

## Effects of sulfur degassing and sulfide separation in some products of Mt. Etna volcano (Sicily, Italy)

R. MORETTI<sup>1</sup>, B. GAMBARELLA<sup>2</sup>, L. MARINI<sup>2</sup>  
AND N. MÉTRICH<sup>3</sup>

<sup>1</sup>INGV-Osservatorio Vesuviano, Napoli, Italy  
(moretti@ov.ingv.it)

<sup>2</sup>Lab. Geochimica, DipTeRis, Università di Genova, Italy

<sup>3</sup>Lab. Pierre Sue, CEA/CNRS, Saclay, France

Application of an internally-consistent model (Moretti and Ottonello, 2005) for melt oxidation state and sulfur solubility allows to study how Etna magmas release sulfur and how the redox control is operated in a volatile-rich basaltic environment.

Different Etna magmas, corresponding to the products of the current activity and of the 122BC plinian eruption, follow different paths of S elimination and during their evolution they reach soon or later the lower limit of sulfide saturation. Interestingly, melt inclusion data indicate that along this threshold (i.e., for  $m_{S2}$  of 18 mmol/kg) the magma involved in the high-energy Plinian eruption of 122 BC is much richer in sulfate (and total S) than the magmas erupted by low-energy Strombolian eruptions from the Bocca Nuova and SE crater. The direct relationship between the high sulfate contents at the lower limit of sulfide saturation and the energy of the eruption does not seem to be fortuitous. The availability of a relatively large amount of S, largely present as sulfate, in the magma of the 122 BC Plinian eruption is confirmed by the distinct  $^{34}S/^{32}S$  isotopic ratios and total S concentrations measured in these products with respect to other rocks of the volcano. Again, this large amount of S, to be eliminated through degassing only, could be considered as a proxy for the high energy of this volcanic event, although further investigations are needed to corroborate this inference. Accepting this explanation, the next question is: why do Etna magmas experience different evolution paths leading to these large differences in sulfate contents at the lower limit of sulfide saturation?

### Reference

Moretti R. and Ottonello G. (2005) *Geochim. Cosmochim. Acta*, In press.

## Identification of the hydrous environments in volcanic glasses

R. PETRINI<sup>1</sup>, F.F. SLEJKO<sup>1</sup>, C. FORTE<sup>2</sup>  
AND M. D'ANTONIO<sup>3</sup>

<sup>1</sup>Università di Trieste (petrini@units.it, fslejko@dst.units.it)

<sup>3</sup>IPCF-CNR, Pisa (c.forte@ipcf.cnr.it)

<sup>4</sup>Università di Napoli (masdanto@unina.it)

The hydrous species distribution in magmatic systems has considerable influence on the style of a volcanic eruption and on many of the physical and chemical properties of silicate melts. In particular, in the understanding of explosive volcanism a source of uncertainty is the process of fragmentation such as the rising magma disintegrates into a spray, resulting from the expansion of hydration bubbles through the progressive drainage of water from the surrounding melt by diffusion, or as a consequence of the interaction with external water. The water speciation and the nature of the solute in high-silica volcanic glasses from the explosive activity in the Phlegrean Volcanic District (Italy) has been determined by  $^1H$  MAS-NMR spectroscopy and Sr isotopic data by TIMS.

The  $^1H$  MAS NMR spectra are characterized by a large spinning sideband pattern with peaks spaced at integer multiples of the spinning speed, resembling a Pake doublet, with an overlapping central contribution. The spectra are best simulated by the contribution of three different types of proton nuclei with  $^1H$ - $^1H$  dipolar couplings of 45 kHz, 18 kHz and 1 kHz. These are attributed to isolated, rigid water molecule; to water molecules or clusters rather mobile and to micropore liquid water or clusters, respectively. Since the strontium of the solute in groundwater or surface water is likely to be isotopically distinct from that of the melt, the  $^{87}Sr/^{86}Sr$  ratio allowed to distinguish hydrous component of probably magmatic origin in isotopic equilibrium with the melt and hydrous components due to the interaction of magma with external fluids during phreatomagmatic fragmentation.

Glasses in deposits from magmatic fragmentation show evidence of water diffusion in response to decreasing gas solubility during magma decompression and the gas partitioning into a separate phase. Glasses from phreatomagmatic fragmentation are characterized by the increasing of water more strongly bonded and less mobile into the structure. This requires an intimate, fine-scale mixing of water and magma during the water-magma interaction process, which is also promoted by shock wave propagation. This also suggests that water and magma were probably close to attain thermal equilibration during the interaction.