

Australian & New Zealand Gold Operations

September Quarter 2019 - Final Report

Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,335/oz, which is up 4.7% (A\$60/oz) on the previous quarter average AISC of A\$1,275/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-414/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$306/oz, then by Kirkland Lakes' Fosterville mine (A\$421/oz). The average gold spot price for the quarter was A\$2,146/oz (US\$1,472/oz). It should be noted that Ernest Henry and Cadia Valley benefit from significant base metal by-products. Aurum Analytics' estimate of these operations AISC on a co-product basis (Co-AISC) is as follows; Ernest Henry Co-AISC of A\$801/oz and Cadia Valley Co-AISC of A\$896/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$421/oz, then Saracen's Thunderbox mine (A\$682/oz) and Evolution's Cowal mine (A\$885/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 171,730 oz for the quarter, followed by Newmont's Boddington (167,000 oz) then Kirkland Lake's Fosterville operation (158,327 oz). Of the mines where gold is a by-product, BHP's Olympic Dam produced the most gold 43,205 oz followed by OZ Minerals' Prominent Hill and Evolution's part of Ernest Henry with 23,378 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.59 g/t (Open Pit (OP) - 1.54 g/t, Underground (UG) - 5.45 g/t, Open Pit & Underground (OP/UG) - 2.48 g/t) which was up on the previous quarter, 3.58 g/t (0.3%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 41.80 g/t, followed by St Barbara's Gwalia mine 7.20 g/t. The lowest grade mine was Evolution's Ernest Henry processing an average head grade of 0.55 g/t. The high-grade operations that do not report an AISC were Mandalay Resources' Costerfield mine with 5.11 g/t and LionGold Corp's Ballarat mine with 3.80 g/t.

Top 10 Gold Producing Operations

| Rank | Operation | Company | Mine Type | Au Produced (oz) |
|------|--------------|--|-----------|------------------|
| 1 | Cadia Valley | Newcrest Mining Limited | UG | 171,730 |
| 2 | Boddington | Newmont Goldcorp Corporation | OP | 167,000 |
| 3 | Fosterville | Kirkland Lake Gold Limited | UG | 158,327 |
| 4 | Tropicana | JV AngloGold Ashanti Limited/Independence Group NL | OP | 123,320 |
| 5 | Kalgoorlie | JV Newmont Goldcorp Corporation/Barrick Gold Corporation | OP/UG | 116,000 |
| 6 | Tanami | Newmont Goldcorp Corporation | UG | 114,000 |
| 7 | Jundee | Northern Star Resources Limited | OP/UG | 84,846 |
| 8 | Telfer | Newcrest Mining Limited | OP/UG | 79,309 |
| 9 | Cowal | Evolution Mining Limited | OP | 75,807 |
| 10 | St Ives | Gold Fields Limited | OP/UG | 75,200 |

