Scoria Cones

- Hawaiian Eruptions
- Strombolian Eruptions


Hekla fires, 1970


Stromboli, 1983


Taal, 1976

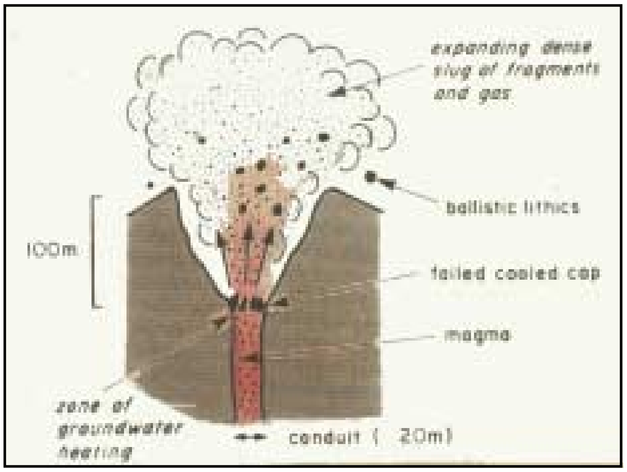

Hekla, 1970


Hekla vent, 1973

Sakurajima, 1973

Strombolian Mechanism

- Two-phase flow model
  - Vergniolle and Mangan (2000)
- Bubbles form a foam in the chamber
- Foam collapses to form a slug
- Slug rises through the conduit
- Slug bursts at the surface

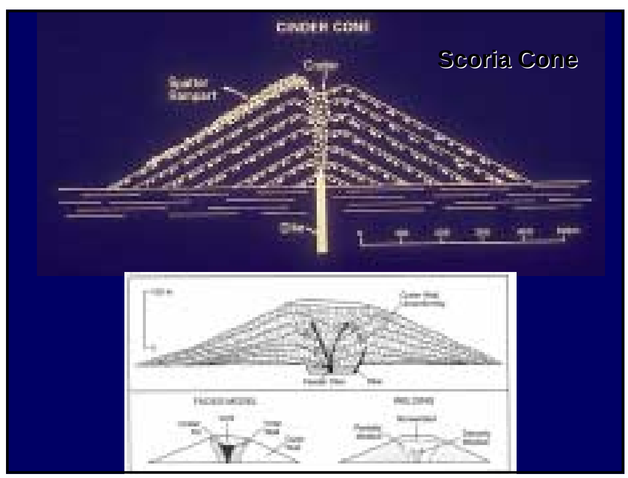


Cone Morphology

- Depends on several factors
  - Rate of ejection
  - Volume of erupted material
  - Velocity of particles
  - Ability of particles to weld on landing
  - Interface with lava and vent

Velocity of Particles

- Muzzle velocity
  - Size of particles
  - Effect of drag on particles
  - Lateral wind velocity
  - Total volume of ejected material
  - Effect of gravitational field



External Morphology

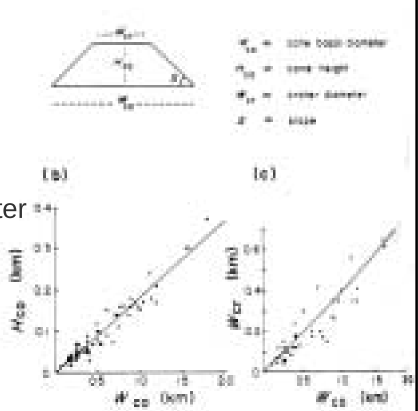
- Fresh cones
  - Slope of 30 degrees
  - Approximate angle of internal friction of cinders

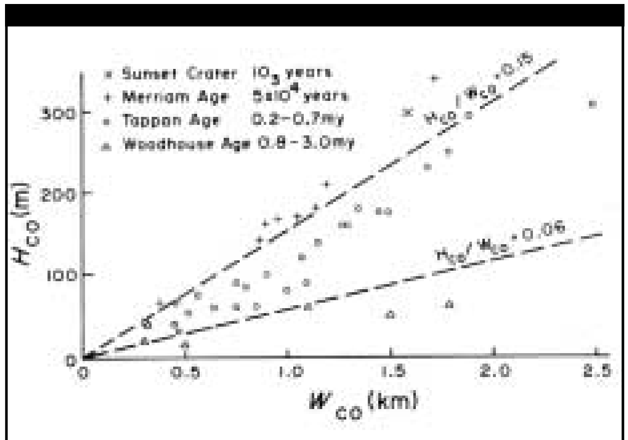
Morphometric Parameters

Cone width (W_{co})

Cone height (H_{co})

Crater diameter (D_{cr})

