

178042: altered volcanoclastic sandstone, Table Top Well

Location and sampling

MARBLE BAR (SF 50-8), NORTH SHAW (2755)
MGA Zone 50, 708100E 7661530N

Sampled on 7 October 2002

The sample was taken from within a small gully along a prominent rocky chert ridge 8.5 km southwest of Table Top Well. The sampling site is 20 m east-northeast of the site of sample 178041.

Tectonic unit/relations

The sample is a pale yellowish-grey, homogeneous, silicified, cross-bedded, fine- to medium- and even-grained volcanogenic sandstone that is interbedded with black chert, from near the base of the Euro Basalt, Warrawoona Group, East Pilbara Granite–Greenstone Terrane (Van Kranendonk et al., 2002). The sample included some rare quartz veins up to 1 mm thick. The sample was dated to constrain the depositional age of the Euro Basalt.

Petrographic description

The principal minerals present in this sample are quartz (80–85 vol.%), sericite (15 vol.%), and leucoxene (1–2 vol.%), with trace amounts of accessory limonite and zircon. This is a quartz–sericite–leucoxene–limonite-altered tuff to volcanic sandstone with a quartz vein containing sericite. Minor limonite could have replaced pyrite. The sample contains irregular quartz veins and possibly a bedding foliation. There are sparsely scattered single-crystal quartz grains up to 0.5 mm in diameter, but most of the rock is composed of leucoxene-rimmed, altered shards and lithic fragments up to 1 mm long. Some of the shards are mostly microcrystalline quartz, but many have minor to abundant sericite and a weak to moderate clouding by diffuse leucoxene. This suggests a mixture of felsic and mafic volcanic components, or a range of compositions from felsic to more mafic. The interstitial material is largely cherty to microsparry quartz with very minor sericite in places. A small grain, altered to limonite, could have been pyrite. Small patches and filaments of limonite are scattered. The more elongate clasts have a subparallel orientation, suggesting bedding and possibly reworking, and the clasts are reasonably well sorted. At one end of the thin section there is a vein up to 2 mm wide and mostly filled with inequigranular to prismatic quartz, with minor sericite and limonite after pyrite, and a large lens of decussate sericite.

Zircon morphology

The zircons isolated from this sample are typically pale yellowish-brown and dark brown, equant to slightly

elongate and euhedral whole grains and fragments, and between $45 \times 50 \mu\text{m}$ and $100 \times 250 \mu\text{m}$ in size. Many have euhedral igneous zonation, although a minority are structureless. Cathodoluminescence images of representative zircons are given in Figure 1.

Analytical details

This sample was analysed on 24 and 28 August 2003. The counter deadtime during both analysis sessions was 24 ns. During the first analysis session, 13 analyses of the CZ3 standard indicated a Pb*/U calibration uncertainty of 2.48% (1σ). Analyses 1.1 to 6.1 were obtained during the first analysis session. During the second analysis session, seven analyses of the CZ3 standard indicated a Pb*/U calibration uncertainty of 1.58% (1σ). Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses, with the exception of analyses 2.1 and 11.1, for which isotopic compositions determined using the method of Cumming and Richards (1975) were assumed.

Results

Twenty-nine analyses were obtained from 27 zircons. Results are given in Table 1 and shown on concordia and Gaussian-summation probability density plots in Figures 2 and 3 respectively.

Interpretation

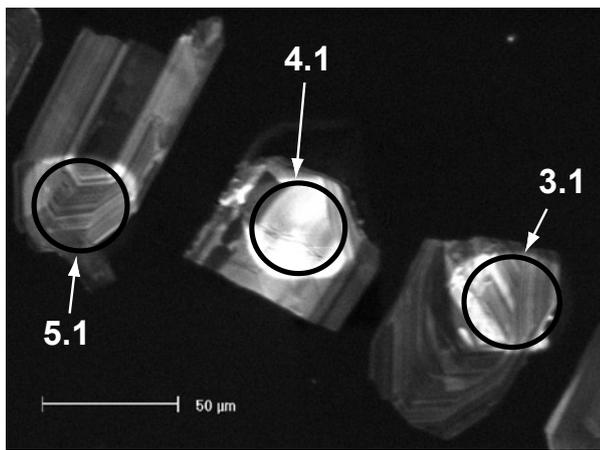
The analyses are concordant to highly discordant, with the discordance pattern consistent with a dominant recent episode of radiogenic-Pb loss. All 29 analyses obtained from 27 zircons have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ date of $3350 \pm 3 \text{ Ma}$ ($\chi^2 = 1.00$; Fig. 3).

