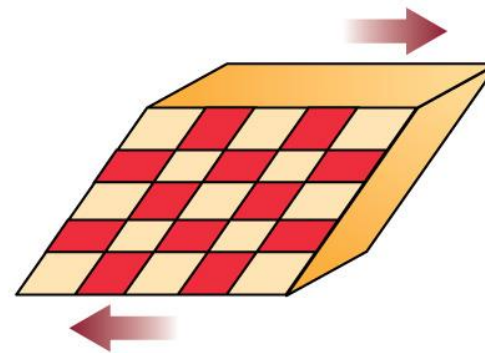
No stress



Compression



Tension



Shear



## Horizontal Motion (cont.)

- A change in the shape of rock caused by stress is called strain.
- Elastic strain does not permanently change, or deform, rocks. It occurs when stresses are small or rocks are very strong.
- Plastic strain creates a permanent change in shape.



# Horizontal Motion (cont.)

## SCIENCE USE V. COMMON USE

plastic

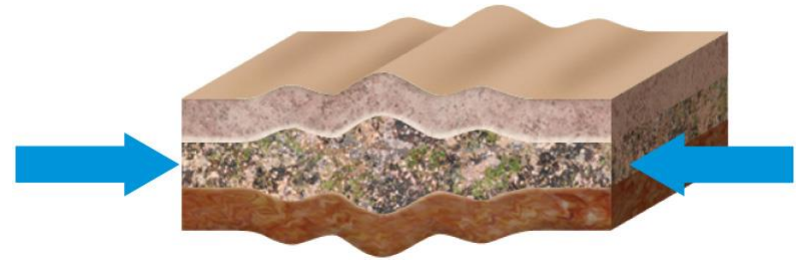
**Science Use** capable of being molded

**Common Use** a commonly used synthetic material



## Horizontal Motion (cont.)

- Compression thickens and folds layers of rock.
- Tension stretches and thins layers of rock.



## Horizontal Motion (cont.)

- When strain breaks rocks rather than just changing their shape, it is called failure.
- When rocks fail, fractures—or faults—form.



# Horizontal Motion (cont.)



## KEY CONCEPT CHECK

What causes rocks to thicken or fold?



Get Connected  
[glencoe.com](http://glencoe.com)

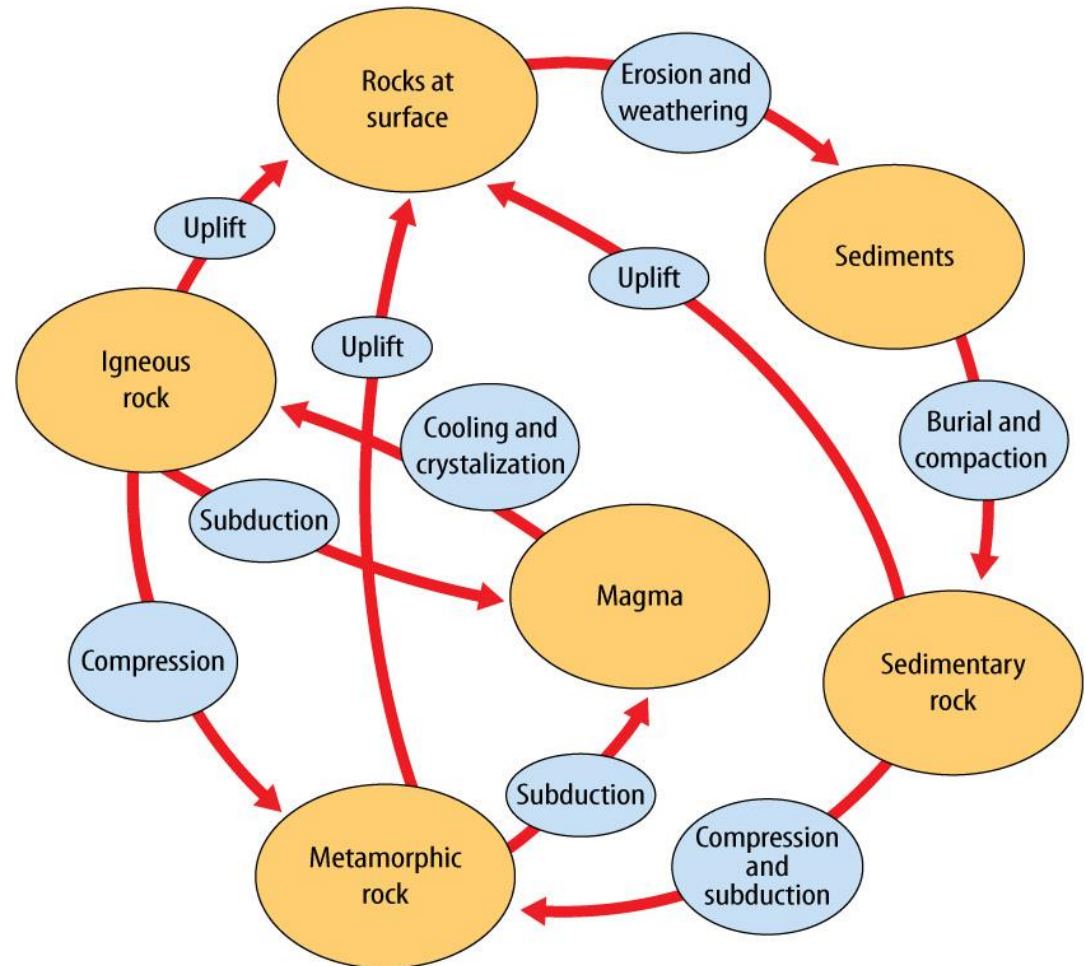


# Plate Tectonics and the Rock Cycle

- The theory of plate tectonics combined with uplift and subsidence explain why there is a rock cycle on Earth.
- The forces that cause plate tectonics produce horizontal motion.
- Isostasy results in vertical motion within continents.



Horizontal tectonic motion and vertical motion by uplift and subsidence help move rocks through the rock cycle.



 **Get Animated**



# Plate Tectonics and the Rock Cycle

(cont.)



## KEY CONCEPT CHECK

How does plate motion affect the rock cycle?

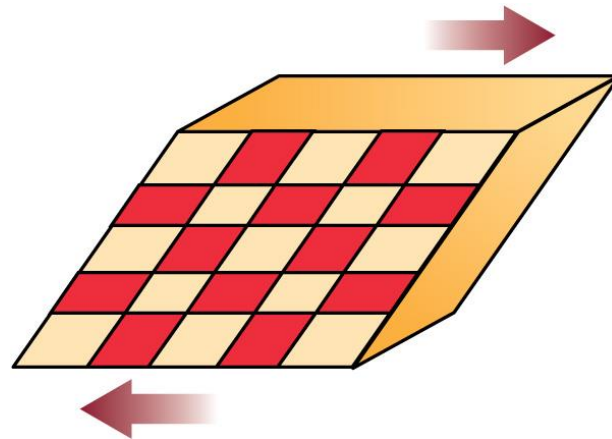


Get Connected  
[glencoe.com](http://glencoe.com)



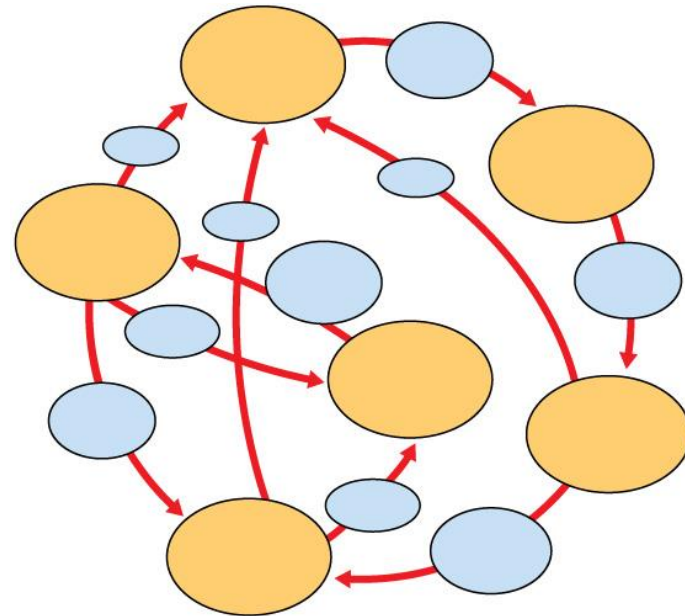
## Summary

- As a mountain is eroded away, the continent will rise until isostatic balance is restored.
- Different types of stress change rocks in different ways.



## Summary

- Horizontal and vertical motions are part of what keep rocks moving through the rock cycle.



