

Magma output rates of Pululahua, the largest Ecuadorian dome complex

F Vasconez¹, A. Vásconez-Müller², D. Andrade¹

¹Instituto Geofísico, Escuela Politécnica Nacional (IG-EPN), Ap. 17-01-2759, Quito, Ecuador

²University of Bristol, Beacon House, Queens Road, Bristol, BS8 1QU, UK

Based on DEM and field-data, a volumetric analysis was carried out at Pululahua dome complex in order to infer a long-term magma output rate. Pululahua volcano, located 20 km northwest of Quito, developed from ~40 to ~2ka. Effusive activity mostly took place between ~40 and ~11ka with the emplacement of units I & II, consisting of voluminous dacite domes. Subsequently, ~9ka of quiescence followed, only interrupted by a minor explosive event that occurred shortly before ~6ka. From 2.5 to 2.3ka, highly explosive eruptions occurred (unit III), resulting in the formation of a semi-rectangular caldera (13 km²). Finally, up to ~2.2 ka a central dome cluster (unit IV) extruded inside the caldera.

The total erupted volume is estimated at 5.2 km³, including lava domes (2.7km³) and their related volcanoclastic deposits (1.5km³), as well as tephra (1km³). Thus, the average long-term magma output rate is calculated to be 0.12 km³/ky. Half of the total volume (2.5km³) makes up the domes and related volcanoclastic material of unit II, which was formed from 18 to 11ka. It implies a significantly increase in the magma output rate of 0.398 km³/ky, which is more than four times higher than the first stage of just 0.098 km³/ky (unit I). However, it should be pointed out, that the ages of unit I are not well constrained. On the other hand, the caldera-forming explosive eruptions (unit III) extruded at ~2.675 km³/ky, which is more than 6 times higher than the second stage. Finally, a dramatic increase to ~12.578 km³/ky is estimated for the formation of unit IV intra-caldera domes.

In a global context, the analysis of the volumetric dynamism of Pululahua's activity gives insights into the temporal variations in magma output rates. Overall, one can observe that the active periods get shorter over time, from thousands to tens of years, accompanied by a marked increase in the magma output rates along the entire eruptive history. This means that Pululahua, a young and potentially active volcano, remains growing even though now it has been in a long repose period of more than 2000 years.