S1 Details of seawater samples used for aerosol leaching

Seawater batch #1 was a surface seawater sample collected from a small boat using a portable pump. Seawater batch #2 was a composite sample taken from several bottles on a trace metal clean CTD rosette spanning depths of 140 – 500 m. Seawater batch #3 was collected from a trace metal clean CTD rosette bottle at 250 m depth. Further details of water column sampling during GN01 are described in Whitmore et al. (2019)

Table S1: Details of seawater samples used for aerosol leaching. GT# is the GEOTRACES sample number.

Batch #	Station #	Depth (m)	GN01 Event #	Date	Latitude (°N)	Longitude (°E)	Notes
1	17	1	6118	22 Aug 2015	78.140	-176.760	GT # 10863
2	43	140-500	6293	15 Sep 2015	85.135	-150.104	GT #'s 11506-11518
3	54	250	6412	28 Sep 2015	76.489	-149.500	no GT #

S2 Filter blanks for different leaching methods

Filter blanks were processed with each batch of samples. For UPW and HAc leaches, all filter blanks were averaged together. For SW leach, blanks were more variable between batches and so filter blanks were applied by batch.

Table S2: Summary of filter blanks for each leaching approach used. For each, the mean ± one standard deviation is shown. All values are pmol. "n/d" indicates not determined.

	UPW (n=16)	SW batch 1 (n=3)	SW batch 2 (n=4)	SW batch 3 (n=5)	HAc (n=3)
Al	144 ± 78 (n=15)	n/d	n/d	n/d	624 ± 112
Ti	2.3 ± 1.5	n/d	8.1 ± 0.4	8.8 ± 0.1	37 ± 15
V	0.81 ± 0.19	2153 ± 202	3887 ± 101	2563 ± 77	11 ± 4
Mn	1.6 ± 1.1	978 ± 40	77 ± 1	108 ± 5	9.7 ± 1.4
Fe	99 ± 47	112 ± 85	163 ± 41	129 ± 60	125 ± 15
Co	0.12 ± 0.14	27 ± 1	2.3 ± 0.1	2.6 ± 0.9	1.4 ± 0.2
Ni	7.9 ± 6.0 (n=14)	691 ± 20	400 ± 8	587 ± 29	10 ± 3
Cu	6.3 ± 8.3	418 ± 21	148 ± 2	249 ± 11	7.4 ± 1.3
Zn	49 ± 35	152 ± 22	581 ± 5	337 ± 16 (n=4)	301 ± 66
Cd	0.033 ± 0.043	33 ± 2	25 ± 1	72 ± 8	2.4 ± 1.6
Pb	0.010 ± 0.028	0.92 ± 0.32	1.6 ± 0.4	0.30 ± 0.27 (n=4)	2.2 ± 3.1

S3 Aerosol iron concentrations and solubility in each leach

Table S3: Concentrations of total, UPW-soluble, SW-soluble, and HAc soluble in GN01 aerosol samples in pmol m^{-3} and fractional solubility of aerosol Fe in each leach, expressed as a percent of total Fe. Uncertainties are propagated from sample and filter blank measurement precision as described in the text. "n/d" indicates not determined – no data are reported for Aer05 due to the low volume of air sampled and no SW leach was applied to Aer14. "<FB" indicates that sample measurement was less than filter blank mean.

