

## Representative Monazite Major Element Analyses

<b>V436A</b>				<b>V436B</b>		
	<u>Mz1</u>	<u>Mz10 rim</u>	<u>Mz10 core</u>	<u>Mz12</u>	<u>Mz1</u>	<u>Mz2</u>
P2O5	29.64	30.09	29.98	29.78	29.61	29.79
SiO2	0.389	0.176	0.208	0.391	0.279	0.308
ThO2	4.892	3.460	4.240	6.03	3.112	3.407
Y2O3	1.089	0.801	1.370	0.675	0.188	0.060
La2O3	12.46	11.19	10.32	11.95	15.48	14.76
Ce2O3	28.00	33.01	30.39	32.54	30.46	31.16
Pr2O3	3.38	3.03	2.90	2.98	3.38	3.03
Nd2O3	11.87	12.32	12.10	11.71	12.43	12.97
Gd2O3	7.93	1.52	2.83	1.24	2.26	2.98
CaO	0.915	0.693	0.835	1.154	0.645	0.609
SmO	2.05	2.50	3.01	2.49	1.81	1.63
total	102.62	98.79	98.18	102.07	99.66	100.70

  

<b>V634A</b>						
	<u>Mz1a</u>	<u>Mz2a</u>	<u>Mz4 core</u>	<u>Mz4 rim</u>	<u>Mz6 core</u>	<u>Mz8</u>
P2O5	29.30	29.56	29.22	29.91	29.38	29.00
SiO2	0.265	0.236	0.409	0.161	0.223	0.319
ThO2	5.30	2.73	4.45	5.34	1.35	4.59
Y2O3	0.960	0.613	1.184	0.283	0.630	1.308
La2O3	14.62	16.14	13.30	15.18	13.56	13.72
Ce2O3	28.25	30.39	26.83	28.57	31.37	29.39
Pr2O3	3.26	3.06	2.79	2.83	3.28	3.26
Nd2O3	11.22	12.73	12.89	10.86	15.00	12.09
Gd2O3	3.44	2.29	5.77	2.66	2.72	5.19
CaO	1.26	0.453	0.749	1.305	0.314	0.782
SmO	1.52	2.09	2.55	1.49	2.06	1.76
total	99.42	100.28	100.13	98.59	99.89	101.42

  

<b>V240</b>				<b>V653</b>		
	<u>Mz1</u>	<u>Mz3</u>	<u>Mz7</u>	<u>Mz4</u>	<u>Mz1a</u>	<u>Mz1b</u>
P2O5	29.91	30.52	29.98	29.78	29.62	29.39
SiO2	0.25	0.08	0.12	0.29	0.28	0.43
ThO2	2.68	1.69	2.88	2.78	3.20	4.31
Y2O3	0.31	1.95	0.17	0.31	0.00	0.45
La2O3	14.49	11.99	11.96	14.83	14.45	13.78
Ce2O3	28.39	33.07	32.26	28.53	31.12	29.59
Pr2O3	3.57	3.35	3.32	3.50	3.22	3.23
Nd2O3	14.06	12.50	13.54	13.89	12.96	12.71
Gd2O3	2.14	0.98	1.42	3.55	1.52	3.11
CaO	0.61	0.64	0.75	0.64	0.60	0.75
SmO	2.19	2.04	2.46	1.90	2.03	2.00
total	98.60	99.40	98.85	100.02	99.02	99.76