## Lesson Review

**What term refers to the equilibrium between continental crust and the denser mantle below it?**

- A. uplift
- B. subsidence
- C. isostasy**
- D. compression



## Lesson Review

**Which term refers to a change in the shape of rock caused by stress?**

- A. tension
- ☒ B. strain
- C. compression
- D. shear



## Lesson Review

**What is the downward vertical motion of Earth's surface called?**

- A.** subsidence
- B.** uplift
- C.** isostasy
- D.** none of the above



## Lesson Review

**What do you think** **NOW?**  
**Do you agree or disagree?**

1. Forces created by plate motion are small and do not deform or break rocks.
2. Plate motion causes only horizontal motion of continents.



- Extra Credit Opportunities:
  - Make a poster for the various kinds of stress





## Lesson 2

# Landforms at Plate Boundaries

## Key Concepts

- What features form where two plates converge?
- What features form where two plates diverge?
- What features form where two plates slide past each other?



## Lesson 2

# Landforms at Plate Boundaries

## Vocabulary

- [ocean trench](#)
- [volcanic arc](#)
- [transform fault](#)
- [fault zone](#)



# Landforms Created by Plate Motion

- Massive, slow-moving tectonic plates have so much force they can build tall mountains, form deep valleys, and rip Earth's surface apart.
- Compression, tension, and shear stresses each produce a different type of landform.

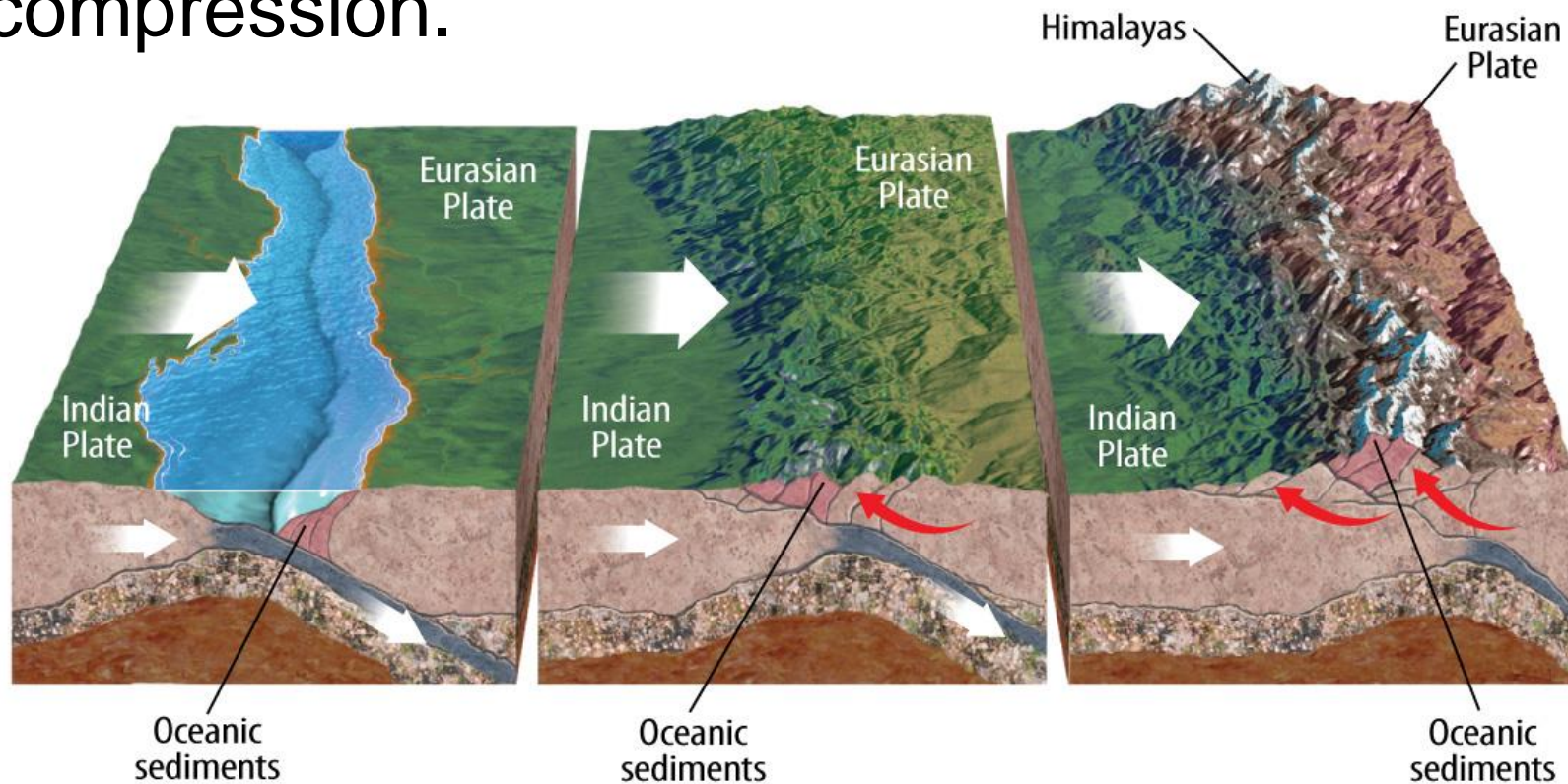


# Landforms Created by Compression

- The largest landforms on Earth are produced by compression at convergent plate boundaries.
- A collision between two continental plates can produce tall mountains that form slowly and in stages over millions of years.



The plates beneath India and Asia started colliding almost 50 million years ago. Because the plates are still colliding, the Himalayas grow a few millimeters each year due to compression.



# Landforms Created by Compression

(cont.)

- When two plates collide, one can go under the other and be forced into the mantle in a process called subduction.
- **Ocean trenches** are deep, underwater troughs created by one plate subducting under another plate at a convergent plate boundary.



# Landforms Created by Compression

(cont.)



## KEY CONCEPT CHECK

What two landforms can form where two plates converge?



Get Connected  
[glencoe.com](http://glencoe.com)





# Landforms Created by Compression

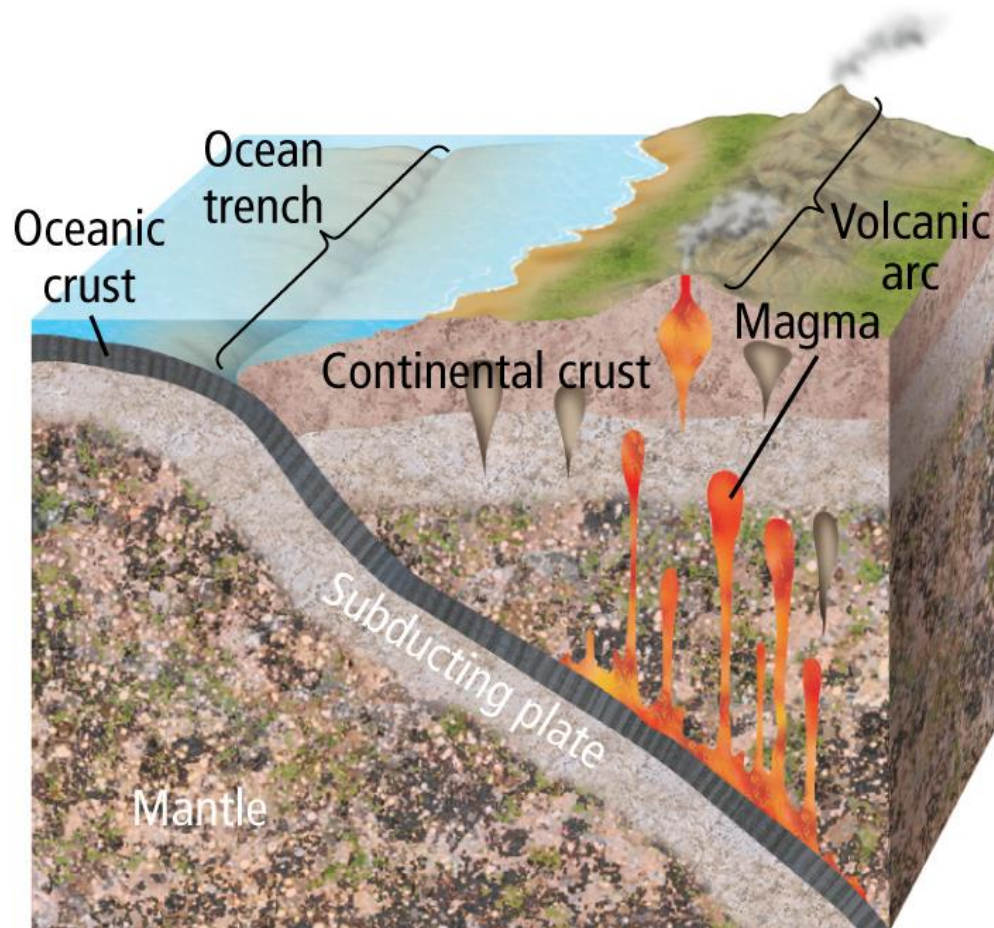
(cont.)

