161285: silicified sandstone, Phenoclast Hill

Location and sampling

TRAINOR (SG 51-2), NICHOLLS (3448) MGA Zone 51, 454850E 7269820N

Sampled on 28 August 2000

The sample was taken from low exposures adjacent to the Trainor track, 55 km north-northeast of Sunday Well and 16 km southwest of Phenoclast Hill.

Tectonic unit/relations

The sample is a silicified, pale pinkish-grey, coarse-grained, quartz-rich, intensely silicified sandstone from the Cornelia Sandstone in the Oldham Inlier (Hocking et al. 2000), Paterson Orogen. The sandstone could be a correlative of the Edmund Group, Edmund Basin (Hocking et al., 2000), or possibly the Earaheedy Group (Hocking, R. M., 2003, written comm.). The sandstone is exposed in the southern limb of a syncline, with a successor syncline infilled by Neoproterozoic rocks (Grey and Cotter, 1996) along its axis. The sample was collected to assess the maximum possible age and the provenance of the Cornelia Sandstone.

Petrographic description

This sample consists principally of quartz (>99 vol.%), and is a coarse-grained, quartz-rich sandstone gradational to orthoquartzite with a lens containing several subrounded to elliptical granules (or very small quartz pebbles) of quartz to 4 mm in diameter. It includes a layer of quartz granules (very small quartz pebbles), rare opaque oxide and zircon, and trace limonite. About half of the granules are single-crystal quartz grains, the others being polycrystalline and possibly vein quartz. The host rock is a massive aggregate of single-crystal quartz grains from 0.1 to 1 mm in diameter, but with well-defined cores and rare distinct, optically continuous, siliceous overgrowths. Some of the quartz grains have deformation lamellae or trails of fluid inclusions, locally decorated with limonite. The host sandstone contains polycrystalline grains, including vein quartz and chert. Some of the single-crystal quartz grains contain inclusions of leucoxene and opaque oxide, with rare muscovite and fine unidentified fibres (?sillimanite). A single zircon crystal was identified between quartz grains. Small patches of interstitial limonite are present but stylolitic grain boundaries could abound in this sample. This is a weakly metamorphosed quartz-rich pebbly sandstone with rare zircon. Plutonic and vein-derived quartz dominate the detrital quartz grains.

Zircon morphology

The zircons isolated from this sample are generally between 50 × 60 µm and 200 × 250 µm in size, colourless or pale yellowish-brown, internally structureless, and equant and rounded. Fluid and mineral inclusions are common. The surfaces of most grains are pitted, consistent with detrital transport. Cathodoluminescence images of representative zircons are given in Figure 1.

Analytical details

This sample was analysed on 12 and 15 May 2002. The counter deadtime during both analysis sessions was 32 ns. Fifteen analyses of the CZ3 standard obtained during the first analysis session indicated a Pb*/U calibration uncertainty of 1.28% (1σ). Analyses 1.1 to 30.1 were obtained during the first analysis session. During the second analysis session, two analyses of the CZ3 standard obtained during the first analysis session indicated a Pb*/U calibration uncertainty of 0.265% (1σ). A calibration uncertainty of 1.0% (1σ) was applied to analyses of unknowns obtained during this analysis session. Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses.

Results

Thirty-two analyses were obtained from 30 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 slightly discordant and indicate a range of $^{207}Pb/^{206}Pb$ dates from c. 1670 to 2600 Ma. On the basis of their $^{207}Pb/^{206}Pb$ ratios, many analyses can be assigned to one of three groups. Concordant analyses 3.1, 3.2, and 3.2, 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 1669 ± 46 Ma (chi-squared = 0.53). Concordant analyses 19.1 and 22.1, 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 1735 ± 32 Ma (±1σ uncertainty). Twenty-five concordant analyses of 25 zircons, assigned to Group 3, have $^{207}Pb/^{206}Pb$ ratios defining a single population and indicating a weighted mean $^{207}Pb/^{206}Pb$ date of 1799 ± 10 Ma (chi-squared = 1.05). The remaining analyses (8.1, 25.1) cannot be confidently grouped.

Grain 3 is 50 × 80 µm in size, structureless and subrounded, and inferred to be detrital. Consequently, the weighted mean $^{207}Pb/^{206}Pb$ date of 1669 ± 46 Ma indicated by the three analyses of Group 1 obtained on grain 3 is interpreted as a maximum age for deposition of the sandstone precursor to the quartzite. The remaining analyses are also interpreted to be of detrital grains.

