

Supplementary Material

BEFORE BUBBLING						
Experiment	Virus-C ($\mu\text{g C L}^{-1}$)	Bacteria-C ($\mu\text{g C L}^{-1}$)	Total NF-C ($\mu\text{g C L}^{-1}$)	Dinoflagellate-C ($\mu\text{g C L}^{-1}$)	Diatoms-C ($\mu\text{g C L}^{-1}$)	Total Biovolume -C ($\mu\text{g C L}^{-1}$)
SI1	0,58	3,09	1,44	0,00	206,21	211,32
SI2	0,54	26,48	4,24	0,00	512,64	543,90
SI3	1,84	53,41	0,87	0,00	263,09	319,21
SI4	0,86	24,74	10,32	1,10	216,24	253,32
Experiment	Virus (%C)	Bacteria (%C)	Total NF (%C)	Dinoflagellates (%C)	Diatoms (%C)	
SI1	0,27	1,46	0,68	0,00	97,58	
SI2	0,10	4,87	0,78	0,00	94,25	
SI3	0,58	16,73	0,27	0,00	82,42	
SI4	0,34	9,77	4,08	0,43	85,36	
Experiment	Chl a ($\mu\text{g L}^{-1}$)	POC	POC:Chlor ($\mu\text{g}:\mu\text{g}$)	TEP-C ($\mu\text{g C eq}$)	POC:TEP ($\mu\text{g}:\mu\text{g}$)	POC: Biovolume

		($\mu\text{g C L}^{-1}$)		(L^{-1})		-C
SI1	9,88	586,75	59,36	64,40	9,11	2,78
SI2	10,14	733,31	72,33	132,21	5,55	1,35
SI3	10,45	1109,33	106,12	164,23	6,75	3,48
SI4	5,54	644,54	116,32	70,70	9,12	2,54
AFTER BUBBLING						
Experiment	Virus-C ($\mu\text{g C L}^{-1}$)	Bacteria-C ($\mu\text{g C L}^{-1}$)	Total NF-C ($\mu\text{g C L}^{-1}$)	Dinoflagellates-C ($\mu\text{g C L}^{-1}$)	Diatoms-C ($\mu\text{g C L}^{-1}$)	Total Biovolume -C ($\mu\text{g C L}^{-1}$)
SI1	0,08	8,52	0,22	0,00	39,65	48,47
SI2	1,48	21,38	0,31	0,00	16,20	39,61
SI3	1,98	37,85	4,79	0,00	47,08	91,71
SI4	----	----	----	---	---	----
Experiment	Virus (%C)	Bacteria (%C)	Total NF (%C)	Dinoflagellates (%C)	Diatoms (%C)	
SI1	0,17	17,58	0,45	0,00	81,80	
SI2	3,74	53,96	0,78	0,00	40,89	

SI3	2,16	41,27	5,22	0,00	51,33	
SI4	----	----	----	---	---	----
Experiment	Chl a ($\mu\text{g L}^{-1}$)	POC ($\mu\text{g C L}^{-1}$)	POC:Chlor ($\mu\text{g}:\mu\text{g}$)	TEP-C ($\mu\text{g C eq L}^{-1}$)	POC:TEP ($\mu\text{g}:\mu\text{g}$)	POC: Biovolume -C
SI1	2,32	389,20	167,76	33,84	11,50	8,03
SI2	1,35	506,96	376,19	90,26	5,62	12,80
SI3	2,12	702,58	331,81	122,28	5,75	7,66
SI4	----	----	----	---	---	----

Supplementary table 1. Selected variables for the four melting sea ice experiments before and after bubbling.

Taxon name Table	Length (μm)	Width (μm)	Equivalent diameter (μm)	Biomass (pg C cell⁻¹)
<i>Amphora</i> sp.1	23,5	8	11,28	62
Pennate no-identified sp 1	40	15,5	20,94	279
<i>Entomoneis alata</i>	103,5	30	44,64	1628
<i>Fragilariopsis cylindrus</i>	10	2,5	3,90	5
<i>Fragilariopsis</i> sp.	41,5	10,5	16,35	153
<i>Pseudo-nitzschia</i> sp.	66,5	5	11,66	67
<i>Thalassiosira</i> sp. 1	20	14,5	18,48	206
<i>Thalassiosira</i> sp. 2	17,5	35	31,80	771
<i>Thalassiosira</i> sp. 3	17,5	65	48,05	2104

