

# Australian & New Zealand Gold Operations

## September Quarter 2021 - Final Report

### Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,571/oz, which is up 9.6% (A\$138/oz) on the previous quarter average AISC of A\$1,433/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-1,345/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$276/oz, then by Kirkland Lakes' Fosterville mine (A\$459/oz). The average gold spot price for the quarter was A\$2,435/oz (US\$1,790/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\$653/oz and Cadia Valley Co-AISC of A\$1,152/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$458/oz, then Gold Fields' Granny Smith mine (A\$1,186/oz) and Gold Fields' St Ives operation (A\$1,302/oz).

Newmont's Boddington operation took out top spot as Australia's largest gold producer with 162,000 oz for the quarter, followed by Kirkland Lake's Fosterville (134,772 oz) and Newmont's Tanami mine (112,000 oz). Of the mines where gold is a by-product, OZ Minerals's Prominent Hill produced the most gold 41,245 oz followed by BHP's Olympic Dam with 26,277 oz and Evolution's part of Ernest Henry with 23,882 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.08 g/t (Open Pit (OP) - 0.92 g/t, Underground (UG) - 5.43 g/t, Open Pit & Underground (OP/UG) - 2.05 g/t) which was down on the previous quarter, 3.16 g/t (-2.5%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 23.60 g/t, followed by Mandalay Resources' Costerfield mine 13.04 g/t. The lowest grade mine was Evolution's part in the Ernest Henry