

Volcanic landforms and processes

by

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Objectives

- To be able to identify on images the various volcanic **landforms** and **processes**.
- To understand their **spatial distribution**.

Volcanism & Volcanoes

- Volcanism: 'The process by which **magma** and **associated gases** rise unto the Earth's crust and are extruded on the earth's surface or in the atmosphere'
- Volcanoes: the **surface manifestations** of volcanism

Global Patterns of Volcanism

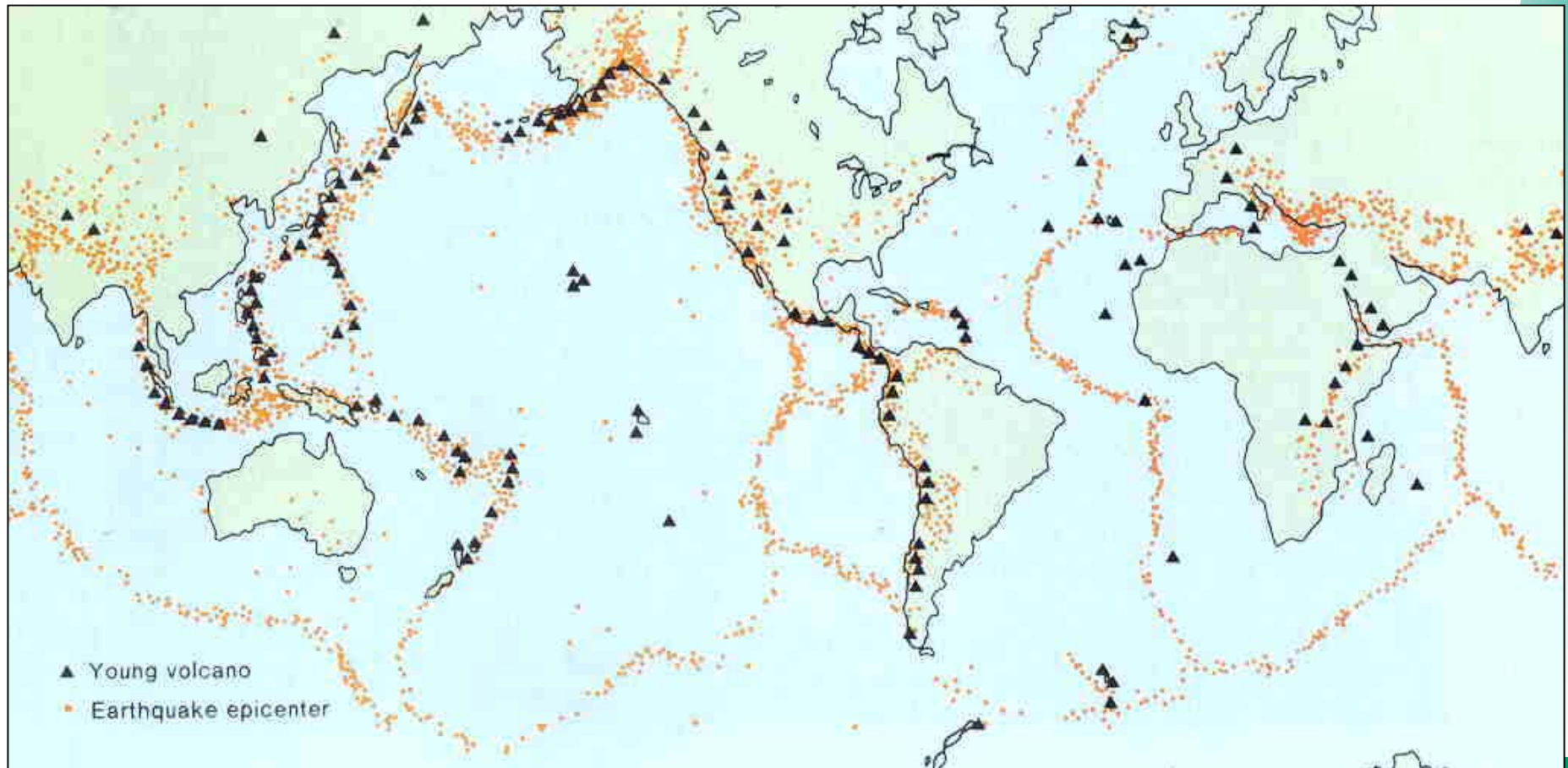
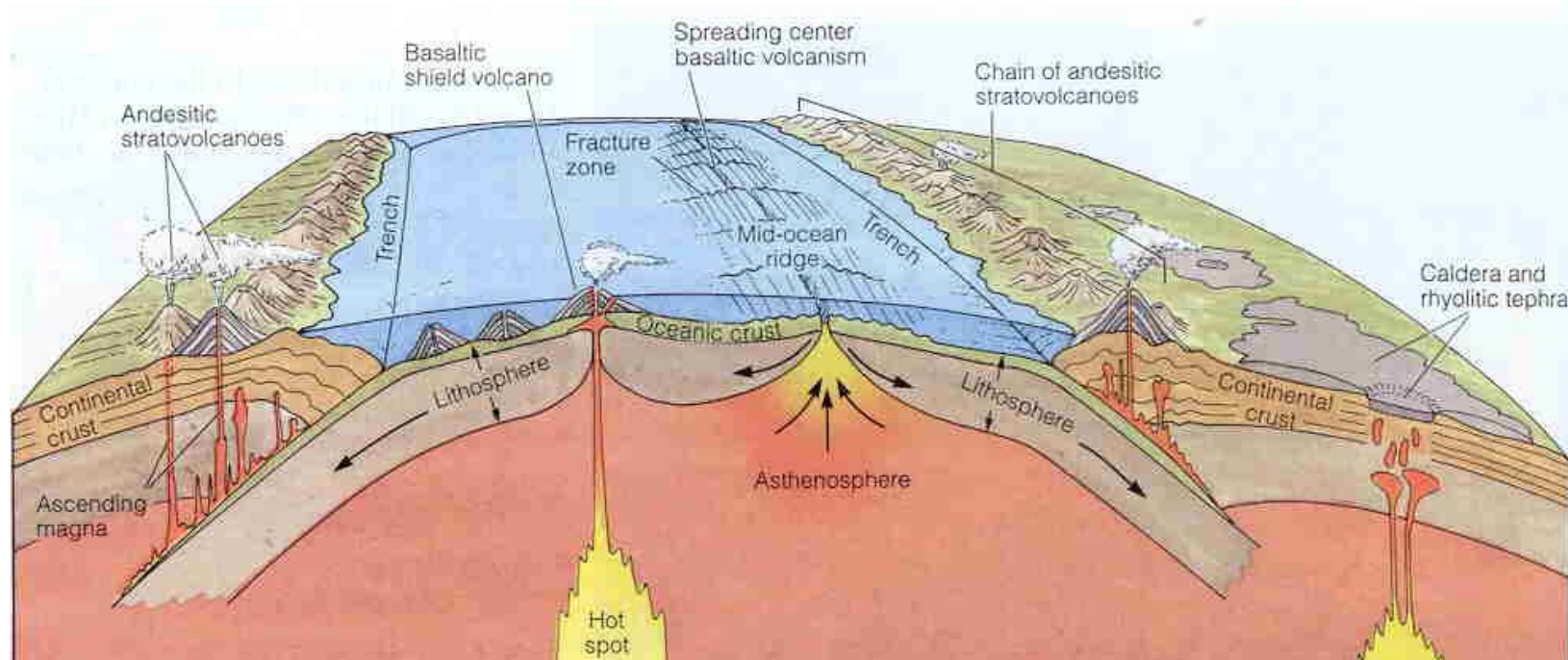


Plate tectonics

- Global patterns of volcanism are related to plate boundaries (active seismic regions)
- The **type of volcanic activity** depends mainly on the **type of plate boundary**
- The shape and dimensions of a volcano depend mainly on the eruption type.

Type of plate margins



- **Diverging plate margins:** quiet eruptions of basaltic magma
- **Converging plate margins (subduction):** explosive eruptions of andesitic magma
- **Intraplate ('hot spots'):** eruptions of basaltic magma

Eruptions

- Eruptions range from quiet outflows of lava to very explosive eruptions.
- This depends on **viscosity** and gas content of the magma.
- Viscosity (opposite of fluidity) depends on :
 1. Chemical composition
 2. Pressure
 3. Temperature



