EGU2020-6725, updated on 28 Oct 2020
https://doi.org/10.5194/egusphere-egu2020-6725
EGU General Assembly 2020

231Pa/230Th in the northwestern Atlantic: circulation versus particles?

Finn Süfke[1], Frerk Pöppelmeier[1,2], Patrick Blaser[1], and Jörg Lippold[1]
[1]Institute of Earth Sciences, Heidelberg University, Heidelberg, Germany (finn.suefke@geow.uni-heidelberg.de)
[2]Climate and Environmental Physics, Physics Institute, University of Bern, Bern, Switzerland

In 2004 McManus et al. published their famous $^{231}Pa/^{230}Th$ record from the Bermuda Rise revealing millennial-scale changes in circulation strength back to the Last Glacial Maximum. This record marks the boost of this proxy as a kinematic circulation change proxy for the Atlantic Ocean and the initial rising slope on the 'Elderfield-Curve'. However, the up-to-date data base of Atlantic sedimentary $^{231}Pa/^{230}Th$ records gives a rather inconsistent picture of changes in the circulation strength in the Atlantic throughout the past 25 ka (Ng et al., 2018). Since both radioisotopes are strongly particle reactive it is obvious that scavenging processes may play a major role in their cycling as well. At ocean margins such processes do have a major impact on $^{231}Pa/^{230}Th$, leading to increased values and thus potentially overprinting the circulation signal. In contrast, records from open ocean sites are assumed to show a less biased circulation signal. In addition, the GEOTRACES program (Schlitzer et al., 2018) provided valuable seawater data allowing for examining the cycling of both radioisotopes under today's circulation regime in more detail. A transect across the North Atlantic by Hayes et al. (2015) revealed that nepheloid layers contribute to strong bottom scavenging of ^{231}Pa and ^{230}Th in the northwestern Atlantic basin. Surprisingly, sedimentary core-top values do not mirror predominant scavenging effects but rather indicate a strong export of ^{231}Pa and therefore a circulation signal. With our modern proxy toolbox, it is impossible to reconstruct the occurrence and intensity of past nepheloid layers and hence their potential effect on recorded $^{231}Pa/^{230}Th$ variations. Therefore, isotope-enabled models may help to better decipher the interwoven processes controlling $^{231}Pa/^{230}Th$ (Rempfer et al., 2017; Lerner et al., 2019). Here an up-to-date compilation of northwestern Atlantic $^{231}Pa/^{230}Th$ data will be presented. Our findings base on records covering the last 25 ka and will be interpreted in the context of recent model simulations as well as compared to seawater data. Thus, we aim for a deeper understanding of ^{231}Pa and ^{230}Th cycling in the northwestern Atlantic.

References:

Hayes, C., et al. (2015), Deep-Sea Res. Pt. II, 116, 29-41.
Lerner et al. (2020), Deep Sea. Res. Pt. I, 155, 1-41.
McManus, J. F., et al. (2004), Nature, 428, 834-837.
Ng, H., et al. (2018), Nat. Comm., 9, 1-10.
Rempfer et al. (2017), EPSL, 468, 27-37.

Schlitzer, R., et al. (2018), Chem. Geol., 493, 210-223.