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Supplementary materials

S1. B isotope measurement data for Figure 4 of the manuscript

Tables S1

B isotope measurement data for the natural samples presented in Figure 4 of the manuscript. In all samples presented here, boron was extracted from the sample matrix.

Tables S1a. S1b. and S1c present measurements and $\delta^{11}B$ calculation in the same manner:
Each sample is bracketed thrice by SRM 951 standard solution. $^{11}B/^{10}B$ and Stderr (abs) are direct MC-ICP-MS measurements (15 cycles of 8 s). Equations for calculating $\delta^{11}B_{stab}$ and $\delta^{11}B_{smp}$ are given in the manuscript and summarized in the following synthetic table. n is the number of $\delta^{11}B_{smp}$ values taken into account for average and 2σ (standard deviation) calculation. When $\delta^{11}B_{stab}$ are below 0.1‰, n is generally 5 because no outlier has to be discarded. When 2SD is higher than 0.10 ‰, then 1 or 2 outlier $\delta^{11}B_{smp}$ values (in red) are discarded for average and 2SD calculation.
In Fig. 4 of the manuscript, the 2SD values represented for the samples are for n=5 (without discarding any outlier).

smp/std	**^{11}B (V)**	**$^{11}B/^{10}B$**	**Stderr (abs)**	**$\delta^{11}B_{stab}$ (‰)**	**average $\delta^{11}B_{stab}$**	**$\delta^{11}B_{smp}$ (‰)**	**average $\delta^{11}B_{smp}$**	**2σ**	**n**
Std1	Meas.	Meas.	Meas.						
smp1a	Meas.	Meas.	Meas.			$(2R_{smpa}/(R_{std1}+R_{std2})-1)x1000$			5
Std2	Meas.	Meas.	Meas.	$(2R_{std2}/(R_{std1}+R_{std3})-1)x1000$	Average	$((R_{smpa}+R_{smpb})/2R_{std2}-1)x1000$		**2x**	4
smp1b	Meas.	Meas.	Meas.	$(2R_{smpb}/(R_{smpa}+R_{smpc})-1)x1000$		$(2R_{smpb}/(R_{std2}+R_{std3})-1)x1000$	**Average**	**standard**	or
Std3	Meas.	Meas.	Meas.	$(2R_{std3}/(R_{std2}+R_{std4})-1)x1000$		$((R_{smpb}+R_{smpc})/2R_{std3}-1)x1000$		**deviation**	3
smp1c	Meas.	Meas.	Meas.			$(2R_{smpc}/(R_{std3}+R_{std4})-1)x1000$			
Std4	Meas.	Meas.	Meas.						

Table S1a: $^{11}B/^{10}B$ data and $\delta^{11}B$ calculations for 26 different **seawater samples**

smp/std	^{11}B (V)	$^{11}B/^{10}B$	Stderr(abs)	$\delta^{11}B_{stab}$ (‰)	average $\delta^{11}B_{stab}$	$\delta^{11}B_{smp}$ (‰)	average $\delta^{11}B_{smp}$	2σ	n
std	6.66	4.7180	0.0001						
smp1	6.70	4.9071	0.0002			40.10			
std	6.70	4.7179	0.0001	0.03	-0.04	40.05			
smp1	6.69	4.9064	0.0001	-0.07		40.03	**40.06**	**0.06**	5
std	6.65	4.7174	0.0001	-0.09		40.08			
smp1	6.60	4.9065	0.0001			40.05			
std	6.52	4.7177	0.0001	0.04					
smp2	6.33	4.9065	0.0001			40.01			
std	6.42	4.7177	0.0000	0.02	0.00	39.95			
smp2	6.29	4.9058	0.0002	-0.02		39.90	**39.92**	**0.11**	5
std	6.41	4.7174	0.0001	0.01		39.88			
smp2	6.29	4.9053	0.0001			39.87			
std	6.40	4.7171	0.0001	-0.13					
smp3	6.23	4.9060	0.0001			39.96			
std	6.42	4.7180	0.0001	0.07	0.05	39.94			
smp3	6.27	4.9067	0.0001	0.05		39.98	**39.97**	**0.04**	5
std	6.44	4.7182	0.0001	0.03		39.98			
smp3	6.28	4.9069	0.0002			39.99			
std	6.44	4.7182	0.0001	-0.02					
smp4	6.39	4.9073	0.0001			40.06			
std	6.59	4.7184	0.0001	-0.01	0.02	40.09			
smp4	6.38	4.9078	0.0001	0.04		40.11	**40.08**	**0.04**	5
std	6.60	4.7186	0.0001	0.02		40.08			
smp4	6.35	4.9078	0.0001			40.07			
std	6.56	4.7187	0.0001	0.03					
smp5	6.37	4.9084	0.0001			40.22			
std	6.54	4.7185	0.0001	-0.01	0.00	40.22			
smp5	6.34	4.9082	0.0002	0.01		40.22	**40.21**	**0.04**	5
std	6.50	4.7184	0.0001	-0.01		40.20			
smp5	6.31	4.9080	0.0001			40.17			
std	6.52	4.7184	0.0001	0.02					
smp6	6.23	4.9067	0.0001			39.93			
std	6.50	4.7182	0.0001	0.01	0.03	39.97			
smp6	6.23	4.9069	0.0002	0.07		40.03	**39.99**	**0.07**	5
std	6.53	4.7179	0.0001	0.00		40.01			
smp6	6.28	4.9065	0.0001			39.99			
std	6.55	4.7177	0.0001	-0.01					
smp7	6.09	4.9058	0.0002			39.90			
std	6.54	4.7176	0.0001	-0.01	-0.02	39.89			
smp7	6.09	4.9056	0.0002	-0.04		39.87	**39.89**	**0.03**	5
std	6.55	4.7175	0.0001	0.00		39.89			
smp7	6.07	4.9058	0.0001			39.91			
std	6.55	4.7175	0.0001	0.01					
smp8	6.12	4.9060	0.0001			39.96			
std	6.56	4.7174	0.0001	-0.01	0.02	39.97			
smp8	6.11	4.9060	0.0001	0.03		39.97	**39.96**	**0.02**	5
std	6.54	4.7174	0.0001	0.05		39.94			
smp8	6.11	4.9057	0.0002			39.96			
std	6.50	4.7169	0.0001	-0.09					
smp9	6.32	4.9056	0.0001			39.94			
std	6.53	4.7173	0.0001	0.05	0.01	39.88			
smp9	6.38	4.9054	0.0002	0.00		39.86	**39.87**	**0.09**	5
std	6.56	4.7173	0.0001	-0.02		39.85			
smp9	6.36	4.9052	0.0002			39.82			
std	6.58	4.7174	0.0001	0.01					
smp10	6.45	4.9036	0.0001			39.47			
std	6.57	4.7174	0.0001	0.02	0.01	39.47			
smp10	6.47	4.9036	0.0001	0.03		39.48	**39.46**	**0.04**	5
std	6.61	4.7173	0.0001	-0.01		39.46			
smp10	6.47	4.9033	0.0002			39.43			
std	6.62	4.7173	0.0001	0.04					
smp11	6.46	4.9053	0.0001			39.90			
std	6.66	4.7168	0.0001	-0.04	-0.01	39.94			
smp11	6.44	4.9052	0.0002	0.00		39.93	**39.92**	**0.03**	5
std	6.64	4.7168	0.0001	0.00		39.93			
smp11	6.43	4.9050	0.0002			39.92			
std	6.63	4.7167	0.0001	-0.01					
smp12	6.43	4.9050	0.0001			39.93			
std	6.62	4.7166	0.0001	0.00	-0.01	39.91			
smp12	6.44	4.9048	0.0001	-0.03		39.91	**39.92**	**0.03**	5
std	6.68	4.7166	0.0001	-0.01		39.93			
smp12	6.43	4.9050	0.0002			39.94			
std	6.65	4.7166	0.0001	0.01					
smp13	6.45	4.9049	0.0001			39.93			
std	6.65	4.7165	0.0001	0.04	-0.03	39.90			