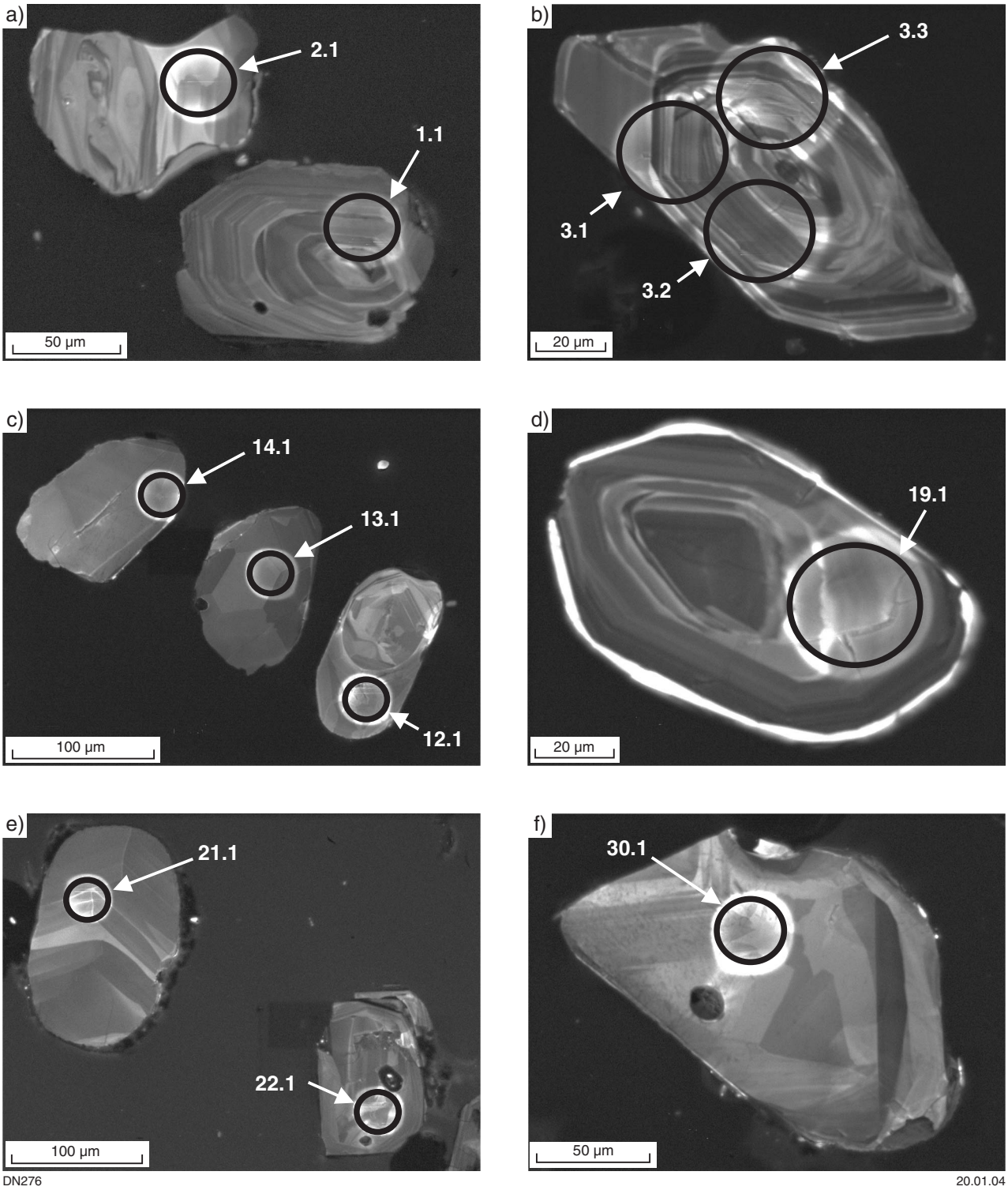

Figure 1. Cathodoluminescence images of representative zircons from sample 161285: silicified sandstone, Phenoclast Hill

Possible source rocks within the western part of Australia having ages matching those of the zircons within this sample include those of the Rudall (Nelson, 1995, 1996), Arunta (Williams et al., 1996 and references cited therein), and Gascoyne (Nelson, 1997, 1998, 1999, 2000, this volume) Complexes. Grain 25 could have been derived from either the Yilgarn or Pilbara Cratons.

