

3. Volcanic Hazards



91 8 24
Mt. Pinatubo, Philippines, 1991

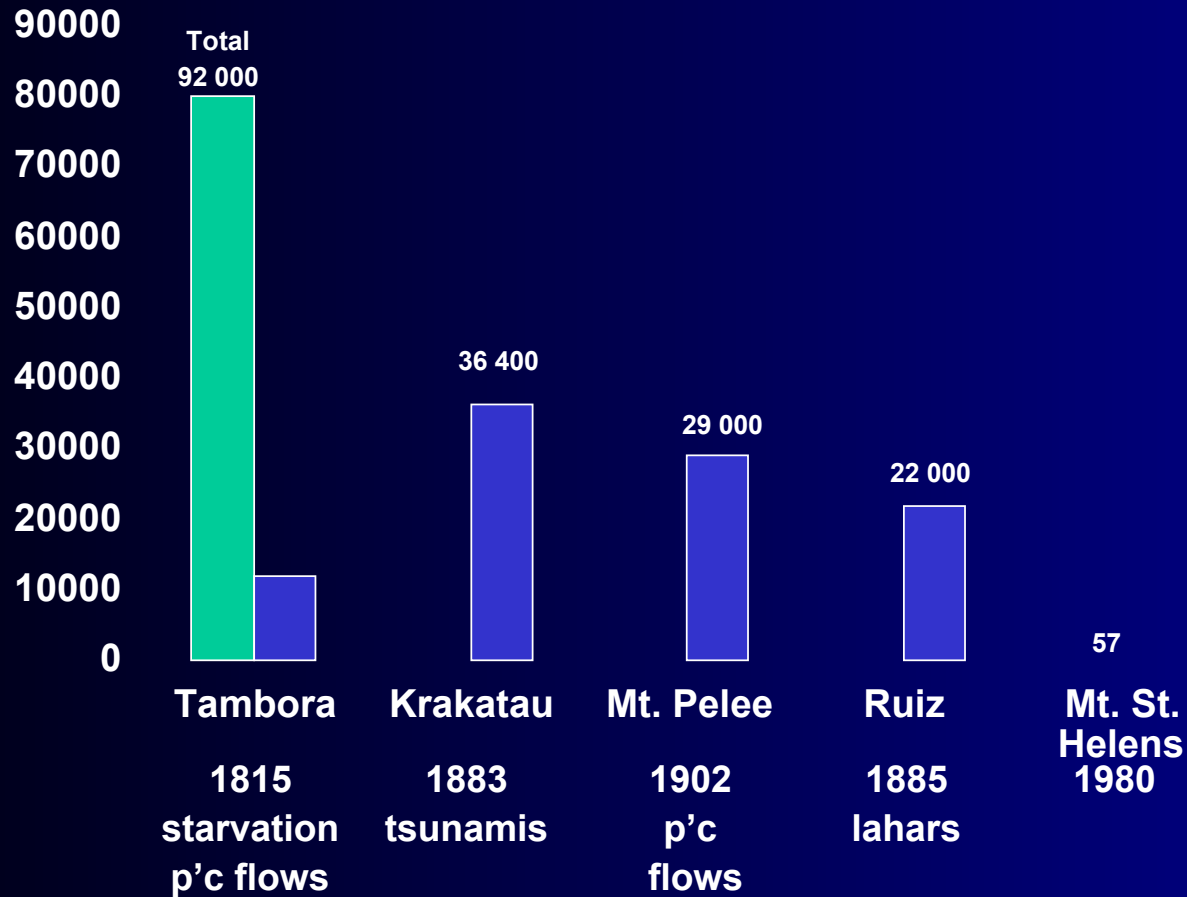
Volcanic Hazard

“..... the probability that an area will be affected by potentially destructive volcanic processes or products within a given period of time.....”

Types

- **lava flows** e.g. Nyiragongo, Zaire, 1977; very fluid lava flows from lake; 30 - 100 kmh⁻¹
- **collapse of lava domes** ∅ avalanches of hot lava + gas e.g. Unzen, Japan, 1991
- **pyroclastic flows** e.g. Tambora, Indonesia, 1815; Mt St Helens, 1980
- **pyroclastic surges** e.g. El Chichon, Mexico, 1985
- **fallout** e.g. Pinatubo, Philippines, 1991
- **lahars** (volcanic mudflows) e.g. Ruiz, Columbia, 1985
- **sector collapse** ∅ avalanche e.g. Mt. St. Helens, 1980
- **tsunamis** (wave)e.g. Krakatau, Indonesia, 1883

