

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% (1 σ). 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% (1 σ). 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

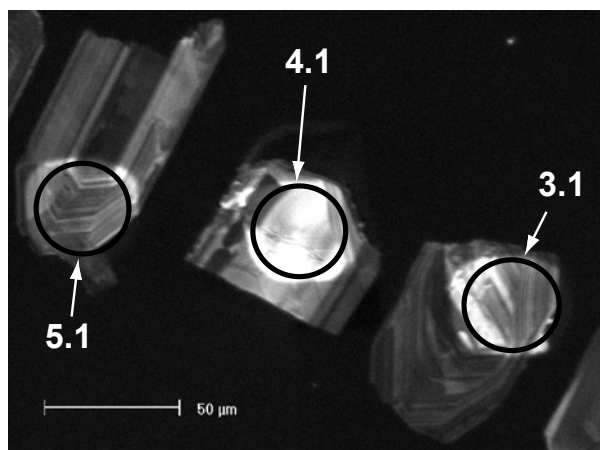
The analyses are concordant to highly discordant, with the discordance pattern consistent with a dominant recent episode of radiogenic-Pb loss. All 29 analyses obtained from 27 zircons have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$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

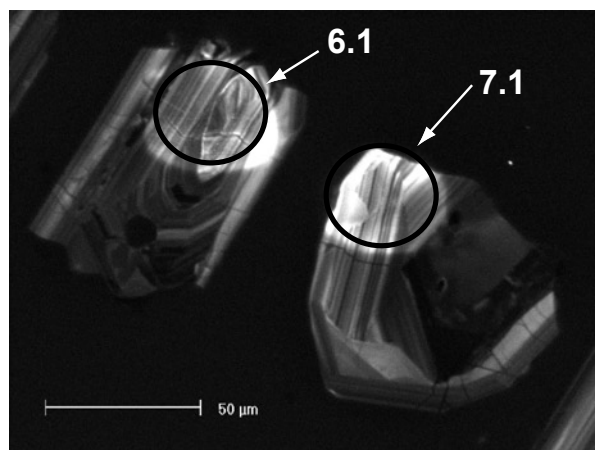
Recommended reference for this publication:

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.

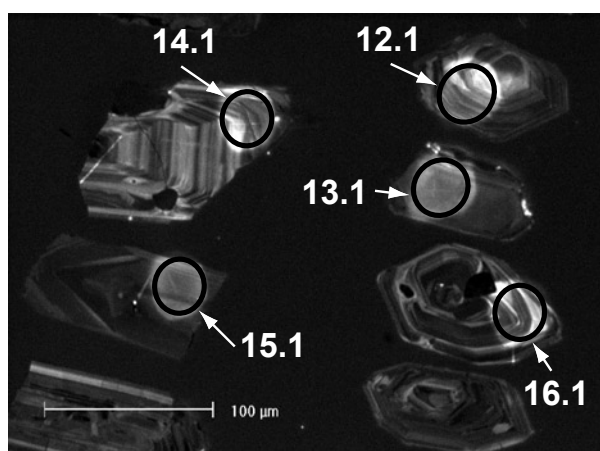
Data obtained: 28/08/2003; Data released: 30/06/2005



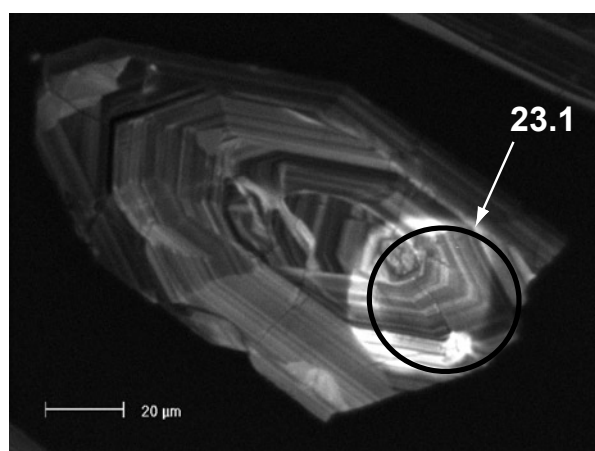
(a)



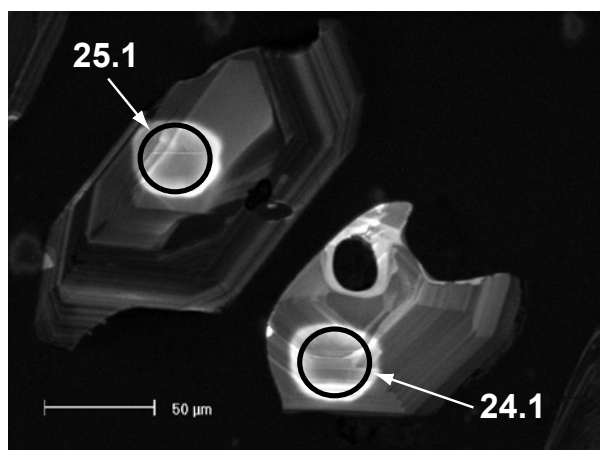
(b)



