Bromine in basaltic volcanic systems: Experimental study on fluid/melt partitioning coefficient

MICHELA COSTA [1]*, ALESSANDRO AIUPPA [1,2], GIADA IACONO MARZIANO [3] AND ANTONIO PAONITA [2].

[1] [Dipartimento delle Scienze della Terra e del Mare – DiSTeM – Palermo (*correspondance: michela.costa@unipa.it)]
[2] [Istituto Nazionale di Geofisica e Vulcanologia – INGV, sezione di Palermo]
[3] [Institut des Sciences de la Terre d'Orléans – ISTO (FR)]

Volcanic halogens play a central role not only in magmatic systems processes but also in atmospheric chemistry, since they have been shown to participate in reactions implicated in tropospheric O_3 destruction [1, 2]. Unfortunately, our current state of knowledge concerning Br behaviour in magmatic systems is still rather poor so a quantitative model of the mechanisms controlling volcanic Br degassing is currently impossible. A fundamental step is understanding Br fluid/melt partitioning coefficient ($D_{Br}^{f/m}$), which has not been investigated yet in basaltic melts. Our work has been mainly aimed to experimentally investigating the distribution of Br between a basaltic melt (Mt. Etna, Italy) and a coexisting fluid phase containing H_2O and known concentrations of Br. Experiments were carried out at ISTO-CNRS of Orléans using rapid-quench autoclaves (T~1200°C; pressure range 500-1000 bar; ~ NNO buffer). Major element in final glasses were measured by EMPA whereas bromine measurements were performed by LA-ICP-MS. In our experiments, Br was found to strongly partition into the fluid phase. This is in agreement with what Bureau *et al.* (2003) reported for an albitic composition and it means that volcanic Br contribution to the atmosphere may be significant. Since no experimental data on $D_{Br}^{f/m}$ in basaltic melts have ever been obtained so far, our study contributes to fill the lack of knowledge concerning Br. In fact, coupling together our experimental results with gas data of Mt. Etna volcanic plume and with information from melt-inclusion, our work can constrain the true Br contents dissolved in Etnean magmas and thus hopefully open the way to constraints Br behaviour during volcanic degassing paths.

[1] Aiuppa A., 2009. Degassing of halogens from basaltic volcanism: insight from volcanic gas observations. Chemical Geology 263 (2009) 99-109. [2] Bobrowski N., Honninger G., Galle B., Platt U., 2003. Detection of bromine monoxide in a volcanic plume. Nature, vol. 423. [3] Bureau H., Mètrich N., 2002. Geochimica et Cosmochimica Acta Vol.67 No. 9,pp 1689-1697, 2003

Frontiers in Laser Ablation U-Th/Pb Petrochronology

JOHN M COTTLE[1]*

[1] Department of Earth Science, University of California Santa Barbara, CA 93106-9630, USA, cottle@geol.ucsb.edu (* presenting author)

Since the first Laser Ablation ICP-MS U-Th/Pb dates were published ~20 years ago, the field has expanded significantly, becoming a key technique for rapidly measuring spatially resolved in-situ isotopic dates. LA-ICP-MS geochronology is now integral to a broad range of studies - from determining sedimentary provenance to quantifying the timing and duration of tectonic processes. Drawing on examples from ongoing research projects at UCSB and elsewhere, this presentation will highlight recent advances and potential future directions *in situ* U-Th/Pb accessory phase geochronology. Specifically, I will focus on four key avenues of progress: 1) improvements in laser and mass spectrometry instrumentation that increase both the precision with which measurements can be made and the spatial resolution at which dates can be measured; 2) development and application of novel data acquisition and reduction methods to interrogate data and produce the best quality dates possible; 3) concomitant analysis of trace elements (Ti, Y, Zr, REE etc.) and/or other isotope systems (e.g. Sm/Nd, Lu/Hf, Li) of petrologic importance along with U-Th/Pb isotopic analysis in order to integrate dates with structural, pressure-temperature, phase relationhips and geochemical data and; 4) development of campaign-style geochronology methods to elucidate the spatial and temporal scale of geologic processes at scales ranging from single crystals to entire orogens.

DOI: 10.1180/minmag.2013.077.5.3