

Supplementary Materials for  
**Zircon trace element evidence for early hydrothermal activity on Mars**

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*Sci. Adv.* **10**, eadq3694 (2024)  
DOI: 10.1126/sciadv.adq3694

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Tables S1 and S2

Cation	EDS-STEM map area Fig 2a		EDS-STEM zircon non- twin domain	
	At. %	Uncertainty %	At. %	Uncertainty %
Mg	0.00	0.00	0.13	0.02
Al	0.34	0.09	0.84	0.23
Si	46.55	12.51	47.31	12.64
Fe	1.31	0.30	0.96	0.22
Y	0.51	0.11	0.49	0.11
Zr	50.12	11.20	48.56	10.76
Hf	0.65	0.14	1.01	0.21
<b>Total</b>	99.48		99.17	

**Table S1.**

Elemental composition of zircon in terms of atomic percent as determined by EDS-STEM analysis.

Cluster no.	Si (at. %)	Zr (at. %)	O (at. %)	Fe (at. %)	Y (at. %)	Hf (at. %)	Al (at. %)	Mg (at. %)
Cluster 1	19.1	15.0	62.8	0.21	2.57	0.21	0.21	0.00
Cluster 2	20.9	16.1	59.6	0.79	1.84	0.04	0.48	0.24
Cluster 3	20.8	16.5	59.4	0.00	2.69	0.31	0.15	0.15
Cluster 4	23.6	15.2	58.0	1.16	1.04	0.14	0.50	0.29
Cluster 5	22.7	14.8	59.3	1.24	1.20	0.17	0.54	0.07
Cluster 6	24.6	14.5	57.7	0.73	1.50	0.13	0.64	0.17
Cluster 7	24.8	13.4	58.4	0.97	1.08	0.68	0.50	0.25
Cluster 8	21.5	14.6	59.7	0.08	3.05	0.29	0.58	0.23
Cluster 9	24.4	17.5	54.6	0.25	1.97	0.34	0.68	0.23
Cluster 10	24.9	14.5	57.6	1.06	0.82	0.13	0.79	0.16
Cluster 11	20.8	17.1	60.2	0.76	0.78	0.05	0.31	0.10
Cluster 12	20.9	17.3	58.7	0.13	2.20	0.25	0.39	0.10
Cluster 13	20.6	15.1	61.4	0.47	1.63	0.18	0.44	0.18
Cluster 14	21.2	14.8	61.6	0.25	1.59	0.22	0.27	0.09
Cluster 15	23.0	16.5	57.9	0.34	1.98	0.04	0.00	0.27
Cluster 16	21.3	15.6	60.0	0.17	2.47	0.21	0.17	0.09
Cluster 17	21.7	17.5	57.8	0.28	1.97	0.04	0.59	0.08
Cluster 18	22.1	14.1	60.3	0.07	2.83	0.21	0.41	0.00
Cluster 19	21.3	15.2	59.7	0.16	2.51	0.32	0.57	0.24
Cluster 20	22.8	16.5	58.2	0.54	1.16	0.08	0.57	0.08
Cluster 21	23.2	15.7	57.9	0.69	1.56	0.08	0.62	0.23
Cluster 22	22.6	15.9	59.4	0.66	0.89	0.11	0.38	0.15
Cluster 23	20.8	17.3	59.1	0.36	1.62	0.26	0.52	0.00
Cluster 24	23.3	15.2	58.9	0.58	1.44	0.11	0.35	0.14
Cluster 25	22.7	16.3	58.9	0.62	0.56	0.24	0.49	0.14
Cluster 26	23.8	12.9	60.5	1.04	0.71	0.14	0.68	0.27
Cluster 27	24.1	15.2	58.3	0.95	0.77	0.12	0.36	0.11
Cluster 28	22.9	14.7	59.5	0.83	1.05	0.14	0.81	0.14
Cluster 29	22.4	14.5	60.2	0.25	2.00	0.13	0.27	0.27
Cluster 30	21.5	16.3	59.6	0.59	1.10	0.00	0.79	0.20
Cluster 31	21.9	15.5	60.2	0.38	1.25	0.19	0.35	0.19
Cluster 32	25.0	14.2	58.2	0.92	0.88	0.21	0.48	0.18
Cluster 33	22.9	14.6	59.1	0.93	1.95	0.03	0.29	0.12
Cluster 34	23.8	14.7	58.7	0.82	1.12	0.10	0.63	0.11
Cluster 35	19.7	23.7	53.6	0.31	1.42	0.26	0.17	0.86
Cluster 36	22.3	16.5	58.7	0.28	1.52	0.18	0.47	0.03
Cluster 37	21.6	15.6	60.2	0.11	1.02	0.14	1.06	0.33
Cluster 38	20.8	15.1	61.4	0.23	1.72	0.00	0.49	0.27
Cluster 39	22.8	15.8	57.9	0.62	1.85	0.16	0.60	0.33
Cluster 40	22.6	15.8	58.6	0.41	1.91	0.12	0.34	0.19
Cluster 41	20.6	16.3	61.1	0.14	1.10	0.20	0.30	0.25
Cluster 42	24.2	14.5	57.8	1.24	1.17	0.12	0.78	0.24