Supplementary table 2. Main diatom taxa contributing to at least 1% of the phytoplankton carbon (estimated from the biovolume of the cells) in a particular time of the experiment. The carbon per cell is estimated with the formula $\text{pgC cell}^{-1} = 0.288 * \text{volume}^{0.811}$, established by Mender-Deuer and Lessard (2000). The volume of the cell was estimated from average length and width values using the formula of the closest geometric figures approximation. Setae and expansions (horns, wings, etc.) dimensions were excluded; in the case of the flattened organisms, manual corrections of the thickness were applied. From the calculated volume, the equivalent diameter of the corresponding sphere is shown.

EXPERIMENT	Before	After	Before	After	Before	After
	% <5µm/ Tot. phot. org.	% <5µm/ Tot. phot. org.	% Phaeo/(P haeo+Act . Pig)	% Phaeo/(P haeo+Act . Pig)	% <5µm Phaeo/(P haeo+Act . Pig)	% <5µm Phaeo/(P haeo+Act . Pig)
SI1	7,2	25,8	4,1	8,2	3,0	3,5
SI2	4,1	13,3	5,5	6,7	5,3	0,0
SI3	7,3	32,2	8,5	1,7	2,4	1,9
SI4	13,1		3,4		0,9	

Supplementary table 3. Summary information of the photosynthetic pigments estimated in each experiment (EXP:1) before and after the incubation. From left to right: contribution (in %) of small photosynthetic organisms (<5µm) to the total photosynthetic community considering the sum of all determined pigments; proportion (%) of phaeopigments (degradation pigments, (phaeophytins and phaeophorbides) related to all determined pigments in the total photosynthetic community; same in the fraction of small organisms (<5µm).

Component	1 st excitation maxima (nm)	2 nd excitation maxima (nm)	Emission maximum (nm)
P1	280	-	330
P2	270	-	300
P3	290	250	340
H1	250	325	410
H2	255	370	490

Supplementary table 4. Approximate wavelength (nm) of main spectral features for the five identified PARAFAC components.

	POC_SI_1 _{BB}	POC_SI_2 _{BB}	POC_SI_1 _{AB}	POC_SI_2 _{AB}
POC_SI_1 _{BB}	1	0.77	0.58	0.50
POC_SI_2 _{BB}	0.77	1	0.55	0.58
POC_SI_1 _{AB}	0.58	0.55	1	0.64
POC_SI_2 _{AB}	0.50	0.58	0.64	1

