

VOLCANOLOGY

1. Eruption Processes & Products
2. Volcanoes
3. Volcanic Hazards and Resources



Mayon Volcano, Philippines, 1984

1. Eruption Processes and Products

Volcano.....

....structure where magma is erupted
....includes the erupted products

ERUPTION STYLE

EXPLOSIVE



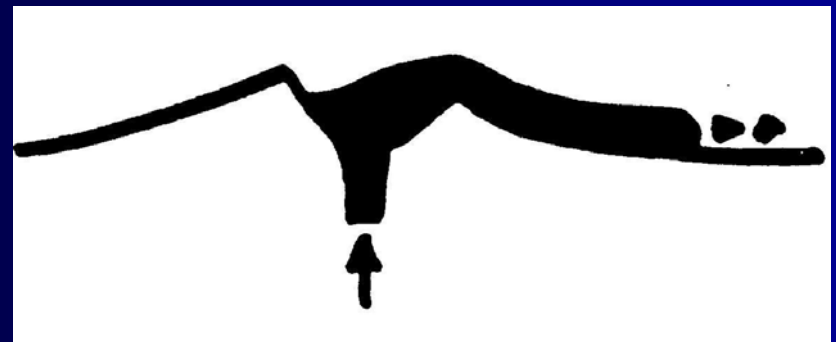
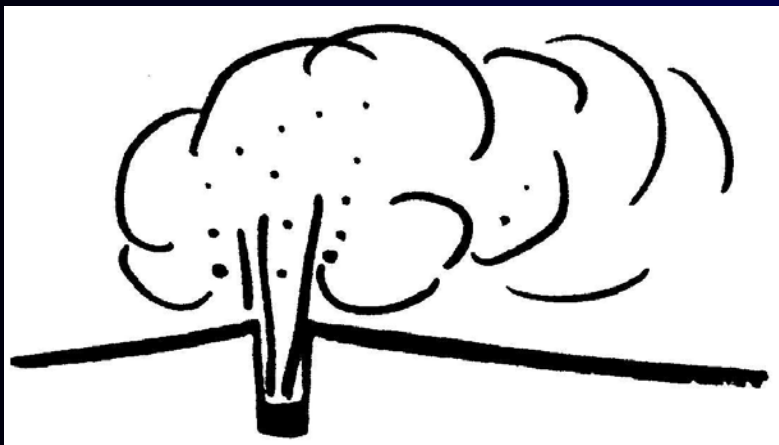
EFFUSIVE