Recommended reference for this publication:

NELSON, D. R., 2004, 161285: silicified sandstone, Phenoclast Hill; Geochronology dataset 216; in Compilation of geochronology data, June 2006 update: Western Australia Geological Survey.

Data obtained: 15/05/2002; Data released: 06/12/2004

Table 1. Ion microprobe analytical results for sample 161285: silicified sandstone, Phenoclast Hill

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	186	314	79	0.427	0.10931	0.00120	0.48544	0.00331	0.3058	0.0041	4.609	0.084	96	1 788	20
2.1	52	71	22	0.828	0.10969	0.00271	0.39309	0.00675	0.3190	0.0047	4.824	0.147	99	1 794	45
3.1	135	123	46	0.746	0.10191	0.00159	0.24150	0.00364	0.2908	0.0040	4.086	0.090	99	1 659	29
4.1	224	479	106	0.195	0.11072	0.00088	0.62186	0.00296	0.3170	0.0042	4.839	0.079	98	1 811	15
5.1	37	32	14	1.156	0.11454	0.00378	0.25157	0.00860	0.3113	0.0049	4.916	0.188	93	1 873	60
6.1	79	92	31	0.618	0.10735	0.00201	0.33623	0.00488	0.3082	0.0043	4.562	0.113	99	1 755	34
7.1	72	97	30	0.460	0.10964	0.00188	0.39049	0.00482	0.3181	0.0045	4.808	0.114	99	1 793	31
8.1	113	43	43	0.199	0.12354	0.00127	0.11157	0.00226	0.3541	0.0049	6.031	0.110	97	2 008	18
9.1	110	127	44	0.080	0.10990	0.00122	0.32893	0.00300	0.3243	0.0045	4.914	0.092	101	1 798	20
10.1	186	308	80	0.175	0.11021	0.00098	0.48513	0.00287	0.3119	0.0042	4.739	0.080	97	1 803	16
11.1	43	70	19	1.054	0.10565	0.00333	0.47762	0.00863	0.3129	0.0047	4.558	0.167	102	1 726	58
12.1	57	103	25	0.930	0.10594	0.00271	0.52162	0.00727	0.3126	0.0046	4.566	0.141	101	1 731	47
13.1	82	76	31	0.418	0.11023	0.00175	0.26390	0.00400	0.3143	0.0044	4.777	0.107	98	1 803	29
14.1	62	106	27	0.061	0.11195	0.00180	0.49794	0.00518	0.3162	0.0045	4.881	0.111	97	1 831	29
15.1	122	60	42	0.380	0.10830	0.00142	0.13991	0.00289	0.3148	0.0043	4.700	0.094	100	1 771	24
16.1	85	57	30	0.475	0.10629	0.00193	0.19472	0.00422	0.3117	0.0044	4.569	0.111	101	1 737	33
17.1	133	146	52	0.196	0.11198	0.00121	0.31733	0.00290	0.3139	0.0043	4.847	0.089	96	1 832	20
18.1	86	59	31	0.156	0.11272	0.00142	0.20641	0.00295	0.3177	0.0044	4.938	0.098	96	1 844	23
19.1	137	85	48	0.374	0.10621	0.00134	0.17634	0.00284	0.3118	0.0042	4.566	0.090	101	1 735	23
20.1	115	100	43	0.341	0.10834	0.00145	0.25209	0.00330	0.3172	0.0043	4.738	0.096	100	1 772	24
21.1	90	115	37	0.216	0.11090	0.00202	0.37023	0.00494	0.3203	0.0045	4.897	0.119	99	1 814	33
22.1	158	184	64	0.468	0.10622	0.00127	0.33788	0.00312	0.3184	0.0043	4.663	0.089	103	1 735	22
23.1	127	142	50	0.198	0.10843	0.00116	0.32226	0.00284	0.3175	0.0043	4.747	0.087	100	1 773	20
24.1	243	134	83	0.182	0.11027	0.00082	0.15950	0.00159	0.3097	0.0041	4.709	0.075	96	1 804	14
25.1	130	155	85	0.134	0.17823	0.00104	0.33022	0.00206	0.4985	0.0068	12.251	0.190	99	2 637	10
26.1	76	62	28	0.259	0.11166	0.00169	0.24327	0.00374	0.3140	0.0044	4.834	0.106	96	1 827	27
27.1	184	157	68	0.174	0.10955	0.00100	0.25303	0.00225	0.3127	0.0042	4.724	0.081	98	1 792	17
28.1	115	116	44	0.148	0.11048	0.00130	0.29678	0.00307	0.3169	0.0043	4.827	0.092	98	1 807	21
29.1	198	33	61	-0.002	0.11020	0.00072	0.05099	0.00065	0.3067	0.0041	4.660	0.072	96	1 803	12
30.1	44	54	18	0.495	0.10872	0.00255	0.36907	0.00636	0.3119	0.0046	4.676	0.137	98	1 778	43
3.2	166	172	59	0.237	0.10208	0.00076	0.29367	0.00184	0.2916	0.0030	4.105	0.055	99	1 662	14
3.3	99	76	32	0.160	0.10367	0.00121	0.21060	0.00267	0.2864	0.0030	4.094	0.068	96	1 691	22

