Supplementary Information for:

Contribution of electroactive humic substances to the iron-binding ligands released during microbial remineralisation of sinking particles

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Note: Some of the following information can also be found in the Supplementary Material of Bressac et al., 2019.

Bressac, M. et al., 2019. Resupply of mesopelagic dissolved iron controlled by particulate iron composition. Nature Geoscience, 12: 995–1000.

Supplementary Table S1. Summary of the (TM-)RESPIRE deployments. Depth* is the average depth of the (TM-)RESPIRE, and in parentheses the depths of the RESPIRE and TM-RESPIRE deployments respectively.

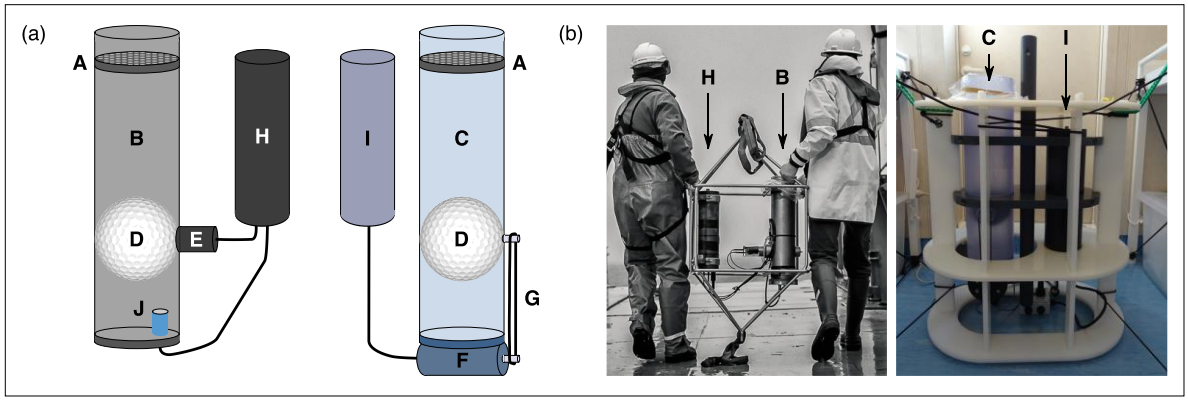
	Mission parameters					Mesopelagic conditions	
	Depth (m) *	Incubation time (h)	Start date (UTC)	Lat (°N)	Lon (°E)	*In situ* O_2 (µM)	Temperature (°C)
EDDY	175 (165-185)	12	31/03/16	-50.393	147.053	286.60	4.18
SAZ	160 (150-170)	18	24/03/17	-46.076	142.268	270.70	9.36
ALG	115 (110-120)	48	02/06/17	37.947	2.905	189.10	14.21
ALG	195 (190-200)	48	02/06/17	37.947	2.905	175.20	13.65
ION	115 (110-120)	36	24/05/17	35.484	19.796	204.40	15.86
ION	195 (190-200)	36	24/05/17	35.484	19.796	195.90	15.46
TYR	25 (20-30)	30	17/05/17	39.334	12.592	N/A	18.22

Supplementary Table S2. Summary of remineralization and flux characteristics for particles collected by the (TM-)RESPIRE (see Bressac et al., 2019). The consumption of O_2 (uM) and the percentage organic carbon consumption are represented by O_2 cons. and OC cons. respectively, with calculations shown in Methods.

		RESPIRE			RESPIRE		TM-RESPIRE		
		Remineralization			Flux characteristics		Flux characteristics		
	Depth (m) *	Remin. Rate (mmol O_2/m^3/d)	O_2 cons. (µM)	OC cons. (%)	Post-incubation POC (µM)	Pre-incubation POC (µM)	Post-incubation POC (µM)	Pre-incubation POC (µM)	Organic / Lithogenic (g/g)
EDDY	175 (165-185)	0.11	0.51	1.92	18.13	18.33	18.13	18.33	NA
SAZ	160 (150-170)	5.28	3.79	15.04	14.77	17.39	5.58	8.19	39.60
ALG	115 (110-120)	29.40	48.28	18.91	142.83	176.15	44.69	78.01	3.91
ALG	195 (190-200)	10.64	17.94	26.96	33.54	45.92	21.79	34.17	1.59
ION	115 (110-120)	20.16	15.81	7.96	126.10	137.01	43.30	54.22	4.13
ION	195 (190-200)	13.07	13.89	33.21	19.27	28.86	16.35	25.93	1.05
TYR	25 (20-30)	NA	NA	NA	23.88	NA	66.86	NA	7.11

