

Table S1: Rietveld agreement factors (GSAS-II terminology).

Sample	Observations	Reflections	Parameters	wR [%]	RF [%]	RF ² [%]
TopP	4950	113	32	11.24	3.58	6.98
TopT	4950	114	32	15.12	8.44	17.40

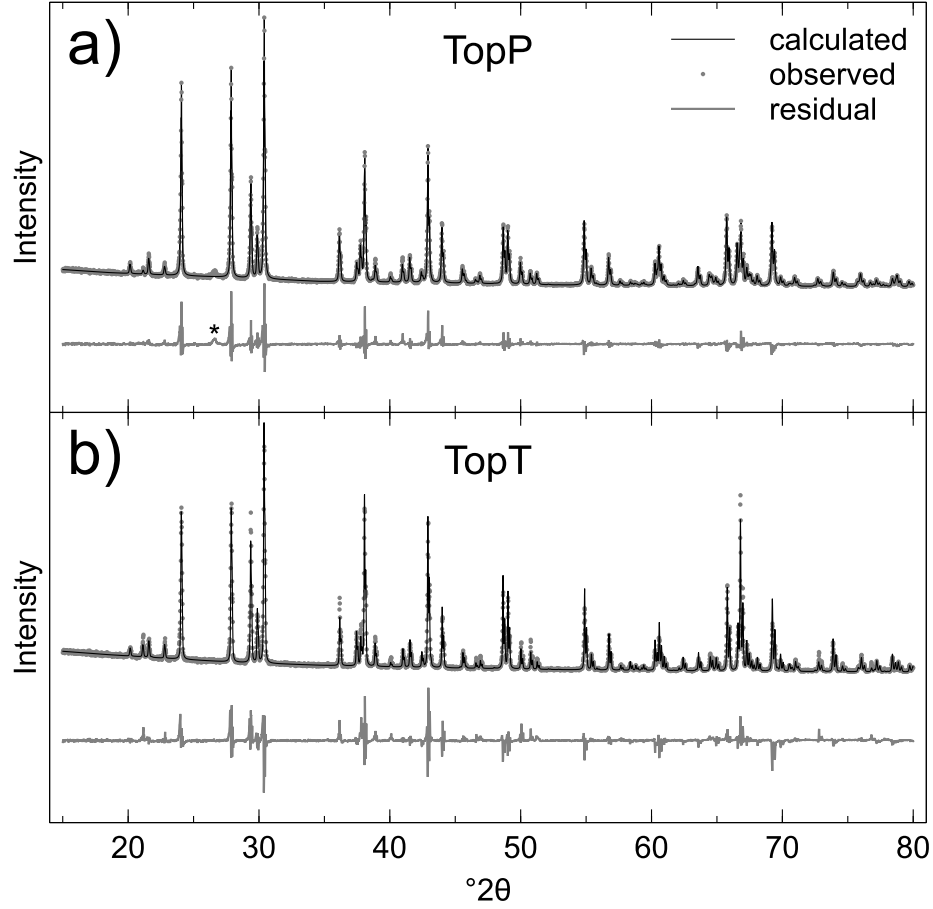


Fig. S1: Experimental XRD data, Rietveld refinement (GSAS-II software package, Toby and Von Dreele, 2013) fits and residuals of both samples. The agreement factors of the fits are listed in table S1. The asterisk in a) marks the 26.6° 2θ peak of quartz caused by contamination from the agate ball mill in sample TopP. The differences in the positions of the individual reflections between the two samples reflect the differences in lattice parameters (see Table S1). The obvious mismatch in intensity for some reflections of sample TopT in b) indicates a preferred orientation of the powder particles. This is due to the single (001) cleavage plane of topaz and the fact that this sample was ground by hand in an alumina mortar not as finely as sample TopP in a) in order to avoid quartz contamination from the agate mill. This does not affect the determination of the lattice constants.

