Supplement of

Volcanic ash leaching alters the trace metal distribution within the coral holobiont of *Stylophora pistillata*

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Table S1: Quality control on Seawater Certified Reference Material (CRM) a) CASS-6, and b) SAFe D1_479. Measured values are compared to certified consensus values to assess analytical accuracy.

a) CASS-6		Consensus value		Measured values					
				External Calibration			Isotope Dilution		
Element	**Unit**	*Mean*	*SD*	*Mean*	*SD*	*Recovery [%]*	*Mean*	*SD*	*Recovery [%]*
V	ug/L	0.5000	0.1200	0.5564	0.0064	89.87	NA	NA	NA
Mn	ug/L	2.2200	0.1200	2.1759	0.0355	102.03	NA	NA	NA
Fe	ug/L	1.5600	0.1200	1.3516	0.0168	115.42	1.5564	0.0148	100.23
Co	ug/L	0.0672	0.0052	0.0663	0.0021	101.29	NA	NA	NA
Ni	ug/L	0.4180	0.0400	0.4360	0.0074	95.88	0.3913	0.0036	106.81
Cu	ug/L	0.5300	0.0320	0.5177	0.0065	102.38	0.4949	0.0171	107.08
Zn	ug/L	1.2700	0.1800	1.1780	0.0126	107.81	NA	NA	NA
Cd	ug/L	0.0217	0.0018	0.0232	0.0002	93.48	0.0195	0.0005	111.35
Pb	ug/L	0.0106	0.0040	0.0110	0.0003	96.18	NA	NA	NA

b) SAFe D1_479		Consensus value		Measured values					
				External Calibration			Isotope Dilution		
Element	**Unit**	*Mean*	*SD*	*Mean*	*SD*	*Recovery [%]*	*Mean*	*SD*	*Recovery [%]*
V	nmol/L	NA	NA	NA	NA	NA	NA	NA	NA
Mn	nmol/L	NA	NA	NA	NA	NA	NA	NA	NA
Fe	nmol/L	0.6900	0.0400	0.6061	0.0524	113.84	0.6914	0.0565	99.79
Co	nmol/L	0.0460	0.0050	0.0465	0.0051	98.94	NA	NA	NA
Ni	nmol/L	8.7900	0.2700	8.7595	0.1493	100.35	8.8692	0.1491	99.11
Cu	nmol/L	2.3300	0.1100	2.1715	0.1058	107.30	2.1715	0.1542	107.30
Zn	nmol/L	7.5900	0.3600	7.5864	0.3518	100.05	NA	NA	NA
Cd	nmol/L	1.0160	0.0320	1.0298	0.0414	98.66	0.9744	0.0265	104.27
Pb	nmol/L	0.0290	0.0030	0.0284	0.0029	102.19	NA	NA	NA

Tab. S2: Input parameters for the compartment model, as described in Sect. 2.2.1.

Element	Seawater blank	Estimated conc. in tank after 24 h*	A_0 (c_{24h}-$c_{sw\ blank}$)	fitted k
	[nmol/L]	*[nmol/L]*	*[nmol/L]*	*[nmol/L/min]*
V	26.3621	26.3453	-0.0168	0.0001
Mn	1.0586	8.3515	7.2928	0.0085
Fe	12.2939	12.4799	0.1860	0.0038
Co	0.1512	0.1947	0.0435	0.0006
Ni	7.6575	7.7648	0.1073	0.0007
Cu	4.2123	5.3631	1.1508	0.3229
Zn	28.0962	39.4547	11.3585	0.4540
Cd	0.2478	0.2533	0.0054	0.0412
Pb	0.0554	0.0552	-0.0002	0.0144

*calculated from mg/kg ash values

Tab.S3: Isotope list and dwell times for elements analysed with LA-ICP-MS.

Element	Selected mass number	Dwell time [s]
Li	7	0.01
B	11	0.01
Na	23	0.01
Mg	25	0.01
V	51	0.03
Mn	55	0.03
Fe	56	0.03
Co	59	0.01
Ni	62	0.03
Cu	65	0.01
Zn	66	0.01
Sr	88	0.01
Cd	111	0.03
U	238	0.01

Tab. S4: Quality control on the Certified Reference Material JCp-1-NP for LA-ICP-MS analyses. Measured values are compared to certified consensus values and to published literature values to assess analytical accuracy and reproducibility.