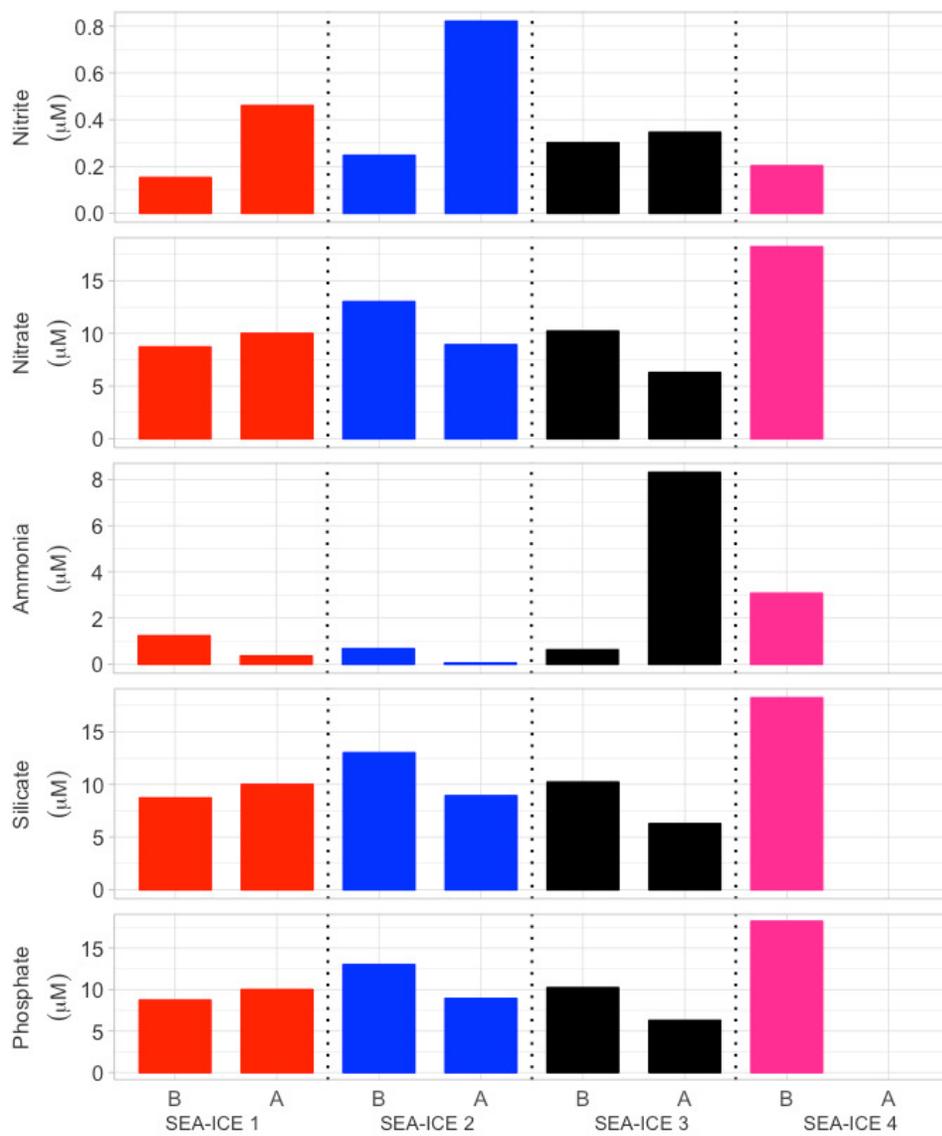
Supplementary table 5. Correlation matrix between the ¹H-NMR spectra of all the SI POC samples analyzed (BEFORE and AFTER bubbling). The correlation is expressed as Pearson coefficient R.

	Av. (SI1,SI2)	St. Dev.	Av. (SI1,SI2)	St. Dev
V1	1.28E+06	4.96E+05	3085000.0	1.83E+06
V2	7.15E+05	1.28E+05	3205000.0	1.49E+06
V3	2.96E+04	5.66E+03	96350.0	2.47E+03
V4	2.96E+05	5.59E+04	368000.0	1.19E+05
VIRUS all	2.32E+06	5.66E+05	6755000.0	3.44E+06
VIRUS all biom	0.5	0.1	1.4	0.7
Bacteria Total	7.98E+05	9.65E+05	2180000.0	1.13E+06
Bacteria HDNA	7.59E+05	9.35E+05	2080000.0	1.19E+06
Bacteria LDNA	2.32E+04	1.64E+04	72450.0	6.02E+04
Bacteria Total biom	14.3	17.3	39.1	20.3
Bacteria HDNA	14.9	18.3	40.8	23.3