- Volcanic mountains can form in the ocean where plates converge and one plate subducts under another one.
- The curved line of volcanic islands that forms parallel to a plate boundary is called a volcanic arc.



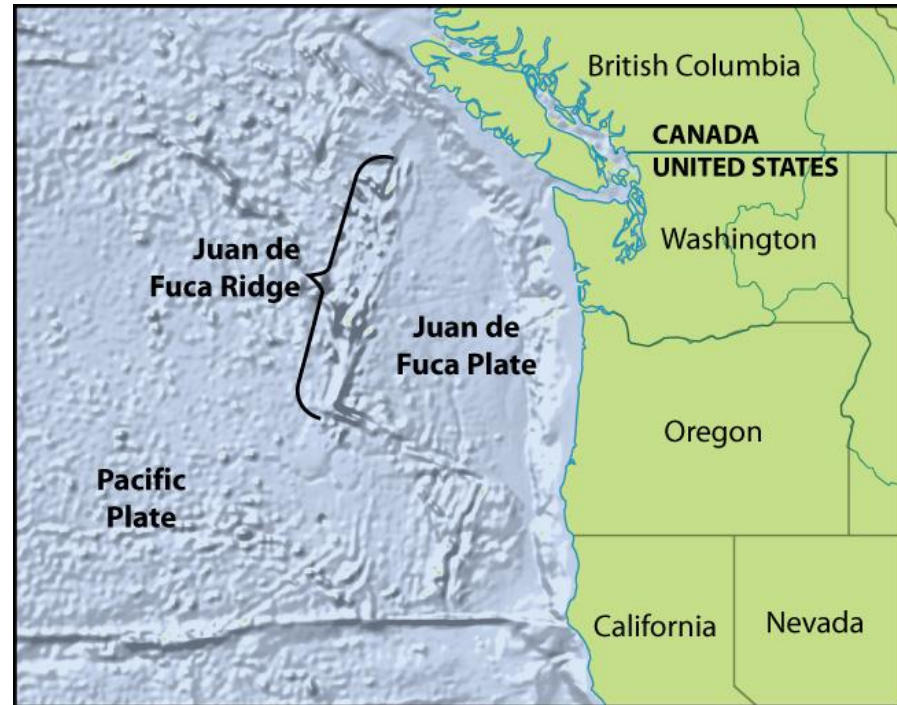


Volcanic arcs can also form on continents.



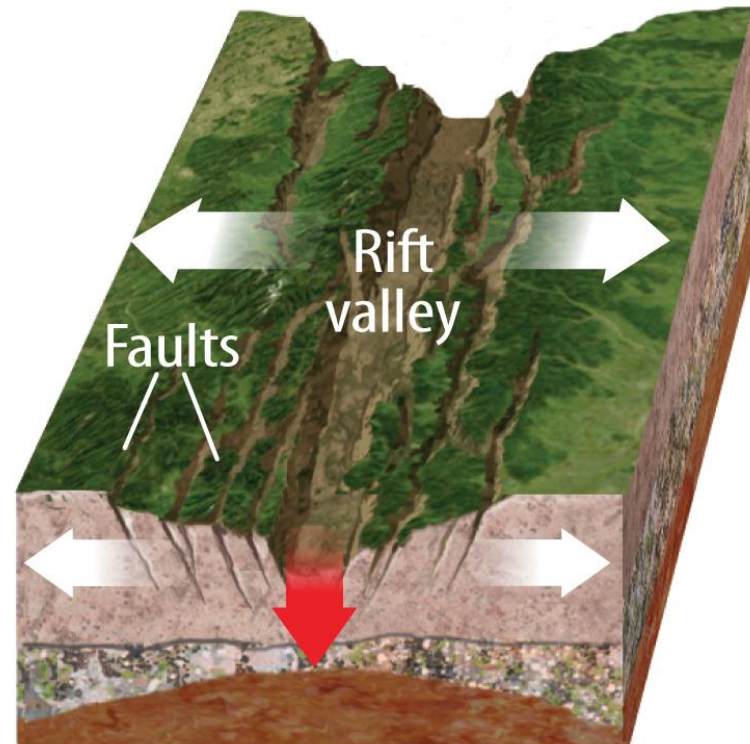
# Landforms Created by Tension

A long, tall mountain range that forms where oceanic plates diverge is called a mid-ocean ridge.



## Landforms Created by Tension (cont.)

When divergent boundaries occur within a continent, they can form continental rifts, or enormous splits in Earth's crust.



# Landforms Created by Tension (cont.)



## KEY CONCEPT CHECK

What features form at divergent boundaries?



Get Connected  
[glencoe.com](http://glencoe.com)



# Landforms Created by Shear Stresses

Transform faults form where tectonic plates slide horizontally past each other.

## WORD ORIGIN

**transform**

from Latin *trans*, means “across,”  
and *formare*, means “to form”

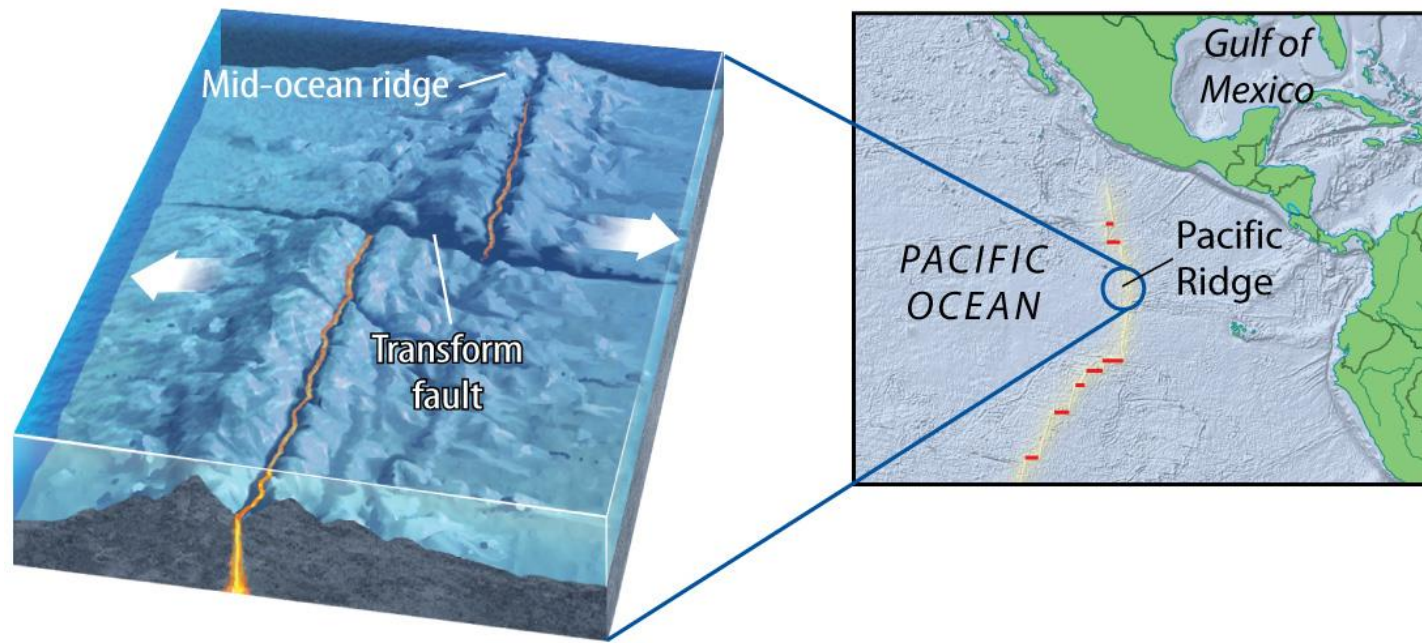




# Landforms Created by Shear Stresses

(cont.)

The yellow line on the map shows the mid-ocean ridge. The red lines are transform faults.



# Landforms Created by Shear Stresses

(cont.)



## KEY CONCEPT CHECK

What features form where plates slide past each other?



