

Supplementary:

Table S1. Structure models and additional parameters used for the Rietveld refinement.

Phase	Space group	References
Corundum	R-3cH	Ishizawa et al. 1980 [58]
Raw materials		
α -Quartz	P3 ₂ 21	Le Page et al. 1976 [37]
Calcite	R-3cH	Chessin et al. 1965 [59]
11A Tobermorite	B11m	Merlino et al. 2001 [60]
Aragonite	Pmcn	De Villiers 1971 [61]
Vaterite	P 6 ₃ /mmc	Kamhi, S.R 1961 [62]
Anhydrite	Amma	Hawthorne et al. 1975 [63]
Bassanite	I 1 2 1	Bezou et al. 1991 [64]
Microcline	C-1	Allan et al. 1997 [65]
Albite	C-1	Winter et al. 1979 [66]
Calcination product		
α' -H-C ₂ S	Pnma	Mumme et.al 1996 [35]
β -C ₂ S	P12 ₁ /n1	Mumme et al. 1995 [53]
Ternesite	Pnma	Irran et al. 1997 [24]
β -Quartz	P6 ₂ 22	Wright et al. 1981 [36]
Lime	Fm-3m	Huang et al. 1994 [67]
Wollastonite	P12 ₁ /a1	Hesse 1984 [68]
Åkermanite-Gehlenite	P-42 ₁ m	Smith 1953 [69]
Spurrite	P12 ₁ /a1	Louisnathan 1971 [70]
Browmillerite	Ibm2	Grice 2005 [71]
Ye'elimite	I-43m	Colville et al. 1971 [72]
		Cuesta et al. 2014 [73]
Additional parameters for XRD measurement and Rietveld refinement		
Background: Chebychev polynomial 4 th order, 1/X Bkg		
Goniometer radius: 240 mm		
Linear PSD		
2Th angular range: 3.347°		
FDS angle: 0.125°		
Source length: 12 mm		
RS length: 14 mm		
Prim./Sec. Soller: 2.3°		
LP factor: 0		
Zero error, sample displacement and sample length: refined for each measurement		

Table S2. Crystalline phase contents determined *in situ* in 100°C steps (*in situ* experiment step50).