smp13	6.43	4.9045	0.0002	-0.05		39.91	**39.93**	**0.05**	5
std	6.62	4.7160	0.0001	-0.10		39.97			
smp13	6.43	4.9046	0.0001			39.93			
std	6.64	4.7164	0.0001	0.08					
smp14	6.45	4.9045	0.0001			39.91			
std	6.63	4.7161	0.0001	-0.03	-0.02	39.91			
smp14	6.40	4.9041	0.0001	0.00		39.88	**39.87**	**0.11**	5
std	6.63	4.7160	0.0001	-0.03		39.85			
smp14	6.43	4.9037	0.0001			39.78			
std	6.63	4.7162	0.0001	0.01					
smp15	6.40	4.9037	0.0002			39.74			
std	6.63	4.7164	0.0001	0.01	0.02	39.80			
smp15	6.41	4.9045	0.0001	0.07		39.88	**39.83**	**0.12**	5
std	6.66	4.7164	0.0001	-0.04		39.88			
smp15	6.40	4.9045	0.0001			39.84			
std	6.66	4.7168	0.0001	0.12					
smp16	6.29	4.9042	0.0002			39.82			
std	6.65	4.7160	0.0001	-0.05	-0.02	39.86			
smp16	6.29	4.9038	0.0002	0.01		39.86	**39.83**	**0.05**	5
std	6.95	4.7156	0.0001	-0.03		39.84			
smp16	6.56	4.9033	0.0002			39.80			
std	6.90	4.7155	0.0002	0.07					
smp17	6.08	4.9024	0.0002			39.71			
std	6.81	4.7147	0.0001	-0.03	-0.03	39.74			
smp17	6.02	4.9018	0.0003	-0.03		39.73	**39.74**	**0.04**	5
std	6.75	4.7143	0.0001	-0.02		39.75			
smp17	5.99	4.9015	0.0002			39.76			
std	6.73	4.7139	0.0001	0.03					
smp18	6.47	4.9012	0.0003			39.78			
std	6.68	4.7133	0.0001	-0.06	-0.03	39.84			
smp18	6.45	4.9011	0.0002	0.00		39.83	**39.81**	**0.05**	5
std	6.65	4.7133	0.0001	-0.03		39.82			
smp18	6.40	4.9009	0.0003			39.78			
std	6.63	4.7136	0.0001	-0.01					
smp19	6.40	4.9011	0.0002			39.76			
std	6.64	4.7139	0.0001	0.06	0.00	39.70			
smp19	6.40	4.9009	0.0002	-0.04		39.70	**39.73**	**0.06**	5
std	6.64	4.7137	0.0001	-0.04		39.75			
smp19	6.41	4.9011	0.0002			39.76			
std	6.63	4.7138	0.0001	-0.03					
smp20	6.52	4.9015	0.0002			39.79			
std	6.72	4.7141	0.0001	-0.03	0.00	39.81			
smp20	6.53	4.9021	0.0001	0.02		39.81	**39.80**	**0.03**	5
std	6.72	4.7147	0.0001	0.01		39.79			
smp20	6.49	4.9026	0.0002			39.79			
std	6.71	4.7152	0.0001	0.06					
smp21	6.36	4.9027	0.0002			39.76			
std	6.70	4.7152	0.0001	-0.01	0.01	39.76			
smp21	6.31	4.9026	0.0001	0.00		39.74	**39.74**	**0.03**	5
std	6.72	4.7152	0.0002	0.03		39.72			
smp21	6.33	4.9024	0.0001			39.73			
std	6.69	4.7150	0.0001	-0.19					
smp22	6.70	4.9015	0.0002			39.38			
std	6.96	4.7167	0.0001	0.13	0.11	39.35			
smp22	6.80	4.9030	0.0002	0.14		39.47	**39.42**	**0.11**	5
std	7.00	4.7171	0.0001	0.07		39.44			
smp22	6.80	4.9032	0.0002			39.48			
std	7.02	4.7168	0.0001	-0.06					
smp23	6.66	4.9039	0.0001			39.62			
std	6.87	4.7172	0.0001	-0.04	0.02	39.71			
smp23	6.65	4.9051	0.0001	0.07		39.75	**39.70**	**0.10**	5
std	6.91	4.7180	0.0001	0.03		39.72			
smp23	6.64	4.9056	0.0001			39.73			
std	6.92	4.7184	0.0001	0.13					
smp24	6.60	4.9058	0.0002			39.79			
std	6.87	4.7177	0.0001	-0.03	-0.04	39.80			
smp24	6.54	4.9051	0.0001	-0.05		39.78	**39.80**	**0.03**	5
std	6.85	4.7173	0.0001	-0.04		39.81			
smp24	6.57	4.9050	0.0002			39.81			
std	6.85	4.7172	0.0001	0.19					
smp25	7.26	4.9029	0.0003			39.58			
std	6.82	4.7153	0.0001	-0.10	-0.08	39.63			
smp25	7.25	4.9014	0.0002	-0.08		39.58	**39.59**	**0.05**	5
std	6.79	4.7143	0.0001	-0.07		39.61			
smp25	7.24	4.9007	0.0003			39.56			
std	6.79	4.7140	0.0001	-0.08					
smp26	6.56	4.9003	0.0001			39.46			
std	6.25	4.7144	0.0001	-0.05	0.00	39.50			
smp26	6.55	4.9010	0.0002	0.02		39.49	**39.48**	**0.04**	5
std	6.25	4.7153	0.0001	0.04		39.46			
smp26	6.53	4.9016	0.0001			39.47			
std	6.23	4.7158	0.0001						

