

# ***Interactive comment on “In depth characterization of diazotroph activity across the Western Tropical South Pacific hot spot of N<sub>2</sub> fixation” by Sophie Bonnet et al.***

## **Anonymous Referee #1**

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Review of “In depth characterization of diazotroph activity across the Western Tropical South Pacific hot spot of N<sub>2</sub> fixation” by Bonnet et al.

Bonnet and coauthors measured nitrogen fixation rates and diazotroph abundance along a west-east transect in the western tropical South Pacific Ocean. They report some astonishingly high rates along this transect and offer explanations for the driving factors. This is a solid piece of work with some important and interesting findings. Most of my comments below are minor although there are a couple of major typographical errors that need to be fixed. But this manuscript can be improved to make it something more than a data report by providing a good oceanographic context to the observations

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reported. It seems very likely that the researchers encountered different water masses along the transect that account for some of the variances in nitrogen fixation rates reported and providing that context would be useful. I suggest not using acronyms when not necessary – the difference between GY and gyre is two letters and it just makes it easier to read. I also suggest some minor modifications to the figures to make them more useful.

I do have a couple a couple of pet peeves to express and hope the authors will pay attention to at least the second and change the manuscript accordingly.

1) While I realize that this was a major oceanographic expedition with many groups, all working at different pace and thus necessarily, some results are available earlier and already published while others more recently processed, it is still frustrating to read to read a manuscript where critical bits of information are presented elsewhere, either already published, in review or in preparation. It is unfortunate that success in the modern scientific enterprise is measured by numbers of papers and careers of especially young scientists are determined by first authorships, resulting in piece meal papers. I don't expect the authors can do much about this but do wish to raise this issue because it is especially important for major interdisciplinary field expeditions such as OUTPACE.

2) The word “hotspot” is starting to get overused. It would seem that each investigator's favorite geography is a “hotspot” and I am having a difficult time with the concept of claiming a quarter or even one eighth of the largest ocean (western tropical South Pacific) as a hotspot. As the authors themselves say, “WTSP is a vast oceanic region” (page 2, line 21). The data to support the idea that the entire WTSP is a hotspot is still sparse and much too variable - 631286 in Melanesian archipelago waters - is a range of almost 45% in this cruise alone. The findings in this manuscript are significant even without that claim. In addition, there is one, potentially two real hotspots within this transect that are important in my view and that get lost when the claim is made to the whole area – I am both supportive and excited by the idea that there is a “sweet spot”

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(to use a different term) for diazotrophy at the interface where there is a supply of iron and phosphorus (around station LDB). This zonal gradient is similar to the meridional gradient in Fe and P that Moore et al characterized in the Equatorial Atlantic. But the South Pacific is more complex and thus interesting in that there is clearly some sort of island effect with higher rates closer to the islands as well as Fe supply from the seafloor.

Specific comments and suggestions:

Page 2, line 5 – is it ammonia or amino acids?

Page 7, line 4 – should be per cell, not par cell

Page 7, line 18 (and elsewhere) – it would be good to discuss what is special about station LDB. This station is clearly a hotspot. Why? Was there any eddy activity here? Why is the water warmer here? Why is the chl higher all along the water column? Are we at the edge of water masses? Actually for that matter, what is going on at LDA where warmer waters are mixed down to almost 150 m.

Page 8, line 2 – what is DL? If it is detection limit, what is it? Why is the range 0-4 in line 4 – i.e. why is this not from detection limit?

Page 9, lines 34-38. This is a very important and interesting finding. While pressure could be one reason, clearly temperature would also play a role (although that would be in the opposite direction?) – i.e. there is a temperature gradient of 6-8 C between surface and 150m.

Page 10, line 11 – suggest using “differing” or some other word such as changing rather than differed?

Page 10, line 15 – what does under in-situ-simulated mean? Why not just on-deck incubations that simulated appropriate light levels?

Page 10, line 21 – it would appear that there is quite a bit of variability even in the

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archipelago waters. I am concerned that the contouring for figure 2 makes it appear as though it is a lot more uniform than it really is. While I understand the attraction of presenting the data along a linear transect this way, I do worry that real numbers are getting lost in this presentation and that the rates are actually a whole bunch more variable.

Page 11, lines 3-22 – why only discussion of DIP – what about DOP? Trichodesmium can use DOP and it would have been interesting to see what was going on with that.

Page 11, lines 26-27 – what is the range for the DFe concentrations?

Page 12, lines 15-16 – Is it not the other way around – PAR explains depth?

Page 12, line 35 – dominated not dominating

Page 13, line 28 – suggest saying “more than” rather than above

Page 14, line 18-19 – the sentence construction suggests that rates have gone up rather than our understand of rates have changed

Page 24, Table 3. It would seem that the table header for the second row is wrong. Spent a lot of time trying to figure out why the numbers were different till I figured out that it is actually for UCYN B rather than Trichodesmium

Page 25, Table 4. Why are the numbers for cDNA gene copies different from that reported in the text?

Page 27 Figure 1: Suggest improving 1a and show the ocean currents better – the superimposition of a big arrow does not do much. I am not clear how 1b was done – am just surprised that there are no clouds in the image. This is not critical expect to understand if the high chl patches seen are temporally relevant.

Page 28, Figure 2: Suggest adding the parameters to the various subfigures.

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