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Article

Pb^{2+} Uptake by Magnesite: The Competition between Thermodynamic Driving Force and Reaction Kinetics

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Supplementary Material

1. Supplementary Material 1. Concentration, saturation indexes and pH of the solutions for the precipitation experiments

Mg mmol/kg

	1	2	3	4	5
a	66.2	131	259	444	622
b	65.5	130	257	440	616
c	64.1	127	251	431	603
d	62.9	125	246	423	592
e	61.3	122	240	413	579
f	60.2	120	236	406	569

Pb mmol/kg

	1	2	3	4	5
a	0	0	0	0	0
b	0.098	0.098	0.096	0.094	0.092
c	0.320	0.318	0.314	0.308	0.302
d	0.503	0.499	0.493	0.483	0.474
e	0.736	0.731	0.721	0.708	0.694
f	0.903	0.897	0.886	0.869	0.853

C mmol/kg

	1	2	3	4	5
a	66.2	65.7	64.8	63.5	62.2
b	65.5	65.1	64.2	62.9	61.6
c	64.1	63.6	62.8	61.5	60.3
d	62.9	62.4	61.6	60.4	59.2
e	61.3	60.9	60.1	59.0	57.9
f	60.2	59.8	59.1	57.9	56.9

SI magnesite

	1	2	3	4	5
a	2.0	2.0	2.1	2.0	2.0
b	1.9	2.0	2.0	2.0	2.0
c	1.9	2.0	2.0	2.0	1.9
d	1.8	1.9	2.0	1.9	1.9
e	1.8	1.9	1.9	1.9	1.8
f	1.7	1.8	1.9	1.9	1.8

SI cerussite

	1	2	3	4	5
a	//	//	//	//	//
b	1.7	1.7	1.8	1.9	1.9
c	2.2	2.3	2.3	2.4	2.4
d	2.4	2.5	2.5	2.6	2.6
e	2.6	2.6	2.7	2.8	2.8
f	2.7	2.7	2.8	2.9	2.9

pH

	1	2	3	4	5
a	7.7	7.6	7.4	7.3	7.2
b	7.7	7.5	7.4	7.3	7.2
c	7.6	7.5	7.4	7.2	7.1
d	7.6	7.5	7.4	7.2	7.1
e	7.5	7.4	7.3	7.2	7.1
f	7.5	7.4	7.3	7.2	7.1

no precipitation few particles precipitation

Figure S1. The first raw shows the concentrations of Mg, Pb and Carbon in mmol/kg. The second raw contains the pH and the saturation indexes of magnesite and cerussite calculated with PHREEQC [1].

