Tephra

• Origin
• Types
• Characteristics

Origin

• Pyroclastic
• Hydrovolcanic
• Epiclastic

Varieties

• Juvenile (essential)
  – Derived from the erupting magma
• Cognate
• Accessory
  – Comagmatic particles from previous eruptions
• Accidental
  – Fragments of prevolcanic basement

Types

• Vitric
  – Pumice, shards, bubbles, etc
• Crystal
• Lithic

Tephra Size Classification

<table>
<thead>
<tr>
<th>Block or bomb</th>
<th>&gt;64 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lapilli</td>
<td>64-2 mm</td>
</tr>
<tr>
<td>coarse ash</td>
<td>2-1/16 mm</td>
</tr>
<tr>
<td>fine ash</td>
<td>&lt;1/16 mm</td>
</tr>
</tbody>
</table>

Blocks and Bombs

• Blocks
  – Angular cognate or accidental clasts
• Bombs
  – Molten clots thrown from the vent
  – Fusiform shape
<table>
<thead>
<tr>
<th>Common Bomb Types</th>
<th>Cored Bombs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bread-crust bombs</td>
<td>• Lava coating</td>
</tr>
<tr>
<td>– Chilled crust</td>
<td>• Cognate or accidental core</td>
</tr>
<tr>
<td>– Expanded interior</td>
<td>• Peridotite, eclogite, etc.</td>
</tr>
<tr>
<td>• Cauliflower bombs</td>
<td></td>
</tr>
<tr>
<td>– Dense interior</td>
<td></td>
</tr>
<tr>
<td>– Hydrovolcanic origin?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agglomerate</th>
<th>Coarse Vesiculated Pyroclasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dense aggregate of welded bombs</td>
<td>• Scoria</td>
</tr>
<tr>
<td>• &lt;25% lapilli and ash</td>
<td>• Spatter</td>
</tr>
<tr>
<td></td>
<td>• Pumice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scoria (Cinders)</th>
<th>Spatter</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mafic composition</td>
<td>• Similar to scoria</td>
</tr>
<tr>
<td>• Dark color</td>
<td>• Welded into agglutinates</td>
</tr>
<tr>
<td>• Highly inflated</td>
<td></td>
</tr>
<tr>
<td>• Density &gt; water</td>
<td></td>
</tr>
</tbody>
</table>

Scoria (Cinders) image
**Pumice**
- Silicic to intermediate foam
- Light color
- Highly vesicular
- Floats on water

**Vitric Particles**
- Bubble rupture shards
- Cuspate or lunate
  - Y-shaped triple junction
- Flat plates come from bubble walls

**Other Glass Textures**
- Glass spheres
- Whole bubbles
- Pele’s hair

**Pumice**
- Highly vesiculated glass
- High porosity
- Floats on water
- Spherical vs. fibrous vesicles

**Scoria**
- Small spherical vesicles
- Vesicles isolated
- No bubble walls

**Reticulite**
- Rare basaltic glass
- Formed at high lava fountains
- Porosity of 95-99%
- Network of polygonal rings
Pyrogenic Minerals
- Whole or broken crystals
- Enclosed in glass
- Generally euhedral form
- May be broken by eruption and transport

Surface Textures
- Record the history of the grains
  - Abrasion
  - Alteration
  - Pitting
  - Hydration

Abrasions
Pitting
Coatings
Hydration