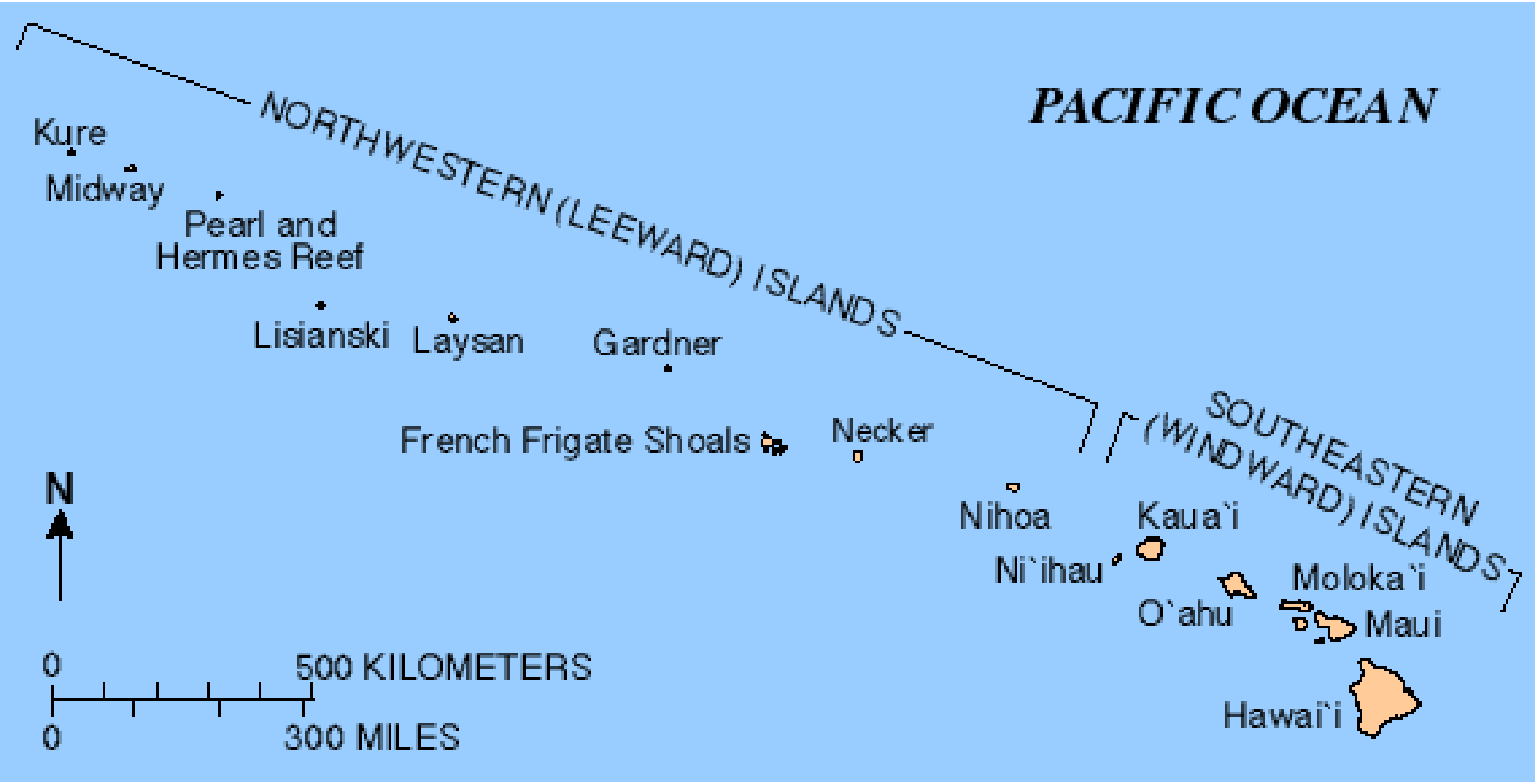
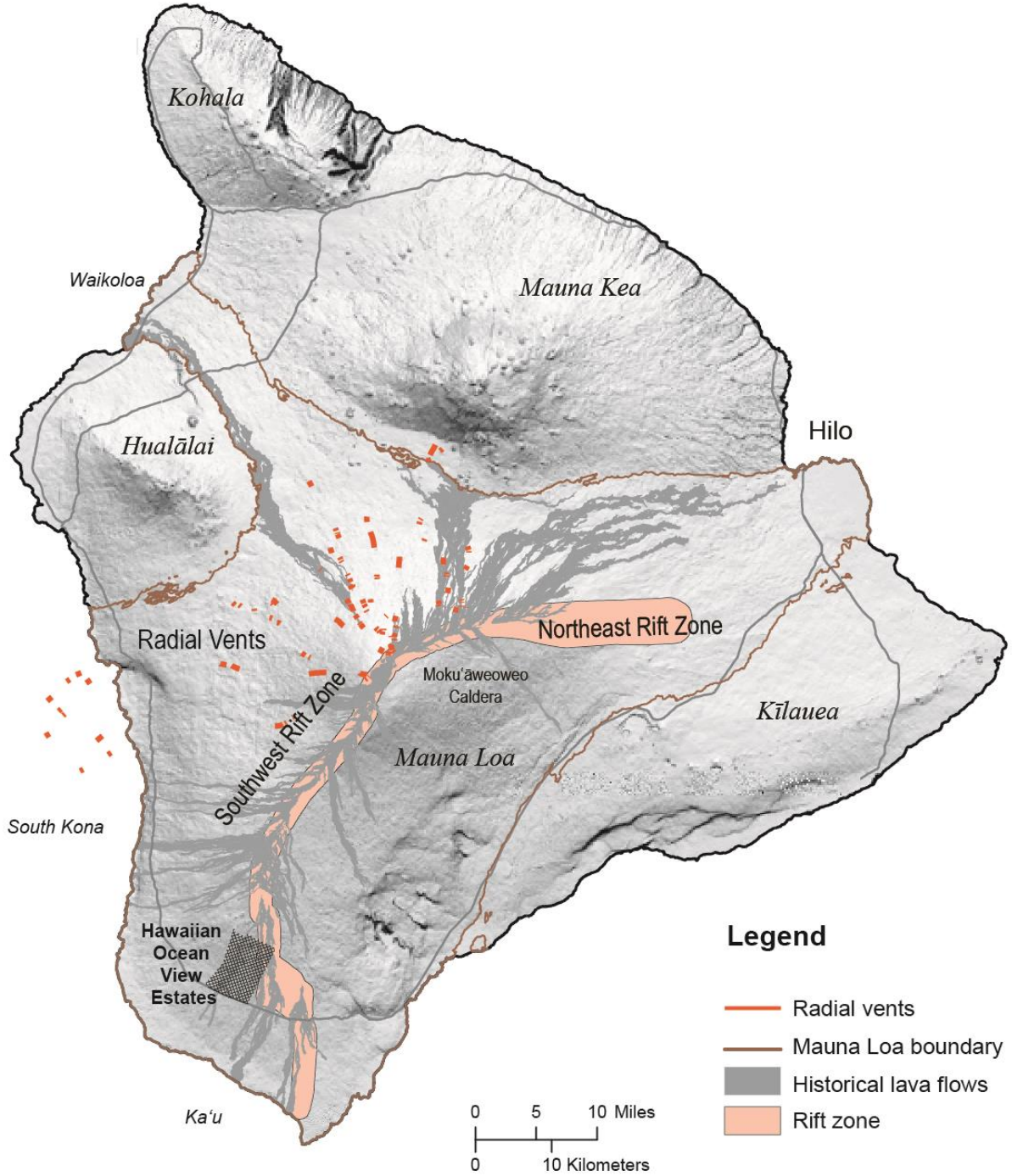
VOLCANOES

