

142942: metasandstone, Croydon Well

Location and sampling

ROEBOURNE (SF 50–3)

117°51'23"E 20°55'51"S

Sampled on 18 September 1998

The sample was taken from a site on the northwestern side of, and about half way up, a large east-northeasterly striking ridge, about 150 m east of the access road to Croydon Homestead and about 1 km southeast of Croydon Well.

Tectonic unit/relations

This sample is of a mature, quartz-rich metasandstone, containing rare ≤ 3 mm diameter fragments of black chert from the Constantine Sandstone. Near the sampling site, the Mallina Shear Zone occurs along a ridge of Constantine Sandstone.

Petrographic description

The principal minerals present in this sample are quartz as single grains (75 vol.%), interstitial decussate sericite (20 vol.%), quartz as disseminated polycrystalline aggregates (2 vol.%), grains composed largely of albite with a granular to foliated texture (3 vol.%), limonite (trace), leucoxene (trace), and zircon (trace). This is a coarse quartzite with interstitial sericite and minor albitized possible volcanic fragments. In thin section, the rock is a metasandstone dominated by abundant single crystal quartz grains. There is a layer 2 mm wide with quartz ≤ 0.5 mm in size, but in the rest of the rock the quartz is from 0.2 to 1.5 mm in size, with the larger grains being mostly elongate parallel to bedding. Less abundant polycrystalline quartz is disseminated and a few grains with a granular to foliated texture are composed largely of albite. These albite-rich chips may represent altered volcanic rock fragments. Abundant interstitial decussate sericite is also present, with rare flakes and books of muscovite to 0.5 mm long. Some of the sericite also occurs as foliae parallel to bedding, with lenses of leucoxene and limonite, as well as accessory zircon grains 50–100 μm long.

Zircon morphology

The zircons isolated from this sample are commonly colourless, light yellow-brown to dark brown, subrounded whole grains or irregular fragments, between $40 \times 60 \mu\text{m}$ and $100 \times 150 \mu\text{m}$ in size. Internal zonation is common but the majority of grains are structureless.

Analytical details

This sample was analysed on 19 and 21 December 1999. The counter deadtime during both analysis sessions was 32 ns. During the first session, fourteen analyses of the CZ3 standard indicated a Pb^*/U calibration error of 2.29 (1 σ %). Analyses 1.1 to 15.1 were obtained during the first session. During the second session, five analyses of the CZ3 standard indicated a Pb^*/U calibration error of 2.92 (1 σ %). Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses.

Results

Thirty-two analyses were obtained from 32 zircons. Results are given in Table 22 and shown on concordia and Gaussian summation probability density plots in Figures 24 and 25.

Interpretation

All analyses are concordant or slightly discordant, with the discordance pattern consistent with a single recent episode of radiogenic-Pb redistribution. On the basis of their $^{207}\text{Pb}/^{206}\text{Pb}$ ratios, many analyses may be assigned to 4 main groups. Sixteen concordant and near-concordant analyses (1.1, 2.1, 3.1, 7.1, 13.1, 15.1, 16.1, 17.1, 18.1, 20.1, 22.1, 24.2, 26.2, 27.1, 28.1 and 32.1), assigned to Group 1, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 2994 ± 4 Ma (chi-squared = 0.72). Six concordant and near-concordant analyses (6.1, 10.1, 11.1, 19.1, 25.1 and 30.1), assigned to Group 2, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 3155 ± 16 Ma (chi-squared = 1.68). Four concordant and slightly discordant analyses (5.1, 8.1, 21.1 and 29.1), assigned to Group 3, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 3200 ± 17 Ma (chi-squared = 0.91). Three concordant and slightly discordant analyses (14.1, 23.1 and 31.1), assigned to Group 4, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 3425 ± 24 Ma (chi-squared = 0.58). The remaining analyses (4.1, 9.1 and 12.1) cannot be assigned to discrete groups.

