We would like to thank the reviewer for their positive and constructive comments on this manuscript. Their time invested is greatly appreciated and certainly improved this manuscript.

Please find below point by point responses to the reviewers comments.

The authors present data on particulate Fe (pFe), Mn (pMn), Ba (pBa) and Al (pAl) in seawater, sediments and sinking particles, and then try to clarify possible transport routes of pFe in seawater around the Kerguelen Plateau. Through their careful evaluation of the data, they conclude that there are the several transport routes including sediment resuspension, glacial/fluvial inputs etc.. The paper is well written and the arguments made are well thought out. I have only a few suggestions.

I recommend publication with minor revision. The authors digested filter samples using only HNO3. On the other hand, they use HF in addition to HNO3 to decompose sediment samples. If HF is not used even in decomposition of filter samples, lithogenic fraction seems not to be completely digested. That is seemingly true for the measurements of the certified reference material, BCR-414, and the analytical precision for Al is extremely poor. When the authors aim to identify the possible transport routes of pFe in seawater, they rely on the elemental ratios of filter, sediment and sediment trap samples. Thus, I think that they should discuss the influence of the difference in digestion method between filter, sediment and sediment trap samples on their interpretation about the sources of pFe in seawater.

Yes, we agree with the reviewer that more clarity is needed with respect to the various digestion protocols used and how the protocols affect the results presented. Suspended particles and sediment trap samples were digested with HNO3 only due to the fact that QMA filters were not compatible with a full HF digestion as this increases the analytical blanks dramatically, while the sediment samples were digested with a mixture of strong acids including HF acid. This means that the recovery of lithogenic particles will be high in the sediment samples (near 100%), while only a fraction of the lithogenics will be completely digested and measured in the suspended particles and sediment trap samples. It should be noted that the recovery of elements within biogenic particles (as evidenced by analysis of the certified reference material BCR414) was close to 100%, although Al did indeed have high analytical variability in this case.

Our decision to use QMA filters was necessary to minimise "wash off" of sample from the surface of the filter during recovery of the in-situ pumps. We reasoned that the error associated with wash-off would likely be much larger than the error associated with low recoveries of lithogenic particles. Wash-off can introduce large errors when membrane filters are used due to the design of the current generation of filter heads (on both McLane and Challenger pumps used for this study) which allow seawater to become turbulent over the surface of the filter during retrieval. If a (HF-compatible) membrane filter is used, the filtered material can easily wash off the surface of the filter, in comparison a "depth filter" such as glass fibre or quartz micro fibre will significantly limit this wash-off effect because the particulate material becomes impregnated within the filter material and is not easily washed off. Of the available depth filters on the market, only quartz micro fibre filters can be cleaned sufficiently for trace metal analysis and digested with HNO3 to obtain suitable blank levels. The QMA filters were also combustible, and therefore subsamples were suitable for POC/PON elemental analysis.

We have added a short discussion on this in the methods section (section 2.4.1) to inform readers and aid interpretation:

"QMA filters were chosen as they could be acid cleaned to a trace-metal-clean level and the filter material allowed high particle loading and low wash-off upon pump retrieval. Furthermore, the filters were compatible for use with both Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and elemental (CHN) analysis due to their ability to be combusted. It should be noted that a compromise was made here by using QMA filters on the ISPs. The compromise is that HF acid cannot be used with QMA filters as it digests the filter material completely and leads to unacceptably high analytical blanks. Therefore, we used HNO<sub>3</sub> for the digestions of the QMAs and for consistency regarding the suspended particles, we also digested the pre-filter with the same acid. On the other hand, we used a full HF acid digestion for the underlying sediment analysis (Section 2.4.2). Therefore, recoveries of lithogenic trace elements will be close to 100% for the sediment analysis, but somewhat lower for the lithogenic suspended particles. However, a HNO<sub>3</sub> only digestion will recover effectively 100% of the trace elements of biogenic suspended particles (Table A1). For further information see Bowie et al., (2010)."

## [Specific comments]

(1) Line 19 on page 13400: The reference of upper crustal ratio of Fe to Al is needed here.

## Reference added.

(2) Lines 27-28 on page 13403, Lines 1-2 on page 13404: Which sample ratios do "the unique ratios" indicate? The ratios at station R-2? If so, I couldn't understand the part regarding "a combination of extremely high pFe and pAI supply over the Kerguelen Plateau.." because the R-2 station is located hydrographical upstream of the Kerguelen Plateau.

