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Biogeosciences Discussions

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.

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We warmly thank the two anonymous referees for their comments. All comments have been addressed here below and in the manuscript when needed.

Anonymous Referee#1

RC : 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.

AC : the sentence has been rephrased as suggested.

RC : 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 50-55°S) (<0.4 nM), which is in stark contrast to the >1 nM observations of Middag et al. (2011) from the Zero and Drake section (i.e., same sampling location). Some explanation is required here. Was it purely poorer sampling resolution that meant you missed this feature?

AC : We observed relatively elevated Mn concentrations at station S4 between 2300 and 2490 m (0.30 to 0.43 nM), compared to the other stations at comparable depths (<0.25 nM). Hence we suspected inputs of Mn at those depths, probably due to hydrothermal inputs since those inputs have shown to be important for Mn (and Fe) above the Bouvet Triple Junction (Middag et al., 2011 ; Klunder et al., 2011). Comparing these 2 data points at station S4 (at 51.85°S) with those at station 110 (at 51.94°S) of the Zero&Drake section between 2250 and 2700 m (e.g.; Mn= 0.21-0.28 nM ; from Middag data set referred in his paper at page 2664-line 3) actually suggests that our Mn concentrations could be even higher than those recorded during the Zero&Drake cruise at this latitude. The strongest feature was indeed missed because of the poorer sampling resolution, where we achieved only 3 stations between 50 and 55°S compared to 6 stations for the Zero&Drake section, with about 5 sampling depths at or below 2000 m compared to about 22 sampling depths for the Zero&Drake cruise. Notably we had no sampling station in the center of the hydrothermal plume (between 52.99 and 54°S) where the highest Mn deep concentrations (>1 nM) were recorded by Middag et al. (2011). We have reported some of those considerations in the text.

RC : 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.

AC : The referee is right and we have made the correction accordingly.

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

AC : The comparison is added.

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

AC : The sentence has been removed.

RC : Page 3598, line 20. Should this be simply “Conclusions”

AC : The tittle was changed to "conclusions"

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

AC : The term "extrapolation" was changed by "gridding"

RC : 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.

AC : We have changed the acknowledgment to ODV when cited as followed : “Figure prepared using Ocean Data View (Schlitzer, 2012)”, with the following reference : Schlitzer, R., Ocean Data View, http://odv.awi.de, 2012.

RC : 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)

AC : The hydrography along the section is already well explained in the results section (and the T/S diagrams are shown in Figure 2) to allow the understanding of the different

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water masses. The distributions of S, T and O2 are also shown in other publications that are easily accessible (Bown et al., 2011 ; Chever et al., 2010), and in publications of the special issue of the Bonus-Goodhope cruise assembled in Biogeosciences (Bown et al., 2012 ; Sarthou et al., 2011). Furthermore the overlay of a section with the water masses misses one dimension which is critical along the section considering the different circulation pathways of the water masses. Hence we think that no additionnal such hydrographic map is needed.

RC : 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.

AC : The plots have been labelled and placed in the good order. The text and figure caption have been corrected accordingly. Furthermore it is now state that the solid line stands for the global Cu/Si relationship.

Technical comments RC : Page 3582, line 14. Remove comma after “(ID-ICPMS)” AC : done

RC : Page 3583, line 14. Do you mean “O-rings”? AC : yes ("O" is now added before rings)

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

AC : We add the model of the collector (Tisch TSP high volume aerosol collector) and provide a reference (Baker et al., 2007).

RC : Page 3586, line 8. Please provide a reference for the aerosol filters washing protocol (Baker et al?) AC : We provide a reference for the washing protocol (Rickli et al., 2010)

RC : Page 3588, lines 5 and 6. “AABW” is used twice in this sentence. Mistake?

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AC : It was indeed a mistake. The sentence was thus corrected and moved to the hydrographic description of the domain south of the ACC where this younger variety of AABW was observed.

RC : Page 3592, line 15. Add “and” after “Fig. 4)” AC : done

RC : Page 3592, line 28. Add “*” between “Ag = 20.61” and “Cu” AC : done

RC : Page 3595, lines 14-15. Replace “suggest the” with “indicates an” AC : done

RC : Page 3603, lines 10-13. This is a conference abstract only. Suitable for citation in Biogeosciences? AC : It is the only way to refer this work so far.

RC : Page 3609. Please re-order “salinity” and “potential temperature” in the first line of the caption to Figure 2 (the plots ate T over S). Also, no need for “(psu)” for salinity units. AC : done

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