Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-198-AC2, 2019

Biogeosciences Discussions

Interactive comment on "Benthic C fixation and cycling in diffuse hydrothermal and background sediments in the Bransfield Strait, Antarctica" *by* Clare Woulds et al.

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Received and published: 23 July 2019

The reviewer's argument is that the measurements of in situ C fixation that we present have conceptual flaws, due to having been conducted ex-situ. Thus the sediment that we incubated was cut off from its supply of the electron donors which provide the energy for chemosynthesis, and which are presumably sourced from the upwards flux of hydrothermal fluid from deeper in the sediment. We acknowledge this point, but suggest that it may not have been a serious consideration at the sites which we studied, and does not warrant exclusion of all the benthic inorganic C fixation material.

Firstly, the hydrothermal site that we studied (Hook Ridge, in the Bransfield Strait) was

rather mildly hydrothermal. Hence, as has been reported, vent endemic fauna were almost absent (Bell et al., 2016), there was no increase in faunal biomass close to venting, and downcore profiles of alkalinity, nitrate and ammonium were consistent with normal microbial processes (Aquilina et al., 2013). There were indications of of hydrothermal flux in chloride, sulphate and sulphide profiles, which allowed Aquilina et al. (2013) to calculate hydrothermal advection rates of 9-33 cm y-1. At these low advection rates we suggest that there would not have been sufficient time during our $\sim$60 h experiment for a noticeable depletion in availability of electron donors supplied by hydrothermal fluid.

Secondly, we measured greatest amounts of benthic inorganic C fixation at our non-hydrothermal control site. The methods we used did not allow us to definitively pinpoint the metabolic processes responsible for inorganic C fixation, but the fact that C fixation was maximal at a non-hydrothermal site suggests that it is not, or not always, inherently linked to hydrothermalism. Indeed this is one of our key findings. Therefore, while our ex-situ incubation technique could have resulted in conservative rate measurements at the hydrothermal site, we do not feel that it would be a proportionate response to exclude all the material about benthic inorganic C fixation.

Finally, we note that other reviewers found the material about benthic inorganic C fixation to be interesting, novel, and worthy of publication.

We will add this discussion of a potential artefact from our experimental technique to our discussion.

In addition the reviewer asks for clarification of methods (e.g depths over which PLFAs were measured, and procedure used to determine whether labelling levels were above background). These details will all be added. Further they also make the same point about use of means and standard deviations as reviewer 1. As stated in the reply to reviewer 1, we will alter our presentation of results to avoid use of means and standard deviations.

References:

Aquilina, A., Connelly, D. P., Copley, J. T., Green, D. R. H., Hawkes, J. A., Hepburn, L. E., Huvenne, V. A. I., Marsh, L., Mills, R. A., and Tyler, P. A.: Geochemical and Visual Indicators of Hydrothermal Fluid Flow through a Sediment-Hosted Volcanic Ridge in the Central Bransfield Basin (Antarctica), Plos One, 8, 2013.

Bell, J. B., Woulds, C., Brown, L. E., Sweeting, C. J., Reid, W. D. K., Little, C. T. S., and Glover, A. G.: Macrofaunal ecology of sedimented hydrothermal vents in the Bransfield Strait, Antarctica, Frontiers in Marine Science, 3, 2016.

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