

Supplementary Material

Geochemical factors affecting the solubility of copper in seawater

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Table S1. The mean and standard deviation of dissolved copper ($\mu\text{g L}^{-1}$) measured in the solubility treatments over 28 days

Treatment	Duration in seawater (days)										
	0	0.04	0.3	1	2	3	4	7	14	21	28
Natural seawater											
	Dissolved copper, $\mu\text{g L}^{-1}$										
	Mean										
0.5 mg L ⁻¹	479	483	463	462	456	455	439	451	452	447	446
1 mg L ⁻¹	810	797	716	700	683	677	636	666	660	655	654
2 mg L ⁻¹	975	915	852	836	803	799	760	755	757	503	498
5 mg L ⁻¹	1180	1064	897	888	852	851	822	745	774	581	322
10 mg L ⁻¹	903	1008	837	805	735	577	560	255	127	99	66
20 mg L ⁻¹	745	798	653	556	460	289	256	314	163	118	53
	Standard Deviation										
0.5 mg L ⁻¹	9	4	23	23	23	23	25	23	25	23	32
1 mg L ⁻¹	74	49	108	96	84	79	70	72	66	62	62
2 mg L ⁻¹	76	37	45	26	26	11	21	26	47	328	318
5 mg L ⁻¹	396	90	91	98	96	76	72	110	68	307	366
10 mg L ⁻¹	517	48	75	28	79	38	128	90	11	14	12
20 mg L ⁻¹	423	57	47	43	74	12	7	161	14	4	2
Artificial seawater											
	Mean										
0.5 mg L ⁻¹	476	476	479	476	473	478	-	469	462	472	466
1 mg L ⁻¹	824	815	793	778	772	768	-	750	748	786	624
2 mg L ⁻¹	1020	913	872	844	835	809	-	792	729	132	414
5 mg L ⁻¹	1250	987	925	846	847	817	826	795	406	122	141
10 mg L ⁻¹	1040	888	855	752	736	761	750	727	220	203	213
20 mg L ⁻¹	896	816	763	696	683	688	-	668	281	-	202
	Standard Deviation										
0.5 mg L ⁻¹	1	1	0	3	2	4	-	9	8	8	10
1 mg L ⁻¹	115	86	77	73	66	67	-	58	67	6	149
2 mg L ⁻¹	144	62	31	48	27	25	-	38	123	47	308
5 mg L ⁻¹	144	47	51	28	45	25	17	39	314	26	44
10 mg L ⁻¹	15	27	31	44	43	17	21	42	28	20	55
20 mg L ⁻¹	34	29	29	18	23	20	-	2	13	-	10

Table S2. The mass of precipitate measured over time in natural and artificial seawater spiked with 20 mg L⁻¹ total copper

Seawater type	Duration (h)	Measured precipitate concentration in solution (mg L⁻¹)
Natural seawater	1	36.4
Natural seawater	7	33.8
Natural seawater	28	32.1
Artificial seawater	1	36.5
Artificial seawater	7	34.3
Artificial seawater	28	31.6

