169000: volcaniclastic sandstone, Cork Tree Well

Location and sampling

MARBLE BAR (SF 50-8), SPLIT ROCK (2854) MGA Zone 50, 783480E 7578840N

Sampled on 3 July 2000.

The sample was taken from near the top of a low, rounded, rocky hill located 9 km south-southwest of Cork Tree Well.

Tectonic unit/relations

This sample is from an altered, light grey, fine- to medium-grained volcaniclastic sandstone of the Wyman Formation in the Warrawoona Group, East Pilbara Granite–Greenstone Terrane (Bagas and Van Kranendonk, in prep.). The sandstone contains sparse remnant quartz up to 2 mm in diameter and altered feldspar phenocrysts, and angular black chert fragments up to 4 mm long. The sandstone is interbedded with beds of altered rhyolite and dacite that are up to 10 cm thick.

Petrographic description

This sample consists principally of sericite-altered lithic or vitric fragments and shards (70 vol.%) together with quartz phenocrysts and fragments (5 vol.%), in a clay- and quartz-rich matrix (25 vol.%, including 7–8 vol.% clay minerals). There is accessory leucoxene after opaque oxide (trace), and zircon (trace). This rock is either a crystal-lithic or vitric tuff, or a reworked medium-grained volcaniclastic sandstone, with limonitized to leached areas. In thin section, much of the rock consists of a weakly bedded, reasonably well sorted aggregate of sparsely disseminated quartz phenocryst fragments (5 vol.%), from 0.2 to 0.8 mm in diameter (medium to coarse sand), with abundant sericite- to quartz-rich altered lithic or vitric fragments of similar size to the quartz. Most of the lithic fragments are rimmed by leucoxene and were probably shards, but some have diffuse leucoxene throughout and may have been derived from a volcanic groundmass. Rare leucoxene occurs after discrete opaque oxide crystals, and some areas are stained by diffuse limonite. Leached voids to 4 mm long are scattered parallel to the layering. The interstitial matrix consists of variable concentrations of colourless to pale orange-brown clay (sericite or illite with ?smectite and limonite), and of cryptocrystalline to microcrystalline quartz. This sample may be a primary crystal-lithic/vitric tuff, but the relatively good sorting indicates some reworking and possible transition to a volcaniclastic sandstone.

Zircon morphology

The zircons isolated from this sample are typically dark yellowish or greenish brown or black fragments and whole grains, between 40 × 65 μm and 80 × 100 μm in size and are equant to slightly elongate and euhedral in shape. Most grains have remnant internal zonation and many are metamict.

Analytical details

This sample was analysed on 25 March 2001. The counter deadtime during the analysis session was 32 ns. Eleven analyses of the CZ3 standard obtained during the analysis session indicated a Pb^*/U calibration error of 1.13 (1σ%). Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses, with

Table 34. Ion microprobe analytical results for sample 169000: volcaniclastic sandstone, Cork Tree Well