pyroclastic deposits

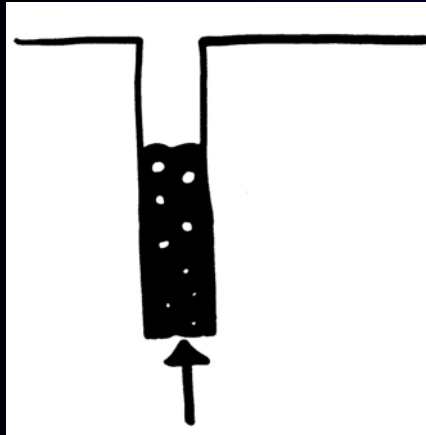


lavas



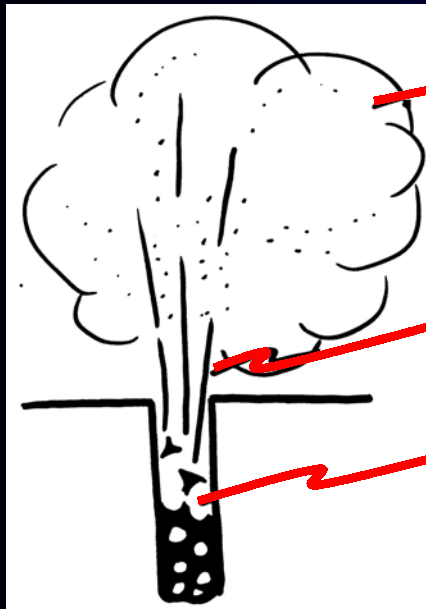
Explosive

- Magma with high gas content
- Magma with high viscosity



- gas forms bubbles
- bubbles are trapped
- P build-up

→ explosive eruption

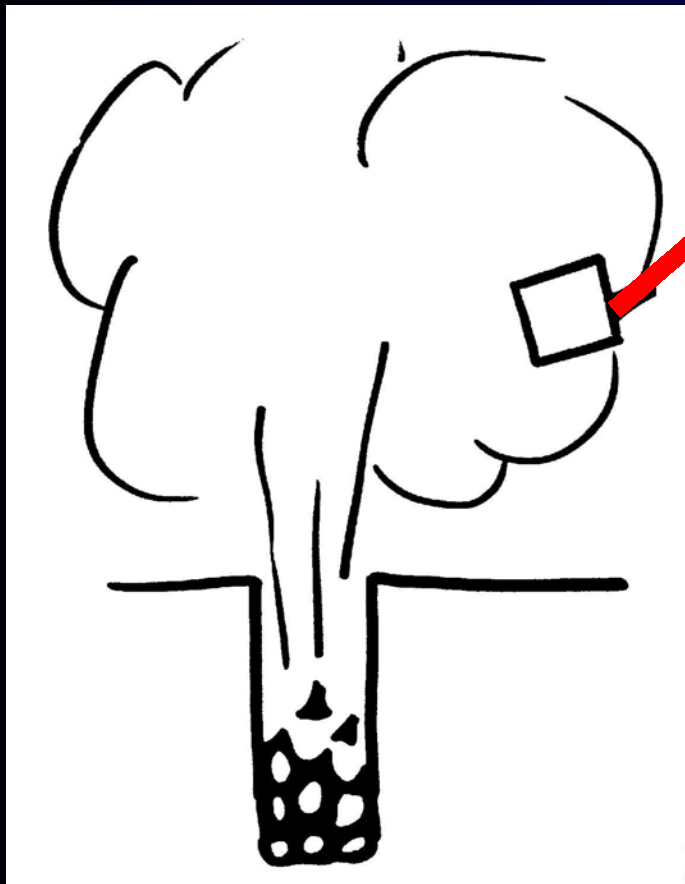


rapidly expanding
cloud of gas +
particles

jet

magma is torn apart
by explosions

- rapidly expanding cloud of gas + particles (buoyant)
- jet (driven by decompression)
- magma is torn apart by explosions

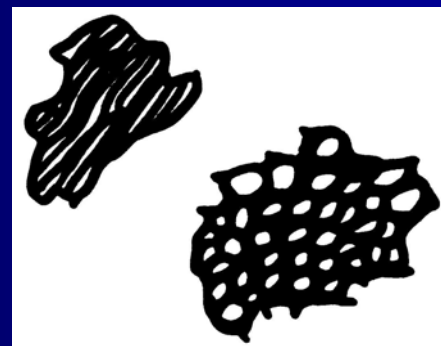


particles
"PYROCLASTS"

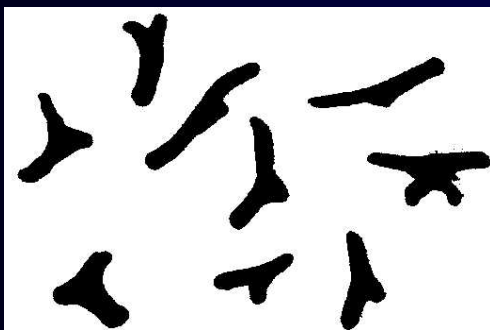
crystals &
broken crystals



pumice or scoria



glass
shards
(walls of
bubbles)

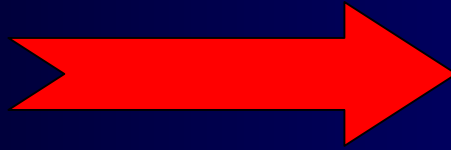


1 mm

wallrock fragments
("lithic clasts")

