

Melt inclusion records of degassing from persistently active volcanoes: Etna, 2006

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Introduction

Mt Etna, Sicily, is Europe's laboratory volcano. Etna is persistently active, and responsible for 5-10% of global annual volcanic emissions of CO₂, SO₂ and volatile trace metals (Pyle & Mather, 2003). Activity on Etna has changed dramatically over the past 5 years. In 2001 – 2003, the eruptions were vigorous and volatile-rich, in contrast, eruptions in 2004 and July 2006 started with the slow effusion of gas-poor magma. We collected a suite of olivine hosted melt inclusions and matrix glasses in newly erupted products from Mt Etna, Sicily, spanning the major eruptions of the previous 5 years. These glasses have been measured for the concentrations of volatile (H, C, Cl, F) and selected trace elements (Li, Zr) by ion microprobe at the University of Edinburgh and for major and trace elements with a particular focus on the volatile trace metals by electron microprobe and laser ablation ICP-MS at the University of Cambridge.

Discussion

Preliminary results will provide data to constrain the nature of the relationship between the earlier (2001-2003) volatile-rich magmas and the later (2004, 2006) volatile-poor magmas. As expected, many of the 2006 melt inclusions show evidence for shallow storages and degassing: dissolved water contents are low; dissolved Li contents are variable, and don't correlate with involatile incompatible tracers; and melt inclusions extend to more evolved compositions than those erupted rapidly during the 2001-2003 eruptions. When combined with new data on dissolved C contents of melt inclusions, we will be able to determine the coupled effects of fractional crystallization, gas loss and gas accumulation on the compositions of Mt Etna magmas.

Conclusion

This thorough investigation into the degassing processes of Mt Etna will not only provide new information into the importance of volatiles for determining the eruptive character and processes of Mt Etna volcano but will also have implications for the environmental and economic effects of the behaviour of metals in such systems.

References

Pyle, DM, Mather, TA, 2003, *Atmospheric Environment* **37**, 5115-5124

Study of the gypsum (010) surface dissolution in water by holographic interferometry

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We have performed holographic interferometry measurements of the dissolution of the (010) surface of a cleaved gypsum single crystal in pure water. This technique gives access to the real-time two-dimensional refractive index evolution of the solution during the dissolution process (cf. figure), enabling a computation of the kinetic parameters of the phenomenon. We have thereby obtained the value of the dissolution rate constant k of the gypsum (010) surface in water and the value of the interdiffusion coefficient D of its aqueous species in water. D is found to be close to the theoretical value generally used in dissolution studies. k is two times lower than the value obtained from standard dissolution experiments (batch experiments, rotating-disk experiments, ...). Compared to these global measurements, holographic interferometry has three advantages:

- it directly characterizes the microscopic transfer rate at the solid-liquid interface, and is not an averaged value deduced from quantities measured far from the surface.
- there is no flow in the cell and therefore no hydrodynamical assumptions and computations are needed.
- the study of a single crystallographic interface avoids to obtain a multifaceted average dissolution rate constant.

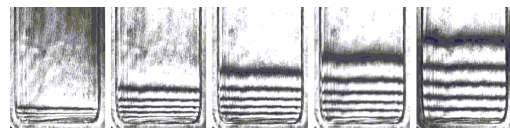


Figure 1: Interferograms during the dissolution of a gypsum single crystal in pure water at several times after the beginning of the experiment. The crystal is situated at the bottom of the optical cell.