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Supplementary material: No direct effect of F, Cl and P on REE partitioning between carbonate and alkaline silicate melts

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This supplementary material contains one supplementary table and one supplementary figure.

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Supplementary Table S1. Major and trace element compositions of the secondary carbonate liquid phase "CL2" analysed by EMPA and LA-ICP-MS (wt % and ppm respectively)

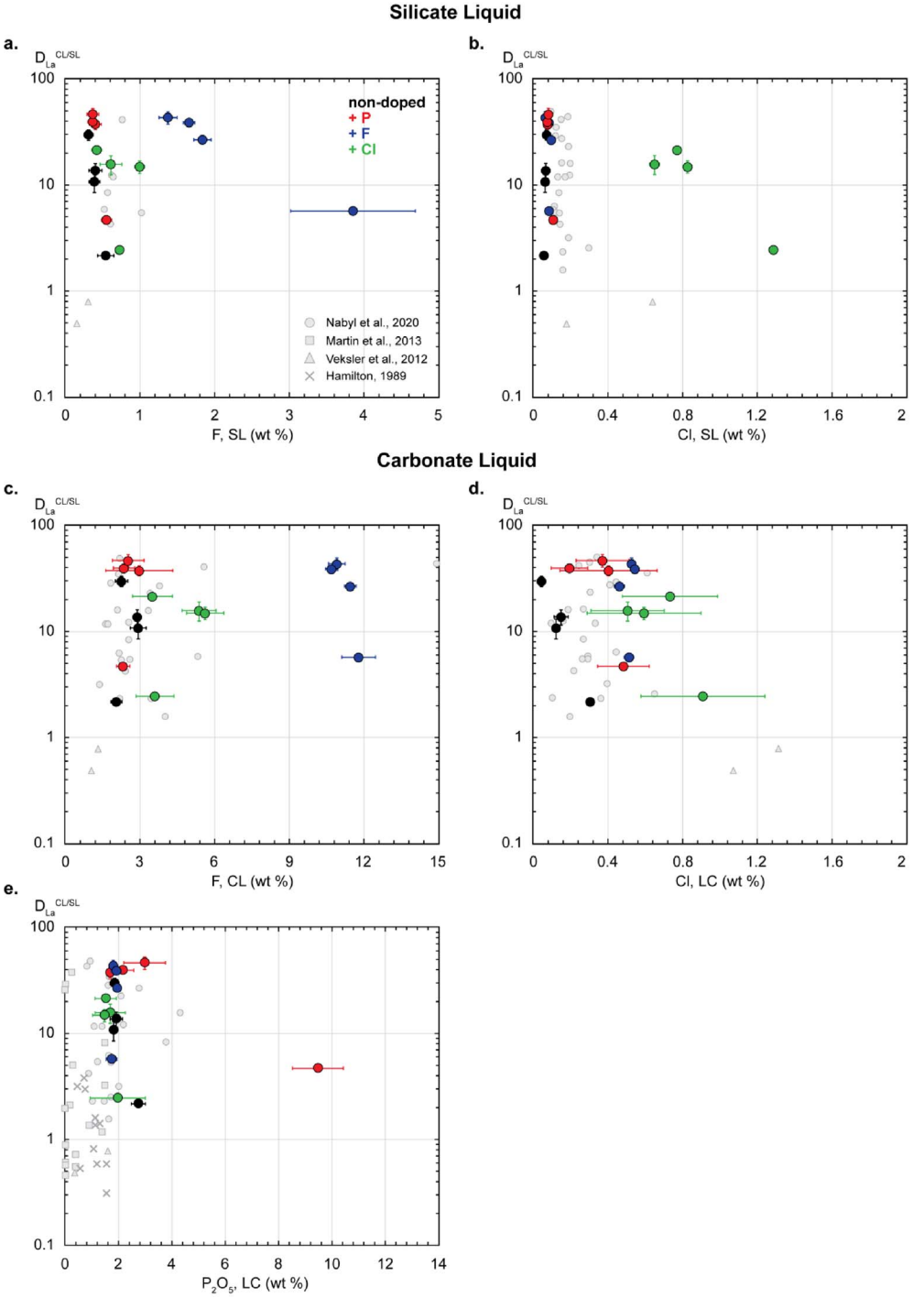
	PCPC1_01		PCPC1_02	
P (Gpa)	0.8		0.8	
T (°C)	850		850	
Starting material	PhCbn1		PhCbn1	
N	7	s.d.	8	s.d.
SiO_2	0.27	0.07	0.94	0.64
TiO_2	bdl	—	bdl	—
Al_2O_3	Bdl	—	0.58	0.33
FeO	0.45	0.06	0.38	0.03
MnO	0.77	0.17	0.55	0.13
MgO	2.26	0.13	2.72	0.25
CaO	44.13	2.55	44.78	3.28
Na_2O	17.68	0.77	17.40	0.77
K_2O	1.46	0.20	1.33	0.05
P_2O_5	2.46	0.36	2.12	0.24
BaO	2.08	0.23	1.84	0.12
SrO	2.46	0.35	2.20	0.26
SO_2	0.28	0.07	0.31	0.12
F	3.03	0.2+	3.02	0.61
Cl	0.43	0.04	0.38	0.02
Total	77.76	—	78.55	—
Na_2O+K_2O	19.14	0.97	18.73	0.83
N	8	σ	6	σ
Sc	24.79	4.01	41.44	10.22
Ti	572.62	123.90	587.54	281.54
Cr	—	—	—	—
Mn	8550.71	671.89	8316.65	368.71
Sr	17627.47	1101.29	15695.88	655.01
Zr	4.28	2.09	47.52	98.51
Nb	143.45	23.80	149.42	45.10
Ba	13229.35	745.79	11003.13	890.24
La	363.67	43.36	243.36	91.71
Ce	359.95	36.58	242.17	72.41
Pr	311.34	36.10	234.19	73.58
Nd	307.74	36.26	232.21	70.43
Sm	299.55	37.57	248.83	70.22
Eu	314.82	45.54	260.20	66.70
Gd	307.63	39.73	231.98	56.60

