



Supplement of

**New insights in the mechanisms of the reaction 3.65 Å phase =
clinoenstatite + water down to nanoscales**

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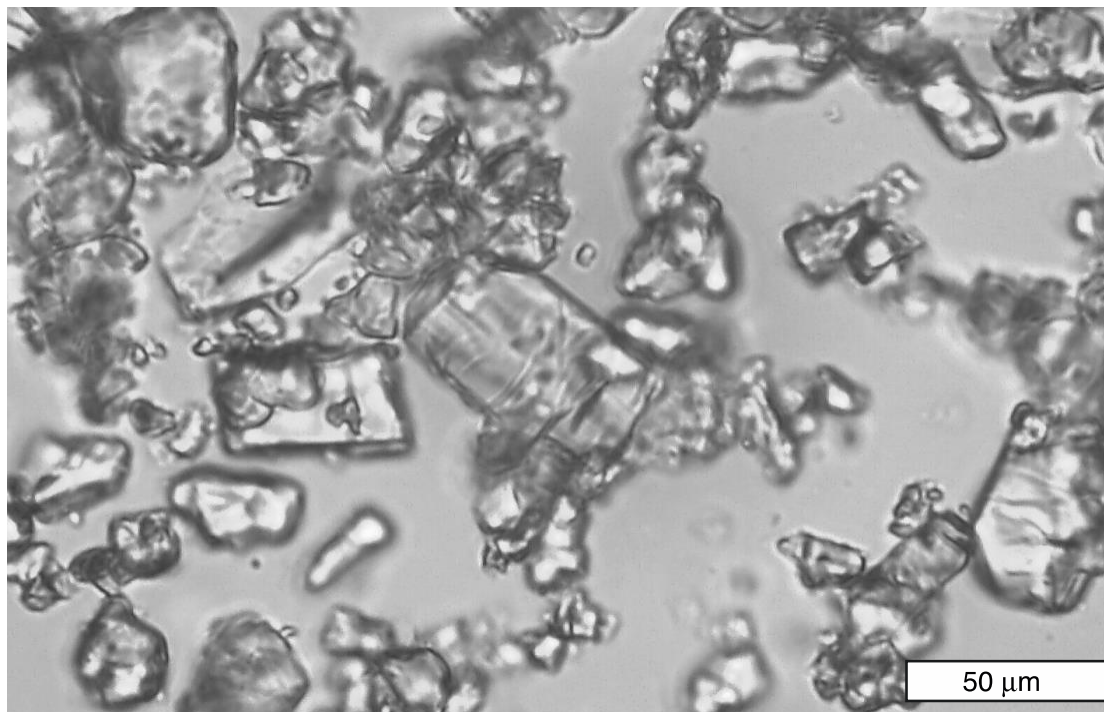


Fig. S1: Optical microphotograph of the starting material consisting of 3.65 Å phase and clinoenstatite which were mechanically mixed in the molar ratio of 1:1. 3.65 Å phase is mostly fine-grained, whereas for clinoenstatite some large-sized crystals (up to 50 μm) are visible.