Get Connected  
[glencoe.com](http://glencoe.com)



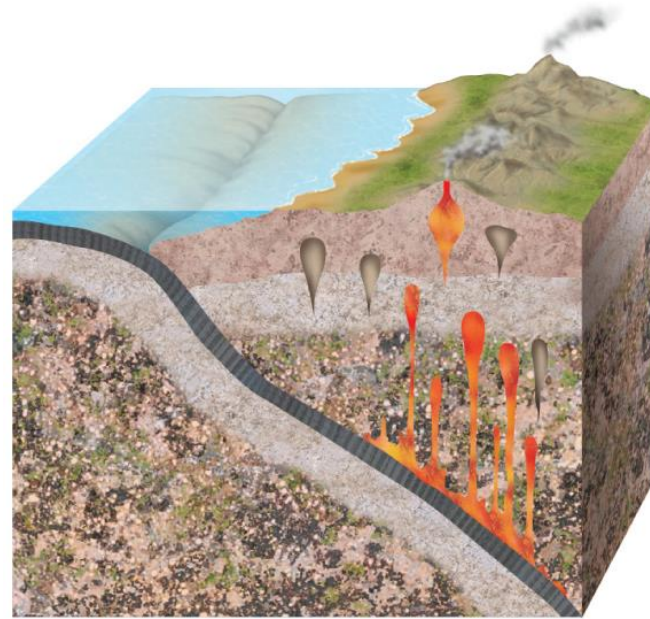
An area of many fractured pieces of crust along a large fault is called a **fault zone**.





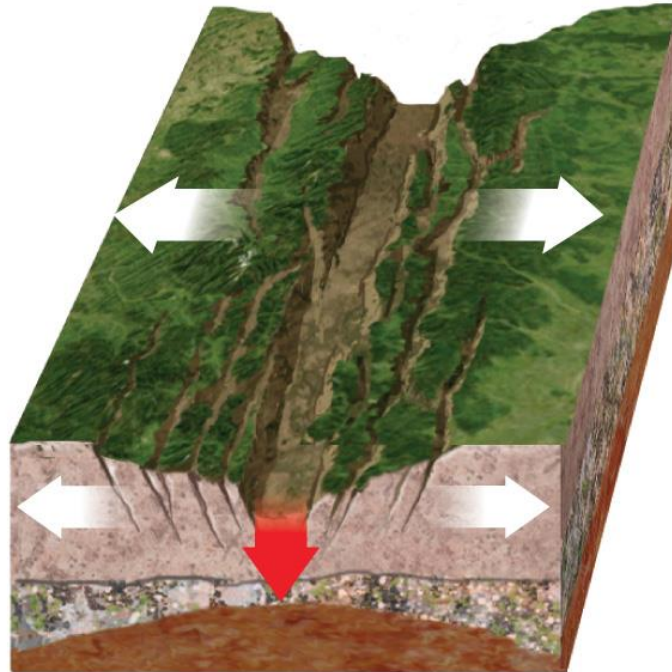
## Summary

- The deepest and tallest landforms on Earth are created at plate boundaries.



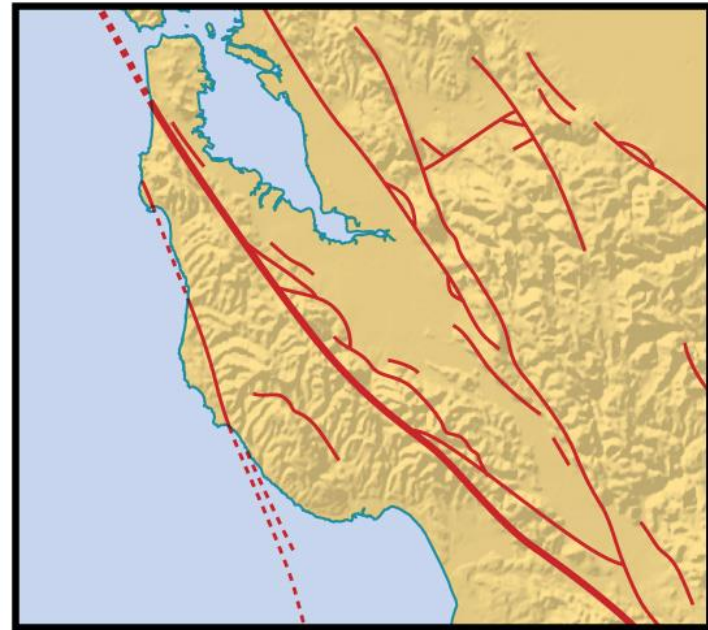
## Summary

- Tension stresses within continents can produce enormous splits in Earth's surface.



## Summary

- Faults at Earth's surface can be part of much larger fault zones that have many underground faults.



## Lesson Review

**Which refers to the process of one plate going under the mantle when two plates collide?**

- A. compression
- B. rift
- C. subduction**
- D. none of these



## Lesson Review

**Which term describes the place where tectonic plates slide horizontally past each other?**

- A. fracture zone
- ☒ B. transform faults
- C. fault zone
- D. none of these



## Lesson Review

**What is the term for a long, tall mountain range that forms where oceanic plates diverge?**

- A.** mid-ocean ridge
- B.** continental rift
- C.** transform fault
- D.** fracture zone





## Lesson Review

**What do you think** **NOW?**  
**Do you agree or disagree?**

3. New landforms are created only at plate boundaries.
4. The tallest and deepest landforms are created at plate boundaries.



## Lesson 3

# Mountain Building

## Key Concepts

- How do mountains change over time?
- How do different types of mountains form?



Get Connected  
[glencoe.com](http://glencoe.com)