Sample and Temperature	α' -H-C ₂ S	β -C ₂ S	Ternesite	Quartz	Calcite	Lime	Anhydrite	Wollastonite
P 600				18.0(8)	75.7(1.2)		2.7(4)	
700	37.0(1.0)			13.4(6)	44.4(1.1)		2.8(3)	
800	55.2(1.0)			7.1(4)	0.6(2)	24.4(5)	1.84(15)	9.2(4)
900	68(2)			2.9(6)		17.6(7)	1.33(16)	4.3(5)
1000	89.9(8)		2.2(4)	1.6(2)		0.03(2)		1.5(3)
900	92.3(1.1)		1.3(3)	0.54(15)		0.05(4)		1.6(3)
800	93.9(9)			0.26(11)				
700	93.7(9)		1.0(3)	0.4(3)				0.7(3)
600	95.6(7)		1.5(3)	0.25(9)				
500	93.6(1.0)	2.3(8)	1.4(3)	0.26(10)				
400	75.2(1.0)	21.6(8)	0.8(2)	0.32(15)	0.5(3)			
300	45(4)	48(4)	1.9(5)	0.8(2)	0.8(4)			0.4(2)
200	26(3)	65(4)	1.7(5)	0.8(2)	1.2(4)			
100	18(2)	77(3)	1.7(5)	1.2(3)				
25	1.7(9)	87.4(1.3)	0.5(3)	1.3(2)	1.1(3)			1.0(3)
D1 600				18.8(6)	79.1(7)		0.52(16)	
700	16.1(7)			17.5(2)	63.4(9)	0.9(2)	0.42(14)	
800	38.2(6)			14.6(4)	1.0(2)	38.0(5)	0.25(8)	4.6(4)
900	50.1(5)			11.6(3)		28.3(3)	0.35(6)	8.0(3)
1000	64.4(5)		1.9(2)	7.9(2)		16.26(17)	0.21(6)	4.6(2)
900	67.7(6)		2.5(3)	7.6(3)		14.6(2)		2.9(3)
800	68.7(6)		2.7(2)	7.9(3)		14.0(2)		2.7(2)
700	66.9(7)		3.0(2)	9.1(4)		14.3(2)	0.3(2)	2.5(2)
600	67.6(7)		2.7(2)	8.3(3)	4.02(13)	11.44(17)		2.09(19)
500	63.6(7)	3.1(4)	1.9(2)	9.8(5)	3.9(2)	10.28(17)		2.3(3)
400	58.4(7)	7.4(6)	1.40(17)	10.0(4)	4.3(2)	10.59(18)		2.5(2)
300	45.7(7)	17.9(6)	2.5(2)	9.1(4)	4.5(3)	11.0(2)		2.4(2)
200	30.6(7)	32.3(7)	2.1(2)	9.6(5)	5.1(3)	11.4(2)		2.3(2)
100	20.5(7)	41.6(8)	2.2(2)	9.4(5)	5.6(3)	12.1(2)	0.8(3)	2.3(2)
25	14.6(8)	46.7(1.6)	1.95(18)	9.4(4)	6.7(3)	12.0(4)	0.52(14)	2.46(19)
D2 600				20.3(6)	65.9(1.0)		10.6(9)	
700	20.0(1.0)			18.2(6)	47.0(1.1)	0.6(2)	11.6(9)	
800	51.8(1.0)			11.7(4)		26.7(6)	5.9(4)	2.9(4)
900	61.9(1.5)		0.5(2)	7.4(5)		20.7(6)	5.6(5)	1.3(3)
1000	72.5(7)		8.1(2)	5.1(3)		1.93(6)	6.90(17)	1.13(14)
900	73.7(5)		10.0(2)	4.45(10)		0.29(129)	5.0(2)	0.49(17)
800	73.9(6)		10.0(2)	4.32(10)		0.38(13)	4.7(2)	0.32(17)
700	74.5(5)		9.5(2)	4.1(10)		0.34(10)	4.6(19)	0.39(17)
600	72.5(6)		9.8(3)	4.87(18)		0.37(10)	5.1(2)	0.44(17)
500	73.0(7)	0.8(3)	9.9(2)	4.4(4)		0.65(6)	4.7(2)	0.57(17)
400	50.3(6)	22.8(5)	10.4(3)	4.9(4)	0.3(2)	0.66(6)	5.0(2)	0.6(2)
300	31.1(1.3)	42(2)	10.3(4)	3.9(4)	0.6(2)	0.67(9)	4.9(3)	0.8(2)
200	18.5(1.0)	52.8(1.9)	9.8(5)	4.3(4)	0.78(19)	0.91(10)	5.0(3)	0.9(2)
100	12.2(9)	59.6(1.7)	10.6(5)	3.4(4)	0.8(2)	0.90(10)	4.9(3)	0.89(2)
25	5.9(5)	65.2(9)	11.0(3)	3.7(2)	0.84(16)	1.10(7)	4.47(17)	0.86(18)
D3 600				20.2(6)	65.0(1.0)		11.2(9)	
700	30.8(9)			15.3(5)	37.4(1.0)	0.7(2)	13.3(8)	
800	55(2)			11.8(6)		22.3(9)	7.3(5)	1.9(5)
900	70(2)		0.3(2)	5.0(4)		13.1(5)	8.7(5)	0.7(2)
1000	74.2(6)		9.2(3)	4.9(2)		0.90(10)	5.1(2)	1.2(2)
900	74.6(7)		10.1(3)	3.0(3)		0.26(5)	3.4(2)	0.8(3)
800	74.(6)		10.1(3)	3.0(4)		0.24(5)	4.0(2)	0.9(3)
700	73.5(7)		10.4(3)	4.5(4)		0.33(6)	3.5(2)	1.0(2)
600	73.2(7)		10.6(3)	4.7(3)		0.25(5)	3.8(2)	0.7(3)
500	74.8(8)	0.9(3)	10.2(3)	3.0(4)		0.25(6)	3.6(29)	0.74(19)

400	53.9(7)	20.3(5)	10.6(3)	3.2(4)	1.0(3)	0.23(6)	3.6(2)	0.9(3)
300	32.5(1.4)	42(2)	9.8(4)	2.1(4)	1.0(2)	0.15(6)	3.5(2)	0.9(2)
200	20.2(1.2)	50(2)	11.1(6)	3.2(5)	0.7(2)	0.38(11)	4.0(3)	1.2(3)
100	11.8(9)	61.0(1.7)	9.8(5)	3.4(5)	0.9(2)	0.19(6)	3.7(2)	1.0(2)
25	5.6(5)	64.7(1.0)	11.1(3)	4.1(2)	0.77(16)	0.50(7)	4.00(17)	1.06(18)