Supported By



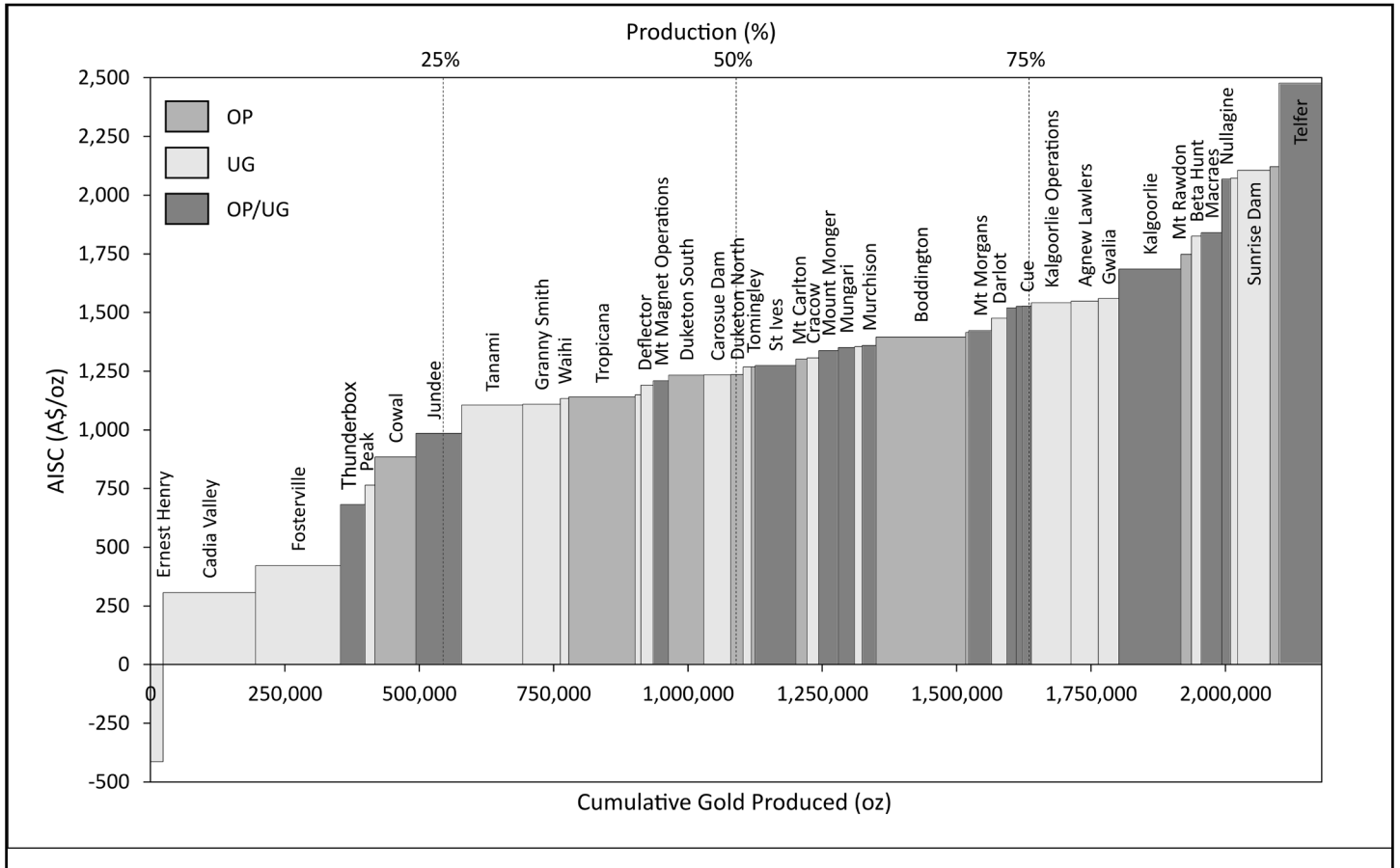
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Gold Operations That Report AISC

