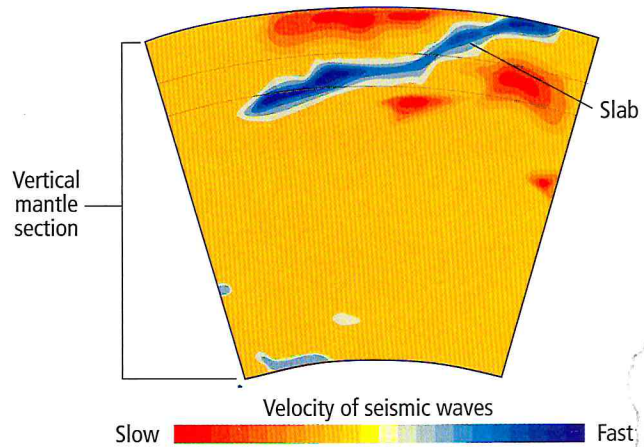


■ **Figure 19.12** Images like this one from Japan are generated by capturing the path of seismic waves through Earth's interior. Areas of red indicate seismic waves that are traveling more slowly than average and areas of blue indicate seismic waves that are traveling faster than average. The blue area is a subducted plate.



**Imaging Earth's interior** Seismic wave speed and Earth's density vary with factors other than depth. Recall from Chapter 17 that cold slabs sink back into Earth at subduction zones, and recall from Chapter 18 that mantle plumes are regions where hot mantle material is rising. Because the speed of seismic waves depends on temperature and composition, it is possible to use seismic waves to create images of structures such as slabs and plumes. In general, the speed of seismic waves decreases as temperature increases. Thus, waves travel more slowly in hotter areas and more quickly in cooler regions. Using measurements made at seismometers around the world and waves recorded from many thousands of earthquakes, Earth's internal structure can be visualized, and features such as slabs can be located in images like the one in **Figure 19.12**. These images are similar to CT scans, except that the images are made using seismic waves instead of X rays.

## Section

### Objective

■ **Compare** earthquake magnitudes on the scales

■ **Explain** three seismic wave types and locate an earthquake

■ **Describe** the Earth's internal structure

### Review

**plot:** to make a graph or chart

### New Vocabulary

Richter scale  
magnitude  
amplitude  
moment magnitude  
modified Mercalli

## Section 19.2 Assessment

### Section Summary

- Seismometers are devices that record seismic wave activity on a seismogram.
- Travel times for P-waves and S-waves enable scientists to pinpoint the epicenters of earthquakes.
- P-waves and S-waves change speed and direction when they encounter different materials.
- Analysis of seismic waves provides a detailed picture of the composition of Earth's interior.

### Understand Main Ideas

1. **MAIN Idea** **Explain** how P-waves and S-waves are used to determine the properties of Earth's core.
2. **Draw** a diagram of a seismometer showing how the movement of Earth is translated into a seismogram.
3. **Describe** how seismic travel-time curves are used to study earthquakes.
4. **Differentiate** between the speed of waves through hot and cold material.

### Think Critically

5. **Infer** Using the seismogram in **Figure 19.8**, suggest why surface waves cause so much damage even though they are the last to arrive at a seismic station.

### WRITING in Earth Science

6. Write a newspaper article reporting on the ways scientists have determined the composition of Earth.

■ **Figure 19.12** was caused by the 2011 earthquake that struck Japan.