

# Australian & New Zealand Gold Operations

## March Quarter 2019 - Final Report

### Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,255/oz, which is up 7.3% (A\$85/oz) on the previous quarter average AISC of A\$1,170/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-510/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$206/oz, then by Kirkland Lakes' Fosterville mine (A\$442/oz). The average gold spot price for the quarter was A\$1,830/oz (US\$1,304/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\$732/oz and Cadia Valley Co-AISC of A\$706/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$442/oz, then Westgold Resources' Fortnum mine (A\$937/oz) and Newmont's Tanami mine (A\$953/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 218,891 oz for the quarter, followed by Newmont's Boddington (155,000 oz) then Newmont's Tanami operation (131,000 oz). Of the mines where gold is a by-product, Oz Mineral's Prominent Hill produced the most gold 32,947 oz followed by BHP's Olympic Dam with 28,609 oz and Evolution's part of Ernest Henry 22,419 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.47 g/t (Open Pit (OP) - 1.71 g/t, Underground (UG) - 5.33 g/t, Open Pit & Underground (OP/UG) - 2.35 g/t) which was down on the previous quarter, 3.91 g/t (-11.3%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 29.00 g/t, followed by St Barbara's Gwalia mine 11.50 g/t. The lowest grade mine was Evolution's Ernest Henry processing an average head grade of 0.56 g/t. The high-grade operations that do not report an AISC were AuStar Gold's Morning Star mine with 10.26 g/t and Mandalay Resources' Costerfield mine with 5.00 g/t.

### Top 10 Gold Producing Operations

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Cadia Valley	Newcrest Mining Limited	UG	218,891
2	Boddington	Newmont Goldcorp Corporation	OP	155,000
3	Tanami	Newmont GoldCorp Corporation	UG	131,000
4	Fosterville	Kirkland Lake Gold Limited	UG	128,445
5	Tropicana	JV AngloGold Ashanti Limited/Independence Group NL	OP	123,236
6	Telfer	Newcrest Mining Limited	OP/UG	121,122
7	Kalgoorlie	JV Newmont Goldcorp Corporation/Barrick Gold Corporation	OP/UG	109,000
8	St Ives	Gold Fields Limited	OP/UG	103,000
9	Kalgoorlie Operations	Northern Star Resources Limited	UG	82,720
10	Duketon South	Regis Resources Limited	OP	72,303

### Supported By



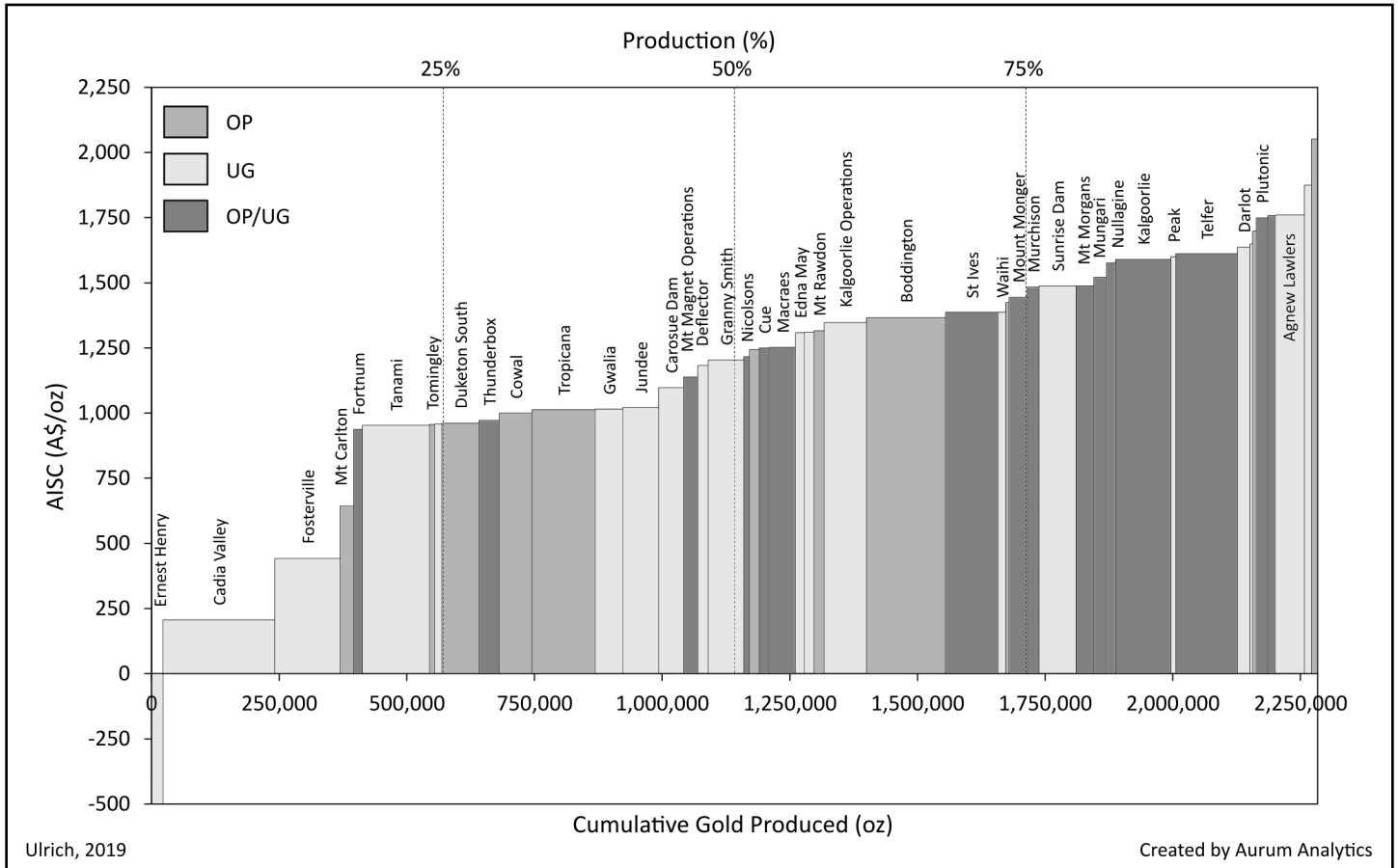
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## Gold Operations That Report AISC