Volcanic Disasters



~1343 volcanoes have erupted in the past 10 000 years

> 500 volcanoes have erupted in historic time

~ 50 volcanoes erupt each year

Mitigation of Hazards

- 1 Identification of hazardous volcanoes
- 2 Hazards assessment (usually a map)
 - style and effects of historic eruptions
 - map of deposits from prehistoric eruptions
 - dating deposits
- 3 Volcano monitoring (visual, geophysics, geochem)
 - volcanic earthquakes (number, type)
 - ground deformation (tilt; changes elevation and distance)
 - volcanic gas (composition, emission rate, T°C)
 - changes in colour, composition, T°C, volume of water in crater lakes, springs, streams
- 4 Volcano emergency management
 - planning, preparation, practice
 - communication (before, during, after)

Pinatubo, 1991

- 2 months of increasing seismicity, deformation and small eruptions
- 3 days of dome growth
- 12th - 15th June, several large explosions
 - ash plumes 25 km above the vent
- 15th June, 11 hours sustained eruption column
 - 30 - 40 km high ∅ widespread fallout, pyroclastic flows
- persistent hazards from mudflows
 - (rain + loose ash + steep slopes)

Volcanoes & Natural Resources

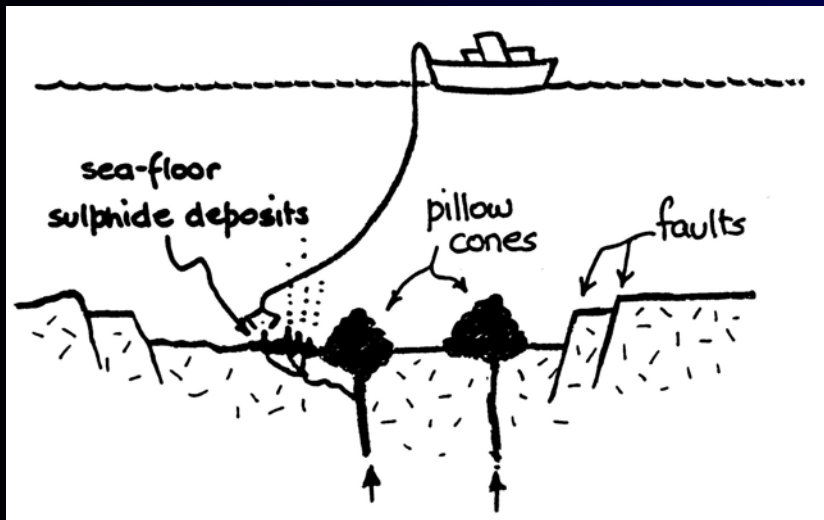
- **metals** e.g. gold
copper
lead, zinc
- **diamonds**
- **geothermal energy**

Volcanoes focus heat and fluids (\pm metals) and provide pathways to the surface

Metals

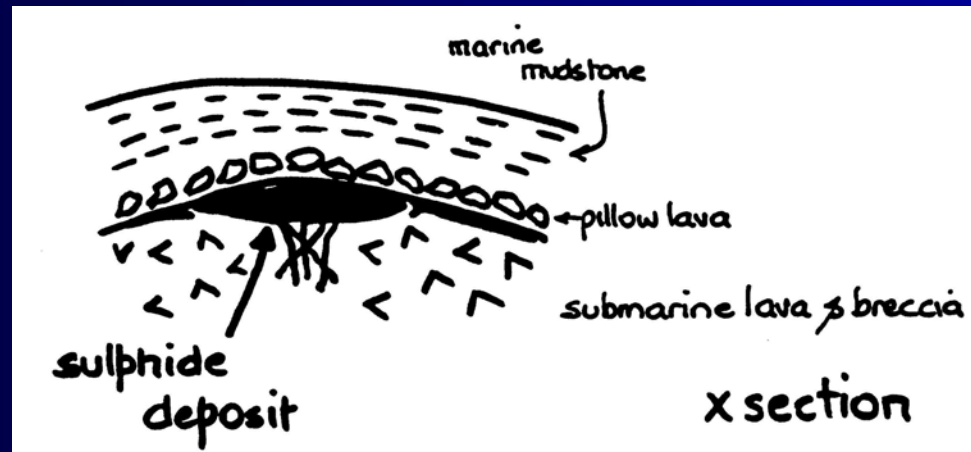
- sea-floor massive sulfides
- e.g. galena (PbS), sphalerite (ZnS)