mine processing an average head grade of 0.54 g/t. The high-grade operations that do not report an AISC were Manuka Resources' Mt Boppy mine with 4.49 g/t and Tribune Resources' and Rand Mining's share of the East Kundana Joint Venture with 4.06 g/t.

### Top 10 Gold Producing Operations

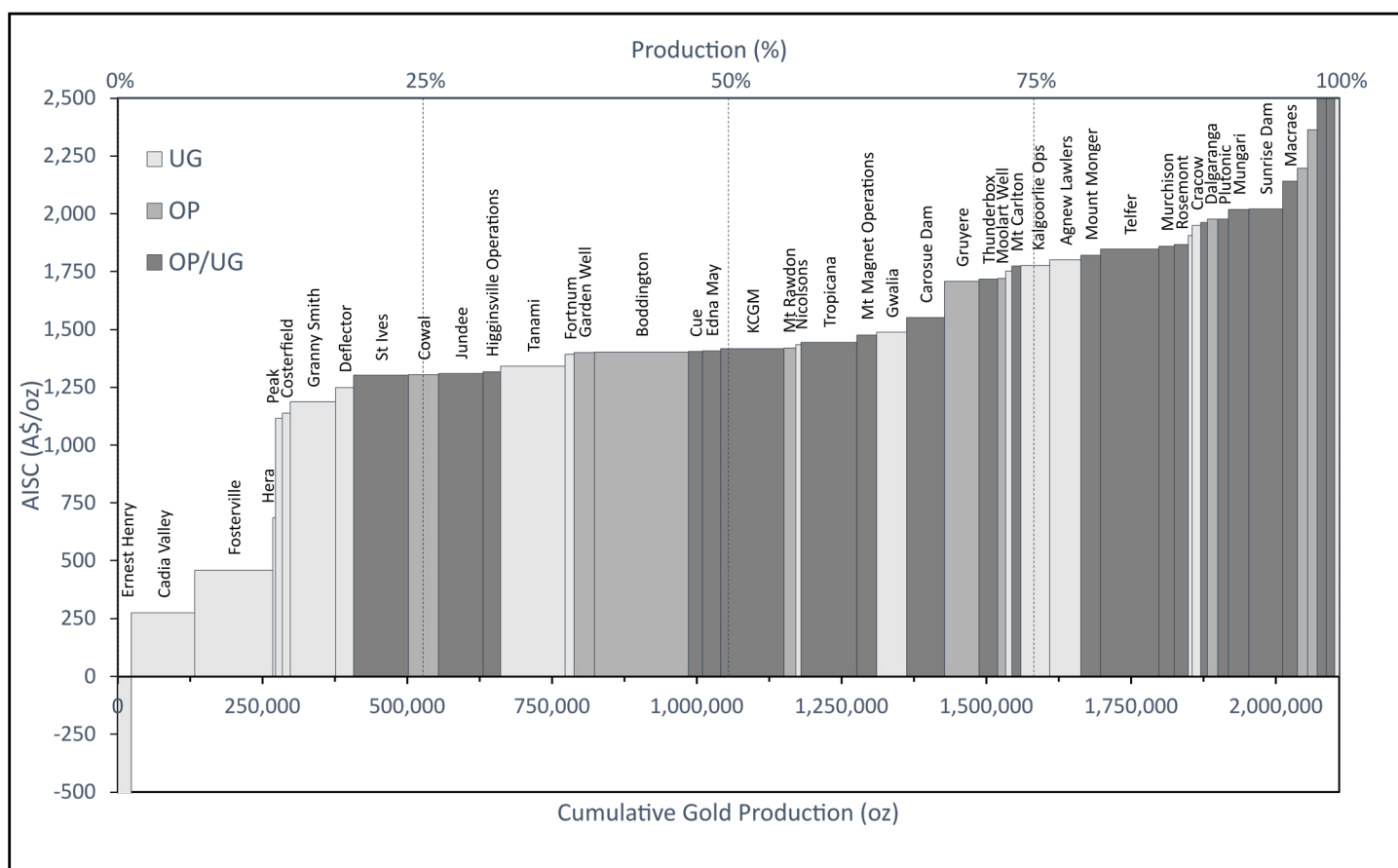
| Rank | Operation    | Company  | Mine Type | Au Produced (oz) |
|------|--------------|--|-----------|------------------|
| 1    | Boddington   | Newmont Corporation                                  | OP        | 162,000          |
| 2    | Fosterville  | Kirkland Lake Gold Limited                           | UG        | 134,772          |
| 3    | Tanami       | Newmont Corporation                                  | UG        | 112,000          |
| 4    | KCGM         | Northern Star Resources Limited                      | OP/UG     | 109,199          |
| 5    | Cadia Valley | Newcrest Mining Limited                              | UG        | 109,005          |
| 6    | Telfer       | Newcrest Mining Limited                              | OP/UG     | 100,993          |
| 7    | Tropicana    | JV AngloGold Ashanti Limited/Regis Resources Limited | OP/UG     | 96,381           |
| 8    | St Ives      | Gold Fields Limited                                  | OP/UG     | 94,000           |
| 9    | Granny Smith | Gold Fields Limited                                  | UG        | 78,900           |
| 10   | Jundee       | Northern Star Resources Limited                      | OP/UG     | 76,428           |