(continued on next page)

Supplementary Table S1. (continued)

	PCPC1_01		PCPC1_02	
P (Gpa)	0.8		0.8	
T (°C)	850		850	
Starting material	PhCbn1		PhCbn1	
N	7	s.d.	8	s.d.
Tb	295.48	71.15	215.42	51.08
Dy	296.87	50.32	247.21	53.52
Y	336.98	60.16	275.02	66.00
Ho	286.15	54.82	242.92	52.84
Er	253.18	49.49	216.65	45.66
Yb	246.49	45.25	213.36	41.76
Lu	204.63	37.60	174.85	33.70
Hf	0.26	0.07	4.11	9.05
Ta	0.92	0.42	1.60	2.12

N. number of analysis; bdl. below detection limit; s.d. standard deviation.



Supplementary Figure S1. La partition coefficients ($D_{La}^{CL/SL}$) between carbonate and silicate liquids (CL and SL) represented versus the silicate liquid F and Cl contents in wt % (a and b), and the carbonate liquid F, Cl and P_2O_5 contents in wt % (c, d and e). All experimental samples synthetised in the four chemical systems (in black for the non-doped system; in red for the P-rich system; blue for the F-rich system and green for the Cl-rich system), at 850 °C–1050 °C–0.8 GPa and ± additional H_2O are represented. The grey symbols correspond to previous experimental studies of carbonate and silicate melt immiscibility [Hamilton *et al.* 1989; Veksler *et al.* 2012; Martin *et al.* 2013; Nabyl *et al.* 2020]. No correlation between the La partition coefficients and the silicate and carbonate melt F, Cl and P_2O_5 concentrations is observed, as well as in previous experimental studies.