2. Supplementary Material 2. Powder x-ray diffraction of the precipitation products in the range 30-70° 2θ Cu-Kα

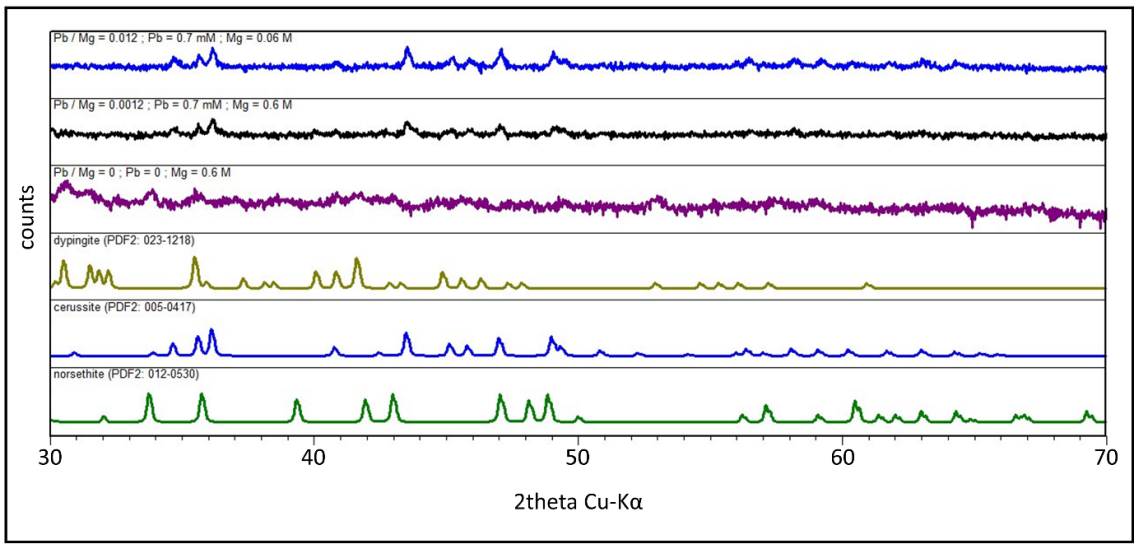

Figure S2. Powder x-ray diffraction of the precipitation products and the reference materials in the region 30-70° 2θ (Cu-Kα). The reference diffraction pattern of norsethite has been included to emphasise the absence of this phase in the reaction products.

3.Supplementary Material 3. Variation of the solubility product of magnesite as a function of temperature

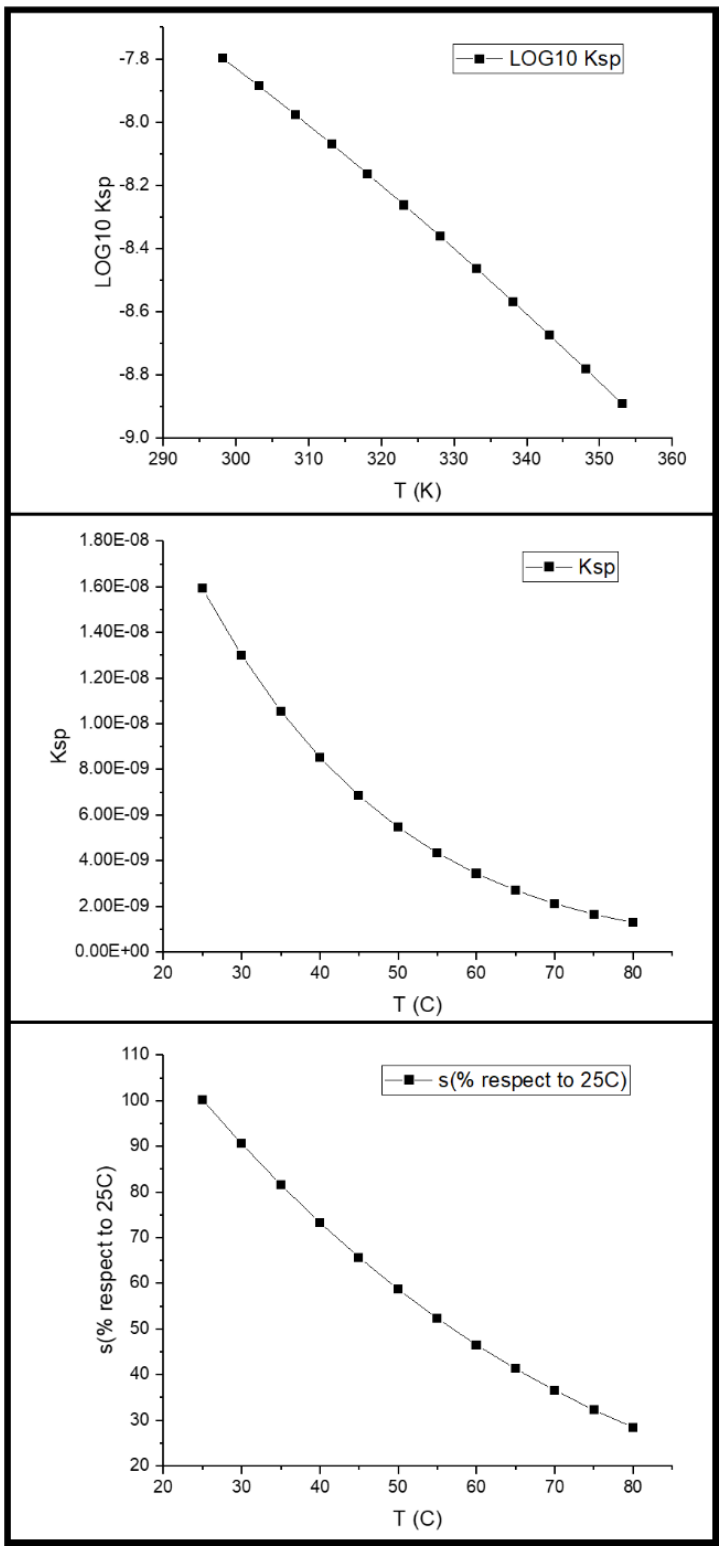

Figure S3. Retrograde solubility of MGS in the range between 25 and 80 °C calculated with the equation provided by Bénézeth et al. [2].