The date of $3350 \pm 3 \text{ Ma}$ indicated by the weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ratio of all 29 concordant to highly discordant analyses from 27 zircons is interpreted as the age of igneous crystallization for the volcanoclastic component within, and a maximum age for deposition of, the sandstone.

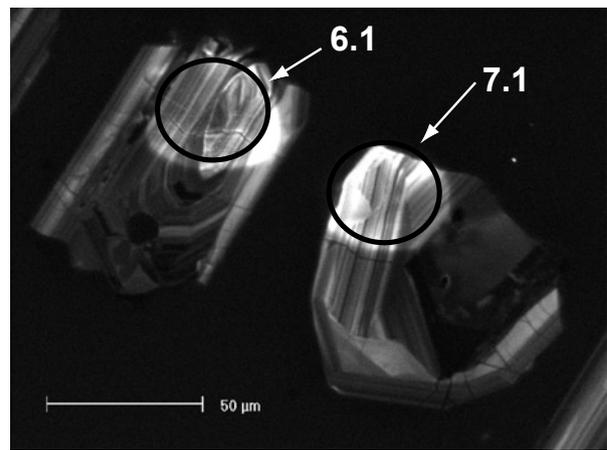
Recommended reference for this publication:

NELSON, D. R., 2005, 178042: altered volcanoclastic sandstone, Table Top Well; Geochronology dataset 564; in *Compilation of geochronology data, June 2006 update*: Western Australia Geological Survey.

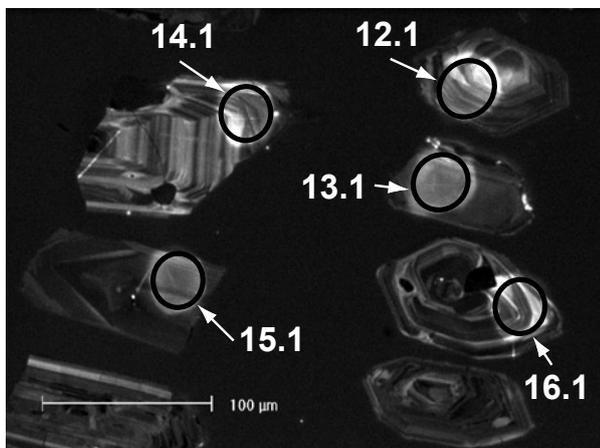
Data obtained: 28/08/2003; Data released: 30/06/2005



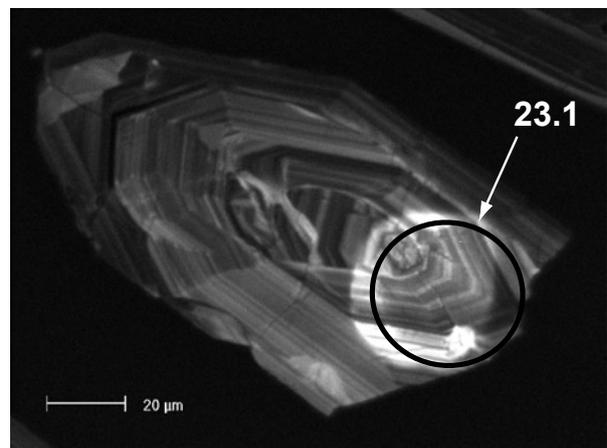
(a)



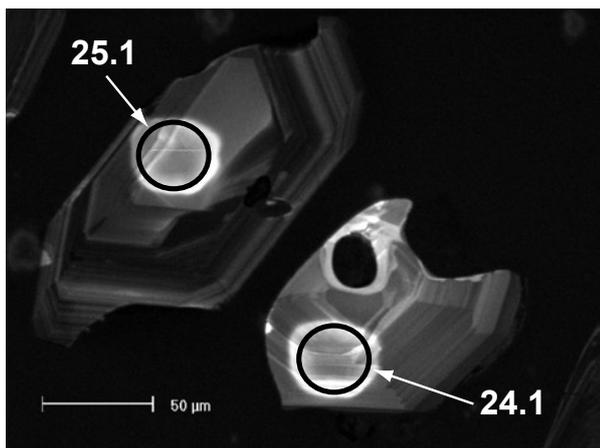
(b)