Study	Parameter	El/Ca ratio														
		Li	**B**	**Na**	**Mg**	**V**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**	**Sr**	**Cd**	**Pb**	**U**
This study	*Number of meas.*	44	41	43	43	38	40	43	40	41	40	44	44	19	43	45
	Median [µmol/mol]	9.40	418.70	18954.33	4309.77	0.55	3.18	67.93	0.58	0.57	0.87	1.38	8670.76	0.03	0.16	1.11
	Average [µmol/mol]	9.42	416.65	18938.08	4297.86	0.56	3.27	68.54	0.59	0.58	0.87	1.43	8661.88	0.04	0.16	1.12
	2SD [µmol/mol]	0.77	55.10	1503.00	310.23	0.11	0.77	16.65	0.13	0.15	0.09	0.35	210.90	0.02	0.01	0.08
	2RSD [%]	8.14	13.23	7.94	7.22	19.20	23.56	24.29	21.71	25.81	10.68	24.34	2.43	58.04	9.04	6.81
	RSD [%]	4.07	6.61	3.97	3.61	9.60	11.78	12.15	10.86	12.91	5.34	12.17	1.22	29.02	4.52	3.40
Boer et al., 2022	*Value [µmol/mol]*	NA	428.06	NA	3558.90	0.48	1.93	111.39	NA	NA	1.10	NA	7653.30	0.08	0.13	1.03
	2SD [µmol/mol]	*NA*	*15.21*	*NA*	*269.99*	*0.10*	*0.29*	*9.19*	*NA*	*NA*	*0.12*	*NA*	*193.06*	*0.01*	*0.01*	*0.03*
McCormick et al., 2023	*Value [µmol/mol]*	NA	NA	NA	4723.29	NA	2.12	93.29	NA	NA	NA	1.61	8813.86	NA	0.16	1.05
	2SD [µmol/mol]	*NA*	*NA*	*NA*	*457.09*	*NA*	*1.00*	*22.94*	*NA*	*NA*	*NA*	*0.31*	*349.54*	*NA*	*0.02*	*0.07*
Jochum et al., 2019	*Value [µmol/mol]*	6.49	449.01	17849.52	3520.85	0.53	2.06	120.44	0.53	1.00	1.23	NA	7870.33	NA	0.15	1.11
	2SD [µmol/mol]	NA	66.66	4005.26	107.07	0.06	0.22	25.09	0.01	0.50	0.68	0.61	753.91	NA	0.02	0.13
MyStandards GmbH	*Value [µmol/mol]*	8.19	434.19	NA	3936.77	0.43	2.08	NA	NA	NA	0.99	1.97	8086.23	0.04	0.14	0.98
	2SD [µmol/mol]	2.75	44.81	NA	347.14	0.02	0.15	NA	NA	NA	0.02	0.01	229.60	0.01	0.00	0.06
Boer et al., 2022	*Recovery [%]*	NA	97.81	NA	121.10	114.09	164.28	60.98	NA	NA	79.47	NA	113.29	37.15	119.43	107.98
McCormick et al., 2023	*Recovery [%]*	NA	NA	NA	91.25	NA	149.66	72.82	NA	NA	NA	85.56	98.38	NA	103.54	105.30
Jochum et al., 2019	*Recovery [%]*	144.94	93.25	106.19	122.41	103.97	154.29	56.40	107.86	57.31	70.93	NA	110.17	NA	109.14	99.86
MyStandards GmbH	*Recovery [%]*	114.83	96.43	NA	109.47	127.71	152.94	NA	NA	NA	87.82	69.65	107.23	75.21	114.00	113.63
Mean recovery [%]		129.88	95.83	106.19	111.06	115.25	155.29	63.40	107.86	57.31	79.40	77.60	107.27	56.18	111.53	106.70
Mean deviation [%]		29.88	4.17	6.19	11.06	15.25	55.29	36.60	7.86	42.69	20.60	22.40	7.27	43.82	11.53	6.70

Tab. S5: Seawater background concentrations and modelled average trace metal concentrations [nmol L^{-1}] in coral culture tanks. The calculations and assumptions justifying the compartment model are described in Sect. 2.2.1.

Element	Seawater blank		Modelled average tank concentration	
	Mean [nmol/L]	*SD [nmol/L]*	*Mean [nmol/L]*	*SD [nmol/L]*
V	26.362	0.465	26.209	0.170
Mn	1.059	0.117	5.897	9.034
Fe	12.294	5.773	12.515	0.406
Co	0.151	0.072	0.334	0.206
Ni	7.657	1.268	8.041	0.452
Cu	4.212	0.609	4.233	0.038
Zn	28.096	4.638	28.231	0.247
Cd	0.248	0.015	0.249	0.002
Pb	0.055	0.003	0.055	0.000

Tab. S6: Trace metal concentrations [nmol L^{-1}] in 0.22 µm filtered Mediterranean seawater before and 1 h, 24 h, and 30 d after the addition of volcanic ash at a 1 g: 100 mL ratio (0.3 g ash: 30 mL. seawater). Data for the blanks and 1h ash leaching experiment is presented as mean concentration (n = 3) ± SD.

