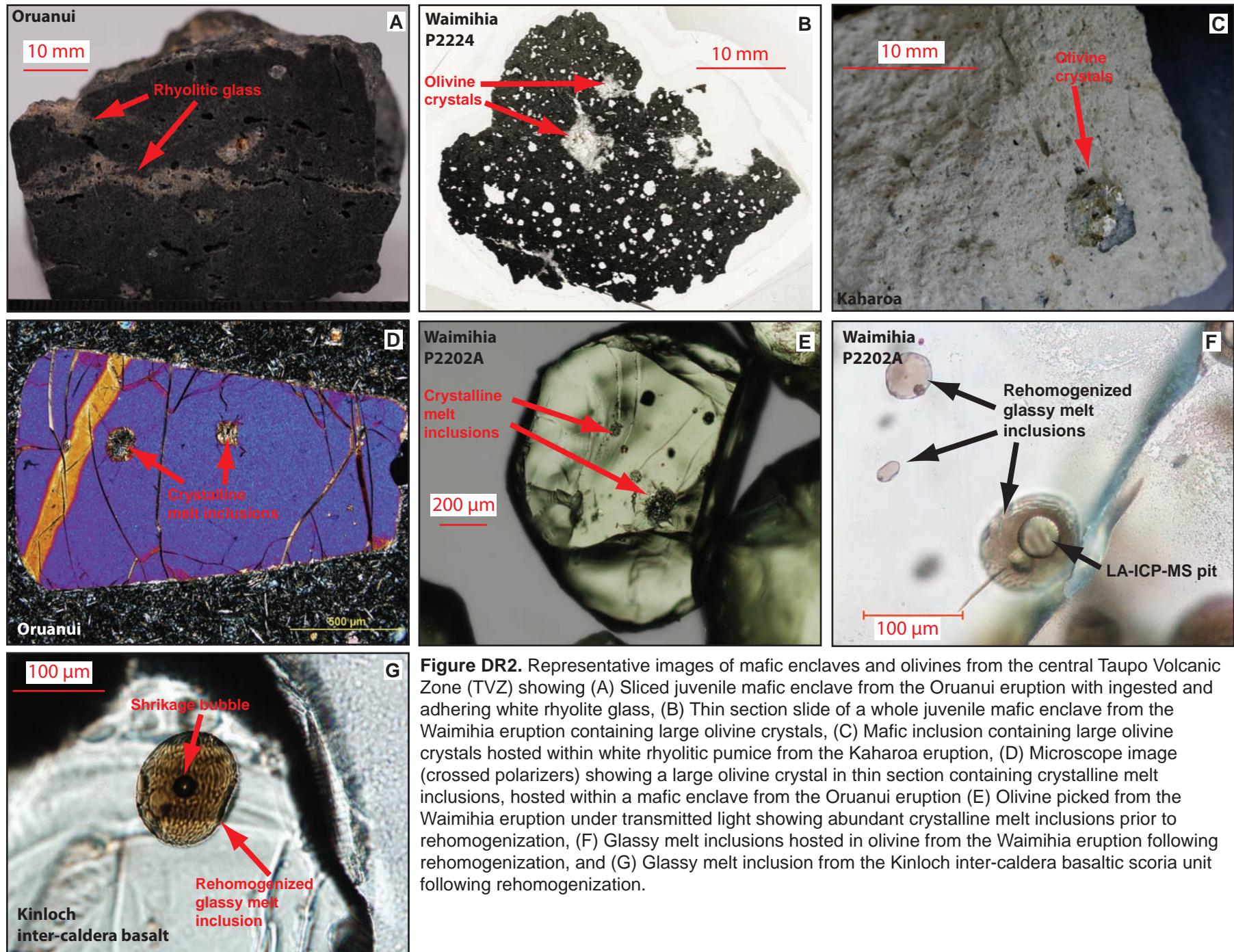


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**Table DR1.** Major element compositions for whole rock samples and standards analysed by X-ray fluorescence (XRF)