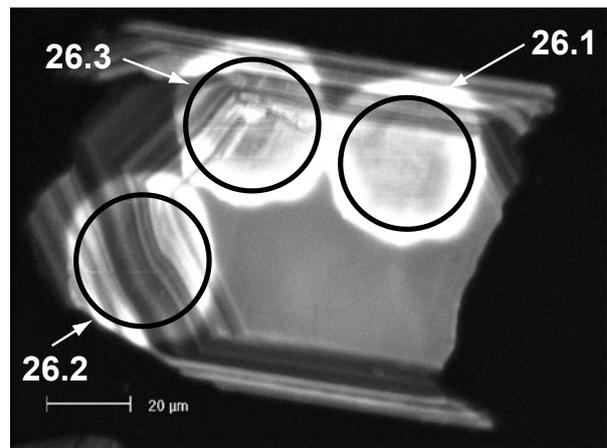
(c)



(d)



(e)



(f)

Figure 1. Cathodoluminescence images of representative zircons from sample 178042: altered volcanoclastic sandstone, Table Top Well

Table 1. Ion microprobe analytical results for zircons from sample 178042: altered volcanoclastic sandstone, Table Top Well

Grain spot	U (ppm)	Th (ppm)	Pb (ppm)	f206%	$^{207}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{208}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{206}\text{Pb}/^{238}\text{U}$	$\pm 1\sigma$	$^{207}\text{Pb}/^{235}\text{U}$	$\pm 1\sigma$	% concordance	$^{207}\text{Pb}/^{206}\text{Pb}$ Age	$\pm 1\sigma$
1.1	161	85	134	0.153	0.28012	0.00123	0.13679	0.00134	0.6776	0.0171	26.172	0.685	99	3.364	7
2.1	87	43	67	1.014	0.27508	0.00220	0.12799	0.00361	0.6175	0.0158	23.419	0.649	93	3.335	13
3.1	134	50	106	0.069	0.27624	0.00132	0.09773	0.00128	0.6652	0.0169	25.337	0.668	98	3.342	7
4.1	56	28	45	0.016	0.27780	0.00199	0.13640	0.00175	0.6532	0.0170	25.018	0.696	97	3.351	11
5.1	284	272	238	0.269	0.27604	0.00096	0.24549	0.00139	0.6337	0.0159	24.119	0.620	95	3.341	5
6.1	132	71	98	0.367	0.27854	0.00149	0.13016	0.00192	0.6044	0.0153	23.213	0.615	91	3.355	8
7.1	85	64	72	0.412	0.27691	0.00231	0.20113	0.00360	0.6533	0.0116	24.942	0.512	97	3.346	13
8.1	88	63	74	0.597	0.27727	0.00223	0.18578	0.00328	0.6563	0.0116	25.090	0.509	97	3.348	13
9.1	277	139	215	0.240	0.27892	0.00113	0.13136	0.00126	0.6347	0.0104	24.408	0.424	94	3.357	6
10.1	108	72	91	0.865	0.27727	0.00213	0.17113	0.00332	0.6576	0.0114	25.140	0.499	97	3.348	12
11.1	451	240	344	0.933	0.27729	0.00118	0.14411	0.00191	0.6042	0.0098	23.100	0.399	91	3.348	7
12.1	159	96	124	0.578	0.27553	0.00167	0.15312	0.00244	0.6241	0.0105	23.708	0.439	94	3.338	9
13.1	253	130	194	0.229	0.27912	0.00121	0.13141	0.00138	0.6268	0.0103	24.121	0.422	93	3.358	7
14.1	197	132	166	0.391	0.27823	0.00137	0.17950	0.00183	0.6635	0.0110	25.453	0.456	98	3.353	8
15.1	178	100	142	0.468	0.27835	0.00150	0.14752	0.00201	0.6420	0.0107	24.640	0.448	95	3.354	8
16.1	245	182	201	0.149	0.27772	0.00115	0.19699	0.00142	0.6440	0.0106	24.659	0.431	96	3.350	6
17.1	251	115	193	0.285	0.27764	0.00121	0.12043	0.00143	0.6338	0.0104	24.262	0.426	94	3.350	7
18.1	154	94	125	0.262	0.27859	0.00150	0.16185	0.00184	0.6505	0.0110	24.985	0.458	96	3.355	8
19.1	340	273	250	0.515	0.27606	0.00111	0.20413	0.00166	0.5694	0.0092	21.674	0.373	87	3.341	6
20.1	332	74	236	0.161	0.27638	0.00100	0.05929	0.00092	0.6147	0.0100	23.425	0.401	92	3.343	6
21.1	324	200	263	0.121	0.27746	0.00099	0.16573	0.00113	0.6507	0.0106	24.893	0.426	96	3.349	6
22.1	160	105	130	0.462	0.27510	0.00158	0.17095	0.00225	0.6447	0.0108	24.455	0.451	96	3.335	9
23.1	103	84	88	0.643	0.27813	0.00205	0.21369	0.00315	0.6539	0.0113	25.076	0.493	97	3.352	12
24.1	39	30	33	0.492	0.28206	0.00342	0.21010	0.00538	0.6490	0.0127	25.241	0.511	96	3.374	19
25.1	58	23	46	1.683	0.27411	0.00346	0.08893	0.00595	0.6483	0.0120	24.500	0.581	97	3.330	20
26.1	57	35	46	0.650	0.27666	0.00274	0.16107	0.00401	0.6428	0.0119	24.522	0.539	96	3.344	15
27.1	249	242	217	0.209	0.27907	0.00118	0.25176	0.00168	0.6560	0.0108	25.242	0.441	97	3.358	7
26.2	137	106	115	0.187	0.27964	0.00115	0.20610	0.00147	0.6505	0.0107	25.080	0.437	96	3.361	6
26.3	59	44	51	0.663	0.27883	0.00225	0.19245	0.00357	0.6632	0.0115	25.498	0.511	98	3.356	13