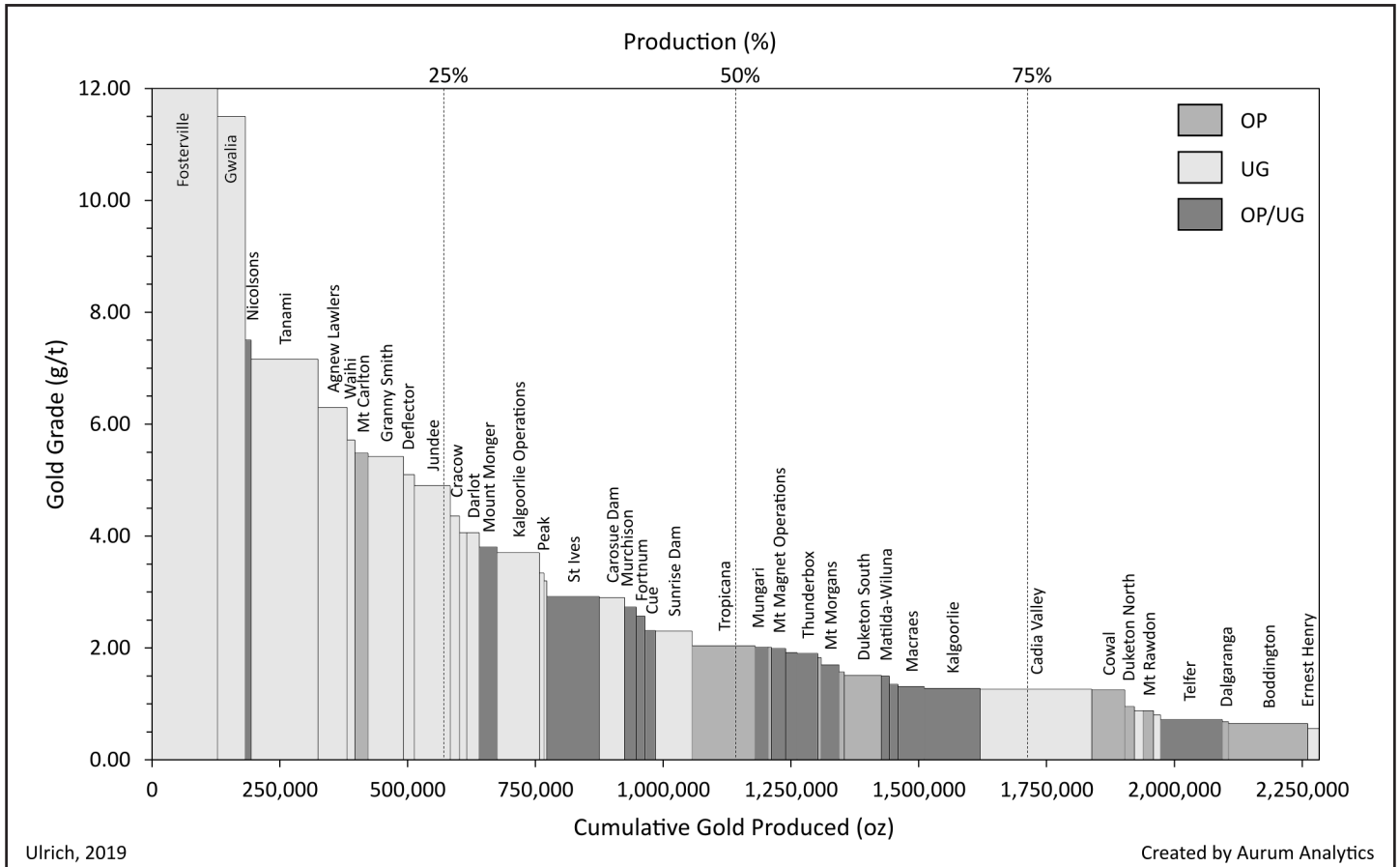
AISC Rank	Operation	Company	Mine Type	AISC (A\$/oz)	Grade (g/t)	Grade Rank	Au Produced (oz)
1	Ernest Henry	Evolution Mining Limited	UG	-510	0.56	47	22,419
2	Cadia Valley	Newcrest Mining Limited	UG	206	1.26	38	218,891
3	Fosterville	Kirkland Lake Gold Limited	UG	442	29.00	1	128,445
4	Mt Carlton	Evolution Mining Limited	OP	643	5.48	7	26,116
5	Fortnum	Westgold Resources Limited	OP/UG	937	2.57	21	17,019
6	Tanami	Newmont Mining Corporation	UG	953	7.16	4	131,000
7	Tomingley	Alkane Resources Limited	OP	956	1.57	32	10,669
8	Hera	Aurelia Metals Limited	UG	957	4.06	12=	14,191
9	Duketon South	Regis Resources Limited	OP	961	1.51	33	72,303
10	Thunderbox	Saracen Mineral Holdings Limited	OP/UG	972	1.90	29	40,170
11	Cowal	Evolution Mining Limited	OP	1,000	1.25	39	64,117
12	Tropicana	JV AngloGold/Independence	OP	1,013	2.04	24	123,236
13	Gwalia	St Barbara Limited	UG	1,016	11.50	2	54,261
14	Jundee	Northern Star Resources Limited	UG	1,021	4.90	10	70,154
15	Carosue Dam	Saracen Mineral Holdings Limited	UG	1,097	2.90	19	49,038
16	Mt Magnet Ops	Ramelius Resources Limited	OP/UG	1,139	1.99	27	27,542
17	Deflector	Silver Lake Resources Limited	UG	1,182	5.10	9	20,961
18	Granny Smith	Gold Fields Limited	UG	1,204	5.42	8	69,300
19	Nicolsons	Pantoro Limited	OP/UG	1,217	7.50	3	11,280
20	Duketon North	Regis Resources Limited	OP	1,244	0.95	40	18,784
21	Cue	Westgold Resources Limited	OP/UG	1,250	2.31	22	20,108
22	Macraes Ops	OceanaGold Corporation	OP/UG	1,252	1.31	36	51,200
23	Edna May	Ramelius Resources Limited	UG	1,309	0.88	41=	17,744
