



Two types of the regular stratovolcano shape: a DEM-based morphometrical analysis

Dávid Karátson (1,2), Massimiliano Favalli (3), Simone Tarquini (3), Alessandro Fornaciai (3), and Gerhard Wörner (2)

(1) Eötvös University, Department of Physical Geography, Budapest, Hungary (dkarat@ludens.elte.hu), (2) Georg-August University, Geoscience Center, Göttingen, Germany, (3) Istituto Nazionale di Geofisica e Vulcanologia, Pisa, Italy

We studied the shape of the most regular-shaped stratovolcanoes of the world to mathematically define the form of the ideal stratovolcano. Based on the Shuttle Radar Topographic Mission (SRTM) DEM data, we selected the 20 most circular and symmetrical volcanoes, which incidentally all belong to subduction-related arcs surrounding the Pacific. The selection of volcanoes benefits from the introduction of a new definition of circularity, which is more robust than previous definitions, being independent of the erosional dissection of the cone.

Our study on the shape of stratovolcanoes was based on the analysis of the radial elevation profiles of each volcano. The lower half section of the volcanoes is always well fitted by a logarithmic curve, while the upper half section is not, and falls into two groups: it is fitted either by a line ("C-type", conical upper part) or by a parabolic arc ("P-type", parabolic/concave upper part).

Chemical composition of the two groups' eruptive products indicates higher SiO₂ and/or higher H₂O content for C-type volcanoes, which could imply a higher incidence of mildly explosive (e.g. strombolian) eruptions. We propose that this higher explosivity is responsible for forming the constant uppermost slopes by the deposition of ballistic tephra and its subsequent stabilisation at a constant angle. In contrast, P-type volcanoes are characterized by a smaller SiO₂ and H₂O content, which can be responsible for a higher incidence of effusive events and/or a lower incidence of upper flank-forming (i.e. mild) explosive eruptions. Therefore, the concave upper flanks of these volcanoes may be shaped prevailingly by lava flows.

Based on this hypothesis, we propose that the advanced morphometric analysis of the elevation profile of stratovolcanoes can provide insights into their dominant eruptive style.