**Table 1.** Major element analyses for monazite grains for each sample.

## Representative Monazite Trace Element Analyses

<b><u>Analysis</u></b>	<b><u>Y</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Th</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Pb</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>U</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Age</u></b>
V634b-Mz4a	10840	25	40450	127	952	31	3000	36	415
V634b-Mz4b	10557	25	40072	125	958	31	2985	36	421
V634b-Mz4c	10350	24	39671	125	860	30	2658	35	389
V634b-Mz4d	5777	18	41070	128	1092	31	6799	41	383
V634b-Mz4e	4643	17	45062	139	1355	32	9655	46	394
V634b-Mz4f	4488	16	44637	138	1292	32	9501	45	380
V634b-Mz4g	4494	17	42381	132	1271	32	9121	45	392
<b><u>Analysis</u></b>	<b><u>Y</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Th</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Pb</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>U</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Age</u></b>
V436A-Mz11a	11771	27	48799	149	1106	32	4305	38	386
V436A-Mz11b	11811	27	52215	158	1156	32	4260	38	384
V436A-Mz11c	10730	25	42330	132	1005	31	3910	37	400
V436A-Mz11h	7208	21	34171	119	883	30	4074	37	410
V436A-Mz11i	7466	22	30647	109	796	30	3822	36	406
V436A-Mz11j	8673	24	32750	115	915	30	4152	37	434
V436A-Mz11d	4683	17	30341	108	802	30	3934	36	411
V436A-Mz11f	9076	24	33244	116	848	30	4032	37	401
V436A-Mz11g	10564	27	32273	113	814	30	3913	37	395
<b><u>Analysis</u></b>	<b><u>Y</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Th</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Pb</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>U</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Age</u></b>
V436B-Mz1c	564	13	33400	114	876	30	3707	37	430
V436B-Mz1d	376	13	33524	115	837	30	3712	37	410
V436B-Mz1e	171	13	34560	118	776	30	3625	36	374
<b><u>Analysis</u></b>	<b><u>Y</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Th</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Pb</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>U</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Age</u></b>
V653-Mz1a	183	13	36119	117	1084	31	9437	47	364
V653-Mz1b	524	13	28724	97	653	30	4851	38	329
V653-Mz1c	552	13	26247	91	575	29	3360	36	346
V653-Mz1d	656	13	29356	99	598	30	3461	36	330
V653-Mz1e	794	13	29320	99	655	30	3374	36	363
V653-Mz1f	4532	18	42302	134	985	31	4090	37	393
V653-Mz1g	8769	26	45615	143	967	31	4225	38	359
V653-Mz1h	9273	27	46399	146	1035	31	4219	38	379
<b><u>Analysis</u></b>	<b><u>Y</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Th</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Pb</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>U</u></b>	<b><u>1<math>\sigma</math></u></b>	<b><u>Age</u></b>
V240-Mz1a	2280	15	19112	89	533	30	3910	38	375
V240-Mz1b	2284	15	18150	82	504	29	3757	37	372
V240-Mz1c	2249	15	17994	74	510	29	3689	36	381
V240-Mz1d	2311	15	17512	82	488	29	3626	37	373
V240-Mz1e	2613	15	20692	82	578	30	4206	37	377
V240-Mz1f	3760	15	17388	69	472	29	3560	36	365
V240-Mz1g	2728	15	26854	83	746	30	4905	37	390

**Table 2.** Representative trace element analyses used for age determination along with analytical errors reported at the 1 $\sigma$  level of confidence. The age for each analysis is also given. Analyses and errors are given in ppm.

### SHRIMP Analyses and Ages for V240 and V634A

Analysis	%206	207Pb/206Pb	206Pb/238U	207Pb/235U	%208	208Pb/232Th	208/232age	1 $\sigma$	206/238 age	1 $\sigma$	207/206 age	1 $\sigma$
V240-Mz1.1	0.28	0.05480	0.0601	0.455	0.320	0.01766	354	7	376	6	405	30
V240-Mz1.2	0.48	0.05360	0.0597	0.441	0.550	0.01761	353	7	374	6	354	36
V240-Mz1.3	0.36	0.05410	0.0615	0.459	0.430	0.01813	363	8	385	6	374	33
V240-Mz1.4	0.62	0.05310	0.0605	0.443	0.740	0.01788	358	8	379	6	335	46
V240-Mz1.5	0.49	0.05450	0.0591	0.444	0.560	0.01743	349	7	370	6	390	39
V240-Mz1.6	0.47	0.05480	0.0614	0.464	0.520	0.01818	364	8	384	6	403	43
V240-Mz2.1	0.34	0.05340	0.0592	0.436	0.490	0.01785	358	8	371	6	347	32
V240-Mz2.3	0.21	0.05590	0.0599	0.462	0.280	0.01812	363	8	375	6	449	34
V240-Mz3.1	0.35	0.05450	0.0626	0.470	0.740	0.01851	371	8	391	6	390	33
V240-Mz4.1	0.29	0.05510	0.0618	0.470	0.340	0.01865	372	8	386	6	418	38
V240-Mz4.2	0.47	0.05290	0.0612	0.446	0.490	0.01833	367	8	383	6	324	40
V240-Mz4.3	0.53	0.05210	0.0624	0.448	0.600	0.01839	368	8	390	6	290	40
V240-Mz7.1	0.25	0.05580	0.0611	0.470	0.320	0.01821	365	8	382	6	444	32
V240-Mz7.2	0.26	0.05360	0.0624	0.462	0.280	0.01864	373	8	390	6	355	30
V634A-Mz22.1	3.94	0.05560	0.0578	0.443	0.121	0.01813	363	8	362	7	436	173
V634A-Mz27.1	15.33	0.05200	0.0569	0.408	10.040	0.01759	352	8	357	7	285	372
V634A-Mz28.1	3.28	0.05800	0.0619	0.495	5.160	0.01839	368	8	387	6	530	61
V634A-Mz29.1	4.96	0.05120	0.0604	0.426	2.120	0.01799	360	7	378	6	248	158
V634A-Mz30.1	56.28	0.05420	0.0515	0.385	46.740	0.01801	361	11	324	11	381	833
V634A-Mz37.1	1.84	0.05460	0.0607	0.457	1.380	0.01754	352	7	380	6	397	67

