GL3241 VOLKANOLOGI

DR. ENG. ASEP SAEPULOH, S.T., M.ENG.

TOPIK 03.
KLASIFIKASI, BENTUK, STRUKTUR GUNUNGAPI DAN TIPE ERUPSINYA

This Photo by Unknown Author is licensed under CC BY-SA

GUNUNGAPI

- LUBANG DI PERMUKAAN BUMI
- TEMPAT MAGMA (BATUAN CAIR) DAN GAS KELUAR
- SAMPAI DI PERMUKAAN (MELETUS)
- MEMBENTUK TUBUH GUNUNGAPI (EDIFICE)
- TERSUSUN MATERIAL LETUSAN (EFUSIF DAN EKSPLOSIF)

Photograph by E. Klett on 27 January 1994; U.S. Fish and Wildlife Service

1. KLASIFIKASI ERUPSI GUNUNGAPI

KOMPLEKS (VARIASI WAKTU LETUSAN BANYAK)

FASE (DISTINCTIVE ERUPTIVE BEHAVIOUR)

SEKUEN/CYCLES (PERULANGAN FASE)

Klasifikasi gunungapi merupakan usaha yang kompleks dalam membagi gunungapi berdasarkan karakteristik tertentu karena banyaknya variasi waktu dan letusan yang terjadi.

FASE (EPISODE LETUSAN)

FASE LETUSAN EFUSIF (RED)


LOW LAVA FOUNTAIN


HIGHER LAVA FOUNTAIN


SUSTAIN LAVA (WITHOUT FOUNTAIN)

FASE LETUSAN EKSPLOSIF (GREY)

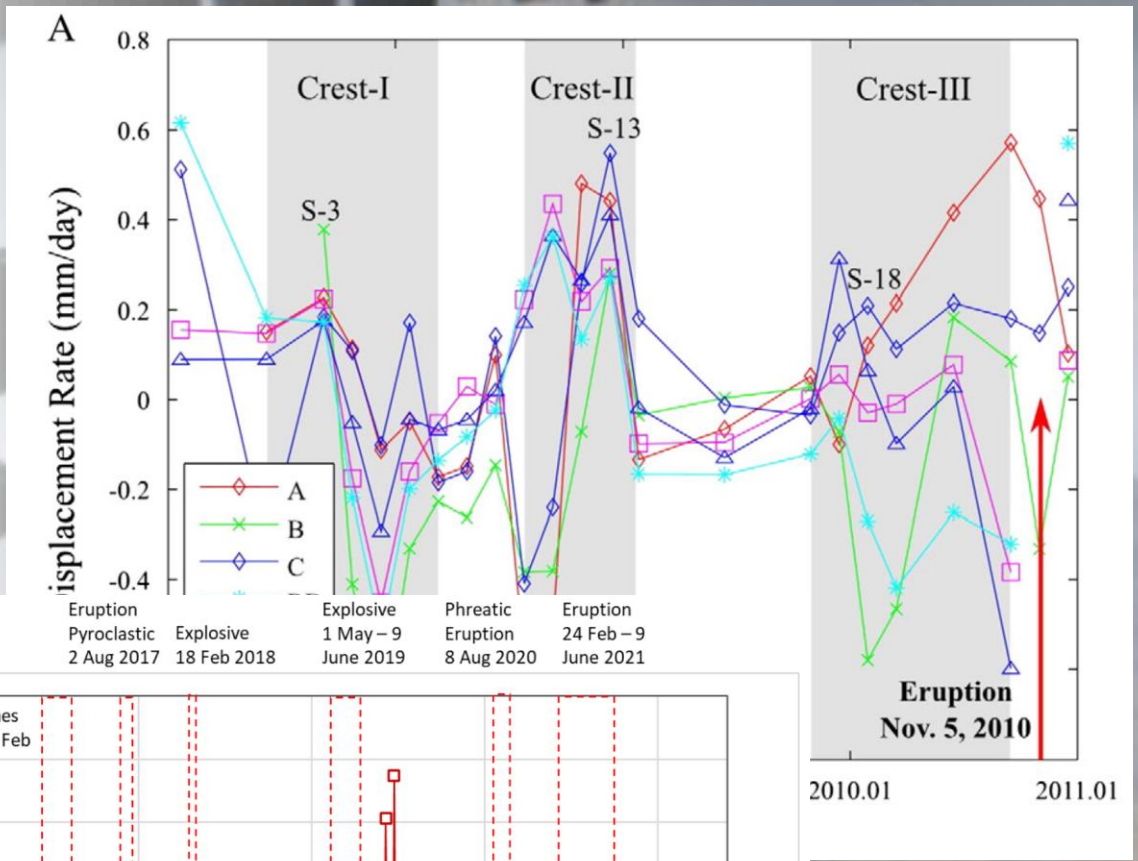

VENT CLEARING

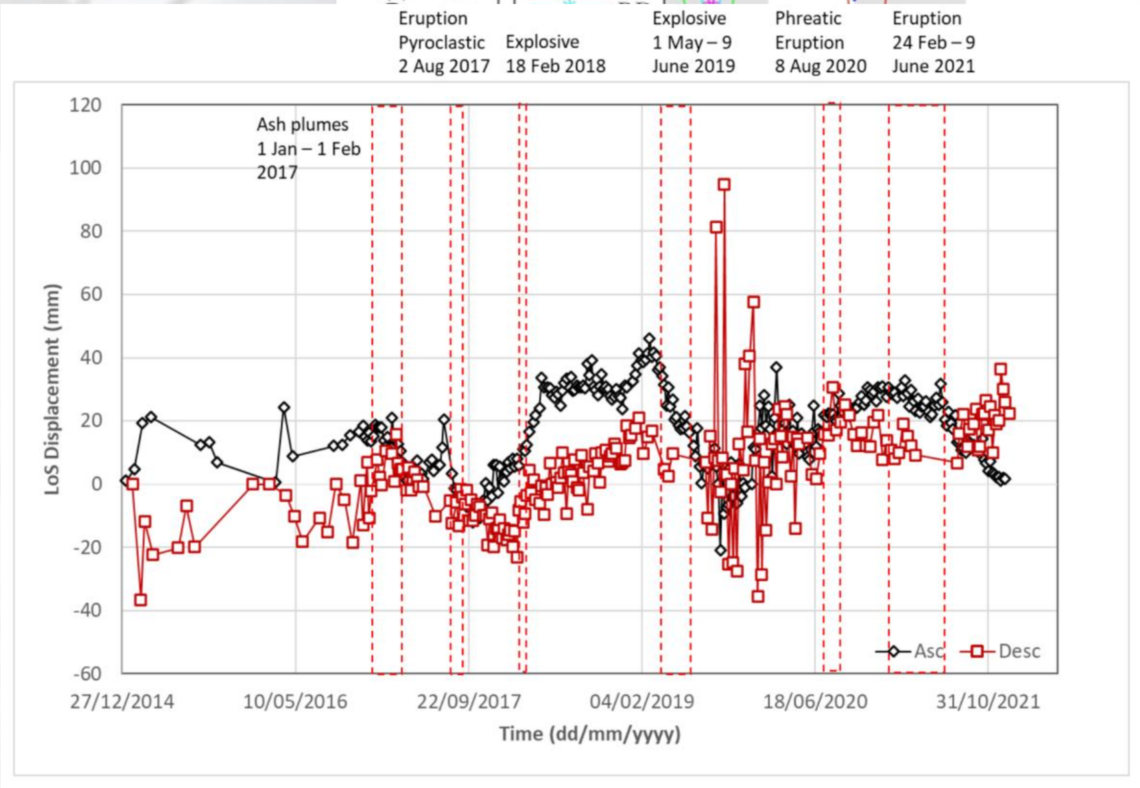

CATACLYSMIC (PUMICE/ASH)


LAVA DOME GROWTH

SEKUEN (PERULANGAN FASE LETUSAN)

- SKALA WAKTU LEBIH LAMA (TAHUN-ABAD)
- PERULANGAN FASE ERUPTIF



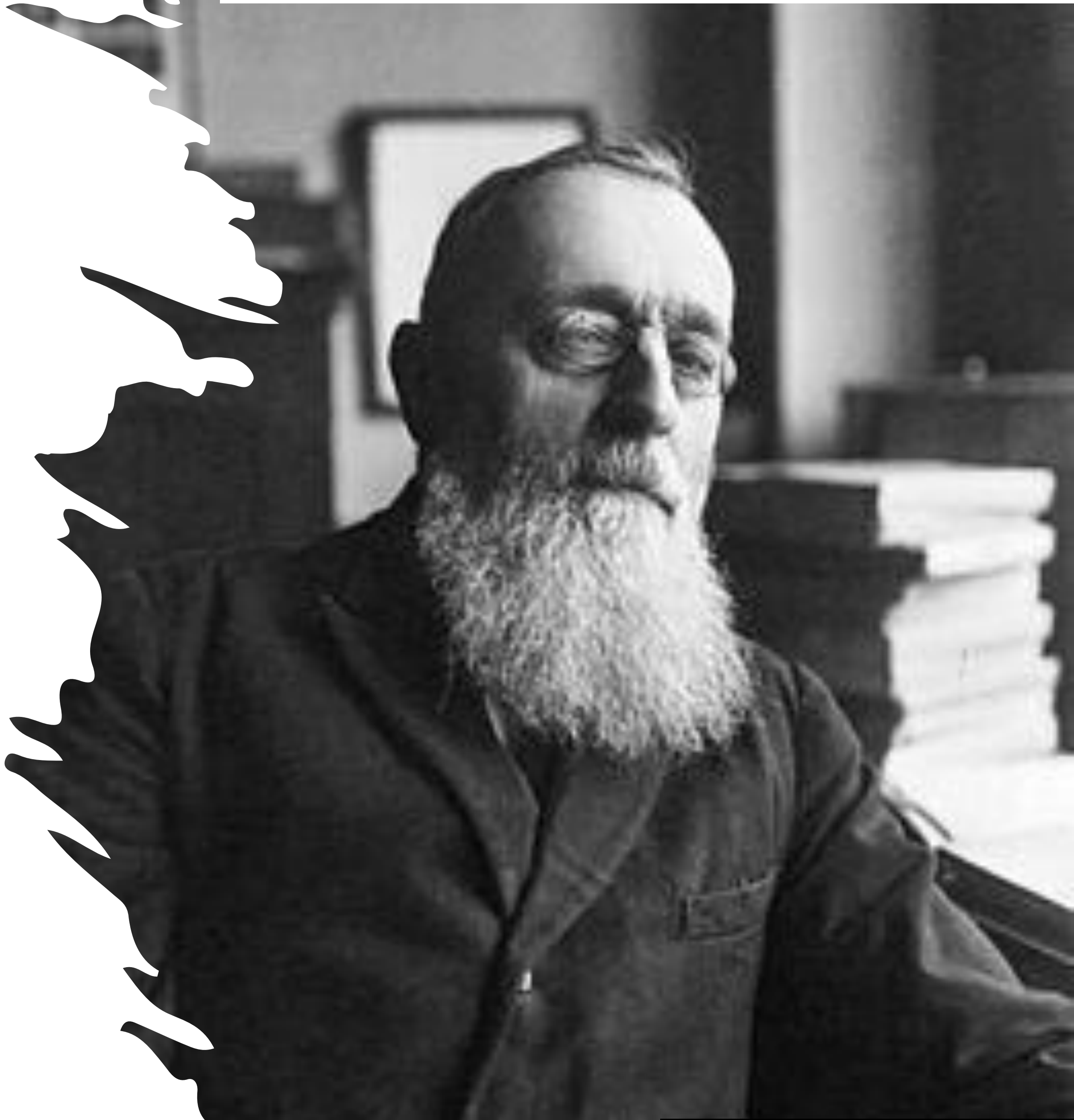


SISTEM KLASIFIKASI LACROIX

BERDASAR KARAKTER LETUSAN:

1. HAWAIIAN
2. STROMBOLIAN
3. PELEAN (PLINIAN)
4. VULCANIAN

*Antoine François Alfred Lacroix (4 February 1863 – 12 March 1948) was a French mineralogist and geologist.



Francois-Antoine Alfred Lacroix (1863-1948)

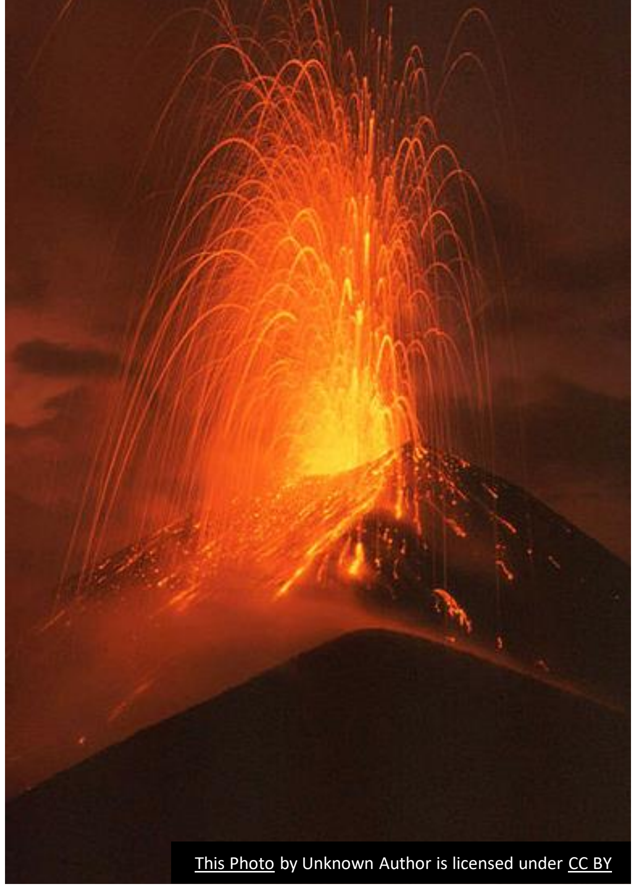
This Photo by Unknown Author is licensed under CC BY-SA

KLASIFIKASI LACROIX

Class	Description
Hawaiian	Effusive eruptions of lava with little or no explosive activity apart from lava fountaining. Primarily basaltic. Originate at fissure vents. Associated with building of shield volcanoes and flood-basalt plains. VEI* = 0–2 (and higher for flood-basalt eruptions).
Strombolian	Moderately explosive eruptions producing cinder, bombs, and ash which are initially incandescent as they leave the vent. Blasts often periodic, associated with bursting of very large gas bubbles in the vent. Typically basaltic and andesitic, with steam-rich light-colored ash clouds. VEI = 1–3.
Vulcanian	Moderate to violent ejection of solid fragments of cold rock (Ultravulcanian eruption), or of solid, recently hardened lava (ordinary Vulcanian eruption). Associated with the clearing of conduits, often plugged with domes. Blast clouds tend to be notably darker (more ash and less steam rich) than in the case of Strombolian eruptions. In addition to numerous blocks, large amounts of ash are produced. Eruption columns feature much lightning, and accretionary lapilli may be abundant with ordinary ash fall. Dense, ground-hugging pyroclastic clouds (PDCs) possible. Any composition, but not often basaltic. VEI = 2–5†
Plinian	Highly violent eruption of large amounts of pumice and ash, generally associated with PDCs. Airfall pumice beds and ash-flows, sometimes including ignimbrites, are characteristic. Caldera collapse is often associated with Plinian eruptions. Eruption columns 20–55 km high penetrate the stratosphere, injecting large quantities of water and sulfur aerosols into the upper atmosphere. Temporary global cooling may ensue. VEI = 4–8