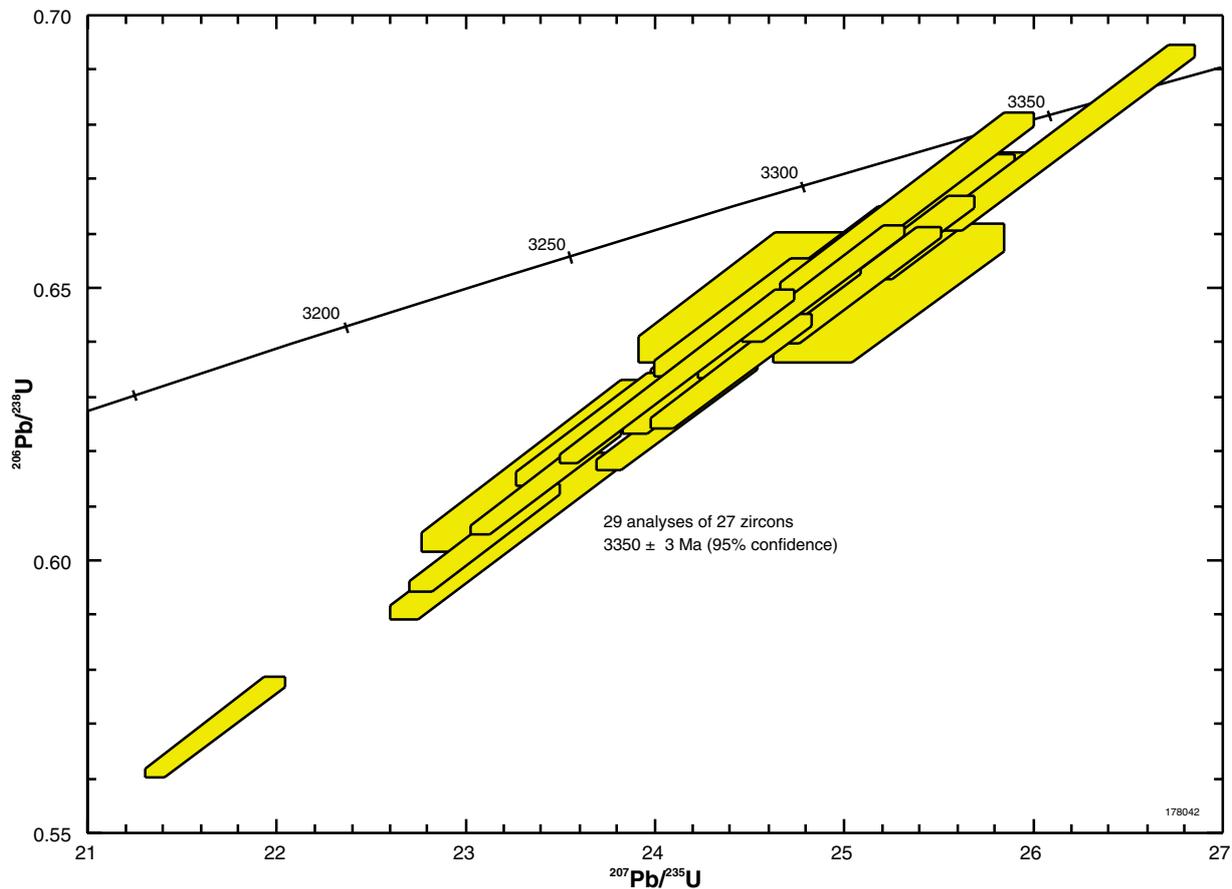


Figure 2. Concordia plot for sample 178042: altered volcanoclastic sandstone, Table Top Well

