Appendices

for

Magma chamber assembly and dynamics of a supervolcano: Whakamaru, Taupo Volcanic Zone, New Zealand

Naomi E. Matthews

Thesis submitted to the University of Oxford
for the degree of Doctor of Philosophy

Department of Earth Sciences
and University College
University of Oxford

Trinity 2011

Appendices

Table A1: ***Whakamaru Group Ignimbrite and Rangitawa Tephra sample catalogue***

					Analysis						
Sample	**Latitude (°S)**	**Longitude (°E)**	**Unit**	**Type of sample**	**Thin section**	**XRF**	**Zirc**	**Qtz**	**Feld**	**Glass EPMA**	**LA-ICP-MS**
P1788	-38.22398	175.94557	Whakamaru	pumice	✓	✓			✓		
P1789	-38.22398	175.94557	Whakamaru	pumice	✓	✓			✓	✓	
P1790	-38.22398	175.94557	Whakamaru	pumice	✓	✓					
P1791	-38.21341	175.93598	Whakamaru	pumice	✓	✓					
P1793	-38.21077	175.93359	Whakamaru	pumice	✓						
P1794	-38.21077	175.93359	Whakamaru	pumice	✓	✓					
P1795	-38.21077	175.93359	Whakamaru	pumice		✓					
P1826	-38.32517	175.68432	Whakamaru	pumice	✓				✓	✓	
P1827	-38.32517	175.68432	Whakamaru	pumice	✓	✓			✓		
P1828	-38.32517	175.68432	Whakamaru	pumice	✓	✓					
P1885	-38.32517	175.68432	Whakamaru	pumice		✓			✓	✓	
P1886	-38.32517	175.68432	Whakamaru	pumice		✓			✓	✓	
P1887	-38.22398	175.94557	Whakamaru	pumice							
P1888	-38.22398	175.94557	Whakamaru	pumice	✓						
P1889	-38.22398	175.94557	Whakamaru	pumices	✓						
P1889m	-38.22398	175.94557	Whakamaru	pumices	✓	✓					
P1890	-38.22398	175.94557	Whakamaru	pumice	✓						
P1893	-38.16822	175.90554	Whakamaru	pumice	✓						
P1894	-38.16822	175.90554	Whakamaru	pumice	✓	✓					
P1895	-38.16822	175.90554	Whakamaru	pumice	✓						
P1896	-38.16822	175.90554	Whakamaru	pumice	✓	✓					
P1897	-38.16822	175.90554	Whakamaru	pumice	✓	✓					
P1899	-38.16822	175.90554	Whakamaru	pumice	✓						
P1900	-38.16822	175.90554	Whakamaru	pumices	✓						
P1900a	-38.16822	175.90554	Whakamaru	pumices	✓						
P1900b	-38.16822	175.90554	Whakamaru	pumice							
P1917	-38.62190	175.82563	Whakamaru	pumices	✓						
P1917f	-38.62190	175.82563	Whakamaru	pumice	✓	✓					
P1918	-38.21077	175.93359	Whakamaru	pumice	✓	✓					
P1919	-38.21077	175.93359	Whakamaru	pumices							
P1919a	-38.21077	175.93359	Whakamaru	pumices	✓						
P1920a	-38.56033	175.94254	Whakamaru	pumice		✓					
P1923	-38.56033	175.94254	Whakamaru	pumice	✓	✓					
P1924	-38.56033	175.94254	Whakamaru	pumices	✓						
P1892	-38.16822	175.90554	Whakamaru	pumice	✓				✓	✓	
P1898	-38.16822	175.90554	Whakamaru	pumice	✓				✓	✓	

Sample	Latitude (°S)	Longitude (°E)	Unit	Type of sample	Thin section	XRF	Zirc	Qtz	Feld	Glass EPMA	LA-ICP-MS
P1891	-38.16822	175.90554	Whakamaru	pumice	✓						
P1788	-38.22398	175.94557	Whakamaru	pumice	✓						
WM1	-38.21912	175.88937	Whakamaru	Vitrophyric tuff	✓						
WH2	-38.59295	175.64412	Whakamaru	Vitrophyric tuff	✓						
P1922	-38.20554	175.92651	Whakamaru	pumice	✓				✓		
P1921	-38.20554	175.92651	Whakamaru	pumice	✓				✓	✓	
P1885	-38.20554	175.92651	Whakamaru	pumice	✓						
P1920	-38.20554	175.92651	Whakamaru	pumice	✓		✓	✓	✓	✓	✓
SB1119/ P2058	-38.32517	175.68432	Whakamaru	Pumice	✓		✓	✓	✓	✓	✓
P1886	-38.22398	175.94557	Whakamaru	Pumice	✓						
710815	-38.78603	175.22764	Whakamaru	Ignimbrite	✓						
710820	-38.49600	175.56383	Whakamaru	Ignimbrite	✓						
710821 710822 710823	-38.43497	175.65431	Whakamaru	Ignimbrite							
91083	-38.57211	175.71950	Whakamaru	Ignimbrite	✓						
91084 91085 91086	-38.58744	175.67881	Whakamaru	Ignimbrite	✓						
91087	-38.55397	175.71731	Whakamaru	Ignimbrite	✓						
91088	-38.54844	175.70394	Whakamaru	Ignimbrite	✓						
910810	-38.56356	175.83378	Whakamaru	Ignimbrite							
910811	-38.56656	175.83519	Whakamaru	Ignimbrite	✓						
910812	-38.58167	175.83681	Whakamaru	Ignimbrite	✓	✓					
910816	-38.58167	175.83681	Whakamaru	Ignimbrite							
910819	-38.61575	175.88747	Whakamaru	Ignimbrite							
111081	-38.77533	175.67119	Whakamaru	Ignimbrite	✓						
111082	-38.72500	175.65897	Whakamaru	Ignimbrite							
111083	-38.71011	175.67156	Whakamaru	Ignimbrite	✓						
11084	-38.70047	175.68217	Whakamaru	Ignimbrite							
111086	-38.66811	175.69700	Whakamaru	Ignimbrite							
111089	-38.66956	175.73444	Whakamaru	Ignimbrite	✓						
1110810	-38.66117	175.69175	Whakamaru	Ignimbrite	✓						
1110811	-38.49978	175.79758	Whakamaru	Ignimbrite	✓						
1110812	-38.48847	175.78644	Whakamaru	Ignimbrite	✓	✓					
1110812a	-38.48847	175.78644	Whakamaru	Ignimbrite	✓						
1110813	-38.49008	175.77497	Whakamaru	Ignimbrite	✓						
1110814	-38.51906	175.83258	Whakamaru	Ignimbrite	✓						
1110815	-38.51450	175.84864	Whakamaru	Ignimbrite							
1110816	-38.50956	175.84925	Whakamaru	Ignimbrite							
1110817	-38.64961	175.82672	Whakamaru	Ignimbrite	✓						

APPENDIX 1: WHAKAMARU GROUP SAMPLE CATALOGUE

Sample	Latitude (°S)	Longitude (°E)	Unit	Type of sample	Thin section	XRF	Zirc	Qtz	Feld	Glass EPMA	LA-ICP-MS
1110818	-38.47608	175.81933	Whakamaru	Ignimbrite	✓						
1110819	-38.44525	175.80739	Whakamaru	Ignimbrite	✓						
1110820	-38.44525	175.80739	Whakamaru	Pumices							
1110821	-38.44525	175.80739	Whakamaru	Ignimbrite		✓					
1110821a	-38.44525	175.80739	Whakamaru	Ignimbrite							
1110822	-38.45894	175.73317	Whakamaru	Ignimbrite	✓						
1110823	-38.42919	175.74214	Whakamaru	Ignimbrite	✓						
121081	-38.35563	175.73744	Whakamaru	Ignimbrite							
121083	-38.35030	175.73967	Whakamaru	Ignimbrite	✓						
121084	-38.34964	175.73861	Whakamaru	Ignimbrite	✓						
121085	-38.34911	175.73772	Whakamaru	Ignimbrite	✓						
121086	-38.34828	175.73750	Whakamaru	Ignimbrite	✓						
121087	-38.34764	175.73692	Whakamaru	Ignimbrite	✓						
121088	-38.34706	175.73617	Whakamaru	Ignimbrite	✓						
121089	-38.34608	175.73475	Whakamaru	Ignimbrite	✓						
1210810	-38.34558	175.73467	Whakamaru	Ignimbrite	✓						
1210811	-38.34600	175.73372	Whakamaru	Ignimbrite							
1210813	-38.34681	175.73403	Whakamaru	Ignimbrite							
1210816	-38.34981	175.73392	Whakamaru	Ignimbrite	✓						
1210817	-38.35508	175.73567	Whakamaru	Ignimbrite	✓						
1210818	-38.35392	175.74714	Whakamaru	Ignimbrite	✓						
1210819	-38.35392	175.74714	Whakamaru	Ignimbrite	✓						
1210820	-38.35472	175.74689	Whakamaru	Ignimbrite	✓						
1210821	-38.36117	175.71919	Whakamaru	Ignimbrite							
1210822	-38.32286	175.68436	Whakamaru	Ignimbrite	✓						
1210823	-38.32028	175.68033	Whakamaru	Ignimbrite	✓						
1210824	-38.34675	175.69697	Whakamaru	Ignimbrite	✓						
1210825	-38.37052	175.73606	Whakamaru	Ignimbrite	✓						
1210826	-38.37953	175.69458	Whakamaru	Pumice	✓						
1210828	-38.39639	175.65503	Whakamaru	Ignimbrite	✓						
BH1/1	-38.40508	175.49067	Whakamaru	Pumice		✓					
BH1/2	-38.40508	175.49067	Whakamaru	Pumice		✓					
BH1/3	-38.40508	175.49067	Whakamaru	Lithics							
BH1/4	-38.40508	175.49067	Whakamaru	Ignimbrite							
BH1/5	-38.40508	175.49067	Whakamaru	Ignimbrite		✓					
BH 1/6	-38.40508	175.49067	Whakamaru	Ignimbrite	✓						
BH1/7	-38.40508	175.49067	Whakamaru	Ignimbrite							
TA 1/1	-38.37133	175.49153	Whakamaru	Pumice	✓	✓					
T1/1	-38.15231	175.54345	Whakamaru	Ignimbrite							

Sample	Latitude (°S)	Longitude (°E)	Unit	Type of sample	Thin section	XRF	Zirc	Qtz	Feld	Glass EPMA	LA-ICP-MS
T1/2	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/3	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/4	-38.15231	175.54345	Whakamaru	Lithics							
T1/6	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/7	-38.15231	175.54345	Whakamaru	Pumice							
T1/8	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/9	-38.15231	175.54345	Whakamaru	Lithic		✓					
T1/10	-38.15231	175.54345	Whakamaru	Pumice							
T1/11	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/12	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/13	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/14	-38.15231	175.54345	Whakamaru	Pumice		✓					
T1/15	-38.15231	175.54345	Whakamaru	Pumice		✓					
T3/1	-38.13274	175.56448	Whakamaru	Pumice	✓						
T3/1a	-38.13274	175.56448	Whakamaru	Pumice	✓						
T3/1b	-38.13274	175.56448	Whakamaru	Pumice	✓						
T3/1c	-38.13274	175.56448	Whakamaru	Pumice	✓						
T3/2	-38.13274	175.56448	Whakamaru	Pumice	✓						
T3/4	-38.13274	175.56448	Whakamaru	Pumice	✓	✓					
T3/5	-38.13274	175.56448	Whakamaru	Pumice	✓	✓					
T4/1	-38.12175	175.55392	Whakamaru	Pumice	✓	✓					
T4/1a	-38.12175	175.55392	Whakamaru	Pumice	✓	✓					
T4/1b	-38.12175	175.55392	Whakamaru	Pumice	✓						
T4/1c	-38.12175	175.55392	Whakamaru	Pumice	✓						
T4/2	-38.12175	175.55392	Whakamaru	Pumice							
T5	-38.22398	175.94557	Whakamaru	Pumice	✓						
T5/1	-38.22398	175.94557	Whakamaru	Pumice	✓	✓					
T5/2	-38.22398	175.94557	Whakamaru	Pumice	✓						
T5/3	-38.22398	175.94557	Whakamaru	Pumice	✓	✓					
T5/4	-38.22398	175.94557	Whakamaru	Pumice	✓	✓					
T3/2	-38.22398	175.94557	Whakamaru	Pumice	✓						
T3/4	-38.22398	175.94557	Whakamaru	Pumice	✓						
T3/5	-38.22398	175.94557	Whakamaru	Pumice	✓						
T2/1	-38.13396	175.56141	Pokai	Pumice	✓						
P1905	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓	✓	✓	✓	✓	✓
P1906	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓					
P1907	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓			✓		
P1908	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓					
P1909	-38.86931	176.05365	Rangitaiki	Pumice	✓				✓		

APPENDIX 1: WHAKAMARU GROUP SAMPLE CATALOGUE

Sample	Latitude (°S)	Longitude (°E)	Unit	Type of sample	Thin section	XRF	Zirc	Qtz	Feld	Glass EPMA	LA-ICP-MS
P1910	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓	✓	✓	✓	✓	✓
P1911	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓					
P1912	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓			✓	✓	
P1913	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓					
P1914	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓					
P1914f	-38.86931	176.05365	Rangitaiki	Pumice	✓	✓					
P1915	-38.86931	176.05365	Rangitaiki	Pumice	✓		✓	✓	✓	✓	✓
P1916	-38.86931	176.05365	Rangitaiki	Pumice	✓				✓	✓	
101081	-38.80622	176.39228	Rangitaiki	Ignimbrite	✓						
101081b	-38.80622	176.39228	Rangitaiki	Ignimbrite							
101085	-38.86800	176.05144	Rangitaiki	Ignimbrite							
141081	-38.88330	175.96670	Rangitaiki	Ignimbrite							
181081	-38.44597	176.56619	Rangitaiki	Ignimbrite	✓						
181082	-38.30772	176.73519	Rangitaiki	Ignimbrite	✓						
181084	-38.30567	176.71572	Rangitaiki	Ignimbrite							
181085	-38.33717	176.60233	Rangitaiki	Ignimbrite	✓						
181086	-38.81378	176.32086	Rangitaiki	Ignimbrite							
191081	-38.81294	176.32161	Rangitaiki	Ignimbrite							
191084	-38.75522	176.38811	Rangitaiki	Ignimbrite		✓					
191086	-38.76833	176.37894	Rangitaiki	Ignimbrite	✓						
191087	-38.67817	176.45564	Rangitaiki	Ignimbrite							
191088	-38.63044	176.49133	Rangitaiki	Ignimbrite							
1910810	-38.56850	176.54481	Rangitaiki	Ignimbrite	✓						
201082	-38.63269	176.55561	Rangitaiki	Ignimbrite	✓						
201083	-38.63428	176.55806	Rangitaiki	Ignimbrite							
201085	-38.58447	176.53306	Rangitaiki	Ignimbrite	✓						
HM-01	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓			✓		
HM-03	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-04	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-05	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-06	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓			✓		
HM-08	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-09	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-10	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-11	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-12	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-13	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-14	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-15	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					

Sample	Latitude (°S)	Longitude (°E)	Unit	Type of sample	Thin section	XRF	Zirc	Qtz	Feld	Glass EPMA	LA-ICP-MS
HM-16	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-17	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-18	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-19	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-20	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
HM-21	-38.52084	176.03123	Rangitaiki	Pumice	✓						
HM-22	-38.52084	176.03123	Rangitaiki	Pumice	✓	✓					
TW1	-38.95063	176.51674	Te Whaiti	vitrophyric tuff	✓						
TW2	-38.95063	176.51674	Te Whaiti	ignimbrite							
TW3	-38.95068	176.51705	Te Whaiti	Ignimbrite							
TW4	-38.21831	175.88591	Te Whaiti	Tuff block	✓						
101082	-38.94890	176.51550	Te Whaiti	Ignimbrite	✓						
101083	-38.92825	176.48464	Te Whaiti	Ignimbrite	✓						
101084	-38.92722	176.48228	Te Whaiti	Ignimbrite	✓						
201081	-38.82431	176.57986	Te Whaiti	Ignimbrite	✓						
MAN 1-1	-38.50427	175.22275	Manunui	Ignimbrite	✓	✓					
MAN 1-6	-38.50427	175.22275	Manunui	Ignimbrite	✓	✓					
MAN 1-8	-38.50427	175.22275	Manunui	Pumice	✓				✓		
MAN2-1	-38.50439	175.22220	Manunui	Ignimbrite							
MAN2-2	-38.50439	175.22220	Manunui	Ignimbrite							
MAN2-3	-38.50439	175.22220	Manunui	Ignimbrite							
MAN2-4	-38.50439	175.22220	Manunui	Ignimbrite							
1210827	-38.41386	175.62072	Manunui	Ignimbrite	✓						
710812	-38.78603	175.22764	Manunui	Ignimbrite							
PA1/1	-38.21111	176.17253	Paeroa	Ignimbrite		✓					
PA1/2	-38.21111	176.17253	Paeroa	Lithic							
PA1/3	-38.21111	176.17253	Paeroa	pumice							
PA1/4	-38.21111	176.17253	Paeroa	Pumices							
PA1/5a	-38.21111	176.17253	Paeroa	Pumice							
PA1/5b	-38.21111	176.17253	Paeroa	Pumice							
PA1/6	-38.21111	176.17253	Paeroa	Pumices							
PA2/1	-38.21138	176.17355	Paeroa	Lithics							
PA3/1	-38.21159	176.17354	Paeroa	Pumice		✓					
PA3/2	-38.21159	176.17354	Paeroa	Pumice	✓				✓		
PA3/3	-38.21159	176.17354	Paeroa	Pumice		✓					
PA3/4	-38.21159	176.17354	Paeroa	Pumice							
PA3/5	-38.21159	176.17354	Paeroa	Pumice							
PA3/6	-38.21159	176.17354	Paeroa	Lithics							
PA3/7	-38.21159	176.17354	Paeroa	Pumice							

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Sample	Latitude (°S)	Longitude (°E)	Unit	Type of sample	Thin section	XRF	Zirc	Qtz	Feld	Glass EPMA	LA-ICP-MS
PA3/8	-38.21159	176.17354	Paeroa	Pumice		✓					
PA3/9	-38.21159	176.17354	Paeroa	Pumice							
PA4/1	-38.21178	176.17359	Paeroa	Pumices							
16108	-38.43972	176.17194	Paeroa	Ignimbrite							
171081	-38.38067	176.25736	Paeroa	Ignimbrite	✓						
171082	-38.37967	176.25886	Paeroa	Ignimbrite	✓						
171084	-38.35575	176.28414	Paeroa	Ignimbrite	✓						
171085a	-38.35381	176.28972	Paeroa	Ignimbrite							
171086	-38.35431	176.29308	Paeroa	Ignimbrite							
131082	-38.36475	176.26869	Paeroa	Lithics							
131081	-38.36475	176.26869	Paeroa	Ignimbrite							
Rangitawa Tephra*											
RA1/1	-39.97063	175.45084	Rangitawa	Tephra							
RA1/2	-39.97063	175.45084	Rangitawa	Tephra							
RA1/3	-39.97063	175.45084	Rangitawa	Tephra		✓					
RA2/1	-39.97063	175.45084	Rangitawa	Tephra							
R2/1	-39.97063	175.45084	Rangitawa	Tephra		✓					
R2/2	-39.97063	175.45084	Rangitawa	Tephra		✓					
RA3/1	-39.58143	175.27031	Rangitawa	Tephra		✓	✓				
R025	-39.97064	175.45084	Rangitawa	Tephra							
R024	-40.13151	175.45971	Rangitawa	Tephra						✓	✓
R011	-43.90147	-176.54196	Rangitawa	Tephra						✓	✓
R006	-43.70539	-176.63727	Kawakawa	Tephra						✓	✓

Notes: 'Pumice' indicates a single pumice clast sample; 'Pumices' indicates that multiple small pumices (< 10 cm) were collected at the same locality; 'Ignimbrite' refers to bulk ignimbrite sample, taken where the deposit was strongly welded and/or pumice-poor. Rangitawa Tephra and Kawakawa Tephra samples were taken at 1 – 2 cm intervals through the stratigraphic section at each of the localities listed above. Pumice samples marked in bold were selected for detailed crystal-specific analysis. Mineral abbreviations are as follows: Zirc = zircon; Qtz = quartz; Feld = plagioclase feldspar.

Table A2: ***Petrographic descriptions for Whakamaru Group pumices and ignimbrite***

Sample	Unit	Crystal content (%)	Mineralogy	Textures* **Note: mineral abbreviations are listed at end of appendix*
P1789	Whakamaru	~15%	Plag, qtz>> opx>>mag, ilm	Plag phenocrysts display complex zoning with distinct cores, and wavy oscillatory zoning in the outer rim. Fluid inclusions are commonly restricted to core zones. Very coarse (~ 5 mm) resorbed qtz crystals. Glassy, vesicular groundmass (rounded vesicles). Qtz-rich.
P1790	Whakamaru	~20%	Qtz, plag >> opx>>mag, ilm	Qtz-rich. Qtz crystals are resorbed with fluid inclusions near rim. Plag phenocrysts display complex zoning, often with sieved textures in core. Core zone typically distinct, with a second phase of growth and concentric oscillatory zoning at rim. Opx phenocrysts are euhedral and commonly have mag/ilm inclusions. Flow-banding in vesicular groundmass.
P1791	Whakamaru	~15%	Plag, qtz>>opx, hbl>>mag, ilm	Glassy, vesicular groundmass. Qtz phenocrysts are coarse (~ 3 mm) and fractured with resorbed rims and fluid inclusions. Plag phenocrysts are zoned and often occur as glomeroporphyritic aggregates. Plag crystals commonly display sieve textures and opx inclusions in core. Rare pleochroic green hbl phenocrysts with oxide inclusions.
P1793	Whakamaru	~15%	Plag, qtz>> opx>>mag, ilm	Strongly zoned plag phenocrysts with fluid inclusions restricted to cores. Aligned and elongated vesicles create flow-banding groundmass texture. Fine opx crystals often occur with Fe-Ti oxide inclusions. Qtz phenocrysts occur as coarse, resorbed crystals (max 6 mm). Crystals occur in elongate clusters/ layers within glassy pumice groundmass.
P1794	Whakamaru	~10%+	Plag, qtz>> opx>>mag, ilm	Very strongly-zoned plag phenocrysts with oscillatory zoning in core and intermediate regions - can distinguish three main episodes of crystal growth. Very vesicular pumice groundmass.
P1826	Whakamaru	~25%	Plag, qtz>> biot>>mag, ilm	Complexly zoned plag phenocrysts, multiple stages of growth and distinct inner core visible with fluid inclusions. Coarse (3 mm+) plag phenocrysts also commonly display fracturing (fragments are not in optical continuity). Biot-rich (coarse, stubby crystal shape). Phenocrysts often occur in aggregates.
P1827	Whakamaru	~20%	Plag, qtz>> biot>>mag, ilm	Biot occurs as stubby euhedral crystals, and commonly display minor alteration/chloritisation. Some biot crystals contain fine euhedral zircon inclusions. Plag phenocrysts are zoned with distinct cores. Groundmass very glassy and highly vesicular (elongate stringy vesicles). Qtz commonly shattered and resorbed.
P1828	Whakamaru	~25%	Plag, qtz>>biot, opx>>mag, ilm	Plag phenocrysts are coarse (max 4 mm) but severely fractured and shattered. Fine opx crystals, which often occur as subhedral inclusions within plag phenocrysts or as free crystals within glassy, vesicular pumice groundmass. Some crystal aggregates of plag, opx, biot and Fe-Ti oxides.
P1887	Whakamaru	~25%	Plag, qtz>>biot, opx>>mag, ilm	Very coarse (6 mm+) qtz phenocrysts, shattered and subhedral with fluid inclusions connected by fracturing.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
P1888	Whakamaru	~25%	Plag, qtz>> opx>>mag, ilm	Coarse euhedral opx crystals (max 1.5 mm length) with mag/ilm inclusions. Very streaky, glassy vesicular groundmass. Strongly zoned plag with fluid inclusions. Opx crystal aggregates. Opx phenocrysts are euhedral and coarse (< 1.5 mm length) with euhedral oxide (mag) inclusions.
P1889	Whakamaru	~25%	Plag, qtz>> biot>>mag, ilm	Biot-rich (stubby, euhedral crystals). Plag phenocrysts display some minor oscillatory zoning, some have a distinct core zone which is commonly sieved and surrounded by a dark oscillatory-zoned band. Vesicular glassy pumice groundmass (with streaky/elongate vesicles). Plag crystals occur in aggregates.
P1889m	Whakamaru	~30%	Plag, qtz>> opx>>mag, ilm	Enclave of fragmented plag crystals (very crystal-rich). Plag displays fine oscillatory zoning. Coarse euhedral opx crystals with oxide inclusions. Crystals occur in aggregates. Highly vesicular, glassy groundmass (elongate vesicles).
P1890	Whakamaru	~30%	Plag, qtz>> opx>>mag, ilm	Coarse, granular, fragmented qtz with resorption textures. Fragmented plag crystals occur in aggregates/clusters.
P1893	Whakamaru	~20%	Plag, qtz>> opx> mag, ilm>> zircon (trace)	Opx euhedral, medium (~ 1 - 2 mm length) often with inclusions of oxides and zircon in core. Enclaves with highly fragmented/shattered plag crystals. Some plag crystals display older complex cores with sieving surrounded by euhedral concentric magmatic rims. Qtz phenocrysts are typically coarse (5 mm +) with strong resorption patterns and fracturing.
P1894	Whakamaru	~20%	Plag, qtz>> opx>> hbl>>mag, ilm	Very coarse opx crystals (~ 2.5 mm length), euhedral with oxide inclusions peppered throughout. Finer opx often occur in clusters or scattered as free crystals in vesicular glassy groundmass. Plag phenocrysts often have skeletal resorbed cores. Plag crystals are strongly zoned, with fluid inclusions restricted to inner core concentric zones. Euhedral tabular hbl (pleochroic green-brown). Qtz very coarse (> 6 mm diameter), fractured and resorbed. Some qtz displays strongly resorbed textures.
P1895	Whakamaru	~20%	Plag, qtz>> biot>> opx>> mag, ilm	Biot-rich. Biot crystals are stubby, often altered (chloritised). Plag phenocrysts commonly occur in aggregates.
P1896	Whakamaru	~25%	Plag, qtz>> opx>> mag, ilm	Plag crystals display complex zoning: older cores with sieve texturing and fluid inclusion zone near edge mantled by concentrically-zoned rim. Plag commonly occur in clusters. Fine opx phenocrysts in glassy groundmass, typically with oxide inclusions in core, and often occurring in clusters. Opx-rich.
P1897	Whakamaru	~20%	Plag, qtz>> opx> mag, ilm	Very complex plag zoning. Coarse plag (5 mm length) with fluid inclusion zone towards rim. Some plag phenocrysts display very strong concentric oscillatory zoning.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
P1899	Whakamaru	~25%	Plag, qtz>>biot> opx mag, ilm	Plag displays complex zoning and sieved texture (skeletal) or with distinct resorbed core surrounded by euhedral overgrowth rim. Plag often present as aggregates with euhedral biot. Qtz fractured, < 3 mm. Biot-rich (euhedral crystals).
P1900	Whakamaru	~20%	Plag, qtz>> biot>>mag, ilm	Strongly zoned plag phenocrysts, with plag commonly occuring in aggregates/glomeroporphyritic clusters. Very vesicular, glassy groundmass. Crystals strongly aligned by groundmass flow-banding. Biot euhedral and stubby, often with chlorite intergrowths.
P1900a	Whakamaru	~15%	Plag, qtz>>hbl, opx>>mag, ilm>>zircon	Strongly zoned plag phenocrysts, commonly with fluid inclusions restricted to specific darker concentric zones. Zircon inclusions in plag cores. Plag phenocrysts are strongly zoned and occur as aggregates. Opx crystals are euhedral and occur in clusters with oxide inclusions. Coarse qtz phenocrysts, resorbed and fractured, < 8 mm diameter. Crystal aggregates of plag, hbl, opx and oxides. Pleochroic green/brown hbl occurs as free euhedral crystals and mantles opx crystals (suggesting a change in conditions from anhydrous to hydrous). Complex intergrowth textures.
P1900b	Whakamaru	~20%	Plag, qtz>> opx>> mag, ilm	Coarse (> 2 mm length) opx phenocrysts with magnetite inclusions and fine plag crystals at core forming a nucleation point. Plag strongly zoned. Groundmass glassy and vesicular but not as flow banded as samples P1900 and P1900a.
P1905	Rangitaiki	~25%	Plag, qtz>>hbl, opx>biot>> mag, ilm	Clusters of fine euhedral opx crystals. Pleochroic green/brown hbl with oxide inclusions throughout (from core to rim). Plag displays complex oscillatory zoning and intergrowths of multiple crystals (recording complex growth history). Plag aggregates poikilitically enclose opx phenocrysts. Qtz strongly resorbed and fractured. Biot euhedral and stubby crystal form. Vesicular glassy groundmass. Some mafic crystal clot inclusions with fine plag, biot and euhedral hbl and opx.
P1906	Rangitaiki	~20%	Plag >>qtz >>opx>>mag, ilm	Phenocryst assemblage dominated by plag. Plag phenocrysts (3 mm +) characterised by complex oscillatory zoning. Fluid inclusions restricted to zones within strongly oscillatory-zoned plag crystals. Plag commonly forms aggregates with crystals radiating out from a central nucleation point. Some opx also occurs as glomeroporphyritic aggregates, commonly with Fe-Ti oxide inclusions.
P1909	Rangitaiki	~20%	Qtz, plag >> biot>>mag, ilm	Plutonic inclusion with granophyric intergrowths, elongate biot, plag and qtz. Distinct core zones to some plag phenocrysts. Plag crystals all strongly zoned and fractured (possibly syn-eruptive). Plag phenocrysts often occur together as aggregates. Stubby, euhedral biot phenocrysts occur as free crystals in glassy groundmass.
P1910	Rangitaiki	~15%	Plag, qtz>> opx>>mag, ilm	Coarse plag often as aggregates and strongly zoned, with fluid inclusions restricted to zones near rim. Plag crystals commonly contain dark euhedral cores, with irregular resorption surface. Some intergrown plag crystals are characterised by sieve textures in core. Qtz is very resorbed with fluid inclusions and advanced embayments. Pumice groundmass is highly vesicular - large rounded vesicles.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
P1911	Rangitaiki	~40%	Qtz> plag >> opx>>mag, ilm	Very coarse (7 mm +) granular qtz crystals (very fractured with resorbed texture). Qtz-rich. Plag occurs in aggregates, sieve texture and complex zoning patterns. Very vesicular, glassy pumice groundmass (very low density pumice). Fine free euhedral opx crystals in glassy groundmass.
P1912	Rangitaiki	~25%+	Qtz, plag >> opx, hbl>>mag, ilm	Euhedral green-brown pleochroic amphibole present as free crystal in groundmass. Opx-rich. Fine crystal clot of opx, plag and oxides. Opx often occur as glomeroporphyritic aggregates. Plag crystals also have distinct core zone with broad zoning, surrounded by oscillatory-zoned rim, or strongly sieved core/skeletal texture (suggestive of magma mixing). Plag phenocrysts typically occur as intergrown crystals or in clusters.
P1913	Rangitaiki	~10%	Qtz, plag >> opx>>mag, ilm	Opx crystal clusters (euhedral, some with oxide inclusions). Strongly oscillatory-zoned plag crystals (often with three distinct zones: core, middle, rim), commonly occur in aggregates of fractured/shattered crystals.
P1914	Rangitaiki	~10%	Qtz, plag >> opx>mag, ilm	Very vesicular pumice (rounded vesicles). Strongly-oscillatory zoned plag. Aggregate of fine plag crystals with some opx inclusions and large opx phenocryst (2 mm length).
P1915	Rangitaiki	~25%+	Mafic clot: cpx, oliv, plag, oxides; Fine mafic enclave: cpx, hbl, plag, oxides; rare oliv. Pumice: Plag, qtz>>opx> hbl>> oliv, oxides	Mafic crystal enclaves with sieved plag with opx inclusions in core, very fine opx and plag crystals in groundmass and coarse pleochroic green-brown amphibole phenocrysts. Main pumice contains coarse plag and is opx-rich. Coarse plag often displays distinct sieved core surrounded by oscillatory-zoned rim. Plag phenocrysts often occur in crystal aggregates, some are subhedral and intergrown. Common mafic crystal clots of opx. Mafic enclave of fine opx, oxides, hbl, oliv. Often hbl/opx and plag intergrown. Very crystal-rich.
P1916	Rangitaiki	~45%+	Plag, opx/cpx, hbl>>mag,ilm	Fine, crystal-rich, mafic pumice. Vesicular (rounded vesicles), mesocratic, equigranular textures. Fine euhedral plag crystals often display very sieved cores. Amphibole is pleochroic green-brown (hbl-rich). No flow alignment of elongate phenocrysts (random orientation). Phenocrysts mantled by thin adhering glass.
P1917	Whakamaru	~25%	Plag, qtz>> biot>>mag, ilm	Biot-rich (coarse, stubby, euhedral crystals). Pumiceous glassy groundmass has low vesicularity. Plag occurs in clusters of crystals. Small, rounded vesicles. Phenocrysts occur in clusters (unevenly distributed throughout glassy vesicular groundmass).
P1917f	Whakamaru	~20%	Plag, qtz>> biot>>mag, ilm	Streaky, elongate vesicles. Highly vesicular glassy groundmass. Zoned plag phenocrysts, commonly occur in aggregates. Qtz resorbed and fragmented. Biot-rich (typically altered). Plag phenocrysts are not strongly zoned.
P1918	Whakamaru	~15%	Plag, qtz>> opx>>mag, ilm	Plag crystals display strong oscillatory zoning and occur in clusters or as intergrown crystals. Minor opx. Vesicles rounded and small. No pervasive crystal alignment.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
P1919	Whakamaru	~25%+	Plag >>qtz>>> opx, mag, ilm	Plag-rich. Strongly zoned, and occur as complex aggregates with some intergrowths. Minor opx crystals occur as inclusions within plag. Qtz crystals are coarse (~ 5 mm), resorbed, and fractured.
P1919a	Whakamaru	~30%	Plag, qtz>> opx>>mag, ilm	Mafic crystal clot/enclave: opx-rich and fine sieved plag. Streaky opx-rich band. Qtz very coarse (5 mm +), strongly resorbed and fractured. Plag strongly zoned and often occurs in clusters of crystals.
P1920a	Whakamaru	~20%	Plag, qtz>> opx>>mag, ilm	Strongly zoned plag phenocrysts (three distinct zones and resorbed core). Fluid inclusions in plag common. Fine subhedral opx occur as free crystals in vesicular glassy groundmass, often with oxide inclusions. Very streaky vesicular groundmass (elongate vesicles). Plag crystals occur in aggregates.
P1923	Whakamaru	~20%	Plag, qtz>> opx>> biot>> mag, ilm	Plag strongly zoned. Biot rare and occurs within aggregates of plag. Opx euhedral and occurs as free crystals. Glassy vesicular pumiceous groundmass provides some minor degree of flow alignment of phenocrysts.
P1924	Whakamaru	~20%	Plag, qtz>> opx>>biot>>mag, ilm	Strongly zoned plag, sometimes with rounded core surrounded by dark zone with fluid inclusions. Euhedral biot in core/ fracture zones of resorbed and fractured qtz phenocrysts. Some plag is sieved with a particularly sieved zone near the rim. Fine mafic-rich enclave with fine euhedral/ equigranular opx crystals and plag. Biot rare (euhedral and stubby-elongate) and occurs in clusters.
P1908	Rangitaiki	~25%	Qtz> plag >> cpx>>biot, hbl>mag	Qtz very coarse, resorbed. Rare hbl phenocrysts (euhedral, pleochroic green, well-defined cleavage). Some glomeroporphyritic clusters of plag phenocrysts. Plag commonly strongly zoned.
P1892	Whakamaru ignimbrite non-welded top	~20%	Plag >qtz>opx, cpx>>mag	Plag phenocrysts occur in complex clusters. Cpx and opx phenocrysts euhedral with magnetite inclusions. Fine opx crystals occur as inclusions within a coarse plag phenocryst (sieved). Glomeroporphyritic clusters of cpx phenocrysts (along with some minor plag). Some aggregates of cpx, more sieved plag and mag. Plag often displays strong oscillatory zoning.
P1898	Whakamaru ignimbrite non-welded top	~15%	Plag >qtz>> opx>>mag	Very vesicular pumiceous groundmass. Opx crystals common, often with very fine ferromagnesian inclusions. Euheral opx also have mag/ilm inclusions. Zoned euhedral and shattered/fragmented plag phenocrysts. Qtz crystals are granular, highly fractured (shattered) with melt inclusions and resorbed crystal boundaries.
P1891	Whakamaru ignimbrite non-welded top	~20%	qtz>plag>>opx>> mag	Opx-rich. Euhedral opx occurs with mag inclusions. Coarse qtz phenocrysts commonly strongly resorbed rims. Plag strongly fragmented.
TW1	Te Whaiti	~20%-25%	qtz, plag> cpx>>hbl> mag, ilm	Streaky glass inclusions. Eutaxitic texture. Elongated vesicles. Phenocrysts are flow aligned when elongate. Rare fine lithic fragments (max 3 mm). Lithics are altered and qtz-rich (hypidiomorphic granular). Coarse qtz phenocrysts have irregular margins, resorbed with hourglass shapes. Rare pleochroic green hbl (euhedral and tabular crystal, cleavage well defined). Plag phenocrysts have subtle to strong oscillatory zoning. Cpx crystals are common, euhedral, coarse (max 2 mm) and often occur in clusters. Cpx displays oxidized (red/brown) reaction rims, commonly with fine Fe-Ti oxide inclusions.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
P1788	Whakamaru ignimbrite non-welded top	~20%	qtz, plag>> opx>>hbl>>mag	Very vesicular glassy pumiceous groundmass. Fine-grained clusters of opx and plag phenocrysts. Fine green pleochroic amphibole. Plag zoned, complex intergrowths of multiple phenocrysts.
WM1	Whakamaru	~35%-40%	qtz, plag> opx>mag	Magnetite poikolitically enclosed within opx phenocrysts. Plag phenocrysts are zoned. Coarse and resorbed qtz phenocrysts.
WH2	Whakamaru	~25%+	qtz, plag> opx>hbl>mag	Very glassy groundmass. Non-vesicular. Fine euhedral biot and opx crystals. Fine lithic fragments (sub-rounded). Fine euhedral hbl present in trace amounts. Restricted zones of fine euhedral flow-aligned plag and opx phenocrysts (fine-grained phenocryst zones). Coarse (~ 4 mm) plag phenocrysts (euhedral) display strong oscillatory zoning. Overall flow alignment/banding of crystals.
P1922	Whakamaru	~20%	qtz>plag>>biot> hbl>>mag	Biot-rich. Coarse stubby euhedral phenocrysts. Some rare clusters of fine euhedral hbl phenocrysts, pleochroic brown-green/yellow. Some qtz and plag phenocrysts are very strongly fragmented/shattered.
P1921	Whakamaru	~20%	Plag>qtz>>opx>> mag	Very streaky/flow-banded pumiceous groundmass, which swirls around flow-aligned phenocrysts. Elongate vesicles. Strongly zoned plag phenocrysts. Fine opx phenocrysts. Opx, mag and plag often occur in crystal-aggregates.
P1885	Whakamaru	~25%+	qtz>plag>>opx>> mag	Opx occurs in clusters of euhedral phenocrysts, commonly with mag inclusions and in association with plag. Plag phenocrysts often strongly/complexly zoned. Qtz phenocrysts very coarse (< 6 mm) and fragmented/resorbed. Glassy pumiceous groundmass with elongated vesicles.
P1920	Whakamaru	~25%	Plag>qtz>>opx>> mag	Very vesicular, pumiceous/glassy groundmass. Complexly zoned plag phenocrysts. Euhedral prismatic opx phenocrysts occur with magnetite inclusions. Plag often sieved. Very coarse qtz phenocrysts up to ~ 6 mm in length (but fragmented).
TW4	Whakamaru	~40%	qtz>plag>>opx> san>>mag	Very crystal-rich and lithic-rich. Mafic lithic fragments (opx, hbl, plag). Qtz resorbed, with fluid inclusions. Plag strongly zoned and skeletal (often only rims preserved). Opx with mag inclusions in core.
P1886	Whakamaru	~15%	Plag, qtz>> opx>>mag	Coarse (< 4 mm) resorbed and fractured qtz phenocrysts. Plag phenocrysts also very fragmented.
910812	Whakamaru	~45%	Plag >qtz>> biot, opx, hbl, mag, ilm	Vesicular groundmass with glomeroporphyritic clusters of plag phenocrysts. Euhedral biot, opx, hbl, but strong fracturing. Host ignimbrite contains angular lithic fragments. Ignimbrite very crystal-rich, fractured crystals, lithic fragments. Coarse resorbed qtz. Strongly oscillatory zoned plag. Some fine lithic fragments.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
101081	Rangitaiki	~35%	Plag, qtz>>opx, lithics>>biot, hbl>>mag, ilm	Rare pleochroic brown biot crystals (subhedral). Rare pleochroic brown - green hbl crystal shards. Common subhedral opx phenocrysts. Coarse (max 3.5 mm diameter), oscillatory zoned and fragmented plag crystals. Some plag is skeletal with resorbed cores. Qtz resorbed and anhedral. Angular lithic fragments common (fine-grained, equigranular, qtz-rich, metasedimentary greywacke lithology). Mag/ilm forms in clusters around the ferromagnesian minerals (opx, hbl) and as inclusions within them and the glassy groundmass.
101081b	Rangitaiki	~30%	Qtz, plag >> biot >opx>> hbl>> mag, ilm	Very coarse qtz and plag crystals (qtz max 4 mm). Qtz fractured, anhedral and resorbed. Coarse-grained lithic present, with qtz and plag phenocrysts and smaller fine-grained greywacke lithics. Older ignimbrite lithic fragments with very altered groundmass. Euhedral biot more common than in sample 101081. Pleochroic green/brown hbl less common, euhedral, cleaved (some crystals coarse ~ 2 mm length). Groundmass contains abundant glassy pumice shards with eutaxitic flowbanded texture.
101082	Te Whaiti	~20%	Plag > qtz>> opx> mag, ilm	Strongly zoned plag crystals - some with resorbed cores visible. Clusters of opx crystals with mag/ilm inclusions. Fine lithics in glassy fine-grained ignimbrite groundmass.
101083	Te Whaiti	~15%	Plag, qtz>> biot > opx>>mag, ilm>>zircon	Rare coarse biot crystals (2 mm length) with altered reaction rims and zircon inclusions (with pleochroic halos). Coarse (3 mm length) plag crystals with multiple twinning and strong oscillatory zoning. Qtz shattered and resorbed. Fine euhedral opx crystals with oxide inclusions. Glassy groundmass.
101084	Te Whaiti	~20%	Plag, qtz>> opx>>mag, ilm	Coarse resorbed qtz crystals. Fine, euhedral opx crystals - often with oxide inclusions in core or at rim and in clusters. Large lithic fragment inclusions with spherulitic groundmass.
111081	Whakamaru	~30%	Plag, qtz>> opx >> biot >> mag, ilm	Euhedral biot common, but often altered. Qtz resorbed and anhedral with fluid inclusions. Some plag crystals skeletal with fine biot inclusions in core.
111083	Whakamaru	~35%	Plag >qtz>> opx> biot > mag, ilm	Groundmass contains many coarse clusters of mag/ilm, sometimes at rims of opx crystals. Biot elongate and euhedral. Elongate crystals aligned parallel flow direction in ignimbrite groundmass. Some opx coarse (max 2.5 mm).
11084	Whakamaru	~35%	Qtz, plag > opx, biot > mag, ilm>> zircon (tr)	Some plag crystals display complex internal zoning (concentric at rims but irregular core). Euhedral opx crystals peppered internally with oxide inclusions (and zircon in core). Opx-rich. Qtz is coarse, anhedral, resorbed and fractured.
111086 111087 111088	Whakamaru	~30%	Qtz, plag >> biot > hbl, cpx>> mag, ilm + lithics, zircon (tr)	Coarse complexly zoned plag crystals (max 5 mm length), fragmented crystals. Some plag crystals are skeletal with resorbed cores. Fine equigranular quartzo-feldspathic lithic fragments. Pleochroic green-brown euhedral hbl crystals. Some pale yellow - colourless euhedral cpx crystals (inclined extinction) with oxides at rim and as inclusions. Glassy eutaxitic ignimbrite groundmass, flattened pumices.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
111089	Whakamaru	~30%	Plag, qtz>> opx> biot >> mag, ilm	Coarse stubby biot crystals. Biot has some reaction rims. Zoned plag with complex older cores (and some sieved texture), coarse 4 mm + length. Some spherulitic groundmass textures. Opx commonly occurs in aggregates/clusters and with mag/ilm inclusions. Fine-grained ignimbritic groundmass. Few lithic fragments, some with spherulitic textures.
1110810	Whakamaru	~30%	Qtz > plag >>opx> biot >> mag, ilm	Very coarse qtz crystals (max 5 mm diameter) which are commonly fragmented and resorbed. Subhedral, cleaved opx crystals common. Euhedral lath-shaped biot crystals (1 mm length). Fine equigranular lithic fragment inclusions in ignimbrite groundmass (quartzo-feldspathic greywacke lithology).
1110813	Whakamaru	~30%	Qtz, plag >> biot >>opx>> mag, ilm	Coarse stubby biot, commonly chloritised. Coarse plag with oscillatory zoning. Opx with mag/ilm inclusions and altered rims. Fine-grained glassy ignimbrite groundmass. Some angular lithic fragments with coarse phenocrysts.
1110814	Whakamaru	~35%	Qtz> plag >> opx, biot>> mag, ilm, zrc (tr)	Euhedral opx with some alteration at rim and zircon inclusions. Oxide inclusions at rim. Qtz crystals are coarse (max 5 mm diameter) and resorbed with fluid inclusions (but fractured). Both stubby and elongate biot crystals present. Biot commonly clustered together in fine aggregates with qtz.
1110815	Whakamaru	~35%	Qtz, plag>> opx>biot>>mag, ilm + lithics	Coarse resorbed qtz crystals (max 6 mm diameter). Some qtz has strongly resorbed cores. Euhedral opx with mag/ilm inclusions in core/rim. Elongate and euhedral biot laths (1 mm length). Oscillatory zoned plag crystals. Small, sub-rounded lithics (equigranular quartzo-feldspathic greywacke lithology).
1110817	Whakamaru	~30%	Plag, qtz>> opx, biot, hbl>> mag, ilm	Coarse (5 mm length) complexly zoned plag crystal with multiple phases of growth visible. All plag appears strongly zoned. Stubby biot crystals. Euhedral to subhedral opx and hbl crystals (pleochroic green-brown). Mag/ilm clusters around rims of opx crystals.
1110822	Whakamaru	~35%+	Qtz, plag >> opx> biot >> mag, ilm + lithics	Opx coarse and euhedral with mag/ilm inclusions. Some plag phenocrysts occur in aggregates. Plag crystals often display a distinctly zoned core. Qtz commonly resorbed and anhedral. Fine-grained lithic fragments, quartzo-feldspathic greywacke. Biot present in both stubby and elongate crystal form, with some minor alteration at rims.
121083	Whakamaru	~40%	Qtz>plag>> hbl, opx, biot >> mag, ilm + lithics	Subhedral pleochroic brown to straw-yellow hbl (max 1.5 mm length). Euhedral opx crystals with oxide inclusions. Anhedral qtz is strongly fractured, resorbed, and very coarse (max 5 mm) with fluid inclusions. Biot stubby and euhedral. Fine, subangular lithics common. Plag commonly strongly zoned with fluid inclusions restricted to lighter concentric zones.
121088	Whakamaru	~40%+	Plag, qtz>> opx>> biot> mag, ilm>> zircon (tr)	Very crystal-rich ignimbrite. Coarse euhedral opx crystals with oxide inclusions at rim (max opx crystal ~ 3 mm length). Opx-rich. Biot less common, elongate and highly altered at rim.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
121089	Whakamaru	~35%	Qtz, plag>> opx> hbl>> biot> mag, ilm	Hbl-rich (pleochroic green, coarse euhedral crystals). Opx-rich (euhedral, oxide inclusions, colourless). Biot euhedral and stubby, alteration at rims. Plag phenocrysts are strongly zoned. Crystals fractured and occur as broken shards.
1210819	Whakamaru	~10%	Pumice: plag, qtz, biot> mag, ilm. Ignimbrite: plag, qtz, opx, mag, ilm	Pumice/ignimbrite contact. Pumice: moderate crystal content. Coarse, stubby euhedral biot crystals. Plag phenocrysts occur in aggregates. Fine-grained groundmass is highly vesicular with pervasive flow banding parallel to direction of crystal alignment. Ignimbrite is crystal-rich. Opx crystals are euhedral with mag/ilm inclusions. Qtz coarse and fractured. Fine, sub-angular lithic fragments. Amygdales (radial crystallisation around fine vesicles).
161082	Te Kopia, Paeroa	~40%	Plag>qtz>> biot > opx>>hbl, mag, ilm> zircon	Very crystal-rich. Glassy groundmass. Plag crystals euhedral and strongly oscillatory zoned, some fractured. Rare euhedral pleochroic brown-green hbl phenocrysts. Fluid inclusions in cores of some plag crystals and in dark concentric zones. Some clusters of fine hbl and opx crystals (with fine plag crystals and mafic crystal clots). Zircon present as free fine crystals in groundmass.
171081	Paeroa	~30%	Plag>qtz>> biot >>mag, ilm	Biot coarse (1 - 2 mm), stubby and euhedral crystal form. Skeletal plag (resorbed/sieved cores) and some aggregates of plag. Fine vesicular glassy groundmass.
171081b	Paeroa	~25%	Plag>qtz>> biot >>mag, ilm	Coarse qtz is commonly resorbed and fractured. Some aggregates of strongly zoned plag (often with distinct rounded core or complexly truncated oscillatory zoning). Biot altered and stubby crystal form.
171082	Paeroa	~30%	Qtz> plag>> biot >> opx>> mag, ilm	Altered green-brown biot crystals (euhedral). Very advanced qtz resorption. Opx peppered internally with coarse mag/ilm inclusions. Strongly zoned plag crystals. Some finer plag crystals occur in interlocking clusters.
171084	Paeroa	~30%	Plag, qtz>> biot, hbl >> san, mag, ilm.	Strongly zoned and fragmented plag crystals. Biot medium-coarse and stubby euhedral crystal form. Qtz fragmented and shattered with fluid inclusions and strongly resorbed textures. Pleochroic green-brown hbl with oxide inclusions and euhedral crystal form. San crystals (single carlsbad twin with some zoning).
171085	Paeroa	~25%	Qtz, plag>> biot, hbl, opx>> mag, ilm	Fine euhedral hbl crystals, pleochroic green-brown. Biot-rich (occurs as both stubby and elongate euhedral crystals). Euhedral opx crystals also present. Tabular/elongate crystals are weakly flow aligned.
181086	Rangitaiki	~20%	Qtz, plag>> opx, hbl>>mag, ilm	Very glassy eutaxitic ignimbrite groundmass (flattened glass shards). Crystals are flow aligned (long axes orientated parallel to flattening direction). Some plag clusters around rim of large vesicle. Qtz crystals finer (max 3 mm) and resorbed/worm-eaten. Euhedral fine pleochroic green-brown hbl crystals with alteration at rim. Hbl phenocrysts common (euhedral, max 1.5 mm length). Euhedral opx crystals peppered internally with oxides, and rim alteration. Plag and opx clusters (mafic crystal clots).

Sample	Unit	Crystal content (%)	Mineralogy	Textures
191081	Rangitaiki	~35%	Qtz, plag>> opx> biot >> mag, ilm	Coarse qtz crystals are resorbed and fractured (max 5 mm diameter). Some clusters of fine plag crystals with opx. Opx euhedral, often with mag/ilm inclusions in core or at rim. Plag displays strong oscillatory zoning patterns and fluid inclusions. Lithics sub-angular with Fe-Mg minerals severely altered.
191086	Rangitaiki	~40%	Qtz> plag>> lithics>opx>> mag, ilm	Very coarse qtz crystals (5mm max), fragmented with resorbed rims. Common lithic fragments: some have mafic mineralogy with plag and opx but severely altered. Ignimbrite groundmass comprises cuspate glass shards. Fluid inclusions in plag restricted to inner-middle concentric zones.
191088	Rangitaiki	~30%	Qtz, plag>>hbl, opx>>san, mag, ilm	Sub-rounded lithics, fine-grained equigranular texture (quartzo-feldspathic metamorphic sandstone). Euhedral, fine opx crystals common (reaction rims, oxide inclusions). Green hbl. Some san crystals (single twin and zoning).
MAN 1-1	Manunui	~10%	Qtz, plag, biot	Strongly oscillatory zoned plag phenocrysts with euhedral rims around resorbed cores. Ignimbrite - fine angular lithics, crystal-rich, crystal shards.
MAN 1-6	Manunui	~10%	Plag, qtz, biot	Small pumice fragment within ignimbrite groundmass. Very vesicular (eutaxitic).
MAN 1-8	Manunui	~20%	Qtz, plag>> biot>> san	Biot-rich, coarse, euhedral, stubby phenocrysts. Qtz phenocrysts are resorbed and highly fragmented or shattered. Some euhedral ~ 1 mm san phenocrysts. Plag often displays older resorbed cores rimmed by oscillatory zoning. Biot sometimes occurs within glomeroporphyritic clusters of plag.
PA3/2	Paeroa	~25%	Qtz>plag>> biot >>oxides	Crystal-rich. Some glomeroporphyritic aggregates of plag, qtz, biot. Qtz is resorbed and fragmented. Pumice very vesicular and glassy. Coarse plag phenocrysts ~ 3 mm in length - often present as aggregates with qtz, biot and oxides. Groundmass very vesicular and glassy.
HM-01	Rangitaiki	~25%	Plag, qtz>> hbl>>oxides	Very vesicular. Aggregates of fragmented plag, qtz and biot. Coarse euhedral pleochroic green hbl phenocrysts, peppered internally with oxides. Some plag has resorbed older core with euhedral oscillatory zoning at rim. Streaky vesicular glassy pumice groundmass.
HM-03	Rangitaiki	~25%	Qtz, plag>> opx>>oxides	Qtz resorbed and shattered. Plag shards occur in clusters. Zones of concentrated crystal fragments – possibly entrained during flow. Glassy, vesicular groundmass.
HM-04	Rangitaiki	~30%	Qtz, plag>> opx>hbl>>oxides	Zones of very streaky glassy vesicular pumice groundmass around crystal-rich zones. Crystal-rich clots of plag and qtz. Some aggregates of opx, plag, oxides, qtz. Pleochroic green, euhedral hbl also present.
HM-05	Rangitaiki	~20%	Plag, qtz>> opx>>hbl>>oxides	Strongly oscillatory-zoned plag - core typically displays some fluid inclusions. Very streaky glassy groundmass, some fine plag microphenocrysts. Fine, euhedral pleochroic green/brown hbl phenocrysts. Opx displays poikilitic texture with fine euhedral lath-like inclusions. Opx also occurs as fine crystal aggregates, often with oxide inclusions.

Sample	Unit	Crystal content (%)	Mineralogy	Textures
HM-06	Rangitaiki	~30%	Plag, qtz>> opx>>hbl >> mag, ilm	Plag displays strong oscillatory zoning with an older core region generating discordant zones. Clusters of fine euhedral opx crystals (aggregates/ferromagnesian crystal clots). Opx commonly has oxide inclusions. Pleochroic green/brown hbl phenocrysts. Some zones of shattered qtz and plag crystal shards. Some coarse (~ 4 mm length) plag with oscillatory zoning.
HM-08	Rangitaiki	~30%	Plag>qtz>>opx	Glomeroporphyritic aggregates of plag crystals. Coarse, euhedral opx crystals with oxide inclusions. Complex zoning patterns in plag - often with shattered core zones. Oscillatory zoning in plag common.
HM-09	Rangitaiki	~30%	Plag, qtz>> opx >> mag, ilm	Very coarse (> 6 mm diameter) resorbed qtz crystals that are commonly shattered/fragmented. Opx is euhedral and typically ~ 2 mm length with oxide inclusions. Opx-rich. Plag displays strong oscillatory zoning.
T3/2	Whakamaru	~25%	Plag>qtz>> opx>>mag, ilm	Oscillatory zoned plag. Plag-rich, often occurring in glomeroporphyritic aggregates.
T4/1	Whakamaru	~25%	Plag>qtz>> opx>>mag, ilm	Strongly oscillatory zoned plag.

Notes: All thin sections are polished, uncovered sections. Mineral abbreviations are as follows: plag = plagioclase feldspar; qtz = quartz; opx = orthopyroxene; cpx = clinopyroxene; biot = biotite; hbl = hornblende; oliv = olivine; san = sanidine; Fe-Ti oxides also referred to as: mag = magnetite; ilm = ilmenite. Sample codes in bold indicate those which were the subject of detailed crystal-specific analyses. Crystal content (vol.%) estimated visually from thin section. Minerals are listed in order of decreasing abundance, and commas divide minerals which are present in approximately equal proportions. Minerals which are present in trace amounts are indicated by (tr). Note that zircon is present in all pumices.