Lookwood dan Hazlett (2010)

Lookwood dan Hazlett (2010)



This Photo by Unknown Author is licensed under CC BY

This Photo by Unknown Author is licensed under CC BY-SA

This Photo by Unknown Author is licensed under CC BY-SA

KLASIFIKASI LACROIX

1. HAWAIIAN (VEI=0-2)
2. STROMBOLIAN (VEI=1-3)
3. VULCANIAN (VEI=2-5)
4. PLINIAN (VEI=4-8)

DIAGRAM RITTMANN (1962)

- PENERUS LACROIX
- DIAGRAM ERUPSI (FASE)
- SEMI-KUANTITATIF (VISUAL OBSERVASI)
- BERGUNA UNTUK MULTI-FASE ERUPSI

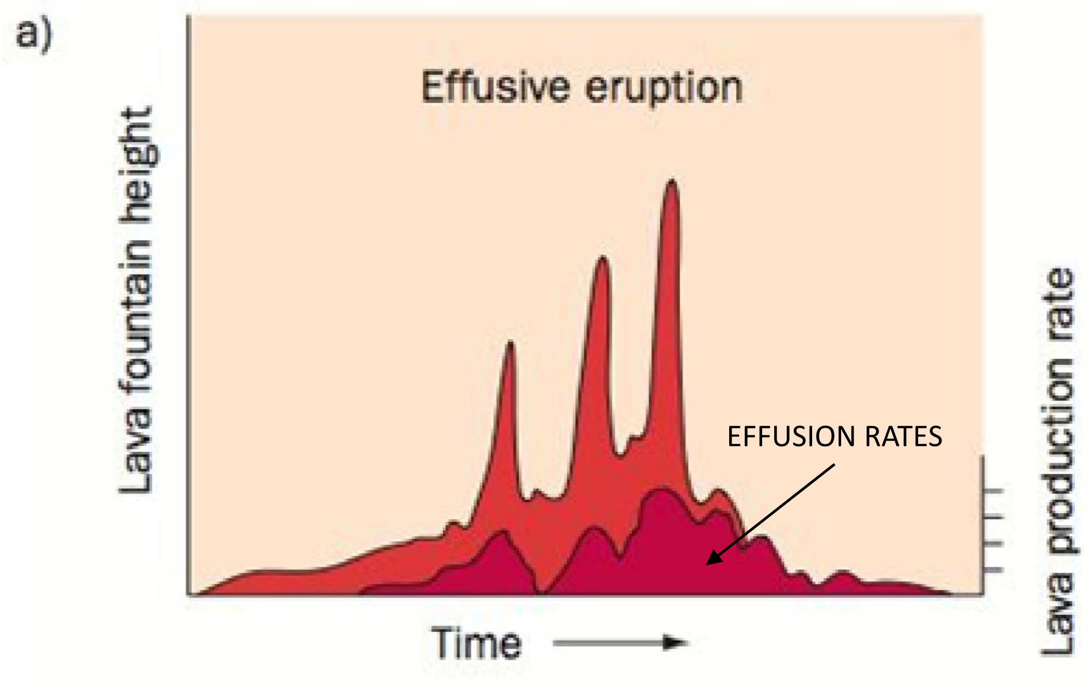
*Volcanologist Switzerland mahasiswa bimbingan Antoine François Alfred Lacroix.

Alfred Rittmann (1893-1980)

https://images.app.goo.gl/ddpeyuEzcFbvSbkK7

DIAGRAM KLASIFIKASI RITTMANN

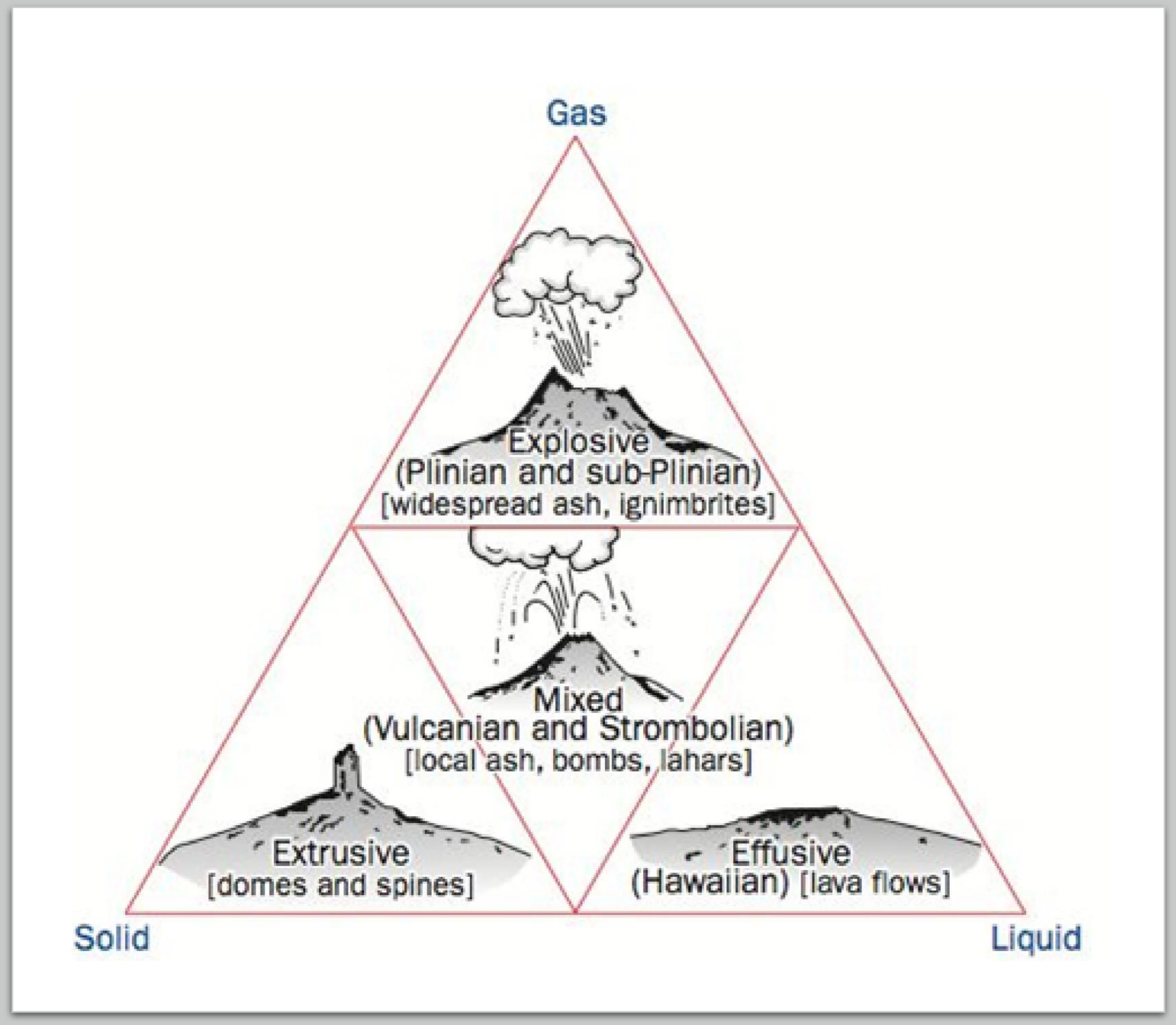
KLASIFIKASI ERUPSI EFUSIF DAN EKSPLOSIF BERDASARKAN OBSERVASI/PENGUKURAN VISUAL



Lookwood dan Hazlett (2010)

DIAGRAM KLASIFIKASI GEZE (1964)

- SIMPLIFIKASI LACROIX
- MENGGUNAKAN TERNER DIAGRAM
- PRODUK EKSTRUSIF
- LIQUID/SOLID/GAS



Lookwood dan Hazlett (2010)

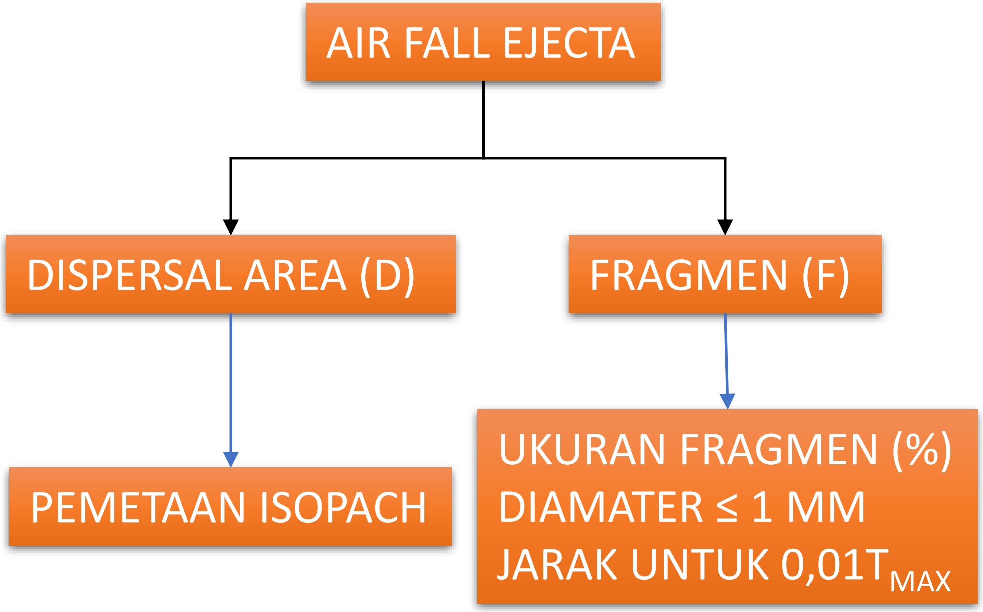
SISTEM KLASIFIKASI WALKER (1973)

LATAR BELAKANG

- METODE SEBELUMNYA EFEKTIF UNTUK KONDISI ERUPSI SEKARANG
- PERLU KRITERIA LAIN UNTUK PEMETAAN DAN SEJARAH LETUSAN
- EVIDEN GEOLOGI LAPANGAN PERLU MASUK SEBAGAI KRITERIA

George P. L. Walker (1925-2005)

https://images.app.goo.gl/PoLPTXx6si4J43uG6

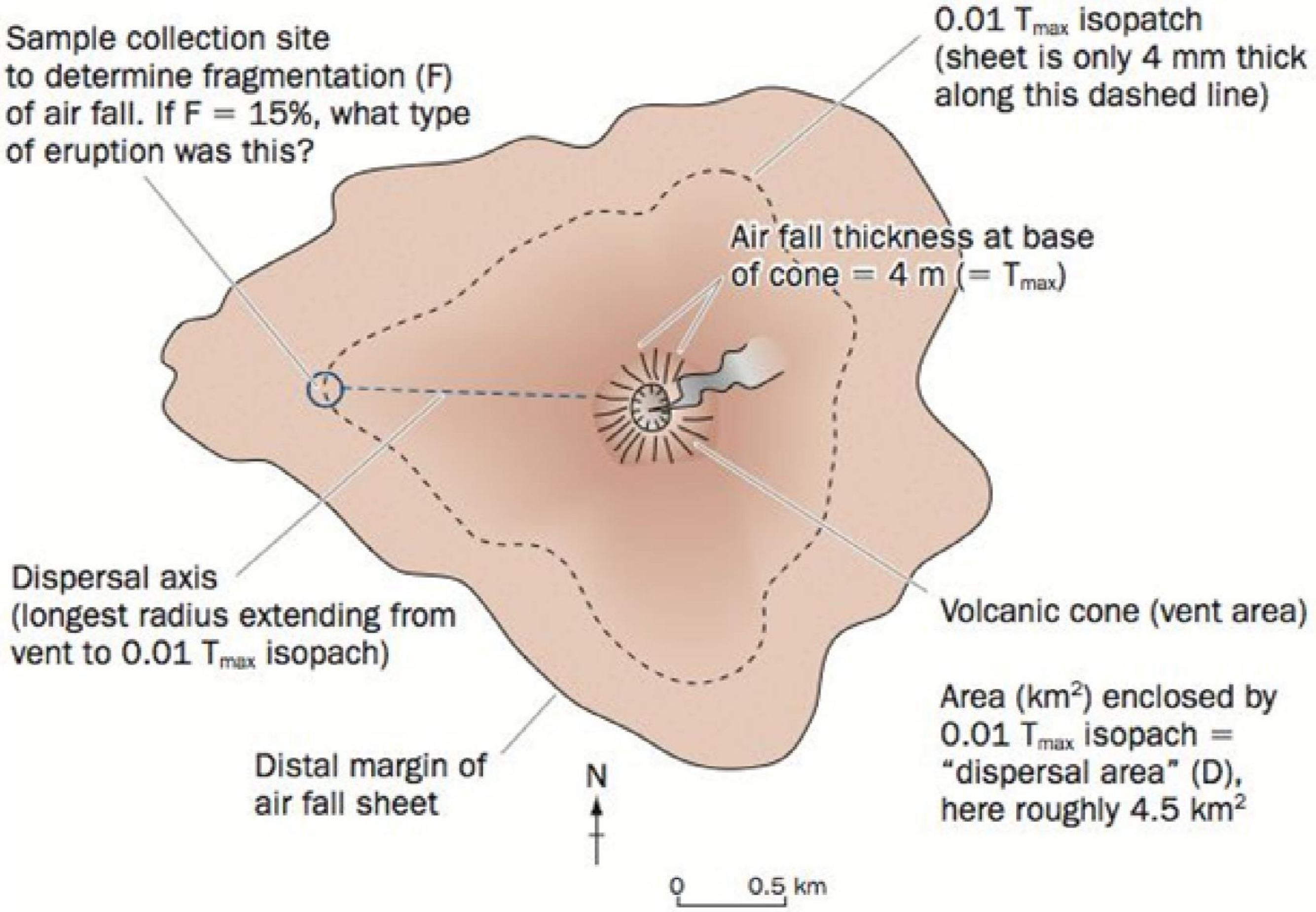


*George Patrick Leonard Walker FRS (2 March 1926 – 17 January 2005) was a British geologist who specialized in mineralogy and volcanology.