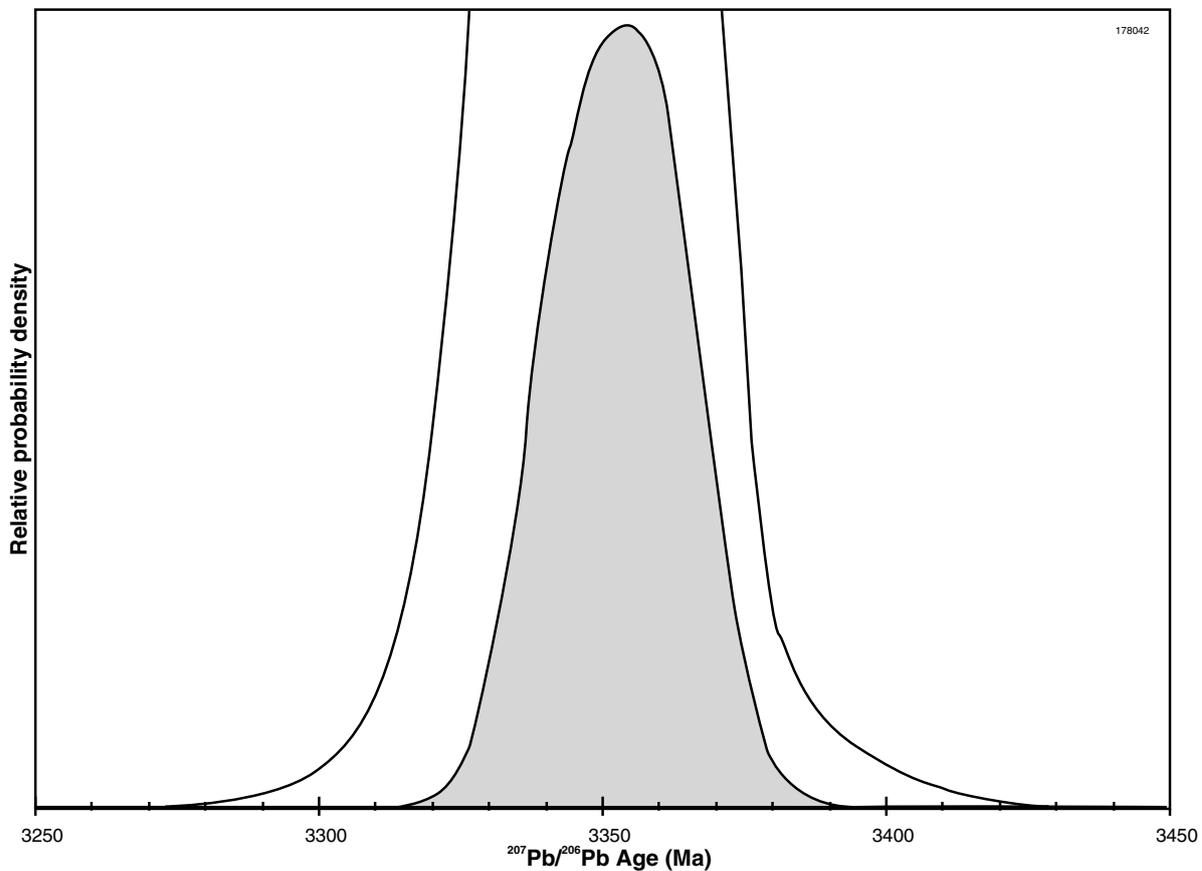


Figure 3. Gaussian-summation probability density plot for sample 178042: altered volcanoclastic sandstone, Table Top Well