Table A3: ***XRF data for single Whakamaru Group pumices***

Sample	T1/1	T1/11	T1/12	T1/13	T1/14	T1/15	T1/2	T1/3	T1/6	T1/8	T1/9	T3/2	T3/4	T3/5
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	A	A	A	A	A	A	A	A	A	A	A	A	A	A
wt%[a]														
SiO_2	72.67	73.58	73.58	74.67	73.50	72.82	73.97	74.65	74.02	73.52	73.74	73.47	72.83	73.03
TiO_2	0.34	0.29	0.30	0.29	0.30	0.33	0.31	0.30	0.30	0.31	0.34	0.30	0.31	0.32
Al_2O_3	14.69	14.29	14.71	13.40	14.27	15.07	13.88	13.36	13.63	14.02	13.73	14.35	14.90	14.47
Fe_2O_3	2.58	2.26	2.45	2.29	2.39	2.47	2.51	2.42	2.63	2.44	2.52	2.23	2.36	2.31
MnO	0.07	0.05	0.06	0.05	0.07	0.06	0.06	0.06	0.06	0.05	0.06	0.05	0.06	0.06
MgO	0.46	0.46	0.44	0.52	0.52	0.51	0.37	0.49	0.49	0.49	0.51	0.50	0.49	0.53
CaO	2.35	2.19	2.12	2.32	2.33	2.34	2.14	2.21	2.12	2.32	2.22	2.26	2.25	2.26
Na_2O	3.90	3.65	3.17	3.52	3.68	3.68	3.68	3.61	3.53	3.81	3.67	3.74	3.45	3.77
K_2O	2.88	3.21	3.12	2.89	2.92	2.69	3.04	2.87	3.19	3.00	3.19	3.08	3.33	3.21
P_2O_5	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02
(LOI)	0.82	1.20	1.32	1.24	1.13	1.67	0.79	0.56	0.69	0.71	0.98	2.07	2.31	2.12
Total	100.57	100.50	100.11	99.91	100.84	100.15	99.81	99.82	100.14	100.22	99.68	99.84	99.61	100.32
Rb	82	102	97	104	94	110	102	97	114	103	118	106	104	112
Sr	184	172	172	171	181	183	167	169	160	177	166	170	173	165
Y	21.8	15.7	18.3	13.8	14.7	13.5	17	15.4	16.8	15.9	16	16	17.7	17.1
Zr	173	155	150	132	145	147	156	154	148	142	146	144	163	147
Nb	7.3	5.9	6.2	6.4	6.1	6	6.2	6.4	5.9	6.1	5.9	6.3	6.6	6.4
Ba	803	742	938	802	808	908	771	759	845	829	890	793	809	819
Pb	13	20	18	18	19	11	15	14	23	16	15	11	12	11
Th	10	11	12	11	10	11	10	8	13	10	10	12	12	14
U	3	2	3	2	2	3	1	2	2	3	4	3	3	3
Sc	5	4	5	5	5	4	5	5	6	5	4	5	4	3
V	27	24	23	19	19	20	23	23	17	17	15	17	17	16
Cr	2	3	3	3	3	3	4	4	2	4	4	3	3	6
Co	2	2	2	2	2	1	2	2	1	1	2	1	2	1
Ni	3	3	5	4	4	4	4	4	3	3	3	4	3	3
Cu	5	4	5	5	4	4	4	3	3	4	4	4	4	4
Zn	35	33	31	28	27	25	32	28	39	30	28	22	23	23
Ga	15	13	14	13	15	15	13	14	14	13	14	14	15	13
Mo	1	1	0	1	0	0	1	1	0	1	0	2	2	2
As	2	7	4	1	2	5	5	3	6	5	4	4	1	3
S	0	29	13	112	47	15	19	14	6	30	55	0	0	0

Sample	T4/1	T4/1a	T5/1	T5/2	T5/3	T5/4	TA1/1	BH1/1	BH1/2	BH1/5	P1894	P1795	P1891	P1892
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	A	A	A	***D***	***C***	***C***	A	A	A	A	A	A	A	A
wt%[a]														
SiO_2	73.78	73.13	73.18	76.07	75.47	75.59	72.16	73.73	74.16	73.50	72.22	73.72	71.17	73.04
TiO_2	0.30	0.33	0.31	0.16	0.18	0.16	0.35	0.31	0.29	0.32	0.35	0.36	0.38	0.34
Al_2O_3	14.42	14.46	14.54	13.35	13.76	13.60	15.37	13.97	13.82	14.30	15.35	14.28	16.58	14.35
Fe_2O_3	2.32	2.44	2.40	1.51	1.68	1.52	2.63	2.22	1.93	2.37	2.63	2.48	2.87	2.66
MnO	0.06	0.07	0.07	0.05	0.06	0.06	0.07	0.04	0.04	0.05	0.07	0.05	0.07	0.07
MgO	0.46	0.51	0.54	0.23	0.26	0.24	0.58	0.53	0.48	0.55	0.58	0.45	0.59	0.54
CaO	2.19	2.17	2.13	1.01	1.13	1.15	2.16	2.40	2.19	2.72	2.14	1.83	2.34	1.97
Na_2O	3.34	3.67	3.65	3.14	3.24	3.34	3.73	3.59	3.53	3.71	3.71	3.19	3.58	3.52
K_2O	3.12	3.19	3.14	4.46	4.20	4.33	2.93	3.15	3.51	2.45	2.93	3.62	2.39	3.50
P_2O_5	0.02	0.02	0.03	0.01	0.01	0.01	0.02	0.06	0.05	0.05	0.02	0.02	0.02	0.02
(LOI)	2.3	2.23	2.5	2.36	2.72	2.47	3.2	0.54	0.66	0.73	2.56	2.75	3.25	2.36
Total	99.92	99.70	100.01	99.45	99.70	100.32	100.27	99.68	100.34	99.44	99.85	99.85	99.27	99.48
Rb	102	109	105	231	208	184	100	98	111	67	103	122	82	117
Sr	168	164	162	73	83	79	140	181	160	212	159	136	176	152
Y	17.3	17.9	21.2	24.1	27.4	21.8	23.4	16.3	15.9	13.6	19.7	19.4	16.7	18.8
Zr	154	165	158	106	117	105	160	152	138	138	170	178	188	163
Nb	6.1	6.8	6.6	8	7.3	8	7.0	6.2	5.6	4.9	6.9	7.2	7.7	6.7
Ba	785	807	797	726	731	666	581	808	888	744	826	824	896	830
Pb	10	11	14	15	15	14	14	10	12	9	12	13	11	10
Th	11	12	14	17	18	17	10	10	11	10	14	14	13	13
U	3	1	2	3	4	3	4	2	2	2	2	4	2	4
Sc	5	5	4	3	2	4	5	4	4	5	4	4	4	5
V	17	21	21	12	13	11	6	21	17	27	22	21	22	22
Cr	2	4	3	2	2	4	1	2	4	4	5	3	3	5
Co	1	2	1	2	1	2	1	2	2	2	2	2	2	2
Ni	2	2	2	3	2	3	3	4	4	4	3	3	8	6
Cu	4	4	4	4	3	3	2	4	5	4	5	4	51	20
Zn	25	28	33	25	27	33	40	21	18	24	32	31	34	28
Ga	14	16	15	14	13	14	14	14	14	14	15	13	15	14
Mo	2	2	2	2	1	2	2	0	0	0	1	0	1	1
As	3	4	4	5	5	4	5	2	4	2	2	3	5	6
S	0	0	14	0	27	40	0	0	0	0	0	0	40	7

Sample	P1918	P1920	P1920a	P1921a	P1922	P1923	P1924	P1828	P1885	P1886	P1889f	P1889m	P1896	P1897
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	A	A	A	A	A	A	A	A	A	A	***B***	A	A	A
wt%[a]														
SiO_2	73.91	73.27	73.16	74.53	72.19	73.17	73.24	72.73	73.19	72.92	75.65	73.96	71.78	73.34
TiO_2	0.31	0.34	0.30	0.28	0.34	0.31	0.34	0.31	0.32	0.31	0.15	0.34	0.36	0.30
Al_2O_3	14.08	14.31	14.58	13.88	16.21	14.40	14.52	14.96	14.88	14.70	14.29	13.94	15.36	14.50
Fe_2O_3	2.23	2.52	2.34	2.19	2.47	2.40	2.46	2.38	2.45	2.37	1.32	2.53	2.68	2.30
MnO	0.05	0.06	0.05	0.05	0.05	0.07	0.06	0.06	0.06	0.06	0.03	0.07	0.06	0.06
MgO	0.46	0.48	0.45	0.40	0.42	0.52	0.51	0.44	0.49	0.45	0.14	0.56	0.56	0.45
CaO	2.17	1.97	2.18	2.13	1.71	2.22	2.14	2.15	2.23	2.10	0.90	2.08	2.19	2.12
Na_2O	3.63	3.42	3.54	3.37	3.29	3.61	3.34	3.52	3.67	3.58	3.14	3.56	3.88	3.56
K_2O	3.11	3.61	3.38	3.15	3.29	3.27	3.36	3.41	2.69	3.50	4.37	2.95	3.10	3.35
P_2O_5	0.06	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.01	0.02	0.02	0.02
(LOI)	1.90	2.44	2.29	2.17	3.46	2.03	2.31	2.34	2.59	2.34	2.99	2.23	2.39	2.27
Total	99.90	99.73	99.04	99.21	99.51	99.63	99.97	100.21	100.47	99.09	100.12	100.12	99.41	99.42
Rb	117	117	107	99	132	108	113	124	92	116	140	99	109	108
Sr	154	153	165	166	136	173	165	169	174	160	68	162	168	166
Y	16.8	17.9	16.9	16.5	20.0	17.7	18.6	23.5	16.5	20.9	23.6	17.4	19.0	24.7
Zr	153	161	156	142	191	142	158	172	154	150	114	154	167	153
Nb	5.6	6.1	6.1	5.2	8.4	5.9	6.9	7.0	6.0	6.9	7.4	6.4	6.6	6.4
Ba	770	808	770	729	953	807	832	779	749	815	796	752	823	780
Pb	14	10	11	11	14	10	11	14	11	12	13	10	11	10
Th	13	12	10	9	14	11	11	12	12	11	17	12	13	12
U	3	4	3	4	4	2	2	3	3	3	4	3	3	4
Sc	4	5	5	4	4	4	4	3	3	4	4	4	4	3
V	25	15	17	16	15	19	19	18	15	18	10	20	20	20
Cr	3	6	6	4	3	6	4	4	8	4	3	5	6	5
Co	2	2	2	1	1	2	2	3	2	2	1	2	1	2
Ni	3	6	3	5	4	2	3	5	9	4	4	2	4	5
Cu	5	39	5	39	9	3	5	3	59	4	3	3	5	3
Zn	32	27	25	28	36	34	29	33	27	32	19	27	31	26
Ga	14	14	13	13	15	15	14	15	14	14	13	14	14	14
Mo	0	0	0	0	1	1	0	0	0	1	0	1	0	1
As	6	3	3	4	3	2	2	5	3	5	7	5	1	6
S	0	0	0	0	0	0	0	0	0	0	0	4	0	0

Sample	P1898	P1900	P1917f	P1921	110821	1110812	910812	P1788	P1789	P1790	P1791	P1794	P1827	HM-01
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Rang
Type	A	A	***B***	A	A	A	A	A	A	A	A	A	***D***	A
wt%[a]														
SiO_2	72.56	73.42	76.07	73.16	73.92	73.83	73.56	74.27	72.05	72.02	72.64	74.49	74.50	72.52
TiO_2	0.35	0.31	0.18	0.30	0.30	0.30	0.30	0.30	0.34	0.33	0.31	0.31	0.27	0.33
Al_2O_3	15.18	14.84	13.34	14.58	13.87	13.93	14.28	13.84	15.63	16.01	15.33	13.45	14.02	14.66
Fe_2O_3	2.57	2.37	1.46	2.34	2.54	2.56	2.35	2.17	2.55	2.48	2.42	2.24	2.08	2.35
MnO	0.06	0.06	0.04	0.05	0.10	0.09	0.05	0.05	0.06	0.06	0.05	0.05	0.05	0.07
MgO	0.55	0.46	0.23	0.45	0.32	0.32	0.48	0.44	0.50	0.45	0.43	0.43	0.36	0.61
CaO	2.17	2.24	1.16	2.18	1.79	1.78	2.36	2.13	2.12	2.28	2.31	1.90	1.71	2.33
Na_2O	3.70	3.55	3.16	3.54	4.42	4.42	3.64	3.72	3.53	3.53	3.60	3.61	3.24	3.56
K_2O	2.84	2.72	4.33	3.38	2.69	2.71	2.93	3.06	3.20	2.83	2.89	3.50	3.74	3.51
P_2O_5	0.02	0.02	0.03	0.02	0.06	0.06	0.04	0.02	0.02	0.02	0.02	0.03	0.02	0.06
(LOI)	3.39	2.22	3.09	2.29	2.83	3.04	1.87	2.17	2.55	2.58	2.52	2.29	2.37	2.06
Total	100.64	99.62	100.26	99.04	99.93	100.28	99.24	100.67	99.84	99.89	100.03	100.02	100.15	99.94
Rb	101	93	145	106	99	99	101	103	104	92	95	117	259	134
Sr	166	174	84	174	166	173	178	163	165	177	179	148	141	175
Y	18.8	17.1	24.2	17.8	33.7	34.0	17.1	17.3	19.2	18.4	14.9	17.8	24.2	17.2
Zr	162	155	109	146	222	221	138	157	178	163	151	167	168	151
Nb	7.0	6.1	7.8	5.8	8.6	8.7	5.9	6.1	6.9	6.1	5.7	6.6	7.3	6.4
Ba	830	807	732	781	591	598	742	714	768	788	743	799	945	781
Pb	11	11	12	11	19	19	12	10	11	10	11	14	13	21
Th	14	13	17	13	12	11	11	12	13	12	11	11	12	12
U	3	3	4	3	3	2	3	2	5	2	2	3	4	4
Sc	6	4	3	4	8	8	4	4	5	6	4	5	4	3
V	21	20	14	16	5	8	22	21	19	13	17	19	17	23
Cr	4	6	2	3	3	1	5	6	3	4	4	5	4	4
Co	1	2	2	2	0	0	1	1	2	1	2	1	2	3
Ni	4	4	3	4	3	2	3	7	3	4	3	3	4	4
Cu	5	4	5	14	4	4	4	38	4	4	6	3	4	4
Zn	30	27	20	28	68	69	24	27	29	27	26	30	30	34
Ga	14	15	12	14	16	16	14	14	16	15	14	13	14	15
Mo	0	0	1	0	0	1	0	0	0	0	0	1	0	2
As	1	5	5	3	6	3	4	3	6	0	2	3	6	6
S	0	0	116	0	0	6	0	0	0	0	4	0	0	0

Sample	HM-02	HM-04	HM-05	HM-06	HM-07	HM-09	HM-10	HM-12	HM-22	HM-08	HM-11	HM-13	HM-14	HM-15
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Type	A	A	A	A	A	A	A	A	A	A	A	A	A	A
wt%[a]														
SiO_2	72.60	71.76	74.15	72.70	73.00	73.08	72.32	70.84	73.07	73.19	72.18	73.10	72.39	73.23
TiO_2	0.33	0.37	0.33	0.33	0.32	0.32	0.32	0.38	0.33	0.35	0.32	0.33	0.29	0.34
Al_2O_3	14.59	15.14	13.58	14.52	14.46	14.41	14.63	15.45	14.58	14.16	15.05	14.23	15.02	14.01
Fe_2O_3	2.61	2.76	2.41	2.35	2.19	2.27	2.37	2.77	2.31	2.40	2.32	2.39	1.99	2.45
MnO	0.06	0.07	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.06	0.08
MgO	0.51	0.67	0.61	0.59	0.52	0.52	0.59	0.74	0.55	0.58	0.54	0.57	0.45	0.62
CaO	2.58	2.56	2.23	2.32	2.28	2.27	2.60	2.96	2.30	2.18	2.49	2.23	2.41	2.30
Na_2O	3.65	3.59	3.27	3.70	3.46	3.52	3.74	3.82	3.35	3.45	3.71	3.41	3.78	3.45
K_2O	3.04	3.01	3.29	3.37	3.65	3.49	3.29	2.89	3.38	3.56	3.26	3.61	3.54	3.47
P_2O_5	0.05	0.07	0.07	0.06	0.06	0.06	0.07	0.08	0.06	0.06	0.06	0.06	0.06	0.06
(LOI)	1.64	2.32	1.81	2.56	1.97	1.98	1.82	2.07	2.29	1.97	1.97	1.94	2.05	1.9
Total	100.08	99.60	100.51	100.38	100.22	100.48	99.76	100.08	100.68	100.29	99.88	99.97	99.94	100.30
Rb	120	111	110	118	124	113	108	99	107	117	109	121	116	121
Sr	189	186	166	170	168	165	192	212	174	157	183	170	179	166
Y	16.9	16.7	16.4	17.5	16.6	17.2	16.3	15.9	16	18.5	18.5	16.4	17.7	18.8
Zr	157	170	155	143	154	151	150	156	148	158	158	143	153	164
Nb	5.9	6.5	6.2	6.2	6.4	6.7	5.7	5.6	6.3	6.8	7.1	6.7	6.9	7.0
Ba	707	765	720	743	739	776	731	735	733	744	758	760	788	695
Pb	18	19	16	18	20	20	18	19	21	17	18	19	19	16
Th	11	13	10	11	12	12	11	10	11	11	11	12	10	11
U	2	3	1	3	3	2	2	3	4	3	3	3	2	3
Sc	4	5	4	4	5	3	5	5	5	4	4	5	4	5
V	22	23	23	21	20	18	21	22	24	24	22	19	17	23
Cr	6	6	5	5	5	2	5	5	3	6	6	5	5	5
Co	1	2	0	1	2	2	1	1	3	2	3	2	1	3
Ni	5	6	3	3	5	4	3	3	2	2	3	4	4	2
Cu	5	5	4	5	4	4	3	4	3	4	7	6	4	3
Zn	29	33	31	34	31	31	31	30	32	33	30	31	32	32
Ga	16	15	14	15	14	14	14	15	15	15	15	15	15	15
Mo	1	1	1	1	1	1	1	1	1	3	2	2	2	3
As	7	4	3	5	7	5	3	5	5	5	8	3	6	4
S	0	17	0	20	0	0	0	11	18	0	0	0	0	4

Sample	HM-16	HM-17	HM-18	HM-19	HM-20	P1905	P1906	P1907	P1910	P1911	P1912	P1913	P1913a	P1914
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Type	A	A	A	A	A	A	A	A	A	A	A	A	A	A
wt%[a]														
SiO_2	73.02	72.53	73.50	73.57	73.00	71.80	72.67	73.94	72.46	73.45	72.80	72.78	72.83	73.68
TiO_2	0.33	0.33	0.32	0.32	0.34	0.38	0.32	0.30	0.33	0.31	0.32	0.32	0.30	0.30
Al_2O_3	14.14	14.66	14.27	14.31	14.15	14.92	14.98	13.72	14.95	14.15	14.82	14.90	14.83	14.16
Fe_2O_3	2.36	2.37	2.20	2.16	2.45	2.97	2.17	2.37	2.40	2.29	2.24	2.19	2.19	2.11
MnO	0.07	0.06	0.06	0.06	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
MgO	0.58	0.55	0.54	0.53	0.56	0.72	0.46	0.50	0.52	0.49	0.47	0.48	0.50	0.47
CaO	2.28	2.37	2.32	2.41	2.30	2.78	2.27	2.01	2.37	2.20	2.34	2.21	2.23	2.31
Na_2O	3.32	3.64	3.44	3.47	3.71	3.84	3.75	3.53	3.53	3.53	3.68	3.62	3.70	3.58
K_2O	3.84	3.42	3.30	3.13	3.36	2.46	3.26	3.54	3.31	3.46	3.20	3.40	3.30	3.29
P_2O_5	0.06	0.06	0.06	0.06	0.06	0.07	0.05	0.03	0.06	0.06	0.06	0.05	0.05	0.05
(LOI)	1.75	1.99	1.83	1.82	1.9	1.98	2.17	1.95	2.21	1.82	2.12	2.2	2.17	1.82
Total	99.22	99.92	99.93	100.14	100.16	99.96	99.68	98.67	99.38	98.78	98.86	97.91	99.35	98.61
Rb	131	114	112	108	115	85	107	105	115	120	106	111	107	108
Sr	158	175	173	179	166	202	174	171	177	165	179	167	173	174
Y	17.6	17.0	15.8	16.4	16.9	16.0	17.1	17.2	16.4	17.2	17.2	16.8	17.3	16.2
Zr	150	152	141	149	148	167	156	152	163	146	155	156	157	144
Nb	7.5	6.8	6.1	6.2	7.1	5.6	6.3	6.1	6.2	6.0	5.9	6.1	6.5	5.7
Ba	783	750	747	712	762	711	813	756	757	752	789	814	783	730
Pb	21	21	20	18	21	24	18	16	20	19	16	17	16	14
Th	12	9	11	11	10	7	10	12	14	12	11	11	14	11
U	4	1	2	2	3	2	1	4	1	4	4	3	3	3
Sc	5	4	4	4	3	5	4	5	3	4	4	3	4	4
V	17	22	20	23	20	26	18	17	23	19	22	19	19	20
Cr	6	4	5	5	4	5	4	6	6	5	4	5	5	7
Co	2	2	1	1	2	1	2	1	2	0	1	0	2	3
Ni	2	4	4	5	2	5	3	6	5	5	3	5	3	2
Cu	6	9	5	4	7	26	4	4	5	6	4	4	5	5
Zn	32	33	28	28	36	39	34	34	31	35	38	33	35	31
Ga	14	14	15	15	14	15	15	15	14	12	14	15	14	13
Mo	3	3	2	2	2	0	0	0	0	1	0	0	0	0
As	7	5	5	8	6	5	4	5	5	7	4	6	2	5
S	0	0	0	1	3	25	0	0	14	0	2	0	0	0

Sample	P1905a	P1908	P1915	191084	PA1/1	PA3/1	PA3/3	PA3/8	MAN1-1	MAN1-6	RA1/3	R2/1	R2/2	R3/1
Unit	Rang	Rang	Rang	Rang	Paeroa	Paeroa	Paeroa	Paeroa	Man	Man	Rangitawa	Rangitawa	Rangitawa	Rangitawa
Type	A	A	A	A	*C*	A	*C*	A	A	*D*	*B*	A	*B*	A
wt%[a]														
SiO_2	69.59	71.75	69.46	73.96	75.21	74.11	77.12	75.63	72.45	73.47	71.96	69.66	76.33	69.62
TiO_2	0.40	0.40	0.41	0.30	0.21	0.31	0.12	0.29	0.36	0.20	0.42	0.60	0.18	0.50
Al_2O_3	15.69	15.01	15.31	13.82	13.71	16.86	12.98	13.55	15.18	15.70	16.51	14.81	12.77	15.32
Fe_2O_3	3.59	3.04	3.86	2.54	1.77	1.15	1.43	1.99	2.65	1.80	2.87	3.95	1.40	3.60
MnO	0.08	0.07	0.07	0.09	0.04	0.05	0.03	0.05	0.05	0.04	0.04	0.08	0.04	0.08
MgO	1.01	0.71	1.37	0.32	0.27	0.23	0.18	0.23	0.54	0.28	0.32	0.90	0.22	0.94
CaO	3.06	2.83	3.36	1.69	1.43	0.96	0.82	1.99	2.30	1.44	1.32	2.87	1.05	2.95
Na_2O	3.90	3.69	3.46	4.48	3.55	2.10	2.74	3.19	3.61	3.23	3.25	4.14	3.02	4.11
K_2O	2.61	2.43	2.63	2.75	3.79	4.17	4.55	3.07	2.81	3.82	3.26	2.90	4.94	2.78
P_2O_5	0.07	0.07	0.07	0.06	0.02	0.06	0.01	0.02	0.05	0.03	0.04	0.10	0.04	0.10
(LOI)	1.98	1.86	2.13	2.71	0.89	9.28	3.83	2.92	2.68	3.81	5.43	2.31	3.63	2.4
Total	96.47	100.59	99.41	99.62	99.55	99.29	99.94	99.95	101.14	99.17	99.65	100.60	99.92	100.26
Rb	96	87	103	99	132	144	185	125	65	288	124	96	149	95
Sr	215	206	200	161	114	170	50	154	177	110	97	211	73	215
Y	16.3	15.7	16.9	34.7	17	20.5	25.0	17.1	14.9	15.1	25.2	16.8	23.2	19.1
Zr	161	155	139	226	116	129	94	135	153	128	159	195	129	173
Nb	6.2	5.8	5.6	7.9	6.8	7.7	9.1	7.4	6.3	6.8	8.7	7.6	7.1	6.8
Ba	762	702	699	597	783	721	394	763	784	912	732	724	786	744
Pb	24	14	21	20	12	21	16	16	17	6	19	15	20	15
Th	10	9	11	11	16	14	20	13	9	13	16	11	15	11
U	3	3	4	3	3	4	4	3	3	2	5	2	4	2
Sc	6	6	8	9	4	6	3	2	4	4	8	7	5	7
V	30	25	47	10	20	31	9	18	22	12	50	41	11	36
Cr	4	7	9	2	2	3	4	6	5	3	13	9	3	10
Co	3	3	6	0	2	1	1	1	2	3	2	3	3	1
Ni	5	6	7	3	3	3	3	2	3	5	12	3	3	3
Cu	9	23	7	4	4	3	3	3	6	6	15	5	4	5
Zn	39	34	43	68	20	23	22	23	33	24	41	36	31	35
Ga	15	16	16	17	14	13	14	14	15	14	16	15	11	15
Mo	0	0	0	1	1	3	3	3	0	1	2	2	1	1
As	5	5	3	3	5	3	6	4	5	8	4	0	4	3
S	4	6	3	0	0	0	0	0	33	25	90	144	0	21

[a]*Major and trace elements analysed at the Open University, Milton Keynes, U.K. Total iron as Fe_2O_3. Normalised values quoted.*

Table A4: ***Major and trace element glass chemistry for pumices and tephra***

Sample	SB3065_1	SB3065_2	SB3065_6	SB3065_13	SB3065_14	SB3065_15	SB3065_16	SB3065_17	SB3065_18	SB3065_22	P1920-1	P1920-2
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Wh	Wh
Type	*Mixed*	*Mixed*	*Mixed*	*Mixed*	*Mixed*	*Mixed*	*Mixed*	*Mixed*	*Mixed*	*Mixed*	*A*	*A*
SiO_2	67.02	66.95	66.83	63.70	67.53	61.71	69.23	64.00	68.72	66.55	78.13	77.52
TiO_2	0.54	0.59	0.47	0.39	0.41	0.26	0.41	0.45	0.60	0.48	0.14	0.13
Al_2O_3	15.69	15.05	18.27	19.68	15.18	21.49	14.18	18.78	13.71	18.48	12.54	12.58
FeO	4.91	4.83	4.16	2.66	4.58	2.64	4.10	3.45	5.00	3.01	0.43	0.58
MnO	0.08	0.18	0.10	0.03	0.16	0.11	0.14	0.09	0.22	0.00	0.01	0.03
MgO	1.20	1.21	0.83	0.61	1.06	0.58	0.91	0.71	1.03	0.33	0.05	0.08
CaO	3.58	4.18	3.02	6.62	3.83	8.01	3.46	6.24	3.43	5.97	0.70	0.74
Na_2O	3.97	4.35	3.56	4.79	4.47	3.55	4.57	4.37	4.27	3.53	2.82	3.42
K_2O	2.02	1.65	1.96	0.97	1.75	1.10	1.95	1.10	1.90	1.32	5.18	4.91
Total	97.24	97.62	94.48	98.65	97.93	98.26	98.07	98.89	97.02	97.30	95.06	96.54

Sample	P1920-3	P1920-14	P1920-14	P1920-av.1	P1920-7	P1920-10	P1920-12	P1920-11	P1920-13	P1920-13a	P1920-av.2	P1920-15
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
SiO_2	77.48	77.37	77.14	77.39	77.40	77.14	77.04	77.31	77.48	77.48	77.39	77.04
TiO_2	0.13	0.15	0.14	0.14	0.17	0.14	0.17	0.12	0.15	0.15	0.14	0.17
Al_2O_3	12.76	12.46	12.64	12.71	12.76	12.81	12.67	12.94	12.89	12.89	12.71	12.67
FeO	0.49	0.83	1.00	0.63	0.51	0.93	1.07	0.64	0.84	0.84	0.63	1.07
MnO	0.00	0.00	0.05	0.02	0.02	0.04	0.05	0.04	0.00	0.00	0.02	0.05
MgO	0.04	0.10	0.10	0.07	0.08	0.11	0.10	0.08	0.09	0.09	0.07	0.10
CaO	0.79	0.78	0.86	0.75	0.69	0.75	0.85	0.74	0.74	0.74	0.75	0.85
Na_2O	3.27	3.52	3.42	3.32	3.47	3.40	3.40	3.27	3.12	3.12	3.32	3.40
K_2O	5.05	4.80	4.65	4.96	4.90	4.69	4.65	4.85	4.69	4.69	4.96	4.65
Total	95.49	96.42	94.72	95.92	95.75	95.68	99.74	94.12	95.31	95.31	95.92	99.74

Sample	P1920-av.3	P1920-11a	P1920-10a	P1920-8	T5_4_1	T5_4_2	T5_4_3	T5_4_5	T5_4_7	T5_4_8	T5_4_9	T5_4_10
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*A*	*A*	*A*	*A*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*
SiO_2	77.39	77.04	77.14	77.40	78.51	78.51	78.15	78.41	78.08	77.93	78.46	77.92
TiO_2	0.14	0.17	0.14	0.14	0.08	0.04	0.05	0.04	0.05	0.05	0.04	0.11
Al_2O_3	12.71	12.67	12.81	12.90	12.01	12.12	12.20	12.17	12.32	12.50	12.45	12.53
FeO	0.63	1.07	0.93	0.38	0.32	0.35	0.29	0.25	0.55	0.24	0.29	0.39
MnO	0.02	0.05	0.04	0.01	0.04	0.05	0.03	0.05	0.00	0.03	0.00	0.03
MgO	0.07	0.10	0.11	0.02	0.04	0.02	0.05	0.02	0.02	0.05	0.03	0.03
CaO	0.75	0.85	0.75	0.78	0.64	0.57	0.65	0.56	0.65	0.61	0.57	0.55
Na_2O	3.32	3.40	3.40	3.27	3.19	3.01	3.36	3.47	3.18	3.19	2.98	3.36
K_2O	4.96	4.65	4.69	5.11	5.00	5.10	4.97	4.85	4.92	5.13	4.96	4.82
Total	95.92	99.74	95.68	95.43	95.01	93.68	92.78	96.32	92.69	94.91	96.60	96.61

Sample	T5_4_11	T5_4_12	T5_4_14	T5_4_15	T5_4_17	T5_4_22	P1917f_2	P1917f_3	P1917f_5	P1917f_6	P1917f_7	P1917f_9
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*C*	*C*	*C*	*C*	*C*	*C*	*B*	*B*	*B*	*B*	*B*	*B*
SiO_2	78.27	77.90	78.05	78.13	78.76	77.69	77.78	77.42	77.83	78.02	77.84	77.81
TiO_2	0.02	0.07	0.08	0.10	0.05	0.08	0.07	0.09	0.08	0.06	0.10	0.06
Al_2O_3	12.35	12.39	12.49	12.31	12.43	12.57	12.73	12.72	12.45	12.34	12.54	12.75
FeO	0.38	0.33	0.43	0.40	0.25	0.29	0.25	0.25	0.22	0.32	0.30	0.33
MnO	0.01	0.02	0.01	0.04	0.03	0.02	0.00	0.07	0.04	0.00	0.00	0.00
MgO	0.02	0.02	0.05	0.01	0.05	0.02	0.00	0.00	0.03	0.03	0.00	0.03
CaO	0.63	0.57	0.54	0.54	0.56	0.58	0.52	0.56	0.58	0.63	0.54	0.53
Na_2O	3.18	3.47	3.27	3.25	2.76	3.46	3.18	2.88	3.07	3.17	3.33	2.77
K_2O	4.86	5.05	4.88	5.02	4.94	5.06	5.30	5.69	5.48	5.21	5.16	5.46
Total	97.20	97.79	97.40	97.03	97.08	95.72	95.84	92.60	95.74	96.55	96.28	94.14

Sample	P1917f_10	P1917f_11	P1917f_12	P1917f_13	P1917f_14	P1917f_15	P1917f_17	P1917f_18	P1917f_19	P1917f_20	P1917f_21	P1917f_22
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
SiO_2	77.77	77.92	77.74	78.08	77.81	77.71	77.93	77.92	77.83	77.74	78.10	77.90
TiO_2	0.07	0.05	0.05	0.07	0.09	0.10	0.06	0.04	0.06	0.08	0.07	0.07
Al_2O_3	12.56	12.57	12.68	12.51	12.57	12.55	12.33	12.26	12.51	12.30	12.50	12.35
FeO	0.28	0.33	0.35	0.28	0.41	0.34	0.30	0.19	0.32	0.36	0.33	0.28
MnO	0.00	0.04	0.02	0.00	0.02	0.00	0.03	0.02	0.00	0.06	0.06	0.02
MgO	0.02	0.01	0.02	0.04	0.00	0.00	0.06	0.03	0.04	0.03	0.01	0.00
CaO	0.58	0.55	0.60	0.56	0.58	0.58	0.59	0.59	0.63	0.57	0.59	0.55
Na_2O	2.83	2.86	2.72	2.72	2.74	2.99	2.90	3.17	2.90	2.90	2.87	3.18
K_2O	5.64	5.43	5.49	5.58	5.55	5.48	5.44	5.31	5.54	5.60	5.22	5.39
Total	93.15	91.83	91.64	96.25	94.41	94.76	91.71	91.01	96.56	93.59	96.54	93.53

Sample	P1917f_23	P1917f_24	P1917f_25	P1917f_26	P1917f_27	P1917f_28	P1917f_29	P1917f_30	P1917f_31	P1917f_33	P1917f_34	P1917f_35
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
SiO_2	77.97	78.02	77.83	77.91	78.11	78.06	77.96	77.98	78.14	77.97	78.13	78.21
TiO_2	0.08	0.06	0.09	0.06	0.09	0.09	0.09	0.10	0.10	0.08	0.05	0.07
Al_2O_3	12.37	12.45	12.45	12.32	12.30	12.36	12.37	12.49	12.41	12.47	12.32	12.40
FeO	0.30	0.28	0.41	0.36	0.35	0.35	0.31	0.22	0.35	0.34	0.36	0.29
MnO	0.05	0.05	0.03	0.05	0.05	0.00	0.03	0.02	0.09	0.05	0.03	0.06
MgO	0.04	0.04	0.03	0.02	0.00	0.00	0.01	0.02	0.00	0.02	0.00	0.00
CaO	0.54	0.57	0.55	0.56	0.53	0.56	0.55	0.60	0.54	0.53	0.55	0.50
Na_2O	3.18	3.19	3.32	3.41	3.18	3.23	3.09	2.95	3.01	2.97	2.85	2.63
K_2O	5.20	5.18	5.11	5.11	5.21	5.19	5.39	5.44	5.19	5.41	5.51	5.61
Total	95.75	97.87	97.07	97.38	97.77	97.20	97.44	97.17	97.12	96.52	94.35	94.99

Sample	P1827-3	P1827-11 av.	P1827-av.4	P1827-av.5	P1827-av.6	P1827-av. 7	SB1119-10	SB1119-9	SB1119-1	SB1119-3	SB1119-4	SB1119-5
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*
SiO_2	77.68	78.06	78.06	78.06	78.06	78.06	77.98	77.92	77.93	77.74	77.66	77.75
TiO_2	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.04	0.07	0.07	0.05	0.08
Al_2O_3	12.66	12.68	12.68	12.68	12.68	12.68	12.64	12.68	12.55	12.75	12.59	12.79
FeO	0.25	0.31	0.31	0.31	0.31	0.31	0.35	0.45	0.24	0.50	0.74	0.41
MnO	0.05	0.04	0.04	0.04	0.04	0.04	0.06	0.04	0.04	0.02	0.00	0.02
MgO	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.02	0.03	0.04	0.01
CaO	0.68	0.74	0.74	0.74	0.74	0.74	0.58	0.62	0.53	0.62	0.57	0.58
Na_2O	3.25	3.29	3.29	3.29	3.29	3.29	3.45	3.35	3.68	3.55	3.53	3.34
K_2O	5.32	4.76	4.76	4.76	4.76	4.76	4.85	4.86	4.93	4.72	4.82	5.02
Total	91.98	95.46	95.46	95.46	95.46	95.46	96.03	96.18	95.80	93.92	96.05	95.35

Sample	SB1119-7	SB1119-8	SB1119-19	SB1119-16	SB1119-av.2	SB1119-av.3	SB1119-18	SB1119-av.4	SB1119-12	P1898/49	P1898/46	P1898/45
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*A*	*A*	*A*
SiO_2	77.91	77.97	77.97	77.82	77.90	77.90	77.93	77.90	77.91	77.20	76.97	77.09
TiO_2	0.05	0.08	0.07	0.07	0.06	0.06	0.07	0.06	0.04	0.17	0.17	0.15
Al_2O_3	12.88	12.56	12.69	12.59	12.73	12.73	12.55	12.73	12.62	12.77	12.89	12.83
FeO	0.30	0.26	0.37	0.55	0.36	0.36	0.24	0.36	0.44	1.00	0.92	1.04
MnO	0.03	0.04	0.01	0.09	0.03	0.03	0.04	0.03	0.00	0.03	0.03	0.04
MgO	0.02	0.01	0.03	0.05	0.03	0.03	0.02	0.03	0.03	0.12	0.11	0.12
CaO	0.61	0.55	0.56	0.56	0.58	0.58	0.53	0.58	0.60	0.82	0.83	0.82
Na_2O	3.26	3.42	3.40	3.51	3.42	3.42	3.68	3.42	3.57	3.31	3.38	3.26
K_2O	4.94	5.11	4.89	4.76	4.91	4.91	4.93	4.91	4.79	4.56	4.67	4.66
Total	96.35	96.84	95.82	95.87	95.86	95.86	95.80	95.86	95.41	96.63	96.90	96.15

Sample	P1898/44	P1898/42	P1898/39	P1898/2	P1892/77	P1892/66	P1892/65	P1892/64	P1892/63	P1892/62	P1892/60	P1885
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
SiO_2	77.24	76.98	77.12	77.07	77.20	77.27	77.32	77.21	77.81	77.15	77.26	77.37
TiO_2	0.18	0.17	0.11	0.15	0.17	0.12	0.13	0.12	0.15	0.13	0.16	0.13
Al_2O_3	12.72	12.81	12.90	12.89	12.69	12.72	12.68	12.70	12.96	12.79	12.76	12.70
FeO	0.91	1.11	0.92	1.02	1.04	1.03	1.07	1.05	1.05	1.06	0.95	0.93
MnO	0.04	0.03	0.03	0.00	0.01	0.05	0.05	0.04	0.00	0.02	0.01	0.04
MgO	0.11	0.13	0.11	0.09	0.10	0.12	0.11	0.09	0.12	0.12	0.10	0.07
CaO	0.81	0.85	0.86	0.83	0.84	0.80	0.86	0.80	0.80	0.75	0.77	0.74
Na_2O	3.32	3.35	3.28	3.22	3.37	3.33	3.23	3.34	2.39	3.45	3.42	3.28
K_2O	4.67	4.54	4.65	4.68	4.55	4.55	4.50	4.63	4.71	4.53	4.56	4.71
Total	96.48	96.89	95.93	97.02	97.01	96.65	96.78	96.98	96.10	96.86	97.02	96.51

Sample	P1885	P1885	P1885	P1885	P1885	P1885	P1789a/72	P1789a/50	P1789a/36	P1885	P1885	P1886
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
SiO_2	77.11	77.25	77.23	77.10	77.10	77.14	77.15	77.24	77.16	77.38	77.48	77.77
TiO_2	0.15	0.13	0.19	0.14	0.14	0.16	0.19	0.15	0.16	0.14	0.13	0.14
Al_2O_3	12.74	12.71	12.74	12.78	12.70	12.72	12.60	12.70	12.73	12.80	12.79	12.83
FeO	0.98	1.00	1.04	1.06	1.07	1.07	1.18	1.02	1.03	0.65	0.75	0.41
MnO	0.02	0.05	0.02	0.02	0.04	0.03	0.05	0.05	0.03	0.06	0.02	0.00
MgO	0.09	0.09	0.09	0.10	0.10	0.08	0.12	0.09	0.09	0.07	0.06	0.05
CaO	0.79	0.76	0.73	0.82	0.80	0.75	0.77	0.79	0.75	0.75	0.74	0.70
Na_2O	3.30	3.28	3.26	3.32	3.30	3.32	3.28	3.24	3.32	3.35	3.17	3.21
K_2O	4.79	4.72	4.66	4.66	4.74	4.72	4.63	4.68	4.72	4.78	4.83	4.90
Total	95.79	96.42	96.33	96.68	96.68	96.15	96.81	97.11	95.98	95.98	96.13	96.72

Sample	P1886	P1886	P1886	P1898/41	P1898/43	P1898/47	P1921	P1789a/19	P1789a/28	P1789a/34	P1789a/37	P1789a/38
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Wh
Type	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
SiO_2	77.54	77.42	77.46	77.28	77.09	77.13	77.42	77.50	77.70	77.38	77.61	77.72
TiO_2	0.14	0.15	0.16	0.13	0.16	0.16	0.16	0.15	0.12	0.15	0.14	0.12
Al_2O_3	12.79	12.89	12.80	12.87	12.91	13.11	13.05	12.81	12.85	12.65	12.64	12.68
FeO	0.52	0.74	0.76	0.82	0.88	0.77	0.63	0.67	0.44	0.86	0.80	0.48
MnO	0.03	0.02	0.01	0.03	0.03	0.01	0.02	0.00	0.05	0.04	0.00	0.04
MgO	0.06	0.07	0.07	0.08	0.10	0.09	0.07	0.07	0.02	0.05	0.03	0.01
CaO	0.74	0.72	0.69	0.82	0.84	0.76	0.77	0.76	0.63	0.69	0.68	0.64
Na_2O	3.28	3.38	3.20	3.29	3.25	3.30	3.23	3.28	3.28	3.39	3.29	3.24
K_2O	4.91	4.61	4.85	4.65	4.72	4.64	4.66	4.73	4.91	4.78	4.79	5.06
Total	95.16	96.32	96.38	96.19	93.18	94.77	96.87	96.76	96.82	97.09	96.95	96.95

Sample	P1789a/46	P1789a/47	P1789a/48	P1789a/49	P1826/64	P1826/65	P1826/66	P1916/15	P1916/20	P1916/35	P1916/39	P1912/44
Unit	Wh	Wh	Wh	Wh	Wh	Wh	Wh	Rang	Rang	Rang	Rang	Rang
Type	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
SiO_2	77.62	77.57	77.48	77.54	77.73	77.64	77.92	77.12	77.89	77.20	77.19	77.54
TiO_2	0.13	0.15	0.13	0.19	0.07	0.07	0.07	0.12	0.17	0.12	0.14	0.15
Al_2O_3	12.75	12.57	12.71	12.62	12.92	12.92	12.77	12.75	12.71	12.70	12.67	12.55
FeO	0.65	0.76	0.85	0.72	0.27	0.22	0.28	0.93	1.00	1.09	1.03	0.84
MnO	0.00	0.00	0.00	0.01	0.02	0.00	0.02	0.02	0.05	0.03	0.02	0.00
MgO	0.05	0.07	0.08	0.06	0.01	0.01	0.00	0.13	0.13	0.13	0.12	0.12
CaO	0.71	0.78	0.76	0.75	0.59	0.54	0.55	0.69	0.67	0.64	0.64	0.60
Na_2O	3.27	3.29	3.23	3.31	3.16	3.02	3.17	2.41	1.71	2.49	2.50	2.77
K_2O	4.81	4.80	4.76	4.80	5.21	5.56	5.21	5.81	5.67	5.60	5.67	5.42
Total	97.26	96.39	96.90	97.29	96.05	92.85	97.40	93.15	94.65	96.97	96.64	95.13

Sample	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1	R011/1
EPMA (wt%)	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*
SiO_2	78.00	77.50	77.95	77.95	77.95	77.81	77.75	77.87	77.92	78.02	77.73	77.95	77.87	77.87
TiO_2	0.15	0.15	0.12	0.12	0.16	0.11	0.14	0.15	0.14	0.15	0.15	0.12	0.15	0.15
Al_2O_3	12.12	12.63	12.25	12.25	12.21	12.45	12.43	12.30	12.18	12.17	12.23	12.25	12.30	12.30
FeO	1.13	1.17	0.97	0.97	1.03	0.94	1.09	1.04	1.13	0.93	1.04	0.97	1.04	1.04
MnO	0.03	0.04	0.06	0.06	0.05	0.05	0.00	0.03	0.03	0.07	0.04	0.06	0.03	0.03
MgO	0.12	0.13	0.12	0.12	0.12	0.14	0.13	0.12	0.13	0.11	0.12	0.12	0.12	0.12
CaO	0.84	0.82	0.80	0.80	0.87	0.88	0.86	0.84	0.85	0.84	0.87	0.80	0.84	0.84
Na_2O	3.15	3.23	3.12	3.12	3.25	3.22	3.01	3.18	3.17	3.24	3.22	3.12	3.18	3.18
K_2O	4.47	4.33	4.61	4.61	4.36	4.40	4.61	4.46	4.45	4.48	4.61	4.61	4.46	4.46
Total	94.20	95.09	95.18	95.18	95.93	95.18	95.26	94.68	95.22	92.34	93.63	95.18	94.68	94.68
LA-ICP-MS (ppm)														
Rb	139	139	143	140	142	143	140	144	55	141	148	144	140	142
Sr	43.5	64.0	57.3	63.9	55.1	59.7	57.6	58.4	83.5	58.0	57.7	62.1	52.3	56.9
Y	21.0	25.4	23.2	22.8	22.1	25.0	25.9	23.5	52.3	25.4	23.5	26.2	21.6	21.5
Zr	109	139	123	126	123	127	123	124	243	130	120	132	119	121
Nb	6.85	8.96	7.64	7.85	7.54	8.34	9.34	6.87	12.57	8.02	7.59	8.11	7.33	8.99
Cs	6.1	6.7	6.6	5.9	7.8	6.0	6.4	7.6	3.5	7.1	7.8	7.1	6.9	7.4
Ba	815	900	878	917	907	908	1159	892	317	904	936	845	864	918
La	21.7	27.8	27.3	27.9	28.7	28.2	27.6	28.2	23.0	28.4	27.5	28.6	25.9	29.1
Ce	46.0	51.5	49.8	50.8	50.3	51.6	45.7	51.2	50.9	51.3	50.9	47.5	48.6	50.7
Pr	4.4	5.2	5.1	5.3	4.9	5.1	5.2	5.0	6.5	5.1	5.4	5.4	4.7	5.4
Nd	13.5	22.1	17.0	18.8	17.0	20.7	25.9	20.9	28.0	19.0	19.4	18.7	19.2	20.4
Sm	2.73	5.34	4.58	1.96	4.54	3.55	4.31	3.47	6.84	3.10	2.76	5.08	3.38	4.11
Eu	0.82	0.47	0.21	0.49	0.53	0.35	0.99	0.95	1.10	0.17	0.65	0.25	0.50	0.56
Gd	3.14	4.03	3.74	4.39	3.64	3.95	3.95	4.23	7.46	3.66	2.58	2.93	3.42	3.38
Tb	0.35	0.58	0.63	0.70	0.87	0.99	1.03	0.47	1.12	0.89	0.54	0.76	0.56	0.63
Dy	4.12	3.89	4.07	3.31	4.10	5.64	1.80	3.47	9.62	5.98	4.22	4.68	3.07	2.89
Ho	0.68	1.02	0.81	1.08	0.72	1.08	0.99	0.86	1.93	1.08	0.97	0.88	0.85	0.99
Er	1.97	2.78	2.91	2.57	3.15	2.92	4.53	2.67	4.21	3.51	2.43	2.18	3.06	4.09
Tm	0.43	0.33	0.44	0.49	0.34	0.50	0.92	0.44	0.65	0.44	0.30	0.70	0.49	0.31
Yb	2.97	3.52	2.66	3.62	3.37	3.37	4.52	2.85	6.53	2.85	3.64	3.03	3.81	3.62
Lu	0.49	0.43	0.50	0.55	0.55	0.63	0.76	0.38	0.98	0.66	0.45	0.72	0.49	0.63
Hf	3.63	5.44	3.26	4.10	4.36	5.34	5.56	4.86	10.48	4.14	5.36	4.38	3.60	4.51
Ta	1.16	1.54	0.94	1.26	1.15	1.18	1.46	1.07	3.28	1.17	1.05	0.96	0.84	1.21
Pb	17.75	25.41	18.08	21.29	19.65	18.66	22.48	16.56	30.96	19.64	17.19	19.39	19.68	21.77
Th	15.87	23.20	18.16	19.75	19.59	18.66	21.49	18.79	29.87	20.45	19.65	21.42	19.10	20.42
U	3.21	3.91	3.54	3.89	4.33	3.68	4.43	3.77	3.89	3.56	4.31	4.05	4.16	3.92

Sample	R011/1	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3
EPMA (wt%)	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*
SiO_2	77.87	77.62	77.62	77.75	77.50	77.45	77.33	77.92	77.78	77.83	77.62	77.62	77.62	77.62
TiO_2	0.15	0.15	0.15	0.17	0.18	0.15	0.13	0.10	0.16	0.20	0.15	0.15	0.15	0.15
Al_2O_3	12.30	12.44	12.44	12.29	12.46	12.49	12.60	12.42	12.32	12.25	12.44	12.44	12.44	12.44
FeO	1.04	1.04	1.04	1.07	1.05	1.08	1.05	0.99	0.94	1.04	1.04	1.04	1.04	1.04
MnO	0.03	0.03	0.03	0.07	0.03	0.06	0.05	0.02	0.03	0.02	0.03	0.03	0.03	0.03
MgO	0.12	0.12	0.12	0.12	0.11	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12
CaO	0.84	0.84	0.84	0.79	0.83	0.83	0.88	0.82	0.88	0.84	0.84	0.84	0.84	0.84
Na_2O	3.18	3.23	3.23	3.26	3.34	3.22	3.29	3.13	3.31	3.30	3.23	3.23	3.23	3.23
K_2O	4.46	4.53	4.53	4.49	4.49	4.60	4.54	4.47	4.45	4.41	4.53	4.53	4.53	4.53
Total	94.68	94.75	94.75	93.83	94.66	96.12	93.47	95.27	95.13	94.55	94.75	94.75	94.75	94.75
LA-ICP-MS (ppm)														
Rb	151	152	153	160	167	166	162	163	153	153	156	165	168	112
Sr	62.5	53.3	69.6	60.7	71.3	57.3	58.6	81.1	57.4	76.8	58.8	50.7	55.1	81.3
Y	24.9	26.2	30.2	24.7	29.0	25.3	27.4	33.9	26.9	33.7	25.2	26.8	30.0	42.5
Zr	132	133	148	130	148	130	137	159	139	156	137	129	150	179
Nb	8.54	7.97	9.31	7.79	9.78	8.64	8.03	10.00	8.41	8.65	8.65	8.20	8.85	7.37
Cs	7.0	7.9	7.5	7.8	9.2	7.4	7.6	8.3	6.6	7.5	8.2	8.1	7.9	6.7
Ba	977	932	882	1004	1016	926	895	954	803	899	956	896	883	642
La	29.0	30.3	31.1	32.2	32.4	29.9	30.7	34.1	27.1	34.8	32.4	30.2	30.7	26.3
Ce	50.7	55.3	61.3	56.7	60.7	55.0	57.2	60.3	51.7	60.3	57.7	55.4	50.1	54.4
Pr	5.5	6.4	6.2	5.9	6.8	5.6	5.6	5.9	5.4	5.8	6.2	5.5	5.3	6.1
Nd	22.4	20.4	24.6	23.7	32.5	25.6	21.7	25.8	22.3	25.1	23.1	20.0	19.7	25.2
Sm	5.76	2.82	4.29	5.16	3.44	4.58	3.49	6.43	3.88	7.14	4.54	3.67	5.93	6.50
Eu	0.60	0.65	0.35	0.27	0.80	0.32	0.52	0.86	0.58	0.31	0.28	0.64	-0.19	2.10
Gd	3.89	5.08	4.94	6.21	5.24	2.60	4.97	5.41	5.86	5.95	3.72	8.14	2.78	6.22
Tb	0.79	0.43	0.78	0.70	0.55	0.82	0.90	0.77	0.11	0.84	1.08	0.46	0.88	0.71
Dy	5.37	3.92	5.84	5.36	5.27	4.77	3.25	4.21	4.75	4.70	2.95	5.16	5.77	8.31
Ho	1.04	1.12	1.36	1.49	1.32	1.41	1.12	1.77	0.98	1.12	1.09	0.73	0.45	0.71
Er	3.29	2.28	3.31	3.14	4.03	3.35	3.78	4.56	2.23	4.41	4.16	3.26	3.00	3.94
Tm	0.53	0.54	0.57	0.59	0.81	0.64	0.90	0.88	0.02	0.38	0.77	0.87	-0.47	0.96
Yb	3.04	2.68	3.78	3.08	4.06	3.56	4.67	5.92	2.99	3.83	3.89	3.15	2.87	4.45
Lu	0.58	0.43	0.45	0.40	0.53	0.47	0.58	0.49	0.80	0.74	0.57	0.60	1.30	0.54
Hf	5.53	5.15	6.25	4.60	5.09	4.68	5.75	7.01	6.41	6.42	4.81	5.42	7.95	6.68
Ta	1.29	0.77	1.79	0.96	1.11	1.33	0.75	1.56	1.41	1.58	0.85	1.17	1.87	1.41
Pb	20.76	17.87	19.75	19.42	19.42	18.03	17.70	23.25	14.95	17.69	17.34	15.75	16.02	118.82
Th	21.34	20.60	23.80	22.88	22.59	20.18	20.77	24.65	18.14	21.89	20.14	20.78	20.37	23.25
U	4.34	4.15	4.42	4.12	4.16	3.92	3.97	3.85	3.30	3.81	3.88	3.68	3.93	3.73

Sample	R011/3	R011/3	R011/3	R011/3	R011/3	R011/3	R011/12	R011/12	R011/12	R011/12	R011/12	R011/12	R011/12	R011/12
EPMA (wt%)	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*
SiO_2	77.62	77.62	77.62	77.62	77.62	77.62	77.92	77.85	77.92	77.80	77.96	77.79	77.92	77.65
TiO_2	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.15	0.14	0.17	0.15	0.15	0.17
Al_2O_3	12.44	12.44	12.44	12.44	12.44	12.44	12.48	12.50	12.48	12.69	12.32	12.45	12.48	12.69
FeO	1.04	1.04	1.04	1.04	1.04	1.04	1.00	0.90	1.00	1.00	1.06	1.10	1.00	0.95
MnO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.06	0.03	0.00	0.04	0.01	0.03	0.00
MgO	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.13	0.14	0.12	0.10
CaO	0.84	0.84	0.84	0.84	0.84	0.84	0.79	0.87	0.79	0.84	0.83	0.87	0.79	0.75
Na_2O	3.23	3.23	3.23	3.23	3.23	3.23	3.10	3.26	3.10	3.08	3.13	3.11	3.10	3.30
K_2O	4.53	4.53	4.53	4.53	4.53	4.53	4.42	4.32	4.42	4.34	4.35	4.37	4.42	4.39
Total	94.75	94.75	94.75	94.75	94.75	94.75	94.92	100.17	94.92	94.31	94.85	94.83	94.92	92.71
LA-ICP-MS (ppm)														
Rb	159	151	157	153	159	153	134	160	148	170	155	153	159	132
Sr	87.0	55.2	58.6	65.7	67.0	74.1	67.0	58.8	48.1	37.2	56.5	57.5	51.4	89.4
Y	39.2	25.9	22.8	26.7	25.2	30.9	51.5	25.6	24.9	24.2	22.6	25.3	25.4	55.7
Zr	169	126	121	141	131	168	185	125	114	134	117	127	136	203
Nb	10.89	9.91	8.42	8.27	8.15	9.67	8.95	8.55	7.33	8.82	7.71	8.05	8.20	10.32
Cs	7.2	7.7	8.2	7.2	7.4	8.0	6.1	6.8	6.0	7.7	7.6	5.9	8.5	7.2
Ba	953	932	912	883	897	986	829	931	767	827	910	672	724	820
La	35.3	30.9	28.4	30.9	29.4	32.9	33.4	30.3	25.7	28.4	27.3	28.1	30.3	33.4
Ce	68.9	56.4	55.2	55.8	55.0	61.2	130.4	56.7	43.2	47.3	53.2	44.9	44.4	59.7
Pr	6.6	6.3	5.9	5.8	5.8	6.1	6.9	6.0	5.5	6.0	5.6	4.9	5.7	6.8
Nd	30.3	23.9	20.8	28.0	16.8	25.5	30.8	21.9	23.4	30.7	22.5	18.9	16.5	31.1
Sm	6.26	4.69	4.57	4.30	5.49	7.60	5.65	3.86	3.10	7.01	5.48	5.21	0.88	6.25
Eu	0.77	0.42	0.35	0.84	0.52	0.30	1.51	0.50	0.02	0.92	0.89	0.03	0.27	2.29
Gd	6.36	4.75	3.84	2.45	3.86	5.16	6.10	4.21	3.48	3.11	4.77	7.20	3.33	9.16
Tb	0.79	0.76	0.62	1.11	0.73	0.77	0.79	0.62	0.66	1.14	0.89	0.81	0.17	1.48
Dy	5.30	4.77	3.79	7.82	6.93	6.81	6.57	3.53	5.96	8.60	3.36	5.52	0.75	6.67
Ho	1.08	0.83	0.99	1.30	0.72	1.27	1.34	0.89	0.77	0.90	1.07	1.09	1.32	2.04
Er	5.31	4.43	2.16	2.46	3.43	3.43	4.75	2.51	3.13	4.78	3.52	3.26	5.64	4.90
Tm	0.65	0.44	0.45	0.60	0.47	0.96	0.83	0.42	0.97	0.30	0.49	0.43	0.30	1.09
Yb	4.16	2.97	3.02	3.30	3.41	5.10	4.75	2.26	3.17	4.65	3.91	3.06	3.24	6.36
Lu	0.72	0.64	0.57	0.26	0.43	0.64	0.59	0.40	0.71	0.47	0.71	0.43	0.53	1.08
Hf	7.46	5.76	4.19	3.49	4.92	5.52	6.44	3.77	4.52	5.25	4.51	4.23	3.84	6.97
Ta	1.62	0.74	0.95	1.38	1.00	1.10	1.89	0.88	1.09	0.29	0.67	1.44	1.58	1.86
Pb	21.62	18.11	15.93	18.64	16.72	20.94	18.68	16.65	17.42	16.01	15.77	16.29	17.98	24.49
Th	24.97	20.84	18.49	22.18	20.67	23.59	31.43	18.25	17.36	18.02	17.30	18.78	18.08	30.30
U	4.44	3.70	3.75	3.85	4.29	4.45	4.10	4.01	3.44	3.89	3.69	3.99	3.67	4.15

Sample	R011/12	R011/12	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22
EPMA (wt%)	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*
SiO_2	77.92	77.92	77.53	77.38	77.73	77.58	77.54	77.65	77.74	77.58	77.58	77.58	77.58	77.58
TiO_2	0.15	0.15	0.12	0.18	0.15	0.14	0.15	0.11	0.15	0.14	0.14	0.14	0.14	0.14
Al_2O_3	12.48	12.48	12.57	12.45	12.44	12.46	12.51	12.60	12.44	12.46	12.46	12.46	12.46	12.46
FeO	1.00	1.00	0.99	1.13	1.05	1.02	0.97	0.95	1.03	1.02	1.02	1.02	1.02	1.02
MnO	0.03	0.03	0.04	0.04	0.05	0.04	0.04	0.11	0.02	0.04	0.04	0.04	0.04	0.04
MgO	0.12	0.12	0.12	0.11	0.13	0.11	0.12	0.09	0.11	0.11	0.11	0.11	0.11	0.11
CaO	0.79	0.79	0.79	0.82	0.83	0.80	0.81	0.80	0.82	0.80	0.80	0.80	0.80	0.80
Na_2O	3.10	3.10	3.23	3.20	3.23	3.29	3.22	1.94	3.08	3.29	3.29	3.29	3.29	3.29
K_2O	4.42	4.42	4.61	4.69	4.39	4.55	4.64	5.77	4.60	4.55	4.55	4.55	4.55	4.55
Total	94.92	94.92	91.30	94.51	95.53	94.79	94.37	94.87	95.69	94.79	94.79	94.79	94.79	94.79
LA-ICP-MS (ppm)														
Rb	148	167	145	154	142	146	148	135	148	163	145	153	145	166
Sr	58.6	65.6	52.0	50.7	55.3	52.8	56.7	57.8	65.2	60.1	46.3	51.7	58.7	35.8
Y	24.6	30.9	20.6	26.9	22.1	22.2	23.6	17.5	27.2	27.8	19.0	21.6	20.5	30.7
Zr	119	145	116	118	117	121	121	77	138	136	103	113	107	105
Nb	9.22	8.42	7.75	8.45	8.80	7.69	8.06	6.96	10.54	7.80	7.04	8.57	7.79	7.82
Cs	6.7	8.7	6.8	7.5	7.7	6.9	7.2	6.6	7.1	7.0	6.9	7.7	7.3	7.9
Ba	850	921	849	968	942	860	912	743	951	920	791	892	863	656
La	26.7	31.7	25.0	28.4	27.3	27.6	27.7	24.7	30.6	29.2	23.6	27.6	25.6	34.7
Ce	48.9	53.1	49.1	53.8	55.1	46.7	51.6	44.9	78.8	54.1	46.1	52.6	48.8	57.6
Pr	5.1	6.2	4.9	5.4	5.6	5.1	5.1	4.0	6.4	5.9	4.6	5.4	4.7	6.6
Nd	21.6	25.1	18.9	24.7	18.1	16.8	20.6	16.1	25.2	20.6	15.4	21.8	16.2	22.2
Sm	4.22	3.20	3.39	3.61	3.93	4.38	2.57	3.52	3.61	4.72	4.65	4.21	3.84	5.93
Eu	0.47	0.70	0.39	0.42	0.32	-0.16	0.39	0.63	-0.09	0.59	0.07	0.47	0.43	-0.10
Gd	3.85	4.38	4.24	4.90	4.15	3.38	3.48	2.88	0.96	4.38	3.07	3.56	3.73	6.44
Tb	0.43	0.72	0.78	0.31	0.88	0.89	0.61	0.73	0.34	0.88	0.15	0.54	0.66	1.00
Dy	3.77	3.17	3.80	5.33	4.05	3.88	4.47	2.68	6.38	3.63	3.22	3.99	3.64	3.23
Ho	0.68	1.51	0.98	1.29	1.05	0.84	1.15	0.44	1.18	0.91	0.84	0.93	0.93	1.16
Er	2.38	3.08	2.86	3.91	3.08	2.66	2.66	1.97	1.96	2.54	2.17	3.49	1.67	3.16
Tm	0.48	1.30	0.59	0.33	0.36	0.65	0.28	0.19	0.85	0.42	0.59	0.44	0.52	0.44
Yb	2.60	4.16	2.62	3.29	3.28	2.51	3.25	2.11	4.34	3.70	1.96	3.30	2.40	4.60
Lu	0.53	0.79	0.59	0.69	0.38	0.21	0.56	0.18	0.62	0.62	0.30	0.48	0.43	0.58
Hf	4.30	4.87	4.13	5.07	4.75	4.17	3.38	2.24	5.97	5.47	4.04	3.48	3.16	3.55
Ta	0.95	0.95	0.88	1.00	1.11	1.07	0.91	1.18	0.95	0.79	0.55	0.86	1.07	0.77
Pb	16.81	13.73	19.35	22.04	22.18	19.24	21.44	21.64	26.17	25.60	17.66	18.05	23.99	21.03
Th	16.99	21.22	18.07	20.03	19.10	18.26	18.59	16.50	65.98	19.70	15.57	18.12	15.78	24.02
U	3.70	4.06	3.91	4.48	4.19	3.81	4.13	3.54	4.87	4.06	3.94	3.97	3.58	4.57