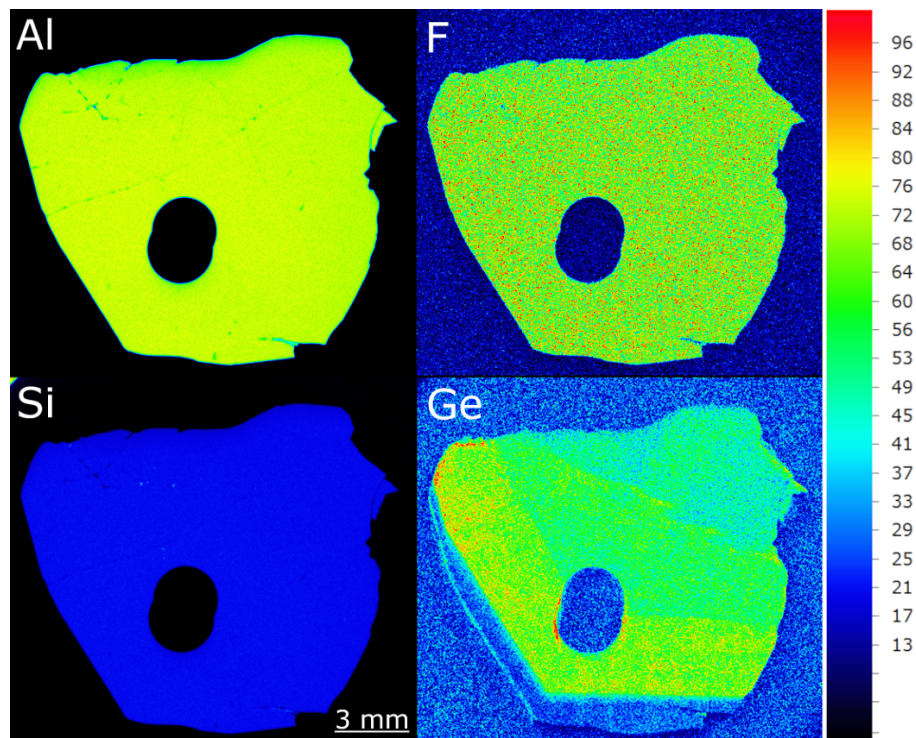


Fig. S2: μ -XRF mapping of sample TopP (polished (001) face). Intensity scale is relative for each individual element. Pronounced growth zoning can be seen for Ge but no zoning is evident for Al, Si, or F. The Al mapping is sensitive to cracks and surface scratches. Note the substantially higher noise for F compared to the other elements. Noise on Ge is comparable to that on F, despite the concentration of the latter being about 1000 times higher, due to different XRF sensitivity and matrix absorption.