24	Cracow	Evolution Mining Limited	UG	1,310	4.36	11	18,158
25	Mt Rawdon	Evolution Mining Limited	OP	1,316	0.88	41=	20,124
26	Kalgoorlie Ops	Northern Star Resources Limited	UG	1,347	3.70	15	82,720
27	Boddington	Newmont Mining Corporation	OP	1,366	0.65	46	155,000
28=	St Ives	Gold Fields Limited	OP/UG	1,387	2.92	18	103,000
28=	Waihi	OceanaGold Corporation	UG	1,387	5.72	6	15,100
30	Higginsville	Westgold Resources Limited	OP	1,424	1.83	30	6,707
31	Mount Monger	Silver Lake Resources Limited	OP/UG	1,444	3.80	14	35,172
32	Murchison	Westgold Resources Limited	OP/UG	1,483	2.73	20	23,333
33=	Sunrise Dam	AngloGold Ashanti Limited	UG	1,488	2.30	23	72,000
33=	Mt Morgans	Dacian Gold Limited	OP/UG	1,488	1.70	31	35,003
35	Mungari	Evolution Mining Limited	OP/UG	1,521	2.01	25=	24,966
36	Nullagine	Millennium Minerals Limited	OP/UG	1,576	1.35	35	17,393
37	Kalgoorlie	JV Newmont/Barrick	OP/UG	1,589	1.28	37	109,000
38	Peak	Aurelia Metals Limited	UG	1,600	3.34	16	9,132
39	Telfer	Newcrest Mining Limited	OP/UG	1,612	0.72	44	121,122
40	Darlot	Red 5 Limited	UG	1,637	4.06	12=	24,187
41	Beta Hunt	Royal Nickel Corporation	UG	1,648	3.20	17	5,168
42	Widgiemooltha	Mincor Resources NL	OP	1,698	2.01	25=	7,058
43	Plutonic	Superior Gold Inc	OP/UG	1,749	1.92	28	22,474
44	Matilda-Wiluna	Blackham Resources Limited	OP/UG	1,757	1.50	34	15,296
45	Agnew Lawlers	Gold Fields Limited	UG	1,760	6.30	5	56,900
46	Ravenswood	Resolute Mining Limited	UG	1,874	0.80	43	13,554
47	Dalgaranga	Gascoyne Resources Limited	OP	2,052	0.68	45	12,088