Sample	Total Fe (pmol m^{-3})	UPW Fe (pmol m^{-3})	SW Fe (pmol m^{-3})	HAc Fe (pmol m^{-3})	UPW Fe (% sol.)	SW Fe (% sol.)	HAc Fe (% sol.)
Aer01	42 ± 12	3.7 ± 0.51	5.1 ± 0.99	11 ± 3.0	8.8 ± 3.0	12.2 ± 4.5	26 ± 11
Aer02	36 ± 8.4	0.10 ± 0.17	0.58 ± 0.82	34 ± 6.5	0.28 ± 0.48	1.6 ± 2.3	96 ± 29
Aer03	28 ± 3.7	0.14 ± 0.10	0.31 ± 0.22	11 ± 2.0	0.50 ± 0.36	1.1 ± 0.78	39 ± 9
Aer04	16 ± 3.8	0.11 ± 0.04	0.12 ± 0.52	4.8 ± 1.5	0.68 ± 0.29	0.72 ± 3.2	30 ± 12
Aer05	n/d	n/d	n/d	n/d	n/d	n/d	n/d
Aer06	126 ± 15	0.24 ± 0.10	0.62 ± 0.19	46 ± 8.7	0.19 ± 0.08	0.49 ± 0.16	37 ± 8
Aer07	125 ± 29	0.14 ± 0.07	2.04 ± 0.34	62 ± 12	0.11 ± 0.06	1.6 ± 0.47	50 ± 15
Aer08	97 ± 23	<FB	<FB	87 ± 16	<FB	<FB	89 ± 27
Aer09	45 ± 24	0.79 ± 1.03	2.40 ± 1.12	39 ± 7.4	1.7 ± 2.5	5.3 ± 3.8	87 ± 50
Aer10	52 ± 12	0.67 ± 0.15	1.24 ± 0.33	28 ± 1.9	1.28 ± 0.42	2.4 ± 0.85	54 ± 13
Aer11	350 ± 82	2.05 ± 0.68	3.20 ± 1.35	155 ± 29	0.59 ± 0.24	0.91 ± 0.44	44 ± 13
Aer12	44 ± 6.4	0.43 ± 0.14	0.18 ± 0.33	26 ± 4.9	0.98 ± 0.35	0.41 ± 0.76	59 ± 14
Aer13	16 ± 3.8	0.17 ± 0.04	<FB	6.8 ± 1.3	1.05 ± 0.35	<FB	42 ± 13
Aer14	29 ± 6.8	0.22 ± 0.01	n/d	10 ± 1.9	0.76 ± 0.18	n/d	36 ± 11

S4 Concentrations of trace elements in GN01 rain and snow samples

Table S4: Trace element concentrations in unfiltered and filtered precipitation samples. All values are nmol L^{-1}. "n/d" indicates not determined.

Sample	Al	Ti	V	Mn	Fe	Co	Ni	Cu	Zn	Cd	Pb
					Total dissolvable concentrations (nmol L^{-1})						
Ppt02	665	3.35	0.58	17.0	76	1.18	17.7	4.6	374	0.160	0.057
Ppt05	32	1.62	0.34	0.6	46	0.04	3.5	5.5	9	0.051	0.018
Ppt06	310	1.25	0.10	0.9	52	0.06	7.4	3.0	n/d	n/d	0.352
Ppt07	381	1.62	0.18	2.5	115	0.09	6.1	10.3	38	0.100	0.095
Ppt08	567	1.37	0.15	3.5	87	0.18	10.9	9.9	59	0.015	0.129
Ppt09	33	0.59	0.04	0.8	18	0.04	24.8	0.6	30	0.024	0.016
Ppt10	4315	3.19	0.69	9.4	165	0.23	13.0	10.1	115	0.008	0.230
Ppt11	25	0.22	0.01	0.1	3	0.002	2.1	0.2	5	0.006	n/d
Ppt13	35	0.31	0.02	0.2	9	0.01	0.9	4.9	4	0.008	0.023
Ppt14	65	1.01	0.04	1.0	23	0.01	1.3	1.0	13	0.006	0.018
Ppt15	297	1.40	0.13	2.9	57	0.16	2.5	2.9	52	0.029	0.090
Ppt16	225	1.74	0.26	5.6	283	0.35	1.1	2.6	43	0.330	22.182
					Dissolved concentrations (nmol L^{-1})						
Ppt07	17	0.05	0.02	0.76	2.2	0.05	5.0	6.7	33	0.060	0.008
Ppt13	17	0.07	0.01	0.16	1.1	0.01	0.8	2.3	4	0.007	0.001
Ppt14	11	0.08	0.02	0.73	0.8	0.01	1.3	0.6	13	0.005	0.018
Ppt16	60	0.19	0.10	4.01	9.6	0.11	0.8	1.6	43	0.117	17.013