Eruption types

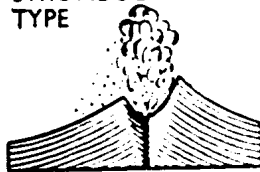
FISSURE or ICELANDIC
TYPE



HAWAIIAN TYPE



STROMBOLIAN
TYPE



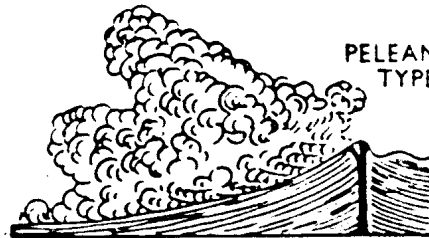
VULCANIAN
TYPE



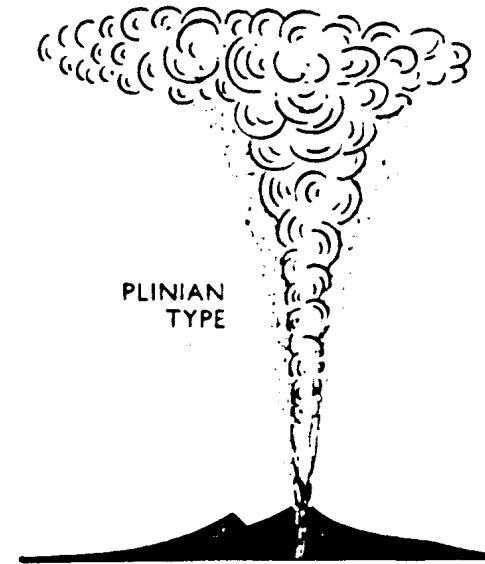
VESUVIAN
TYPE



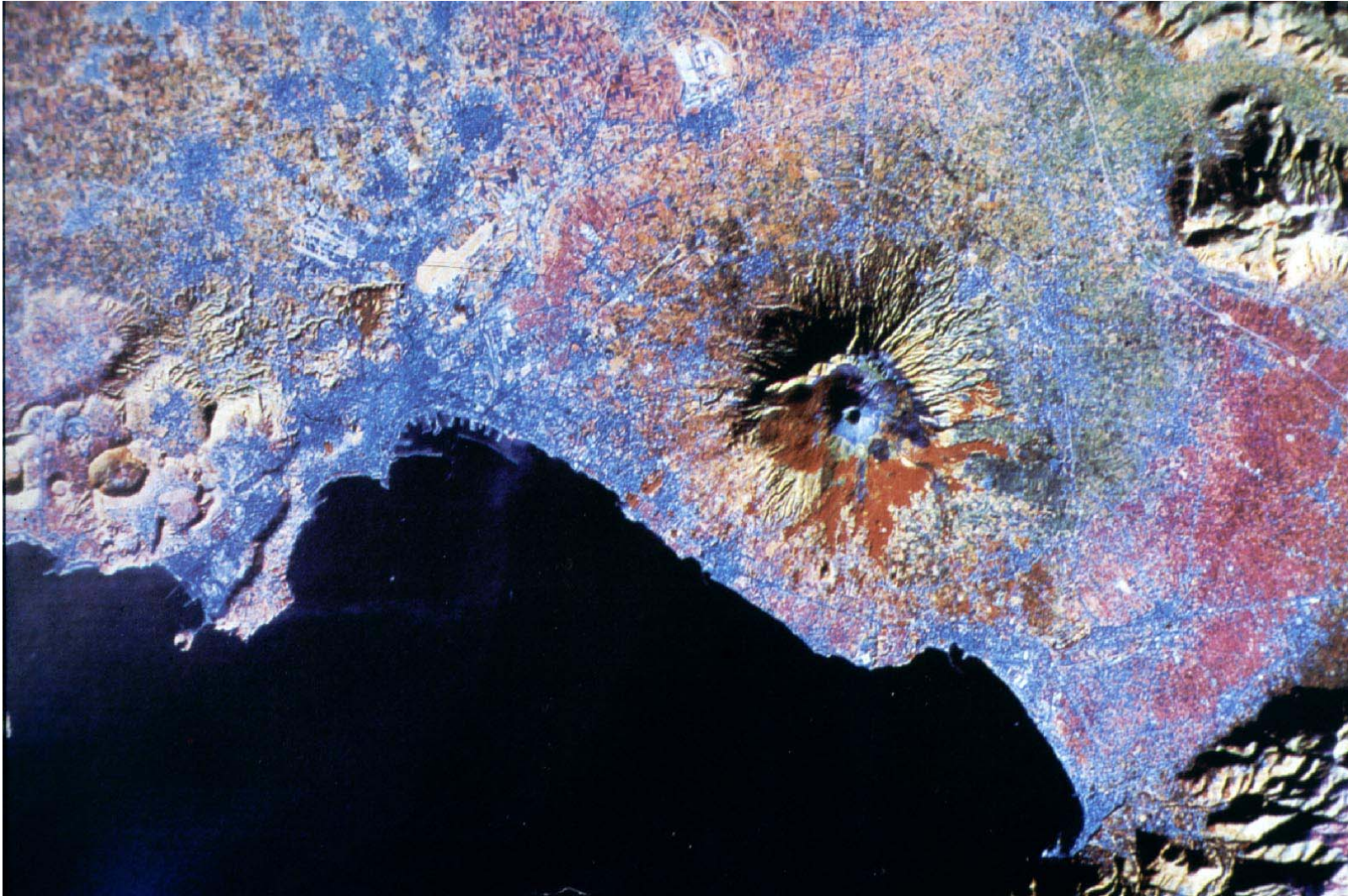
PELEAN
TYPE



PLINIAN
TYPE



Vesuvius (Italy)



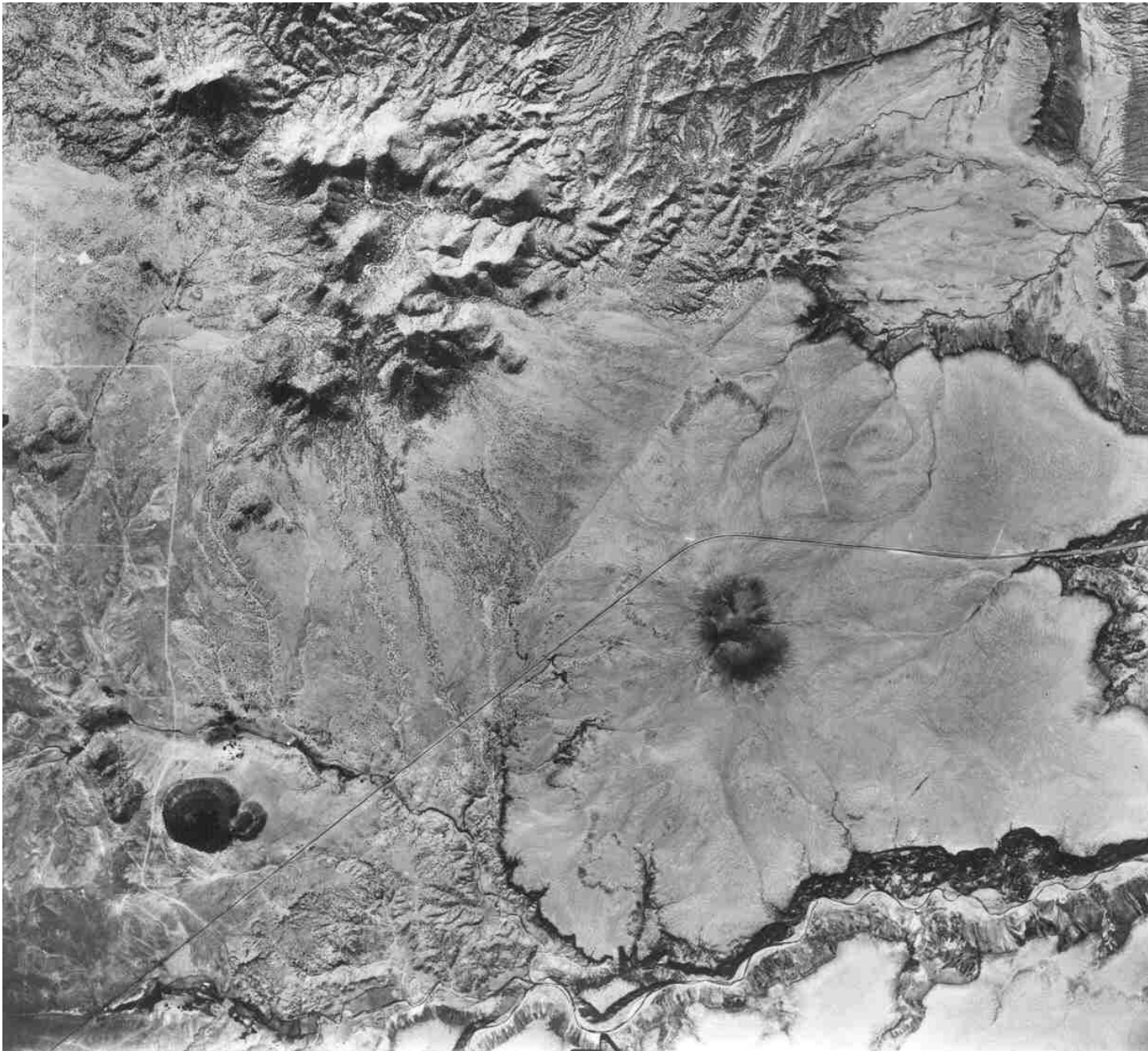
Volcanoes along the East African Rift Valley



Shield volcanoes

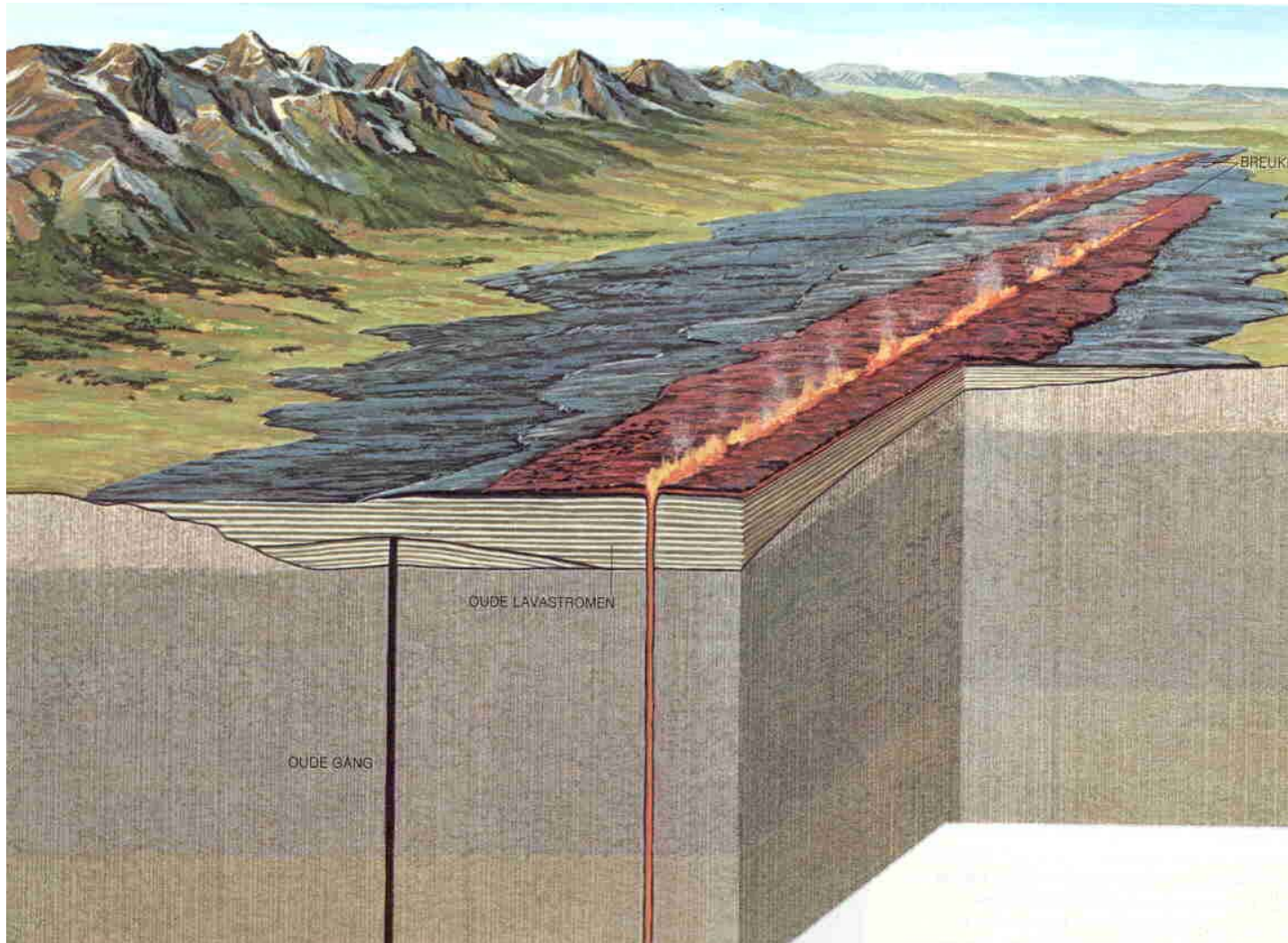
- **Basaltic lavas** are comparatively fluid, so they flow far when erupted. Consequently, the kind of volcano they produce is very **flat and low** in relation to its diameter.
- Though the individual lava flows may be thin, the buildup of **hundreds or thousands of flows** over time can produce quite large volcanic structures.