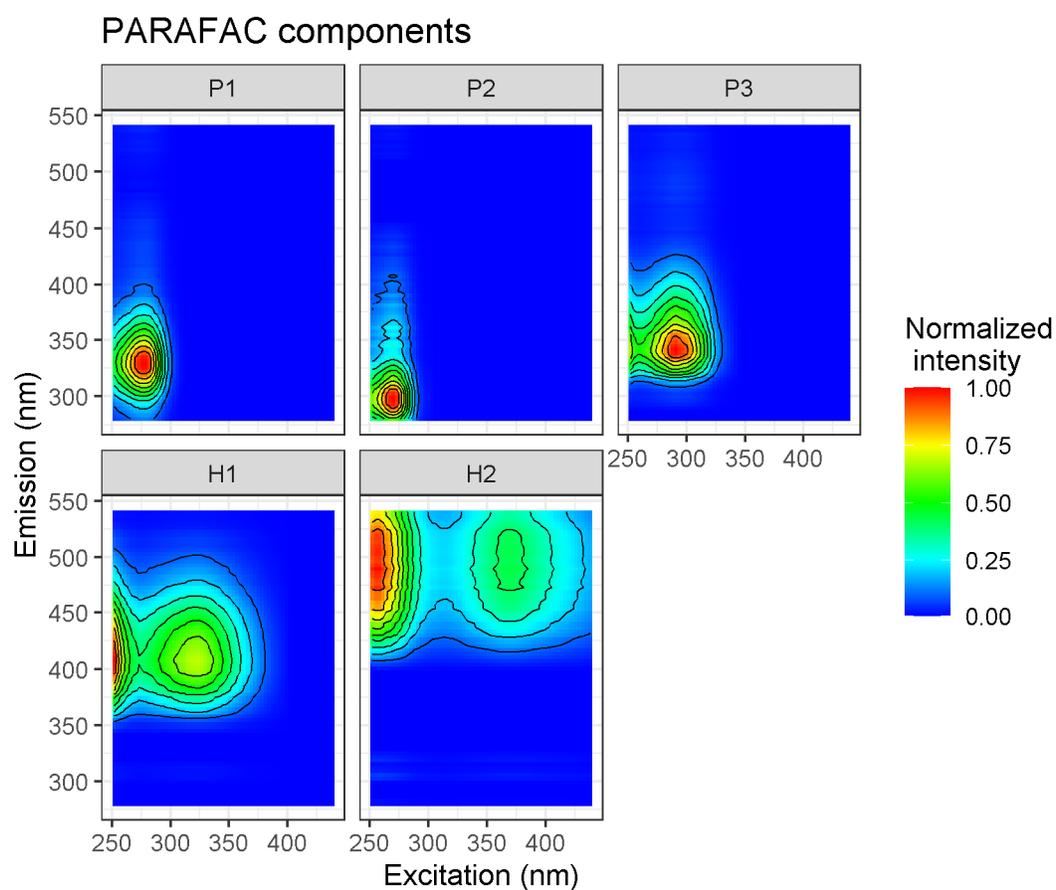
biom				
Bacteria LDNA biom	0.4	0.2	1.1	0.9
Chla	10.0	0.2	8.0	3.5
PN	6.8	1.9	9.5	3.7
PC	55.0	8.6	73.1	27.4
C/N	6.8	1.1	7.7	0.2
DOC	208.6	61.5	264.9	55.0
TEP Average	192.8	93.9	230.3	129.7
CSP Average	97.0	31.4	86.0	22.5
HNF Epifl abund	124.6	3.3	1095.9	1485.4
HNF Epifl biomass	0.5	0.2	5.6	7.8
PNF Epifl abund	295.1	134.4	359.2	94.9
PNF Epifl biomass	4.6	4.0	0.7	0.0
HNF Epifl $\leq 2\mu\text{m}$	<i>45.4</i>	<i>12.8</i>	<i>133.4</i>	<i>188.6</i>
HNF Epifl 2- 5 μm	<i>233.9</i>	<i>54.1</i>	<i>2754.1</i>	<i>3702.4</i>

HNF Epifl 5-10 μ m	<i>33.5</i>	<i>29.6</i>	<i>400.0</i>	<i>565.8</i>
HNF Epifl 10-20 μ m	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>	<i>0.0</i>
PNF Epifl $\leq 2\mu$ m	<i>244.0</i>	<i>155.3</i>	<i>337.5</i>	<i>369.5</i>
PNF Epifl 2-5 μ m	<i>454.9</i>	<i>318.8</i>	<i>740.2</i>	<i>84.7</i>
PNF Epifl 5-10 μ m	<i>25.5</i>	<i>2.4</i>	<i>0.0</i>	<i>0.0</i>
PNF Epifl 10-20 μ m	<i>60.7</i>	<i>68.1</i>	<i>0.0</i>	<i>0.0</i>

