

at a subduction boundary, along a downwelling zone in the mantle that compensates for the upwelling on the other side of the convection cell.

Many scientists think that mantle convection does not completely explain why plates move. In particular, the model does not account for the enormous force needed to move the lithospheric plates.

## Ridge Push

The molten magma that rises at a mid-ocean ridge is very hot and heats the rocks around it. As the asthenosphere and lithosphere at the ridge are heated, they expand and become elevated above the surrounding sea floor. This elevation produces a slope down and away from the ridge.

Because the rock that forms from the magma is very hot at first, it is less dense and more buoyant than the rocks farther away from the mid-ocean ridge. However, as the newly formed rock ages and cools, it becomes more dense. Gravity then causes this older, denser lithosphere to slide away from the ridge, down the sloping asthenosphere. As the older, denser lithosphere slides away, new molten magma wells up at the mid-ocean ridge, eventually becoming new lithosphere.

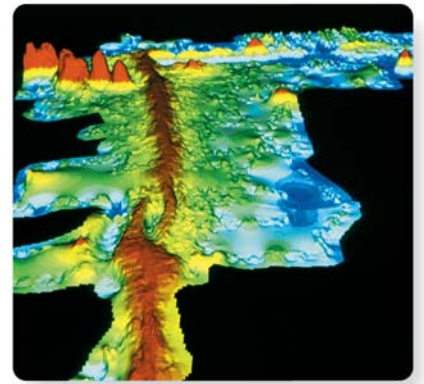
Scientists have used computer models to show that the cooling, subsiding rock exerts a force on spreading lithospheric plates that could help drive their movements. This force is called **ridge push**, though the phrase “ridge push” is somewhat misleading. It might be more accurate to refer to ridge push as gravitational sliding.

## Slab Pull

At a subduction boundary, one plate is denser and heavier than the other plate. The denser, heavier plate begins to subduct beneath the plate that is less dense. The edge of the subducting plate is much colder and heavier than the mantle, so it continues to sink, pulling the rest of the plate along with it. The force that the sinking edge of the plate exerts on the rest of the plate is called **slab pull**.

Slab pull can be compared to the following situation: Suppose your jacket is resting on a table. You drop a heavy set of keys into a pocket that is dangling over the edge. The weight of the keys pulls downward on the rest of the jacket, causing it to slide toward the edge of the table.

Currently, many scientists consider slab pull to be a much stronger factor than ridge push or mantle convection in driving plate movements.



**MID-OCEAN RIDGE** In this computer-generated topographic map of a section of the East Pacific Rise, the highest elevations are shown in red. The sea floor slopes down from the mid-ocean ridge to lower elevations, which are shown in blue.

### 8.3 Section Review

- 1 How does the mantle convection hypothesis explain plate movements at divergent boundaries and subduction boundaries?
- 2 **CRITICAL THINKING** Describe the differences between the ridge push hypothesis and the slab pull hypothesis.
- 3 **PHYSICS** Construct and label a model that shows the processes of ridge push and slab pull.