**Basaltic
lava
outflow
from
central
eruption
point**

Fissure eruption: quiet outflow of basaltic lava > lava fields





Cinder cone with lava flows.

Parícutin, Mexico

Cinder cone: Parícutin (Mexico)



Complex of cones

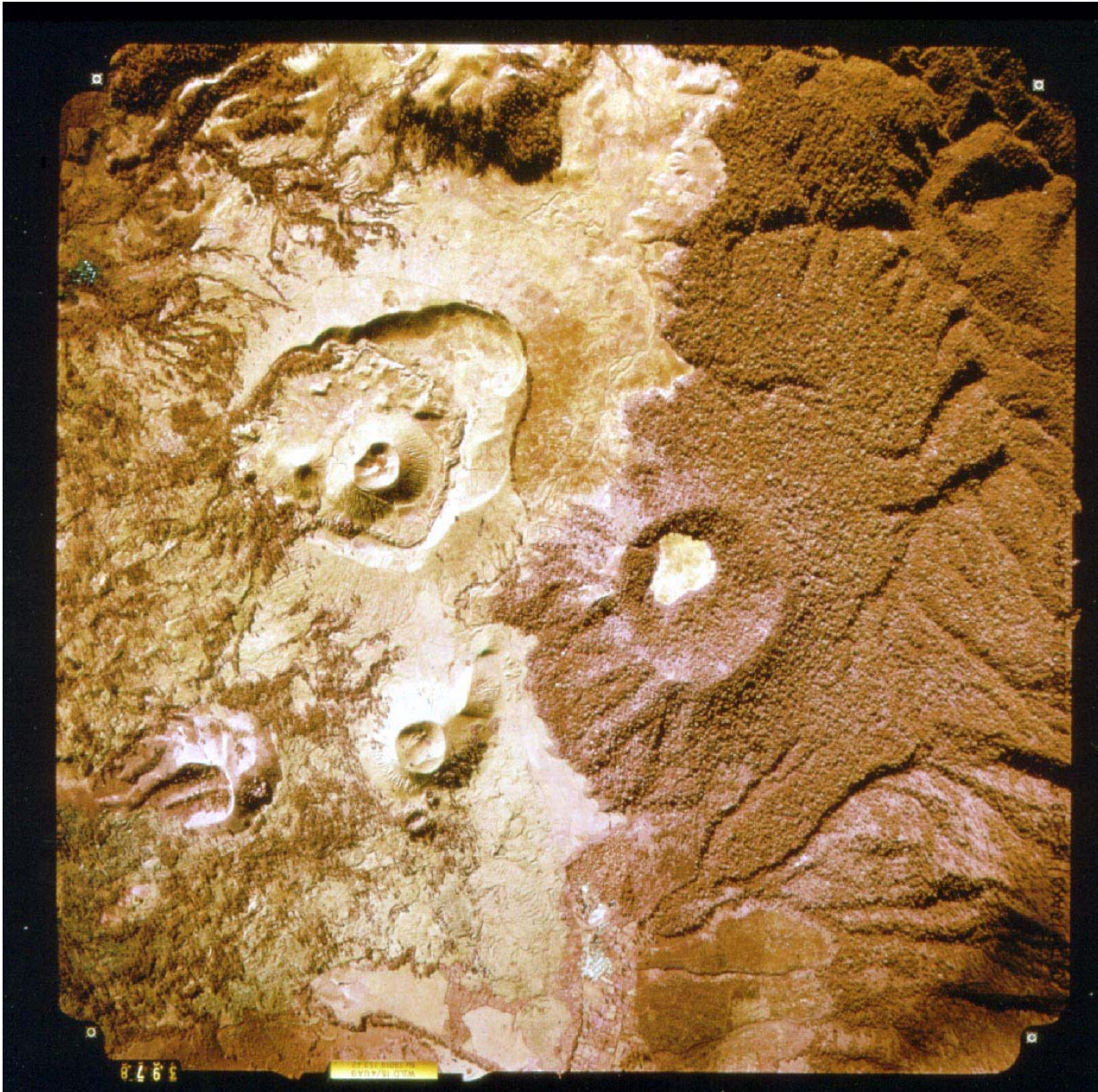


Tengger, East Java, Indonesia



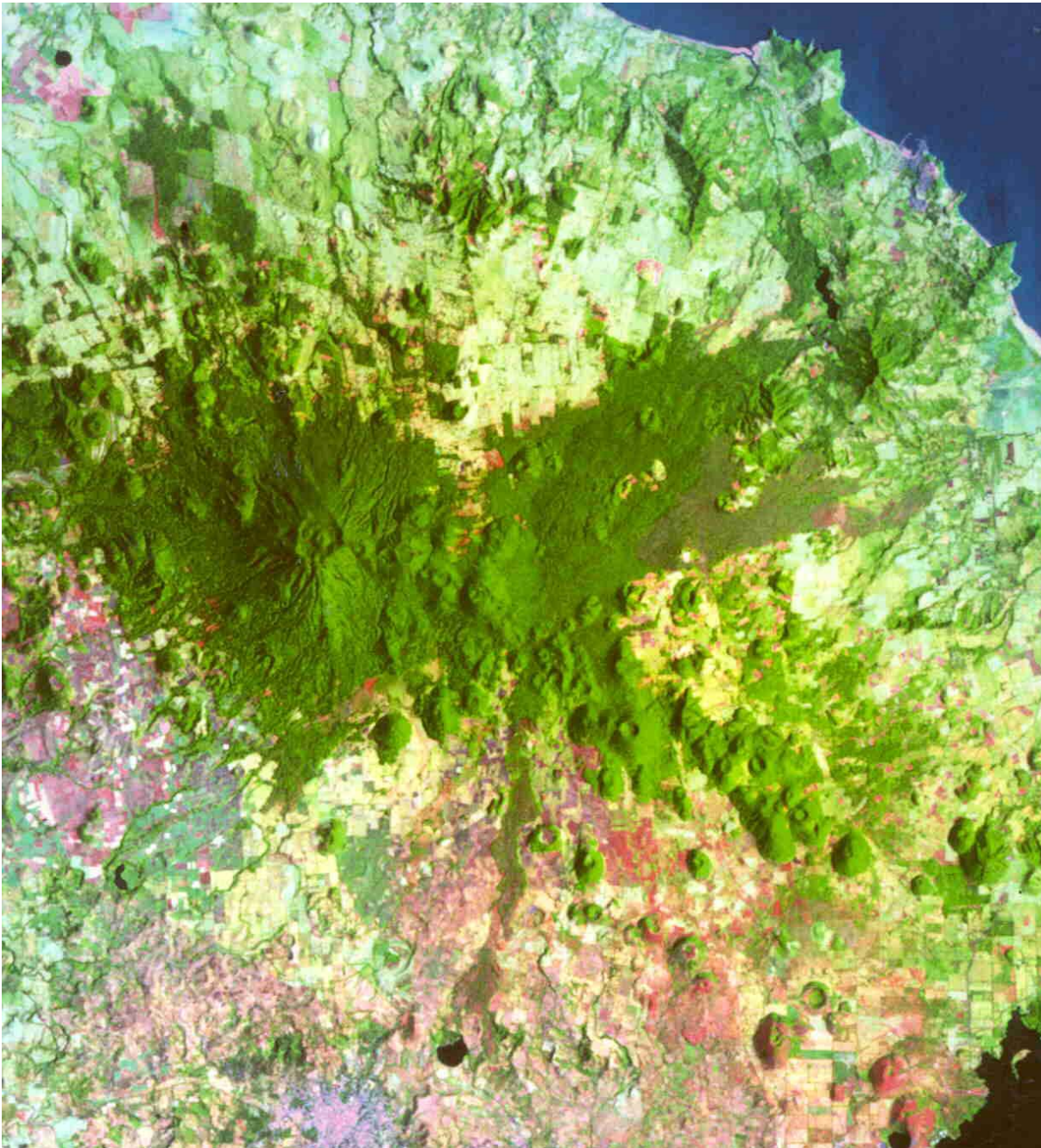
**Complex of
cinder
cones, of
different
ages**