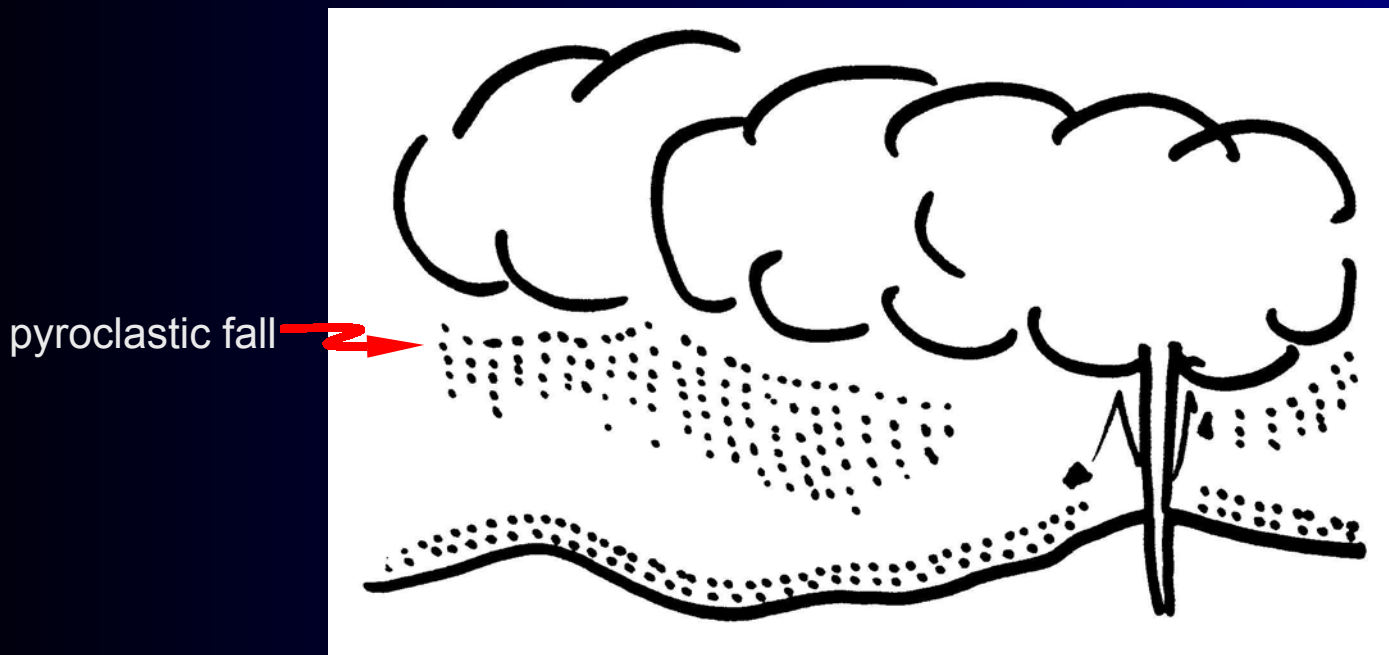


**EXPLOSIVE
ERUPTION**



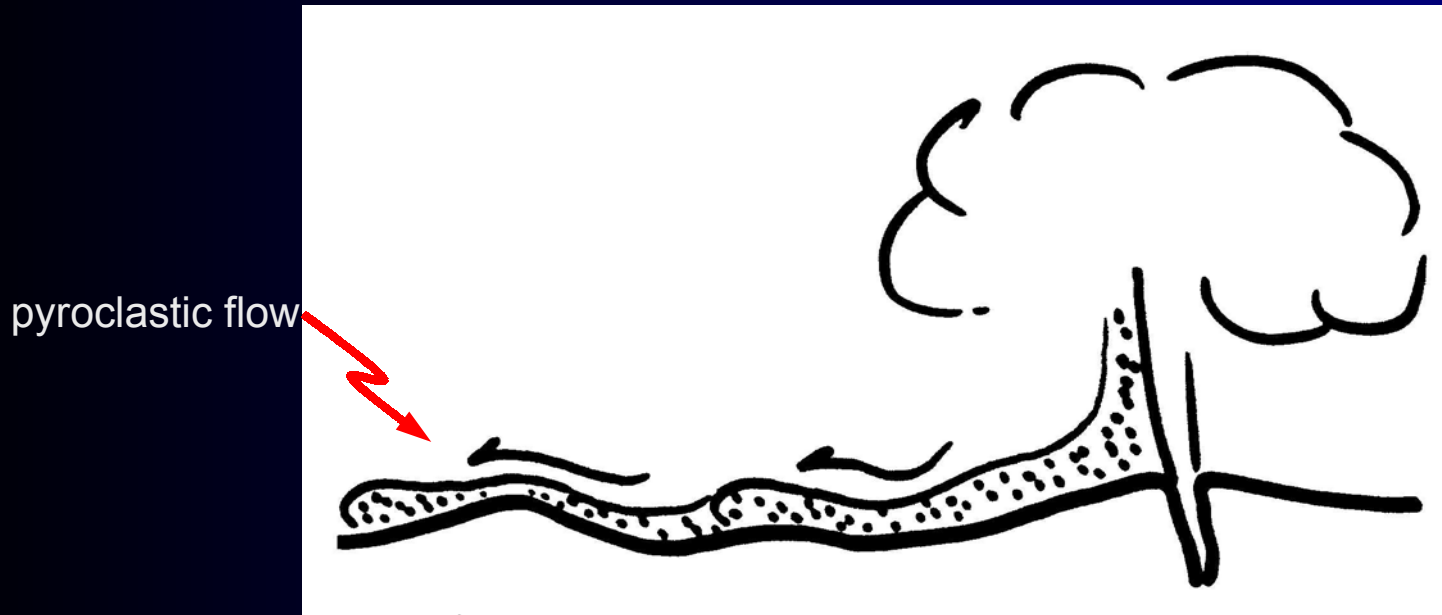
**pyroclastic
deposits**

Pyroclastic fall



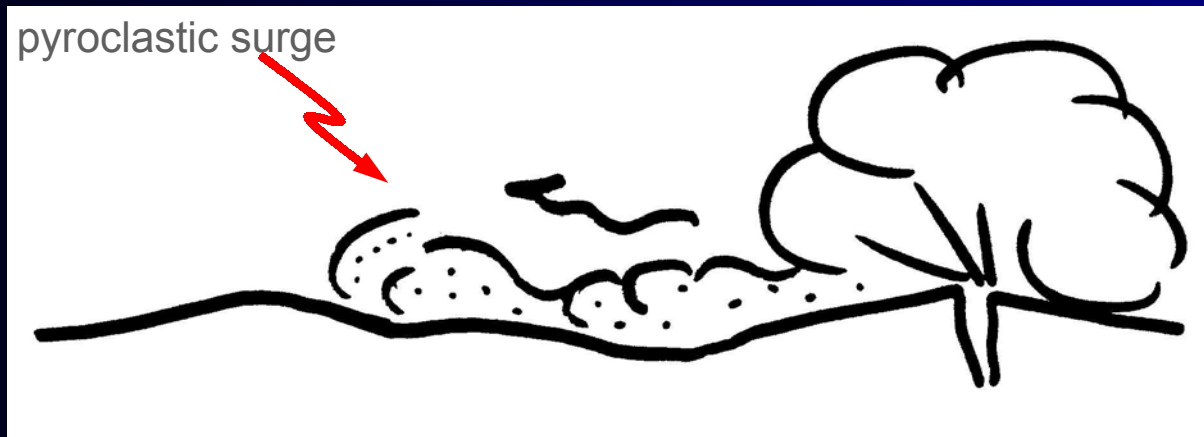
Pyroclastic flow

- hot, laterally moving, gas-particle dispersion
- high particle concentration



