

## Calderas

References:

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Smith, RL and Bailey, RA, 1968, Resurgent Calderas,  
Geol. Soc. America Memoir 116, pp 83-104

Bacon, CR, 183, Eruptive history of Mt. Mazama and  
Crater Lake Caldera, Cascade Range, USA, Jour. Volc.  
Geotherm. Res., **18**:57-115

## Caldera Topics

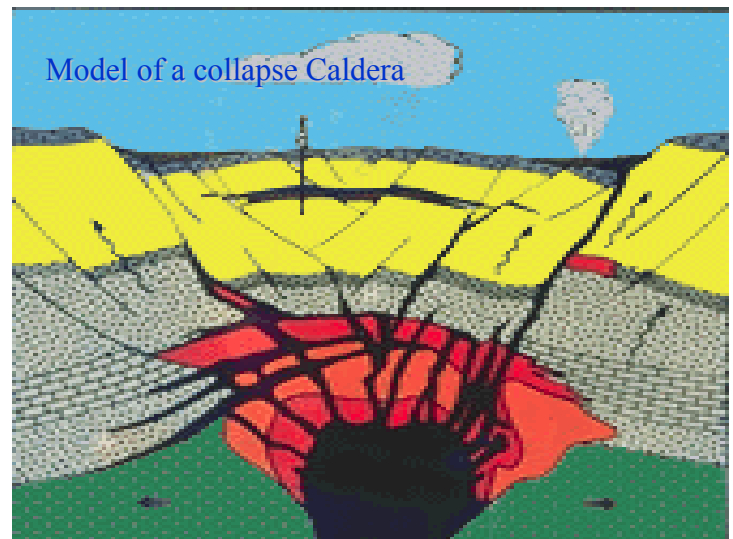
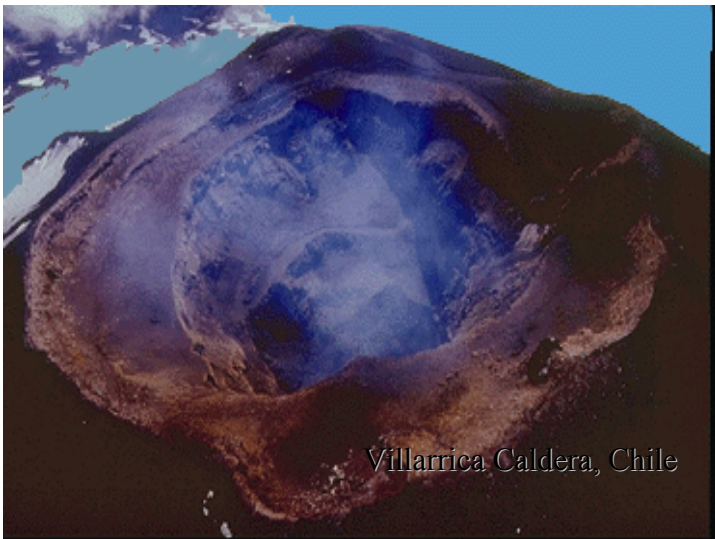
- Cauldron subsidence
- Resurgent calderas
- Caldera complexes
- Origin of silicic calderas
- Basaltic calderas
- Active calderas

## Collapse Calderas

- Atitlan, Guatemala
- Crater Lake, Oregon
- Ksudach, Russia
- Toya Caldera, Japan
- Thera, Greece
- Taupo, New Zealand