Sample no.	Volcano	Type	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	Fe <sub>2</sub> O <sub>3</sub>	MgO	MnO	Na <sub>2</sub> O	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Sum	LOI
KAH1	Okataina (Kaharoa eruption)	Enclave	55.47	0.73	16.24	8.97	8.17	4.77	0.15	2.78	1.16	0.13	98.57	1.11
KAK1	Kakuki	Scoria	48.61	1.13	17.28	11.24	9.61	7.54	0.16	2.59	0.31	0.19	98.66	0.59
KAK1(B)	Kakuki	Scoria	48.81	1.13	17.25	11.26	9.59	7.54	0.16	2.59	0.31	0.19	98.83	0.57
KAK2	Kakuki	Scoria	49.01	1.15	17.49	11.46	9.71	7.68	0.16	2.66	0.32	0.19	99.83	0.27
KAK2	Kakuki	Scoria	49.28	1.14	17.45	11.45	9.70	7.62	0.16	2.66	0.32	0.20	99.98	0.27
KAK3	Kakuki	Scoria	48.92	1.14	17.31	11.39	9.64	7.60	0.16	2.65	0.33	0.19	99.32	0.24
ONGA1	Ongaroto	Lava	50.32	1.11	15.25	10.06	10.02	9.12	0.17	2.57	0.57	0.28	99.47	-0.17
ONGA2	Ongaroto	Lava	50.20	1.06	15.61	10.29	9.87	9.23	0.17	2.49	0.52	0.25	99.68	0.07
ONGA3	Ongaroto	Lava	49.66	1.07	15.69	10.46	9.83	8.92	0.17	2.38	0.48	0.24	98.89	0.24
ONGA4	Ongaroto	Lava	49.10	1.10	15.78	9.78	9.98	9.01	0.17	2.36	0.43	0.23	97.94	0.94
Pun1	Punatekahi	Scoria	46.54	1.13	17.57	9.01	11.80	5.13	0.19	1.77	0.20	0.09	93.43	5.94
Pun2	Punatekahi	Scoria	48.74	1.00	17.18	11.48	10.57	6.42	0.17	1.89	0.21	0.12	97.78	1.51
Pun3	Punatekahi	Scoria	48.16	0.99	17.19	11.98	10.55	7.00	0.18	2.13	0.25	0.12	98.55	0.54
Pun4	Punatekahi	Scoria	48.70	0.99	17.28	12.07	10.55	6.93	0.18	2.18	0.33	0.12	99.32	0.80
Pun5	Punatekahi	Scoria	49.13	1.00	17.17	12.14	10.55	7.12	0.17	2.11	0.30	0.13	99.82	0.13
Pun6	Punatekahi	Scoria	48.79	0.99	16.95	11.94	10.43	7.04	0.17	2.09	0.32	0.13	98.85	0.52
Tat1(A)	Tatua	Scoria	49.26	1.00	17.12	12.03	10.52	7.02	0.18	2.28	0.31	0.13	99.84	0.11
Tat1(B)	Tatua	Scoria	49.10	0.99	16.92	11.97	10.49	6.98	0.17	2.26	0.31	0.13	99.33	-0.01
SY-2	Internal standard SY-2	Average	59.74	0.13	11.95	7.88	6.17	2.64	0.32	4.24	4.44	0.43		
SY-2	Internal standard SY-2	2 sd % (precision)	0.35	1.89	0.40	0.44	0.31	0.32	0.61	0.39	0.43	1.22		
SY-2	Internal standard SY-2	Recommended value	60.11	0.15	12.04	7.96	6.31	2.69	0.32	4.31	4.45	0.43		
SY-2	Internal standard SY-2	% offset (accuracy)	-0.62	-11.17	-0.79	-1.07	-2.18	-1.93	-1.33	-1.62	-0.17	0.64		

Analyses performed at the University of Auckland on a PANalytical Axios XRF spectrometer. Loss on ignition (LOI) was conducted on all sample powders after heating at 900 °C for 16 h. Glass beads for XRF analysis were made from a 2:1 mixture (by mass) of non-ignited powder and lithium meta (64.7%)/ tetra (36.3%) borate fused in a PANalytical Eagon 2 at 1000 °C for 85 min. Oxide abundances given in wt %, with original values and analytical totals.