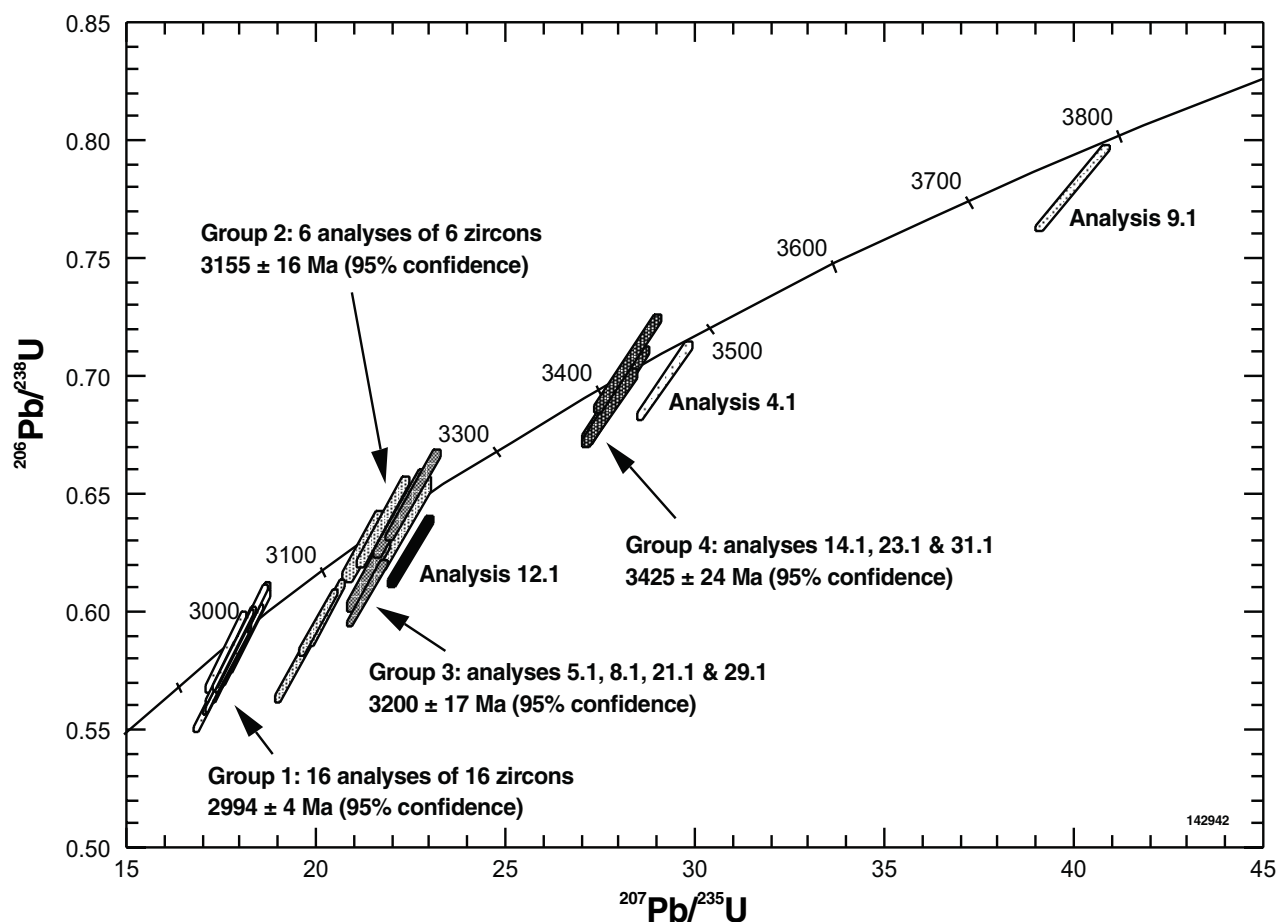


Figure 24. Concordia plot for sample 142942: metasandstone, Croydon Well

The zircons isolated from this metasandstone have morphological features consistent with a detrital origin. The date of 2994 ± 4 Ma indicated by sixteen concordant and near-concordant analyses of Group 1 is therefore interpreted as a maximum time of deposition for the metasandstone. Apart from analysis 9.1, for which a source is currently not known within Australia, the remaining analyses indicate $^{207}\text{Pb}/^{206}\text{Pb}$ dates consistent with derivation of these detrital zircons from the eastern (Group 4 and analysis 4.1) and western parts of the Pilbara Craton.