Table S1b: $^{11}B/^{10}B$ data and $\delta^{11}B$ calculations for 26 different **carbonate samples**

smp/std	**^{11}B (V)**	**$^{11}B/^{10}B$**	**Stderr(abs)**	**$\delta^{11}B_{stab}$ (‰)**	**average $\delta^{11}B_{stab}$**	**$\delta^{11}B_{smp}$ (‰)**	**average $\delta^{11}B_{smp}$**	**2σ**	**n**
std	8.64	4.6475	0.0001						
smp1	7.89	4.5313	0.0003			-25.03			
std	8.70	4.6478	0.0002	-0.11	0.03	-24.91			
smp1	7.91	4.5328	0.0001	0.09		-24.89	**-24.94**	**0.12**	5
std	8.73	4.6491	0.0001	0.11		-24.95	**-24.91**	**0.05**	4
smp1	7.89	4.5334	0.0002			-24.90			
std	8.68	4.6493	0.0002	-0.10					
smp2	7.89	4.5319	0.0004			-25.38			
std	8.84	4.6505	0.0002	-0.17	0.02	-25.17			
smp2	7.96	4.5351	0.0002	0.04		-25.11	**-25.13**	**0.34**	5
std	8.88	4.6533	0.0002	0.20		-25.10	**-25.07**	**0.24**	4
smp2	7.96	4.5379	0.0002			-24.90	**-25.13**	**0.07**	3
std	8.95	4.6542	0.0003	-0.10					
smp3	8.19	4.5402	0.0002			-24.67			
std	8.92	4.6560	0.0002	0.20	0.06	-24.83			
smp3	8.19	4.5405	0.0003	0.02		-24.80	**-24.79**	**0.13**	
std	8.88	4.6560	0.0003	-0.04		-24.79	**-24.81**	**0.04**	4
smp3	8.22	4.5406	0.0002			-24.82			
std	8.89	4.6563	0.0001	0.05					
smp4	7.80	4.5881	0.0001			-14.65			
std	8.86	4.6562	0.0001	-0.02	0.00	-14.67			
smp4	7.79	4.5877	0.0002	0.04		-14.72	**-14.76**	**0.23**	
std	8.96	4.6563	0.0001	-0.02		-14.81	**-14.72**	**0.14**	4
smp4	7.84	4.5870	0.0004			-14.93	**-14.68**	**0.07**	3
std	8.92	4.6567	0.0001	0.05					
smp5	8.48	4.5879	0.0002			-14.76			
std	8.87	4.6565	0.0001	-0.03	0.01	-14.77			
smp5	8.46	4.5876	0.0003	-0.04		-14.81	**-14.78**	**0.08**	5
std	8.85	4.6567	0.0001	0.10		-14.82			
smp5	8.53	4.5877	0.0001			-14.72			
std	8.95	4.6558	0.0002	-0.20					
smp6	7.82	4.5867	0.0003			-14.96			
std	8.92	4.6569	0.0001	0.21	0.10	-15.03			
smp6	7.75	4.5871	0.0002	0.17		-14.89	**-14.97**	**0.13**	
std	8.81	4.6560	0.0001	-0.09		-14.92	**-14.97**	**0.14**	4
smp6	7.81	4.5859	0.0004			-15.03	**-14.93**	**0.07**	3
std	8.93	4.6558	0.0003	-0.08					
smp7	8.20	4.5582	0.0001			-21.04			
std	8.91	4.6564	0.0001	0.09	0.03	-21.10			
smp7	8.16	4.5581	0.0001	0.00		-21.07	**-21.05**	**0.07**	5
std	8.86	4.6561	0.0001	0.00		-21.04			
smp7	8.13	4.5581	0.0001			-21.01			
std	8.94	4.6558	0.0001	0.03					
smp8	8.19	4.5569	0.0001			-21.18			
std	8.86	4.6552	0.0001	-0.04	-0.09	-21.22			
smp8	8.12	4.5559	0.0003	-0.14		-21.31	**-21.25**	**0.10**	
std	8.82	4.6550	0.0001	-0.08		-21.25	**-21.23**	**0.08**	4
smp8	8.08	4.5563	0.0001			-21.27			
std	8.80	4.6555	0.0001	0.11					
smp9	8.36	4.5703	0.0001			-18.26			
std	8.87	4.6550	0.0001	-0.09	0.04	-18.17			
smp9	8.32	4.5706	0.0000	0.09		-18.18	**-18.22**	**0.09**	5
std	8.85	4.6554	0.0000	0.12		-18.27			
smp9	8.36	4.5701	0.0002			-18.24			
std	8.83	4.6546	0.0001	-0.15					
smp10	7.77	4.5690	0.0002			-18.44			
std	8.84	4.6552	0.0001	0.01	0.01	-18.47			
smp10	7.74	4.5694	0.0002	-0.03		-18.48	**-18.45**	**0.06**	5
std	8.82	4.6557	0.0001	0.05		-18.47			
smp10	7.75	4.5701	0.0002			-18.40			
std	8.93	4.6558	0.0001	-0.01					
smp11	8.64	4.5715	0.0001			-18.11			
std	8.89	4.6559	0.0001	0.02	0.00	-18.11			
smp11	8.64	4.5717	0.0001	-0.01		-18.10	**-18.09**	**0.05**	5
std	8.88	4.6559	0.0001	-0.01		-18.07			
smp11	8.59	4.5719	0.0001			-18.05			
std	8.82	4.6560	0.0001	0.06					
smp12	8.18	4.6507	0.0002			-1.09			
std	8.92	4.6555	0.0002	-0.11	0.00	-0.92			
smp12	8.15	4.6518	0.0002	0.07		-0.86	**-0.92**	**0.20**	5
std	8.87	4.6561	0.0001	0.03		-0.87	**-0.87**	**0.07**	4
smp12	8.18	4.6523	0.0002			-0.84			
std	8.95	4.6563	0.0001	-0.04					
smp13	7.92	4.6516	0.0003			-1.09			
std	8.99	4.6570	0.0002	-0.10	0.03	-1.00			