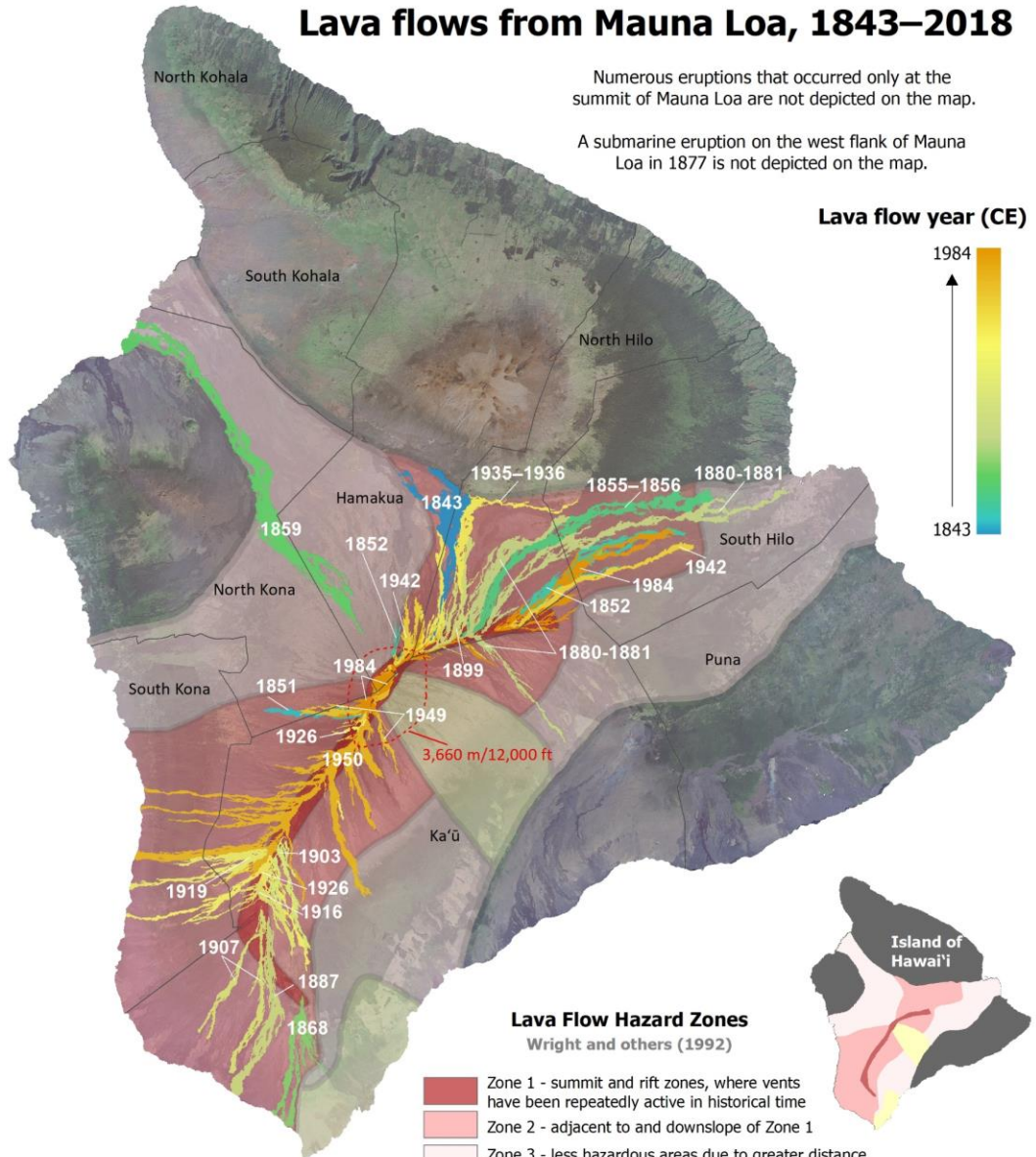
Have you heard of these volcanoes?


PACIFIC OCEAN
NORTHWESTERN (LEEWARD) ISLANDS
SOUTHEASTERN (WINDWARD) ISLANDS
Kure
Midway
Pearl and Hermes Reef
Lisianski
Laysan
Gardner
French Frigate Shoals
Necker
Nihoa
Kaua`i
Ni`ihau
O`ahu
Moloka`i
Maui
Hawai`i
N
0
500 KILOMETERS
0
300 MILES


PACIFIC OCEAN
Hawaiian Islands
PACIFIC OCEAN
Kilauea
Wainiha
Kapa'a
Līhu'e
Kekaha
Kaua'i
Pu'uwai
Ni'ihau
Kaulakahi Channel
Ka'ula
Haleiwa
O'ahu
Wahiawa
Kaneohe
Pearl City
Kailua
Ewa Beach
HONOLULU
Kaiwi Channel
Moloka'i
Maunaloa
Kualapuu
Kaunakakai
Maui
Lahaina
Lanai City
Kahului
Wailua
Kihei
Hana
Kaupo
Lāna'i
Kaho'olawe
Alenuihāhā Channel
Kapaau
Puako
Waimea
Honokaa
Mauna Kea
4,207 m
Hilo
Kailua-Kona
Mountain View
Captain Cook
Mauna Loa
4,169 m
Kalapana
Hawai'i
Naalehu


Kohala
Waikoloa
Mauna Kea
Hualālai
Hilo
Radial Vents
Northeast Rift Zone
Moku'āweoweo
Caldera
Southwest Rift Zone
Kīlauea
Mauna Loa
South Kona
Hawaiian
Ocean
View
Estates
Ka'u
0 5 10 Miles
0 10 Kilometers
Legend
Radial vents
Mauna Loa boundary
Historical lava flows
Rift zone

Lava flows from Mauna Loa, 1843–2018



Numerous eruptions that occurred only at the summit of Mauna Loa are not depicted on the map.

A submarine eruption on the west flank of Mauna Loa in 1877 is not depicted on the map.

Lava flow year (CE)

1984

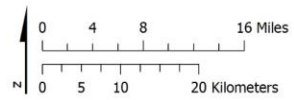
1843

Lava Flow Hazard Zones

Wright and others (1992)

- Zone 1 - summit and rift zones, where vents have been repeatedly active in historical time
- Zone 2 - adjacent to and downslope of Zone 1
- Zone 3 - less hazardous areas due to greater distance from recently active vents and (or) because of topography
- Zone 6 - protected by topography

Lava flow hazard zone boundaries are approximate and gradational. They are not distinct as portrayed on the map.



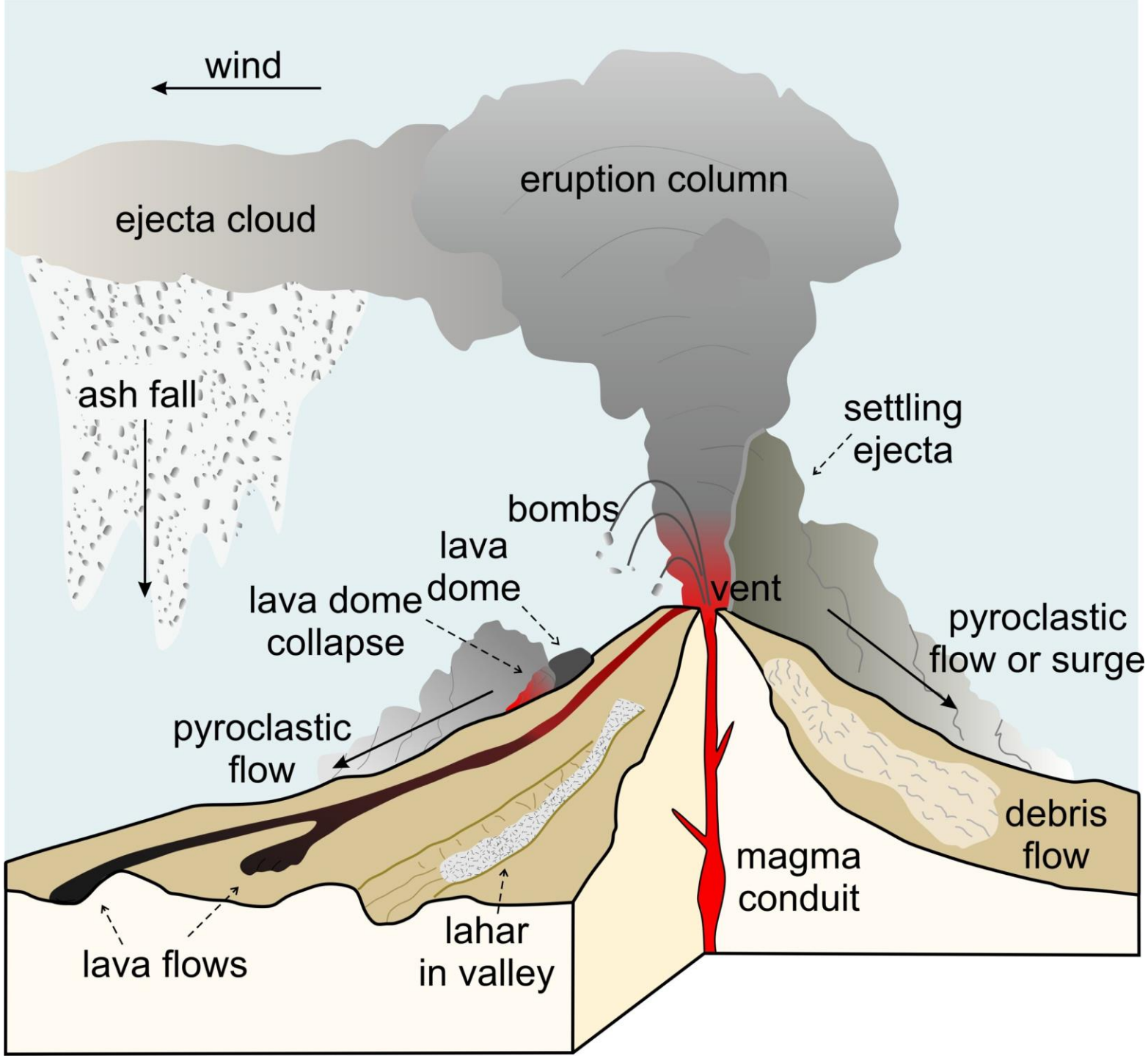
Base map source: LANDSAT 15 m satellite image obtained from Hawaii Statewide GIS Program

Lava flow polygon data from Wolfe and Morris (1996) and unpublished HVO data.

