

142949: metasandstone, Whim Creek

Location and sampling

ROEBOURNE (SF 50–3)

117°49'59"E 20°52'34"S

Sampled on 19 September 1998

The sample was taken from a 0.5 m³ boulder on the north side, and 20 m from the top, of an east-trending ridge, about 2 km south of Whim Creek.

Tectonic unit/relations

This sample is from a quartzofeldspathic sandstone within the Cistern Formation of the Whim Creek Group, near the contact with the overlying Rushall Slate.

Petrographic description

The principal minerals present in this sample are plagioclase (35 vol.%), quartz as single crystal quartz grains with undulose extinction (35 vol.%) and as recrystallized quartz matrix (20–25 vol.%), albite after K-feldspar (7–8 vol.%), muscovite (trace), sericite (trace), leucoxene (trace), opaque oxide (trace), and limonite (trace). This is a poorly sorted, medium- to very coarse-grained sandstone with quartz, weakly altered plagioclase and albitized K-feldspar, and rare clasts of muscovite and quartz–sericite schist. Accessory minerals include leucoxene and limonite after pyrite. Grains range up to 2 mm in diameter, with abundant smaller grains from 0.25 to 0.8 mm. Scattered single crystal quartz grains, with undulose extinction, are common. Also present are albite- to sericite-altered plagioclase, relatively less abundant, smaller grains of checkerboard albite after K-feldspar, rare detrital muscovite, and rare quartz–sericite schist clasts that are ≤1 mm in length. An extensive matrix is composed of recrystallized quartz, 0.05 mm in grain size, with rare schistose sericite. The quartz grains are commonly elongated parallel to the schistosity. Leucoxene has replaced accessory opaque oxide, partly as inclusions in altered plagioclase, partly as separate grains to 0.4 mm long. A lens of limonite, apparently after pyrite, is present with limonite apparently replacing sulfide grains to 0.3 mm in diameter.

Zircon morphology

The zircons isolated from this sample are commonly straw-brown or dark brown to black, generally euhedral to subhedral, and between 80 × 150 μm and 150 × 250 μm in size. Remnant internal zonation is common, although a minority of grains are structureless or have structureless rims. Many are black and metamict.

Analytical details

This sample was analysed on 28 December 1999. The counter deadtime was 32 ns. Eleven analyses of the CZ3 standard obtained during the analysis session indicated a Pb*/U calibration error of 1.00 (1σ%). Common-Pb corrections were applied assuming Broken Hill common-Pb isotopic compositions for all analyses with the exception of analysis 7.1, for which isotopic compositions determined using the method of Cumming and Richards (1975) were assumed.

Results

Twenty-eight analyses were obtained from 28 zircons. Results are given in Table 27 and shown on concordia and Gaussian-summation probability density plots in Figures 31 and 32.

Interpretation

The analyses range from concordant to highly discordant, with the discordance pattern consistent with several episodes, including one recent episode, of radiogenic-Pb loss. On the basis of their $^{207}\text{Pb}/^{206}\text{Pb}$ ratios, most analyses may be assigned to one of three groups. Twenty-two analyses of 22 zircons, including many that are concordant, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 2978 ± 5 Ma (chi-squared = 1.54). Concordant analyses 1.1, 13.1 and 19.1, assigned to Group 2, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 3004 ± 30 Ma (chi-squared = 1.65). Slightly discordant analyses 7.1 and 18.1, assigned to Group 3, have $^{207}\text{Pb}/^{206}\text{Pb}$ ratios defining a single population and indicating a weighted mean date of 3161 ± 8 Ma. Analysis 2.1 is highly discordant and cannot be assigned to any of these groups.

