

## 206916: metadolerite sill, Swamp Well

### (Waldburg Dolerite, Edmund Basin, Capricorn Orogen)

#### Location and sampling

MOUNT PHILLIPS (SG 50-2), MOUNT AUGUSTUS (2249)  
MGA Zone 50, 484821E 7296261N

Sampled on 2 September 2012

This sample was collected from a prominent outcrop (Fig. 1) about 4.6 km southeast of Crossroad Well, 5.6 km east of Lassie Well, and 2.1 km north-northeast of Swamp Well.

#### Tectonic unit/relations

The unit sampled is a dolerite sill assigned to the Waldburg Dolerite, which intrudes sedimentary rocks of depositional packages 1, 2, and 3 of the Edmund Group (Martin and Thorne, 2004). The dolerite sill at this locality is intruded into siltstone and fine-grained sandstone of the Kiangi Creek Formation. A dolerite sill intruded into Irregularly Formation, about 61 km to the southeast, yielded a crystallization age of  $1500 \pm 4$  Ma (GSWA 143445; Wingate et al., 2012). A dolerite sill intruded into the Yilgatherra Formation, about 156 km to the northwest, yielded a crystallization age of  $1513 \pm 5$  Ma (GSWA 207259; Wingate et al., 2013). Zircons from a late-magmatic granophyric vein filling cooling fractures in a dolerite sill intruded into Kiangi Creek Formation, about 31 km to the northwest, yielded an identical crystallization age of  $1513 \pm 5$  Ma (GSWA 206991; Wingate et al., 2015). These ages are considered to date emplacement of the Waldburg Dolerite, and demonstrate that the lower Edmund Group is intruded by dolerite sills significantly older than the c. 1465 Ma Narimbunna Dolerite (Wingate, 2002).

#### Petrographic description

The sample is a metadolerite, consisting of about 40–50% plagioclase, 40–50% amphibole, 5–10% chlorite, 5% quartz-feldspar granophyre, and minor titanite, epidote, and iron–titanium oxide minerals. The rock displays relict gabbroic to ophitic textures. Plagioclase is subhedral, up to 5 mm long, and strongly altered to saussurite. Amphibole is present as subhedral pseudomorphs, up to 5 mm long, after pyroxene. Iron–titanium oxide minerals are rimmed by leucoxene or titanite.

#### Zircon morphology

Zircons isolated from this sample are colourless and mainly euhedral. The crystals are up to 300  $\mu\text{m}$  long, and elongate, with aspect ratios up to 8:1. In cathodoluminescence (CL) images, concentric zoning is ubiquitous, although the zoning is broad and indistinct in some crystals. A CL image of representative zircons is shown in Figure 2.

#### Analytical details

This sample was analysed on 11 September 2014, using SHRIMP-A. Seven analyses of the BR266 standard were obtained during the session, and indicated an external spot-to-spot (reproducibility) uncertainty of 0.86% ( $1\sigma$ ) and a  $^{238}\text{U}/^{206}\text{Pb}^*$  calibration uncertainty of 0.40% ( $1\sigma$ ). 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

Twenty analyses were obtained from 20 zircons. Results are listed in Table 1, and shown in a concordia diagram (Fig. 3).

#### Interpretation

The analyses are concordant to moderately discordant (Fig. 3). The analyses yield  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  dates that correlate with their common-Pb contents ( $f_{204}$ ), indicating that corrections using  $^{204}\text{Pb}$  may be inaccurate for some or all of these analyses. However, there is no significant difference between the weighted means of the (uncorrected)  $^{207}\text{Pb}/^{206}\text{Pb}$  and the (204-corrected)  $^{207}\text{Pb}^*/^{206}\text{Pb}^*$  ratios, and the former are much less dispersed. The age of the sample is therefore based on the weighted mean of the uncorrected  $^{207}\text{Pb}/^{206}\text{Pb}$  data. The analyses define a single coherent group, based on their  $^{207}\text{Pb}/^{206}\text{Pb}$  ratios.

