VolOM : 2-year postdoctoral position at LaMP, France

Organics in the atmosphere of volcanic environments impacted by thermal degassing : detection and impact on air quality

Project : Volatile Organic Compounds (VOCs) are ubiquitous in the atmosphere and are key ingredients of atmospheric pollution. They are highly reactive and are well-known precursors of secondary ozone and aerosols. They are both emitted by a variety of anthropogenic and natural sources. Volcanic gas emissions are very often associated with the release of acidic gases, in reduced form (CO_2, SO_2, H_2S, HCl, HF, etc.) by hydrothermal and magmatic systems (crater fumaroles, magmatic degassing). Little is known about the presence of volatile organics in those environments. While the presence of VOCs near volcanic edifices has already been reported at several ppm levels, data on the VOC composition of geogenic fluids remain scarce (Randazzo et al., 2023). The commonly detected chemical families include alkanes, alkenes, and aromatics, as well as numerous substituted compounds (sulfur or halogenated) (Tassi et al., 2012). Although the geogenic origin of VOCs is confirmed, the associated processes are far from being understood. The recent Taijogaite eruption in La Palma also revealed the multi-source nature of those environments where biogenic and biomass burning emissions from the surrounding vegetation mix with anthropogenic ones.

The objective of this project is to quantify the volatile organic matter in volcanic environments under the influence of hydrothermal degassing. The project will address two questions: *What is the composition of the volatile organic matter emitted by hydrothermal degassing? What is the impact of volatile organic matter on air quality?*

Within the scope of this project, we seek a high-quality candidate for a post-doctoral position of 24 months to work on the quantification of Volatile Organic Matter composition and its impacts from hydrothermal systems. The position combines analytical work, near-volcanoe field work at la Soufrière de Guadeloupe (Guadeloupe, France) and/or Mombacho (Nicaragua) and data analysis. The position is open at the Laboratoire of Meteorology and Physics (LaMP), Université Clermont Auvergne, Clermont-Ferrand (France) from February 2026 at earliest. The project is part of the IHYDE ANR coordinated by S. Moune (LMV/OPGC).

Programme

The first axis will consist in the design and optimization of the set-up for capturing organic matter from soil diffusion, events and plumes adapted to target hydrothermal systems and in accordance with platform constraints (UAV and chambers). To do so the researcher will beneficiate from the sampling supports (Tenax tubes, bags, canisters) and anaytical devices available at LaMP (GCFID, TDGCMS and PTR-Tof-MS). A chamber (Rayment et al., 2017) to quantify VOC fluxes from soils will be optimized and evaluated locally in the Chaine des puys before its deployment abroad.

The second axis will be the field work to collect new VOC data in the target volcanic environments to search for their presence from thermal degassing and to build the first atmospheric VOC database from soil, event and degassing plumes.

The third axis will analyze the spatially resolved VOC database from the field. The initial step will be to establish concentration ratios from pairs of judiciously chosen species (Borbon et al., 2013) and by cross-referencing the VOC measurements with those of other major volatile gases such as CO_2. This parameterization will support upscaling which could be combined with the gas dispersion modeling exercise planned in IHYDE to establish the dispersion of emitted gases at the regional scale. These models will make it possible to see the effect on air quality beyond local measurements, by taking into account orography, wind, and atmospheric conditions (e.g., Rave et al., 2023). The second step will be to quantify the reactivity potential of the sampled air masses by applying different reactivity metrics, as carried out in Dominutti et al. (2019) for a multi-influenced urban environment.

Collaborative framework LaMP in connexion with the ANR IHYDE consortium (Laboratoire Magma and Volcans), OPGC team.

Salary and application The salary is fixed between 2658 and 2855€/month according to experience. The position is available for 24 months with an ideal starting date in February 2026.

Candidate profile : atmospheric chemistry, experience with atmospheric measurements (in VOC techniques would be an added-value), data analysis.

To apply, please have a CV, cover letter and 2 reference letters sent to the coordinator, Agnès Borbon **before December 15th of 2025**

Contact : Agnès Borbon : agnes.borbon@uca.fr ; Aurélie Colomb : aurelie.colomb@uca.fr

----

Housing and mobility in Clermont : Monthly rent for a 1-bedroom (c. 18 m2) apartment in Clermont-Ferrand is typically 300–650€. The UCA campus has good public transport links to the city centre and train station (each about 3 km). The city is very walkable, has an extensive bike-share network (C-Velo) and an ever increasing network of interconnected and dedicated bike lanes. The city of Lyon is 2-hour distant and Paris is 3,5-hour away by train.

References :

Borbon, A., et al., 2013. Emission ratios of anthropogenic volatile organic compounds in northern mid latitude megacities: Observations versus emission inventories in Los Angeles and Paris. doi:10.1002/jgrd.50059, 201

Mangani, et al., 1991. Sampling and Analysis of Light Hydrocarbons in Volcanic Gases. Chromatographia Vol. 32, No. 9/10, November 1991

Randazzo, A., et al., 2023. Biogeochemical processes in soils affecting volatile organic compounds 2 (VOCs) from geogenic sources and municipal waste landfills: A 3 comprehensive study. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4604291

Rave-Bonilla, Y.P., D. E. Jessop, S. Moune, C. Garbin, and R. Moretti (2023). “Numerical modelling of the volcanic plume dispersion from the hydrothermal system of La Soufrière de Guadeloupe”. Volcanica 6.2, pp. 459–477. doi: 10.30909/vol.06.02.459477. url:https://uca.hal.science/hal04311969v1

Rayment M.B., Jarvis, P.G., An improved open chamber system for measuring soil CO_2 effluxes in the field. J. Geophys. Res.-Atmos. 102, 28779–28784, 1997. https://doi.org/10.1029/97JD01103).

Tassi, F., et al., 2010. Origin and Distribution of Thiophenes and Furans in Gas Discharges from Active Volcanoes and Geothermal Systems. doi:10.3390/ijms1104143

Tassi, F., et al., 2012. Geogenic and atmospheric sources for volatile organic compounds in fumarolic emissions from Mt. Etna and Vulcano Island (Sicily, Italy). doi:10.1029/2012JD017642.