smp13	7.95	4.6530	0.0002	0.07		-1.01	**-1.05**	**0.08**	5
std	9.01	4.6585	0.0001	0.12		-1.09			
smp13	7.98	4.6539	0.0002			-1.04			
std	9.02	4.6589	0.0003	-0.04					
smp14	8.34	4.6553	0.0002			-0.87			
std	9.08	4.6597	0.0001	0.13	0.06	-0.96			
smp14	8.27	4.6553	0.0003	0.01		-0.92	**-0.90**	**0.10**	5
std	9.04	4.6594	0.0001	0.05		-0.90			
smp14	8.26	4.6551	0.0003			-0.83			
std	9.09	4.6586	0.0001	-0.07					
smp15	8.11	4.6548	0.0001			-0.80			
std	9.06	4.6584	0.0001	-0.02	0.04	-0.79			
smp15	8.07	4.6547	0.0001	0.10		-0.79	**-0.84**	**0.14**	5
std	9.00	4.6584	0.0001	0.05		-0.89	**-0.82**	**0.10**	4
smp15	8.07	4.6538	0.0003			-0.94	**-0.79**	**0.02**	3
std	9.07	4.6580	0.0001	-0.36					
smp16	7.86	4.6514	0.0004			-1.72			
std	9.34	4.6609	0.0004	0.37	0.15	-1.96			
smp16	7.94	4.6521	0.0003	-0.05		-1.83	**-1.72**	**0.47**	5
std	9.39	4.6603	0.0005	0.13		-1.77	**-1.82**	**0.20**	4
smp16	7.94	4.6532	0.0002			-1.33	**-1.85**	**0.19**	3
std	9.32	4.6585	0.0004	-0.85					
smp17	8.70	4.6586	0.0003			-0.64			
std	9.34	4.6647	0.0003	0.50	0.30	-0.92			
smp17	8.66	4.6622	0.0004	0.34		-0.70	**-0.79**	**0.23**	5
std	9.28	4.6662	0.0003	0.07		-0.82	**-0.83**	**0.19**	4
smp17	8.56	4.6626	0.0003			-0.88	**-0.87**	**0.10**	3
std	9.27	4.6671	0.0001	0.17					
smp18	9.17	4.6622	0.0004			-0.99			
std	9.26	4.6665	0.0002	-0.04	0.04	-0.83			
smp18	9.11	4.6629	0.0002	0.13		-0.72	**-0.80**	**0.22**	5
std	9.16	4.6662	0.0002	0.03		-0.75	**-0.76**	**0.10**	4
smp18	9.13	4.6624	0.0002			-0.74	**-0.73**	**0.02**	3
std	9.19	4.6656	0.0001	0.04					
smp19	9.09	4.6605	0.0002			-0.99			
std	9.20	4.6647	0.0002	0.02	-0.06	-1.08			
smp19	9.08	4.6588	0.0004	-0.19		-1.14	**-1.02**	**0.18**	5
std	9.22	4.6636	0.0004	-0.02		-1.01	**-1.05**	**0.13**	4
smp19	9.10	4.6589	0.0003			-0.90	**-1.03**	**0.09**	3
std	9.18	4.6626	0.0002	-0.25					
smp20	8.91	4.6605	0.0003			-0.59			
std	9.14	4.6640	0.0001	0.27	0.11	-0.81			
smp20	8.90	4.6599	0.0001	0.07		-0.75	**-0.74**	**0.17**	5
std	9.13	4.6628	0.0001	0.00		-0.77	**-0.78**	**0.05**	4
smp20	8.82	4.6586	0.0002			-0.78			
std	9.07	4.6617	0.0001	0.00					
smp21	10.90	4.5620	0.0002			-21.27			
std	8.98	4.6606	0.0001	-0.06	0.03	-21.28			
smp21	10.82	4.5608	0.0002	0.00		-21.34	**-21.32**	**0.11**	5
std	8.97	4.6600	0.0001	0.15		-21.41			
smp21	10.91	4.5597	0.0002			-21.33			
std	8.99	4.6580	0.0001	-0.07					
smp22	9.83	4.5579	0.0001			-21.36			
std	8.95	4.6567	0.0001	-0.16	0.02	-21.26			
smp22	9.78	4.5575	0.0001	0.10		-21.31	**-21.38**	**0.20**	5
std	8.90	4.6568	0.0001	0.12		-21.46	**-21.35**	**0.17**	4
smp22	9.90	4.5563	0.0001			-21.49	**-21.31**	**0.10**	3
std	9.02	4.6559	0.0001	0.00					
smp23	10.24	4.5555	0.0002			-21.44			
std	8.91	4.6549	0.0001	-0.05	-0.01	-21.37			
smp23	10.24	4.5552	0.0002	0.00		-21.36	**-21.37**	**0.10**	5
std	8.95	4.6544	0.0001	0.03		-21.35			
smp23	10.24	4.5549	0.0001			-21.30			
std	8.93	4.6536	0.0001	-0.01					
smp24	10.42	4.6502	0.0002			-0.67			
std	8.94	4.6530	0.0001	-0.04	0.00	-0.60			
smp24	10.41	4.6502	0.0001	0.00		-0.57	**-0.58**	**0.13**	5
std	8.92	4.6527	0.0001	0.03		-0.55	**-0.56**	**0.09**	4
smp24	10.39	4.6501	0.0002			-0.50	**-0.58**	**0.05**	3
std	8.92	4.6521	0.0001	0.01					
smp25	10.22	4.6489	0.0002			-0.61			
std	8.97	4.6515	0.0001	-0.05	0.01	-0.48			
smp25	10.19	4.6495	0.0001	0.11		-0.40	**-0.48**	**0.16**	5
std	8.89	4.6513	0.0001	-0.03		-0.43	**-0.45**	**0.08**	4
smp25	10.12	4.6491	0.0001			-0.49	**-0.44**	**0.08**	3
std	8.89	4.6514	0.0001	0.15					
smp26	10.76	4.6484	0.0002			-0.50			
std	8.49	4.6501	0.0001	-0.10	-0.04	-0.41			
smp26	10.77	4.6480	0.0002	-0.02		-0.42	**-0.43**	**0.07**	5
std	8.45	4.6498	0.0001	-0.02		-0.41			
smp26	10.80	4.6477	0.0002			-0.43			
std	8.51	4.6496	0.0001						

