Parameterized lattice strain models for REE partitioning between amphibole and silicate melt

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Recalibration of the empirical model of Tiepolo et al. (2007)

We recalibrated the melt composition model of Tiepolo et al. (2007) for 15 elements (REE+Y) using our compiled database. Their model takes on the following expression,

$$\ln D_{\mathrm{REE}}^{\text{amph-melt}} = a + b X_{nf} / X \,, \qquad \text{(S1)}$$

where a and b are constants determined by linear regression analysis of individual amphibole-melt REE+Y partition coefficients; X_{nf}/X is the measure of melt polymerization (mole fractions of Si and Al balanced by alklais, Nielsen 1985). The new coefficients obtained from the recalibration are given in Table S1.

Table S1. Coefficients in the regression equations of Tiepolo et al. (2007) recalibrated using the partitioning data compiled in this study (Table 1).

	a	1σ	*b*	1σ
La	-5.06	0.02	5.26	0.02
Ce	-5.23	0.02	6.6	0.02
Pr	-2.14	0.04	0.89	0.04
Nd	-4.84	0.02	7.34	0.02
Sm	-4.63	0.02	7.64	0.02
Eu	-4.42	0.03	7.4	0.04
Gd	-4.15	0.01	7.34	0.01
Tb	-4.56	0.03	8.29	0.04
Dy	-4.59	0.02	8.16	0.02
Y	-4.02	0.02	6.84	0.02
Ho	-5.27	0.03	9.23	0.04
Er	-4.81	0.02	8.36	0.02
Tm	-6.04	0.03	10.34	0.03
Yb	-5.06	0.02	8.39	0.02
Lu	-5.93	0.03	9.28	0.03

Note: a and *b* are coefficients of Eq. (S1).

References cited

Nielsen, R.L. (1985) A method for the elimination of the compositional dependence of trace element distribution coefficients. Geochimica et Cosmochimica Acta, 49(8), 1775–1779.

Tiepolo, M., Oberti, R., Zanetti, A., Vannucci, R., and Foley, S.F. (2007) Trace-element partitioning between amphibole and silicate melt. Reviews in Mineralogy and Geochemistry, 67(1), 417–452.

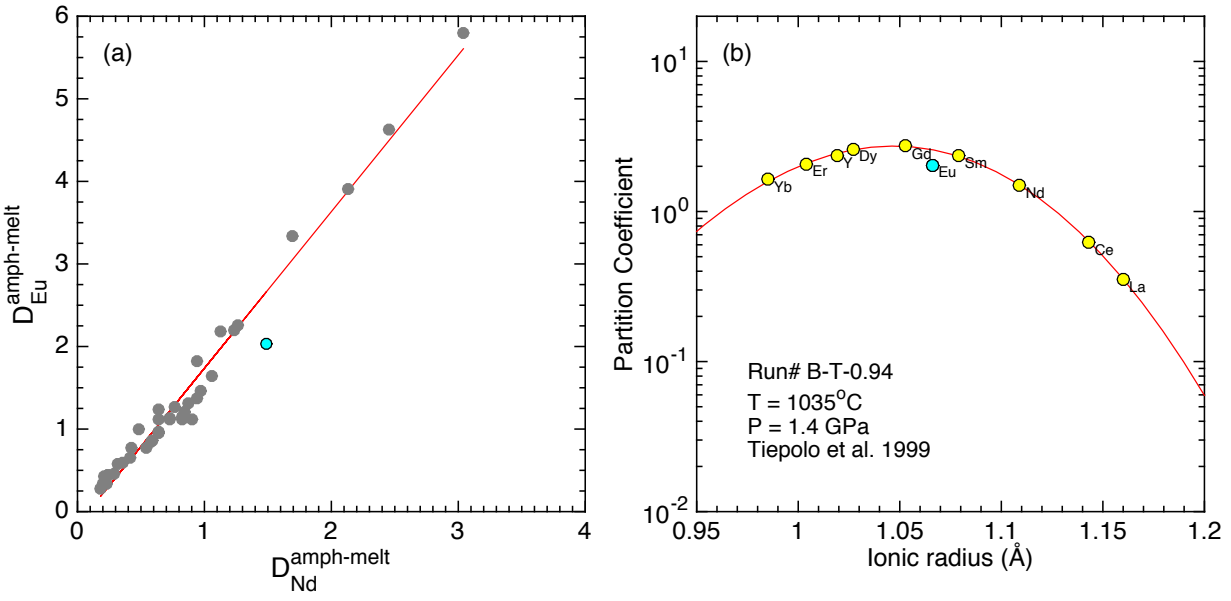
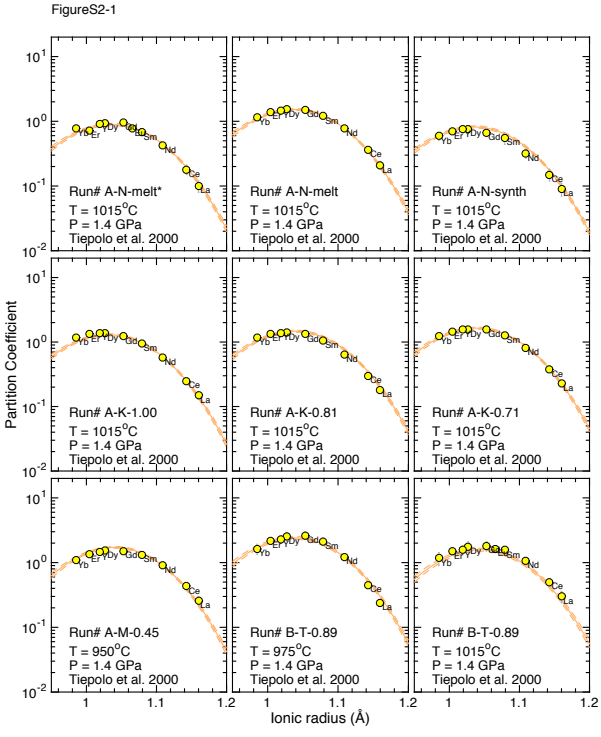
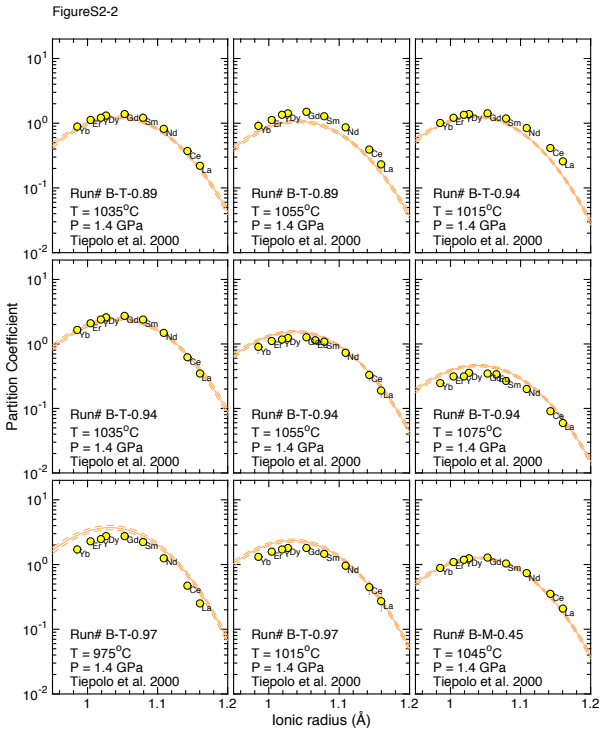


