Supplementary materials – Riker et al.: VOLATILE PARTITIONING IN THE SYSTEM APATITE–SILICATE MELT

EPMA analytical conditions - apatite

Our standard analytical setup for electron probe microanalysis of apatite using the 5-spectrometer Cameca SX-100 electron microprobe at University of Bristol was (peak counting times given for each element; background counting times half as long):

Spectrometer 1 [LPET]:	Cl (120 s)			
Spectrometer 2 [PC1]:	F (120 s)			
Spectrometer 3 [LPET]:	Ca (30 s)	P (30 s)	K (30 s)	Ti (30 s)
Spectrometer 4 [TAP]:	Na (60 s)	Si (30 s)	Al (30 s)	Mg (60 s)
Spectrometer 5 [LLIF]:	Fe (60 s)	Mn (60 s)		

A 15 kV, 10 nA, 10 μm electron beam was used as a pragmatic compromise between the need for accurate analyses and the need to mitigate sample damage (e.g. Stormer et al. 1983; Goldoff et al. 2012; Stock et al. 2015). Na was calibrated on albite; Si and Mg on St John's Island olivine; Cl on NaCl; F on MgF_2; P and Ca on Durango apatite; K and Al on sanidine; Mn on Mn metal and Ti and Fe on ilmenite. Oriented secondary standards of Durango (Young et al. 1969) and Wilberforce apatite were analysed before, during and after every run.

EPMA analytical conditions - glass

Our standard analytical setup for electron probe microanalysis of hydrous glass using the 5-spectrometer Cameca SX-100 electron microprobe at University of Bristol was (peak counting times given for each element; background counting times half as long):

Spectrometer 1 [LPET]:	Cl (120 s)			
Spectrometer 2 [PC1, or PC0 for Fe-bearing glasses]:			F (120 s)	
Spectrometer 3 [LPET]:	Ca (30 s)	P (30 s)	K (30 s)	Ti (30 s)
Spectrometer 4 [TAP]:	Na (60 s)	Si (30 s)	Al (30 s)	Mg (30 s)
Spectrometer 5 [LLIF]:	Fe (60 s)	Mn (60 s)		

We used a 15 kV, 2 nA, 15 μm electron beam to mitigate sample damage (e.g. Devine et al. 1995; Humphreys et al. 2006). Na and Si were calibrated on albite; Mg on St John's Island olivine; Cl on NaCl; F on MgF_2; P on Durango apatite; Ca on wollastonite; K and Al on sanidine; Mn on Mn metal and Ti and Fe on ilmenite. Secondary standards KN18 (Nielsen & Sigurdsson 1981) and BCR were analysed before, during and after every analytical run, together with Durango apatite and three synthetic, fluorine-bearing basaltic glasses prepared using starting material SH3.

Reference materials used for analysis of volatiles

Reference	Sample	Phase	Used for
Shishkina et al. (2010)	M5, M10, M21, M36, M40, M47, N72	Basalt glass	Glass CO_2
Shishkina et al. (2010)	M5, M36, M40, N72	Basalt glass	Glass H_2O
Mangan & Sisson (2000)	♯51	Rhyolite glass	Glass CO_2 and H_2O
Hauri et al. (2002)	519-4-1	Basalt glass	Glass CO_2 and H_2O
Brooker et al. (1999)	RB480	Basalt glass	Glass CO_2
Mandeville et al. (2002)	Run84	Andesite glass	Glass H_2O
Hunt & Hill (1993)	Lipari	Rhyolite glass	Glass H_2O, F and Cl

Vetere et al. (2014)	AH1, AH2_4, St3_AH2_3, St3_AH1_2	Alkali glass	Glass CO_2 and H_2O
In-house standards	DUR, TNK, LIN, YAT, BAH2, IML5, SIB1, WIL2, JUM, PAN2, MAD2	Apatite	Apatite volatiles
Schettler et al. (2011)	APS-17, APS-26, APS25	Apatite	Apatite volatiles

Volatile-exchange K_Ds (mole fraction basis)

Experiment	$\log K_D^{OH-F}$	$\log K_D^{OH-Cl}$	$\log K_D^{Cl-F}$	XOH_m	XF_m	XCl_m
BA6	-1.070			0.041	0.016	
BA9	-1.032			0.168	0.028	
BA10	-1.228			0.088	0.02	
BA11	-1.026			0.062	0.031	
BA12	-1.074	-0.766	-0.148	0.054	0.018	0.015
BA14	-1.183	-0.468	0.627	0.171	0.017	0.015
BM13	-1.546			0.081	0.017	
BM14	-1.584	-0.716	-0.391	0.078	0.017	0.025
BM16	-1.604	-0.684	-0.276	0.085	0.019	0.025

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