

Response to Anonymous Referee #2

We thank Referee #2 for the time and effort devoted to the review of our manuscript. Below we reproduce his/her comments and address them point by point. The reviewer's comments are in regular font black with our responses in blue. Text from the manuscript is shown in italics and changes are shown with deletions in strikethrough and additions in bold.

Major revision report of the manuscript with ref. no. bg-2018-181, titled “Distribution of Fe isotopes in particles and colloids in the salinity gradient along the Lena River plume, Laptev Sea” by Conrad et al.

The present manuscript has come to me after major revision. The MS looks good after revision and I believe it is recommend that the manuscript with few technical corrections can be published in BGD journal. Please find the comments below as page wise.

Page 4

Line 20: **The samples were collected in August 2008 during.....**

But the dates in the table 1 are something different and looks wrong.

Thank you for pointing this out. There must have been a problem with the format of the table copying from excel into word. We corrected the dates. Please see table 1 below.

Table 1: Sampling stations in the Laptev Sea of the ISSS-08 research cruise. Temperature, salinity, pH and Oxygen data for the Lena River freshwater plume are obtained from waters at a depth of 4 m, whereas the data for the shelf sediment sample locations are obtained from the overlying bottom waters. The measurements were done with a CTD Seabird 19+. Salinity is based on the Practical Salinity Scale PSS-78.

	Station	Lat. (N)		Long. (E)		Date	Water depth m	Salinity*	Temp. °C	pH	Oxygen %	POC µM	DOC µM	TOC µM
		degrees minutes (')	(°)	degrees minutes (')	(°)									
Lena River freshwater plume	YS-128	76°59.220		130°21.340		17/09/2008	51	29.13	-1.43	7.9	99.6	-	-	-
	YS-4*	75°59.220'		129°59.050'		23/08/2008	52	13.3	-1.54	7.7	99.4	8	320	-
	YS-5	75°15.590'		130°0.990'		24/08/2008	44	9.03	-1.56	7.6	99.5	12	434	503
	YS-6	74°43.440'		130°0.980'		24/08/2008	34	5.29	-1.61	7.6	100.5	13	440	543
	YS-7	74°7.920'		129°59.980'		24/08/2008	17	6.31	-1.26	7.6	100.6	11	432	454
	YS-8	73°33.940'		130°0.470'		24/08/2008	13	5.29	-0.78	7.6	99.4	15	391	-
	YS-9	73°21.980'		129°59.820'		25/08/2008	25	8.15	-1.13	7.6	101.7	11	397	437
	YS-10	73°11.040'		129°59.740'		25/08/2008	21	5.37	-0.89	7.6		36	414	441
	YS-11	73°1.110'		129°59.350'		25/08/2008	12	3.54	-0.32	7.5	94.6	53	435	468
	YS-14*	71°37.820'		130°2.970'		25/08/2008	8	1.08	11.14	-		89	442	476
Shelf sediment sample locations	YS-2	73°24.300'		72°59.710		19/08/2008	30	31.53	-1.09	7.5	67.9	20	544	-
	YS-3	73°29.520'		79°53.090'		19/08/2008	38	32.27	-1.06	7.6	70.5	-	-	-
	YS-13	71°58.080'		131°42.080'		26/08/2008	22	27.82	-1.03	-	-	10	453	-
	YS-26	72°27.590'		150°35.740'		31/08/2008	17	27.13	-0.72	7.3	62.3	5	185	-

YS-28	72°39.050'	154°11.120'	01/09/2008	29	31.05	-0.86	7.2	42.9	4	94	-
YS-30	71°21.460'	152°9.160'	01/09/2008	10	22.94	1.19	7.5	90.4	13	198	-
YS-39	71°13.150'	169°22.370'	04/09/2008	46	32.41	-1.64	7.4	64.3	5	46	-

- * station was also sampled for surface sediment 0
- + salinity. pH. And oxygen saturation for shelf sediment samples are measured in bottom water
- ^ measured with a Hydrosonde M5

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Line15: **Titan?**

I believe the authors must be referring to titanium. Typo error? I didn't see anything discussion related to either aluminium or titanium in the MS.

