

SUPPLEMENTAL TABLE S1. Comparison of the best fitting angles and planes of different Ca-, Y- and REE-phosphate phases. a) The observed angles of the diffraction pattern (FFT) of the solid inclusion in sample H12 were 33.6 and 63.0°. Notably, only the calculated angles of monoclinic (Ca-Y)-phosphate fit within 1°, thereby confirming the presence of the phase. b) The observed angles of the diffraction patterns (FFT) of the solid inclusion in sample AL04-P10 were 30 and 57°. The best agreement between observed and calculated values corresponds to the monoclinic (Ca-Y)-phosphate phase.

d_{hkl} observed	Xenotime tetragonal Ni et al., (1995)	Monazite monoclinic Ni et al., (1995)	CaYP ₇ O ₂₀ monoclinic Hamady and Jouini (1994)
	$a_0 = 0.68951 \text{ nm}$ $b_0 = 0.68943 \text{ nm}$ $c_0 = 0.60276 \text{ nm}$	$a_0 = 0.67902 \text{ nm}$ $b_0 = 0.70203 \text{ nm}$ $c_0 = 0.64674 \text{ nm}$	$a_0 = 2.46661 \text{ nm}$ $b_0 = 0.68503 \text{ nm}$ $c_0 = 1.06986 \text{ nm}$
angles between adjacent planes			
a) sample H12			
33.6°	33.75° (112 121)	39.39° (200 101)	33.93° (103 2 $\bar{1}$ 2)
63.0°	66.70° (112 0 $\bar{1}$ 1)	53.48° (200 10 $\bar{1}$)	62.90° (103 $\bar{1}$ 11)
b) sample AL04-P10			
30.0°	37.20° (121 020)	39.39° (200 101)	29.51° (121 $\bar{6}$ 22)
57.0°	52.78° (121 101)	53.48° (200 10 $\bar{1}$)	56.36° (121 202)

SUPPLEMENTAL TABLE 2. Comparison of the best fitting angles, planes and the *d*-spacing values of xenotime, monazite, $\text{Ca}_3\text{Y}(\text{PO}_4)_3$ and $\text{CaYP}_7\text{O}_{22}$ phases. The observed angles of the diffraction pattern of the solid inclusion in sample AL03-29B were 39.9 and 49.8°. The best agreement between observed and calculated values corresponds to the cubic (Ca-Y)-phosphate phase. Moreover, the measured *d*-spacing values of the diffraction patterns of cubic Ca-Y phosphate fit better than those of xenotime or monazite.

d_{hkl} observed	$\text{Ca}_3\text{Y}(\text{PO}_4)_3$ cubic Fukuda et al., (2006)	Xenotime tetragonal Ni et al., (1995)	Monazite monoclinic Ni et al., (1995)	$\text{CaYP}_7\text{O}_{20}$ monoclinic Hamady and Jouini (1994)
	$a_0 = 0.9833 \text{ nm}$	$a_0 = 0.68951 \text{ nm}$ $b_0 = 0.68943 \text{ nm}$ $c_0 = 0.60276 \text{ nm}$	$a_0 = 0.67902 \text{ nm}$ $b_0 = 0.70203 \text{ nm}$ $c_0 = 0.64674 \text{ nm}$	$a_0 = 2.46661 \text{ nm}$ $b_0 = 0.68503 \text{ nm}$ $c_0 = 1.06986 \text{ nm}$
d-spacing				
0.402 nm	0.4014 nm ($\bar{2}\bar{1}1$)	0.4530 nm (101)	0.5100 nm ($10\bar{1}$)	
0.340 nm	0.3477 nm (022)	0.3441 nm (020)	0.3990 nm (200)	
0.261 nm	0.2630 nm ($\bar{2}13$)	0.2740 nm (121)	0.3078 nm (101)	
angles between adjacent planes				
39.9°	40.89° ($\bar{2}13 011$)	37.20° ($121 020$)	39.39° ($200 101$)Ee	46.43° ($\bar{2}\bar{1}0 1\bar{1}0$)
49.8°	49.11° ($\bar{2}13 \bar{2}\bar{1}1$)	52.78° ($121 101$)	53.48° ($200 10\bar{1}$)	59.80° ($\bar{2}\bar{1}0 \bar{3}00$)