Sample	R024/22	R024/22	R024/22	R024/22	R024/22	R024/22	R006/2	R006/2	R006/2	R006/2	R006/2	R006/2	R006/2	R006/2
EPMA (wt%)	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Rang Tephra*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*
SiO_2	77.58	77.58	77.58	77.58	77.58	77.58	78.77	78.37	78.40	78.35	78.16	78.28	78.37	78.37
TiO_2	0.14	0.14	0.14	0.14	0.14	0.14	0.11	0.12	0.13	0.09	0.13	0.11	0.12	0.12
Al_2O_3	12.46	12.46	12.46	12.46	12.46	12.46	12.52	12.68	12.54	12.86	12.89	12.83	12.68	12.68
FeO	1.02	1.02	1.02	1.02	1.02	1.02	1.10	1.14	1.06	1.11	1.16	1.22	1.14	1.14
MnO	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.05	0.07	0.10	0.01	0.03	0.05	0.05
MgO	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.13	0.13	0.15	0.12	0.12
CaO	0.80	0.80	0.80	0.80	0.80	0.80	1.02	1.07	1.09	0.99	1.11	1.20	1.07	1.07
Na_2O	3.29	3.29	3.29	3.29	3.29	3.29	3.32	3.34	3.29	3.21	3.39	3.28	3.34	3.34
K_2O	4.55	4.55	4.55	4.55	4.55	4.55	3.05	3.10	3.29	3.16	3.01	2.91	3.10	3.10
Total	94.79	94.79	94.79	94.79	94.79	94.79	94.16	93.48	92.04	92.69	93.34	93.57	93.48	93.48
LA-ICP-MS (ppm)														
Rb	171	196	167	154	141	152	102	106	110	105	106	102	108	113
Sr	46.4	90.9	56.8	63.5	56.5	43.7	72.3	84.0	69.3	73.1	79.1	72.8	80.2	65.4
Y	36.8	47.3	27.8	27.1	20.8	20.1	23.9	23.0	25.2	24.7	24.6	23.1	29.9	24.3
Zr	114	178	147	131	135	119	100	101	114	107	105	119	128	105
Nb	8.63	10.80	8.96	8.90	8.49	8.17	7.08	6.75	6.75	6.95	6.78	7.11	7.06	6.20
Cs	8.2	7.8	7.4	8.8	6.6	8.1	5.4	5.2	6.0	5.6	6.2	6.2	5.4	5.2
Ba	547	999	888	975	865	729	625	606	553	598	591	571	605	523
La	36.0	41.2	29.8	29.6	28.0	25.7	22.9	23.7	23.6	23.8	22.9	22.0	27.2	23.9
Ce	60.5	59.0	53.5	55.3	45.8	39.8	48.4	46.3	43.1	47.8	45.3	49.8	44.2	40.1
Pr	6.5	7.3	7.5	6.5	5.2	5.1	5.4	4.7	6.3	4.6	5.2	5.3	5.2	4.3
Nd	24.9	42.1	27.3	28.1	18.5	20.8	20.5	21.3	21.1	18.7	20.6	20.2	24.5	21.9
Sm	6.05	4.61	6.00	5.07	6.79	3.69	4.42	10.72	2.47	4.13	4.39	4.94	4.23	6.32
Eu	0.58	1.03	0.13	1.01	-0.13	0.86	0.90	0.66	0.51	0.57	1.11	0.83	0.87	0.42
Gd	6.10	1.47	6.05	6.21	4.17	4.28	4.32	3.88	5.42	3.69	4.54	5.57	5.75	5.97
Tb	1.51	0.28	0.02	0.64	1.65	0.92	0.96	0.68	0.67	0.75	0.66	0.33	1.01	0.92
Dy	5.78	7.10	6.19	6.21	4.53	5.61	4.60	4.35	6.25	4.60	6.08	3.85	5.01	5.86
Ho	1.20	1.66	1.17	0.87	0.70	1.50	0.97	0.92	0.53	0.93	1.13	0.85	0.99	0.86
Er	6.02	5.33	5.76	4.37	3.69	3.46	2.22	2.27	2.81	2.71	3.18	2.94	3.42	3.11
Tm	0.62	2.28	0.56	0.04	0.77	0.53	0.30	0.29	0.73	0.53	0.42	0.63	0.64	1.35
Yb	4.04	5.59	3.26	3.92	2.66	3.50	2.30	3.22	2.95	3.75	3.58	3.49	3.58	3.33
Lu	0.85	0.04	0.25	0.52	0.66	0.42	0.43	0.56	1.26	0.42	0.44	0.92	0.46	0.78
Hf	4.69	5.50	6.24	4.57	4.15	6.42	4.49	4.10	4.44	4.67	4.55	3.86	4.02	4.80
Ta	1.48	1.06	0.04	1.08	1.54	1.49	0.74	0.78	1.38	0.73	0.58	1.05	0.62	0.50
Pb	35.58	26.37	19.00	20.77	31.12	17.16	21.00	17.10	16.99	16.87	14.88	20.13	15.72	16.09
Th	22.58	26.37	21.90	20.07	21.16	18.08	12.59	12.67	13.66	12.38	12.87	13.40	15.26	12.77
U	4.22	5.52	4.13	3.92	4.86	4.20	3.01	2.61	3.61	3.11	2.99	3.31	3.04	2.54

Sample	R006/2	R006/2	R006/2	R006/2	R006/2	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5
	Kawa	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*
EPMA (wt%)														
SiO_2	78.37	78.37	78.37	78.37	78.37	78.37	78.24	78.63	78.24	78.40	78.24	78.27	78.24	78.24
TiO_2	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.14	0.13	0.13	0.13	0.12	0.13	0.13
Al_2O_3	12.68	12.68	12.68	12.68	12.68	12.68	12.67	12.60	12.67	12.59	12.67	12.44	12.67	12.67
FeO	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.20	1.14	1.16	1.14	1.13	1.14	1.14
MnO	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.02	0.05	0.09	0.05	0.09	0.05	0.05
MgO	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.11	0.13	0.11	0.13	0.11	0.13	0.13
CaO	1.07	1.07	1.07	1.07	1.07	1.07	1.09	1.01	1.09	1.01	1.09	1.06	1.09	1.09
Na_2O	3.34	3.34	3.34	3.34	3.34	3.34	3.41	3.09	3.41	3.30	3.41	3.40	3.41	3.41
K_2O	3.10	3.10	3.10	3.10	3.10	3.10	3.16	3.20	3.16	3.22	3.16	3.38	3.16	3.16
Total	93.48	93.48	93.48	93.48	93.48	93.48	93.85	95.33	93.85	93.87	93.85	93.22	93.85	93.85
LA-ICP-MS (ppm)														
Rb	112	94	129	106	105	112	92	102	114	111	118	104	110	115
Sr	63.5	77.3	86.3	75.2	67.9	77.7	73.7	91.6	85.5	75.6	55.6	74.4	81.0	75.1
Y	25.6	29.2	29.2	20.9	24.4	25.8	21.6	25.7	23.6	25.2	32.6	24.5	26.6	23.0
Zr	113	161	134	114	100	131	253	121	118	107	134	145	113	100
Nb	6.92	14.92	8.93	6.73	5.85	8.03	16.55	7.38	7.71	7.68	8.18	8.32	8.20	6.91
Cs	5.4	6.0	4.7	6.9	5.9	5.7	6.3	5.9	5.1	6.2	7.2	6.4	5.3	6.7
Ba	505	611	609	538	483	634	466	615	553	627	660	588	604	594
La	25.0	28.2	26.7	22.0	22.5	26.4	25.9	25.7	27.0	24.1	26.8	25.1	25.6	22.8
Ce	40.3	55.8	47.4	38.7	37.0	51.5	64.1	48.5	39.6	49.9	48.5	48.0	47.5	47.4
Pr	4.8	7.3	5.8	6.4	5.5	5.4	6.7	5.9	5.0	5.2	6.1	5.4	5.6	5.2
Nd	25.6	21.8	23.5	15.3	23.5	25.0	27.9	21.2	21.1	16.6	34.1	20.7	23.1	20.3
Sm	3.07	7.23	3.94	3.09	5.93	5.64	6.16	3.81	7.05	6.35	5.26	4.73	4.41	3.42
Eu	1.01	1.43	0.18	0.09	-0.48	0.91	1.08	0.88	0.49	0.50	1.07	1.02	0.78	0.59
Gd	3.48	4.47	6.07	3.79	6.59	5.78	6.06	4.83	6.45	5.93	6.30	5.48	5.65	4.55
Tb	1.37	1.28	1.38	0.12	0.52	0.83	0.95	0.82	0.56	0.87	0.76	0.50	0.83	0.51
Dy	4.64	4.83	10.08	5.67	8.14	5.50	4.84	6.51	4.33	5.68	4.28	8.21	4.11	3.44
Ho	1.66	1.51	1.86	1.25	0.63	1.35	1.39	1.35	0.97	1.28	1.03	1.35	1.54	0.87
Er	2.01	3.46	5.52	1.95	1.49	3.67	3.10	2.46	5.57	3.16	3.48	3.70	3.47	2.25
Tm	1.69	0.31	0.96	0.88	0.35	0.68	0.78	0.52	0.72	0.37	0.62	0.81	0.74	0.43
Yb	3.79	3.12	4.50	3.96	2.00	2.86	2.87	4.23	4.82	2.82	3.37	3.04	3.17	2.78
Lu	0.86	0.44	0.59	0.56	0.76	0.67	0.59	0.48	0.53	0.61	0.97	0.77	0.53	0.62
Hf	3.96	7.05	4.07	6.47	4.24	5.91	7.65	5.27	6.23	3.71	4.82	4.86	3.93	3.88
Ta	0.76	1.76	1.63	0.83	1.03	1.05	2.13	0.92	1.12	0.69	1.09	1.21	0.80	0.78
Pb	38.11	25.16	18.57	20.21	10.49	18.92	35.99	15.17	16.31	15.29	17.31	21.97	15.16	15.49
Th	12.54	15.01	15.49	11.76	13.09	15.51	23.30	13.97	13.96	13.65	17.79	17.25	13.42	12.77
U	2.68	3.12	3.81	2.74	2.82	2.93	3.06	3.02	2.75	3.09	3.53	2.73	2.70	3.20

Sample	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5	R006/5
	Kawa	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*	*Kawa*
EPMA (wt%)										
SiO_2	78.63	78.24	78.24	78.24	78.24	78.24	78.24	78.24	78.24	78.24
TiO_2	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Al_2O_3	12.60	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
FeO	1.20	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
MnO	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
MgO	0.11	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
CaO	1.01	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Na_2O	3.09	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41
K_2O	3.20	3.16	3.16	3.16	3.16	3.16	3.16	3.16	3.16	3.16
Total	95.33	93.85	93.85	93.85	93.85	93.85	93.85	93.85	93.85	93.85
LA-ICP-MS (ppm)										
Rb	107	113	108	121	118	105	122	113	107	
Sr	86.5	88.8	78.6	81.3	71.7	96.6	92.1	94.9	90.0	
Y	24.7	28.2	22.0	29.4	23.7	28.0	26.8	25.0	28.3	
Zr	108	135	111	169	106	140	158	127	124	
Nb	6.87	25.97	7.31	7.96	7.56	7.52	10.85	6.97	6.08	
Cs	5.9	6.3	5.7	8.8	6.3	5.4	6.1	5.2	5.4	
Ba	587	682	571	544	586	587	570	556	569	
La	22.9	28.5	25.7	30.2	23.8	29.2	25.3	24.1	28.0	
Ce	46.5	54.1	45.8	49.5	47.0	47.3	48.6	40.8	41.8	
Pr	4.7	5.7	5.0	7.5	5.6	5.4	5.1	5.8	5.7	
Nd	21.7	22.0	23.7	24.0	18.6	21.4	25.0	25.0	34.8	
Sm	4.29	2.31	8.30	5.13	3.31	6.36	7.47	4.17	4.42	
Eu	0.93	0.41	0.64	0.17	0.43	1.77	0.14	1.75	0.41	
Gd	3.78	5.46	4.18	4.03	3.93	6.21	4.20	4.13	8.66	
Tb	0.46	0.94	0.46	1.03	0.71	1.31	1.30	0.41	1.45	
Dy	4.73	6.04	4.76	4.42	4.64	2.50	6.80	3.65	8.81	
Ho	0.78	0.94	0.87	1.67	1.34	1.51	0.98	2.22	1.33	
Er	3.09	4.04	4.23	3.55	3.60	4.35	3.75	3.71	2.83	
Tm	0.31	0.69	1.02	1.02	0.35	0.62	-0.79	0.21	0.56	
Yb	3.36	3.57	1.30	4.06	3.85	3.26	4.47	3.29	4.76	
Lu	0.45	0.55	0.34	-0.02	0.56	0.23	-0.14	0.60	0.75	
Hf	4.14	5.96	5.35	9.61	2.92	5.49	7.35	6.36	5.18	
Ta	0.73	1.27	0.37	1.36	0.69	0.59	1.78	1.01	1.03	
Pb	14.69	19.02	14.53	28.83	12.80	15.65	35.55	16.97	12.40	
Th	12.53	17.46	12.14	19.19	13.12	15.60	22.28	13.98	14.63	
U	2.85	3.07	2.67	3.25	3.07	3.05	2.93	3.06	2.93	

Notes: Glass data major elements are quoted as anhydrous (normalised). Wh refers to Whakamaru pumice; Rang refers to Rangitaiki pumice; Tephra is Rangitawa Tephra; Kawakawa is distal tephra from the Oruanui eruption. Sample codes and locations provided in Appendix 1.

Table A5: ***Feldspar major-element transects for Whakamaru Group pumices (by EPMA)***

Feldspar	P1905-5_1	P1905-5_2	P1905-5_3	P1905-5_4	P1905-5_5	P1905-5_6	P1905-7_1	P1905-7_2	P1905-7_3	P1905-7_4	P1905-19_1	P1905-19_2
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Distance from rim (µm)	5	56	107	158	209	260	5	56	107	158	5	55
EPMA (wt%)												
SiO_2	61.82	61.54	61.16	60.59	61.60	61.91	61.10	60.40	59.96	60.78	61.26	60.74
TiO_2	0.01	0.02	0.00	0.03	0.02	0.01	0.00	0.01	0.02	0.01	0.00	0.03
Al_2O_3	23.54	23.68	24.01	24.41	23.76	23.68	23.79	24.28	24.00	23.87	23.79	23.73
FeO	0.23	0.23	0.28	0.30	0.21	0.22	0.27	0.25	0.23	0.28	0.21	0.23
MnO	0.01	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.00	0.01	0.01	0.00
MgO	0.01	0.01	0.01	0.02	0.00	0.02	0.01	0.02	0.03	0.00	0.02	0.02
CaO	6.11	6.31	6.50	6.95	6.23	6.06	6.61	7.19	6.97	6.85	6.54	6.80
Na_2O	7.51	7.36	7.34	7.19	7.54	7.49	7.20	7.10	7.14	7.20	7.37	7.23
K_2O	0.76	0.74	0.67	0.59	0.73	0.74	0.71	0.62	0.61	0.64	0.67	0.63
Total	100.00	99.90	99.97	100.08	100.10	100.13	99.72	99.87	98.96	99.64	99.87	99.43
An	30	31	32	34	30	30	32	35	34	33	32	33
Ab	66	65	65	63	66	66	64	62	63	63	64	63
Or	4	4	4	3	4	4	4	4	4	4	4	4

Feldspar	P1915-28_1	P1915-28_2	P1915-28_3	P1915-28_4	P1915-28_5	P1915-28_6	P1915-28_7	P1915-28_8	P1915-28_9	P1915-28_10	P1915-28_11	P1915-28_12
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Distance from rim (µm)	5	56	107	158	209	260	311	362	413	464	515	566
EPMA (wt%)												
SiO_2	61.40	60.50	60.76	61.01	58.30	60.71	61.31	59.89	60.53	61.58	78.21	59.57
TiO_2	0.00	0.01	0.02	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.02	0.01
Al_2O_3	23.73	23.79	23.59	22.92	22.66	23.04	23.08	23.21	23.67	23.00	12.42	22.97
FeO	0.18	0.29	0.20	0.23	0.31	0.24	0.21	0.21	0.23	0.22	0.70	0.25
MnO	0.02	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.03	0.01	0.00	0.00
MgO	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.01
CaO	6.43	6.78	6.65	6.58	6.70	6.54	6.42	6.64	6.98	6.04	1.57	6.63
Na_2O	7.30	7.18	7.28	7.27	7.32	7.43	7.39	7.30	7.20	7.51	5.27	7.07
K_2O	0.74	0.64	0.67	0.67	0.61	0.68	0.67	0.65	0.63	0.74	0.55	0.62
Total	99.81	99.24	99.18	98.71	95.93	98.65	99.11	97.92	99.30	99.10	98.75	97.14
An	31	33	32	32	32	31	31	32	34	29	13	33
Ab	64	63	64	64	64	65	65	64	63	66	81	63
Or	4	4	4	4	4	4	4	4	4	4	6	4

Feldspar	P1905-19_3	P1905-19_4	P1905-19_5	P1905-19_6	P1905-19_7	P1905-19_8	P1905-19_9	P1905-19_10	P1905-19_11	P1905-19_12	P1905-19_13	P1905-19_14
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Distance from rim (μm)	105	155	205	255	305	355	405	455	505	555	605	655
EPMA (wt%)												
SiO_2	60.82	60.86	60.31	60.29	60.45	60.77	59.55	59.66	61.29	60.43	60.79	60.21
TiO_2	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.01	0.03	0.00	0.02	0.01
Al_2O_3	23.68	23.49	23.53	23.77	23.69	23.59	23.16	22.97	23.63	24.56	24.23	24.46
FeO	0.21	0.26	0.24	0.27	0.23	0.23	0.23	0.29	0.23	0.25	0.25	0.27
MnO	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00
MgO	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.03	0.02	0.01
CaO	6.68	6.62	6.88	7.14	6.99	6.65	6.35	6.35	6.51	6.89	6.77	7.18
Na_2O	7.32	7.41	7.20	7.02	7.28	7.25	6.92	7.32	7.50	7.00	7.39	7.11
K_2O	0.63	0.64	0.59	0.58	0.61	0.66	0.63	0.69	0.67	0.62	0.63	0.60
Total	99.35	99.28	98.79	99.10	99.26	99.17	96.85	97.29	99.86	99.79	100.10	99.85
An	32	32	33	35	33	32	32	31	31	34	32	35
Ab	64	64	63	62	63	64	64	65	65	62	64	62
Or	4	4	3	3	3	4	4	4	4	4	4	3

Feldspar	P1915-28_13	P1915-28_14	P1915-28_15	P1915-28_16	P1915-28_17	P1915-28_18	P1915-28_19	P1915-28_20	P1915-28_21	P1915-28_22	P1915-28_23	P1915-28_24
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Distance from rim (μm)	617	668	719	770	821	872	923	974	1025	1076	1127	1178
EPMA (wt%)												
SiO_2	60.58	60.18	60.19	60.18	59.95	60.45	60.25	60.90	60.25	60.88	61.12	60.69
TiO_2	0.01	0.00	0.00	0.00	0.00	0.04	0.01	0.01	0.00	0.00	0.01	0.03
Al_2O_3	23.45	23.45	23.27	23.36	23.32	23.33	23.45	22.97	22.96	23.14	23.17	23.43
FeO	0.24	0.20	0.23	0.24	0.23	0.21	0.18	0.23	0.26	0.25	0.27	0.27
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.00
MgO	0.02	0.01	0.02	0.02	0.01	0.02	0.01	0.00	0.02	0.01	0.00	0.01
CaO	6.83	7.15	6.93	6.94	7.05	6.72	6.91	6.30	6.36	6.44	6.44	6.71
Na_2O	7.18	7.24	7.34	7.24	7.16	7.32	7.21	7.51	7.30	7.47	7.41	7.38
K_2O	0.64	0.60	0.61	0.61	0.62	0.66	0.63	0.69	0.72	0.72	0.69	0.71
Total	98.96	98.83	98.59	98.59	98.33	98.74	98.66	98.63	97.88	98.92	99.11	99.22
An	33	34	33	33	34	32	33	30	31	31	31	32
Ab	63	62	63	63	62	64	63	66	65	65	65	64
Or	4	3	3	4	4	4	4	4	4	4	4	4

Feldspar	P1905-19_15	P1905-19_16	P1905-23_1	P1905-23_2	P1905-23_3	P1905-23_4	P1905-23_5	P1905-23_6	P1905-23_7	P1905-23_8	P1905-23_9	P1905-23_12
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Distance from rim (µm)	705	755	5	155	305	455	605	755	905	1055	1205	1655
EPMA (wt%)												
SiO_2	60.41	60.63	61.39	59.32	61.12	59.63	61.76	61.33	61.20	61.35	62.62	63.63
TiO_2	0.01	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.05	0.13
Al_2O_3	24.23	24.06	23.12	22.89	23.16	24.00	22.98	23.18	23.32	23.83	18.05	13.50
FeO	0.22	0.27	0.26	0.26	0.25	0.26	0.24	0.22	0.19	0.21	0.90	0.67
MnO	0.00	0.02	0.00	0.04	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.04
MgO	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.03	0.01	0.00	0.07
CaO	7.04	7.01	6.19	6.56	6.41	7.43	6.27	6.53	6.57	6.60	2.49	0.60
Na_2O	7.11	7.17	7.63	7.11	7.29	6.86	7.50	7.32	7.43	7.30	5.27	1.27
K_2O	0.60	0.63	0.74	0.67	0.69	0.55	0.73	0.66	0.70	0.68	1.56	4.37
Total	99.61	99.79	99.34	96.86	98.94	98.72	99.49	99.27	99.43	99.98	90.98	84.28
An	34	34	30	32	31	36	30	32	32	32	18	7
Ab	62	63	66	64	65	61	66	64	64	64	69	28
Or	3	4	4	4	4	3	4	4	4	4	13	64

Feldspar	P1915-36_1	P1915-36_2	P1915-36_3	P1915-36_4	P1915-36_5	P1915-36_6	P1915-36_7	P1915-36_8	P1915-36_9	P1915-36_10	P1915-36_12	P1915-36_13
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Distance from rim (µm)	5	103	201	299	397	495	593	691	789	887	985	1083
EPMA (wt%)												
SiO_2	59.24	60.30	60.26	60.19	60.49	60.72	59.90	61.79	60.19	61.19	56.64	57.13
TiO_2	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.02
Al_2O_3	23.22	23.52	23.54	23.38	23.09	22.98	24.00	22.58	22.53	22.04	25.22	25.34
FeO	0.24	0.22	0.21	0.27	0.24	0.20	0.20	0.19	0.25	0.23	0.18	0.18
MnO	0.00	0.02	0.03	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.03	0.01
MgO	0.02	0.00	0.03	0.01	0.00	0.03	0.02	0.00	0.00	0.02	0.02	0.01
CaO	6.93	6.61	6.63	6.76	6.46	6.22	7.33	5.76	6.34	5.90	9.24	8.82
Na_2O	7.24	7.31	7.30	7.26	7.40	7.47	6.95	7.52	7.33	7.63	6.01	6.24
K_2O	0.61	0.68	0.66	0.65	0.71	0.71	0.59	0.81	0.67	0.81	0.39	0.42
Total	97.49	98.67	98.67	98.54	98.41	98.33	98.99	98.66	97.32	97.82	97.75	98.19
An	33	32	32	33	31	30	36	28	31	29	45	43
Ab	63	64	64	64	65	66	61	67	65	67	53	55
Or	3	4	4	4	4	4	3	5	4	5	2	2

Feldspar	P1905-23_15	P1905-23_16	P1905-23_17	P1905-26_1	P1905-26_2	P1905-26_3	P1905-26_4	P1905-26_5	P1905-26_6	P1905-26_7	P1905-26_8	P1905-26_9
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Distance from rim (µm)	2105	2255	2405	5	55	105	155	205	255	305	355	405
EPMA (wt%)												
SiO_2	60.80	61.31	60.49	61.42	60.53	61.19	59.51	60.31	59.83	62.12	60.44	59.88
TiO_2	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.02	0.00	0.00
Al_2O_3	24.56	24.37	24.65	23.70	24.47	24.12	25.47	24.60	25.00	23.56	24.19	24.40
FeO	0.21	0.26	0.25	0.24	0.22	0.19	0.20	0.19	0.17	0.23	0.24	0.17
MnO	0.02	0.01	0.00	0.03	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00
MgO	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.02	0.01	0.02	0.00	0.00
CaO	6.77	6.50	6.87	6.49	7.11	6.80	7.96	7.26	7.46	6.10	7.07	7.61
Na_2O	7.19	7.46	7.20	7.35	7.19	7.28	6.78	7.08	6.99	7.66	7.22	7.00
K_2O	0.63	0.67	0.64	0.69	0.60	0.64	0.50	0.57	0.55	0.75	0.64	0.54
Total	100.18	100.62	100.12	99.92	100.13	100.23	100.44	100.04	100.04	100.45	99.80	99.61
An	33	31	33	31	34	33	38	35	36	29	34	36
Ab	63	65	63	65	62	64	59	62	61	66	63	61
Or	4	4	4	4	3	4	3	3	3	4	4	3

Feldspar	P1915-36_14	P1915-36_16	P1915-36_17	P1915-36_18	P1915-36_19	P1915-36_20	P1920-2_1	P1920-2_2	P1920-2_3	P1920-2_4	P1920-2_5	P1920-2_6
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang		Rang	Rang	Rang	Rang
Distance from rim (µm)	1181	1279	1377	1475	1573	1671	5	71	137	203	269	335
EPMA (wt%)												
SiO_2	58.46	61.32	59.84	60.33	60.19	60.26	61.11	61.10	60.98	59.05	60.48	61.26
TiO_2	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.00	0.01	0.00
Al_2O_3	24.33	22.64	23.39	23.09	23.06	23.17	23.98	23.97	23.77	23.06	24.10	23.49
FeO	0.23	0.23	0.24	0.27	0.23	0.23	0.27	0.31	0.22	0.24	0.25	0.22
MnO	0.03	0.03	0.02	0.00	0.00	0.01	0.02	0.00	0.03	0.00	0.00	0.02
MgO	0.02	0.02	0.00	0.00	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01
CaO	7.83	5.94	6.91	6.72	6.66	6.57	6.60	6.62	6.57	6.60	7.05	6.50
Na_2O	6.86	7.73	7.33	7.16	7.33	7.38	7.31	7.39	7.43	7.03	7.18	7.53
K_2O	0.54	0.79	0.64	0.65	0.68	0.69	0.68	0.65	0.63	0.63	0.58	0.66
Total	98.28	98.70	98.38	98.24	98.15	98.33	100.01	100.04	99.65	96.64	99.66	99.69
An	38	28	33	33	32	32	32	32	32	33	34	31
Ab	59	67	63	63	64	64	64	64	65	63	63	65
Or	3	5	4	4	4	4	4	4	4	4	3	4

Feldspar	P1905-26_10	P1905-26_11	P1905-26_12	P1905-26_13	P1905-26_14	P1905-26_15	P1905-27_1	P1905-27_2	P1905-27_3	P1905-27_4	P1905-27_5	P1905-27_6
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Distance from rim (µm)	455	505	555	605	655	705	5	83	161	239	317	395
EPMA (wt%)												
SiO_2	61.53	59.14	59.41	60.53	61.00	60.97	60.81	60.52	60.54	60.74	60.79	61.15
TiO_2	0.00	0.04	0.01	0.03	0.04	0.00	0.02	0.03	0.01	0.01	0.04	0.03
Al_2O_3	23.69	25.33	24.69	24.21	23.84	23.79	23.79	23.77	23.96	24.11	24.32	23.99
FeO	0.27	0.25	0.20	0.27	0.28	0.21	0.28	0.27	0.27	0.18	0.21	0.19
MnO	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.00	0.02
MgO	0.00	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.03	0.00	0.00	0.01
CaO	6.49	8.19	7.75	7.06	6.78	6.63	6.76	6.94	6.96	6.80	7.03	6.43
Na_2O	7.43	6.67	6.87	7.10	7.28	7.33	7.26	7.32	7.21	7.23	7.20	7.45
K_2O	0.66	0.48	0.51	0.62	0.63	0.69	0.64	0.60	0.63	0.63	0.64	0.68
Total	100.09	100.11	99.42	99.81	99.87	99.64	99.58	99.48	99.63	99.69	100.23	99.96
An	31	39	37	34	33	32	33	33	34	33	34	31
Ab	65	58	60	62	64	64	64	63	63	63	63	65
Or	4	3	3	4	4	4	4	3	4	4	4	4

Feldspar	P1920-2_7	P1920-2_8	P1920-2_9	P1920-2_10	P1920-2_11	P1920-2_12	P1920-2_16	P1920-2_17	P1920-2_18	P1920-2_19	P1920-2_20	P1920-3_1
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Distance from rim (µm)	401	467	533	599	665	731	995	1061	1127	1193	1259	5
EPMA (wt%)												
SiO_2	61.26	60.79	61.04	61.44	61.77	61.54	61.00	61.20	60.95	61.02	61.02	61.39
TiO_2	0.01	0.00	0.01	0.02	0.02	0.02	0.00	0.01	0.00	0.00	0.01	0.00
Al_2O_3	23.47	23.59	23.62	23.31	23.07	23.00	24.11	23.90	23.82	23.98	23.89	24.33
FeO	0.17	0.26	0.28	0.23	0.23	0.23	0.18	0.20	0.21	0.24	0.22	0.26
MnO	0.01	0.01	0.01	0.01	0.01	0.00	0.04	0.01	0.01	0.00	0.00	0.03
MgO	0.00	0.01	0.02	0.00	0.01	0.01	0.02	0.00	0.01	0.00	0.00	0.00
CaO	6.55	6.83	6.69	6.44	6.08	6.18	6.85	6.62	6.76	6.77	6.71	6.41
Na_2O	7.47	7.29	7.35	7.42	7.49	7.47	7.31	7.37	7.17	7.25	7.24	7.38
K_2O	0.66	0.64	0.68	0.67	0.74	0.71	0.60	0.64	0.62	0.62	0.62	0.70
Total	99.61	99.42	99.71	99.54	99.41	99.16	100.10	99.95	99.56	99.88	99.71	100.50
An	31	33	32	31	30	30	33	32	33	33	33	31
Ab	65	63	64	65	66	66	64	64	63	64	64	65
Or	4	4	4	4	4	4	3	4	4	4	4	4

Feldspar	P1905-27_7	P1905-27_8	P1905-27_9	P1905-27_10	P1905-27_11	P1905-27_12	P1905-27_13	P1905-27_14	P1905-27_15	P1905-27_16	P1905-27_17	P1905-27_18
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Distance from rim (μm)	473	551	629	707	785	863	941	1019	1097	1175	1253	1331
EPMA (wt%)												
SiO_2	61.39	60.23	61.29	61.29	61.52	61.26	61.23	61.36	61.73	61.11	60.09	60.97
TiO_2	0.00	0.01	0.00	0.02	0.00	0.00	0.02	0.00	0.02	0.00	0.01	0.00
Al_2O_3	23.71	24.12	23.94	23.89	23.73	23.98	24.06	23.95	23.67	23.96	24.74	23.89
FeO	0.23	0.25	0.28	0.24	0.22	0.20	0.18	0.15	0.20	0.25	0.23	0.22
MnO	0.00	0.02	0.00	0.00	0.02	0.00	0.05	0.03	0.00	0.00	0.00	0.01
MgO	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.02	0.02
CaO	6.34	6.74	6.57	6.49	6.23	6.48	6.52	6.45	6.24	6.68	7.44	6.69
Na_2O	7.39	7.24	7.47	7.36	7.47	7.47	7.34	7.30	7.47	7.36	6.96	7.41
K_2O	0.69	0.64	0.68	0.68	0.72	0.67	0.65	0.66	0.71	0.64	0.54	0.64
Total	99.77	99.26	100.24	99.98	99.91	100.08	100.05	99.90	100.04	100.00	100.02	99.84
An	31	33	31	31	30	31	32	32	30	32	36	32
Ab	65	64	65	65	66	65	65	65	66	64	61	64
Or	4	4	4	4	4	4	4	4	4	4	3	4

Feldspar	P1920-3_2	P1920-3_3	P1920-3_4	P1920-3_5	P1920-3_6	P1920-3_7	P1920-3_8	P1920-3_9	P1920-3_10	P1920-3_11	P1920-3_12	P1920-3_13
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Distance from rim (μm)	55	105	155	205	255	305	355	405	455	505	555	605
EPMA (wt%)												
SiO_2	60.47	61.26	60.87	61.00	60.07	61.72	61.35	61.49	61.42	61.40	60.94	61.05
TiO_2	0.04	0.00	0.04	0.00	0.01	0.00	0.01	0.01	0.03	0.03	0.01	0.01
Al_2O_3	24.41	24.28	24.56	24.45	25.07	23.84	24.01	24.02	24.43	24.42	24.62	24.44
FeO	0.24	0.21	0.26	0.26	0.22	0.22	0.23	0.18	0.23	0.21	0.25	0.24
MnO	0.02	0.03	0.03	0.03	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00
MgO	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.00	0.01	0.01	0.00	0.01
CaO	6.70	6.76	7.03	6.89	7.53	6.48	6.67	6.41	6.65	6.56	6.94	6.80
Na_2O	7.21	7.28	7.25	7.29	6.83	7.50	7.35	7.39	7.45	7.39	7.15	7.30
K_2O	0.63	0.64	0.60	0.65	0.56	0.70	0.65	0.69	0.68	0.67	0.61	0.64
Total	99.73	100.47	100.67	100.58	100.31	100.49	100.31	100.19	100.89	100.72	100.51	100.48
An	33	33	34	33	37	31	32	31	32	32	34	33
Ab	64	64	63	63	60	65	64	65	64	65	63	64
Or	4	4	3	4	3	4	4	4	4	4	4	4

Feldspar	P1905-27_19	P1905-27_20	P1905-29	P1905-30	P1920-36_1	P1920-36_2	P1920-36_3	P1920-36_4	P1920-36_5	P1920-36_6	P1920-36_7	P1920-36_8
Unit	Whak	Whak	Whak	Whak	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Distance from rim (µm)	1409	1487			5	105	205	305	405	505	605	705
EPMA (wt%)												
SiO_2	61.28	60.08	58.00	60.33	61.11	62.16	61.25	60.92	61.09	61.08	61.02	60.89
TiO_2	0.02	0.00	0.05	0.12	0.01	0.02	0.01	0.00	0.01	0.00	0.00	0.01
Al_2O_3	23.57	24.60	22.38	21.10	23.84	23.19	23.89	24.20	23.89	24.36	23.95	23.98
FeO	0.20	0.29	2.87	1.33	0.21	0.14	0.18	0.15	0.20	0.21	0.22	0.21
MnO	0.02	0.00	0.11	0.05	0.00	0.02	0.00	0.01	0.02	0.00	0.02	0.00
MgO	0.03	0.00	1.39	0.46	0.00	0.02	0.01	0.01	0.02	0.00	0.01	0.02
CaO	6.57	7.31	8.07	6.55	6.56	5.89	6.50	6.77	6.57	6.72	6.79	6.68
Na_2O	7.50	7.06	5.15	5.89	7.46	7.76	7.37	7.26	7.48	7.29	7.38	7.32
K_2O	0.66	0.59	0.46	0.66	0.68	0.78	0.65	0.62	0.66	0.64	0.64	0.64
Total	99.85	99.93	98.47	96.48	99.88	99.97	99.85	99.94	99.93	100.29	100.01	99.76
An	31	35	45	36	31	28	32	33	31	33	32	32
Ab	65	61	52	59	65	67	65	64	65	64	64	64
Or	4	3	3	4	4	4	4	4	4	4	4	4

Feldspar	P1920-3_14	P1920-3_15	P1920-3_16	P1920-3_17	P1920-3_18	P1920-3_19	P1920-3_20	P1920-3_21	P1920-11_1	P1920-11_2	P1920-11_3	P1920-11_4
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Distance from rim (µm)	655	705	755	805	855	905	955	1005	5	55	105	155
EPMA (wt%)												
SiO_2	61.44	61.38	61.64	60.71	60.40	62.58	58.06	61.34	57.95	57.92	57.47	59.29
TiO_2	0.03	0.04	0.04	0.00	0.02	0.02	0.00	0.03	0.00	0.00	0.01	0.01
Al_2O_3	24.32	24.43	24.00	25.06	25.12	23.71	22.95	24.23	26.48	27.08	27.25	25.16
FeO	0.24	0.25	0.19	0.26	0.27	0.21	0.24	0.23	0.25	0.26	0.19	0.20
MnO	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.01
MgO	0.00	0.01	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.04	0.00
CaO	6.69	6.65	6.31	7.27	7.40	5.78	6.36	6.59	8.36	9.14	9.52	7.54
Na_2O	7.40	7.33	7.41	7.03	7.07	7.77	6.99	7.43	6.48	6.30	5.95	6.91
K_2O	0.63	0.66	0.70	0.57	0.57	0.80	0.66	0.65	0.41	0.40	0.38	0.53
Total	100.74	100.74	100.30	100.94	100.85	100.89	95.28	100.51	99.95	101.13	100.83	99.63
An	32	32	31	35	35	28	32	32	41	43	46	36
Ab	64	64	65	62	61	68	64	65	57	54	52	60
Or	4	4	4	3	3	5	4	4	2	2	2	3

Feldspar Unit	P1920-36_9 Rang	P1920-36_10 Rang	P1920-36_11 Rang	P1920-36_12 Rang
Distance from rim (µm)	805	905	1005	1105
EPMA (wt%)				
SiO_2	61.06	60.07	60.38	60.46
TiO_2	0.00	0.01	0.02	0.01
Al_2O_3	23.96	24.16	23.62	23.64
FeO	0.23	0.22	0.25	0.25
MnO	0.00	0.04	0.02	0.00
MgO	0.02	0.01	0.02	0.01
CaO	6.68	7.34	6.93	6.91
Na_2O	7.24	7.03	7.35	7.26
K_2O	0.63	0.55	0.62	0.60
Total	99.82	99.43	99.20	99.14
An	33	35	33	33
Ab	64	61	63	63
Or	4	3	3	3

Feldspar Unit	P1920-11_5 Rang	P1920-11_6 Rang	P1920-11_7 Rang	P1920-11_8 Rang
Distance from rim (µm)	205	255	305	355
EPMA (wt%)				
SiO_2	60.71	61.03	58.97	57.38
TiO_2	0.01	0.01	0.02	0.02
Al_2O_3	25.17	24.65	25.74	26.75
FeO	0.17	0.20	0.18	0.27
MnO	0.06	0.05	0.00	0.00
MgO	0.00	0.00	0.01	0.01
CaO	7.03	6.71	8.38	9.77
Na_2O	7.20	7.32	6.53	5.99
K_2O	0.61	0.66	0.46	0.35
Total	100.96	100.64	100.29	100.53
An	34	32	40	46
Ab	63	64	57	52
Or	3	4	3	2

Notes: Major-element compositions for plagioclase feldspar transects measured by EPMA at University of Oxford.

Table A6: ***Biotite major-element compositions for Whakamaru Group pumices***

Sample	P1909/14	P1909/15	P1909/16	P1909/22	P1909/23	P1909/29	P1909/46	P1909/64	P1909-28	P1909-29
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Type	type *A*	type *A*	type *A*	type *A*	type *A*	type *A*	type *A*	type *A*	type *A*	type *A*
SiO_2	36.36	36.47	36.51	37.38	37.00	36.49	36.28	36.48	36.57	36.29
TiO_2	4.41	4.53	4.42	4.00	3.68	4.18	3.67	4.12	3.97	3.98
Al_2O_3	13.90	13.78	13.97	14.95	15.11	14.42	14.01	15.00	13.04	12.80
FeO	23.17	23.27	23.48	21.58	20.90	22.53	26.83	22.59	23.43	23.55
MnO	0.42	0.37	0.39	0.28	0.27	0.38	0.49	0.41	0.33	0.46
MgO	9.08	9.14	9.19	9.92	9.55	8.51	6.30	8.64	8.18	8.17
CaO	0.02	0.01	0.00	0.02	0.08	0.09	0.12	0.04	0.06	0.03
Na_2O	0.43	0.42	0.42	0.39	0.40	0.43	0.46	0.49	0.32	0.43
P_2O_5	0.03	0.02	0.01	0.02	0.13	0.15	0.25	0.16	-	-
K_2O	9.01	8.99	9.09	8.73	8.23	8.78	8.58	8.43	8.20	8.39
Total	96.83	96.99	97.48	97.26	95.33	95.95	96.99	96.35	94.09	94.11
Atomic proportions										
SiO_2	1.21	1.21	1.22	1.24	1.23	1.21	1.21	1.21	1.22	1.21
TiO_2	0.11	0.11	0.11	0.10	0.09	0.10	0.09	0.10	0.10	0.10
Al_2O_3	0.41	0.41	0.41	0.44	0.44	0.42	0.41	0.44	0.38	0.38
FeO	0.32	0.32	0.33	0.30	0.29	0.31	0.37	0.31	0.33	0.33
MnO	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.01
MgO	0.23	0.23	0.23	0.25	0.24	0.21	0.16	0.21	0.20	0.20
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na_2O	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00
K_2O	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
*Mg**	41	41	41	45	45	40	30	41	38	38

Sample	P1909-52	Pa3/2-22	Pa3/2-23	P1826/9	P1826/10	P1826/11	P1826/27	P1826/36	P1826/68	P1922
Unit	Rang	Paeroa	Paeroa	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Type	type *A*			type *A*	type *A*	type *A*	type *A*	type *A*	type *A*	type *A*
SiO_2	37.13	35.77	35.37	36.17	36.06	37.93	37.03	36.27	37.34	36.81
TiO_2	3.83	4.46	4.34	4.62	4.73	4.37	4.28	4.52	4.33	4.80
Al_2O_3	12.86	13.04	12.89	13.83	13.64	15.36	15.74	13.77	14.55	13.69
FeO	21.99	23.88	24.32	22.83	23.33	21.81	20.79	22.31	22.11	18.62
MnO	0.26	0.26	0.59	0.62	0.30	0.29	0.28	0.28	0.28	0.19
MgO	9.95	8.20	8.64	9.00	9.23	8.88	8.74	9.93	10.01	12.20
CaO	0.04	0.02	0.01	0.05	0.09	0.05	0.21	0.01	0.00	0.06
Na_2O	0.32	0.38	0.44	0.53	0.70	0.42	0.75	0.50	0.52	0.72
P_2O_5	-	-	-	0.09	0.45	0.04	0.48	0.05	0.03	0.06
K_2O	8.25	8.78	8.64	8.75	8.71	7.94	7.68	8.78	8.66	8.71
Total	94.62	94.79	95.24	96.47	97.24	97.09	95.97	96.40	97.83	95.84
Atomic proportions										
SiO_2	1.24	1.19	1.18	1.20	1.20	1.26	1.23	1.21	1.24	1.23
TiO_2	0.10	0.11	0.11	0.12	0.12	0.11	0.11	0.11	0.11	0.12
Al_2O_3	0.38	0.38	0.38	0.41	0.40	0.45	0.46	0.41	0.43	0.40
FeO	0.31	0.33	0.34	0.32	0.32	0.30	0.29	0.31	0.31	0.26
MnO	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.25	0.20	0.21	0.22	0.23	0.22	0.22	0.25	0.25	0.30
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na_2O	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
P_2O_5	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00
K_2O	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.09	0.09
*Mg**	45	38	39	41	41	42	43	44	45	54

Sample	P1922	P1922	P1922	P1917f_1	P1917f_2	P1917f_3	P1917f_6	P1917f_8	P1917f_11	P1917f_13
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Type	type *A*	type *A*	type *A*	type B	type B	type B	type B	type B	type B	type B
SiO_2	36.71	36.79	37.06	35.01	35.12	35.80	36.16	35.40	35.63	36.06
TiO_2	4.80	4.94	5.08	4.41	4.33	4.12	3.96	4.22	4.26	4.12
Al_2O_3	13.94	14.06	13.98	13.89	13.12	14.48	14.85	13.14	13.70	14.38
FeO	18.79	18.76	18.73	24.21	23.64	22.86	22.30	23.99	23.28	22.67
MnO	0.14	0.14	0.14	0.38	0.30	0.40	0.33	0.41	0.39	0.32
MgO	12.03	12.16	12.09	8.41	8.73	8.20	7.86	8.64	8.43	8.06
CaO	0.02	0.04	0.01	0.04	0.01	0.05	0.06	0.00	0.02	0.05
Na_2O	0.67	0.70	0.72	0.45	0.47	0.48	0.49	0.48	0.50	0.48
P_2O_5	0.01	0.04	0.03	0.37	0.41	0.35	0.38	0.41	0.38	0.37
K_2O	8.64	8.75	8.70	8.54	8.47	8.17	7.93	8.57	8.28	8.00
Total	95.73	96.38	96.52	95.71	94.59	94.92	94.33	95.26	94.87	94.51
Atomic proportions										
SiO_2	1.22	1.22	1.23	1.17	1.17	1.19	1.20	1.18	1.19	1.20
TiO_2	0.12	0.12	0.13	0.11	0.11	0.10	0.10	0.11	0.11	0.10
Al_2O_3	0.41	0.41	0.41	0.41	0.39	0.43	0.44	0.39	0.40	0.42
FeO	0.26	0.26	0.26	0.34	0.33	0.32	0.31	0.33	0.32	0.32
MnO	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.00
MgO	0.30	0.30	0.30	0.21	0.22	0.20	0.20	0.21	0.21	0.20
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na_2O	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
P_2O_5	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
K_2O	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.09	0.08
*Mg**	53	54	54	38	40	39	39	39	39	39

Sample	P1917f_16	P1917f_18	P1917f_19	P1917f_20	P1917f_22	P1917f_23	P1917f_24	P1917f_25	T5_4_3	T5_4_7
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Type	type B	type B	type B	type B	type B	type B	type B	type B	type *C*	type *C*
SiO_2	36.64	36.53	35.46	35.98	36.23	36.12	35.95	35.49	35.76	35.79
TiO_2	3.89	4.08	4.02	4.13	4.21	4.18	4.18	4.22	4.44	4.05
Al_2O_3	15.13	14.51	13.67	13.48	13.88	13.69	13.97	13.09	13.19	13.90
FeO	21.72	22.52	23.50	23.05	23.51	23.16	23.46	23.64	23.94	22.89
MnO	0.38	0.35	0.35	0.40	0.42	0.43	0.42	0.48	0.38	0.42
MgO	8.06	8.21	8.36	8.52	8.33	8.41	8.43	8.82	8.86	8.39
CaO	0.05	0.03	0.20	0.28	0.02	0.03	0.01	0.12	0.02	0.03
Na_2O	0.40	0.45	0.59	0.51	0.44	0.49	0.43	0.50	0.43	0.45
P_2O_5	0.33	0.32	0.36	0.37	0.39	0.36	0.38	0.37	0.39	0.39
K_2O	7.91	8.15	8.24	8.32	8.44	8.44	8.41	8.42	8.67	8.36
Total	94.50	95.16	94.76	95.04	95.86	95.31	95.65	95.16	96.08	94.66
Atomic proportions										
SiO_2	1.22	1.22	1.18	1.20	1.21	1.20	1.20	1.18	1.19	1.19
TiO_2	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.11	0.11	0.10
Al_2O_3	0.45	0.43	0.40	0.40	0.41	0.40	0.41	0.39	0.39	0.41
FeO	0.30	0.31	0.33	0.32	0.33	0.32	0.33	0.33	0.33	0.32
MnO	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
MgO	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.21
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na_2O	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
P_2O_5	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
K_2O	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
*Mg**	40	39	39	40	39	39	39	40	40	40

Sample	T5_4_9	T5_4_10	T5_4_11	T5_4_13	T5_4_21	T5_4_23	SB1119_39	SB1119_35	SB1119_33	SB1119_31
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Type	type *C*	type *C*	type *C*	type *C*	type *C*	type *C*	type *D*	type *D*	type *D*	type *D*
SiO_2	35.62	36.03	36.05	35.95	35.65	35.69	35.77	35.30	34.90	35.33
TiO_2	4.15	4.30	4.23	4.41	4.31	4.30	4.05	4.18	4.39	4.48
Al_2O_3	13.49	13.22	13.40	12.98	13.16	12.96	14.19	13.19	12.78	13.04
FeO	23.25	23.84	23.96	24.11	24.05	24.15	23.02	23.99	24.11	23.98
MnO	0.33	0.34	0.38	0.43	0.42	0.40	0.34	0.41	0.41	0.41
MgO	8.50	8.79	8.79	8.77	8.95	8.91	8.36	8.92	8.87	8.95
CaO	0.06	0.00	0.03	0.04	0.02	0.02	0.05	0.04	0.15	0.01
Na_2O	0.50	0.45	0.42	0.43	0.42	0.39	0.42	0.47	0.39	0.45
P_2O_5	0.41	0.38	0.37	0.44	0.40	0.40	-	-	-	-
K_2O	8.28	8.90	8.92	8.54	8.72	8.71	7.91	8.79	8.33	8.80
Total	94.60	96.25	96.55	96.12	96.09	95.94	94.65	95.85	94.97	95.92
Atomic proportions										
SiO_2	1.19	1.20	1.20	1.20	1.19	1.19	1.19	1.18	1.16	1.18
TiO_2	0.10	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.11	0.11
Al_2O_3	0.40	0.39	0.39	0.38	0.39	0.38	0.42	0.39	0.38	0.38
FeO	0.32	0.33	0.33	0.34	0.33	0.34	0.32	0.33	0.34	0.33
MnO	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
MgO	0.21	0.22	0.22	0.22	0.22	0.22	0.21	0.22	0.22	0.22
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Na_2O	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
P_2O_5	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00
K_2O	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.09	0.09
*Mg**	39	40	40	39	40	40	39	40	40	40

Sample	SB1119_30	SB1119_3	SB1119_23	SB1119_21	SB1119_20	SB1119_17	RO24_48	RO24_47	RO24_33	RO24_31
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Rangitawa	Rangitawa	Rangitawa	Rangitawa
Type	type *D*	type *D*	type *D*	type *D*	type *D*	type *D*	*Tephra*	*Tephra*	*Tephra*	*Tephra*
SiO_2	35.69	35.67	38.71	35.28	35.19	35.60	35.79	35.92	35.89	36.00
TiO_2	4.12	4.24	3.39	4.33	4.30	4.04	3.84	3.89	5.83	4.36
Al_2O_3	14.54	14.46	18.93	13.24	13.81	14.80	13.04	13.04	13.24	13.14
FeO	23.49	24.36	19.88	24.24	23.59	22.67	22.31	22.23	18.69	20.69
MnO	0.36	0.30	0.39	0.44	0.78	0.59	0.30	0.24	0.13	0.23
MgO	8.32	7.75	6.56	8.72	8.05	7.83	11.24	10.93	12.35	11.84
CaO	0.11	0.23	0.15	0.31	0.11	0.13	0.07	0.06	0.06	0.04
Na_2O	0.39	0.36	0.28	0.45	0.32	0.39	0.40	0.44	0.48	0.48
P_2O_5	-	-	-	-	-	-	-	-	-	-
K_2O	7.83	7.92	6.43	8.19	7.99	8.01	8.67	8.72	8.56	8.51
Total	95.51	96.13	95.08	95.84	94.89	94.65	96.53	96.15	95.88	96.05
Atomic proportions										
SiO_2	1.19	1.19	1.29	1.17	1.17	1.19	1.19	1.20	1.19	1.20
TiO_2	0.10	0.11	0.08	0.11	0.11	0.10	0.10	0.10	0.15	0.11
Al_2O_3	0.43	0.43	0.56	0.39	0.41	0.44	0.38	0.38	0.39	0.39
FeO	0.33	0.34	0.28	0.34	0.33	0.32	0.31	0.31	0.26	0.29
MnO	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
MgO	0.21	0.19	0.16	0.22	0.20	0.19	0.28	0.27	0.31	0.29
CaO	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Na_2O	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K_2O	0.08	0.08	0.07	0.09	0.08	0.09	0.09	0.09	0.09	0.09
*Mg**	39	36	37	39	38	38	47	47	54	51

Notes: Analysis by EPMA, only totals > 94 wt% accepted; Atomic proportions expressed as proportion of oxygen from each molecule; Mg refers to atomic % Mg/(Mg+Fe).*

Table A7: ***Pyroxene major-element compositions for Whakamaru Group pumices***

Sample	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1920
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Analysis	5/2	5/3	5/8	5/9	5/10	5/11	5/13	5/18	5/19	5/23	5/25	5/26
Zone	C	R	C	R	C	R	C	C	R	C	M	C
EPMA (wt.%)												
SiO_2	51.83	51.96	51.71	51.65	51.37	43.66	52.36	52.25	52.39	51.59	52.24	52.54
TiO_2	0.08	0.10	0.10	0.12	0.10	0.11	0.08	0.10	0.07	0.22	0.09	0.12
Al_2O_3	0.33	0.36	0.43	0.39	0.74	1.84	0.28	0.48	0.38	0.91	0.40	1.19
FeO	26.61	25.88	26.60	25.72	26.38	25.41	25.88	26.50	25.83	25.23	26.34	26.41
MnO	1.31	1.25	1.34	1.26	1.24	1.17	1.34	1.35	1.27	1.16	1.37	1.43
MgO	18.90	19.29	19.05	19.24	19.59	15.79	19.01	18.80	19.00	18.51	18.75	17.85
CaO	0.88	0.94	0.94	0.93	1.00	0.94	0.84	0.92	0.96	1.93	0.86	0.94
Na_2O	0.01	0.02	0.01	0.01	0.02	0.05	0.02	0.02	0.01	0.07	0.02	0.03
K_2O	0.01	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.04	0.01	0.02
Total	99.96	99.82	100.18	99.34	100.46	88.99	99.82	100.43	99.92	99.64	100.08	100.54
Wo	2	2	2	2	2	2	2	2	2	4	2	2
En	54	55	54	55	55	50	54	54	54	53	54	52
Fs	45	43	44	43	43	48	44	45	44	43	45	46

Sample	P1788	P1788	P1788	P1788	P1788	P1788	P1788	P1788	P1788	P1788	P1788	P1788
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Analysis	6/18	6/25	6/26	6/43	6/45	6/46	6/48	6/49	6/53	6/54	6/56	6/57
Zone	C	INC	R	C	C	C	C	C	C	R	C	C
EPMA (wt.%)												
SiO_2	52.10	51.84	52.05	52.74	52.05	52.11	52.44	51.96	52.26	52.12	51.71	52.35
TiO_2	0.09	0.11	0.10	0.19	0.17	0.17	0.18	0.15	0.07	0.11	0.09	0.09
Al_2O_3	0.31	0.36	0.35	0.54	0.44	0.51	0.53	0.53	0.35	0.47	0.43	0.34
FeO	25.71	25.74	25.30	25.51	25.52	25.50	25.68	25.60	25.85	25.56	26.11	25.63
MnO	1.30	1.29	1.31	1.25	1.22	1.26	1.26	1.18	1.37	1.30	1.33	1.25
MgO	18.56	18.83	18.81	19.09	18.82	18.80	19.20	18.74	18.74	18.84	18.35	18.69
CaO	0.92	0.79	0.98	1.13	0.93	0.95	0.96	0.96	0.93	1.01	0.96	0.87
Na_2O	0.04	0.01	0.02	0.01	0.01	0.02	0.02	0.00	0.02	0.01	0.02	0.02
K_2O	0.01	0.01	0.02	0.01	0.01	0.03	0.02	0.02	0.02	0.02	0.02	0.01
Total	99.03	98.97	98.93	100.48	99.18	99.37	100.27	99.16	99.60	99.45	99.06	99.26
Wo	2	2	2	2	2	2	2	2	2	2	2	2
En	54	54	55	55	55	54	55	54	54	54	53	54
Fs	44	44	43	43	44	44	43	44	44	44	45	44

Sample	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1920	P1886	P1886	P1886
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Analysis	5/27	5/37	5/38	5/39	5/56	5/57	5/58	5/64	5/66	8/5	8/6	8/11
Zone	R	C	R	C	C	C	R	C	C	C	R	C
EPMA (wt.%)												
SiO_2	52.17	51.68	52.59	52.01	52.57	51.76	46.72	52.31	50.96	52.52	45.11	52.28
TiO_2	0.11	0.36	0.12	0.25	0.10	0.10	0.08	0.26	0.32	0.14	0.08	0.15
Al_2O_3	0.38	1.60	0.51	0.75	0.36	0.36	9.42	1.68	1.41	0.58	4.53	0.87
FeO	25.58	24.27	25.48	25.28	25.99	26.23	24.17	23.75	23.93	25.62	23.66	26.18
MnO	1.28	1.09	1.25	1.24	1.29	1.32	1.20	1.15	1.12	1.17	1.10	1.11
MgO	19.10	19.57	19.26	19.09	18.80	19.21	16.79	19.68	19.38	19.56	16.36	18.20
CaO	0.96	1.51	0.95	1.41	0.92	0.92	0.89	1.58	1.40	0.98	0.90	1.06
Na_2O	0.02	0.02	0.02	0.02	0.03	0.01	0.06	0.13	0.07	0.01	0.03	0.05
K_2O	0.03	0.02	0.04	0.02	0.02	0.01	0.04	0.07	0.03	0.02	0.03	0.07
Total	99.62	100.11	100.21	100.07	100.07	99.92	99.37	100.60	98.62	100.60	91.80	99.96
Wo	2	3	2	3	2	2	2	3	3	2	2	2
En	55	56	55	55	54	54	53	57	56	55	53	53
Fs	43	41	43	43	44	44	45	40	41	43	45	45

Sample	P1788	P1885	P1885	P1885	P1885	P1885	P1885	P1885	P1885	P1908	P1908	P1908
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Rang	Rang	Rang
Analysis	6/58	9/1	9/7	9/26	9/27	9/37	9/38	9/44	9/62	2/13	2/14	2/18
Zone	C	C	INC	C	C	C	C	C	C	C	R	C
EPMA (wt.%)												
SiO_2	52.49	52.19	52.32	52.64	52.55	52.75	52.25	52.27	52.52	51.89	51.99	51.55
TiO_2	0.07	0.08	0.09	0.09	0.10	0.09	0.12	0.13	0.10	0.07	0.10	0.09
Al_2O_3	0.34	0.30	0.35	0.33	1.46	0.26	0.44	0.62	0.35	0.35	0.38	0.28
FeO	25.88	25.50	26.54	25.58	25.41	25.57	25.71	25.78	26.16	26.19	25.56	25.40
MnO	1.29	1.25	1.58	1.34	1.29	1.32	1.32	1.30	1.26	1.41	1.28	1.35
MgO	18.80	18.88	18.34	18.95	18.85	18.97	18.64	18.86	18.86	18.55	18.96	18.22
CaO	0.98	0.97	0.82	0.93	0.96	0.98	1.08	0.86	0.89	0.78	0.89	0.84
Na_2O	0.02	0.03	0.01	0.02	0.02	0.03	0.01	0.03	0.02	0.03	0.01	0.01
K_2O	0.02	0.02	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.01
Total	99.89	99.24	100.07	99.89	100.69	99.98	99.59	99.85	100.18	99.28	99.19	97.74
Wo	2	2	2	2	2	2	2	2	2	2	2	2
En	54	55	53	55	55	55	54	54	54	54	55	54
Fs	44	43	45	43	43	43	44	44	44	45	43	44

Sample	P1886	P1886	P1886	P1886	P1886	P1886	P1886	P1886	P1886	P1886	P1886	P1886
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Analysis	8/12	8/18	8/19	8/22	8/23	8/27	8/34	8/35	8/43	8/44	8/53	8/54
Zone	R	C	R	C	C	R	: inclusion in p	pyx	pyx core	pyx rim	INC	R
EPMA (wt.%)												
SiO_2	52.02	51.66	51.48	51.50	51.78	52.09	51.69	52.48	52.38	52.21	52.57	51.41
TiO_2	0.08	0.07	0.08	0.08	0.10	0.09	0.25	0.10	0.10	0.11	0.10	0.23
Al_2O_3	0.35	0.26	0.70	0.33	0.40	0.33	1.54	0.40	0.39	0.39	0.36	1.35
FeO	25.50	27.75	26.47	28.12	26.85	26.22	23.23	25.12	24.50	25.79	24.25	24.94
MnO	1.29	1.57	1.33	1.59	1.50	1.38	0.81	1.15	1.17	1.30	1.15	1.15
MgO	19.19	18.02	18.29	17.24	18.51	18.48	20.67	19.60	20.05	18.97	19.69	18.65
CaO	0.94	0.86	0.87	0.81	0.94	0.86	1.57	1.03	0.89	0.94	0.98	1.40
Na_2O	0.02	0.02	0.03	0.01	0.03	0.01	0.01	0.02	0.02	0.01	0.02	0.02
K_2O	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.03	0.02	0.01
Total	99.42	100.21	99.25	99.70	100.13	99.49	99.78	99.92	99.50	99.73	99.14	99.16
Wo	2	2	2	2	2	2	3	2	2	2	2	3
En	55	51	53	50	53	53	59	56	57	54	57	54
Fs	43	47	45	48	45	45	38	42	41	44	41	43

Sample	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Analysis	2/19	2/29	2/30	2/31	2/32	2/33	2/34	2/35	2/38	2/39	2/40	2/41
Zone	R	C	R	C	C	R	C	R	C	C	INC	C
EPMA (wt.%)												
SiO_2	51.41	52.23	52.65	52.18	51.48	52.13	52.37	52.28	51.78	51.76	51.44	51.31
TiO_2	0.14	0.12	0.09	0.10	0.18	0.12	0.07	0.10	0.08	0.10	0.09	0.22
Al_2O_3	0.52	0.49	0.41	0.35	0.83	0.44	0.27	0.37	0.34	0.36	0.37	0.70
FeO	24.94	25.28	24.35	25.13	25.67	24.76	25.38	25.12	25.35	25.29	25.59	26.15
MnO	1.16	1.26	1.22	1.22	1.19	1.23	1.24	1.27	1.24	1.27	1.33	1.13
MgO	18.31	18.90	19.56	18.84	18.13	18.57	18.95	18.99	18.72	18.76	18.10	17.97
CaO	1.19	1.04	0.89	0.91	1.03	1.01	0.89	0.96	0.89	0.90	0.94	1.19
Na_2O	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.01	0.01	0.01	0.03
K_2O	0.03	0.02	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02
Total	97.74	99.35	99.23	98.78	98.53	98.30	99.20	99.13	98.43	98.46	97.88	98.72
Wo	3	2	2	2	2	2	2	2	2	2	2	3
En	54	55	57	55	53	55	55	55	55	55	53	53
Fs	43	43	42	43	44	43	43	43	44	43	45	45

Sample	P1886	P1886	P1921	P1921	P1921	P1921	P1921	P1921	P1921	P1921	P1921	P1921
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Analysis	8/55	8/60	7/6	7/7	7/9	7/14	7/15	7/23	7/24	7/36	7/37	7/39
Zone	C	C	C	R	C	C	R	C	R	C	R	C
EPMA (wt.%)												
SiO_2	52.31	51.88	51.94	52.07	52.32	52.37	52.29	50.94	51.44	51.53	52.93	52.56
TiO_2	0.11	0.09	0.13	0.08	0.09	0.08	0.09	0.12	0.09	0.10	0.18	0.07
Al_2O_3	0.43	0.40	0.69	0.34	0.35	0.27	0.37	0.39	0.38	0.37	0.56	0.25
FeO	25.20	25.07	25.53	26.17	25.82	25.86	25.92	26.72	26.06	25.78	25.85	25.58
MnO	1.23	1.21	1.32	1.33	1.29	1.33	1.29	1.23	1.26	1.32	1.30	1.34
MgO	19.01	19.66	18.72	19.08	19.17	19.17	19.17	18.83	19.19	18.93	19.47	19.23
CaO	0.97	0.94	0.95	0.91	0.91	0.91	0.93	0.88	0.80	0.82	0.89	0.85
Na_2O	0.01	0.01	0.05	0.01	0.02	0.01	0.00	0.01	0.03	0.01	0.01	0.02
K_2O	0.02	0.01	0.03	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Total	99.29	99.27	99.36	100.00	99.98	100.02	100.09	99.13	99.26	98.88	101.21	99.92
Wo	2	2	2	2	2	2	2	2	2	2	2	2
En	55	56	54	54	55	55	55	54	55	55	55	55
Fs	43	42	44	44	43	43	43	45	44	44	43	43

Sample	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1908	P1905
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Analysis	2/42	2/48	2/49	2/56	2/62	2/63	2/64	2/70	2/71	2/73	2/86	1/3
Zone	R	C	R	C	C	M	R	C	R	C	C	INC
EPMA (wt.%)												
SiO_2	52.02	51.90	52.30	52.14	51.58	50.31	51.74	51.99	51.61	52.30	51.72	51.74
TiO_2	0.08	0.08	0.12	0.11	0.09	0.09	0.13	0.10	0.12	0.10	0.09	0.25
Al_2O_3	0.34	0.37	0.51	0.38	0.39	0.41	0.46	0.43	0.64	0.36	0.36	0.75
FeO	25.38	26.69	24.17	25.21	26.16	25.72	26.33	25.45	25.25	25.36	25.80	25.31
MnO	1.28	1.45	1.05	1.25	1.35	1.29	1.19	1.21	1.18	1.25	1.30	1.26
MgO	18.63	18.15	19.65	18.92	18.10	17.98	18.13	18.50	18.30	18.60	18.22	18.32
CaO	0.85	0.83	1.18	0.91	0.88	0.93	0.88	0.94	0.93	0.95	0.82	1.46
Na_2O	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.02	0.03	0.01	0.03
K_2O	0.01	0.02	0.02	0.03	0.01	0.02	0.02	0.01	0.03	0.01	0.02	0.02
Total	98.61	99.51	99.01	98.95	98.56	96.76	98.90	98.64	98.07	98.97	98.35	99.14
Wo	2	2	2	2	2	2	2	2	2	2	2	3
En	54	53	57	55	53	53	53	54	54	54	54	53
Fs	44	46	41	43	45	45	45	44	44	44	45	43

Sample	P1921	P1921	P1921	P1921	P1921	P1921	P1788	P1788
Unit	Whak	Whak	Whak	Whak	Whak	Whak	Whak	Whak
Analysis	7/40	7/48	7/49	7/52	7/62	7/63	6/5	6/6
Zone	R	C	R	C	C	R	C	R
EPMA (wt.%)								
SiO_2	52.12	52.25	52.49	52.43	52.24	52.37	51.71	52.40
TiO_2	0.10	0.08	0.08	0.06	0.15	0.09	0.14	0.09
Al_2O_3	0.33	0.30	0.31	0.31	0.57	0.39	1.50	0.43
FeO	25.98	26.23	25.68	25.94	26.21	25.79	25.47	25.90
MnO	1.26	1.33	1.29	1.36	1.30	1.30	1.28	1.31
MgO	18.99	18.82	19.16	18.84	18.89	19.10	18.58	18.87
CaO	0.89	0.81	0.99	0.90	0.96	0.92	1.06	0.97
Na_2O	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.03
K_2O	0.02	0.01	0.02	0.02	0.02	0.03	0.02	0.01
Total	99.70	99.86	100.03	99.85	100.36	100.00	99.88	100.05
Wo	2	2	2	2	2	2	2	2
En	54	54	55	54	54	55	54	54
Fs	44	44	43	44	44	43	44	44

Sample	P1905	P1905	P1905	P1905	P1905	P1905	P1905	P1905
Unit	Rang	Rang	Rang	Rang	Rang	Rang	Rang	Rang
Analysis	1/7	1/26	1/27	1/50	1/61	1/68	1/69	1/70
Zone	INC	C	pyx	C	C	C	R	M
EPMA (wt.%)								
SiO_2	51.67	53.05	53.20	51.81	53.45	52.61	51.03	51.93
TiO_2	0.15	0.23	0.21	0.13	0.22	0.14	0.12	0.10
Al_2O_3	0.64	1.57	1.51	0.52	1.55	0.89	2.81	0.35
FeO	25.41	17.41	16.63	25.92	17.51	23.43	20.47	25.36
MnO	1.21	0.46	0.49	1.26	0.58	1.04	1.01	1.23
MgO	18.68	25.30	25.34	18.84	25.23	21.23	13.07	19.60
CaO	1.11	1.25	1.18	0.91	1.17	1.09	0.92	0.94
Na_2O	0.01	0.02	0.02	0.03	0.02	0.02	0.65	0.02
K_2O	0.01	0.02	0.02	0.02	0.01	0.02	0.88	0.02
Total	98.89	99.31	98.60	99.43	99.73	100.47	90.95	99.55
Wo	2	2	2	2	2	2	3	2
En	54	70	71	54	70	59	51	56
Fs	43	28	27	44	28	38	47	42

Notes: Pyroxene crystal zone indicated as follows: C = core; R = rim; M = mid; INC = inclusion. Major-element data quoted in wt% by EPMA.