We agree with the reviewer that this section was not clear. We have changed the MS as follows:

"Figure 5 illustrates the full water column elemental ratios at the reference station (R-2) in comparison to the Kerguelen Plateau stations (A3-1 and A3-2) and reveals that Mn:Fe as well as Ba:Al are strikingly unique. At station R-2, below 500 m, we see Mn:Fe 2x higher than A3, Mn:Al 4.5x higher and Ba:Al ratios 10x higher than at A3, making this source signature relatively clear (Table 4). The unique ratios below 500 m at R-2, may arise from a source of dissolved or particulate Mn, uncoupled from pFe and pAl from the Leclaire Rise. Furthermore, the elemental ratios over station A3 are generally much lower due to high pFe and pAl supply over the Kerguelen Plateau that is relatively deficient in pMn such as would be found in glacial runoff that has a signature which reflects fresh weathering of basaltic rocks (Doucet et al., 2005)."

(3) Lines 15-16 on page 13405: I recommend the authors to show each metal ratio of upper crust and basalt.

Thank you, we have now included the elemental ratios of upper continental crust as well as the ratio of Kerguelen basalts in table 2. We have also combined tables 2, 3 and 4 into one table which simplifies the layout and makes it easier to compare values.

(4) Lines 23-25 on page 13406: Do the authors measure particulate phosphorus of their samples for the calculation written here?

Yes, particulate phosphorus was measured together with a suite of other elements on the ICPMS.

We have modified the text in the methods section (2.4.1) as follows:

"Samples were analyzed by Sector Field ICP-MS (Finnigan Element II, Thermo Scientific) (Cullen and Sherrell, 1999; Townsend, 2000). A full suite of trace elements was measured including Fe, Al, Mn, Ba, and P."

(5) Lines 19-21 on page 13407: How can the author calculate the fraction of authigenic sediment within each sample by the calculation method written here? I think that the amounts of Mn and Al of sediments added to suspended particles are mixed with other components Mn and Al, which seems not to allow the authors to use the method.

If sediments were a major source of trace metals to the overlying waters we would expect to see similar elemental ratios when comparing the sediments to suspended particles. Likewise if weathering of basaltic or crustal material was a major source. To address the reviewers concerns, we have rewritten this section in a simplified and more qualitative sense using Figure 6 to highlight the sources to each region as follows:

"Alternatively, the relative importance of sedimentary input at each of the stations can be gauged by observing the pMn:pAl molar ratio within suspended particles and comparing these to known molar ratios of pMn:pAl within Kerguelen Island basalts, A3 authigenic sediments and R-2 authigenic sediments (Fig. 6). At station A3 we see that almost all the suspended particles lie within the ratio of plateau sediments and Kerguelen Island basalts with the remaining suspended particles associated with the development of a bloom in surface waters at A3-2, which is also where we see an increase in biogenic Fe. Mid-depth suspended particles at E4-W (red dots) also lie between Kerguelen Island basalts and plateau sediments, indicating a similar source to station A3. The reference station exhibits highly modified pMn:pAl molar ratios within the suspended particles and its underlying sediment. This modification is most likely due to biogenic incorporation of bioessential elements such as Mn into particles. The remaining stations are intermediate between A-3 and R-2."

(6) Lines 14-18 on page 13410: Before this part, the authors state that pAl is stripped out preferentially with settling lithogenics (Lines 16-17 on page 13408), but here that kind of thing is not referred to. Why?

We agree that this is also a possibility that cannot be excluded, although the surface freshening that corresponds to the surface enrichment suggests that a glacial/fluvial source may well be driving this enrichment. We have modified the text accordingly:

"The observation of pFe enrichment in surface waters of the recirculation structure without proportional concentrations of pAI may be due to biological uptake and conversion from a bioavailable pool into the biogenic particulate pool. Settling of refractory lithogenics that are high in AI may also partially explain the observation. Alternatively or in combination, a high pFe, low pAI source such as nanoparticulate Fe characteristic of glacial/fluvial runoff (Hawkings et al., 2014; Raiswell et al., 2008a, 2006a) on Kerguelen Island could explain this observation. Indeed, temperature and salinity profiles within the recirculation structure reveal fresher and warmer water within the upper 110 m than either R-2 or A3 stations suggesting that glacial/fluvial runoff from Kerguelen Island may well be delivering this high pFe, low pAI surface enrichment."