Enrichment of gold in oceanic crust by the Iceland mantle plume: Constraints from the Reykjanes Ridge

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It has recently been suggested that the subduction of gold-enriched crust, such as oceanic plateaus and primitive basaltic crust, can increase the chances of developing gold mineralization in the overlying arc [1]. The Reykjanes Ridge is an ideal place to test the addition of Au to oceanic crust by plume activity because the mantle sources are well constrained by an extensive geochemical dataset. The ridge is under influence from the spreading Iceland plume head which progressively mixes with atlantic MORB southwards. Mixing can be identified primarily between three sources: enriched Iceland plume, depleted Iceland plume and depleted upper mantle [2]. We find this mixing process produces values between 0.22 and 1.67 ppb Au in the basaltic pillow lavas, with the highest values associated with the Iceland source members. These data correlate well with other mantle source indicators such as incompatible trace elements. Au proves to be a particularly sensitve tracer of mantle source mixing. However our lowest value of 0.22 ppb is ~4 times lower than the average of published Au data for atlantic MORB and we attribute this to the sensitivity of the analysis method used in this case.

We suggest that the Iceland plume is enriching this portion of the Mid-Atlantic Ridge with respect to gold by up to 7 times. If it were to be subducted, a considerable amount of extra gold would enter the Arc system compared to subduction of MORB.

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Process oriented modelling of gas evolution in iron-based permeable reactive barriers

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Geochemical conditions that determine rates of gas production and consumption within iron-based permeable reactive barriers are not well understood to date [1, 2]. Here we attempt to establish a numerical model representing dominant hydraulic and geochemical processes within zero-valent iron (ZVI) barriers. Initial simulations modeled the anaerobic corrosion of ZVI depending on I) the concentration of aqueous carbonate, which enhances iron reactivity, and II) mineral precipitates decreasing the reactive iron surface area. A version of the numerical model MIN3P [3, 4] that includes chemical gas production and consumption reactions is applied. A balanced degassing approach, which allows for gas storage and gas release was implemented. Thus the impact on residence time and chemical turnover is reflected. Results of laboratory ZVI filled columns, carried out under distinct conditions, delivered data for inverse modeling. After parameterization the model could reflect chemical conditions measured in the column effluent, gas evolution from the columns, and gas saturation within the columns. According to this stepwise approach the implementation of further processes into the model is planned.

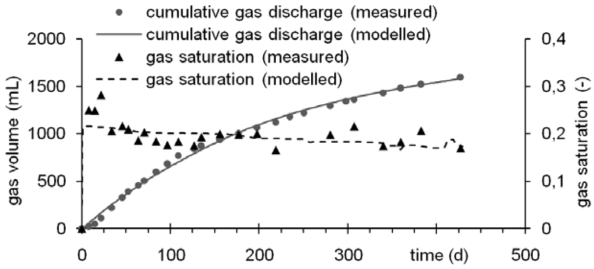

Figure 1: Gas evolution and gas saturation in a column experiment with greycast, 4 mL/h DW + 40 mg/L TIC.

[1] Kohn *et al.* (2005) *Environ. Sci. Technol.* **39**, 2867–2879. [2] Williams *et al.* (2007) *Appl. Geochem.* **22**, 90–108. [3] Amos & Mayer (2006) *J. Contam. Hydrol.* **87**, 123–154. [4] Jeen *et al.* (2007) *Environ. Sci. Technol.* **40**, 6432–6437.