Wolfe, E.W., and Morris, J., 1996, Geologic Map of the Island of Hawaii: U.S. Geological Survey IMAP 2524.
Wright T.L., Chun J.Y., Esposo J., Heliker C., Hodge J., Lockwood J.P., and Vogt S.M., 1992, Map showing lava-flow hazard zones, Island of Hawaii: US Geological Survey Miscellaneous Field Studies Map 2193.


Kilauea is erupting now!
https://www.usgs.gov/observatories/hvo

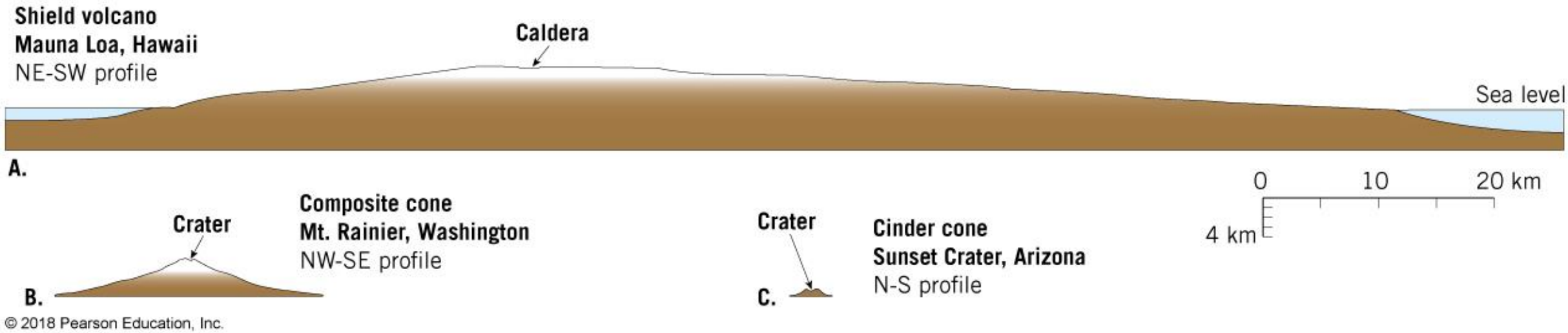
Terminology

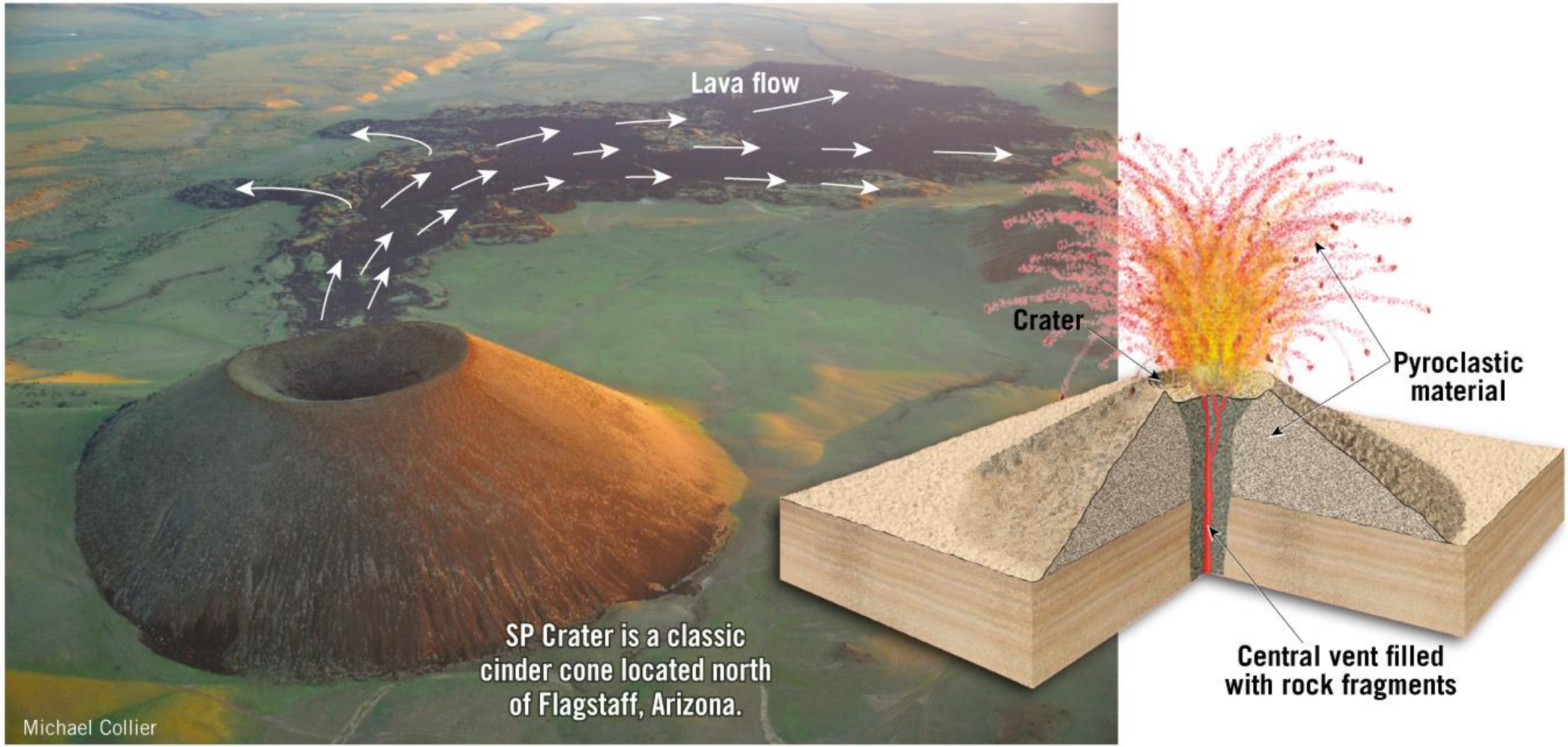


Pyroclastic Materials (Tephra)

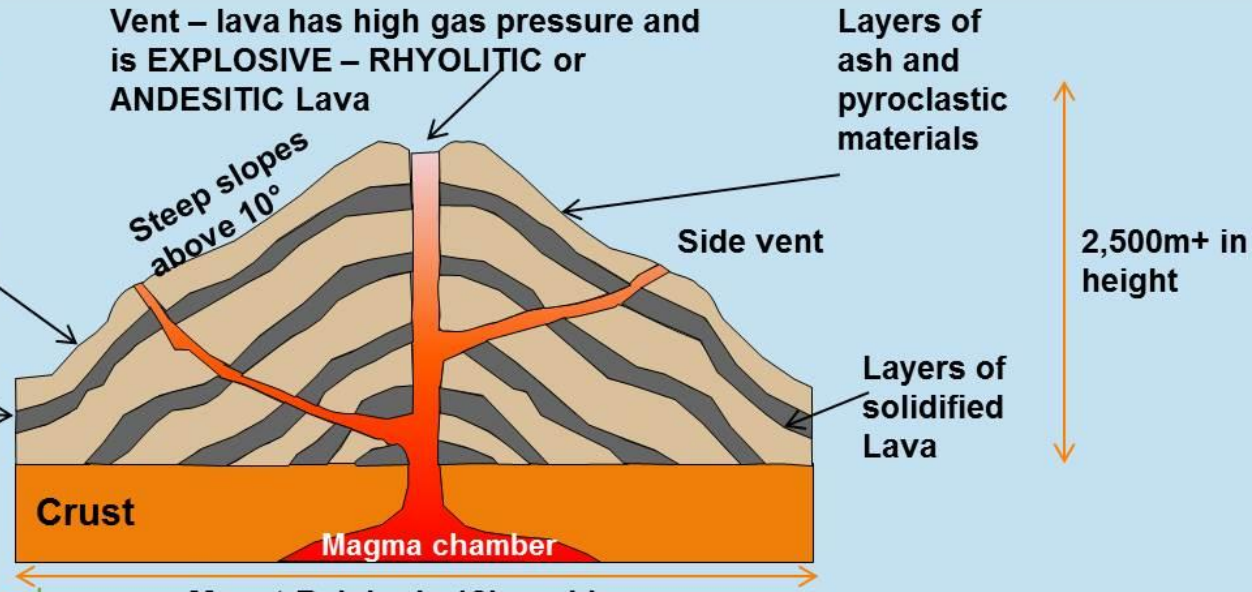
Particle name	Particle size	Image
Volcanic ash*	Less than 2 mm (0.08 inch)	
Lapilli (Cinders)	Between 2 mm and 64 mm (0.08–2.5 inches)	
Volcanic bombs	More than 64 mm (2.5 inches)	
Volcanic blocks		

*The term volcanic dust is used for fine volcanic ash less than 0.063 mm (0.0025 inch).



