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# Amblygonite-montebrasite solid solutions as monitors of fluorine in evolved granitic and pegmatitic melts

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## ABSTRACT

The distribution of F between amblygonite (Amb, $LiAlPO_4F$)–montebrasite (Mbr, $LiAlPO_4OH$) solid solutions and metaluminous haplogranitic melt has been calibrated at 585 °C and 200 MPa $H_2O$. The partition coefficient for F between the crystalline phase and melt, $D_F^{Mbr/melt}$, is linear between 0 to ~10 wt% F in amblygonite, which contains 13 wt% F at the end-member:

$$C_F^{Mbr} = 3.65C_F^{melt} + 0.07,\ r^2 = 0.995,\ n = 6.$$

Values of $D_F^{Amb/melt}$ decrease sharply above 10 wt% F in amblygonite as the amblygonite reaches saturation in F at 200 MPa $H_2O$. In natural occurrences, however, the vast majority of primary amblygonite-montebrasite solid solutions contain ~4–7 wt% F, well within the linear range of the calibrated exchange reaction, and the montebrasite-bearing assemblages are among the last to crystallize. If the F contents of the montebrasite are magmatic, then these most-fractionated residual melts of the LCT (Li-Cs-Ta, and mostly peraluminous S-types) rare-element class generally contained up to ~1.0–1.8 wt% F near the end of their crystallization. The modest F contents of pegmatites are consistent with the common association of Li aluminosilicates and with the general paucity of topaz in these occurrences. In topaz-bearing granites of Western Europe, however, high-F amblygonite (~10–11 wt% F) reflects >3 wt% F in melt during crystallization of these magmatic phases.