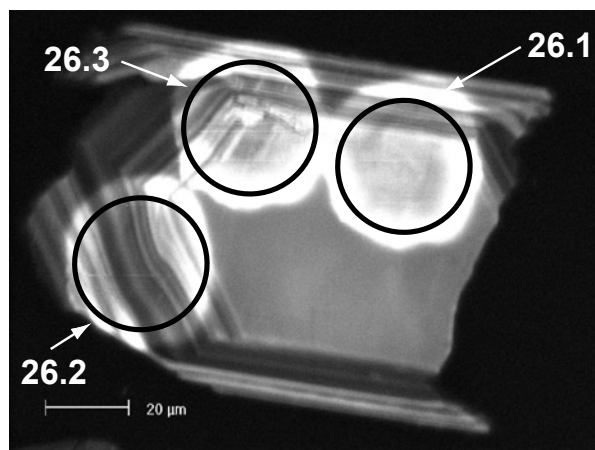
(c)



(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 volcanlastic sandstone, Table Top Well

| Grain spot | U (ppm) | Th (ppm) | Pb (ppm) | $f_{206\%}$ | $^{207}\text{Pb}/^{206}\text{Pb}$ | $\pm 1\sigma$ | $^{208}\text{Pb}/^{206}\text{Pb}$ | $\pm 1\sigma$ | $^{206}\text{Pb}/^{238}\text{U}$ | $\pm 1\sigma$ | $^{207}\text{Pb}/^{235}\text{U}$ | $\pm 1\sigma$ | % 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 | 0.612 | 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 |