Lookwood dan Hazlett (2010)

METODE WALKER

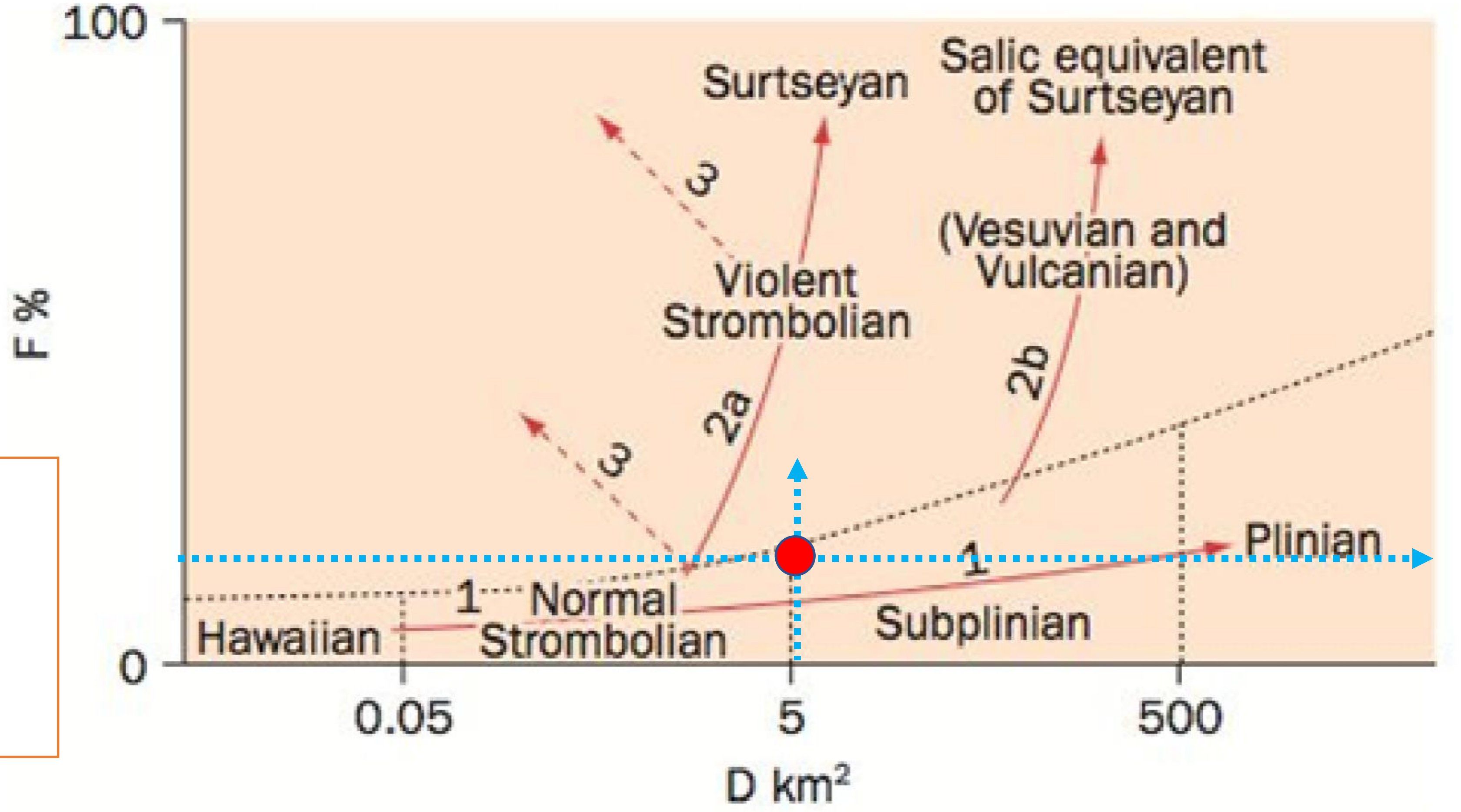
- PENGUKURAN ISOPACH
- PENGUKURAN LUAS AREA (D)
- PENGUKURAN BESAR BUTIR ≤ 1 MM (%F)
- JARAK $0{,}01T_{MAX}$



Lookwood dan Hazlett (2010)

DIAGRAM WALKER

- F=15 %
- D=5,5 KM
- **ERUPSI TIPE APA?**



Lookwood dan Hazlett (2010)

INDEKS EKSPLOSIF

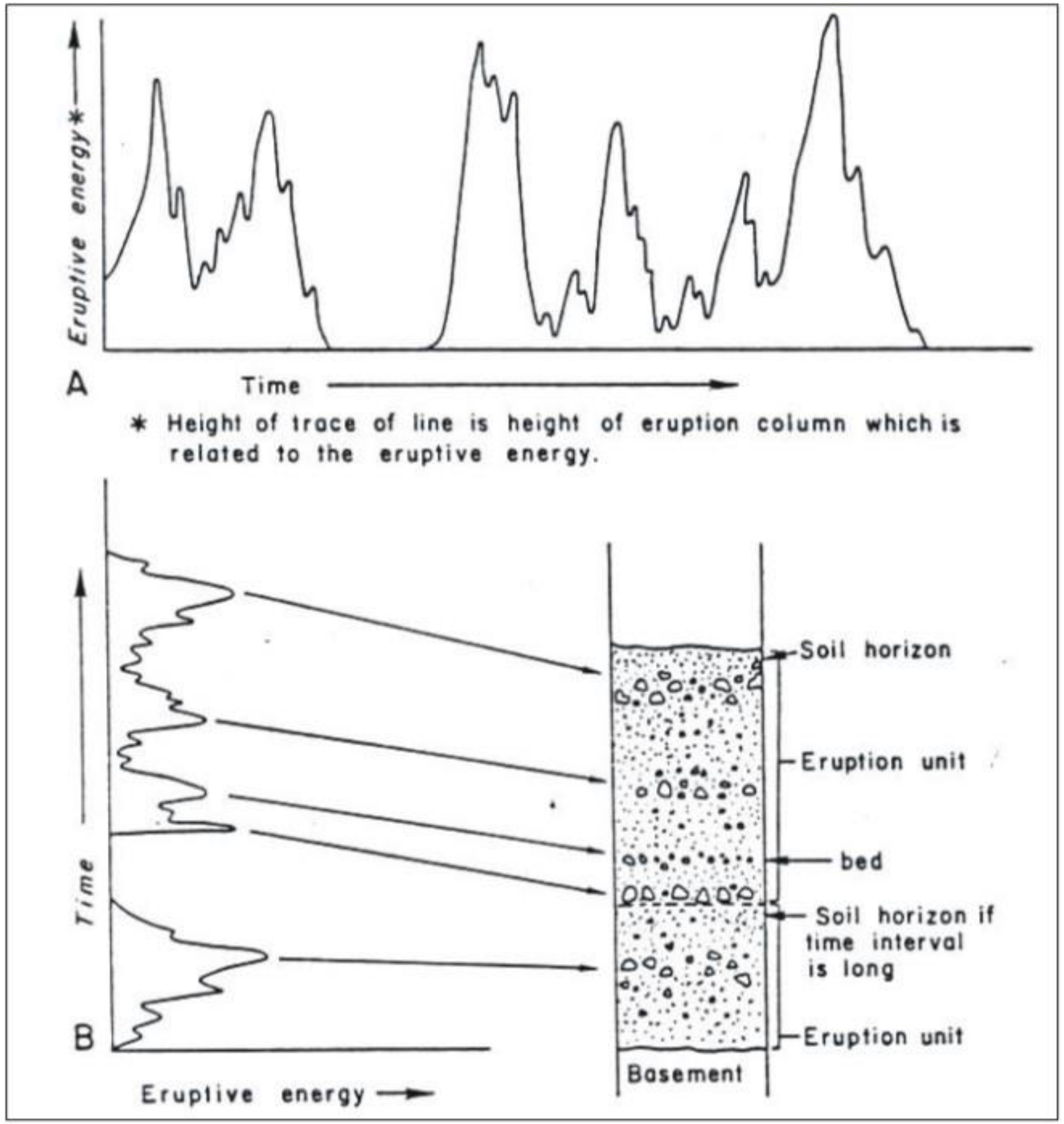
- SAPPER (1927 OP.CIT. BULLARD,1977)
- KOMPOSISI LAVA DAN PIROKLASTIK

$$\text{INDEKS EKSPLOSIF} = \frac{\text{JUMLAH MATERIAL FRAGMEN YANG DIKELUARKAN}}{\text{JUMLAH SELURUH MATERIAL YANG DIKELUARKAN}}$$

ENERGI EKSPLOSIF VS (WAKTU, FRAGMEN)

Fisher dan Schminke (1984):

Hubungan antara energi eksplosif terhadap waktu dan ukuran fragmen.

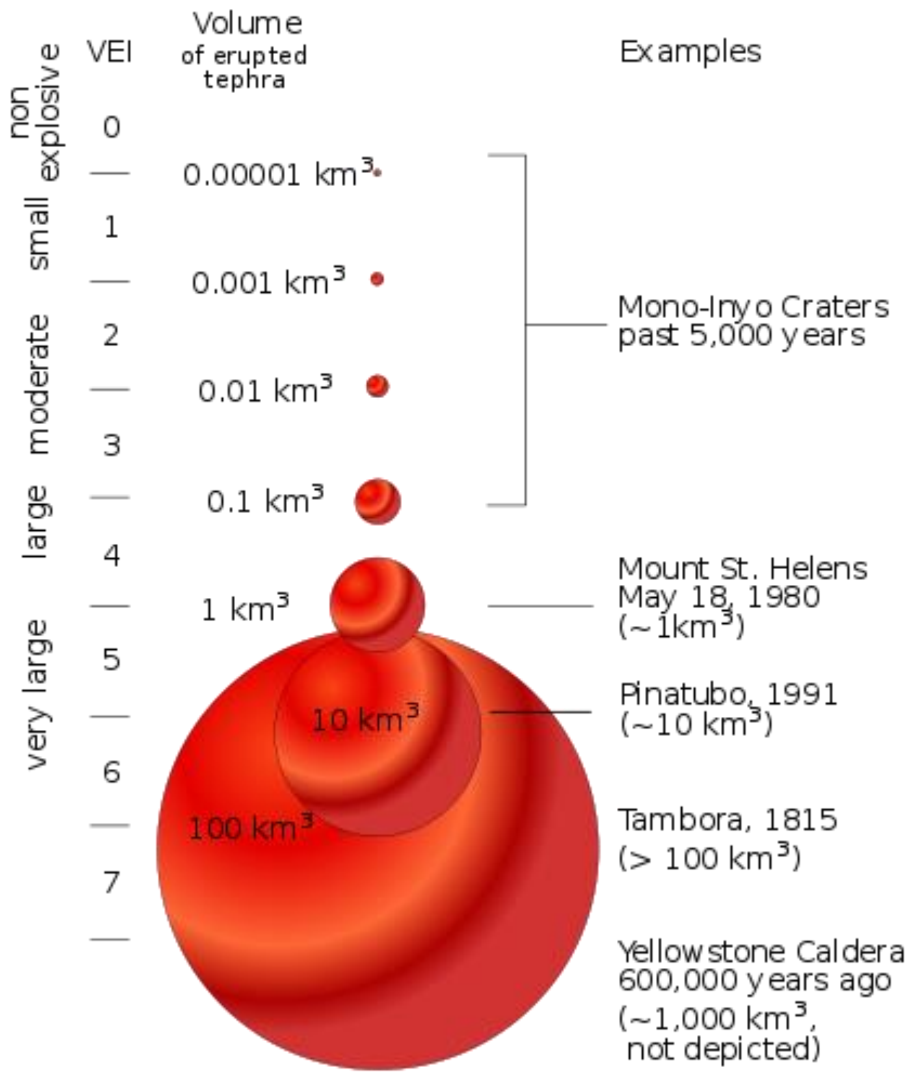


Fisher dan Schminke (1984)

VOLCANIC EXPLOSIVITY INDEX

Dirancang oleh Chris Newhall (USGS) dan Stephen Self (University of Hawaii) tahun 1982:

1. Tinggi plume
2. Volume produk



PENERAPAN VEI

- BERLAKU GLOBAL
- KUANTITATIF
- LETUSAN MASA SEJARAH
- PRA SEJARAH SULIT TERUKUR

Volcanic eruptions by VEI index[6]

VEI	Plume height	Eruptive volume *	Eruption type	Frequency **	Example
0	<100 m (330 ft)	1,000 m^3 (35,300 cu ft)	Hawaiian	Continuous	Kilauea
1	100–1,000 m (300–3,300 ft)	10,000 m^3 (353,000 cu ft)	Hawaiian/Strombolian	Months	Stromboli
2	1–5 km (1–3 mi)	1,000,000 m^3 (35,300,000 cu ft) †	Strombolian/Vulcanian	Months	Galeras (1992)
3	3–15 km (2–9 mi)	10,000,000 m^3 (353,000,000 cu ft)	Vulcanian	Yearly	Nevado del Ruiz (1985)
4	10–25 km (6–16 mi)	100,000,000 m^3 (0.024 cu mi)	Vulcanian/Peléan	Few years	Eyjafjallajökull (2010)
5	>25 km (16 mi)	1 km^3 (0.24 cu mi)	Plinian	5–10 years	Mount St. Helens (1980)
6	>25 km (16 mi)	10 km^3 (2 cu mi)	Plinian/Ultra Plinian	1,000 years	Krakatoa (1883)
7	>25 km (16 mi)	100 km^3 (20 cu mi)	Ultra Plinian	10,000 years	Tambora (1815)
8	>25 km (16 mi)	1,000 km^3 (200 cu mi)	Ultra Plinian	100,000 years	Lake Toba (74 ka)

* This is the minimum eruptive volume necessary for the eruption to be considered within the category.

** Values are a rough estimate. Exceptions occur.

† There is a discontinuity between the 2nd and 3rd VEI level; instead of increasing by a magnitude of 10, the value increases by a magnitude of 100 (from 10,000 to 1,000,000).

This Photo by Unknown Author is licensed under CC BY-NC

This Photo by Unknown Author is licensed under CC BY-SA

This Photo by Unknown Author is licensed under CC BY-SA-NC

KLASIFIKASI BERDASAR SUMBER KEJADIAN ERUPSI

A. MAGMATIK
B. FREATIK
C. FREATOMAGMATIK

KARAKTERISTIK ERUPSI

MAGMATIK

- KLASTIK JUVENIL
- DEKOMPRESI EKSPLOSIF
- PELEPASAN GAS
- HAWAII-ULTRA PLINIAN

FREATIK

- ULTRAVULCANIAN
- KONTAK PANAS-AIR
- LEDAKAN UAP AIR
- ABU - BOM VOLKANIK

FREATO MAGMATIK

- PEMBENTUKAN JUVENILE
- KONTAK MAGMA DAN AIR
- KLASTIK JUVENILE
- EKSPLOSIF BESAR

A. MAGMATIK

Erupsi Tipe *Hawaiian*

1. The calmest types of volcanic events, characterized by the effusive eruption eruption of very fluid basalt-type lavas with low gaseous content.
2. Steady production of small amounts of lava builds up the large, broad form of a shield volcano.
3. Eruptions are not centralized at the main summit as with other volcanic types, and often occur at vents around the summit and from fissure vents radiating out of the center.
4. Flows from Hawaiian eruptions are basaltic,
5. Pahoehoe lava is a relatively smooth lava flow that can be billowy or ropey.
6. A'a lava flows are denser and more viscous then pahoehoe.