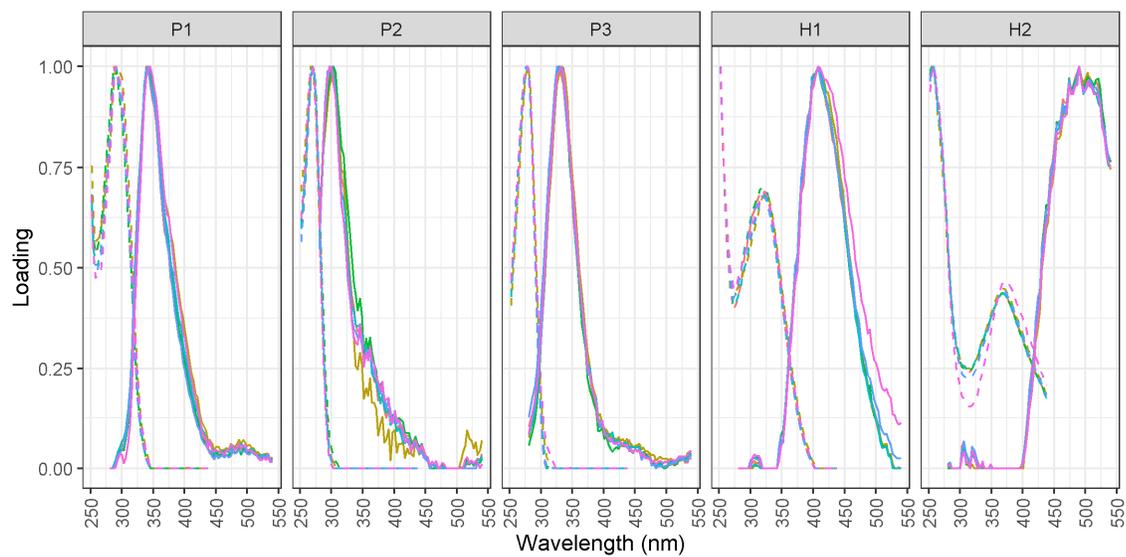
Supplementary table 6. Selected averages (± 2 sigma) for the two groups: SI1 and SI2 (low SSA production); SI3 and SI4 (high aerosol production). Variables for the four sea ice experiments before and after bubbling.



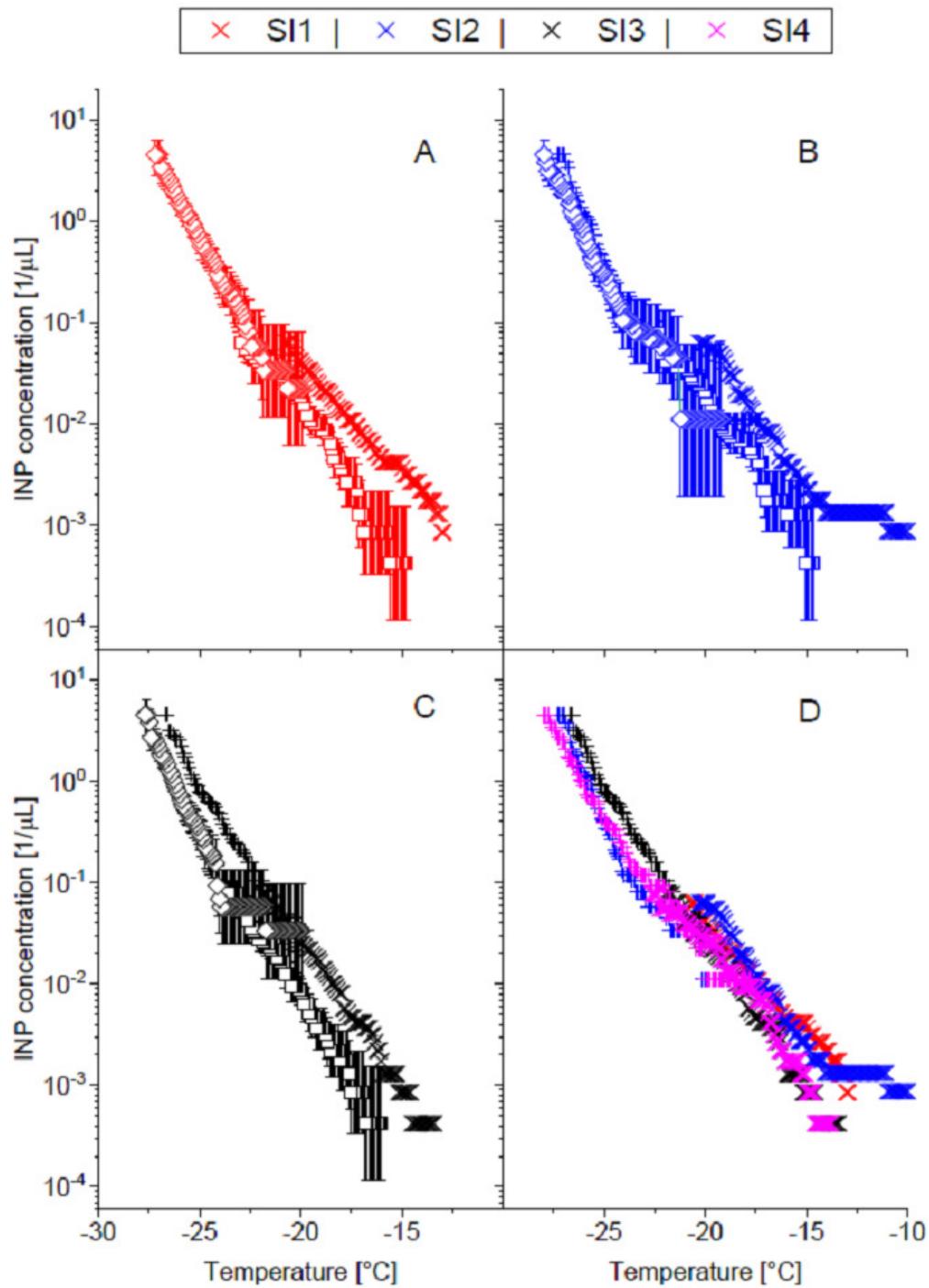
Supplementary figure 1. Concentrations of Nitrite, Nitrate, Ammonia, Silicate and Phosphate for the four SSA aerosol experiments before (B) and after (A) bubbling.



