Dissolved barium (dBa) has been used as a water mass tracer and Ba can be applied as a proxy for productivity due to a relationship between particulate Ba (pBa) and organic carbon. The utility of Ba depends on predictable behavior of the tracer.

We aim to describe and quantify non-conservative behavior (sources and sinks) of Ba in the Arctic marine system.

New data in this study are from GEOTRACES campaigns conducted throughout the Arctic Ocean from July – October 2015.

Barium distribution is controlled predominantly by inputs from Atlantic, Pacific, and riverine contributions. The role of ice, pBa, and shelves on the Ba mass balance is poorly constrained.

We assume that ice and pBa input and removal terms are small; we solve for the shelf flux considering only the surface 500 m:

\[ \frac{\Delta[pBa]}{\Delta t} = \text{Inputs} - \text{Outputs} \]

**Barium Behavior**

**If dBa behaves conservatively then we expect:**

\[ B_{\text{pBa,obs}} = B_{\text{rivers}} + B_{\text{atlas}} + B_{\text{ice}} \]

We define \( B_{\text{pBa,obs}} \) as the difference between observed and predicted Ba:

\[ B_{\text{pBa,obs}} = d\text{Ba} - d\text{Ba}_{\text{pred}} \]

Using water mass fractions from Pasqualini et al. for the US transect, we observe a positive Ba anomaly between 25 and 250 m, which is consistent with Pacific-derived waters. Is this evidence of a shelf Ba signal?

**Barium Distributions**

**Mass Balance**

\[ pBa = f_{\text{transport}} + f_{\text{Pacific}} + f_{\text{Atlantic}} + f_{\text{Rivers}} \]

**Carbon Proxy**

\[ C_{\text{org}} + pBa_{\text{non-lithogenic}} \]

**Isotopes**

Barium isotopes have a linear relationship, which indicates mixing – although of what endmembers is unclear. Two low [dBa] shelf samples deviate from the trend.

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