## Lesson 3

# Mountain Building

## Vocabulary

- folded mountain
- fault-block mountain
- uplifted mountain

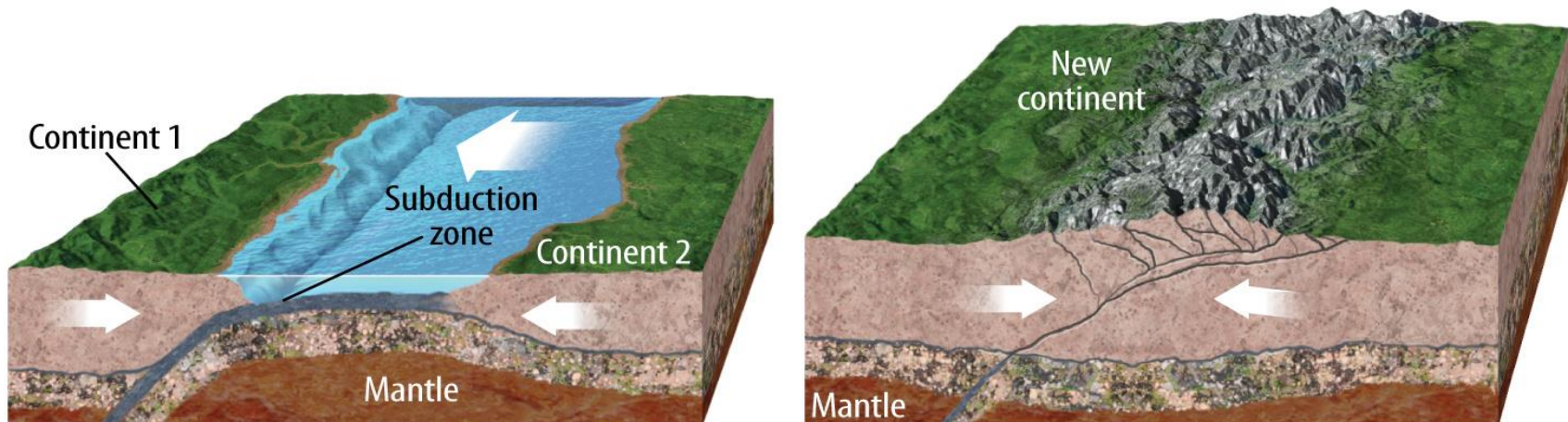


# The Mountain-Building Cycle

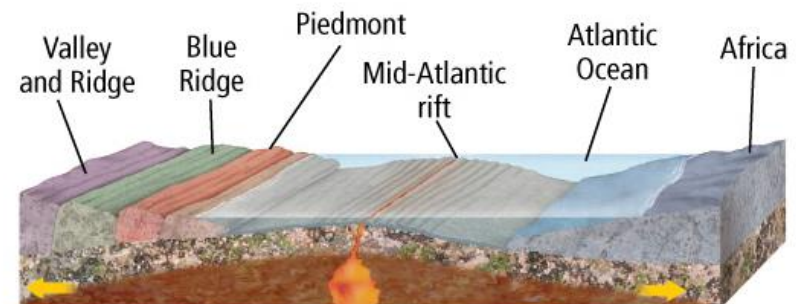
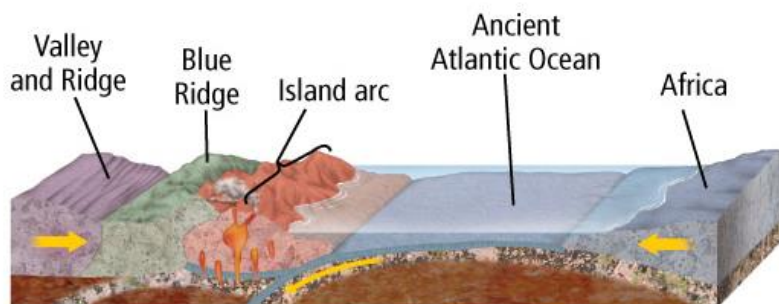
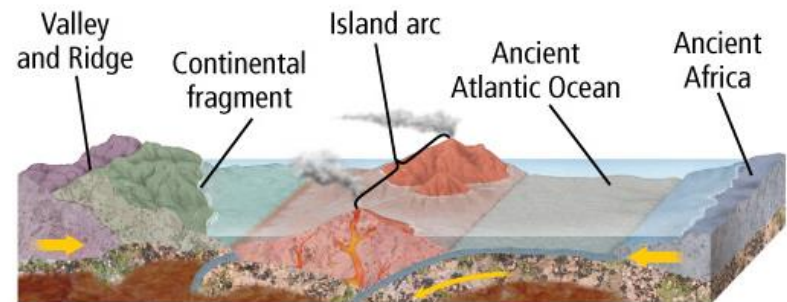
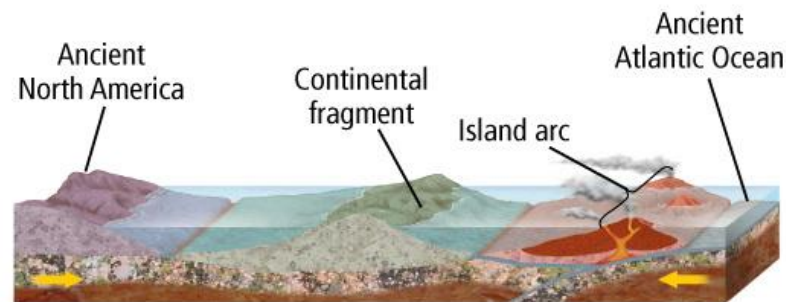
- Mountain ranges are built slowly. They are the result of many different plate collisions over many millions of years.
- After millions of years, the forces that originally caused plates to move together can become inactive.



When the forces that caused two plates to move become inactive, a single new continent is formed from the two old ones.



The cycle of repeated collisions and rifting can create old and complicated mountain ranges, such as the Appalachian Mountains.



 **Get Animated**



**Get Connected**  
glencoe.com



# The Mountain-Building Cycle (cont.)

## WORD ORIGIN

### Appalachian

from the Apalachee *abalahci*,  
means “other side of the river”



## The Mountain-Building Cycle (cont.)

- In old mountain ranges, metamorphic rocks that formed deep below the surface are exposed on the top of mountains.
- Weathering can round the peaks and lower the elevations of older mountain ranges.
- Erosion and uplift can also change older mountain ranges, because they affect the process of isostasy.



# The Mountain-Building Cycle (cont.)



## KEY CONCEPT CHECK

How can mountains change over time?



Get Connected  
[glencoe.com](http://glencoe.com)





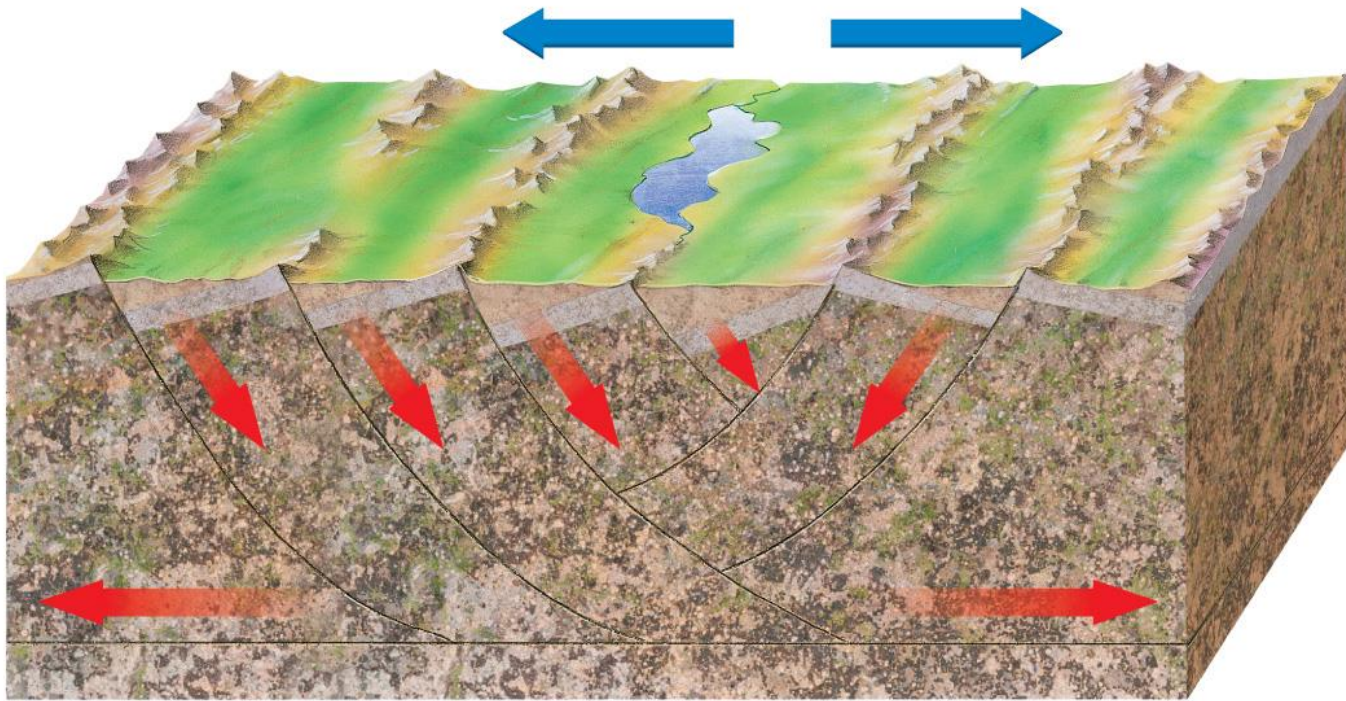
## Types of Mountains

- **Folded mountains** are made of layers of rocks that are folded.
- **Fault-block mountains** are parallel ridges that form where blocks of crust move up at faults.





Tension can pull crust apart in the middle of a continent. Where the crust breaks, fault-block mountains and valleys can form as blocks of the crust rise or fall.

**Get Animated****Get Connected**  
[glencoe.com](http://glencoe.com)

# Types of Mountains (cont.)



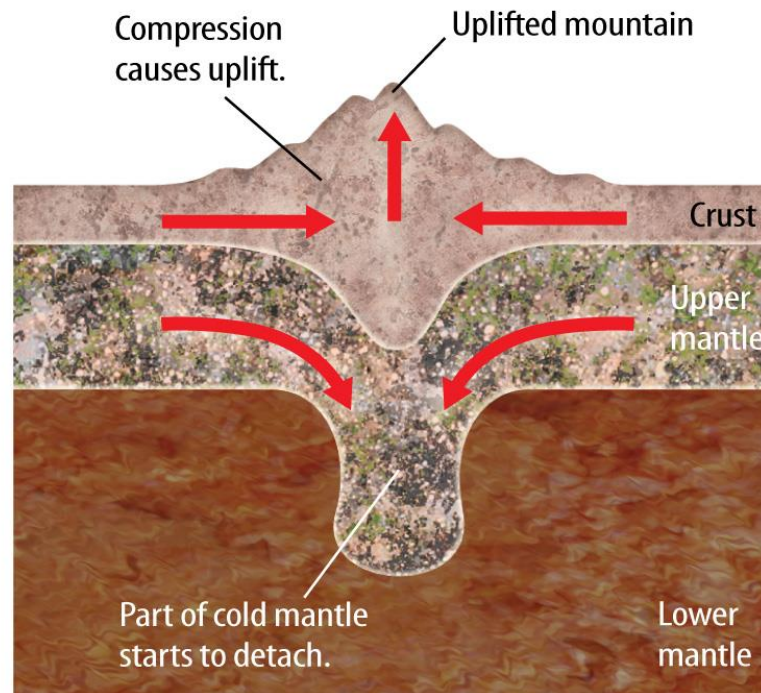
## KEY CONCEPT CHECK

How do folded and fault-block mountains form?



## Types of Mountains (cont.)

When large regions rise vertically with very little deformation, uplifted mountains form.



## Types of Mountains (cont.)

Some of the largest mountains on Earth are made by volcanic eruptions.



