

Author Responses to RC2 (in *blue italics*)

The findings are impressive and important for our understanding of global biogeochemical cycles. I also imagine that this work will carry weight in the Precambrian community where transition metal cycles may have been quite distinct from today. This work is therefore timely and likely to have significant impact.

I'm not an expert in the methods and can therefore not comment on those aspects in detail. The results sound plausible; however, I strongly suggest reorganizing the structure of the paper. Separating results from discussion would go a long way in making the paper more accessible to an interdisciplinary audience. In its current form, the text is often difficult to follow, because it seems to jump between topics unexpectedly, at least for reader who is somewhat outside of this field.

Response: We have kept the current formatting of discussing results and discussion together, but we have tried to edit the transitions between sections to show how the different results build on one another.

Line comments:

l. 52: Please define how this K value is defined with an equation. Otherwise, this notation is not understandable.

Response: We thank the reviewer for this comment and have added the definition in in the methods appendix.

l. 67: comma after 'ocean'

Response: We thank you the review for their comment made the correction.

l. 101: This sentence that all known L1 sources are biological needs a reference.

Response: We thank the review for this comment and have added:

Gledhill, M. and Buck, K. N.: The organic complexation of iron in the marine environment: A review, Front. Microbiol., 3, 1–17, <https://doi.org/10.3389/fmicb.2012.00069>, 2012.

Which reviews discussion about L₁ ligands being biologically produced.

ll. 106-129: This paragraph is out of place. It should be moved to the end of the introduction, because it includes background information (xxx has never been measured) and methods. It's confusing to read about the method in the middle of the results & discussion section. Please move this upwards.

Response: We thank the reviewer for this comment. We have reworked this paragraph to relocate or removed repetitive background and methods information and incorporate the rest within the results/discussion section.

I. 118: Does total L1 ligands refer to ligands for Fe only? Or are other metal ligands included in this pool? Please clarify.

Response: We thank the reviewer for this comment. We are only describing strong organic Fe binding ligands and have defined these at L1 in this manuscript. We have included this definition at line 93.

II. 132-133: This statement about energetic costs and Fe-regulation of siderophore production needs a reference. It is not something that is evident from the data.

Response: We added the reference Rizzi et al. (2019).

Rizzi, A., Roy, S., Bellenger, J.P. and Beauregard, P.B., 2019. Iron homeostasis in *Bacillus subtilis* requires siderophore production and biofilm formation. *Applied and Environmental Microbiology*, 85(3), pp.e02439-18

Section 2.2 (identifying ligands) should probably come before Section 2.1 (the role of ligands). It would feel more logical to first discuss what was found before discussing the implications.

Response: We have reorganized some of the text to first talk about the total ligands we identified, and then the siderophores, and finally the implications.

II. 151-153: Elaborate on this. How do siderophores change with distance and vent type?

Response: We appreciate this feedback from the reviewer and have added this line to expand on this:

“Summed siderophore abundance in plumes above spreading centers was similarly more than twice that of samples from fracture zones or off-axis (Fig. 2c).”

II. 200-202: This was already said earlier. Please streamline the order of sections in the manuscript.

Response: We rearranged some sections and removed repetitive information.

Methods: I'm not familiar with most of these and won't comment in detail. However, I think, it would be helpful for the reader to briefly summarize at the end of the introduction which methods were used. For example, I found myself being surprised when suddenly in the results & discussion section genomic data were brought up. It would have helped if I had known from the beginning that this was coming.

Response: We thank the review for this comment and have added clarifying sentences to the introduction to inform the reader of the methods used in this study (see lines 81-84)

Fig. 2b: Explain in the caption or legend what the star next to point 35 means.

Response: We appreciate this feedback from the reviewer and have added this to the mention of TAG (St. 35) in the caption:

“TAG (St. 35) — denoted by the asterisk — was not included in the regression due to its large range of dFe values and statistical outlier behavior.”

Fig. 3: Does ‘depth’ mean water depth? Please clarify.

Response: Yes, depth means water depth from surface of the ocean. We have a clarifying comment within the caption.

“...each sample, separated by depth from water surface,...”

Eva Stüeken