Isotopic and modelling constraints on experimental dissolution of lithogenic material

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Isotopic budget of macro and micro-nutrients (e.g. Si, Mg, Zn, Mo, Ni) in the ocean have revealed an imbalance between their sources and sinks [1]. Recent oceanic elemental budget has highlighted the importance of taking into account continental margins as a source of elements to oceans and as one of the key mechanisms explaining “boundary exchange” [1, 2]. For many elements, the quantification of the dissolved fraction inherited from dissolution of lithogenic material at the margins remains to be determined, both in the field and experimentally. To explore such process, we have investigated the fate of pure mineral particles in distilled and seawater.

Different lithologies were investigated in batch reactor through selected fractions of olivine, pyroxene and anorthosite in both static and agitated modes at lab temperature and using water/rocks ratios of 5 over the course two weeks.

Our experiments in agitated mode and distilled water clearly showed pure dissolution phase and re-precipitation with the formation of neo-minerals. Kinetics of dissolution followed two distinct patterns: some major and trace elements (e.g. Si, Mg, Ca, Sr, etc.) did reach the saturation concentration while others depicted drastic decrease in concentration after several hours to days (e.g. Fe, Al, Ni, Mn, etc.). Stable isotope compositions of Si and Ni were measured over the course of the experiment. Both elements presented similar directions but different magnitudes in isotopic fractionation. Dissolved fractions were significantly enriched in the lighter isotopes at the initiation of the experiment while they were being enriched in the heavier thereafter. Dissolution/re-precipitation were modelled using PHREEQC to determine precisely their corresponding fractionation factors.

[1] Jeandel and Oelkers. (2015). *Chem. Geol.*, **395**, 50-66. [2] Tréguer & De La Rocha (2013). *Annu. Rev. Marine*, **5**, 477-501.