Cluster 43	22.5	15.3	59.6	0.38	1.71	0.14	0.18	0.18
Cluster 44	21.4	16.4	60.2	0.47	1.12	0.04	0.31	0.09
Cluster 45	22.3	16.3	59.4	0.60	0.95	0.04	0.40	0.09
Cluster 46	21.8	14.7	60.4	0.85	1.31	0.10	0.50	0.29
Cluster 47	23.1	16.4	58.1	0.75	0.74	0.15	0.59	0.17
Cluster 48	23.4	16.3	57.2	0.87	1.29	0.10	0.78	0.16
Cluster 49	21.3	16.7	59.7	0.12	1.20	0.13	0.57	0.24
Cluster 50	23.8	15.0	58.5	0.47	1.33	0.16	0.54	0.23
Cluster 51	23.0	15.6	59.2	0.51	1.13	0.06	0.38	0.04
Cluster 52	22.6	16.0	58.1	0.55	2.09	0.15	0.34	0.23
Cluster 53	21.2	15.5	60.0	0.49	1.86	0.23	0.39	0.39
Cluster 54	21.5	17.3	59.5	0.12	1.23	0.09	0.32	0.07
Cluster 55	23.2	16.2	58.1	0.69	1.27	0.11	0.29	0.14
Cluster 56	25.4	15.0	56.9	0.79	1.23	0.12	0.36	0.18
Cluster 57	23.5	15.1	59.2	0.70	0.92	0.08	0.47	0.17
Cluster 58	25.6	14.9	56.5	1.14	1.03	0.13	0.63	0.13
Cluster 59	22.4	15.9	58.4	0.23	2.43	0.09	0.35	0.16
Cluster 60	24.7	15.1	57.4	0.82	0.95	0.09	0.61	0.25
Cluster 61	22.9	16.6	58.5	0.53	0.78	0.16	0.45	0.10
Cluster 62	23.6	15.9	57.6	0.89	1.22	0.13	0.48	0.20
Cluster 63	24.7	14.2	56.8	1.69	1.40	0.27	0.60	0.39
Cluster 64	21.9	16.8	59.3	0.61	0.91	0.14	0.30	0.07
Cluster 65	23.6	14.7	59.1	0.83	1.13	0.08	0.34	0.18
Cluster 66	24.3	14.4	57.8	1.17	1.41	0.08	0.59	0.22
Cluster 67	24.2	15.8	57.5	0.99	0.78	0.11	0.57	0.13
Cluster 68	24.9	14.0	58.0	1.33	0.81	0.07	0.58	0.37
Cluster 69	24.0	15.4	58.0	0.93	0.67	0.12	0.72	0.16
Cluster 70	24.0	16.6	57.0	1.03	0.74	0.12	0.32	0.21
Cluster 71	21.2	15.4	61.0	0.17	1.26	0.11	0.52	0.28
Cluster 72	22.8	16.3	58.7	0.56	0.82	0.12	0.51	0.09
Cluster 73	25.2	15.7	55.8	2.10	0.46	0.13	0.57	0.15
Cluster 74	23.9	15.4	57.6	1.22	0.39	0.06	0.93	0.58
Cluster 75	20.8	17.3	58.5	0.16	2.76	0.08	0.16	0.32
Cluster 76	22.0	15.6	59.2	0.20	1.82	0.18	0.73	0.24
Cluster 77	25.5	16.5	55.1	1.25	0.90	0.29	0.23	0.23
Cluster 78	23.3	15.5	58.6	0.70	1.56	0.07	0.21	0.07
Cluster 79	21.6	17.0	58.2	0.53	1.59	0.32	0.55	0.18
Cluster 80	22.0	16.6	59.4	0.57	1.06	0.04	0.26	0.09
Cluster 81	18.6	19.0	59.6	0.31	2.07	0.08	0.33	0.00
Cluster 82	23.0	16.5	57.8	0.87	1.04	0.08	0.42	0.34
Cluster 83	24.1	16.4	57.1	0.46	1.30	0.08	0.49	0.00
Cluster 84	23.2	15.3	59.3	0.29	0.87	0.12	0.64	0.16
Cluster 85	25.3	15.4	56.4	1.28	0.72	0.12	0.59	0.28
Cluster 86	19.7	17.8	60.0	0.19	1.76	0.04	0.54	0.00