S5 Concentrations of trace elements in GN01 rain and snow samples

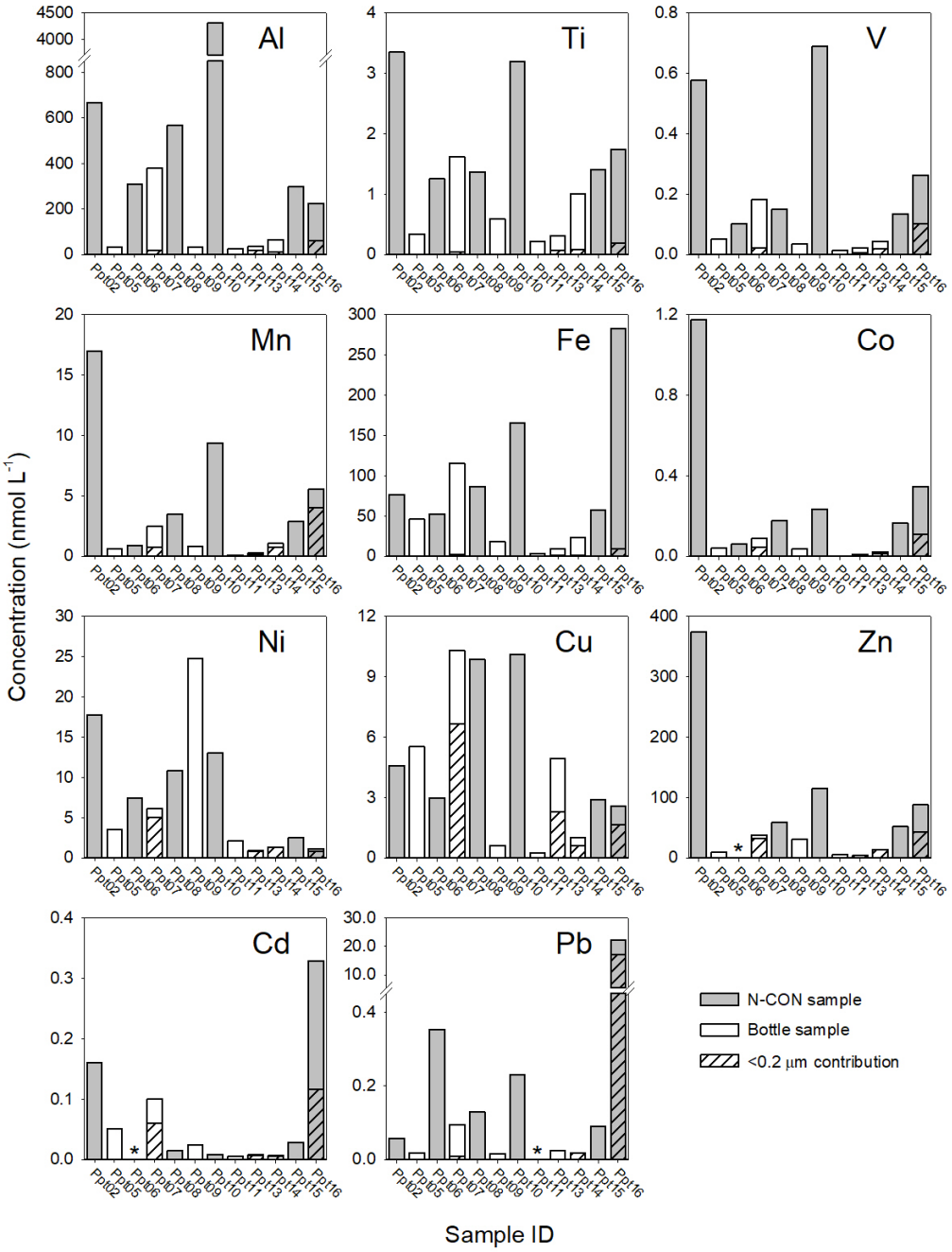

Figure S1: Trace element concentrations in GN01 precipitation samples. Samples were collected by two different methods, as indicated by shading. Also shown are concentrations in filtered subsamples for Ppt07, Ppt13, Ppt14, and Ppt16 (hatched areas). Samples for which negligible volume was collected (Ppt01, Ppt03, Ppt04, Ppt12) are not included. Note that Al and Pb charts each have a break in the concentration axis. Asterisks indicate concentrations below detection limit.