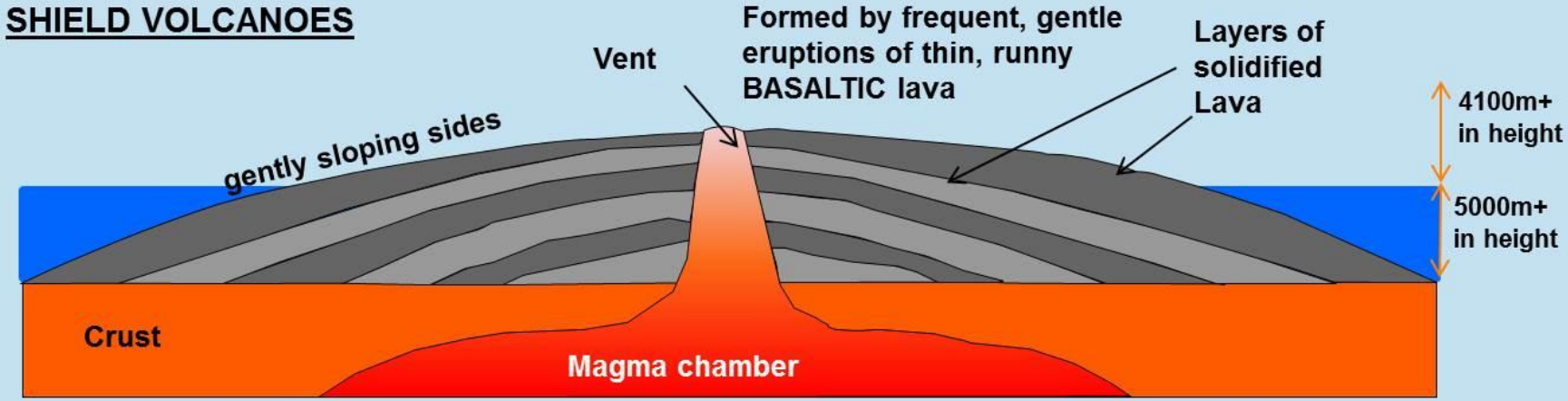


COMPOSITE OR STRATO VOLCANOES



Composite volcanoes are called so because they are COMPOSED of different materials and are usually found at destructive or compressional boundaries.

SHIELD VOLCANOES



Shield volcanoes are usually found at constructive boundaries or over hot spots.

Some eruptions are more dangerous than others? Why?

Volcanic Eruptions

- Type of Volcano: Cinder Cone, Composite (Stratovolcano), Shield Volcano
- Composition of Magma: Viscosity, Content of Dissolved Gases
- Origin of Magma: Deep vs Surface
- Proximity to Settlements: People, Buildings, etc.
- Infrastructure to Study the Volcano: Predictive Data

Properties of Magma Bodies with Differing Compositions

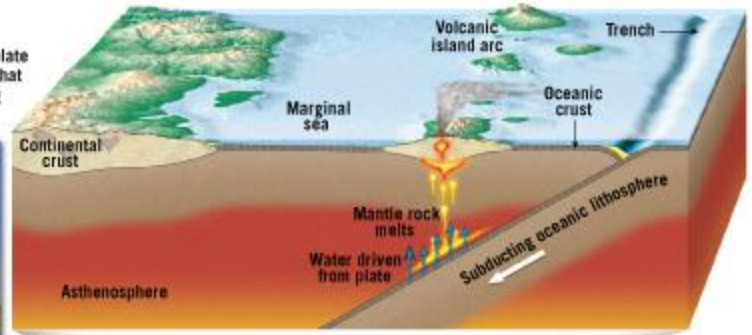
Composition	Silica Content (SiO_2)	Gas Content (% by weight)	Eruptive Temperature	Viscosity	Tendency to Form Pyroclastics	Volcanic Landform
Basaltic (MAFIC) High in Fe, Mg, Ca, low in K, Na	**Least** (~50%)	**Least** (0.5–2%)	**Highest** 1000–1250°C	**Least**	**Least**	Shield volcanoes, basalt plateaus, cinder cones
Andesitic (INTERMEDIATE) Varying amounts of Fe, Mg, Ca, K, Na	**Intermediate** (~60%)	**Intermediate** (3–4%)	**Intermediate** 800–1050°C	**Intermediate**	**Intermediate**	Composite cones
Rhyolitic/ Granitic (FELSIC) High in K, Na, low in Fe, Mg, Ca	**Most** (~70%)	**Most** (5–8%)	**Lowest** 650–900°C	**Greatest**	**Greatest**	Pyroclastic flow deposits, lava domes

A. Active aa flow overriding an older pahoehoe flow.

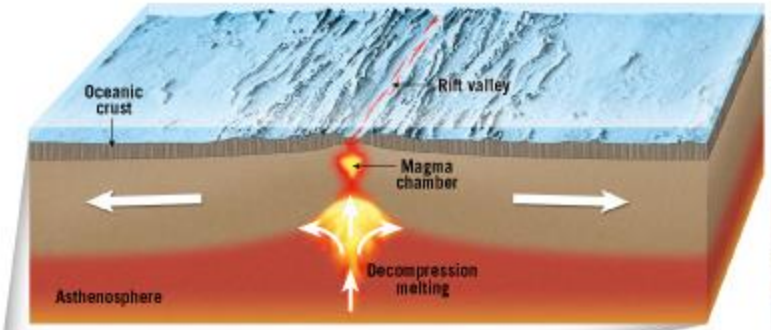
B. Pahoehoe flow displaying the characteristic ropy appearance.

A. Convergent Plate Volcanism When an oceanic plate subducts, melting in the mantle produces magma that gives rise to a volcanic island arc on the overlying oceanic crust.

Cleveland Volcano, Aleutian Islands (USGS)

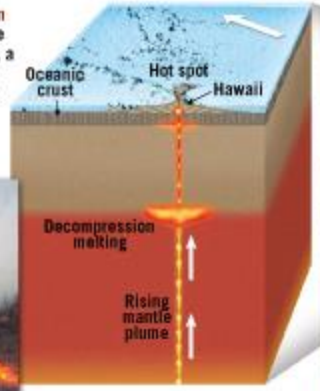


B. Divergent Plate Volcanism Along the oceanic ridge, where two plates are being pulled apart, upwelling of hot mantle rock creates new seafloor.

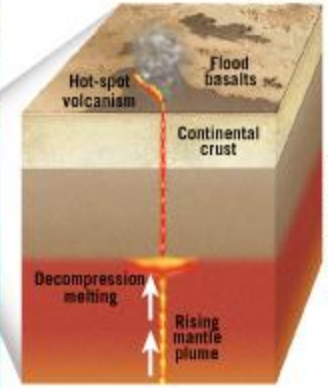


Iceland (S Jonasson/FLPA)

C. Intraplate Volcanism When an oceanic plate moves over a hot spot, a chain of volcanic structures such as the Hawaiian Islands is created.

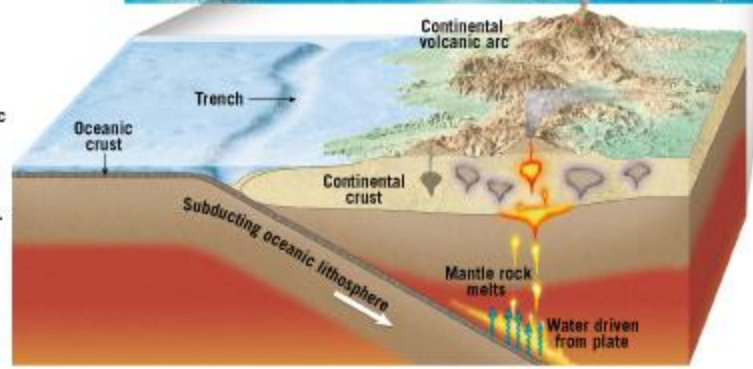


Kilauea, Hawaii (USGS)

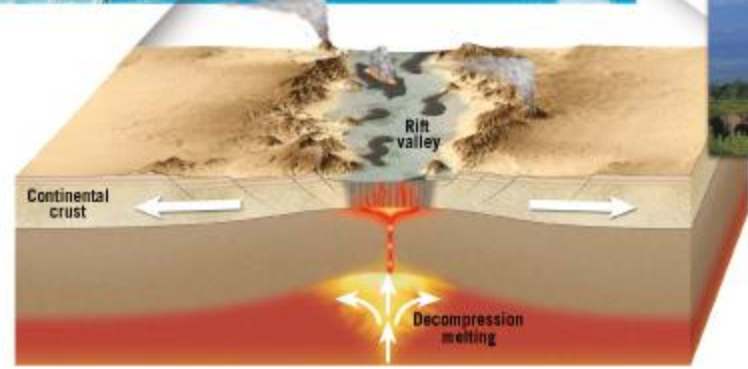


D. Intraplate Volcanism When a large mantle plume ascends beneath continental crust, vast outpourings of fluid basaltic lava like those that formed the Deccan Plateau may be generated.