## Gold Operations That Report AISC

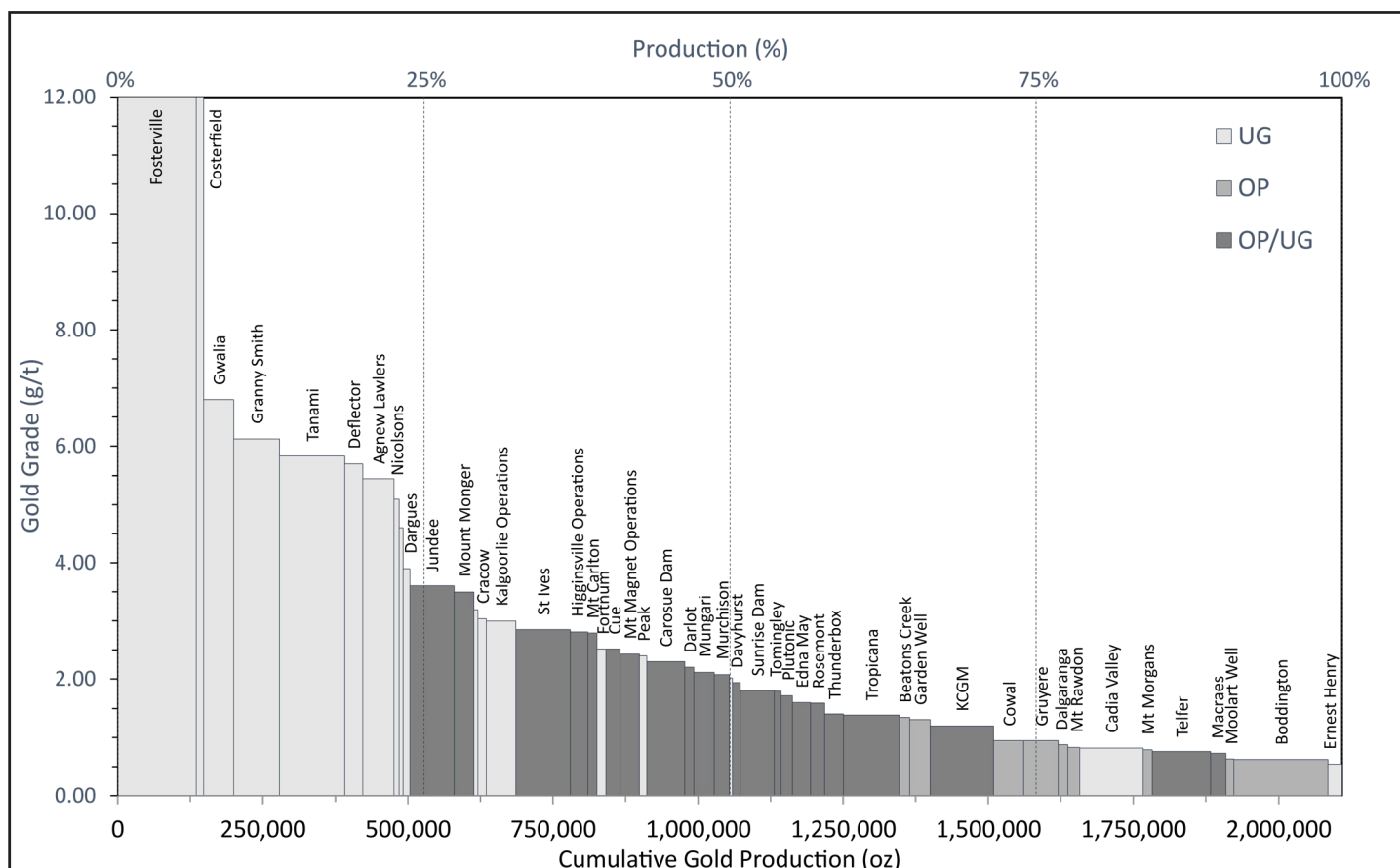
| AISC Rank | Operation               | Company                         | Mine Type | AISC (A\$/oz) | Grade (g/t) | Grade Rank | Au Produced (oz) |
|-----------|-------------------------|---------------------------------|-----------|---------------|-------------|------------|------------------|
| 1         | Ernest Henry            | Evolution Mining Limited        | UG        | -1,345        | 0.54        | 49         | 23,882           |
| 2         | Cadia Valley            | Newcrest Mining Limited         | UG        | 276           | 0.82        | 43         | 109,005          |
| 3         | Fosterville             | Kirkland Lake Gold Limited      | UG        | 459           | 23.60       | 1          | 134,772          |
| 4         | Hera                    | Aurelia Metals Limited          | UG        | 685           | 2.02        | 27         | 4,650            |
| 5         | Peak                    | Aurelia Metals Limited          | UG        | 1,117         | 2.40        | 22         | 11,873           |
| 6         | Costerfield             | Mandalay Resources Limited      | UG        | 1,139         | 13.04       | 2          | 13,315           |
| 7         | Granny Smith            | Gold Fields Limited             | UG        | 1,186         | 6.13        | 4          | 78,900           |
| 8         | Deflector               | Silver Lake Resources Limited   | UG        | 1,249         | 5.70        | 6          | 31,212           |
| 9         | St Ives                 | Gold Fields Limited             | OP/UG     | 1,302         | 2.85        | 16         | 94,000           |
| 10        | Cowal                   | Evolution Mining Limited        | OP        | 1,304         | 0.94        | 39=        | 52,513           |
| 11        | Jundee                  | Northern Star Resources Limited | OP/UG     | 1,310         | 3.60        | 11         | 76,428           |
| 12        | Higginsville Operations | Karora Resources Inc            | OP/UG     | 1,316         | 2.81        | 17         | 30,365           |
| 13        | Tanami                  | Newmont Corporation             | UG        | 1,341         | 5.83        | 5          | 112,000          |
| 14        | Fortnum                 | Westgold Resources Limited      | UG        | 1,393         | 2.52        | 19=        | 15,636           |
| 15        | Garden Well             | Regis Resources Limited         | OP        | 1,400         | 1.30        | 37         | 34,646           |
| 16        | Boddington              | Newmont Corporation             | OP        | 1,403         | 0.62        | 48         | 162,000          |
| 17        | Cue                     | Westgold Resources Limited      | OP/UG     | 1,405         | 2.52        | 19=        | 24,422           |
| 18        | Edna May                | Ramelius Resources Limited      | OP/UG     | 1,407         | 1.60        | 32         | 31,728           |
| 19        | KCGM                    | Northern Star Resources Limited | OP/UG     | 1,418         | 1.20        | 38         | 109,199          |
| 20        | Mt Rawdon               | Evolution Mining Limited        | OP        | 1,420         | 0.83        | 42         | 20,042           |
| 21        | Nicolsons               | Pantoro Limited                 | UG        | 1,435         | 5.09        | 8          | 9,473            |
| 22        | Tropicana               | JV AngloGold/Regis Resources    | OP/UG     | 1,445         | 1.38        | 35         | 96,381           |
| 23        | Mt Magnet Operations    | Ramelius Resources Limited      | OP/UG     | 1,476         | 2.43        | 21         | 33,958           |