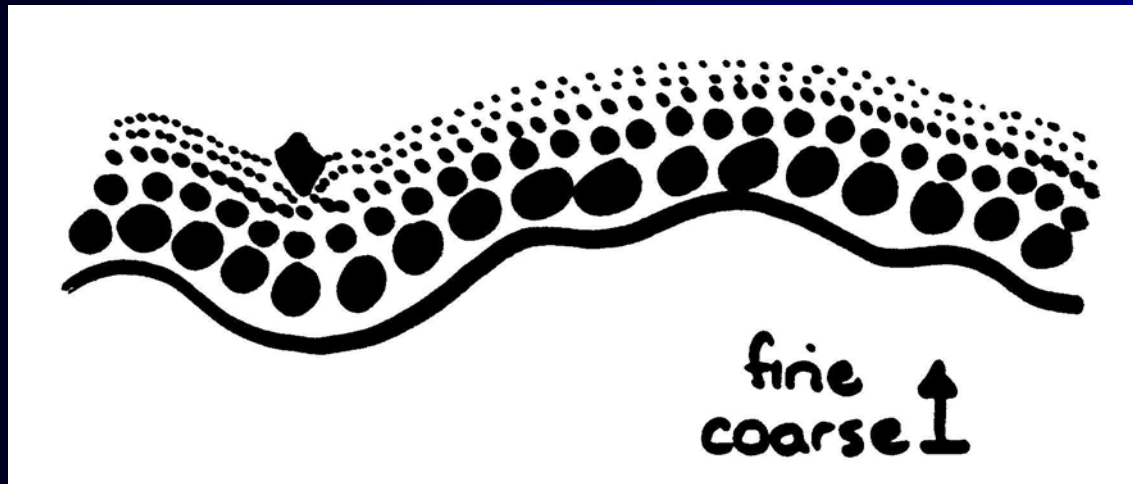
Pyroclastic surge

- warm-hot, laterally moving, gas-particle dispersion
- low particle concentration
- turbulent



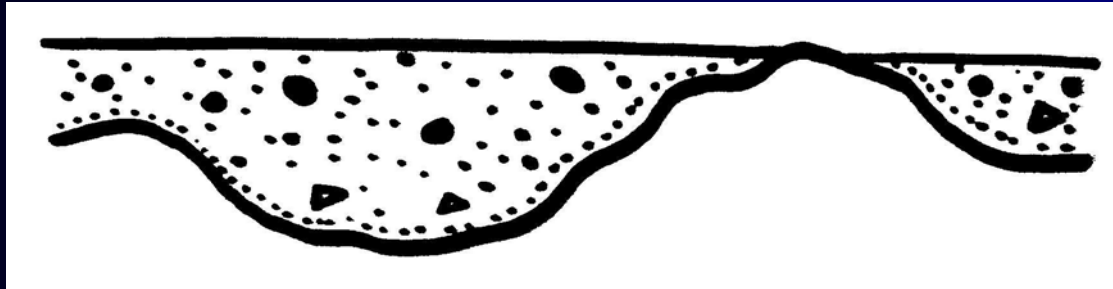
Fall deposits

- good layering, often graded (coarse to fine)
- mantle uneven surfaces (uniform thickness)
- smaller grain size & thinner with distance from source



Flow deposits

- massive
- infill topography, flat top surface
- poorly sorted
- may be very thick (100's m)
- aka "ignimbrite"



Ignimbrite

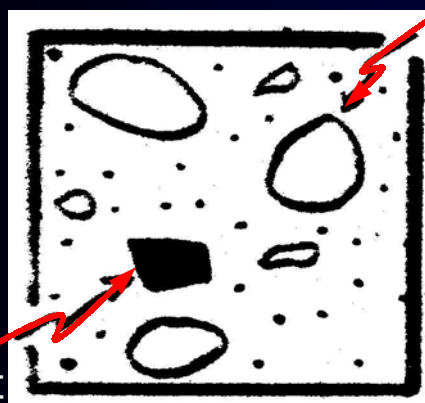
..... pumice-rich pyroclastic flow deposit

