Supplementary materials

Magnesium Coprecipitation with Calcite at Low Supersaturation: Implications for Mg-enriched Water in Calcareous Soils

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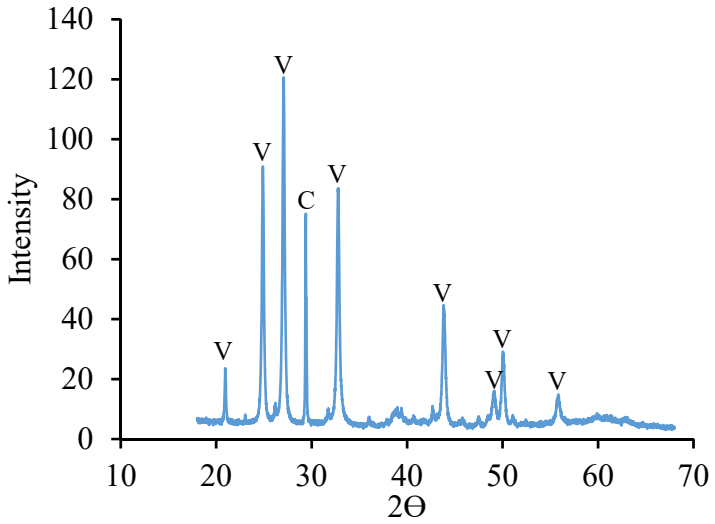
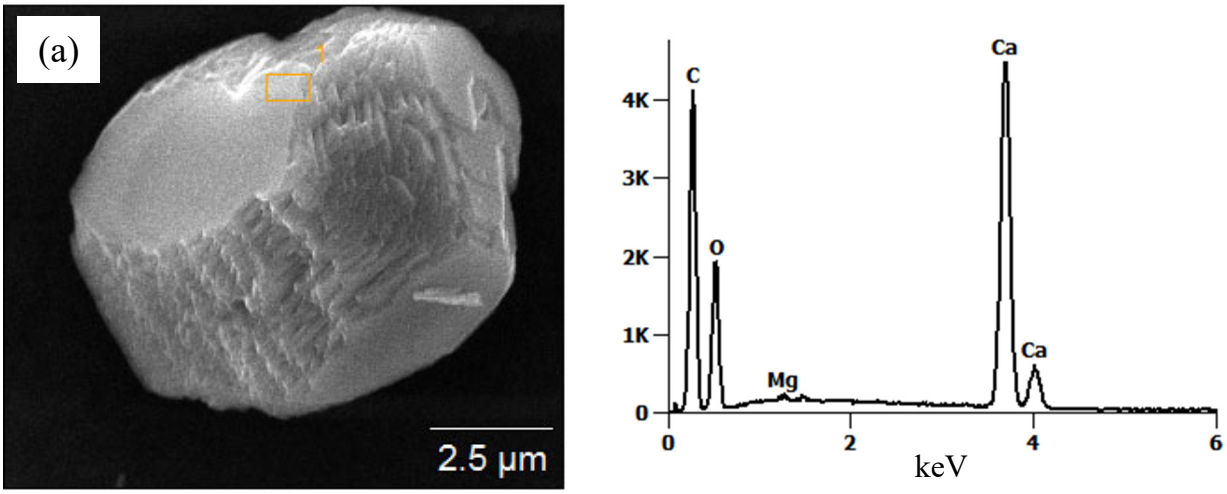
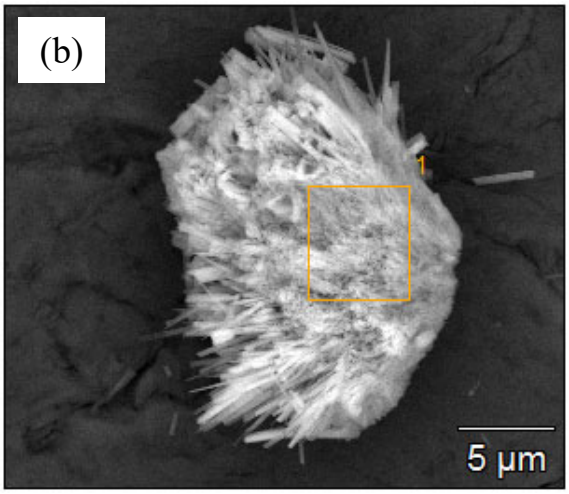
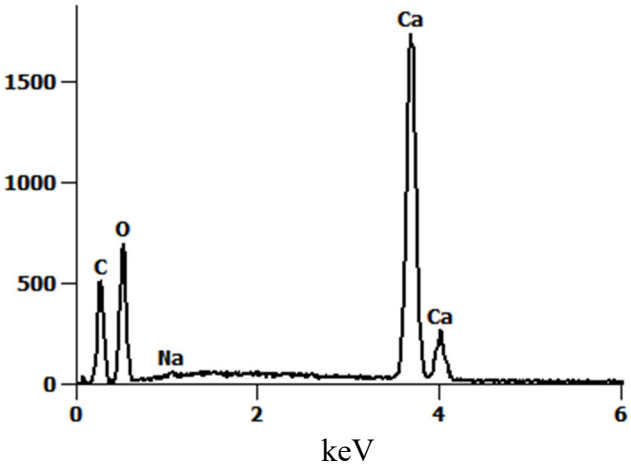
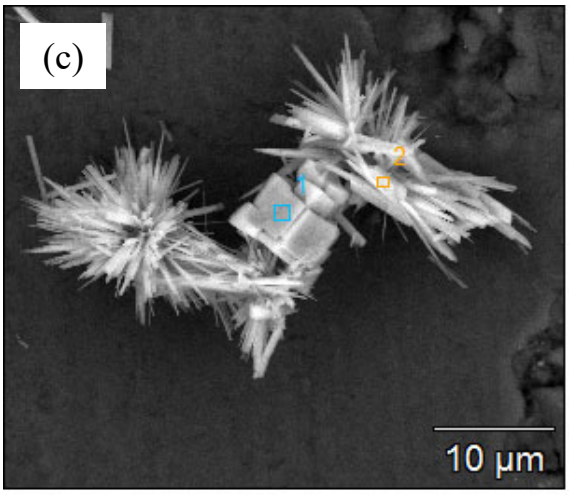


