

177278: schistose metagreywacke, Bald Hill

(Killi Killi Formation, Tanami Group, Granites–Tanami Orogen)

Location and sampling

BILLILUNA (SE 52-14), WATTS (4658)
MGA Zone 52, 485634E 7833807N

Sampled on 30 September 2004

The sample was collected from a depth of 126.8 – 129.4 m in drillcore LKD100. The drillhole is near the Sandpiper openpit mine, approximately 15.1 km southeast of Tent Hill, and 200 m east of Bald Hill.

Tectonic unit/relations

The unit sampled is a metagreywacke assigned to the Killi Killi Formation of the Tanami Group within the Granites–Tanami Orogen (Bagas et al., 2007). The c. 1880–1830 Ma Tanami Group is divided into the Dead Bullock Formation and conformably overlying Killi Killi Formation, and is intruded by pre-tectonic dolerite sills (Bagas et al., 2007). Rare exposures of c. 2520–2500 Ma amphibolite-facies gneiss and metasedimentary rocks form the basement to the Tanami Group. The Killi Killi Formation represents turbiditic sedimentary rocks, correlated with the widespread Lander Rock Formation of the Arunta Orogen. Deposition of the Tanami Group was terminated by regional deformation and greenschist-to amphibolite-facies metamorphism during the Tanami Event at c. 1830 Ma (Bagas et al., 2007). The Tanami Group is unconformably overlain by rhyolite, siliciclastic sedimentary rocks, and felsic ignimbrite of the Ware Group, which was deposited at c. 1825–1810 Ma (Crispe et al., 2007). Dating of detrital zircons from metasandstone sample GSWA 184363, obtained about 14 km north of Mount Tietkens on MACDONALD, yielded a maximum depositional age of 1838 ± 15 Ma (1σ) for the Lander Rock Formation (Kirkland et al., 2009), a figure consistent with previous estimates of 1840–1830 Ma for the unit (Crispe et al., 2007).

Petrographic description

The sample is a schistose metagreywacke, containing 25–30% disseminated single-crystal quartz grains up to 0.8 mm long, and 3–5% disseminated detrital muscovite as narrow flakes up to 1.5 mm long; muscovite defines a bedding-parallel foliation. Polycrystalline quartz grains are rare, and the matrix is composed largely of quartz–sericite

schist with disseminated decussate biotite. Patches of leucoxene–anatase and microcrystalline hematite are distributed throughout the rock, although the main heavy mineral is tourmaline; apatite and zircon are rare. The nature of the metamorphic assemblage is unclear, but may indicate middle to high greenschist facies conditions.

Zircon morphology

Zircons from this sample are mainly subhedral with rounded terminations, and range from colourless to black. The grains are up to 250 μm long, with aspect ratios up to 4:1. Cathodoluminescence (CL) images reveal a variety of internal textures, including oscillatory zoning and apparently older cores. A CL image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 30–31 May 2008, using SHRIMP-B. Six analyses of the Temora standard were obtained during the session, and indicated an external spot-to-spot (reproducibility) uncertainty of 1.49% (1σ) and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.68% (1σ). Calibration uncertainties are included in the errors of $^{238}\text{U}/^{206}\text{Pb}^*$ ratios and dates listed in Table 1. Common-Pb corrections were applied to all analyses using contemporaneous isotopic compositions determined according to the model of Stacey and Kramers (1975).

Results

Eighteen analyses were obtained from 18 zircons. Results are listed in Table 1, and shown on a concordia diagram (Fig. 2) and a probability density diagram (Fig. 3). Many grains could not be successfully analysed as they are enriched in uranium and common Pb.

Interpretation

The analyses are concordant to strongly discordant (Fig. 2). Five analyses are characterized by >5% discordance. The dates obtained from these five analyses (Group D; Table 1) are imprecise or unreliable, and are not considered geologically significant. The remaining 13 analyses can be separated into two groups, based on

