

EGU22-9728

<https://doi.org/10.5194/egusphere-egu22-9728>

EGU General Assembly 2022

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Halogen measurements with in-situ sampling techniques: Studies at Vulcano and Mt. Etna (Italy)

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Halogens in volcanic plumes are important for both volcanic and environmental research. For example, changes in the composition of the volcanic plume can be an indication of changes in the activity of the volcano. In addition to entrained air components, volcanic plumes consist mainly of SO₂, CO₂, and H₂O. However, HF, HCl and HBr are also significant constituents of volcanic emissions. A particularly interesting element in this context is bromine because of its atmospheric relevance, but also since BrO forms in the volcanic plume and, like SO₂, can be determined spectroscopically using remote sensing techniques, making it ideal for monitoring and surveillance of volcanoes. However, to interpret and use BrO concentrations, we need a fully understanding of the formation and evolution of BrO in volcanic plumes. A step forward can be gained by measuring all relevant halogen species.

Currently, several methods are used to detect the various halogen compounds. Remote sensing methods exist for only a few so we use in-situ sampling methods such as diffusion separators, filter packs or aqueous alkali traps to collect reactive and total halogen species, respectively.

In this study, we will present the results of total fluorine, chlorine, bromine and sulfur as well as CO₂ and their ratios between, for field campaigns at a closed volcanic system - Vulcano in September 2019 and October 2020 and at an open vent volcano Mt Etna in July 2021. The results will be discussed in the light of the different degassing activity and therefore different temperature and will be compared to earlier studies at Masaya, Nyamulagira and Etna.