FIGURE S1. Example of the procedure used to filter unusual experimental REE partitioning data. (**a**) Partition coefficients of similarly incompatible element pairs in experiments (gray dot) with the off-trend data highlighted in cyan color. The red line is a linear least squares fit to the data. (**b**) Onuma diagram (Onuma et al., 1968) showing the partition coefficients (yellow dots) measured in the highlighted experiment in **a**, and the outlier element is highlighted in cyan color. The red line is a non-linear least-squares regression to the lattice strain model (Blundy and Wood, 1994). This particular example shows that there is a Eu anomaly in the experimental partitioning data that must be filtered.





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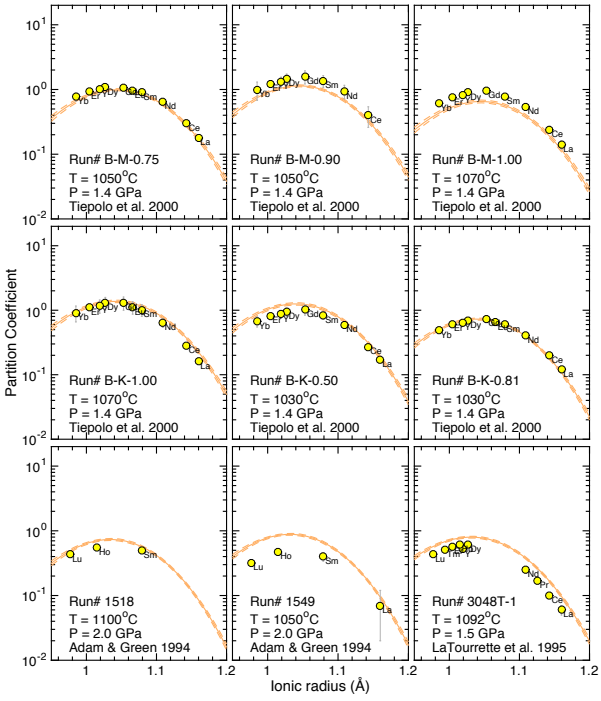

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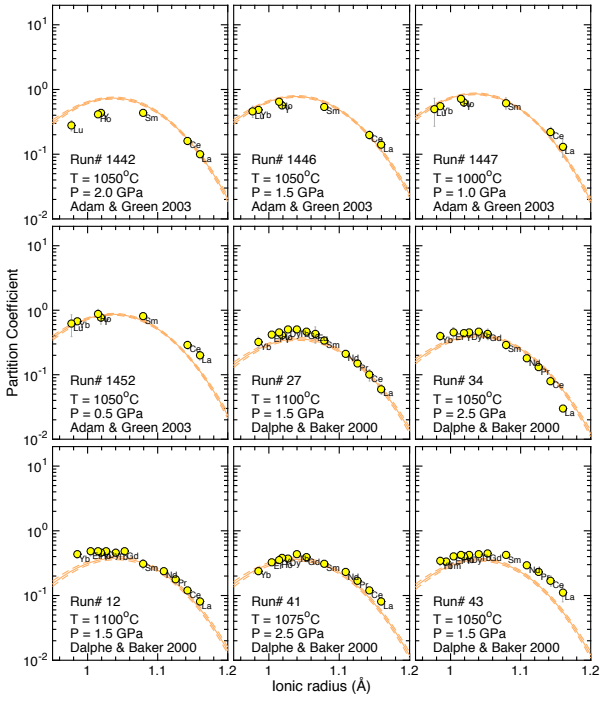