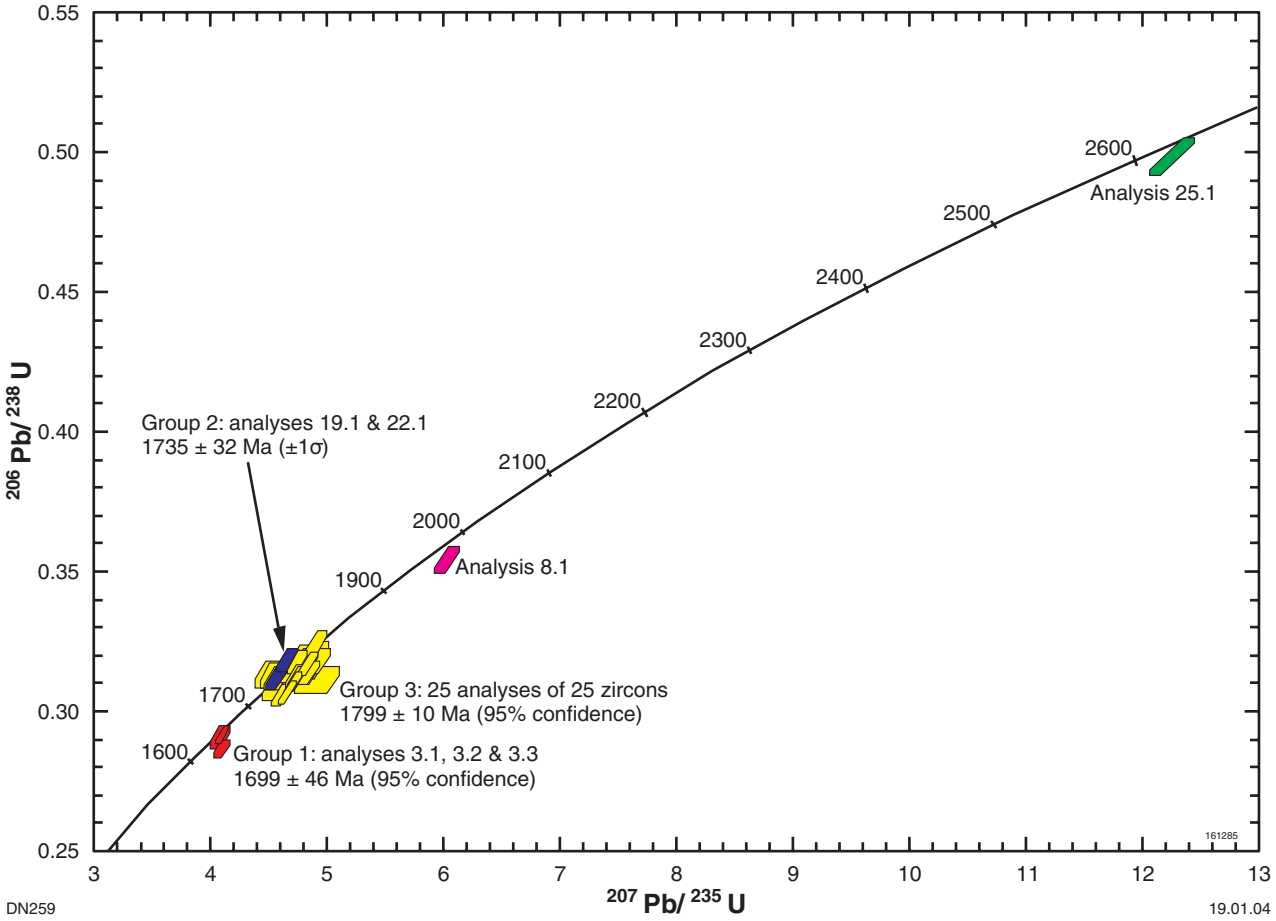

Figure 2. Concordia plot for sample 161285: silicified sandstone, Phenoclast Hill

