The Theory of Plate Tectonics

Objectives

- **Describe** the three types of tectonic plate boundaries.

- **Describe** the three forces thought to move tectonic plates.

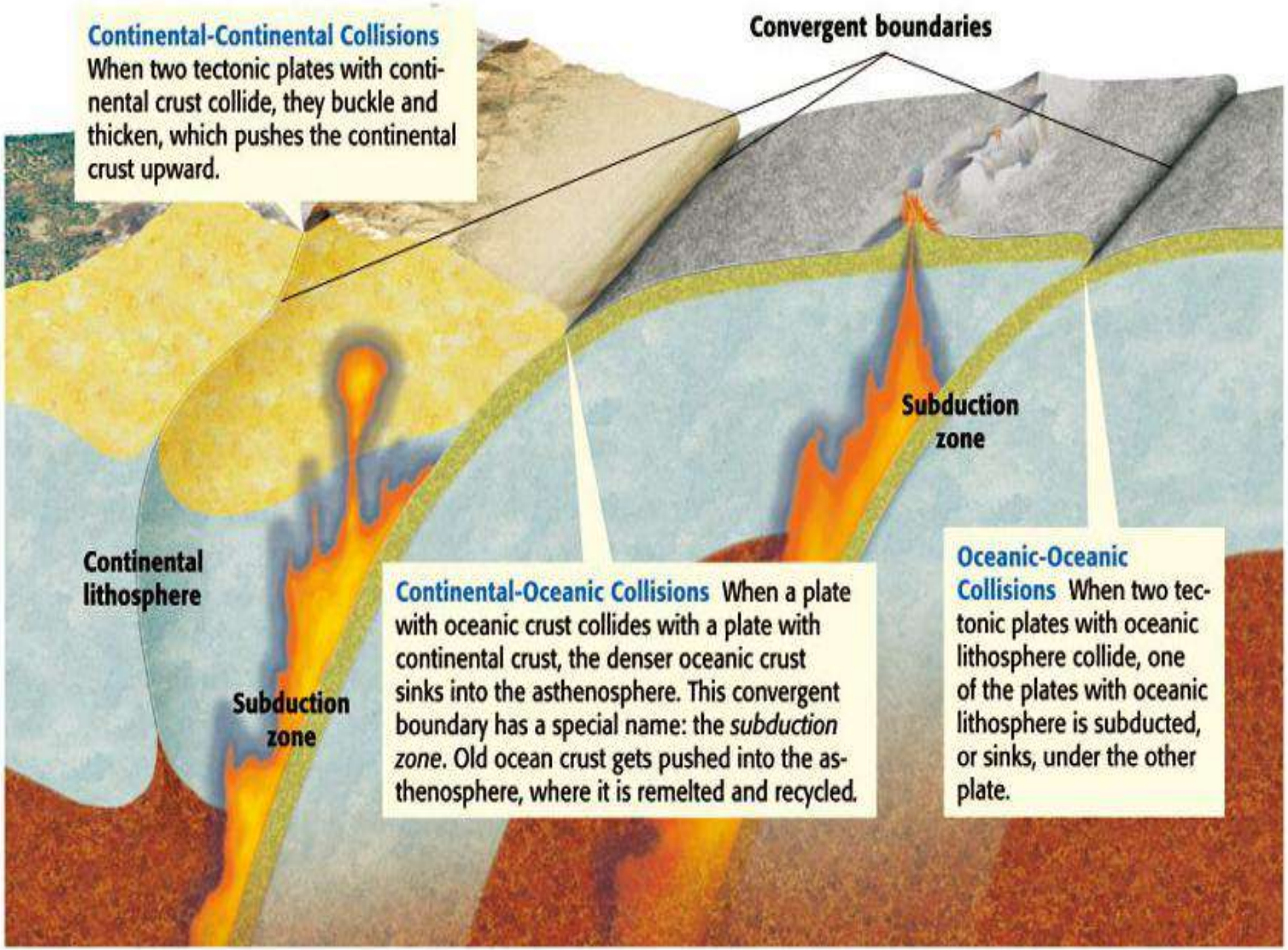
- **Explain** how scientists measure the rate at which tectonic plates move.