E. Convergent Plate Volcanism When oceanic lithosphere descends beneath a continent, magma generated in the mantle rises to form a continental volcanic arc.



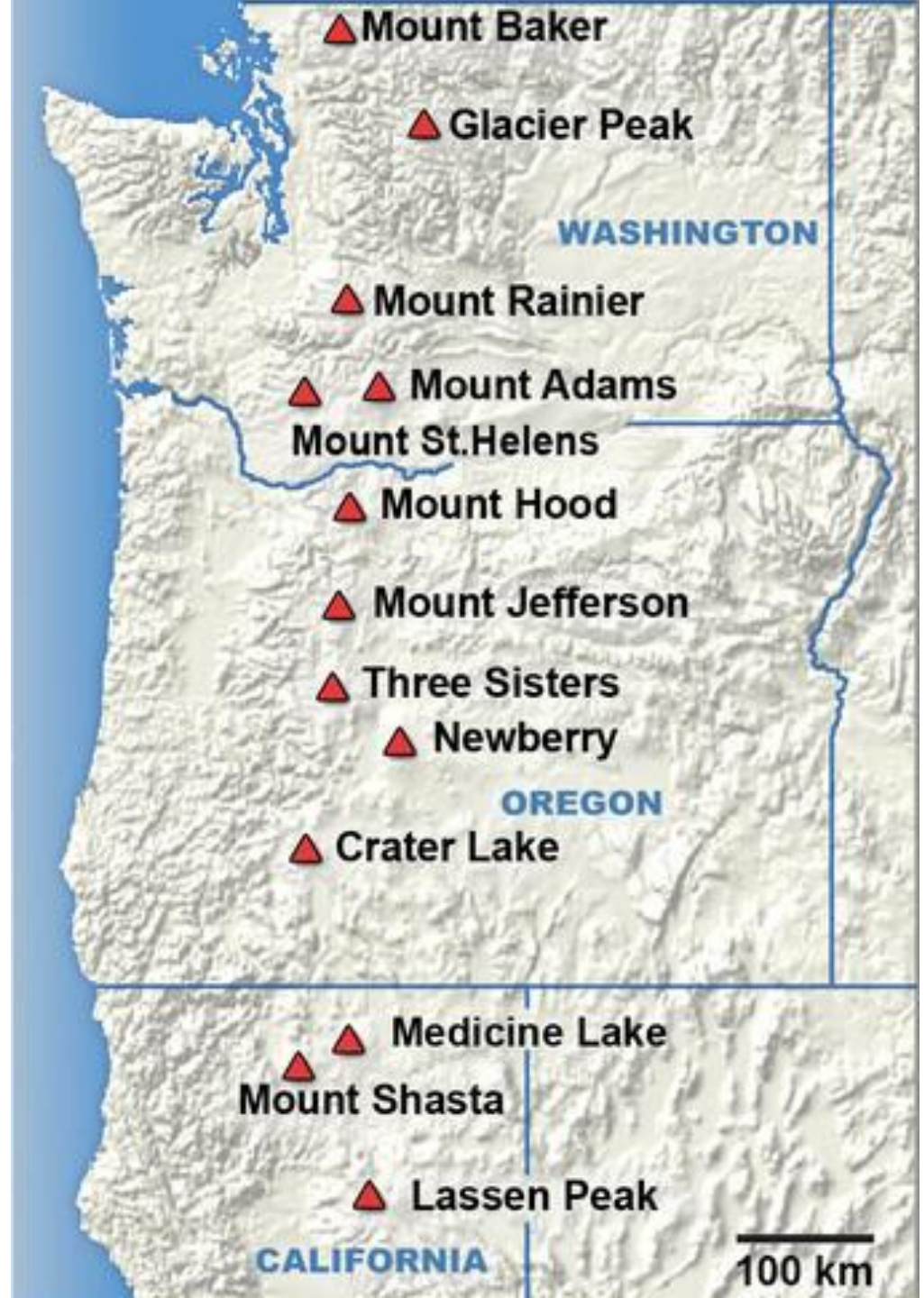
Mount Kilimanjaro, Africa (Corbis/Photolibrary)



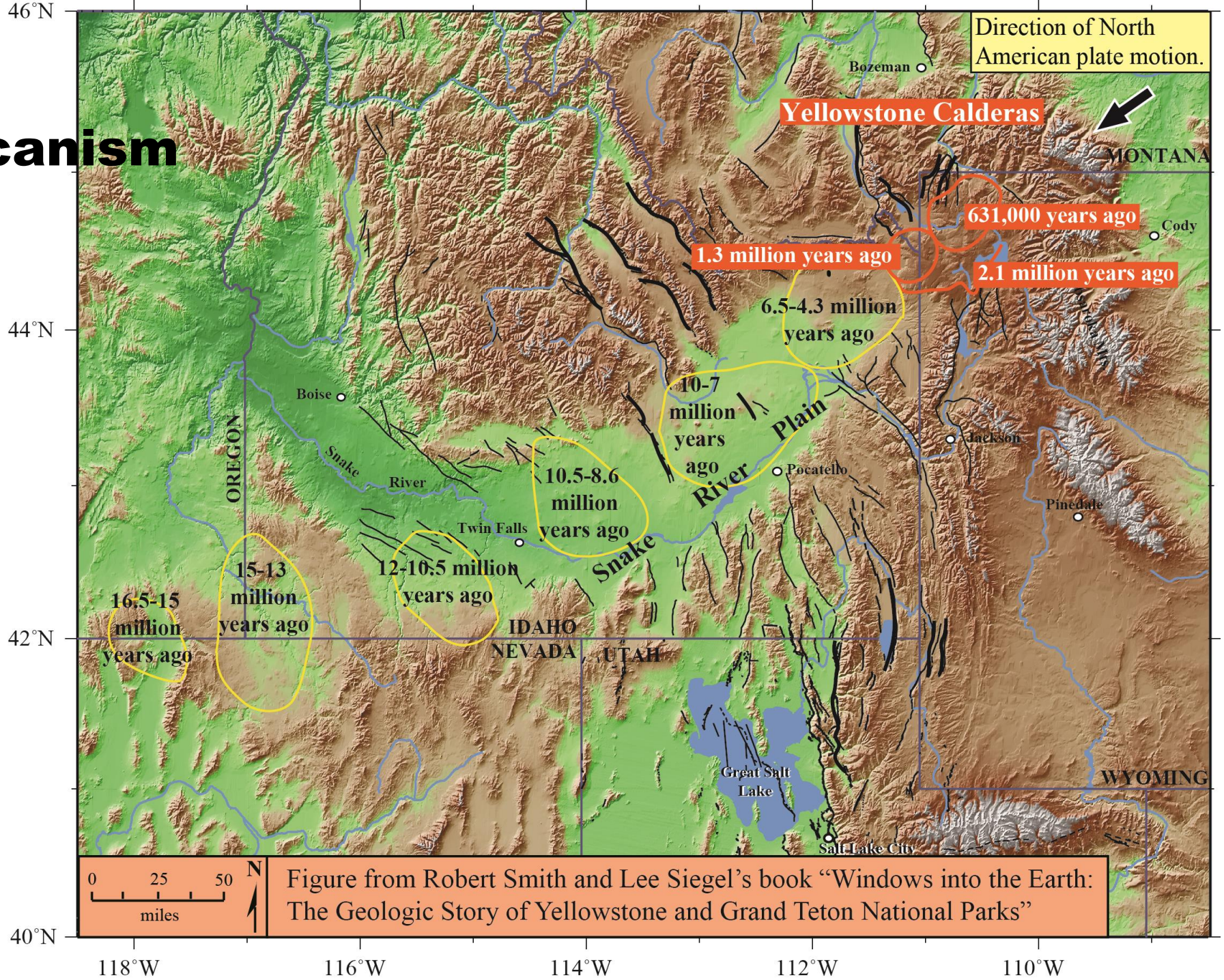
F. Divergent Plate Volcanism When plate motion pulls a continental block apart, stretching and thinning of the lithosphere causes molten rock to ascend from the mantle.