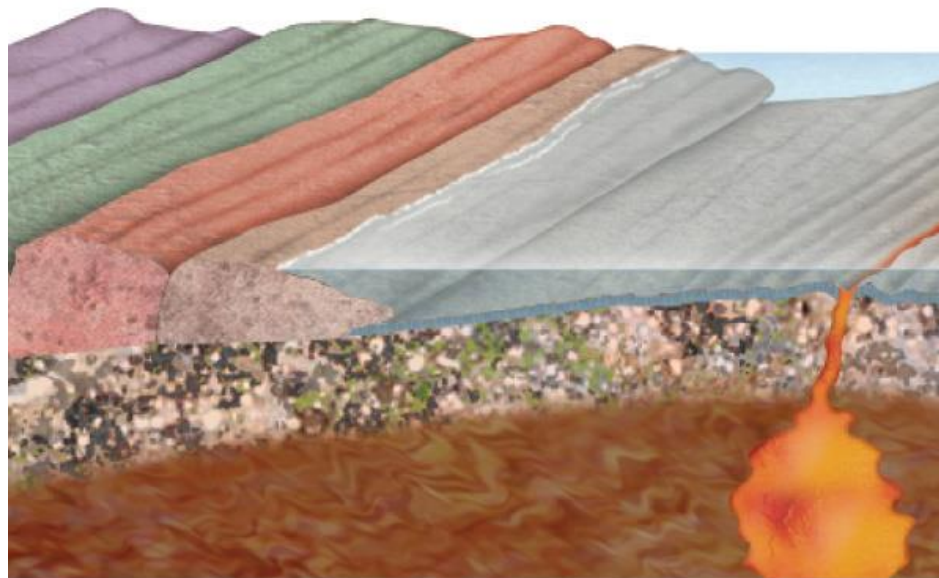
### KEY CONCEPT CHECK

How do uplifted and volcanic mountains form?



## Summary

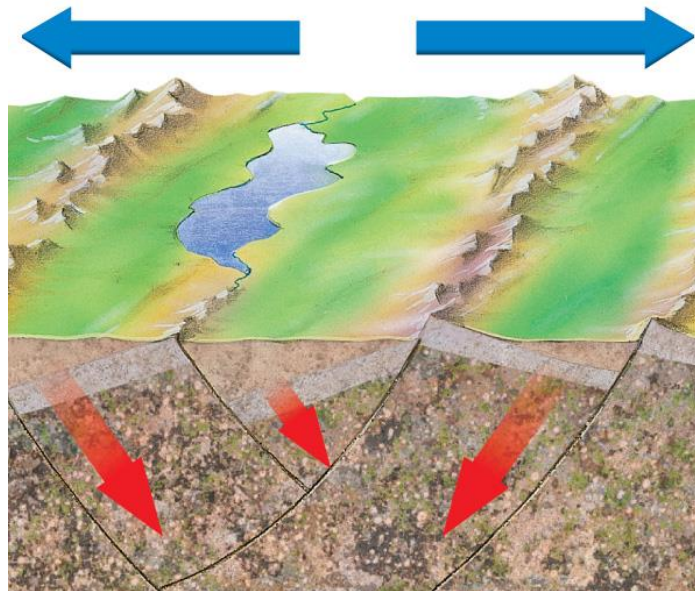
- Mountain ranges can be the result of repeated continental collision and rifting.





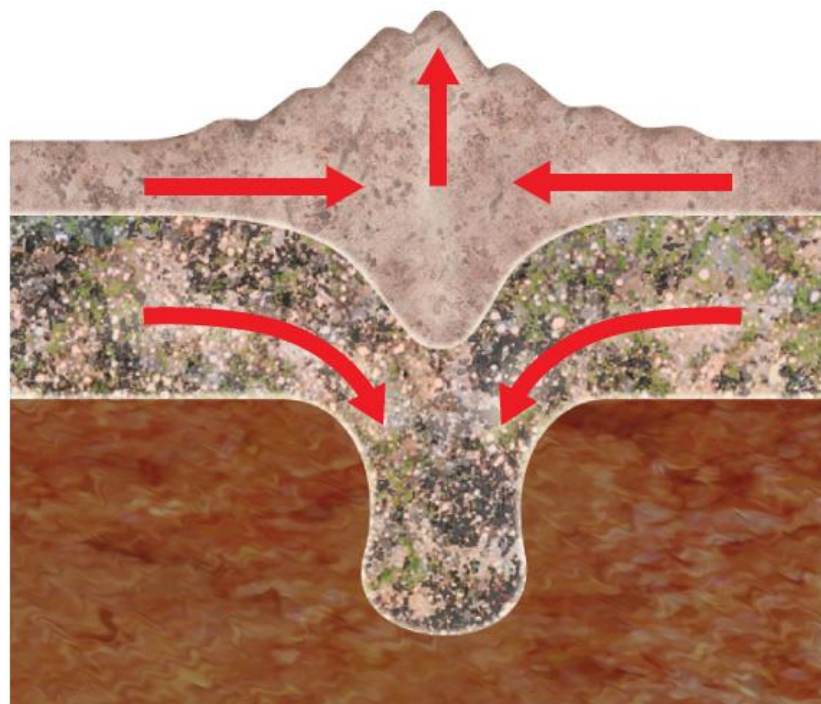
## Summary

- Tension stresses create mountain ranges that are a series of faults, ridges, and valleys.



## Summary

- Uplifted mountains rise with little rock deformation.



## Lesson Review

**When large regions rise vertically with very little deformation, what type of mountains form?**

- A. folded mountains
- B. fault-block mountains
- C. uplifted mountains**
- D. volcanoes





## Lesson Review

**Which of these can affect mountain ranges?**

- A. erosion
- B. uplift
- C. weathering
- D. all of these**



## Lesson Review

**Which type of mountains are parallel ridges that form where blocks of crust move up at faults?**

- A. folded mountains
- B. fault-block mountains**
- C. uplifted mountains
- D. none of the above



## Lesson Review

**What do you think** **NOW?**  
**Do you agree or disagree?**

5. Metamorphic rocks formed deep below Earth's surface sometimes can be located near the tops of mountains.
6. Mountain ranges can form over long periods of time through repeated collisions between plates.



## Lesson 4

# Continent Building

## Key Concepts

- What are two ways continents grow?
- What are the differences between interior plains, basins, and plateaus?



## Lesson 4

# Continent Building

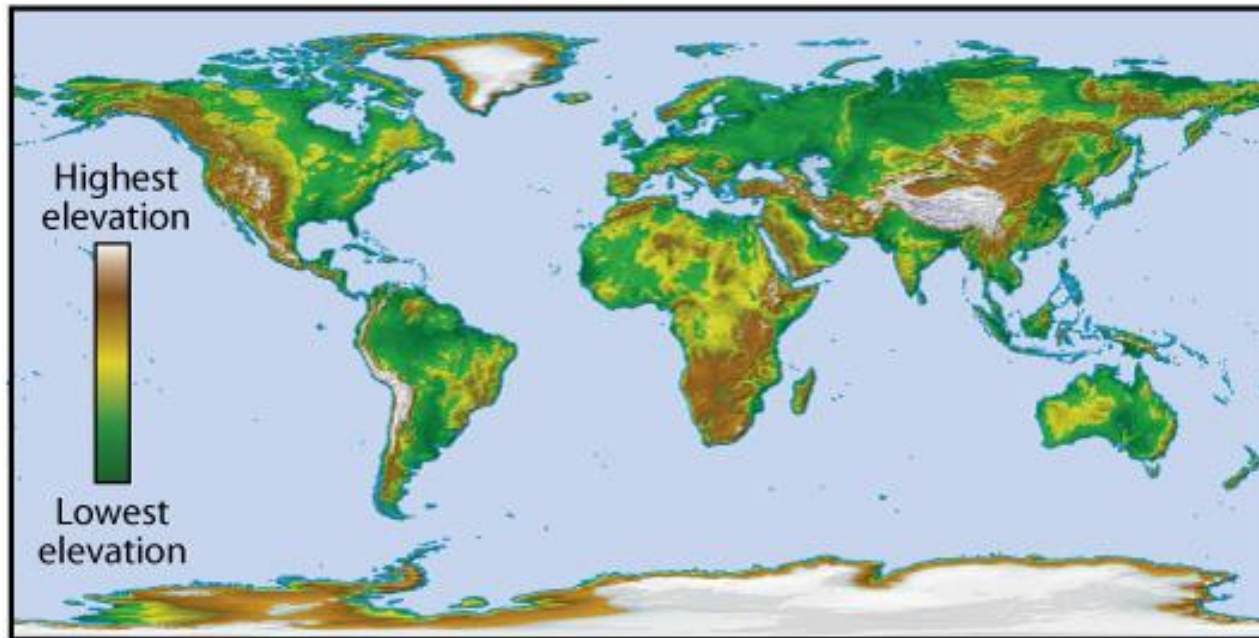
## Vocabulary

- plains
- basin
- plateau



# The Structure of Continents

Most of the highest elevations are located near the edges of continents.