..... may be welded

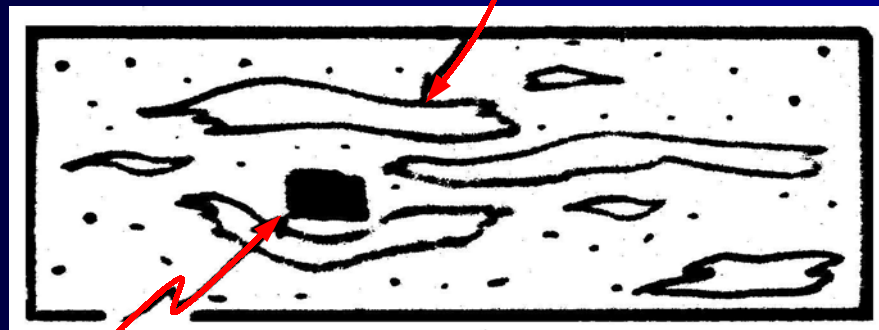
- particles still v.hot (= 500°C) when deposited
- load pressure causes hot, sticky particles to weld together
- pore spaces between particles, and vesicles in pumice are eliminated

“instant” hard, solid rock called “**welded ignimbrite**”

➔ e.g. Battleship Rock ignimbrite, New Mexico



pumice

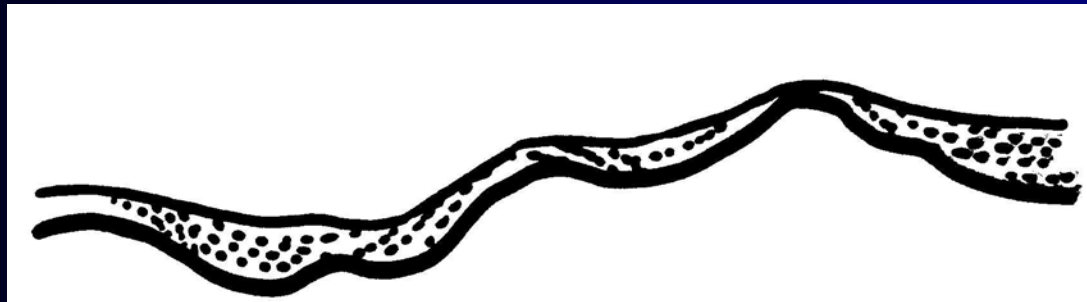


flattened pumice

lithic clast still the same

Surge deposits

- good layering, cross bedding
- partly mantle, partly infill topography
- usually only small volume & close to source



P'c fall, flow and surge deposits
may be lithified to form **pyroclastic rock**

Grainsize

PYROCLASTS

> 64 mm	block (angular), bomb (fluidal)
2 - 64 mm	lapilli
< 2 mm	ash

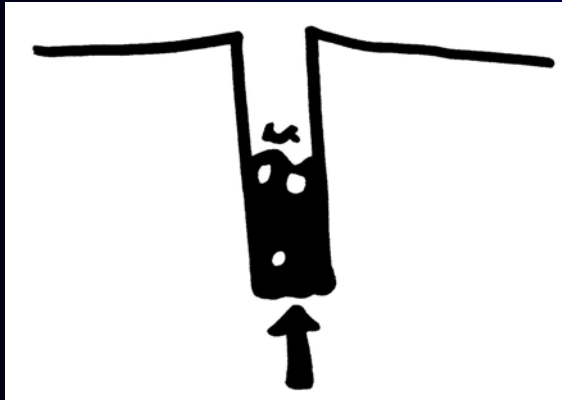
PYROCLASTIC ROCKS

> 64 mm	pyroclastic breccia, agglomerate
2 - 64 mm	lapillistone, lapilli tuff
< 2 mm	tuff