Table A8: ***Calculations of a_{TiO2} in Whakamaru and Rangitaiki melt based on oxide equilibrium pairs, for TitaniQ geothermometry (Chapter 3)***

weighted average a_{TiO2} value:
0.66

Calculations from oxide equilibrium pairs

		calculated using Ghiorso & Evans 2008			calculated using modelling		predicted
Sample	**n**	**$T_{Fe\text{-}Ti}$ (°C)**	**DNNO**	**$T_{Fe\text{-}Mg}$ (°C)**	**$aTiO_2$**	**DNNO**	**ppm Ti in qtz**
P1905/1	4	688	0.55	795	0.46	0.07	27.3
P1905/4	3	*649*	0.69	555	0.40	0.06	16.2
P1905/6	4	782	0.14	831	0.58	-0.23	76.4
P1905/8	1	678	0.58	840	0.48	0.34	26.1
P1905/10	4	793	0.27	844	0.67	0.13	97.1
P1905/15	2	773	0.21	1091	0.58	-0.15	71.3
median		731	0.41		0.54	0.09	47.1
average		729	0.43		0.53	0.02	45.5
standard dev		62	0.23		0.10	0.20	33.4
P1910/2	3	864	0.09	1149	0.77	-0.13	148.1
P1910/3	1	753	0.37	972	0.59	0.05	62.0
P1910/4	4	899	0.02	1194	0.82	-0.22	246.3
P1910/5	3	733	0.47	989	0.54	0.05	48.3
P1910/6	4	778	0.30	721	0.62	-0.01	79.6
P1910/7	2	838	0.10	774	0.72	-0.11	143.2
P1910/8	2	721	0.47	584	0.52	0.04	41.5
P1910/9	3	683	0.68	723	0.47	0.15	26.7
median		766	0.34		0.60	0.01	69.5
average		784	0.31		0.62	-0.07	82.9
standard dev		76	0.23		0.13	0.12	74.6
P1915/3	9	796	0.23	862	0.64	-0.07	93.8
P1915/6	9	716	0.56	747	0.53	0.18	40.7
P1915/7	9	839	0.12	1127	0.70	-0.17	141.4
P1915/8	10	727	0.46	922	0.52	0.02	44.1
P1915/9	9	888	0.02	1188	0.78	-0.26	218.8
P1915/11	10	789	0.28	1090	0.64	-0.02	88.8
P1915/12	10	713	0.54	811	0.51	0.10	38.2
P1915/13	11	700	0.59	926	0.49	0.11	32.5
P1915/14	1	877	0.04	1229	0.76	-0.26	198.2
P1915/16	1	740	0.43	901	0.55	0.06	52.1
median		789	0.43		0.64	-0.02	88.7
average		790	0.37		0.65	0.02	91.5
standard dev		70	0.22		0.11	0.16	68.9

Sample	n	$T_{Fe\text{-}Ti}$ (^oC)	DNNO	$T_{Fe\text{-}Mg}$ (^oC)	$aTiO_2$	DNNO	ppm Ti in qtz
P1920/33	9	779	0.38	747	0.67	0.12	86.1
P1920/13	10	794	0.37	1199	0.69	0.11	100.7
P1920/1,18,32,34	52	790	0.36	1089	0.68	0.11	95.5
P1920/4,23	28	789	0.37	1058	0.67	0.09	93.7
P1920/2,3,15,17,24,29,31	105	771	0.42	1013	0.64	0.11	77.7
P1920/14	15	794	0.33	677	0.69	0.11	99.7
P1920/36	15	786	0.37	1014	0.66	0.08	90.6
P1920/5	18	795	0.33	1011	0.68	0.07	99.4
P1920/8,21,26	54	786	0.37	1003	0.67	0.09	91.1
P1920/30,35,38	54	785	0.37	1043	0.66	0.09	89.9
P1920/6,10,20,28,37	100	786	0.37	1015	0.67	0.09	91.2
median		786	0.37		0.67	0.09	91.2
average		787	0.37		0.67	0.09	92.1
standard dev		7	0.02		0.01	0.02	6.4

Table A9.1: ***Magnetite and Ilmenite compositions for selected pumice samples***

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1905/1	0.35	5.58	2.34	84.03	0.41	0.71	0.00	0.01	0.03	93.46	0.01	0.03
P1905/2	0.39	7.71	1.60	80.88	0.46	1.12	0.03	0.00	0.08	92.28	0.01	0.04
P1905/4	0.78	4.58	1.83	84.95	0.30	0.50	0.01	0.02	0.03	93.00	0.01	0.02
P1905/5	0.33	6.41	3.68	81.80	0.32	1.66	0.01	0.00	0.02	94.22	0.01	0.06
P1905/6	0.08	9.35	1.39	82.19	0.40	0.76	0.04	0.00	0.00	94.20	0.01	0.03
P1905/7	0.49	5.70	1.87	82.55	0.56	0.43	0.07	0.00	0.02	91.70	0.01	0.02
P1905/8	0.23	4.80	4.23	82.42	0.50	0.71	0.13	0.00	0.00	93.01	0.01	0.03
P1905/10	0.19	8.34	4.17	79.37	0.47	0.83	0.06	0.00	0.00	93.43	0.01	0.03
P1905/11	0.42	6.34	3.43	80.61	0.32	1.23	0.04	0.02	0.00	92.40	0.01	0.05
P1905/12	0.10	8.47	3.55	79.43	0.44	2.26	0.02	0.00	0.00	94.26	0.01	0.08
P1905/13	0.08	6.12	3.32	84.13	0.41	0.46	0.04	0.00	0.00	94.57	0.01	0.02
P1905/14	0.13	9.88	3.26	79.71	0.56	0.59	0.04	0.00	0.00	94.17	0.01	0.02
P1905/15	0.37	8.79	1.55	81.25	0.53	0.79	0.07	0.00	0.00	93.37	0.01	0.03

ILMENITE

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1905/16	0.25	46.72	0.12	49.76	1.21	0.73	0.06	0.00	0.02	98.86	0.02	0.02
P1905/17	0.22	47.95	0.13	48.63	0.81	2.06	0.02	0.00	0.02	99.83	0.01	0.05
P1905/18	0.23	47.91	0.12	49.71	0.70	1.62	0.01	0.00	0.02	100.31	0.01	0.04
P1905/20	0.02	48.08	0.09	48.76	1.23	1.05	0.01	0.00	0.01	99.26	0.02	0.03
P1905/21	0.00	46.81	0.10	50.05	0.67	1.60	0.00	0.01	0.00	99.24	0.01	0.04
P1905/22	0.35	46.44	0.12	49.60	0.57	1.65	0.03	0.00	0.02	98.80	0.01	0.04
P1905/23	0.02	45.88	0.05	51.04	1.32	0.49	0.00	0.01	0.00	98.81	0.02	0.01

MAGNETITE

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1920/1	0.32	9.02	1.52	83.00	0.53	0.84	0.00	0.00	0.02	95.25	0.01	0.03
P1920/2	0.36	8.95	1.55	83.19	0.52	0.80	0.01	0.01	0.02	95.40	0.01	0.03
P1920/3	0.35	9.03	1.51	83.23	0.56	0.86	0.02	0.01	0.02	95.59	0.01	0.03
P1920/4	0.33	8.89	1.47	81.67	0.53	0.83	0.01	0.01	0.03	93.77	0.01	0.03
P1920/5	0.35	9.17	1.43	82.80	0.55	0.78	0.01	0.00	0.02	95.10	0.01	0.03
P1920/6	0.35	9.05	1.53	82.85	0.49	0.77	0.01	0.00	0.03	95.06	0.01	0.03
P1920/8	0.41	8.87	1.51	82.54	0.51	0.72	0.00	0.00	0.02	94.58	0.01	0.03
P1920/9	2.86	6.72	0.26	84.22	0.23	0.80	0.02	0.00	0.03	95.15	0.00	0.03
P1920/10	0.34	9.07	1.51	82.95	0.55	0.82	0.00	0.01	0.02	95.26	0.01	0.03
P1920/12	2.50	0.67	0.29	88.65	0.13	0.29	0.09	0.00	0.04	92.66	0.00	0.01
P1920/13	0.33	9.11	1.50	83.13	0.54	0.77	0.03	0.00	0.02	95.43	0.01	0.03
P1920/14	0.36	9.05	1.49	83.23	0.55	0.62	0.00	0.00	0.02	95.31	0.01	0.02
P1920/15	0.40	4.65	1.63	85.80	0.38	0.58	0.02	0.00	0.03	93.48	0.01	0.02
P1920/17	0.35	9.03	1.49	83.13	0.54	0.85	0.00	0.00	0.02	95.40	0.01	0.03
P1920/18	0.35	9.03	1.49	83.13	0.54	0.85	0.00	0.00	0.02	95.40	0.01	0.03
P1920/19	0.05	8.62	1.41	83.20	0.54	0.77	0.01	0.01	0.00	94.62	0.01	0.03
P1920/20	0.03	8.60	1.48	83.51	0.48	0.77	0.02	0.00	0.00	94.90	0.01	0.03
P1920/21	0.04	8.74	1.43	82.82	0.54	0.79	0.01	0.00	0.00	94.37	0.01	0.03
P1920/23	0.02	8.74	1.39	82.94	0.52	0.82	0.00	0.00	0.00	94.43	0.01	0.03
P1920/24	0.03	8.72	1.41	83.29	0.50	0.79	0.02	0.04	0.00	94.81	0.01	0.03

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1920/25	0.03	8.78	1.39	82.69	0.44	0.81	0.07	0.00	0.01	94.22	0.01	0.03
P1920/26	0.08	8.64	1.39	83.01	0.52	0.79	0.02	0.02	0.00	94.48	0.01	0.03
P1920/27	0.08	12.32	1.15	79.40	0.71	0.58	0.16	0.01	0.00	94.40	0.01	0.02
P1920/28	0.05	8.63	1.44	84.41	0.54	0.78	0.02	0.00	0.00	95.88	0.01	0.03
P1920/29	0.06	8.77	1.41	84.26	0.52	0.80	0.02	0.00	0.00	95.85	0.01	0.03
P1920/30	0.10	8.83	1.50	82.18	0.55	0.81	0.02	0.02	0.00	94.00	0.01	0.03
P1920/31	0.10	8.56	1.42	83.43	0.54	0.83	0.06	0.00	0.00	94.94	0.01	0.03
P1920/32	0.05	8.73	1.41	83.64	0.49	0.82	0.01	0.00	0.00	95.14	0.01	0.03
P1920/33	0.04	8.55	1.37	83.66	0.49	0.54	0.01	0.00	0.00	94.67	0.01	0.02
P1920/34	0.04	8.68	1.36	83.18	0.54	0.87	0.03	0.03	0.00	94.73	0.01	0.03
P1920/35	0.05	8.63	1.40	83.63	0.52	0.75	0.02	0.01	0.00	95.00	0.01	0.03
P1920/36	0.04	8.84	1.44	83.37	0.52	0.79	0.01	0.00	0.00	95.00	0.01	0.03
P1920/37	0.05	8.74	1.38	83.95	0.50	0.68	0.03	0.01	0.00	95.34	0.01	0.03
P1920/38	0.04	8.90	1.43	83.58	0.54	0.79	0.02	0.00	0.00	95.30	0.01	0.03

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Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1920/40	0.22	47.29	0.12	50.28	0.85	1.62	0.00	0.00	0.01	100.38	0.01	0.04
P1920/41	0.22	46.89	0.12	50.49	0.77	1.21	0.01	0.00	0.03	99.75	0.01	0.03
P1920/42	0.22	46.94	0.12	50.07	0.82	1.74	0.01	0.00	0.02	99.95	0.01	0.05
P1920/43	0.21	47.04	0.09	50.89	0.83	1.40	0.02	0.00	0.02	100.50	0.01	0.04
P1920/44	0.00	46.52	0.07	49.81	0.81	1.68	0.02	0.00	0.00	98.91	0.01	0.04
P1920/45	0.00	45.95	0.07	49.77	0.84	1.64	0.17	0.00	0.00	98.43	0.01	0.04
P1920/46	0.00	46.33	0.08	49.87	0.79	1.64	0.05	0.01	0.00	98.78	0.01	0.04
P1920/47	0.00	46.14	0.07	50.99	0.82	1.03	0.09	0.00	0.00	99.14	0.01	0.03
P1920/48	0.01	46.39	0.07	49.75	0.86	1.68	0.03	0.05	0.00	98.83	0.01	0.04
P1920/49	0.02	46.38	0.10	49.76	0.82	1.67	0.02	0.01	0.00	98.78	0.01	0.04
P1920/50	0.03	45.57	0.07	49.79	0.95	1.66	0.04	0.00	0.01	98.11	0.01	0.04
P1920/51	0.00	46.25	0.10	50.15	0.82	1.63	0.04	0.00	0.00	99.00	0.01	0.04
P1920/52	0.00	46.47	0.07	50.19	0.89	1.47	0.01	0.00	0.01	99.12	0.01	0.04
P1920/53	0.00	46.59	0.06	50.38	0.73	1.26	0.00	0.00	0.00	99.02	0.01	0.03
P1920/54	0.00	48.69	0.01	48.25	1.32	1.08	0.00	0.01	0.03	99.39	0.02	0.03
P1920/55	0.00	46.32	0.09	50.68	0.80	1.68	0.01	0.01	0.00	99.59	0.01	0.04
P1920/56	0.00	46.56	0.09	50.52	0.88	1.65	0.01	0.00	0.00	99.70	0.01	0.04
P1920/57	0.01	46.19	0.06	50.60	0.92	1.68	0.00	0.00	0.00	99.46	0.01	0.04
P1920/58	0.00	46.19	0.07	50.83	0.83	1.37	0.01	0.00	0.01	99.31	0.01	0.04
P1920/59	0.00	45.97	0.09	49.90	0.86	1.71	0.03	0.01	0.00	98.56	0.01	0.05
P1920/60	0.02	46.23	0.07	50.48	0.86	1.39	0.05	0.01	0.00	99.09	0.01	0.04
P1920/61	0.00	46.12	0.05	50.67	0.83	1.12	0.01	0.00	0.00	98.81	0.01	0.03
P1920/62	0.02	46.78	0.08	50.19	0.85	1.61	0.00	0.01	0.00	99.55	0.01	0.04

MAGNETITE

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1910/1	0.05	4.54	1.59	86.22	0.39	0.50	0.00	0.01	0.00	93.31	0.01	0.02
P1910/2	0.04	12.06	1.23	78.39	0.75	0.90	0.02	0.03	0.00	93.40	0.02	0.03
P1910/3	0.06	7.77	1.49	83.00	0.54	0.51	0.02	0.00	0.00	93.40	0.01	0.02

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1910/4	0.03	13.58	1.27	76.85	0.65	0.97	0.04	0.00	0.00	93.40	0.01	0.03
P1910/5	0.03	7.07	1.51	83.86	0.48	0.75	0.00	0.00	0.00	93.70	0.01	0.03
P1910/6	0.09	8.60	1.44	82.32	0.44	0.64	0.01	0.00	0.00	93.53	0.01	0.02
P1910/7	0.03	11.07	1.31	79.95	0.64	0.70	0.01	0.00	0.00	93.71	0.01	0.03
P1910/8	0.05	6.74	1.49	84.96	0.48	0.54	0.01	0.00	0.00	94.27	0.01	0.02
P1910/9	0.04	5.44	1.51	85.41	0.51	0.61	0.04	0.00	0.00	93.57	0.01	0.02

ILMENITE

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1910/10	0.03	46.52	0.07	49.23	0.91	1.60	0.04	0.01	0.00	98.42	0.01	0.04
P1910/11	0.02	46.13	0.05	49.21	0.95	1.60	0.07	0.02	0.02	98.06	0.01	0.04
P1910/12	0.00	46.69	0.06	49.51	0.80	1.65	0.08	0.02	0.00	98.82	0.01	0.04
P1910/13	0.00	46.13	0.04	50.10	1.27	0.49	0.09	0.01	0.00	98.14	0.02	0.01
P1910/14	0.00	45.81	0.05	49.47	0.83	1.60	0.04	0.01	0.02	97.84	0.01	0.04
P1910/15	0.01	46.41	0.07	50.04	0.98	1.12	0.00	0.00	0.00	98.63	0.01	0.03

MAGNETITE

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1915/1	0.34	6.17	3.81	81.66	0.32	1.71	0.03	0.03	0.03	94.14	0.01	0.06
P1915/2	0.32	8.26	3.92	79.88	0.31	2.57	0.01	0.01	0.02	95.32	0.01	0.09
P1915/3	0.35	9.32	1.49	81.33	0.49	0.85	0.03	0.01	0.04	93.91	0.01	0.03
P1915/4	0.32	6.95	2.60	80.93	0.37	1.60	0.03	0.03	0.02	92.91	0.01	0.06
P1915/5	0.35	9.67	3.00	80.03	0.47	1.18	0.03	0.02	0.02	94.77	0.01	0.04
P1915/6	0.36	6.13	2.40	83.64	0.43	0.77	0.03	0.03	0.03	93.84	0.01	0.03
P1915/7	0.35	11.34	1.32	80.79	0.57	1.04	0.00	0.04	0.01	95.48	0.01	0.04
P1915/8	0.33	6.95	1.62	84.33	0.55	0.84	0.02	0.03	0.01	94.69	0.01	0.03
P1915/9	0.34	13.53	1.24	78.79	0.66	1.14	0.01	0.02	0.03	95.80	0.01	0.04
P1915/10	0.36	8.07	4.32	79.33	0.44	2.73	0.00	0.01	0.02	95.31	0.01	0.09
P1915/11	0.50	8.91	1.63	80.49	0.63	0.92	0.05	0.03	0.02	93.23	0.01	0.03
P1915/12	0.36	6.32	1.76	84.25	0.49	0.75	0.03	0.03	0.01	94.01	0.01	0.03
P1915/13	0.40	5.88	1.79	83.93	0.52	0.80	0.02	0.00	0.02	93.38	0.01	0.03
P1915/14	0.32	13.01	1.33	78.86	0.58	1.15	0.04	0.03	0.03	95.36	0.01	0.04
P1915/15	0.34	6.34	1.57	84.54	0.55	0.36	0.08	0.01	0.02	93.84	0.01	0.01
P1915/16	0.59	7.04	1.82	81.11	0.57	0.80	0.04	0.01	0.03	92.04	0.01	0.03
P1915/17	0.68	16.76	1.28	71.75	1.49	1.20	0.05	0.06	0.04	93.32	0.03	0.04

ILMENITE

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1915/18	0.21	47.14	0.11	49.78	0.80	1.89	0.02	0.01	0.02	99.99	0.01	0.05
P1915/19	0.21	47.46	0.12	50.03	0.81	1.94	0.01	0.01	0.02	100.63	0.01	0.05
P1915/20	0.22	47.64	0.12	49.24	0.79	2.01	0.02	0.02	0.02	100.08	0.01	0.05
P1915/21	0.22	43.03	0.24	53.00	0.56	2.15	0.01	0.00	0.02	99.25	0.01	0.06
P1915/22	0.25	47.23	0.11	49.66	0.71	1.99	0.01	0.03	0.05	100.06	0.01	0.05
P1915/23	0.21	47.02	0.12	49.73	0.86	1.83	0.02	0.01	0.02	99.84	0.01	0.05
P1915/24	0.20	47.03	0.10	49.70	0.87	1.83	0.01	0.03	0.02	99.81	0.01	0.05
P1915/25	0.23	47.70	0.11	50.09	0.91	1.68	0.02	0.03	0.02	100.79	0.01	0.04

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total	Mn	Mg
P1915/26	0.29	46.86	0.10	49.37	0.89	1.90	0.03	0.03	0.05	99.53	0.01	0.05
P1915/27	0.48	46.20	0.12	49.85	0.89	1.94	0.03	0.02	0.02	99.55	0.01	0.05
P1915/28	0.20	46.93	0.12	49.90	0.95	1.74	0.03	0.02	0.02	99.92	0.01	0.05
P1915/29	0.22	46.70	0.11	49.51	0.92	1.74	0.04	0.01	0.03	99.32	0.01	0.05
P1915/30	0.22	46.92	0.11	49.66	1.07	1.68	0.03	0.00	0.02	99.73	0.02	0.04
P1915/31	0.27	47.00	0.12	49.58	0.84	1.86	0.02	0.04	0.01	99.81	0.01	0.05
P1915/32	0.18	46.29	0.11	49.86	0.88	1.23	0.06	0.11	0.01	98.88	0.01	0.03

Notes: All magnetite and ilmenite major element EPMA analyses are from co-existing pairs, which are in equilibrium based on the Bacon and Hirschmann 1988 test. The following tables show the temperatures derived using the Ghiorso and Evans (2008) Fe-Ti geothermometery based on the above pairs.

Table A9.2: Fe-Ti oxide temperatures and oxygen fugacity (Ghiorso and Evans, 2008)

Sample	Temp (°C)	dNNO	$logfO_2$
P1905	685	0.55	-15.73
	682	0.47	-15.15
	699	0.66	-14.98
	842	1.08	-13.38
	755	0.42	-15.23
	772	0.06	-13.72
	780	0.12	-13.94
	783	0.19	-13.22
	804	0.38	-13.05
	803	0.37	-13.60
	783	0.29	-14.32
	762	0.11	-13.84
	783	0.3	-13.95
	764	**0.38**	**-14.16**
P1910	647	0.75	-16.99
	651	0.79	-16.82
	647	0.76	-16.97
	656	0.86	-16.60
	871	0.14	-12.30
	871	0.15	-12.29
	753	0.37	-14.56
	752	0.32	-14.64
	893	-0.03	-12.05
	900	0.02	-11.87
	894	-0.02	-12.03
	907	0.08	-11.68
	773	0.26	-14.20
	785	0.37	-13.83
	774	0.27	-14.18
	773	0.26	-14.20
	775	0.31	-14.12
	774	0.27	-14.18
	785	0.47	-13.73
	835	0.08	-13.06
	778	0.25	-14.12
	719	0.45	-15.32
	719	0.45	-15.31
	678	0.62	-16.23
	683	0.67	-16.05
	688	0.73	-15.85
	768	**0.30**	**-13.90**
P1915	795	0.23	-13.74
	795	0.23	-13.75
	783	0.12	-14.12
	793	0.21	-13.80
	796	0.24	-13.72
	795	0.23	-13.75
	796	0.23	-13.74
	812	0.36	-13.25
	795	0.23	-13.76
	874	0.78	-11.60
	719	0.52	-15.25
	708	0.4	-15.65
	717	0.5	-15.32
	719	0.52	-15.24
	719	0.52	-15.26
	719	0.51	-15.26
	733	0.64	-14.78
	718	0.51	-15.28
	712	0.5	-15.46
	763	**0.39**	**-14.35**
P1920	782	0.27	-14.00
	787	0.31	-13.85
	788	0.32	-13.82

Sample (SB)	Temp (°C)	dNNO	$logfO_2$
9043	795	0.54	-13.44
	783	0.59	-13.65
	785	0.61	-13.59
	790	0.58	-13.51
	791	0.6	-13.47
	788	0.57	-13.56
	789	0.59	-13.52
	789	0.63	-13.48
	791	0.57	-13.50
	793	0.59	-13.43
	773	0.41	-14.06
	788	**0.57**	**-13.57**
1010	808	0.57	-13.13
	677	0.93	-15.95
	699	0.84	-15.44
	721	0.76	-14.96
	732	0.73	-14.71
	732	0.71	-14.73
	791	0.54	-13.53
	836	0.38	-12.74
	730	0.74	-14.75
	767	0.62	-13.99
	834	0.39	-12.77
	716	0.7	-15.14
	726	0.67	-14.92
	795	0.44	-13.54
	726	0.65	-14.94
	762	0.56	-14.16
	793	0.44	-13.58
	829	0.32	-12.94
	799	0.48	-13.41
	672	0.87	-16.15
	717	0.7	-15.12
	727	0.67	-14.90
	728	0.65	-14.89
	764	0.56	-14.12
	753	**0.62**	**-14.35**
1001	808	0.57	-13.13
	677	0.93	-15.95
	962	0.34	-10.48
	936	0.2	-11.06
	774	0.84	-13.61
	754	0.69	-14.22
	757	0.72	-14.12
	686	1.16	-15.47
	669	1.01	-16.09
	672	1.04	-15.98
	694	1.15	-15.27
	677	1	-15.88
	680	1.03	-15.77
	672	0.97	-16.05
	946	0.36	-10.73
	920	0.21	-11.32
	924	0.24	-11.22
	912	0.18	-11.50
	946	0.36	-10.73
	920	0.21	-11.32
	924	0.24	-11.22
	912	0.18	-11.50
	674	1.09	-15.87
	666	1.03	-16.16
	798	**0.66**	**-13.53**
3058	785	0.71	-13.49
	799	0.66	-13.23

Sample	Temp (°C)	dNNO	$logfO_2$
	770	0.23	-14.32
	789	0.33	-13.78
	794	0.37	-13.63
	801	0.43	-13.43
	796	0.39	-13.57
	803	0.44	-13.37
	798	0.4	-13.52
	788	0.32	-13.82
	780	0.28	-14.03
	785	0.31	-13.88
	786	0.33	-13.84
	793	0.38	-13.64
	789	0.35	-13.77
	788	0.34	-13.79
	788	0.33	-13.81
	800	0.43	-13.43
	774	0.3	-14.14
	781	0.33	-13.95
	779	0.35	-13.98
	794	0.39	-13.60
	801	0.44	-13.41
	796	0.4	-13.55
	786	0.33	-13.85
	781	0.28	-14.00
	784	0.32	-13.89
	785	0.33	-13.86
	774	0.3	-14.16
	788	0.36	-13.78
	767	0.25	-14.35
	787	0.34	-13.82
	800	0.44	-13.44
	792	0.39	-13.65
	780	0.33	-13.98
	798	0.44	-13.47
	793	0.4	-13.61
	800	0.45	-13.42
	795	0.41	-13.56
	785	0.34	-13.86
	782	0.27	-14.00
	787	0.3	-13.86
	788	0.32	-13.82
	795	0.38	-13.60
	790	0.34	-13.74
	792	0.34	-13.71
	791	0.33	-13.73
	804	0.43	-13.35
	797	0.38	-13.56
	803	0.43	-13.38
	798	0.39	-13.53
	805	0.44	-13.33
	800	0.4	-13.47
	790	0.33	-13.77
	786	0.26	-13.92
	791	0.3	-13.77
	792	0.31	-13.74
	799	0.37	-13.53
	794	0.34	-13.66
	794	0.32	-13.69
	806	0.42	-13.32
	781	0.27	-14.03
	794	0.36	-13.65
	786	0.3	-13.89
	790	**0.35**	**-13.73**
SB4001	797	0.73	-13.21
	805	0.77	-12.99
	808	0.76	-12.94
	805	0.76	-13.00
	808	0.76	-12.94

Sample (SB)	Temp (°C)	dNNO	$logfO_2$
	781	0.7	-13.59
	795	0.64	-13.34
	797	0.65	-13.29
	781	0.63	-13.66
	792	0.6	-13.45
	779	0.68	-13.65
	793	0.62	-13.40
	775	0.67	-13.75
	789	0.61	-13.50
	780	0.49	-13.82
	779	0.5	-13.83
	787	0.47	-13.69
	770	0.6	-13.94
	784	0.54	-13.68
	788	**0.62**	**-13.53**
3062	753	0.96	-13.97
	775	0.87	-13.55
	784	0.85	-13.37
	781	0.83	-13.46
	788	0.82	-13.31
	823	0.7	-12.68
	886	0.51	-11.64
	777	0.78	-13.60
	774	0.76	-13.69
	774	0.87	-13.58
	777	0.78	-13.60
	774	0.76	-13.69
	816	0.64	-12.89
	747	0.89	-14.19
	765	0.8	-13.85
	754	0.79	-14.12
	770	0.76	-13.78
	777	0.75	-13.63
	812	0.64	-12.97
	873	0.44	-11.95
	748	0.91	-14.14
	769	0.82	-13.74
	778	0.8	-13.56
	775	0.78	-13.64
	782	0.77	-13.50
	817	0.65	-12.86
	879	0.46	-11.82
	774	0.78	-13.67
	771	0.76	-13.76
	741	0.86	-14.36
	762	0.77	-13.95
	751	0.76	-14.22
	770	0.75	-13.79
	767	0.73	-13.88
	774	0.72	-13.73
	809	0.6	-13.08
	870	0.41	-12.04
	793	0.66	-13.36
	777	0.5	-13.88
	741	0.49	-14.73
	738	0.47	-14.83
	785	**0.72**	**-13.51**
2042	765	0.97	-13.68
	777	0.92	-13.46
	779	0.93	-13.40
	782	0.92	-13.35
	780	0.91	-13.40
	780	0.9	-13.41
	786	0.91	-13.27
	790	0.88	-13.21
	778	0.92	-13.44
	781	0.91	-13.38

Sample	Temp (°C)	dNNO	$logfO_2$
	811	0.75	-12.88
	803	0.75	-13.06
	808	0.75	-12.95
	805	0.75	-13.01
	803	0.75	-13.06
	808	0.74	-12.96
	786	0.62	-13.56
	789	0.62	-13.49
	786	0.62	-13.56
	789	0.62	-13.49
	791	0.61	-13.46
	799	0.72	-13.17
	802	0.71	-13.12
	799	0.71	-13.18
	804	0.7	-13.08
	799	0.72	-13.17
	802	0.71	-13.12
	799	0.71	-13.18
	802	0.71	-13.12
	804	0.7	-13.08
	783	0.61	-13.63
	786	0.61	-13.57
	783	0.61	-13.63
	789	0.6	-13.51
	803	0.76	-13.05
	808	0.75	-12.95
	806	0.75	-12.99
	806	0.75	-12.99
	808	0.74	-12.96
	803	0.75	-13.06
	798	0.73	-13.18
	798	0.72	-13.19
	775	0.6	-13.82
	778	0.6	-13.76
	775	0.59	-13.83
	780	0.58	-13.73
	803	0.76	-13.05
	808	0.75	-12.95
	806	0.75	-12.99
	803	0.75	-13.06
	806	0.75	-12.99
	808	0.74	-12.96
	803	0.76	-13.05
	798	0.72	-13.19
	775	0.6	-13.82
	778	0.6	-13.76
	775	0.59	-13.83
	780	0.58	-13.73
	797	**0.70**	**-13.25**
SB 3026	799	0.65	-13.24
	804	0.64	-13.14
	801	0.65	-13.20
	799	0.65	-13.24
	788	0.6	-13.53
	793	0.59	-13.43
	808	0.72	-12.98
	813	0.72	-12.87
	810	0.72	-12.94
	808	0.72	-12.98
	807	0.71	-13.01
	812	0.7	-12.91
	809	0.73	-12.95
	814	0.72	-12.85
	801	0.62	-13.23
	799	0.61	-13.28
	807	0.6	-13.12
	799	**0.67**	**-13.11**

Sample (SB)	Temp (°C)	dNNO	$logfO_2$
	779	0.9	-13.43
	780	0.89	-13.42
	783	0.91	-13.33
	785	0.9	-13.30
	762	0.95	-13.77
	774	0.91	-13.54
	775	0.91	-13.51
	778	0.9	-13.46
	776	0.89	-13.51
	777	0.88	-13.50
	782	0.89	-13.38
	786	0.86	-13.32
	781	0.96	-13.33
	784	0.95	-13.27
	782	0.94	-13.33
	786	0.95	-13.23
	788	0.94	-13.19
	778	0.93	-13.43
	782	0.92	-13.35
	779	0.91	-13.42
	783	0.92	-13.32
	786	0.91	-13.27
	756	0.95	-13.91
	768	0.9	-13.68
	770	0.89	-13.65
	771	0.87	-13.65
	780	0.86	-13.45
	764	0.97	-13.71
	777	0.92	-13.46
	778	0.93	-13.43
	779	0.91	-13.42
	780	0.9	-13.41
	785	0.91	-13.29
	789	0.88	-13.23
	766	0.99	-13.64
	780	0.94	-13.37
	783	0.93	-13.31
	781	0.92	-13.37
	782	0.91	-13.36
	782	0.93	-13.34
	787	0.92	-13.24
	761	0.95	-13.80
	761	0.91	-13.84
	775	0.91	-13.51
	778	0.9	-13.46
	776	0.89	-13.51
	777	0.88	-13.50
	786	0.86	-13.32
	760	0.94	-13.83
	772	0.9	-13.59
	777	0.89	-13.49
	775	0.88	-13.54
	775	0.87	-13.55
	781	0.88	-13.41
	784	0.85	-13.37
	736	0.75	-14.59
	747	0.7	-14.38
	749	0.69	-14.34
	750	0.67	-14.34
	759	0.66	-14.13
	776	**0.90**	**-13.52**

Table A10: ***Amphibole Geothermobarometry for Whakamaru Group pumices***

Sample (SB)	Species	Unit	T (°C)	1sd (σest)	P (MPa)	1sd (Max error)	continental depth (km)	ΔNNO	H_2O melt (wt%)	1sd
1022	**Mg-Hbl**	Whakamaru	793	22	77	8	2.9	1.52	4.3	0.4
1065	**Mg-Hbl**	Whakamaru	764	22	90	10	3.4	1.05	4.9	0.4
1065	**Mg-Hbl**	Whakamaru	765	22	84	9	3.2	0.95	4.1	0.4
1065	**Mg-Hbl**	Whakamaru	764	22	91	10	3.4	1.17	4.8	0.4
1065	**Mg-Hbl**	Whakamaru	844	22	92	10	3.5	0.86	4.6	0.4
1065	**Mg-Hbl**	Whakamaru	763	22	78	9	2.9	1.19	4.8	0.4
1065	**Mg-Hbl**	Whakamaru	763	22	86	9	3.2	0.98	4.4	0.4
1065	**Mg-Hbl**	Whakamaru	764	22	94	10	3.6	0.96	5.0	0.4
1064	**Mg-Hbl**	Whakamaru	765	22	94	10	3.6	1.01	4.9	0.4
1064	**Mg-Hbl**	Whakamaru	756	22	82	9	3.1	1.12	4.3	0.4
1064	**Mg-Hbl**	Whakamaru	749	22	84	9	3.2	1.01	4.9	0.4
1064	**Mg-Hbl**	Whakamaru	766	22	96	11	3.6	0.83	5.1	0.4
1064	**Mg-Hbl**	Whakamaru	796	22	108	12	4.1	0.96	4.7	0.4
1064	**Mg-Hbl**	Whakamaru	788	22	107	12	4.0	0.96	5.0	0.4
1064	**Mg-Hbl**	Whakamaru	762	22	98	11	3.7	0.86	5.0	0.4
1064	**Mg-Hbl**	Whakamaru	745	22	83	9	3.1	1.16	4.8	0.4
1058	**Mg-Hbl**	Whakamaru	757	22	85	9	3.2	1.09	4.3	0.4
1058	**Mg-Hbl**	Whakamaru	775	22	99	11	3.7	0.85	4.6	0.4
1058	**Mg-Hbl**	Whakamaru	756	22	81	9	3.0	1.07	4.3	0.4
1058	**Mg-Hbl**	Whakamaru	749	22	81	9	3.0	1.11	4.7	0.4
1058	**Mg-Hbl**	Whakamaru	765	22	91	10	3.5	1.00	4.7	0.4
1058	**Tsch-Prg**	Whakamaru	887	22	253	63	9.6	1.15	6.8	1.0
3015-1	**Mg-Hbl**	U. Rangitaiki	759	22	89	10	3.3	1.04	4.6	0.4
3015-1	**Mg-Hbl**	U. Rangitaiki	788	22	119	13	4.5	0.89	5.0	0.4
3015-1	**Mg-Hbl**	U. Rangitaiki	760	22	70	8	2.6	1.58	4.4	0.4
3015-1	**Mg-Hbl**	U. Rangitaiki	766	22	92	10	3.5	1.14	4.8	0.4
3015-2	**Mg-Hbl**	U. Rangitaiki	777	22	93	10	3.5	1.03	4.3	0.4
3015-2	**Mg-Hbl**	U. Rangitaiki	769	22	75	8	2.8	1.25	4.4	0.4
3015-2	**Mg-Hbl**	U. Rangitaiki	774	22	92	10	3.5	0.96	4.5	0.4
3015-2	**Mg-Hbl**	U. Rangitaiki	771	22	80	9	3.0	1.25	4.4	0.4
3015-2	**Mg-Hbl**	U. Rangitaiki	774	22	86	10	3.3	1.19	5.1	0.4
1063	**Mg-Hbl**	Whakamaru	822	22	94	10	3.5	1.48	4.8	0.4
1063	**Mg-Hbl**	Whakamaru	835	22	102	11	3.9	0.73	2.5	0.4
1063	**Mg-Hbl**	Whakamaru	824	22	94	10	3.6	1.54	5.1	0.4
1063	**Mg-Hbl**	Whakamaru	846	22	93	10	3.5	1.12	4.8	0.4
1063	**Mg-Hbl**	Whakamaru	855	22	97	11	3.7	1.06	4.9	0.4
1063	**Mg-Hbl**	Whakamaru	878	22	100	11	3.8	1.09	3.9	0.4
1063	**Mg-Hbl**	Whakamaru	874	22	102	11	3.9	1.18	4.5	0.4
1063	**Mg-Hbl**	Whakamaru	878	22	106	12	4.0	1.08	4.5	0.4
1063	**Mg-Hbl**	Whakamaru	850	22	88	10	3.3	1.11	3.8	0.4
1063	**Mg-Hbl**	Whakamaru	823	22	97	11	3.7	0.98	2.9	0.4
1063	**Mg-Hbl**	Whakamaru	863	22	95	10	3.6	1.05	4.1	0.4

Sample (SB)	Species	Unit	T (°C)	1sd (σest)	P (MPa)	1sd (Max error)	continental depth (km)	ΔNNO	H_2O melt (wt.%)	1sd
1063	**Mg-Hbl**	Whakamaru	864	22	103	11	3.9	1.06	4.2	0.4
1047	**Mg-Hbl**	Whakamaru	858	22	121	13	4.6	2.19	5.8	0.4
1047	**Tsch-Prg**	Whakamaru	890	22	172	19	6.5	1.85	6.2	0.9
1047	**Tsch-Prg**	Whakamaru	885	22	195	21	7.4	1.63	5.7	0.9
1047	**Tsch-Prg**	Whakamaru	874	22	166	18	6.3	1.95	5.7	0.9
1047	**Tsch-Prg**	Whakamaru	924	22	215	24	8.1	1.58	5.9	0.9
1047	**Tsch-Prg**	Whakamaru	921	22	240	26	9.0	1.58	6.3	0.9
1047	**Tsch-Prg**	Whakamaru	908	22	247	27	9.3	1.28	6.1	0.9
1047	**Tsch-Prg**	Whakamaru	926	22	238	26	9.0	1.57	5.8	0.9
1047	**Tsch-Prg**	Whakamaru	935	22	251	28	9.5	1.61	5.8	0.9
1043	**Mg-Hbl**	Whakamaru	830	22	99	11	3.7	1.60	5.4	0.4
1043	**Mg-Hbl**	Whakamaru	889	22	103	11	3.9	1.26	4.6	0.4
1043	**Mg-Hbl**	Whakamaru	871	22	94	10	3.6	1.35	4.3	0.4
1043	**Mg-Hbl**	Whakamaru	875	22	106	12	4.0	1.15	4.7	0.4
1043	**Tsch-Prg**	Whakamaru	968	22	409	45	15.4	1.45	7.2	1.1
1043	**Tsch-Prg**	Whakamaru	905	22	140	15	5.3	2.00	5.2	0.8
1041	**Mg-Hbl**	Whakamaru	908	22	91	10	3.4	1.55	4.6	0.4
1041	**Mg-Hbl**	Whakamaru	867	22	115	13	4.4	2.25	5.1	0.4
1047	**Mg-Hbl**	Whakamaru	869	22	181	20	6.8	1.26	6.1	0.4
2042	**Mg-Hbl**	Manunui	783	22	97	11	3.7	1.37	4.8	0.4
2042Li	**Tsch-Prg**	Manunui	884	22	218	24	8.2	1.15	6.1	0.9
2042Li	**Tsch-Prg**	Manunui	919	22	277	30	10.5	1.04	6.2	0.9
2042	**Mg-Hbl**	Manunui	814	22	123	14	4.7	1.33	5.3	0.4
2042	**Mg-Hbl**	Manunui	832	22	94	10	3.6	1.68	5.0	0.4
2042	**Tsch-Prg**	Manunui	879	22	178	20	6.7	1.63	6.4	1.0
2042	**Mg-Hbl**	Manunui	851	22	98	11	3.7	1.05	5.0	0.4
2042	**Mg-Hbl**	Manunui	834	22	92	10	3.5	1.62	4.8	0.4
2042	**Mg-Hbl**	Manunui	842	22	88	10	3.3	1.33	4.5	0.4
2042	**Mg-Hbl**	Manunui	828	22	100	11	3.8	1.50	4.9	0.4
2042	**Mg-Hbl**	Manunui	840	22	109	12	4.1	1.51	5.3	0.4
2042	**Tsch-Prg**	Manunui	893	22	230	25	8.7	1.41	6.1	0.9
2042	**Mg-Hbl**	Manunui	842	22	87	10	3.3	1.21	4.3	0.4
2042	**Mg-Hbl**	Manunui	822	22	100	11	3.8	1.47	4.8	0.4
2042	**Mg-Hbl**	Manunui	847	22	86	10	3.3	1.23	4.3	0.4
2042	**Mg-Hbl**	Manunui	833	22	114	13	4.3	1.73	5.7	0.4
2042	**Mg-Hbl**	Manunui	854	22	97	11	3.6	1.10	4.5	0.4
2023	**Mg-Hbl**	Manunui	867	22	93	10	3.5	1.22	4.3	0.4
2023	**Mg-Hbl**	Manunui	821	22	95	10	3.6	1.52	4.6	0.4
2023	**Mg-Hbl**	Manunui	837	22	101	11	3.8	1.50	5.0	0.4
2023	**Mg-Hbl**	Manunui	791	22	101	11	3.8	1.20	5.7	0.4
2023	**Mg-Hbl**	Manunui	853	22	94	10	3.6	1.22	4.6	0.4
2023	**Mg-Hbl**	Manunui	845	22	87	10	3.3	1.43	4.6	0.4
2023	**Mg-Hbl**	Manunui	893	22	108	12	4.1	1.00	7.7	0.4
2023	**Mg-Hbl**	Manunui	854	22	116	13	4.4	1.60	5.5	0.4

Sample (SB)	Species	Unit	T (°C)	1sd (σest)	P (MPa)	1sd (Max error)	continental depth (km)	ΔNNO	H_2O melt (wt.%)	1sd
2023	**Mg-Hbl**	Manunui	847	22	128	14	4.8	1.28	4.8	0.4
2023	**Mg-Hbl**	Manunui	863	22	101	11	3.8	1.23	4.6	0.4
2023	**Mg-Hbl**	Manunui	844	22	95	10	3.6	1.80	5.1	0.4
2030	**Mg-Hbl**	Manunui	843	22	85	9	3.2	1.26	4.1	0.4
2030	**Mg-Hbl**	Manunui	844	22	99	11	3.7	1.68	4.7	0.4
2030	**Mg-Hbl**	Manunui	858	22	94	10	3.6	1.26	4.2	0.4
2030	**Mg-Hbl**	Manunui	868	22	104	11	3.9	1.13	4.3	0.4
2030	**Mg-Hbl**	Manunui	863	22	103	11	3.9	1.23	4.4	0.4
2030	**Mg-Hbl**	Manunui	822	22	95	10	3.6	1.71	5.1	0.4
2030	**Mg-Hbl**	Manunui	836	22	95	10	3.6	1.57	4.5	0.4
2030	**Mg-Hbl**	Manunui	852	22	93	10	3.5	1.20	4.5	0.4
2030	**Mg-Hbl**	Manunui	839	22	81	9	3.0	1.33	3.8	0.4
2030	**Mg-Hbl**	Manunui	856	22	96	11	3.6	1.22	4.2	0.4
2033	**Mg-Hbl**	Manunui	846	22	90	10	3.4	1.25	4.6	0.4
2033	**Mg-Hbl**	Manunui	835	22	93	10	3.5	1.64	4.9	0.4
2033	**Mg-Hbl**	Manunui	853	22	135	15	5.1	1.54	5.9	0.4
2033	**Mg-Hbl**	Manunui	828	22	106	12	4.0	1.53	5.1	0.4
2033	**Mg-Hbl**	Manunui	859	22	101	11	3.8	0.95	4.8	0.4
2033	**Mg-Hbl**	Manunui	800	22	91	10	3.5	1.63	5.0	0.4
2033	**Mg-Hbl**	Manunui	856	22	83	9	3.1	1.54	4.4	0.4
2033	**Mg-Hbl**	Manunui	843	22	133	15	5.0	1.99	5.7	0.4
2033	**Mg-Hbl**	Manunui	865	22	102	11	3.8	1.07	4.3	0.4
2033	**Mg-Hbl**	Manunui	836	22	95	10	3.6	1.72	5.0	0.4
9043	**Mg-Hbl**	Manunui	838	22	131	14	4.9	0.86	4.6	0.4
9043	**Tsch-Prg**	Manunui	863	22	208	23	7.9	1.12	6.7	1.0
9043	**Mg-Hbl**	Manunui	810	22	99	11	3.7	1.40	5.3	0.4
9043	**Tsch-Prg**	Manunui	923	22	292	32	11.0	-0.07	6.2	0.9
9043	**Tsch-Prg**	Manunui	862	22	198	22	7.5	0.37	5.4	0.8
2080	**Tsch-Prg**	Manunui	919	22	272	30	10.3	1.06	4.6	0.7
2080	**Mg-Hst**	Manunui	943	22	294	32	11.1	0.88	5.1	0.8
2080	**Mg-Hst**	Manunui	946	22	288	32	10.9	0.94	5.0	0.7
2080	**Mg-Hst**	Manunui	959	22	338	37	12.7	1.25	5.4	0.8
2085	**Mg-Hbl**	Manunui	827	22	95	10	3.6	1.17	2.6	0.4
2085	**Mg-Hbl**	Manunui	850	22	89	10	3.4	0.96	4.6	0.4
2085	**Mg-Hbl**	Manunui	780	22	97	11	3.7	1.14	4.9	0.4
2085	**Mg-Hbl**	Manunui	813	22	84	9	3.2	1.82	4.9	0.4
2085	**Mg-Hbl**	Manunui	832	22	101	11	3.8	1.55	5.3	0.4
2085	**Mg-Hbl**	Manunui	847	22	101	11	3.8	1.66	5.0	0.4
1001	**Mg-Hbl**	Manunui	850	22	112	12	4.2	1.45	5.0	0.4

Notes: Temperatures and pressures are derived using the Ridolfi et al. (2010) geothermometer based on amphibole major element geochemistry (data from EPMA from Brown et al., 1998a). Abbreviations for amphibole are as follows: Mg-Hbl = Magnesio-hornblende; Tsch-Prg = Tschmakite Pargasite; Mg-Hst =Magnesio-hastingsitic hornblende.

Table A10.1: ***Amphibole Geothermobarometry for Rangitawa Tephra***

Sample (SB)	Species	Unit	T (°C)	1sd (σest)	P (MPa)	1sd (Max error)	continental depth (km)	ΔNNO	H_2O melt (wt.%)	1sd
R024	Mg-Hbl	Tephra	745	22	64	7	2.4	1.12	1.4	0.4
R024	Mg-Hbl	Tephra	1026	22	665	73	25.1	1.13	7.7	0.4
R024	Mg-Hbl	Tephra	838	22	130	15	4.9	1.14	4.9	0.4
R024	Mg-Hbl	Tephra	789	22	110	12	4.1	1.00	4.8	0.4
R024	Mg-Hbl	Tephra	787	22	105	12	4.0	1.26	4.8	0.4
R024	Mg-Hbl	Tephra	802	22	115	13	4.4	0.98	4.8	0.4
R024	Mg-Hbl	Tephra	796	22	102	11	3.8	1.12	4.4	0.4
R011	Tsch-Prg	Tephra	958	22	497	124	18.8	0.82	8.3	1.2
R011	Tsch-Prg	Tephra	901	22	282	70	10.6	1.07	6.9	1.0
R011	Mg-Hbl	Tephra	827	22	136	15	5.1	1.31	5.2	0.4
R011	Mg-Hbl	Tephra	819	22	133	15	5.0	1.37	5.4	0.4
R011	Mg-Hbl	Tephra	826	22	138	15	5.2	1.22	5.3	0.4
R011	Mg-Hbl	Tephra	795	22	104	11	3.9	1.17	4.3	0.4
R011	Mg-Hbl	Tephra	795	22	104	11	3.9	1.15	4.4	0.4
R011	Mg-Hbl	Tephra	805	22	112	12	4.2	1.08	4.4	0.4

Notes: Temperatures and pressures are derived using the Ridolfi et al. (2010) geothermometer based on amphibole major element geochemistry (data from EPMA). Abbreviations for amphibole are as follows: Mg-Hbl = Magnesio-hornblende; Tsch-Prg = Tschmakite Pargasite.

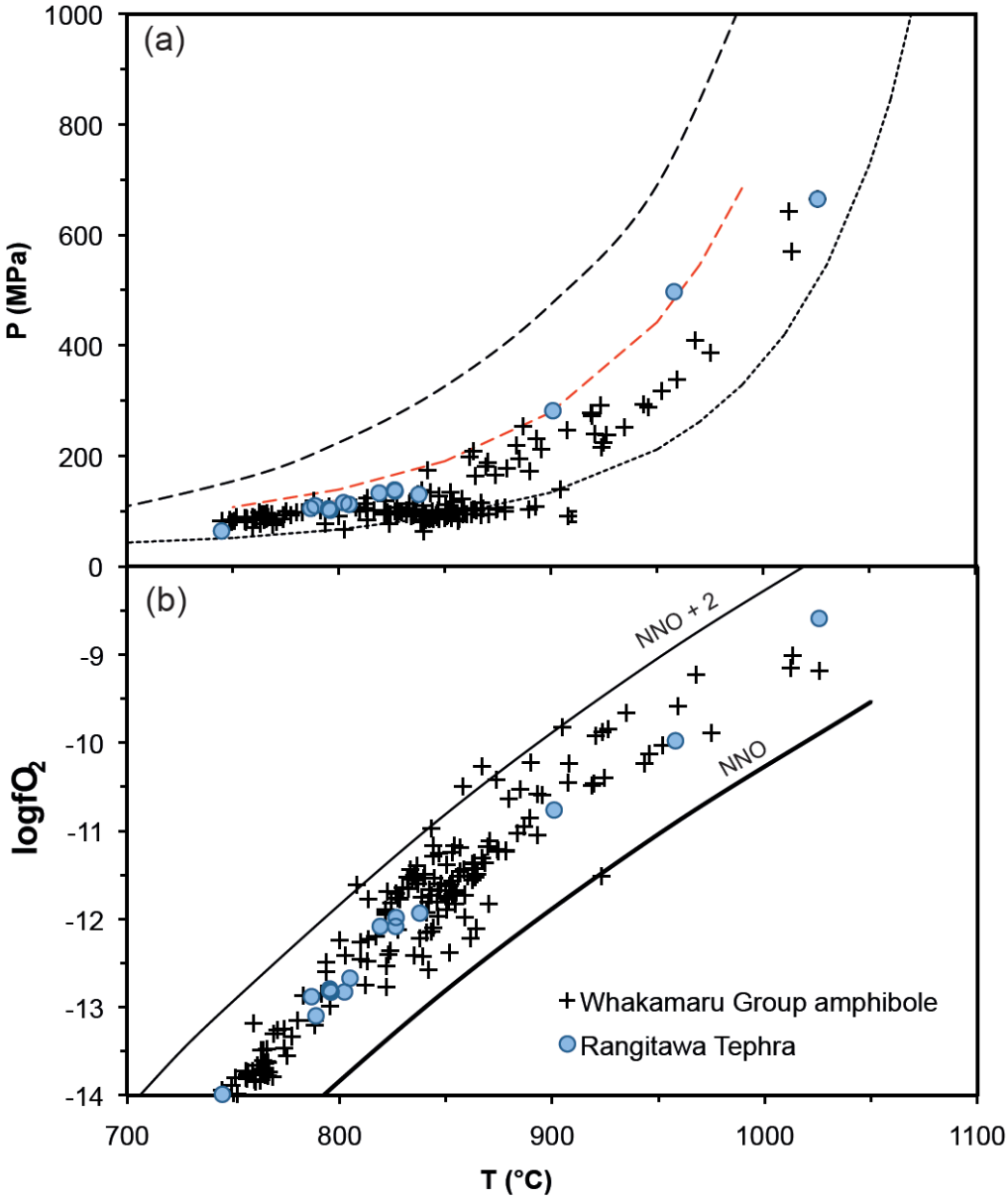

Fig. A10: Amphibole geothermobarometry using Ridolfi et al. (2010) formulation; hornblende data for Whakamaru Group pumices by EPMA supplemented by previous data from Brown et al. (1998a), compared to amphibole extracted from Rangitawa Tephra. (a) P-T plot; (b) logfO_2-T plot showing NNO and NNO + 2 curves.