Group I comprises 20 analyses (Table 1), which yield a weighted mean  $^{207}\text{Pb}/^{206}\text{Pb}$  date of  $1517 \pm 8$  Ma (MSWD = 0.89).

The date of  $1517 \pm 8$  Ma for the 20 analyses in Group I is interpreted as the magmatic crystallization age of the dolerite sill.



Figure 1. Outcrop image for sample 206916: metadolerite sill, Swamp Well.

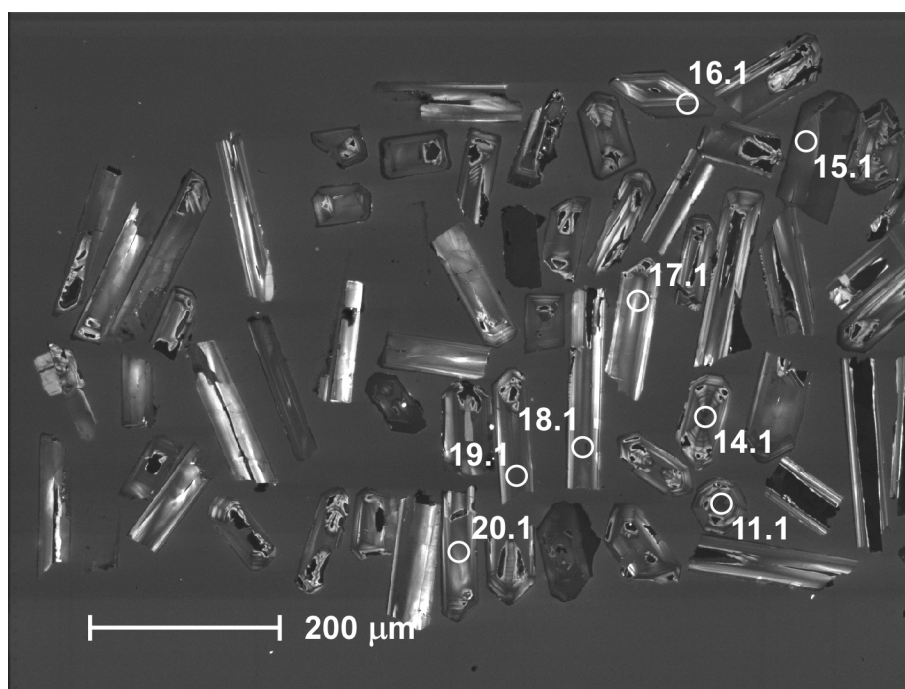
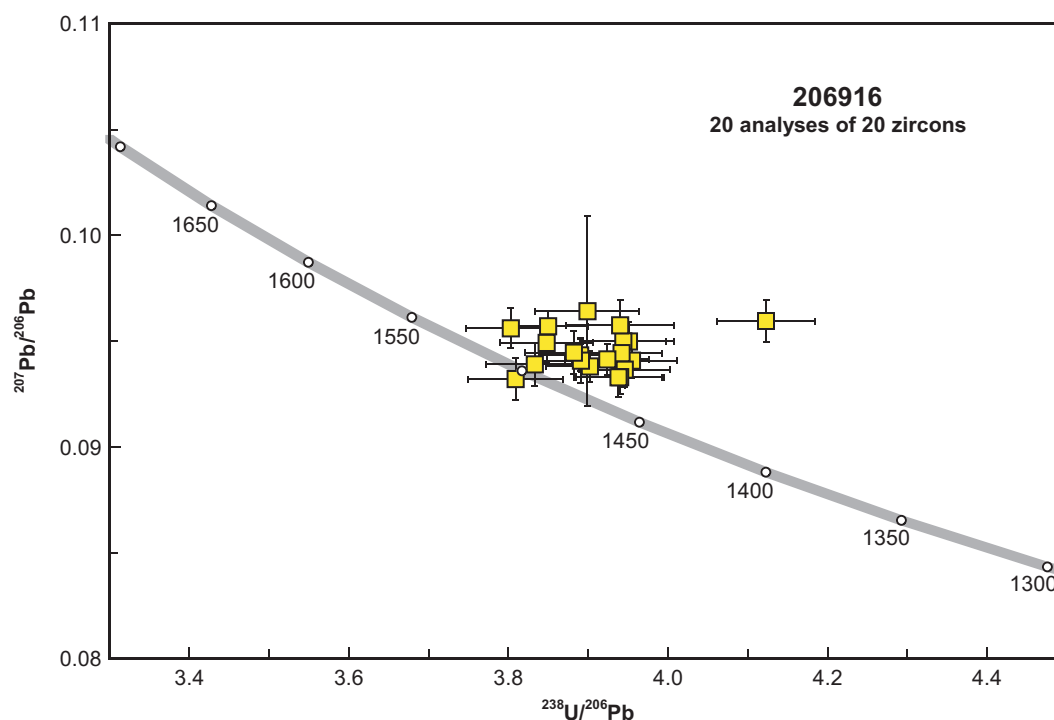