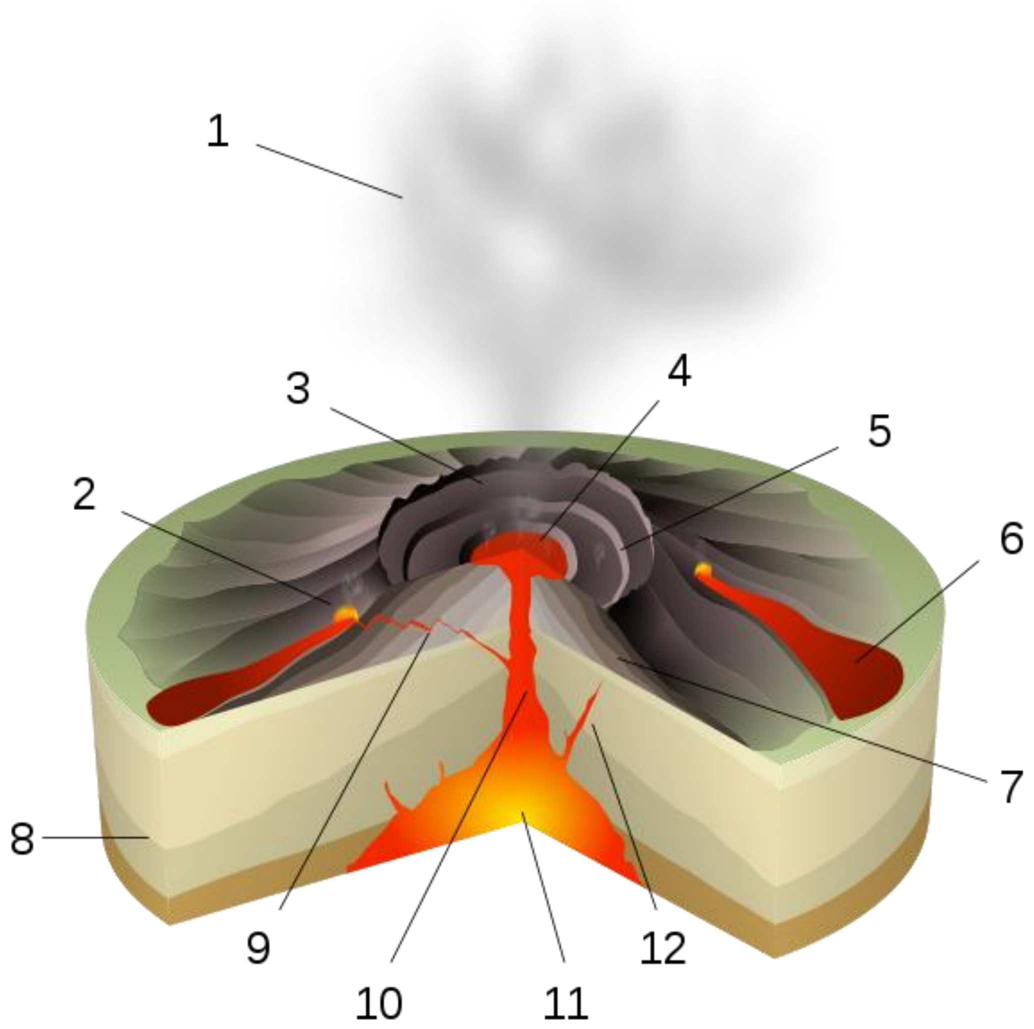


Diagram of a Hawaiian eruption. (key: 1. Ash plume 2. Lava fountain 3. Crater 4. Lava lake 5. Fumaroles 6. Lava flow 7. Layers of lava and ash 8. Stratum 9. Sill 10. Magma conduit 11. Magma chamber 12. Dike)

Erupsi Tipe *Hawaiian*

Ropy pahoehoe

Ropy pahoehoe is the most common surface texture of pahoehoe flows. The numerous folds and wrinkles ("ropes") that are characteristic of ropy pahoehoe form when the thin, partially solidified crust of a flow is slowed or halted (for example, if the crust encounters an obstruction or slower-moving crust). Because lava beneath the crust continues to move forward, it tends to drag the crust along. The crust then behaves like an accordian that is squeezed together--the crust is flexible enough to develop wrinkles or a series of small ridges and troughs as it is compressed and driven forward.

Photograph by T.N. Mattox on 11 June 1995

Close view of ropy texture forming on the surface of a pahoehoe flow at Kilauea Volcano, Hawai`i

GL-3241

Erupsi Tipe *Strombolian*

1. **Strombolian eruptions are driven by the bursting of gas bubbles within the magma.**
2. **Upon reaching the surface, the difference in air pressure causes the bubble to burst with a loud pop, throwing magma in the air in a way similar to a soap bubble.**
3. **Strombolian eruptions eject volcanic bombs and lapilli fragments that travel in parabolic paths before landing around their source vent.**
4. **The steady accumulation of small fragments builds cinder cones composed completely of basaltic pyroclasts. This form of accumulation tends to result in well-ordered rings of tephra.**

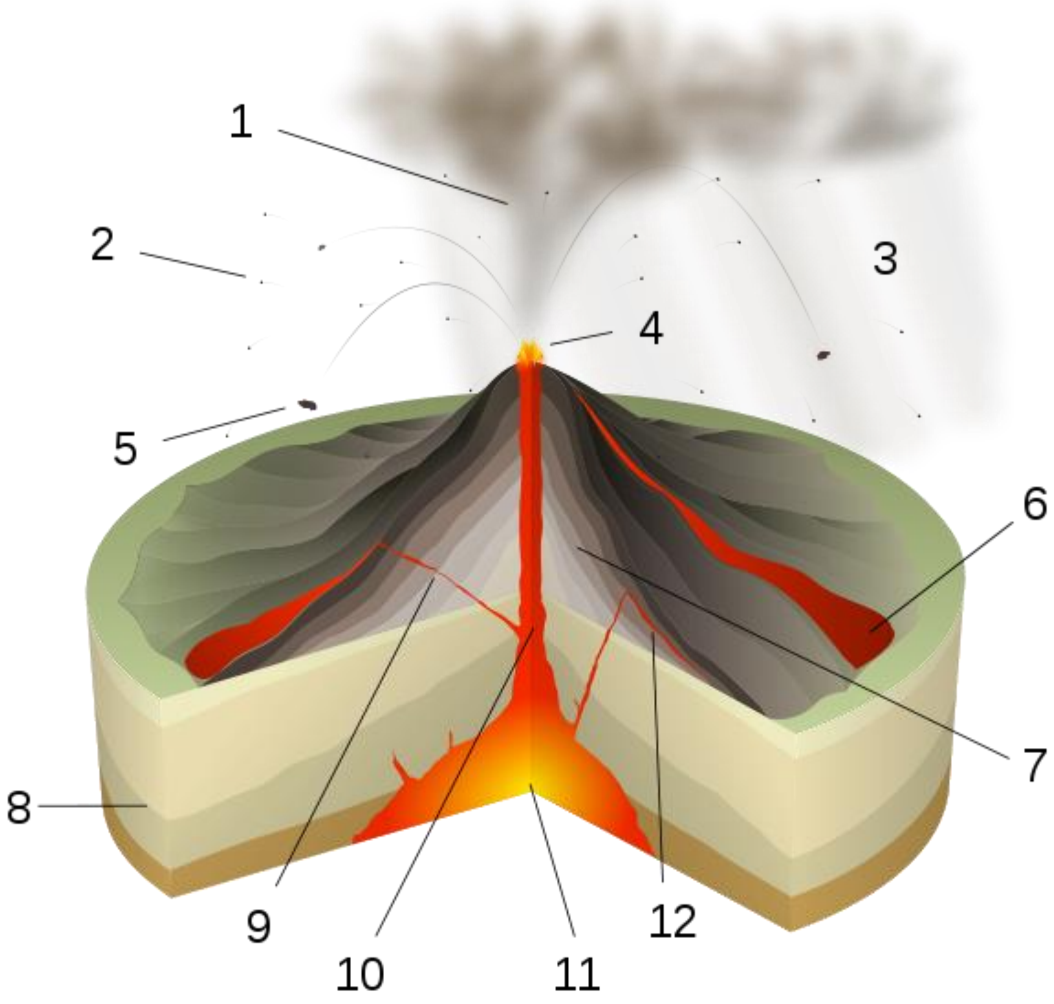


Diagram of a Strombolian eruption. (key: 1. Ash plume 2. Lapilli 3. Volcanic ash rain 4. Lava fountain 5. Volcanic bomb 6. Lava flow 7. Layers of lava and ash 8. Stratum 9. Dike 10. Magma conduit 11. Magma chamber 12. Sill)

Erupsi Tipe *Strombolian*

Paricutin, Mexico This slide taken in 1943 shows a spectacular view of an eruption of Paricutin at night. Glowing projectiles and pyroclastic fragments outline the conical shape of the volcano. The eruption consisted mostly of spheroidal bombs, lapilli, glassy cinder, and glassy ash formed by disintegration of the cinder

Erupsi Tipe *Vulcanian*

1. **Similar to Strombolian eruptions, this leads to the buildup of high gas pressure, eventually popping the cap holding the magma down and resulting in an explosive eruption.**
2. **However, unlike Strombolian eruptions, ejected lava fragments are not aerodynamical; this is due to the higher viscosity of Vulcanian magma and the greater incorporation of crystalline material broken off from the former cap.**
3. **They are also more explosive than their Strombolian counterparts, with eruptive columns often reaching between 5 and 10 km (3 and 6 mi) high. Lastly, Vulcanian deposits are andesitic to dacitic rather than basaltic.**
4. **Deposits near the source vent consist of large volcanic blocks and bombs, with so-called "bread-crust bombs" being especially common**

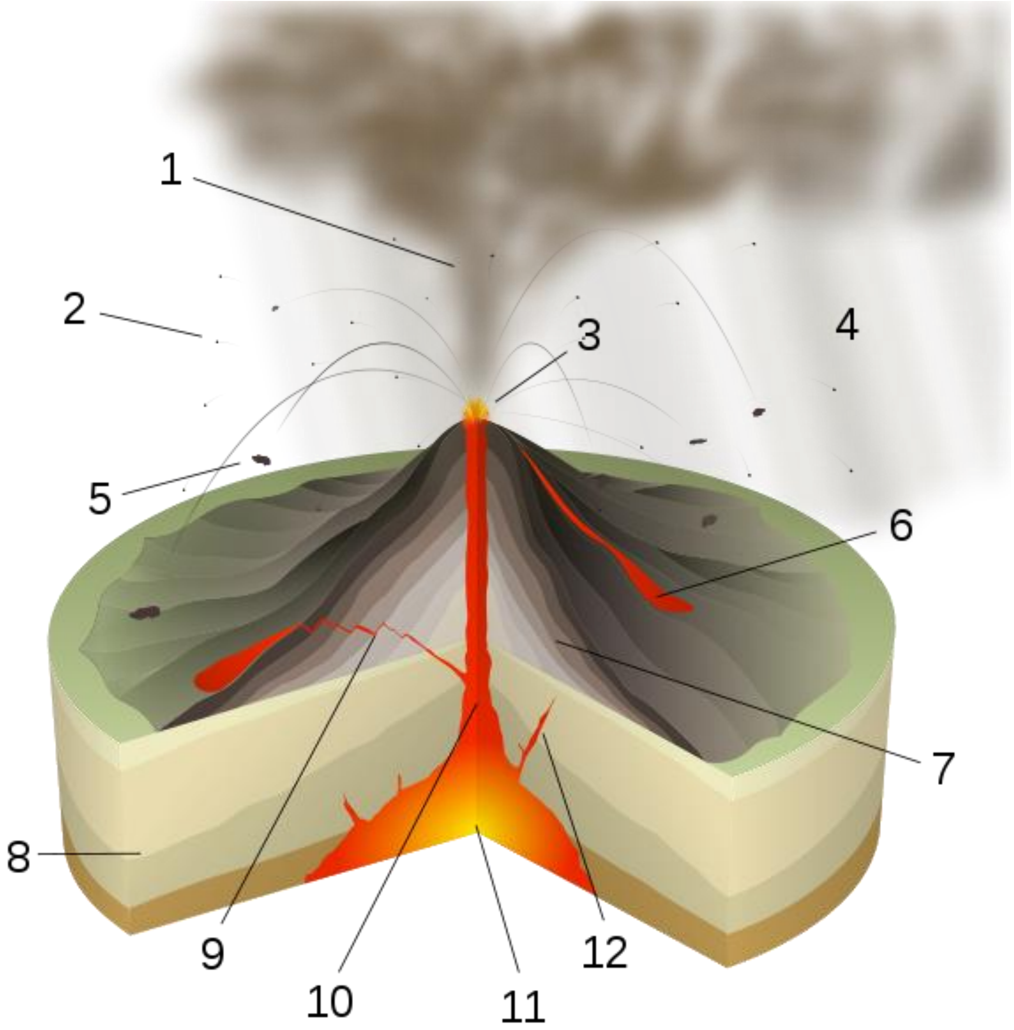


Diagram of a Vulcanian eruption. (key: 1. Ash plume 2. Lapilli 3. Lava fountain 4. Volcanic ash rain 5. Volcanic bomb 6. Lava flow 7. Layers of lava and ash 8. Stratum 9. Sill 10. Magma conduit 11. Magma chamber 12. Dike)

Erupsi Tipe *Vulcanian*

Tavurvur in Papua New Guinea erupting

Erupsi Tipe *Pelean*

1. **A large amount of gas, dust, ash, and lava fragmets are blown out the volcano's central crater, driven by the collapse of rhyolite, dacite, and andesite lava dome.**
2. **An early sign of a coming eruption is the growth of a so-called Peléan or lava spine, a bulge in the volcano's summit preempting its total collapse.**
3. **The material collapses upon itself, forming a fast-moving pyroclastic flow21 (known as a block-and-ash flow) that moves down the side of the mountain at tremendous speeds, often over 150 km (93 mi) per hour.**
4. **The 1902 eruption of Mount Pelée caused tremendous destruction, killing more than 30,000 people and competely destroying the town of St. Pierre, the worst volcanic event in the 20th century.**

