

## ***Interactive comment on* “Chemosynthesis in the deep-sea: life without the sun” by C. Smith**

### **Anonymous Referee #3**

Received and published: 29 January 2013

The manuscript “Chemosynthesis in the deep-sea: life without sun” discusses the role of photosynthetically produced oxygen by deep-sea chemoautotrophic organisms and argues the point that chemically fueled habitats, in most instances, are still reliant on the sun. While this manuscript is very readable and approachable by a broad audience, the ideas that are presented are not novel, specifically they were essentially introduced and accepted 1985 in responses to a manuscript by HW Jannasch in Science. The author of the current manuscript has updated this general discussion with knowledge of larvae consuming photosynthetic material as well as microbial processes and fixation pathways however does not catch up to the current status of deep-sea chemosynthetic communities in those fields. In general, I am confused as to why this was submitted to Biogeosciences: It is not a review of the field, nor is it a commentary on a previous article, it presents no new data and thus is not a research article, nor does it provide a future direction for research.

As stated by the other two reviewers, as a popular science piece this has merit as it is quite easy to read and enjoyable. However, a key aspect that would need to be improved upon is that in many instances reviews are cited in place of primary literature. Van Dover's 2000 book on the subject of vent ecology is cited many times. In addition, there are many more updated works on the subject of vent and seep ecology, including those suggested by the other two reviews, but I would also suggest reference Middelburg 2011 "Chemoautotrophy in the oceans" as chemosynthesis is not even limited to those habitats, in addition to what we now know about the deep pelagic (G. Herndl, C. Wuchter, R. Hansman, AE Ingalls have all produced works that would be to reference). Finally, the deep biosphere is an area where our current understanding of chemosynthesis is changing and seems like it should be mentioned if not fully discussed as this is very much in line with the authors point.

I also concur with L. Levin that the roll of biogenic methane is an important aspect of the subject that was not discussed as it further ties chemosynthetic production with the sun. I would also suggest including Kelp falls as another example of reducing habitat in the deep sea (see Bernardino et al. 2010 Deep-Sea Research – also see this for more key references on discoveries of wood falls in the deep).

As to the figures, they did little to help the reader. I would suggest that rather than have figure 1 separate from figure 2 (the first is an equation not a figure and the second is a table not a figure?) it would be good to include photosynthesis in this table. In addition, how is figure 2 adapted from table 4 in Takai? It appears to be an exact copy – this violates copyright without permission from the publisher. Figure 3 could be expanded to include seeps and the reactants could be color coded to be based on photosynthetic production and chemosynthetic production. It would be good to color code the chemicals in Table 2 as well in this same fashion. Figure 3 is also almost an exact copy of the Tivey figure – the only difference is that '(b)' has been taken out of the corner. If used this would need to get permission from that publisher as well. Figure 4 is not entirely necessary. I would recommend just omitting it, however if left in then it

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should be referenced, and not to a lecture – similar figures have been published.

A few specific comments: 17039 Line 1 – Heterotrophic fauna that feed off non-symbiotic bacteria, in addition to symbionts bearing fauna, thrive in many of these habitats and thus should be referenced. 17039 Line 5 - sunlight to 1000m and the amount of export production that reach the seafloor should both have references to accompany those values. 1740 Line 13 – Gibbs free energy is more appropriate than potential energy. The potential energy is that stored in the bonds – the Gibbs free energy is a function of how one breaks those bonds not how much energy was in them in the first place. 1741 line 1 – There are many more recent citations for anaerobic processes in cold seeps - I would recommend reading the review by Knittel and Boetius 2009 – Ann. Rev. Microbio. 63:311-334 for more of an up to date view. 1741 line 14 – Sulphide-oxidizing rather than reducing. Sulfate is reduced, sulfide oxidized. 1747 Line 28 – Takai not Takail.

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**BGD**

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