**Table 3.** Isotopic ratios and ages determined by SHRIMP analysis. %206 and %208 denote amount of common Pb.

## Electron Microprobe Monazite Ages

<b>V634A</b>									
Monazite	Monazite position	Ages					Mean	Stdev	Std error
V634A-Mz1	median	390	385	389	392	382	388	4	2
V634A-Mz4R	rim	389	383	394	380	392	387	4	2
V634A-Mz4C	rim	415	421				418	7	3
V634A-Mz6	matrix	360	366	370	368		366	4	3
V634A-Mz8	median	392	420	387	374	395	394	17	8
V634A-Mz9	median	397	375	372	405		387	16	8
V634A-Mz20	core	394					394	N/A	N/A
V634A-Mz21	core	434	395	405			411	20	12
V634A-Mz22	core	436	426				431	7	5
V634A-Mz24	median	407	401	399			402	4	2
V634A-Mz27	median	418	408				413	7	5
V634A-Mz28	rim	374	387	377			379	7	4
V634A-Mz29	core	432	426	434			431	4	2
V634A-Mz30	median	384	411				398	19	14
V634A-Mz33	matrix	414	401	408			408	7	4
V634A-Mz36R	median	405	407	387			400	11	6
V634A-Mz36C	median	432					432	N/A	N/A
V634A-Mz37	core	424	425				425	1	1
V634A-Mz38	core	416	420	435			424	10	6

  

<b>V436A</b>									
Monazite	Monazite position	Ages					Mean	Stdev	Std error
V436A-Mz1	core	399	385	381	397	399	392	9	4
V436A-Mz4	rim	390	377	388	374		382	8	4
V436A-Mz5	core	388	395	376	378		384	9	4
V436A-Mz10-C	median	399	396	381	384		390	9	4
V436A-Mz10-R	median	367	353	366	371		364	8	5
V436A-Mz11	median	434	411	401	395	406	386		
		384	400	410			403	15	5
V436A-Mz12-C	rim	418	394	404	393		402	12	6
V436A-Mz12-R	rim	368	375	377			373	5	3
V436A-Mz25		374	388	401	379		386	12	6
V436A-Mz20-C	rim	374	346	348	362		358	13	7
V436A-Mz20-R	rim	316	329	301			315	14	8
V436A-Mz21	rim	359	366				363	5	4
V436A-Mz22	rim	383	403				393	14	10

**Table 4 .** Electron microprobe ages for all analysed monazite grains from 5 samples. Each monazite grain was analysed numerous times so that a mean age and standard deviation (Stdev) and standard error (Std error) could be calculated. Monazite position refers to relative position in a garnet porphyroblast or matrix.

**V436B**

Monazite	Monazite position	Ages						Mean	Stdev	Std error
V436B-Mz1	rim	407	430	410				416	13	7
V436B-Mz2	rim	358	365					362	5	4
V436B-Mz3	rim	346	334	354	342	366	342	357	14	4
		370	363	373	361	378	356			
V436B-Mz4	matrix	342	332					337	7	4
V436B-Mz6	matrix	342	333	335	345			339	6	3
V436B-Mz8	rim	346	351					349	4	3
V436B-Mz9	rim	350	372	335	334			348	18	9

**V653**

Monazite	Monazite position	Ages						Mean	Stdev	Std error
V653Mz1	rim	364	329	346	330	363		346	17	8
V653Mz1	rim	359	379	393				377	17	10
V653Mz4	matrix	357	344	353	345			350	6	3
V653Mz5a	rim	347	353					350	4	3
V653Mz5b	rim	371	366					369	4	3
V653Mz7	rim	362	349	343	382	351	369	358	12	4
		356	354							
V653Mz21		324	313					319	8	6
V653Mz23	matrix	313	331	334	330			327	9	5
V653Mz24	matrix	363	344	326	355			347	16	8
V653Mz30	rim	348	352	348	332			345	9	4
V653Mz31	rim	351	357					354	4	3
V653Mz33	rim	307	316	303				309	7	4

**V240**

Monazite	Monazite position	Ages						Mean	Stdev	Std error
V240Mz1	rim	375	372	381	373	377	365	376	8	3
		390								
V240Mz2	rim	384	391	368	384	370	392	388	20	7
		427								
V240Mz3	core	428	407	434				423	14	8
V240Mz7	matix	367	386	389	372	370		377	10	4

**Table 4 continued.**