Table A11: ***Ti-in-quartz and TitaniQ temperatures for Whakamaru Group quartz***

Sample/ Analysis number	SiO_2 (wt%)	TiO_2 (wt%)	Total	Distance (μm) from crystal rim	Ti (ppm)	TitaniQ Temp (°C) a_{TiO2} = 0.7
Line 1 P1905/11	102.48	0.022	102.50	10	132	830
Line 2 P1905/11	102.47	0.020	102.49	133	120	816
Line 3 P1905/11	102.61	0.011	102.62	255	66	740
Line 4 P1905/11	102.33	0.010	102.34	378	60	729
Line 5 P1905/11	102.29	0.011	102.30	500	66	740
Line 6 P1905/11	101.98	0.012	101.99	623	72	751
Line 7 P1905/11	102.12	0.012	102.13	746	72	751
Line 8 P1905/11	102.10	0.012	102.11	868	72	751
Line 1 P1905/12	101.24	0.019	101.26	10	114	809
Line 2 P1905/12	100.65	0.009	100.66	192	54	717
Line 3 P1905/12	100.39	0.012	100.40	373	72	751
Line 4 P1905/12	100.59	0.013	100.61	555	78	760
Line 5 P1905/12	100.45	0.013	100.46	736	78	760
Line 6 P1905/12	100.83	0.013	100.84	918	78	760
Line 7 P1905/12	100.94	0.017	100.96	1100	102	795
Line 8 P1905/12	101.36	0.009	101.37	1281	54	717
Line 1 P1905/17	101.87	0.023	101.89	10	138	836
Line 2 P1905/17	101.70	0.019	101.72	116	114	809
Line 3 P1905/17	101.57	0.023	101.59	222	138	836
Line 4 P1905/17	101.56	0.015	101.58	327	90	778
Line 5 P1905/17	101.70	0.015	101.72	433	90	778
Line 6 P1905/17	101.80	0.015	101.82	539	90	778
Line 7 P1905/17	101.91	0.016	101.93	645	96	787
Line 1 P1905/19	97.75	0.018	97.76	10	108	802
Line 2 P1905/19	97.56	0.017	97.58	101	102	795
Line 3 P1905/19	97.34	0.007	97.34	192	42	689
Line 4 P1905/19	97.49	0.007	97.50	284	42	689
Line 5 P1905/19	97.42	0.008	97.43	375	48	704
Line 6 P1905/19	97.89	0.007	97.90	466	42	689
Line 1 P1920/25	96.67	0.018	96.69	10	108	802
Line 2 P1920/25	97.49	0.018	97.51	87	108	802
Line 3 P1920/25	98.37	0.021	98.39	164	126	823
Line 4 P1920/25	98.99	0.009	99.00	240	54	717
Line 5 P1920/25	99.74	0.006	99.75	317	36	673
Line 6 P1920/25	99.60	0.008	99.61	394	48	704
Line 7 P1920/25	98.49	0.008	98.50	471	48	704
Line 8 P1920/25	99.31	0.008	99.32	548	48	704
Line 9 P1920/25	98.25	0.008	98.26	625	48	704
Line 10 P1920/25	99.25	0.013	99.26	701	78	760
Line 1 P1920/24	99.05	0.015	99.07	10	90	778
Line 2 P1920/24	99.04	0.006	99.05	69	36	673
Line 3 P1920/24	99.07	0.007	99.08	128	42	689
Line 4 P1920/24	98.91	0.008	98.92	188	48	704
Line 5 P1920/24	99.07	0.008	99.08	247	48	704

Sample/ Analysis number	SiO_2 (wt%)	TiO_2 (wt%)	Total	Distance (μm) from crystal rim	Ti (ppm)	TitaniQ Temp (°C) a_{TiO2} = 0.7
Line 6 P1920/24	98.97	0.010	98.98	306	60	729
Line 7 P1920/24	99.24	0.013	99.25	365	78	760
Line 1 P1920/15	98.29	0.022	98.31	10	132	830
Line 2 P1920/15	98.58	0.016	98.60	157	96	787
Line 3 P1920/15	98.41	0.015	98.43	305	90	778
Line 4 P1920/15	98.78	0.012	98.79	452	72	751
Line 5 P1920/15	99.51	0.013	99.53	600	78	760
Line 6 P1920/15	100.06	0.009	100.07	747	54	717
Line 7 P1920/15	100.64	0.009	100.65	895	54	717
Line 1 P1920/23	101.00	0.023	101.02	10	138	836
Line 2 P1920/23	100.64	0.013	100.66	155	78	760
Line 3 P1920/23	100.51	0.013	100.52	301	78	760
Line 4 P1920/23	100.36	0.009	100.37	446	54	717
Line 5 P1920/23	100.34	0.009	100.35	591	54	717
Line 6 P1920/23	100.32	0.007	100.33	737	42	689
Line 7 P1920/23	99.99	0.007	100.00	882	42	689
Line 1 P1827/19	101.09	0.009	101.10	10	54	717
Line 2 P1827/19	101.43	0.008	101.44	82	48	704
Line 3 P1827/19	101.43	0.007	101.43	154	42	689
Line 4 P1827/19	101.50	0.006	101.50	226	36	673
Line 5 P1827/19	101.60	0.005	101.60	298	30	655
Line 6 P1827/19	101.64	0.007	101.65	370	42	689
Line 7 P1827/19	101.90	0.006	101.91	442	36	673
Line 1 P1827/22	99.19	0.013	99.20	10	78	760
Line 2 P1827/22	99.85	0.010	99.86	55	60	729
Line 3 P1827/22	99.82	0.015	99.84	100	90	778
Line 4 P1827/22	99.91	0.006	99.92	144	36	673
Line 5 P1827/22	99.54	0.008	99.55	189	48	704
Line 6 P1827/22	99.71	0.008	99.72	234	48	704
Line 7 P1827/22	99.45	0.006	99.45	279	36	673
Line 8 P1827/22	99.02	0.006	99.03	323	36	673
Line 9 P1827/22	99.86	0.013	99.87	368	78	760
Line 1 P1827/21	100.35	0.013	100.36	10	78	760
Line 2 P1827/21	100.61	0.015	100.63	94	90	778
Line 3 P1827/21	99.71	0.012	99.73	178	72	751
Line 4 P1827/21	100.80	0.006	100.80	262	36	673
Line 5 P1827/21	100.72	0.006	100.72	346	36	673
Line 6 P1827/21	100.78	0.007	100.79	430	42	689
Line 7 P1827/21	100.76	0.006	100.77	514	36	673
Line 1 P1827/11	99.79	0.013	99.80	10	78	760
Line 2 P1827/11	97.51	0.007	97.51	69	42	689
Line 3 P1827/11	99.60	0.007	99.61	128	42	689
Line 4 P1827/11	99.46	0.007	99.47	187	42	689
Line 5 P1827/11	99.56	0.005	99.57	245	30	655
Line 6 P1827/11	99.67	0.007	99.68	304	42	689

Sample/ Analysis number	SiO_2 (wt%)	TiO_2 (wt%)	Total	Distance (μm) from crystal rim	Ti (ppm)	TitaniQ Temp (°C) a_{TiO2} = 0.7
Line 7 P1827/11	99.93	0.006	99.94	363	36	673
Line 8 P1827/11	100.25	0.012	100.26	422	72	751
Line 1 P1915/2	98.04	0.017	98.06	10	102	795
Line 2 P1915/2	97.73	0.019	97.75	185	114	809
Line 3 P1915/2	98.14	0.016	98.16	361	96	787
Line 4 P1915/2	98.02	0.013	98.04	536	78	760
Line 5 P1915/2	100.26	0.014	100.28	711	84	770
Line 6 P1915/2	98.90	0.010	98.91	887	60	729
Line 7 P1915/2	99.25	0.008	99.26	1062	48	704
Line 8 P1915/2	99.68	0.006	99.69	1237	36	673
Line 1 P1915/10	100.26	0.021	100.28	10	126	823
Line 2 P1915/10	99.89	0.018	99.91	187	108	802
Line 3 P1915/10	99.94	0.014	99.95	363	84	770
Line 4 P1915/10	99.79	0.009	99.80	540	54	717
Line 5 P1915/10	100.09	0.008	100.09	716	48	704
Line 1 P1915/22	99.43	0.023	99.46	10	138	836
Line 2 P1915/22	99.07	0.019	99.09	127	114	809
Line 3 P1915/22	99.21	0.019	99.22	244	114	809
Line 4 P1915/22	99.32	0.022	99.34	362	132	830
Line 5 P1915/22	99.38	0.011	99.39	479	66	740
Line 6 P1915/22	99.41	0.012	99.42	596	72	751
Line 7 P1915/22	99.68	0.011	99.69	713	66	740
Line 8 P1915/22	99.58	0.013	99.59	830	78	760
Line 9 P1915/22	100.32	0.013	100.34	948	78	760
Line 10 P1915/22	100.51	0.012	100.53	1065	72	751
Line 1 P1915/29	101.60	0.021	101.62	10	126	823
Line 2 P1915/29	101.19	0.019	101.21	84	114	809
Line 3 P1915/29	100.93	0.016	100.94	158	96	787
Line 4 P1915/29	100.36	0.015	100.38	232	90	778
Line 5 P1915/29	99.99	0.013	100.00	305	78	760
Line 6 P1915/29	99.30	0.009	99.31	379	54	717
Line 7 P1915/29	98.61	0.012	98.62	453	72	751
Line 8 P1915/29	97.76	0.013	97.77	527	78	760
Line 9 P1915/29	96.97	0.014	96.99	601	84	770
Line 10 P1915/29	96.06	0.012	96.07	675	72	751
Line 1 P1910/18	101.92	0.019	101.94	10	114	809
Line 2 P1910/18	101.91	0.018	101.93	91	108	802
Line 3 P1910/18	101.73	0.012	101.75	171	72	751
Line 4 P1910/18	101.62	0.010	101.63	252	60	729
Line 5 P1910/18	101.38	0.009	101.39	333	54	717
Line 6 P1910/18	101.20	0.009	101.21	413	54	717
Line 7 P1910/18	101.06	0.011	101.07	494	66	740
Line 8 P1910/18	100.66	0.011	100.67	574	66	740
Line 9 P1910/18	100.85	0.011	100.86	655	66	740
Line 10 P1910/18	100.71	0.011	100.72	736	66	740

Sample/ Analysis number	SiO_2 (wt%)	TiO_2 (wt%)	Total	Distance (μm) from crystal rim	Ti (ppm)	TitaniQ Temp (°C) a_{TiO2} = 0.7
Line 1 P1910/20	99.19	0.015	99.21	10	90	778
Line 2 P1910/20	99.15	0.015	99.17	109	90	778
Line 3 P1910/20	99.37	0.009	99.38	208	54	717
Line 4 P1910/20	99.00	0.009	99.01	308	54	717
Line 5 P1910/20	99.13	0.011	99.14	407	66	740
Line 6 P1910/20	99.01	0.009	99.01	506	54	717
Line 7 P1910/20	98.92	0.012	98.93	605	72	751
Line 8 P1910/20	99.55	0.017	99.57	704	102	795
Line 9 P1910/20	99.41	0.015	99.42	803	90	778
Line 10 P1910/20	99.49	0.016	99.51	903	96	787
Line 1 P1910/19	100.65	0.017	100.67	10	102	795
Line 2 P1910/19	100.57	0.007	100.58	106	42	689
Line 3 P1910/19	100.44	0.006	100.45	202	36	673
Line 4 P1910/19	100.22	0.009	100.23	298	54	717
Line 5 P1910/19	100.35	0.012	100.36	394	72	751
Line 6 P1910/19	100.21	0.011	100.22	490	66	740
Line 7 P1910/19	100.14	0.009	100.15	586	54	717
Line 8 P1910/19	100.07	0.011	100.08	682	66	740
Line 1 P1910/15	100.35	0.018	100.37	10	108	802
Line 2 P1910/15	100.24	0.013	100.25	238	78	760
Line 3 P1910/15	100.20	0.012	100.21	466	72	751
Line 4 P1910/15	100.29	0.008	100.30	694	48	704
Line 5 P1910/15	99.95	0.007	99.96	923	42	689

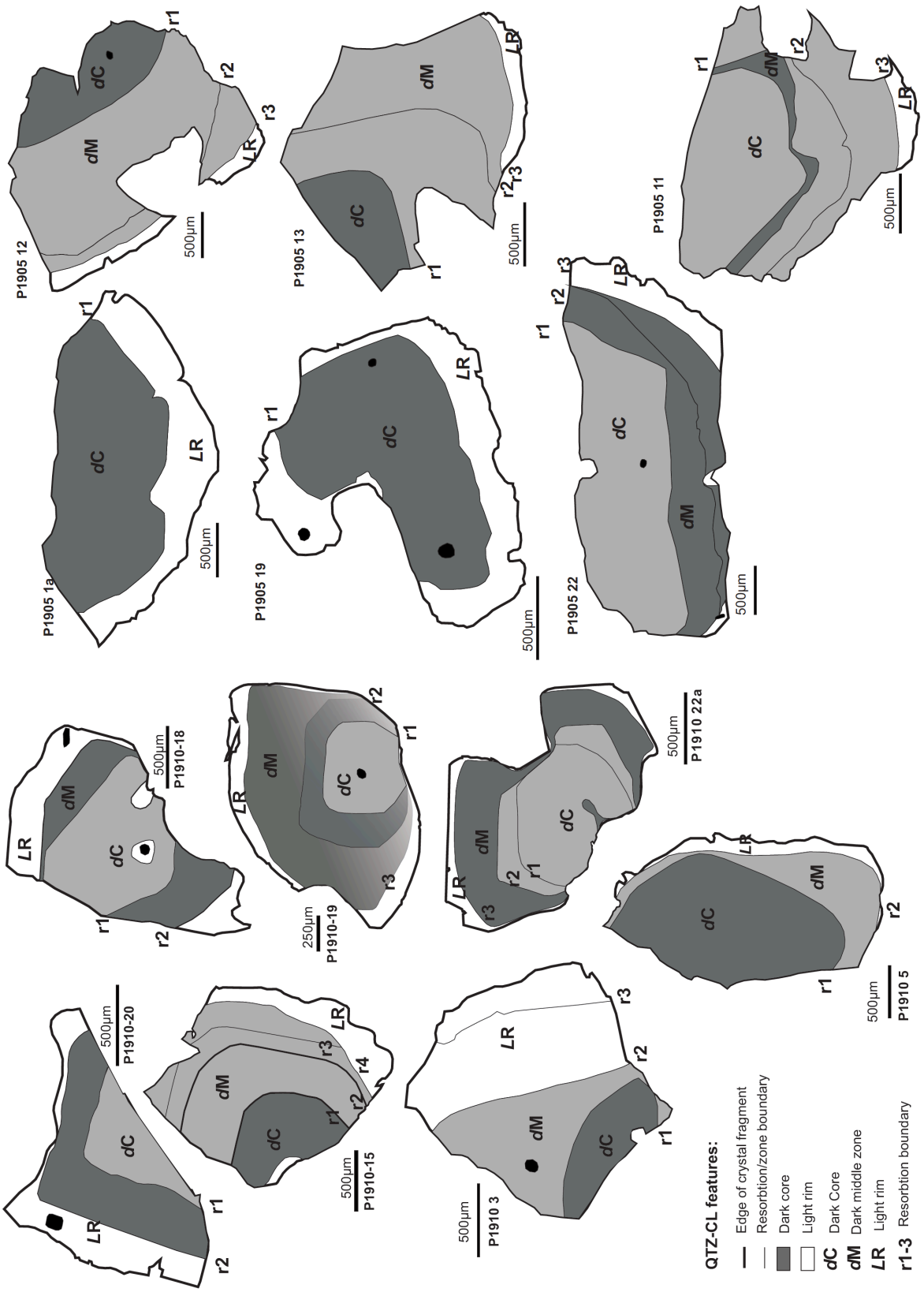

Fig A11.1: Sketch maps of CL-zoning patterns in Whakamaru Group quartz

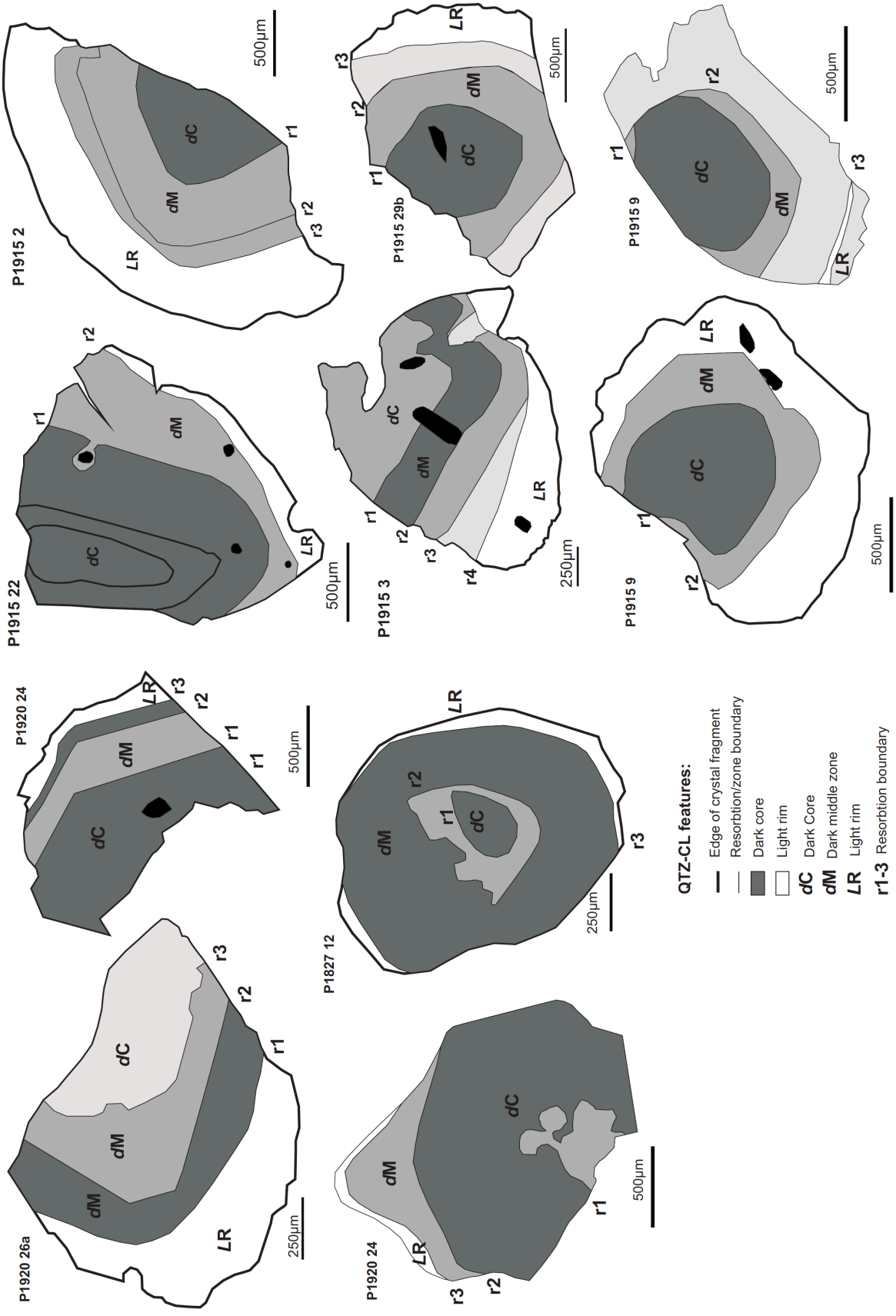

Fig A11.2: Sketch maps of CL-zoning patterns in Whakamaru Group quartz

Table A12.1: ***Ti-in-quartz and TitaniQ temperatures for YTT quartz***

Sample/ Analysis number	TiO_2 (wt%)	Ti (ppm)	TitaniQ Temp °C, a_{TiO2} = 0.5	Crystal location	Distance (µm) from crystal rim
YTT-17/1_1	0.01	**86**	817	rim	5
YTT-17/1_2	0.01	116	859		59
YTT-17/1_3	0.01	64	778		113
YTT-17/1_4	0.00	49	745		167
YTT-17/1_5	0.01	58	765		221
YTT-17/1_6	0.01	50	748		275
YTT-17/1_7	0.00	26	675		329
YTT-17/2_1	0.00	**21**	655	rim	3
YTT-17/2_2	0.02	214	958		60
YTT-17/2_3	0.01	74	797		117
YTT-17/2_4	0.01	73	794		174
YTT-17/2_5	0.01	109	851		231
YTT-17/2_6	0.01	130	877		288
YTT-17/3_1	0.01	**81**	809	rim	5
YTT-17/3_2	0.01	69	787		90
YTT-17/3_3	0.01	72	794		175
YTT-17/3_4	0.01	53	754		260
YTT-17/3_5	0.01	55	758		345
YTT-17/3_6	0.01	54	756		430
YTT-17/3_7	0.01	55	758		515
YTT-17/4_1	0.01	**101**	839	rim	3
YTT-17/4_2	0.01	128	874		87
YTT-17/4_3	0.01	106	846		171
YTT-17/4_4	0.01	89	821		255
YTT-17/4_6	0.01	58	765		339
YTT-17/4_7	0.00	42	726		423
YTT-17/4_8	0.00	11	594		507
YTT-17/4_10	0.00	26	673		675
YTT-17/5_1	0.01	**121**	866	rim	1
YTT-17/5_2	0.00	28	682		56
YTT-17/5_3	0.01	88	820		111
YTT-17/5_4	0.01	55	758		166
YTT-17/5_5	0.01	98	835		221
YTT-17/5_6	0.02	162	911		276
YTT-17/5_7	0.01	59	767		331
YTT-17/5_8	0.01	68	785		386
YTT-17/5_9	0.01	66	782		441
YTT-17/5_10	0.01	66	782		496
YTT-17/6_1	0.01	**98**	836	rim	5
YTT-17/6_2	0.01	102	841		37
YTT-17/6_3	0.01	103	842		69

Sample/ Analysis number	TiO_2 (wt%)	Ti (ppm)	TitaniQ Temp °C, a_{TiO2} = 0.5	Crystal location	Distance (μm) from crystal rim
YTT-17/7_1	0.01	**78**	804	rim	1
YTT-17/7_2	0.01	53	755		84
YTT-17/7_3	0.01	56	761		167
YTT-17/7_4	0.00	43	729		250
YTT-17/7_5	0.01	60	769		333
YTT-17/7_6	0.00	43	729		416
YTT-17/7_7	0.00	34	702		499
YTT-17/7_8	0.00	41	724		582
YTT-17/7_9	0.01	53	754		665
YTT-17/7_10	0.01	52	752		748
YTT-17/8_1	0.01	**64**	777	rim	1
YTT-17/8_2	0.01	73	794		36
YTT-17/8_3	0.01	77	802		71
YTT-17/8_4	0.01	62	774		106
YTT-17/8_5	0.01	68	785		141
YTT-17/8_6	0.01	82	810		176
YTT-17/8_7	0.01	84	814		211
YTT-17/9_1	0.01	**93**	828	rim	2
YTT-17/9_2	0.01	111	853		37
YTT-17/9_3	0.01	107	848		72
YTT-17/9_4	0.01	52	752		107
YTT-17/9_5	0.01	64	778		142
YTT-17/9_6	0.00	45	734		177
YTT-17/9_7	0.01	77	802		212
YTT-17/10_1	0.01	**122**	867	rim	1
YTT-17/10_2	0.01	120	864		55
YTT-17/10_3	0.01	119	863		109
YTT-17/10_4	0.01	122	867		163
YTT-17/10_5	0.01	121	865		217
YTT-17/10_6	0.01	101	840		271
YTT-17/10_7	0.00	39	719		325
YTT-17/10_8	0.00	34	702		379
YTT-17/11_1	0.01	**74**	797	rim	5
YTT-17/11_2	0.01	80	806		65
YTT-17/11_3	0.01	131	878		125
YTT-17/11_4	0.01	130	877		185
YTT-17/11_5	0.01	148	897		245

Table A12.2: ***Ti-in-quartz and TitaniQ temperatures for EQF quartz***

Sample/ Analysis number	TiO_2 (wt%)	Ti (ppm)	TitaniQ Temp °C, a_{TiO2} = 0.4	Distance (µm) from crystal rim
EQ4-CL30-c	0.00	43	756	
EQ4-CL30-m	0.01	57	792	
EQ4-CL30-r	0.01	56	789	rim
EQ4-CL24-c	0.01	58	794	
EQ4-CL24-m	0.01	63	805	
EQ4-CL24-r	0.01	55	787	rim
EQ4-CL21-c	0.00	49	772	
EQ4-CL21c	0.00	49	772	
EQ4-CL21m	0.01	56	789	
EQ4-CL21-r	0.01	65	809	rim
EQ4-CL29-c	0.01	51	777	
EQ4-CL29-r	0.01	68	815	rim
EQ4-CL26-c	0.00	45	762	
EQ4-CL26-m	0.01	69	817	
EQ4-CL26-r	0.00	46	764	rim
EQ4-CL15-c	0.01	52	780	
EQ4-CL15-r	0.01	61	801	rim
EQ4-CL15-r2	0.01	62	803	rim
EQ4-CL11-c	0.01	55	787	
EQ4-CL11-r	0.01	60	798	rim
EQ4-CL8-c	0.00	49	772	
EQ4-CL19	0.01	54	785	1192
EQ4-CL19	0.01	50	775	1172
EQ4-CL19	0.01	53	782	1151
EQ4-CL19	0.01	56	789	1131
EQ4-CL19	0.01	50	775	1111
EQ4-CL19	0.01	66	811	1091
EQ4-CL19	0.01	56	789	1071
EQ4-CL19	0.01	63	805	1050
EQ4-CL19	0.01	62	803	1030
EQ4-CL19	0.01	66	811	1010
EQ4-CL19	0.01	65	809	990
EQ4-CL19	0.01	64	807	970
EQ4-CL19	0.01	52	780	949
EQ4-CL19	0.01	67	813	929
EQ4-CL19	0.01	56	789	909
EQ4-CL19	0.01	58	794	889
EQ4-CL19	0.01	57	792	869
EQ4-CL19	0.01	55	787	848
EQ4-CL19	0.01	51	777	828
EQ4-CL19	0.01	60	798	808

Sample/ Analysis number	TiO_2 (wt%)	Ti (ppm)	TitaniQ Temp °C, a_{TiO2} = 0.4	Distance (µm) from crystal rim
EQ4-CL19	0.01	53	782	788
EQ4-CL19	0.01	53	782	768
EQ4-CL19	0.01	56	789	747
EQ4-CL19	0.01	59	796	727
EQ4-CL19	0.01	58	794	707
EQ4-CL19	0.01	60	798	687
EQ4-CL19	0.01	59	796	667
EQ4-CL19	0.01	61	801	646
EQ4-CL19	0.00	43	756	626
EQ4-CL19	0.00	47	767	606
EQ4-CL19	0.01	56	789	586
EQ4-CL19	0.01	54	785	566
EQ4-CL19	0.01	52	780	545
EQ4-CL19	0.01	50	775	525
EQ4-CL19	0.00	49	772	505
EQ4-CL19	0.00	48	770	485
EQ4-CL19	0.01	56	789	465
EQ4-CL19	0.01	79	836	444
EQ4-CL19	0.01	87	850	424
EQ4-CL19	0.01	91	857	404
EQ4-CL19	0.01	100	871	384
EQ4-CL19	0.01	122	901	364
EQ4-CL19	0.01	126	907	343
EQ4-CL19	0.01	88	852	323
EQ4-CL19	0.01	88	852	303
EQ4-CL19	0.01	83	843	283
EQ4-CL19	0.01	76	831	263
EQ4-CL19	0.01	77	833	242
EQ4-CL19	0.01	79	836	222
EQ4-CL19	0.01	81	840	202
EQ4-CL19	0.01	83	843	182
EQ4-CL19	0.01	77	833	162
EQ4-CL19	0.01	76	831	141
EQ4-CL19	0.01	68	815	121
EQ4-CL19	0.01	59	796	101
EQ4-CL19	0.01	67	813	81
EQ4-CL19	0.01	56	789	61
EQ4-CL19	0.01	55	787	40
EQ4-CL19	0.00	48	770	20
EQ4-CL19	0.00	49	772	0
EQ4-CL14	0.00	49	772	558
EQ4-CL14	0.01	53	782	539
EQ4-CL14	0.00	49	772	520
EQ4-CL14	0.01	51	777	501

Sample/ Analysis number	TiO_2 (wt%)	Ti (ppm)	TitaniQ Temp °C, a_{TiO2} = 0.4	Distance (µm) from crystal rim
EQ4-CL14	0.01	54	785	481
EQ4-CL14	0.01	52	780	462
EQ4-CL14	0.01	50	775	443
EQ4-CL14	0.00	47	767	424
EQ4-CL14	0.01	51	777	404
EQ4-CL14	0.01	56	789	385
EQ4-CL14	0.01	63	805	366
EQ4-CL14	0.01	56	789	347
EQ4-CL14	0.01	56	789	327
EQ4-CL14	0.00	49	772	308
EQ4-CL14	0.00	48	770	289
EQ4-CL14	0.00	49	772	270
EQ4-CL14	0.01	50	775	250
EQ4-CL14	0.01	54	785	231
EQ4-CL14	0.01	57	792	212
EQ4-CL14	0.01	56	789	193
EQ4-CL14	0.01	52	780	173
EQ4-CL14	0.01	53	782	154
EQ4-CL14	0.01	51	777	135
EQ4-CL14	0.01	64	807	116
EQ4-CL14	0.01	64	807	96
EQ4-CL14	0.01	62	803	77
EQ4-CL14	0.01	63	805	58
EQ4-CL14	0.01	60	798	39
EQ4-CL14	0.01	64	807	19
EQ4-CL14	0.01	62	803	0
EQ4-CL13	0.00	48	770	1508
EQ4-CL13	0.00	47	767	1456
EQ4-CL13	0.01	50	775	1404
EQ4-CL13	0.00	44	759	1352
EQ4-CL13	0.01	61	801	1300
EQ4-CL13	0.01	53	782	1248
EQ4-CL13	0.01	63	805	1196
EQ4-CL13	0.01	56	789	1144
EQ4-CL13	0.01	50	775	1092
EQ4-CL13	0.00	48	770	1040
EQ4-CL13	0.01	62	803	988
EQ4-CL13	0.01	61	801	936
EQ4-CL13	0.01	52	780	884
EQ4-CL13	0.01	50	775	832
EQ4-CL13	0.01	57	792	780
EQ4-CL13	0.01	58	794	728
EQ4-CL13	0.01	64	807	676
EQ4-CL13	0.01	57	792	624

Sample/ Analysis number	TiO_2 (wt%)	Ti (ppm)	TitaniQ Temp °C, a_{TiO2} = 0.4	Distance (µm) from crystal rim
EQ4-CL13	0.01	56	789	572
EQ4-CL13	0.00	49	772	520
EQ4-CL13	0.01	55	787	468
EQ4-CL13	0.01	54	785	416
EQ4-CL13	0.01	53	782	364
EQ4-CL13	0.01	56	789	312
EQ4-CL13	0.01	58	794	260
EQ4-CL13	0.01	53	782	208
EQ4-CL13	0.00	41	750	156
EQ4-CL13	0.01	58	794	104
EQ4-CL13	0.01	56	789	52
EQ4-CL13	0.01	52	780	0
EQ4-CL34	0.00	49	772	264
EQ4-CL34	0.00	43	756	245
EQ4-CL34	0.01	54	785	226
EQ4-CL34	0.01	55	787	207
EQ4-CL34	0.01	56	789	189
EQ4-CL34	0.01	58	794	170
EQ4-CL34	0.01	97	866	151
EQ4-CL34	0.01	97	866	132
EQ4-CL34	0.01	87	850	113
EQ4-CL34	0.01	75	829	94
EQ4-CL34	0.01	54	785	75
EQ4-CL34	0.01	53	782	57
EQ4-CL34	0.01	54	785	38
EQ4-CL34	0.01	58	794	19
EQ4-CL34	0.01	55	787	0
EQF4-CL1	0.00	47	767	406
EQF4-CL1	0.01	51	777	392
EQF4-CL1	0.00	44	759	378
EQF4-CL1	0.00	47	767	364
EQF4-CL1	0.00	47	767	350
EQF4-CL1	0.00	44	759	336
EQF4-CL1	0.00	48	770	322
EQF4-CL1	0.00	47	767	308
EQF4-CL1	0.00	46	764	294
EQF4-CL1	0.01	52	780	280
EQF4-CL1	0.00	47	767	266
EQF4-CL1	0.01	58	794	252
EQF4-CL1	0.00	47	767	238
EQF4-CL1	0.01	50	775	224
EQF4-CL1	0.01	50	775	210
EQF4-CL1	0.00	49	772	196
EQF4-CL1	0.01	50	775	182

Sample/ Analysis number	TiO_2 (wt%)	Ti (ppm)	TitaniQ Temp °C, a_{TiO2} = 0.4	Distance (µm) from crystal rim
EQF4-CL1	0.01	51	777	168
EQF4-CL1	0.01	133	915	154
EQF4-CL1	0.01	96	865	140
EQF4-CL1	0.01	86	848	126
EQF4-CL1	0.01	82	841	112
EQF4-CL1	0.01	106	880	98
EQF4-CL1	0.01	108	882	84
EQF4-CL1	0.01	105	878	70
EQF4-CL1	0.01	99	869	56
EQF4-CL1	0.01	90	855	42
EQF4-CL1	0.01	103	875	28
EQF4-CL1	0.01	117	895	14
EQF4-CL1	0.01	72	823	0
EQF4-CL5	0.01	54	785	601
EQF4-CL5	0.01	53	782	581
EQF4-CL5	0.01	64	807	560
EQF4-CL5	0.01	55	787	539
EQF4-CL5	0.01	53	782	519
EQF4-CL5	0.01	54	785	498
EQF4-CL5	0.01	55	787	477
EQF4-CL5	0.01	57	792	456
EQF4-CL5	0.01	59	796	436
EQF4-CL5	0.01	55	787	415
EQF4-CL5	0.01	68	815	394
EQF4-CL5	0.01	90	855	373
EQF4-CL5	0.01	89	853	353
EQF4-CL5	0.01	82	841	332
EQF4-CL5	0.01	59	796	311
EQF4-CL5	0.01	57	792	290
EQF4-CL5	0.01	60	798	270
EQF4-CL5	0.01	54	785	249
EQF4-CL5	0.01	53	782	228
EQF4-CL5	0.01	52	780	207
EQF4-CL5	0.01	51	777	187
EQF4-CL5	0.01	60	798	166
EQF4-CL5	0.01	64	807	145
EQF4-CL5	0.01	59	796	124
EQF4-CL5	0.01	52	780	104
EQF4-CL5	0.01	54	785	83
EQF4-CL5	0.01	53	782	62
EQF4-CL5	0.01	56	789	41
EQF4-CL5	0.01	55	787	21
EQF4-CL5	0.01	65	809	0

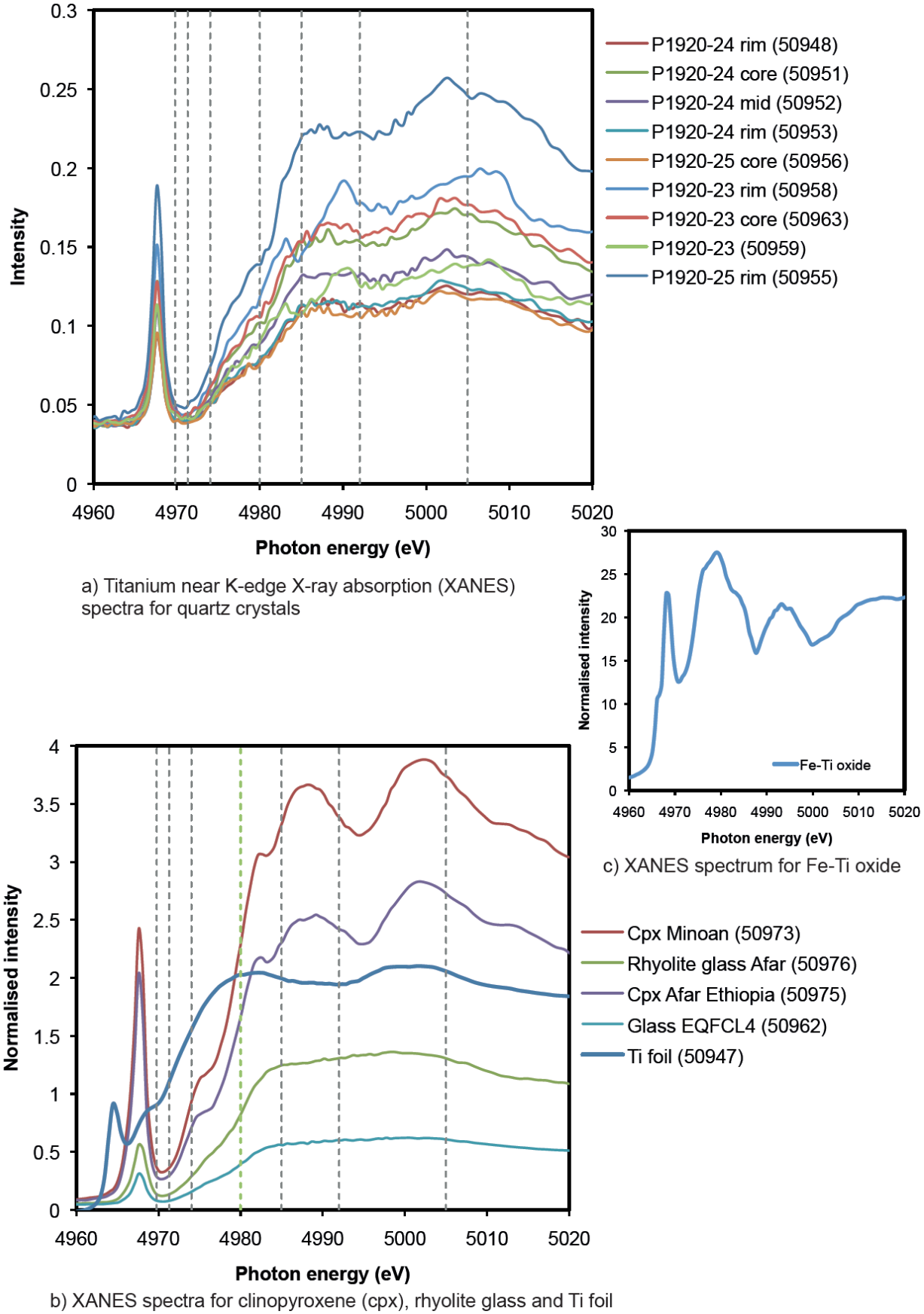

Fig. A13.1: XANES spectra for quartz and reference materials, Diamond Beamline I18

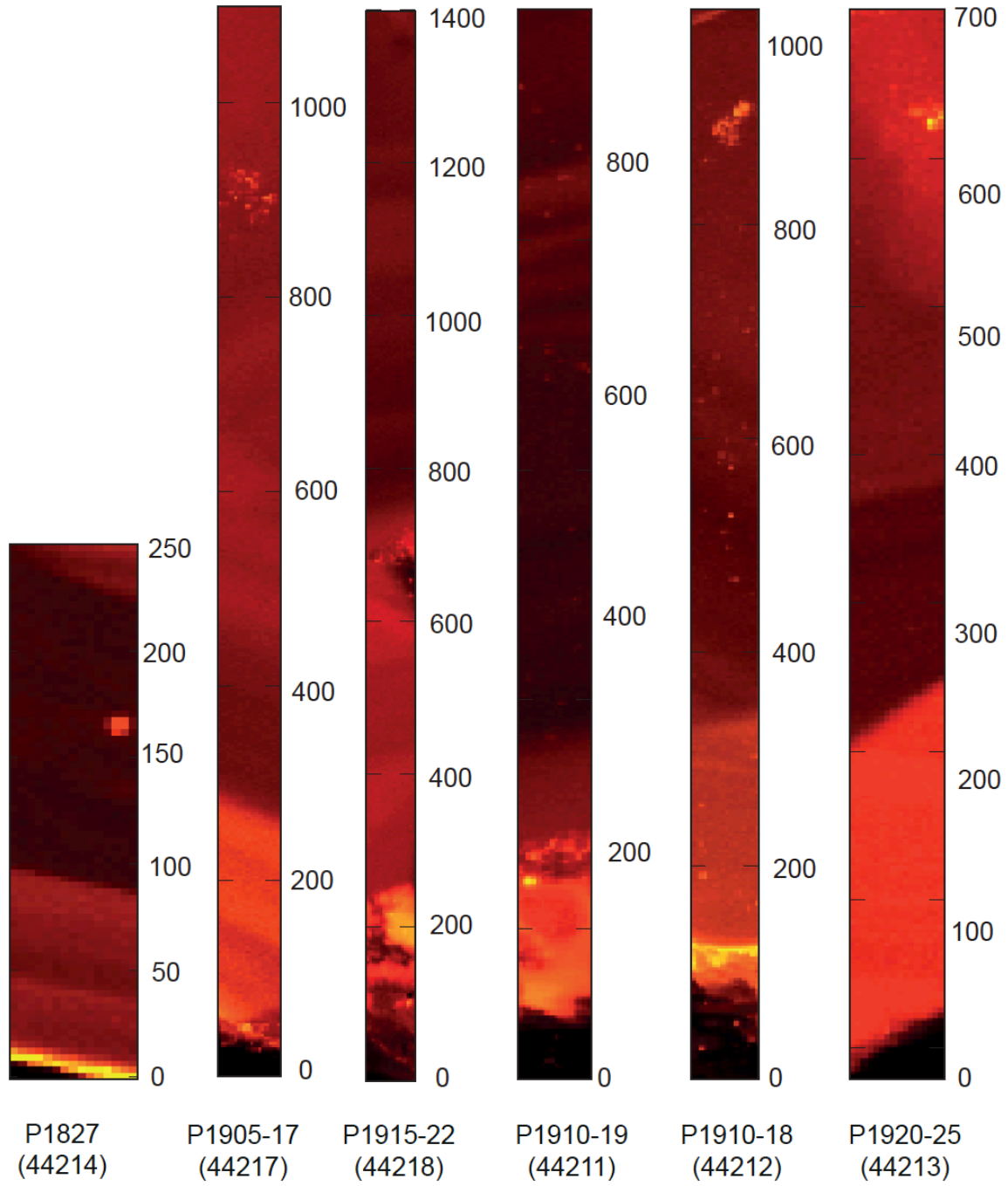

Fig. A13.2: Selected synchrotron µ-XRF transects of Whakamaru quartz crystals from core-to-rim (where 0 = rim, and scale is in µm). Colour intensity reflects Ti-in-quartz concentration, where yellow is very-high Ti (adhering glass rim or melt inclusions), red is the high-Ti quartz rim, dark red is the low-Ti quartz core, black is the edge of the crystal (epoxy mount).

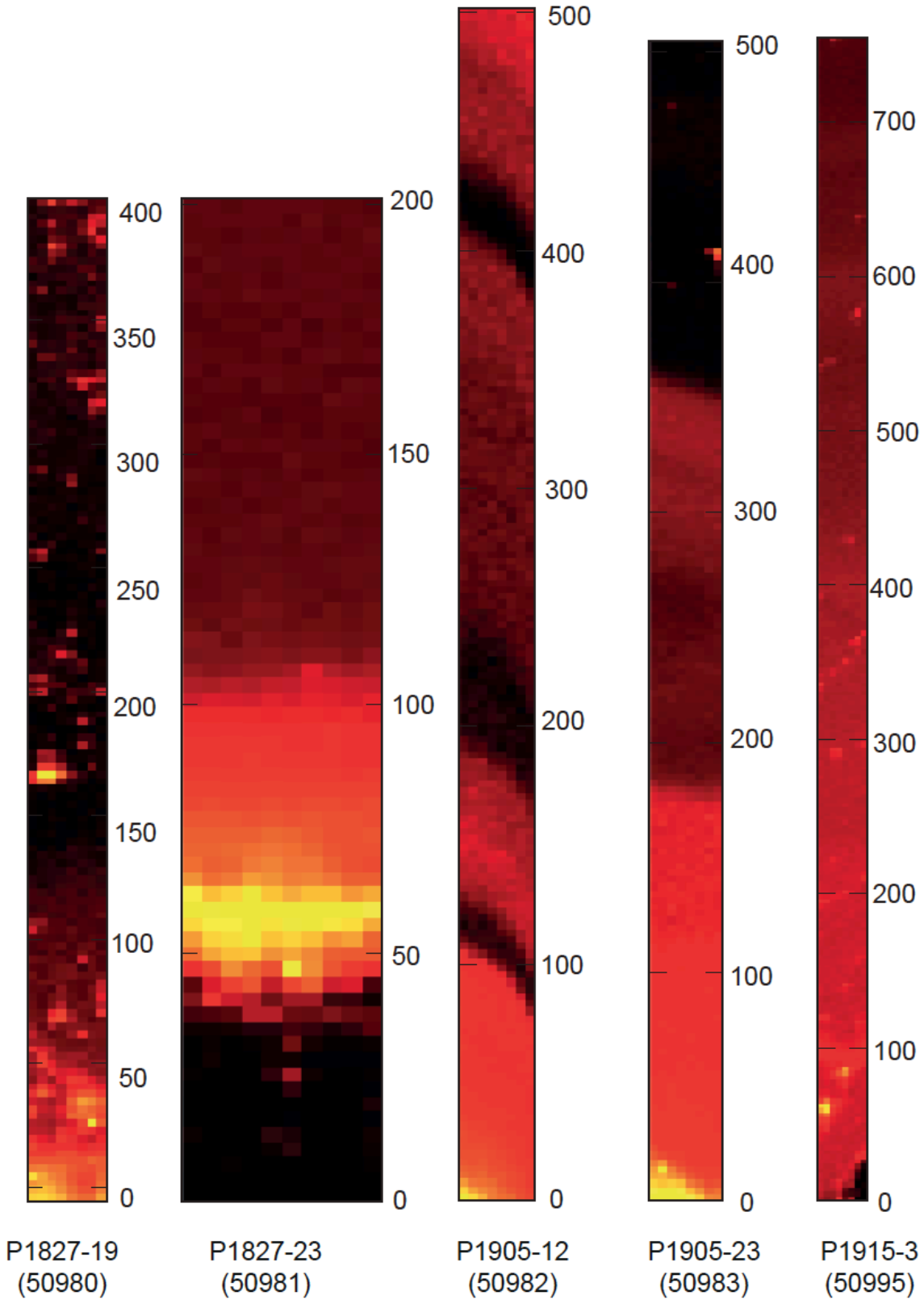

Fig. A13.3: Synchrotron µ-XRF transects of Whakamaru quartz crystals from core-to-rim (where 0 = rim, and scale is in µm). Colour intensity reflects Ti-in-quartz concentration, where yellow is very-high Ti (adhering glass rim or melt inclusions), red is the high-Ti quartz rim, dark red is the low-Ti quartz core, black is the edge of the crystal (epoxy mount).

Table A14.1: ***U-Pb ($^{206}Pb/^{238}U$ ages corrected for ^{207}Pb and initial ^{230}Th disequilibrium) for zircons from Rangitaki pumice sample P1905***

Spot name	ppm U	ppm Th	206/238	% comm 206	1σ error	230 corr. Age (Ma)	2σ error
P1905A-54.1	700	826	3.81E-05	13.8	0.02	**0.286**	0.039
P1905A-47.1	555	354	4.69E-05	25.5	0.03	**0.313**	0.067
P1905B-3.1	879	1008	4.66E-05	19.4	0.020	**0.318**	0.039
P1905A-50.1	1585	1564	4.18E-05	10.8	0.02	**0.321**	0.031
P1905A-52.1	721	575	4.01E-05	7.0	0.02	**0.325**	0.039
P1905B-07.1	914	867	4.16E-05	8.8	0.02	**0.326**	0.040
P1905A-30.1	2859	2787	4.23E-05	8.7	0.01	**0.330**	0.022
P1905A-31.1	380	327	4.68E-05	18.1	0.03	**0.330**	0.067
P1905B-4.1	591	592	4.30E-05	9.4	0.022	**0.331**	0.043
P1905A-48.1	773	722	4.42E-05	12.1	0.02	**0.332**	0.042
P1905A-43.1	557	567	4.77E-05	17.2	0.02	**0.334**	0.048
P1905A-33.1	896	810	4.13E-05	2.8	0.02	**0.341**	0.037
P1905A-4.1	811	551	4.59E-05	14.4	0.022	**0.342**	0.044
P1905A-42.1	1041	1289	4.24E-05	0.1	0.02	**0.348**	0.036
P1905A-51.1	1327	1702	4.53E-05	3.0	0.02	**0.358**	0.034
P1905A-45.1	691	775	4.96E-05	11.1	0.03	**0.362**	0.053
P1905A-6.1	1684	2087	5.13E-05	13.3	0.016	**0.362**	0.033
P1905B-5.1	3997	3808	4.54E-05	3.7	0.009	**0.364**	0.017
P1905A-38.1	1302	2403	4.73E-05	0.6	0.02	**0.364**	0.032
P1905A-16.1	1267	1019	4.68E-05	7.4	0.016	**0.365**	0.033
P1905A-17.1	1031	1264	4.98E-05	9.5	0.020	**0.366**	0.041
P1905A-46.1	1546	1541	4.78E-05	6.9	0.02	**0.368**	0.031
P1905A-24.1	2857	4912	5.24E-05	9.6	0.013	**0.369**	0.025
P1905B-1.1	3558	7532	5.05E-05	2.9	~~0.010~~	**0.371**	0.020
P1905A-11.1	2006	2918	5.08E-05	8.2	0.015	**0.371**	0.030
P1905A-49.1	435	316	4.89E-05	9.1	0.04	**0.374**	0.084
P1905A-28.1	1380	1821	4.95E-05	5.5	0.02	**0.375**	0.033
P1905A-44.1	697	536	6.36E-05	29.2	0.03	**0.377**	0.060
P1905B-2.1	1987	2215	5.07E-05	8.1	0.016	**0.379**	0.032
P1905A-11.2	2544	2186	4.84E-05	5.7	0.01	**0.379**	0.028
P1905A-32.1	788	663	5.13E-05	11.0	0.03	**0.379**	0.052
P1905A-39.1	362	273	7.15E-05	36.7	0.05	**0.379**	0.092
P1905B-08.1	4212	5101	4.78E-05	1.8	0.01	**0.379**	0.021
P1905A-34.1	645	563	5.21E-05	12.0	0.03	**0.380**	0.057
P1905A-7.1	1094	1164	5.53E-05	15.2	0.021	**0.382**	0.042
P1905B-09.1	1331	1265	6.15E-05	24.0	0.02	**0.384**	0.039
P1905B-06.1	2040	4092	5.10E-05	0.8	0.01	**0.384**	0.029
P1905A-19.1	1322	1763	5.49E-05	12.1	0.018	**0.385**	0.037
P1905A-41.1	2881	5459	5.24E-05	3.9	0.01	**0.385**	0.027
P1905A-37.1	526	676	4.59E-05	-5.1	0.03	**0.386**	0.052

Spot name	ppm U	ppm Th	206/238	% comm 206	1σ error	230 corr. Age (Ma)	2σ error
P1905A-40.1	1866	1979	4.94E-05	2.6	0.01	**0.391**	0.027
P1905A-27.1	311	232	6.18E-05	23.6	0.04	**0.392**	0.078
P1905A-9.1	3270	3148	7.47E-05	34.9	0.025	**0.396**	0.050
P1905A-36.1	1897	2143	5.25E-05	5.8	0.01	**0.397**	0.028
P1905A-1.1	2241	3124	5.85E-05	11.7	0.015	**0.405**	0.031
P1905A-14.1	2271	3262	5.47E-05	4.3	0.015	**0.409**	0.029
P1905A-5.1	1242	1586	5.80E-05	9.9	0.020	**0.412**	0.041
P1905A-10.1	2354	3610	5.84E-05	8.7	0.014	**0.413**	0.029
P1905A-12.1	3497	4206	5.73E-05	8.3	0.012	**0.416**	0.024
P1905A-53.1	772	843	5.89E-05	11.2	0.03	**0.417**	0.050
P1905A-29.1	1214	1333	5.37E-05	2.6	0.02	**0.417**	0.038
P1905A-18.1	10167	15033	5.63E-05	4.1	0.007	**0.419**	0.014
P1905A-23.1	2299	3108	6.08E-05	11.7	0.015	**0.420**	0.030
P1905A-25.1	3346	8567	6.78E-05	13.5	0.029	**0.423**	0.057
P1905A-22.1	9051	11814	5.73E-05	5.0	0.007	**0.426**	0.015
P1905A-15.1	1273	1912	6.07E-05	5.6	0.020	**0.440**	0.040
P1905A-21.1	2508	2238	5.75E-05	3.4	0.016	**0.443**	0.033
P1905A-26.1	1117	1565	6.91E-05	10.4	0.02	**0.472**	0.038
P1905A-2.1	3232	3783	7.58E-05	16.9	0.035	**0.485**	0.071
P1905A-20.1	7843	13654	7.44E-05	4.0	0.009	**0.526**	0.018

AV	**0.381**
MIN	**0.286**
MAX	**0.526**

Note: 'Spot' name represents the sample number, and grain number. Abbreviations are as follows: % comm 206 refers to the % of common ^{206}Pb; 1σ error refers to ^{207}corr ^{206}Pb/^{238}U age; quoted age (in Ma) is corrected for ^{230}Th disequilibrium (230 corr) and ^{207}Pb. Full dataset provided in Appendix 14.