**Figure DR2.** Representative images of mafic enclaves and olivines from the central Taupo Volcanic Zone (TVZ) showing (A) Sliced juvenile mafic enclave from the Oruanui eruption with ingested and adhering white rhyolite glass, (B) Thin section slide of a whole juvenile mafic enclave from the Waimihia eruption containing large olivine crystals, (C) Mafic inclusion containing large olivine crystals hosted within white rhyolitic pumice from the Kaharoa eruption, (D) Microscope image (crossed polarizers) showing a large olivine crystal in thin section containing crystalline melt inclusions, hosted within a mafic enclave from the Oruanui eruption (E) Olivine picked from the Waimihia eruption under transmitted light showing abundant crystalline melt inclusions prior to rehomogenization, (F) Glassy melt inclusions hosted in olivine from the Waimihia eruption following rehomogenization, and (G) Glassy melt inclusion from the Kinloch inter-caldera basaltic scoria unit following rehomogenization.

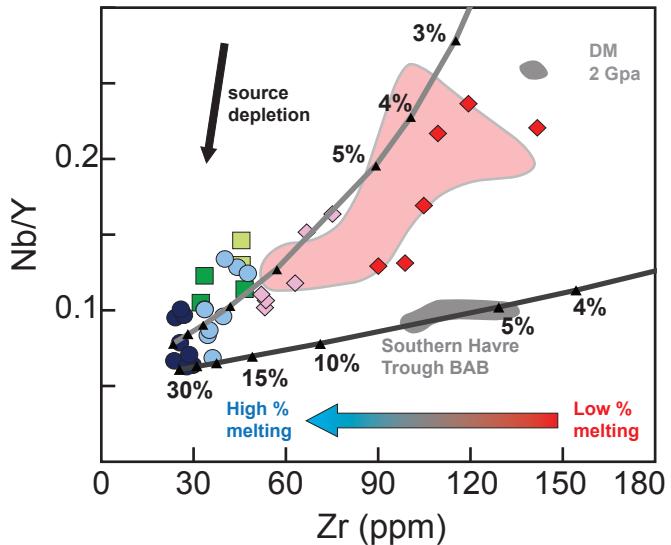
GSA Data Repository 2020145

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Table DR3. Major element compositions for melt inclusions (raw data and corrected), olivine hosts, and analytical standards as determined by Electron Microprobe Analysis (EPMA) (see detailed methods in caption)

Table DR4. Trace element compositions for melt inclusions and analytical standards by Laser Ablation ICP-MS (LA-ICP-MS) (see caption for full analytical methods)

Table DR5. Major and trace element abundances for melt inclusions back-calculated for parental primary melt compositions using the PRIMACALC 2.0 software from Kimura and Ariskin (2014)



**INTRA-CALDERA    INTER-CALDERA**

- |                 |            |
|-----------------|------------|
| ■ Okareka (Ok)  | ◆ Kinloch  |
| ■ Kaharoa (Ok)  | ◆ Ongaroto |
| ● Oruanui (Tp)  |            |
| ○ Waimihia (Tp) |            |

**Figure DR6.** Nb/Y (degree of mantle depletion) versus Zr for primary melts back-calculated using PRIMACALC 2 software (Kimura and Ariskin, 2014) with homogenized olivine-hosted melt inclusion and olivine data from intra- and inter-caldera basalts from the central TVZ. See Figure 3d for further details and Table DR5 for raw data.