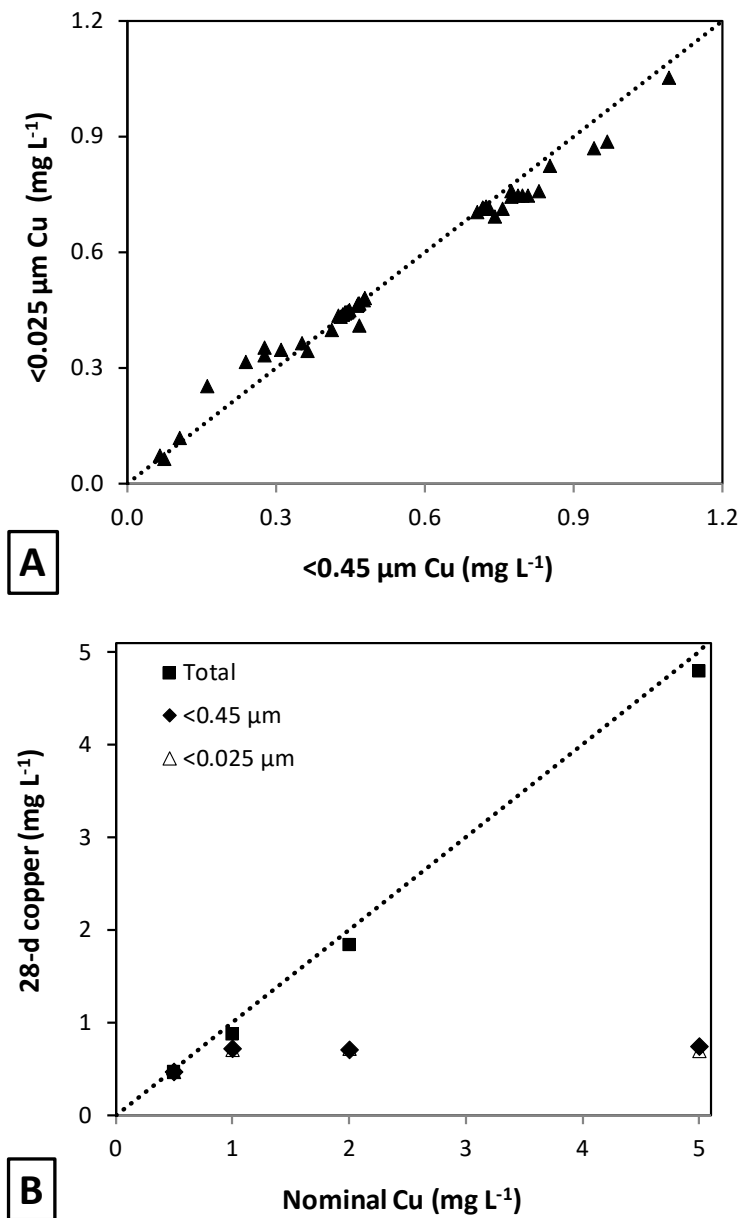


Figure S1. The relationship between (A) measured concentrations of copper in the 0.025 and 0.45 μm filtered fractions for all time points, and (B) comparison of the 28-d concentrations of the total, $<0.45 \mu\text{m}$ and $<0.025 \mu\text{m}$ copper, where the unity line indicates the nominal concentration of copper spiked into solution

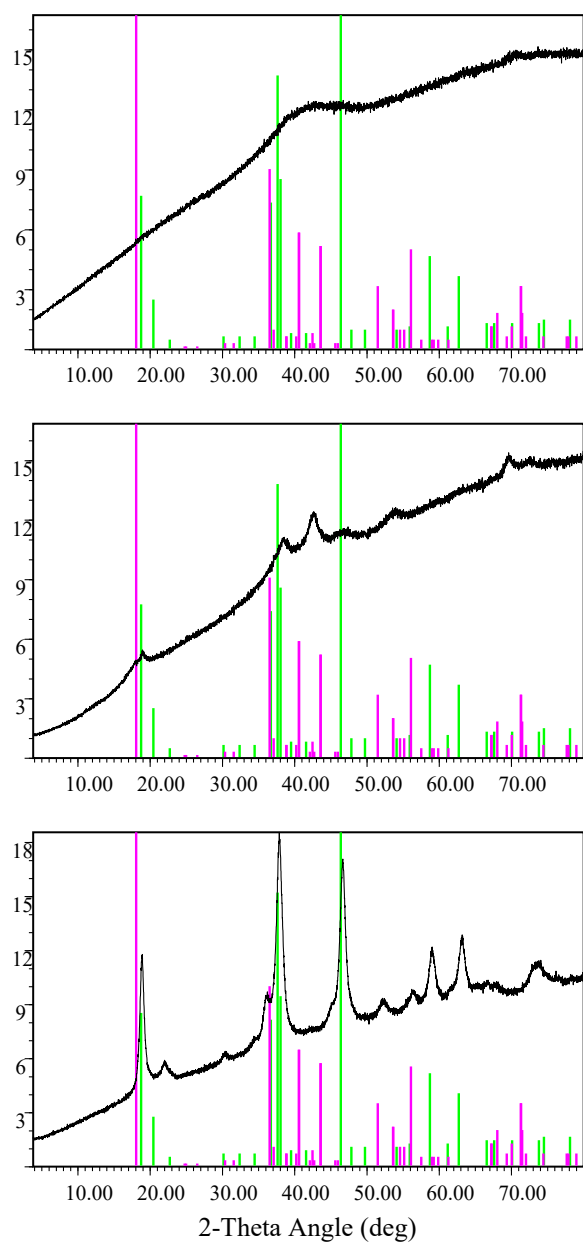


Figure S2. XRD diffractograms of the precipitate formed in natural seawater after 1 (left), 7 (centre) and 28 (right) days. The vertical green and pink lines represent the expected intensities of the clinooatcamite polymorphs atacamite and botallackite, respectively.

