Biogeosciences Discuss., referee comment RC1
https://doi.org/10.5194/bg-2022-73-RC1, 2022

Comment on bg-2022-73

Anonymous Referee #1

Referee comment on "Tracing differences in iron supply to the Mid-Atlantic Ridge valley between hydrothermal vent sites: implications for the addition of iron to the deep ocean" by Alastair J. M. Lough et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-73-RC1, 2022

General comments

Lough et al. report the variability in dissolved iron to excess helium ratios (dFe:xs^{3}He) across geochemically distinct hydrothermal vent sites along the Mid-Atlantic Ridge, and compare methods for estimating dFe:xs^{3}He. This is important to investigate since dFe:xs^{3}He derived hydrothermal Fe fluxes are used in global biogeochemical models. Hydrothermal vents were tracked during the expedition using temperature, salinity, light scattering, oxidation-reduction potential indicative of reduced chemical species, and dMn via flow injection. Total dissolvable and dissolved Fe/Mn and He were measured onshore.

The variability in estimated dFe:xs^{3}He among methods was higher at stations close to the vent site, and the authors determined that using Mn:xs^{3}He measured in the standard rosette cast (where He is measured) and using dMn to extrapolate xs^{3}He in the trace metal cast is the most appropriate method for calculating dFe:xs^{3}He ratios, since this can account for differences in CTD sampling position between the two separate casts. This methods comparison is valuable and will be useful for guiding future work. The authors furthermore document particulate-dissolved Fe exchange at most of their sites, suggesting hydrothermal dFe does not consistently behave conservatively, at least over short distances from the vent. Fe binding ligands are likely important in limiting the amount of dFe released from vents and stabilized in plumes.

The manuscript is very well written and arguments are clear. Below are minor comments.

Line 92 – Include specific dates of sampling for reference

Table 2 – If I am following correctly, the major difference between Method 1/2 and Method 3 is that He measurements were not obtained at the same sampling depths as trace metals, and interpolations are needed to be performed. In contrast, sampling depths in Method 1 are the same, though He and trace metals are measured from different casts. Given this, I am confused as to why the number of measurements collected from the standard rosette does not match up with the trace metal rosette in the second and fourth columns (e.g., n = 4:3 for Site 6) of Table 2. And why do the TMR sampling depths integrated in the 4th column not match the TMR sampling depths integrated in the 2nd column? Being as clear as possible in the caption will help readers less familiar with these calculations follow along.

Line 246 – What about TDMn? Any differences between TDMn and dMn, and evidence for Mn precipitation in the plume? I understand it should be minimal compared to Fe precipitation, but would be helpful to see it plotted in the supplemental section for reference