**Tengger,
Java,
Indonesia**



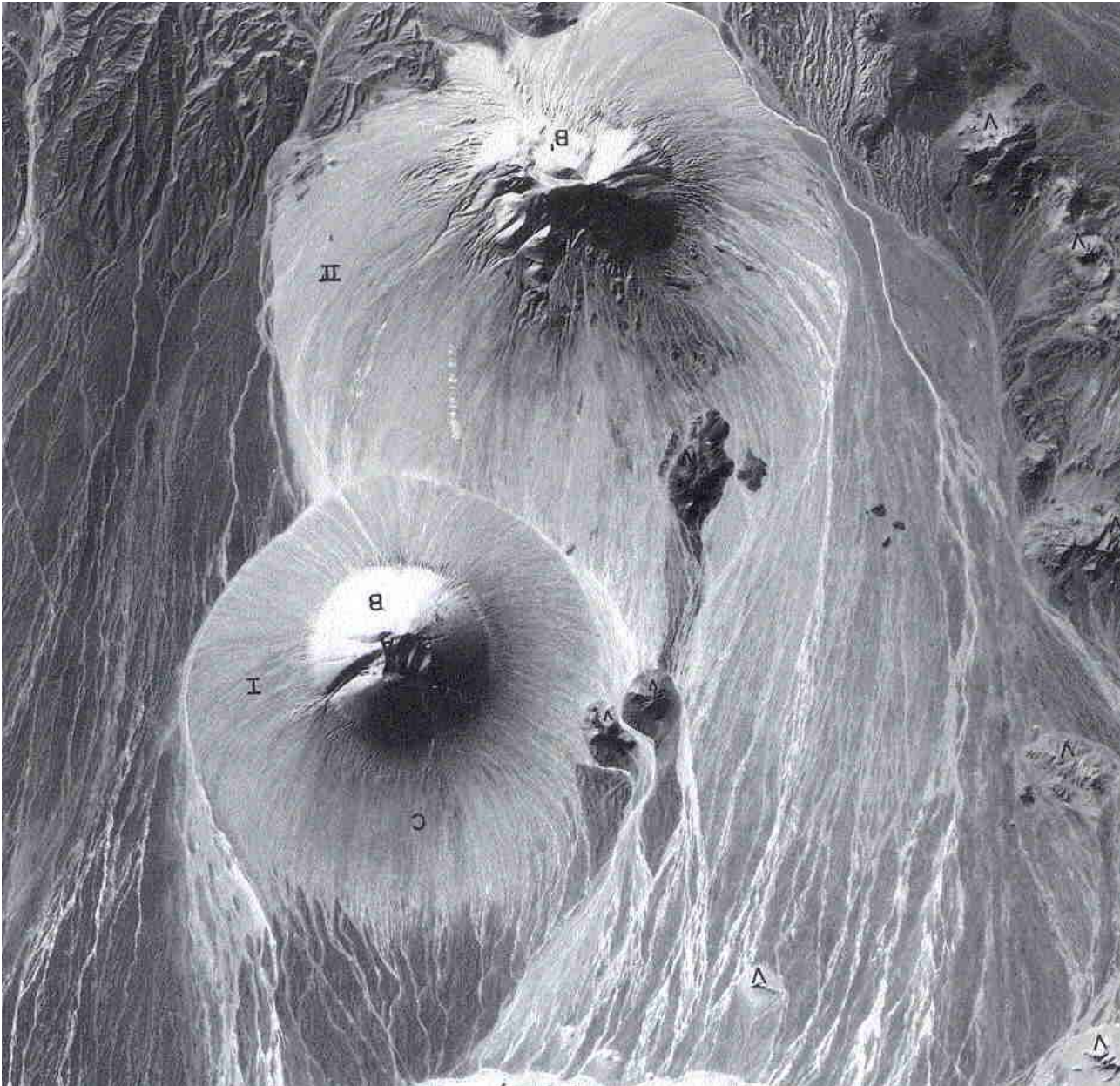
Cinder cones and example of subsidence

**Idjen,
Indonesia**



Cinder cones and strato volcano.

Mexico



Volcanoes in arid climate

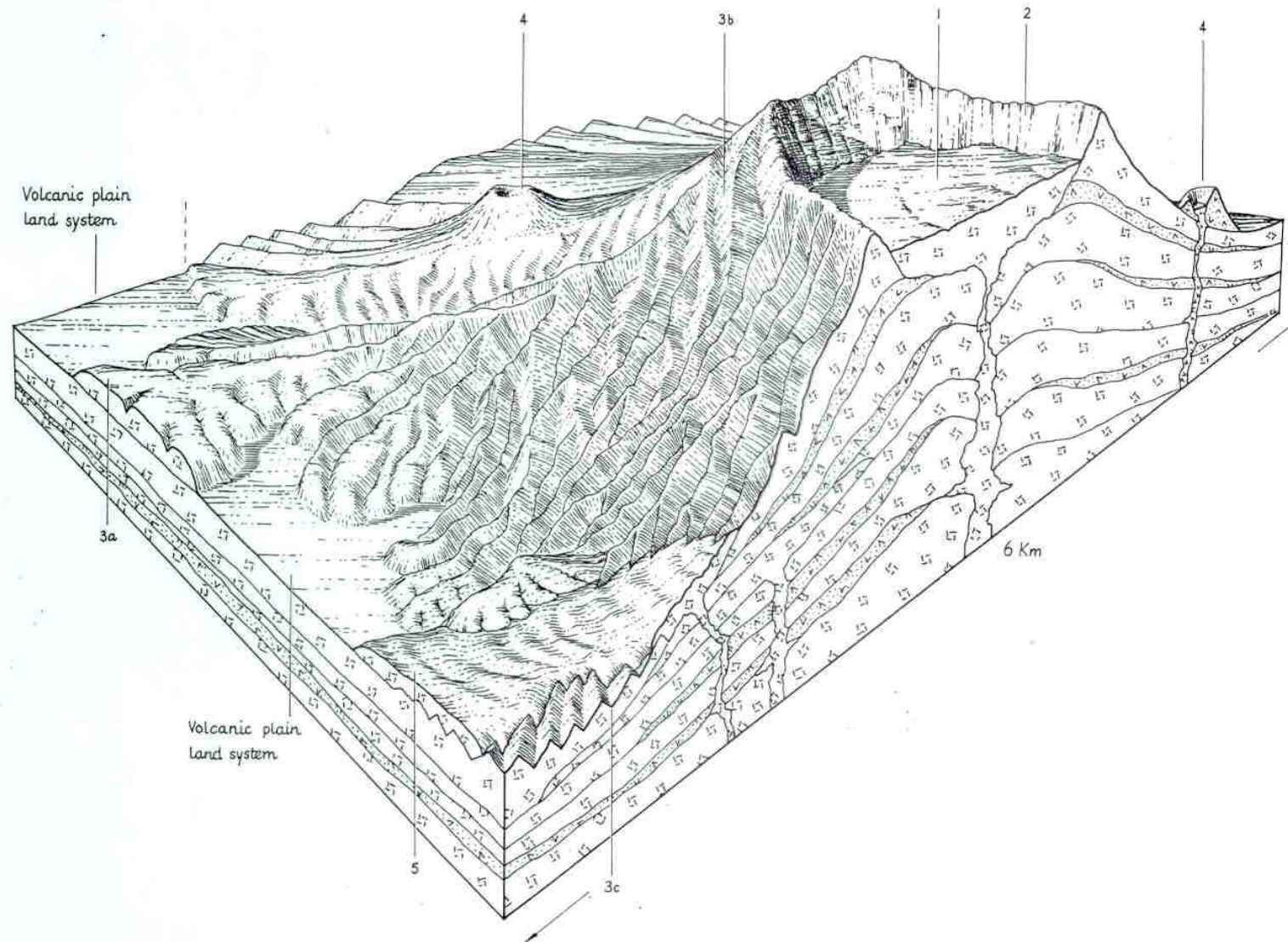
Iran

IRS-1C,
panchromatic,
5.8 m resolution

Composite or strato volcanoes

- ◆ **Explosive eruptions produce composite or strato volcanoes. These cones usually steepen towards the summit**

