Geology 12
Igneous Rocks:
Part #3-
EXTRUSIVE STRUCTURES

Lecture Notes, Figures, and Images
How do we classify volcanoes?
Kinds of Volcanoes

Shield Volcano
- Usually basaltic
- Example: Hawaii

Composite Volcano or Stratovolcano
- Usually andesitic to rhyolitic
- Examples: Cascades; Mt. Fuji

Pipe

Flood Basalt or Fissure Eruption
- Example: Columbia Plateau

Cinder Cone

Volcanic Dome
- Usually rhyolitic
1. Volcanic / Igneous Extrusive Structures

2. Volcanic Lava / Eject types
Volcanic / Igneous Extrusive Structures:

1. Shield Volcanoes
2. Cinder Cones
3. Composite Cones
4. Columnar Jointing
5. Volcanic (Lava) Domes
6. Lava Plateaus
Note the low profile...Why is this so?

Shield volcano
Built up of many thin layers of mafic lava flows

Low viscosity!!!
Shield volcano
Shield volcano
CINDER CONE
Built of pyroclastic ejected lava

What's this?

Steeper sides!
Cinder cone
Cinder cone
Cinder cone
COMPOSITE CONE
Mt. Fuji - A Famous Composite Cone

Composite cone
(= stratovolcano)
Mount Rainier
Mount Baker - seen from Vancouver
Mount St Helens
Mount St Helens - 2014
A Summary of Basic Volcanic Rock Structures - Cone Types:

- Cinder cone
- Composite volcano
- Volcanic dome

<table>
<thead>
<tr>
<th>Volcanic feature</th>
<th>Height in km</th>
<th>Width in km</th>
<th>Angle of slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>1.5</td>
<td>100</td>
<td>1–2 degrees</td>
</tr>
<tr>
<td>X</td>
<td>10</td>
<td>100</td>
<td>5–10 degrees</td>
</tr>
<tr>
<td>Y</td>
<td>5</td>
<td>20</td>
<td>20–30 degrees</td>
</tr>
<tr>
<td>Z</td>
<td>0.3</td>
<td>1</td>
<td>30–40 degrees</td>
</tr>
</tbody>
</table>
Volcanic (LAVA) Dome

Found at a felsic volcanic vent
DISTANT VIEW OF A LAVA DOME!

Mount St Helens, Washington
Lava Flow / Plateau:

What Type of Magma would Produce this Structure? Explain How You Know...

Why is the structure so wide, yet so low?
Rift Zone

A “rift” or rip in the Earth’s surface through which lava flows onto the surface...

Lava Plateaus arise from them!
A close up of One Branch of A "Rift Zone"
Also Known As A “Fissure” –

Therefore eruption from these are known as “Fissure Eruptions”
What is this? Sill
Columnar Jointing:

Results From Rapid-Cooling Basalt Contracting & Cracking!
Two imaginable modes of contraction for a hot lava flow

Starting Condition:
Hot (expanded) lava flow
1. Whole-sheet contraction (unlikely)
Actual columns of basalt are more elongate:
A Close Up!

Individual Columns.
As Seen From Above...
Giant's Causeway - Northern Ireland (2002)
Each column always has 6 sides...
Volcanic neck - column of solidified lava inside a volcano vent, exposed by erosion.
Shiprock - New Mexico...
Devil's Tower - Wyoming...

A classic volcanic neck demonstrating columnar jointing!
Drawing Review Assignment
Part 2

Draw all igneous extrusive structures to top half of page

(Shield Volcano, Cinder Cone, Composite Volcano, Columnar Jointing, Volcanic Dome, Volcanic Neck, Lava Plateau)

Definitions on back of sheet
How do we classify volcanoes?
Volcanic Lava / Eject types:

- Formed From Lava

- **Lava** = magma that reaches the surface!

- You need to know Four main Types of materials ejected from volcanoes:
  - Ash Flows
  - Pillow Lava
  - Pahoehoe
  - AA
Ash Flows

- Not really lava, rather a dense cloud of fine, hot, airborne ash mixed with gasses

- a.k.a....Nuee Ardente.
ASH FLOW

a.k.a. “Nuee Ardente”

or “Pyroclastic Clouds”
Ash Flow - Mt. St. Helen's
Ash flows are deadly...they travel at speeds up to 700 km/h and incinerate/asphyxiate everything in their path...

You can’t outrun them!
Ash Flows are the most devastating part of volcanic eruptions!

What type of Volcanic cones would create this phenomena?

What would the composition of the erupting material be?

How can you tell?
Ash Flows Create Thick Layers Of Ash!!

These layers are from successive eruptions of Kilauea Volcano in Hawaii in 1790.
Pillow Lava

- Formed when lava is extruded **underwater**.

- Results in bulbous **pillow shaped deposits**.
PILLOW LAVA!

Diver
More Pillow Lava - Note **Roundness** in Cross-Section!

Hammer intended to provide a size scale
Pillow lava
Pillow lava
Pahoehoe

- Very “Runny” Fluid lava.

- Cools with a smooth ropy surface.
Notice The ropy Texture!!
Pahoehoe lava
Hot Lava - Cooling to form Pahoehoe...
Pahoehoe lava
Pahoehoe lava
Guess what!?
Aa

- Very **Thick** lava.
- Produces **rough, blocky** lava flows.
Lava Cooling To Form "Aa"
Blocky, Rough "Aa"
Lava River - Forms **Lava Tubes!**
Inside An Extinct “Lava Tube”
Lava can be destructive, but rarely kills people because it moves slowly and we outrun it… it tends to damage property that gets in its way!

**Ash Flows** - a.k.a. “Nuee Ardente” or “Pyroclastic Clouds” are the real danger to human life!

See the person watching the "Show"