Although many of the zircons isolated from this sample are euhedral or consist of broken fragments, many are sub-rounded and have pitted surfaces, morphological features consistent with a detrital origin. The date of 2978 ± 5 Ma indicated by the weighted mean $^{207}\text{Pb}/^{206}\text{Pb}$ ratio of

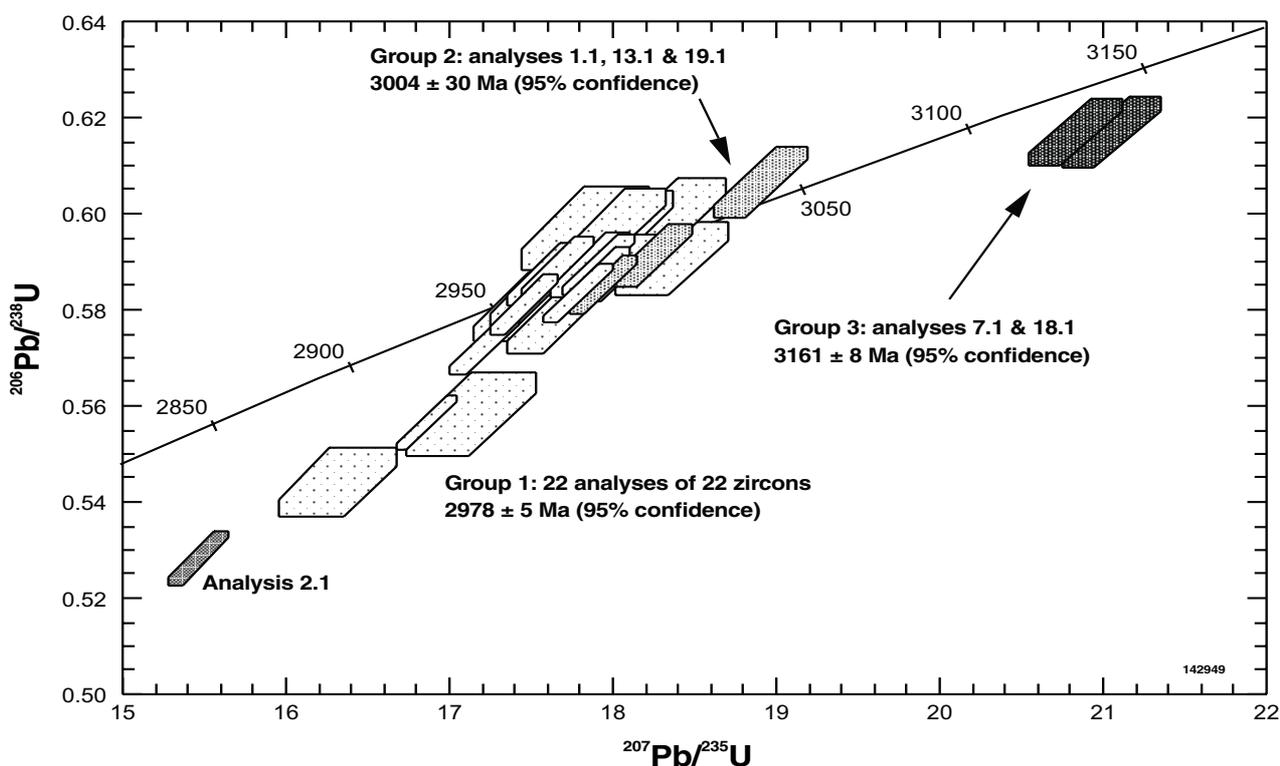


Figure 31. Concordia plot for sample 142949: metasandstone, Whim Creek

22 analyses is therefore interpreted as providing a maximum time for deposition of the metasandstone. The remaining older analyses of Groups 2 and 3 are interpreted to be of detrital zircons possibly derived from the western part of the Pilbara Craton. Highly discordant analysis 2.1 is interpreted to have lost radiogenic Pb during a disturbance episode.