Cluster 87	22.7	17.4	57.2	0.74	1.51	0.08	0.38	0.08
Cluster 88	23.1	16.4	57.7	0.46	1.63	0.00	0.42	0.28
Cluster 89	18.6	17.5	60.0	0.09	2.99	0.14	0.41	0.27
Cluster 90	23.9	16.3	56.9	0.83	1.04	0.17	0.70	0.08
Cluster 91	21.9	13.8	61.1	0.63	1.55	0.06	0.52	0.39
Cluster 92	23.7	14.9	58.5	0.67	1.35	0.12	0.80	0.06
Cluster 93	22.0	14.6	60.6	0.10	2.21	0.06	0.24	0.12
Cluster 94	21.0	18.0	59.4	0.11	1.12	0.09	0.18	0.06
Cluster 95	22.6	16.2	57.7	0.69	2.20	0.23	0.35	0.00
Cluster 96	21.9	15.3	60.1	0.52	1.45	0.17	0.46	0.17
Cluster 97	25.0	15.0	57.3	0.73	1.17	0.00	0.68	0.11
Cluster 98	21.9	15.3	59.7	0.19	2.25	0.15	0.20	0.31
Cluster 99	22.2	16.1	58.9	1.07	1.52	0.05	0.20	0.00
Cluster 100	19.9	16.9	60.4	0.16	1.76	0.20	0.51	0.15
Cluster 101	24.9	15.2	57.1	0.78	1.47	0.10	0.30	0.10
Cluster 102	22.5	16.7	58.8	0.13	0.93	0.15	0.56	0.23
Cluster 103	20.3	14.3	60.6	0.24	3.02	0.19	0.38	0.95
Cluster 104	23.2	17.2	56.9	0.77	1.10	0.10	0.39	0.39
Cluster 105	22.5	15.6	58.3	0.17	2.64	0.00	0.28	0.47
Cluster 106	21.8	15.2	60.2	0.29	1.91	0.05	0.37	0.18
Cluster 107	23.9	14.0	59.1	0.64	1.44	0.14	0.73	0.09
Cluster 108	22.4	16.3	58.0	0.20	2.38	0.13	0.43	0.09
Cluster 109	21.3	15.0	60.1	0.31	2.02	0.08	0.49	0.73
Cluster 110	23.3	15.6	58.3	0.65	1.28	0.12	0.55	0.31
Cluster 111	22.9	16.2	58.3	0.81	1.31	0.08	0.23	0.15
Cluster 112	23.9	15.5	57.9	1.10	0.88	0.09	0.48	0.26
Cluster 113	23.7	15.5	58.1	0.68	1.19	0.15	0.51	0.22
Cluster 114	20.3	16.5	60.7	0.33	1.41	0.04	0.36	0.29
Cluster 115	21.3	15.0	60.7	0.10	1.62	0.15	0.96	0.22
Cluster 116	23.7	14.7	58.9	0.81	1.46	0.07	0.36	0.00
Cluster 117	24.4	15.2	57.4	1.07	0.94	0.11	0.71	0.14
Cluster 118	22.8	15.0	60.0	0.96	0.96	0.14	0.07	0.21
Cluster 119	21.5	15.2	60.4	0.95	1.32	0.23	0.39	0.06
Cluster 120	22.1	14.6	60.1	0.62	1.76	0.29	0.46	0.07
Cluster 121	22.0	16.6	59.6	0.41	0.67	0.19	0.58	0.00
Cluster 122	23.1	15.5	58.7	1.04	0.71	0.06	0.71	0.13
Cluster 123	22.4	17.1	58.0	0.55	1.23	0.09	0.53	0.12
Cluster 124	23.2	14.9	59.0	0.83	1.19	0.13	0.64	0.20
Cluster 125	22.9	16.4	58.0	0.71	1.28	0.14	0.35	0.17
Cluster 126	24.6	14.4	58.1	0.62	1.26	0.25	0.68	0.17
Cluster 127	22.4	15.2	59.1	0.65	1.58	0.14	0.34	0.56
Cluster 128	23.9	16.9	56.1	0.87	1.02	0.21	0.72	0.41
Cluster 129	24.3	14.1	58.4	1.15	1.04	0.11	0.66	0.27
Cluster 130	22.1	16.2	59.6	0.07	1.24	0.11	0.48	0.21