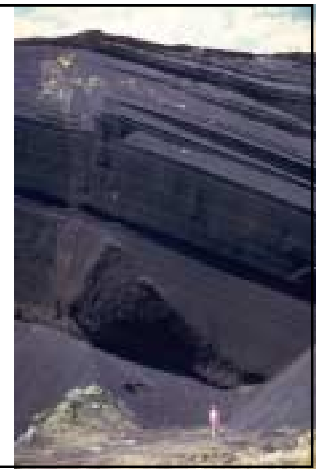




Scoria Cone Deposits

- Beds at angle of repose
- Bed thickness of 5-15 cm
- Coarse grain-supported clasts (cm-sized)
- Inversely graded beds
- Represent avalanche materials
- Related to supercritical slope angle

Scoria cone
Armenia

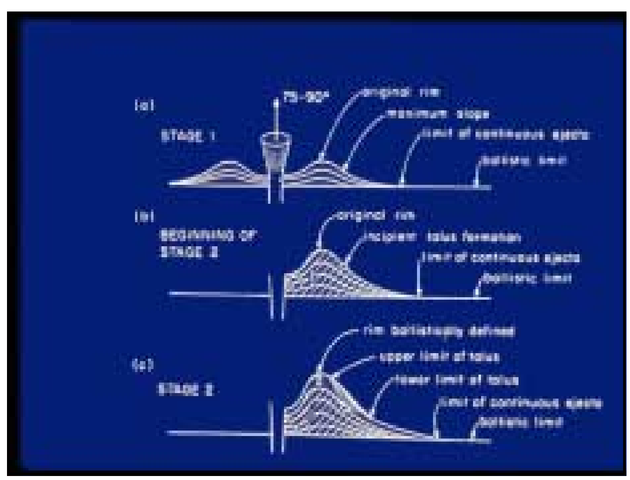


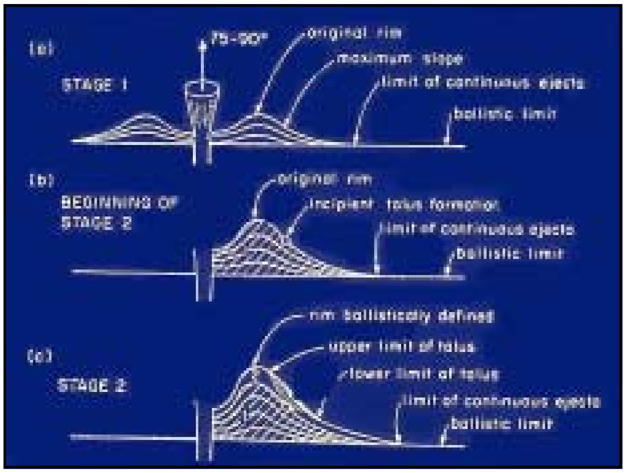
Strombolian Type Cone Growth

- McGetchin and others (1974)] model
- Parameters to be understood
  - Cone profile
  - Rim location
  - Limit of continuous ejecta
  - Ballistic limit
    - (maximum range of ejected fragment)
  - Size and location of talus slopes

Stages of Growth

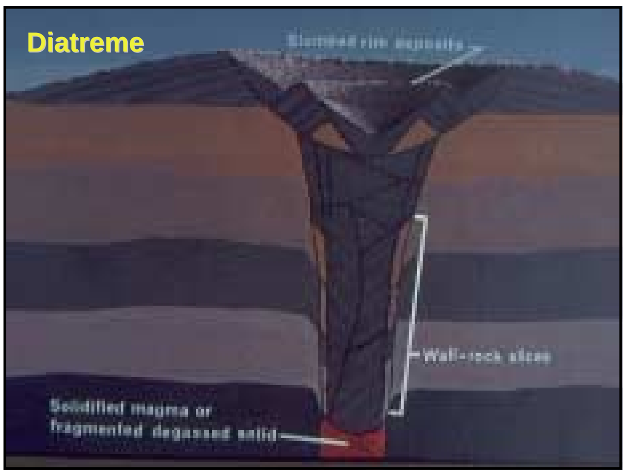
- Simple cone with mantle bedding and low rounded rim
- Onset of an exterior talus slope
- Destruction of original rounded rim by backward migration of the talus
- Outward growth of talus beyond the ballistic limit





Conduits

- Diatreme model
- What is the conduit diameter?
- Fissure to conduit flow



Comparison of Vulcanian and Strombolian Eruptions

Strombolian Eruptions

- Magma rise at a few m/s
- Bubbles rise more rapidly and coalesce
- Muzzle velocities generally < 100 m/s
- Parabolic trajectories of large clasts

Vulcanian Eruptions

- Discrete bursts with long pauses
- Much solid material ejected
- Vesiculation occurs at depth
- Vaporization of ground water important
- Ejection velocities up to 400 m/s
- Paradox of large blocks thrown great distances

Ballistic Ejection

Basic equations of motion

$$m\ g\ h = 1/2\ m\ v^2$$
$$h = v^2/2g$$
$$v = (2g\ h)^{1/2}$$

Fallout of Tephra

Terminal fall velocity (v_t)

$$v_t = C_d\ (d\ g\ \sigma/\beta)^{1/2}$$

d = **clast diameter**

C_d = **drag coefficient**

σ = **clast density**

β = **atmospheric density**