

## ***Interactive comment on “Influence of intense scavenging on Pa-Th fractionation in the wake of Kerguelen Island (Southern Ocean)” by C. Venchiarutti et al.***

**Anonymous Referee #2**

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### General comments

The manuscript contributes a very welcome set of data from the Southern Ocean, in an area characterised by enhanced productivity due to stimulation by natural iron fertilization. Being embedded in a larger programme, these new data can be considered in the context of a wealth of other information, which is a big advantage when studying such a complex system. In general, the text is well written, and the authors are experienced in applying the methods they use here. I clearly recommend the manuscript for publication after the two issues outlined below have been addressed. The first issue concerns analytical uncertainties of a part of the data. This becomes most evident in

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figure 8, where not a single value for KPa is significantly different from zero (see detailed comments below to this figure). Less critical, but still affecting the robustness of the interpretation, is the analytical uncertainty in Fig. 3, especially station A3-77. This may at least in part result from the analytical drawbacks, which have been clearly stated by the authors in the text. My recommendation would be to see if it is possible for certain profiles to use the mean value of several depths, together with the standard deviation of these values, to obtain a more robust value for further calculations. E.g., for station A3-77, there are four samples from the upper 100m, none of which gives a significant value on its own. The mean value for the upper 100 m from four samples would be a much better estimate, and the error bar would be much smaller, without sacrificing too much resolution. My second criticism is more general, and would require some re-structuring of the text. It currently reads a bit like a data report, maybe as a consequence of the close relation to the paper from 2008 (Venchiarutti et al. 2008). Therefore, a clearer focus of the article, being more precise about the aims, maybe with a hypothesis that can be tested with the data, would benefit the structure. The second aim that is currently given at the end of the introduction is not very different from the first one. The statement on P 4876 L 15-19 is currently quite descriptive, and the purpose of this part of the study should be explained more specifically. After these issues have been addressed, I recommend the manuscript for publication in BG.

Detailed comments P. 4874 L5: I am not convinced that 231Pa is always linear with depth in the upper 1000 m, see e.g. the profiles of (Edmonds et al. 2004) in the Arctic, or structures in many profiles closer to the sea surface. Please re-phrase.

P4877 L13-14 Can you name the water mass that is being advected?

P4879 L5 and following It would be better to address first the co-precipitation, then the column, assuming that this was the sequence of events. Can you swap the first and second paragraph of section 2.3.1?

P4879 L12. Is this value (97.9%) required for further calculations? When you really

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have just two values, better report the individual data than the standard deviation, which doesn't make real sense for just two data points.

P4880 L12 It seems that for some of the samples, there was effectively no yield tracer. If this is correct, which error did you add to the final data to take this into account?

P4880 L 24-26 To which samples does this statement apply? Just the particulate samples?

P4890 L1 and following: Please remove the statement about Fig. 8, see comments below.

P4893 L13 Again, it would be useful to know which water mass is advected, and which concentration of  $^{231}\text{Pa}$  it might carry.

P4894 L8 and following: An important result. Maybe strengthen this part in the introduction?

Figures While the profiles together with the map actually give the full information, it may be more intuitive to present oceanographic data as sections. Consider presenting the data as three sections. If it proves to be difficult, maybe because of the scatter of the data, don't feel obliged to do it, but it could really help the reader to understand the structures. This is particularly true as BGD/BG is well suited to provide extra colour figures.

Figure 8 should be removed or changed substantially. None of the data points shown here has a KPa significantly different from zero. Both regression lines are being almost entirely determined by a single data point, with a huge error. The apparently good correlation is purely a consequence of this situation, and it conceals the fact that within the analytical error, completely different relationships would be possible.

References Edmonds HN, Moran SB, Cheng H, Edwards RL (2004)  $^{230}\text{Th}$  and  $^{231}\text{Pa}$  in the Arctic Ocean: implications for particle fluxes and basin-scale Th/Pa fractionation. *Earth and Planetary Science Letters* 227:155-167 Venchiarutti C, Jeandel C, C1968

Roy-Barman M (2008) Particle dynamics study in the wake of Kerguelen Island using thorium isotopes. *Deep Sea Research Part I: Oceanographic Research Papers* 55:1343-1363

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