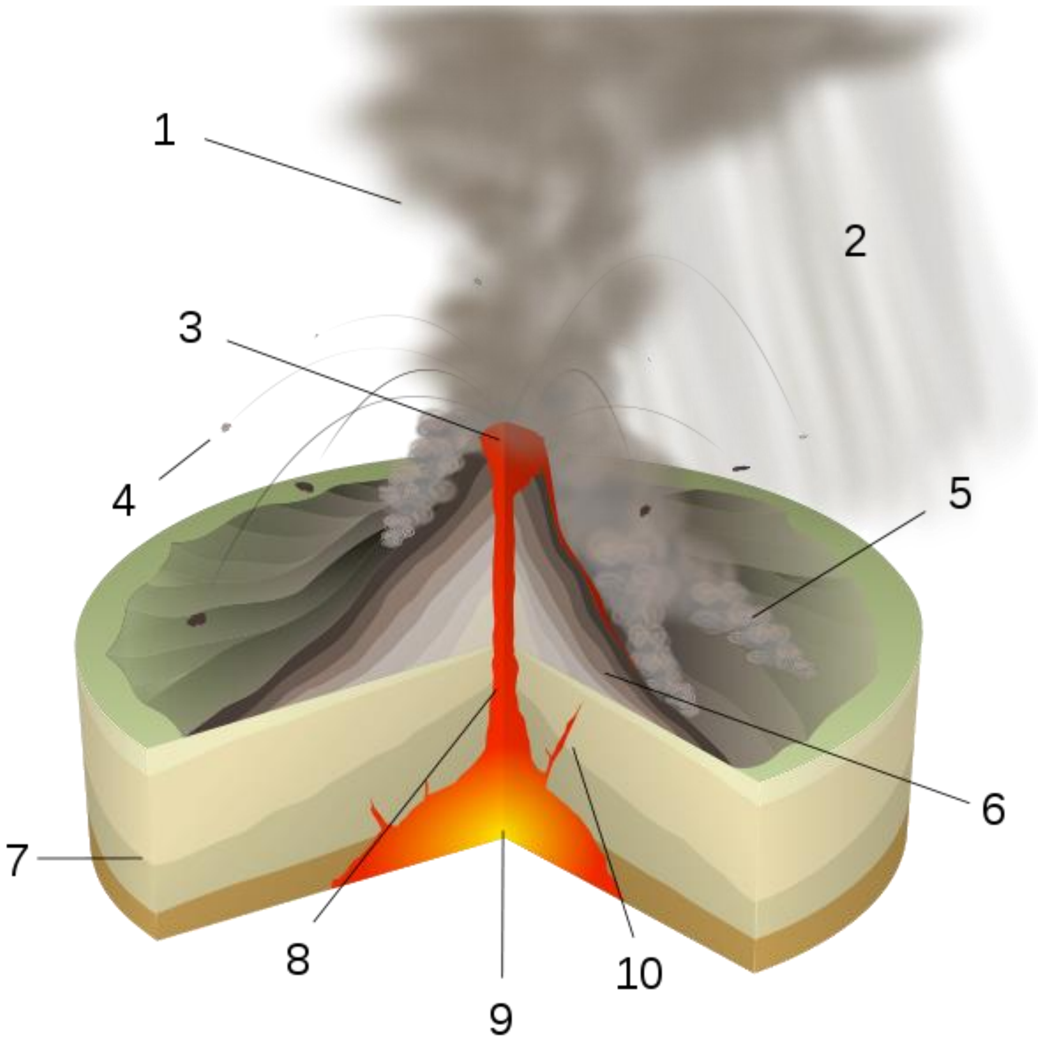


Diagram of Peléan eruption. (key: 1. Ash plume 2. Volcanic ash rain 3. Lava dome 4. Volcanic bomb 5. Pyroclastic flow 6. Layers of lava and ash 7. Stratum 8. Magma conduit 9. Magma chamber 10. Dike)

Erupsi Tipe *Pelean*

Pyroclastic flows descend the south-eastern flank of Mayon Volcano, Philippines. Maximum height of the eruption column was 15 km above sea level, and volcanic ash fell within about 50 km toward the west. There were no casualties from the 1984 eruption because more than 73,000 people evacuated the danger zones as recommended by scientists of the Philippine Institute of Volcanology and Seismology

Erupsi Tipe *Plinian*

1. The gases vesiculate and accumulate as they rise through the magma conduit. These bubbles agglutinate and once they reach a certain size (about 75% of the total volume of the magma conduit) they explode.
2. The narrow confines of the conduit force the gases and associated magma up, forming an eruptive column.
3. These massive eruptive columns are the distinctive feature of a Plinian eruption, and reach up 2 to 45 km (1 to 28 mi) into the atmosphere.
4. The densest part of the plume, directly above the volcano, is driven internally by gas expansion.
5. Plinian eruptions are similar to both Vulcanian and Strombolian eruptions, except that rather than creating discrete explosive events, Plinian eruptions form sustained eruptive columns.

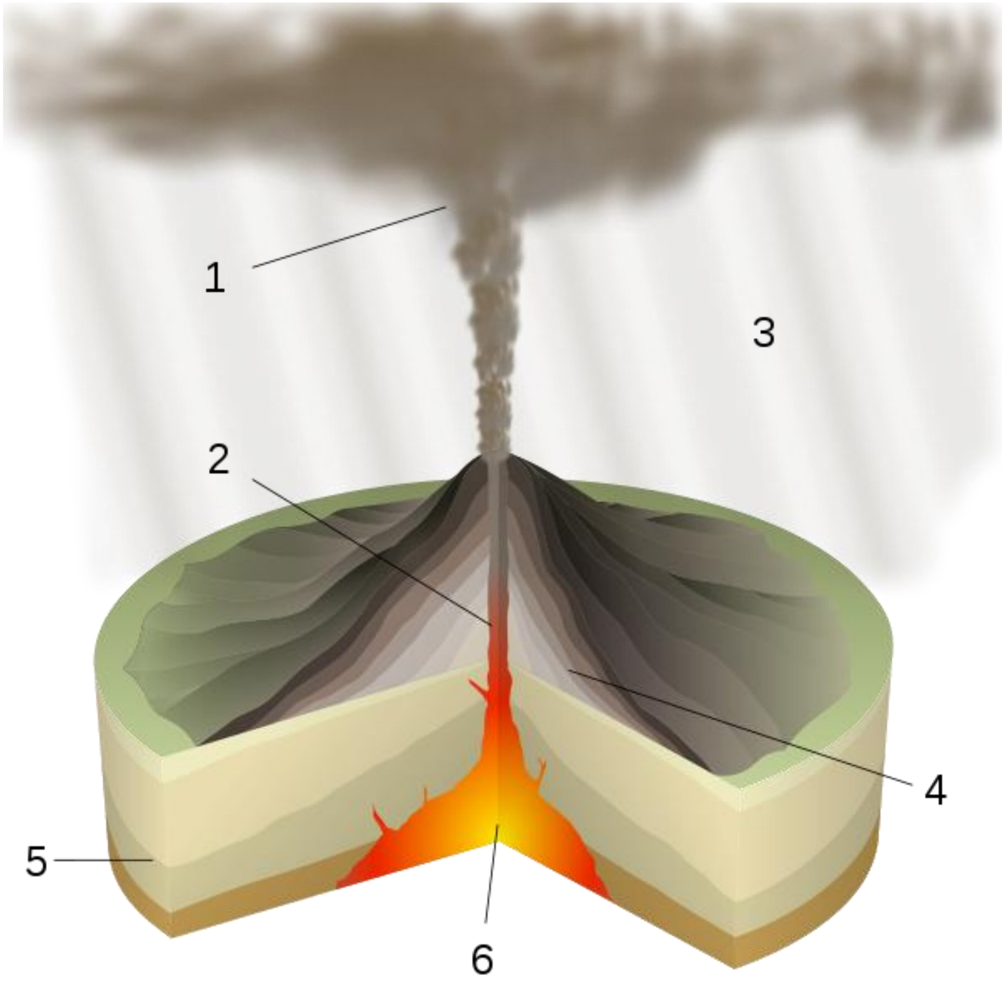
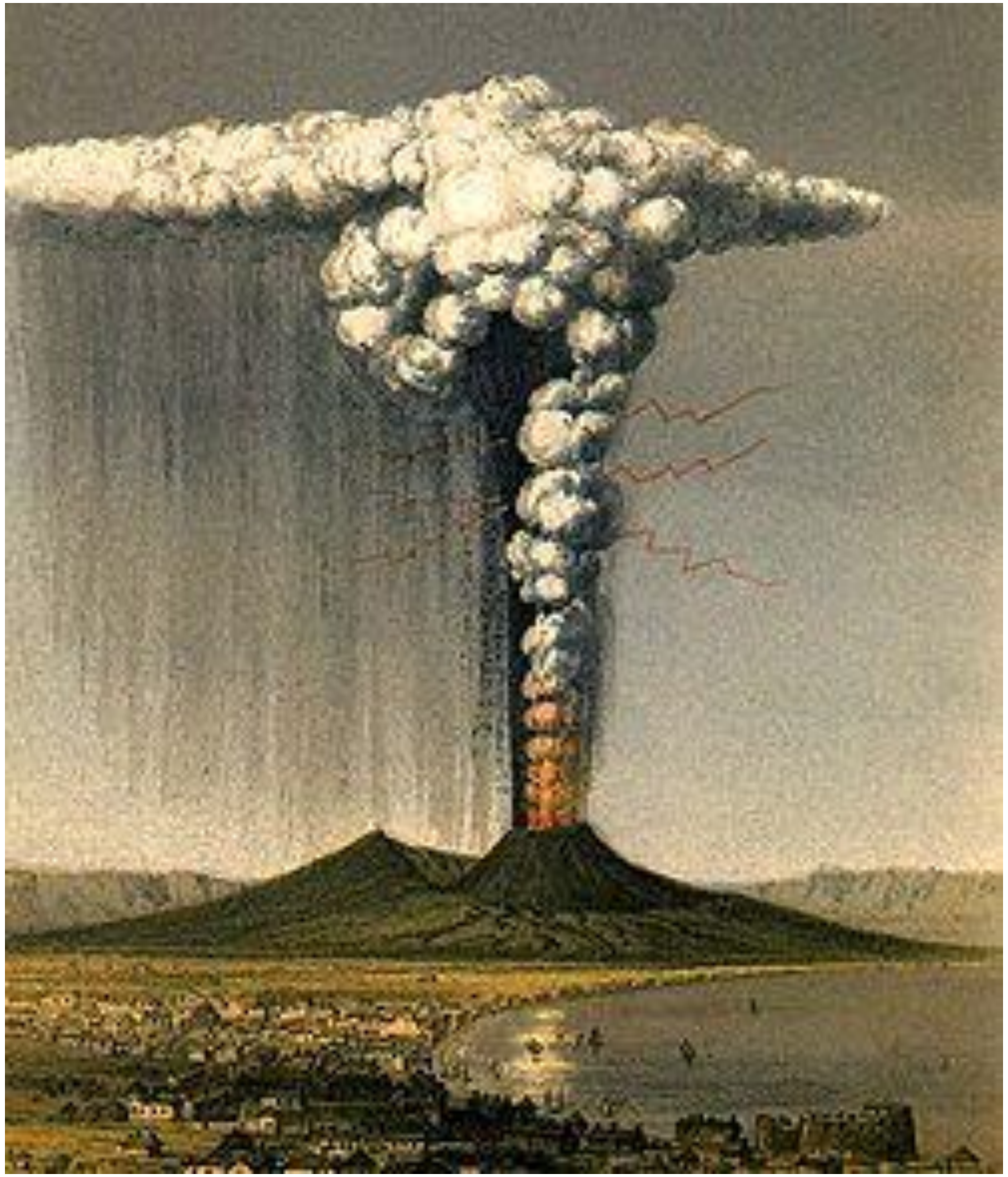


Diagram of a Plinian eruption. (key: 1. Ash plume 2. Magma conduit 3. Volcanic ash rain 4. Layers of lava and ash 5. Stratum 6. Magma chamber)

Erupsi Tipe Plinian (Krakatau)



1882 artist rendition of the eruption of Vesuvius, depicting what the AD 79 eruption may have looked like

Erupsi Tipe Plinian (Krakatau)

Computer-generated imagery of the eruption of Vesuvius in BBC/Discovery Channel's co-production Pompeii.

B. FREATIK

Erupsi Tipe *Phreatic*

1. **Phreatic eruptions (or steam-blast eruptions) are a type of eruption driven by the expansion of steam.**
2. **When cold ground or surface water come into contact with hot rock or magma it superheats and explodes, fracturing the surrounding rock and thrusting out a mixture of steam, water , ash, volcanic bombs, and volcanic blocks.**
3. **The distinguishing feature of phreatic explosions is that they only blast out fragments of pre-existing solid rock from the volcanic conduit; no new magma is erupted.**
4. **Often a precursor of future volcanic activity, Phreatic eruptions are generally weak, although there have been exceptions.**

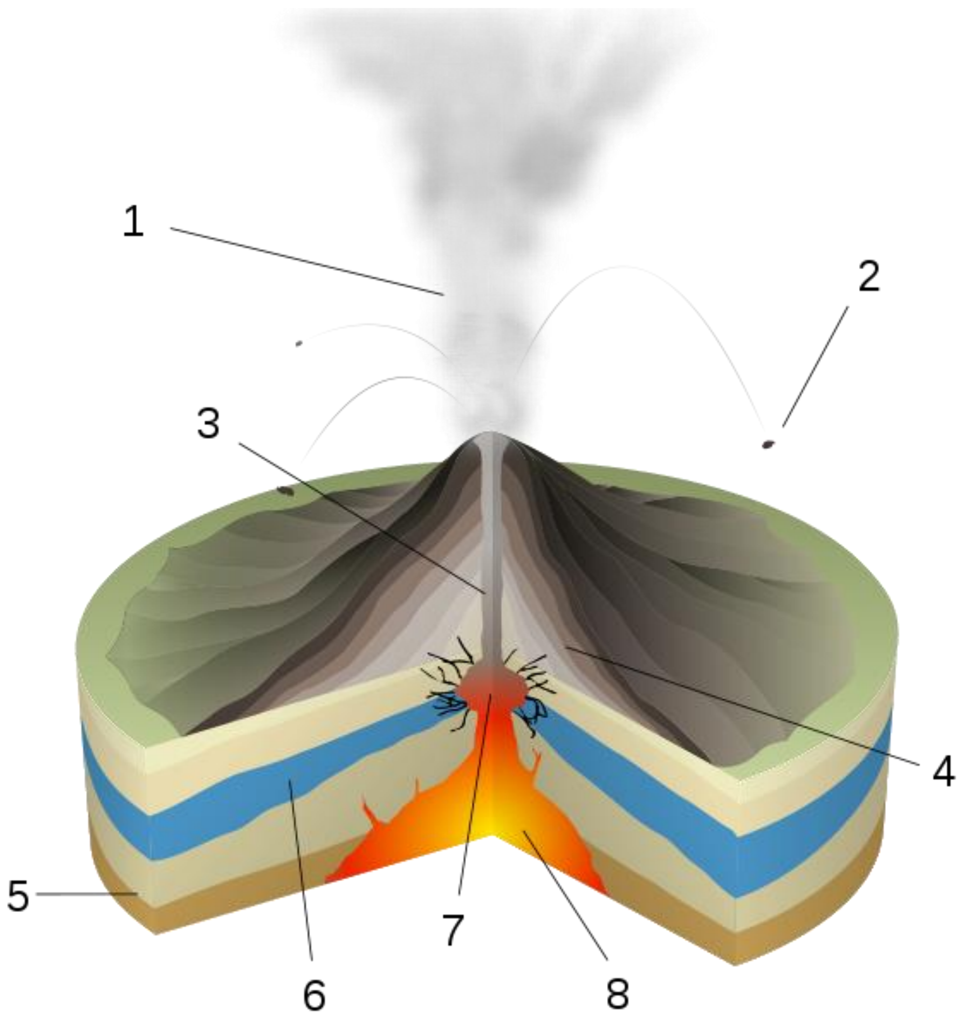
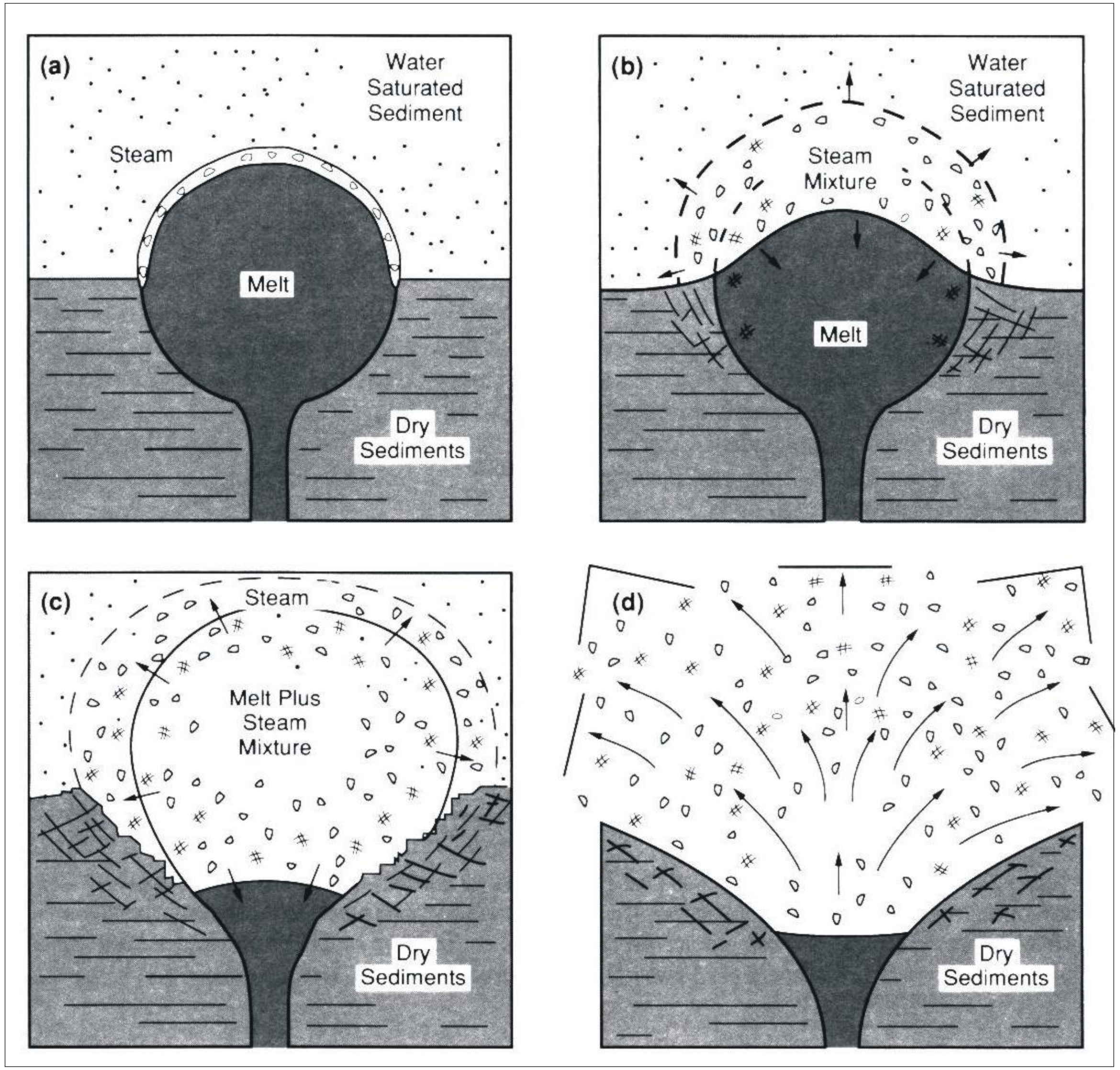