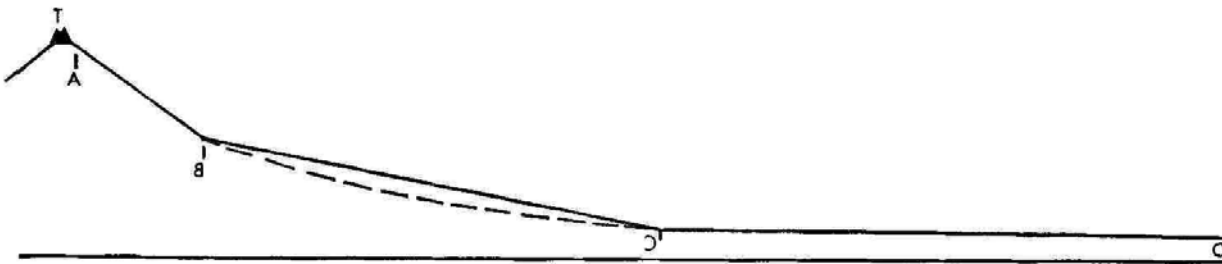
Strato volcano



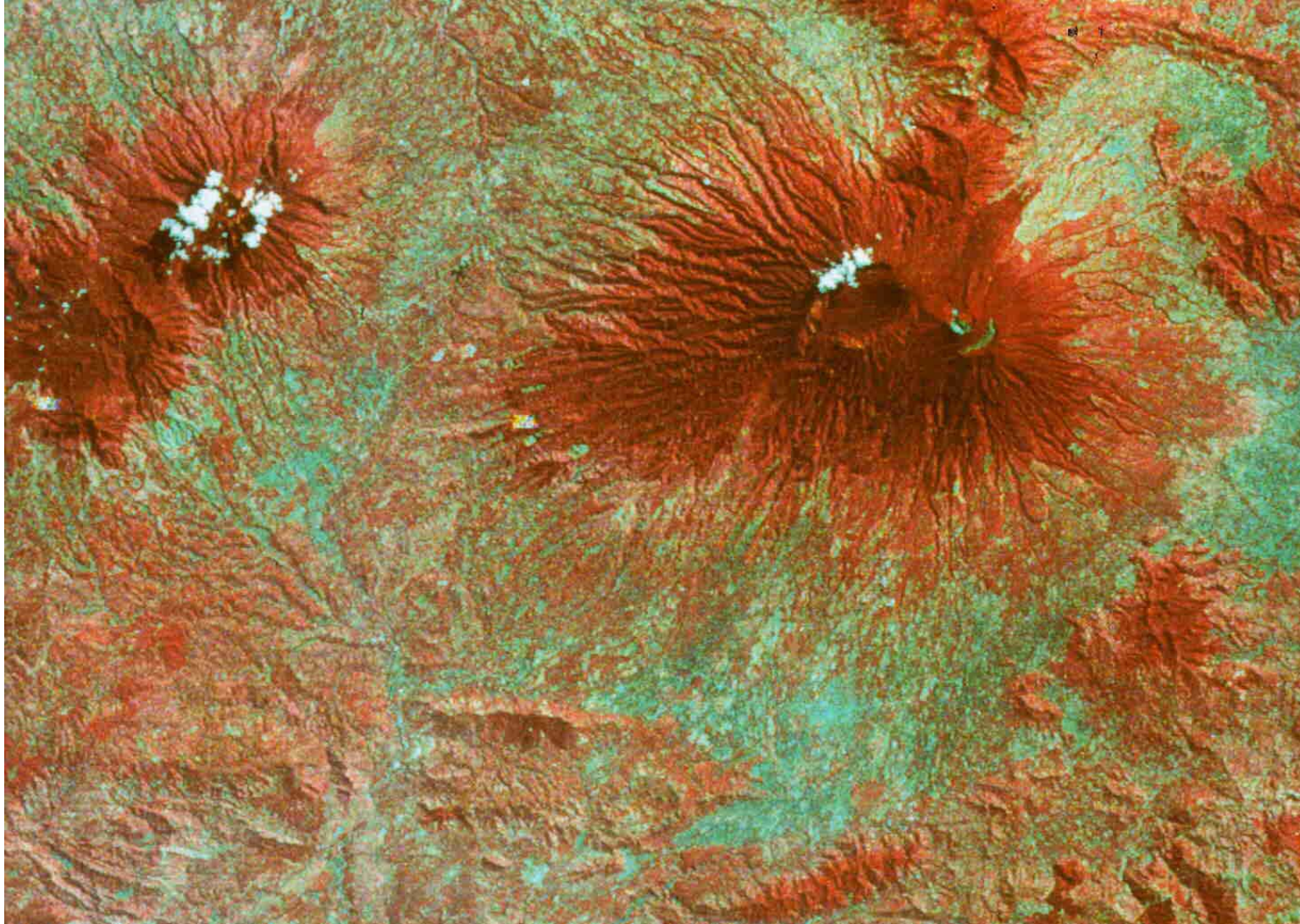


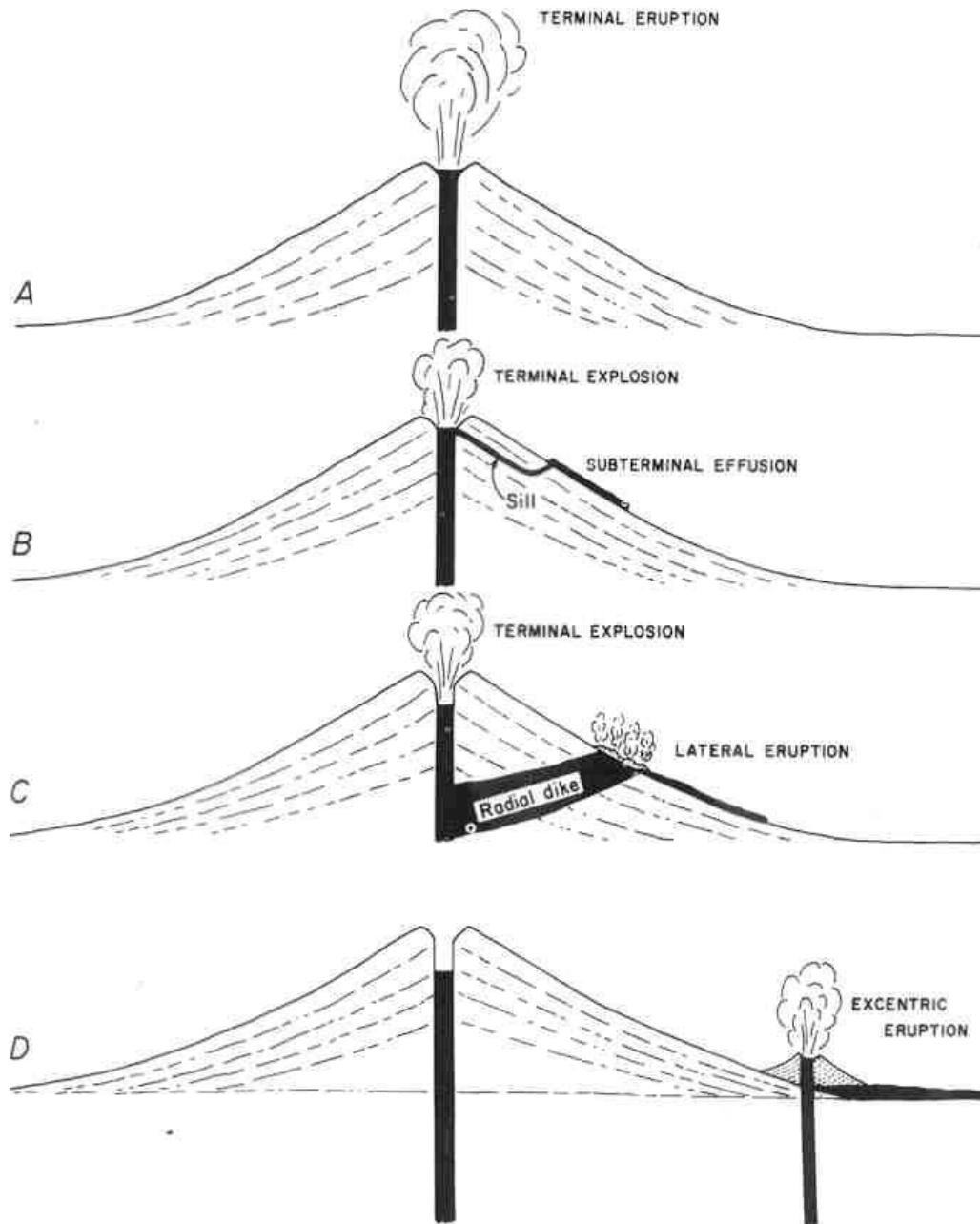
Slope facets of a strato volcano

**Semeru,
Indonesia**



Strato volcanoes (Java)



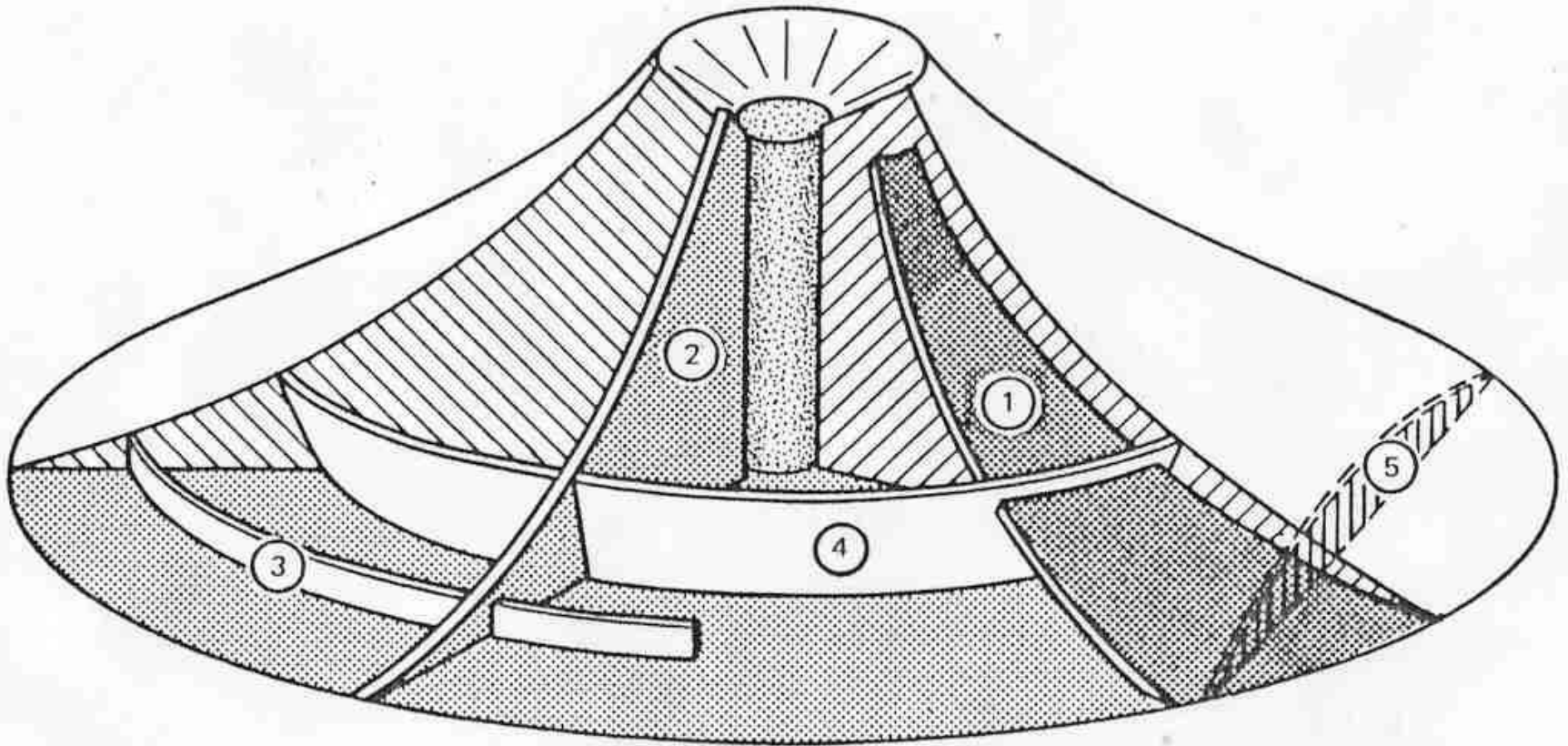


Type and location of eruption influence the morphology of the volcano and the hazard distribution

