

183275: psammitic schist, Mount Dalgety

(Mumba Psammite, Moogie Metamorphics, Gascoyne Province)

Location and sampling

GLENBURGH (SG 50-6), DAURIE CREEK (2047)
MGA Zone 50, 393838E 7217124N

Sampled on 31 July 2006

The sample was collected from a rubbly exposure of psammitic schist less than 10 m wide on low undulating ground approximately 5 km west-northwest of Mount Dalgety and 7.4 km northeast of Bookanbah Well.

Tectonic unit/relations

The psammitic schist is part of the Paleoproterozoic Mumba Psammite, a unit of metamorphosed quartzofeldspathic psammitic schists, quartz-rich psammitic schists, and metamorphosed quartz sandstones; all with minor interbedded pelitic schists (Occhipinti and Sheppard, 2000). The Mumba Psammite is a component of the Moogie Metamorphics, a succession of largely retrogressed psammitic and pelitic rocks, with minor mafic meta-igneous and calc-silicate rocks. The Moogie Metamorphics are the oldest identified metasedimentary package in the Gascoyne Province (Occhipinti et al., 2001). Related geochronology samples include GSWA 184160, a quartz-rich psammitic schist, and GSWA 184161, a retrogressed quartzofeldspathic migmatite (Kirkland et al., 2009) from the Mumba Psammite also on the DAURIE CREEK map sheet. Gascoyne Province supersedes the term Gascoyne Complex (e.g. Johnson et al., 2009).

Petrographic description

The sample is a blocky to schistose, coarse-grained, grey sandstone that underwent low- to medium-grade metamorphism. This rock consists of quartz, with subordinate chlorite, apatite, and opaque oxide minerals. Most of the rock consists of medium- to coarse-grained (to 5 mm long) anhedral and strained quartz with variable grain size and texture. Quartz-grain boundaries vary from straight, to indented and convoluted. A striking feature of the petrographic section is the abundance of small equant apatite crystals scattered through the quartz grains. Small biotite crystals are common and typically form inclusions within quartz grains (1–2 modal %), but also locally form chloritized aggregates, up to 1 mm across. Equant opaque-oxide grains (possibly magnetite), up to 0.5 mm across, are scattered throughout the rock, but comprise much less

than 1 modal % of this sample. Several large, well-formed zircon crystals are also present. Disseminated garnet was also observed in hand specimen, although it is largely replaced by fine-grained chlorite.

Zircon morphology

This sample yielded colourless to pale brown zircons, many of which feature abraded terminations, although several are subhedral and only slightly rounded. The zircons are 50–200 µm long, and rounded to elongate with aspect ratios up to 5:1. Most grains display concentric growth zoning, which, in many cases, is truncated at grain edges. Surface pitting and the high degree of rounding are consistent with mechanical abrasion during sedimentary transport. A cathodoluminescence image of representative zircons is shown in Figure 1.

Analytical details

This sample was analysed on 15–18 April 2007, using SHRIMP-A. Twenty-five analyses of the Temora standard were obtained during the session, and following deletion of two analyses as outliers, the remaining 23 analyses yielded an external spot-to-spot (reproducibility) uncertainty of 1.18% (1σ), and a $^{238}\text{U}/^{206}\text{Pb}^*$ calibration uncertainty of 0.30% (1σ). Common-Pb corrections were applied to all analyses using contemporaneous common-Pb isotopic compositions determined according to the model of Stacey and Kramers (1975).

Results

Fifty-one analyses were obtained from 51 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 2) and a probability density diagram (Fig. 3).

Interpretation

The analyses are concordant to slightly normally discordant (Fig. 2). Five analyses are characterized by slight discordance (>5%). The dates from these five analyses (Group D; Table 1) are imprecise or unreliable, and are not considered geologically significant. The remaining 46 analyses can be divided into two groups, based on their $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ ratios.

