Noble gases in pumices: Magmatic or atmosphere-derived?

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Noble gases are chemically inert and therefore can only fractionate during physical processes such as diffusion. For that reason, they provide strong constraints on degassing processes. Pinti *et al.* [1] have studied noble gases trapped in pumices from Japanese and Lipari volcanoes. They suggested that the noble gas signature was linked to a mechanism of air incorporation during the eruption. Thus, noble gases could represent a potential tool for understanding the dynamics of the plinian eruptions. We have decided to focus on well-studied eruptions to improve our knowledge on the origin of rare gases trapped in pumice.

Therefore, we measured by mass spectrometry noble gas abundances and isotopic compositions in pumices from Martinique island (Lesser Antilles), and from several volcanoes around the world. Gases were extracted by step crushing under vacuum and then purified and analyzed with our mass spectrometers. All pumices show enrichments (up to 40 times) in neon over argon compared to the atmospheric ratio. Krypton and xenon abundances vary with the different arcs, but are similar for a same eruption.

These features are explained by a model of fractional degassing with several steps from the mantle wedge towards the surface. When the magma fragmentation occurs in the magmatic chamber or in the conduit, pumices are formed and trap the gases in their vesicles. Then, pumices spend few seconds in the plinian column before being deposed.

We therefore have a different interpretation than the one of Pinti *et al.* on the origin of noble gases in pumices. Rather than a contamination during eruption in the atmosphere with preferential incorporation of neon, we suggest than pumices can trap gases during magma fragmentation.

[1] Pinti & Wada *et al.* (1999) *Journal of Volcanology & Geothermal Research* **88**, 279-289.

A new approach for estimating more accurate groundwater gas concentrations

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We combine a passive gas diffusion sampler with field-measured total dissolved gas pressures (TDGPs) to provide improved estimates of groundwater gas concentrations. The passive gas diffusion sampler is deployed downhole forperiod of up to 3 months. Upon recovery, the gas sample is isolated in a gas-tight syringe for transport to the laboratory where it can be directly injected into a gas chromatograph. This sampling and analytical approach was used for a wide variety of geochemical environments, and appeared to be less prone to systematic bias than a traditional sampling approach.

Gas concentrations estimated from gas chromatographic analysis were multiplied by field-measured TDGPs. Groundwater in Alberta was consistently ‘gas-charged’ (i.e. TDGP greater than atmospheric). Total dissolved gas pressures were typically higher when biogeochemical gases (e.g. CO_2 and CH_4) were observed.

When the groundwater in monitoring wells was isolated from the atmosphere using a packer, substantially high TDGPs (more than 2000 mm Hg) were measured. This suggests groundwater gas concentrations are being routinely underestimated.