

Lunar Volcanism Notes

(adapted from <http://www.asi.org/adb/m/04/02/volcanic-activity.html>)

The volcanic rocks produced on the moon are basalts. Basalts are common products of mantle partial melting on the terrestrial planets. This is mainly due to broad similarity of their mantle compositions. For partial melting to occur on the moon, temperatures greater than 1100°C at depths of about 200 km are required. The bulk eruption styles appear to be in the form of lava flows. There is also widespread evidence of fire-fountaining forming pyroclastic deposits (typically glass beads).

Sinuuous Rilles

These are meandering channels which commonly begin at craters. They end by fading into the mare surface, or into chains of elongated pits. Sizes range from a few tens of meters to 3km in width. Lengths range up to 300km in length. Channels are U-shaped or V-shaped, but fallen debris (from the walls, or crater ejecta) have generally modified their cross-sections. Most sinuous rilles are near the mare basin edges, although they are found in most mare deposits. Apollo 15 confirmed the theory that sinuous rilles were analogous to lava channels and collapsed lava tubes. Lunar rilles are much larger than their terrestrial equivalents. This is thought to be due to a combination of reduced gravity, high melt temperature, low viscosity, and high extrusion rates.

Domes (Shield Volcanoes)

Domes are defined as broad, shallow landforms. These are convex, circular to oval in shape, and occur on the mare basins. Eighty low domes (2-3 degree slopes) have been mapped (Guest & Murray, 1976). Diameters range from 2.5 to 24km, and heights vary from 100 to 250m. Most of these domes are in the Marius Hills area where they accompany other interesting geological features (possible collapsed lava tubes, etc). Some domes have summit craters or fissures. Observation and mapping of lava domes still continues. Due to their low profile, Lunar Orbiter and Clementine images do not tend to show them very well, due to the typically high solar angle on such images (they have short shadows).

Lava Terraces

Small lava terraces have been observed within some craters and along mare-highland boundaries. These have been interpreted as "shorelines" left as lava has withdrawn (e.g., back into a vent or lower basin).

Cinder Cones

Terrestrial cinder cones are formed from lava bombs, "cinders", etc., erupted explosively from a central vent. The volume of each cinder cone is much smaller than the total basalt erupted from the cone. On the moon, cone-like landforms have been observed in association with rilles. Most are less than 100m high with diameters of 2 - 3km, and have a low albedo. Some have summit craters (with diameters of less than 1km). Lines of cones are thought to be fissure vents.

Dark-haloed craters & Pyroclastic Deposits

Extrapolation from terrestrial cinder cones suggests that lunar deposits should be broad, pancake-shaped, and low. Although no such structures have been identified for certain, this might be an

explanation for the numerous dark-haloed craters. Again, these are usually along the margins of mare basins, or along rilles and other lineaments. Most are shallow with dark rim deposits 2-10km in diameter. Whether these black deposits are from the central crater, or exhumed by an impact, they are still of interest due to their relation to explosive volcanic activity. Such active eruptions imply a high volatile content in the melt.