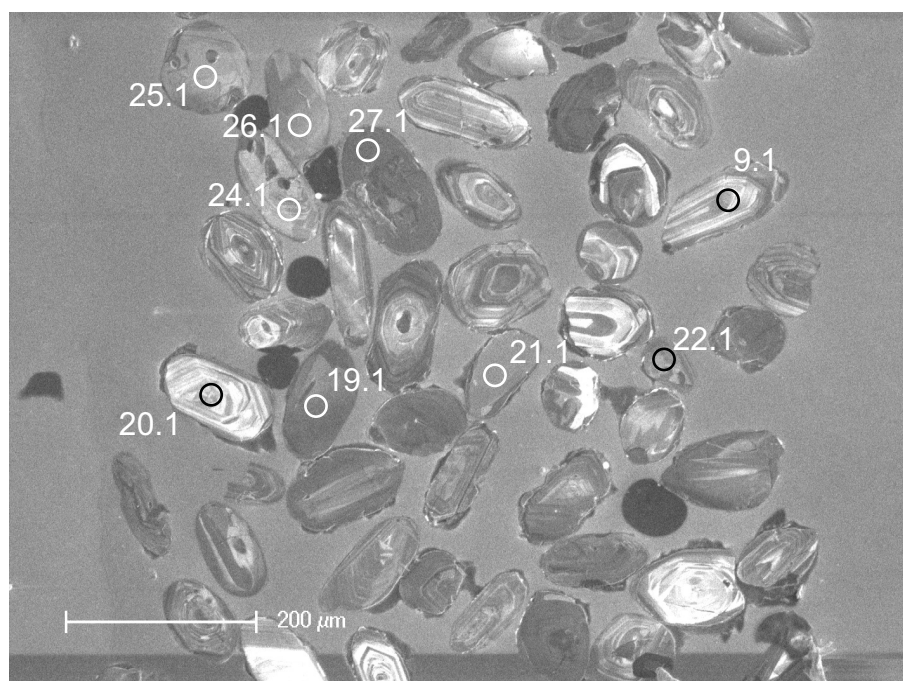


Figure 1. Cathodoluminescence image of representative zircons from sample 183275: psammitic schist, Mount Dalgety. Numbered circles indicate approximate locations of analysis sites.

Group Y comprises four analyses of four zircons (Table 1) which yield a weighted mean $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ date of 2306 ± 12 Ma (MSWD = 1.4).

Group S comprises 42 analyses of 42 zircons (Table 1) which yield $^{207}\text{Pb}^*/^{206}\text{Pb}^*$ dates of 3007–2341 Ma.

It is possible that all of the analyses in Groups Y and S represent unmodified detrital zircons, in which case, the weighted mean date of 2306 ± 12 Ma for the four youngest analyses in Group Y represents the maximum age for the deposition of the sandstone protolith of this metasedimentary rock.

The 46 analyses in combined Groups Y and S indicate dates that define significant age components at c. 2671, 2520, 2451, and 2386 Ma (Fig. 3, defined by contributions from 9, 5, 5, and 4 analyses, respectively), and several minor components spanning the range 3007–2341 Ma. These 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.

it means for mineral exploration: Geological Survey of Western Australia, Record 2009/2, p. 23–25.

Occhipinti, SA and Sheppard, S 2000, Geology of the Glenburgh 1:100 000 sheet: Geological Survey of Western Australia, 1:100 000 Geological Series Explanatory Notes, 37p.

Occhipinti, SA, Sheppard, S, Myers, JS, Tyler, IM and Nelson, DR 2001, Archaean and Palaeoproterozoic geology of the Narryer Terrane (Yilgarn Craton) and the southern Gascoyne Complex (Capricorn Orogen), Western Australia — a field guide: Geological Survey of Western Australia, Record 2001/8, 70p.

Recommended reference for this publication

Kirkland, CL, Wingate, MTD, Bodorkos, S, Sheppard, S and Johnson, SP 2009, 183275: psammitic schist, Mount Dalgety; Geochronology Record 836: Geological Survey of Western Australia, 4p.