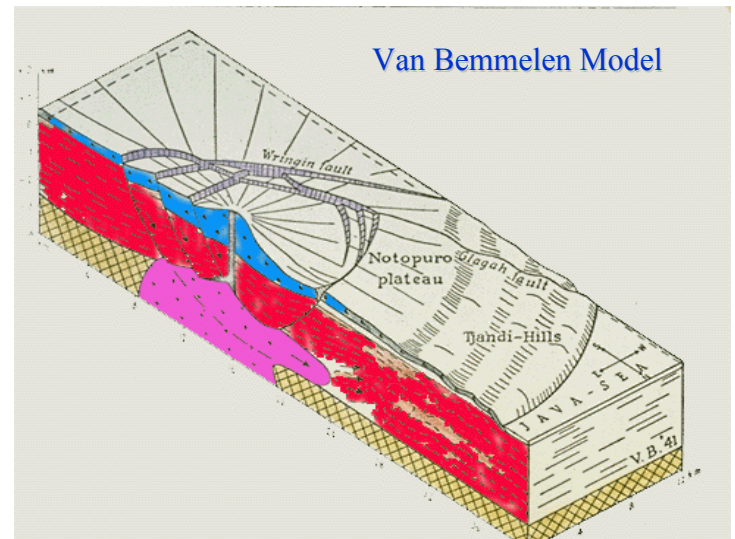
## Characteristics

- Simple circular form
- Diameter > 2 km
- V of collapse = V of tephra
- Steep walls
- Collapse megabreccia
- Generally a lake

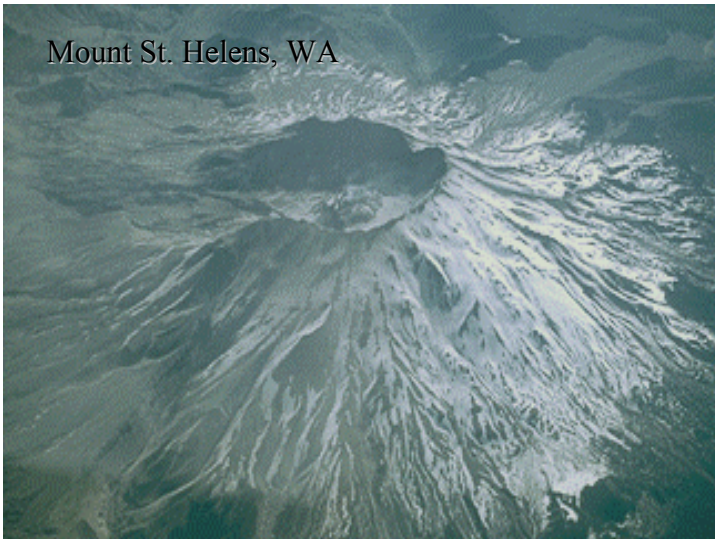


## Sector Collapse Scarps

- Horseshoe shape
- Open towards debris apron
- Gravitational mechanism
- Associated with andesite cones
- Van Bemmelen model
- Mount St. Helens