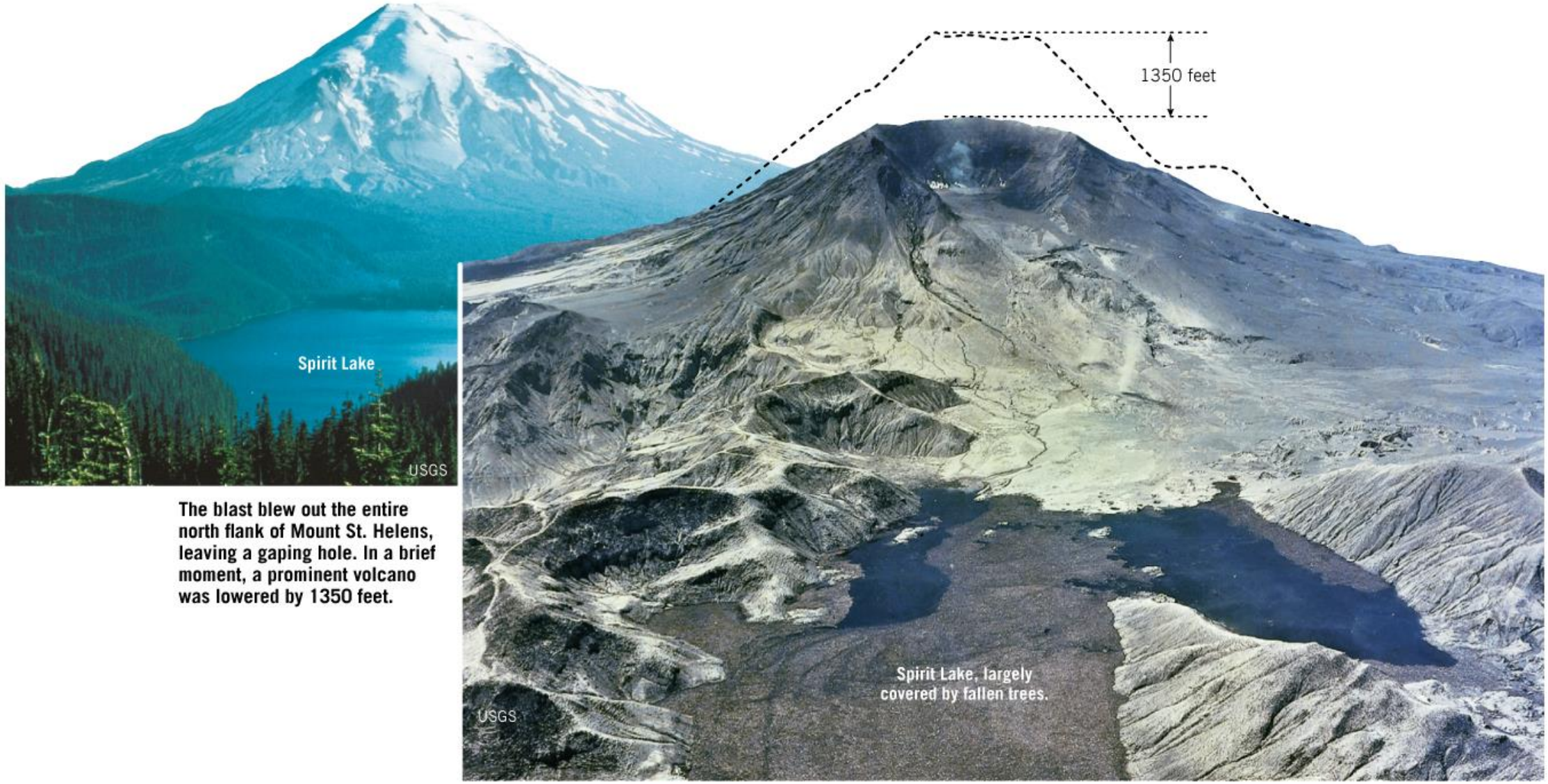

Potentially Active Volcanoes of Western United States
Bellingham
Mount Baker
Glacier Peak
Seattle
WASHINGTON
Spokane
Great Falls
Mount Rainier
Mount St. Helens
Mount Adams
Portland
MONTANA
Mount Hood
Billings
Mount Jefferson
Three Sisters
Bend
IDAHO
Eugene
Yellowstone
Newberry Crater
Crater Lake
Boise
Craters of the Moon
OREGON
Casper
Pocatello
WYOMING
Mount Shasta
Medicine Lake
Cheyenne
Lassen Peak
Reno
Salt Lake City
Denver
Clear Lake
NEVADA
Sacramento
UTAH
COLORADO
San Francisco
Long Valley Caldera
CALIFORNIA
Coso
Las Vegas
San Francisco Field
Santa Fe
Volcano active during past 2,000 years
Other potentially active volcanic areas
Los Angeles
Albuquerque
ARIZONA
Bandera Field
San Diego
Phoenix
NEW MEXICO
0 100 200 kilometers
0 100 miles
Tucson
USGS
Topinka, USGS/CVO, 1999, Modified from: Brantley, 1994, Volcanoes of the United States: USGS General Interest Publication