Data obtained: 18 April 2007
Data released: 30 September 2009

References

- Kirkland, CL, Wingate, MTD, Bodorkos, S and Sheppard, S 2009, 184161: quartzofeldspathic migmatite, Mount Dalgety; Geochronology Record 835: Geological Survey of Western Australia, 4p.
- Johnson, SP, Sheppard, S, Rasmussen, B, Muhling, JR, Fletcher, IR, Wingate, MTD, Kirkland, CL and Pirajno, F 2009, Meso- to Neoproterozoic reworking in the Gascoyne Complex and what

| Group | ID | Spot no. | Spot | Grain. spot | ^{238}U (ppm) | ^{232}Th (ppm) | $\frac{^{232}\text{Th}}{^{238}\text{U}}$ | f_{204} (%) | $\frac{^{238}\text{U}}{^{207}\text{Pb}}$ | | | $\frac{^{238}\text{U}}{^{207}\text{Pb}} \pm 1\sigma$ | | | $\frac{^{238}\text{U}}{^{207}\text{Pb}} \pm 1\sigma$ | | | $\frac{^{238}\text{U}}{^{207}\text{Pb}} \pm 1\sigma$ | | | Disc. (%) |
|-------|----|----------|------|-------------|------------------------|-------------------------|--|---------------|--|---------------|---------------|--|---------------|---------------|--|---------------|---------------|--|------|------|-----------|
| | | | | | | | | | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | $\pm 1\sigma$ | | | |
| Y | Y | 23 | 23.1 | 271 | 262 | 1.00 | -0.015 | 2.303 | 0.029 | 0.14586 | 0.00051 | 2.302 | 0.029 | 0.14599 | 0.00062 | 2325 | 24 | 2300 | 7 | -1.1 | |
| Y | Y | 50 | 50.1 | 398 | 295 | 0.76 | 0.058 | 2.287 | 0.029 | 0.14654 | 0.00042 | 2.289 | 0.029 | 0.14603 | 0.00046 | 2337 | 25 | 2300 | 5 | -1.6 | |
| Y | Y | 36 | 36.1 | 274 | 228 | 0.80 | 0.037 | 2.441 | 0.030 | 0.14742 | 0.00054 | 2.442 | 0.030 | 0.14709 | 0.00061 | 2213 | 23 | 2312 | 7 | 4.3 | |
| Y | Y | 31 | 31.1 | 283 | 165 | 0.60 | 0.055 | 2.295 | 0.028 | 0.14772 | 0.00053 | 2.296 | 0.029 | 0.14723 | 0.00056 | 2331 | 24 | 2314 | 7 | -0.7 | |
| S | S | 9 | 9.1 | 124 | 66 | 0.55 | -0.015 | 2.303 | 0.031 | 0.14943 | 0.00077 | 2.303 | 0.031 | 0.14957 | 0.00095 | 2325 | 26 | 2341 | 11 | 0.7 | |
| S | S | 34 | 34.1 | 263 | 248 | 0.98 | 0.088 | 2.283 | 0.029 | 0.15042 | 0.00054 | 2.285 | 0.029 | 0.14963 | 0.00060 | 2340 | 25 | 2342 | 7 | 0.1 | |
