

Table DR1. Pressure Characterizations from Quartz Thermobarometry

Lava flow Ar-Ar age (ka)		Scaup Lake	Mallard Lake	Buffalo Lake	Pitchstone Plateau
		255	164	160	79
ppm Ti in quartz	unzoned crystals	mean range n	126 123-129 2	117 109-125 22	111 98-120 30
	rims of zoned crystals	mean range n	122 112-134 20	116 106-128 18	113 101-122 25
	cores of zoned crystals	mean range n	152 150-155 3	134 125-148 11	130 119-146 17
T (°C)			820-890	820-890	820-890
$a_{TiO_2}$			0.35-0.55	0.35-0.55	0.35-0.55
P (kbar)	Thomas et al. (2010)		5.5-12 (9.4)	5.7-12.3 (9.6)	5.9-12.7 (9.9)
Depth (km)			21-45 (36)	21-46 (36)	22-48 (37)
P (kbar)	Huang and Audébat (2012)		0.6-4 (2.1)	0.7-4 (2.3)	0.8-5 (2.5)
Depth (km)			2-16 (8)	3-17 (9)	3-18 (9)
					2-20 (9)

n= number of analyses. Temperatures based on compilation of Central Plateau Member rhyolite data of Watts et al. (2012). Activity ranges from Vazquez et al. (2009). Depths calculated using 2700 kg m<sup>-3</sup> as crustal density. Pressure ranges calculated for the range of Ti content of unzoned crystals and zoned rims combined, activity ranges and temperature ranges using the equations of Thomas et al. (2010):

$$RT \ln X_{TiO_2}^{quartz} = -60952 + 1.520T - 1741P + RT \ln a_{TiO_2} \quad (1)$$

and Huang and Audébat (2012):

$$\log Ti_{aTiO_2=1} = -0.27943 \times \frac{10000}{T(K)} - 660.53 \left( \frac{P}{T} \right)^{0.35} + 5.6459 \quad (2)$$

where T is in K, P in kbar,  $a_{TiO_2}$  the activity of  $TiO_2$ , X a molar fraction and R the gas constant 8.34 J/K.  $Ti_{aTiO_2=1}$  is the solubility of Ti in quartz in ppm at  $a_{TiO_2}=1$ . Assuming

that Ti behaves following Henry's law, we calculate  $Ti_{aTiO_2=1} = \frac{Ti_{measured(ppm)}^{quartz}}{a_{TiO_2}}$

Pressures and depths in brackets were obtained by using average Ti content for unzoned and rims of quartz zoned quartz, and average activity and temperature values for each sample.