Osmium isotopes in manganese nodules from the Labrador Sea

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Using a remotely operated vehicle, manganese nodules were retrieved in 2010, at the base (2870 m depth) of a small bedrock-cored mound, south-east of Orphan Knoll (southern Labrador Sea), in a field of rounded polymetallic balls found at the base of a small cliff of weakly consolidated calcareous ooze.

Using a Thermo Triton™ (NTIMS), we measured the osmium $^{187}Os/^{188}Os$ isotopic ratio in the outer <1mm-thick layer of three nodules. These outer layers were expected to yield the Os isotopic composition of modern seawater (ca. 1.06), in relation with recent co-precipitation of hydrogenous osmium and Fe/Mn oxyhydroxides.

We obtained Os-isotopic values (<0.92) much lower than expected, both for the bulk analysis of the Fe/Mn material, and for mild cold HBr-leachates. We are currently investigating possible reasons for such low values, notably a lower than average growth rate (less than few mm/Ma), or a recent gap in precipitation, or some on-site contamination by the calcareous ooze found within the nodules field area. These contain nanofossils of Eocene age and yielded a low Os-composition (0.59) reflecting typical marine-Os values of this interval.

Isotope composition of iron delivered to the oceans by intertropical rivers: The Amazon River case

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Riverborne iron is a notable source for this biogeochemically key element to the oceans. A proper understanding of the Fe cycle at the surface of the Earth require a good characterization of the isotopic composition of the various reservoirs of this element.

However, as the database growths, it appears that the isotope composition of the riverborne Fe delivered to the oceans may be more varied than initially thought, in agreement with inferences from soil studies from different climatic contexts. It is therefore important to compare major rivers from different latitudes. We focused our attention on the Amazon River and its tributaries that represent ca. 20% of the freshwater delivered to the oceans by world rivers.

Preliminary experiment suggests that water filtration may induce biases in stable Fe isotope composition. Therefore, we worked first on bulk waters, sampled through multidisciplinary field campaigns on the Amazon River and its tributaries, including the Solimoes, Negro, Madeira and Tapajos Rivers. Besides a complete sample physical-chemical characterization, Fe isotope determinations were conduced after water sample mineralization, iron purification and MC-ICP-MS analysis.

Our first results reveal that most bulk water samples cluster close to the continental crust value (0.1‰ $\delta^{57}Fe_{IRMM-14}$) with an overall range of 0.2‰. This is consistent with the restricted range found in lateritic soils elsewhere that represent 80% of the Amazon basin surface. This result holds whatever the relative proportion of dissolved Fe in the bulk waters budget, that ranges from 5 to 50% in these waters, whatever the sample depth and whenever the samples were taken in the river cycle. Hence, the bulk waters from the Amazon River delivered to the ocean have an isotopic composition that is close to that of the continental crust.