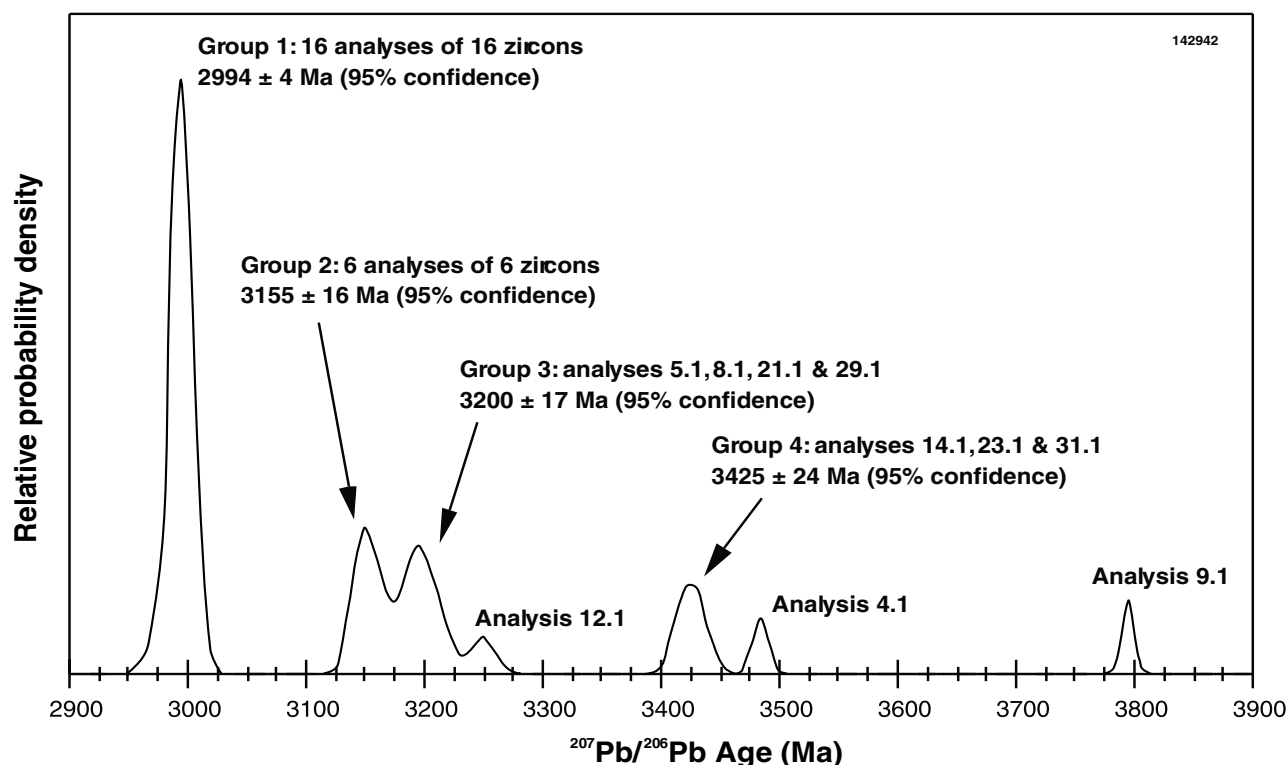


Figure 25. Gaussian-summation probability density plot for sample 142942: metasandstone, Croydon Well

Table 22. Ion microprobe analytical results for sample 142942: metasandstone, Croydon Well