Cluster 131	21.7	15.9	59.9	0.16	1.21	0.15	0.75	0.20
Cluster 132	23.4	17.9	56.1	0.37	1.68	0.25	0.29	0.10
Cluster 133	21.4	17.8	58.8	0.15	1.22	0.13	0.44	0.10
Cluster 134	24.3	15.1	57.8	0.93	0.93	0.07	0.68	0.18
Cluster 135	25.1	14.8	56.9	1.12	1.24	0.11	0.53	0.18
Cluster 136	25.1	13.2	58.7	0.63	1.39	0.13	0.65	0.17
Cluster 137	24.0	15.0	57.7	0.56	1.78	0.19	0.34	0.38
Cluster 138	21.9	15.1	59.7	0.38	1.72	0.06	0.85	0.32
Cluster 139	23.5	15.0	58.8	0.89	0.84	0.12	0.59	0.20
Cluster 140	22.3	14.9	60.3	0.53	1.04	0.20	0.59	0.12
Cluster 141	23.1	15.4	58.7	1.08	0.73	0.19	0.65	0.15
Cluster 142	24.2	15.1	57.2	1.22	1.61	0.08	0.27	0.34
Cluster 143	23.4	15.7	58.2	0.87	1.13	0.11	0.48	0.15
Cluster 144	24.0	16.1	56.9	0.94	1.22	0.20	0.58	0.15
Cluster 145	22.6	15.8	59.1	0.62	0.98	0.16	0.54	0.14
Cluster 146	21.3	16.2	60.1	0.39	1.54	0.14	0.24	0.17
Cluster 147	21.5	14.5	61.5	0.16	1.47	0.08	0.58	0.27
Cluster 148	20.4	17.2	60.5	0.12	1.26	0.15	0.43	0.07
Cluster 149	22.9	16.1	57.8	1.05	1.20	0.16	0.63	0.14
Cluster 150	20.1	17.5	60.8	0.08	1.21	0.14	0.11	0.07
Cluster 151	21.7	16.1	60.3	0.17	1.12	0.14	0.43	0.07
Cluster 152	20.6	16.8	58.5	0.26	3.37	0.26	0.26	0.00
Cluster 153	21.7	15.1	59.9	0.37	2.28	0.20	0.40	0.00
Cluster 154	19.2	16.7	61.0	0.31	2.26	0.20	0.13	0.13
Cluster 155	18.8	15.9	62.4	0.10	2.80	0.00	0.00	0.00
Cluster 156	26.2	14.4	56.1	0.43	1.20	0.10	1.40	0.20
Cluster 157	22.1	15.5	59.6	0.40	1.95	0.12	0.24	0.12
Cluster 158	23.9	16.7	56.2	0.87	1.21	0.35	0.35	0.46
Cluster 159	24.0	15.4	57.9	0.73	1.27	0.17	0.34	0.25
Cluster 160	25.4	14.3	57.3	1.05	1.49	0.17	0.33	0.00
Cluster 161	24.9	16.0	56.4	0.72	0.99	0.10	0.72	0.26
Cluster 162	20.7	16.7	59.7	0.38	1.66	0.16	0.54	0.22
Cluster 163	23.3	14.8	59.0	0.35	1.62	0.08	0.65	0.16
Cluster 164	22.2	13.2	60.6	0.32	2.13	0.22	0.60	0.60
Cluster 165	22.4	15.9	58.5	1.14	1.40	0.14	0.55	0.00
Cluster 166	21.8	14.2	60.4	0.54	2.16	0.13	0.81	0.00
Cluster 167	18.7	14.5	62.4	0.22	2.91	0.00	1.06	0.26
Cluster 168	21.6	15.1	61.1	0.32	1.51	0.00	0.26	0.13
Cluster 169	20.1	14.8	61.5	0.10	2.33	0.21	0.42	0.42
Cluster 170	21.6	16.8	58.3	0.19	2.36	0.00	0.25	0.50
Cluster 171	23.7	14.6	59.0	0.62	1.45	0.06	0.49	0.12
Cluster 172	21.6	15.2	60.4	0.86	1.24	0.09	0.42	0.12
Cluster 173	19.7	16.7	60.8	0.26	1.58	0.23	0.68	0.00
Cluster 174	21.8	16.7	59.0	0.44	1.33	0.11	0.55	0.00