| 24        | Gwalia                  | St Barbara Limited              | UG        | 1,488         | 6.80        | 3          | 51,757           |
| 25        | Carosue Dam             | Northern Star Resources Limited | OP/UG     | 1,551         | 2.30        | 23         | 65,472           |
| 26        | Gruyere                 | JV Gold Fields/Gold Road        | OP        | 1,707         | 0.94        | 39=        | 59,371           |
| 27        | Thunderbox              | Northern Star Resources Limited | OP/UG     | 1,718         | 1.40        | 34         | 32,049           |
| 28        | Moolart Well            | Regis Resources Limited         | OP        | 1,720         | 0.63        | 47         | 14,185           |
| 29        | Dargues                 | Aurelia Metals Limited          | UG        | 1,753         | 3.90        | 10         | 10,827           |
| 30        | Mt Carlton              | Evolution Mining Limited        | OP/UG     | 1,773         | 2.79        | 18         | 15,170           |
| 31        | Kalgoorlie Operations   | Northern Star Resources Limited | UG        | 1,776         | 3.00        | 15         | 50,201           |
| 32        | Agnew Lawlers           | Gold Fields Limited             | UG        | 1,800         | 5.44        | 7          | 53,800           |
| 33        | Mount Monger            | Silver Lake Resources Limited   | OP/UG     | 1,821         | 3.50        | 12         | 33,914           |
| 34        | Telfer                  | Newcrest Mining Limited         | OP/UG     | 1,848         | 0.76        | 45         | 100,993          |
| 35        | Murchison               | Westgold Resources Limited      | OP/UG     | 1,860         | 2.08        | 26         | 26,115           |
| 36        | Rosemont                | Regis Resources Limited         | OP/UG     | 1,868         | 1.59        | 33         | 24,243           |
| 37        | Henty                   | Catalyst Metals Limited         | UG        | 1,905         | 4.60        | 9          | 6,775            |
| 38        | Cracow                  | Aeris Resources Limited         | UG        | 1,951         | 3.04        | 14         | 14,691           |
| 39        | Tomingley               | Alkane Resources Limited        | OP/UG     | 1,961         | 1.79        | 30         | 12,141           |
| 40        | Dalgaranga              | Gascoyne Resources Limited      | OP        | 1,976         | 0.87        | 41         | 16,744           |
| 41        | Plutonic                | Superior Gold Inc               | OP/UG     | 1,977         | 1.72        | 31         | 19,379           |
| 42        | Mungari                 | Evolution Mining Limited        | OP/UG     | 2,018         | 2.12        | 25         | 34,765           |
| 43        | Sunrise Dam             | AngloGold Ashanti Limited       | OP/UG     | 2,020         | 1.80        | 29         | 58,000           |
| 44        | Macraes                 | OceanaGold Corporation          | OP/UG     | 2,140         | 0.73        | 46         | 25,720           |
| 45        | Beatons Creek           | Novo Resources Corp             | OP        | 2,198         | 1.34        | 36         | 18,144           |
| 46        | Mt Morgans              | Dacian Gold Limited             | OP        | 2,362         | 0.79        | 44         | 15,819           |
| 47        | Darlot                  | Red 5 Limited                   | OP/UG     | 2,686         | 2.20        | 24         | 16,377           |
| 48        | Davyhurst               | Ora Banda Mining Limited        | OP/UG     | 2,756         | 1.94        | 28         | 14,279           |
| 49        | Waihi                   | OceanaGold Corporation          | UG        | 2,819         | 3.19        | 13         | 7,547            |

