

Interactive comment on “Distributions of dissolved trace metals (Cd, Cu, Mn, Pb, Ag) in the southeastern Atlantic and the Southern Ocean” by M. Boye et al.

Anonymous Referee #1

Received and published: 4 May 2012

Review of manuscript bgd-9-3579-2012 submitted to Biogeosciences.

"Distributions of dissolved trace metals (Cd, Cu, Mn, Pb, Ag) in the southeastern Atlantic and the Southern Ocean", by M. Boye, B. D. Wake, P. Lopez Garcia, J. Bown, A. R. Baker, and E. P. Achterberg

General comments

The manuscript by Boye et al. presents the full water column sections for the trace elements cadmium, copper, manganese, lead and silver from a broadly north-to-south transect of the Atlantic sector of the Southern Ocean during the International Polar Year – GEOTRACES program (cruise BONUS-GOOD HOPE). The data is of high quality

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(excellent use and discussion of SRMs on page 3585), and novel in that this is the first time that full profiles have been reported for some of the trace elements which allows a comparison to the major nutrients and hydrography. The authors investigate source mechanisms (mainly dusts, continental margin sediments, hydrothermal vents), relationships with different water masses, and sink mechanisms (mainly biological uptake) to explain the observed distributions. They also closely link the observed distributions to phytoplankton assemblages that exist in the micronutrient limited waters of the Southern Ocean. It is also worth noting that considerable effort was undertaken by the field-going scientists to cleanly collect these samples using individual GO-Flo bottles suspended on Kevlar wire and triggered with Teflon messengers.

The manuscript text is well-written and structured, providing useful background on methods, concise results and a thorough discussion. The complex oceanography of the region is also discussed well on page 3587-8, as is the Mn and Zn biological uptake systems and their role in controlling the Cd-P relationship on pages 3596-3597. References are up-to-date and cited appropriately. Tables and figures are also good (taking consideration of my note to Figure 3 below). I enjoyed reading the paper and recommend it for publication in Biogeosciences after some minor revisions. Specific and technical comments and questions are given below.

Specific comments

Page. 3580, lines 5-6. Please make clear which trace elements are associated with Si and which with P (presumably Cu, Ag with Si, and Cd with P). Rephrase.

Page 3580, line 16 and page 3593, line 15. The authors state that hydrothermal inputs are a source of trace metals to deep waters over the Bouvet Triple Junction, as evidenced by enhanced dissolved Mn concentrations. However, these enhanced concentrations are not evident in the Mn section (Figure 3). In fact, Mn seems to be quite depleted at depths around 2000 m (at ~50-55oS) (<0.4 nM), which is in stark contrast to the >1 nM observations of Middag et al. (2011) from the Zero and Drake section

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(i.e., same sampling location). Some explanation is required here. Was it purely poorer sampling resolution that meant you missed this feature?

Page 3589, line 4. When you state that there was no north-south trend in Ag concentrations, do you mean in ACC and Weddell Gyre waters only? There appears to be a general north-south gradient over the whole section shown in Figure 3, both in surface and deep waters.

Page 3595, lines 25-30. Briefly compare the Cu/Si ratio with the global relationship shown in Figure 5

Page 3598, lines 1-2. The sentence starting "This comparison" is superfluous here and should be removed

Page 3598, line 20. Should this be simply "Conclusions"

Page 3610, line 4 of the caption to Figure 3. This should read "colour mapping interpolation" or "gridding", rather than "extrapolation".

Page 3610, last line of caption. ODV has some particular text used to acknowledge how figures are prepared. I think it is something like "Figure prepared using Ocean Data View (Schlitzer, 2007)." (with reference). Please check at www.odv.awi.de. As it stands, it sounds like Reiner Schlitzer actually prepared the figures himself.

Page 3610, Figure 3. It is hard to link the description of the different water masses (especially deep waters) with trace element features in the current figure. I think you need to add another figure showing the salinity or temperature section (plus map), and overlay this with the water masses (similar to Figure 2 in Chever et al., 2010)

Page 3612, Figure 5. It may be easier to label each plot (a), (b), (c), and (d) and refer to these from the text. Note, (b) is cited before (a), and (d) before (c) in the text (need to re-order the plots on this Figure. For the Cu/Si plot, please state that the solid line shows the global relationship.

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Technical comments

Page 3582, line 14. Remove comma after "(ID-ICPMS)"

Page 3583, line 14. Do you mean "O-rings"?

Page 3586, line 3. Please state the make and model of the aerosol collector and provide a reference

Page 3586, line 8. Please provide a reference for the aerosol filters washing protocol (Baker et al?)

Page 3588, lines 5 and 6. "AABW" is used twice in this sentence. Mistake?

Page 3592, line 15. Add "and" after "Fig. 4)"

Page 3592, line 28. Add "*" between "Ag = 20.61" and "Cu"

Page 3595, lines 14-15. Replace "suggest the" with "indicates an"

Page 3603, lines 10-13. This is a conference abstract only. Suitable for citation in Biogeosciences?

Page 3609. Please re-order "salinity" and "potential temperature" in the first line of the caption to Figure 2 (the plots are T over S). Also, no need for "(psu)" for salinity units.

Interactive comment on Biogeosciences Discuss., 9, 3579, 2012.

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