Cluster 175	23.1	14.6	59.5	0.82	1.05	0.11	0.63	0.21
Cluster 176	17.8	14.9	63.2	0.34	2.66	0.61	0.61	0.00
Cluster 177	20.9	15.0	60.8	0.20	2.85	0.10	0.20	0.00
Cluster 178	22.0	17.3	57.9	0.30	2.41	0.10	0.00	0.00
Cluster 179	21.6	17.3	58.5	0.42	1.55	0.20	0.39	0.10
Cluster 180	26.1	14.8	56.8	0.82	0.69	0.10	0.78	0.00
Cluster 181	22.2	16.2	58.7	0.80	1.51	0.16	0.39	0.06
Cluster 182	20.9	15.9	59.9	0.83	1.89	0.14	0.29	0.19
Cluster 183	21.3	14.1	61.5	1.37	0.54	0.36	0.89	0.00
Cluster 184	23.2	14.2	59.4	0.56	1.84	0.09	0.18	0.53
Cluster 185	23.3	15.9	57.6	0.97	1.36	0.26	0.35	0.26
Cluster 186	21.4	15.2	59.8	0.12	2.44	0.22	0.35	0.44
Cluster 187	20.8	16.0	60.2	0.52	1.46	0.26	0.69	0.00
Cluster 188	20.4	15.8	61.2	0.17	2.06	0.00	0.17	0.17
Cluster 189	21.9	14.7	59.4	0.11	2.41	0.41	0.73	0.41
Cluster 190	24.8	14.7	57.3	1.43	1.24	0.16	0.32	0.11
Cluster 191	23.6	15.8	57.3	0.93	1.75	0.08	0.36	0.21
Cluster 192	21.2	16.9	60.1	0.16	0.97	0.17	0.41	0.09
Cluster 193	21.9	14.4	60.7	0.17	2.40	0.07	0.34	0.05
Cluster 194	23.8	14.7	58.2	0.97	1.74	0.10	0.30	0.18
Cluster 195	20.4	16.9	60.4	0.44	1.04	0.00	0.74	0.00
Cluster 196	24.0	13.7	59.2	0.80	0.98	0.07	0.88	0.39
Cluster 197	27.0	16.3	54.3	0.36	1.42	0.29	0.29	0.14
Cluster 198	24.1	13.6	60.2	0.75	0.65	0.04	0.58	0.07
Cluster 199	23.0	12.8	60.3	1.19	1.06	0.21	0.86	0.57
Cluster 200	21.4	16.2	58.7	0.26	3.14	0.14	0.00	0.14
Cluster 201	23.7	14.9	58.2	0.65	1.70	0.09	0.42	0.37
Cluster 202	23.5	14.7	58.5	0.50	2.30	0.00	0.55	0.00
Cluster 203	26.0	14.9	56.5	0.63	1.12	0.07	0.84	0.00
Cluster 204	21.8	14.5	60.6	0.27	2.21	0.27	0.40	0.00
Cluster 205	22.7	15.2	58.4	0.89	1.31	0.17	0.87	0.47
Cluster 206	23.4	16.6	57.0	0.36	1.96	0.20	0.41	0.14
Cluster 207	24.0	15.1	58.6	0.81	0.90	0.26	0.40	0.00
Cluster 208	23.6	15.3	57.6	1.32	0.93	0.13	0.68	0.39
Cluster 209	23.6	15.2	58.3	1.08	1.15	0.13	0.35	0.16
Cluster 210	22.5	16.1	58.4	0.41	2.08	0.13	0.32	0.06
Cluster 211	22.9	14.9	58.4	0.23	2.63	0.19	0.38	0.38
Cluster 212	22.8	14.5	58.6	0.20	2.96	0.24	0.36	0.24
Cluster 213	23.5	14.3	59.0	1.18	1.20	0.16	0.51	0.12
Cluster 214	20.0	15.5	60.3	0.31	2.72	0.17	0.35	0.58
Cluster 215	23.6	15.0	58.9	1.10	0.94	0.09	0.17	0.17
Cluster 216	22.3	16.9	58.1	0.41	1.46	0.00	0.79	0.00
Cluster 217	22.3	16.2	58.5	0.54	1.67	0.19	0.44	0.11
Cluster 218	20.1	16.2	60.1	0.19	2.91	0.21	0.21	0.10