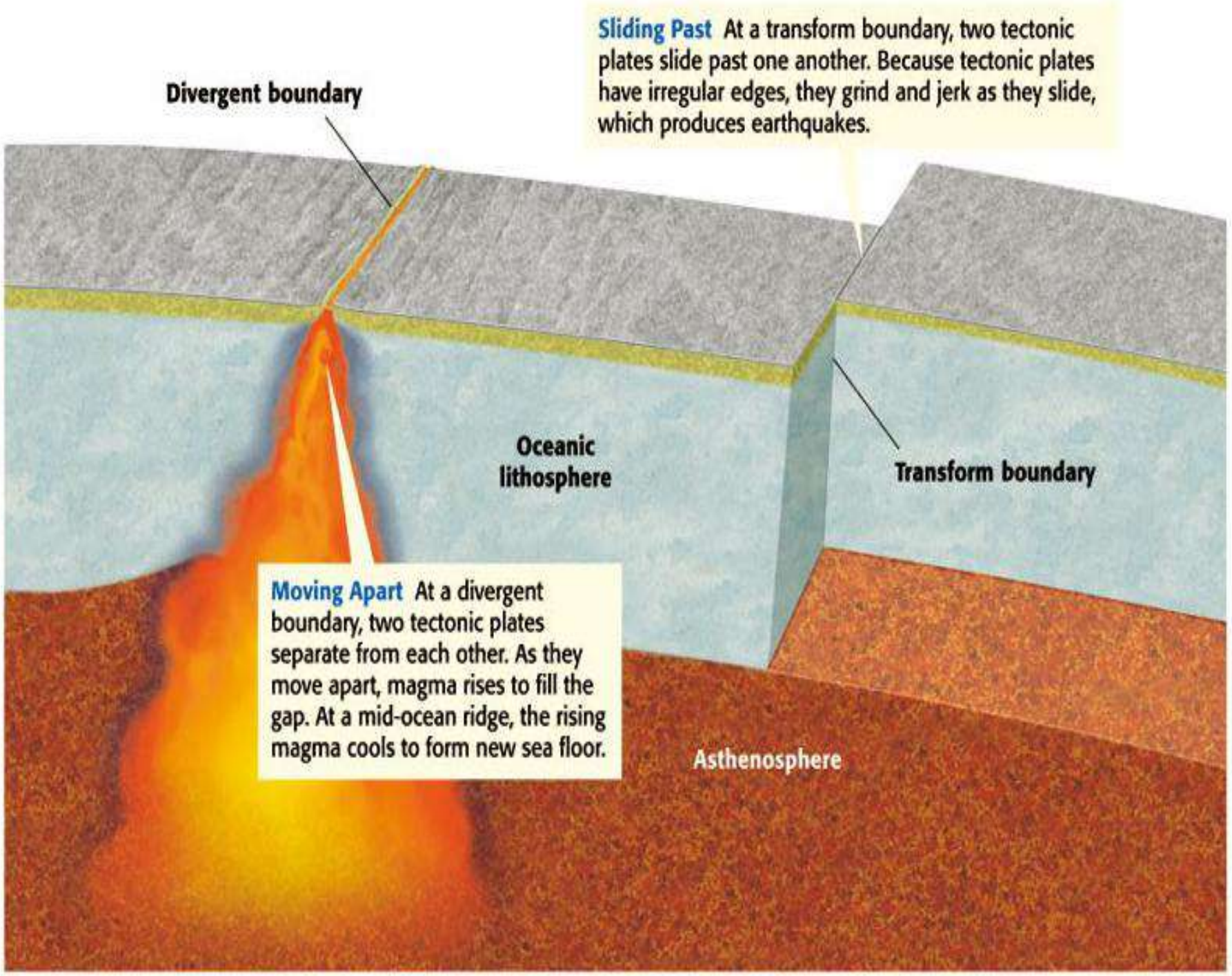
I. Tectonic Plate Boundaries

A. **Convergent Boundaries** When two tectonic plates collide, the boundary between them is a convergent boundary.

B. **Divergent Boundaries** When two tectonic plates separate, the boundary between them is called a divergent boundary.

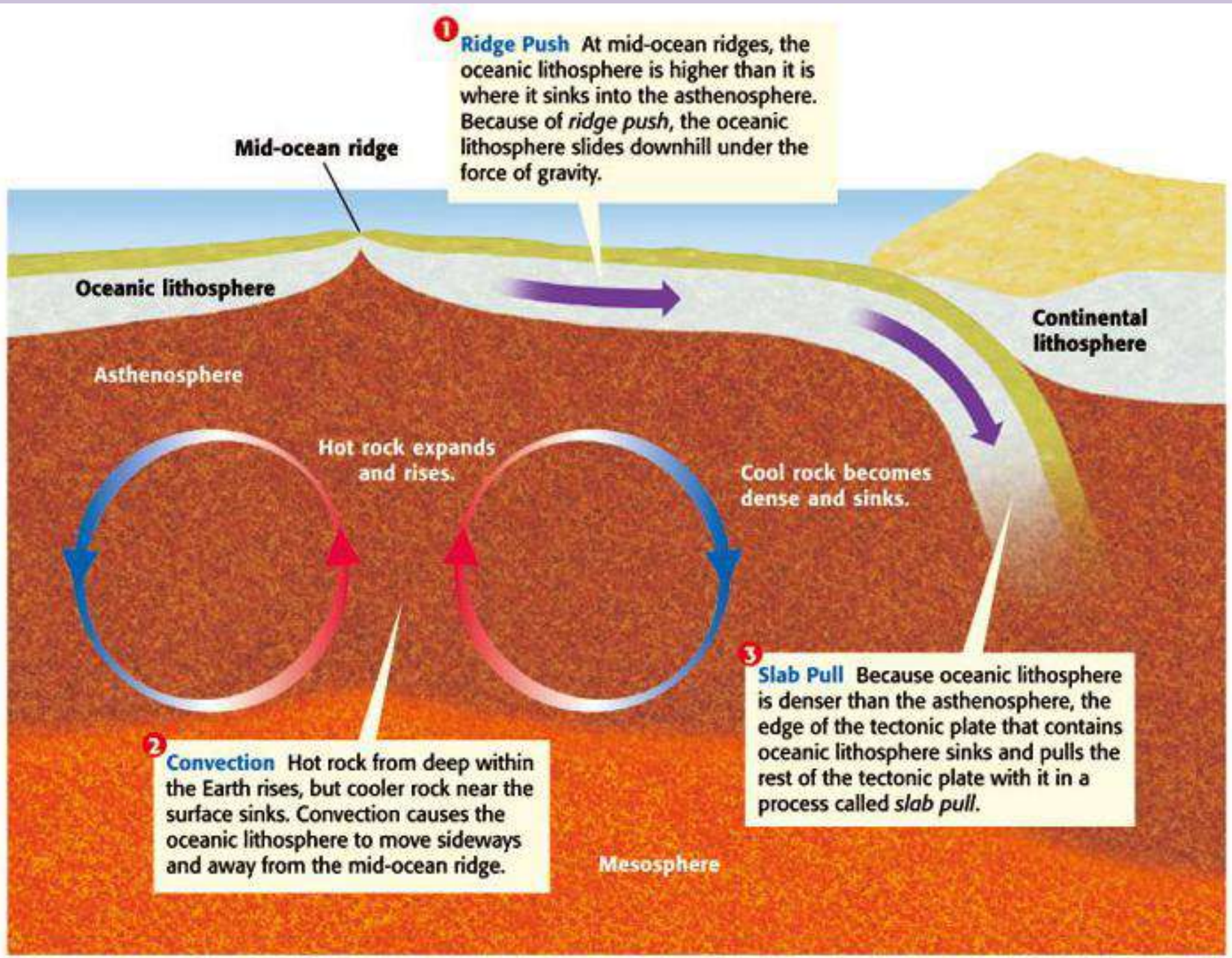
C. **Transform Boundaries** When two tectonic plates slide past each other horizontally, the boundary between them is a transform boundary.


Convergent boundaries
Continental-Continental Collisions
When two tectonic plates with continental crust collide, they buckle and thicken, which pushes the continental crust upward.
Subduction zone
Continental lithosphere
Subduction zone
Continental-Oceanic Collisions When a plate with oceanic crust collides with a plate with continental crust, the denser oceanic crust sinks into the asthenosphere. This convergent boundary has a special name: the *subduction zone*. Old ocean crust gets pushed into the asthenosphere, where it is remelted and recycled.
Oceanic-Oceanic Collisions When two tectonic plates with oceanic lithosphere collide, one of the plates with oceanic lithosphere is subducted, or sinks, under the other plate.


Sliding Past At a transform boundary, two tectonic plates slide past one another. Because tectonic plates have irregular edges, they grind and jerk as they slide, which produces earthquakes.
Divergent boundary
Oceanic lithosphere
Transform boundary
Moving Apart At a divergent boundary, two tectonic plates separate from each other. As they move apart, magma rises to fill the gap. At a mid-ocean ridge, the rising magma cools to form new sea floor.