Grain .spot	*U (ppm)*	*Th (ppm)*	*Pb (ppm)*	*f206%*	$^{207}Pb/^{206}Pb$	*±1σ*	$^{208}Pb/^{206}Pb$	*±1σ*	$^{206}Pb/^{238}U$	*±1σ*	$^{207}Pb/^{235}U$	*±1σ*	*% concordance*	$^{207}Pb/^{206}Pb$ *age*	*±1σ*
1.1	220	94	166	0.232	0.27211	0.00106	0.08112	0.00108	0.6426	0.0079	24.109	0.321	96	3 318	6
2.1	241	218	179	0.872	0.27186	0.00133	0.23466	0.00232	0.5606	0.0069	21.015	0.288	87	3 317	8
3.1	136	86	107	0.342	0.26946	0.00140	0.15323	0.00183	0.6354	0.0081	23.609	0.339	96	3 303	8
4.1	177	112	124	0.528	0.27079	0.00142	0.15710	0.00210	0.5629	0.0070	21.018	0.295	87	3 311	8
5.1	153	76	86	1.225	0.27329	0.00214	0.12333	0.00358	0.4493	0.0056	16.930	0.262	72	3 325	12
6.1	177	131	148	0.183	0.27181	0.00135	0.18946	0.00174	0.6599	0.0084	24.731	0.352	99	3 316	8
7.1	213	160	165	0.455	0.27226	0.00137	0.17179	0.00195	0.6139	0.0077	23.044	0.324	93	3 319	8
8.1	121	101	104	0.049	0.27287	0.00155	0.22413	0.00185	0.6642	0.0088	24.991	0.378	99	3 323	9
9.1	163	92	130	0.073	0.26807	0.00135	0.13636	0.00144	0.6583	0.0085	24.333	0.351	99	3 295	8
10.1	63	23	51	0.241	0.26690	0.00229	0.09472	0.00275	0.6935	0.0104	25.522	0.465	103	3 288	13
11.1	132	75	97	0.428	0.27078	0.00179	0.15425	0.00266	0.5903	0.0077	22.038	0.340	90	3 311	10
12.1	219	83	170	0.065	0.27359	0.00121	0.10319	0.00131	0.6548	0.0081	24.701	0.338	98	3 327	7
13.1	195	120	150	0.375	0.26601	0.00144	0.16920	0.00220	0.6152	0.0078	22.565	0.323	94	3 283	8
14.1	78	54	66	0.300	0.25903	0.00205	0.18697	0.00290	0.6719	0.0096	23.995	0.412	102	3 241	12
15.1	135	64	106	0.249	0.27287	0.00159	0.12875	0.00203	0.6490	0.0085	24.418	0.367	97	3 323	9
16.1	126	47	97	0.211	0.26675	0.00167	0.09014	0.00214	0.6528	0.0086	24.009	0.368	99	3 287	10
17.1	303	129	448	34.413	0.25688	0.00818	0.01363	0.01911	0.5121	0.0079	18.137	0.672	83	3 228	50
18.1	165	81	133	0.079	0.26877	0.00132	0.13310	0.00137	0.6666	0.0085	24.702	0.353	100	3 299	8
19.1	168	54	129	0.354	0.26934	0.00145	0.08340	0.00182	0.6487	0.0082	24.092	0.346	98	3 302	8
20.1	163	113	129	0.420	0.27130	0.00150	0.14983	0.00202	0.6393	0.0082	23.912	0.348	96	3 314	9
21.1	78	34	60	0.543	0.26136	0.00232	0.11567	0.00350	0.6352	0.0091	22.891	0.408	97	3 255	14
22.1	286	150	212	0.762	0.26816	0.00117	0.12399	0.00177	0.6053	0.0073	22.381	0.299	93	3 295	7
23.1	113	61	92	0.108	0.26824	0.00177	0.14312	0.00242	0.6691	0.0091	24.746	0.391	100	3 296	10
24.1	92	51	77	0.151	0.26355	0.00233	0.14288	0.00246	0.6937	0.0109	25.210	0.479	104	3 268	14
25.1	84	32	66	0.118	0.27461	0.00215	0.10143	0.00267	0.6599	0.0094	24.985	0.427	98	3 333	12
26.1	129	78	104	0.098	0.27122	0.00160	0.16734	0.00187	0.6507	0.0087	24.334	0.372	98	3 313	9
27.1	201	382	158	0.582	0.27258	0.00152	0.19137	0.00238	0.6109	0.0077	22.959	0.331	93	3 321	9
28.1	161	88	127	0.087	0.27496	0.00140	0.14406	0.00147	0.6454	0.0083	24.470	0.354	96	3 335	8
29.1	170	89	138	0.210	0.27144	0.00146	0.13888	0.00184	0.6637	0.0086	24.840	0.363	99	3 314	8
30.1	98	61	81	0.209	0.27393	0.00184	0.16988	0.00229	0.6626	0.0092	25.025	0.404	98	3 329	11
31.1	215	198	108	2.049	0.27331	0.00228	0.15557	0.00436	0.3843	0.0047	14.484	0.228	63	3 325	13
32.1	134	73	109	0.236	0.27224	0.00166	0.15084	0.00217	0.6607	0.0087	24.799	0.377	99	3 319	10
33.1	152	140	124	0.250	0.26790	0.00149	0.23839	0.00217	0.6245	0.0081	23.067	0.340	95	3 294	9
9.2	170	113	146	0.137	0.27225	0.00109	0.16782	0.00135	0.6879	0.0098	25.823	0.395	102	3 319	6
13.2	189	78	155	0.170	0.27085	0.00106	0.10500	0.00122	0.6887	0.0098	25.720	0.391	102	3 311	6
27.2	220	843	170	1.507	0.27069	0.00152	0.27002	0.00298	0.5620	0.0080	20.976	0.333	87	3 310	9

the exception of analyses 2.1, 17.1, 22.1, 27.2 and 31.1, for which isotopic compositions determined using the method of Cumming and Richards (1975) were assumed.