Notes: Operations shown on a 100% basis, except Northern Star's Kalgoorlie Operations.

## 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    | Karlawinda     | Capricorn Metals Limited                         | OP        | 0.84        | 24,329           |
| 2    | Kundana EKJV   | JV Tribune Resources Limited/Rand Mining Limited | UG        | 4.06        | 16,980           |
| 3    | Mt Boppy       | Manuka Resources Limited                         | OP        | 4.49        | 10,089           |
| 4    | Matilda-Wiluna | Wiluna Mining Corporation Limited                | UG        | NA          | 8,332            |
| 5    | Jaurdi         | Beacon Minerals Limited                          | OP        | 1.62        | 7,375            |
| 6    | Hillgrove      | Red River Resources Limited                      | UG        | 1.50        | 1,179            |
| NR   | Paddington     | Zijin Mining Group Company Limited <sup>1</sup>  | OP/UG     | NA          | NA               |
| NR   | Marvel Loch    | Minjar Gold Pty Ltd <sup>1</sup>                 | OP/UG     | NA          | NA               |
| NR   | Ravenswood     | EMR Capital <sup>1</sup>                         | OP/UG     | NA          | NA               |
| NR   | Pajingo        | Minjar Gold Pty Ltd <sup>1</sup>                 | UG        | NA          | NA               |
| NR   | Ballarat       | Shen Yao Holdings Limited <sup>1</sup>           | UG        | NA          | NA               |

1. These companies did not provide detailed quarterly production statistics.

## Mines Where Gold Is A By-Product

| Rank | Operation      | Company   | Mine Type | Au Produced (oz) |
|------|----------------|---|-----------|------------------|
| 1    | Prominent Hill | OZ Minerals Limited                                   | UG        | 41,245           |
| 2    | Olympic Dam    | BHP Group Limited                                     | UG        | 26,277           |
| 3    | Ernest Henry   | Evolution Mining Limited                              | UG        | 23,882           |
| 4    | Carrapateena   | OZ Minerals Limited                                   | UG        | 23,226           |
| 5    | Golden Grove   | 29Metals Limited                                      | UG        | 9,035            |
| 6    | DeGrussa       | Sandfire Resources NL                                 | UG        | 7,515            |
| 7    | Rosebery       | MMG Limited   | UG        | 7,281            |
| NR   | North Parkes   | JV China Molybdenum Co Ltd/Sumitomo Australia Pty Ltd | UG        | 6,961            |
| 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) <sup>1</sup>   | 1,571         | 9.6%       | 3.08        | -2.5%      |
| Average (Weighted) <sup>2</sup> | 1,405         | 13.6%      | 1.44        | -2.0%      |
| Minimum                         | -1,345        | -3.1%      | 0.54        | 14.9%      |
| First Quartile <sup>3</sup>     | 1,304         | 9.3%       | 0.94        | -6.0%      |
| Median <sup>3</sup>             | 1,418         | 2.6%       | 2.02        | 9.2%       |
| Third Quartile <sup>3</sup>     | 1,776         | 13.3%      | 3.60        | -10.0%     |
| Maximum                         | 2,819         | 4.6%       | 23.60       | -19.2%     |

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                              | Boddington   | 162,000 | 1                       | Cadia Valley | 276    |
| 2                              | Fosterville  | 134,772 | 2                       | Fosterville  | 459    |
| 3                              | Tanami       | 112,000 | 3                       | Granny Smith | 1,186  |
| 4                              | KCGM         | 109,199 | 4                       | St Ives      | 1,302  |
| 5                              | Cadia Valley | 109,005 | 5                       | Jundee       | 1,310  |

