Estimates of particle fluxes and boundary scavenging in the seawater around the Kerguelen Plateau using $^{230}Th_{xs}$ and ^{231}Pa

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The Kerguelen Ocean and Plateau compared Study (KEOPS, 19 Jan.- 13 Feb. 2005) took place in the wake of Kerguelen, characterized by a recurrent bloom allocated to natural fertilisation due to iron rich shelf inputs.

Particle dynamics (settling velocities, residence times) and dissolved/particle exchanges (boundary scavenging) are essential to understand the mechanisms responsible for the fertilisation over the Plateau. This work proposes to use two oceanic radionuclides ^{230}Th and ^{231}Pa –both decay products of soluble and conservative U and sensitive to scavenging- as particle dynamic tracers.

The measured dissolved and particulate ^{230}Th and ^{231}Pa data are consistent with other published data for near shelf area and open-ocean site. Dissolved excess ^{230}Th (noted $^{230}Th_{xs}$) distributions increase linearly with depth down to 700 m at most of the stations. This linear trend reaches the bottom (1550 m) for both tracers at Kerfix, located west of the Kerguelen Plateau, with dissolved concentrations ranging from 0.6 to 11 fg/kg and from 0.02 to1.8 fg/kg for $^{230}Th_{xs}$ and ^{231}Pa respectively.

A reversible scavenging model using the $^{230}Th_{xs}$ dataset allowed us to estimate scavenging rates ($k_1 \approx 0.3$-$0.9\ y^{-1}$), re-mineralization rates ($k_{-1} \approx 1$-$5\ y^{-1}$) and partition coefficients (average K= 0.15±0.06). Assessed particle settling velocities S are 800 $m.y^{-1}$ at Kerfix and surprisingly lower over the biologically productive Plateau with ca. 500 $m.y^{-1}$. These latter velocities are nevertheless consistent with the high mineralization rates characterizing this area. The deep layers of the three stations located east of the Plateau display depleted tracer distribution (ca. 50% of the Th stock is lost) interpreted as reflecting intense scavenging due to the presence of nepheloid layers.

Single column procedure for quantitative separation and recovery of cadmium (Cd) for high precision isotope analysis by MC-ICP-MS

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Cadmium isotope analyses gain increasing interest since terrestrial Cd isotopic compositions can be measured with higher resolution and precision. However, Cd isotopic studies face analytical challenges related to potential low Cd contents, non-spectral matrix effects as well as molecular ($M^{40}Ar+$ and $M^{16}0+$) and elemental isobaric interferences of Sn (112, 114, 116), In (113) and Pd (106, 108, 110) (Wombacher *et al.*, 2003). As a result, complete isolation of Cd from its sample matrix is important.

We propose a novel Cd separation procedure based on the Pb separation described in Lugmair and Galer (1992) as an interesting alternative to the current procedures of Wombacher *et al*. (2003) and Cloquet *et al*. (2005). The present chromatographic method is performed on a single stage micro column with AG1-X8 anion-exchange resin with a total processed acid volume of 7 ml.

For the 14 estuarine suspended particulate matter (SPM) samples passed through the column, total Cd recovery is better than 96%. The separation procedure removes more than 98% of the Sn present in the sample. Potential problematic elements such as Mo and Zr, inducing molecular interferences during MC-ICP-MS analyses, are not present (not detected with a Thermo Finigan *element 2* HR-ICP-MS) in the Cd fraction and the recovery of Zn is less than 0.6%. No problematic presence of major elements (Na, K, Mg, Ca) was detected suggesting that a single column procedure should be sufficient for subsequent isotopic measurements on a MC-ICP-MS. Some Pb (up to 2% of the initial Pb) and Cr (up to 10%) are still present in the Cd fraction. A second processing on the same column displays a recovery of better than 96% Cd (n=3), no Sn, nor Zn and only 0.2% of Pb is recovered in the Cd fraction.

The $\delta^{114/110}$Cd value obtained on four duplicate (total chemistry) SPM samples is of 0.17±0.06(2sd)‰/amu against our in-house B-JMC Cd standard.

References

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