S6 Solubility comparison of GN01 aerosols and precipitation samples

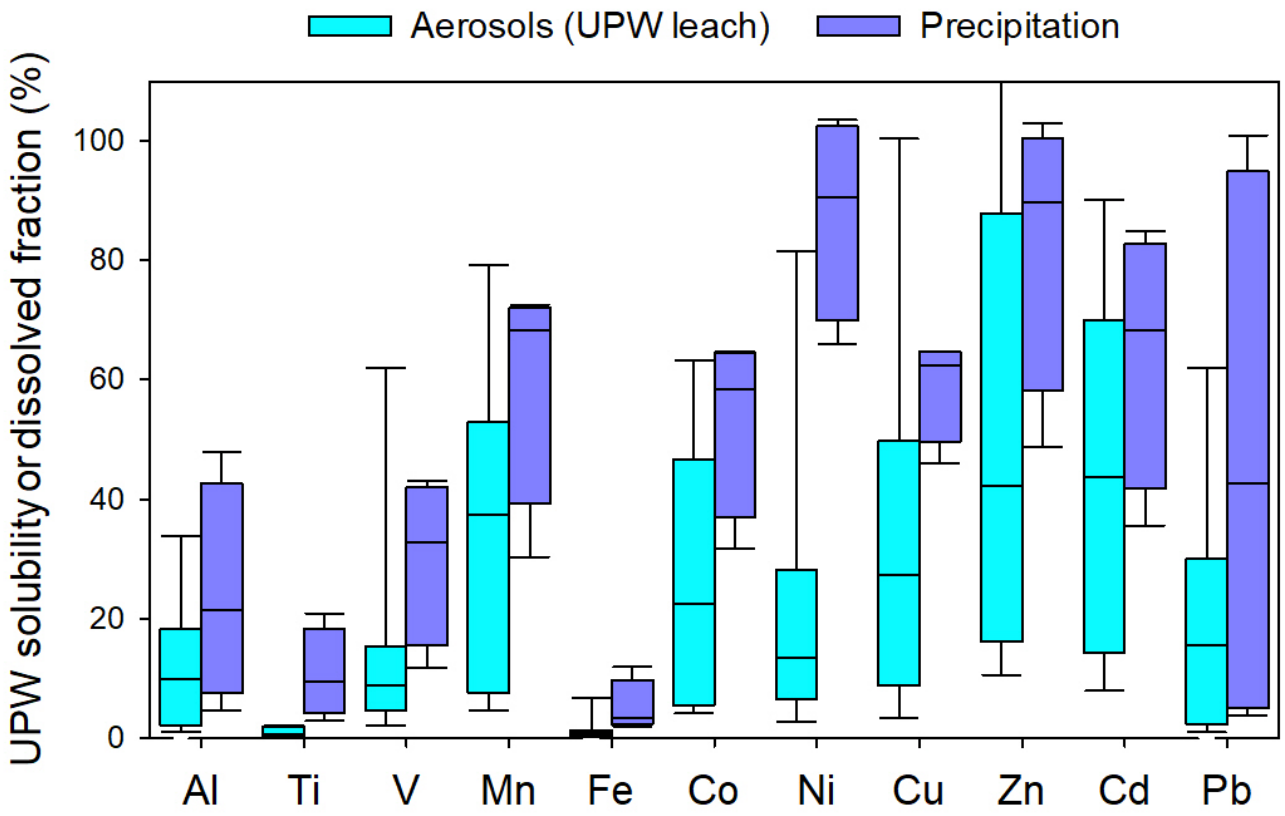

Figure S2: Comparison of trace element solubility in GN01 aerosol and precipitation samples. Aerosol solubility is determined by concentration in UPW leach as a percentage of total aerosol trace element concentration (thirteen samples). Precipitation solubility is determined by concentration in the dissolved fraction as a percentage of the "total dissolvable" trace element concentration (four samples only). Boxes span 25th to 75th percentiles of data and are bisected by median, with whiskers extending to 10th and 90th percentiles.