The Cascade Range: Subduction Volcanism

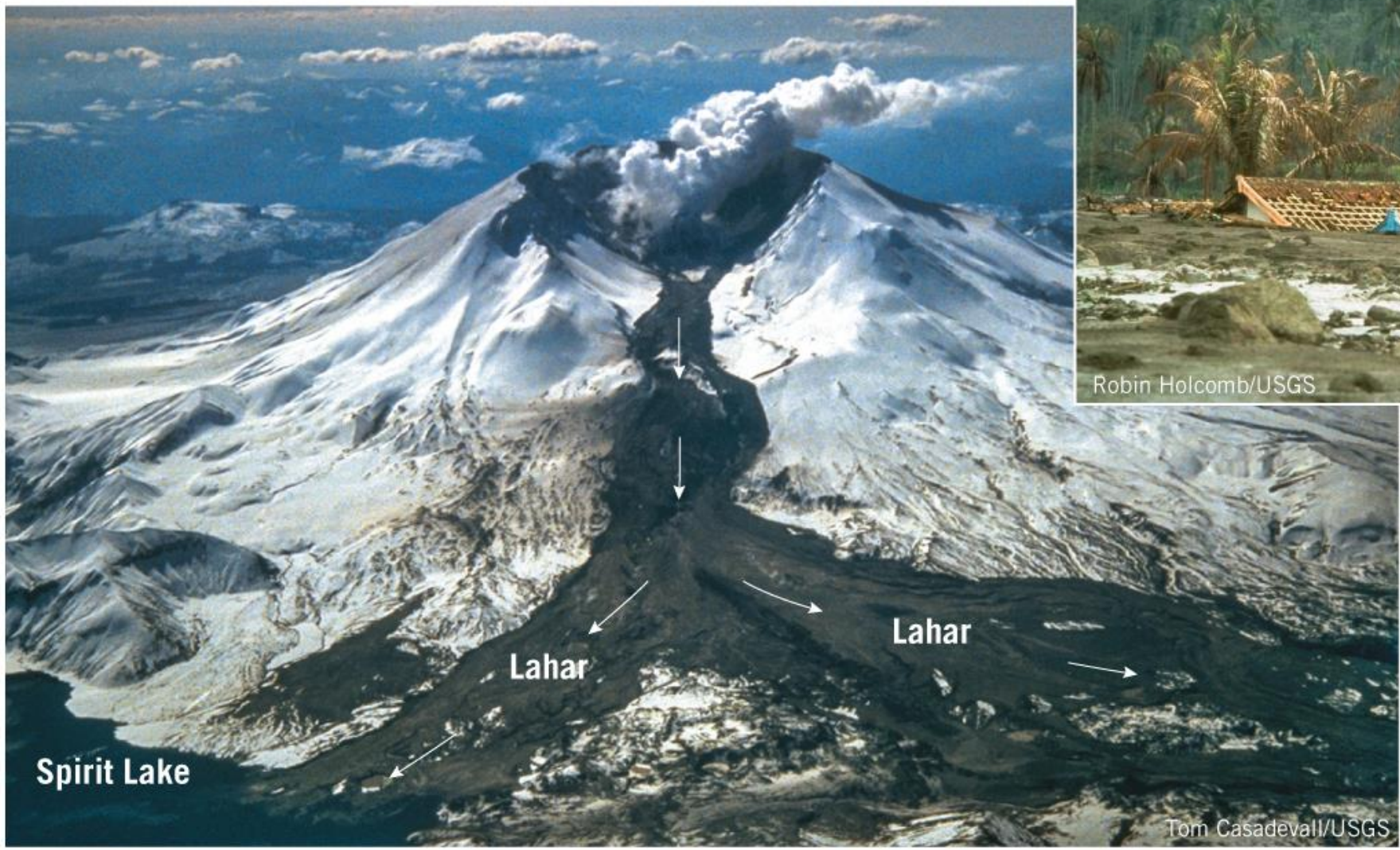


Hot Spot Volcanism



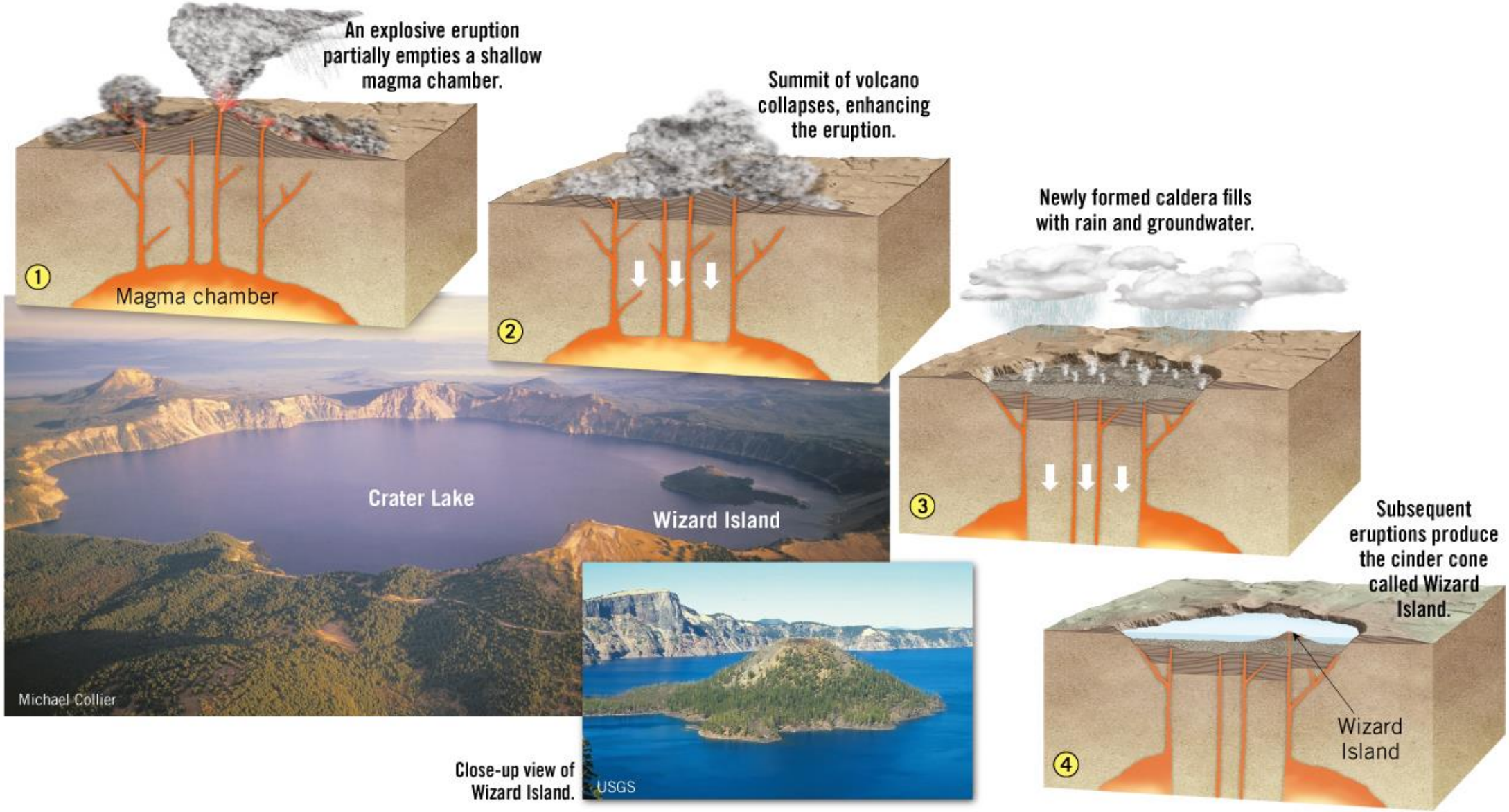


The blast blew out the entire north flank of Mount St. Helens, leaving a gaping hole. In a brief moment, a prominent volcano was lowered by 1350 feet.

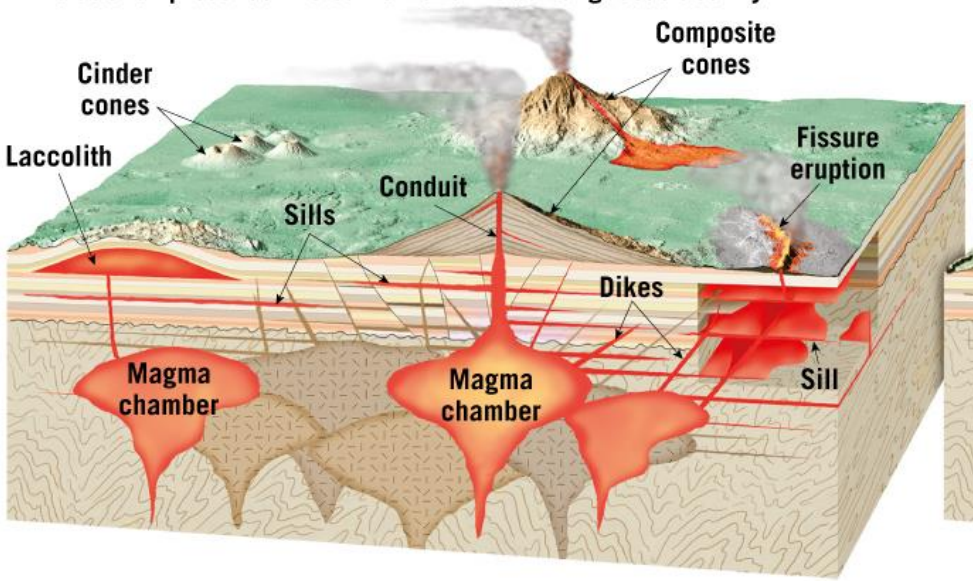


A.

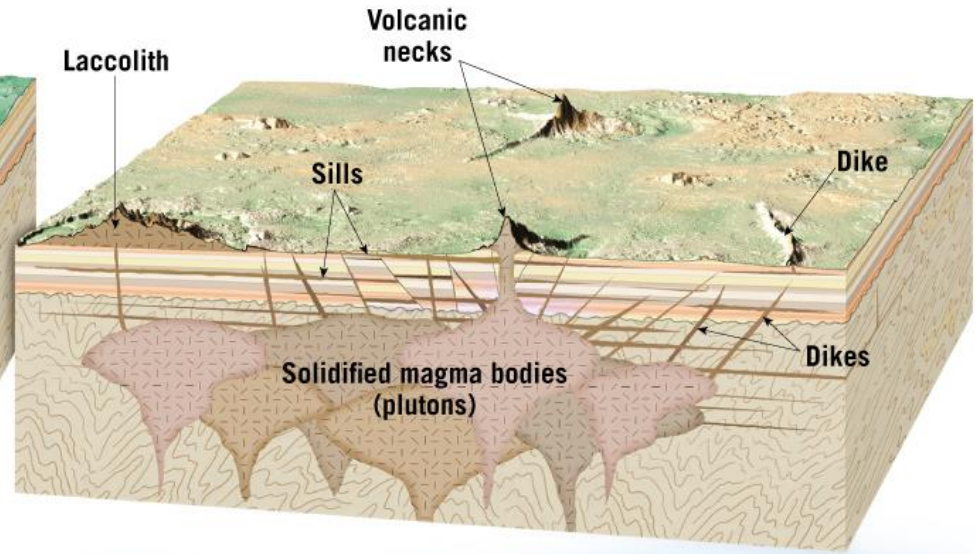
B.



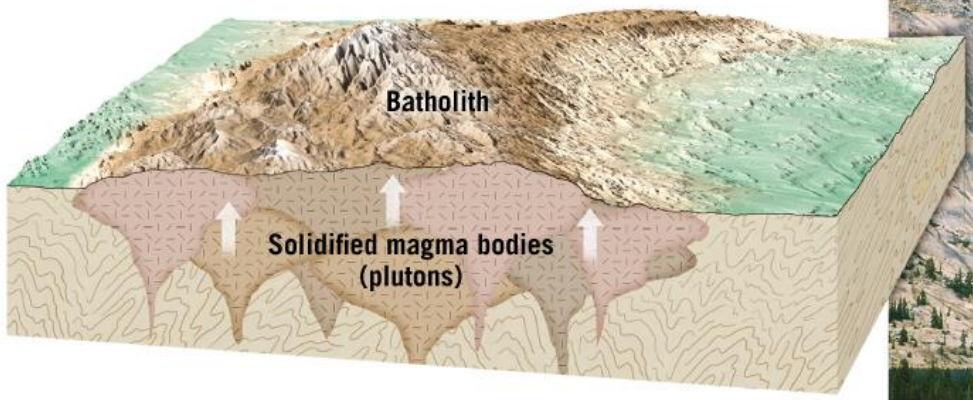
A. Relationship between volcanism and intrusive igneous activity.