Diagram of a Phreatic eruption. (key: 1. Water vapor cloud 2. Volcanic bomb 3. Magma conduit 4. Layers of lava and ash 5. Stratum 6. Water table 7. Explosion 8. Magma chamber)

GL-3241

Model Hipotetis Kegiatan Erupsi Preatik Yang Diakibatkan Oleh Adanya Magma,
a. Kontak Awal Antara Magma Dengan Air Formasi, b. Uap Terbentuk, c. Magma bercampur Dengan Batuan Sekitarnya, d. Ekspansi Uap Bertekanan Tinggi Menyebabkan Terjadinya Letusan (Menurut Sheridan dan Wohletz, 1983, op.cit. Wohletz dan Heiken, 1992)



Erupsi Tipe *Phreatic*

Phreatic eruption at the summit of Mount St. Helens, Washington, in the spring of 1980

Photograph by K.A. McGee on 19 September 1995

Sulfur dioxide and other volcanic gases rise from the Pu`u `O`o vent on Kilauea Volcano, Hawai`i. During periods of sustained eruption from Pu`u `O`o between 1986 and 2000, Kilauea emitted about 2,000 to 1,000 metric tonnes of irritating sulfur dioxide gas (SO_2) gas each day.

Volcanic gas

Magma contains dissolved gases that are released into the atmosphere during eruptions. Gases are also released from magma that either remains below ground (for example, as an intrusion) or rises toward the surface. In such cases, gases may escape continuously into the atmosphere from the soil, volcanic vents, fumaroles, and hydrothermal systems. The most common gas released by magma is steam (H_2O), followed by CO_2 (carbon dioxide), SO_2 (sulfur dioxide), (HCl) hydrogen chloride and other compounds.

Photograph by S.R. Brantley in September 1983

Castle Geyser erupts water and steam, Yellowstone National Park, Wyoming.

Geyser

Most geysers are hot springs that episodically erupt fountains of scalding water and steam. Such eruptions occur as a consequence of groundwater being heated to its boiling temperature in a confined space (for example, a fracture or conduit). A slight decrease in pressure or an increase in temperature will cause some of the water to boil. The resulting steam forces overlying water up through the conduit and onto the ground. This loss of water further reduces pressure within the conduit system, and most of the remaining water suddenly converts to steam and erupts at the surface.

C. FREATO-MAGMATIK

1. **A Surtseyan eruption (or hydrovolcanic) is a type of volcanic eruption caused by shallow-water interactions between water and lava**

2. **Surtseyan eruptions can happen on land as well, and are caused by rising magma that comes into contact with an aquifer at shallow levels under the volcano.**

3. **A distinct defining feature of a Surtseyan eruption is the formation of a pyroclastic surge (or *base surge*), a ground hugging radial cloud that develops along with the eruption column.**
4. **Over time Surtseyan eruptions tend to form maars, broad low-relief volcanic craters dug into the ground, and tuff rings, circular structures built of rapidly quenched lava.**

Erupsi Tipe *Surtseyan*

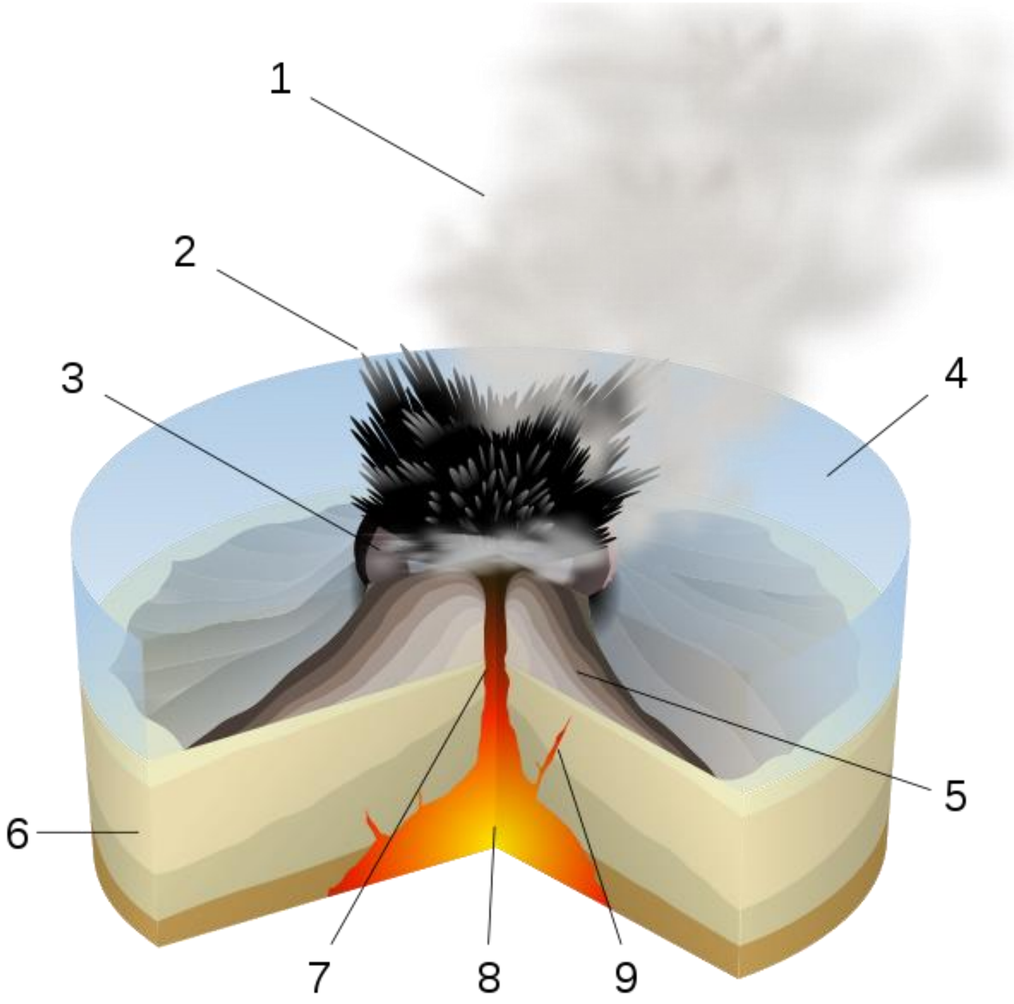


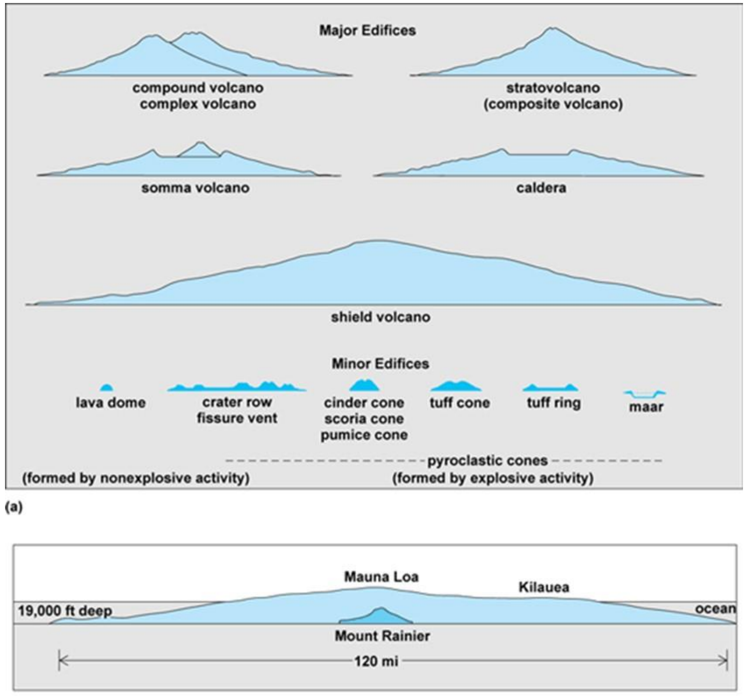
Diagram of a Surtseyan eruption. (key: 1. Water vapor cloud 2. Compressed ash 3. Crater 4. Water 5. Layers of lava and ash 6. Stratum 7. Magma conduit 8. Magma chamber 9. Dike)

Erupsi Tipe *Surtseyan*

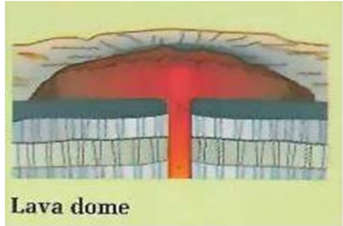
Surtsey on November 30, 1963, 16 days after the beginning of the eruption. Image: Howell Williams. Image source: NOAA

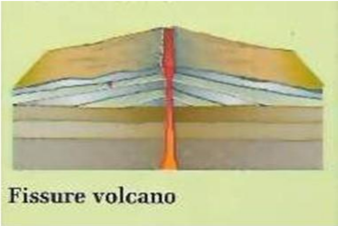
NEXT PART: 2. BENTUK EDIFICE

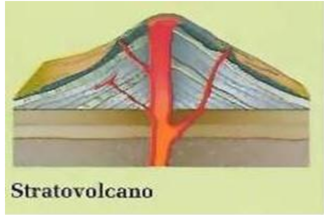
2. BENTUK EDIFICE

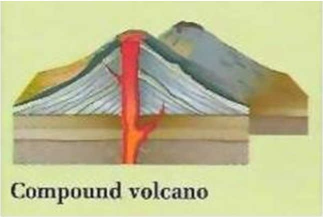


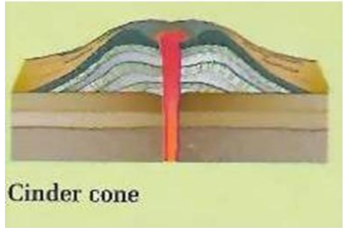
Simkin dan Siebert (1994)

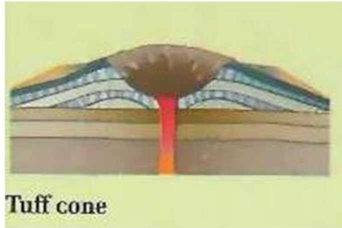


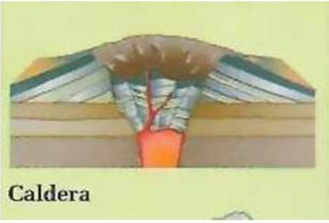


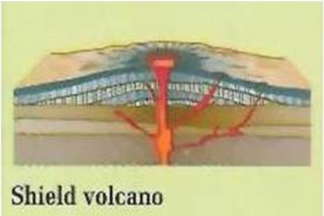






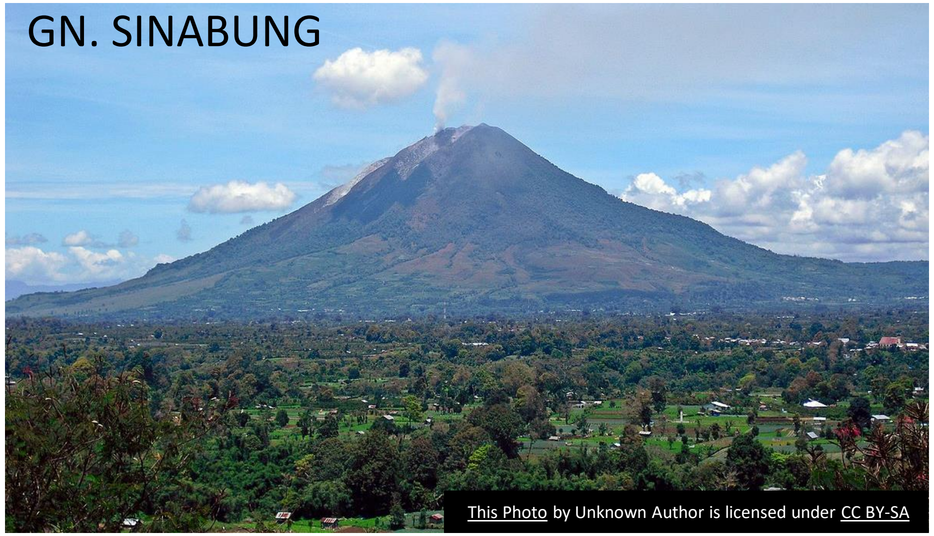






A. STRATOVOLCANO

- GUNUNGAPI CURAM
- MENGERUCUT
- PRODUK LETUSAN
- ALIRAN LAVA KENTAL
- TEFRA
- ALIRAN PIROKLASTIK
- VARIASI SEKUEN LETUSAN
- VARIASI JENIS MAGMA