Cluster 219	21.3	15.1	61.0	0.12	1.35	0.10	0.63	0.45
Cluster 220	20.2	16.6	59.9	0.11	2.57	0.13	0.21	0.31
Cluster 221	24.4	14.2	58.6	0.20	1.62	0.10	0.30	0.51
Cluster 222	22.9	15.9	59.1	0.33	1.20	0.10	0.10	0.30
Cluster 223	25.0	13.4	59.3	0.73	0.81	0.10	0.39	0.29
Cluster 224	24.7	13.8	58.3	1.10	1.19	0.19	0.56	0.19
Cluster 225	23.7	15.0	58.5	0.76	1.52	0.14	0.18	0.23
Cluster 226	22.7	15.4	59.3	0.11	1.67	0.00	0.65	0.19
Cluster 227	19.6	15.5	62.2	0.18	1.86	0.09	0.27	0.27
Cluster 228	20.2	15.9	60.7	0.03	2.83	0.09	0.09	0.17
Cluster 229	24.1	16.6	56.6	0.75	1.05	0.21	0.68	0.08
Cluster 230	23.5	16.4	57.3	0.64	1.61	0.04	0.49	0.00
Cluster 231	20.5	17.1	59.7	0.41	1.76	0.12	0.33	0.00
Cluster 232	25.4	13.1	58.5	0.63	1.50	0.12	0.44	0.32
Cluster 233	21.2	16.1	59.1	0.07	2.53	0.20	0.79	0.00
Cluster 234	22.3	14.7	59.8	0.83	1.68	0.12	0.42	0.19
Cluster 235	21.1	15.6	60.2	0.15	2.46	0.15	0.23	0.15
Cluster 236	22.2	14.7	60.1	0.15	2.18	0.18	0.21	0.28
Cluster 237	21.6	15.6	59.9	0.73	1.53	0.10	0.38	0.14
Cluster 238	20.5	18.1	58.9	0.27	0.95	0.24	0.69	0.27
Cluster 239	21.2	16.4	59.4	0.49	1.96	0.16	0.20	0.20
Cluster 240	22.0	15.3	60.0	0.80	1.04	0.20	0.59	0.20
Cluster 241	21.8	16.4	59.4	0.16	1.35	0.08	0.48	0.35
Cluster 242	22.4	16.1	58.7	0.70	1.40	0.10	0.52	0.13
Cluster 243	22.2	15.7	58.7	0.08	2.39	0.16	0.57	0.13
Cluster 244	24.8	15.0	57.0	1.23	0.91	0.20	0.71	0.16
Cluster 245	23.0	14.4	59.9	0.48	1.08	0.24	0.67	0.30
Cluster 246	19.6	17.2	61.6	0.37	0.89	0.18	0.12	0.06
Cluster 247	23.6	16.5	57.0	0.51	1.48	0.08	0.68	0.17
Cluster 248	21.5	17.4	59.3	0.13	0.96	0.14	0.36	0.17
Cluster 249	22.6	15.8	58.6	0.66	1.50	0.11	0.60	0.11
Cluster 250	22.6	15.1	59.2	0.87	1.33	0.10	0.66	0.15
Cluster 251	25.0	14.7	57.5	1.16	0.73	0.13	0.76	0.05
Cluster 252	24.2	14.7	58.4	0.41	1.57	0.15	0.35	0.20
Cluster 253	22.9	15.5	58.6	0.73	1.36	0.23	0.38	0.34
Cluster 254	23.4	14.9	58.9	1.31	0.74	0.10	0.49	0.08
Cluster 255	23.5	14.1	59.6	0.66	1.40	0.13	0.40	0.17
Cluster 256	20.6	16.3	59.5	0.12	3.27	0.00	0.18	0.00
Cluster 257	22.2	13.5	60.4	1.34	0.64	0.08	0.97	0.81
Cluster 258	20.9	13.3	61.8	0.30	3.29	0.30	0.15	0.00
Cluster 259	18.5	16.5	61.8	0.20	2.63	0.00	0.30	0.00
Cluster 260	22.2	14.7	60.2	0.55	1.71	0.15	0.29	0.15
Cluster 261	21.8	18.0	56.9	0.73	1.56	0.14	0.43	0.43
Cluster 262	23.9	13.6	60.1	0.69	1.25	0.14	0.42	0.00