4. Supplementary Material 4. Variation of magnesite dissolution rate as a function of temperature

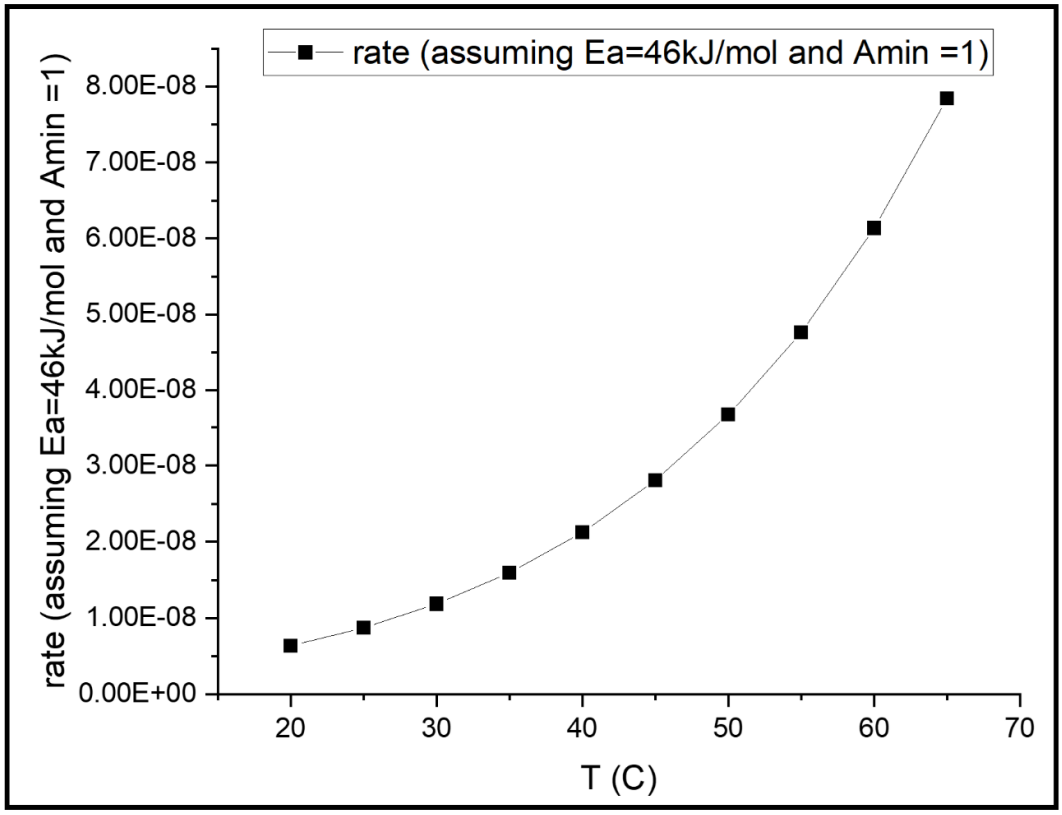

Figure S4. Increase with temperature of magnesite dissolution, a unitary surface area and the activation energy from Pokrovsky et al. [3] were used in the calculation.

References

1. Parkhurst, D.L.; Appelo, C.A.J. *Description of Input and Examples for PHREEQC Version 3–A Computer Program for Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations*; Book 6, Section A; US Geological Survey: Reston, VA, USA, 2013; Chapter 43.
2. Bénézeth, P.; Saldi, G.D.; Dandurand, J.-L.; Schott, J. Experimental determination of the solubility product of magnesite at 50 to 200 °C. *Chem. Geol.* **2011**, *286*, 21–31, doi:10.1016/j.chemgeo.2011.04.016.
3. Pokrovsky, O.S.; Golubev, S.V.; Schott, J.; Castillo, A. Calcite, dolomite and magnesite dissolution kinetics in aqueous solutions at acid to circumneutral pH, 25 to 150 °C and 1 to 55 atm pCO2: New constraints on CO2 sequestration in sedimentary basins. *Chem. Geol.* **2009**, *265*, 20–32, doi:10.1016/j.chemgeo.2009.01.013.