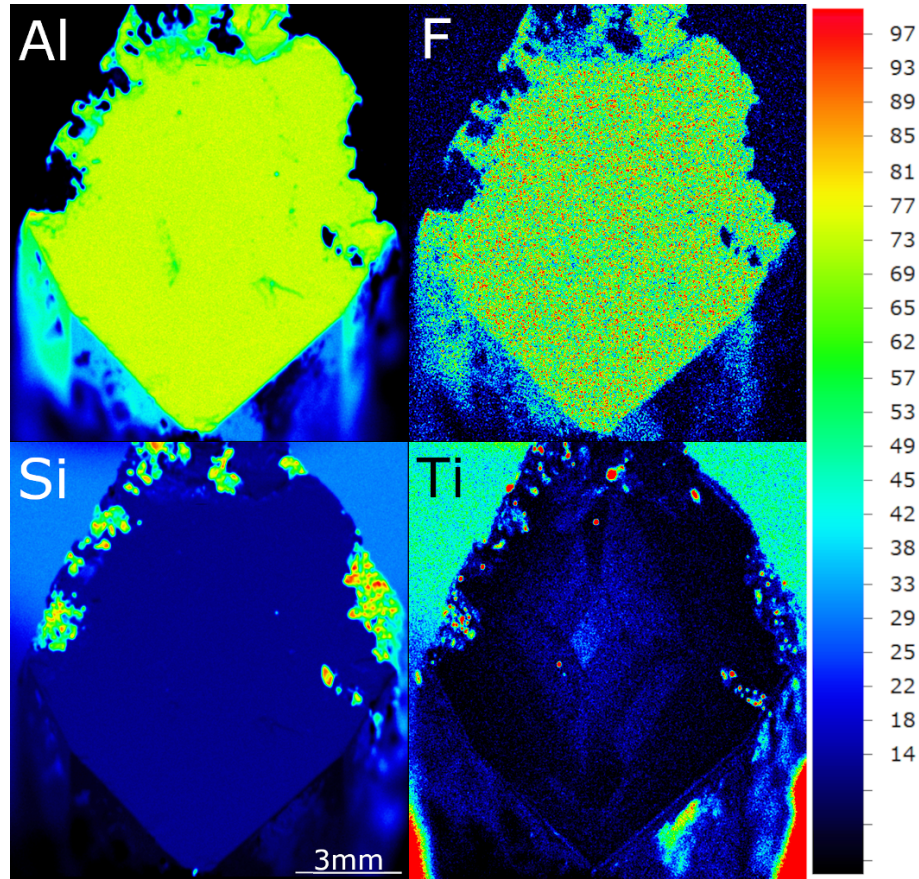


Fig. S3: μ -XRF mapping of the (001) cleavage plane of sample TopT before removal of host-rock fragments and solid inclusions. Intensity scale is relative for each individual element. Growth and sector zoning can be seen for Ti but no zoning is evident for Al, Si, or F. The Al mapping is sensitive to cracks and surface unevenness of the cleavage plane. Note the substantially higher noise for F compared to the other elements.

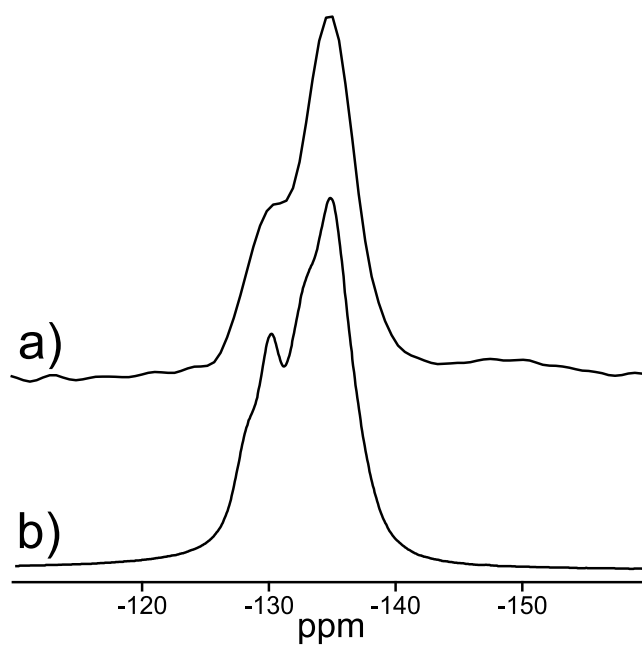


Fig. S4: ^{19}F MAS NMR spectra ($\nu_{\text{rot}} = 25$ kHz) relative to CFCl_3 of two further commercially available samples: a) zharchikhite, b) topaz, Boa Vista, Brazil.

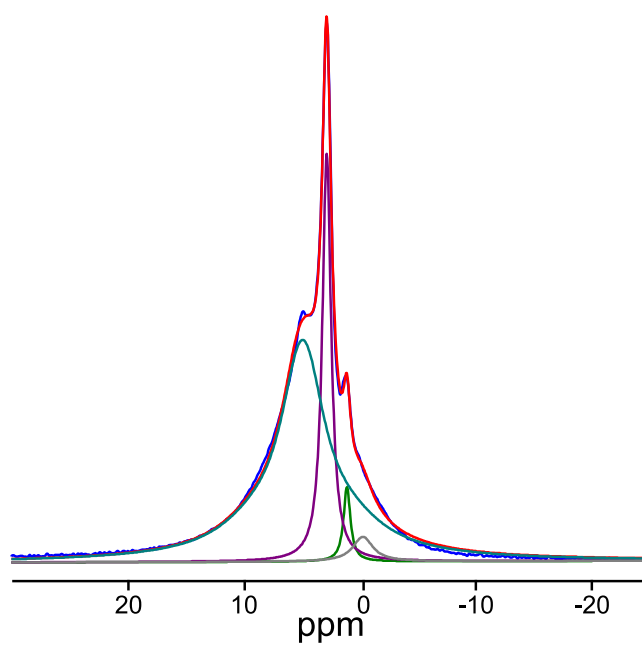


Fig. S5: Decomposition of the ^1H MAS NMR spectrum of TopP, recorded with a recycle delay of 10 s ($n_s = 128$); identification of four species: 4.9 ppm, 2.8 ppm, 1.1 ppm, -0.3 ppm.