Supplemental Table OM1. Experimental details for bennesherite

Crystal Data	
	Bennesherite
Crystal system	tetragonal
Unit cell dimensions	a = 8.2334(14) Å
	c = 5.2854(8)Å
	$\alpha = 90°$, $\beta = 90°$, $\gamma = 90°$
Space group	$P\bar{4}\,2_1m$, no.113
Volume	358.29(13) Å^3
Z	2
Density (calculated)	4.27 g/cm^3
Chemical formula sum	$(Ba_{1.70}Ca_{0.30})(Fe_{1.62}Mg_{0.38})Si_2O_7$.
Crystal size (μm)	30×30×20 μm
Data collection	
Diffractometer	STOE IPDS II
Exposure time / step size	1800s /1°
Number of frames	180
Max. θ°-range for data collection	29.16
Index ranges	$-11 \le h \le 11$
	$-11 \le k \le 11$
	$-6 \le l \le 7$
No. of measured reflections	2758
No. of unique reflections	533
No. of observed reflections ($I > 2\sigma(I)$)	463
Refinement of the structure	
no. of parameters	36
R_{int}	0.0401
$R\sigma$	0.0229
$R1$, $I > 2\sigma(I)$	0.0469
$R1$ all data	0.0595
$wR2$ on (F2)	0.1110
GooF	1.129
Δρ min (-e. Å-3)	2.59 (0.91 Å from Mg1/Fe1)
Δρ max (e. Å-3)	-1.33 (0.84 Å from Ca1)