Figure 2. Cathodoluminescence image of representative zircons from sample 206916: metadolerite sill, Swamp Well. Numbered circles indicate the approximate positions of analysis sites.

Table 1. Ion microprobe analytical results for zircons from sample 206916: metadolerite sill, Swamp Well

| Group ID | Spot no. | Grain. spot | $^{238}\text{U}$ (ppm) | $^{232}\text{Th}$ (ppm) | $\frac{^{232}\text{Th}}{^{238}\text{U}}$ | $f_{204}$ (%) | $^{238}\text{U}/^{206}\text{Pb} \pm 1\sigma$ | $^{207}\text{Pb}/^{206}\text{Pb} \pm 1\sigma$ | $^{238}\text{U}/^{208}\text{Pb}^* \pm 1\sigma$ | $^{207}\text{Pb}^*/^{206}\text{Pb}^* \pm 1\sigma$ | $^{238}\text{U}/^{206}\text{Pb}^* \text{ date (Ma)} \pm 1\sigma$ | $^{207}\text{Pb}^*/^{206}\text{Pb}^* \text{ date (Ma)} \pm 1\sigma$ | Disc. (%) |         |      |    |      |    |      |
|----------|----------|-------------|------------------------|-------------------------|--|---------------|--|---|--|---|--|---|-----------|---------|------|----|------|----|------|
| I        | 4        | 4.1         | 113                    | 124                     | 1.13                                     | 0.400         | 3.848  | 0.058   | 0.09491  | 0.00097   | 3.864  | 0.059   | 0.09148   | 0.00142 | 1484 | 20 | 1457 | 30 | -1.9 |
| I        | 5        | 5.1         | 151                    | 174                     | 1.19                                     | 0.105         | 3.940  | 0.055   | 0.09330  | 0.00082   | 3.944  | 0.056   | 0.09240   | 0.00093 | 1457 | 19 | 1476 | 19 | 1.3  |
| I        | 13       | 13.1        | 179                    | 309                     | 1.78                                     | 0.130         | 3.924  | 0.053   | 0.09413  | 0.00075   | 3.929  | 0.053   | 0.09301   | 0.00088 | 1462 | 18 | 1488 | 18 | 1.8  |
| I        | 2        | 2.1         | 277                    | 561                     | 2.09                                     | 0.040         | 3.902  | 0.055   | 0.09380  | 0.00072   | 3.903  | 0.055   | 0.09346   | 0.00076 | 1470 | 19 | 1497 | 15 | 1.8  |
| I        | 6        | 6.1         | 187                    | 270                     | 1.49                                     | 0.085         | 3.890  | 0.052   | 0.09433  | 0.00074   | 3.894  | 0.052   | 0.09359   | 0.00083 | 1474 | 18 | 1500 | 17 | 1.8  |
| I        | 3        | 3.1         | 213                    | 298                     | 1.45                                     | 0.051         | 3.955  | 0.056   | 0.09408  | 0.00082   | 3.957  | 0.056   | 0.09364   | 0.00088 | 1452 | 19 | 1501 | 18 | 3.2  |
| I        | 1        | 1.1         | 113                    | 126                     | 1.16                                     | 0.314         | 3.899  | 0.065   | 0.09641  | 0.00449   | 3.911  | 0.065   | 0.09371   | 0.00463 | 1468 | 22 | 1502 | 93 | 2.3  |
| I        | 14       | 14.1        | 236                    | 438                     | 1.91                                     | 0.068         | 3.942  | 0.050   | 0.09443  | 0.00067   | 3.945  | 0.050   | 0.09385   | 0.00073 | 1457 | 17 | 1505 | 15 | 3.2  |
| I        | 10       | 10.1        | 107                    | 119                     | 1.15                                     | 0.000         | 3.833  | 0.061   | 0.09390  | 0.00102   | 3.833  | 0.061   | 0.09390   | 0.00102 | 1495 | 21 | 1506 | 21 | 0.8  |
