STRATOVOLCANOES

Stratovolcanoes consist of a stratified succession of lava flows, and interbedded pyroclastic deposits, and tend to have a conical form with slopes that steepen upward until approximating to the repose angle (33-36°) of loose debris. Most subduction-related basaltic volcanoes conform with this type. Commonly the cone is truncated by a caldera. Rift zones tend to be diffuse and ill-defined and grade into radial vent systems. Cinder cones tend to be conspicuous on the volcano flanks. In many arc volcanoes basaltic andesite and more silicic types accompany basalt.

Why do stratovolcanoes tend to have a steep conical shape?

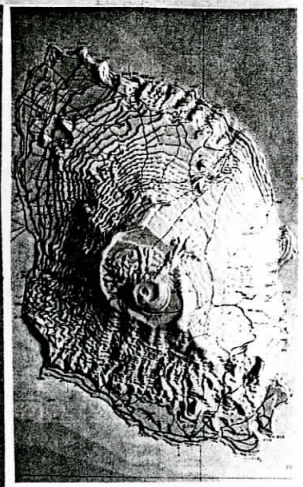
- A large proportion of the eruptive activity takes place at the central vent.
- Many of the explosive eruptions are relatively weak and their pyroclastic deposits are heaped immediately around the summit crater.
- The lava has a moderate to high viscosity and does not flow far. Often it forms steep-sided lava domes in the summit region.

The small Japanese island volcano of Izu-Oshima is representative of the arc-type basaltic cone. It has a basal diameter of 27 km, rises about 2200 m above the sea floor to 758 , above sea level, and has a volume of 415 km^3 of which 23 km^3 (5%) are above sea level. Subaerial slopes are up to 20° but the cone is truncated by a caldera 3 km wide. Pyroclastic rocks are more voluminous than lava flows. A broad and rather ill-defined rift zone parallels the long axis of the island and is marked by cinder cones and, near the coast, phreatomagmatic tuff rings.

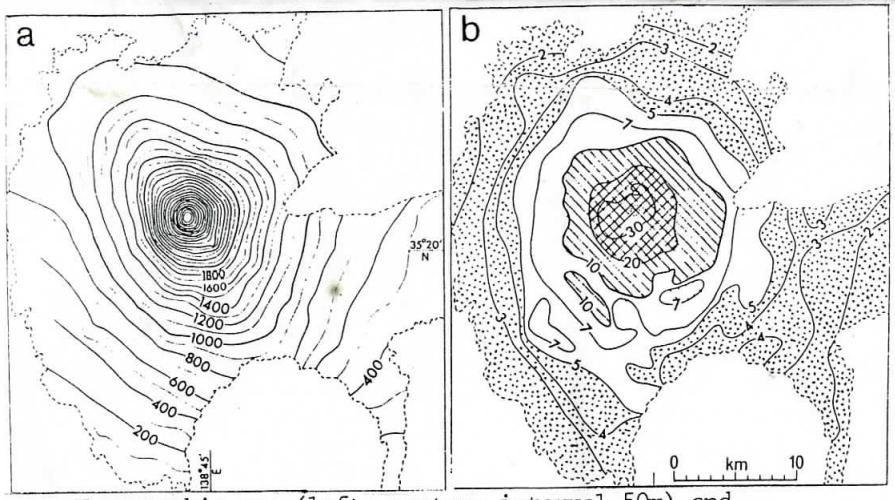
Izu-Oshima has displayed periodic activity through the past 10,000 y with an average 100 y between larger eruptions. From a careful volumetric study of eruptive products in the historic period (the past 1100 y), Izu-Oshima is a prime example of a "steady state" volcano in which magma is fed at a uniform rate of not less than 30 kg/sec into the magma chamber, and the output is modulated by the chamber characteristics.

Fuji is a fine example of a stratovolcano having the form of a typical andesitic cone but is exclusively basalt apart from a minor volume of dacite pumice erupted in the latest eruption in 1707. Fuji is the highest volcano in Japan; it rises to 3776 m above sea level and 3700 m above its base, and has an estimated volume of 1400 km^3. The basal diameter is 25 km. The steep cone above the 2000 m level has slopes >20°, but a broad apron sloping mostly <10° below the 1500 m level accounts for 75% of the total area. Many cinder cones occur on its flanks.
Kliuchevskaya, in Kamchatka that rises 3000 m above its base to 4830 m elevation, is very similar in form to Fuji.
Etna is a less steep cone but has about the same volume (700 km^3) as the other two. It has much more frequent eruptions and has an output little lower than that of Hawaiian volcanos.

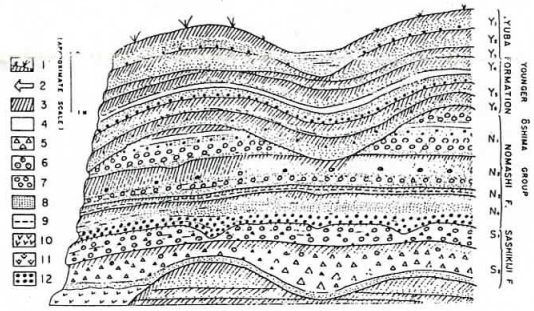
The basaltic volcano Izalco, in El Salvador, was born in 1769 or 1770 and was frequently in eruption but activity ceased in 1966. Izalco began as a cinder cone; this grew and basaltic lava flows buttressed it. The flows are aa and that of 1793 extends 7 km from the crater. The top of the new cone was 525 m above its surroundings by 1825, 600 m in 1953 and 665 m in 1956. Activity was of strombolian type.



