Seamounts and Subglacial Volcanoes

References:
Encyclopedia of Volcanoes, pp. 383-402
Francis, pp. 21-339
Cas and Wright, pp. 406-409

Seamount Composition

- Most seamounts are basaltic
- Larger ones evolve to more alkalic compositions with time.

Examples

- Typical example is Hawaii (Loihi)
- Also Galapagos, Easter Island, Azores
- Range in size from enormous to tiny
  - Mauna Loa, Earth's largest volcano
  - Small structures <50 m tall and <100 m in diameter

Axial Valley of the MAR

- Contains many large seamounts
- Linear volcanic ridges
- Outside of the *neovolcanic zone* there are none

East Pacific Rise

- No seamounts in the neovolcanic zone of the EPR
- There are a few, small, off-axis pillow ridges
- Hundreds of seamounts lie within a few tens of kilometers of the EPR.
  - These seamounts form chains
  - Their size is limited by spreading rate and magma supply

Near-the EPR

- Seamounts fed from "leaky" MOR magma chambers through the relatively thin crust near the ridge axis.
- The crust is thin because it's still young and hasn't had sufficient time to cool and thicken.

Away From MORs

- Fed by plumes of unknown source
- Smaller seamounts are probably not fed by large plumes (like the one feeding Hawaii)
- Source of the smaller plumes is uncertain

Rhyolite Seamounts

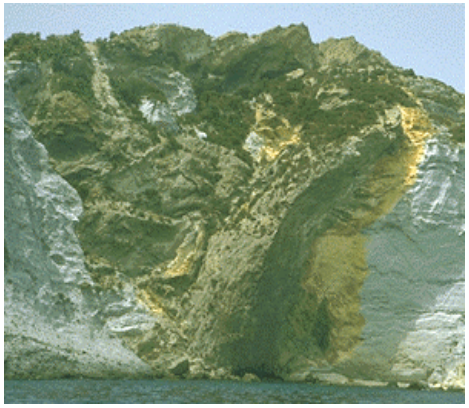
Rare features

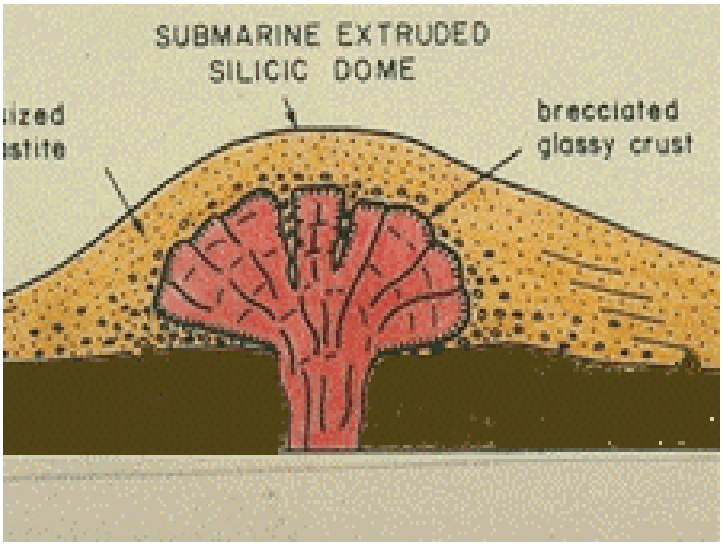
Island of Ponza

Tyrrhenian Sea

Obsidian feeder dikes

Pumice breccia





Main Seamount Units

- Pillows
- Pillow breccias
- Hyaloclastites
- Capping lavas

Seamount Morphology

- Typically circular and flat-topped
- With or without summit caldera
- A summit caldera indicates a magma chamber (however long- or short-lived) within the construct of the seamount itself

Stratigraphy

- Commonly composed of pillowed flows
- Capped with ponded sheet flows in the caldera
- Hyaloclastites occur if the seamount is tall enough (within ~2000 m of sea surface)

Eruption Characteristics

- Small seamounts are probably monogenetic
- These would be the submarine equivalent of scoria cones
- Large seamounts may take 150,000 years to form

Subglacial Eruptions

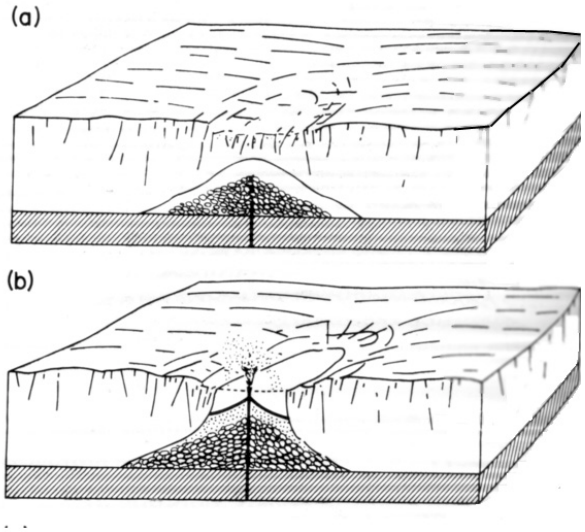
- Form table mountains
- Also called "tuyas“ in Iceland
- These volcanoes erupted beneath a sheet of ice

Initial Stage

- Lava is under a great deal of pressure
- Behaves similarly to deep-marine lavas
- Typical pillow lavas form

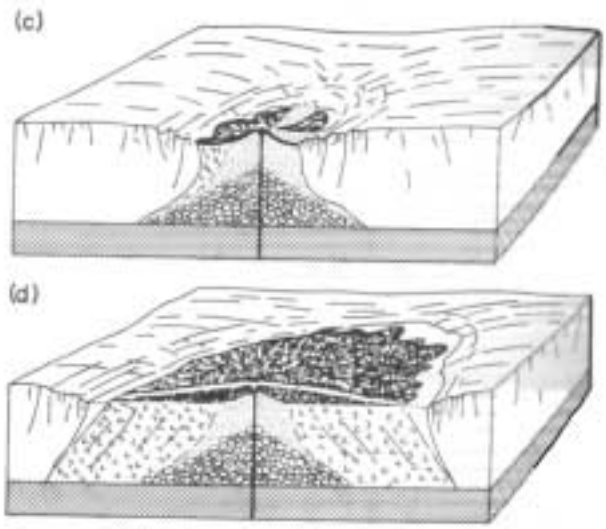
Later Stage

- As the lava pile grows, the overlying pressure decreases
- Eventually, the lava is overlain by a relatively thin layer of meltwater
- Explosions can occur
- This produces hyaloclastites above the pillow lavas



Final Stage

- When the lava pile reaches the surface of the glacier
- “Normal" subaerial basaltic lava (usually pahoehoe) is emplaced
- The resulting volcano can be used to determine the thickness of ice at the time of eruption.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