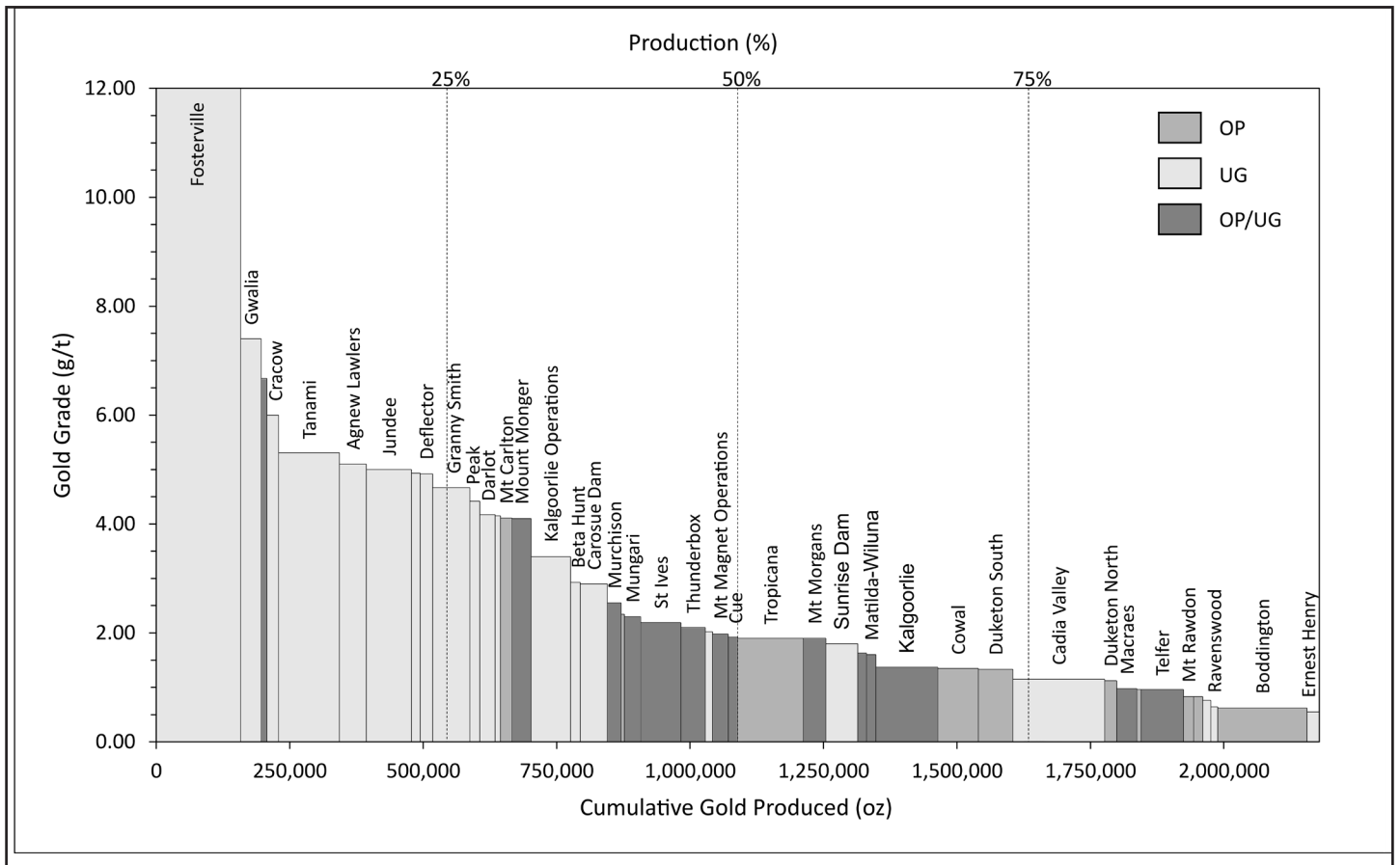
| AISC Rank | Operation | Company | Mine Type | AISC (A\$/oz) | Grade (g/t) | Grade Rank | Au Produced (oz) |
|-----------|-----------------------|---|-----------|---------------|-------------|------------|------------------|
| 1 | Ernest Henry | Evolution Mining Limited | UG | -414 | 0.55 | 45 | 23,378 |
| 2 | Cadia Valley | Newcrest Mining Limited | UG | 306 | 1.15 | 35 | 171,730 |
| 3 | Fosterville | Kirkland Lake Gold Limited | UG | 421 | 41.80 | 1 | 158,327 |
| 4 | Thunderbox | Saracen Mineral Holdings Limited | OP/UG | 682 | 2.10 | 23 | 45,735 |
| 5 | Peak | Aurelia Metals Limited | UG | 764 | 4.42 | 11 | 18,772 |
| 6 | Cowal | Evolution Mining Limited | OP | 885 | 1.35 | 33 | 75,807 |
| 7 | Jundee | Northern Star Resources Limited | OP/UG | 985 | 5.00 | 7 | 84,846 |
| 8 | Tanami | Newmont Goldcorp Corporation | UG | 1,105 | 5.31 | 5 | 114,000 |
| 9 | Granny Smith | Gold Fields Limited | UG | 1,109 | 4.67 | 10 | 69,700 |
| 10 | Waihi | OceanaGold Corporation | UG | 1,134 | 4.93 | 8 | 16,021 |
| 11 | Tropicana | JV AngloGold/Independence | OP | 1,140 | 1.90 | 27= | 123,320 |
| 12 | Hera | Aurelia Metals Limited | UG | 1,149 | 4.15 | 13 | 10,535 |
| 13 | Deflector | Silver Lake Resources Limited | UG | 1,190 | 4.92 | 9 | 23,230 |
| 14 | Mt Magnet Operations | Ramelius Resources Limited | OP/UG | 1,209 | 1.98 | 25 | 29,013 |
| 15 | Duketon South | Regis Resources Limited | OP/UG | 1,233 | 1.33 | 34 | 64,890 |
| 16 | Carosue Dam | Saracen Mineral Holdings Limited | UG | 1,234 | 2.90 | 18 | 50,590 |
| 17 | Duketon North | Regis Resources Limited | OP | 1,236 | 1.12 | 36 | 22,743 |
| 18= | Edna May | Ramelius Resources Limited | UG | 1,268 | 0.76 | 42 | 15,151 |
| 18= | Tomingley | Alkane Resources Limited | OP | 1,268 | 0.96 | 38= | 7,497 |
| 20 | St Ives | Gold Fields Limited | OP/UG | 1,275 | 2.19 | 22 | 75,200 |
| 21 | Mt Carlton | Evolution Mining Limited | OP | 1,301 | 4.11 | 14 | 20,877 |