Supplementary Table S3. Concentrations of dissolved iron (DFe), iron-binding ligands (L_T) expressed in nM Fe equivalent, conditional stability constant (log $K_{Fe'}$) and dissolved electroactive humic substances (eHS). SD denotes standard deviation of the preceding column. Post-incubation depths are the average depth

Site	Depth (m)	DFe (nM)	SD (nM)	L_T (nM)	SD (nM)	log $K_{Fe'}$	SD	eHS (µg/L)	SD (µg/L)
In situ:									
EDDY	40	0.05	0.01	0.52	0.15	11.1	0.3	28.5	3.3
EDDY	200	0.07	0.01	0.53	0.06	11.4	0.2	36.6	5.2
SAZ	150	0.14	0.01	0.65	0.15	11.2	0.2	37.7	4.7
SAZ2	70	0.16	0.01	0.95	0.2	11.1	0.3	46.6	4.1
SAZ2	150	0.29	0.01	1.18	0.16	11	0.2	35.8	3.4
SAZ2	200	0.13	0.01	0.55	0.09	11.3	0.2	26.7	5
SAZ2	300	0.16	0.01	0.62	0.03	11.5	0.1	32.8	6.7
SAZ2	500	0.2	0.01	0.79	0.1	11.4	0.1	33.6	4.3
SAZ2	1250	0.43	0.08	0.89	0.06	11.3	0.1	57.1	6.9
ALG	5	1.14	0.04	2.06	0.09	11.5	0.1	49.2	8.1
ALG	50	0.44	0.01	1.05	0.13	11	0.1	64.6	5.3
ALG	100	0.6	0.01	1.21	0.08	11.4	0.1	68.9	8.4
ALG	200	0.53	0.02	0.95	0.11	10.9	0.1	59.2	4.8
ION	100	0.48	0.01	1.05	0.32	11.1	0.2	63.7	8.4
ION	200	0.41	0.01	0.97	0.12	11.2	0.1	57.5	7.5
Post-incubation (TM-RESPIRE):									
EDDY	175	1.29	0.08	2.1	0.07	11.6	0.1	136	46.4
SAZ	160	1.09	0.01	1.53	0.04	11.8	0.1	76.2	5.5
ALG	115	4.69	0.01	4.94	0.33	11.3	0.1	111.7	5.2
ALG	195	1.14	0.02	1.32	0.06	11.6	0.1	79.5	8
ION	115	1.38	0.01	1.5	0.03	11.9	0.1	107.5	11.4
ION	195	1.05	0.02	1.26	0.03	11.6	0.1	31.1	5.3
TYR	25	2.87	0.08	2.99	0.12	11.7	0.2	175.3	20.8



Supplementary Figure 1. Characteristics of the RESPIRE and TM-RESPIRE particle interceptors (from Bressac et al., 2019). a, Schematic of the RESPIRE (left) and TM-RESPIRE (right). Settling particles enter the traps via a polycarbonate (PC) baffle (A) situated near the top of the RESPIRE titanium (B) and TM-RESPIRE PC (C) cylinders (total volume of 6.9 L). After settling onto the indented rotating sphere (IRS; D) made of polyvinyl chloride (PVC), they are transferred within the incubation chamber (1.6 L) every 10 min by a pre-programmed 360° rotation of the IRS (designed to exclude zooplankton and deliver particles into the incubation chamber). The IRS is driven by a motor (E and F) and a rotating shaft (a plastic belt (G) links both components in the TM-RESPIRE). Pre-programmed titanium (H) and PVC (I) controller units drive the motors, and in the case of the RESPIRE, record O_2 concentration and temperature measured every 5 min within the incubation chamber by an oxygen optode (J). **b**, Images of the RESPIRE (left) and TM-RESPIRE (right). Note the metal and plastic frames that house the RESPIRE and TM-RESPIRE, respectively, along with their respective controller unit.