Secondary eruption points



Sills and dikes in a volcano



1. Mantle sill or buried flow, 2. Radial dike, 3. Ring dike, 4. Cone sheet, 5. Peripheral dike

Destruction of cone

**Mount St. Helens
(USA), before and
after the eruption of
March 1980**



Large crater in the summit



Raung, East Java, Indonesia

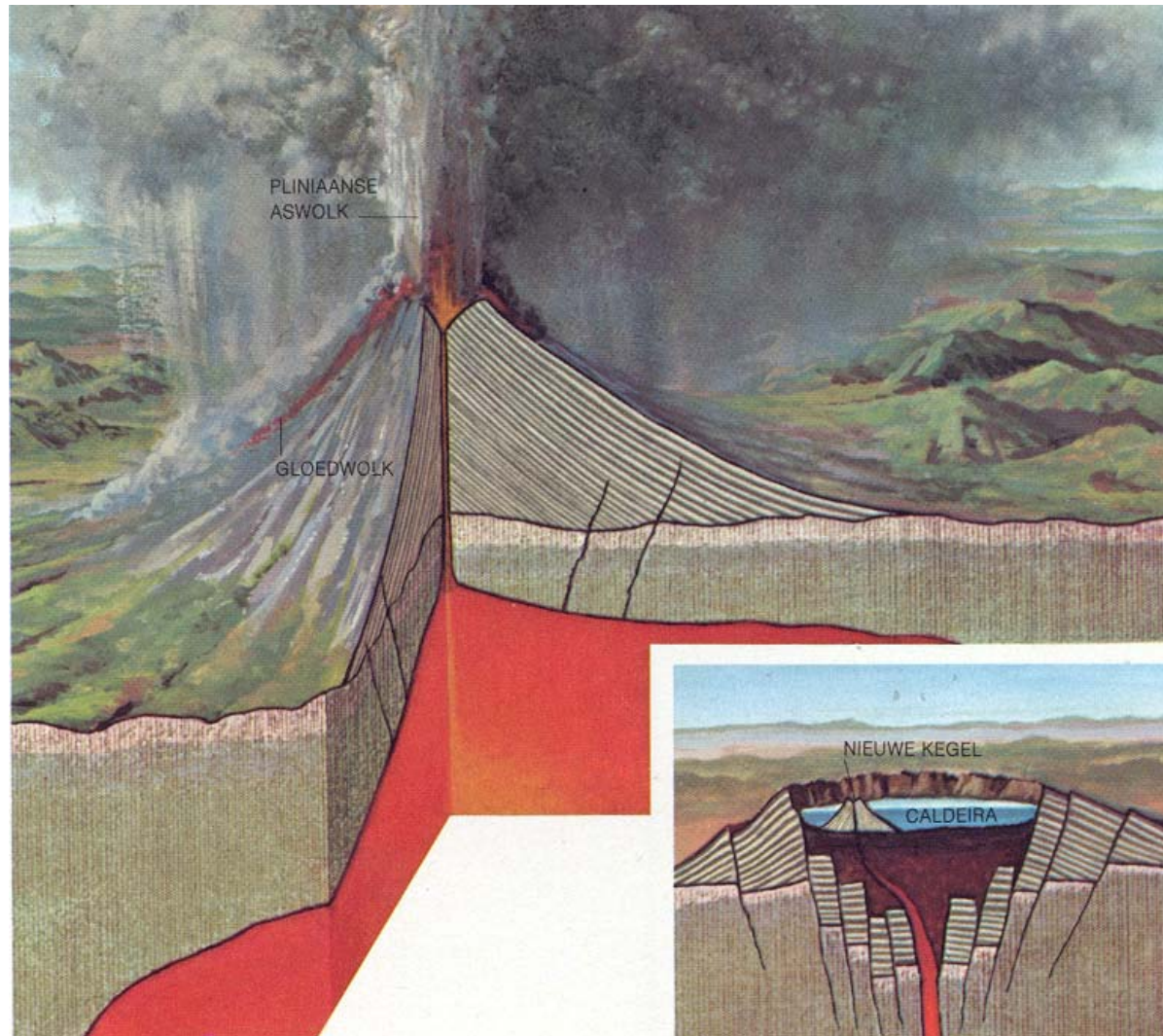


**Small
caldeira
with new
cone**

**Rindjani,
Indonesia**



Caldeira formation

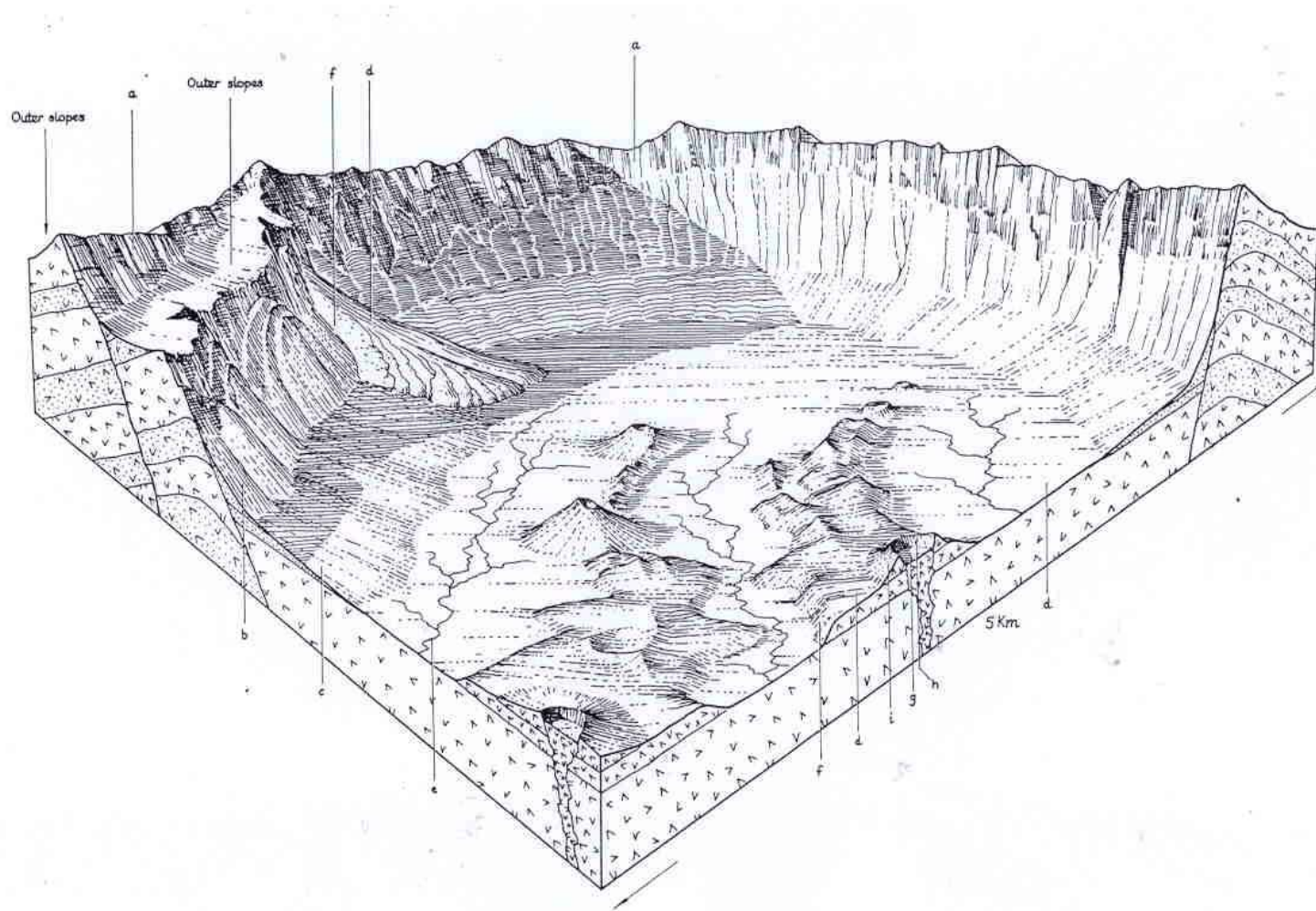