This Photo by Unknown Author is licensed under CC BY-SA

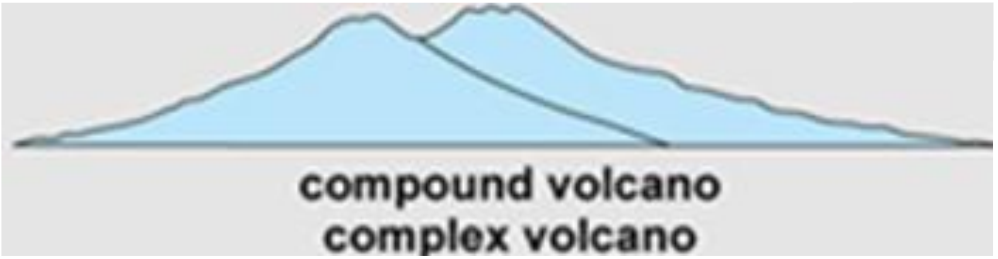
This Photo by Unknown Author is licensed under CC BY-SA

STRATOVOLCANO INDONESIA

B. COMPLEX VOLCANO

- GUNUNGAPI KOMPLEKS
- COMPUND VOLCANO
- NESTED VOLCANO
- RUMPUN GUNUNGAPI
- SATU AREA BEBERAPA PUSAT
- PERUBAHAN KARAKTERISTIK LETUSAN
- VENT BERPINDAH

This Photo by Unknown Author is licensed under CC BY-SA



Simkin dan Siebert (1994)

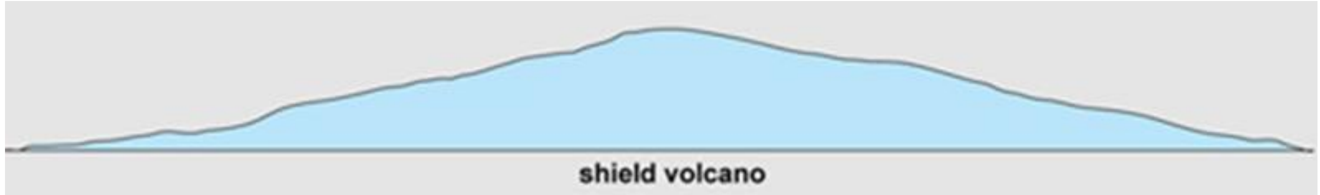
NEXT PART: 3. STRUKTUR

3. STRUKTUR GUNUNGAPI

SHIELD VOLCANO

- GUNUNG API PERISAI
- LERENG LANDAI
- AREA LUAS
- EDIFICE LETUSAN EFUSIF
- LAVA BASAL
- LAVA LOBE
- PULUHAN KILOMETER

This Photo by Unknown Author is licensed under CC BY-SA



Simkin dan Siebert (1994)

CALDERA VOLCANO

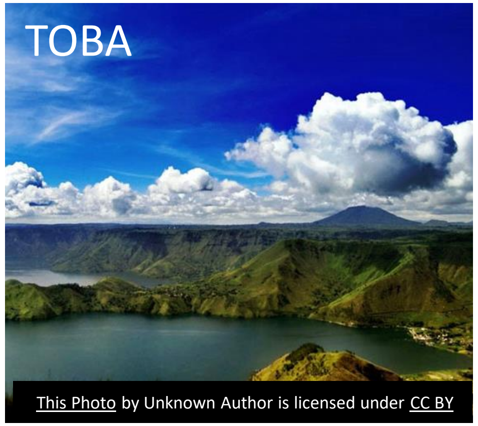
This Photo by Unknown Author is licensed under CC BY-SA

Simkin dan Siebert (1994)

- DEPRESI BESAR MELINGKAR
- DI PUNCAK GUNUNGAPI
- TERBENTUK SAAT PENGOSONGAN MAGMA
- LETUSAN BESAR
- RUNTUHAN PERMUKAAN

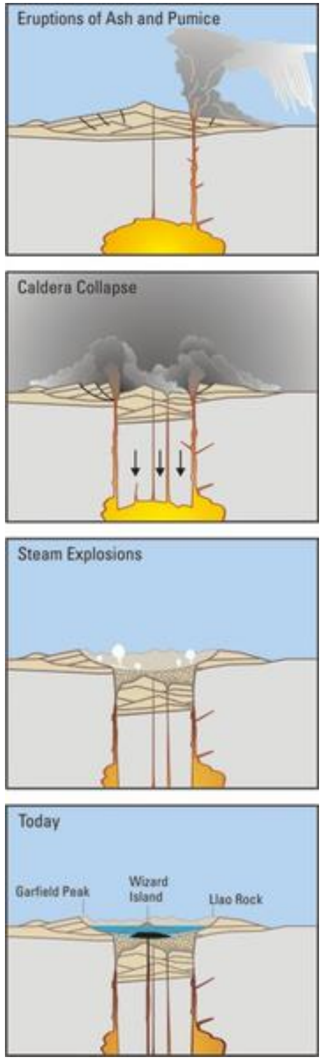
PEMBENTUKAN KALDERA

- ➢ERUPSI BESAR
- ➢COLLAPSE
- ➢FREATIK
- ➢TERISI AIR

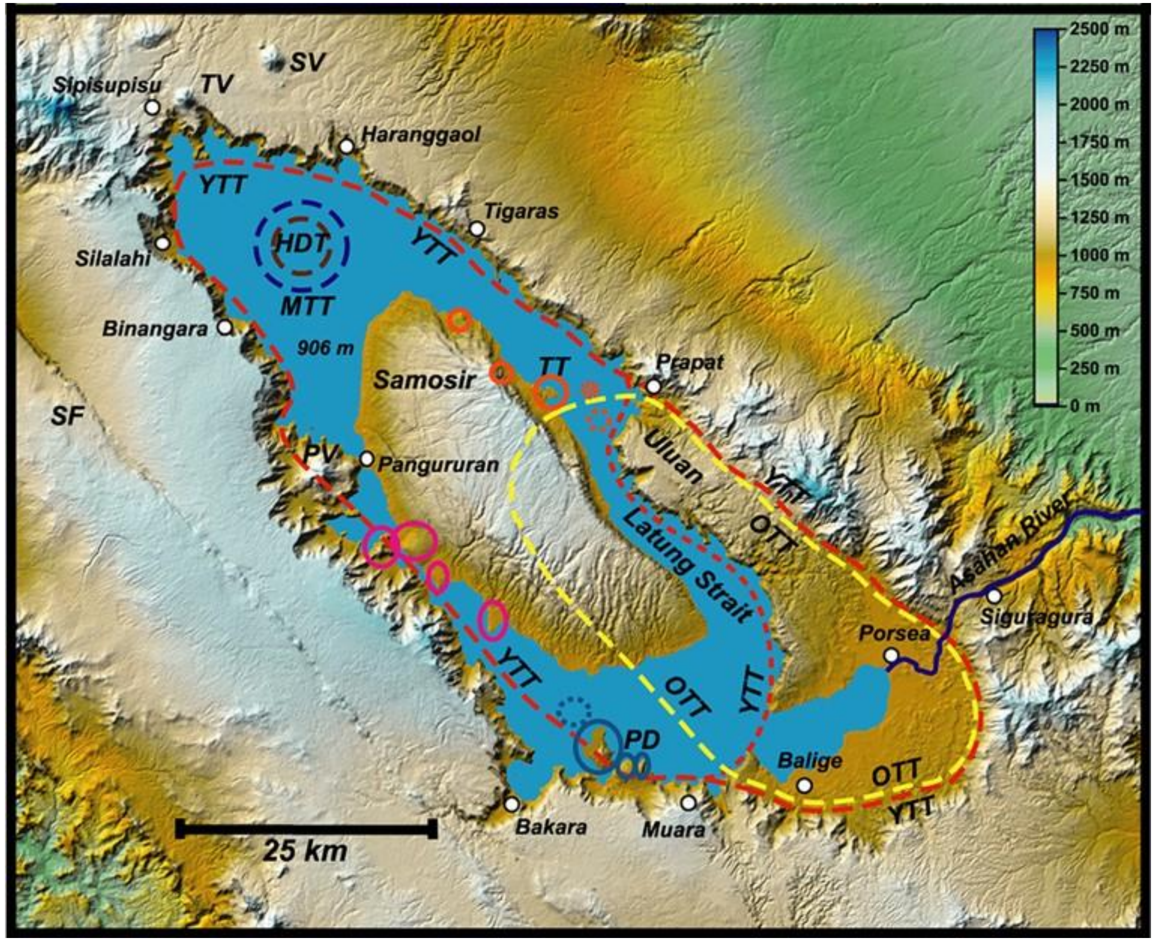


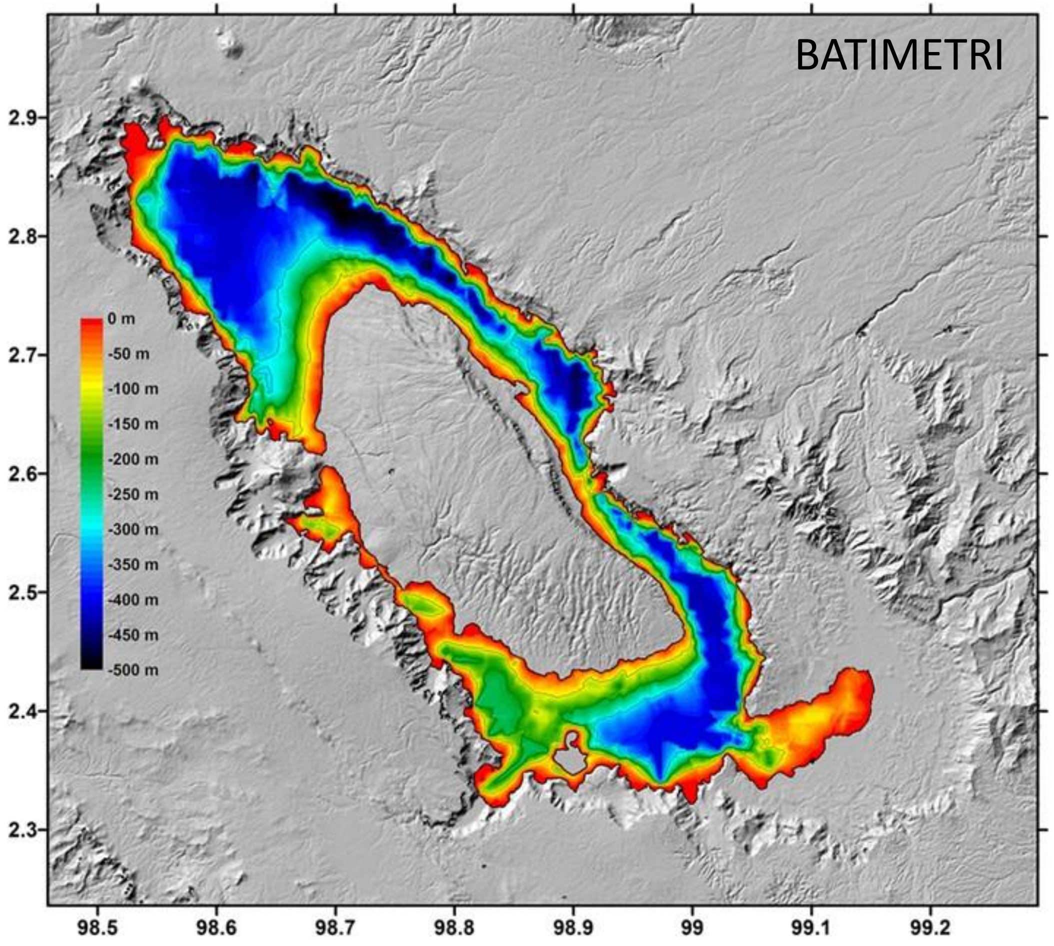
This Photo by Unknown Author is licensed under CC BY

This Photo by Unknown Author is licensed under CC BY-NC-ND



KALDERA TOBA





Chesner (2012)