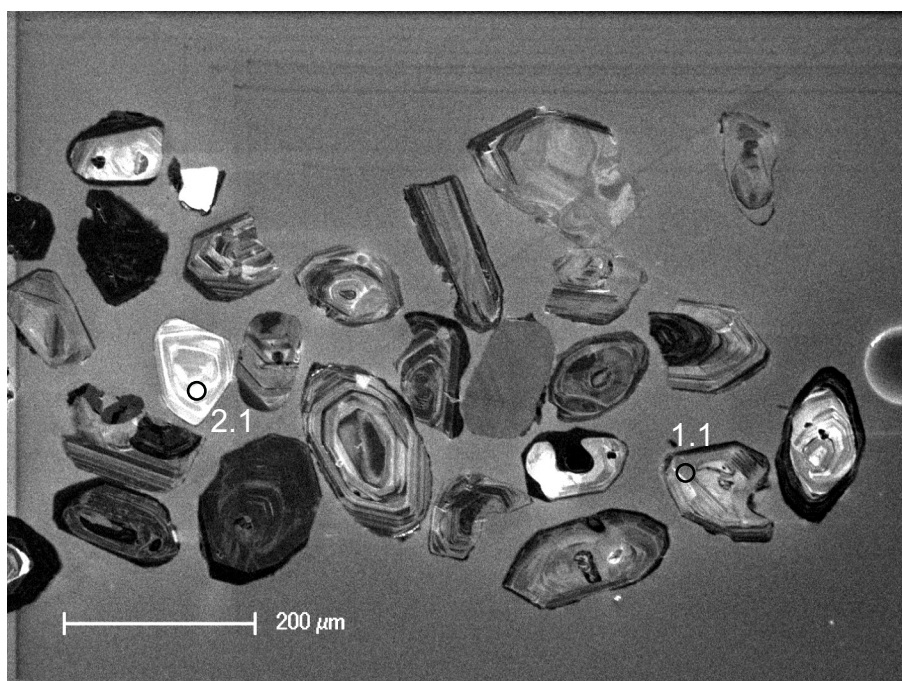


Figure 1. Cathodoluminescence image of representative zircons from sample 177278: schistose metagreywacke, Bald Hill. Numbered circles indicates the approximate positions of analysis sites.

their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

Group Y comprises two analyses (2.1 and 7.1, Table 1), which yield a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 1844 ± 36 Ma (MSWD = 0.44).

Group S comprises 11 analyses (Table 1), which yield $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ dates of 3024–1907 Ma.

It is possible that all analyses in Groups Y and S are of unmodified detrital zircons, in which case the concordant date of 1844 ± 36 Ma for the two analyses in Group Y represents a maximum age of deposition for the greywacke.

The 13 analyses in combined Groups Y and S indicate dates that define significant age components at c. 2527 and 1844 Ma, and several minor components in the range 3024–1907 Ma. These dates are interpreted as the ages of zircon-crystallizing rocks in the detrital source region(s), or the ages of detrital components within sediments which have been reworked into this rock.

References

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- Crispe, AJ, Vandenberg, LC and Scrimgeour, IR 2007, Geological framework of the Archean and Paleoproterozoic Tanami Region,

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Stacey, JS and Kramers, JD 1975, Approximation of terrestrial lead isotope evolution by a two-stage model: Earth and Planetary Science Letters, v. 26, p. 207–221.

Recommended reference for this publication

Kirkland, CL and Wingate, MTD 2010, 177278: schistose metagreywacke, Bald Hill; Geochronology Record 922: Geological Survey of Western Australia, 4p.

Data obtained: 31 May 2008

Data released: 30 June 2010

Table 1. Ion microprobe analytical results for zircons from sample 177278: schistose metagreywacke, Bald Hill