| 22 | Cracow | Evolution Mining Limited | UG | 1,307 | 6.00 | 4 | 21,917 |
| 23 | Mount Monger | Silver Lake Resources Limited | OP/UG | 1,338 | 4.10 | 15 | 36,058 |
| 24 | Mungari | Evolution Mining Limited | OP/UG | 1,351 | 2.30 | 21 | 30,738 |
| 25 | Fortnum | Westgold Resources Limited | UG | 1,354 | 2.02 | 24 | 13,764 |
| 26 | Murchison | Westgold Resources Limited | OP/UG | 1,360 | 2.55 | 19 | 25,958 |
| 27 | Boddington | Newmont Goldcorp Corporation | OP | 1,396 | 0.62 | 44 | 167,000 |
| 28 | Higginsville | Royal Nickel Corporation (RNC Minerals) | OP | 1,415 | 2.34 | 20 | 5,756 |
| 29 | Mt Morgans | Dacian Gold Limited | OP/UG | 1,423 | 1.90 | 27= | 42,002 |
| 30 | Darlot | Red 5 Limited | UG | 1,476 | 4.17 | 12 | 28,649 |
| 31 | Matilda-Wiluna | Blackham Resources Limited | OP/UG | 1,519 | 1.60 | 31 | 17,565 |
| 32 | Nicolsons | Pantoro Limited | OP/UG | 1,526 | 6.67 | 3 | 10,631 |
| 33 | Cue | Westgold Resources Limited | OP/UG | 1,528 | 1.92 | 26 | 17,750 |
| 34 | Kalgoorlie Operations | Northern Star Resources Limited | UG | 1,542 | 3.40 | 16 | 73,861 |
| 35 | Agnew Lawlers | Gold Fields Limited | UG | 1,548 | 5.10 | 6 | 50,400 |
| 36 | Gwalia | St Barbara Limited | UG | 1,559 | 7.40 | 2 | 38,153 |
| 37 | Kalgoorlie | JV Newmont/Barrick | OP/UG | 1,685 | 1.37 | 32 | 116,000 |
| 38 | Mt Rawdon | Evolution Mining Limited | OP | 1,748 | 0.83 | 40= | 19,250 |
| 39 | Beta Hunt | Royal Nickel Corporation (RNC Minerals) | UG | 1,825 | 2.93 | 17 | 18,460 |
| 40 | Macraes | OceanaGold Corporation | OP/UG | 1,840 | 0.98 | 37 | 37,918 |
| 41 | Nullagine | Millennium Minerals Limited | OP/UG | 2,068 | 1.63 | 30 | 16,286 |
| 42 | Ravenswood | Resolute Mining Limited | UG | 2,072 | 0.64 | 43 | 13,206 |
| 43 | Sunrise Dam | AngloGold Ashanti Limited | UG | 2,105 | 1.80 | 29 | 60,000 |
| 44 | Dalgaranga | Gascoyne Resources Limited | OP | 2,121 | 0.83 | 40= | 17,016 |
| 45 | Telfer | Newcrest Mining Limited | OP/UG | 2,477 | 0.96 | 38= | 79,309 |