Notes: Operations are shown on a 100% basis, except Northern Star's Kalgoorlie Operations. Ballarat 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	Kundana EKJV	Tribune Resources Limited & Rand Mining Limited	UG	NA	34,473
2	Costerfield	Mandalay Resources Limited	UG	5	4,105
3	Morning Star	AuStar Gold Limited	UG	10.26	129
NR	Pajingo	Minjar Gold Pty Ltd <sup>2</sup>	UG	NA	NA
NR	Ballarat	LionGold Corp Ltd <sup>1</sup>	UG	NA	NA
NR	Marvel Loch	Minjar Gold Pty Ltd <sup>2</sup>	OP/UG	NA	NA
NR	Paddington	Zijin Mining Group Company Limited <sup>2</sup>	OP/UG	NA	NA
NR	Comet Vale	JV Orminex Limited/Sand Queen Gold Mines Pty Ltd <sup>3</sup>	UG	NA	NA
NR	A1	Centennial Mining Limited <sup>4</sup>	UG	NA	NA

1. These companies usually report AISC but had not at the time of compiling this report.
2. These companies do not provide detailed quarterly production statistics for these mines.
3. Comet Vale is a joint venture between Orminex Limited (51%) and Sand Queen Gold Mines Pty Ltd (49%).
4. Centennial Mining Limited entered voluntary administration during the quarter

## Mines Where Gold Is A By-Product

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Prominent Hill	OZ Minerals Limited	UG	32,947
2	Olympic Dam	BHP Billiton Limited	UG	28,609
3	Ernest Henry	Evolution Mining Limited	UG	22,419
4	DeGrussa	Sandfire Resources NL	UG	10,921
5	North Parkes <sup>1</sup>	JV China Molybdenum Co Ltd/Sumitomo Australia Pty Ltd	UG	6,300
6	Rosebery	MMG Limited	UG	1,842
7	Kanmantoo	Hillgrove Resources Limited	OP	961
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) <sup>1</sup>	1,255	7.3%	3.47	-11.3%
Average (Weighted) <sup>2</sup>	1,119	3.7%	1.66	0.6%
Minimum	-510	-26.6%	0.56	-1.8%
First Quartile <sup>3</sup>	961	-0.3%	1.26	-0.8%
Median <sup>3</sup>	1,204	11.4%	2.04	-8.5%
Third Quartile <sup>3</sup>	1,444	2.7%	4.90	8.4%
Maximum	2,058	6.1%	29.00	-27.0%

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	218,891	1	Cadia Valley	206
2	Boddington	155,000	2	Tanami	953
3	Tanami	131,000	3	Tropicana <sup>1</sup>	1,013
4	Tropicana <sup>1</sup>	123,236	4	Granny Smith	1,204
5	Telfer	121,122	5	Boddington	1,366

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	128,445	1	Ernest Henry	-510
2	Kalgoorlie Operations <sup>1</sup>	82,720	2	Fosterville	442
3	Duketon South	72,303	3	Mt Carlton	643
4	Jundee	70,154	4	Fortnum	937
5	Cowal	64,117	5	Duketon South	961

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	35,003	1	Tomingley	956
2	Kundana EKJV <sup>1</sup>	34,473	2	Hera	957
3	Mt Magnet Operations	27,542	3	Mt Magnet Operations	1,139
4	Darlot	24,187	4	Nicolsons	1,217
5	Plutonic	22,474	5	Edna May	1,309

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	Tanami	131,000	1	Fosterville	442
2	Fosterville	128,445	2	Fortnum	937
3	Tropicana <sup>1</sup>	123,236	3	Tanami	953
4	Kalgoorlie <sup>2</sup>	109,000	4	Tomingley	956
5	St Ives	103,000	5	Duketon South	961

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

2. Kalgoorlie is a joint venture between Newmont Mining 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 (0.7123) 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."

## Contact

### Sam Ulrich

#### Aurum Analytics

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

### Liam Twigger

#### PCF Capital Group

**E** liam@pcfcapital.com.au  
**W** www.pfcapital.com.au  
**T** +61 8 9486 7111