Insight into the CE 1600 Huaynaputina Plinian tephra, combining the re-analysis of observational datasets with recent methods for tephra dispersal modelling

Jean-Marie Prival[1], Jean-Claude Thouret[1], Lucia Gurioli[1], Costanza Bonadonna[2], Saida Japura[3]

[1]*Université Clermont-Auvergne, Laboratoire Magmas et Volcans, France*
[2]*Département des Sciences de la Terre, Université de Genève, Genève, Switzerland*
[3]*Observatorio Vulcanologico del INGEMMET, Perù*

In the Central Andes, large Plinian eruptions (VEI ≥ 6) occur at a relatively high frequency: one every 2000 to 4000 years over the past 50,000 years in southern Peru. This recurring, explosive activity poses a challenge to a region hosting c. three million people. Our objective is to use the 1600 CE Huaynaputina eruption as a reference to better assess the impacts of large events in the region. With VEI 6, this is considered the largest historical eruption in South America. In the framework of the Huayruro project, we have re-examined the Plinian stage of the eruption using recent models to estimate the volume and dispersal of the tephra-fall deposit.

We reconsidered the case study in 2015–2017, revising the dataset and applying recent models to unravel to which extent these developments improved tephra studies. These studies have considerably evolved over the past decade. Sampling strategy is now standardized. New tools allow to propagate measurement errors into uncertainty of eruption source parameters. Volume estimation methods have been developed allowing thickness extrapolation to be made beyond the most distal isopach contour, thus better accounting for fine ash dispersed far away from the source. More recent methods consider thickness measurements instead of isopach data, removing the subjectivity inherently associated with hand-drawn contours. Previous studies of the Huaynaputina eruption were done in 1999-2002.

The bulk volume of pumice fallout from the Plinian stage is approximately 14–15 km^3, almost twice as the previous estimate (7–8 km^3 within the 1 cm isopach). The revised plume height estimate, 32.2 ± 2.5 km, is consistent with past studies. As a result, the Huaynaputina 1600 CE Plinian eruption lies in the upper part of the Plinian field close to the ultra-Plinian transition, making this eruption one of the largest in the past millennium.

S01.14 Talk