Does magma degassing affect rhenium contents of MORB?

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There is growing evidence that Re behaves as a moderately volatile element during subaerial and shallow marine eruptions, thus explaining the low Re contents of many OIB (e.g.[1]). However, the possibility that Re loss during magma degassing may also affect Re contents of MORB has received little consideration. Nearly all MORB magmas have experienced substantial volatile element loss (>80% for CO_2, the main volatile species in MORB [2]), suggesting that this process might be important. To investigate this possibility we determined the Re contents of 20 MORB glasses from the Southeast Indian Ridge (SEIR), previously investigated for major and trace element contents, isotopic compositions, and volatile element systematics [3, 4, 5]. A strong negative correlation exists between $\ln[^{40}Ar^*]$ and $\ln(^{4}He/^{40}Ar^*)$ among these samples [5], coherent with the expected results of variable degrees of solubility-controlled fractional degassing. ($^{40}Ar^*$ indicates ^{40}Ar corrected for atmospheric contamination).

Re contents of the SEIR samples (mean = 0.68 ±0.29 ppb, 2σ) are lower than those of most MORB. A negative correlation exists between [Re] and Mg# (R^2=0.49) indicating that fractionation is one of the main factors controlling Re concentrations. To minimize this effect, Re concentrations were normalized to those of Sm. A rough negative correlation (R^2=0.39) exists between ln(Re/Sm) and $\ln(^{4}He/^{40}Ar^*)$, with the most degassed lavas (highest $^{4}He/^{40}Ar^*$) having the lowest Re/Sm ratios. Ln(Re/Sm) and $\ln(Ar^*/CO_2)$ are positively correlated (R^2=0.37), which is also consistent with the expected consequences of degassing. These results must be interpreted with caution, given the weakness of the correlations and the possibility of source variations. Nevertheless, they suggest that degassing may have a significant effect on the Re contents of MORB magmas, and thus on estimates of Re partition coefficients during partial melting. They may also imply that magma degassing provides a non-negligible flux of Re to the oceans.

[1] Lassiter (2003) *EPSL* **214**, 311-325. [2] Marty & Zimmermann (1999) *GCA* **63**, 3619-3633. [3] Mahoney *et al.* (2002) *J. Petrol.* **43**, 1155-1176. [4] Graham *et al.* (2001) *Nature* **409**, 701-703. [5] Burnard *et al.* (2004) EPSL **227**, 457-472.

The distribution of gold in biogenic and abiogenic carbonates

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Soil carbonates are important sampling media for geochemical Au exploration in the semi-arid and arid regions of Australia, because they are widespread, easy to sample and Ca shows a strong positive correlation with Au, but not with other metals in carbonates overlying buried Au mineralisation [1]. This suggests a unique mechanism of co-precipitation of Au with Ca during carbonatogenesis. Co-precipitation is biomediated through the activity of ureolytic bacteria and other microorganisms resident in these soils, and is not the result of purely abiotic processes [2]. However, at resolutions possible with LA-ICP-MS (>20 μm^2), Au was homogenously distributed in biogenic carbonates precipitated in the laboratory [2], in contrast to soil carbonates, in which Au displays a reduced nugget effect, but not a homogeneous distribution [1].

Synchrotron-based µXRF-mapping (at ~150 nm^2 resolution) was used to assess the fine distribution of Au, Ca and other metals in biogenically- and abiogenically precipitated carbonates containing ppm-levels of Au. In Ca-carbonates, precipitated by ureolytic bacteria enriched from calcareus Australian soils, the distribution Au was not uniform and differed from base metal distribution, thus mimicking the decoupling between these metals observed in field samples. In contrast, in abiogenically precipitated Ca-carbonates (produced by raising the pH or the concentration of CO_2^{3-} in solution) the Au distribution was homogenous and decoupling of Au and Ca from other base metals was not apparent. In conclusion, this study confirmes the importance of biomineralisation for the formation of Au anomalous carbonates in Australia.

[1] Lintern *et al*. (2006) *Chem. Geol*. **235**, 299-324. [2] Reith *et al.* (2009) *Chem. Geol*. **258**, 315-326.