Caldeira with younger cones



Idjen, East Java, Indonesia

Caldera terrain features



Very viscous lava dome

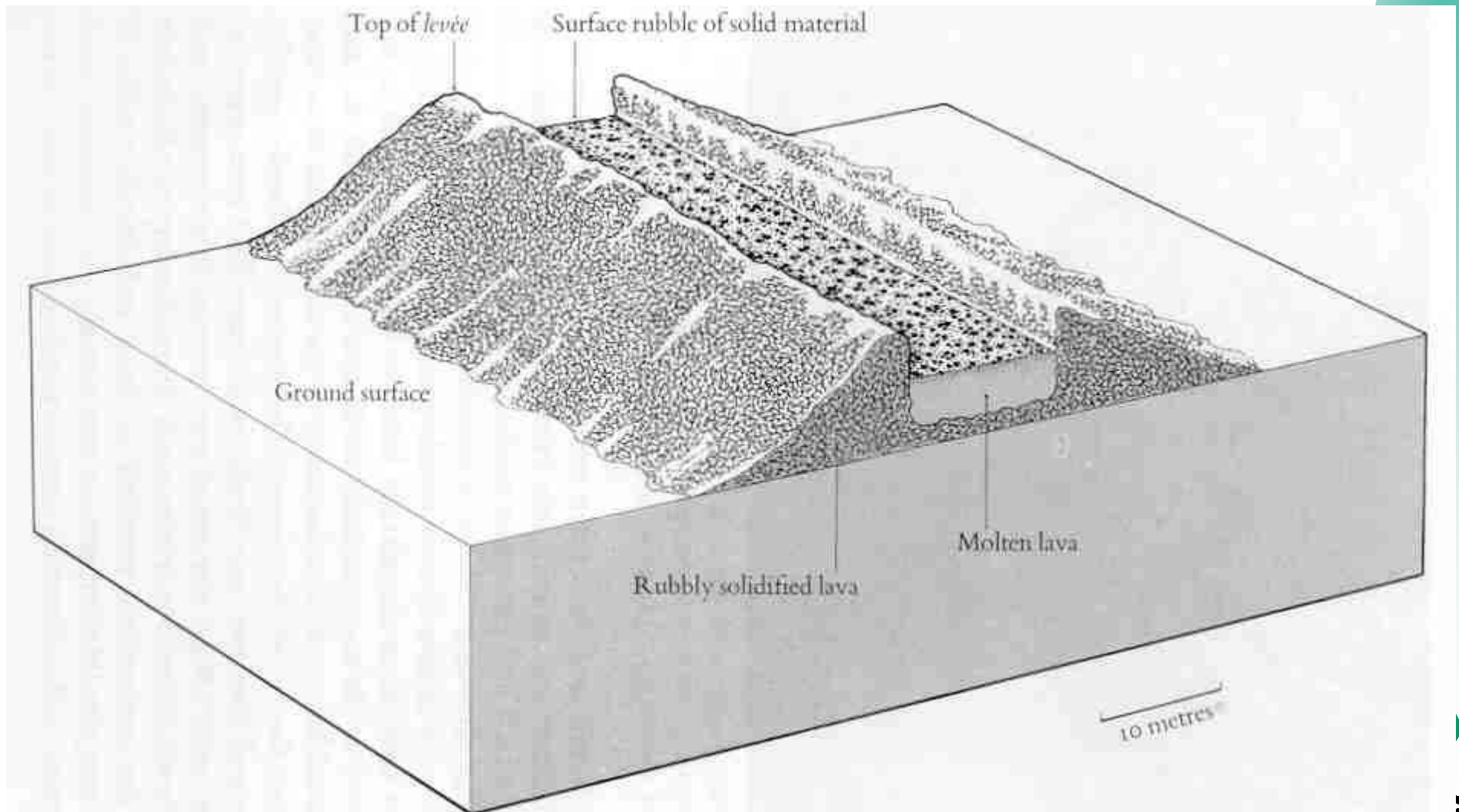


**Galunggung,
West-Java,
Indonesia**

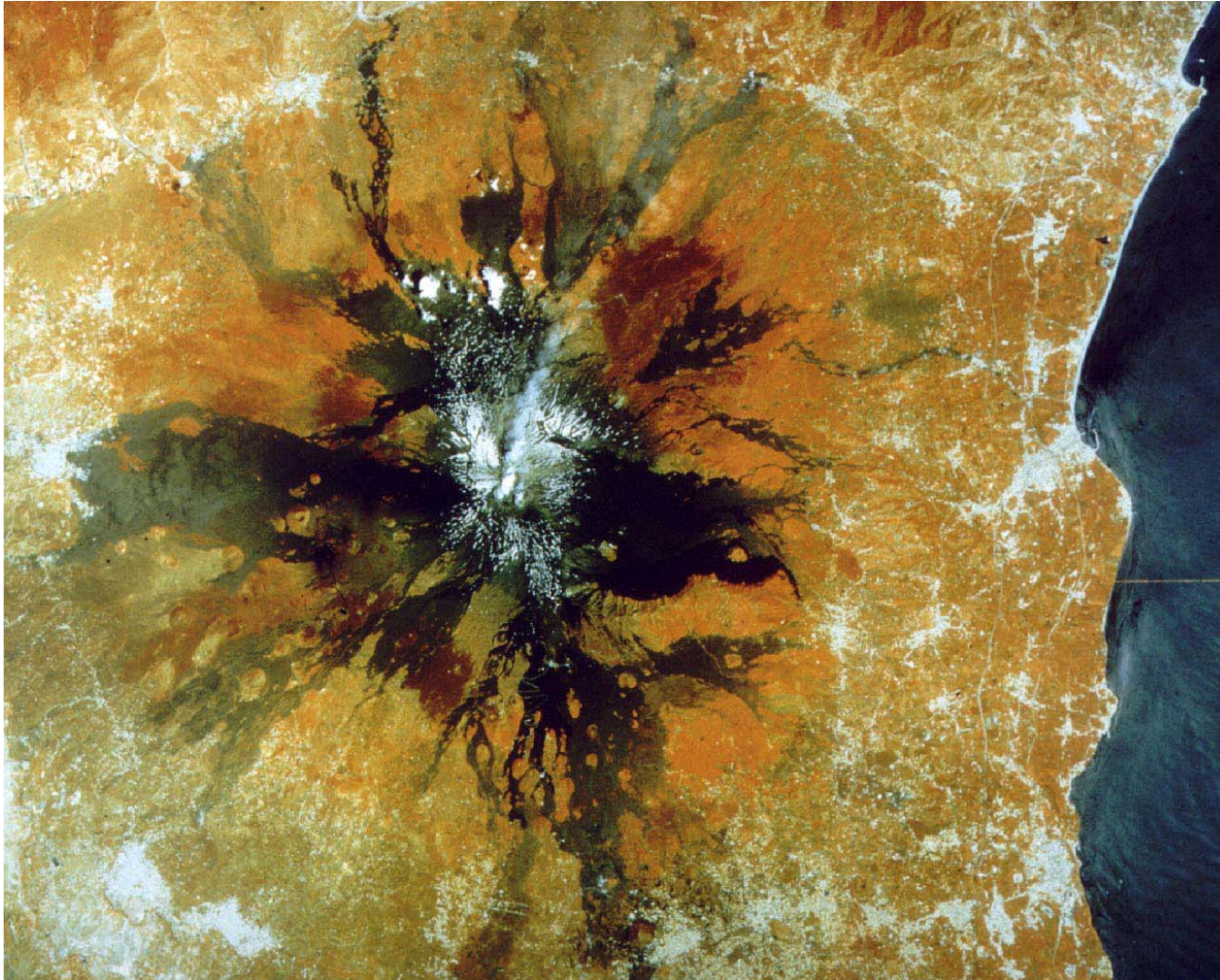
Lava flow (Etna, Italy)



Lava levees



Lava flows and parasitic cones



**Etna, Sicily,
Italy**

SPOT





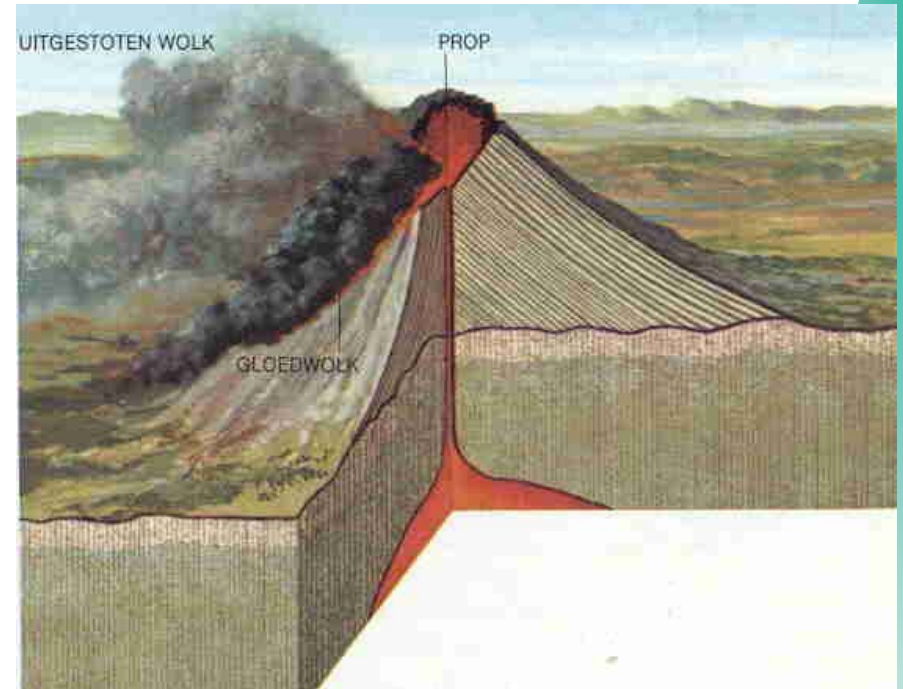
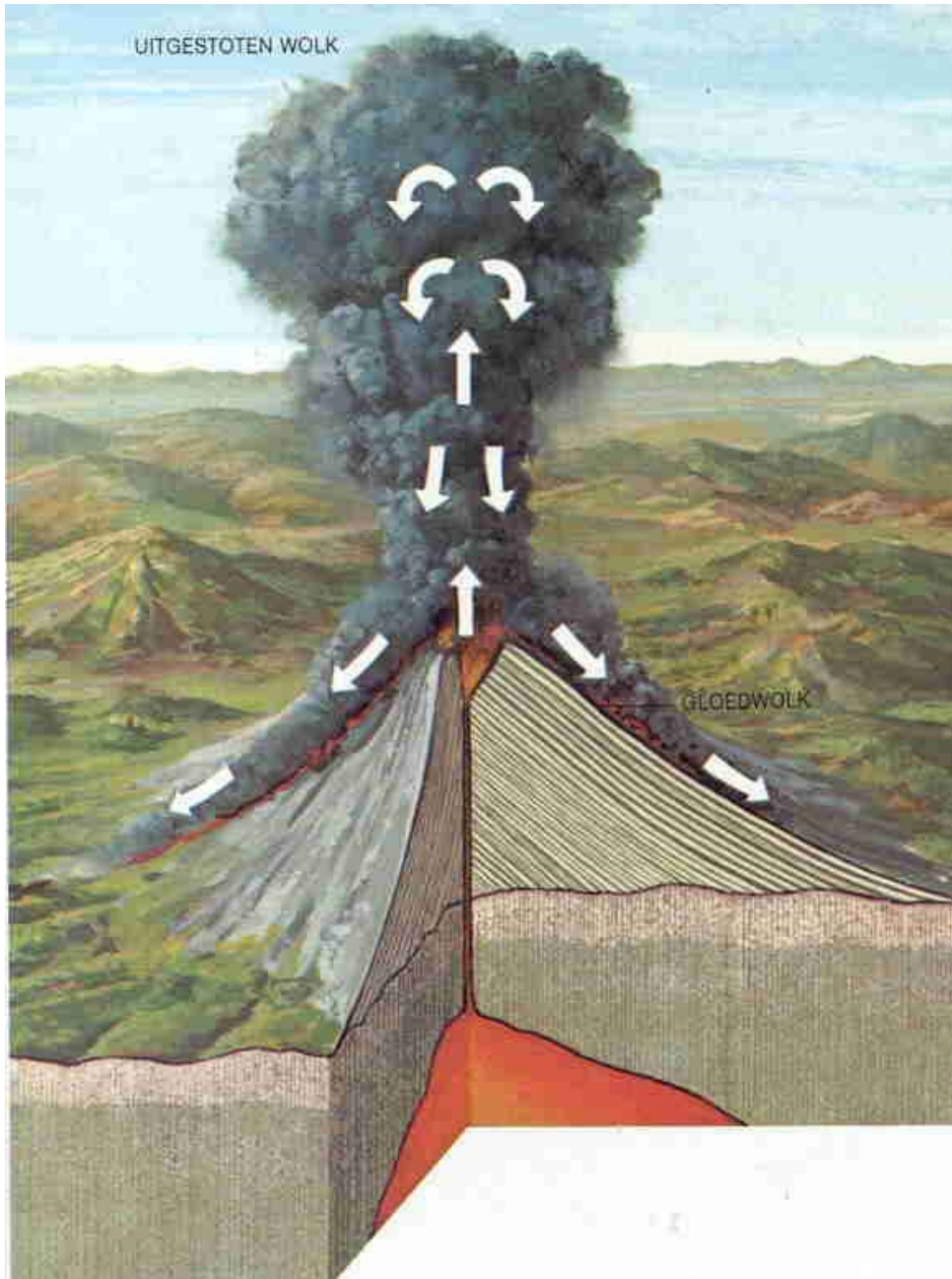
Lava flows from fissure eruption