Cluster 263	23.0	16.7	57.5	0.65	1.13	0.07	0.81	0.13
Cluster 264	21.9	16.0	58.9	1.01	1.30	0.10	0.59	0.26
Cluster 265	22.2	17.4	56.8	0.14	2.46	0.06	0.24	0.72
Cluster 266	23.7	15.0	58.8	1.07	0.83	0.06	0.48	0.12
Cluster 267	24.9	12.9	58.6	0.95	1.59	0.06	0.83	0.12
Cluster 268	22.0	16.6	58.6	0.10	1.17	0.18	1.19	0.12
Cluster 269	21.0	16.3	59.8	0.11	1.41	0.34	0.80	0.23
Cluster 270	23.4	16.7	57.1	0.92	0.98	0.10	0.73	0.00
Cluster 271	22.9	14.5	60.3	0.26	0.88	0.05	0.98	0.10
Cluster 272	23.9	14.5	58.8	0.51	1.82	0.05	0.27	0.18
Cluster 273	23.5	14.3	58.8	0.22	2.14	0.12	0.62	0.23
Cluster 274	23.2	13.9	60.1	0.81	1.48	0.00	0.37	0.15
Cluster 275	22.7	15.1	59.5	0.20	1.96	0.11	0.29	0.15
Cluster 276	25.2	14.9	57.4	0.71	0.97	0.17	0.56	0.07
Cluster 277	21.7	16.4	59.5	0.39	1.36	0.15	0.47	0.06
Cluster 278	22.8	15.0	58.3	0.14	2.64	0.08	0.31	0.73
Cluster 279	22.8	13.4	60.0	0.74	2.20	0.18	0.35	0.35
Cluster 280	18.1	16.5	61.8	0.04	3.07	0.18	0.24	0.12
Cluster 281	21.8	14.5	60.4	0.05	2.15	0.05	0.38	0.58
Cluster 282	22.6	15.8	59.6	1.07	0.45	0.22	0.30	0.00
Cluster 283	20.3	15.2	61.6	0.47	1.78	0.19	0.50	0.00
Cluster 284	21.9	16.2	59.4	0.38	1.19	0.00	0.69	0.23
Cluster 285	23.9	16.3	57.1	0.96	1.40	0.10	0.21	0.10
Cluster 286	23.6	14.7	59.0	0.74	1.28	0.10	0.62	0.00
Cluster 287	21.9	15.9	59.2	0.82	1.11	0.21	0.51	0.34
Cluster 288	21.4	15.2	60.3	0.11	2.39	0.04	0.08	0.49
Cluster 289	22.6	14.7	59.7	0.65	1.73	0.23	0.39	0.00
Cluster 290	19.4	16.1	61.8	0.09	2.39	0.07	0.15	0.00
Cluster 291	23.5	14.4	59.1	0.57	1.23	0.14	0.72	0.29
Cluster 292	21.9	14.4	60.9	1.07	1.11	0.07	0.47	0.07
Cluster 293	22.4	14.0	59.6	0.51	2.23	0.20	0.60	0.40
Cluster 294	24.0	13.4	59.2	0.21	2.23	0.10	0.62	0.31
Cluster 295	17.9	16.5	62.4	0.54	2.37	0.00	0.22	0.00
Cluster 296	17.8	16.7	62.2	0.20	2.81	0.10	0.20	0.00
Cluster 297	24.2	16.3	56.1	0.42	1.73	0.00	0.85	0.34
Cluster 298	21.0	16.6	59.3	0.38	2.04	0.19	0.38	0.13
Cluster 299	20.9	15.9	60.2	0.24	2.34	0.06	0.12	0.35
Cluster 300	20.5	15.0	61.2	0.26	1.94	0.17	0.90	0.11
Cluster 301	22.6	15.4	59.5	0.25	1.80	0.09	0.26	0.17
Cluster 302	22.7	15.6	59.2	0.56	1.11	0.12	0.40	0.32
Cluster 303	23.1	15.9	58.6	1.13	0.99	0.00	0.33	0.00
Cluster 304	24.2	11.2	61.8	0.90	1.41	0.17	0.34	0.00
Cluster 305	25.0	13.7	58.0	0.71	1.77	0.18	0.35	0.24
Cluster 306	24.4	14.7	58.2	0.70	1.48	0.06	0.34	0.11