## Top 5 Gold Operations - Mid-Tier Gold Miners

| Gold Production (Attributable) |                      |        | All-in Sustaining Costs |              |        |
|--------------------------------|----------------------|--------|-------------------------|--------------|--------|
| Rank                           | Operation            | oz     | Rank                    | Operation    | A\$/oz |
| 1                              | Cowal                | 52,513 | 1                       | Ernest Henry | -1,345 |
| 2                              | Gwalia               | 51,757 | 2                       | Deflector    | 1,249  |
| 3                              | Mungari              | 34,765 | 3                       | Cowal        | 1,304  |
| 4                              | Garden Well          | 34,646 | 4                       | Fortnum      | 1,393  |
| 5                              | Mt Magnet Operations | 33,958 | 5                       | Garden Well  | 1,400  |

## Top 5 Gold Operations - Junior Gold Miners

| Gold Production (Attributable) |  |        | All-in Sustaining Costs |                         |        |
|--------------------------------|--|--------|-------------------------|-------------------------|--------|
| Rank                           | Operation  | oz     | Rank                    | Operation               | A\$/oz |
| 1                              | Higginsville Operations                                | 29,831 | 1                       | Hera                    | 685    |
| 2                              | Gruyere (50% Gold Road Resources Limited) <sup>1</sup> | 26,566 | 2                       | Peak                    | 1,117  |
| 3                              | Karlawinda   | 25,558 | 3                       | Costerfield             | 1,139  |
| 4                              | Plutonic   | 19,889 | 4                       | Higginsville Operations | 1,316  |
| 5                              | Beatons Creek  | 19,356 | 5                       | Nicolsons               | 1,435  |

1. Gruyere gold produced and AISC represents Gold Road Resources Limited's 50% attributable interest.

## 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            | 134,772 | 1                       | Fosterville  | 459    |
| 2                       | Tanami                 | 112,000 | 2                       | Granny Smith | 1,186  |
| 3                       | KCGM                   | 109,199 | 3                       | St Ives      | 1,302  |
| 4                       | Tropicana <sup>1</sup> | 96,381  | 4                       | Cowal        | 1,304  |
| 5                       | St Ives                | 94,000  | 5                       | Jundee       | 1,310  |

1. Tropicana is a joint venture between AngloGold Ashanti Limited (70%) and Regis Resources Limited (30%).

## 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 Gruyere 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 (0.7350) from the Reserve Bank of Australia was used.

## Disclaimer

The information contained in this report is provided for information purposes only. Accordingly, it is provided on the basis of no liability whatsoever to Aurum Analytics, or the directors, officers and employees of Aurum Analytics who will not be responsible for any damages arising from any use made of the information herein. While all care has been taken in its preparation, this information has not been independently audited and Aurum Analytics, or the directors, officers and employees of Aurum Analytics make no representation and give no warranty or undertaking, express or implied, nor assume any responsibility for the authenticity, origin, validity, accuracy or completeness, or for any errors or omissions contained in the information. The assumptions that were made in its preparation were based on publicly available information which has not been verified by Aurum Analytics, or formally audited.



**ARGONAUT**  
*The Natural Choice in Resources*

## About Argonaut

Argonaut is a full-service corporate finance, stockbroking and investment house based in Perth with a Foreign Broker-Dealer Agreement for the USA and an International Dealer Exemption for Canada. Argonaut is technically driven & focused on natural resource companies & businesses that service the metals, mining, energy, industrial and agri-business sectors. Argonaut is led by an experienced executive team with deep industry knowledge, who have previously held senior executive roles at leading international investment and securities houses. In our target markets, Argonaut is recognised as a trusted, independent corporate advisor with a strong track record of success. Argonaut has proven expertise across the full capital spectrum, being able to deliver optimal financing solutions during a company's entire life cycle.



## 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 "Insights into the Economic Cost Structure of Gold Mining: From All-in Sustaining Costs to Quantifying Externalities."

## Contact

### Sam Ulrich

#### Aurum Analytics

**E** sam@aurumanalytics.com.au  
**W** www.aurumanalytics.com.au  
**T** +61 439 997 814

### Liam Twigger

#### Argonaut Group

**E** ltwigger@argonaut.com  
**W** www.argonaut.com  
**T** +61 8 9224 6888