**Mauna Loa & Kilauea,
Hawaii.**

Old and young lava flows



Batur, Bali, Indonesia



Glowing clouds

Ash deposits (air fall)



**Bandung,
Indonesia**

Lahars



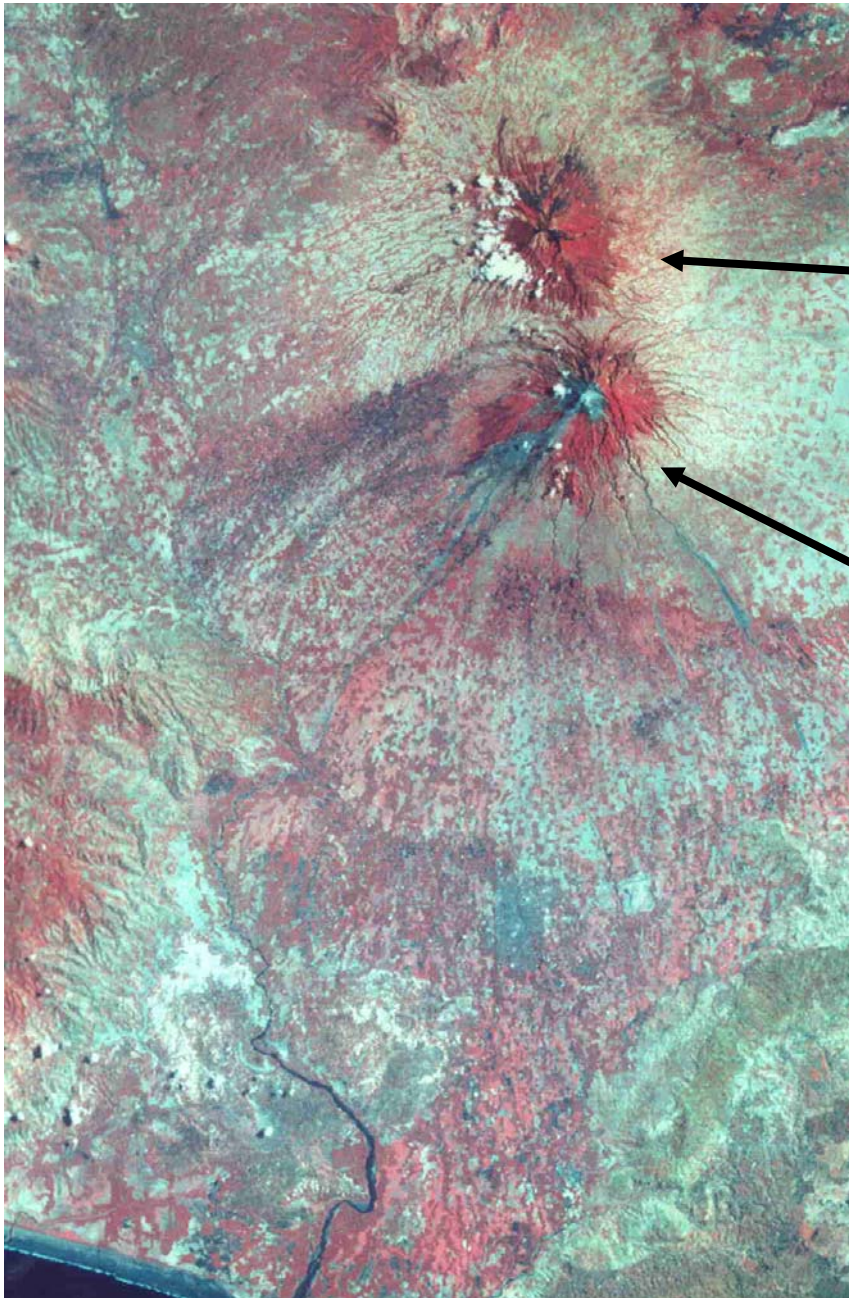
**Volcanic
mudflows
of
Galunggung,
Indonesia**



**Glowing
cloud -and
lahar
deposits,**

**Merapi,
Indonesia**





Dormant volcano:
Merbabu

Active volcano:
Merapi

Lahar flows (Landsat image)



Kelut, Java, Indonesia

Lahar deposits

Agung, Indonesia



Lahar field (Kelut, Indonesia)





**Valley, before
and after filling-
up by lahars**

**Pinatubo,
Philippines**



House before and after deposition of lahars

**Pinatubo,
Philippines**



Thickness of volcanic deposits: 6m. Age temple: 1000 years



**Merapi,
Java,
Indonesia**

Remnants of large volcanic landslide



Raung, East Java, Indonesia

Volcanic sector collapse



**Galunggung
Java,
Indonesia**

Crater open at one side

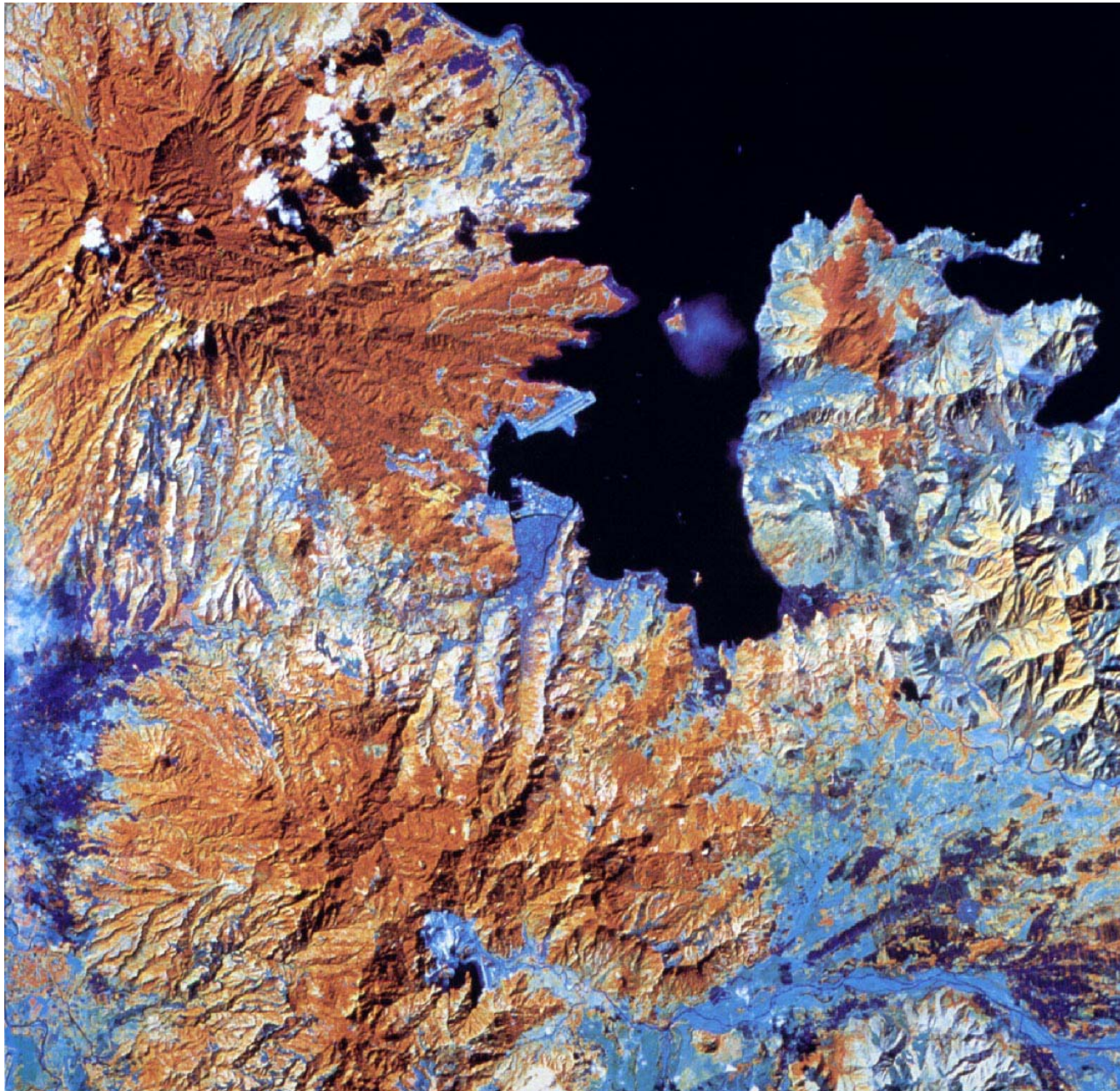


Galunggung, Java, Indonesia

Erosion of extinct volcano



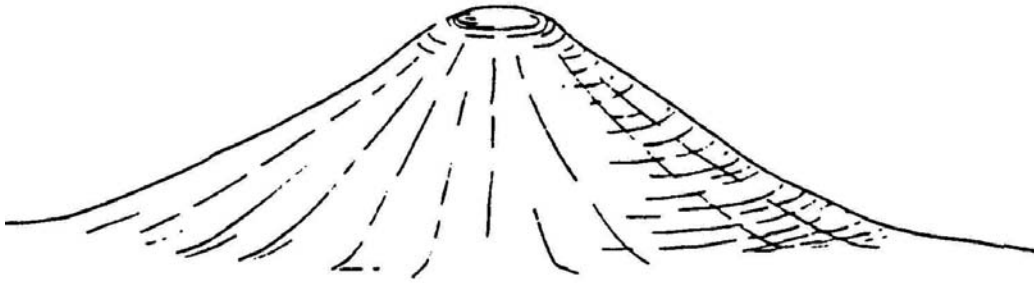
Baluran, East Java, Indonesia



Eroded volcanoes

Subic Bay,
Philippines

Stages in the erosion of a volcano



Erosional remnant of volcano



Muria, Central Java, Indonesia

Volcanic necks



**Erosional
remnants of
crater infills**

Cameroun