

Biogeosciences Discuss., author comment AC3  
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## Reply on RC3

Alastair Jason Mackenzie Lough et al.

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Author comment on "Tracing differences in iron addition to the Mid-Atlantic Ridge valley between hydrothermal vent sites: implications for the addition of iron to the deep ocean" by Alastair Jason Mackenzie Lough et al., *Biogeosciences Discuss.*, <https://doi.org/10.5194/bg-2022-73-AC3>, 2022

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We thank reviewer three for their helpful comments.

We will revise the manuscript and split sentences into shorter ones where possible to improve clarity.

We will adjust the title to: The impact of hydrothermal vent geochemistry on the addition of iron to the deep ocean: case study of the northern Mid-Atlantic Ridge.

The two methods of estimation refer to the two methodologies of used to calculate Fe/xsHe ratios. A third methodology is assessed briefly but as this method produced negative numbers the results are in the supplement, and it is not discussed at length. The two different types of sampling equipment used are described on line 102 and 116. We will go through the manuscript and make sure the terminology is consistent throughout to make sure this is clear.

We will add a brief description of the helium isotope analysis to section 2.2

We will add sample station number to figure 1 and table 1 which was also requested by reviewer 2.

Much of the manuscript focuses on TAG and Rainbow as a wider range of distances were sampled from around those vent sites, so we could compare the separation of iron into colloids and particles between those two sites over the same distance. For Menez Gwen and Lucky Strike we only sampled directly over the vent site. As a result, the discussion of results from Lucky Strike and Menez Gwen is restricted to section 3.2.

In figure 3 we present the depth profiles of elements and sensors in order to highlight the real consequences of the concept shown in figure 2. Which is that the plume shifts between sampling casts and the full extent of the plume over a vent site cannot be captured without sampling based on sensor signals and ideally multiple sampling casts.

The depth profiles from all stations are presented in the supplement to avoid overloading the manuscript with multi panel plots.

The units for dFe/H<sub>2</sub>S are mmol/mmol, this will be added to the table 1 to make it clear.

Whilst the issue of obtaining representative samples of hydrothermal plumes is not mentioned in the title of the paper we do feel it is a key and often overlooked subject within this area of research. We therefore think it is necessary to highlight the need for hydrothermal sampling programs led by sensor data, as well as providing technical solutions so that future research programs will be able to trace hydrothermal inputs from the vent source beyond the near field and into the open ocean.