Asthenosphere

II. Possible Causes of Tectonic Plate Motion

A. **Movement of the Asthenosphere** The solid rock of the asthenosphere flows very slowly. This movement occurs because of changes in density within the asthenosphere. These density changes are caused by the outward flow of thermal energy from deep within the Earth. As you can see on the next slide, movements of the asthenosphere may lead to tectonic plate motion.


1 Ridge Push At mid-ocean ridges, the oceanic lithosphere is higher than it is where it sinks into the asthenosphere. Because of *ridge push*, the oceanic lithosphere slides downhill under the force of gravity.
Mid-ocean ridge
Oceanic lithosphere
Continental lithosphere
Asthenosphere
Hot rock expands and rises.
Cool rock becomes dense and sinks.
2 Convection Hot rock from deep within the Earth rises, but cooler rock near the surface sinks. Convection causes the oceanic lithosphere to move sideways and away from the mid-ocean ridge.
3 Slab Pull Because oceanic lithosphere is denser than the asthenosphere, the edge of the tectonic plate that contains oceanic lithosphere sinks and pulls the rest of the tectonic plate with it in a process called *slab pull*.
Mesosphere

III. Tracking Tectonic Plate Motion

A. **Measuring Tectonic Plate Movement** Tectonic plate movements are so slow and gradual that you can't see or feel them— the movement is measured in centimeters per year.

B. **The Global Positioning System** Scientists use a system of satellites called the *global positioning system* (GPS) to measure the rate of tectonic plate movement.