Particulate barium at station ALOHA and K2 during VERTIGO I & II
Objectives:

* Evaluate the potential of biogenic Ba, barite, as a proxy for organic carbon mineralization in the twilight zone, by comparing this proxy-tool with other approaches (NBST, bacterial production, respiration)

* Compare the outcome of this proxy-tool between an oligotrophic (ALOHA, Hawaii) and a HNLC system (K2, NW Pacific)
State of the art:

The non-lithogenic fraction of Ba (i.e. excess Ba or \( \text{Ba}_{xs} \)) in suspended matter is present mainly as micro-crystalline barite.

This barite appears to be formed in degrading biogenic material (aggregates, fecal pellets) settling through the water column.

Profiles of suspended Ba usually show increased concentrations at mesopelagic depths, which appear to reflect mineralization of exported matter.
$Ba_{xs}$ profiles at ALOHA (Jun-Jul 2004)

Maximum $Ba_{xs}$ values reached at >200m
$Ba_{xs}$ profiles at K2 (Jul-Aug 2005)

$Ba_{xs}$ increase starts at shallow depths (50m)

Max. values observed at ALOHA
$\text{Ba}_{\text{xs}}$ profiles at K2
Depth weighted average $Baxs$ (pM) in 150 to 500m depth layer

**ALOHA**

**K2**
Column integr. Prim Prod from Phil

Prim Prod Total, mgC/m²/d

0 100 200 300 400 500 600 700

K2

31.07 1.08 02.08 03.08 04.08 06.08 08.08 11.08 12.08 13.08 14.08 15.08 17.08
Column integrated Bact. Prod. from Ben & Phil
av. mesopelagic $B_{axs}$ vs. gradient of integrated bacterial production between 50 and 100m

av. mesopelagic $B_{axs}$ vs. gradient of integrated bacterial production between 100 and 1000m
av. mesopelagic $B_{a_{xsc}}$ vs. bacterial production integr. between 150 and 500m
av. mesopelagic $Ba_{xs}$ vs. 300m NBST POC flux norm. to POC flux at 150m

av. mesopelagic $Ba_{xs}$ vs. 500m NBST POC flux norm. to POC flux at 150m
300m NBST POC flux norm. to POC flux at 150m vs. bacterial production gradient between 50 and 150m

500m NBST POC flux norm. to POC flux at 150m vs. bacterial production gradient between 100 and 1000m
500m NBST POC flux norm. To POC flux at 150m vs. bacterial production integr. between 150 and 500m

300m NBST POC flux norm. to POC flux at 150m vs. bacterial production integr. between 150 and 500m
Mesopelagic $\text{Ba}_{xs}$ stocks and POC mineralization:

Earlier Southern Ocean results revealed the following empirical relationship:

$$JO_2 = \frac{[\text{Ba}_{xs}]_{\text{meso}} - \text{bgrd}}{17200}$$

In terms of POC mineralized and integrated between 150 and 500m (i.e. depth range of the sediment traps):

$$JPOC = JO_2 \times \frac{125}{175} \times 350$$
<table>
<thead>
<tr>
<th></th>
<th>NBST (\Delta) POC flux 150-500m mgC/m²/d</th>
<th>POC min. from Ba 150-500m mgC/m²/d</th>
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<tbody>
<tr>
<td>ALOHA</td>
<td></td>
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<tr>
<td>#1</td>
<td>13.7</td>
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</tr>
<tr>
<td>#2</td>
<td>16.6</td>
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<tr>
<td>K2</td>
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<tr>
<td>#1</td>
<td>36.7</td>
<td>34</td>
</tr>
<tr>
<td>#2</td>
<td>10.2</td>
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<td>From B.P. 10% G.E. ?? 150-500m mgC/m2/d</td>
<td>POC min. from Ba 150-500m mgC/m2/d</td>
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<tr>
<td>ALOHA depl #1</td>
<td>~28</td>
<td>18</td>
</tr>
<tr>
<td>depl #2</td>
<td>~28</td>
<td>17</td>
</tr>
<tr>
<td>K2</td>
<td>~70 (11.08)</td>
<td>65 (11.08)</td>
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<tr>
<td></td>
<td>~80 (15.08)</td>
<td>80 (14.08)</td>
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