Tracing the sources of carbon in the rivers of Lesser Antilles

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At long timescales, the continental weathering of volcanic areas is one of the processes that control the atmospheric CO_2 (e.g. Louvat, 1997, Dessert *et al*., 2003). However, the nature of the links between CO_2 cycle and the chemical weathering of volcanic rocks is poorly known.

The CO_2 consumption by chemical weathering can be estimated with the concentration of Dissolved Inorganic Carbon (DIC ≈ HCO_3^-) in the rivers. Nevertheless, some processes are likely to modify the DIC concentration in the river (e.g. equilibration with the atmosphere, precipitation of calcite, photosynthesis, respiration).

The processes governing the CO_2 consumption by chemical weathering were studied in three volcanic islands in Lesser Antilles (Guadeloupe, Martinique and Dominica). The Lesser Antilles are ideal sites for the study of weathering due to their tropical climate and high relieves, inducing high weathering rates (Rad *et al*., 2006). Carbon stable isotopes of DIC and major elements chemistry were studied in streams, springs and soil solutions of these three islands during dry and wet season.

The $\delta^{13}C_{DIC}$ and major elements concentrations, highly variable, allowed us to identify the origin of DIC as a mixing between soil CO_2 (average value of $\delta^{13}C \approx -29.1 \pm 2.0‰$) and volcanic CO_2 ($\delta^{13}C_{DIC} = -3.25 \pm 0.25‰$, Agrinier *et al*., 2002). In addition, we observed an equilibration process of the riverine DIC with the atmospheric CO_2. Finally, as highlighted by Rad *et al*. (2006) for major elements, this isotopic study of the DIC cycling in the river demonstrates the importance of the volcanic fluids on chemical weathering processes.

References

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Sedimentary ^{232}Th as a tracer of dissolved detrital inputs to the ocean

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This study uses long lived thorium isotopes as a tracer for dissolved detrital inputs to seawater. ^{232}Th is derived exclusively from the partial dissolution of detritus. ^{230}Th is produced at a predictable rate by the decay of uranium, and its subsequent removal by efficient adsorption onto settling particles provides a method to quantify dissolved ^{232}Th fluxes to the seafloor. Ten core-top sediment samples were treated with up to eight leaching techniques and a total digestion to determine the best method for the separating adsorbed from lattice-bound thorium. Adsorbed (and total) ratios giving high dissolved (and total) ^{232}Th fluxes were measured in sediments from locations with high expected detrital inputs. These fluxes are reasonable by comparison to global estimates of detrital inputs to the ocean. The half-lives of both thorium isotopes are long enough to allow us to apply this technique to sediments that span several glacial-interglacial cycles. Coupled with total sedimentary ^{232}Th fluxes this data has the potential to evaluate various proposed linkages between ocean and atmospheric processes in the past. Preliminary downcore results display higher ^{232}Th/^{230}Th ratios that are consistent with enhanced ice-age dust deposition in the central Atlantic, North Pacific and three out of four Southern Ocean sites. However the two- to four-fold glacial increases indicated by the thorium isotope proxy are smaller than the order of magnitude changes recorded in high latitude ice cores.