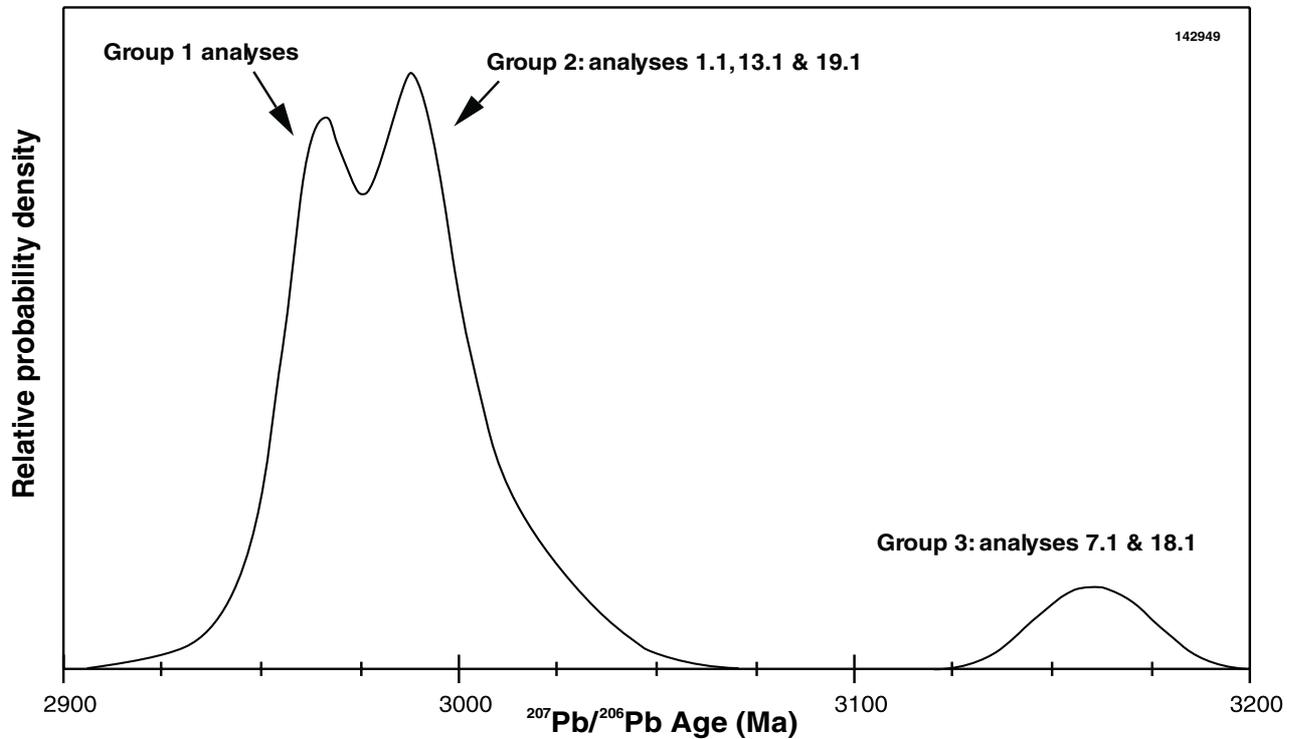


Figure 32. Gaussian-summation probability density plot for sample 142949: metasandstone, Whim Creek

Table 27. Ion microprobe analytical results for sample 142949: metasandstone, Whim Creek