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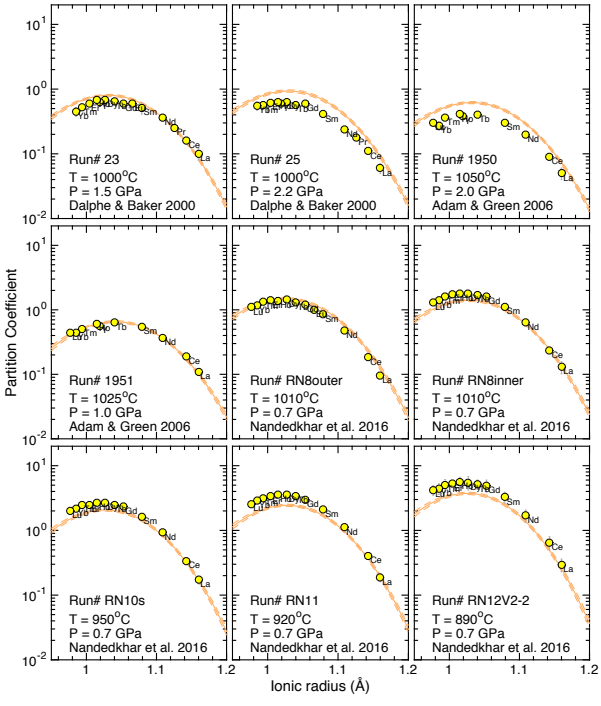

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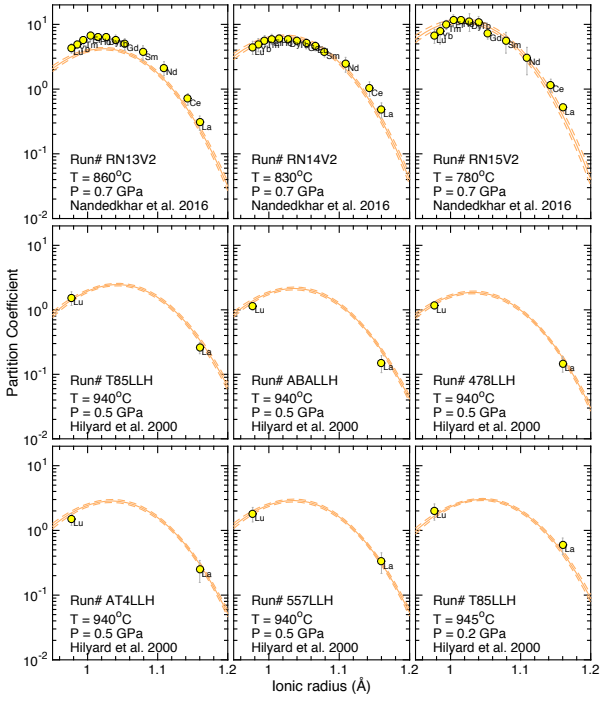

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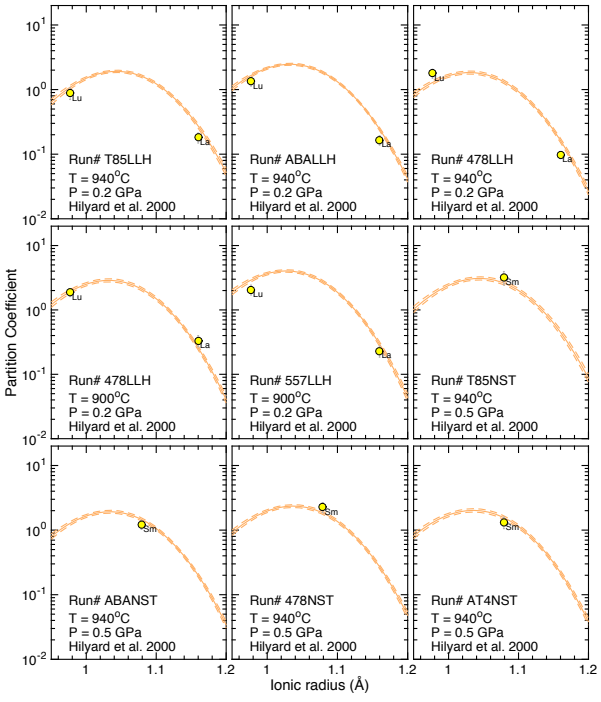

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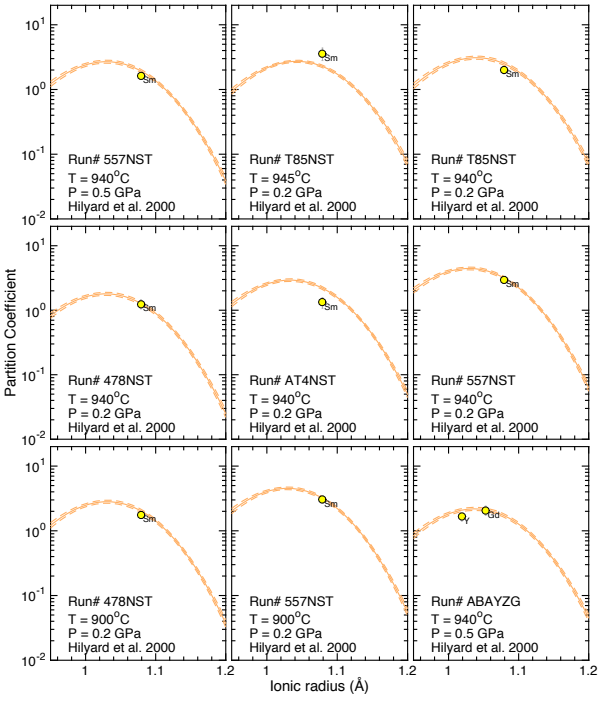

