Geophysical Research Abstracts
Vol. 20, EGU2018-4378-2, 2018
EGU General Assembly 2018

Downcore variations of sedimentary detrital (^{238}U/^{232}Th) ratio: implications on the use of ^{230}Th$_{xs}$ and ^{231}Pa$_{xs}$ to reconstruct sediment flux and ocean circulation

Lise Missiaen (1), Sylvain Pichat (1,2,3), Claire Waelbroeck (1), Eric Douville (1), Louise Bordier (1), Arnaud Dapoigny (1), François Thil (1), Lorna Foliot (1), and Lukas Wacker (4)

(1) Laboratoire des Sciences du Climat et de l'Environnement, LSCE/IPSL, CEA-CNRS-UVSQ-Université Paris-Saclay, F-91198 Gif-sur-Yvette, France, (2) Laboratoire de Géologie de Lyon (LGL-TPE), Ecole Normale Supérieure de Lyon, Université de Lyon, CNRS UMR5276, F-69007 Lyon, France, (3) Climate Geochemistry Department, Max Planck Institute for Chemistry, Mainz, Germany, (4) Laboratory of Ion Beam Physics, ETH Zürich, 8093 Zürich, Switzerland

U-series nuclides, have been widely used to reconstruct past oceanic sedimentation (using ^{230}Th-normalized flux) and circulation changes (using (^{231}Pa/^{230}Th)$_{xs,0}$, hereafter Pa/Th). These proxies are computed from excess ^{231}Pa and ^{230}Th activities (^{231}Pa$_{xs}$ and ^{230}Th$_{xs}$), $i.e.$ the activities produced in the water column by U decay and transferred to the sediment by adsorption on sinking particles. ^{231}Pa$_{xs}$ and ^{230}Th$_{xs}$ are determined by subtracting the computed detrital and authigenic contributions from bulk sediment measurements. The method relies on the use of a prescribed and poorly constrained value of the detrital (^{238}U/^{232}Th) activity ratio (hereafter (U/Th)$_{det}$). But, the provenance of the detrital material or the relative contributions between various sources can vary temporally, especially across climatic transitions. It is thus likely that modifications in detrital inputs amounts and/or provenance induce changes in the (U/Th)$_{det}$ value.

In this study, we have extracted the detrital fraction of the sediments from North Atlantic deep-sea core SU90-08 (43˚03'1N, 30˚02'5W, 3080m) and determined its (U/Th)$_{det}$ value over the last 40 ky. We found that (U/Th)$_{det}$ varied significantly through time with a minimum value of 0.4 during the Holocene and a maximum value of 0.7 during the Last Glacial Maximum (LGM). Based on our new data and the study of published records from other North-Atlantic sites, we also have shown that the sensitivity of sedimentary ^{230}Th-normalized flux and Pa/Th to changes in (U/Th)$_{det}$ is highly dependent on the core location and its terrigenous supply. Both proxies are very sensitive to (U/Th)$_{det}$ changes in cores with relatively high detrital contribution. In the that case, changes in the ^{230}Th-normalized flux and Pa/Th due to a misestimate of (U/Th)$_{det}$ can largely exceed the uncertainty on the ^{230}Th-normalized flux and Pa/Th, inducing potential biases in the amplitude and temporal variability of reconstructed sedimentation and ocean circulation changes. We have further tested the impacts of those biases on age models using ^{230}Th-normalized flux to refine the sedimentation rate between alignments or radiocarbon dated tie-points.