Group ID	Spot no.	Grain. spot	^{238}U (ppm)	^{232}Th (ppm)	$\frac{^{232}\text{Th}}{^{238}\text{U}}$	f^{204} (%)	$\frac{^{238}\text{U}}{^{206}\text{Pb}} \pm 1\sigma$	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}} \pm 1\sigma$	$\frac{^{238}\text{U}}{^{206}\text{Pb}^*} \pm 1\sigma$	$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*} \pm 1\sigma$	$\frac{^{238}\text{U}}{^{206}\text{Pb}^*} \text{ date (Ma)} \pm 1\sigma$	$\frac{^{207}\text{Pb}^*}{^{206}\text{Pb}^*} \text{ date (Ma)} \pm 1\sigma$	Disc. (%)						
Y	7	7.1	106	102	0.99	0.380	2.953	0.054	0.11528	0.00103	2.964	0.054	0.11196	0.00163	1874	30	1831	26	-2.3
Y	2	2.1	107	83	0.81	0.653	3.012	0.054	0.11920	0.00098	3.032	0.055	0.11349	0.00162	1838	29	1856	26	1.0
S	6	6.1	180	62	0.36	0.175	3.014	0.053	0.11829	0.00078	3.019	0.053	0.11676	0.00103	1844	28	1907	16	3.3
S	4	4.1	183	49	0.28	0.593	2.806	0.049	0.13087	0.00081	2.822	0.050	0.12565	0.00135	1955	30	2038	19	4.1
S	5	5.1	123	92	0.78	0.720	2.523	0.046	0.13890	0.00099	2.542	0.046	0.13254	0.00160	2139	34	2132	21	-0.3
S	16	16.1	142	39	0.28	0.424	2.432	0.043	0.14107	0.00089	2.443	0.043	0.13731	0.00121	2212	34	2194	15	-0.8
S	14	14.1	75	97	1.35	1.274	2.259	0.042	0.16636	0.00123	2.289	0.043	0.13503	0.00218	2337	37	2402	24	2.7
S	10	10.1	98	69	0.73	0.904	2.187	0.040	0.16606	0.00114	2.207	0.041	0.15801	0.00174	2409	38	2434	19	1.0
S	13	13.1	67	50	0.77	0.464	2.086	0.040	0.16667	0.00130	2.096	0.040	0.16253	0.00170	2515	40	2482	18	-1.3
S	3	3.1	77	31	0.41	0.546	2.050	0.038	0.17094	0.00120	2.061	0.039	0.16608	0.00167	2549	40	2519	17	-1.2
S	11	11.1	59	35	0.62	0.282	2.082	0.040	0.17031	0.00142	2.088	0.041	0.16780	0.00169	2522	41	2536	17	0.5
S	9	9.1	28	109	3.98	0.272	2.051	0.046	0.17712	0.00217	2.057	0.048	0.17469	0.00498	2554	50	2603	47	1.9
S	17	17.1	73	35	0.49	0.769	1.708	0.032	0.23278	0.00151	1.722	0.033	0.22597	0.00203	2952	46	3024	14	2.4
D	12	12.1	9	2	0.24	9.429	3.921	0.121	0.19270	0.00466	4.329	0.169	0.11049	0.02122	1340	49	1808	349	25.9
D	1	1.1	173	60	0.36	2.577	3.138	0.055	0.13635	0.00088	3.221	0.057	0.11383	0.00222	1743	27	1861	35	6.4
D	15	15.1	59	36	0.63	0.848	2.240	0.044	0.17188	0.00144	2.259	0.045	0.16432	0.00241	2363	40	2501	25	5.5
D	18	18.1	99	35	0.37	2.287	2.412	0.044	0.18745	0.00138	2.468	0.045	0.16707	0.00242	2193	34	2528	24	13.3
D	8	8.1	61	33	0.55	1.817	1.932	0.038	0.24535	0.00200	1.968	0.039	0.22928	0.00313	2649	44	3047	22	13.1