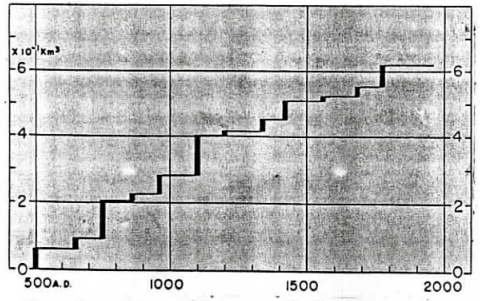
Mosaic of vertical aerial photographs showing the whole island, 15 km long, of Izu-Oshima and the caldera of Mihara-yama. Note close-spaced pattern of stream valleys, cut into ash deposits. Right: topographic relief model, and map showing distribution of historic lava flows, cinder zones and other vents. The island volcano has distinct rift zones trending near NW-SE.



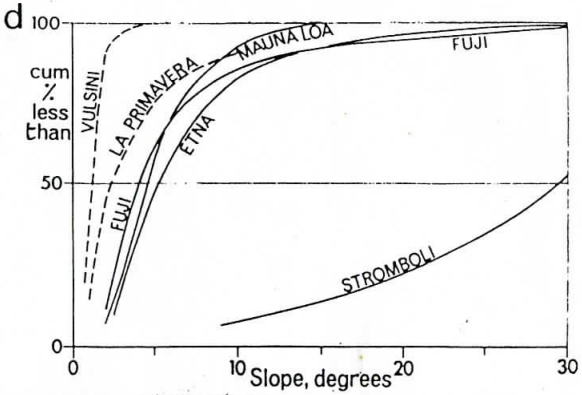
Topographic map (left; contour interval 50m) and slope-angle map (right: slope in degrees measured from the horizontal) of Fuji volcano. Like most stratovolcanoes, teh central cone is surrounded by a broad apron of volcaniclastic deposits and lava flows.



Idealised exposure showing the succession of pyroclastic deposits; the cumulative-volume plot is based on measurements on these deposits



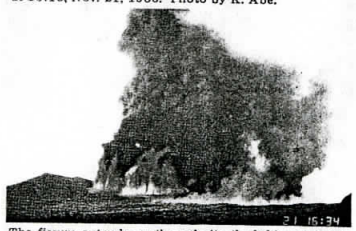
Cumulative volume of fall deposits from the summit vents of Izu-Oshima, from 500 A.D. to the present. The plot approximates a straight line, suggestive of steady-state conditions: the first-documented steady=state volcano to be documented.



Cumulative percentage of volcano surface sloping at less than any given ~~slope~~ grade, for several basaltic and (dashed lines) two silicic volcanoes.

Beginning of the fissure eruption on the caldera floor, at 16:15, Nov. 21, 1986. Photo by K. Abe.

An early stage of fountaining with ash column rapidly rising (16:19, Nov. 21, 1986). Photo by K. Abe.



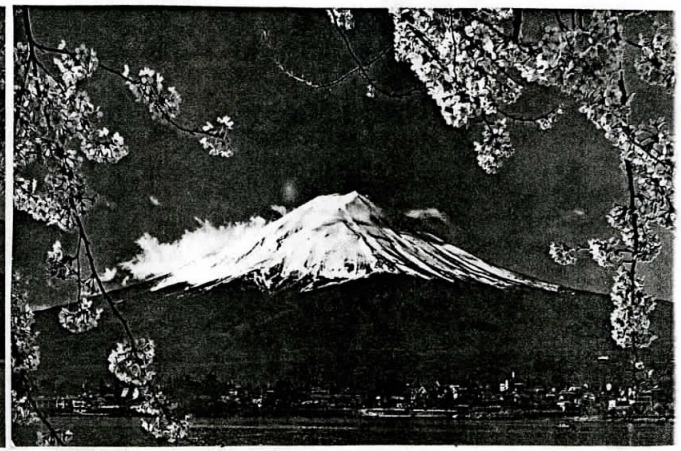
The fissure extends southwards (to the left) en echelon. 16:34, Nov. 21, 1986. Photo by K. Abe.

The climax of high fountaining, 16:59, Nov. 21, 1986. Photo by K. Abe.

Fire fountains seen from the same spot as above. Photo by K. Abe.

Voilent fountaining with thick ash cloud, leading to a sub-plinian type eruption. Photo by T. Miyazaki.

The 1986 eruption on Izu-Oshima was particularly powerful, with lava fountains up to 1600 m high



General views of the well-known Japanese basaltic stratovolcano, Mt Fuji. This volcano has not yet experienced a caldera-forming eruption. The fact that the latest eruption (in 1707) erupted evolved (dacite) magma for the first time may not augur well for the future.