Table S1c: $^{11}B/^{10}B$ data and $\delta^{11}B$ calculations for 28 different **river water samples**

smp/std	^{11}B (V)	$^{11}B/^{10}B$	Stderr(abs)	$\delta^{11}B_{stab}$ (‰)	average $\delta^{11}B_{stab}$	$\delta^{11}B_{smp}$ (‰)	average $\delta^{11}B_{smp}$	2σ	n
std	4.26	4.7597	0.0001						
smp1	6.06	4.7652	0.0006			3.54			
std	4.54	4.7371	0.0002	-2.01	-0.64	5.86			
smp1	5.97	4.7645	0.0005	0.19		6.17	5.63	2.37	5
std	4.54	4.7335	0.0001	-0.08		6.28	6.16	0.41	4
smp1	6.05	4.7620	0.0004			6.32	6.26	0.16	3
std	4.60	4.7307	0.0002	-0.07					
smp2	4.66	4.7581	0.0004			6.01			
std	4.57	4.7286	0.0002	0.05	0.03	5.95			
smp2	4.65	4.7554	0.0004	-0.03		5.95	5.99	0.09	5
std	4.45	4.7260	0.0002	0.06		5.97			
smp2	4.60	4.7530	0.0003			6.06			
std	4.63	4.7229	0.0002	-0.17					
smp3	4.24	4.7564	0.0003			7.27			
std	4.66	4.7213	0.0001	-0.16	0.01	7.36			
smp3	4.21	4.7557	0.0001	0.02		7.28	7.27	0.12	5
std	4.53	4.7213	0.0001	0.16		7.19	7.25	0.08	4
smp3	4.17	4.7548	0.0001			7.25			
std	4.52	4.7198	0.0002	0.15					
smp4	3.92	4.7584	0.0004			8.48			
std	4.50	4.7169	0.0002	-0.06	-0.01	8.44			
smp4	3.91	4.7550	0.0003	-0.10		8.33	8.41	0.14	5
std	4.48	4.7146	0.0001	0.12		8.33	8.42	0.13	4
smp4	3.89	4.7527	0.0003			8.45	8.46	0.04	3
std	4.52	4.7111	0.0001	-0.37					
smp5	5.17	4.7336	0.0002			4.78			
std	4.48	4.7111	0.0002	0.16	-0.02	4.59			
smp5	5.14	4.7319	0.0002	-0.12		4.57	4.66	0.16	5
std	4.54	4.7097	0.0001	-0.10		4.67	4.62	0.10	4
smp5	5.23	4.7314	0.0003			4.67	4.64	0.09	3
std	4.47	4.7091	0.0002	0.18					
smp6	6.33	4.7336	0.0003			5.45			
std	4.71	4.7068	0.0003	-0.06	-0.12	5.49			
smp6	6.37	4.7316	0.0001	-0.19		5.46	5.55	0.22	
std	4.66	4.7051	0.0001	-0.11		5.63	5.51	0.17	4
smp6	6.23	4.7315	0.0002			5.69	5.47	0.04	3
std	4.61	4.7044	0.0002	0.01					
smp7	5.98	4.7281	0.0003			5.13			
std	4.67	4.7036	0.0001	0.01	0.01	5.06			
smp7	6.16	4.7267	0.0002	0.00		5.00	5.01	0.17	5
std	4.59	4.7028	0.0002	0.04		4.94	4.98	0.12	4
smp7	6.01	4.7253	0.0003			4.92	4.95	0.08	3
std	4.67	4.7016	0.0001	-0.01					
smp8	6.50	4.7239	0.0003			4.87			
std	4.62	4.7004	0.0002	0.02	-0.05	4.86			
smp8	6.37	4.7227	0.0002	-0.09		4.88	4.92	0.15	5
std	4.63	4.6991	0.0001	-0.08		4.99	4.90	0.12	4
smp8	6.32	4.7224	0.0003			5.02	4.87	0.02	3
std	4.62	4.6985	0.0001	0.03					
smp9	5.74	4.7254	0.0003			5.81			
std	4.63	4.6977	0.0001	-0.05	-0.08	5.76			
smp9	5.83	4.7241	0.0002	-0.20		5.66	5.77	0.15	5
std	4.65	4.6973	0.0002	0.02		5.76	5.80	0.11	4
smp9	5.83	4.7247	0.0002			5.87	5.78	0.06	3
std	4.63	4.6968	0.0001	0.01					
smp10	6.12	4.7204	0.0002			5.08			
std	4.61	4.6963	0.0002	-0.13	0.01	5.22			
smp10	5.92	4.7212	0.0002	0.09		5.23	5.16	0.12	5
std	4.55	4.6970	0.0002	0.08		5.14	5.18	0.10	4
smp10	6.03	4.7211	0.0002			5.14	5.12	0.07	3
std	4.68	4.6969	0.0002	0.06					
smp11	5.92	4.7216	0.0002			5.33			
std	4.57	4.6963	0.0002	0.01	0.04	5.41			
smp11	5.89	4.7218	0.0002	0.16		5.50	5.40	0.16	5
std	4.75	4.6955	0.0002	-0.06		5.44	5.37	0.12	4
smp11	5.95	4.7204	0.0002			5.31	5.39	0.11	3
std	4.67	4.6954	0.0003	0.07					
smp12	5.76	4.7219	0.0004			5.75			
std	4.72	4.6946	0.0001	-0.01	-0.08	5.82			
smp12	5.82	4.7218	0.0002	-0.03		5.88	5.85	0.16	5
std	4.57	4.6939	0.0002	-0.20		5.96	5.82	0.11	4
smp12	5.96	4.7219	0.0002			5.84	5.85	0.06	3
std	4.62	4.6950	0.0001	0.21					
smp13	5.74	4.7224	0.0002			5.92			
std	4.75	4.6942	0.0001	-0.14	-0.03	5.98			