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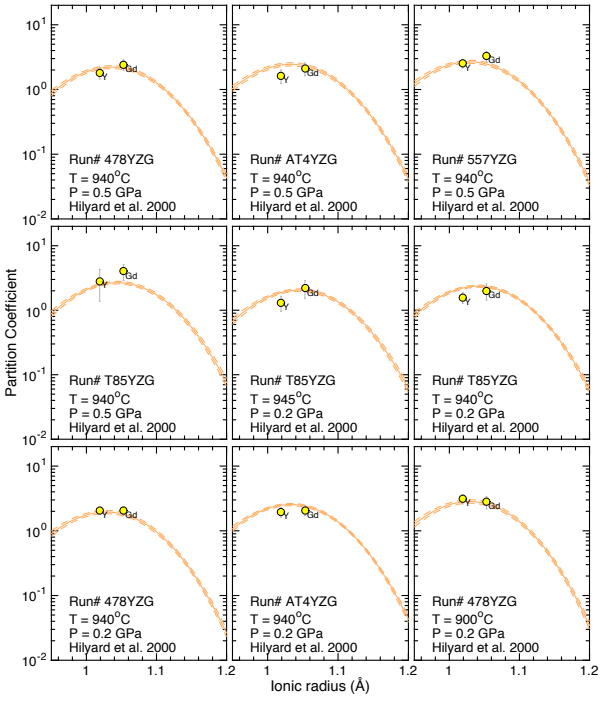

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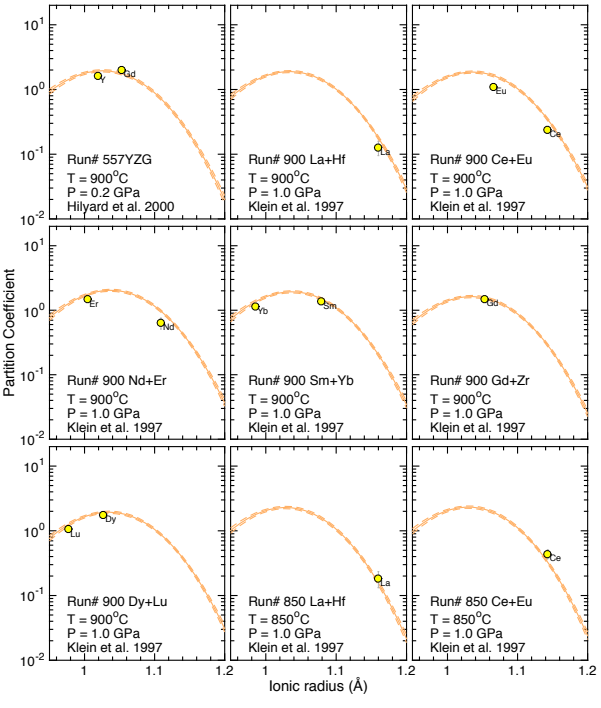

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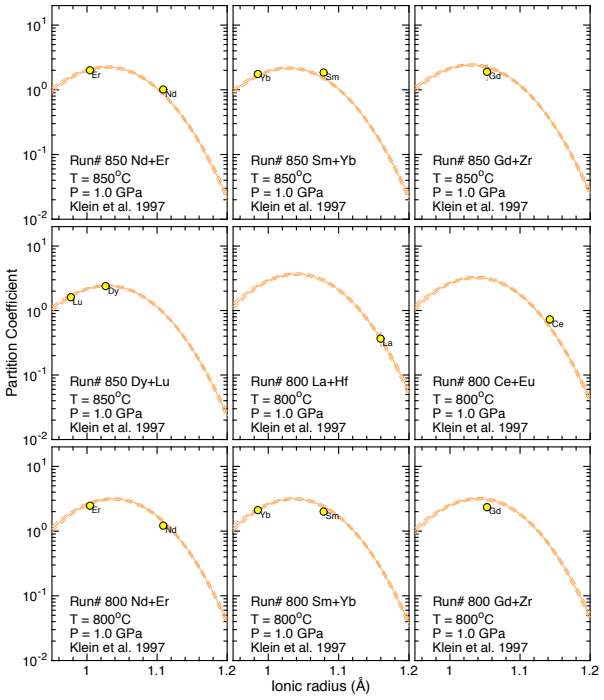

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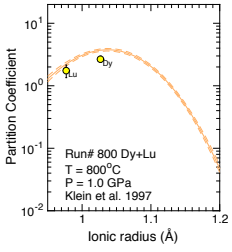
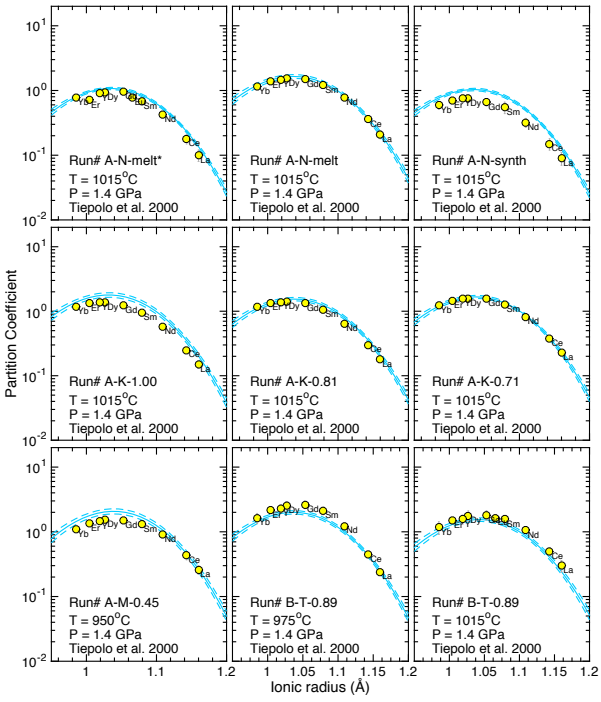


FIGURE S2. Comparisons of measured amphibole-melt partitioning data (yellow circles) and those predicted by the melt composition model (Eqs. (1, (11)–(13)). Dashed lines are the 95% confidence interval of the predicted partition coefficients.

