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Volcanogenic halogen fluxes from plinian eruptions towards the atmosphere

THIEBAUT D'AUGUSTIN[1], HÉLÈNE BALCONE-BOISSARD[2], GEORGES BOUDON[3], ETIENNE DELOULE[4], PIERRE BÜRCKEL[5] AND CORALIE VESIN[6]

[1]Sorbonne Université - ISTeP

[2]Institut des Sciences de la Terre de Paris (ISTeP), UMR 7193, CNRS-Sorbonne Université

[3]Université de Paris, Institut de physique du globe de Paris, CNRS, F-75005

[4]Université de Lorraine, CNRS, CRPG

[5]Université de Paris, Institut de physique du globe de Paris, CNRS UMR 7154

[6]CRPG

Presenting Author: thiebaut.daugustin@sorbonne-universite.fr

Explosive eruptions inject a great amount of gases in the atmosphere through a plume that can reach altitudes as high as several tens of kilometers. Such events affect the stratosphere chemistry, in particular its ozone content, and can thus impact the climate. Halogen compounds are known to be highly reactive but fluxes of volcanogenic halogen elements are only sparsely monitored. It results in an unawareness of the volume of halogen elements that can reach the stratosphere and their contribution to the impact of volcanoes on climate.

We studied several plinian eruptions from volcanoes of various geographic origins : Kizimen and Bezymianny (Kamchatka, Russia), Phlegrean Fields, Vesuvius and Etna (Italy), Morne Trois Pitons-Micotrin (Dominica, Lesser Antilles), Montagne Pelée (Martinique, Lesser Antilles) and Huaynaputina (Peru). We present herein eruptive fluxes towards the atmosphere for F, Cl, Br and S during these eruptions, calculated by the difference in concentration between pre-eruptive concentration in magmas (measured in melt inclusions) and post-eruptive concentrations (measured in residual glasses). All the concentrations provided for melt inclusions were obtained by direct measurement and not through ratio estimates, including for bromine. These fluxes are linked to plume and chemistry models to estimate fluxes of halogen elements towards the stratosphere and their impact on its chemistry.