Table A14.2*: U-Pb ($^{206}Pb/^{238}U$ ages corrected for ^{207}Pb and initial ^{230}Th disequilibrium) for zircons from Whakamaru pumice sample P1920*

Spot name	ppm U	ppm Th	206/238	% comm 206	1σ error	230 corr. Age (Ma)	2σ error
P1920A-14.1	708	1080	3.97E-05	9.25	0.02	**0.299**	0.039
P1920A-11.1	342	246	4.41E-05	21.77	0.03	**0.308**	0.063
P1920B-61.1	660	743	4.57E-05	14.88	0.02	**0.328**	0.047
P1920B-44.1	1413	1785	4.59E-05	9.92	0.016	**0.341**	0.031
P1920A-08.1	697	499	4.16E-05	4.95	0.02	**0.342**	0.041
P1920B-6.1	365	296	5.51E-05	27.29	0.033	**0.343**	0.066
P1920A-02.1	1296	1559	4.57E-05	8.99	0.02	**0.344**	0.034
P1920B-9.1	277	197	4.67E-05	13.90	0.036	**0.347**	0.072
P1920B-22.1	1187	1199	4.78E-05	12.76	0.016	**0.349**	0.032
P1920B-40.1	1841	2606	4.85E-05	10.34	0.013	**0.351**	0.027
P1920A-22.1	900	1080	4.97E-05	13.58	0.02	**0.353**	0.040
P1920A-12.1	1670	2346	4.80E-05	8.57	0.01	**0.354**	0.029
P1920A-10.1	1065	1044	4.58E-05	7.02	0.02	**0.356**	0.040
P1920B-27.1	1424	1424	4.37E-05	1.73	0.015	**0.358**	0.030
P1920B-04.2	772	1076	4.67E-05	4.50	0.02	**0.359**	0.041
P1920B-15.1	1791	2328	4.73E-05	6.40	0.013	**0.359**	0.026
P1920B-03.2	498	335	4.67E-05	9.06	0.03	**0.362**	0.051
P1920B-24.1	155	88	5.21E-05	19.17	0.048	**0.363**	0.097
P1920B-01.2	680	518	7.63E-05	43.90	0.06	**0.363**	0.126
P1920A-03.1	1042	961	4.63E-05	5.58	0.02	**0.365**	0.038
P1920B-51.1	1275	708	4.93E-05	13.47	0.02	**0.367**	0.033
P1920B-37.1	357	233	5.04E-05	14.62	0.032	**0.367**	0.064
P1920B-54.1	740	697	4.69E-05	5.04	0.02	**0.370**	0.041
P1920A-07.1	2116	2019	5.02E-05	9.22	0.02	**0.376**	0.030
P1920B-30.1	5370	9689	5.09E-05	3.95	0.008	**0.378**	0.016
P1920B-12.1	876	1218	5.12E-05	7.14	0.023	**0.379**	0.045
P1920A-19.1	3549	8680	5.30E-05	2.80	0.01	**0.379**	0.022
P1920A-26.1	638	506	4.95E-05	8.12	0.03	**0.379**	0.053
P1920B-39.1	1492	2020	5.33E-05	10.38	0.015	**0.381**	0.030
P1920A-20.1	643	678	4.82E-05	2.50	0.03	**0.383**	0.054
P1920B-52.1	380	393	5.52E-05	14.81	0.03	**0.384**	0.063
P1920B-14.1	332	323	5.65E-05	17.01	0.035	**0.385**	0.070
P1920B-42.1	460	302	5.07E-05	9.68	0.026	**0.385**	0.052
P1920B-53.1	775	1509	8.10E-05	37.33	0.04	**0.386**	0.076
P1920B-25.1	1004	1159	5.16E-05	7.19	0.018	**0.387**	0.036
P1920B-17.1	527	520	5.66E-05	16.13	0.027	**0.388**	0.053
P1920B-47.1	1180	844	4.96E-05	6.07	0.02	**0.389**	0.032
P1920B-10.1	682	724	6.46E-05	25.77	0.059	**0.389**	0.119
P1920B-46.1	1854	2231	5.15E-05	5.75	0.01	**0.390**	0.029
P1920B-5.1	863	925	5.16E-05	6.16	0.021	**0.392**	0.041
P1920B-23.1	1528	1956	5.24E-05	5.71	0.015	**0.393**	0.030

Spot name	ppm U	ppm Th	206/238	% comm 206	1σ error	230 corr. Age (Ma)	2σ error
P1920B-50.1	3478	6520	5.51E-05	6.23	0.01	**0.394**	0.023
P1920A-04.1	793	1057	5.52E-05	9.93	0.02	**0.394**	0.047
P1920B-55.1	429	272	5.77E-05	18.18	0.03	**0.395**	0.062
P1920B-57.1	306	190	5.68E-05	16.09	0.04	**0.398**	0.071
P1920A-25.1	1002	1100	5.22E-05	4.78	0.02	**0.400**	0.041
P1920A-01.1	407	422	5.09E-05	2.24	0.03	**0.402**	0.061
P1920B-33.2	2828	3472	5.39E-05	5.52	0.01	**0.405**	0.022
P1920B-21.1	446	372	5.33E-05	7.04	0.027	**0.405**	0.053
P1920B-3.1	960	884	5.51E-05	9.35	0.021	**0.406**	0.041
P1920A-17.1	385	510	5.31E-05	2.74	0.03	**0.407**	0.064
P1920B-49.1	1321	2027	5.37E-05	2.44	0.02	**0.407**	0.032
P1920A-23.1	778	911	5.45E-05	6.11	0.02	**0.408**	0.048
P1920B-16.1	1718	2254	5.29E-05	1.99	0.014	**0.409**	0.028
P1920A-13.1	331	217	5.95E-05	13.58	0.04	**0.422**	0.078
P1920B-1.1	836	735	5.57E-05	6.21	0.022	**0.422**	0.044
P1920B-4.1	1167	2024	7.27E-05	23.71	0.074	**0.422**	0.148
P1920A-18.1	746	885	6.58E-05	18.70	0.03	**0.423**	0.051
P1920B-59.1	443	226	6.02E-05	14.96	0.03	**0.424**	0.066
P1920B-7.1	1189	1498	5.67E-05	3.79	0.018	**0.428**	0.036
P1920B-26.1	1238	2461	9.57E-05	39.32	0.052	**0.433**	0.104
P1920B-36.1	308	266	5.85E-05	6.34	0.034	**0.439**	0.068
P1920A-05.1	379	330	5.22E-05	-6.26	0.04	**0.443**	0.076
P1920B-45.1	3342	5000	5.95E-05	2.59	0.011	**0.444**	0.022
P1920B-19.2	451	457	5.55E-05	-1.45	0.03	**0.445**	0.063
P1920B-28.1	613	553	6.37E-05	11.75	0.025	**0.448**	0.051
P1920B-8.1	895	1141	6.17E-05	6.01	0.023	**0.450**	0.046
P1920B-38.1	403	380	5.93E-05	3.37	0.032	**0.453**	0.063
P1920B-60.1	2354	3156	6.79E-05	11.94	0.03	**0.460**	0.068
P1920B-31.1	2635	4626	6.26E-05	1.04	0.013	**0.464**	0.025
P1920A-24.2	4125	6489	6.53E-05	4.58	0.02	**0.471**	0.037
P1920B-32.1	1759	3273	9.57E-05	29.69	0.055	**0.496**	0.110
P1920B-58.1	234	141	6.64E-05	5.37	0.04	**0.498**	0.087
P1920A-16.1	925	987	6.81E-05	3.77	0.02	**0.504**	0.046
P1920A-21.1	904	819	7.15E-05	4.54	0.03	**0.526**	0.050
P1920B-33.1	3580	9212	9.05E-05	17.41	0.022	**0.527**	0.045
P1920B-2.1	1089	2049	7.36E-05	1.94	0.023	**0.527**	0.045
P1920B-19.1	2361	3622	7.34E-05	2.95	0.013	**0.530**	0.027
P1920B-6.2	138	87	1.22E-04	28.98	0.085	**0.652**	0.170
P1920B-48.1	2365	2955	1.04E-04	1.26	0.02	**0.739**	0.037

AV	**0.408**
MIN	**0.221**
MAX	**0.739**

Table A14.3: ***U-Pb ($^{206}Pb/^{238}U$ ages corrected for ^{207}Pb and initial ^{230}Th disequilibrium) for zircons from Whakamaru pumice sample P2058***

Spot name	ppm U	ppm Th	206/238	% comm 206	1σ error	230 corr. Age (Ma)	2σ error
P2058A-34	2064	2173	2.87E-04	87.12	0.19	**0.317**	0.100
P2058A-01	516	383	4.11E-05	10.74	0.10	**0.322**	0.043
P2058A-21	1393	1638	4.23E-05	9.27	0.01	**0.323**	0.030
P2058A-04	1026	655	7.10E-05	48.69	0.09	**0.323**	0.064
P2058A-18	945	855	9.76E-05	61.52	0.38	**0.324**	0.288
P2058A-14	1062	803	4.02E-05	4.51	0.08	**0.334**	0.033
P2058A-08	293	226	5.27E-05	26.33	0.07	**0.336**	0.067
P2058A-43	521	459	4.65E-05	13.09	0.02	**0.344**	0.051
P2058A-44	4667	7854	5.01E-05	13.04	0.01	**0.345**	0.019
P2058A--11	760	638	4.42E-05	7.64	0.02	**0.348**	0.038
P2058A-25	476	269	4.48E-05	10.27	0.03	**0.350**	0.054
P2058A-15	1592	2148	4.63E-05	6.84	0.01	**0.351**	0.029
P2058A-12	736	672	5.07E-05	16.87	0.12	**0.354**	0.038
P2058A-10	639	585	4.44E-05	2.96	0.10	**0.361**	0.044
P2058A-39	138	80	3.88E-05	-8.19	0.13	**0.361**	0.089
P2058A-35	1218	923	7.19E-05	40.05	0.08	**0.365**	0.049
P2058A-05	1272	1187	4.67E-05	4.88	0.02	**0.369**	0.034
P2058A-19	644	630	5.18E-05	13.24	0.10	**0.371**	0.046
P2058A-16	1317	2068	4.82E-05	1.19	0.02	**0.375**	0.032
P2058A-31	4214	5950	5.02E-05	5.95	0.03	**0.376**	0.020
P2058A-02	2156	2042	7.58E-05	39.78	0.09	**0.377**	0.034
P2058A-20	6049	8064	4.83E-05	2.38	0.01	**0.377**	0.015
P2058A-33	5677	14168	5.33E-05	1.86	0.01	**0.383**	0.016
P2058A-06	970	1333	6.18E-05	22.02	0.10	**0.383**	0.043
P2058A-23	258	201	6.92E-05	33.22	0.33	**0.385**	0.114
P2058A-38	3331	7708	5.46E-05	3.71	0.04	**0.389**	0.020
P2058A-41	4679	9762	5.57E-05	6.96	0.03	**0.389**	0.019
P2058A-24	1264	1341	5.04E-05	3.52	0.02	**0.394**	0.032
P2058A-28	2612	3785	5.21E-05	3.24	0.01	**0.396**	0.026
P2058A-27	1828	2283	5.18E-05	1.65	0.01	**0.405**	0.028
P2058A-03	1779	1644	5.37E-05	7.06	0.01	**0.406**	0.028
P2058A-13	1802	2528	1.77E-04	70.50	0.15	**0.409**	0.099
P2058A-17	4339	11811	5.92E-05	2.60	0.01	**0.412**	0.020
P2058A-37	908	670	5.54E-05	6.89	0.23	**0.421**	0.041
P2058A-42	1391	1648	5.47E-05	1.80	0.06	**0.424**	0.034
P2058A-22	681	694	5.66E-05	6.14	0.02	**0.424**	0.051
P2058A-26	5577	9387	6.68E-05	15.53	0.04	**0.430**	0.019
P2058A-32	3020	4981	5.97E-05	4.19	0.04	**0.436**	0.025
P2058A-36	10241	18084	6.01E-05	2.87	0.02	**0.440**	0.013
P2058A-30	550	620	5.86E-05	3.56	0.03	**0.444**	0.057
P2058A-40	5210	10471	6.29E-05	2.98	0.01	**0.452**	0.017

Spot name	ppm U	ppm Th	206/238	% comm 206	1σ error	230 corr. Age (Ma)	2σ error
P2058A-29	503	335	6.70E-05	2.83	0.03	**0.511**	0.065
P2058A-09	637	576	1.03E-04	23.66	0.23	**0.593**	0.346

AV	0.389
MIN	0.317
MAX	0.593

Table A14.4: ***Xenocrystic zircon U-Pb ages***

Spot name	U, ppm	Th, ppm	% comm 206	207corr $^{206}Pb/^{238}U$ Age (Ma)	1σ error
P1905A-8.1	1484	451	0.24	**158.7**	0.470
P1920B-29.1	1258	552	-0.03	**172.9**	0.5
P1920B-56.1	401	404	0.19	**341.1**	1.6
P1920B-18.1	201	76	0.71	**919.5**	5.0
P1920B-34.1	477	425	0.10	**210.9**	1.0

Table A15.1: ***Zircon trace elements, sample P1920***

Sample-crystal	P1920ATi-01.2	P1920ATi-01.3C	P1920ATi-02.2	P1920ATi-02.3C	P1920ATi-03.2	P1920ATi-04.2	P1920ATi-04.3	P1920ATi-5.2	P1920ATi-6.2	P1920ATi-6.3R	P1920ATi-7.2
Crystal zone	R	C	R	C	R	C	R	R		R	I
AGE	**0.402**		**0.344**		**0.365**	**0.394**		**0.443**	***High 204Pb***		**0.376**
1 sd (Ma)	0.061		0.034		0.038	0.047		0.076			0.03
Li	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.0	0.3	4.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
B	0.0	0.0	0.3	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.0
F	5	5	4	5	4	8	38	5	7	7	9
Na	1.5	1.9	**277**	1.8	1.5	1.9	9.4	1.3	2.1	1.9	1.8
Al	11	22	**3985**	13	10	7	86	13	13	21	12
P	253	312	406	278	534	595	367	558	1124	303	1204
K	0.2	0.3	**673**	0.3	0.2	0.2	4.6	0.2	0.3	0.3	0.3
Ca	1.2	1.2	**17**	1.2	1.2	1.1	8.6	0.9	1.2	1.2	1.4
Sc	57	84	78	78	127	141	65	98	163	63	255
Ti	4.6	6.9	11.2	5.6	5.4	11.8	4.8	4.0	5.3	4.7	8.3
Fe	3.1	3.3	7.4	2.7	2.8	3.0	3.2	2.6	3.2	3.3	3.2
Y	851	914	1564	737	2273	2186	1254	1976	2472	497	6193
Nb	3	1	7	3	12	9	6	4	7	1	63
La	0.000	0.007	0.189	0.000	0.005	0.003	0.021	0.011	0.005	0.005	0.014
Ce	16	8	25	15	68	40	31	24	31	6	204
Nd	0.3	0.8	0.8	0.4	1.2	1.3	0.7	1.3	1.0	0.1	3.7
Sm	1.13	2.28	2.00	1.12	3.98	4.49	1.89	3.49	3.89	0.52	13.02
Eu	0.257	0.817	0.633	0.370	0.799	1.138	0.381	0.989	0.775	0.167	1.322
Gd	12	19	23	16	46	51	23	33	42	7	132
Ho	34	39	60	44	90	88	48	73	98	20	251
Tb	5.9	7.0	9.5	7.3	17.1	19.6	9.3	12.5	17.6	3.2	49.8
Dy	72	85	129	102	213	223	109	155	221	44	601
Er	160	186	278	237	423	397	225	327	493	109	1148
Tm	39	40	69	57	94	83	53	75	110	26	251
Yb	356	355	638	516	822	688	457	664	972	250	2142
Lu	72	73	126	102	151	122	89	136	188	50	384
Hf	11255	9680	8628	10114	10428	9592	11535	10305	10551	10836	11239
Pb7/6	0.7778	0.6071	0.5263	1.3333	0.9565	0.6364	0.4800	1.4615	1.5000	0.9524	0.5000
Th	**182**	**84**	**274**	**180**	**1491**	**1302**	**745**	**305**	**499**	**51**	**4598**
U	**288**	**120**	**416**	**279**	**1245**	**881**	**672**	**442**	**704**	**130**	**3728**
Hf ppm	11255	9680	8628	10114	10428	9592	11535	10305	10551	10836	11239
Ferry	709	745	792	726	722	798	711	697	720	710	762

Sample-crystal	P1920ATi-7.3C	P1920ATi-8.2	P1920ATi-9.2R	P1920ATi-10.2	P1920ATi-10.3C	P1920ATi-11.2	P1920ATi-11.3R	P1920ATi-12.2	P1920ATi-13.2	P1920ATi-14.2	P1920ATi-15.2
Crystal zone	C	C	R	R	C	I	R	R			I
AGE		**0.342**	***High 204Pb***	**0.356**		**0.308**		**0.354**			**High 204Pb**
1 sd (Ma)		**0.041**		**0.04**		**0.063**		**0.029**			
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.0	0.0	0.0	1.0	0.6	0.0	0.0	0.1	0.0	0.1	1.0
B	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.0	0.1	0.0	0.1
F	6	10	7	9	11	17	46	11	8	10	13
Na	2.4	2.9	2.4	2.0	2.5	3.7	14.1	2.9	3.0	3.0	2.5
Al	13	11	12	12	128	18	43	9	28	20	9
P	705	522	269	798	1113	486	247	1060	878	306	581
K	0.3	0.4	0.3	0.3	10.7	0.5	4.0	0.4	0.9	0.4	0.4
Ca	1.4	1.6	1.7	1.3	1.6	2.8	6.0	1.5	1.3	1.6	1.1
Sc	97	102	56	191	305	107	69	82	131	78	133
Ti	2.5	3.7	4.6	6.2	5.8	4.0	7.0	11.2	5.2	6.5	2.7
Fe	2.8	3.2	3.1	2.8	3.1	3.2	3.3	3.5	3.1	3.1	3.3
Y	2020	1772	801	3881	3725	2160	643	5274	1699	938	3739
Nb	6	9	4	28	8	16	2	32	3	3	9
La	0.003	0.002	0.003	0.008	0.006	0.000	0.008	0.022	0.006	0.003	0.011
Ce	27	40	15	144	46	55	15	148	17	19	57
Nd	0.9	0.8	0.3	2.2	2.5	0.9	0.3	4.3	0.6	0.5	2.7
Sm	2.86	2.63	1.14	7.00	6.57	3.54	0.96	12.21	2.26	1.65	8.42
Eu	0.472	0.408	0.267	1.182	1.812	0.562	0.230	3.881	0.752	0.363	1.096
Gd	34	32	11	84	73	42	11	111	25	15	78
Ho	76	70	31	148	156	87	26	201	64	36	151
Tb	13.6	12.5	5.1	31.5	28.5	16.1	4.8	40.1	10.8	6.7	28.7
Dy	167	164	69	372	359	204	58	472	144	86	362
Er	364	348	160	688	750	412	123	963	320	184	691
Tm	81	78	38	150	168	92	28	219	77	41	149
Yb	710	683	362	1258	1477	790	258	1944	697	364	1274
Lu	136	130	71	228	281	149	50	370	140	72	234
Hf	11408	12598	10976	10511	9797	11400	10624	7763	9520	10398	11213
Pb7/6	0.8000	0.5333	0.7826	1.0400	1.0714	0.8235	0.8214	0.5897	0.7059	0.6800	0.5429
Th	**404**	**435**	**152**	**3449**	**1102**	**1336**	**107**	**3967**	**292**	**199**	**961**
U	**603**	**680**	**266**	**2160**	**1172**	**1243**	**178**	**2041**	**420**	**274**	**1076**
Hf ppm	**11408**	**12598**	**10976**	**10511**	**9797**	**11400**	**10624**	**7763**	**9520**	**10398**	**11213**
Ferry	**657**	**689**	**709**	**735**	**728**	**696**	**746**	**792**	**719**	**739**	**664**

Sample-crystal	P1920ATi-16.2	P1920ATi-16.3R	P1920ATi-17.2	P1920ATi-17.3C	P1920ATi-18.2	P1920ATi-18.3R	P1920ATi-20.2R	P1920ATi-21.2R	P1920ATi-21.3C	P1920ATi-22.2R	P1920ATi-23.2R
Crystal zone	I	R	R	C	I	R	R	R	C	R	R
AGE	**0.504**		**0.407**		**0.423**		**0.384**	**0.526**		**0.353**	**0.408**
1 sd (Ma)	**0.046**		**0.064**		**0.051**		**0.054**	**0.05**		**0.04**	**0.048**
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.0	0.0	0.6	0.2	0.1	0.0	0.2	0.0	0.0	0.7	0.0
B	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0
F	8	10	7	9	12	7	10	11	13	8	7
Na	2.8	3.3	5.7	2.6	2.2	2.2	2.4	2.9	3.2	2.2	2.5
Al	8	16	16	16	12	7	12	14	10	16	21
P	245	301	271	383	876	241	336	455	189	538	645
K	0.4	0.4	6.3	0.5	0.4	0.4	0.4	0.5	0.5	0.3	0.4
Ca	1.4	1.6	2.0	2.4	1.5	1.4	1.4	1.5	2.0	1.0	1.2
Sc	56	78	69	115	140	66	114	47	110	68	89
Ti	2.6	7.2	6.1	16.2	15.2	6.3	5.6	10.2	8.5	4.3	4.0
Fe	3.2	3.3	3.9	5.6	3.1	3.2	3.1	3.2	3.5	2.4	3.1
Y	1215	834	873	2007	3902	679	1324	1537	1478	1034	1141
Nb	4	3	3	7	20	2	5	5	1	2	3
La	0.009	0.003	0.056	0.239	0.011	0.000	0.004	0.003	0.043	0.003	0.000
Ce	19	16	16	33	109	13	21	34	24	15	15
Nd	0.7	0.4	0.4	1.4	3.2	0.3	0.4	1.3	2.3	0.3	0.4
Sm	2.16	1.47	1.31	2.66	10.09	1.05	1.32	3.01	5.19	1.24	1.49
Eu	0.382	0.374	0.357	1.190	2.438	0.255	0.389	0.486	4.719	0.283	0.357
Gd	25	15	15	35	93	12	16	30	41	16	18
Ho	53	33	34	74	156	26	44	56	57	38	44
Tb	10.3	6.0	5.7	12.8	33.3	4.5	6.8	11.5	13.3	6.4	7.3
Dy	131	77	76	161	378	58	83	135	141	79	98
Er	271	167	173	347	713	129	191	279	268	184	229
Tm	61	37	41	81	156	30	44	64	64	44	53
Yb	558	321	372	720	1363	278	405	568	586	412	482
Lu	105	63	76	146	250	56	77	106	122	80	97
Hf	11335	10402	11010	9666	8428	10447	10992	11580	5327	10712	10494
Pb7/6	1.2609	1.0870	0.8529	0.8065	0.5833	0.5217	0.5946	0.6857	0.7308	0.6667	0.7200
Th	**344**	**158**	**173**	**322**	**3532**	**96**	**139**	**1620**	**1220**	**173**	**197**
U	**452**	**228**	**232**	**343**	**1934**	**171**	**241**	**1342**	**737**	**301**	**337**
Hf ppm	**11335**	**10402**	**11010**	**9666**	**8428**	**10447**	**10992**	**11580**	**5327**	**10712**	**10494**
Ferry	**661**	**749**	**732**	**831**	**824**	**736**	**726**	**783**	**764**	**703**	**696**

Sample-crystal	P1920ATi-24.3R	P1920ATi-24.4C	P1920ATi-25.2R	P1920ATi-26.2R	P1920ATi-26.3C	P1920BTi-1.3C	P1920BTi-1.4R	P1920BTi-02.2C	P1920BTi-02.3R	P1920BTi-03.3R	P1920BTi-04.3R
Crystal zone	R	C	R	R	C	C	R	C	R	R	R
AGE	**0.394**	**0.471**	**0.4**	**0.379**		**0.422**	**0.363**	**0.527**		**0.362**	**0.359**
1 sd (Ma)	0.052	0.037	0.041	0.053		0.044	0.126	0.045		0.051	0.041
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.7	0.0	0.0	0.0
B	0.1	0.0	0.0	0.3	0.2	0.1	0.0	0.1	0.0	0.0	0.0
F	8	25	9	9	14	10	70	24	8	7	9
Na	2.5	4.5	2.6	2.7	7.0	2.2	3.9	5.7	2.9	2.5	2.7
Al	13	37	12	9	70	10	8	59	14	12	11
P	418	2196	256	296	527	847	541	965	204	337	304
K	0.3	9.6	0.4	0.5	9.2	0.4	0.4	6.3	0.4	0.3	0.4
Ca	1.6	2.4	1.6	1.2	2.5	1.3	**299**	1.9	1.4	1.3	1.2
Sc	89	344	53	96	104	190	86	95	58	60	78
Ti	3.6	7.4	2.5	3.6	16.7	7.7	5.6	10.6	4.2	6.0	7.4
Fe	3.3	4.0	3.0	2.9	3.7	2.9	2.0	4.0	2.8	2.7	2.7
Y	1610	9214	994	1578	2534	3897	1301	6695	589	1000	902
Nb	10	34	3	8	3	21	7	13	2	3	4
La	0.003	0.033	0.005	0.002	0.040	0.013	1.472	0.055	0.003	0.003	0.003
Ce	40	226	13	32	26	85	34	124	9	21	19
Nd	0.7	4.6	0.5	0.5	3.2	2.2	2.5	9.5	0.3	0.5	0.5
Sm	2.49	14.22	1.45	1.87	6.63	7.20	2.24	20.86	0.69	1.53	1.38
Eu	0.517	1.867	0.305	0.397	2.575	1.422	0.469	6.249	0.190	0.452	0.338
Gd	28	159	16	26	62	80	23	175	7	18	16
Ho	62	355	37	65	103	154	49	266	22	40	35
Tb	11.5	64.1	6.7	10.8	22.4	29.8	8.7	61.4	3.5	7.3	6.5
Dy	146	812	85	132	263	356	114	674	48	88	79
Er	311	1728	186	292	473	685	238	1208	112	193	178
Tm	70	387	43	67	103	149	54	259	28	44	40
Yb	633	3381	387	587	889	1237	478	2196	248	388	347
Lu	122	619	74	113	165	227	93	392	52	77	70
Hf	11402	9441	11004	11378	8997	9539	10684	8821	10837	10409	10254
Pb7/6	0.4857	0.4603	1.1818	0.8710	0.9643	0.5588	1.1429	0.4286	1.2308	0.8065	0.6316
Th	**599**	**5993**	**124**	**302**	**278**	**1331**	**452**	**2518**	**63**	**466**	**287**
U	**783**	**4427**	**219**	**455**	**280**	**1434**	**556**	**1293**	**132**	**473**	**320**
Hf ppm	**11402**	**9441**	**11004**	**11378**	**8997**	**9539**	**10684**	**8821**	**10837**	**10409**	**10254**
Ferry	**687**	**751**	**659**	**687**	**835**	**755**	**725**	**786**	**701**	**731**	**751**

Sample-crystal	P1920BTi-04.4I	P1920BTi-6.3R	P1920BTi-6.4C	P1920BTi-07.2	P1920BTi-08.2	P1920BTi-09.2	P1920BTi-10.2C	P1920BTi-10.3R	P1920BTi-11.2C	P1920BTi-13.3R	P1920BTi-13.2C
Crystal zone	I	R	C	R	I	I	C	R	C	R	C
AGE	**0.422**	**0.343**	**0.652**	**0.428**	**0.45**	**0.347**	**0.389**		**high 204 Pb**	**high 204 Pb**	
1 sd (Ma)	0.148	0.066	0.17	0.036	0.046	0.072	0.119				
Li	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Be	0.3	0.0	0.0	0.0	0.0	2.0	0.0	0.0	4.1	0.0	0.1
B	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1
F	11	8	10	10	11	8	12	8	10	8	15
Na	2.6	2.8	3.1	2.3	2.7	2.7	**237**	2.8	2.8	2.2	3.3
Al	12	12	12	10	17	13	**2490**	27	21	14	38
P	1489	296	367	309	757	350	674	467	337	363	1039
K	0.3	0.5	0.5	0.4	0.3	0.4	**481**	0.4	2.8	0.3	0.7
Ca	1.3	1.2	1.6	1.1	1.4	1.3	10.8	1.7	1.1	1.7	2.7
Sc	199	63	137	107	141	91	133	69	52	71	167
Ti	10.1	5.7	9.4	6.4	8.1	7.0	9.7	5.9	3.2	3.1	9.8
Fe	2.7	2.7	3.0	2.6	2.5	2.7	4.0	3.1	2.6	3.1	2.9
Y	6896	872	925	1064	2360	1367	2238	835	1119	1271	5726
Nb	17	3	3	4	7	4	10	2	7	6	12
La	0.045	0.006	0.000	0.006	0.007	0.013	0.090	0.064	0.015	0.008	0.047
Ce	105	18	12	17	31	25	49	10	22	27	66
Nd	8.6	0.4	0.5	0.4	1.3	1.0	1.2	0.3	0.5	0.6	6.8
Sm	19.20	1.39	1.68	1.36	3.74	2.56	3.90	1.07	1.58	1.74	15.47
Eu	3.811	0.329	0.465	0.368	1.386	0.559	0.842	0.242	0.331	0.208	4.170
Gd	162	14	17	16	48	28	44	12	16	19	134
Ho	273	33	39	40	97	55	90	31	44	50	240
Tb	58.8	6.1	6.8	6.3	17.8	10.1	16.8	4.9	7.4	8.9	50.0
Dy	675	81	85	85	224	126	211	64	94	115	588
Er	1226	165	187	195	450	259	416	155	215	246	1161
Tm	265	40	41	46	100	58	90	38	51	56	259
Yb	2228	348	347	427	866	498	770	357	467	518	2252
Lu	402	69	68	88	170	97	146	73	90	94	429
Hf	8192	10614	10130	10431	9012	10089	10268	10706	11069	11966	8491
Pb7/6	0.7391	0.5357	0.8000	0.5172	1.0952	0.5217	0.5625	0.6522	0.6429	0.7273	0.9655
Th	**1736**	**270**	**140**	**132**	**528**	**266**	**1031**	**110**	**339**	**359**	**2035**
U	**1276**	**327**	**191**	**229**	**561**	**331**	**915**	**224**	**543**	**585**	**1873**
Hf ppm	**8192**	**10614**	**10130**	**10431**	**9012**	**10089**	**10268**	**10706**	**11069**	**11966**	**8491**
Ferry	**781**	**727**	**775**	**738**	**760**	**746**	**777**	**730**	**678**	**676**	**778**

Sample-crystal	P1920BTi-12.2I	P1920BTi-12.3R	P1920BTi-14.2C	P1920BTi-15.2I	P1920BTi-16.2I	P1920BTi-17.2C	P1920BTi-17.3R	P1920BTi-19.3C	P1920BTi-19.4R	P1920BTi-21.2	P1920BTi-22.2
Crystal zone	I	R	C	I	I	C	R	C	R	C	R
AGE	**0.379**		**0.385**	**0.359**	**0.409**	**0.388**		**0.445**		**0.405**	**0.349**
1 sd (Ma)	**0.045**		**0.07**	**0.026**	**0.028**	**0.054**		**0.063**		**0.053**	**0.032**
Li	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Be	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
F	11	10	8	8	10	9	8	7	8	6	8
Na	2.6	2.8	2.5	2.4	2.9	6.8	2.9	2.7	2.4	2.1	1.9
Al	12	12	26	14	12	23	14	18	9	15	12
P	409	275	460	624	760	364	303	489	239	293	492
K	0.4	0.4	0.3	0.3	0.4	8.1	0.4	0.5	0.4	0.3	0.3
Ca	1.3	1.3	1.4	1.2	1.6	2.1	1.5	1.5	1.4	1.3	1.2
Sc	78	68	107	97	164	68	76	67	45	67	141
Ti	4.6	6.1	6.2	10.9	6.7	6.7	6.7	4.2	4.4	5.0	5.3
Fe	2.7	2.8	2.9	2.7	3.3	3.7	2.9	3.3	2.9	3.0	2.9
Y	1277	748	1009	3316	3147	1205	878	829	653	1234	1889
Nb	6	2	3	15	20	4	4	2	3	2	11
La	0.000	0.003	0.003	0.007	0.007	0.026	0.001	0.004	0.000	0.003	0.003
Ce	27	15	12	83	81	26	21	10	13	15	36
Nd	0.6	0.4	0.4	2.0	1.6	0.6	0.5	0.3	0.3	0.6	0.6
Sm	2.02	1.17	1.39	6.69	5.55	1.95	1.66	1.22	0.96	1.80	2.67
Eu	0.366	0.339	0.446	2.371	1.132	0.501	0.398	0.268	0.238	0.443	0.553
Gd	22	13	15	68	63	23	17	13	10	22	29
Ho	50	30	36	128	124	46	38	32	26	46	74
Tb	9.2	5.1	5.7	25.5	25.0	8.8	6.7	5.4	4.3	8.2	12.6
Dy	124	66	78	296	297	109	86	70	57	102	159
Er	245	143	193	610	568	229	178	161	126	219	368
Tm	53	33	46	142	121	51	40	38	30	47	82
Yb	463	301	420	1300	1005	467	357	356	270	431	739
Lu	87	59	88	255	188	92	69	70	55	86	140
Hf	11540	10720	9510	8757	10734	10659	10673	10700	11104	10654	11171
Pb7/6	1.1000	0.9600	0.9600	0.8000	0.5946	0.5652	0.8333	0.7059	0.7273	0.8519	1.2273
Th	**490**	**138**	**98**	**1931**	**2358**	**469**	**387**	**134**	**186**	**155**	**395**
U	**604**	**211**	**191**	**1626**	**1683**	**467**	**349**	**244**	**269**	**233**	**615**
Hf ppm	**11540**	**10720**	**9510**	**8757**	**10734**	**10659**	**10673**	**10700**	**11104**	**10654**	**11171**
Ferry	**708**	**733**	**734**	**790**	**741**	**741**	**742**	**700**	**705**	**715**	**720**

Sample-crystal	P1920BTi-23.2C	P1920BTi-23.3R	P1920BTi-24.2C	P1920BTi-24.3R	P1920BTi-25.2C	P1920BTi-27.2C	P1920BTi-26.2C	P1920BTi-26.3R	P1920BTi-28.2C	P1920BTi-28.3R	P1920BTi-39.2
Crystal zone	C	R	C	R	C	C	C	R	C	R	C
AGE	**0.393**		**0.363**		**0.387**	**0.358**	**0.433**		**0.448**		**0.381**
1 sd (Ma)	**0.03**		**0.097**		**0.036**	**0.03**	**0.104**		**0.051**		**0.03**
Li	0.0	0.0	8.5	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
Be	0.1	0.0	0.0	0.0	0.0	0.0	3.0	0.1	0.0	0.0	0.5
B	0.0	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
F	10	8	9	8	12	8	38	5	7	8	10
Na	2.4	2.1	**384**	2.6	1.9	3.4	**543**	2.0	2.7	3.0	2.3
Al	11	9	**4985**	11	9	33	**4555**	10	11	13	5
P	1179	233	146	388	1230	1369	2037	229	310	239	261
K	0.3	0.4	**996**	0.4	0.2	1.0	**891**	0.3	0.4	0.6	0.4
Ca	1.3	1.0	15.1	1.3	1.1	1.3	25.8	1.1	1.3	1.8	1.4
Sc	140	60	27	133	146	235	207	57	60	67	58
Ti	7.7	4.5	6.2	6.6	7.8	7.1	15.1	5.8	5.4	6.8	4.4
Fe	3.1	2.5	5.4	2.8	2.6	2.6	4.4	2.3	2.8	3.2	3.0
Y	5921	730	326	1531	7833	4637	12737	554	972	638	1448
Nb	13	3	1	8	16	11	39	3	5	2	2
La	0.018	0.004	0.020	0.001	0.063	0.022	0.207	0.003	0.004	0.001	0.003
Ce	79	12	6	25	115	66	263	12	21	14	20
Nd	5.9	0.3	0.2	0.5	11.6	3.8	11.2	0.2	0.4	0.3	1.0
Sm	13.73	0.94	0.43	1.83	23.68	9.20	27.41	0.92	1.71	1.14	2.87
Eu	3.082	0.213	0.104	0.469	6.285	2.113	5.567	0.196	0.357	0.244	0.732
Gd	124	11	4	22	204	91	278	10	21	10	31
Ho	222	28	12	56	309	173	501	22	39	26	57
Tb	44.2	4.6	1.8	9.3	66.0	33.0	99.6	3.8	7.4	4.6	11.3
Dy	525	60	25	126	761	406	1188	48	96	56	136
Er	1014	145	62	295	1362	799	2129	111	193	123	265
Tm	224	35	15	70	291	177	438	26	44	29	59
Yb	1928	328	152	626	2406	1526	3512	238	390	257	510
Lu	353	66	32	125	436	284	614	48	74	50	99
Hf	8570	10813	11659	10406	8503	10011	7942	10792	10939	10498	10179
Pb7/6	0.7586	0.9565	0.7692	0.5333	0.9091	0.4500	0.4902	1.0476	0.7083	0.6250	0.9565
Th	**1361**	**91**	**38**	**246**	**2000**	**1110**	**6811**	**88**	**503**	**107**	**200**
U	**1289**	**197**	**93**	**400**	**1502**	**1192**	**3097**	**155**	**461**	**167**	**242**
Hf ppm	**8570**	**10813**	**11659**	**10406**	**8503**	**10011**	**7942**	**10792**	**10939**	**10498**	**10179**
Ferry	**754**	**706**	**735**	**741**	**756**	**747**	**824**	**729**	**721**	**743**	**703**

Sample-crystal	P1920BTi-30.2	P1920BTi-31.2	P1920BTi-31.3R	P1920BTi-32.2	P1920BTi-33.3	P1920BTi-33.4R	P1920BTi-36.2	P1920BTi-37.2	P1920BTi-38.2C	P1920BTi-38.3R	P1920BTi-40.2
Crystal zone	R	C	R	I	C	R	C	C	C	R	C
AGE	**0.378**	**0.464**		**0.496**	**0.527**	**0.405**	**0.439**	**0.367**	**0.453**		**high 204 Pb**
1 sd (Ma)	0.016	0.025		0.11	0.045	0.022	0.068	0.064	0.063		
Li	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.2	4.6	0.0	**46**	0.2	0.1	0.1	0.0	0.1	0.0	0.0
B	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
F	11	12	8	28	8	10	7	8	11	7	6
Na	2.5	**56**	3.0	**13**	3.2	3.3	2.3	2.4	2.4	2.7	1.9
Al	10	**462**	22	**129**	18	13	9	7	10	10	5
P	1256	1014	281	2753	458	532	493	317	410	264	733
K	0.3	**46**	0.4	**14**	0.7	0.4	0.3	0.4	0.3	0.4	0.3
Ca	1.3	3.0	1.7	1.9	1.6	1.6	1.0	1.1	1.4	1.2	0.9
Sc	371	143	65	431	58	74	202	68	66	86	180
Ti	8.4	12.0	5.9	10.6	4.8	6.7	13.2	3.6	6.8	6.0	4.3
Fe	2.9	2.6	2.3	5.7	3.2	3.0	2.6	2.7	2.7	2.5	1.9
Y	7183	6227	787	12474	1695	2113	2801	835	3369	740	3713
Nb	72	29	3	32	9	33	5	4	4	3	30
La	0.010	0.046	0.009	0.046	0.046	0.012	0.008	0.003	0.015	0.003	0.004
Ce	299	168	17	270	47	35	26	15	29	12	132
Nd	3.9	8.5	0.4	12.7	1.5	0.8	2.2	0.4	4.8	0.2	2.0
Sm	13.91	18.61	1.17	33.53	3.71	3.57	6.22	1.13	11.34	0.85	6.91
Eu	2.242	3.750	0.309	6.262	0.250	0.215	2.628	0.220	2.065	0.209	1.024
Gd	154	152	13	322	37	46	61	14	97	12	81
Ho	289	250	30	476	68	92	118	32	145	29	161
Tb	57.9	54.5	5.3	107.4	13.3	19.9	22.3	5.3	32.7	4.8	33.3
Dy	696	627	69	1218	160	248	272	71	368	63	388
Er	1333	1143	149	2019	300	468	516	167	609	145	734
Tm	286	247	34	405	66	101	112	39	126	35	159
Yb	2426	2064	304	3192	547	901	959	364	983	320	1372
Lu	432	369	60	551	104	154	180	75	172	65	244
Hf	10915	8492	10316	9334	11517	12077	8735	12000	9972	10199	10798
Pb7/6	0.5000	0.4571	0.1053	0.3824	0.6563	0.8387	1.0000	0.8333	0.8235	0.8182	0.5000
Th	**4559**	**6441**	**181**	**5542**	**1238**	**3005**	**290**	**202**	**566**	**79**	**3844**
U	**3528**	**3297**	**242**	**2725**	**880**	**2217**	**318**	**355**	**464**	**152**	**2639**
Hf ppm	**10915**	**8492**	**10316**	**9334**	**11517**	**12077**	**8735**	**12000**	**9972**	**10199**	**10798**
Ferry	**764**	**799**	**730**	**786**	**712**	**742**	**809**	**688**	**743**	**731**	**702**

Sample-crystal	P1920BTi-42.2	P1920BTi-42.3R	P1920BTi-46.2	P1920BTi-46.3C	P1920BTi-47.2I	P1920BTi-47.3R	P1920BTi-48.2	P1920BTi-49.2R	P1920BTi-49.3C	P1920BTi-50.2	P1920BTi-51.2I
Crystal zone	I	R	R	C	I	R	C	R	C	R	I
AGE	**0.385**		**0.39**			**0.389**	**0.739**	**0.407**		**0.394**	
1 sd (Ma)	**0.052**		**0.029**			**0.032**	**0.037**	**0.032**		**0.023**	
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1
Be	0.0	0.0	0.0	0.2	1.8	0.1	0.1	0.0	0.0	1.7	0.0
B	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1
F	6	5	9	15	7	6	16	8	11	17	11
Na	2.0	2.0	2.7	4.1	2.4	2.2	**39**	2.3	2.5	2.8	7.5
Al	5	6	13	19	12	10	**450**	15	12	13	34
P	384	219	498	1554	826	150	1287	120	510	971	939
K	0.3	0.3	0.4	0.8	0.4	0.4	**89**	0.3	0.4	2.2	1.2
Ca	1.0	0.9	1.6	1.8	1.3	1.0	2.2	1.3	1.5	1.7	2.1
Sc	127	59	84	235	176	30	240	26	80	274	144
Ti	7.5	6.0	3.0	6.7	2.8	3.4	4.0	3.7	8.1	9.8	5.0
Fe	2.3	2.2	2.8	2.9	3.0	2.6	3.0	3.0	3.1	3.2	3.8
Y	1525	585	1766	5351	2532	346	5685	260	3794	6724	3123
Nb	5	3	10	39	14	2	51	1	3	76	17
La	0.006	0.003	0.000	0.010	0.004	0.001	0.015	0.004	0.015	0.008	0.030
Ce	22	13	41	120	41	6	214	6	35	322	66
Nd	0.6	0.3	0.8	2.8	0.6	0.1	2.7	0.1	4.2	5.2	1.3
Sm	1.82	0.87	2.65	9.23	2.78	0.41	9.82	0.27	10.66	17.29	4.91
Eu	0.586	0.207	0.401	1.047	0.532	0.058	0.927	0.077	2.741	2.529	0.651
Gd	21	9	30	105	36	4	115	3	103	173	57
Ho	59	22	70	210	102	12	228	9	165	280	124
Tb	8.9	3.8	13.1	42.4	16.1	1.9	46.0	1.4	37.0	62.7	23.6
Dy	118	52	164	529	217	28	552	22	427	712	297
Er	299	112	343	1038	479	65	1055	56	740	1240	583
Tm	72	26	77	228	112	17	230	13	151	261	128
Yb	675	235	661	1966	995	161	1927	123	1214	2163	1085
Lu	140	47	124	351	192	33	342	26	215	373	198
Hf	9792	10408	12234	11400	11790	11636	12714	11584	9238	10684	12448
Pb7/6	0.8750	0.4500	0.6207	0.6585	1.3750	0.6087	0.1912	0.8276	0.6786	0.3800	0.6667
Th	**215**	**92**	**899**	**3179**	**474**	**38**	**5253**	**31**	**446**	**9211**	**2181**
U	**364**	**160**	**1121**	**2688**	**763**	**99**	**3814**	**78**	**427**	**4376**	**2211**
Hf ppm	**9792**	**10408**	**12234**	**11400**	**11790**	**11636**	**12714**	**11584**	**9238**	**10684**	**12448**
Ferry	**753**	**732**	**672**	**742**	**665**	**682**	**696**	**688**	**760**	**778**	**715**

Sample-crystal	P1920BTi-51.3R	P1920BTi-52.2I	P1920BTi-53.2	P1920BTi-55.2	P1920BTi-54.2	P1920BTi-57.2	P1920BTi-58.2	P1920BTi-59.2	P1920BTi-60.2
Crystal zone	R	I	R	I		I	C	C	C
AGE	**0.367**	**0.384**	**0.386**	**0.395**		**0.398**	**0.498**	**0.424**	**0.46**
1 sd (Ma)	**0.033**	**0.063**	**0.076**	**0.062**		**0.071**	**0.087**	**0.066**	**0.066**
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2
B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
F	9	44	11	14	10	11	7	8	12
Na	3.0	2.7	2.1	3.1	2.7	3.1	2.6	2.8	2.5
Al	15	33	12	8	21	12	10	12	11
P	226	279	1629	478	662	448	270	451	1542
K	0.4	0.4	0.3	0.4	0.4	0.5	0.4	0.5	0.4
Ca	1.5	2.6	1.5	1.5	1.6	1.4	1.3	1.4	1.2
Sc	58	79	314	158	100	136	67	151	268
Ti	5.9	4.2	13.7	6.1	3.6	9.1	4.3	6.2	9.2
Fe	3.2	3.0	3.0	3.2	3.6	2.9	2.7	2.7	6.1
Y	622	928	5701	2350	1142	1851	1406	1823	6011
Nb	2	4	15	14	3	8	3	10	35
La	0.003	0.010	0.017	0.023	0.004	0.003	0.003	0.004	0.027
Ce	12	15	60	44	12	28	16	29	145
Nd	0.3	0.3	3.6	0.8	0.3	0.8	0.9	0.7	3.9
Sm	0.93	1.26	9.90	2.37	1.52	2.59	2.75	2.12	12.59
Eu	0.199	0.281	3.739	0.643	0.346	0.872	0.523	0.486	2.095
Gd	9	14	98	33	16	32	27	25	131
Ho	23	36	213	93	46	75	56	72	239
Tb	4.3	5.6	37.5	14.7	7.4	13.2	10.2	10.9	49.4
Dy	56	73	475	193	98	171	129	150	594
Er	119	181	1057	453	231	375	267	361	1106
Tm	27	44	245	106	54	86	61	87	237
Yb	253	411	2239	949	483	748	544	784	2000
Lu	50	84	437	184	96	147	108	157	362
Hf	10925	10639	7948	10681	10610	9148	10673	10735	10374
Pb7/6	0.6286	0.5806	1.1000	0.8333	1.1212	0.6296	1.6429	0.3704	0.4516
Th	**100**	**126**	**878**	**610**	**174**	**476**	**220**	**299**	**3179**
U	**178**	**241**	**713**	**842**	**331**	**505**	**332**	**522**	**2640**
Hf ppm	**10925**	**10639**	**7948**	**10681**	**10610**	**9148**	**10673**	**10735**	**10374**
Ferry	**729**	**701**	**813**	**733**	**688**	**771**	**703**	**734**	**772**

Table A15.2: Zircon trace elements, sample P1905

Sample-crystal	P1905ATi-1.2	P1905ATi-26.3C	P1905ATi-26.4R	P1905ATi-28.2R	P1905ATi-28.3C	P1905ATi-27.2R	P1905ATi-27.3C	P1905ATi-2.2C	P1905ATi-2.3R	P1905ATi-3.2C	P1905ATi-3.3R	P1905ATi-29.2I	P1905ATi-29.3R
Crystal zone	R	C	R	R	C	R	C	C	R	C	R	I	R
AGE	**0.405**	**0.472**	**High Pb204**	**0.375**		**0.392**			**0.485**		**High Pb204**		**0.417**
1 sd (Ma)	**0.031**	**0.038**		**0.033**		**0.078**			**0.071**				**0.038**
Li	0.0	0.0	0.0	1.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.4	0.0	6.2	0.0
B	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1
F	6	9	6	11	11	7	10	35	15	12	7	9	7
Na	2.1	3.6	2.5	**119**	**137**	2.5	15.7	2.4	5.6	4.6	2.7	7.4	2.5
Al	13	16	12	**642**	**1419**	11	119	9	22	55	11	30	8
P	361	479	301	853	646	252	459	1831	191	1069	504	483	346
K	0.3	10.9	0.4	8.2	**175**	0.4	**15**	0.4	1.8	2.5	0.4	4.7	0.4
Ca	1.5	1.8	1.4	1.9	12.9	1.2	1.8	1.8	3.3	2.4	1.5	1.4	1.2
Sc	103	113	73	151	131	56	91	259	56	167	185	193	81
Ti	5.3	5.3	6.3	5.3	13.8	4.1	5.6	6.3	4.5	15.7	5.7	5.8	5.8
Fe	3.2	3.1	2.5	3.1	5.8	2.8	3.1	3.2	2.7	3.0	2.7	2.9	2.8
Y	1112	1808	880	2057	1924	787	1888	12538	607	6400	2514	2051	1160
Nb	4	9	3	8	9	2	11	32	2	55	13	11	6
La	0.000	0.019	0.000	0.021	0.204	0.005	0.019	0.088	0.004	0.031	0.003	0.002	0.004
Ce	15	38	19	31	34	13	54	363	11	238	54	33	28
Nd	0.3	0.7	0.3	0.8	1.0	0.4	1.6	16.6	0.3	6.0	0.8	0.9	0.7
Sm	1.27	2.68	1.54	2.65	2.54	1.17	4.74	39.06	0.68	17.93	2.90	2.60	1.80
Eu	0.416	0.537	0.315	0.583	0.515	0.308	0.773	4.142	0.234	3.943	0.653	0.599	0.352
Gd	15	31	15	30	28	13	43	335	10	156	39	27	21
Ho	39	69	35	78	73	31	76	521	24	258	96	76	46
Tb	6.2	11.6	6.0	13.0	12.4	4.7	15.9	117.2	4.0	56.2	15.0	11.7	8.6
Dy	88	153	77	167	164	62	189	1317	51	627	206	160	109
Er	208	338	153	378	366	149	350	2253	113	1112	459	388	228
Tm	48	78	37	89	83	34	74	466	27	232	104	91	50
Yb	450	686	326	766	719	310	627	3842	248	1870	911	831	462
Lu	89	132	65	152	136	63	116	665	52	324	178	167	86
Hf	10687	10327	10175	9913	10966	10244	10539	10527	10736	8681	9870	10580	10772
Pb7/6	0.7750	0.4634	0.5862	0.9231	0.7353	0.8000	0.5500	0.4815	0.7188	0.4000	0.5806	1.2121	1.0800
Th	**125**	**861**	**287**	**431**	**377**	**163**	**1686**	**5369**	**95**	**6028**	**431**	**308**	**419**
U	**231**	**757**	**320**	**617**	**562**	**260**	**982**	**3468**	**175**	**2784**	**613**	**553**	**487**
Hf ppm	10687	10327	10175	9913	10966	10244	10539	10527	10736	8681	9870	10580	10772
Ferry	**721**	**720**	**736**	**720**	**814**	**698**	**726**	**736**	**707**	**828**	**728**	**729**	**729**

Sample-crystal	P1905ATi-4.2C	P1905ATi-4.3R	P1905ATi-30.2I	P1905ATi-30.3C	P1905ATi-30.4R	P1905ATi-5.2I	P1905ATi-5.3R	P1905ATi-31.2R	P1905ATi-31.3C	P1905ATi-6.2C	P1905ATi-6.3R	P1905ATi-7.2I	P1905ATi-7.3R
Crystal zone	**C**	**R**	**I**	**C**	**R**	**I**	**R**	**R**	**C**	**C**	**R**	**I**	**R**
AGE	**0.342**				**0.33**	**0.412**		**0.33**		**0.362**		**0.382**	
1 sd (Ma)	**0.044**				**0.022**	**0.041**		**0.067**		**0.033**		**0.042**	
Li	0.0	0.0	0.0	0.6	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.1	0.0	0.1	0.0	0.0	0.0	0.0	2.3	2.9	0.1	0.0	6.6	0.0
B	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0
F	8	7	13	9	11	10	**895**	81	7	11	7	11	8
Na	2.0	2.1	2.4	**41**	**34**	6.8	23.3	4.3	2.3	3.2	2.5	2.4	3.4
Al	10	6	12	**682**	**315**	41	19	30	9	47	9	10	36
P	476	370	552	213	249	619	2465	420	1143	942	298	463	296
K	0.2	0.3	0.4	**140**	**50**	1.5	1.6	0.8	0.4	4.4	0.3	0.3	2.1
Ca	1.1	1.0	1.5	4.1	2.9	1.5	**2054**	1.8	1.2	2.8	1.4	1.2	2.8
Sc	157	105	122	55	73	100	66	98	199	153	76	115	72
Ti	3.2	5.7	4.2	15.0	8.8	7.2	6.7	7.1	11.4	12.0	5.9	4.9	6.5
Fe	2.7	3.0	2.4	9.6	3.1	2.8	4.2	2.6	2.4	3.0	2.4	2.8	2.6
Y	2225	1341	3777	1248	707	1758	660	1427	4404	3271	843	2521	900
Nb	18	6	12	2	3	6	2	7	9	12	3	4	3
La	0.001	0.001	0.007	0.034	0.020	0.075	9.648	0.040	0.009	1.394	0.001	0.007	0.012
Ce	43	25	62	15	16	32	46	32	56	89	18	30	18
Nd	0.6	0.6	2.9	0.8	0.4	1.5	10.2	0.8	2.4	8.9	0.4	2.1	0.5
Sm	2.55	1.97	8.54	2.37	1.24	3.39	3.09	2.44	7.73	8.38	1.27	5.51	1.59
Eu	0.310	0.451	1.066	0.743	0.294	0.567	0.497	0.574	2.983	0.998	0.307	1.139	0.355
Gd	30	22	77	24	12	33	15	25	90	62	15	48	16
Ho	85	53	151	48	27	76	26	55	172	122	33	87	34
Tb	12.9	9.0	26.3	9.3	4.7	12.8	5.1	10.5	32.7	22.3	5.8	17.3	6.1
Dy	178	119	314	108	60	160	63	125	403	273	71	200	79
Er	414	266	598	229	130	340	133	260	775	561	156	393	169
Tm	98	62	129	54	29	80	30	59	168	126	36	85	39
Yb	887	577	1083	470	269	711	268	509	1424	1095	315	724	365
Lu	174	110	198	95	53	142	53	102	266	207	64	136	71
Hf	11630	10135	10548	9643	10159	10525	10428	10064	8528	9871	10468	10406	10131
Pb7/6	0.6452	0.6250	0.6667	0.6857	0.7037	0.6500	0.8846	0.8387	1.1176	0.6023	0.3636	0.8857	0.6970
Th	**381**	**301**	**785**	**175**	**115**	**488**	**135**	**455**	**804**	**1326**	**231**	**334**	**216**
U	**738**	**415**	**825**	**249**	**183**	**569**	**193**	**514**	**738**	**1319**	**275**	**393**	**284**
Hf ppm	11630	10135	10548	9643	10159	10525	10428	10064	8528	9871	10468	10406	10131
Ferry	**678**	**727**	**700**	**823**	**768**	**749**	**742**	**748**	**794**	**799**	**731**	**714**	**739**

Sample-crystal	P1905ATi-32.2	P1905ATi-10.3C	P1905ATi-10.4I	P1905ATi-33.2R	P1905ATi-33.3C	P1905ATi-11.3R	P1905ATi-11.4C	P1905ATi-12.2C	P1905ATi-12.3R	P1905ATi-36.2C	P1905ATi-36.3R	P1905ATi-38.2R	P1905ATi-38.3C
Crystal zone	R	C	I	R	C	R	C	C	R	C	R	R	C
AGE	**0.379**	**0.413**	**0.387**	**0.341**		**0.379**	**0.371**	**0.416**			**0.397**	**0.364**	
1 sd (Ma)	0.052	0.029	0.034	0.037		0.022	0.03	0.024			0.028	0.032	
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Be	0.0	1.1	5.3	1.0	2.2	2.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
B	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
F	11	8	9	11	11	11	10	15	7	8	9	7	8
Na	2.3	2.7	2.5	5.3	4.9	2.5	2.7	**67**	2.8	2.4	2.6	2.1	2.1
Al	10	12	10	76	53	15	11	**507**	9	19	12	9	13
P	449	383	529	523	942	900	830	2462	222	689	490	595	172
K	0.3	0.4	0.3	1.2	3.7	1.2	0.5	**79**	0.4	0.4	0.4	0.4	0.3
Ca	1.3	1.4	1.3	5.3	1.9	1.9	1.5	3.9	1.3	1.4	1.3	1.5	1.2
Sc	102	73	110	124	200	174	133	284	54	98	168	142	38
Ti	4.6	6.0	6.1	4.0	7.9	3.7	10.2	5.6	5.5	2.7	7.3	4.8	3.2
Fe	2.6	3.4	2.7	2.8	3.5	2.9	2.7	4.9	2.2	2.8	3.1	2.7	2.5
Y	2987	1480	2101	1770	3341	4834	3858	7392	550	1369	2045	2485	681
Nb	5	6	13	8	17	11	24	22	2	4	11	13	2
La	0.018	0.014	0.005	0.043	0.056	0.037	0.006	0.040	0.001	0.004	0.002	0.005	0.009
Ce	37	38	50	33	71	90	121	100	11	17	33	60	10
Nd	2.7	0.9	1.0	0.8	1.9	4.5	3.0	4.7	0.3	0.5	0.7	0.8	0.5
Sm	7.36	2.85	3.56	2.79	6.25	11.08	10.31	13.57	0.82	2.01	2.42	3.32	1.35
Eu	1.416	0.510	0.722	0.617	1.335	1.923	2.432	1.608	0.220	0.433	0.651	0.318	0.286
Gd	61	30	42	31	69	104	95	143	8	22	27	45	14
Ho	119	58	82	73	129	187	152	293	20	56	78	103	30
Tb	23.0	11.4	16.5	13.0	24.5	38.2	33.3	58.0	3.7	9.4	11.9	18.7	4.7
Dy	277	147	206	163	300	448	378	715	48	123	163	242	62
Er	540	275	425	337	601	815	683	1361	110	267	383	504	135
Tm	118	63	94	75	132	176	149	288	24	63	90	113	31
Yb	1012	557	837	660	1138	1458	1274	2412	231	560	819	981	290
Lu	192	106	156	127	212	263	231	435	46	113	157	182	58
Hf	10689	10671	10710	11358	10081	10596	9388	11076	10853	10676	10067	10486	11133
Pb7/6	0.7931	0.8387	0.6333	0.8621	0.5349	0.7241	1.0769	0.2982	0.5172	0.7407	1.4348	0.6216	0.6333
Th	**578**	**1073**	**1267**	**565**	**1422**	**1314**	**5657**	**2360**	**83**	**246**	**324**	**664**	**114**
U	**647**	**695**	**1169**	**764**	**1322**	**1266**	**2761**	**2336**	**155**	**432**	**540**	**868**	**180**
Hf ppm	10689	10671	10710	11358	10081	10596	9388	11076	10853	10676	10067	10486	11133
Ferry	**707**	**731**	**734**	**695**	**757**	**690**	**783**	**726**	**724**	**665**	**750**	**712**	**678**

Sample-crystal	P1905ATi-14.2C	P1905ATi-37.2R	P1905ATi-37.3C	P1905ATi-39.2R	P1905ATi-39.3C	P1905ATi-40.2	P1905ATi-40.3C	P1905ATi-41.2R	P1905ATi-16.2C	P1905ATi-16.3I	P1905ATi-16.4R	P1905ATi-15.2R	P1905ATi-42.2R
Crystal zone	C	R	C	R	C	R	C	R	C	I	R	R	R
AGE	**0.409**	**0.386**		**0.379**		**0.391**		**0.385**			**0.365**	**0.44**	**0.348**
1 sd (Ma)	**0.029**	**0.052**		**0.092**		**0.027**		**0.027**			**0.033**	**0.04**	**0.036**
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Be	0.1	0.4	0.1	6.8	4.6	0.1	0.0	0.0	0.0	0.0	0.0	6.1	12.6
B	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.4	0.1	0.1
F	9	7	10	11	10	9	9	6	12	8	17	9	8
Na	2.6	2.1	**115**	2.3	10.4	2.2	2.2	2.1	20.1	2.3	8.0	2.6	2.3
Al	11	10	**1042**	12	43	8	17	10	**154**	9	**4543**	11	10
P	1084	454	1583	392	293	846	726	234	504	217	333	1534	677
K	0.5	0.3	**301**	0.4	2.9	0.3	0.3	0.3	1.3	0.4	2.0	0.4	0.4
Ca	1.6	1.2	8.2	3.2	1.6	1.2	1.1	1.0	2.0	1.0	16.2	1.2	1.2
Sc	197	97	174	100	69	238	101	68	103	48	86	209	162
Ti	9.3	7.5	4.7	5.7	4.8	5.0	4.9	5.8	9.2	4.6	15.2	5.5	8.0
Fe	3.0	2.6	3.0	2.6	3.0	2.5	2.5	2.5	3.8	2.7	3.5	2.6	6.4
Y	4085	1561	4664	1436	929	4913	2164	676	1847	637	1118	3458	3095
Nb	26	6	21	7	3	37	4	2	11	3	5	11	18
La	0.006	0.001	0.034	0.015	0.015	0.007	0.007	0.003	0.160	0.002	0.312	0.005	0.010
Ce	112	33	73	30	12	194	24	15	40	13	30	49	85
Nd	2.4	0.8	2.3	0.8	0.5	2.4	2.0	0.3	1.0	0.3	0.5	1.5	1.8
Sm	8.44	2.90	7.48	2.58	1.56	8.41	4.18	1.20	2.73	0.82	1.59	5.03	6.01
Eu	1.652	0.697	0.663	0.563	0.236	1.291	0.986	0.262	0.399	0.201	0.324	0.897	1.213
Gd	91	29	86	26	15	92	40	14	29	10	19	59	61
Ho	162	62	177	55	30	194	81	27	64	26	43	131	121
Tb	34.7	12.3	32.6	10.0	5.5	36.0	14.2	4.7	11.2	4.2	8.1	24.0	24.0
Dy	398	149	405	124	67	446	180	62	144	54	103	306	287
Er	738	291	823	258	140	900	364	132	312	126	221	629	555
Tm	154	66	180	60	32	200	84	30	71	29	49	140	125
Yb	1287	561	1557	531	268	1731	727	263	627	268	451	1229	1081
Lu	235	110	291	103	52	322	144	53	122	54	83	232	205
Hf	10635	10280	11226	10208	11116	10560	9371	10186	10730	11041	10434	10184	10005
Pb7/6	0.5306	1.0556	0.9500	1.3600	0.6667	0.5806	0.6250	0.6957	0.4118	0.5714	1.2857	1.1500	0.5161
Th	**4302**	**782**	**2554**	**430**	**142**	**2323**	**369**	**126**	**519**	**125**	**290**	**1122**	**1710**
U	**2518**	**665**	**2547**	**562**	**199**	**2400**	**483**	**197**	**659**	**218**	**423**	**1158**	**1563**
Hf ppm	10635	10280	11226	10208	11116	10560	9371	10186	10730	11041	10434	10184	10005
Ferry	**773**	**752**	**710**	**726**	**711**	**715**	**714**	**729**	**772**	**707**	**824**	**724**	**759**

Sample-crystal	P1905ATi-17.2R	P1905ATi-17.3C	P1905ATi-19.2R	P1905ATi-19.3C	P1905ATi-43.2R	P1905ATi-43.3C	P1905ATi-20.3R	P1905ATi-44.2R	P1905ATi-21.2C	P1905ATi-21.3R	P1905ATi-22.2C	P1905ATi-22.3R	P1905ATi-45.2R
Crystal zone	R	C	R	C	R	C	R	R	C	R	C	R	R
AGE	**0.366**		**0.385**			**0.334**		**0.377**	**0.443**		**0.426**		**0.362**
1 sd (Ma)	**0.04**		**0.037**			**0.048**		**0.06**	**0.033**		**0.015**		**0.053**
Li	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Be	1.8	8.5	0.0	0.1	3.2	0.9	0.0	0.0	10.4	5.3	0.1	0.7	0.1
B	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
F	7	8	10	**3863**	10	12	9	7	5	11	20	9	7
Na	2.5	2.8	2.3	18.1	2.6	3.5	2.4	2.1	1.6	2.4	43.9	2.8	2.0
Al	10	11	14	81	11	11	7	9	8	11	**250**	13	10
P	385	858	304	1438	424	511	277	305	1822	370	1401	319	333
K	0.3	0.4	0.4	2.2	0.4	4.2	0.4	0.3	0.3	0.4	111.9	0.5	0.4
Ca	1.2	1.7	1.4	**416**	1.3	1.6	1.1	1.1	1.0	1.3	6.6	1.4	1.1
Sc	75	137	73	187	148	119	73	84	342	89	235	78	76
Ti	5.8	6.0	6.4	9.5	6.4	5.0	5.0	4.6	8.9	2.7	7.4	7.3	3.9
Fe	2.6	2.9	2.7	4.5	2.6	2.8	2.3	2.6	2.5	2.9	3.9	2.8	2.3
Y	1351	2604	955	4678	1719	2599	1039	948	5084	1399	6064	904	1052
Nb	6	10	4	10	8	9	5	3	11	11	67	3	5
La	0.004	0.001	0.006	1.655	0.007	0.015	0.004	0.002	0.005	0.004	0.037	0.003	0.001
Ce	28	48	20	72	25	55	17	16	59	27	92	17	22
Nd	0.8	1.3	0.5	5.2	0.6	2.0	0.4	0.4	2.1	0.3	1.7	0.5	0.4
Sm	2.44	3.98	1.88	8.44	1.89	5.40	1.45	1.28	6.65	1.49	8.18	1.59	1.46
Eu	0.601	0.956	0.463	2.750	0.581	0.868	0.315	0.320	2.316	0.179	0.325	0.377	0.351
Gd	26	42	18	85	25	53	15	15	83	19	108	18	18
Ho	54	96	38	177	69	99	41	37	194	54	239	35	40
Tb	9.9	17.5	6.9	32.8	10.7	20.4	6.4	6.3	34.7	8.9	43.9	6.4	7.0
Dy	123	222	87	408	147	244	87	81	441	117	546	79	90
Er	248	475	181	865	348	457	204	182	947	273	1086	177	196
Tm	56	111	41	201	84	101	49	44	215	65	236	40	45
Yb	481	1009	360	1800	746	846	459	402	1895	574	2020	351	404
Lu	95	196	70	346	147	160	93	78	369	109	364	68	78
Hf	10176	9605	10236	8147	9981	10852	10457	10448	9102	12405	12841	10348	11089
Pb7/6	0.4516	0.8235	0.5455	0.5926	0.7250	0.9032	0.7308	1.0000	0.4333	0.6429	0.3871	1.0000	0.8000
Th	**639**	**776**	**354**	**1271**	**257**	**754**	**195**	**142**	**1126**	**296**	**3460**	**262**	**350**
U	**642**	**956**	**355**	**1332**	**447**	**837**	**328**	**238**	**1140**	**551**	**4156**	**301**	**443**
Hf ppm	10176	9605	10236	8147	9981	10852	10457	10448	9102	12405	12841	10348	11089
Ferry	**729**	**732**	**737**	**775**	**737**	**715**	**715**	**707**	**769**	**663**	**751**	**750**	**693**