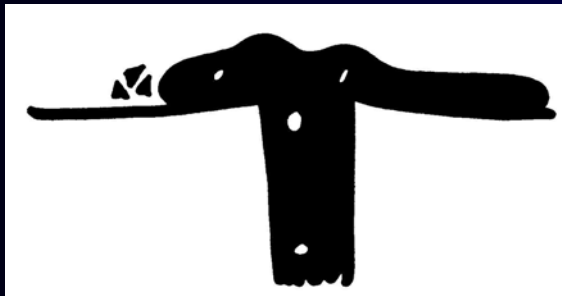
these terms should be reserved for proven
pyroclasts and pyroclastic rocks
i.e. generated by **EXPLOSIVE ERUPTIONS**

Effusive

- Magma with low gas content
- Magma with low viscosity



- gas forms few bubbles
- these grow and rise
- bubbles break easily
- magma continues to rise and eventually erupts



➔ effusive eruption

(generally only minor, mild accompanying explosive activity)

➔ Lavas: coherent + autoclastic

Lavas

..... surface flows of molten rock

..... behaviour & features controlled by

- composition, especially SiO_2
- temperature
- volatile content
- shape of vent
- gradient of substrate
- discharge rate

Lavas

Low SiO₂ lava e.g. basalt

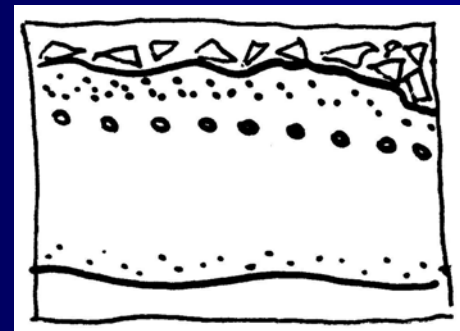
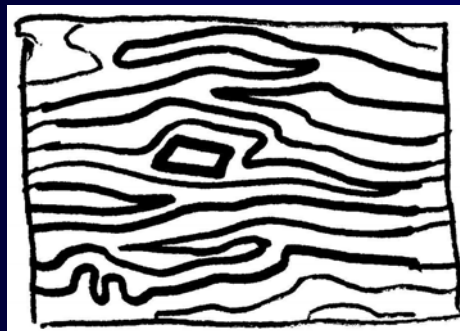
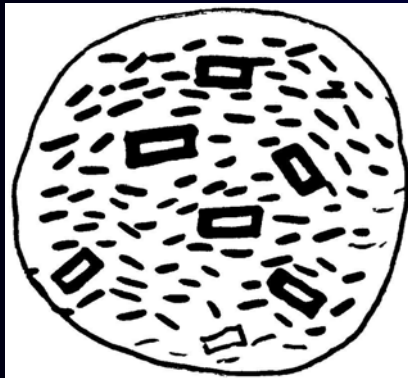
- two common types: pahoehoe - fluidal surface
 a'a - lots of fragments, "clinker"
- sheets, tubes, channels; thin but extensive

High SiO₂ lava e.g. rhyolite

- thick, short flows; domes
- abundant loose blocks of pasty, congealed lava

Characteristic features of lavas

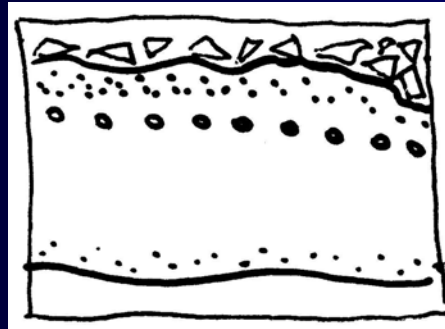
- once cooled \neq “instant”, solid rock
- may be flow banded
- may contain euhedral crystals (“phenocrysts”)
- may be vesicular
- may contain volcanic glass if rapidly cooled
- may have columnar jointing
- foreign rock fragments are uncommon
- typically include both coherent & clastic textures
(cf. clastic texture of pyroclastic rocks)



} lava

Autobreccia

- broken fragments of lava
- formed during active flow of hot lava when cooler brittle parts of the lava are torn apart and break up
- fragments may be flow banded and vesicular
- typically tabular, slabby and twisted shapes



} autobreccia
} coherent lava