PEMBENTUKAN KALDERA TOBA

1. LETUSAN EKSPLOSIF
2. BEBERAPA PUSAT ERUPSI
3. REKAHAN MELINGKAH
4. COLLAPSE
5. PEMBENTUKAN DOME

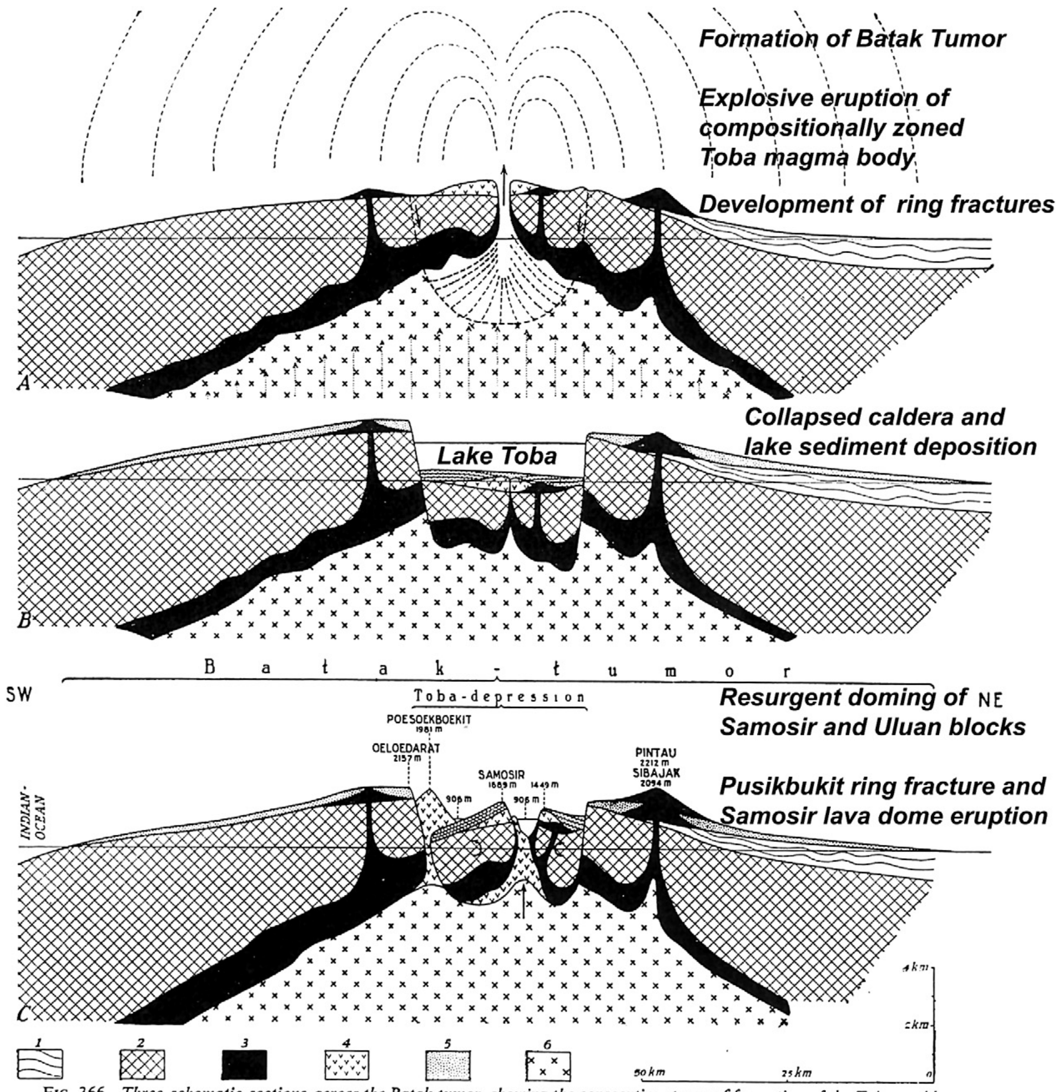
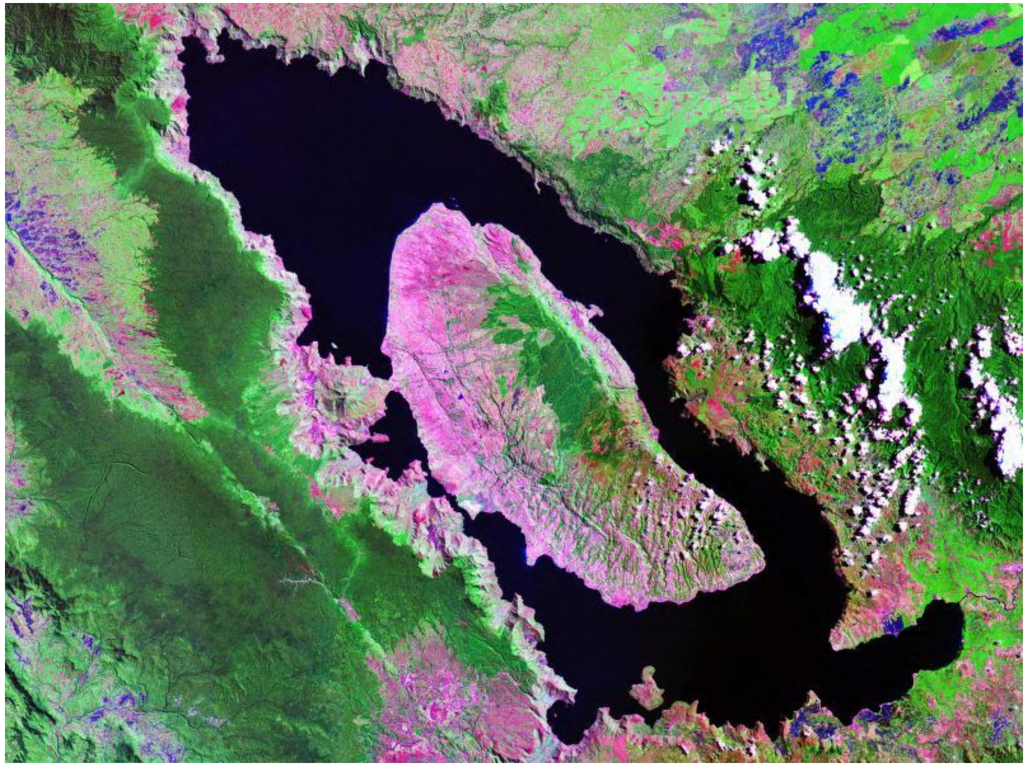


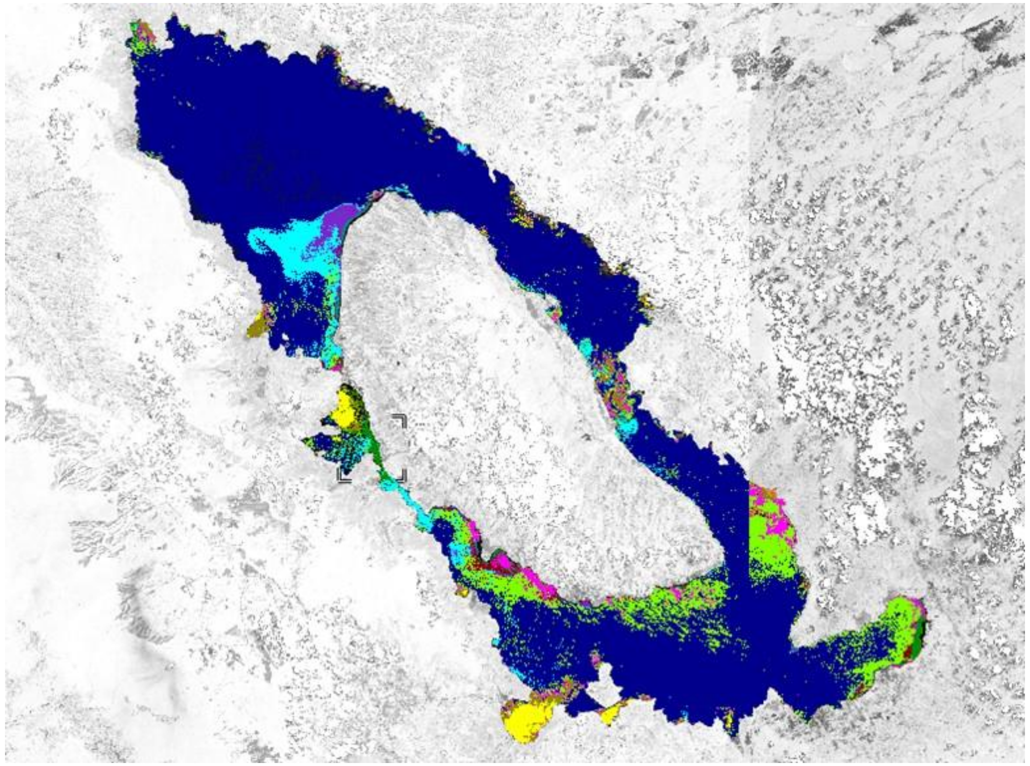
FIG. 366. *Three schematic sections across the Batak tumor, showing the consecutive stages of formation of the Toba cauldron.*

Chesner (2012)

CITRA KALDERA TOBA

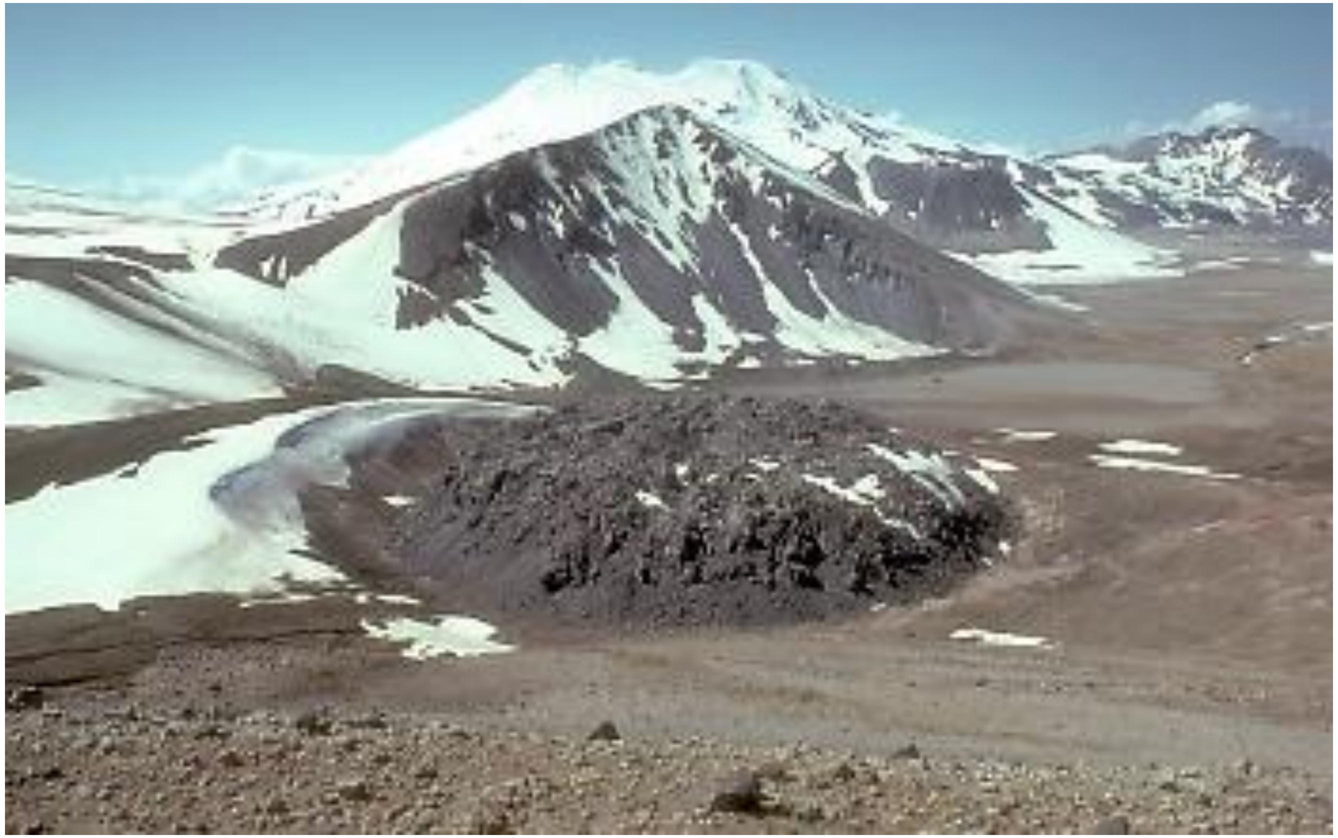


LANDSAT 7 ETM+ NATURAL COLOR



DETECTED FLOATING SEDIMENT

Volcanic caldera partially filled by a new central cone lava dome



Photograph by T.P. Miller in June 1979

Volcanic dome atop Novarupta vent, Valley of Ten Thousand Smokes, Katmai National Park and Preserve, Alaska. The dome was erupted from the same vent that expelled about 15 km^3 of magma in an enormous explosive eruption in 1912.

Volcanic dome

Volcanic domes are rounded, steep-sided mounds built by very viscous magma, usually either dacite or rhyolite. Such magmas are typically too viscous (resistant to flow) to move far from the vent before cooling and crystallizing. Domes may consist of one or more individual lava flows. Volcanic domes are also referred to as lava domes.

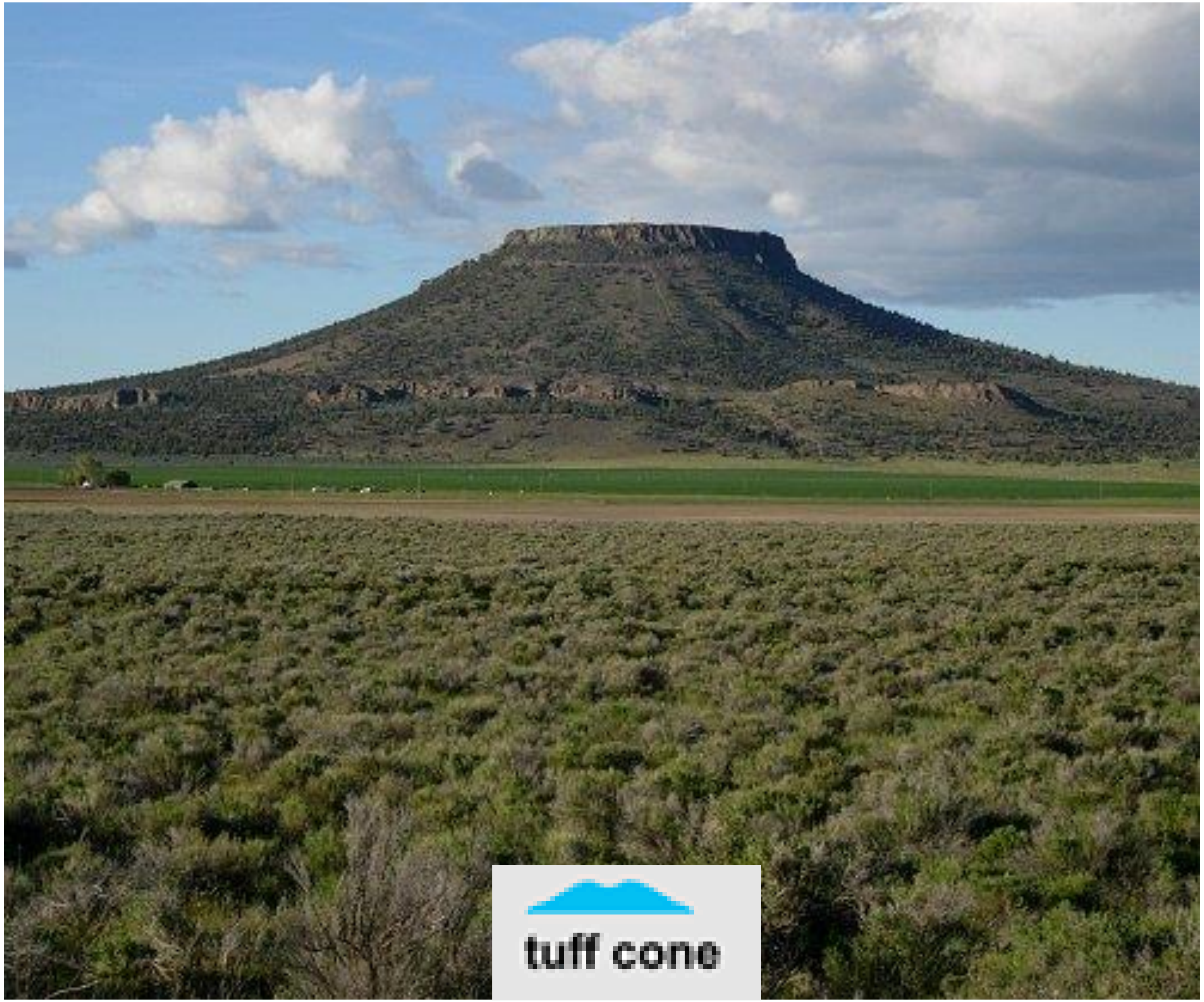
Cinder cone

A cinder cone is a steep, conical hill of volcanic fragments that accumulate around and downwind from a vent. The rock fragments, often called cinders or scoria, are glassy and contain numerous gas bubbles "frozen" into place as magma exploded into the air and then cooled quickly. Cinder cones range in size from tens to hundreds of meters tall.

Photograph by J.P. Lockwood on 1 December 1975

This cinder cone (Pu`u ka Pele) was erupted low on the southeast flank of Mauna Kea Volcano. The cone is 95 m in height, and the diameter of the crater at the top is 400 m. Hualalai Volcano in background.

Tuff Cone, Oregon



Hverfell Tuff Ring, near Lake Myvatn, Iceland.
Also known as a tephra or ash ring (or cone), this structure is 463m high with a 1040m wide crater

MAAR

- A maar is a low-relief, broad volcanic crater formed by shallow explosive eruptions.
- The explosions are usually caused by the heating and boiling of groundwater when magma invades the groundwater table.
- Maars often fill with water to form a lake.

USGS *http://volcanoes.usgs.gov*

SELESAI

6AX7V2