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UNRAVELLING DEGASSING PROCESSES THROUGH EXPERIMENTAL PETROLOGY AND NEON ISOTOPES

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The origin of volatile elements on Earth is still an open question in planetary sciences because: (i) there are many possible sources within the solar system and (ii) significant processes can alter the chemical and isotopic signatures. Particularly, a fundamental physical process that is required to be understood is the behavior of volatile elements during magmatic processes, including possible kinetic isotopic fractionation during vesiculation.

In this study, we look into the processes of magma degassing that take place in the magmatic chamber and during magma transportation. Since CO_2 becomes oversaturated when pressure decreases in the magmatic chamber, it starts to exsolve and, other volatile elements (e.g. noble gases), are partitioned into this newly-formed gas phase. As inert element, neon is an important tracer of magma-degassing processes, since it passively follows the magma-vapor system's evolution.

This work is focused on bubble formation and growth in a closed system, either under isobaric or polybaric conditions. We synthesized Neon-saturated glass at 1bar, which was then exposed to CO_2 as a volatile phase in different experimental time series (10 min to 24h). The experiments were performed with an internally heated pressure vessel, at 1200°C, and held either at constant pressure (≈ 2kbar) or simulated decompression conditions (from 2kbar to 0.5/0.25kbar at about 1bar/s), using a basanitic melt. All the experiments were drop quenched.

This research allows us to study the processes of neon kinetic isotopic fractionation while the volatile phase is starting to exsolve and rises up the surface until magma erupts. For studying the neon isotopic signature of the vesicles, we have used the bubble-by-bubble extraction technic using laser ablation coupled with mass spectrometry [1].

Our results show that a clear neon isotopic fractionation is taking place during the early stages of bubble nucleation, growth, and coalescence, beyond the theoretical maximum fractionation (up to 10.47±0.10 for $^{20}Ne/^{22}Ne$) expected for the standard used for the glass preparation (air = 9.8). These results provide some light on the origin of neon and other volatiles on Earth that will be discussed.

Péron, Moreira, Colin, Arbaret, Putlitz, & Kurz (2016). *Earth and Planetary Science Letters*, *449*, 145-154.