Supp. Figure

(a) (b) (c)

Temperature (°C)

(d) (e) (f)

Temperature (°C)
Supp. calculation

The F and Cl contents in melt were calculated based on apatite (Mathez and Webster, 2005; Webster et al., 2009; Zhang et al., 2012), biotite (Icenhower and London, 1997) and amphibole compositions (Sato et al., 2005). The calculation details as follows:

1. **Calculations from apatite** are performed using following equations given by Mathez and Webster (2005; equations (1) and (2)), Webster (2009; equations (3) and (4)) and Zhang et al. (2012; equation (5)).

\[
\begin{align*}
W_F^m &= W_F^{Ap} / 3.4 \quad (1) \\
W_{Cl}^m &= W_{Cl}^{Ap} / 0.8 \quad (2) \\
W_F^m &= (X_F^{Ap} - 0.12) / 3.02 \quad (3) \\
W_{Cl}^F &= X_{Cl}^{Ap} / 0.011 \quad (4) \\
W_{Cl}^m &= W_{Cl}^F / (4.51 \times P^{2.16}) \quad (5)
\end{align*}
\]

where \( W_F^m \) and \( W_F^{Ap} \) are concentrations (wt. %) of F in melt and apatite, \( W_{Cl}^f \), \( W_{Cl}^m \) and \( W_{Cl}^{Ap} \) are concentrations (wt. %) of F in fluid, melt and apatite, respectively; \( X_F^{Ap} \) and \( X_{Cl}^{Ap} \) are mole fraction of F and Cl in apatite, respectively, and \( P \) is pressure in kbar. The melt compositions utilized by Mathez and Webster in the experiments (2005; at 1.99-2.05 kbar and 1066-1150°C) are mafic silicate melts, whereas those utilized by Webster (2009; at 2kbar and 900-924°C) are rhyodacitic melts.

2. **Calculation from biotite** are based on the work by Icenhower and London (1997) and London (1997), where they experimentally determined that the F and Cl partitioning coefficients between biotite and rhyolitic melt (2 kbar and H2O-saturated) are correlated with Mg#. For F, the \( D_{F/Bt/Melt} \) value is a function of Mg#: \( D_{F/Bt/Melt} = 10.08 \times \text{Mg#} - 1.08 \). For Cl, we take the \( D_{Cl/Bt/Melt} \) values which have Mg#Bt similar
to our samples, that is, $D_{Cl}^{Bt/Melt} = 1.53$ when $Mg^#_{Bt} > 0.65$, $D_{Cl}^{Bt/Melt} = 1.22$ when $Mg^#_{Bt} = 0.5-0.65$, and $D_{Cl}^{Bt/Melt} = 2.06$ when $Mg^#_{Bt} = 0.3-0.5$. Consequently, the equations can be written as

$$W_F^m = W_F^{Bt} / (10.08 \times Mg^# - 1.08)$$  \hspace{1cm} (6)

$$W_{Cl}^m = W_{Cl}^{Bt} / D_{Cl}^{Bt/Melt}$$ \hspace{1cm} (7)

3. **Calculations of Cl in melt from amphibole** are performed according to the Cl-OH partitioning results between amphibole and dacitic melt (Sato et al., 2005; at 2-3 kbar and 800-850°C). The relevant equation are expressed as

$$\log(\text{Cl/OH})_{melt} = \log(\text{Cl/OH})_{Amp} - 3.74 + 1.5 \times Mg^# + 0.0027 \times T$$  \hspace{1cm} (8)

in which (Cl/OH)$_{melt}$ and (Cl/OH)$_{Amp}$ are molar ratios of Cl/OH in melt and amphiboles, respectively, $Mg^#$ is molar ratio of Mg/(Mg+Fe) and T is temperature in Kelvin. However, no experimental works are found concerning the partitioning of F between amphibole and melt.