FigureS3-1



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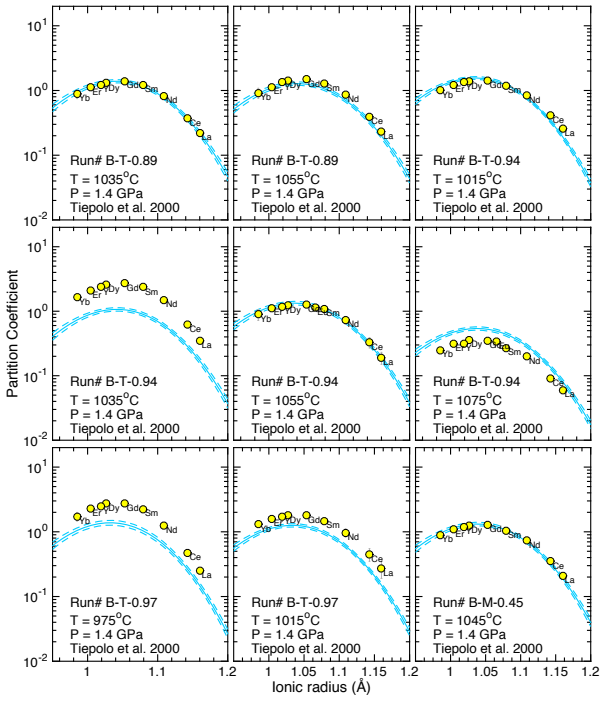

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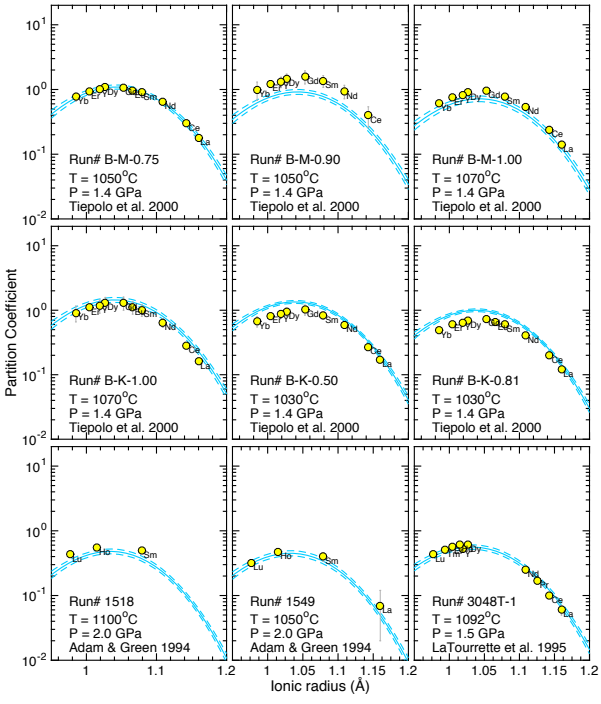

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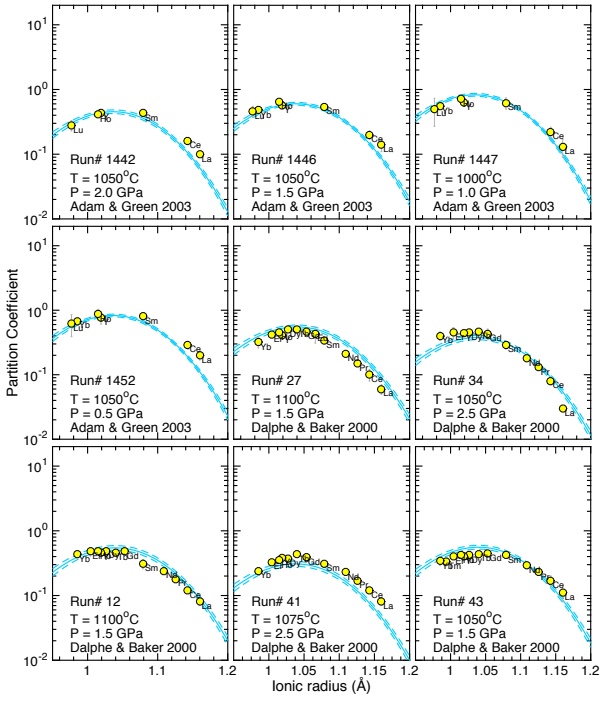