Results

Thirty-six analyses were obtained from 33 zircons. Results are given in Table 34 and shown on concordia and Gaussian-summation probability density plots in Figures 52 and 53.

Interpretation

The analyses are concordant to highly discordant, with the discordance pattern consistent with several episodes of radiogenic Pb loss, including a dominant recent episode. On the basis of their $^{207}Pb/^{206}Pb$ ratios, most analyses may be assigned to two groups. Thirty concordant and highly discordant analyses of 28 zircons, assigned to Group 1, have $^{207}Pb/^{206}Pb$ ratios defining a single population and indicating a weighted mean $^{207}Pb/^{206}Pb$ date of 3312 ± 4 Ma (chi-squared = 1.66). Discordant analyses 13.1, 16.1 21.1 and 24.1, assigned to Group 2, have $^{207}Pb/^{206}Pb$ ratios defining a single population and indicating a weighted mean $^{207}Pb/^{206}Pb$ date of 3278 ± 21 Ma (chi-squared = 1.23). Analyses 14.1 and 28.1 are discordant and cannot be grouped.

Several interpretations of these results are possible. The date of 3312 ± 4 Ma indicated by the weighted mean $^{207}Pb/^{206}Pb$ ratio of the 30 concordant and highly discordant analyses of Group 1 may be interpreted as the age of igneous crystallization of the felsic volcanic precursor to the volcaniclastic sandstone, with the younger date indicated by the discordant analyses of Group 2 corresponding to the timing of an ancient disturbance event during which these analysis sites lost radiogenic Pb. However,

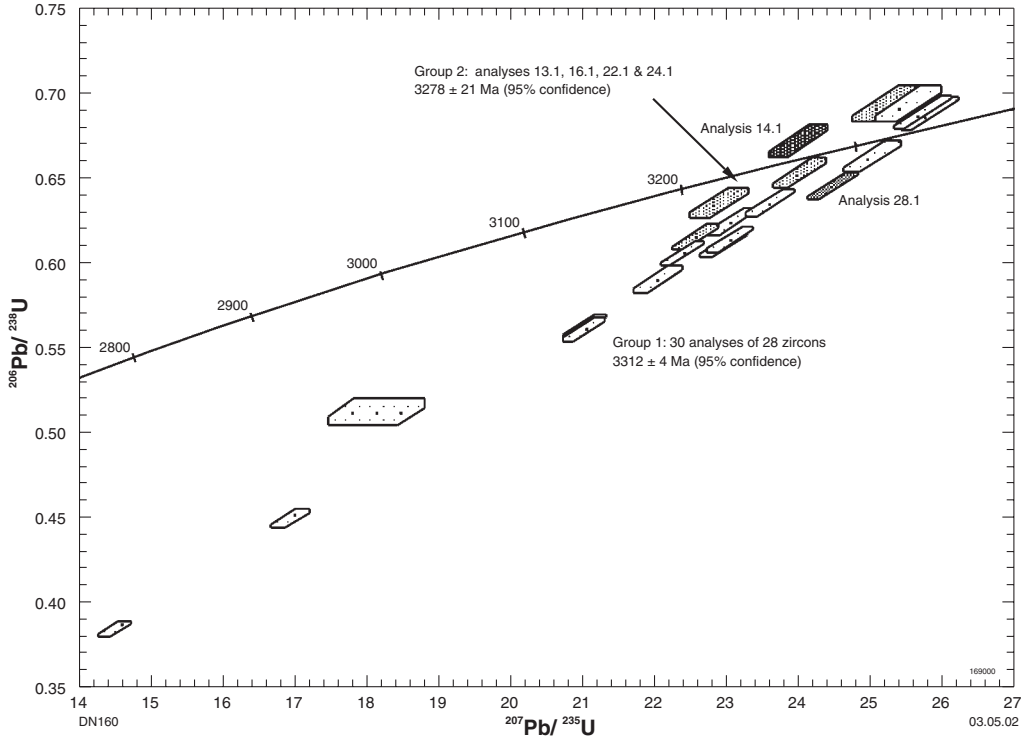

Figure 52. Concordia plot for sample 169000: volcaniclastic sandstone, Cork Tree Well