Sample-crystal	P1905ATi-45.3C	P1905ATi-46.2R	P1905ATi-46.3C	P1905ATi-47.2R	P1905ATi-47.3C	P1905ATi-48.2C	P1905ATi-49.2C	P1905ATi-49.3R	P1905ATi-24.3R	P1905ATi-53.2	P1905ATi-54.2	P1905ATi-25.2	P1905ATi-25.3I
Crystal zone	C	R	C	R	C	C	C	R	R	C	R	R	I
AGE		**0.368**		**0.313**		**0.332**	**0.374**			**0.417**	**0.286**	**0.423**	**0.362**
1 sd (Ma)		**0.031**		**0.067**		**0.042**	**0.084**			**0.05**	**0.039**	**0.057**	**0.033**
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.6	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	61.4	0.1
B	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1
F	10	12	14	9	8	6	8	9	5	8	7	12	7
Na	2.8	2.4	4.8	2.6	2.1	1.6	2.5	2.8	2.0	2.0	1.3	2.4	2.4
Al	**249**	13	8	12	22	11	8	16	12	8	7	22	10
P	672	566	628	468	416	1038	768	210	178	244	458	1385	200
K	0.7	0.9	0.4	0.5	0.4	0.2	0.4	0.5	0.4	11.2	0.3	0.6	0.6
Ca	2.4	1.7	1.4	1.5	1.1	0.8	1.4	1.5	1.3	1.4	1.0	2.9	1.7
Sc	97	150	126	95	64	119	152	49	47	52	135	281	49
Ti	4.0	6.0	7.8	2.9	4.0	5.2	8.3	6.2	5.1	4.8	6.9	21.0	3.1
Fe	2.6	3.0	2.9	3.1	2.8	2.4	2.9	2.8	2.5	2.8	2.5	2.4	2.8
Y	1870	2854	3454	1745	748	2490	2671	530	412	1549	2173	9465	779
Nb	5	13	11	10	2	6	11	2	2	2	10	74	3
La	0.006	0.006	0.018	0.001	0.010	0.014	0.007	0.003	0.008	0.017	0.008	0.037	0.002
Ce	23	55	58	39	8	29	60	10	9	12	36	446	18
Nd	1.2	1.0	3.4	0.7	0.4	1.2	1.4	0.3	0.1	1.7	1.0	13.8	0.3
Sm	3.45	4.04	8.86	2.42	1.05	3.69	4.49	0.72	0.62	4.35	2.82	31.97	1.37
Eu	0.799	0.742	1.781	0.292	0.237	1.087	0.954	0.212	0.147	0.999	0.743	7.232	0.316
Gd	31	43	78	29	12	41	51	8	6	40	33	272	16
Ho	70	112	135	68	30	96	105	20	16	67	86	380	32
Tb	11.8	18.7	27.6	12.0	4.7	16.2	20.8	3.4	2.7	15.8	13.4	88.3	5.6
Dy	145	244	328	158	61	213	251	45	35	183	178	978	69
Er	318	527	595	337	152	482	478	106	77	313	411	1589	144
Tm	74	119	127	76	36	113	107	25	18	65	98	325	33
Yb	640	1050	1058	671	336	1062	906	239	161	546	881	2594	295
Lu	128	200	191	126	68	209	172	47	33	97	173	443	59
Hf	10232	10340	9642	11782	10559	8580	10688	10227	10806	9621	9944	9198	11753
Pb7/6	0.7333	0.5227	0.8824	0.3810	0.4348	0.9643	0.7097	0.9714	1.1429	0.7714	1.6250	0.3529	0.6571
Th	**346**	**653**	**1022**	**491**	**83**	**611**	**1261**	**92**	**51**	**164**	**424**	**12180**	**383**
U	**497**	**817**	**818**	**754**	**180**	**834**	**1180**	**172**	**103**	**222**	**596**	**4648**	**314**
Hf ppm	10232	10340	9642	11782	10559	8580	10688	10227	10806	9621	9944	9198	11753
Ferry	**696**	**732**	**756**	**670**	**696**	**719**	**762**	**734**	**716**	**711**	**744**	**861**	**675**

Sample-crystal	P1905BTi-06.2R	P1905BTi-06.3I	P1905ATi-50.2R	P1905ATi-52.2	P1905ATi-52.3C	P1905ATi-23.2C	P1905ATi-23.3R	P1905ATi-24.2C	P1905BTi-07.2	P1905BTi-1.2I	P1905BTi-1.3C	P1905BTi-1.4R	P1905BTi-2.2C
Crystal zone	R	I	R	R	C	C	R	C	R	I	C	R	C
AGE	**0.384**		**0.321**	**0.325**			**0.42**	**0.369**	**0.384**			**0.371**	
1 sd (Ma)	0.029		0.031	0.039			0.03	0.025	0.029			0.02	
Li	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.8	0.1	0.0	0.0
Be	0.0	0.6	0.1	0.0	0.0	0.8	2.6	0.3	0.1	0.1	0.0	0.0	1.4
B	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	1.0	0.1	0.2	0.0
F	9	7	8	6	7	14	10	12	109	56	9	5	9
Na	2.4	1.6	2.4	1.8	2.1	**136**	2.5	2.3	5.4	**183**	**30**	2.0	2.3
Al	13	9	13	8	10	**836**	12	13	14	**1550**	**353**	29	11
P	235	881	656	474	142	1824	730	1316	1093	932	810	241	309
K	0.4	0.2	0.4	0.3	0.4	46.9	0.6	1.3	0.4	313.6	67.1	0.5	2.5
Ca	1.4	1.1	1.3	1.2	1.2	5.6	1.4	1.4	**642**	**16**	2.6	1.8	1.4
Sc	62	224	154	106	30	257	123	204	160	183	120	60	66
Ti	5.9	14.5	11.2	2.6	3.3	11.4	4.8	4.2	4.5	19.3	4.2	5.1	4.5
Fe	3.0	2.4	2.8	2.7	2.8	4.2	2.6	3.2	3.9	7.4	2.9	2.4	3.3
Y	598	3639	2328	1687	370	5925	2357	4579	2667	5599	2414	680	1644
Nb	2	20	8	9	2	18	12	14	16	42	11	3	2
La	0.001	0.018	0.008	0.001	0.005	0.255	0.008	0.014	4.584	0.247	0.016	0.026	0.029
Ce	13	95	36	35	7	98	54	65	86	215	54	15	17
Nd	0.3	2.9	1.0	0.5	0.1	4.4	1.1	2.4	6.0	6.8	1.1	0.3	1.1
Sm	1.03	9.31	2.88	2.43	0.38	11.86	3.76	7.71	4.22	17.18	3.63	0.99	3.17
Eu	0.232	2.543	1.082	0.404	0.101	1.815	0.609	1.270	0.657	3.777	0.561	0.270	0.832
Gd	10	93	37	28	4	116	44	85	42	148	42	12	32
Ho	24	141	90	68	14	233	94	179	100	221	90	26	61
Tb	4.2	31.7	15.4	11.0	2.1	43.5	17.4	32.3	17.3	47.5	16.6	4.4	11.6
Dy	54	361	207	143	28	531	214	401	227	524	206	57	143
Er	118	636	460	314	72	1056	435	842	488	885	441	122	282
Tm	28	134	103	72	18	227	98	185	113	187	100	29	61
Yb	251	1135	927	620	168	1920	830	1608	1004	1556	867	251	543
Lu	50	205	177	122	37	354	152	299	192	277	166	51	103
Hf	10248	8823	10154	11581	11208	9992	11894	10240	10735	8690	9999	10160	10375
Pb7/6	0.8049	0.3913	0.6757	0.5366	0.9630	0.6170	0.5510	0.4545	0.6600	0.4667	0.6977	0.7200	0.5455
Th	**98**	**3875**	**447**	**371**	**42**	**1866**	**1027**	**1493**	**734**	**7149**	**989**	**139**	**214**
U	**168**	**1718**	**554**	**600**	**107**	**1775**	**1206**	**1778**	**1023**	**3204**	**987**	**200**	**280**
Hf ppm	10248	8823	10154	11581	11208	9992	11894	10240	10735	8690	9999	10160	10375
Ferry	**730**	**819**	**792**	**662**	**680**	**794**	**711**	**700**	**706**	**851**	**700**	**718**	**705**

Sample-crystal	P1905BTi-2.3R	P1905BTi-3.2R	P1905BTi-3.3C	P1905BTi-08.2	P1905BTi-5.2C	P1905BTi-5.3R	P1905BTi-4.2I	P1905BTi-4.3C	P1905BTi-4.4R
Crystal zone	R	R	C	R	C	R	I	C	R
AGE	**0.379**	**0.318**		**0.379**		**0.364**			**0.331**
1 sd (Ma)	**0.032**	**0.039**		**0.021**		**0.017**			**0.043**
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	1.2	0.0	0.0	0.1	0.4	0.3	0.0	0.0	0.0
B	0.0	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0
F	14	8	4	12	9	6	5	7	7
Na	2.1	2.1	2.1	1.6	5.4	2.0	1.9	1.5	2.4
Al	14	19	16	10	32	8	9	7	11
P	1086	331	320	954	1454	284	337	916	328
K	0.3	0.3	0.3	1.3	0.8	0.3	0.3	0.2	0.4
Ca	1.3	1.7	1.2	1.2	2.6	1.1	1.1	0.9	1.2
Sc	181	91	70	174	159	71	62	114	66
Ti	7.8	6.8	4.9	4.4	7.0	6.7	7.8	6.0	5.4
Fe	2.7	2.4	2.5	2.5	3.1	2.3	2.5	2.1	2.5
Y	5333	1424	759	4564	3267	775	1108	3590	1059
Nb	78	12	2	48	13	3	4	8	4
La	0.012	0.015	0.016	0.014	0.074	0.003	0.011	0.015	0.000
Ce	220	54	11	114	45	16	25	46	22
Nd	3.3	0.9	0.3	2.3	1.4	0.4	0.6	3.0	0.6
Sm	11.38	2.69	0.92	7.95	4.29	1.27	1.80	7.34	1.74
Eu	0.563	0.407	0.283	0.664	0.471	0.311	0.684	2.025	0.411
Gd	125	27	12	96	53	15	19	74	19
Ho	225	53	28	189	126	30	42	142	41
Tb	48.8	9.7	4.7	34.8	21.7	5.6	7.6	27.8	7.4
Dy	571	118	61	427	287	72	94	332	93
Er	1038	230	143	801	606	150	194	676	197
Tm	218	50	33	171	136	35	44	151	44
Yb	1832	415	307	1410	1181	318	389	1292	415
Lu	318	78	61	256	222	63	77	247	79
Hf	11965	10062	10096	11859	10936	10224	10117	8902	10887
Pb7/6	0.3729	0.6667	0.5833	0.6250	0.6563	0.7500	0.6364	0.6923	0.8750
Th	**5595**	**827**	**86**	**3508**	**955**	**178**	**419**	**751**	**654**
U	**4218**	**613**	**160**	**2889**	**1364**	**247**	**372**	**831**	**530**
Hf ppm	11965	10062	10096	11859	10936	10224	10117	8902	10887
Ferry	**757**	**743**	**713**	**704**	**746**	**742**	**756**	**731**	**722**

Table A15.3: Zircon trace elements, sample P2058

Sample-crystal	P2058ATi-01.2R	P2058ATi-01.3C	P2058ATi-02.2R	P2058ATi-03.2C	P2058ATi-04.2R	P2058ATi-05.2R	P2058ATi-05.3I	P2058ATi-06.2I	P2058ATi-07.3R	P2058ATi-08.2C	P2058ATi-08.3R	P2058ATi-09.2R
Crystal zone	R	C	R	C	R	R	I	I	R	C	R	R
AGE	**0.322**		**0.377**	**0.406**	**0.323**	**0.369**		**0.383**		**0.336**		**0.593**
1 sd (Ma)	**0.043**		**0.034**	**0.028**	**0.064**	**0.034**		**0.043**		**0.067**		**0.346**
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Be	0.6	0.5	0.5	1.4	0.1	0.1	6.6	1.9	0.0	0.0	0.0	0.0
B	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
F	9	9	14	10	12	12	9	11	11	12	8	6
Na	4.5	7.8	**24**	3.6	6.0	5.3	6.7	7.7	6.3	8.2	6.1	5.0
Al	14	19	**204**	15	17	17	16	93	17	45	16	18
P	539	613	1212	1179	686	718	319	869	401	451	377	598
K	0.5	0.7	**33**	0.5	0.7	0.7	0.6	4.8	0.8	1.1	0.8	0.6
Ca	1.7	2.3	3.1	1.4	1.9	2.0	1.9	3.3	2.2	3.8	2.0	1.7
Sc	152	186	214	196	117	141	101	162	85	86	71	143
Ti	3.6	6.6	6.6	5.6	3.6	3.2	5.8	21.7	5.2	10.1	3.9	4.2
Fe	3.7	3.7	9.2	4.0	3.9	4.2	3.4	5.0	3.9	5.3	3.4	3.8
Y	2067	2460	6048	4425	2259	3001	1128	4167	1237	1872	1374	2277
Nb	14	4	51	34	11	21	5	24	6	7	9	13
La	0.013	0.001	0.235	0.006	0.001	0.004	0.004	0.326	0.006	0.788	0.006	0.010
Ce	39	30	162	109	49	75	17	102	20	32	31	48
Nd	0.6	1.4	3.5	2.0	0.9	1.4	0.4	4.1	0.6	1.8	0.6	0.7
Sm	2.53	4.79	10.85	7.88	3.55	4.47	1.32	11.16	1.92	3.31	1.78	3.29
Eu	0.389	1.892	0.878	1.010	0.471	0.502	0.406	2.719	0.490	0.788	0.369	0.584
Gd	29	48	120	92	40	54	14	100	20	33	24	41
Ho	80	95	236	175	92	118	43	167	47	74	54	89
Tb	13.3	18.2	47.4	36.6	17.1	22.4	6.5	35.8	8.3	13.3	9.6	15.9
Dy	175	217	575	440	215	284	89	411	107	169	121	216
Er	417	441	1103	836	449	570	208	737	252	365	256	459
Tm	99	93	241	181	100	127	53	159	57	84	59	107
Yb	889	809	2024	1503	870	1108	481	1351	513	764	530	943
Lu	178	163	358	275	161	209	100	247	98	151	102	178
Hf	12121	10069	11221	12229	12421	12124	10882	9227	10961	10154	11484	11608
Pb7/6	0.7714	0.5588	0.6316	0.8222	0.7660	0.6000	0.6250	0.8333	0.9355	0.7000	0.4286	0.5250
Th	**376**	**450**	**4805**	**3543**	**1019**	**1463**	**153**	**2415**	**465**	**604**	**586**	**571**
U	**681**	**470**	**4248**	**2944**	**1235**	**1699**	**288**	**1506**	**530**	**637**	**739**	**869**
Hf ppm	12121	10069	11221	12229	12421	12124	10882	9227	10961	10154	11484	11608
Ferry	**687**	**740**	**740**	**725**	**687**	**678**	**729**	**865**	**719**	**782**	**693**	**701**

Sample-crystal	P2058ATi-09.3C	P2058ATi-10.2R	P2058ATi-10.3C	P2058ATi-11.2R	P2058ATi-12.2R	P2058ATi-12.3I	P2058ATi-14.2R	P2058ATi-14.3I	P2058ATi-15.2R	P2058ATi-16.2I	P2058ATi-16.3R	P2058ATi-17.2I
Crystal zone	C	R	C	R	R	I	R	I	R	I	R	I
AGE		**0.361**		**0.348**	**0.354**		**0.334**		**0.351**	**0.375**		**0.412**
1 sd (Ma)		0.044		0.038	0.038		0.033		0.029	0.032		0.02
Li	0.1	0.0	5.7	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Be	0.0	0.1	0.2	0.1	0.0	0.1	0.0	0.0	1.6	25.1	0.3	0.5
B	0.0	0.1	1.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1
F	11	10	17	9	11	14	9	8	15	18	12	**129**
Na	9.8	11.5	**935**	4.8	**56**	4.1	3.8	3.6	**86**	5.3	19.4	10.2
Al	47	130	**3386**	13	823	15	14	15	**606**	16	76	18
P	289	416	382	594	690	347	599	253	984	1411	516	2135
K	5.7	**32**	1.5	0.6	**177**	0.6	0.5	0.5	**164**	0.6	0.8	1.1
Ca	2.8	2.8	1.3	1.8	4.3	2.2	1.6	1.5	6.3	1.9	1.4	**350**
Sc	55	91	63	113	124	225	115	67	166	247	97	319
Ti	5.2	5.0	5.6	3.2	4.7	11.9	3.1	6.4	8.7	10.0	5.9	12.5
Fe	5.3	5.7	3.7	3.3	4.8	3.8	3.7	3.9	6.5	3.7	3.3	5.8
Y	805	2208	1373	1922	3023	1791	2520	677	3844	9368	1976	8825
Nb	4	10	5	11	36	3	19	2	32	26	12	56
La	0.171	0.235	0.012	0.005	0.065	0.009	0.001	0.006	0.818	0.062	0.002	1.730
Ce	18	47	27	43	69	10	54	11	94	152	49	285
Nd	0.7	1.6	0.8	0.7	1.3	1.5	1.0	0.4	2.8	13.9	1.2	8.8
Sm	1.31	4.12	2.28	2.87	4.88	3.89	3.58	0.99	7.37	31.37	3.98	19.86
Eu	0.269	0.572	0.617	0.490	0.395	1.610	0.393	0.379	0.730	4.823	0.693	3.588
Gd	14	46	26	35	55	37	47	11	78	260	42	189
Ho	31	90	56	76	120	68	100	26	155	373	81	339
Tb	5.7	17.1	10.0	13.6	21.8	13.2	18.7	4.5	31.0	87.5	16.4	68.6
Dy	72	215	127	174	267	161	237	60	375	980	200	808
Er	156	439	263	366	531	296	486	136	726	1630	377	1524
Tm	38	96	63	85	118	61	106	33	157	336	83	324
Yb	341	823	547	738	992	505	914	285	1334	2699	700	2701
Lu	65	157	108	138	187	94	171	59	240	468	128	490
Hf	11089	11750	9740	12118	12588	8987	12085	10227	11487	8698	11046	8997
Pb7/6	0.6222	0.7586	1.8333	0.6471	1.3077	0.5556	0.7857	0.7368	0.6667	0.7105	0.6667	0.4035
Th	**257**	**713**	**571**	**604**	**1701**	**97**	**1346**	**97**	**3399**	**2899**	**1328**	**6865**
U	**328**	**831**	**604**	**861**	**1828**	**140**	**1553**	**177**	**2389**	**1685**	**1026**	**3529**
Hf ppm	11089	11750	9740	12118	12588	8987	12085	10227	11487	8698	11046	8997
Ferry	**719**	**715**	**725**	**678**	**710**	**799**	**676**	**737**	**767**	**780**	**730**	**804**

Sample-crystal	P2058ATi-17.3I	P2058ATi-17.4R	P2058ATi-19.3R	P2058ATi-20.2I	P2058ATi-21.2I	P2058ATi-22.2I	P2058ATi-23.2C	P2058ATi-23.3R	P2058ATi-24.2R	P2058ATi-25.2I	P2058ATi-27.2R	P2058ATi-27.3C
Crystal zone	I	R	R	I	I	I	C	R	R	I	R	C
AGE			**0.371**	**0.377**	**0.323**	**0.423**			**0.394**	**0.35**	**0.405**	
1 sd (Ma)			**0.046**	**0.015**	**0.03**	**0.051**			**0.032**	**0.054**	**0.028**	
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
F	12	9	8	19	9	7	8	6	8	10	9	13
Na	5.3	6.6	**30**	5.6	3.4	5.6	3.6	4.2	4.0	3.6	4.6	4.9
Al	20	31	**660**	18	18	33	18	14	8	13	20	25
P	342	516	265	2146	830	357	640	493	650	415	1243	442
K	0.6	5.8	**116**	0.7	0.4	1.1	0.5	0.4	0.5	0.5	0.6	0.6
Ca	1.7	1.4	3.0	2.0	1.5	1.3	1.5	1.6	1.4	1.7	2.4	2.6
Sc	50	88	87	281	270	76	118	106	149	98	144	153
Ti	2.3	3.1	5.3	6.7	6.1	6.1	6.4	9.2	3.3	3.2	2.2	7.0
Fe	3.7	3.7	4.0	4.5	4.1	3.5	3.6	3.5	3.4	3.6	4.2	4.2
Y	561	1659	891	9582	3925	1550	1244	1741	3185	1585	2903	2206
Nb	3	9	4	100	20	5	2	7	27	10	13	3
La	0.007	0.020	0.041	0.008	0.085	0.007	0.004	0.005	0.009	0.005	0.002	0.022
Ce	9	36	11	189	62	24	12	41	83	33	38	15
Nd	0.1	0.7	0.2	4.8	1.9	1.1	0.6	1.0	1.3	0.7	0.7	2.4
Sm	0.54	2.31	1.09	19.53	5.29	3.07	1.77	2.82	4.55	2.21	3.32	5.75
Eu	0.123	0.297	0.277	1.198	1.100	0.644	0.656	0.766	0.552	0.310	0.336	2.320
Gd	7	29	14	222	65	31	21	35	57	24	45	54
Ho	21	64	34	392	155	58	48	69	126	61	114	94
Tb	3.4	12.0	5.4	85.6	27.3	11.1	8.4	13.4	22.4	10.2	18.6	19.6
Dy	48	149	75	1005	360	137	113	162	280	133	257	238
Er	121	312	174	1750	770	273	232	318	576	296	560	420
Tm	28	72	43	361	171	61	56	72	126	67	129	90
Yb	262	632	400	2940	1495	543	506	633	1102	606	1122	748
Lu	54	117	82	496	276	105	102	118	204	118	213	139
Hf	11812	12219	10709	11888	11209	10378	9559	10157	11995	11908	11875	9520
Pb7/6	1.2400	0.6176	1.4500	0.3548	0.7143	0.9487	1.0606	0.7727	0.4902	0.6757	0.8611	0.8070
Th	**65**	**493**	**85**	**14873**	**838**	**395**	**178**	**1239**	**1174**	**458**	**746**	**168**
U	**204**	**727**	**196**	**8436**	**1126**	**414**	**287**	**886**	**1519**	**678**	**1228**	**212**
Hf ppm	11812	12219	10709	11888	11209	10378	9559	10157	11995	11908	11875	9520
Ferry	**651**	**676**	**720**	**741**	**733**	**733**	**738**	**772**	**680**	**678**	**649**	**746**

Sample-crystal	P2058ATi-28.2C	P2058ATi-29.2I	P2058ATi-29.4R	P2058ATi-30.2I	P2058ATi-31.2I	P2058ATi-32.3R	P2058ATi-34.3I	P2058ATi-35.2I	P2058ATi-35.3R	P2058ATi-36.2I	P2058ATi-37.2I	P2058ATi-37.3R
Crystal zone	C	I	R	I	I	R	I	I	R	I	I	R
AGE	**0.396**	**0.511**		**0.444**	**0.376**		**High Pb**	**0.365**		**0.44**	**0.421**	
1 sd (Ma)	**0.026**	**0.065**		**0.057**	**0.02**			**0.049**		**0.013**	**0.041**	
Li	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Be	0.2	18.4	2.3	51.0	0.2	0.2	35.6	0.0	0.1	0.2	1.3	5.6
B	0.1	0.0	0.1	0.1	1.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0
F	23	12	15	20	19	9	8	6	11	15	7	9
Na	6.9	5.2	4.3	**40**	**687**	4.0	3.3	3.7	4.9	**50**	3.6	3.3
Al	32	12	20	**304**	**6227**	13	12	13	15	**503**	15	13
P	1102	422	337	923	1425	332	734	1936	683	2395	1712	587
K	1.5	0.5	0.6	19.1	**1129**	0.4	0.4	0.4	0.5	**81**	0.4	0.4
Ca	3.2	1.7	1.5	12.2	**24**	1.1	1.5	1.4	1.7	**11**	1.1	1.0
Sc	188	128	79	156	208	63	96	213	110	263	199	99
Ti	4.3	2.9	3.1	9.7	6.1	4.6	7.3	4.0	3.5	13.9	3.9	2.8
Fe	5.2	3.7	3.9	5.5	10.0	3.5	3.6	3.3	3.5	8.5	3.7	3.5
Y	8096	2158	1265	2643	5395	983	4145	3838	2050	10125	3308	1804
Nb	22	14	7	7	58	4	31	11	12	97	8	11
La	0.061	0.001	0.002	0.079	0.791	0.000	0.009	0.009	0.006	10.722	0.004	0.004
Ce	199	51	27	35	98	19	178	45	40	219	38	32
Nd	8.6	0.5	0.5	1.8	10.9	0.5	4.0	1.4	0.8	22.3	1.2	0.7
Sm	20.93	2.28	2.00	4.64	17.29	1.39	11.25	4.39	2.69	26.25	4.65	2.24
Eu	2.253	0.311	0.314	1.004	0.807	0.351	2.465	0.670	0.291	1.253	0.783	0.272
Gd	194	31	22	49	146	16	105	58	33	252	58	28
Ho	320	85	51	97	235	37	173	137	82	445	133	71
Tb	71.8	14.0	9.1	18.4	52.6	7.1	38.6	23.9	14.6	94.8	24.5	12.0
Dy	819	188	116	222	580	91	448	304	190	1116	313	157
Er	1462	426	250	459	1032	189	814	664	395	1978	669	334
Tm	309	98	57	103	221	45	172	146	89	411	151	75
Yb	2556	877	505	890	1877	401	1486	1288	778	3390	1339	688
Lu	459	164	96	169	334	78	265	241	144	580	257	128
Hf	11109	11581	11623	9682	12897	10879	8919	11282	12854	11014	10780	13572
Pb7/6	0.4340	0.8667	0.8611	0.9500	0.5769	0.9722	0.6200	0.7778	0.6667	0.3636	0.7568	0.6774
Th	**2786**	**494**	**297**	**683**	**3340**	**370**	**4330**	**906**	**437**	**15421**	**873**	**397**
U	**2340**	**776**	**510**	**653**	**3304**	**427**	**1981**	**1182**	**801**	**9392**	**1150**	**807**
Hf ppm	11109	11581	11623	9682	12897	10879	8919	11282	12854	11014	10780	13572
Ferry	**701**	**669**	**675**	**778**	**732**	**708**	**750**	**697**	**684**	**814**	**693**	**668**

Sample-crystal	P2058ATi-38.2R	P2058ATi-39.2I	P2058ATi-40.2I	P2058ATi-40.3R	P2058ATi-41.2I	P2058ATi-42.2I	P2058ATi-42.3R	P2058ATi-43.2I	P2058ATi-43.3R	P2058ATi-44.2R
Crystal zone	R	I	I	R	I	I	R	I	R	R
AGE		**0.361**	**0.452**		**0.389**		**0.424**		**0.344**	**0.345**
1 sd (Ma)		0.089	0.017		0.019		0.034		0.051	0.019
Li	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be	0.0	1.4	0.5	0.0	0.1	0.2	0.1	1.3	0.0	1.0
B	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
F	8	6	21	8	9	9	8	8	7	11
Na	**29**	8.1	3.6	3.5	3.3	6.0	3.0	4.2	3.5	2.9
Al	**519**	11	16	14	25	21	13	14	10	11
P	465	396	4139	252	1116	475	469	381	339	989
K	**118**	0.3	0.9	0.5	1.5	0.5	0.4	0.7	0.4	0.3
Ca	2.1	1.1	1.1	1.0	1.6	1.9	0.9	1.1	1.0	0.8
Sc	89	154	503	61	250	88	85	84	71	144
Ti	3.5	10.5	10.5	4.9	10.0	6.1	2.8	6.6	2.9	3.7
Fe	3.8	4.3	3.9	3.6	5.2	5.7	3.3	10.0	2.8	8.3
Y	1553	1201	14674	692	5134	2179	1772	1388	1140	3864
Nb	8	4	120	2	37	10	12	5	5	30
La	0.044	0.020	0.031	0.019	0.090	0.007	0.003	0.005	0.006	0.007
Ce	35	16	307	13	181	42	40	28	22	83
Nd	0.6	0.7	9.5	0.3	3.7	1.1	0.7	0.8	0.5	1.7
Sm	2.37	1.96	31.29	0.95	11.38	3.38	2.67	2.32	1.42	6.75
Eu	0.320	0.878	2.220	0.246	1.728	0.870	0.275	0.595	0.258	0.446
Gd	28	21	328	10	123	37	31	24	21	79
Ho	62	48	586	27	212	85	69	56	46	153
Tb	11.0	8.9	123.9	4.5	41.6	15.7	12.7	9.9	8.1	30.3
Dy	141	113	1483	58	491	198	160	126	103	378
Er	304	224	2663	129	917	410	339	282	226	736
Tm	69	51	557	32	195	94	75	65	53	157
Yb	600	421	4588	287	1618	821	644	583	472	1335
Lu	113	80	776	57	296	153	124	115	90	240
Hf	12127	9295	10928	11168	9865	10275	12378	10492	11817	12565
Pb7/6	0.8438	0.9655	0.3590	1.4400	0.1744	1.0000	0.8108	1.0571	0.4706	0.7143
Th	**374**	**210**	**12560**	**114**	**4526**	**414**	**667**	**496**	**229**	**3347**
U	**600**	**236**	**7594**	**203**	**2525**	**578**	**905**	**515**	**421**	**3230**
Hf ppm	12127	9295	10928	11168	9865	10275	12378	10492	11817	12565
Ferry	**684**	**785**	**786**	**713**	**781**	**733**	**666**	**741**	**669**	**690**

Notes: Trace elements measured by SHRIMP-RG (as described in Chapter 5). 'Ferry' refers to Ti-in-zircon temperatures calculated using geothermometer of Ferry and Watson (2007).

Table A16.1: ***Oxygen isotope compositions for Rangitaiki P1905 zircons***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM	Crystal zone/comment
P1905-1	2.01E-03	1.53E-02	**5.26**	0.50	C	
P1905-2	2.01E-03	1.91E-02	**5.85**	0.50	R	
P1905-3	2.01E-03	1.70E-02	**4.91**	0.50	C	
P1905-4	2.01E-03	1.68E-02	**4.96**	0.50	R	
P1905-5	2.01E-03	1.45E-02	**6.65**	0.50	C	
P1905-6	2.01E-03	1.42E-02	**5.46**	0.50	R	
P1905-7	2.01E-03	1.18E-02	**6.34**	0.50	C	Greywacke core - Waipapa terrane
P1905-8	2.01E-03	2.01E-02	**4.78**	0.50	C	
P1905-9	2.01E-03	1.62E-02	**6.08**	0.50	R	
P1905-10	2.01E-03	1.93E-02	**5.60**	0.50	C	
P1905-11	2.01E-03	1.52E-02	**5.35**	0.50	R	
P1905-12	2.01E-03	1.67E-02	**5.81**	0.16	C	Adjacent P1905A-12.1 U Pb spot
P1905-13	2.01E-03	1.09E-02	**5.10**	0.16	C	Core adjacent P1905A-13.1 U Pb spot
P1905-14	2.01E-03	1.04E-02	**5.52**	0.16	C	Core adjacent P1905A-14.1 U Pb spot
P1905-15	2.01E-03	1.13E-02	**5.42**	0.16	C	Core adjacent P1905A-15.1 U Pb spot
P1905-16	2.01E-03	1.30E-02	**4.94**	0.16	R	Rim of same grain
P1905-17	2.01E-03	1.35E-02	**5.16**	0.26	C	Core adjacent P1905A-16.1 U Pb spot
P1905-18	2.01E-03	1.31E-02	**5.69**	0.26	R	Rim of P1905A-16.1
P1905-19	2.01E-03	1.04E-02	**4.82**	0.26	C	Core of P1905A-17.1
P1905-20	2.01E-03	1.23E-02	**6.24**	0.26	R	Rim of P1905A-17.1
P1905-21	2.01E-03	1.59E-02	**5.61**	0.26	C	Core adjacent P1905A-18.1 U Pb spot
P1905-22	2.01E-03	1.59E-02	**5.21**	0.26	C	Core adjacent P1905A-19.1 U Pb spot
P1905-23	2.01E-03	1.12E-02	**6.52**	0.26	C	Core adjacent P1905A-20.1 U Pb spot
P1905-24	2.01E-03	1.12E-02	**5.40**	0.26	C	Core adjacent P1905A-22.1 U Pb spot
P1905-25	2.01E-03	1.43E-02	**6.02**	0.26	C	
P1905-26	2.01E-03	1.55E-02	**5.29**	0.26	R	Rim P1905A
P1905-27	2.01E-03	1.40E-02	**5.31**	0.22	C	Core adjacent P1905A-23.1
P1905-28	2.01E-03	1.17E-02	**5.52**	0.22	C	Core of 25.1
P1905-29	2.01E-03	7.70E-03	**5.45**	0.22	C	Core undated
P1905-30	2.01E-03	1.25E-02	**5.30**	0.22	R	Rim undated
P1905-31	2.01E-03	9.00E-03	**5.77**	0.22	C	Core adjacent P1905B-1.1
P1905-32	2.01E-03	1.05E-02	**5.20**	0.22	R	Rim of P1905B-1.1
P1905-33	2.01E-03	1.60E-02	**5.40**	0.22	R	Rim adjacent P1905B-2.1
P1905-34	2.01E-03	8.12E-03	**5.35**	0.22	M	Middle of P1905B-2.1
P1905-35	2.01E-03	1.28E-02	**5.17**	0.22	C	Core of P1905B-3.1
P1905-36	2.01E-03	1.17E-02	**5.19**	0.22	R	Rim adjacent P1905B-4.1
P1905-37	2.01E-03	1.38E-02	**4.80**	0.22	C	Core of P1905B-4.1
P1905-38	2.01E-03	1.68E-02	**4.87**	0.22	C	Core undated
P1905-39	2.01E-03	1.42E-02	**5.16**	0.22	R	Rim undated

Notes: Analysis Cameca IMS-1270; Edinburgh Ionmicroprobe Facility; C = core; M = mid; R = rim crystal zones. Comments refer to zircon age analysis codes (see Appendix 15).

Table A16.2: ***Oxygen isotope compositions for Rangitaiki P1910 zircons***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM
P1910-1	2.00E-03	1.73E-02	**4.05**	0.26	C
P1910-2	2.00E-03	1.66E-02	**4.06**	0.26	R
P1910-3	2.01E-03	1.38E-02	**4.48**	0.26	C
P1910-4	2.01E-03	1.75E-02	**4.58**	0.26	R
P1910-5	2.00E-03	2.22E-02	**4.10**	0.26	C
P1910-6	2.01E-03	1.34E-02	**5.33**	0.32	C
P1910-7	2.01E-03	1.34E-02	**5.79**	0.32	R
P1910-8	2.01E-03	2.09E-02	**5.94**	0.32	C
P1910-9	2.01E-03	1.91E-02	**4.28**	0.32	C
P1910-10	2.01E-03	2.12E-02	**5.04**	0.50	C
P1910-11	2.01E-03	1.75E-02	**4.87**	0.50	C
P1910-12	2.01E-03	1.80E-02	**4.98**	0.50	C
P1910-13	2.01E-03	2.09E-02	**4.76**	0.50	R
P1910-14	2.01E-03	1.57E-02	**6.21**	0.50	C
P1910-15	2.01E-03	1.53E-02	**4.85**	0.50	R
P1910-16	2.01E-03	5.52E-03	**5.91**	0.16	C
P1910-17	2.01E-03	1.12E-02	**5.38**	0.16	R
P1910-18	2.01E-03	1.24E-02	**5.54**	0.16	R
P1910-19	2.01E-03	1.01E-02	**5.48**	0.16	C
P1910-20	2.01E-03	1.47E-02	**5.50**	0.16	C
P1910-21	2.01E-03	1.30E-02	**5.45**	0.16	C
P1910-22	2.01E-03	1.29E-02	**5.55**	0.16	C
P1910-23	2.01E-03	1.23E-02	**5.52**	0.16	C
P1910-24	2.01E-03	1.20E-02	**4.71**	0.26	C
P1910-25	2.01E-03	1.13E-02	**5.05**	0.26	R
P1910-26	2.01E-03	1.05E-02	**5.16**	0.26	C
P1910-27	2.01E-03	6.68E-03	**5.37**	0.26	C
P1910-28	2.01E-03	1.07E-02	**5.37**	0.26	C
P1910-29	2.01E-03	1.39E-02	**4.95**	0.22	C
P1910-30	2.01E-03	9.06E-03	**4.88**	0.22	R
P1910-31	2.01E-03	9.06E-03	**4.88**	0.22	C
P1910-32	2.01E-03	1.73E-02	**4.99**	0.22	C
P1910-33	2.01E-03	1.32E-02	**5.20**	0.22	C
P1910-36	2.01E-03	1.39E-02	**5.75**	0.23	R
P1910-37	2.01E-03	1.52E-02	**5.43**	0.23	C
P1910-38	2.01E-03	1.06E-02	**5.60**	0.23	C
P1910-39	2.01E-03	8.99E-03	**5.66**	0.23	R
P1910-40	2.01E-03	1.16E-02	**5.25**	0.23	C
P1910-42	2.01E-03	9.08E-03	**5.20**	0.21	C
P1910-43	2.01E-03	9.97E-03	**5.29**	0.21	C
P1910-44	2.01E-03	1.05E-02	**5.59**	0.21	R
P1910-45	2.01E-03	9.65E-03	**5.95**	0.21	C
P1910-46	2.01E-03	1.26E-02	**6.91**	0.21	C
P1910-47	2.01E-03	1.29E-02	**5.28**	0.21	C
P1910-48	2.01E-03	1.74E-02	**5.81**	0.21	C
P1910-49	2.01E-03	1.22E-02	**6.00**	0.21	R
P1910-50	2.01E-03	1.38E-02	**6.09**	0.21	C
P1910-51	2.01E-03	1.36E-02	**6.01**	0.21	C
P1910-52	2.01E-03	7.60E-03	**6.24**	0.15	R
P1910-53	2.01E-03	9.04E-03	**6.18**	0.15	C
P1910-54	2.01E-03	1.22E-02	**6.00**	0.15	C
P1910-55	2.01E-03	1.24E-02	**5.99**	0.15	C

APPENDIX 16: ZIRCON $\delta^{18}O$ SIGNATURES

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM
P1910-56	2.01E-03	1.44E-02	**5.71**	0.15	R
P1910-57	2.01E-03	1.17E-02	**6.35**	0.15	C
P1910-58	2.01E-03	1.53E-02	**5.56**	0.15	R
P1910-59	2.01E-03	1.38E-02	**6.21**	0.15	C
P1910-60	2.01E-03	1.52E-02	**6.22**	0.15	C
P1910-61	2.01E-03	1.37E-02	**6.00**	0.15	C
P1910-62	2.01E-03	8.67E-03	**6.08**	0.15	C
P1910-63	2.01E-03	1.42E-02	**5.18**	0.15	C
P1910-64	2.01E-03	1.32E-02	**5.01**	0.15	R
P1910-65	2.01E-03	1.43E-02	**5.52**	0.15	R
P1910-66	2.01E-03	1.34E-02	**6.44**	0.15	C
P1910-67	2.01E-03	1.29E-02	**6.47**	0.15	R
P1910-68	2.01E-03	1.06E-02	**6.51**	0.15	C

Table A16.3: ***Oxygen isotope compositions for Rangitaiki P1915 zircons***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM
P1915-1	0.002015	0.01	**6.49**	0.17	C
P1915-2	0.002015	0.01	**6.23**	0.17	R
P1915-3	0.002014	0.01	**6.00**	0.17	C
P1915-4	0.002015	0.01	**6.06**	0.17	R
P1915-5	0.002014	0.01	**5.87**	0.17	C
P1915-6	0.002015	0.01	**6.10**	0.17	R
P1915-7	0.002014	0.01	**5.58**	0.17	C
P1915-8	0.002014	0.01	**5.65**	0.17	R
P1915-9	0.002014	0.01	**5.88**	0.17	C
P1915-10	0.002014	0.02	**5.86**	0.17	R
P1915-11	0.002014	0.01	**5.51**	0.18	C
P1915-12	0.002014	0.01	**5.98**	0.18	R
P1915-13	0.002014	0.01	**5.96**	0.18	C
P1915-14	0.002015	0.01	**6.21**	0.18	R
P1915-15	0.002014	0.01	**5.83**	0.18	C
P1915-16	0.002014	0.01	**6.01**	0.18	R
P1915-17	0.002015	0.01	**6.07**	0.18	C
P1915-18	0.002015	0.01	**6.03**	0.18	C
P1915-19	0.002014	0.01	**5.80**	0.18	R
P1915-20	0.002015	0.01	**6.31**	0.18	C
P1915-21	0.002014	0.01	**5.75**	0.18	R
P1915-22	0.002014	0.01	**5.49**	0.12	C
P1915-23	0.002014	0.01	**5.81**	0.12	R
P1915-24	0.002013	0.01	**5.24**	0.12	C
P1915-25	0.002014	0.01	**6.04**	0.12	R
P1915-26	0.002015	0.01	**6.36**	0.12	C
P1915-27	0.002014	0.01	**5.99**	0.12	R
P1915-28	0.002015	0.01	**6.41**	0.12	C
P1915-29	0.002015	0.01	**6.08**	0.12	C
P1915-30	0.002015	0.02	**6.28**	0.12	C
P1915-31	0.002014	0.01	**5.95**	0.12	R
P1915-32	0.002014	0.01	**5.82**	0.12	C
P1915-33	0.002015	0.01	**6.16**	0.15	C
P1915-34	0.002015	0.01	**6.20**	0.15	C
P1915-35	0.002015	0.01	**6.46**	0.15	C
P1915-36	0.002015	0.01	**6.26**	0.15	R
P1915-37	0.002014	0.01	**5.91**	0.15	C
P1915-38	0.002015	0.01	**6.08**	0.15	C
P1915-39	0.002015	0.01	**5.91**	0.15	R
P1915-40	0.002015	0.01	**6.17**	0.15	C
P1915-41	0.002015	0.01	**6.40**	0.15	R
P1915-42	0.002015	0.01	**6.09**	0.15	C
P1915-43	0.002013	0.01	**5.18**	0.24	C
P1915-45	0.002015	0.01	**6.47**	0.24	R
P1915-46	0.002016	0.01	**6.70**	0.24	C
P1915-47	0.002015	0.01	**6.26**	0.24	R
P1915-48	0.002015	0.01	**6.16**	0.24	C
P1915-49	0.002014	0.01	**5.71**	0.24	C
P1915-50	0.002017	0.01	**6.99**	0.24	C
P1915-51	0.002015	0.01	**6.27**	0.24	R
P1915-52	0.002015	0.01	**6.18**	0.24	C
P1915-53	0.002017	0.01	**7.06**	0.24	C

APPENDIX 16: ZIRCON $\delta^{18}O$ SIGNATURES

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM
P1915-54	0.002016	0.01	**6.64**	0.16	R
P1915-55	0.002015	0.01	**6.29**	0.16	C
P1915-56	0.002015	0.01	**6.36**	0.16	R
P1915-57	0.002015	0.01	**6.19**	0.16	C
P1915-58	0.002015	0.01	**6.56**	0.16	C
P1915-59	0.002015	0.01	**6.28**	0.16	C
P1915-60	0.002015	0.02	**6.15**	0.16	R
P1915-61	0.002015	0.01	**6.21**	0.16	C
P1915-62	0.002017	0.02	**7.21**	0.16	C
P1915-63	0.002015	0.01	**6.13**	0.16	R

Table A16.4: ***Oxygen isotope compositions for Whakamaru P1920 zircons***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM	Crystal zone/comment
P1920-40	0.0128844	0.00	**4.86**	0.21	C	Core adjacent P1920B-1.1
P1920-41	0.0098100	0.00	**5.18**	0.21	R	Rim of P1920B-1.1
P1920-42	0.0131149	0.00	**5.15**	0.21	M	Middle adjacent 3.1
P1920-43	0.0144124	0.00	**5.26**	0.21	R	Rim of 3.1
P1920-44	0.0148744	0.00	**5.60**	0.21	C	Core adjacent P1920B-2.1
P1920-45	0.0143853	0.00	**5.00**	0.21	R	Rim of P1920B-2.1
P1920-46	0.0101797	0.00	**4.99**	0.21	R	Rim of 4.1
P1920-47	0.0165267	0.00	**5.32**	0.21	M	Middle adjacent 4.1
P1920-48	0.0137111	0.00	**4.78**	0.21	C	Core adjacent 5.1
P1920-49	0.0123253	0.00	**6.25**	0.21	C	Core adjacent 6.2 U Pb spot
P1920-50	0.0094110	0.00	**5.49**	0.21	R	Rim adjacent 6.1 U Pb spot
P1920-51	0.0125012	0.00	**5.06**	0.24	C	Core adjacent 7.1
P1920-52	0.0125670	0.00	**5.05**	0.24	R	Rim adjacent 7.1
P1920-53	0.0153422	0.00	**5.66**	0.24	R	Rim adjacent 10.1
P1920-54	0.0121505	0.00	**5.28**	0.24	R	Rim 11.1
P1920-55	0.0106366	0.00	**5.40**	0.24	C	Core adjacent 11.1
P1920-56	0.0062467	0.00	**6.22**	0.24	C	Core adjacent 12.1
P1920-57	0.0109343	0.00	**5.21**	0.24	R	Rim adjacent 12.1
P1920-58	0.0161344	0.00	**5.33**	0.24	C	Core adjacent 13.1
P1920-59	0.0096500	0.00	**5.38**	0.24	R	Rim of 13.1
P1920-60	0.0187292	0.00	**5.55**	0.24	C	Core adjacent 13.1
P1920-61	0.0189939	0.00	**6.02**	0.24	R	RIM
P1920-62	0.0142425	0.00	**5.18**	0.22	C	Core 17.1
P1920-63	0.0146464	0.00	**5.06**	0.22	R	Rim 17.1
P1920-64	0.0157484	0.00	**4.89**	0.22	C	Core adjacent 19.1
P1920-65	0.0130268	0.00	**4.92**	0.22	R	Rim 19.1
P1920-66	0.0162956	0.00	**5.32**	0.22	R	Rim adjacent 20.1
P1920-67	0.0180103	0.00	**5.20**	0.22	R	Rim adjacent 23.1
P1920-68	0.0096477	0.00	**5.25**	0.22	C	Core adjacent 24.1
P1920-69	0.0083845	0.00	**5.02**	0.22	R	Rim 24.1
P1920-70	0.0185254	0.00	**5.57**	0.22	C	Core adjacent 26.1
P1920-71	0.0156785	0.00	**5.37**	0.22	R	Rim 26.1
P1920-72	0.0176201	0.00	**5.21**	0.22	C	Core adjacent 28.1
P1920-73	0.0182232	0.00	**5.22**	0.22	R	Rim 28.1
P1920-74	0.0141925	0.00	**6.87**	0.22	C	Adjacent 29.1 greywacke
P1920-75	0.0120266	0.00	**4.97**	0.22	C	Core adjacent 31.1
P1920-76	0.0134563	0.00	**5.58**	0.22	C	Core adjacent 32.1
P1920-77	0.0114495	0.00	**4.89**	0.22	R	Rim adjacent 34.1
P1920-78	0.0122710	0.00	**5.67**	0.22	C	Core adjacent 37.1
P1920-79	0.0190043	0.00	**4.86**	0.22	C	Core adjacent 42.1
P1920-80	0.0111310	0.00	**5.40**	0.22	R	Rim of 42.1

Table A16.5: ***Oxygen isotope compositions for Whakamaru P1827 zircons***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM
P1827-24	0.0020162	0.02	4.73	0.24	R
P1827-25	0.0020159	0.01	6.01	0.24	C
P1827-26	0.0020157	0.01	5.77	0.24	R
P1827-27	0.0020173	0.01	6.63	0.24	C
P1827-28	0.0020153	0.01	5.54	0.24	R
P1827-29	0.0020164	0.01	6.03	0.24	C
P1827-30	0.0020173	0.01	6.49	0.24	R
P1827-31	0.0020156	0.01	5.64	0.24	C
P1827-32	0.0020155	0.01	5.60	0.24	R
P1827-33	0.0020164	0.01	6.17	0.24	C
P1827-34	0.0020163	0.01	5.92	0.24	R
P1827-35	0.0020155	0.01	5.63	0.21	C
P1827-36	0.0020175	0.02	6.57	0.21	R
P1827-37	0.0020172	0.02	6.45	0.21	C
P1827-38	0.0020149	0.02	5.34	0.21	C
P1827-39	0.0020157	0.01	4.88	0.21	C
P1827-40	0.0020161	0.01	5.91	0.21	R
P1827-41	0.0020152	0.01	5.55	0.21	C
P1827-42	0.0020164	0.01	6.08	0.21	C
P1827-43	0.0020161	0.01	5.88	0.21	C
P1827-44	0.0020160	0.01	5.95	0.21	R
P1827-45	0.0020155	0.01	5.70	0.21	C
P1827-46	0.0020162	0.01	5.91	0.21	C
P1827-47	0.0020172	0.01	6.32	0.40	C
P1827-48	0.0020163	0.01	5.99	0.40	C
P1827-49	0.0020154	0.01	5.50	0.40	R
P1827-50	0.0020183	0.01	6.06	0.40	C
P1827-52	0.0020163	0.02	5.97	0.40	C
P1827-53	0.0020174	0.02	6.45	0.40	R
P1827-54	0.0020165	0.01	6.00	0.40	C
P1827-55	0.0020165	0.01	4.98	0.40	R
P1827-56	0.0020190	0.01	7.21	0.40	C
P1827-57	0.0020167	0.01	6.34	0.40	R
P1827-58	0.0020173	0.01	6.26	0.50	C
P1827-59	0.0020166	0.01	5.26	0.50	C
P1827-60	0.0020159	0.01	5.98	0.50	C
P1827-61	0.0020165	0.01	6.09	0.50	C
P1827-62	0.0020163	0.02	5.99	0.50	R
P1827-63	0.0020163	0.01	5.97	0.50	C
P1827-64	0.0020159	0.01	5.86	0.50	R
P1827-65	0.0020165	0.02	6.22	0.50	C
P1827-66	0.0020179	0.01	6.78	0.50	R
P1827-67	0.0020167	0.01	6.24	0.50	C
P1827-68	0.0020174	0.01	6.56	0.26	C
P1827-69	0.0020162	0.01	5.94	0.26	C
P1827-70	0.0020169	0.01	6.29	0.26	C
P1827-71	0.0020176	0.02	6.63	0.26	R
P1827-72	0.0020170	0.01	6.28	0.26	C
P1827-73	0.0020185	0.01	7.18	0.26	C
P1827-74	0.0020171	0.01	6.44	0.26	R
P1827-75	0.0020161	0.02	5.73	0.26	C
P1827-76	0.0020187	0.01	6.99	0.26	C

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	CORE/ RIM
P1827-77	0.0020164	0.01	6.00	0.26	R
P1827-78	0.0020172	0.02	6.36	0.26	C
P1827-79	0.0020172	0.02	6.50	0.26	C
P1827-80	0.0020210	0.01	8.31	0.26	C
P1827-82	0.0020169	0.01	6.20	0.26	C
P1827-83	0.0020171	0.01	6.05	0.26	R
P1827-84	0.0020177	0.02	6.91	0.26	C
P1827-85	0.0020160	0.01	5.79	0.26	R
P1827-86	0.0020162	0.01	6.05	0.26	C
P1827-87	0.0020157	0.01	5.76	0.26	R
P1827-88	0.0020185	0.01	7.09	0.26	R
P1827-1	0.0020062	0.01	5.14	0.33	M
P1827-2	0.0020076	0.02	5.90	0.33	C
P1827-3	0.0020069	0.01	5.47	0.33	R
P1827-4	0.0020061	0.02	5.05	0.33	C
P1827-5	0.0020090	0.02	6.43	0.33	C
P1827-6	0.0020076	0.02	5.84	0.33	R
P1827-7	0.0020076	0.01	5.71	0.33	C
P1827-8	0.0020072	0.02	5.60	0.33	R
P1827-9	0.0020075	0.01	5.74	0.33	C
P1827-10	0.0020073	0.01	5.65	0.33	R
P1827-11	0.0020068	0.02	5.37	0.35	R
P1827-12	0.0020093	0.01	6.77	0.35	C
P1827-13	0.0020085	0.01	6.33	0.35	R
P1827-14	0.0020100	0.02	7.03	0.35	C
P1827-15	0.0020059	0.01	4.95	0.35	C
P1827-16	0.0020075	0.02	5.74	0.35	R
P1827-17	0.0020081	0.02	6.06	0.35	C
P1827-18	0.0020070	0.02	5.43	0.35	R
P1827-19	0.0020083	0.02	6.16	0.35	C
P1827-20	0.0020078	0.01	5.88	0.35	R
P1827-21	0.0020076	0.02	5.75	0.35	C
P1827-22	0.0019983	0.02	5.93	0.35	R

Table A16.6: ***P1905 zircon $\delta^{18}O$ standards***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)
R33-1	2.00E-03	1.73E-02	**4.05**	**0.26**
R33-2	2.00E-03	1.66E-02	**4.06**	**0.26**
R33-3	2.01E-03	1.38E-02	**4.48**	**0.26**
R33-4	2.01E-03	1.75E-02	**4.58**	**0.26**
R33-5	2.00E-03	2.22E-02	**4.10**	**0.26**
R33-6	2.01E-03	1.34E-02	**5.33**	**0.32**
R33-7	2.01E-03	1.34E-02	**5.79**	**0.32**
R33-8	2.01E-03	2.09E-02	**5.94**	**0.32**
R33-9	2.01E-03	1.91E-02	**4.28**	**0.32**
R33-11	2.01E-03	2.12E-02	**5.04**	**0.50**
R33-12	2.01E-03	1.75E-02	**4.87**	**0.50**
R33-13	2.01E-03	1.80E-02	**4.98**	**0.50**
R33-14	2.01E-03	2.09E-02	**4.76**	**0.50**
R33-15	2.01E-03	1.57E-02	**6.21**	**0.50**
R33-16	2.01E-03	1.53E-02	**4.85**	**0.50**
R33-17	2.01E-03	5.52E-03	**5.91**	**0.16**
R33-18	2.01E-03	1.12E-02	**5.38**	**0.16**
R33-19	2.01E-03	1.24E-02	**5.54**	**0.16**
R33-20	2.01E-03	1.01E-02	**5.48**	**0.16**
R33-21	2.01E-03	1.47E-02	**5.50**	**0.16**
R33-22	2.01E-03	1.30E-02	**5.45**	**0.16**
R33-23	2.01E-03	1.29E-02	**5.55**	**0.16**
R33-24	2.01E-03	1.23E-02	**5.52**	**0.16**
R33-25	2.01E-03	1.20E-02	**4.71**	**0.26**
R33-26	2.01E-03	1.13E-02	**5.05**	**0.26**
R33-27	2.01E-03	1.05E-02	**5.16**	**0.26**
R33-28	2.01E-03	6.68E-03	**5.37**	**0.26**
R33-29	2.01E-03	1.07E-02	**5.37**	**0.26**
R33-30	2.01E-03	1.39E-02	**4.95**	**0.22**
R33-31	2.01E-03	9.06E-03	**4.88**	**0.22**
R33-32	2.01E-03	9.06E-03	**4.88**	**0.22**
R33-33	2.01E-03	1.73E-02	**4.99**	**0.22**
R33-34	2.01E-03	1.32E-02	**5.20**	**0.22**

Table A16.7: ***P1910 zircon $\delta^{18}O$ standards***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)
KIM5-1	2.01E-03	5.62E-03	**7.78**	0.35
KIM5-2	2.01E-03	8.06E-03	**7.69**	0.35
KIM5-3	2.01E-03	9.56E-03	**7.50**	0.35
KIM5-4	2.01E-03	6.15E-03	**7.19**	0.35
KIM5-5	2.01E-03	9.85E-03	**7.23**	0.35
KIM5-6	2.01E-03	8.76E-03	**6.95**	0.35
KIM5-7	2.01E-03	1.21E-02	**6.73**	0.35
KIM5-8	2.01E-03	9.34E-03	**6.95**	0.35
KIM5-9	2.01E-03	1.35E-02	**6.91**	0.35
KIM5-10	2.01E-03	1.00E-02	**7.07**	0.35
KIM5-11	2.01E-03	1.39E-02	**7.16**	0.16
KIM5-12	2.01E-03	9.45E-03	**6.93**	0.16

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)
KIM5-13	2.01E-03	1.31E-02	**6.70**	0.16
KIM5-14	2.01E-03	6.12E-03	**7.20**	0.16
KIM5-15	2.01E-03	1.45E-02	**6.73**	0.16
KIM5-16	2.01E-03	1.00E-02	**7.04**	0.16
KIM5-17	2.01E-03	7.69E-03	**6.79**	0.16
KIM5-18	2.01E-03	9.92E-03	**6.97**	0.16
KIM5-19	2.01E-03	7.70E-03	**6.89**	0.16
KIM5-20	2.01E-03	1.01E-02	**6.96**	0.16
Laura-1	2.01E-03	1.50E-02	**6.05**	0.19
Laura-10	2.01E-03	1.03E-02	**5.89**	0.19
Laura-2	2.01E-03	1.60E-02	**6.05**	0.19
Laura-3	2.01E-03	8.77E-03	**5.96**	0.19
Laura-4	2.01E-03	1.27E-02	**5.62**	0.19
Laura-5	2.01E-03	9.56E-03	**5.83**	0.19
Laura-6	2.01E-03	1.26E-02	**5.73**	0.19
Laura-7	2.01E-03	1.18E-02	**5.75**	0.19
Laura-8	2.01E-03	7.10E-03	**5.72**	0.19
Laura-9	2.01E-03	1.14E-02	**5.44**	0.19
Laura-11	2.01E-03	1.18E-02	**4.68**	0.47
Laura-12	2.01E-03	1.28E-02	**5.09**	0.47
Laura-13	2.01E-03	1.02E-02	**5.20**	0.47
Laura-14	2.01E-03	1.48E-02	**4.74**	0.47
Laura-15	2.01E-03	1.94E-02	**4.98**	0.47
Laura-16	2.01E-03	1.47E-02	**4.75**	0.58
Laura-17	2.00E-03	1.74E-02	**4.17**	0.58
Laura-18	2.01E-03	9.44E-03	**4.22**	0.58
Laura-19	2.01E-03	1.52E-02	**6.23**	0.58
Laura-20	2.01E-03	1.08E-02	**4.82**	0.58
Laura-21	2.01E-03	1.25E-02	**5.24**	0.53
Laura-22	2.01E-03	1.11E-02	**5.52**	0.53
Laura-23	2.01E-03	1.01E-02	**4.82**	0.53
Laura-24	2.01E-03	9.98E-03	**5.09**	0.53
Laura-25	2.01E-03	1.43E-02	**5.21**	0.53
Laura-26	2.01E-03	1.19E-02	**5.36**	0.53
Laura-27	2.01E-03	9.66E-03	**5.04**	0.53
Laura-28	2.01E-03	1.20E-02	**5.23**	0.53
Laura-29	2.01E-03	1.46E-02	**5.48**	0.53
Laura-30	2.01E-03	1.18E-02	**5.65**	0.53
Laura-31	2.01E-03	1.46E-02	**5.52**	0.23
Laura-32	2.01E-03	8.90E-03	**5.00**	0.23
Laura-33	2.01E-03	1.04E-02	**5.32**	0.23
Laura-34	2.01E-03	1.29E-02	**5.54**	0.23
Laura-35	2.01E-03	1.19E-02	**5.31**	0.23
Laura-36	2.01E-03	1.05E-02	**5.02**	0.21
Laura-37	2.01E-03	1.31E-02	**5.44**	0.21
Laura-38	2.01E-03	1.49E-02	**4.97**	0.21
Laura-39	2.01E-03	1.37E-02	**5.26**	0.21
Laura-40	2.01E-03	1.77E-02	**5.14**	0.21
Laura-41	2.01E-03	1.15E-02	**5.26**	0.15
Laura-42	2.01E-03	1.01E-02	**5.09**	0.15
Laura-43	2.01E-03	1.13E-02	**5.00**	0.15
Laura-44	2.01E-03	6.57E-03	**5.13**	0.15
Laura-45	2.01E-03	1.12E-02	**4.98**	0.15

