Global biogeochemical cycle

Supporting Information for

Vertical flux of trace elements associated with lithogenic and biogenic carrier phases in the Southern Ocean

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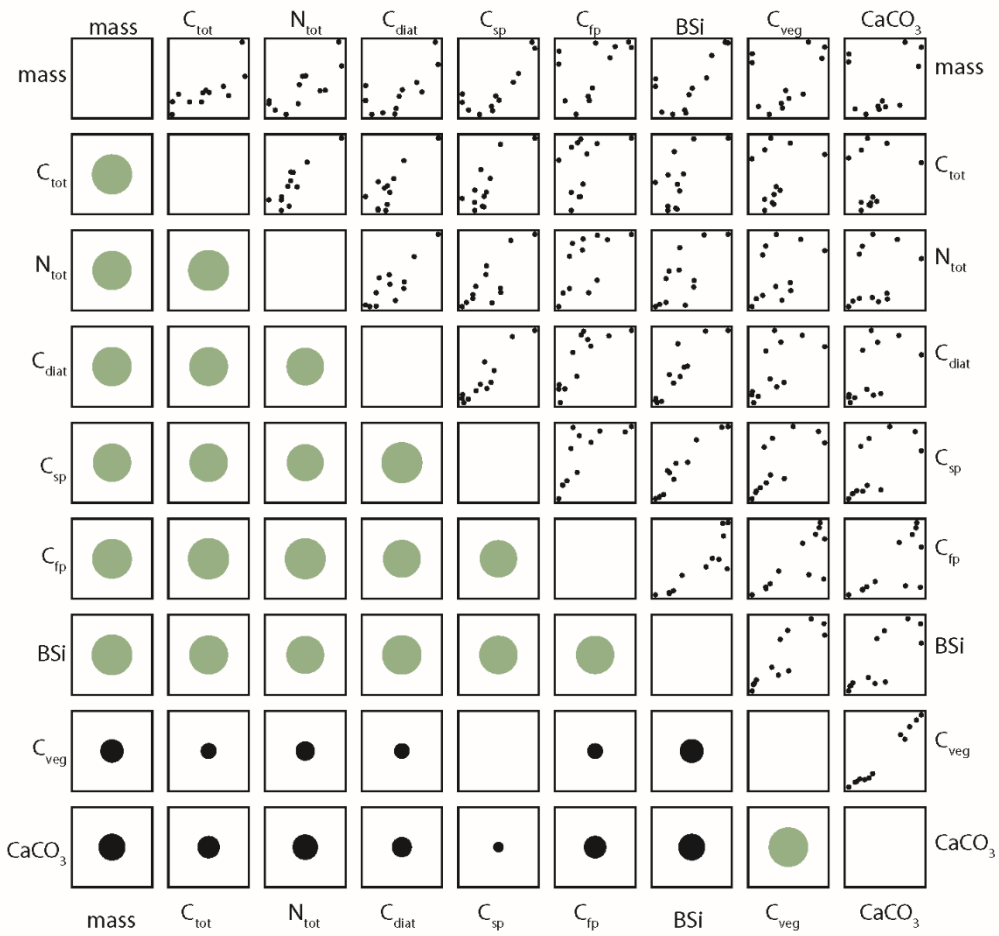

Figure S1. Correlation matrices between centered standardized fluxes of biological parameters. The diameter of the circles presented in the inferior triangles of the plot are proportional to the correlation coefficient of the linear regression. The colour code is green for $p<0.01$and black for $p>0.05$. Plots in the upper triangles show the scatter of the data used for the correlation calculation.