Supplementary figure 2. Loadings of fluorescent dissolved organic matter (FDOM) components in the PARAFAC model. Panels show the normalized loadings of each component (P1,P2,P3,H1,H2) across the excitation-emission matrix.

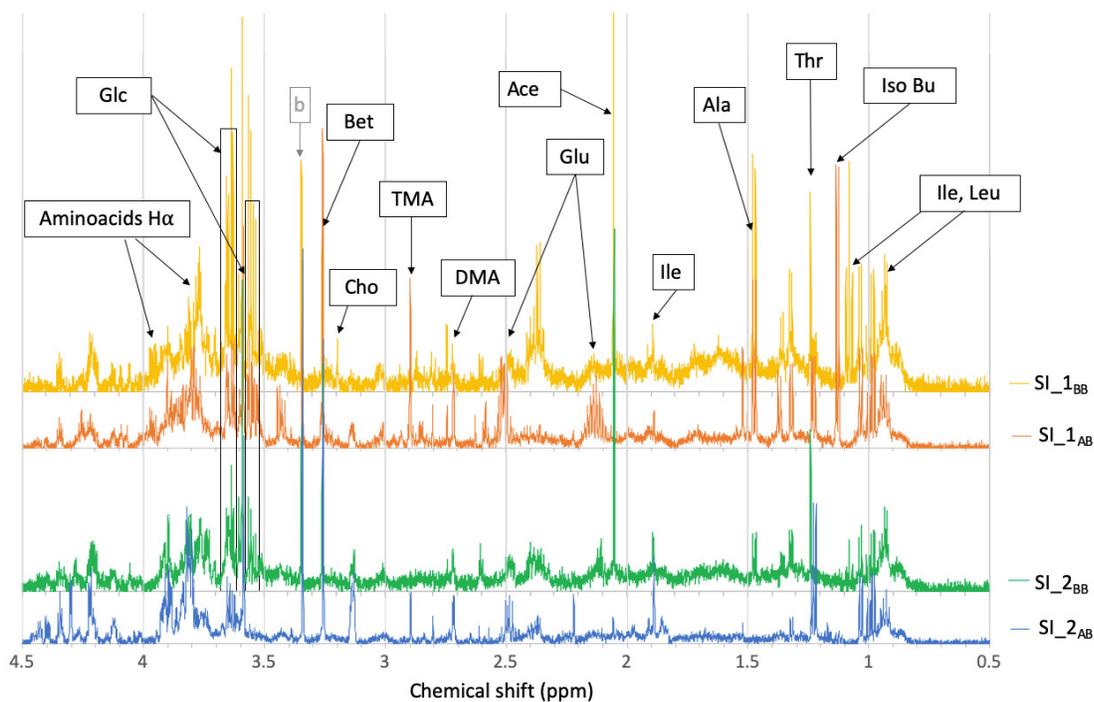


Supplementary figure 3. Split-half validation of the PARAFAC model. For each component (P1,P2,P3,H1,H2), excitation (dashed lines) and emission (solid lines) loadings are shown resulting from six independent model recalculations using randomized halves of the dataset.

