

## ***Interactive comment on “Archaeal Intact Polar Lipids in Polar Waters: A Comparison Between the Amundsen and Scotia Seas” by Charlotte L. Spencer-Jones et al.***

### **Anonymous Referee #1**

Received and published: 15 December 2020

In this study, Spencer-Jones et al. present the results of intact polar lipid-GDGTs in suspended particulate matters from the Amundsen Sea and the Scotia Sea. The topic is interesting and relevant to the field of Biogeosciences, which is important for understanding and predicting the changes of West Antarctic Ice Sheet. The authors, however, are suggested to make the significance of the work clearer, and the discussion and conclusion more focused and concise. Thus, this manuscript is not ready for publication in the current stage for several reasons:

1. It is not clear what the outcome of the comparison between the Amundsen and Scotia Seas are. The authors mainly present the results in the two seas, respectively, but

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rarely make comparisons between the two. Moreover, the methods of lipid extraction are different for the samples of two seas (line 171-187). The authors are suggested to make a reasonable discussion on how different methods of lipid extraction may influence the results.

2. It is important to understand the main driver of Southern Ocean GDGT distributions. However, there is a lack of strong relative discussion. For example, it is unclear how circumpolar deep water affects IPL distributions in Amundsen Sea (line 398-469). An improvement in this aspect would be helpful.

3. The authors are suggested to specify the main results in the Abstract. How did IPL-GDGT signatures shift in the study areas? And how did the signatures correlate with physicochemical parameters?

4. The structure of some sections should be revised. Please move the section 1.2 to Methodology and remove the subtitle of 1.1. Also, the Result section should be condensed by, for example, removing redundant sentences, e.g., repeating results on water masses (line 236 and 241).

5. The conclusion is suggested to be re-written to sufficiently show the significance of this study.

Some detailed suggestions are given below:

Line 109 and line 233: A colon should be used instead of semicolon.

Line 110: should it be SFACC?

Line 162-166: it is possible to quantify the proportion of 0.2-0.7  $\mu\text{m}$  microbes?

Line 222-223: please check the use of semicolon: — are not available, therefore—.

Line 238: please check the unit of oxygen concentration.

Line 283: Why to present the results of MH/DH and MH/HPH ratios? It is not introduced

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in the Introduction or discussed later.

L288-293 and line 308-319: Please clarify to which figure or table these results refer.

L293-295: This statement is inconsistent with the information in Fig. 3b, which shows that the relative abundance of the HPH head group decreased from CTD station no. 1 to no. 3.

Line 302: Are samples 1 and 25 equal to CTD 1 and 25?

Line 332-333: this information is already presented in the last paragraph.

Line 349-350: repeated information, please revise this sentence.

Line 411: – have shown an increase in group I —

Line 413-418: are there any data of bacterial or algal community, and environmental factors from the same cruise? These data of biotic and abiotic factors would strongly support the discussion here.

Line 429: please specify what use of this head group as a biomarker for the archaeal community.

Line 430-431: Is this conclusion made based on the results from previous studies stated on line 423-425? If yes, how to exclude the possibility of the MH head group synthesized recently by archaea?

Line 438-442: are these data of productivity, nutrient concentration and light intensity from the same cruise with the present study?

Line 447-448: it is not clear how figure 4 shows an increase in diversity downwards in IPL-GDGT. As I see it, the diversity is also high in the surface layer as shown by bars.

Line 455 and line 498: what does the word 'This' exactly mean? Please clarify.

Line 466-467: the difference between stations?

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Line 468: It is not clear what the small contrast in HPH and DH-cren distribution is.

Line 471-474: These sentences should be moved to the Method or Result section.

Line 516: — was detected —

Fig. 1: This figure should be improved. For example, the color and size of the names of ocean fronts should be changed. Fig. 2: Consider to use different colors for different water masses and write the Amundsen Sea and the Scotia Sea in the panel. Fig. 3: It is not clear why GDGT concentration is presented as units/L.

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