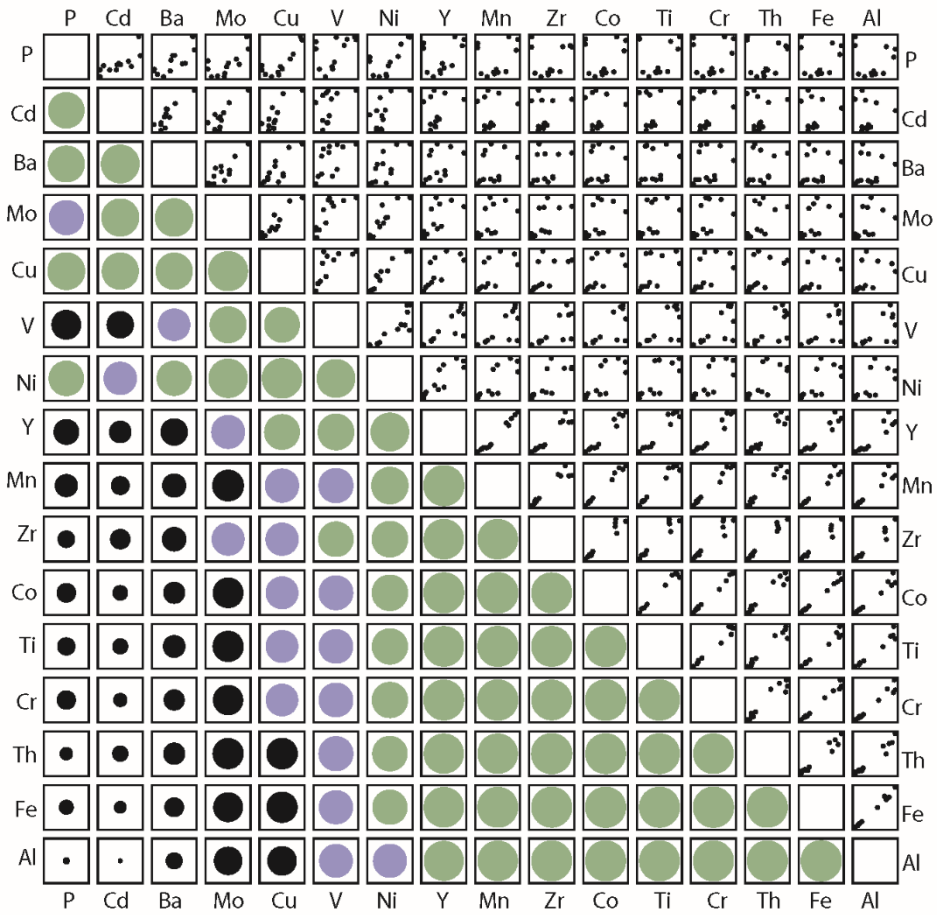

Figure S2. Correlation matrices between centered standardized fluxes of trace elements. The diameter of the circles presented in the inferior triangles of the plot are proportional to the correlation coefficient of the linear regression. Green colour is for $p<0.01$, blue for $0.01<p<0.05$, and black colour for $p>0.05$. Plots in the upper triangles show the scatter of the data used for the correlation calculation.

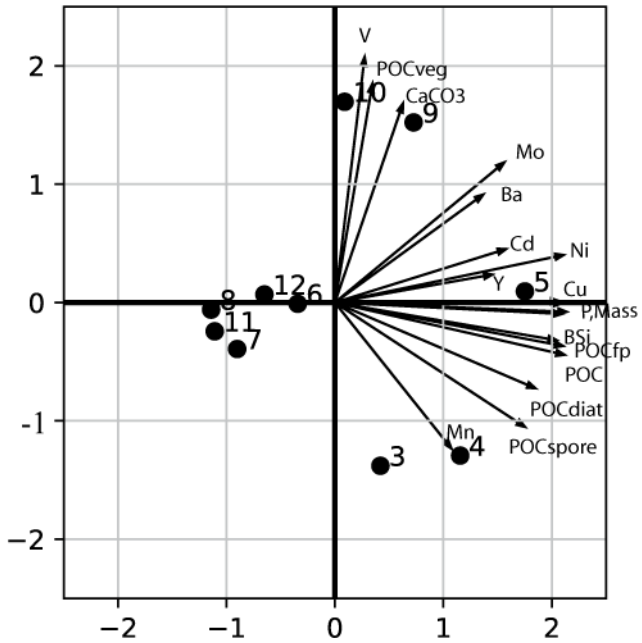

Figure S3. PCA correlation biplots of Fxs of TE and biological fluxes: Black dots denote the cups associated with their labels from 3 to 12 (3 corresponds to the third cup collected). Blue arrows represent the projection of the descriptors into the two first principal component plan (for clarity their lengths were multiplied by 2).

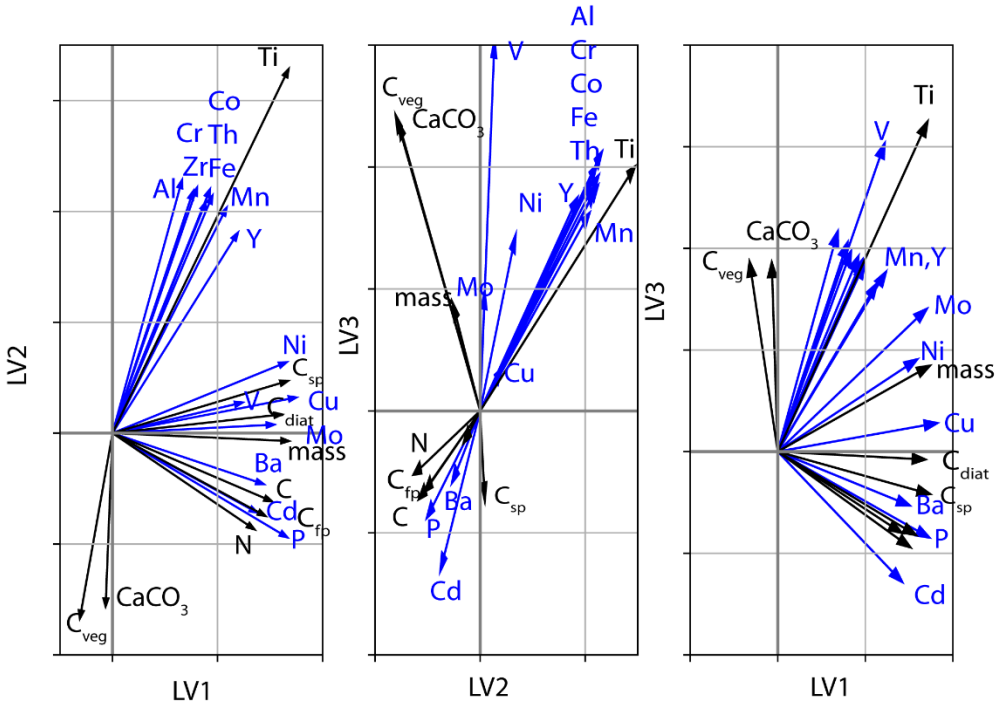

Figure S4: PLSR results: Projections of the predictors (in black) and descriptors (in blue) into the plans formed by 2 latent variables, LV1/LV2, LV2/LV3 and LV1/LV3 from right to left.