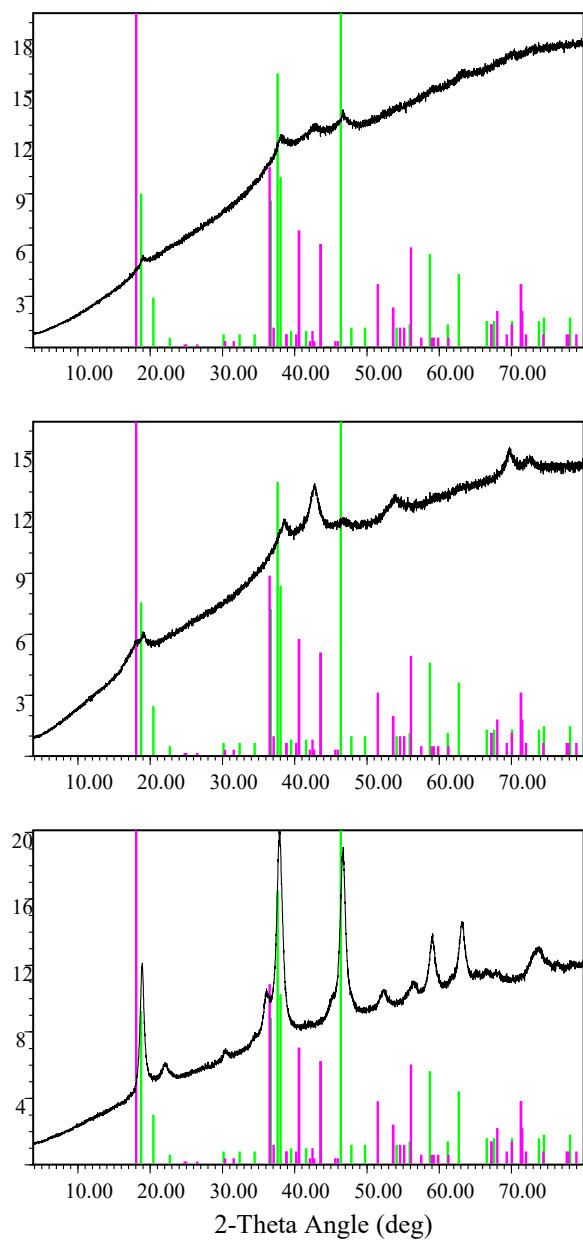


Figure S3. XRD diffractograms of the precipitate formed in artificial seawater after 1 (left), 7 (centre) and 28 (right) days. The vertical green and pink lines represent the expected intensities of the clinooatcamite polymorphs atacamite and botallackite, respectively.

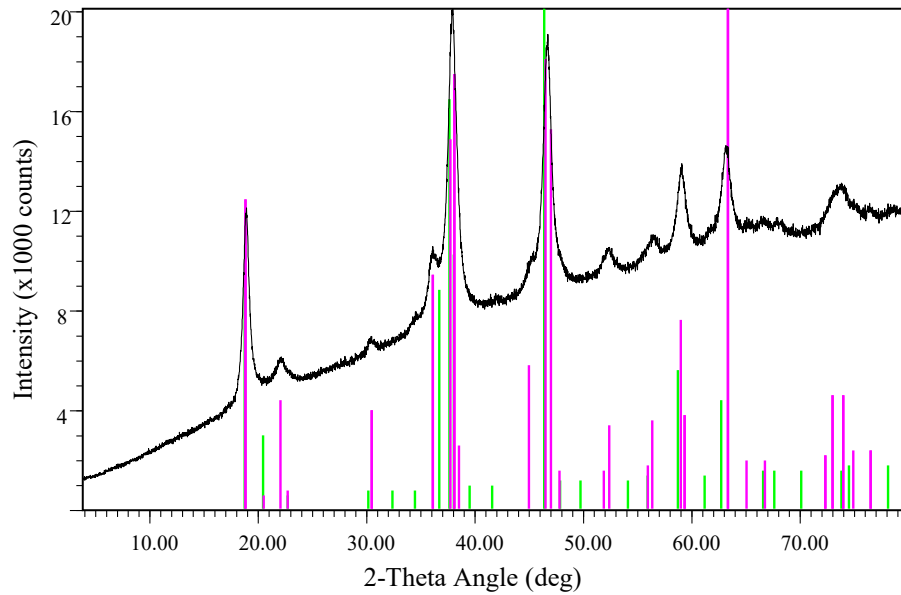


Figure S4. XRD diffractogram of the precipitate formed after 28 days in artificial seawater. The vertical green and pink lines represent the expected intensities of the polymorphs atacamite and clinoatacamite, respectively, and indicate that clinoatacamite predominates.