smp13	5.65	4.7222	0.0002	0.00		5.90	**5.88**	**0.17**	5
std	4.72	4.6948	0.0002	0.04		5.81	**5.91**	**0.14**	4
smp13	5.64	4.7220	0.0002			5.77	**5.88**	**0.12**	3
std	4.78	4.6950	0.0001	0.05					
smp14	5.60	4.7234	0.0001			6.08			
std	4.68	4.6947	0.0002	-0.05	-0.07	6.08			
smp14	5.59	4.7231	0.0002	-0.16		6.03	**6.11**	**0.16**	5
std	4.65	4.6949	0.0002	0.01		6.13	**6.08**	**0.09**	4
smp14	5.51	4.7243	0.0002			6.25	**6.06**	**0.06**	3
std	4.71	4.6950	0.0002	0.17					
smp15	6.07	4.7208	0.0003			5.65			
std	4.89	4.6935	0.0002	-0.20	-0.04	5.75			
smp15	6.20	4.7201	0.0002	-0.02		5.64	**5.64**	**0.15**	5
std	4.76	4.6939	0.0002	0.11		5.56	**5.61**	**0.09**	4
smp15	6.43	4.7197	0.0003			5.58	**5.59**	**0.09**	3
std	4.91	4.6932	0.0002	-0.01					
smp16	7.25	4.7178	0.0003			5.30			
std	4.89	4.6927	0.0002	0.07	-0.11	5.13			
smp16	7.53	4.7157	0.0002	-0.22		5.03	**5.14**	**0.20**	5
std	5.09	4.6915	0.0002	-0.17		5.15	**5.10**	**0.11**	4
smp16	7.53	4.7156	0.0003			5.10	**5.13**	**0.06**	3
std	5.08	4.6919	0.0002	0.13					
smp17	7.02	4.7178	0.0002			5.61			
std	5.35	4.6911	0.0001	-0.08	-0.07	5.59			
smp17	7.31	4.7168	0.0002	-0.13		5.50	**5.56**	**0.09**	5
std	5.28	4.6910	0.0002	0.00		5.54			
smp17	7.32	4.7170	0.0002			5.58			
std	5.31	4.6908	0.0002	0.06					
smp18	6.85	4.7173	0.0003			5.73			
std	5.33	4.6901	0.0001	0.02	0.00	5.73			
smp18	7.06	4.7167	0.0003	-0.01		5.75	**5.75**	**0.05**	5
std	5.33	4.6893	0.0001	-0.01		5.77			
smp18	7.00	4.7161	0.0002			5.79			
std	5.31	4.6885	0.0002	-0.18					
smp19	6.91	4.7162	0.0002			5.80			
std	5.27	4.6894	0.0002	0.10	0.07	5.72			
smp19	6.99	4.7163	0.0002	0.03		5.74	**5.76**	**0.07**	5
std	5.23	4.6894	0.0002	0.07		5.73			
smp19	6.90	4.7161	0.0002			5.79			
std	5.30	4.6886	0.0002	-0.14					
smp20	6.21	4.7169	0.0001			5.97			
std	5.23	4.6892	0.0002	0.03	0.06	5.98			
smp20	6.31	4.7175	0.0003	0.07		6.03	**6.00**	**0.05**	5
std	5.22	4.6894	0.0004	0.06		6.00			
smp20	6.26	4.7175	0.0002			6.03			
std	5.19	4.6890	0.0001	-0.07					
smp21	7.10	4.7137	0.0002			5.24			
std	5.13	4.6893	0.0001	0.02	-0.03	5.22			
smp21	7.17	4.7138	0.0002			5.21	**5.22**	**0.03**	3
std	5.13	4.6894	0.0002	-0.08					
smp21	0.01	3.7470							
std	5.33	4.6903	0.0001	0.20					
smp22	7.09	4.7170	0.0003			5.81			
std	5.48	4.6893	0.0002	-0.05	-0.04	5.86			
smp22	7.18	4.7165	0.0002	-0.03		5.85	**5.85**	**0.05**	5
std	5.56	4.6888	0.0001	-0.05		5.88			
smp22	7.21	4.7162	0.0002			5.86			
std	5.55	4.6887	0.0003	-0.20					
smp23	5.71	4.6893	0.0002			-0.06			
std	5.24	4.6904	0.0003	0.17	0.09	-0.10			
smp23	5.67	4.6907	0.0002	0.17		0.03	**-0.05**	**0.12**	5
std	5.24	4.6906	0.0003	-0.07		-0.01	**-0.07**	**0.10**	4
smp23	5.57	4.6905	0.0002			-0.13	**-0.06**	**0.08**	3
std	5.13	4.6915	0.0001	0.12					
smp24	5.74	4.6908	0.0002			-0.14			
std	5.16	4.6913	0.0002	-0.01	-0.02	-0.10			
smp24	5.77	4.6909	0.0002	0.05		-0.08	**-0.13**	**0.11**	5
std	5.11	4.6912	0.0002	-0.09		-0.10	**-0.10**	**0.05**	4
smp24	5.61	4.6905	0.0002			-0.21			
std	4.99	4.6919	0.0002	0.02					
smp25	5.84	4.6923	0.0002			0.02			
std	5.09	4.6924	0.0002	0.09	0.07	-0.06			
smp25	5.85	4.6920	0.0002	0.03		-0.06	**-0.05**	**0.08**	5
std	5.10	4.6921	0.0002	0.07		-0.09			
smp25	5.94	4.6914	0.0002			-0.04			
std	5.21	4.6911	0.0002	-0.16					
smp26	1.48	4.6816	0.0002			-2.07			
std	5.27	4.6916	0.0002	0.11	-0.01	-2.17			
smp26	1.48	4.6813	0.0002	-0.03		-2.16	**-2.14**	**0.09**	5
std	5.21	4.6911	0.0001	-0.10		-2.12			
smp26	1.45	4.6811	0.0002			-2.18			
std	5.18	4.6916	0.0002	-0.04					

smp27	1.48	4.6819	0.0002			-2.16			
std	5.07	4.6924	0.0002	0.08	0.04	-2.13			
smp27	1.47	4.6829	0.0002	0.03		-2.03	**-2.03**	**0.24**	5
std	5.06	4.6925	0.0002	0.00		-1.95	**-1.99**	**0.22**	4
smp27	1.47	4.6837	0.0002			-1.87	**-2.04**	**0.19**	3
std	4.92	4.6925	0.0003	-0.05					
smp28	1.48	4.6835	0.0002			-1.98			
std	5.09	4.6930	0.0003	0.07	0.04	-2.02			
smp28	1.49	4.6836	0.0002	0.06		-1.98	**-2.00**	**0.04**	5
std	5.05	4.6929	0.0002	0.00		-2.01			
smp28	1.47	4.6833	0.0002			-2.03			
std	5.04	4.6927	0.0002						