% recovery	Cd	Al	P	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Mo
PACS-3 (n=2)	86	100	100	99	96	86	94	100	100	88	84	99
	14	18	16	9	13	12	15	20	28	14	16	14
MESS-4(n=2)	103	126	110	90	100	98	90	99	72	99	100	100
	4	4	5	2	1	1	2	1	1	0	5	3
BCR 414 (n=2)	100	-	-	-	100	100	88	100*	95*	100	92	100*
	3				24	4	4	5	4	5	3	6

Table S1. Recoveries (in % of certified or indicative* value) of the different reference materials analysed alongside our sample set. The first line reports the mean recovery for two digest replicates, the second line reports the uncertainty estimated as the difference between the upper value and the average.

	blank nmol/L	blank nmol/cup	cup number	supernatant nmol/L	supernatant nmol/cup	Total PM nmol/cup	dissolution %
Mn	100	24.95	1	97	24.19	862.44	-0.09
			2	101	25.20	761.01	0.03
			3	131	32.86	1012.95	0.78
			4	153	38.16	949.09	1.39
			5	151	37.69	703.52	1.81
			6	109	27.34	264.15	0.90
			7	127	31.80	197.22	3.47
			8	116	29.10	163.45	2.54
			9	128	31.98	209.26	3.36
			10	132	32.89	189.22	4.19
			11	188	46.91	94.17	23.32
			12	156	38.94	156.73	8.92
Fe	32	8.02	1	56	13.98	75913.32	0.01
			2	42	10.54	56876.01	0.00
			3	108	27.11	64926.23	0.03
			4	108	26.93	60124.80	0.03
			5	128	32.02	44511.84	0.05
			6	77	19.29	17116.16	0.07
			7	112	27.93	12705.28	0.16
			8	76	18.89	11005.13	0.10
			9	61	15.32	12444.93	0.06
			10	134	33.51	11000.90	0.23
			11	385	96.24	5388.45	1.64
			12	263	65.68	9953.52	0.58
Co	0.71	0.18	1	0.70	0.17	27.39	-0.01
			2	0.74	0.19	24.00	0.03
			3	0.98	0.25	28.80	0.24
			4	1.23	0.31	26.35	0.49
			5	1.25	0.31	19.48	0.69
			6	0.86	0.22	7.46	0.51
			7	0.89	0.22	5.44	0.83
			8	0.89	0.22	4.52	0.99
			9	0.93	0.23	5.54	1.01
			10	0.99	0.25	5.00	1.42
			11	0.91	0.23	2.37	2.12
			12	1.20	0.30	3.77	3.27

Table S2 continues on the next page

	blank nmol/L	blank nmol/cup	cup number	supernatant nmol/L	supernatant nmol/cup	Total PM nmol/cup	dissolution %
Cu	55	13.65	1	70	17.47	115.56	3.30
			2	61	15.20	88.91	1.74
			3	104	26.03	181.47	6.82
			4	113	28.22	262.57	5.55
			5	113	28.16	282.34	5.14
			6	67	16.65	109.20	2.74
			7	90	22.41	76.39	11.46
			8	80	20.11	63.76	10.13
			9	72	17.99	153.24	2.83
			10	70	17.61	95.68	4.14
			11	117	29.13	50.34	30.75
			12	70	17.60	62.05	6.36

Table S2. Concentrations in the saline formalin solution (blank) and in the supernatant of the individual cups. The percentage of dissolution in the individual cups was calculated using the following equation:
% = (supernatant – blank) / (total PM + supernatant) where total PM is the amount of particulate metal (nmol) measured in the cup.

Table S3 : allometric equations for biovolume (V) to carbon biomass (C) conversion.

Diatoms and spores other than CRS	C= 0.582 (pmol C μm^{-3}) x $V^{0.811}$ from Menden-Deuer and Lessard (2000)	V (μm^{-3}) calculated following Table 1 in Hilldebrand et al. (1999) for the diatoms and Rembauville et al. (2015) for spores.
Chaetoceros spores (CRS)	C= 0.039 (pmol C μm^{-3}) x V from Rembauville et al. (2015)	V (μm^{-3}) calculated as in Rembauville et al. (2015).
Fecal pellets	C= 0.036 (pmol C μm^{-3}) x V from Gonzales and Smetacek (1994).	V (μm^{3}) calculated as function of the shape: Sphere : $4/3\ \pi R^3$, Cylinder : $\pi h R^2$ Ovoid and ellipsoid: $4/3\ \pi(a/2)(b/2)^2$