| I        | 15       | 15.1        | 165                    | 157                     | 0.98                                     | -0.123        | 3.938  | 0.055   | 0.09329  | 0.00095   | 3.933  | 0.055   | 0.09434   | 0.00106 | 1460 | 18 | 1515 | 21 | 3.6  |
| I        | 12       | 12.1        | 139                    | 168                     | 1.25                                     | -0.082        | 3.946  | 0.057   | 0.09365  | 0.00085   | 3.942  | 0.057   | 0.09435   | 0.00094 | 1457 | 19 | 1515 | 19 | 3.8  |
| I        | 19       | 19.1        | 240                    | 376                     | 1.62                                     | 0.133         | 3.850  | 0.050   | 0.09570  | 0.00071   | 3.855  | 0.050   | 0.09455   | 0.00083 | 1487 | 17 | 1519 | 17 | 2.1  |
| I        | 20       | 20.1        | 134                    | 150                     | 1.16                                     | 0.095         | 3.803  | 0.056   | 0.09560  | 0.00094   | 3.807  | 0.056   | 0.09478   | 0.00106 | 1504 | 20 | 1524 | 21 | 1.3  |
| I        | 16       | 16.1        | 148                    | 162                     | 1.13                                     | 0.000         | 3.951  | 0.057   | 0.09498  | 0.00092   | 3.951  | 0.057   | 0.09498   | 0.00092 | 1454 | 19 | 1528 | 18 | 4.8  |
| I        | 7        | 7.1         | 103                    | 122                     | 1.22                                     | -0.311        | 3.809  | 0.060   | 0.09321  | 0.00100   | 3.797  | 0.060   | 0.09589   | 0.00137 | 1507 | 21 | 1546 | 27 | 2.5  |
| I        | 11       | 11.1        | 143                    | 178                     | 1.28                                     | -0.285        | 3.891  | 0.057   | 0.09408  | 0.00106   | 3.880  | 0.057   | 0.09654   | 0.00133 | 1478 | 20 | 1558 | 26 | 5.2  |
| I        | 9        | 9.1         | 118                    | 146                     | 1.28                                     | -0.069        | 4.123  | 0.062   | 0.09595  | 0.00099   | 4.120  | 0.062   | 0.09655   | 0.00108 | 1401 | 19 | 1559 | 21 | 10.1 |
| I        | 17       | 17.1        | 75                     | 82                      | 1.13                                     | -0.104        | 3.940  | 0.068   | 0.09575  | 0.00118   | 3.936  | 0.068   | 0.09665   | 0.00134 | 1459 | 23 | 1560 | 26 | 6.5  |
| I        | 18       | 18.1        | 190                    | 211                     | 1.14                                     | -0.206        | 3.944  | 0.053   | 0.09500  | 0.00078   | 3.936  | 0.053   | 0.09677   | 0.00097 | 1459 | 18 | 1563 | 19 | 6.6  |
| I        | 8        | 8.1         | 111                    | 117                     | 1.09                                     | -0.442        | 3.882  | 0.061   | 0.09446  | 0.00103   | 3.865  | 0.061   | 0.09828   | 0.00153 | 1483 | 21 | 1592 | 29 | 6.8  |



**Figure 3.** U–Pb analytical data, not corrected from common Pb, for sample 206916: metadolerite sill, Swamp Well. Yellow squares indicate Group I (magmatic zircons).

## References

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## Recommended reference for this publication

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