**Table DR7.** Thermal calculations of magma flux along the length of the central TVZ using geothermal and eruptive outputs

Table DR7. Thermal calculations of magma flux along the length of the central TVZ using geothermal and eruptive outputs							
Location (from NNE to SSW)	Heat source	MW thermal release	Basalt equivalent, Kg from geothermal	Kg magma per sec	Rhyolite per kyr, since 53 ka (km <sup>3</sup> )	Basalt per kyr, continuous (km <sup>3</sup> )	Mafic magma (km <sup>3</sup> ) per kyr per km
<b>Okataina (20 km length)</b>	Kawerau	100	1.8E+12	58		0.7	0.035
	Rotoma	220	4.0E+12	128		1.5	0.077
	Waimangu	325	5.9E+12	188		2.3	0.114
	Tikitere	190	3.5E+12	110		1.3	0.067
Erupted rhyolite = 188 km <sup>3</sup>					3.55	17.7	0.887
			<b>Total caldera 1</b>	<b>484</b>		<b>23.6</b>	<b>1.181</b>
<b>Inter-caldera (80 km length)</b>	Waiotapu/Waikite	610	1.1E+13	354		4.3	0.054
	Taheke	13	2.4E+11	8		0.1	0.001
	Rotorua	420	7.7E+12	243		3.0	0.037
	Horohoro	4	7.3E+10	2		0.0	0.000
	Reporoa	15	2.7E+11	9		0.1	0.001
	Te Kopia	150	2.7E+12	87		1.1	0.013
	Atiamuri	10	1.8E+11	6		0.1	0.001
	Orakeikorako	340	6.2E+12	197		2.4	0.030
	Ngatamariki	40	7.3E+11	23		0.3	0.004
	Ohaaki	70	1.3E+12	41		0.5	0.006
	Mokai	400	7.3E+12	232		2.8	0.035
	Rotokawa	300	5.5E+12	174		2.1	0.026
	Wairakei	420	7.7E+12	243		3.0	0.037
	Tauhara	110	2.0E+12	64		0.8	0.010
			<b>Total inter-caldera</b>	<b>1682</b>		<b>20.4</b>	<b>0.255</b>
<b>Taupo (20 km length)</b>	Taupo	200	3.7E+12	116		1.4	0.070
	Tokaanu	200	3.7E+12	116		1.4	0.070
Erupted rhyolite = 587 km <sup>3</sup>					11.08	55.4	2.769
			<b>Total caldera 2</b>	<b>232</b>		<b>58.2</b>	<b>2.910</b>

Thermal release of geothermal systems is from Bibby et al. (1995). Total rhyolite erupted volumes and ages are from Wilson et al. (2009) and references therein. Heat capacity defined as 1500 J/kg K from XXXX et al. (XXXX) and calculated for basalt cooling over a temperature interval of 1150 K. Calculations of basalt supply from rhyolitic eruptive volumes assumes that a minimum of five times the amount of basalt is required to drive rhyolitic volcanism, considering that ~80 to 90% fractional crystallisation is required to link basaltic and rhyolitic compositions (Barker et al., 2015). Average eruptive volumes are subject to a large degree of uncertainty, depending on the sampling interval and the total time required to form large crustal magma reservoirs. Post-Rotoiti (53 ka) eruptions only are used here as older eruptions have poor preservation and eruptive histories/volumes are not as well constrained (Wilson et al., 2009). Longer crystallisation histories of 100 ka, for example, would reduce mafic magma flux to 0.75 and 1.5 km<sup>3</sup> / kyr / km at Okataina and Taupo, respectively.

<b>References cited:</b>	Bibby, H.M., Caldwell, T.G., Davey, F.J. and Webb, T.H., 1995, Geophysical evidence on the structure of the Taupo Volcanic Zone, New Zealand, <i>Tectonophysics</i> , v. 295, p. 1-16.
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