

## **In-situ characterization of fluids and melts to shallow supercritical and magmatic conditions**

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Volatile saturation of magmas, and the ensuing exsolution of high-temperature fluids and vapors ( $450 < T < 900$  °C) are key processes of volcanic activity and ore genesis [1,2,3]. Additionally, meteoritic fluids reaching temperature above 400 °C close to magmas in volcanic active areas recently sparked interest for their potential as enhanced sources for geothermal energy [4]. Despite their economic and environmental significance, the actual compositions and properties of these high-temperature mobile phases at depth remain elusive. This is both due to the fact that they cannot be sampled as such in nature and are impossible or difficult to quench without back-reaction occurring.

To overcome these issues an internally heated pressure vessel equipped with 'transparent' windows was built for in-situ spectroscopic analysis of hydrothermal fluids up to 600 °C and 1.5 kbar [5]. During the last 15 years, this device has been successfully used to investigate minerals solubility and metals speciation (Cu, Fe, Zn, Au, Sb, Bi, etc...) in hydrothermal fluids [6,7,8].

Here, we wish to present recent developments of the autoclave that enable 1) the characterization of H<sub>2</sub>O-CO<sub>2</sub>-salt fluids structure and density under supercritical conditions and 2) the study of volatiles speciation and partitioning during degassing of granitic/dacitic magmas combining Raman and XAS spectroscopy. The preliminary results provide new constraints on the particular properties of fluids and melts under high-temperature (500-1000 °C) and low-pressure (0.4 - 1.5 kbar) that were previously unexplored and pave the way towards a better understanding of supercritical geothermal systems or volcanic degassing.

[1] Gonnermann and Manga, 2007. *Annu. Rev. Fluid Mech.* [2] Chiodini et al., 2016. *Nature Comm.* 7, 13712. [3] Webster, 2004. *Chem. Geol.* 210, 33-48. [4] Scott et al., 2015. *Nature Comm.* 6, 7837. [5] Testemale et al., 2005. *Rev. Sci. Instrum.* 76, 043905. [6] Brugger et al., 2016. *Chem. Geol.* 447, 219-253. [7] Louvel et al., 2017. *Chem. Geol.* 466, 500-511. [8] Pokrovski et al., 2009. *GCA* 73, 5406-5427.