Cluster 307	22.1	16.5	59.0	0.55	1.35	0.00	0.30	0.15
Cluster 308	22.0	14.8	60.9	0.35	1.51	0.06	0.35	0.00
Cluster 309	23.0	13.8	59.2	0.43	3.19	0.20	0.20	0.00
Cluster 310	22.5	17.7	57.4	0.26	1.37	0.09	0.68	0.00
Cluster 311	20.2	16.0	60.1	0.29	2.49	0.00	0.81	0.14
Cluster 312	20.8	17.0	58.6	0.24	2.08	0.13	0.52	0.65
Cluster 313	22.3	13.7	60.3	0.19	2.76	0.48	0.19	0.00
Cluster 314	22.3	14.3	60.0	0.21	2.66	0.00	0.47	0.00
Cluster 315	20.9	17.2	59.5	0.14	1.65	0.14	0.43	0.00
Cluster 316	20.3	16.6	58.8	0.24	3.27	0.00	0.86	0.00
Cluster 317	20.0	17.1	59.1	0.19	2.47	0.22	0.67	0.22
Cluster 318	23.5	12.8	59.7	0.16	3.21	0.16	0.32	0.16
Cluster 319	22.5	14.8	58.9	0.00	3.53	0.00	0.22	0.00
Cluster 320	21.3	14.8	60.2	0.00	3.68	0.12	0.00	0.00

**Table S2.**

Elemental composition of trace element enriched clusters within zircon (Figure 3D) in terms of atomic percent as determined by APT analysis.