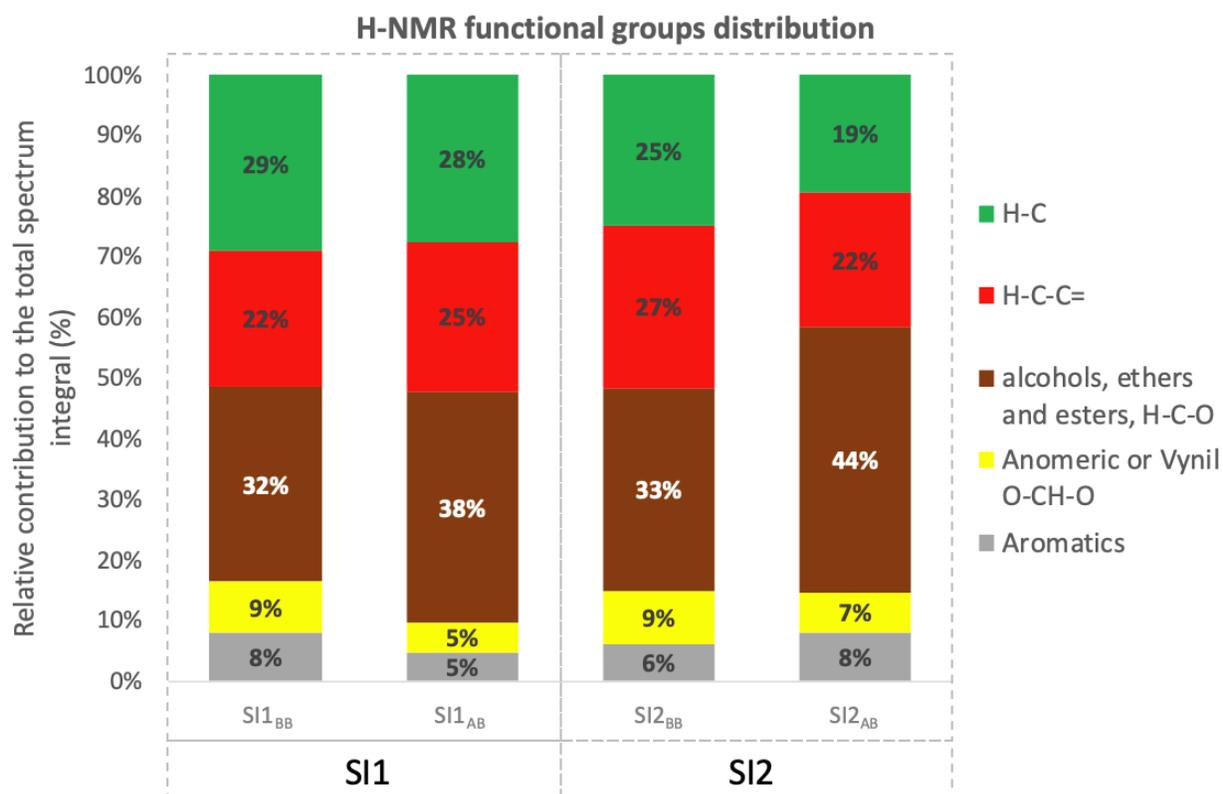


Supplementary figure 4. INP concentrations for different experiments, obtained from two different freeing assays (shown in different symbols, for details see text). Panels A-C show results for samples before (x and +) and after bubbling (open squares and diamonds) for SI1, SI2, SI3, respectively,

while panel D shows data for all samples combined, but only for samples taken prior to bubbling (SI1-SI4). Error bars indicating the statistical measurement uncertainty (95% confidence range) are given exemplarily for samples collected after bubbling, only, to improve the clarity of the plot.



Supplementary figure 5. Aliphatic region of the ^1H -NMR spectra of the POC sea-ice (SI) samples before and after the bubbling (BB and AB, respectively), from SI1 and SI2. Specific resonances were assigned to the residuals of amino acids (Ala, Thr, Val, Glu, Asp, Ile, and Leu) and their alpha hydrogen atoms, isobutyric acid (IsoBu), acetic acid (Ace), N-osmolytes (Bet: betaine; Cho: choline), and glycerol (Glc). Some unresolved mixtures of aliphatic compounds were not attributed yet to specific tracers but already identified in previous studies.



Supplementary figure 6. H-NMR functional groups distribution of the SI POC samples analyzed before-bubbling (BB) and after-bubbling (AB) in Experiments SI1 and SI2.