

Biogeosciences Discuss., referee comment RC1
<https://doi.org/10.5194/bg-2021-305-RC1>, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Refereed Comment on bg-2021-305

Anonymous Referee #1

Referee comment on "Major processes of the dissolved cobalt cycle in the North and equatorial Pacific Ocean" by Rebecca Chmiel et al., Biogeosciences Discuss.,
<https://doi.org/10.5194/bg-2021-305-RC1>, 2021

This is a review of the paper titled "Major processes of the dissolved cobalt cycle in the North and equatorial Pacific Ocean" by Rebecca Chmiel et al. for consideration in Biogeosciences Discussions. The authors show high quality dissolved and labile cobalt data from a recent GEOTRACES expedition (GP15) to the North and South Pacific Oceans. Co shows evidence of biological uptake and remineralization in the surface ocean and scavenging with depth, accordant with its typical global distribution. While hydrothermal sources were observed and discussed, persistent oxygen minimum zones sampled in this study were determined to be a larger input of dissolved Co to intermediate waters. The distribution of labile vs organically-complexed Co, as determined by UV radiation, is discussed throughout, highlighting in particular the importance of ligands in protecting dCo in Pacific deep waters. Comparison to particulate samples, collected by pumping, and Fe and Mn are also discussed at select stations.

I found this manuscript to be an enjoyable and easy read. While these processes are being explored across multiple elements for other GEOTRACES parameters, this manuscript provides a nice foundation for oxidative release, scavenging, and mixing of deep waters along this transect. The organization supported the findings and the logic of conclusions throughout. I thought the addition of other dissolved metals (Fe and Mn) and particle species (pCo, POC, etc) to be complimentary rather than extraneous in telling the story. The figures were likewise appropriate and well-designed.

I recommend acceptance to Biogeosciences following minor revisions as outlined below.

General comments to this manuscript: While there was thorough discussion of possible processes it felt a little long and I was having trouble following the deep water/POC export and modeling sections as a result. I wonder if there is a way to streamline? It seems that you discuss deep water Co trends through the lens of Co:PO4, labile Co, and then again in a separate section. I also thought that the mention in the conclusions about deepwater Fe-Mn nodules as a source of Co could be expanded slightly. Do you expect this inventory to increase with increased deoxygenation, for example? How efficient are Fe-Mn nodules in scavenging Co? Just thinking this would be of interest to a broader community and inform ongoing deepwater mining studies.

Line comments:

Line 121: "The Chelex resin was prepared as described..."

Line 135: Can you clarify if the labile dCo analyses were done on the exact same sample as the total dCo? Or an aliquot? If I understand correctly, the total dCo was done using an aliquot, does that mean that the rest of the sample is only able to be used for repeat labile analyses in the future?

Lines 495-496: I wonder if this was true in the Arctic as well, since you just compared the Alaskan source to Arctic processes?

Line 501: What are typical river endmember concentrations of Co in this area?

Line 505: By "open" do you mean open ocean or yet unknown?

Line 536: ODF stands for "Oceanographic Data Facility", I believe this is wrong in your acknowledgements as well. I would mention it is hosted at Scripps Institution of Oceanography.

Line 541: Can you clarify which samples are coming from the ODF rosette? The FIA Fe and Mn samples?

Line 578+595-596: It is odd to mention the flux from hydrothermal vents twice with different units. Can you combine these sentences?

Line 591: local scavenging of the labile or ligand-bound Co?

Line 749: "expeditions"

Lines 843-845: Will this model now be updated to reflect these new Co data?