MANUS BASIN, PNG



- active

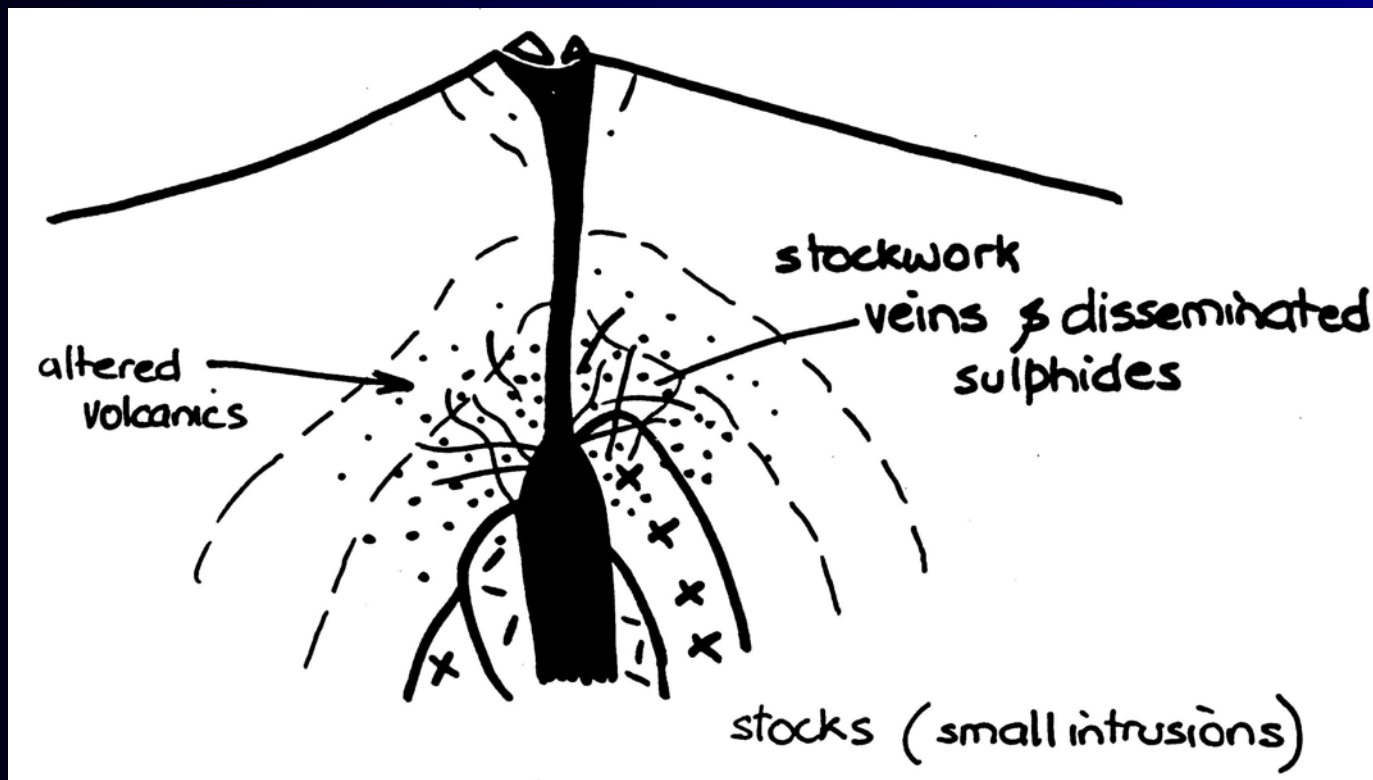
HELLYER, western Tasmania



- Cambrian (500 Ma)
- Mt Read Volcanics

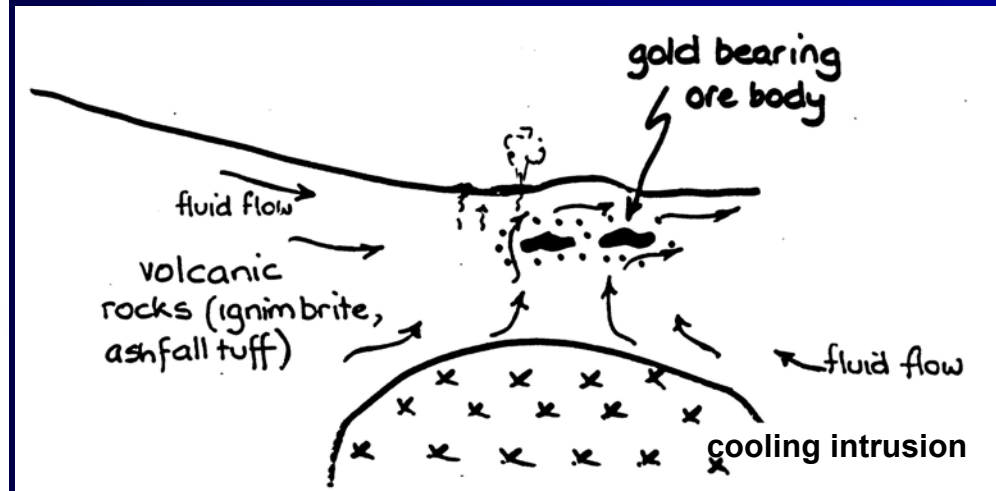
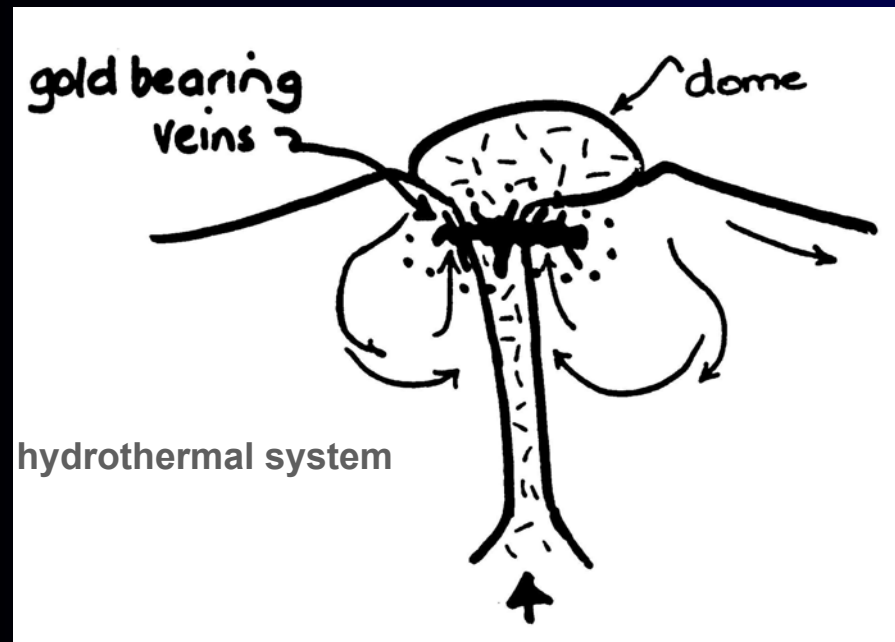
Metals

- porphyry copper (Au, Mo)
 - deep inside composite volcanoes
 - hosted by small intrusions
 - veins, stockwork, disseminated



Metals

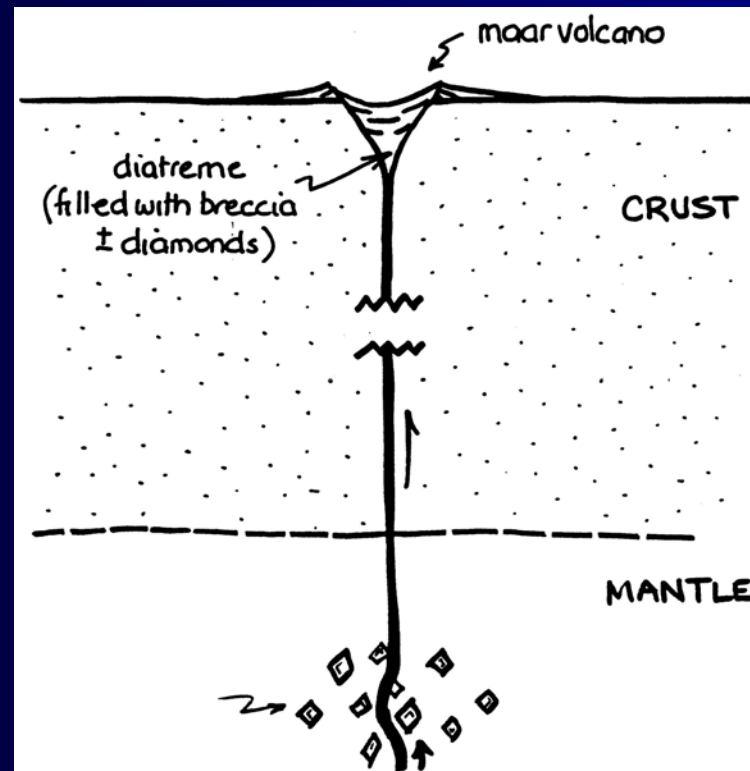
- epithermal gold (silver)
 - commonly associated with subaerial volcanic successions, especially domes and caldera volcanoes
 - veins and disseminated



Diamonds

- formed in the mantle at high P
- brought up in diatremes (pipe-shaped feeder) that may be linked to small maar volcanoes at the surface
- diamonds occur in breccia in the diatreme and in the maar rim deposits

e.g. Argyle, WA



diamond
bearing
source

Geothermal energy

HEAT (from cooling magma) + **GROUNDWATER**

∅ tapped by wells; fluids drive turbines
that produce electricity

e.g. Hawaii, New Zealand (Broadlands - Ohaaki), Iceland (Krafla)

- surface features associated with geothermal systems
 - geysers
 - hot springs
 - fumaroles
 - boiling mud pools
 - steaming ground