| S | S | 24 | 24.1 | 149 | 67 | 0.46 | 0.025 | 2.206 | 0.029 | 0.15078 | 0.00070 | 2.206 | 0.029 | 0.15056 | 0.00083 | 2410 | 26 | 2352 | 9 | -2.4 | |
| S | S | 33 | 33.1 | 301 | 160 | 0.55 | 0.016 | 2.294 | 0.029 | 0.15118 | 0.00053 | 2.294 | 0.029 | 0.15104 | 0.00055 | 2332 | 24 | 2358 | 6 | 1.1 | |
| S | S | 14 | 14.1 | 221 | 99 | 0.46 | 0.113 | 2.245 | 0.028 | 0.15394 | 0.00059 | 2.248 | 0.029 | 0.15293 | 0.00094 | 2373 | 25 | 2379 | 10 | 0.3 | |
| S | S | 25 | 25.1 | 144 | 65 | 0.46 | -0.048 | 2.188 | 0.031 | 0.15297 | 0.00100 | 2.187 | 0.031 | 0.15339 | 0.00124 | 2427 | 28 | 2384 | 14 | -1.8 | |
| S | S | 22 | 22.1 | 211 | 109 | 0.53 | 0.039 | 2.201 | 0.028 | 0.15418 | 0.00068 | 2.202 | 0.028 | 0.15383 | 0.00080 | 2414 | 25 | 2389 | 9 | -1.0 | |
| S | S | 17 | 17.1 | 67 | 60 | 0.93 | 0.267 | 2.112 | 0.031 | 0.15669 | 0.00116 | 2.118 | 0.031 | 0.15431 | 0.00142 | 2493 | 30 | 2394 | 16 | -4.1 | |
| S | S | 47 | 47.1 | 78 | 66 | 0.86 | 0.291 | 2.285 | 0.032 | 0.15909 | 0.00097 | 2.292 | 0.032 | 0.15649 | 0.00118 | 2334 | 27 | 2418 | 13 | 3.5 | |
| S | S | 43 | 43.1 | 206 | 106 | 0.53 | 0.055 | 2.146 | 0.027 | 0.15747 | 0.00063 | 2.147 | 0.027 | 0.15698 | 0.00067 | 2465 | 26 | 2423 | 7 | -1.7 | |
| S | S | 27 | 27.1 | 702 | 81 | 0.12 | 0.013 | 2.133 | 0.026 | 0.15939 | 0.00046 | 2.133 | 0.026 | 0.15928 | 0.00049 | 2478 | 25 | 2448 | 5 | -1.2 | |
| S | S | 18 | 18.1 | 315 | 125 | 0.41 | 0.086 | 2.088 | 0.026 | 0.16049 | 0.00051 | 2.090 | 0.026 | 0.15972 | 0.00057 | 2521 | 26 | 2453 | 6 | -2.8 | |
| S | S | 7 | 7.1 | 201 | 102 | 0.52 | 0.016 | 2.181 | 0.028 | 0.16017 | 0.00062 | 2.181 | 0.028 | 0.16003 | 0.00063 | 2433 | 26 | 2456 | 7 | 0.9 | |
| S | S | 3 | 3.1 | 114 | 39 | 0.35 | 0.191 | 2.245 | 0.030 | 0.16202 | 0.00085 | 2.249 | 0.030 | 0.16032 | 0.00120 | 2371 | 27 | 2459 | 13 | 3.6 | |
| S | S | 10 | 10.1 | 190 | 116 | 0.63 | 0.082 | 2.174 | 0.028 | 0.16188 | 0.00127 | 2.176 | 0.028 | 0.16115 | 0.00128 | 2468 | 26 | 2468 | 13</ | | |