Notes: Operations are shown on a 100% basis, except Northern Star's Kalgoorlie Operations. Ballarat and Plutonic usually reports AISC but had not reported at the time this report was compiled.

Gold Production Cost Curve Ranked By Reported AISC



Gold Production Grade Curve Ranked By Average Mill Feed/Head Grade



Gold Mines That Did Not Report All-in Sustaining Costs

| Rank | Operation | Company | Mine Type | Grade (g/t) | Au Produced (oz) |
|------|---------------|--|-----------|-------------|------------------|
| 1 | Gruyere | JV Gold Fields Limited/Gold Road Resources Limited ¹ | OP | 1.00 | 29,107 |
| 2 | Kundana EKJV | JV Tribune Resources Limited/Rand Mining Limited | UG | NA | 25,016 |
| 3 | Plutonic | Superior Gold Inc ² | OP/UG | 1.46 | 16,627 |
| 4 | Ballarat | LionGold Corp Ltd ² | UG | 3.80 | 7,387 |
| 5 | Widgiemooltha | Mincor Resources NL | OP | 2.24 | 7,055 |
| 6 | Costerfield | Mandalay Resources Limited | UG | 5.11 | 3,103 |
| 7 | Comet Vale | JV Orminex Limited/Sand Queen Gold Mines Pty Ltd ³ | UG | 3.53 | 1,818 |
| 8 | Morning Star | AuStar Gold Limited | UG | NA | 673 |
| 9 | Penny's Find | Orminex Limited | NA | 2.75 | 251 |
| NR | Trouser Legs | JV Hawthorn Resources Limited/Gel Resources Pty Ltd ⁴ | OP | NA | NA |
| NR | Pajingo | Minjar Gold Pty Ltd ⁵ | UG | NA | NA |
| NR | Marvel Loch | Minjar Gold Pty Ltd ⁵ | OP/UG | NA | NA |
| NR | Paddington | Zijin Mining Group Company Limited ⁵ | OP/UG | NA | NA |

1. Gruyere is a joint venture between Gold Fields Limited (50%) and Gold Road Resources Limited (50%)
2. These companies usually report AISC but had not at the time of compiling this report.
3. Comet Vale is a joint venture between Orminex Limited (51%) and Sand Queen Gold Mines Pty Ltd (49%).
4. Trousers Legs is a joint venture between Hawthorn Resources Limited (75%) and Gel Resources Pty Ltd (25%)
5. These companies do not provide detailed quarterly production statistics for these mines.

Mines Where Gold Is A By-Product

| Rank | Operation | Company | Mine Type | Au Produced (oz) |
|------|---------------------------|---|-----------|------------------|
| 1 | Olympic Dam | BHP Group Limited | UG | 43,205 |
| 2 | Prominent Hill | OZ Minerals Limited | UG | 28,844 |
| 3 | Ernest Henry | Evolution Mining Limited | UG | 23,378 |
| 4 | DeGrussa | Sandfire Resources NL | UG | 8,647 |
| 5 | North Parkes ¹ | JV China Molybdenum Co Ltd/Sumitomo Australia Pty Ltd | UG | 6,068 |
| 6 | Rosebery | MMG Limited | UG | 2,171 |
| 7 | Kanmantoo | Hillgrove Resources Limited | NM | 858 |
| NR | Golden Grove | EMR Capital | UG | NA |
| NR | Jaguar | Washington H. Soul Pattinson and Company Limited | UG | NA |

1. North Parkes is a joint venture between China Molybdenum Co Ltd (80%) and Sumitomo Australia Pty Ltd (20%).

Quarter on Quarter Change in AISC and Grade

| Statistic | AISC (A\$/oz) | Change (%) | Grade (g/t) | Change (%) |
|---------------------------------|---------------|------------|-------------|------------|
| Average (Simple) ¹ | 1,335 | 4.7% | 3.59 | 0.3% |
| Average (Weighted) ² | 1,218 | 9.7% | 1.62 | 5.2% |
| Minimum | -414 | 35.7% | 0.55 | -8.3% |
| First Quartile ³ | 1,002 | 4.3% | 1.15 | -5.7% |
| Median ³ | 1,183 | -1.7% | 1.90 | -5.0% |
| Third Quartile ³ | 1,331 | -7.8% | 4.67 | 1.5% |
| Maximum | 2,477 | 4.3% | 41.80 | 4.8% |

1. Simple averages done by number of mining operations.
2. AISC weighted by gold ounces produced, Au grade weighted by ore tonnes milled.
3. First Quartile, Median and Third Quartile values are based on production in the AISC Cost Curve and Grade Curve.