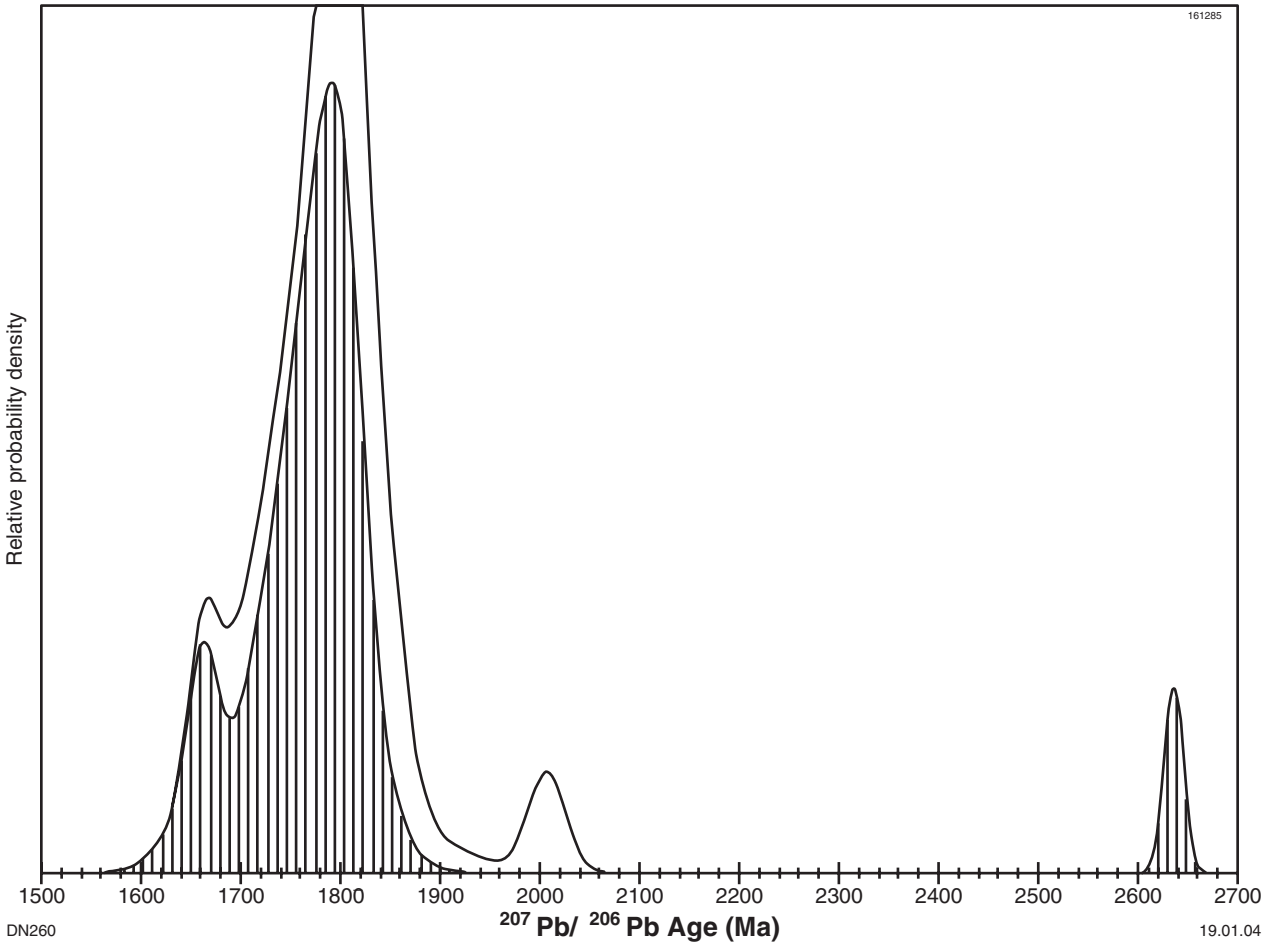

Figure 3. Gaussian-summation probability density plot for sample 161285: silicified sandstone, Phenoclast Hill