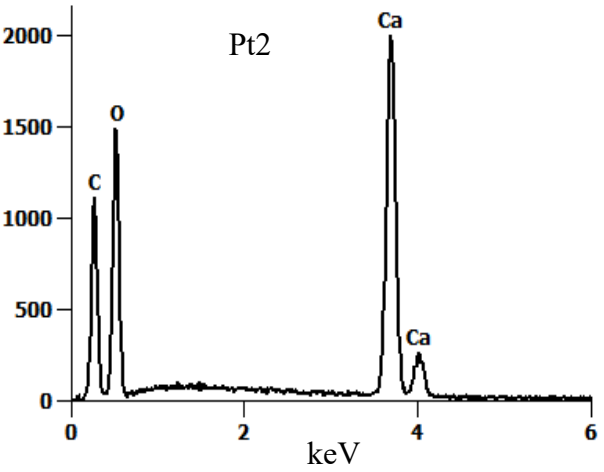
Figure S1. X-ray diffraction pattern (XRD) of the synthesized vaterite. V and C denote the diffraction peaks assigned to vaterite and calcite, respectively. Rietveld analysis shows that about 98% of the solid phase is vaterite. The remaining 2% are calcite.

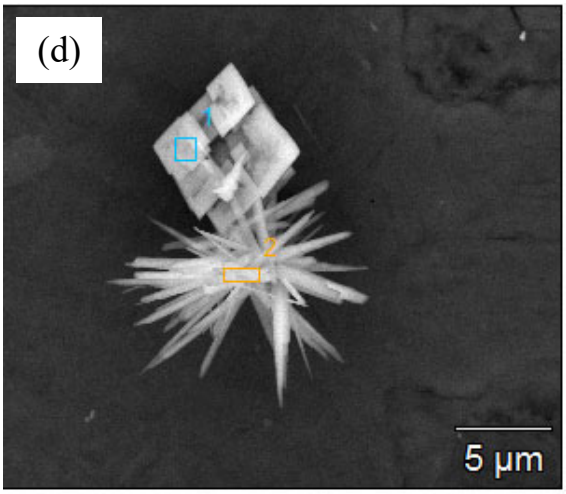


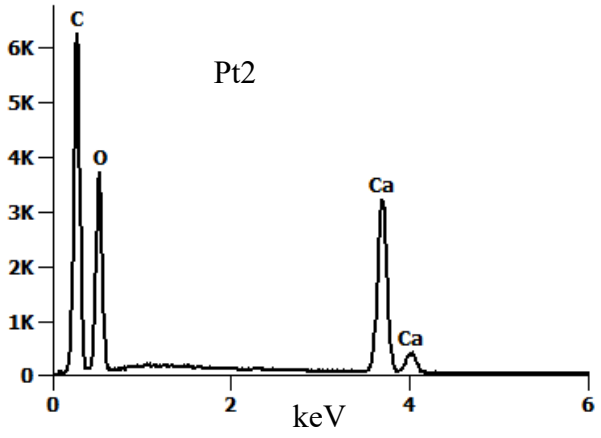

(b)
1
5 µm


Ca
1500
1000
O
C
500
Ca
Na
0
0
2
4
6
keV


(c)
2
1
10 µm


Pt2
Ca
2000
1500
O
C
1000
500
Ca
0
0
2
4
6
keV


(d)
1
2
5 µm


C
Pt2
6K
5K
4K
O
Ca
3K
2K
1K
Ca
0
0
2
4
6
keV

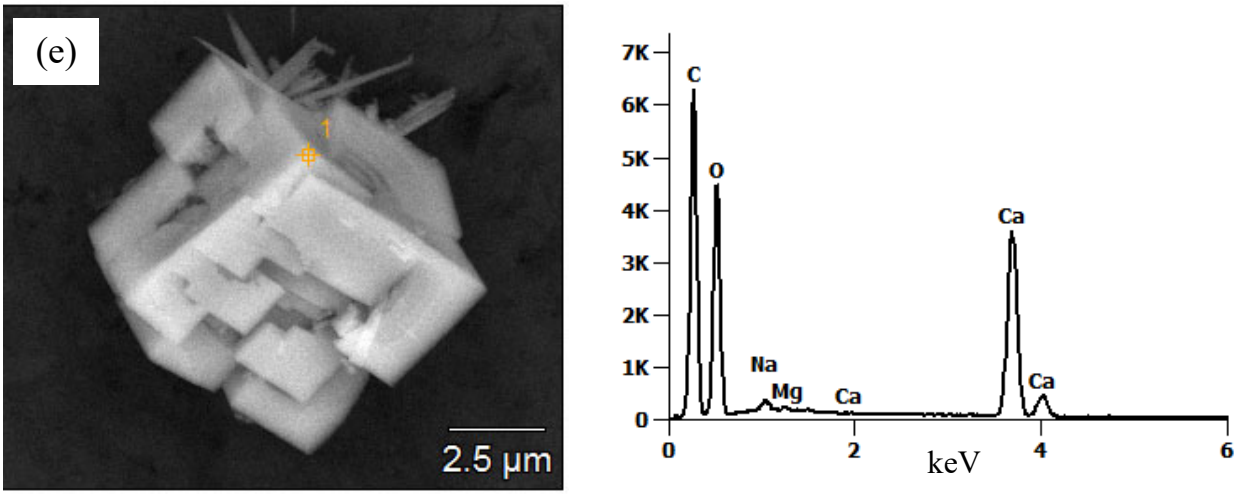


Figure S2. Selected scanning electron microscopy (SEM) images and their corresponding EDX analyses results of precipitated solids during transformation of vaterite to Mg-calcite and/or aragonite for an average actual pH of 8.8. Mg to Ca ratios are (**a**) 0.2, (**b**) 1, (**c**) 2, (**d**) 5, and (**e**) 10. EDX analyses results for Figures (**c**) and (**d**) are related to the point 2. At lower Mg to Ca ratio, where the Mg incorporation is relatively high, more EDX measurements were performed. For instance, at Mg to Ca ratio of 0.2, more than 45 surface points of Mg-Calcite were analyzed. At higher Mg to Ca ratios, less surface points were analyzed.