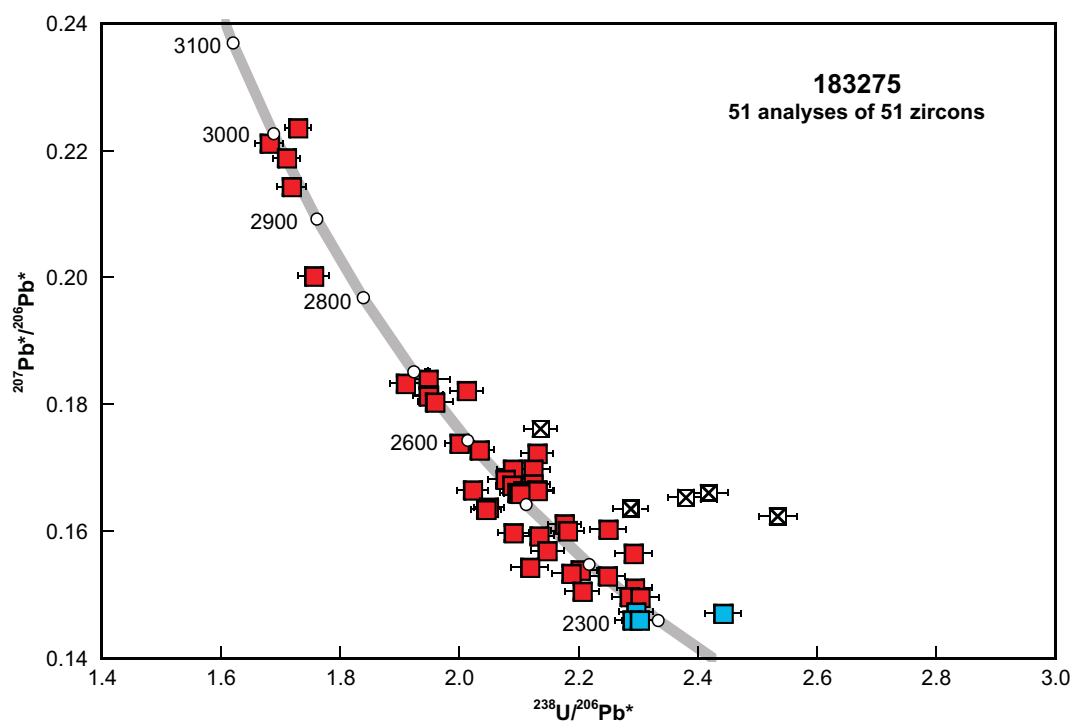


Figure 2. U-Pb analytical data for zircons from sample 183275: psammitic schist, Mount Dalgety. Blue squares indicate Group Y (youngest detrital zircons); red squares indicate Group S (older detrital zircons); crossed squares indicate Group D (discordance >5%).

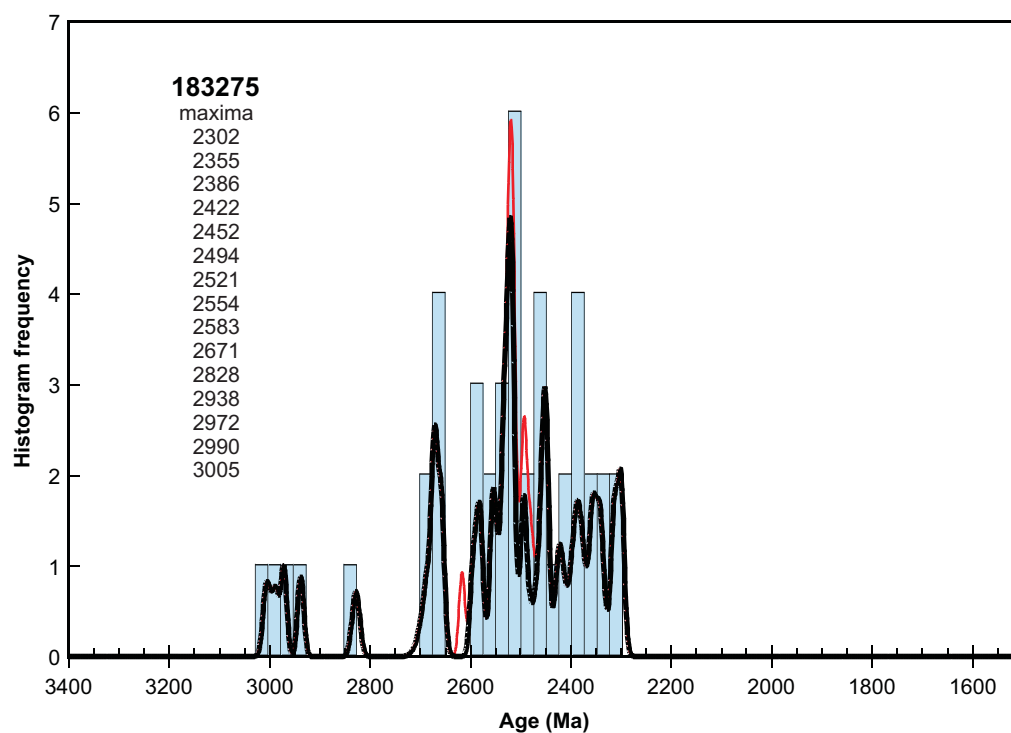


Figure 3. Probability density diagram and histogram for sample 183275: psammitic schist, Mount Dalgety. Heavy curve, maxima values, and frequency histogram (bin width 25 Ma) includes only concordant data (46 analyses of 46 zircons). Light curve includes all data (51 analyses of 51 zircons).