Grain spot	U (ppm)	Th (ppm)	Pb (ppm)	f206%	$^{207}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{208}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$	$^{206}\text{Pb}/^{238}\text{U}$	$\pm 1\sigma$	$^{207}\text{Pb}/^{235}\text{U}$	$\pm 1\sigma$	%	$^{207}\text{Pb}/^{206}\text{Pb}$	$\pm 1\sigma$
													concordance	Age	
1.1	192	289	157	0.157	0.22274	0.00105	0.40167	0.00205	0.5817	0.0137	17.864	0.438	98	3001	8
2.1	231	261	176	0.133	0.22256	0.00093	0.29853	0.00159	0.5791	0.0135	17.772	0.431	98	2999	7
3.1	183	160	132	0.176	0.22187	0.00107	0.23668	0.00170	0.5696	0.0134	17.425	0.428	97	2994	8
4.1	142	85	125	0.148	0.30283	0.00132	0.15465	0.00157	0.6992	0.0165	29.194	0.717	98	3485	7
5.1	64	39	49	0.309	0.25155	0.00195	0.16266	0.00279	0.6162	0.0151	21.371	0.568	97	3195	12
6.1	53	41	42	0.463	0.24570	0.00241	0.20807	0.00411	0.6283	0.0156	21.285	0.591	100	3157	16
7.1	267	332	205	0.109	0.22067	0.00085	0.32756	0.00149	0.5747	0.0134	17.486	0.421	98	2986	6
8.1	132	106	100	0.286	0.25442	0.00135	0.17550	0.00191	0.6084	0.0144	21.344	0.531	95	3212	8
9.1	174	163	189	0.139	0.37094	0.00125	0.23119	0.00140	0.7815	0.0184	39.970	0.968	98	3795	5
10.1	116	112	89	0.374	0.24511	0.00149	0.22928	0.00234	0.6000	0.0143	20.278	0.512	96	3153	10
11.1	169	138	127	0.289	0.24392	0.00117	0.20321	0.00173	0.5962	0.0140	20.052	0.493	96	3146	8
12.1	70	39	54	0.180	0.26071	0.00183	0.15071	0.00238	0.6261	0.0152	22.507	0.588	96	3251	11
13.1	206	232	155	0.155	0.22240	0.00099	0.29764	0.00168	0.5710	0.0134	17.509	0.427	97	2998	7
14.1	80	61	71	0.448	0.29277	0.00190	0.19241	0.00279	0.6873	0.0166	27.742	0.717	98	3432	10
15.1	178	198	132	0.205	0.22196	0.00109	0.29213	0.00186	0.5625	0.0132	17.216	0.424	96	2995	8
16.1	152	199	121	0.493	0.21932	0.00144	0.34246	0.00277	0.5834	0.0174	17.641	0.552	100	2976	11
17.1	175	216	140	0.177	0.22227	0.00121	0.32825	0.00214	0.5953	0.0177	18.245	0.563	100	2997	9
18.1	171	243	140	0.252	0.22224	0.00128	0.37065	0.00245	0.5913	0.0176	18.118	0.561	100	2997	9
19.1	131	70	102	0.531	0.24701	0.00162	0.13730	0.00244	0.6389	0.0191	21.758	0.683	101	3166	10
20.1	307	434	248	0.126	0.22121	0.00090	0.37481	0.00170	0.5857	0.0173	17.865	0.541	99	2990	7
21.1	115	29	84	0.272	0.25087	0.00163	0.06428	0.00210	0.6426	0.0193	22.227	0.699	100	3190	10
22.1	240	406	205	0.181	0.22146	0.00104	0.44526	0.00214	0.5944	0.0176	18.150	0.554	101	2991	8
23.1	128	86	115	0.340	0.28986	0.00160	0.16934	0.00215	0.7067	0.0211	28.244	0.878	101	3417	9
24.1	213	271	170	0.072	0.22303	0.00114	0.33907	0.00209	0.5923	0.0175	18.215	0.558	100	3003	8
25.1	55	42	45	0.490	0.25327	0.00315	0.20112	0.00589	0.6381	0.0197	22.283	0.773	99	3205	20
26.1	180	209	138	0.287	0.22212	0.00132	0.30608	0.00241	0.5793	0.0172	17.741	0.550	98	2996	10
27.1	453	450	339	0.068	0.22141	0.00071	0.26081	0.00109	0.5843	0.0172	17.838	0.535	99	2991	5
28.1	231	244	176	0.199	0.22348	0.00105	0.27373	0.00172	0.5864	0.0173	18.068	0.552	99	3006	8
29.1	135	97	110	0.278	0.25174	0.00147	0.18706	0.00212	0.6499	0.0194	22.557	0.702	101	3196	9
30.1	144	174	111	0.420	0.24443	0.00161	0.29220	0.00284	0.5795	0.0173	19.531	0.611	94	3149	10
31.1	82	54	72	0.385	0.29211	0.00201	0.17079	0.00272	0.6931	0.0210	27.915	0.891	99	3429	11
32.1	161	175	123	0.228	0.22158	0.00131	0.29099	0.00230	0.5826	0.0173	17.799	0.552	99	2992	10

STRATIGRAPHIC REFERENCE:

SMITHIES, R. H., NELSON, D. R., and PIKE, G., 2001, Development of the Archaean Mallina Basin, Pilbara Craton, northwestern Australia; a study of detrital and inherited zircon ages: *Sedimentary Geology*, v. 141–142, p. 79–94.

Recommended reference for this publication:

NELSON, D. R., 2000, 142942: metasandstone, Croydon Well; in *Compilation of geochronology data, 1999*: Western Australia Geological Survey, Record 2000/2, p. 93–96.

OR

NELSON, D. R., 2000, 142942: metasandstone, Croydon Well; Geochronology dataset 327; in *Compilation of geochronology data, June 2006 update*: Western Australia Geological Survey.

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