# The Structure of Continents (cont.)

## WORD ORIGIN

**continent**

from Latin *terra continens*, means  
“continuous land”

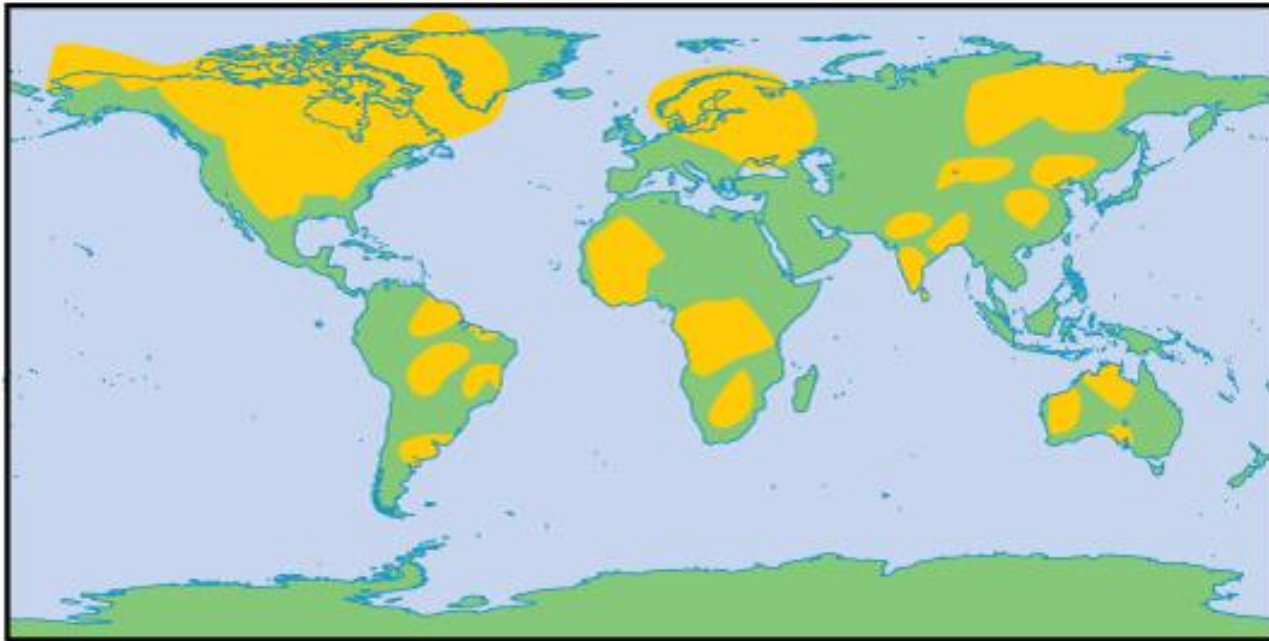


Get Connected  
[glencoe.com](http://glencoe.com)





The interiors of most continents are flat; in these regions, the rocks exposed at Earth's surface are old igneous and metamorphic rocks.



## How Continents Grow

- One way continents get bigger is through the addition of igneous rocks by erupting volcanoes.
- A second way is when tectonic plates carry island arcs, whole continents, or fragments of continents with them.



- When a plate carrying fragments reaches a continent at a convergent boundary, the least dense fragments get pushed onto the edge of the continent.
- The green areas show parts of North America that were attached in this way.



 **Get Animated**

# How Continents Grow (cont.)



## KEY CONCEPT CHECK

What are two ways continents grow?



Get Connected  
[glencoe.com](http://glencoe.com)



# Continental Interiors

- Rocks in continental interiors tend to be stable, flat, very old, and very strong.
- A plain is an extensive area of level or rolling land.
- The plains have been flattened by millions of years of weathering and erosion.



# Continental Interiors (cont.)



## KEY CONCEPT CHECK

What is a plain?

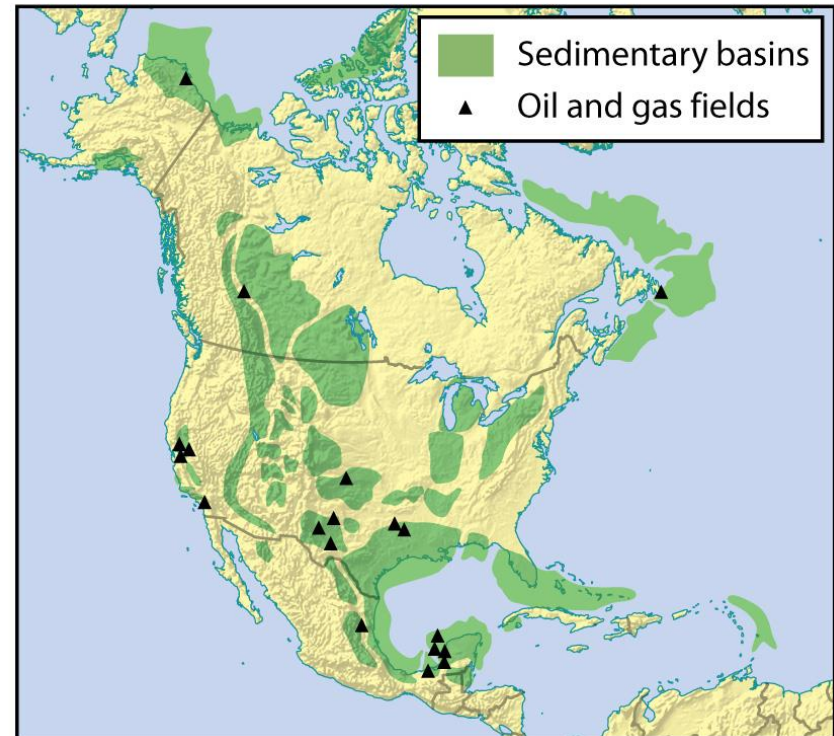


Get Connected  
[glencoe.com](http://glencoe.com)



# Continental Interiors (cont.)

- Areas of subsidence and regions with low elevation are called basins.
- Sediments eroded from mountains accumulate in basins.





# Continental Interiors (cont.)

- Flat regions with high elevations are called plateaus.
- The Colorado Plateau is an example of a plateau formed through uplift.



## Continental Interiors (cont.)

- The eruption of lava also can create large plateaus.
- Some parts of the Columbia River Plateau consist of more than 3 km of basalt.



# Continental Interiors (cont.)



## KEY CONCEPT CHECK

What are the differences between plains, basins, and plateaus?



Get Connected  
[glencoe.com](http://glencoe.com)



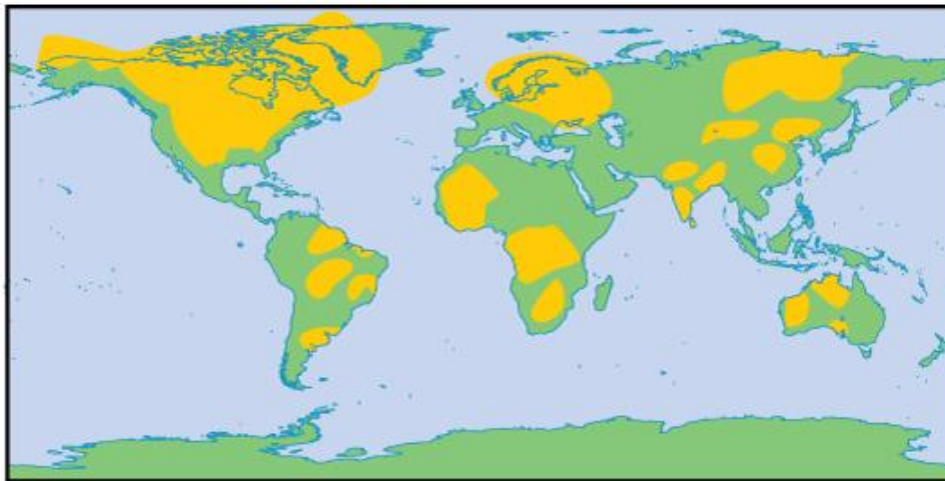
## Dynamic Landforms

- The Earth's surface is constantly changing.
- Mountains form only to be eroded away.
- Continents grow, shift, and shrink.



## Summary

- Rocks at the center of most continents are very old, very strong, and flat.





## Summary

- Fragments of crust are added to continents at convergent boundaries.



## Summary

- Large, elevated plateaus are created through uplift and lava flows.