S2. Blank correction and $\delta^{11}B_{blank}$ determination

SRM 951 solutions, at concentrations between 1 and 400 ppb, were measured by sample standard bracketing (SSB) with a SRM 951 solution at a concentration of 200 ppb. The HNO_3 0.05 N "blank" solution was measured between each B solution. Measured $\delta^{11}B$ are represented in Figure 6 of the manuscript against [B] (B concentration), with and without blank correction, as well as in Figure S1 hereby.

For blank correction we used the following equation:

$$({}^{11}B/{}^{10}B)_{corr} = \{({}^{11}B/{}^{10}B)_{sol} - ({}^{11}B/{}^{10}B)_{blk} \times {}^{10}B_{blk}/{}^{10}B_{sol}\} / (1 - {}^{10}B_{blk}/{}^{10}B_{sol}) \qquad \text{(eq. S1)}$$

which is directly derived from:

$$({}^{11}B/{}^{10}B)_{corr} = ({}^{11}B_{sol} - {}^{11}B_{blk}) / ({}^{10}B_{sol} - {}^{10}B_{blk}) \qquad \text{(eq. S2)}$$

Practically, average ${}^{10}B_{blk}$ and $({}^{11}B/{}^{10}B)_{blk}$ values of the blank just after and before the measured sample or standard solution are used to calculate $({}^{11}B/{}^{10}B)_{corr}$.

Table S2

Data for SRM 951 solution at concentrations between 1 and 400 ppb, bracketed by SRM 951 solution at 200 ppb. $\delta^{11}B$ values are average of the 5 $\delta^{11}B_{smp}$ values calculated from uncorrected and blank-corrected ${}^{11}B/{}^{10}B$ ratios.

$[B]_{smp}$ ppb	$\delta^{11}B_{smp}$ (‰)	2σ	$\delta^{11}B_{corr}$ (‰)	2σ
200	0.06	0.09	0.05	0.09
1	-21.50	4.67	1.09	2.89
5	-5.32	1.08	0.47	1.16
10	-3.12	0.70	0.42	1.98
25	-1.62	0.25	-0.12	0.21
50	-0.65	0.06	-0.04	0.09
100	-0.24	0.02	-0.07	0.07
200	0.02	0.07	0.01	0.08
400	0.03	0.02	0.02	0.03
200	-0.03	0.06	-0.03	0.04

From these data, $\delta^{11}B$ and [B] of the blank are estimated from a mixing equation between boron in the sample solution and residual boron in the blank.

$$\delta^{11}B_{meas} = \alpha\, \delta^{11}B_{true} + (1-\alpha)\, \delta^{11}B_{blk} \qquad \text{(eq. S3)}$$

where $\alpha = [B]_{smp} /([B]_{smp} + [B]_{blk})$

In our case, $\delta^{11}B_{true}$ is 0‰, as the same SRM 951 boron solution is measured, only the concentrations are different. Thus equation S3 can be simply written as:

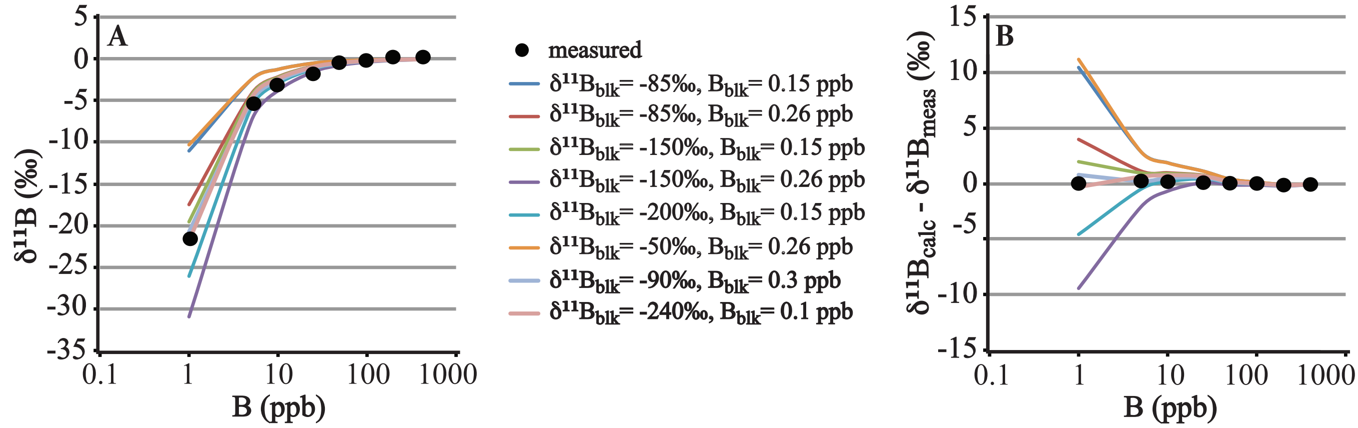
$$\delta^{11}B_{meas} = \{[B]_{blk} /([B]_{smp} + [B]_{blk})\} \times \delta^{11}B_{blk} \qquad \text{(eq. S4)}$$

From this equation, we estimated possible values of $\delta^{11}B_{blk}$ and $[B]_{blk}$ that could explain the trend in Figure 6 for uncorrected $\delta^{11}B$ values against $[B]_{smp}$. An infinite number of solutions exists but we can put some constraints on these two values. By bracketing blank solution with SRM 951 solutions of low [B] (1, 5 and 10 ppb), $\delta^{11}B_{blk}$ value was between -85 and -150‰, and $[B]_{blk}$ between 150 and 260 ppt.

