

**Table 1.** Summary of Na<sub>2</sub>CO<sub>3</sub> melting and orthopyroxene assimilation experiments and results.

Label	JKR-1b	YL-250	JKR-2a	JKR-3a	JKR-4b	JKR-9a	JKR-5a	JKR-5b	YL-252	JKR-8a	JKR-6a	JKR-7a	YL-253
Wt. % Opx	0.00	0.00	4.66	9.03	16.45	20.46	23.08	23.08	25.00	25.59	33.38	37.42	40.01
T <sub>max</sub> (°C)	1000	1100	1000	1025	1025	1075	1050	1075	1100	1100	1075	1100	1100
Time (min)	60	85	37	40	45	40	40	60	75	60	50	50	75
Original Bulk Compositions													
SiO <sub>2</sub>	0.00	0.00	2.79	5.41	9.85	12.25	13.81	13.81	14.96	15.31	19.98	22.39	23.94
MgO	0.00	0.00	1.87	3.63	6.60	8.21	9.27	9.27	10.04	10.27	13.40	15.02	16.06
Na <sub>2</sub> O	58.48	58.48	55.75	53.19	48.86	46.51	44.98	44.98	43.86	43.52	38.96	36.60	35.08
CO <sub>2</sub>	41.52	41.52	39.59	37.77	34.69	33.03	31.94	31.94	31.14	30.90	27.66	25.99	24.91
Experimental Results & Evolved Melt Compositions													
Wt. Loss (%)	0.90	1.84	5.20	20.43	20.56	18.29	16.17	16.21	16.45	23.21	22.30	23.07	20.99
SiO <sub>2</sub>	0.00	0.00	2.94	6.80	12.39	14.99	16.48	16.49	17.91	19.94	25.71	29.11	30.30
MgO	0.00	0.00	1.97	4.56	8.31	10.05	11.05	11.06	12.01	13.38	17.25	19.53	20.33
Na <sub>2</sub> O	59.01	59.57	58.81	66.85	61.50	56.93	53.66	53.68	52.49	56.67	50.14	47.57	44.40
CO <sub>2</sub>	40.99	40.43	36.28	21.80	17.79	18.03	18.81	18.77	17.59	10.02	6.90	3.79	4.97
Δ CO <sub>2</sub> (%)	-0.53	-1.09	-3.31	-15.97	-16.90	-14.99	-13.16	-13.13	-13.55	-20.88	-20.76	-22.20	-19.95

**Table 2.** Comparison of Igwisi Hills kimberlite<sup>32</sup> to model melts resulting from carbonatite assimilation of orthopyroxene.

No. Label	Igwisi Hills Lavas				Model Compositions						
	2 BD864*	3 BD853*	6 BD864**	7 BD864***	0	10	Opx Assimilated (wt. %)				
SiO <sub>2</sub>	22.2	19.6	16.3	18.8	5.2	12.0	15.7	19.6	23.4	27.3	38.9
Al <sub>2</sub> O <sub>3</sub>	3.6	3.2	4.7	4.2	0.3	0.4	0.4	0.4	0.5	0.5	0.5
MgO#	37.2	36.9	30.7	33.7	23.3	28.8	31.3	33.5	35.6	37.4	41.8
CaO	21.1	24.0	27.5	24.7	25.9	26.9	26.6	26.0	25.0	23.8	18.7
Na <sub>2</sub> O	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO <sub>2</sub>	15.9	16.3	20.7	18.6	45.3	31.9	26.0	20.5	15.5	11.0	0.0

# Oxide wt.% combined for MgO + FeO including converted Fe<sub>2</sub>O<sub>3</sub>, \* Samples of matrix rich tops of Igwisi Hills kimberlite lavas, \*\* Calculated composition based on removing ~21% mantle olivine from BD864, \*\*\* Calculated composition based on sample BD864 and removing mantle olivine component and adding ~10% phenocrystic olivine.