Element	Concentration [nmol/L]					
	0 h*	*SD*	**1 h***	**24 h***	*SD*	**742 h***
V	26.362	0.465	22.632	24.348	1.260	19.510
Mn	1.059	0.117	435.303	876.200	69.344	1083.520
Fe	12.294	5.773	8.888	34.615	16.027	15.061
Co	0.151	0.072	3.122	5.373	0.567	8.767
Ni	7.657	1.268	12.781	20.535	0.392	26.990
Cu	4.212	0.609	185.077	142.304	25.657	111.751
Zn	28.096	4.638	1548.582	1391.114	191.942	1043.915
Cd	0.248	0.015	0.963	0.899	0.072	1.029
Pb	0.055	0.003	0.038	0.030	0.003	0.025

***Leaching duration**

Tab. S7: Statistical results of the effect of volcanic ash on the metal concentrations in coral skeletons, host tissues and symbionts of the coral *Stylophora pistillata*.

Normal distribution and homoskedasticity were assessed using Shapiro-Wilk test and Levene test, respectively. Based on former and latter outcome, statistical tests (ANOVA, WMW and Welch) were performed. Differences between control and ash-exposed condition were termed statistically significant when $p \leq 0.05$ in all cases. Levels of significance are indicated as p-value > 0.05 (not significant), p-value ≤ 0.05 (*), p-value ≤ 0.01 (**), and p-value ≤ 0.001 (***).

	Element	n			Normality				Homoscedasticity		Statistical test		
					Control		Ash-exposed						
		Control	Ash-exposed	Total	*W*	*p-value*	*W*	*p-value*	*F*	*p-value*	*Type*	*p-value*	*Level*
Coral skeleton	V	360	390	750	0.95	1.75E-08	0.97	2.88E-06	16.27	6.12E-05	WMW	5.33E-13	***
	Mn	360	390	750	0.94	3.20E-04	0.93	4.85E-11	37.33	2.32E-09	WMW	2.20E-16	***
	Fe	227	217	444	0.82	1.96E-15	0.78	2.20E-16	62.58	2.03E-14	Welch	2.20E-16	***
	Co	360	390	750	0.91	5.22E-10	0.92	1.06E-09	3.30	0.07	WMW	0.12	
	Ni	360	390	750	0.98	1.17E-04	0.97	1.79E-07	21.57	4.08E-06	WMW	2.20E-16	***
	Cu	360	390	750	0.96	1.58E-08	0.90	7.39E-15	1.26	0.26	WMW	0.02	*
	Zn	360	390	750	0.91	2.60E-13	0.87	2.20E-16	22.44	2.64E-06	WMW	1.00E-03	**
	Cd	360	390	750	0.96	0.65	0.93	0.53	1.55	0.23	WMW	0.08	
	Pb	360	390	750	0.93	1.90E-11	0.88	7.72E-16	8.64	0.003	WMW	2.20E-16	***
Coral tissue	V	6	6	12	0.78	0.04	0.88	0.25	0.02	0.89	ANOVA	1.00	
	Mn	6	6	12	0.96	0.85	0.94	0.64	14.81	3.22E-03	Welch	0.01	**
	Fe	6	6	12	0.80	0.05	0.96	0.79	4.22	0.07	ANOVA	0.02	*
	Co	6	6	12	0.96	0.81	0.95	0.73	3.90	0.08	ANOVA	0.19	
	Ni	6	6	12	0.88	0.27	0.95	0.75	3.36	0.10	ANOVA	0.93	
	Cu	6	6	12	0.80	0.05	0.85	0.16	5.52	0.04	Welch	0.40	
	Zn	6	6	12	0.94	0.62	0.88	0.25	4.52	0.06	ANOVA	0.41	
	Cd	6	6	12	0.92	0.52	1.00	0.92	0.83	0.39	ANOVA	0.32	
	Pb	6	6	12	0.92	0.52	0.85	0.15	4.78	0.05	ANOVA	0.20	
Symbionts	V	6	6	12	0.88	0.32	0.74	0.03	0.87	0.38	WMW	1.00	
	Mn	6	6	12	0.88	0.31	0.92	0.52	0.02	0.88	ANOVA	0.99	
	Fe	6	6	12	0.76	0.03	0.84	0.15	0.10	0.76	WMW	0.55	
	Co	6	6	12	0.76	0.04	0.83	0.15	0.38	0.55	WMW	0.42	
	Ni	6	6	12	0.86	0.22	0.90	0.43	0.58	0.47	ANOVA	0.31	
	Cu	6	6	12	0.79	0.07	0.96	0.78	0.43	0.53	ANOVA	0.25	
	Zn	6	6	12	0.69	0.01	0.93	0.58	0.62	0.45	WMW	0.31	