**Lesson Review**

**Which term refers to flat regions with high elevations?**

- A. basins
- B. plains
- C. plateaus**
- D. none of the above



## Lesson Review

### How do continents get bigger?

- A. addition of igneous rocks by erupting volcanoes
- B.** tectonic plates carry fragments of continents with them
- C. A and B



## Lesson Review

**Where are most of the highest elevations located on continents?**

- A.** near the edges of continents
- B.** the continental interiors
- C.** both of these
- D.** neither of these



## Lesson Review

**What do you think** **NOW?**  
**Do you agree or disagree?**

7. The centers of continents are flat and old.
8. Continents are continually shrinking because of erosion.



**Menu**

[Key Concept Summary](#)

[Interactive Concept Map](#)

[Chapter Review](#)

[Standardized Test Practice](#)



Get Connected  
[glencoe.com](http://glencoe.com)



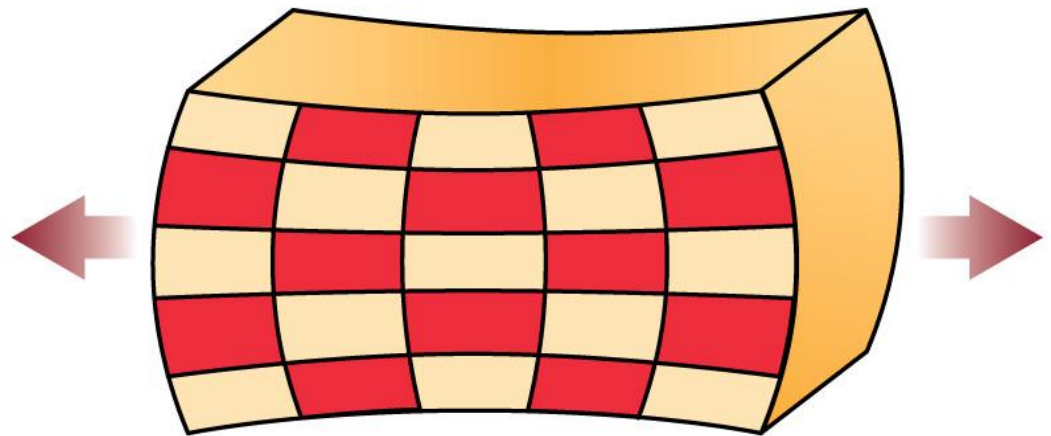


The constructive and destructive forces created by the movement of tectonic plates are responsible for the variety of Earth's constantly changing landforms, including volcanoes, mountains, and ocean basins.



# Lesson 1: Forces That Shape Earth

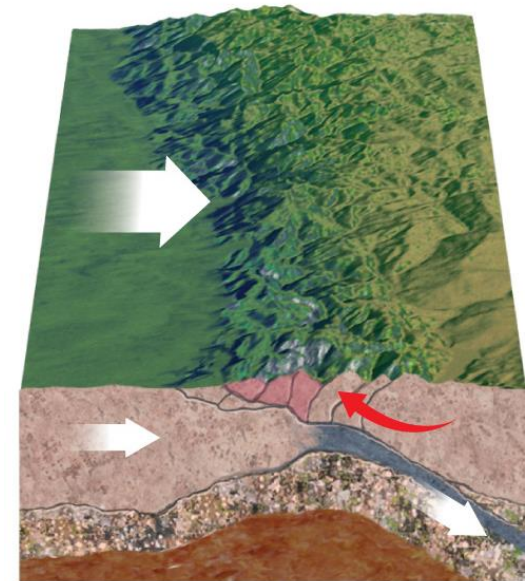
- As continents float in the mantle, they rise and fall to maintain the balance of isostasy.
- Forces called compression, tension, and shear can deform or break rocks.
- Uplift and plate motion move rocks through the rock cycle.





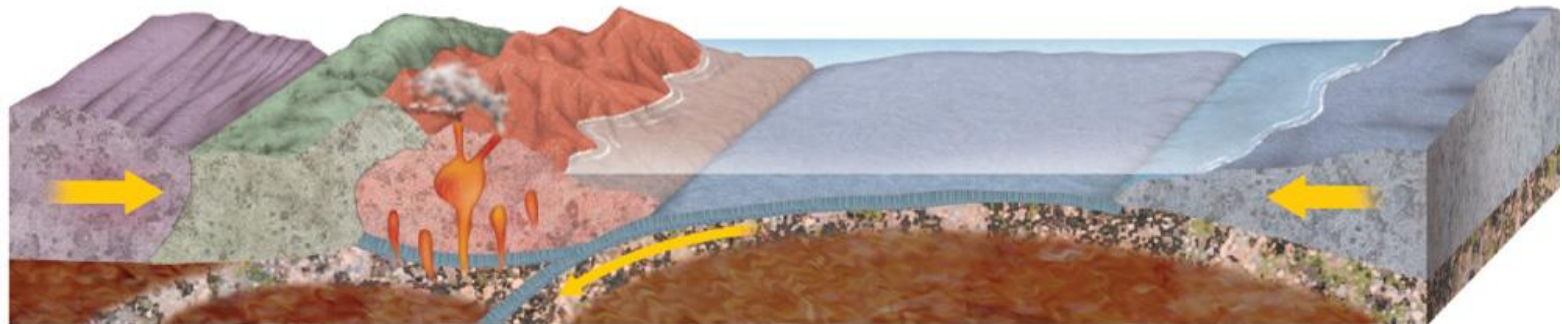
## Lesson 2: Landforms at Plate Boundaries

- When two continental plates collide, tall mountain ranges form.
- When an oceanic plate subducts below another one, an ocean trench and a volcanic arc form.
- At divergent boundaries, mid-ocean ridges and continental rifts form.
- Transform faults can create large areas of faulting and fracturing, not all of which can be seen at Earth's surface.



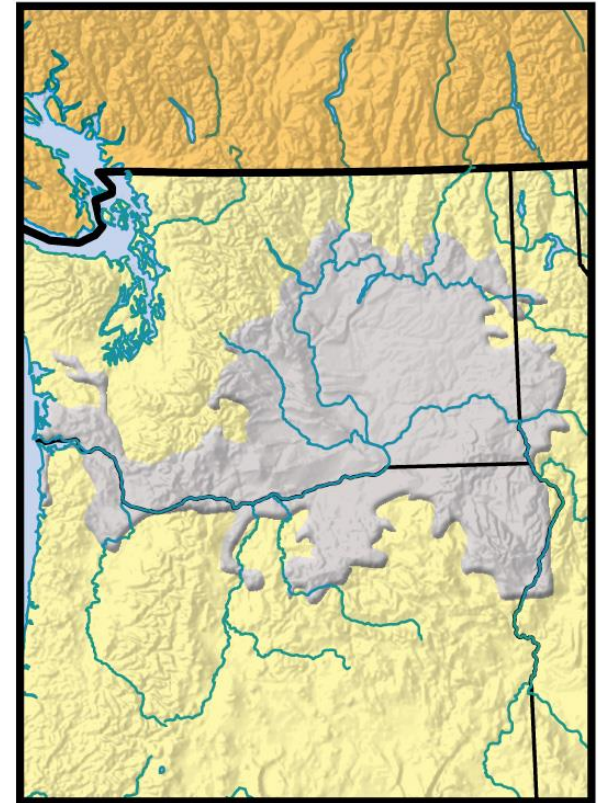
## Lesson 3: Mountain Building

- Mountain ranges can grow from repeated plate collisions.
- Folded mountains form by compression of plastic rock.
- Tension in continental crust creates parallel fault-block mountains.



## Lesson 4: Continent Building

- Continents shrink because of erosion and rifting.
- Continents grow through volcanic activity and continental collisions.
- Large, flat regions at high elevation are called plateaus.
- Basins are regions at low elevation where sediments accumulate or once accumulated.



## Chapter Review

**What term refers to the upward vertical motion of Earth's surface?**

- A. subsidence
- B. isostasy
- C. uplift**
- D. tension



## Chapter Review

**What term refers to pressure that pulls something apart?**

- A.** tension
- B.** strain
- C.** compression
- D.** shear



## Chapter Review

Which term refers to deep, underwater troughs created by one plate subducting under another plate at a convergent plate boundary?

- A. mid-ocean ridge
- ☒ B. ocean trench
- C. volcanic arc
- D. none of these





**Chapter Review**

**Which word best describes the interiors of most continents?**

- A.** elevated
- B.** unstable
- C.** flat
- D.** none of the above





## Chapter Review

How do plateaus form?

- A. eruption of lava
- B. through uplift
- ☒ C. A and B
- D. none of these



**Standardized Test Practice**

**Which term describes squeezing stress?**

- A. shear
- B. tension
- C. compression**
- D. none of the above



**Standardized Test Practice**

**What kind of strain creates a permanent change in shape?**

- A. elastic strain
- ☒ B. plastic strain
- C. fractures
- D. none of the above



**Standardized Test Practice**

**What term describes the curved line of volcanic islands that forms parallel to a plate boundary?**

**A.** ocean trenches

**B.** fracture zone

**C.** fault zone

**D.** volcanic arc



**Standardized Test Practice**

Which of these has been flattened by millions of years of weathering and erosion?

- A. basins
- ☒ B. plains
- C. mountains
- D. plateaus



**Standardized Test Practice**

**Sediments eroded from mountains accumulate in which of these?**

- A. plateaus
- B. plains
- ☒ C. basins
- D. none of the above