<i>Grain spot</i>	<i>U (ppm)</i>	<i>Th (ppm)</i>	<i>Pb (ppm)</i>	<i>f206%</i>	<i>²⁰⁷Pb/²⁰⁶Pb</i>	<i>±1σ</i>	<i>²⁰⁸Pb/²⁰⁶Pb</i>	<i>±1σ</i>	<i>²⁰⁶Pb/²³⁸U</i>	<i>±1σ</i>	<i>²⁰⁷Pb/²³⁵U</i>	<i>±1σ</i>	<i>% concordance</i>	<i>²⁰⁷Pb/²⁰⁶Pb Age</i>	<i>±1σ</i>
1.1	175	100	124	0.359	0.22372	0.00133	0.15216	0.00198	0.5913	0.0067	18.239	0.244	100	3008	10
2.1	312	52	179	0.208	0.21224	0.00093	0.04264	0.00106	0.5285	0.0057	15.464	0.187	94	2923	7
3.1	78	57	57	0.254	0.21949	0.00207	0.19432	0.00343	0.5972	0.0076	18.071	0.303	101	2977	15
4.1	40	18	28	0.575	0.21665	0.00320	0.11657	0.00550	0.5969	0.0088	17.830	0.395	102	2956	24
5.1	88	55	65	0.992	0.22201	0.00234	0.17013	0.00433	0.6001	0.0074	18.368	0.317	101	2995	17
6.1	154	138	114	0.223	0.21720	0.00138	0.23455	0.00234	0.5874	0.0067	17.591	0.242	101	2960	10
7.1	211	105	161	1.651	0.24495	0.00162	0.12990	0.00309	0.6168	0.0069	20.833	0.284	98	3152	11
8.1	154	157	117	0.249	0.21985	0.00131	0.27063	0.00222	0.5894	0.0067	17.865	0.242	100	2980	10
9.1	79	55	57	0.777	0.22039	0.00223	0.17972	0.00397	0.5835	0.0074	17.732	0.305	99	2984	16
10.1	561	57	337	0.216	0.21972	0.00068	0.02681	0.00076	0.5565	0.0058	16.860	0.189	96	2979	5
11.1	350	53	224	0.158	0.22121	0.00084	0.03907	0.00084	0.5866	0.0062	17.892	0.210	100	2990	6
12.1	131	79	95	0.875	0.22178	0.00174	0.16240	0.00302	0.5887	0.0069	18.000	0.267	100	2994	13
13.1	86	54	63	0.052	0.22611	0.00168	0.17094	0.00217	0.6065	0.0075	18.909	0.287	101	3025	12
14.1	117	102	86	0.212	0.21754	0.00155	0.23266	0.00255	0.5835	0.0069	17.501	0.254	100	2963	11
15.1	71	48	52	0.443	0.21874	0.00206	0.17630	0.00326	0.5975	0.0076	18.021	0.302	102	2971	15
16.1	216	168	157	0.181	0.21753	0.00111	0.20520	0.00172	0.5889	0.0065	17.664	0.224	101	2962	8
17.1	237	319	185	0.078	0.21805	0.00100	0.35861	0.00183	0.5726	0.0062	17.215	0.213	98	2966	7
18.1	118	44	86	0.513	0.24748	0.00165	0.10049	0.00232	0.6169	0.0072	21.050	0.299	98	3169	11
19.1	379	105	248	0.129	0.22238	0.00083	0.07550	0.00091	0.5852	0.0062	17.942	0.210	99	2998	6
20.1	86	65	62	0.591	0.22062	0.00231	0.19984	0.00412	0.5837	0.0075	17.756	0.312	99	2985	17
21.1	111	86	80	0.346	0.21750	0.00184	0.20603	0.00306	0.5807	0.0071	17.416	0.274	100	2962	14
22.1	409	58	259	0.029	0.22105	0.00080	0.03883	0.00053	0.5836	0.0062	17.786	0.208	99	2988	6
23.1	81	43	59	1.381	0.22547	0.00280	0.14499	0.00516	0.5906	0.0077	18.361	0.352	99	3020	20
24.1	95	55	65	0.344	0.22119	0.00200	0.15291	0.00312	0.5784	0.0073	17.639	0.290	98	2989	15
25.1	77	49	54	2.188	0.21749	0.00346	0.17913	0.00693	0.5441	0.0073	16.315	0.360	95	2962	26
26.1	301	300	228	0.142	0.22045	0.00102	0.26310	0.00167	0.5893	0.0064	17.912	0.222	100	2984	7
27.1	50	37	35	0.849	0.22249	0.00339	0.19337	0.00613	0.5584	0.0087	17.131	0.395	95	2999	24
28.1	411	462	313	0.109	0.21784	0.00084	0.29580	0.00142	0.5810	0.0062	17.452	0.206	100	2965	6

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, 142949: metasandstone, Whim Creek; in *Compilation of geochronology data, 1999*: Western Australia Geological Survey, Record 2000/2, p. 113–116.

OR

NELSON, D. R., 2000, 142949: metasandstone, Whim Creek; Geochronology dataset 299; in *Compilation of geochronology data, June 2006 update*: Western Australia Geological Survey.

Data obtained: 28/12/1999; Data released: 30/06/2000