Cd	6	6	12	0.90	0.39	-	-	0.50	0.55	WMW	0.50	
Pb	6	6	12	-	-	-	-	-	-	Welch	-	

Tab. S8: Correlation analysis of several El/Ca ratios in the skeletons of *S. pistillata* reared in control condition and after 6 weeks of exposure to 250 mg volcanic ash L^{-1} per week. Correlation strength is presented as a) Pearson correlation coefficient (r), and b) statistically significant correlations exists when $p < 0.05$.

a) Pearson r

Ash-exposed \ Control	Li	B	Na	Mg	V	Mn	Co	Ni	Cu	Zn	Pb	Sr	U
Li	1	-0.48	0.77	0.83	0.03	0.10	-0.23	0.48	0.26	0.23	-0.12	0.20	-0.47
B	-0.33	1	-0.38	-0.48	0.10	-0.01	0.02	-0.52	-0.20	-0.26	0.27	0.01	0.33
Na	0.76	-0.25	1	0.72	0.03	0.13	-0.18	0.38	0.34	0.26	-0.12	0.16	-0.43
Mg	0.77	-0.35	0.59	1	-0.11	0.04	-0.36	0.33	0.25	0.27	-0.25	0.14	-0.56
V	0.03	-0.17	0.08	-0.07	1	0.29	0.36	0.17	0.18	0.16	0.31	0.14	0.12
Mn	-0.03	-0.07	-0.01	0.10	0.22	1	0.43	0.35	0.22	0.26	0.41	-0.04	-0.07
Co	-0.13	-0.17	-0.04	-0.09	0.21	0.03	1	0.14	0.06	0.07	0.41	-0.06	0.23
Ni	0.02	-0.36	-0.01	0.18	0.18	0.58	0.13	1	0.39	0.43	0.09	0.21	-0.06
Cu	-0.13	-0.06	-0.10	-0.24	0.34	0.36	0.09	0.30	1	0.48	0.30	0.19	-0.01
Zn	-0.12	-0.27	-0.07	-0.08	0.45	0.40	0.34	0.37	0.44	1	0.17	0.10	-0.09
Pb	-0.32	0.12	-0.23	-0.49	0.37	0.13	0.12	0.09	0.61	0.30	1	0.23	0.31
Sr	0.04	0.10	0.21	-0.08	0.08	0.02	-0.07	-0.01	0.06	-0.12	0.16	1	0.41
U	-0.34	0.04	-0.19	-0.57	0.22	0.15	0.09	0.10	0.42	0.17	0.37	0.64	1

b) p-values

Ash-exposed \ Control	Li	B	Na	Mg	V	Mn	Co	Ni	Cu	Zn	Pb	Sr	U
Li	1	**1.30E-04**	**2.71E-08**	**2.04E-09**	0.21	0.82	**0.02**	**0.01**	0.13	0.11	**0.00**	0.78	**4.41E-05**
B	0.06	1	**3.58E-04**	**3.67E-04**	0.43	0.72	0.27	**2.56E-05**	**0.03**	**0.01**	**0.04**	0.85	**0.01**
Na	**2.60E-07**	0.09	1	**6.91E-08**	0.20	0.85	**0.02**	**0.02**	0.10	0.10	**4.07E-03**	0.90	**3.25E-05**
Mg	**7.30E-07**	0.04	**9.75E-05**	1	0.13	0.72	**0.01**	**0.02**	0.13	0.09	**1.93E-03**	0.81	**1.98E-05**
V	0.32	0.33	0.35	0.26	1	0.23	**0.04**	0.74	0.80	0.82	0.14	0.64	0.37
Mn	0.41	0.37	0.30	0.80	0.35	1	0.04	0.33	0.60	0.41	0.21	0.10	0.65
Co	0.26	0.40	0.29	0.37	0.22	0.90	1	0.58	0.52	0.59	**0.01**	0.26	0.09
Ni	0.82	**0.03**	0.62	0.74	0.37	**7.35E-04**	0.54	1	**0.03**	**0.01**	0.21	0.84	0.05
Cu	**0.02**	0.96	**0.02**	**0.02**	**0.05**	0.10	0.51	0.20	1	**0.01**	0.81	0.90	0.20
Zn	0.16	0.19	0.12	0.28	**0.01**	**0.04**	0.06	**0.04**	**0.01**	1	0.49	0.76	0.10
Pb	**6.96E-04**	0.33	**2.25E-03**	**4.16E-05**	0.08	0.59	0.48	0.89	**3.62E-04**	0.11	1	0.96	0.43
Sr	0.71	0.40	0.91	0.40	0.67	0.34	0.30	0.29	0.80	0.15	0.60	1	**0.01**
U	**1.18E-03**	0.35	**0.01**	**3.40E-05**	0.21	0.65	0.59	0.92	**0.01**	0.29	0.17	**2.41E-05**	1