Volatile systematics of the Canary Islands hotspot

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We report new volatile (CO_2-He-Ne-Ar) isotope and relative abundance data on an integrated sample suite (phenocrysts, xenoliths and geothermal fluids) from the Canary Islands. Separated mineral fractions (OL, CPX) come from Recent/Holocene eruptions, minimizing post-eruptive modifications. We targeted basinite lavas from El Hierro, La Palma and Lanzarote, and xenoliths - pyroxenites and dunites from La Palma and harzburgites from Lanzarote. Geothermal fluids were sampled on La Palma and Tenerife (Teide volcano). Our aim is to identify potential mantle contributions (e.g. plume vs. MORB vs. lithosphere) to the volatile inventory of the Canary Islands.

The highest $^3He/^4He$ ratios occur in the western archipelago, up to $9.2R_A$ in geothermal fluids of La Palma – as observed previously [1]. All other values for La Palma and El Hierro (phenocrysts and xenoliths), however, fall within the canonical MORB range ($8\pm1R_A$). Neon isotope ratios for these samples overlap with air but $^{40}Ar/^{36}Ar$ (296-504) shows minor radiogenic additions. $CO_2/^3He$ and $\delta^{13}C$ for La Palma fluids are 2×10^9 and -3.8‰ respectively. These values overlap with summit fumaroles on Teide, but Teide $^3He/^4He$ ($<6.6R_A$) is lower than the western islands. The same range of $^3He/^4He$ values characterizes both the basinite phenocrysts and harzburgite xenoliths of Lanzarote. However, whereas the phenocrysts have $^{40}Ar/^{36}Ar$ dominated by air (<634), this is not the case for the xenoliths ($^{40}Ar/^{36}Ar$ = 1000-5000). The harzburgites also have distinctly non-atmospheric neon with trends less steep than MORB on a 3-isotope Ne plot.

The volatile results are consistent with a high-^3He plume component in the western archipelago, most clearly sampled by CO_2-rich geothermal fluids on La Palma. This component is absent in the lavas/xenoliths, likely as a result of temporal and/or spatial differences in sampling depth, or is masked by air contamination (Ne and Ar). The central-eastern Canaries (Tenerife and Lanzarote) are dominated by lithospheric additions to the volatile inventory with xenoliths best preserving source features. Significantly, the observation that Lanzarote harzburgites contain neither high $^3He/^4He$ nor solar neon appears to negate such refractory sources as reservoirs of volatiles with “plume-like” characteristics.

[1] Hilton *et al.* (2000) GCA **57**, 2119-2132.

Calcium isotope variations at the Damma glacier, Switzerland

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Calcium isotope studies have the potential to provide new insights into geochemical and biogeochemical weathering processes. Calcium is particularly important since the dissolution of Ca from silicate minerals is intimately linked to the carbon cycle.

The Damma glacier fieldsite provides an ideal opportunity to study the early stages of silicate weathering processes. The glacier is situated in the Central Aar granite massif and its retreat has been monitored annually since 1921 providing a 1.5km chronosequence.

Calcium isotope ratios were measured by TIMS (Triton) utilising a ^{43}Ca-^{46}Ca double spike, to enable the study of radiogenic enrichments and stable isotope variations. Samples were first purified using cation and anion exchange chromatography in a newly developed four-column procedure. This was required to ensure quantitative removal of Fe and Al, both elements which are found in high abundance relative to calcium in soil and rock samples. Purification ensured optimum ionisation efficiency, which ultimately resulted in higher precision. Preliminary results indicate that we can reproduce the $\delta^{44/42}Ca$ value of NIST 915b to within 0.06‰ (95% confidence).

An initial study into stable Ca isotope fractionation in soils sampled along the chronosequence showed that the $\delta^{44/42}Ca$ values increase with increasing soil age. Thus, the soils are enriched in the heavier Ca isotope during soil formation, possibly as a result of increased vegetation cover which preferentially stores the lighter isotope (e.g. [1]).

Radiogenic enrichements from mineral separates of one granitic rock sample show that, combined with $^{87}Sr/^{86}Sr$ data, each mineral has a distinct fingerprint which could trace the different mineral contributions to weathering over time.

[1] Wieg& *et al.* (2005) *Geophy. Res. Let.* **32**, L11404.