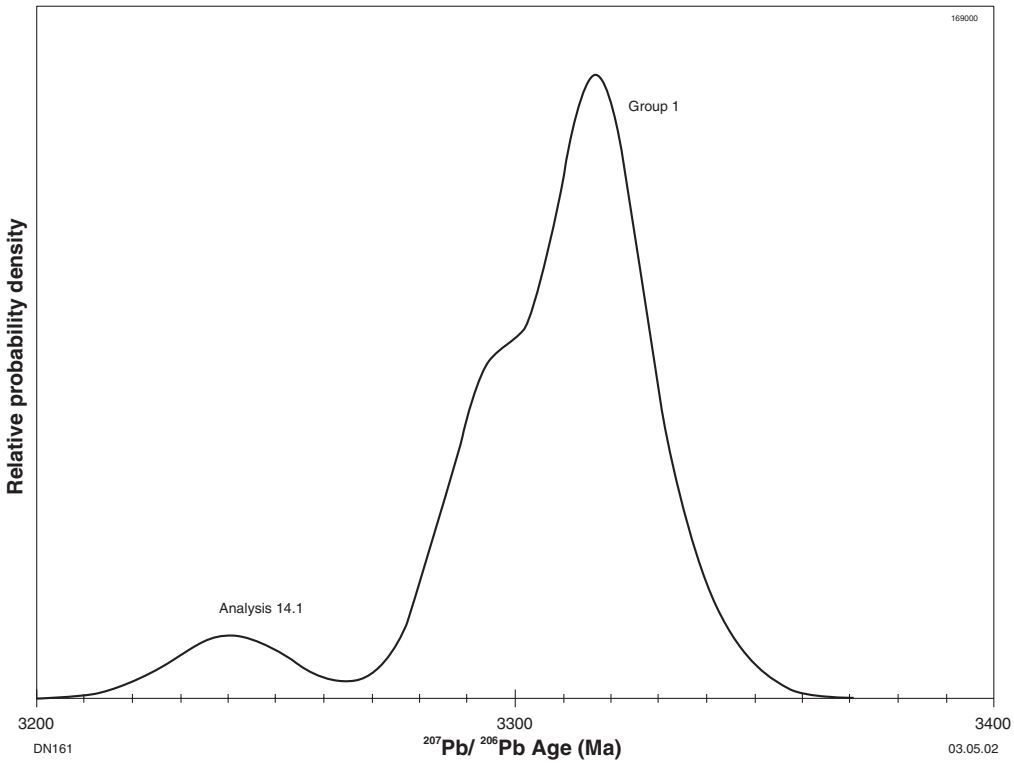

Figure 53. Gaussian-summation probability density plot for sample 169000: volcaniclastic sandstone, Cork Tree Well

analyses belonging to Group 2 indicate generally low U and Th contents at these analysis sites, and it is unclear why these sites should have lost radiogenic Pb when those of Group 1 did not. An alternative explanation is that the date of 3278 ± 21 Ma indicated by the weighted mean $^{207}Pb/^{206}Pb$ ratio of the four analyses of Group 2, or perhaps the younger date indicated by analysis 14.1, provides a maximum age for reworking and redeposition of a predominantly 3312 ± 4 Ma volcanic precursor rock. Analysis 28.1 is interpreted to be of a detrital or xenocrystic zircon.

STRATIGRAPHIC REFERENCE:

BAGAS, L., and VAN KRANENDONK, M. J., in prep., Split Rock, W.A. Sheet 2854: Western Australia Geological Survey, 1:100 000 Geological Series.

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NELSON, D. R., 2002, 169000: volcaniclastic sandstone, Cork Tree Well; in Compilation of geochronology data, 2001: Western Australia Geological Survey, Record 2002/2, p. 137–140.
OR
NELSON, D. R., 2002, 169000: volcaniclastic sandstone, Cork Tree Well; Geochronology dataset 166; in Compilation of geochronology data, June 2006 update: Western Australia Geological Survey.

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