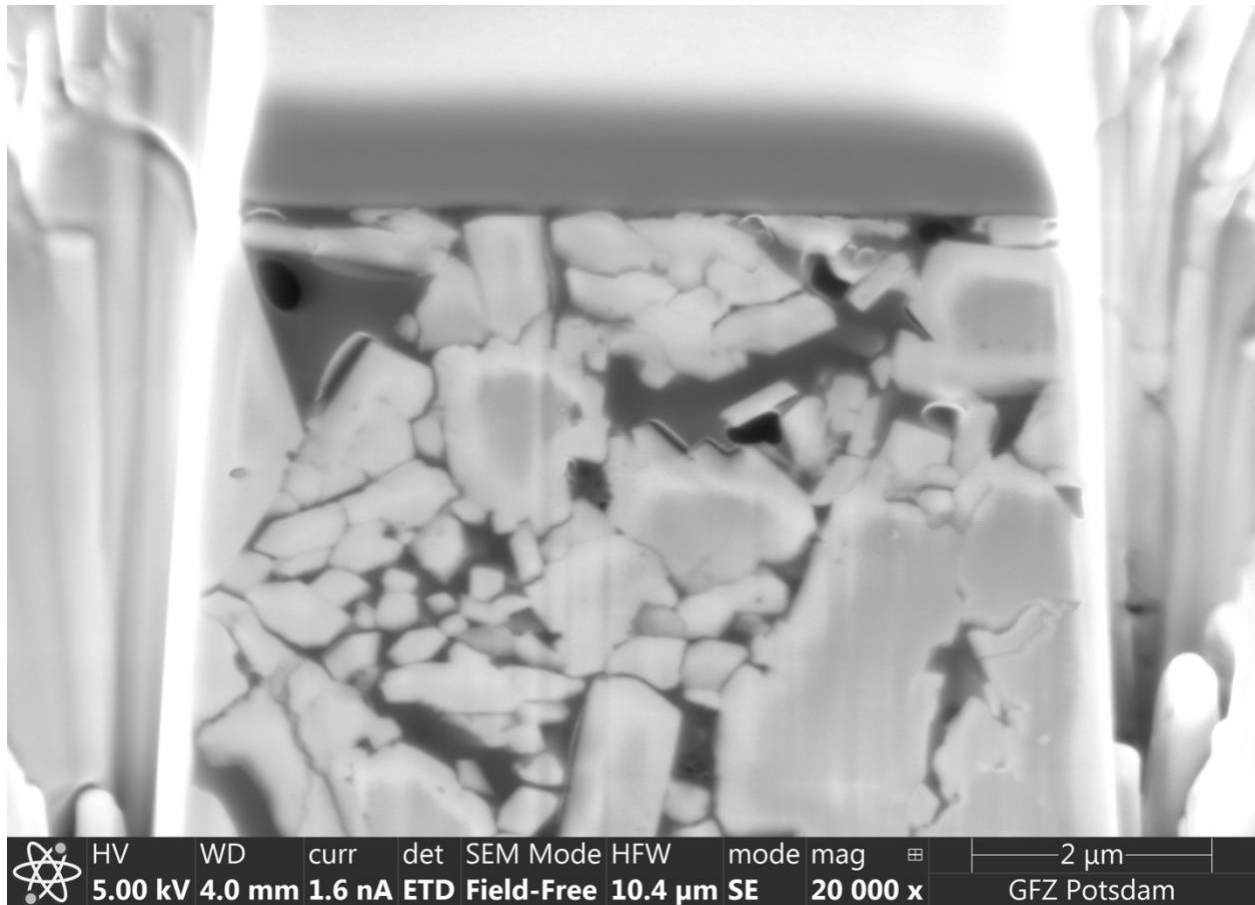


Fig. S2: TEM sample preparation with cross section through the experimental charge of MA-535 showing the size distribution of Cen.

Table S1

Characterization of the starting materials

Clinoenstatite was synthesized at 1 atm heating a MgSiO_3 -glas at 1500 °C for 3 hours, followed by rapid quenching using the method described by Anderson and Browen (1914). The synthetic clinoenstatite was already described in Wunder and Schreyer (1997)¹ and had the following cell-dimensions: $a = 9.607(4) \text{ \AA}$, $b = 8.817(3) \text{ \AA}$, $c = 5.172(4) \text{ \AA}$, $\beta = 108.35(5)^\circ$, $V = 415.7(5) \text{ \AA}^3$, S.G. = $P2_1/c$.

3.65 \AA -phase was synthesized at 10 GPa, 425 °C, 77 hours using a gel with the Mg/Si-ratio of 1/1 plus water in excess. The sample contained 3.65 \AA -phase together with traces of the 10 \AA -phase. The synthetic 3.65 \AA -phase was already described by Wunder et al. (2012) and had the following cell-dimensions: $a = 5.1131(3) \text{ \AA}$, $b = 5.1898(3) \text{ \AA}$, $c = 7.3303(4) \text{ \AA}$, $\beta = 90.03(1)^\circ$, $V = 194.52(2) \text{ \AA}^3$, S.G.: $P2_1$.

¹Wunder, B. and Schreyer, W.: Antigorite: High-pressure stability in the system $\text{MgO-SiO}_2\text{-H}_2\text{O}$. Lithos, 41, 213-227, 1997.

Table S2

Details of the TEM analyses: d_{hkl} -spacing and angles between adjacent planes

MA-527	hkl	observed d_{hkl} (Å)	calculated d_{hkl} (Å) ^{1,2}	angle between	observed angle (°)	calculated angle (°)
clinoenstatite	001	5.09	4.9169	011/001	29.28	29.10°

Fig.3g	010	8.94	8.834	011/010	60.4°	60.90°
#5417	011	4.53	4.2963			
MA-535						
Clinoenstatite³						
Fig. 4c	11-1	4.48	4.4462	2-1-1/11-1	22.8°	59.78°
#5916 (Sep 2020)	2-1-1	3.73	3.7337	2-1-1/100	55.8°	55.46°
	100	9.42	9.2295	0-11/100	74.4°	73.60°
	0-11	4.37	4.3472	11-1/ 1-1-1	27.1°	59.58°
Orthoenstatite³	111	4.48	4.3387	311/111	22.8°	22.56°
Fig. 4c	311	3.73	3.5988	311/200	55.8°	53.67°
#5916 (Sep 2020)	200	9.42	9.1115	3-1-1/200	74.4°	76.21
	1-1-1	4.37		1-1-1/ -1-1-1	27.1°	27.51°
Clinoenstatite⁴	100	9.61	9.1380	100/110	46.4°	45.97°
Fig. 5	110	6.78	6.3513			
#5916 (April 2019)	010	8.65	8.834	010/110	44.8°	44.03°

¹Lattice parameter clino-enstatite (P2₁/c) (Å): a₀= 9.627; b₀= 8.834; c₀= 5.180; beta = 108.34°
Pannhorst Neues Jahrbuch fuer Mineralogie, Abhandlungen (1984) 150, (*) Article ID * (p. 219-228)

²Lattice parameter enstatite (Pbca) (Å): a₀= 18.2230 Å; b₀= 8.8190; c₀= 5.1810

Ganguly, J., Ghose, S. Contributions to Mineralogy and Petrology (1979) 69, (*) Article ID * (p. 375-385)

³The diffraction pattern can only be indexed as orthoenstatite. Indexing as clinoenstatite does not match the angles between the planes 2-1-1/11-1 and 11-1/1-1-1.

⁴In this orientation the assignment to Cen, is not unambiguous. The diffraction pattern could also be indexed as Oen. However, as the most of our final reaction products of the dehydration experiments were assigned to Cen (also by X-ray diffraction), we are in favour with the assignment to Cen