Characterizing degassing and magma recharge from measurement of short-lived U-series isotopes in volcanic gases and lavas

KENNETH WW SIMS[1] AND PIERRE-JEAN GAUTHIER[2]

[1]Department of Geology and Geophysics – Woods Hole Oceanographic Institution Woods Hole, MA 02543, USA (ksims@whoi.edu)

[2]Laboratoire Magmas et Volcans – Observatoire de Physique du Globe de Clermont-Ferrand (CNRS, UBP) – 5 rue Kessler – 63000 Clermont-Ferrand, France (P.J.Gauthier@opgc.univ-bpclermont.fr)

Magma recharge and degassing are directly linked to volcanic activity. Determining the timescales of these shallow level processes is fundamental to our understanding of physical eruption dynamics and hazard assessment.

At many quiescent but potentially dangerous volcanoes, persistent degassing is the most common manifestation of volcanic activity. While it is generally agreed that these gas fluxes are mostly sustained by the exsolution of volatiles that were initially dissolved in the magma at depth, it has been unclear whether these gases originated from small ascending magma batches (ultimately recycled at depth once degassed) or large magma reservoirs beneath active volcanoes. Setting constraints on magma residence times in shallow degassing reservoirs and/or feeding systems is critical to distinguish between these two end-member models. Measurement of radioactive disequilibria between short-lived ^{238}U-series isotopes in volcanic gases and rocks can provide previously unobtainable constraints on the timescales of shallow level magma dynamics (e.g. magma recharge and degassing).

We present new data on radioactive disequilibria (^{222}Rn, ^{210}Pb, ^{210}Bi, and ^{210}Po) in gases and tephras collected from inside the Santiago Crater of volcano Masaya (Nicaragua). To our knowledge these are the first measurements of ^{222}Rn from magmatic gases. Masaya's (^{210}Po/^{210}Pb) and (^{222}Rn/^{210}Pb) are best explained by ^{222}Rn enrichment and subsequent decay in gas bubbles of a magma body having a residence time between 3 and 150 years. Our measurements of radioactive disequilibria in Masaya's gases also display significant variability through time (periodically since 2000) that are correlated with observed variations in activity and gas fluxes at the surface. Taken together, these observations suggest that degassing occurs in a large magma reservoir beneath the active Santiago crater and that input of deep pristine magma into this reservoir controls the eruptive activity at the surface.

Anthropogenic signatures in sediments of the fast growing urban area of Natal (NE-Brazil) – A study of heavy metals and organic components

S. SINDERN[1], H.C. OSKIERSKI[1], J.C. SCHWARZBAUER[2], R.F.S. LIMA[3] AND R.A. PETTA[3]

[1]Institut für Mineralogie und Lagerstättenlehre, RWTH Aachen University, Wüllnerstr. 2, D-52062 Aachen, Germany (sindern@rwth-aachen.de)

[2]Lehrstuhl für Geologie, Geochemie und Lagerstätten des Erdöls und der Kohle, RWTH Aachen University, Lochnerstr. 4-20, D-52062 Aachen, Germany (schwarzbauer@lek.rwth-aachen.de)

[3]Depto. de Geologia, Campus Universitário, Natal/RN CEP: 59072-970, Brazil (raquel@geologia.ufrn.br)

In this study the effect of anthropogenic discharges on the composition of sediments in the Potengi – Jundiai river system near the fast growing city of Natal, NE-Brazil, is investigated.

In general, the sediments of the Rio Potengi – Jundiai river system in the studied area are not severely polluted. Rather they represent an incipient stage of anthropogenic accumulation. A previous study (Sindern *et al*. 2006) has shown that heavy metals such as Zn, Pb, Cu, Cd and in part also Sn, Hg and Ag have enhanced values relative to reference elements such as Al and Fe. Sources are domestic and animal waste, combustion products and hydrocarbons. These heavy metals are mainly bound to organic matter.

The elements Cr, Ni and V are characteristic of weathering heavy minerals in crystalline rocks exposed in the catchment area of the river system and are not significantly added from anthropogenic sources.

Additionally, a comprehensive spectrum of organic compounds was identified in sediment as well as water samples of the Potengi-Jundiai river system. Individual organic components were characterized dominantly to be of biogenic origin. However, huge amounts of indicative substances, e.g. fatty acids, suggest a significant emission of natural organic matter as the result of anthropogenic waste discharge. This might reflect incomplete of insufficiently working waste water treatment. Further on, well known xenobiotics, such as plastiziers, pharmaceuticals or pesticides, were detected only to a minor extend, although this type of anthropogenic contamination has frequently been found in riverine systems. The anthropogenic impact on the organic emission within the riverine system differs significantly from the organic signature of rivers from other regions, e.g. Europe or North America.

References

Sindern, S., Lima, R.F.S., Schwarzbauer, J., Petta, R.A. (2006): *Environ. Geol.*, Online published, DOI 10.1007/s00254-006-0510-z