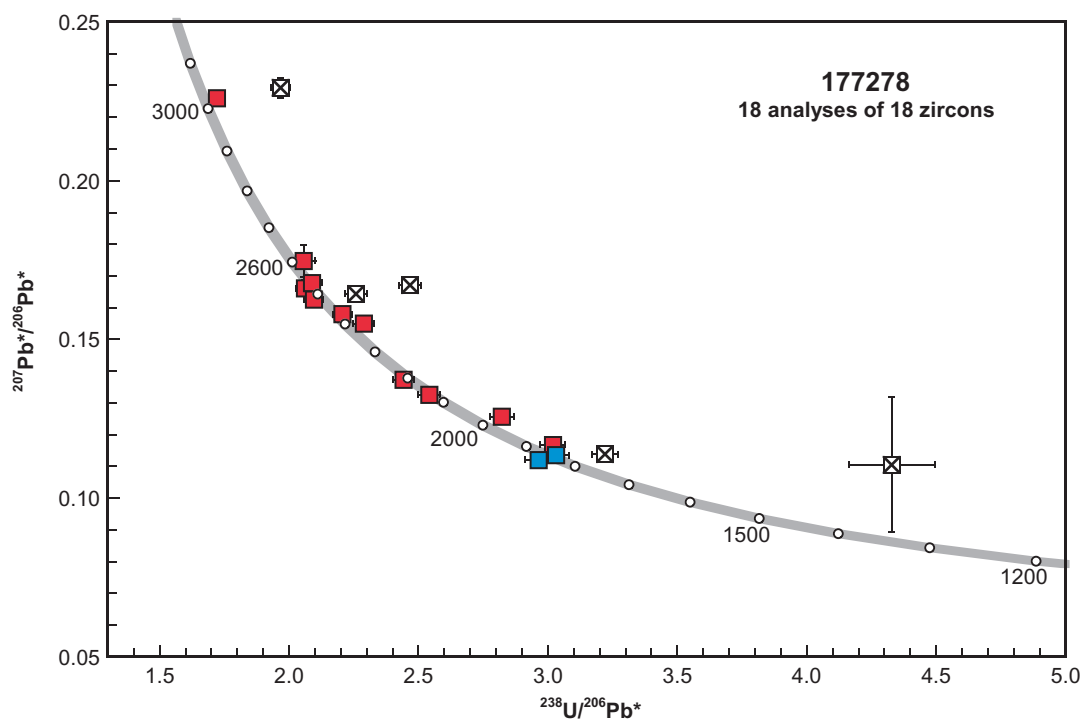


Figure 2. U-Pb analytical data for sample 177278: schistose metagreywacke, Bald Hill. Blue squares indicate Group Y (youngest detrital zircons); red squares indicate Group S (older detrital zircons); crossed squares indicate Group D (discordance >5%).

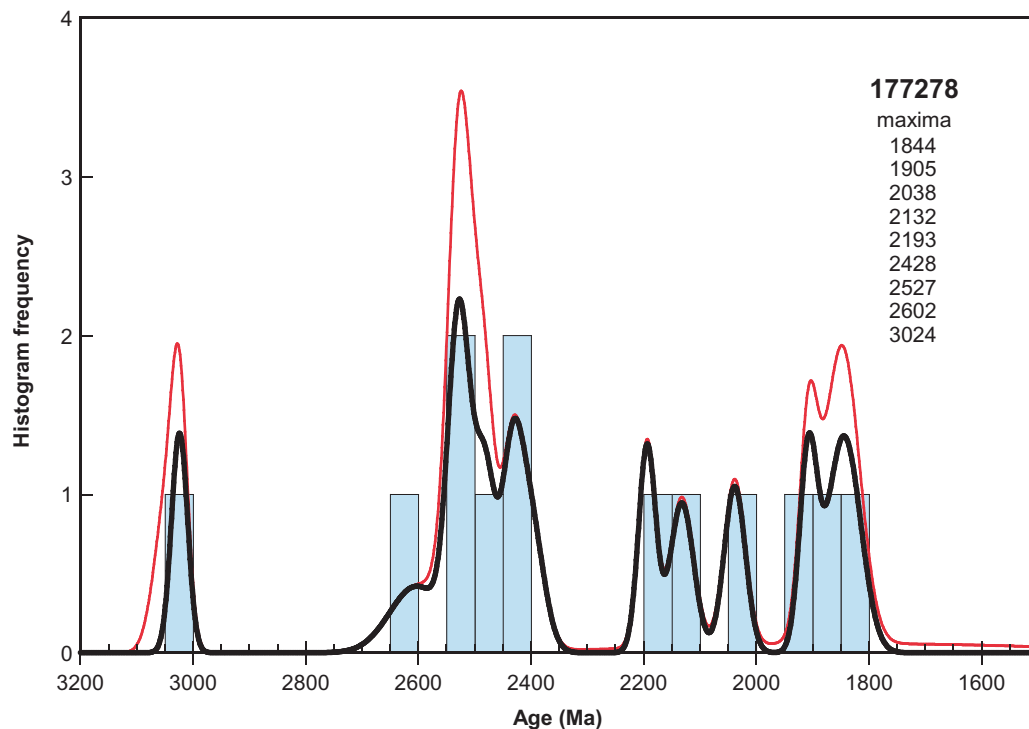


Figure 3. Probability density diagram and histogram for sample 177278: schistose metagreywacke, Bald Hill. Thick curve, maxima values, and frequency histogram (bin width 50 Ma) include only data with discordance <5% (13 analyses of 13 zircons). Thin curve includes all data (18 analyses of 18 zircons).