Mount St. Helens, WA



## Mt. Mazama

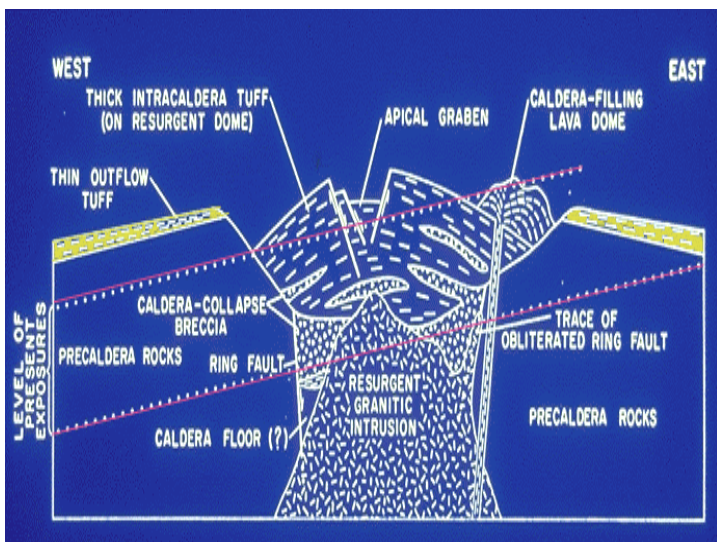
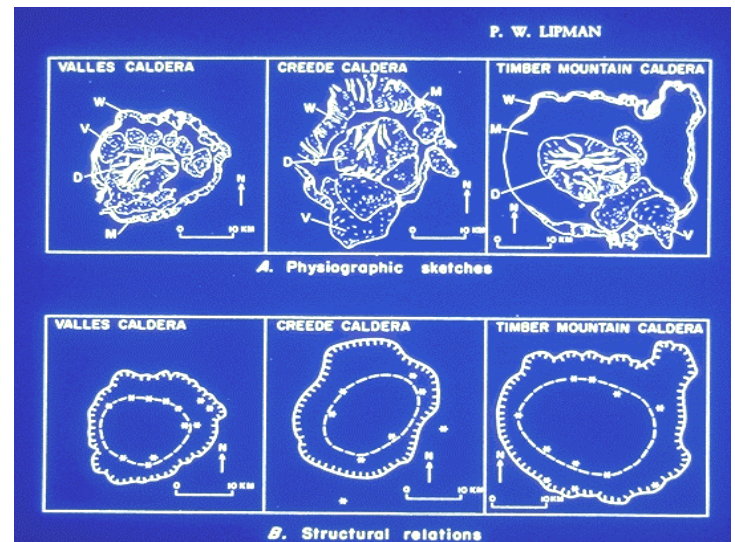
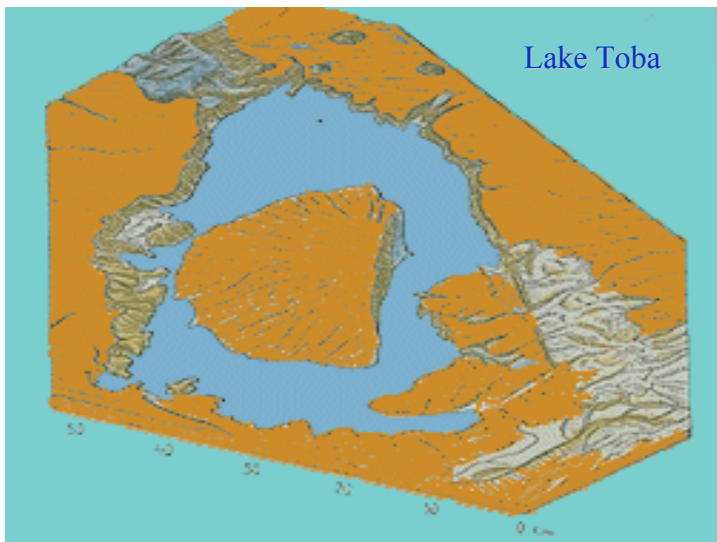
- Formed 6845 ybp
- 9 km diameter with 1200 m walls
- Original cone was 3600 m high
- Started with plinian eruption
  - Single vent phase
- Later column collapse and ash flows
  - Ring fracture phase
- Finally caldera founded

Crater Lake, OR



## Resurgent Calderas

Toba, Sumatra	74,000 yBP
Valles Caldera, USA	0.6 & 1.1 my
Long Valley, USA	0.74 my
Cerro Galan, Argentina	4.2 my



## Long Valley Caldera

- Tumescence      ????
- Early rhyolite dome      ~ 1 my
- Plinian fall      ~ 100 km<sup>3</sup>, 0.6 my
- Ash flow stage      ~ 400 km<sup>3</sup>, 0.6 my
- Collapse      0.6 my
- Resurgent domes      0.6, 0.3, & 0.1 my
- Geothermal stage      current

## Caldera Complexes

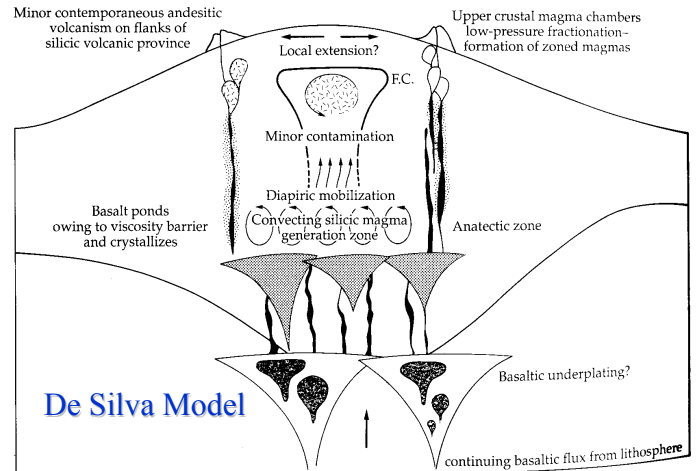
- Clusters of calderas
- 100s of km diameter zones
- Broad ignimbrite plateaus
- Probably surface expression of batholiths