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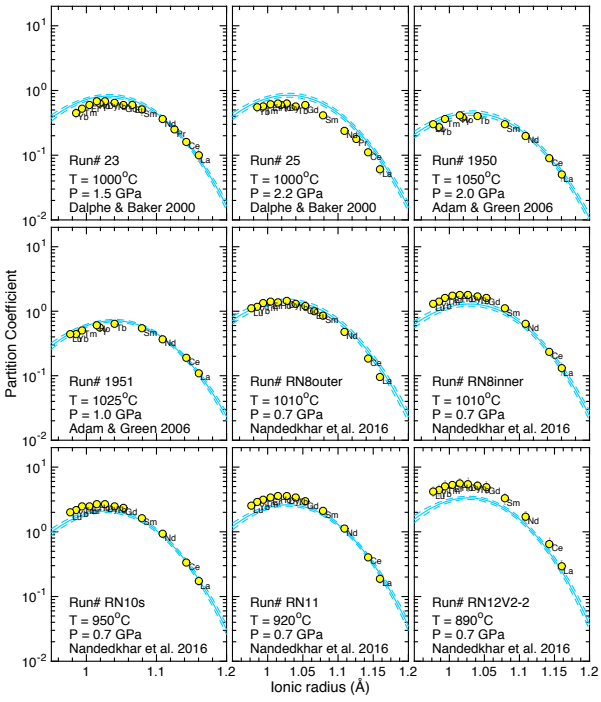

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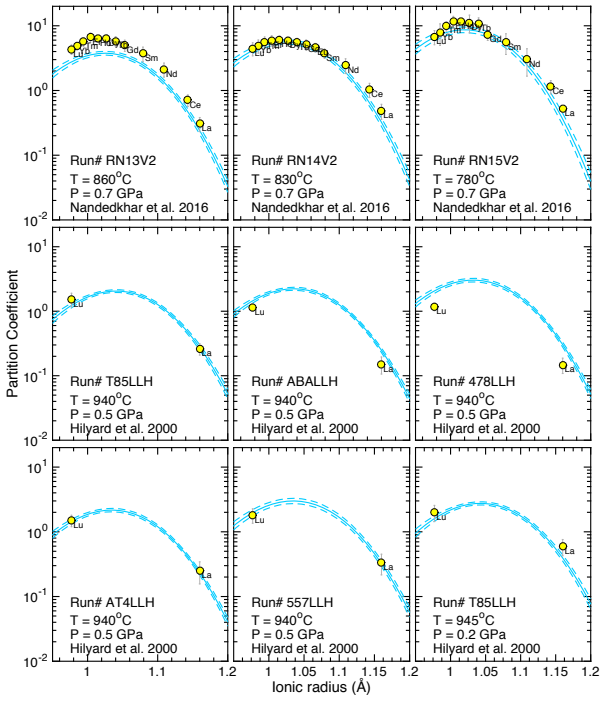

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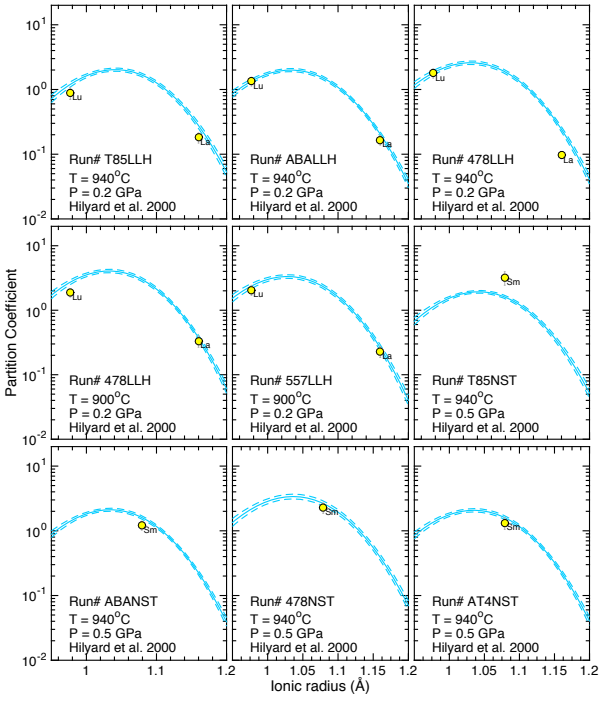

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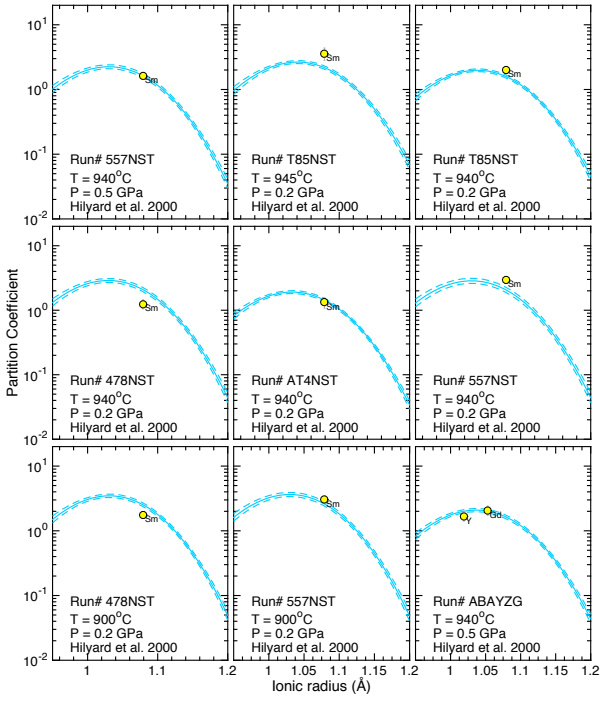