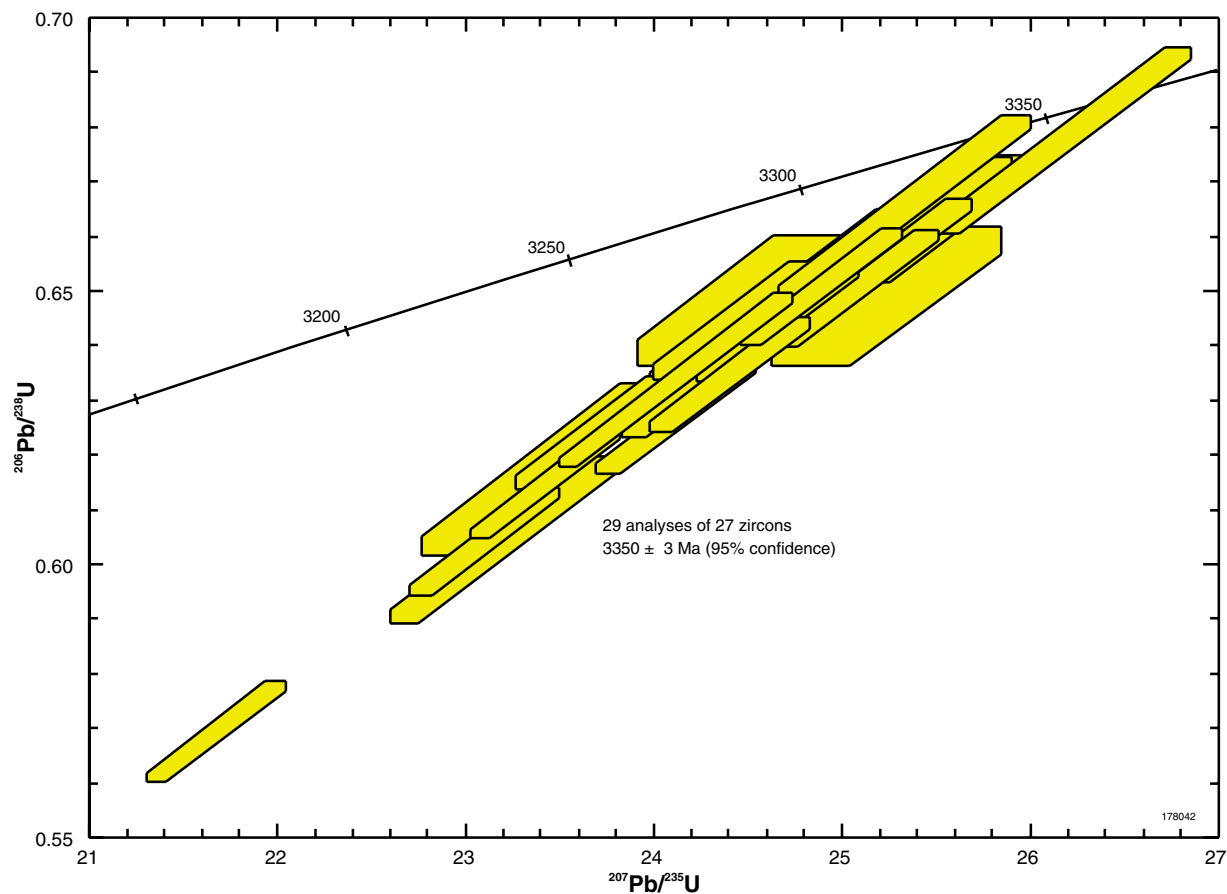


Figure 2. Concordia plot for sample 178042: altered volcanoclastic sandstone, Table Top Well

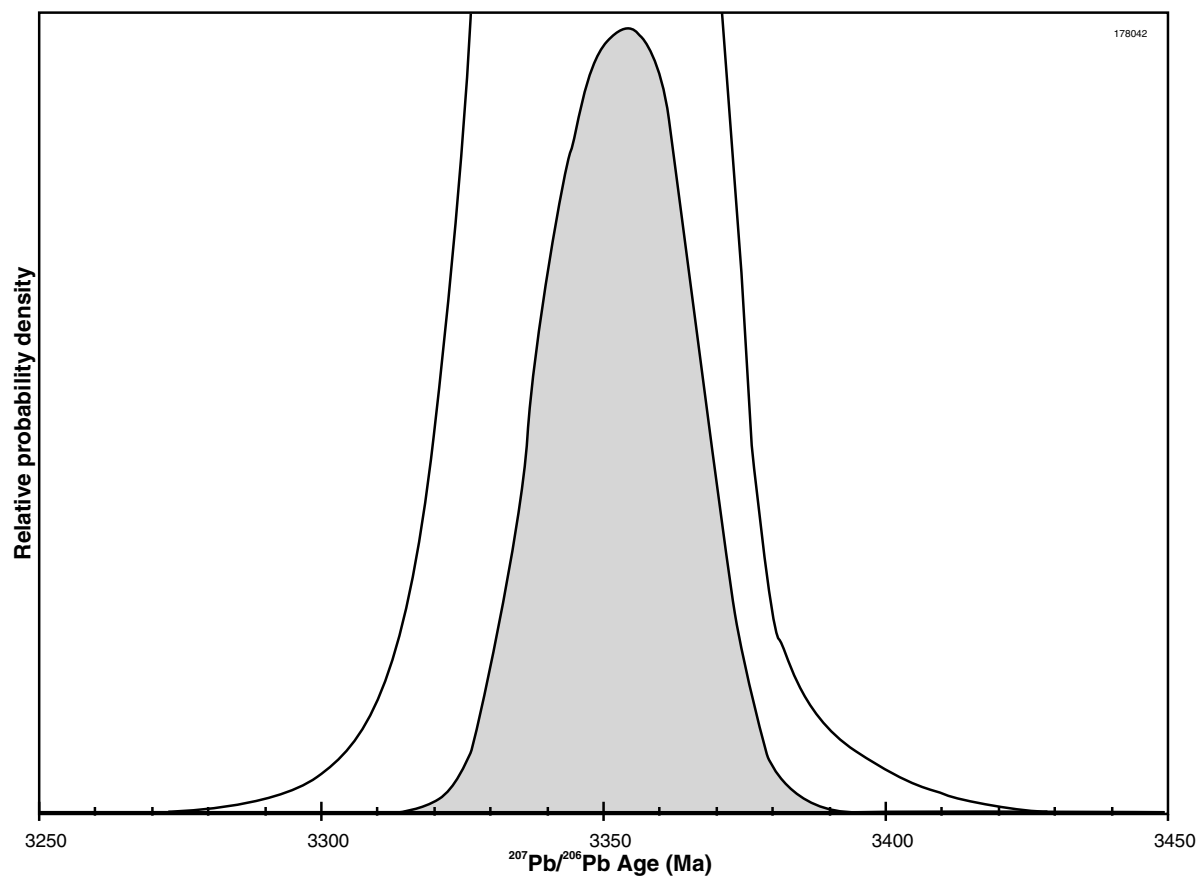


Figure 3. Gaussian-summation probability density plot for sample 178042: altered volcanoclastic sandstone, Table Top Well