Investigating the Magma Dynamics at Huaynaputina Volcano

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Magma ascent rate is a challenging parameter to constrain yet a crucial element to investigate magma dynamics. The 1600 eruption of the Huaynaputina volcano was the largest recorded eruption in South America, with an impact area that now hosts approximately a quarter of Peru's population. The aim of this study is to investigate the magma ascent rate of the initial Plinian phase of the eruption using pyroclast texture. Scanning electron microscopy (SEM) was employed to image several pumice clasts. The images were then cleaned and processed using the Fast Object Acquisition and Measurement System (FOAMS) to obtain a vesicle number density. Melt inclusions in crystals were identified and double polished, and their H_2O content was analyzed using infrared spectroscopy (FTIR). The mean value of the VND is 4.09×10^6 mm^{-3}, while the mean value of the H_2O content is 3.05%. According to the nucleation theory, the average decompression rate is thus calculated to be 13.47 MPa/s (ascent rate of 548 m/s). An alternative equation, which relies solely on the VND, provides a decompression rate of 9.06 MPa/s (ascent rate of 362 m/s). Both calculated values are high, but remain within a reasonable range for eruptions of this magnitude. If this eruption were to occur today, it would have a catastrophic impact. These results emphasize the necessity for further research to provide a deeper understanding of such destructive eruptions.