Top 5 Gold Operations - Major Gold Miners

| Gold Production (Attributable) | | | All-in Sustaining Costs | | |
|--------------------------------|------------------------|---------|-------------------------|------------------------|--------|
| Rank | Operation | oz | Rank | Operation | A\$/oz |
| 1 | Cadia Valley | 171,730 | 1 | Cadia Valley | 306 |
| 2 | Boddington | 167,000 | 2 | Tanami | 1,105 |
| 3 | Tropicana ¹ | 123,320 | 3 | Granny Smith | 1,109 |
| 4 | Kalgoorlie | 116,000 | 4 | Tropicana ¹ | 1,140 |
| 5 | Tanami | 114,000 | 5 | St Ives | 1,275 |

1. Tropicana is a joint Venture between AngloGold Ashanti Limited (70%) and Independence Group NL (30%).

Top 5 Gold Operations - Mid-Tier Gold Miners

| Gold Production (Attributable) | | | All-in Sustaining Costs | | |
|--------------------------------|------------------------------------|---------|-------------------------|--------------|--------|
| Rank | Operation | oz | Rank | Operation | A\$/oz |
| 1 | Fosterville | 158,327 | 1 | Ernest Henry | -414 |
| 2 | Jundee | 84,846 | 2 | Fosterville | 421 |
| 3 | Cowal | 75,807 | 3 | Thunderbox | 682 |
| 4 | Kalgoorlie Operations ¹ | 73,861 | 4 | Cowal | 885 |
| 5 | Duketon South | 64,890 | 5 | Jundee | 985 |

1. Kalgoorlie Operations gold produced represents Northern Star Resources Limited's attributable gold production.

Top 5 Gold Operations - Junior Gold Miners

| Gold Production (Attributable) | | | All-in Sustaining Costs | | |
|--------------------------------|---------------------------|--------|-------------------------|----------------------|--------|
| Rank | Operation | oz | Rank | Operation | A\$/oz |
| 1 | Mt Morgans | 42,002 | 1 | Peak | 764 |
| 2 | Mt Magnet Operations | 29,013 | 2 | Hera | 1,149 |
| 3 | Darlot | 28,649 | 3 | Mt Magnet Operations | 1,209 |
| 4 | Peak | 18,772 | 4= | Edna May | 1,268 |
| 5 | Kundana EKJV ¹ | 18,762 | 4= | Tomingley | 1,268 |

1. Kundana EKJV gold produced represents Tribune Resources Limited's and Rand Mining Limited's attributable gold production.

Top 5 Pure Gold Operations (No Base Metal By or Co-Products)

| Gold Production (Total) | | | All-in Sustaining Costs | | |
|-------------------------|-------------------------|---------|-------------------------|-------------|--------|
| Rank | Operation | oz | Rank | Operation | A\$/oz |
| 1 | Fosterville | 158,327 | 1 | Fosterville | 421 |
| 2 | Tropicana ¹ | 123,320 | 2 | Thunderbox | 682 |
| 3 | Kalgoorlie ² | 116,000 | 3 | Cowal | 885 |
| 4 | Tanami | 114,000 | 4 | Jundee | 985 |
| 5 | Jundee | 84,846 | 5 | Tanami | 1,105 |

1. Tropicana is a joint venture between AngloGold Ashanti Limited (70%) and Independence Group NL (30%).

2. Kalgoorlie is a joint venture between Newmont Goldcorp Corporation (50%) and Barrick Gold Corporation (50%).

General Notes

Data was sourced from company quarterly reports. Aurum Analytics created the cost and grade curves. Mine Type reflects the source of the ore mined for the quarter, OP - Open Pit, UG - Underground, OP/UG - Open Pit and Underground and NM - No Mining.

For operations in joint venture such as Kalgoorlie and Tropicana AISC values were apportioned by equity ownership percentages. Kalgoorlie Operations is based on Northern Star Resources Limited's reported AISC only as Tribune Resources Limited and Rand Mining Limited do not report an AISC.

Where AISC values were reported in US\$ and no A\$ equivalent provided, the quarterly average US\$/A\$ exchange rate (0.6860) from the Reserve Bank of Australia was used.

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About Aurum Analytics

Aurum Analytics is an independent business providing information and analysis on the Australian and New Zealand gold industry. The information and analysis given is a by-product of Sam Ulrich's PhD research at The University of Western Australia's Centre for Exploration Targeting titled "Geological drivers and strategic implications of competitive advantage in Australian and New Zealand gold mines, linking geology to mine economics."

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