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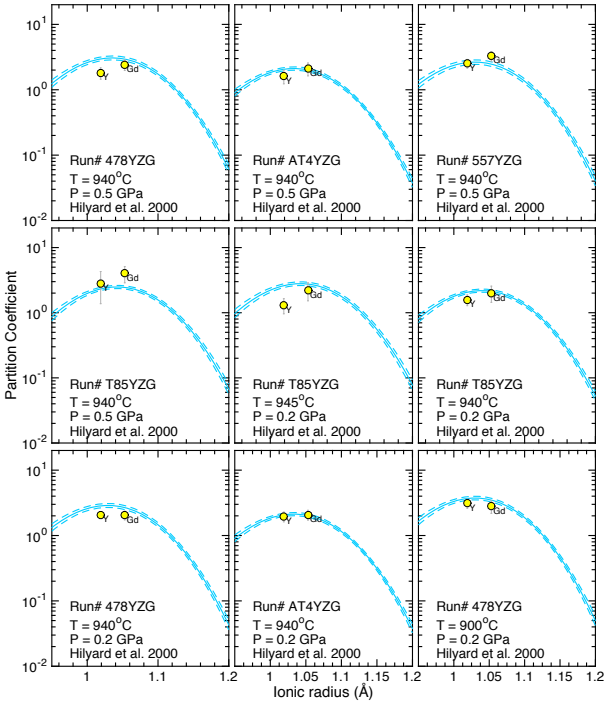

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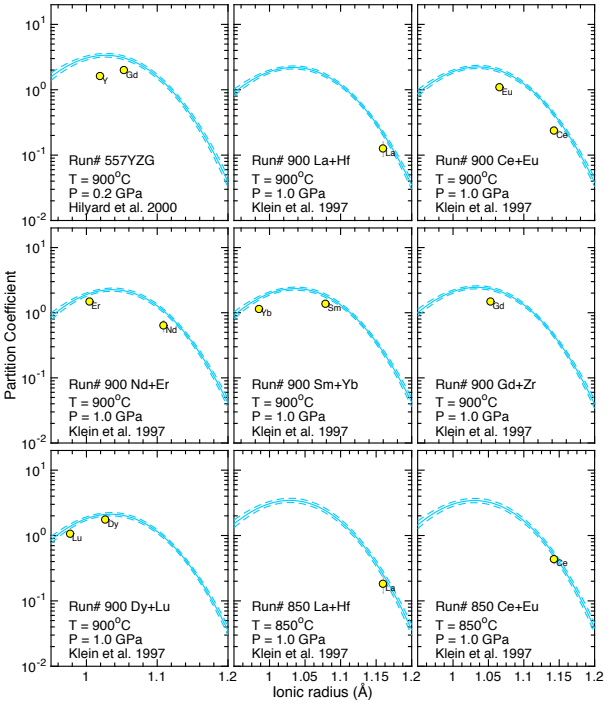

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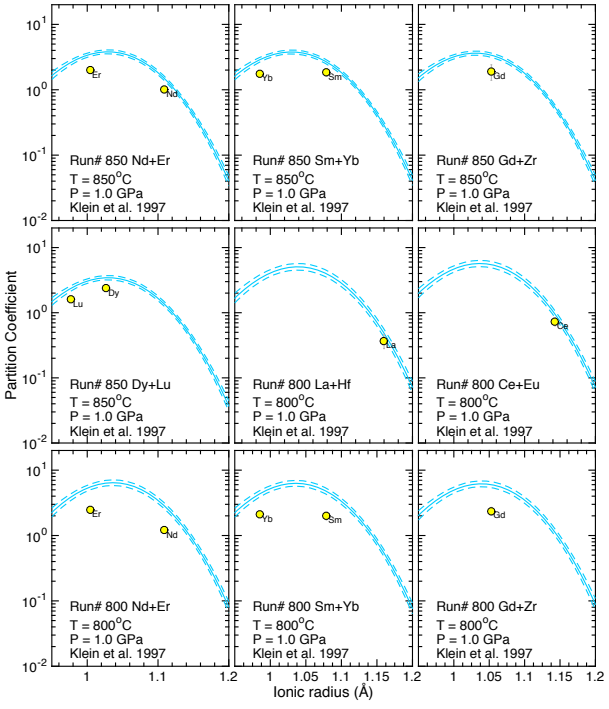

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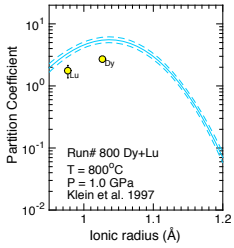

FIGURE S3. Comparisons of measured amphibole-melt partitioning data (yellow circles) and those predicted by the mineral composition model (Eqs. (1, (14)–(16))). Dashed lines are the 95% confidence interval of the predicted partition coefficients.