Table S1. The ionic composition of solution phase and X-ray diffraction results of the precipitated solids precipitated in contact with 0.2 and 1 g/L of kaolinite and bentonite clays and four magnesium (Mg) to calcium (Ca) ratios. The acronym 'TIC denotes total inorganic carbon.

Clay (g/L)	Mg to Ca ratio	Initial Mg (mmol/L)	Mg (mmol/L) Supernatant	Ca (mmol/L) Supernatant	TIC (mmol/L) Supernatant	Removed Mg (mol/kg) Solution	Mg (mol/kg) Solid	Mg-calcite %	Aragonite %	Vaterite %
Kaolinite 0.2	0.2	0.5	0.42	0.83	1.52	0.10	0.05	82	18	-
	1	2.5	2.46	0.83	0.99	0.05	0.02	6	94	-
	2	5	4.84	0.85	0.90	0.19	0.02	5	95	-
	5	12.5	10.79	0.89	0.96	2.05	0.02	3	97	-
Kaolinite 1	0.2	0.5	0.39	0.91	1.12	0.22	0.09	59	41	-
	1	2.5	2.46	0.94	1.24	0.09	0.04	5	95	-
	2	5	4.81	0.96	1.31	0.37	0.05	4	96	-
	5	12.5	10.82	0.99	2.07	3.35	0.04	7	93	-
Bentonite 0.2	0.2	0.5	0.38	0.83	1.05	0.15	0.12	66	44	-
	1	2.5	2.43	0.86	1.14	0.08	0.09	6	68	26
	2	5	4.81	0.87	1.20	0.22	0.10	4	72	24
	5	12.5	10.70	1.00	1.34	2.15	0.12	4	39	57
Bentonite 1	0.2	0.5	0.41	0.64	0.98	0.18	0.17	7	8	85
	1	2.5	2.32	0.78	1.05	0.37	0.33	3	3	94
	2	5	4.65	0.83	1.07	0.70	0.41	3	3	94
	5	12.5	10.54	1.01	1.30	3.92	0.48	1	-	99