Some possible values have been plotted on Figure S1, which is similar to Fig. 6.

Figure S1

Mixing simulations between a SRM 951 solution (concentrations between 1 and 400 ppb, and $\delta^{11}B$ of 0‰) and an instrumental blank with $\delta^{11}B_{blk}$ between -50 and -250‰ and $[B]_{blk}$ between 0.1 and 0.3 ppb, in order to define the possible values of $\delta^{11}B_{blk}$ and $[B]_{blk}$ that best fit the measured $\delta^{11}B$, uncorrected from blank, as a function of B concentration in the solution (all solutions were measured by SSB against a 200 ppb B SRM 951 solution). A: plot of the calculated (coloured curves) and measured (black dots) $\delta^{11}B$ values versus B concentration of the standard solution. B: plot of the differences between calculated and measured $\delta^{11}B$ versus B concentration of the standard solution for different $\delta^{11}B_{blk}$ and $[B]_{blk}$ values.

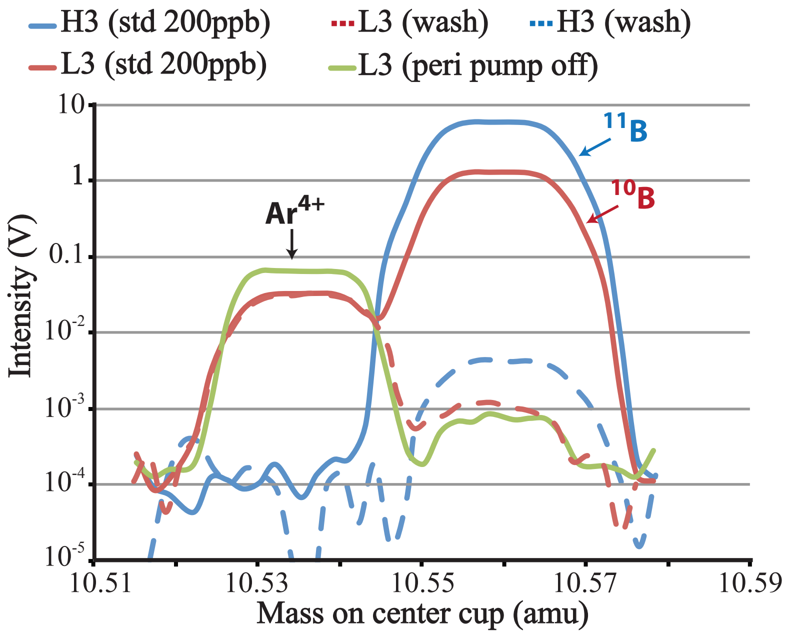


Reasonable values of $\delta^{11}B_{blk}$ and $[B]_{blk}$ to explain the observed trend are between -90‰ and 0.3 ppb, and -240‰ and 0.1 ppb. The lower $[B]_{blk}$ is, the lower $\delta^{11}B_{blk}$ has to be to explain the observed mixing trend.

Ar^{4+} interference on ^{10}B cannot explain the low $\delta^{11}B_{blk,}$ as can be observed on the following mass scans.

Figure S2

Low-resolution mass scan over Ar^{4+}, ^{10}B and ^{11}B in a SRM 951 solution at 200 ppb, in a wash solution, and with the peristaltic pump off. Turning it off improves the, Ar^{4+} peak shape, as the plasma is not in extra wet conditions anymore. Signal intensities on Faraday cups L3 (Ar^{4+} and ^{10}B) and H3 (^{11}B) are shown. X-axis represents the mass range on the center cup.



Scans on Faraday cup L3 show that the Ar^{4+} peak is well separated from ^{10}B peak, and that no significant contribution from Ar^{4+} is measured on L3 at mass 10.56 (center cup mass).

S3. Reproducibility of chemical separations

Reproducibility of boron chemical extraction is reported here for 4 different sample types (river water, coral-COM4, seawater-NASS5, and basalt-JB2). Preparation steps are not identical for all samples. In particular, carbonates (e.g. coral here) are dissolved in HNO_3 0.5 N, while rocks and soils samples (basalt JB2 here) are digested by alkaline fusion; solutions are passed through a cationic exchange column AG-50X8, and then through two successive Amberlite IRA-743 columns (with volumes of 50 and 10 µL) to separate and purify boron. River and seawater samples are directly passed on 50 µL Amberlite columns.

Table S3

Reproducibility of chemical separations for 4 different types of samples: river water, coral (COM4), seawater and basalt (reference material JB2). Each sample was processed at least 4 times and the reproducibility of the chemical separation (in red) for each type of sample is given as 2SD value over measured $\delta^{11}B_{smp}$ values. For seawater samples, 2 $\delta^{11}B_{smp}$ values were considered as outliers (in italic blue); average and 2SD were determined on only 10 $\delta^{11}B$ values over 12.

	$\delta^{11}B_{smp}$ (‰)	**2SD**
Seawater_smp1	40.02	0.28
Seawater_smp2	39.76	0.13
Seawater_smp3	39.87	0.04
Seawater_smp4	39.81	0.03
Seawater_smp5	39.85	0.05
Seawater_smp6	39.90	0.08
Seawater_smp7	39.88	0.19
Seawater_smp8	39.72	0.12
Seawater_smp9	*36.45*	*0.22*
Seawater_smp10	*39.49*	*0.22*
Seawater_smp11	39.65	0.03
Seawater_smp12	39.81	0.06
average	***39.83***	***0.20***
River_smp1	8.71	0.60
River_smp2	8.85	0.43
River_smp3	8.72	0.29
River_smp4	9.03	0.57
average	***8.83***	***0.30***
Coral_smp1	25.10	0.30
Coral_smp2	25.13	0.14
Coral_smp3	24.80	0.27
Coral_smp4	25.04	0.15
average	***25.02***	***0.30***
JB2_smp1	6.91	0.21
JB2_smp2	6.97	0.26
JB2_smp3	7.42	0.15
JB2_smp4	7.07	0.13
JB2_smp5	7.28	0.04
JB2_smp6	7.49	0.37
JB2_smp7	7.51	0.05
JB2_smp8	7.35	0.59
average	***7.25***	***0.47***