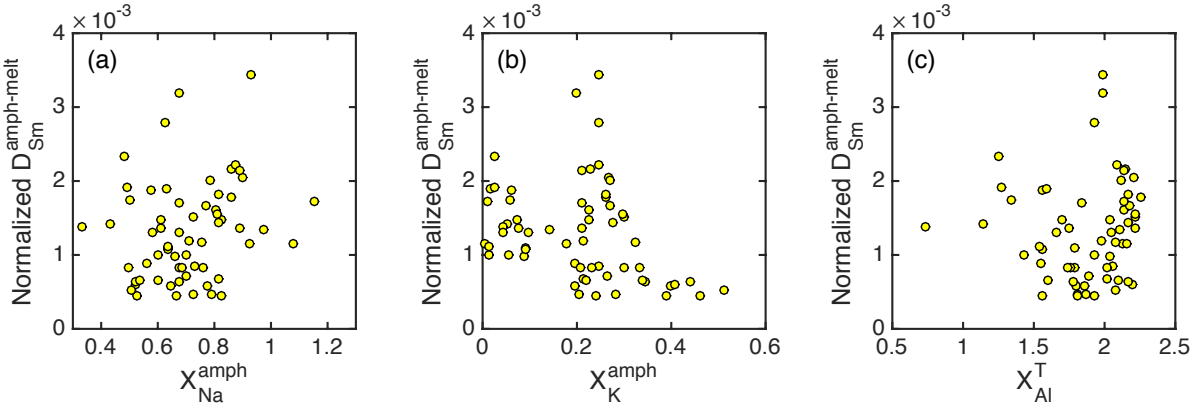

Figure S4. Plots of amphibole-melt Sm partition coefficient against (**a**) Na, (**b**) K, and (**c**) tetrahedrally coordinated Al^T in the amphibole. The partition coefficients of Sm are normalized using Eq. (17). The partitioning data are from the compiled experiments in Table 1.

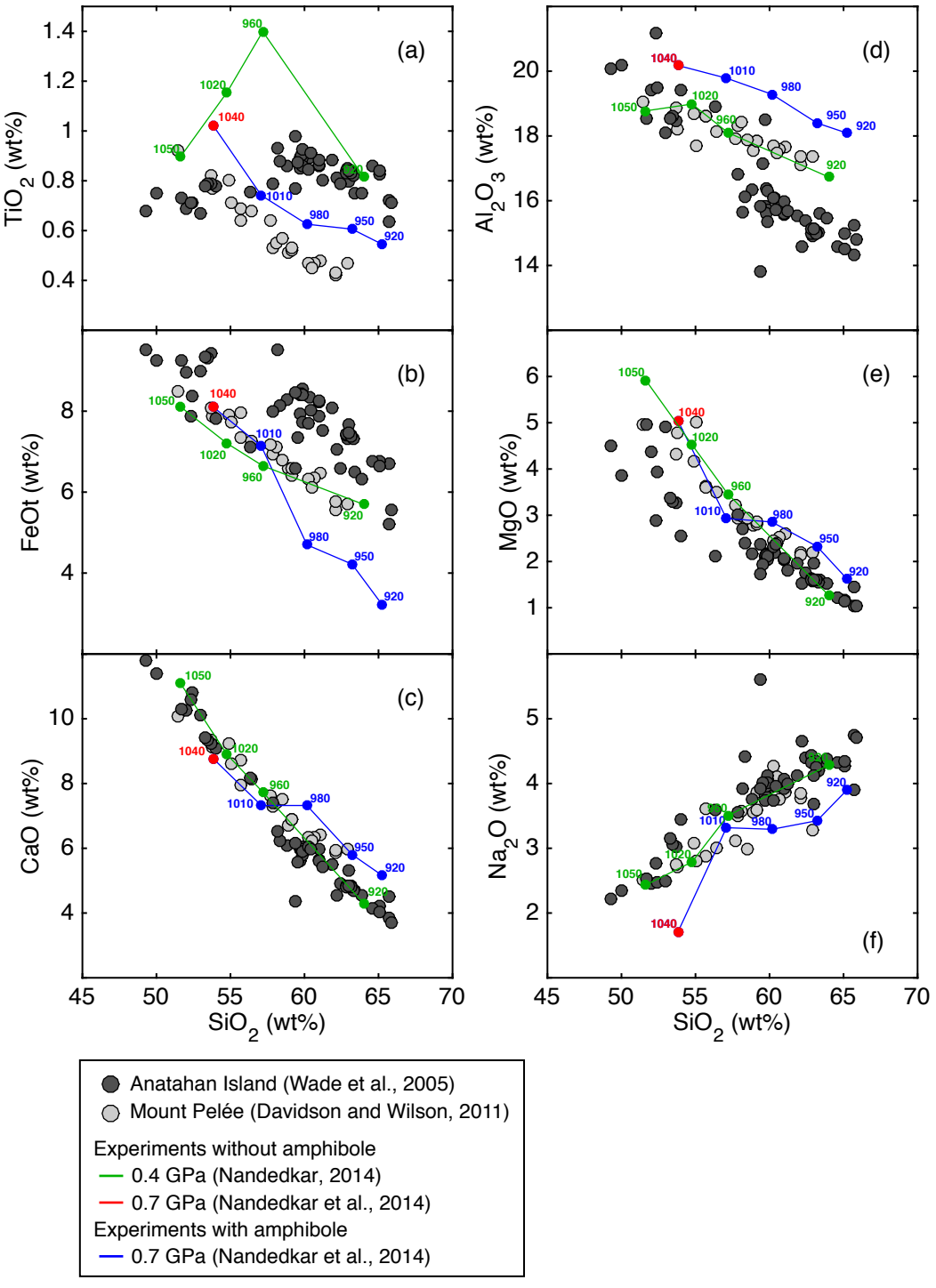

FIGURE S5. Major element composition of the samples from Mt. Pelée in the Lesser Antilles Arc (Davidson and Wilson, 2011) and Anatahan Island in the Mariana Arc (Wade et al., 2005). Also plotted are subsets of the 0.7 GPa melts (Nandedkar et al., 2014) and 0.4 GPa melts (Nandedkar, 2014) that have similar major element concentrations to those in the samples, which were used for the calculation shown in Figure 8. The major element concentration of the experimental melts is normalized on an anhydrous basis since some experiments have H_2O contents of up to 8.7 wt%. The numbers associated with each circles correspond to experimental temperatures in degrees Celsius. The red circles are 0.7 GPa melts saturated in clinopyroxene, the blue circles are those saturated in amphibole, and the green circles are the 0.4 GPa melts.