We corrected it to titanium, it was a misspelling. We added the Al and Ti data after a comment from the major reviews.

*Aluminum and **titanium** concentrations can be found in the supplement.*

Line 19: Cu was eluted with 8 mL 5M Cl.

I this authors must be referring to HCl. Typo error?

Yes of course, we corrected it to HCl.

After the sample was loaded, the matrix was washed with 9.6 M HCl, and Cu was eluted with 8 ml 5M HCl.

Page 10

Line 5: **The methodology for pH and oxygen is described.....**

The methodology for pH and oxygen measurements is described.....

Changed accordingly.

*The methodology for pH and oxygen **measurements** is described in the supplement (after Dudarev, 2008).*

Page 11

Line 1: The DOC concentrations show a small variation of between 320-442 uM in the surface.....

The DOC concentrations show a small variation ~~of~~ between 320-442 μM in the surface.....

Changed accordingly.

The DOC concentrations show a small variation ~~of~~ between 320 and 442 μM in the surface waters of the inner and outer plume (Tab. 1; Fig. 3).

Line 27: The $\delta^{56}\text{Fe}$ values in the particles varied between $-0.05 \pm 0.11\text{‰}$

$\delta^{56}\text{Fe}$ values in the **particulates** varied between $-0.05 \pm 0.11\text{‰}$

Changed accordingly.

*The $\delta^{56}\text{Fe}$ values in the **particulates** varied between $-0.05 \pm 0.11\text{‰}$ (YS-14) in the inner plume and $-0.41 \pm 0.12\text{‰}$ (YS-4) in the outer plume (Fig. 6), with the $\delta^{56}\text{Fe}$ values in the outer plume all lower compared to the inner plume.*

Line 30: The surface sediments from the Laptev Sea all had negative $\delta^{56}\text{Fe}$ values ($-0.23 \pm 0.08\text{‰}$ and $-0.25 \pm 0.12\text{‰}$). Surface sediments obtained from 10 samples in other parts of the East Siberian Arctic Shelf (ESAS) showed only small variations (Fig 1 and Fig 6; Tab. 4; Tab. S2)

The surface sediments from the Laptev Sea all had negative $\delta^{56}\text{Fe}$ values ($-0.23 \pm 0.08\text{‰}$ and $-0.25 \pm 0.12\text{‰}$) and when compared with surface sediments from other parts of the East Siberian Arctic Shelf (ESAS) showed only small variations (Fig 1 and Fig 6; Tab. 4; Tab. S2).

Changed accordingly.

The surface sediments from the Laptev Sea all had negative $\delta^{56}\text{Fe}$ values ($-0.23 \pm 0.08\text{‰}$ and $-0.25 \pm 0.12\text{‰}$). Surface sediments obtained from 10 samples in other parts of the East Siberian Arctic Shelf (ESAS) showed only small variations (Fig 1 and Fig. 6; Tab. 4; Tab. S2).

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Line 14-17: Within the Arctic Ocean, dissolved Fe (CFe+DFe) concentrations vary between 0.2 and 63 nM and the concentrations depend on distance to the shore and depths of sampling, with generally higher values in surface waters as well as close to the bottom sediments, which might be related to resuspension, sinking of brines, or resuspension from the sediment of Fe (Klunder et al., 2012).

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Changed accordingly.

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Page 15

Table 27: The Fe isotope compositions in the Lena River freshwater plume provide clear indications of which forms of Fe.....

The Fe isotope compositions in the Lena River freshwater plume provide clear indications ~~of~~on which forms of Fe.....

Changed accordingly.

*The Fe isotope compositions in the Lena River freshwater plume provide clear indications **on** which forms of Fe reach the deep ocean basin.*