## Examples of Complexes

- San Juan Volcanic Field
- Sierra Madre Occidental, Mexico
- Puna volcanic complex, Andes
- Ignimbrite province of Turkey
- African rift valley, Ethiopia
- Oslo Graben, Norway

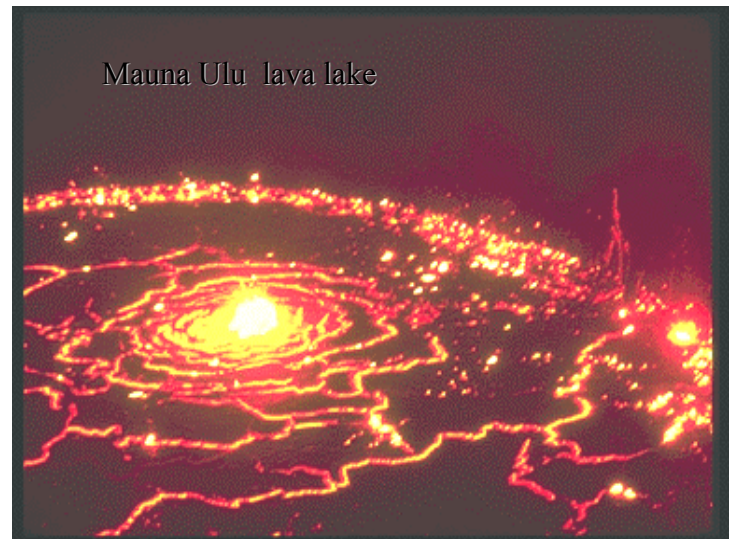
## Origin of Silicic Complexes

- Large calderas only in continental crust
- Basaltic under plating
- Silicic magmas rise towards the surface
- Mixed magmas are evidence
- Marginal basaltic eruptions
- Zoned magma chambers
- Sequential tapping



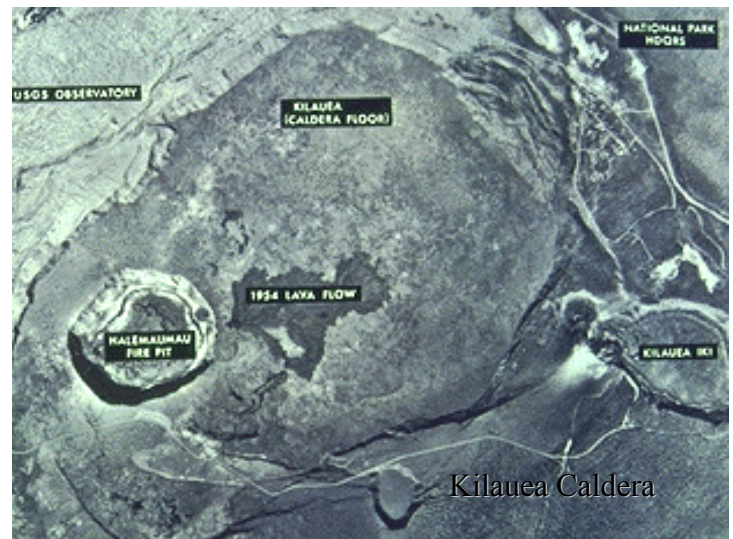
## Basaltic Calderas

- Elliptical and aligned
- Generally small, > 4 km diameter
- Never resurgent
- Subterranean withdrawal of magma



## Examples of Basaltic Calderas

- Hawaii (Mauna Loa and Kilauea)
- Hawaii (chain of pit craters)
- Galapagos (Fernandina)
- Reunion (Dolomieu)



## Historical Campi Flegrei

- Campanian Tuff - 35,000 ybp
- Yellow tuffs - 10,000 ybp
- Monte Nuovo 1538
- Solfatara active fumaroles
- Serapis temple ups and downs
- Uplift of 1975 (~1.5 m)
- New uplift 1982-84 (1.8 m)

