Volcanism & extrusive rocks

*Extrusive* – lava or ash onto the Earth surface

*pyroclastic*
  pyro – fire
  clastic – small pieces of rock
Volcanic glass – obsidian

Figure 4.9
Andesite porphyry

What set of events creates a porphyry?

Figure 4.10
Porphyry thin section
Vesicular basalt

Bubbles produced by expanding gas in the magma

Figure 4.11
Pumice

A volcanic glass full of bubbles

Usually rhyolitic (lots of silica)

Figure 4.12
Pumice
Volcanic bombs

Figure 4.13
Volcanic tuff

Figure 4.14
Volcanic tuff

Welded tuff
Volcanic breccia

Big chunks of broken rock in a matrix of ash
### Types of volcanoes

#### Table 4.2: Comparison of the Three Types of Volcanoes

<table>
<thead>
<tr>
<th>Profile of Volcano</th>
<th>Description</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mauna Loa in Hawaii</td>
<td><strong>Shield Volcano</strong>&lt;br&gt;Gentle slopes—between 2 and 10 degrees. The Hawaiian example rises 10 km from the sea floor.</td>
<td>Basalt. Layers of solidified lava flows.</td>
</tr>
<tr>
<td>&lt; 300 meters</td>
<td><strong>Cinder Cone</strong>&lt;br&gt;Steep slopes—33 degrees.&lt;br&gt;Smallest of the 3 types.</td>
<td>Pyroclastic fragments of any composition.&lt;br&gt;Basalt is most common.</td>
</tr>
<tr>
<td>Typically 1000 to 4000 meters</td>
<td><strong>Composite Volcano</strong>&lt;br&gt;Slopes less than 33 degrees.&lt;br&gt;Considerably larger than cinder cones.</td>
<td>Layers of pyroclastic fragments and lava flows.&lt;br&gt;Mostly andesite.</td>
</tr>
</tbody>
</table>

Another word for composite volcano: *stratovolcano*
Types of volcanoes

- **Shield**
  - basalt flows

- **Cinder**
  - coarse ash

- **Composite**
  - layered
  - Andesite or rhyolite
Tectonic settings for volcanoes

- Subduction zones
- Mid-ocean ridge
- Hot spots
- Continental rifting
Differences between magmas

Basaltic lava flows easily

Figure 4.1
Differences between magmas

Rhyolitic and andesitic lavas tend to explode water & volatiles under pressure, viscous magma
Cascades
volcanoes of
the Pacific Northwest

Subduction of Juan de Fuca plate

Figure 4.5
Volcanoes produced by subduction

Juan de Fuca plate is young, hot, low density
The Cascades, Washington and Oregon
Composite or strato-volcanoes

Mt. Shasta, northern California
Composite or strato-volcanoes

Mt. Fuji, Japan
Composite volcano

Figure 4.21
Mt. Fuji, Japan
Mt. Fuji, Japan
Mt. Fuji, Japan
Mount St. Helens before eruption 1980
Mount St. Helens

After eruption (7 years later)
Mount St. Helens
Mt. St. Helens eruption sequence

Box 4.1
Mount St. Helens
Bulge on NE flank prior to eruption
Initial blast – 500x the Hiroshima bomb
Pressure wave with 200 mph winds
Lahar – flow of hot, fluid mud
Mount St. Helens
Ashfall
Eruption from space

Blast covered 150 sq miles
Figure 4.32b

Approximate area covered by at least 5 mm of ash

Path of ash cloud — May 18, 19, 20, 1980

Mt. St. Helens
Forming a dome – because of viscous lava

Figure 4.26
Pyroclastic flow

Cloud of hot gas and ash collapses and flows down the side
Process of pyroclastic flow

Responsible for many of the volcano-related disasters in history

Pompeii

Figure 4.7
Result of pyroclastic flow

Mt. Pelée
1902

Martinique

Figure 4.8