Table A16.8: ***P1915 zircon $\delta^{18}O$ standards***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)
Laura-1	0.002013	0.01	**5.13**	**0.15**
Laura-2	0.002012	0.01	**5.04**	**0.15**
Laura-3	0.002013	0.01	**5.07**	**0.15**
Laura-4	0.002013	0.01	**5.39**	**0.15**
Laura-5	0.002013	0.02	**5.39**	**0.15**
Laura-6	0.002013	0.01	**5.39**	**0.15**
Laura-7	0.002013	0.01	**5.38**	**0.15**
Laura-8	0.002013	0.01	**5.04**	**0.15**
Laura-9	0.002013	0.01	**5.23**	**0.15**
Laura-10	0.002013	0.01	**5.27**	**0.15**
Laura-11	0.002013	0.01	**5.26**	**0.17**
Laura-12	0.002013	0.01	**5.39**	**0.17**
Laura-13	0.002013	0.01	**5.45**	**0.17**
Laura-14	0.002012	0.01	**4.89**	**0.17**
Laura-15	0.002013	0.01	**5.17**	**0.17**
Laura-16	0.002013	0.01	**5.38**	**0.18**
Laura-17	0.002013	0.01	**5.22**	**0.18**
Laura-18	0.002013	0.01	**5.22**	**0.18**
Laura-19	0.002013	0.01	**5.45**	**0.18**
Laura-20	0.002013	0.01	**5.41**	**0.12**
Laura-21	0.002013	0.01	**5.06**	**0.12**
Laura-22	0.002013	0.01	**5.20**	**0.12**
Laura-23	0.002013	0.01	**5.30**	**0.12**
Laura-24	0.002013	0.01	**5.24**	**0.12**
Laura-25	0.002013	0.01	**5.23**	**0.15**
Laura-27	0.002013	0.01	**5.02**	**0.15**
Laura-29	0.002013	0.01	**5.18**	**0.15**
Laura-30	0.002013	0.01	**4.93**	**0.15**
Laura-31	0.002013	0.01	**5.26**	**0.15**
Laura-32	0.002014	0.01	**5.53**	**0.15**
Laura-33	0.002013	0.01	**5.32**	**0.15**
Laura-34	0.002013	0.01	**5.22**	**0.15**
Laura-35	0.002013	0.01	**5.53**	**0.15**
Laura-36	0.002014	0.01	**5.68**	**0.24**
Laura-37	0.002014	0.01	**5.64**	**0.24**
Laura-38	0.002014	0.01	**5.81**	**0.24**
Laura-39	0.002014	0.01	**5.93**	**0.24**
Laura-40	0.002014	0.01	**5.80**	**0.24**
Laura-41	0.002014	0.01	**5.55**	**0.16**
Laura-42	0.002014	0.01	**5.93**	**0.16**
Laura-43	0.002014	0.01	**5.61**	**0.16**
Laura-44	0.002014	0.01	**5.88**	**0.16**
Laura-45	0.002014	0.01	**5.52**	**0.16**

Table A16.9: ***P1920 zircon $\delta^{18}O$ standards***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)
R33-34	0.0141216	0.00	**4.72**	**0.21**
R33-35	0.0080364	0.00	**5.01**	**0.21**
R33-36	0.0156708	0.00	**4.78**	**0.21**
R33-37	0.0188536	0.00	**5.25**	**0.21**
R33-38	0.0133443	0.00	**5.37**	**0.21**
R33-39	0.0086680	0.00	**5.14**	**0.24**
R33-40	0.0170722	0.00	**4.99**	**0.24**
R33-41	0.0109333	0.00	**4.65**	**0.24**
R33-42	0.0131053	0.00	**4.69**	**0.24**
R33-43	0.0177538	0.00	**5.01**	**0.24**
R33-30	0.0020091	0.01	**4.95**	**0.22**
R33-31	0.0020089	0.01	**4.88**	**0.22**
R33-32	0.0020089	0.01	**4.88**	**0.22**
R33-33	0.0020091	0.02	**4.99**	**0.22**
R33-34	0.0020093	0.01	**5.20**	**0.22**

Table A16.10: ***P1827 zircon $\delta^{18}O$ standards***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)
Laura-1	0.0020145	0.01	5.21	0.21
Laura-3	0.0020148	0.01	5.37	0.21
Laura-4	0.0020149	0.01	5.31	0.21
Laura-5	0.0020143	0.01	5.16	0.21
Laura-6	0.0020145	0.01	5.22	0.21
Laura-7	0.0020140	0.02	4.94	0.21
Laura-8	0.0020142	0.01	4.92	0.21
Laura-9	0.0020153	0.01	5.60	0.21
Laura-10	0.0020143	0.02	5.05	0.21
Laura-11	0.0020144	0.01	5.21	0.21
Laura-12	0.0020152	0.01	5.48	0.24
Laura-13	0.0020159	0.01	5.80	0.24
Laura-14	0.0020148	0.01	5.30	0.24
Laura-15	0.0020145	0.01	5.09	0.24
Laura-16	0.0020151	0.01	5.40	0.21
Laura-17	0.0020147	0.01	5.24	0.21
Laura-18	0.0020147	0.01	5.38	0.21
Laura-19	0.0020144	0.01	5.11	0.21
Laura-20	0.0020152	0.01	5.52	0.21
Laura-21	0.0020149	0.01	5.26	0.40
Laura-22	0.0020149	0.01	4.49	0.40
Laura-23	0.0020148	0.02	4.34	0.40
Laura-25	0.0020145	0.01	6.10	0.40
Laura-26	0.0020145	0.01	5.48	0.50
Laura-27	0.0020141	0.01	5.48	0.50
Laura-29	0.0020141	0.02	4.87	0.50
Laura-30	0.0020150	0.01	5.34	0.50
Laura-31	0.0020150	0.01	5.45	0.26
Laura-32	0.0020139	0.01	5.04	0.26
Laura-33	0.0020140	0.01	4.98	0.26
Laura-34	0.0020142	0.01	4.99	0.26
Laura-1	0.0020064	0.01	5.17	0.26
Laura-2	0.0020063	0.01	5.18	0.26
Laura-3	0.0020060	0.01	5.05	0.26
Laura-4	0.0020062	0.01	5.27	0.26
Laura-5	0.0020061	0.01	5.53	0.26
Laura-6	0.0020070	0.01	5.79	0.26
Laura-7	0.0020073	0.01	5.74	0.26
Laura-8	0.0020069	0.01	5.44	0.26
Laura-9	0.0020062	0.01	5.11	0.26
Laura-10	0.0020066	0.01	5.31	0.26
Laura-11	0.0020074	0.02	5.68	0.33
Laura-12	0.0020068	0.02	5.41	0.33
Laura-13	0.0020078	0.01	6.01	0.33
Laura-14	0.0020057	0.01	4.88	0.33
Laura-15	0.0020059	0.02	4.96	0.33
Laura-16	0.0020061	0.02	4.98	0.35
Laura-17	0.0020065	0.02	5.41	0.35
Laura-18	0.0020065	0.01	5.01	0.35
Laura-19	0.0020064	0.01	5.21	0.35
Laura-20	0.0020065	0.01	5.21	0.35

Table A17.1: ***Oxygen isotope compositions for Rangitaiki P1905 quartz***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)	Crystal zone/comment
P1905-1	2.01E-03	5.97E-03	**7.84**	**0.33**	R (light-CL)
P1905-2	2.01E-03	8.33E-03	**7.93**	**0.33**	M (dark-CL)
P1905-3	2.01E-03	6.26E-03	**8.08**	**0.33**	C (dark-CL)
P1905-4	2.01E-03	5.13E-03	**7.88**	**0.33**	R (bright-CL)
P1905-5	2.01E-03	7.49E-03	**7.92**	**0.33**	M (mid-CL)
P1905-6	2.01E-03	8.01E-03	**8.15**	**0.33**	C (dark-CL)
P1905-7	2.01E-03	1.17E-02	**7.05**	**0.33**	R (bright-CL)
P1905-10	2.01E-03	6.01E-03	**7.27**	**0.33**	C (dark-CL)
P1905-11	2.01E-03	7.12E-03	**7.53**	**0.15**	R (light-CL)
P1905-12	2.01E-03	9.38E-03	**7.47**	**0.15**	M (dark-CL)
P1905-13	2.01E-03	6.48E-03	**7.80**	**0.15**	C (dark-CL)
P1905-14	2.01E-03	7.90E-03	**8.31**	**0.15**	R (light-CL)
P1905-15	2.01E-03	9.04E-03	**7.98**	**0.15**	C (sieved dark-CL)
P1905-16	2.01E-03	8.82E-03	**7.69**	**0.15**	M (sieved dark-CL)
P1905-17	2.01E-03	7.61E-03	**7.43**	**0.15**	C (dark-CL)
P1905-18	2.01E-03	7.25E-03	**7.53**	**0.15**	R (light-CL)
P1905-19	2.01E-03	5.81E-03	**7.49**	**0.15**	R (light-CL)
P1905-20	2.01E-03	7.90E-03	**7.14**	**0.15**	M (dark-CL)
P1905-21	2.01E-03	6.28E-03	**7.91**	**0.15**	R (light-CL)
P1905-22	2.01E-03	5.95E-03	**7.72**	**0.15**	M (mid-CL)
P1905-23	2.01E-03	9.72E-03	**8.38**	**0.15**	C (dark-CL)
P1905-24	2.01E-03	6.79E-03	**7.97**	**0.15**	R (light-CL)
P1905-25	2.01E-03	4.52E-03	**8.02**	**0.15**	C (dark-CL)
P1905-26	2.01E-03	7.45E-03	**7.91**	**0.15**	R (light-CL)
P1905-27	2.01E-03	6.90E-03	**8.20**	**0.15**	M (dark-CL)
P1905-28	2.01E-03	8.22E-03	**6.98**	**0.15**	R (light-CL)
P1905-29	2.01E-03	5.64E-03	**6.71**	**0.15**	M (dark-CL)
P1905-30	2.01E-03	8.66E-03	**7.65**	**0.15**	C
P1905-31	2.01E-03	6.65E-03	**8.15**	**0.20**	C
P1905-32	2.01E-03	8.71E-03	**7.72**	**0.20**	M
P1905-33	2.01E-03	8.39E-03	**7.41**	**0.20**	R
P1905-35	2.01E-03	7.97E-03	**7.85**	**0.20**	C
P1905-36	2.01E-03	7.86E-03	**7.88**	**0.20**	R
P1905-37	2.01E-03	6.74E-03	**8.06**	**0.20**	C
P1905-38	2.01E-03	8.13E-03	**7.90**	**0.20**	R
P1905-39	2.01E-03	7.96E-03	**7.73**	**0.20**	M
P1905-40	2.01E-03	8.06E-03	**7.81**	**0.20**	R
P1905-43	2.01E-03	4.28E-03	**7.87**	**0.11**	M
P1905-44	2.01E-03	6.80E-03	**7.93**	**0.11**	R
P1905-45	2.01E-03	1.04E-02	**8.35**	**0.11**	C
P1905-46	2.01E-03	9.26E-03	**8.26**	**0.11**	R
P1905-47	2.01E-03	7.90E-03	**8.18**	**0.11**	C
P1905-48	2.01E-03	7.25E-03	**7.83**	**0.11**	R

Notes: C = core; M = mid; R = rim crystal zones; analysis by SIMS.

Table A17.2: ***Oxygen isotope compositions for Rangitaiki P1910 quartz***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)	Crystal zone/comment
P1910-1	2.01E-03	9.32E-03	**8.55**	**0.15**	R (bright-CL)
P1910-2	2.01E-03	1.12E-02	**8.83**	**0.15**	M (dark CL)
P1910-3	2.01E-03	1.22E-02	**8.73**	**0.15**	C (mid/dark CL)
P1910-4	2.01E-03	9.33E-03	**8.91**	**0.15**	C (dark CL)
P1910-5	2.01E-03	7.94E-03	**8.86**	**0.15**	C (complex sieving)
P1910-6	2.01E-03	9.71E-03	**9.08**	**0.15**	R (mid-grey, sieved)
P1910-7	2.01E-03	1.00E-02	**8.96**	**0.15**	M (light CL)
P1910-8	2.01E-03	1.14E-02	**9.00**	**0.15**	R (light CL)
P1910-9	2.01E-03	7.91E-03	**9.03**	**0.15**	C (mid/dark CL)
P1910-10	2.01E-03	1.11E-02	**8.90**	**0.15**	M (mid CL)
P1910-11	2.01E-03	6.09E-03	**8.95**	**0.40**	R (light CL)
P1910-12	2.01E-03	6.42E-03	**9.18**	**0.40**	M (mid-CL)
P1910-13	2.01E-03	1.05E-02	**9.11**	**0.40**	C (dark-CL)
P1910-14	2.01E-03	1.07E-02	**9.02**	**0.40**	C (dark-CL)
P1910-15	2.01E-03	1.14E-02	**9.54**	**0.40**	R (bright CL)
P1910-16	2.01E-03	1.07E-02	**9.77**	**0.40**	M (dark CL)
P1910-17	2.01E-03	1.13E-02	**9.73**	**0.40**	C (dark CL)
P1910-18	2.01E-03	1.04E-02	**9.49**	**0.40**	R (bright CL)
P1910-19	2.01E-03	9.72E-03	**9.14**	**0.40**	M (dark CL)
P1910-20	2.01E-03	1.36E-02	**9.16**	**0.40**	M (mid CL)
P1910-21	2.01E-03	1.15E-02	**8.96**	**0.40**	C (bright CL)
P1910-22	2.01E-03	9.29E-03	**8.95**	**0.40**	C (bright CL)
P1910-23	2.01E-03	1.43E-02	**8.36**	**0.20**	C (dark CL)
P1910-24	2.01E-03	1.38E-02	**8.54**	**0.20**	M (mid CL)
P1910-25	2.01E-03	1.08E-02	**8.56**	**0.20**	R (light CL)
P1910-26	2.01E-03	9.78E-03	**8.26**	**0.20**	R (light CL)
P1910-27	2.01E-03	1.07E-02	**8.63**	**0.20**	M (mid-CL)
P1910-28	2.01E-03	1.20E-02	**8.66**	**0.20**	M (mid CL)
P1910-29	2.01E-03	1.69E-02	**8.89**	**0.20**	C (dark CL)
P1910-30	2.01E-03	7.84E-03	**8.62**	**0.20**	C (mid-CL)
P1910-31	2.01E-03	1.08E-02	**9.08**	**0.20**	R (light CL)
P1910-32	2.01E-03	8.26E-03	**8.33**	**0.20**	M (dark CL)
P1910-33	2.01E-03	1.16E-02	**8.56**	**0.20**	C (dark CL)
P1910-34	2.01E-03	1.21E-02	**8.45**	**0.48**	C
P1910-35	2.01E-03	1.38E-02	**8.53**	**0.48**	C (mid-grey)
P1910-36	2.01E-03	1.01E-02	**8.21**	**0.48**	M
P1910-37	2.01E-03	9.10E-03	**8.22**	**0.48**	R (bright CL)
P1910-38	2.01E-03	1.06E-02	**8.49**	**0.48**	R (bright CL)
P1910-39	2.01E-03	1.09E-02	**8.36**	**0.48**	R
P1910-40	2.01E-03	9.97E-03	**8.39**	**0.48**	C
P1910-41	2.01E-03	9.45E-03	**8.57**	**0.48**	R
P1910-42	2.01E-03	1.67E-02	**7.97**	**0.48**	M
P1910-43	2.01E-03	7.09E-03	**8.05**	**0.48**	C
P1910-44	2.01E-03	1.55E-02	**8.31**	**0.36**	R (bright CL)
P1910-45	2.01E-03	1.10E-02	**8.34**	**0.36**	M (bright CL)
P1910-46	2.01E-03	1.28E-02	**8.20**	**0.36**	C (dark CL)
P1910-47	2.01E-03	1.32E-02	**8.29**	**0.36**	C (dark CL)
P1910-48	2.02E-03	1.16E-02	**8.68**	**0.36**	M (mid CL)
P1910-49	2.02E-03	1.67E-02	**8.97**	**0.36**	R (mid CL)
P1910-50	2.02E-03	1.33E-02	**8.74**	**0.36**	R (light CL)
P1910-51	2.01E-03	1.70E-02	**8.41**	**0.36**	M (dark CL)
P1910-52	2.02E-03	3.28E-02	**9.08**	**0.36**	C (dark CL)
P1910-53	2.01E-03	1.31E-02	**8.26**	**0.36**	R (light CL)

Table A17.3: ***Oxygen isotope compositions for Rangitaiki P1915 quartz***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)	Crystal zone/comment
P1915-11	2.01E-03	9.24E-03	**7.64**	0.14	R
P1915-12	2.01E-03	1.03E-02	**7.58**	0.14	M
P1915-13	2.01E-03	1.17E-02	**7.51**	**0.17**	C
P1915-14	2.01E-03	8.05E-03	**7.31**	**0.17**	R
P1915-15	2.01E-03	7.49E-03	**7.53**	**0.17**	M
P1915-16	2.01E-03	8.38E-03	**7.82**	**0.17**	R (bright-CL)
P1915-17	2.01E-03	7.94E-03	**7.67**	**0.17**	M (mid-CL)
P1915-18	2.01E-03	9.90E-03	**7.80**	**0.17**	M (dark-CL)
P1915-19	2.01E-03	8.75E-03	**7.90**	**0.17**	C (dark-CL)
P1915-20	2.01E-03	7.87E-03	**8.28**	**0.17**	C (dark-CL)
P1915-21	2.01E-03	1.02E-02	**8.06**	**0.17**	M (mid-CL)
P1915-22	2.01E-03	1.24E-02	**8.05**	**0.17**	R (light-CL)
P1915-28	2.01E-03	1.34E-02	**8.03**	**0.11**	C (dark-CL)
P1915-29	2.01E-03	1.24E-02	**8.77**	**0.11**	M (dark-CL)
P1915-30	2.01E-03	1.27E-02	**7.99**	**0.11**	R (light CL)
P1915-31	2.01E-03	7.10E-03	**8.01**	**0.11**	R (mid-CL)
P1915-32	2.01E-03	1.11E-02	**7.88**	**0.11**	M (dark-CL)
P1915-33	2.01E-03	1.12E-02	**8.25**	**0.11**	C (mid-CL)
P1915-34	2.01E-03	8.99E-03	**8.02**	**0.11**	R (light CL)
P1915-35	2.01E-03	1.21E-02	**8.03**	**0.11**	M (mid-CL)
P1915-36	2.01E-03	9.87E-03	**8.26**	**0.11**	C (dark CL)
P1915-37	2.01E-03	1.23E-02	**7.75**	**0.13**	R (mid-CL)
P1915-38	2.01E-03	9.47E-03	**8.18**	**0.13**	M (light-CL)
P1915-39	2.01E-03	9.28E-03	**7.88**	**0.13**	M (dark-CL)
P1915-40	2.01E-03	8.33E-03	**8.10**	**0.13**	C (dark-CL)
P1915-41	2.01E-03	1.06E-02	**8.69**	**0.13**	R (light-CL)
P1915-42	2.01E-03	8.71E-03	**8.31**	**0.13**	M (dark-CL)
P1915-43	2.01E-03	9.17E-03	**8.19**	**0.13**	C (dark-CL)
P1915-49	2.01E-03	1.23E-02	**7.42**	**0.12**	R (bright-CL)
P1915-50	2.01E-03	9.15E-03	**7.52**	**0.12**	M (mid-CL)
P1915-51	2.01E-03	4.57E-03	**7.48**	**0.12**	C (mid-CL)
P1915-52	2.01E-03	8.07E-03	**7.85**	**0.12**	C (dark-CL)
P1915-53	2.01E-03	1.08E-02	**7.69**	**0.12**	M (mid-CL)
P1915-54	2.01E-03	7.90E-03	**7.75**	**0.12**	R (light-CL)
P1915-55	2.01E-03	9.07E-03	**8.02**	**0.12**	C (dark-CL)
P1915-56	2.01E-03	1.10E-02	**7.99**	**0.12**	M (mid-CL)
P1915-57	2.01E-03	1.32E-02	**8.15**	**0.12**	R (bright-CL)
P1915-63	2.01E-03	9.88E-03	**8.57**	**0.12**	R (mid-CL)
P1915-64	2.01E-03	1.09E-02	**8.02**	**0.47**	C (mid-CL)
P1915-65	2.01E-03	1.01E-02	**8.00**	**0.47**	C (mid-CL)
P1915-66	2.01E-03	9.87E-03	**8.05**	**0.47**	R (light CL)
P1915-67	2.01E-03	8.96E-03	**8.07**	**0.47**	R (light CL)
P1915-68	2.01E-03	6.65E-03	**8.02**	**0.47**	C (dark CL)
P1915-69	2.01E-03	8.46E-03	**8.36**	**0.47**	C (dark CL)
P1915-70	2.01E-03	9.90E-03	**8.46**	**0.47**	R (light CL)
P1915-71	2.01E-03	1.23E-02	**8.44**	**0.47**	M (mid CL)
P1915-72	2.01E-03	1.25E-02	**8.04**	**0.47**	C (mid CL)

Table A17.4: ***Oxygen isotope compositions for Whakamaru P1920 quartz***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)	Crystal zone/comment
P1920-1	2.01E-03	7.50E-03	**8.39**	**0.34**	C
P1920-2	2.01E-03	5.55E-03	**8.79**	**0.34**	M
P1920-3	2.01E-03	7.23E-03	**9.35**	**0.34**	M (dark-CL)
P1920-4	2.01E-03	1.06E-02	**9.19**	**0.34**	M
P1920-5	2.01E-03	5.07E-03	**9.19**	**0.34**	R
P1920-6	2.01E-03	7.94E-03	**8.65**	**0.34**	R
P1920-7	2.01E-03	8.74E-03	**8.92**	**0.34**	C
P1920-8	2.01E-03	7.00E-03	**8.97**	**0.34**	R
P1920-9	2.01E-03	9.32E-03	**9.26**	**0.34**	M
P1920-10	2.01E-03	7.77E-03	**8.88**	**0.34**	C (dark-CL)
P1920-11	2.01E-03	1.17E-02	**10.01**	**0.34**	R
P1920-12	2.01E-03	7.83E-03	**9.62**	**0.34**	C
P1920-13	2.01E-03	7.66E-03	**9.21**	**0.34**	M
P1920-14	2.01E-03	1.03E-02	**9.04**	**0.34**	R
P1920-15	2.01E-03	7.97E-03	**9.40**	**0.34**	R
P1920-16	2.02E-03	1.11E-02	**11.06**	**0.34**	C
P1920-17	2.01E-03	7.65E-03	**9.75**	**0.34**	M
P1920-18	2.01E-03	8.31E-03	**9.02**	**0.34**	C
P1920-19	2.01E-03	1.10E-02	**8.62**	**0.34**	R
P1920-20	2.01E-03	8.12E-03	**8.75**	**0.20**	C
P1920-21	2.01E-03	1.47E-02	**9.90**	**0.20**	M
P1920-20a	2.01E-03	9.28E-03	**9.39**	**0.20**	C
P1920-21a	2.01E-03	1.19E-02	**10.17**	**0.20**	M
P1920-22	2.01E-03	7.56E-03	**10.10**	**0.20**	C
P1920-23	2.01E-03	8.69E-03	**9.78**	**0.20**	R
P1920-24	2.01E-03	9.63E-03	**10.10**	**0.20**	M
P1920-25	2.01E-03	6.96E-03	**9.77**	**0.20**	R
P1920-26	2.01E-03	7.91E-03	**9.60**	**0.20**	C
P1920-27	2.01E-03	9.60E-03	**9.10**	**0.20**	R
P1920-28	2.01E-03	1.16E-02	**10.08**	**0.20**	C
P1920-29	2.01E-03	8.48E-03	**8.64**	**0.20**	R
P1920-30	2.01E-03	8.98E-03	**9.22**	**0.20**	M
P1920-31	2.01E-03	7.07E-03	**8.30**	**0.49**	C
P1920-32	2.01E-03	8.41E-03	**8.55**	**0.49**	M
P1920-33	2.01E-03	7.83E-03	**8.23**	**0.49**	R
P1920-34	2.01E-03	1.16E-02	**8.33**	**0.49**	R
P1920-35	2.01E-03	9.81E-03	**8.37**	**0.49**	C
P1920-36	2.01E-03	1.01E-02	**8.68**	**0.49**	R (light-CL)
P1920-37	2.01E-03	1.10E-02	**8.48**	**0.49**	M
P1920-38	2.01E-03	8.94E-03	**8.20**	**0.49**	C
P1920-39	2.01E-03	1.00E-02	**8.49**	**0.49**	R
P1920-40	2.01E-03	9.68E-03	**8.27**	**0.49**	M
P1920-41	2.01E-03	8.14E-03	**8.67**	**0.49**	C
P1920-42	2.01E-03	1.07E-02	**8.73**	**0.49**	M
P1920-43	2.01E-03	8.21E-03	**8.56**	**0.49**	R
P1920-44	2.01E-03	8.64E-03	**8.52**	**0.49**	R
P1920-45	2.01E-03	1.37E-02	**8.75**	**0.49**	C
P1920-46	2.01E-03	7.54E-03	**8.24**	**0.36**	M
P1920-47	2.01E-03	7.35E-03	**8.60**	**0.36**	C
P1920-48	2.01E-03	8.43E-03	**8.22**	**0.36**	R
P1920-49	2.01E-03	8.67E-03	**8.46**	**0.36**	C
P1920-50	2.01E-03	7.16E-03	**8.54**	**0.36**	R

Table A17.5: ***Oxygen isotope compositions for Whakamaru P1827 quartz***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)	Crystal zone/comment
P1827-1	2.02E-03	8.34E-03	**7.82**	**0.23**	C (dark-CL)
P1827-2	2.01E-03	8.94E-03	**6.51**	**0.23**	R (light-CL)
P1827-3	2.01E-03	8.93E-03	**6.71**	**0.23**	M
P1827-4	2.01E-03	1.37E-02	**7.36**	**0.23**	R
P1827-5	2.01E-03	1.29E-02	**7.28**	**0.23**	C
P1827-6	2.01E-03	7.16E-03	**7.09**	**0.23**	C
P1827-7	2.02E-03	1.17E-02	**8.47**	**0.23**	R
P1827-8	2.02E-03	9.07E-03	**7.84**	**0.23**	R
P1827-9	2.01E-03	9.60E-03	**6.82**	**0.23**	C (dark-CL)
P1827-10	2.01E-03	8.83E-03	**6.29**	**0.23**	R
P1827-11	2.01E-03	7.61E-03	**6.79**	**0.23**	M
P1827-12	2.01E-03	1.12E-02	**6.85**	**0.23**	C (dark-CL)
P1827-13	2.01E-03	7.64E-03	**6.51**	**0.23**	R
P1827-14	2.02E-03	1.33E-02	**8.34**	**0.42**	C (light-CL)
P1827-15	2.02E-03	1.23E-02	**7.61**	**0.42**	M (dark-CL)
P1827-16	2.01E-03	7.53E-03	**6.17**	**0.42**	R (light-CL)
P1827-17	2.01E-03	8.19E-03	**6.71**	**0.42**	R (light-CL)
P1827-18	2.01E-03	9.98E-03	**6.59**	**0.42**	C (dark-CL)
P1827-20	2.01E-03	1.21E-02	**7.06**	**0.42**	M
P1827-21	2.01E-03	1.05E-02	**6.46**	**0.42**	R
P1827-22	2.02E-03	1.04E-02	**7.77**	**0.42**	R
P1827-23	2.02E-03	1.34E-02	**8.15**	**0.42**	C
P1827-24	2.02E-03	1.07E-02	**7.85**	**0.42**	R
P1827-25	2.01E-03	1.14E-02	**7.47**	**0.42**	C (dark-CL)
P1827-26	2.01E-03	7.62E-03	**7.22**	**0.27**	C
P1827-27	2.02E-03	8.77E-03	**7.63**	**0.27**	M
P1827-28	2.02E-03	1.32E-02	**8.17**	**0.27**	R
P1827-29	2.01E-03	9.87E-03	**6.96**	**0.27**	R (light-CL)
P1827-30	2.02E-03	9.71E-03	**8.05**	**0.27**	C (dark-CL)
P1827-32	2.01E-03	9.85E-03	**7.39**	**0.27**	C (dark-CL)
P1827-33	2.01E-03	6.90E-03	**7.48**	**0.27**	M
P1827-34	2.01E-03	9.16E-03	**6.62**	**0.27**	C
P1827-35	2.02E-03	1.24E-02	**7.80**	**0.27**	M
P1827-36	2.02E-03	1.34E-02	**8.53**	**0.27**	R
P1827-37	2.01E-03	1.11E-02	**6.92**	**0.21**	C (dark-CL)
P1827-38	2.01E-03	1.13E-02	**7.09**	**0.21**	M
P1827-39	2.01E-03	9.95E-03	**7.25**	**0.21**	R (light-CL)
P1827-40	2.01E-03	1.29E-02	**7.24**	**0.21**	C (light-CL)
P1827-42	2.01E-03	9.34E-03	**7.26**	**0.21**	C
P1827-43	2.02E-03	1.18E-02	**8.03**	**0.21**	R (light-CL)
P1827-44	2.02E-03	9.45E-03	**8.86**	**0.21**	C (dark-CL)
P1827-45	2.01E-03	8.38E-03	**6.42**	**0.21**	R (light-CL)
P1827-46	2.01E-03	1.12E-02	**7.07**	**0.21**	M
P1827-47	2.01E-03	1.30E-02	**7.17**	**0.15**	C (dark-CL)
P1827-48	2.01E-03	1.11E-02	**7.43**	**0.15**	M
P1827-49	2.01E-03	1.12E-02	**6.43**	**0.15**	R
P1827-50	2.01E-03	8.23E-03	**7.01**	**0.15**	C
P1827-51	2.01E-03	8.66E-03	**7.46**	**0.15**	C (light-CL)
P1827-52	2.01E-03	8.98E-03	**7.40**	**0.15**	M (light-CL)
P1827-53	2.02E-03	8.01E-03	**8.16**	**0.15**	M (dark-CL)
P1827-54	2.02E-03	7.97E-03	**8.71**	**0.15**	R (ligh-CL)
P1827-55	2.01E-03	1.12E-02	**7.37**	**0.22**	C
P1827-56	2.01E-03	1.04E-02	**7.19**	**0.22**	C

APPENDIX 17: QUARTZ $\delta^{18}O$ SIGNATURES

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)	Crystal zone/comment
P1827-57	2.01E-03	1.36E-02	**7.25**	**0.22**	M
P1827-58	2.01E-03	5.53E-03	**6.34**	**0.22**	R
P1827-60	2.02E-03	1.48E-02	**8.97**	**0.22**	M
P1827-61	2.01E-03	9.31E-03	**7.34**	**0.22**	R
P1827-62	2.01E-03	1.09E-02	**6.14**	**0.22**	R (light-CL)
P1827-63	2.01E-03	1.01E-02	**6.90**	**0.22**	M (dark-CL)
P1827-64	2.02E-03	1.16E-02	**8.31**	**0.22**	C (dark-CL)
P1827-65	2.01E-03	9.82E-03	**6.39**	**0.22**	R
P1827-66	2.02E-03	1.38E-02	**8.68**	**0.22**	M
P1827-67	2.02E-03	9.94E-03	**7.83**	**0.22**	R
P1827-68	2.01E-03	1.25E-02	**7.22**	**0.22**	M
P1827-69	2.01E-03	1.09E-02	**6.41**	**0.22**	C
P1827-70	2.02E-03	1.32E-02	**7.42**	**0.22**	R
P1827-72	2.02E-03	1.20E-02	**7.73**	**0.22**	C
P1827-73	2.02E-03	1.18E-02	**8.13**	**0.22**	C
P1827-74	2.01E-03	8.97E-03	**6.24**	**0.22**	R
P1827-75	2.01E-03	1.10E-02	**6.14**	**0.22**	R (light-CL)
P1827-76	2.01E-03	7.18E-03	**6.92**	**0.22**	C (dark-CL)
P1827-77	2.01E-03	1.06E-02	**7.05**	**0.22**	C (dark-CL)
P1827-78	2.02E-03	1.71E-02	**8.95**	**0.22**	R (light-CL)

Table A17.6: ***Quartz reference materials for sample P1905***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
P1905-7/1	2.01E-03	7.53E-03	**8.18**	**0.17**
P1905-7/2	2.01E-03	7.32E-03	**8.38**	**0.17**
P1905-7/3	2.01E-03	9.30E-03	**8.23**	**0.17**
P1905-7/4	2.01E-03	8.66E-03	**7.51**	**0.17**
P1905-7/5	2.01E-03	8.05E-03	**7.87**	**0.17**
P1905-7/6	2.01E-03	8.59E-03	**8.23**	**0.17**
P1905-7/7	2.01E-03	5.93E-03	**7.93**	**0.17**
P1905-7/8	2.01E-03	7.61E-03	**8.14**	**0.17**
P1905-7/9	2.01E-03	9.59E-03	**8.01**	**0.17**
P1905-7/10	2.01E-03	9.03E-03	**8.06**	**0.17**
NBS28-1	2.01E-03	5.75E-03	**9.20**	**0.17**
NBS28-2	2.01E-03	7.82E-03	**8.96**	**0.17**
NBS28-3	2.01E-03	8.69E-03	**8.82**	**0.17**
NBS28-4	2.01E-03	9.46E-03	**9.09**	**0.17**
NBS28-5	2.01E-03	8.45E-03	**9.24**	**0.17**
NBS28-6	2.02E-03	9.62E-03	**9.95**	**0.33**
NBS28-7	2.01E-03	9.46E-03	**9.34**	**0.33**
NBS28-8	2.01E-03	6.66E-03	**9.30**	**0.33**
NBS28-9	2.01E-03	9.16E-03	**9.46**	**0.33**
P1905-7/11	2.01E-03	1.08E-02	**8.10**	**0.15**
P1905-7/12	2.01E-03	6.31E-03	**7.98**	**0.15**
P1905-7/13	2.01E-03	8.68E-03	**7.76**	**0.15**
P1905-7/14	2.01E-03	9.33E-03	**8.03**	**0.15**
P1905-7/15	2.01E-03	9.50E-03	**7.70**	**0.15**
P1905-7/16	2.01E-03	6.57E-03	**8.13**	**0.15**
P1905-7/17	2.01E-03	6.96E-03	**8.00**	**0.15**
P1905-7/18	2.01E-03	1.26E-02	**7.87**	**0.15**
P1905-7/19	2.01E-03	5.53E-03	**8.10**	**0.15**
NBS28-10	2.01E-03	6.97E-03	**9.36**	**0.28**
NBS28-11	2.01E-03	9.23E-03	**9.88**	**0.28**
NBS28-12	2.01E-03	7.71E-03	**9.43**	**0.28**
NBS28-13	2.02E-03	8.43E-03	**10.00**	**0.28**
NBS28-14	2.01E-03	7.43E-03	**9.82**	**0.28**
NBS28-15	2.01E-03	9.07E-03	**9.68**	**0.20**
NBS28-16	2.01E-03	8.95E-03	**9.53**	**0.20**
NBS28-17	2.01E-03	8.61E-03	**9.58**	**0.20**
NBS28-18	2.01E-03	5.43E-03	**9.62**	**0.20**
NBS28-19	2.01E-03	8.20E-03	**9.59**	**0.20**
P1905-7/20	2.01E-03	8.46E-03	**7.76**	**0.21**
P1905-7/21	2.01E-03	1.08E-02	**7.91**	**0.21**
P1905-7/22	2.01E-03	1.01E-02	**8.34**	**0.21**
P1905-7/23	2.01E-03	1.14E-02	**8.15**	**0.21**
P1905-7/24	2.01E-03	9.59E-03	**8.22**	**0.21**
P1905-7/25	2.01E-03	1.14E-02	**8.10**	**0.21**
NBS28-20	2.01E-03	8.06E-03	**9.63**	**0.11**
NBS28-21	2.01E-03	8.10E-03	**9.48**	**0.11**
NBS28-22	2.01E-03	8.23E-03	**9.71**	**0.11**
NBS28-23	2.01E-03	8.72E-03	**9.50**	**0.11**
NBS28-24	2.01E-03	5.53E-03	**9.49**	**0.11**

Table A17.7: ***Quartz reference materials for sample P1910***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
NBS28-1	2.01E-03	9.44E-03	**9.33**	**0.11**
NBS28-2	2.01E-03	8.69E-03	**9.22**	**0.11**
NBS28-3	2.01E-03	7.72E-03	**9.22**	**0.11**
NBS28-4	2.01E-03	1.01E-02	**9.38**	**0.11**
NBS28-5	2.01E-03	9.35E-03	**9.22**	**0.11**
NBS28-6	2.01E-03	9.36E-03	**9.36**	**0.11**
NBS28-7	2.01E-03	7.19E-03	**9.22**	**0.11**
NBS28-8	2.01E-03	8.96E-03	**9.35**	**0.11**
NBS28-9	2.01E-03	1.24E-02	**9.54**	**0.11**
NBS28-10	2.01E-03	9.95E-03	**9.41**	**0.11**
NBS28-11	2.01E-03	1.36E-02	**9.60**	**0.14**
NBS28-12	2.01E-03	7.99E-03	**9.45**	**0.14**
NBS28-13	2.01E-03	1.28E-02	**9.65**	**0.14**
NBS28-14	2.01E-03	1.06E-02	**9.51**	**0.14**
NBS28-15	2.01E-03	1.33E-02	**9.59**	**0.14**
NBS28-16	2.02E-03	9.59E-03	**10.42**	**0.20**
NBS28-17	2.02E-03	1.29E-02	**10.46**	**0.20**
NBS28-18	2.02E-03	7.47E-03	**10.10**	**0.20**
NBS28-19	2.02E-03	8.30E-03	**10.38**	**0.20**
NBS28-20	2.02E-03	1.73E-02	**10.03**	**0.20**
Quartz11-1	2.01E-03	1.09E-02	**8.69**	**0.18**
Quartz11-2	2.01E-03	1.01E-02	**8.82**	**0.18**
Quartz11-3	2.01E-03	1.22E-02	**8.75**	**0.18**
Quartz11-4	2.01E-03	1.15E-02	**8.81**	**0.18**
Quartz11-5	2.01E-03	1.13E-02	**8.76**	**0.18**
Quartz11-6	2.01E-03	1.58E-02	**8.75**	**0.18**
Quartz11-7	2.01E-03	9.81E-03	**8.56**	**0.18**
Quartz11-8	2.01E-03	1.36E-02	**8.44**	**0.18**
Quartz11-9	2.01E-03	1.46E-02	**8.27**	**0.18**
Quartz11-10	2.01E-03	1.14E-02	**8.67**	**0.18**
NBS28-11	2.02E-03	1.00E-02	**10.30**	**0.50**
NBS28-12	2.02E-03	7.59E-03	**10.14**	**0.50**
NBS28-13	2.02E-03	1.07E-02	**9.84**	**0.50**
NBS28-14	2.01E-03	1.20E-02	**8.97**	**0.50**
NBS28-15	2.01E-03	1.37E-02	**8.74**	**0.50**
NBS28-16	2.02E-03	1.20E-02	**9.61**	**0.48**
NBS28-17	2.02E-03	1.36E-02	**9.92**	**0.48**
NBS28-18	2.02E-03	1.20E-02	**9.81**	**0.48**
NBS28-19	2.02E-03	9.51E-03	**9.50**	**0.48**
NBS28-20	2.02E-03	1.20E-02	**9.75**	**0.48**
Quartz11-11	2.01E-03	1.20E-02	**8.17**	**0.20**
Quartz11-12	2.01E-03	1.49E-02	**8.38**	**0.20**
Quartz11-13	2.01E-03	1.25E-02	**8.48**	**0.20**
Quartz11-14	2.01E-03	1.53E-02	**8.27**	**0.20**
Quartz11-15	2.01E-03	1.27E-02	**8.51**	**0.20**
Quartz11-16	2.01E-03	1.28E-02	**7.84**	**0.36**
Quartz11-17	2.01E-03	1.34E-02	**7.96**	**0.36**
Quartz11-18	2.01E-03	1.02E-02	**8.04**	**0.36**
Quartz11-19	2.01E-03	1.14E-02	**7.90**	**0.36**
Quartz11-20	2.01E-03	1.21E-02	**7.93**	**0.36**
Quartz11-21	2.01E-03	1.47E-02	**7.31**	**0.36**
Quartz11-22	2.01E-03	1.58E-02	**7.36**	**0.36**
Quartz11-23	2.01E-03	2.27E-02	**7.74**	**0.36**
Quartz11-24	2.01E-03	7.59E-03	**7.29**	**0.36**

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
Quartz11-25	2.01E-03	1.15E-02	**7.26**	**0.36**
NBS28-31	2.02E-03	2.54E-02	**9.35**	**0.33**
NBS28-32	2.02E-03	1.24E-02	**9.26**	**0.33**
NBS28-33	2.02E-03	2.19E-02	**9.33**	**0.33**
NBS28-34	2.02E-03	2.27E-02	**8.83**	**0.33**
NBS28-35	2.02E-03	2.24E-02	**9.16**	**0.33**

Table A17.8: ***Quartz reference materials for sample P1915***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
NBS28-1	2.01E-03	9.54E-03	**9.25**	**0.14**
NBS28-2	2.01E-03	9.10E-03	**9.49**	**0.14**
NBS28-3	2.02E-03	1.15E-02	**9.65**	**0.14**
NBS28-4	2.02E-03	1.08E-02	**9.49**	**0.14**
NBS28-5	2.02E-03	9.68E-03	**9.53**	**0.14**
NBS28-6	2.01E-03	9.13E-03	**8.27**	**0.11**
NBS28-7	2.01E-03	1.19E-02	**8.43**	**0.11**
NBS28-8	2.01E-03	1.06E-02	**8.34**	**0.11**
NBS28-9	2.01E-03	6.90E-03	**8.17**	**0.11**
NBS28-10	2.01E-03	7.94E-03	**8.17**	**0.11**
Qtz-10/1	2.01E-03	5.95E-03	**7.50**	**0.10**
Qtz-10/2	2.01E-03	8.33E-03	**7.80**	**0.10**
Qtz-10/3	2.01E-03	7.43E-03	**7.63**	**0.10**
Qtz-10/4	2.01E-03	7.27E-03	**7.48**	**0.10**
Qtz-10/5	2.01E-03	6.40E-03	**7.63**	**0.10**
Qtz-10/6	2.01E-03	9.94E-03	**7.55**	**0.10**
Qtz-10/7	2.01E-03	1.06E-02	**7.67**	**0.10**
Qtz-10/8	2.01E-03	7.94E-03	**7.54**	**0.10**
Qtz-10/9	2.01E-03	9.92E-03	**7.55**	**0.10**
Qtz-10/10	2.01E-03	9.21E-03	**7.68**	**0.10**
NBS28-11	2.02E-03	8.09E-03	**9.65**	**0.13**
NBS28-12	2.02E-03	8.63E-03	**9.54**	**0.13**
NBS28-13	2.01E-03	7.39E-03	**9.47**	**0.13**
NBS28-14	2.02E-03	8.14E-03	**9.63**	**0.13**
NBS28-15	2.02E-03	6.07E-03	**9.83**	**0.13**
NBS28-16	2.02E-03	9.38E-03	**9.50**	**0.13**
NBS28-17	2.02E-03	1.22E-02	**9.82**	**0.13**
NBS28-18	2.02E-03	6.96E-03	**9.57**	**0.13**
NBS28-19	2.02E-03	9.96E-03	**9.63**	**0.13**
NBS28-20	2.02E-03	9.06E-03	**9.49**	**0.13**
NBS28-21	2.01E-03	8.84E-03	**8.26**	**0.47**
NBS28-22	2.01E-03	1.36E-02	**8.90**	**0.47**
NBS28-23	2.01E-03	8.83E-03	**9.28**	**0.47**
NBS28-24	2.01E-03	1.16E-02	**9.22**	**0.47**
Qtz-10/11	2.01E-03	1.22E-02	**7.99**	**0.47**
Qtz-10/12	2.01E-03	8.46E-03	**7.93**	**0.47**
Qtz-10/13	2.01E-03	9.44E-03	**7.87**	**0.17**
Qtz-10/14	2.01E-03	9.17E-03	**7.77**	**0.17**
Qtz-10/15	2.01E-03	9.12E-03	**7.76**	**0.17**
Qtz-10/16	2.01E-03	7.83E-03	**7.87**	**0.17**
Qtz-10/17	2.01E-03	7.35E-03	**8.01**	**0.17**
Qtz-10/18	2.01E-03	8.23E-03	**7.73**	**0.12**
Qtz-10/19	2.01E-03	8.77E-03	**7.77**	**0.12**

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
Qtz-10/20	2.01E-03	1.12E-02	**7.94**	**0.12**
Qtz-10/21	2.01E-03	8.25E-03	**8.02**	**0.12**
Qtz-10/22	2.01E-03	1.03E-02	**7.79**	**0.12**
Qtz-10/23	2.01E-03	8.75E-03	**7.69**	**0.12**
Qtz-10/24	2.01E-03	1.07E-02	**7.76**	**0.12**
Qtz-10/25	2.01E-03	8.10E-03	**7.80**	**0.12**
Qtz-10/26	2.01E-03	1.22E-02	**7.83**	**0.12**
Qtz-10/27	2.01E-03	7.86E-03	**7.59**	**0.12**

Table A17.9: ***Quartz reference materials for sample P1920***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
NBS28-1	2.01E-03	8.15E-03	**9.91**	**0.13**
NBS28-2	2.01E-03	8.47E-03	**9.85**	**0.13**
NBS28-3	2.01E-03	9.05E-03	**9.59**	**0.13**
NBS28-4	2.01E-03	8.40E-03	**9.66**	**0.13**
NBS28-5	2.01E-03	8.59E-03	**9.74**	**0.13**
NBS28-6	2.01E-03	1.23E-02	**9.31**	**0.34**
NBS28-7	2.01E-03	1.12E-02	**9.13**	**0.34**
NBS28-8	2.01E-03	1.14E-02	**8.99**	**0.34**
NBS28-9	2.01E-03	8.19E-03	**9.05**	**0.34**
NBS28-10	2.01E-03	8.90E-03	**9.44**	**0.34**
Quartz7-1	2.01E-03	9.23E-03	**8.71**	**0.20**
Quartz7-2	2.01E-03	8.67E-03	**8.54**	**0.20**
Quartz7-3	2.01E-03	1.03E-02	**8.33**	**0.20**
Quartz7-4	2.01E-03	8.75E-03	**8.25**	**0.20**
Quartz7-5	2.01E-03	9.05E-03	**8.58**	**0.20**
NBS28-11	2.01E-03	9.20E-03	**9.23**	**0.50**
NBS28-12	2.01E-03	7.37E-03	**9.27**	**0.50**
NBS28-13	2.01E-03	9.39E-03	**10.10**	**0.50**
NBS28-14	2.01E-03	1.15E-02	**10.17**	**0.50**
NBS28-15	2.01E-03	9.76E-03	**9.15**	**0.36**
NBS28-16	2.01E-03	6.83E-03	**9.14**	**0.36**
NBS28-17	2.01E-03	6.75E-03	**9.66**	**0.36**
NBS28-18	2.01E-03	1.10E-02	**8.76**	**0.36**
Quartz7-6	2.01E-03	9.84E-03	**8.68**	**0.36**
Quartz7-7	2.01E-03	5.58E-03	**8.53**	**0.36**
Quartz7-8	2.01E-03	8.73E-03	**7.76**	**0.31**
Quartz7-9	2.01E-03	7.45E-03	**8.72**	**0.31**
Quartz7-10	2.01E-03	8.51E-03	**8.67**	**0.31**
Quartz7-11	2.01E-03	7.86E-03	**8.54**	**0.31**
Quartz7-12	2.01E-03	8.48E-03	**8.60**	**0.31**
Quartz7-13	2.01E-03	9.77E-03	**8.48**	**0.31**
Quartz7-14	2.01E-03	5.31E-03	**8.76**	**0.31**
Quartz7-15	2.01E-03	9.40E-03	**8.71**	**0.31**
Quartz7-16	2.01E-03	1.07E-02	**8.46**	**0.31**

Table A17.10: ***Quartz reference materials for sample P1827***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
Quartz26-1	2.01E-03	7.67E-03	**7.98**	**0.20**
Quartz26-2	2.01E-03	9.28E-03	**7.98**	**0.20**
Quartz26-3	2.01E-03	1.23E-02	**8.43**	**0.20**
Quartz26-4	2.01E-03	1.37E-02	**8.29**	**0.20**
Quartz26-5	2.01E-03	8.22E-03	**8.14**	**0.20**
Quartz26-6	2.01E-03	8.21E-03	**8.49**	**0.20**
Quartz26-7	2.01E-03	9.65E-03	**8.05**	**0.20**
Quartz26-8	2.01E-03	1.30E-02	**8.01**	**0.20**
Quartz26-9	2.01E-03	8.15E-03	**7.98**	**0.20**
Quartz26-10	2.01E-03	5.92E-03	**8.03**	**0.20**
NBS28-1	2.02E-03	1.04E-02	**9.22**	**0.35**
NBS28-2	2.02E-03	7.69E-03	**9.61**	**0.35**
NBS28-3	2.02E-03	9.63E-03	**8.77**	**0.35**
NBS28-4	2.02E-03	1.22E-02	**9.61**	**0.35**
NBS28-5	2.02E-03	1.19E-02	**9.23**	**0.35**
Quartz26-11	2.01E-03	9.34E-03	**8.07**	**0.23**
Quartz26-12	2.01E-03	1.12E-02	**7.94**	**0.23**
Quartz26-13	2.01E-03	9.44E-03	**7.64**	**0.23**
Quartz26-14	2.01E-03	8.95E-03	**7.80**	**0.23**
Quartz26-15	2.01E-03	1.19E-02	**8.33**	**0.23**
NBS28-6	2.02E-03	1.09E-02	**9.95**	**0.42**
NBS28-7	2.02E-03	1.11E-02	**9.95**	**0.42**
NBS28-8	2.02E-03	1.14E-02	**9.87**	**0.42**
Quartz26-16	2.01E-03	1.11E-02	**8.34**	**0.27**
Quartz26-17	2.01E-03	1.10E-02	**8.34**	**0.27**
Quartz26-18	2.01E-03	1.03E-02	**7.99**	**0.27**
Quartz26-19	2.01E-03	5.83E-03	**7.88**	**0.27**
Quartz26-20	2.01E-03	9.00E-03	**8.45**	**0.27**
NBS28-9	2.02E-03	1.55E-02	**8.84**	**0.50**
NBS28-10	2.02E-03	9.38E-03	**8.69**	**0.50**
NBS28-11	2.02E-03	1.08E-02	**8.98**	**0.50**
NBS28-12	2.02E-03	1.27E-02	**9.52**	**0.50**
Quartz26-21	2.01E-03	1.30E-02	**8.15**	**0.15**
Quartz26-22	2.01E-03	9.57E-03	**8.27**	**0.15**
Quartz26-23	2.01E-03	6.70E-03	**8.51**	**0.15**
Quartz26-24	2.01E-03	8.50E-03	**8.49**	**0.15**
Quartz26-25	2.01E-03	8.39E-03	**8.43**	**0.15**
Quartz26-26	2.01E-03	1.16E-02	**8.16**	**0.15**
Quartz26-27	2.01E-03	1.20E-02	**8.45**	**0.15**
Quartz26-28	2.01E-03	1.37E-02	**8.57**	**0.15**
Quartz26-29	2.01E-03	1.47E-02	**8.36**	**0.15**
Quartz26-30	2.01E-03	9.07E-03	**7.88**	**0.22**
Quartz26-31	2.01E-03	8.62E-03	**8.48**	**0.22**
Quartz26-32	2.01E-03	6.60E-03	**8.12**	**0.22**
Quartz26-33	2.01E-03	1.29E-02	**8.18**	**0.22**
Quartz26-34	2.01E-03	1.25E-02	**8.36**	**0.22**

Table A18.1: ***Oxygen isotope compositions for Rangitaiki P1915 Feldspar***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰) drift corrected	1sd (‰)	Crystal zone
P1915-1	2.02E-03	1.21E-02	**6.92**	0.09	R
P1915-2	2.02E-03	7.46E-03	**6.99**	0.09	M
P1915-3	2.02E-03	1.17E-02	**6.85**	0.09	C
P1915-4	2.02E-03	9.94E-03	**7.34**	0.09	C
P1915-5	2.02E-03	7.85E-03	**7.44**	0.09	R
P1915-6	2.02E-03	1.09E-02	**7.09**	0.09	M
P1915-7	2.02E-03	9.63E-03	**7.35**	0.09	R
P1915-8	2.02E-03	9.52E-03	**7.13**	0.09	C
P1915-9	2.02E-03	8.80E-03	**7.55**	0.09	M
P1915-10	2.02E-03	1.03E-02	**7.14**	0.09	C
P1915-11	2.02E-03	6.76E-03	**6.97**	0.09	R
P1915-12	2.02E-03	1.19E-02	**7.77**	0.09	R
P1915-13	2.02E-03	1.08E-02	**7.28**	0.11	C
P1915-14	2.02E-03	9.28E-03	**7.07**	0.11	M
P1915-15	2.02E-03	1.20E-02	**7.18**	0.11	R
P1915-16	2.02E-03	1.42E-02	**6.70**	0.11	R
P1915-17	2.02E-03	1.22E-02	**7.45**	0.11	M
P1915-18	2.02E-03	1.23E-02	**7.01**	0.11	C
P1915-19	2.02E-03	9.85E-03	**6.96**	0.11	M
P1915-20	2.02E-03	1.42E-02	**7.07**	0.11	C
P1915-21	2.02E-03	9.59E-03	**7.16**	0.11	R
P1915-22	2.02E-03	1.01E-02	**7.28**	0.11	R
P1915-23	2.02E-03	1.20E-02	**7.79**	0.11	M
P1915-24	2.02E-03	1.24E-02	**7.62**	0.11	R
P1915-25	2.02E-03	1.12E-02	**6.99**	0.33	R
P1915-26	2.02E-03	1.28E-02	**7.06**	0.33	M
P1915-27	2.02E-03	8.57E-03	**6.63**	0.33	C
P1915-28	2.02E-03	1.24E-02	**6.65**	0.33	R
P1915-29	2.02E-03	1.12E-02	**7.26**	0.33	C
P1915-30	2.02E-03	1.03E-02	**7.14**	0.33	R
P1915-31	2.02E-03	1.02E-02	**7.02**	0.33	C
P1915-32	2.02E-03	1.10E-02	**6.60**	0.33	M
P1915-33	2.02E-03	9.96E-03	**7.05**	0.33	R
P1915-34	2.02E-03	1.19E-02	**6.97**	0.33	C
P1915-35	2.02E-03	1.11E-02	**6.98**	0.11	R
P1915-36	2.02E-03	1.41E-02	**6.90**	0.11	M
P1915-37	2.02E-03	9.37E-03	**7.03**	0.11	C
P1915-38	2.02E-03	1.18E-02	**7.06**	0.11	R
P1915-39	2.02E-03	1.26E-02	**7.03**	0.11	C
P1915-40	2.02E-03	1.07E-02	**7.26**	0.11	M
P1915-41	2.02E-03	1.43E-02	**6.87**	0.11	M
P1915-42	2.02E-03	1.17E-02	**7.07**	0.11	M
P1915-43	2.02E-03	1.61E-02	**7.16**	0.11	R
P1915-44	2.02E-03	1.06E-02	**7.07**	0.11	C
P1915-45	2.02E-03	1.17E-02	**6.30**	0.17	R

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)	Crystal zone
P1915-46	2.02E-03	1.22E-02	**6.85**	0.17	C
P1915-47	2.02E-03	1.23E-02	**7.33**	0.17	R
P1915-48	2.02E-03	1.08E-02	**7.00**	0.17	C
P1915-49	2.02E-03	9.49E-03	**6.99**	0.17	C
P1915-50	2.02E-03	1.21E-02	**6.96**	0.17	M
P1915-51	2.02E-03	1.46E-02	**6.92**	0.17	R
P1915-52	2.02E-03	2.17E-02	**6.68**	0.17	R

Notes: Analysis Cameca IMS-1270; Edinburgh Ionmicroprobe Facility

Table A18.2: ***P1915 feldspar $\delta^{18}O$ standards***

Reference spot	$^{18}O/^{16}O$ Measured	% Std Err	$\delta^{18}O$ (‰)	1sd (‰)
Sierra60-1	2.02E-03	1.08E-02	**6.30**	0.09
Sierra60-2	2.02E-03	1.22E-02	**6.23**	0.09
Sierra60-3	2.02E-03	1.05E-02	**6.39**	0.09
Sierra60-4	2.02E-03	1.21E-02	**6.18**	0.09
Sierra60-5	2.02E-03	9.03E-03	**6.25**	0.09
Sierra60-6	2.02E-03	1.18E-02	**6.19**	0.11
Sierra60-7	2.02E-03	1.34E-02	**6.22**	0.11
Sierra60-8	2.02E-03	1.46E-02	**6.42**	0.11
Sierra60-9	2.02E-03	8.56E-03	**6.39**	0.11
Sierra60-10	2.02E-03	1.03E-02	**6.35**	0.11
Sierra60-11	2.02E-03	1.66E-02	**6.23**	0.33
Sierra60-12	2.02E-03	1.63E-02	**6.42**	0.33
Sierra60-13	2.02E-03	1.22E-02	**6.24**	0.33
Sierra60-14	2.02E-03	1.11E-02	**6.54**	0.33
Sierra60-15	2.02E-03	1.40E-02	**6.15**	0.33
Sierra60-16	2.02E-03	1.11E-02	**6.30**	0.33
Sierra60-17	2.02E-03	1.17E-02	**6.15**	0.33
Sierra60-18	2.02E-03	1.08E-02	**6.16**	0.33
Sierra60-19	2.02E-03	1.34E-02	**5.94**	0.33
Sierra60-20	2.02E-03	8.98E-03	**5.98**	0.11
Sierra60-21	2.02E-03	1.49E-02	**5.86**	0.11
Sierra60-22	2.02E-03	8.43E-03	**5.94**	0.11
Sierra60-23	2.02E-03	1.13E-02	**5.80**	0.11
Sierra60-24	2.02E-03	1.11E-02	**5.84**	0.11
Sierra60-25	2.02E-03	1.26E-02	**5.83**	0.11
Sierra60-26	2.02E-03	1.04E-02	**5.92**	0.11
Sierra60-27	2.02E-03	1.22E-02	**5.92**	0.11
Sierra60-28	2.02E-03	1.14E-02	**5.59**	0.17
Sierra60-29	2.02E-03	1.06E-02	**5.86**	0.17
Sierra60-30	2.02E-03	2.47E-02	**5.40**	0.17
Sierra60-31	2.02E-03	1.44E-02	**5.84**	0.17
Sierra60-32	2.02E-03	1.13E-02	**5.93**	0.17
Sierra60-33	2.02E-03	1.41E-02	**5.97**	0.17
Sierra60-34	2.02E-03	1.24E-02	**5.74**	0.17