

## Tracing mantle enrichments into oceanic crust and hydrothermal systems, Juan de Fuca Ridge

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High-precision Pb isotopes have become useful in discovering segment-scale (<100 km) heterogeneity in MORB sources. Here I describe how this heterogeneity co-varies with other isotopes and with major and trace elements within a 10-km long “4<sup>th</sup> order” segmentation of the axial magma chamber at the Endeavour segment of the Juan de Fuca Ridge, and how this heterogeneity is passed on to hydrothermal systems. Basalts in the one km-wide axial valley at Endeavour are characterized by large (3 to 4-fold) variations in their K/Ti, Zr/Nb, and La/Yb ratios at 7-8% MgO. Variations in Sr, Nd, and Hf isotopes are small (<0.0001) but correlate with the element ratios. Variations in Pb isotopes are larger ( $^{206}\text{Pb}/^{204}\text{Pb} = 18.4\text{-}18.9$ ) and therefore more useful. Pb correlations lie below the NHRL.  $^{206}\text{Pb}/^{204}\text{Pb}$  correlates best with HFSE-enrichment, especially Nb. That correlation differs from what is seen along the southern JdFR and EPR, and defines a type of mantle enrichment specific to the northernmost JdFR. This enriched mantle only began to be tapped within the last ~30 Ka. Qualitatively, I attribute the enrichment to a young pyroxenitic source with a lower solidus than the surrounding peridotite, and with “C”-type isotopic characteristics. The Pb in the vigorous hydrothermal systems at Endeavour is entirely basalt-sourced, without evidence of sediment, which leaves the anomalously high CH<sub>4</sub> and NH<sub>3</sub> in the hydrothermal fluids unexplained. Preliminary results indicate differences in Pb isotopes between hydrothermal fields a few km apart. This may help to map their recharge zones and the integrated architecture of the basaltic crust.

## Kinetics of free radical formation at mineral-water interfaces

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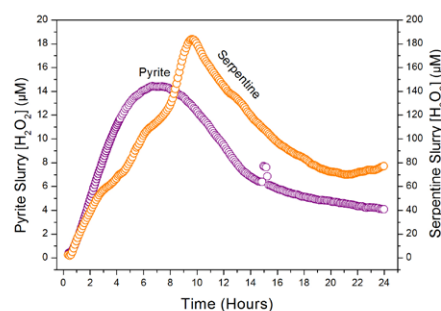
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The formation of free radicals on sulphide and silicate mineral surfaces [1,2] is a relevant topic due to its great importance in the treatment of mine wastes, geomedicine and, more recently, as an hypothetical oxidation pathway on Mars and Early Earth [3]. Although the atomic mechanisms involved in mineral surface reactions are relatively well understood, the kinetics pathways as well as the time extent of these reactions in natural environments have not yet been well characterized.

In this work, the kinetics of H<sub>2</sub>O<sub>2</sub> generation at mineral-water interface was monitored with real time microelectrode measurements. Experiments were performed under continuous stirring by using aqueous slurries of pyrite, antigorite, olivine, and glauconite, as sample probes, in both oxic and anoxic conditions



**Figure 1.** Kinetic of H<sub>2</sub>O<sub>2</sub> formation from pyrite and serpentine slurries in water, under anoxic conditions.

Our experimental results show that, under oxic conditions, peroxide formation takes place very fast at the initial stages of the process with a significant consumption of O<sub>2</sub>(g), whereas, under anoxic condition, the rate of H<sub>2</sub>O<sub>2</sub> generation proceeds more slowly, giving rise to the formation of O<sub>2</sub>(g) as a by-product and, thus indicating the presence of different reaction mechanisms. Preliminary kinetics models based on the experimentally determined constants, coupled with surface complexation calculations, will also be presented.

- [1] Borda et al. (2003) *Geochim. et Cosmochim. Acta* **67**, 935-939. [2] Gournis et al. (2002) *Phys. Chem. Miner* **29**, 155-158. [3] Davila et al (2008) *EPSL* **272**, 456-463.