S7 Air mass back-trajectories for aerosol samples

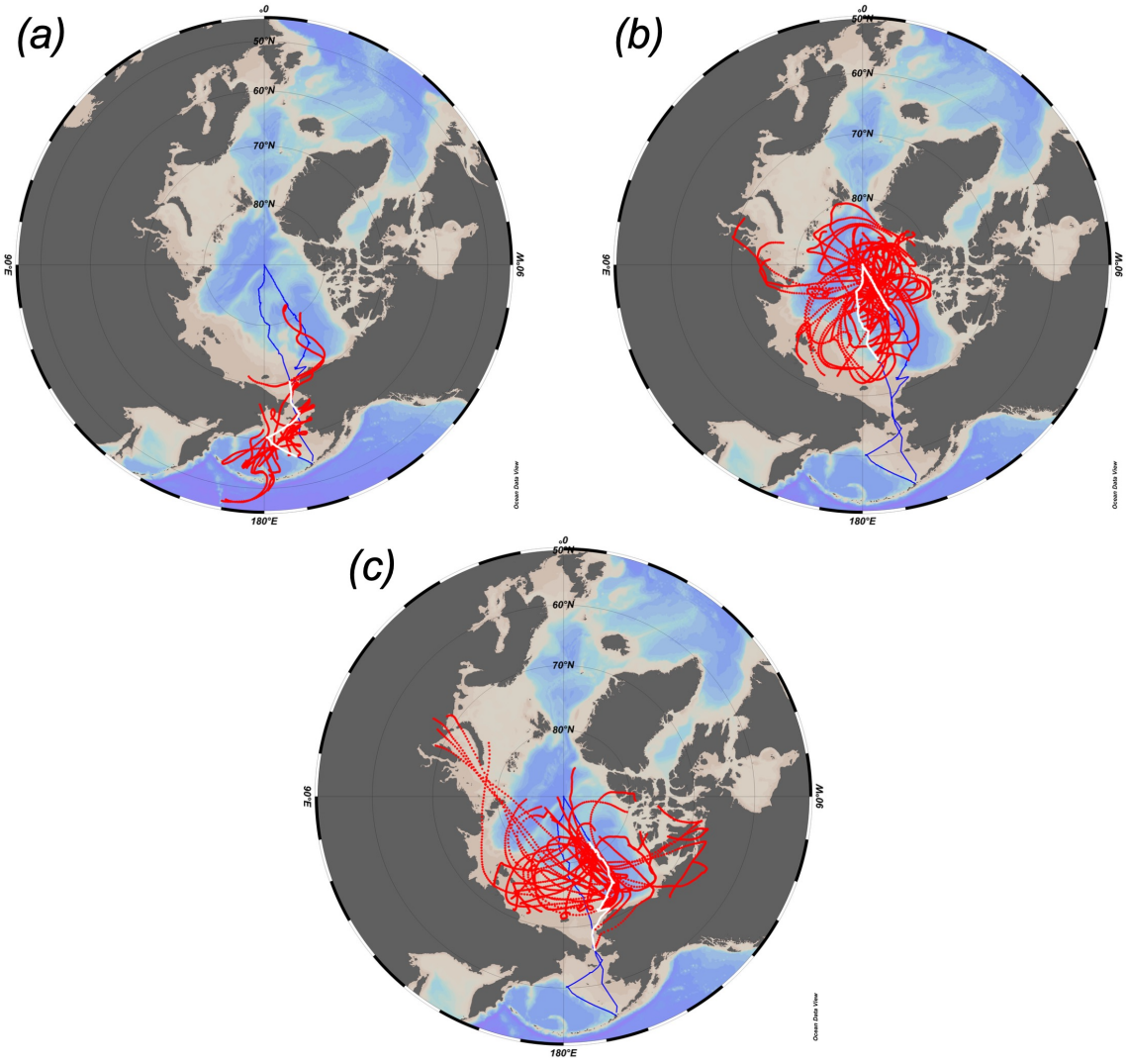

Figure S3: Air mass back trajectory characteristics for groups of aerosols during GN01. Group 1 *(a)* consists of Aer01 only, Group 2 *(b)* consists of Aer02-Aer09, and Group 3 *(c)* consists of Aer10-Aer14. In each plot the cruise track is marked by a blue line and the track during that specific part of the cruise is picked out in white. Red lines depict 100-hour back trajectories of air masses arriving at the ship's location at 6-hourly intervals (300 m arrival height), as modelled using the NOAA HYSPLIT model (Rolph et al., 2017; Stein et al., 2015) with GDAS 1-degree meteorology. Figure produced using Ocean Data View (Schlitzer, 2025).

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