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Volatile distributions in recent volcanic products from Mayotte active volcanic ridge revealed by simultaneous thermal and evolved gas analyses

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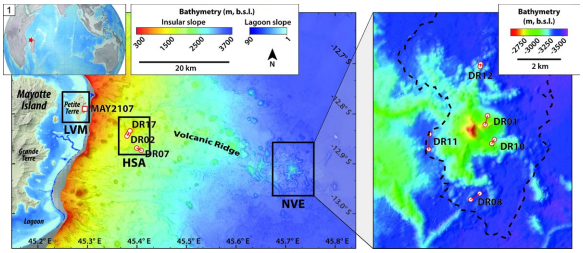

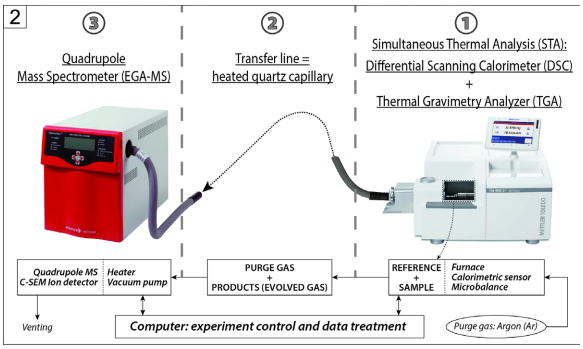

On July 2018, a large (ca. 6.5 km^3) and deep (ca. 2.5 to 3.3 km b.s.l) submarine eruption started 50 km east of Mayotte (French island in the Comoros archipelago). Samples of fresh basanite lava rims were collected by dredging, at different times and locations of the New Volcanic Edifice (NVE). The attention paid to this extraordinary event also brought the opportunity to dredge shallower (ca. 1.2 to 1.6 km b.s.l.) phonolite lava rims in the so-called Horse-Shoe Area (HSA), ca. 15 km east of Mayotte. Emplacement mechanisms, chemical and physical characteristics of these samples are expected to be significantly different from their better-known subaerial counterparts, which have also been sampled in La Vigie Maar (LVM) phonolitic deposits (ca. sea level), for comparison (Fig. 1). All investigated samples belong to the same volcanic ridge that extends from LVM to NVE passing through HSA. Together with Simultaneous Thermal Analysis (STA), which combined Differential Scanning Calorimetry (DSC) and Thermal Gravimetry Analysis (TGA), as well as Evolved Gas Analysis conducted by Mass Spectrometry (EGA-MS), Scanning Electron Microscopy (SEM), Electron Probe Micro-Analysis (EPMA) and Raman spectroscopy analyses enable a reconstruction of the sample textures as well as their volatile contents, compositions and distributions (Fig. 2). Degassing profiles upon heating reveal different volatile "reservoirs" within the studied samples, among with (i) external H_20 stored within sample connected porosities, (ii) H_2O- and CO_2-rich isolated magmatic vesicles, (iii) dissolved H_2O in magmatic melts, (iv) magmatic H_2O stored in apatite microlites, and (v) CO_2- and SO_2-rich crystal-hosted melt or fluid inclusions. Based on the acquired results, the present study argue that such an approach is an efficient and fast method to determine volatile distributions and associated behaviors in volcanic products and more generally in geological samples, which could represent useful assets to better understand and model volatile degassing in natural systems.