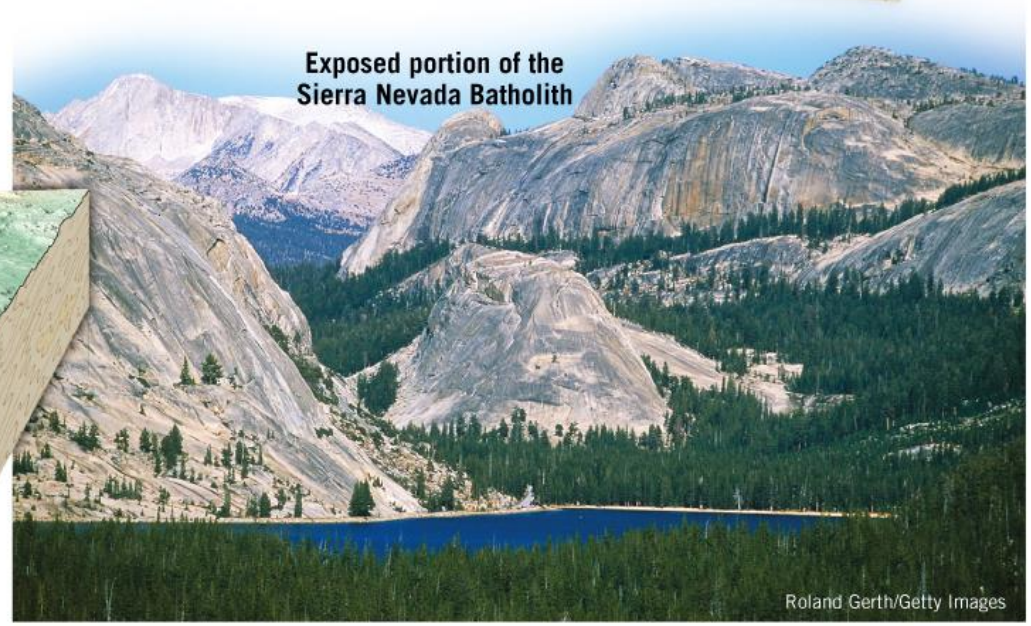


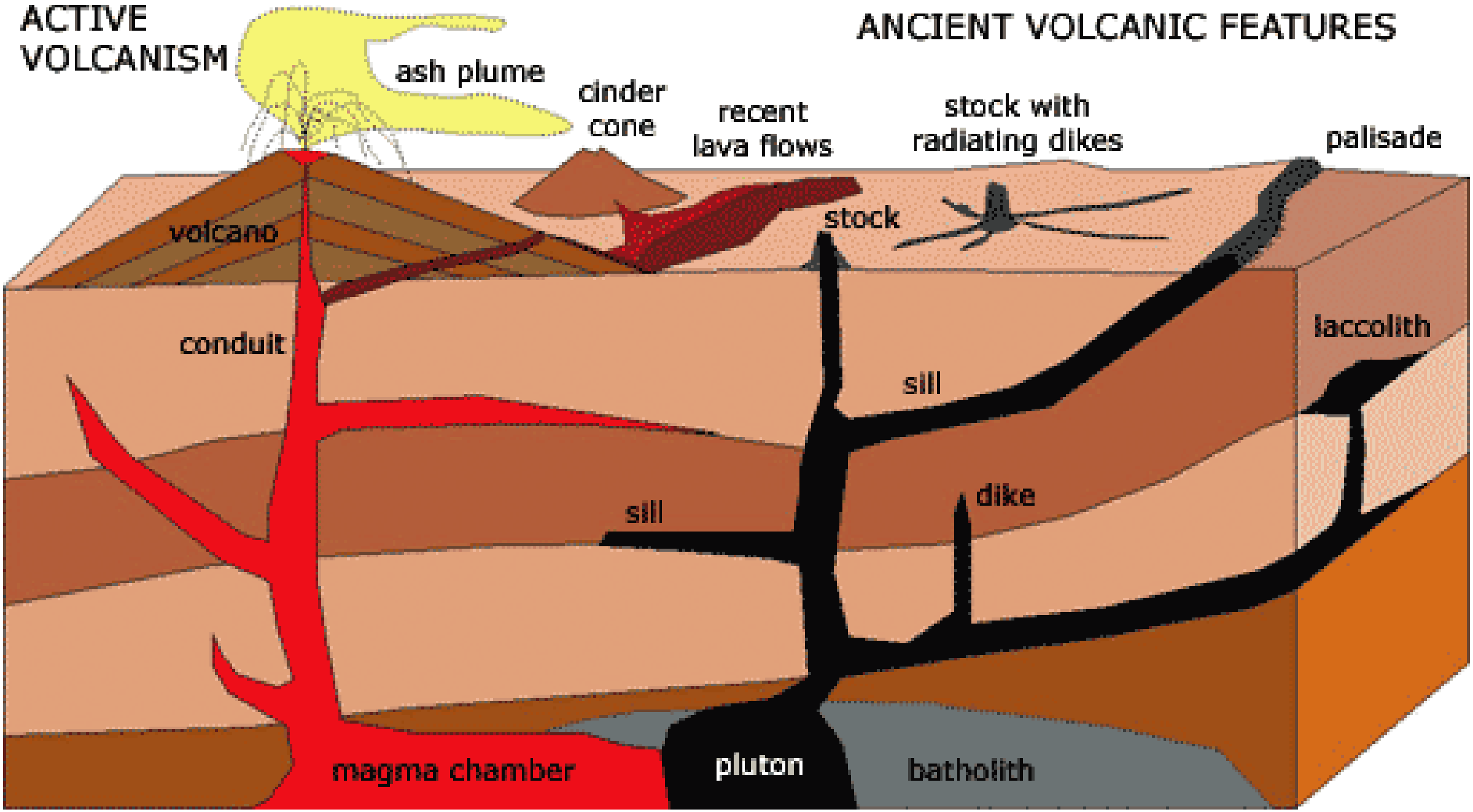
B. Basic intrusive structures, some of which have been exposed by erosion.



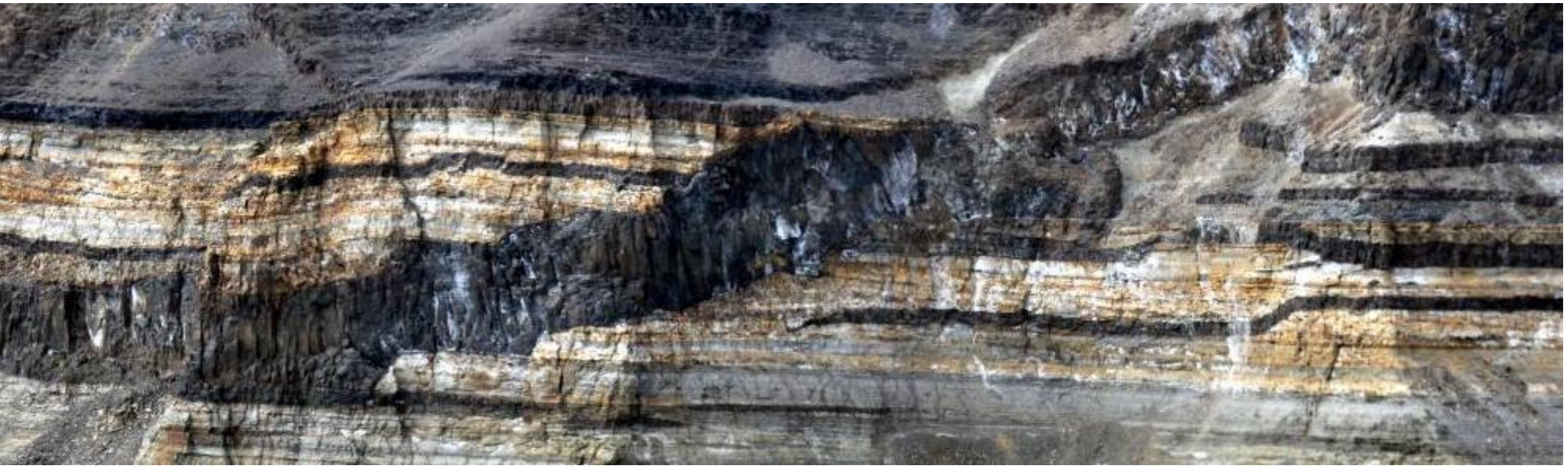
C. Extensive uplift and erosion exposed a batholith composed of several smaller intrusive bodies (plutons).






ACTIVE VOLCANISM
ash plume
cinder cone
recent lava flows
ANCIENT VOLCANIC FEATURES
stock with radiating dikes
palisade
volcano
stock
conduit
laccolith
sill
dike
sill
magma chamber
pluton
batholith


Yosemite Batholith



Pine Valley Laccolith, Utah