

# Australian & New Zealand Gold Operations

## December Quarter 2018 - Final Report

### Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,170/oz, which is down 1.6% (A\$19/oz) on the previous quarter average AISC of A\$1,189/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-403/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$169/oz, then by Aurelia Metals' Hera (A\$425/oz). The average gold spot price for the quarter was A\$1,710/oz (US\$1,227/oz). It should be noted that Ernest Henry, Cadia Valley and Hera all 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\$703/oz, Cadia Valley Co-AISC of A\$695/oz and Hera Co-AISC of A\$903/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville with an AISC of A\$463/oz, then Regis Resources' Duketon North (A\$941/oz) and Newmont's Tanami (A\$964/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 239,470 oz for the quarter, followed by Newmont's Boddington (162,000 oz) then Newmont's Tanami operation (155,000 oz). Of the mines where gold is a by-product, Oz Mineral's Prominent Hill produced the most gold 37,719 oz followed by Evolution's part of Ernest Henry 24,812 oz and BHP's Olympic Dam with 17,856 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.91 g/t (Open Pit (OP) - 1.80 g/t, Underground (UG) – 6.22 g/t, Open Pit & Underground (OP/UG) - 1.83 g/t) which was up on the previous quarter, 3.52 g/t (11.1%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 39.70 g/t, followed by St Barbara's Gwalia mine 9.90 g/t. The lowest grade mine was Evolution's Ernest Henry processing an average head grade of 0.57 g/t. The high-grade operations that do not report an AISC by the time of this report was RNC Minerals' Beta Hunt mine with 9.42 g/t and LionGold's Ballarat mine with 5.50 g/t.

### Top 10 Gold Producing Operations

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Cadia Valley	Newcrest Mining Limited	UG	239,470
2	Boddington	Newmont Mining Corporation	OP	162,000
3	Tanami	Newmont Mining Corporation	UG	155,000
4	Tropicana	JV AngloGold Ashanti Limited/Independence Group NL	OP	136,891
5	Fosterville	Kirkland Lake Gold Limited	UG	124,307
6	Kalgoorlie	JV Newmont Mining Corporation/Barrick Gold Corporation	OP/UG	122,000
7	Telfer	Newcrest Mining Limited	OP/UG	109,049
8	St Ives	Gold Fields Limited	OP/UG	87,900
9	Kalgoorlie Ops	Northern Star Resources Limited	UG	79,496
10	Sunrise Dam	AngloGold Ashanti Limited	UG	75,000

### Supported By



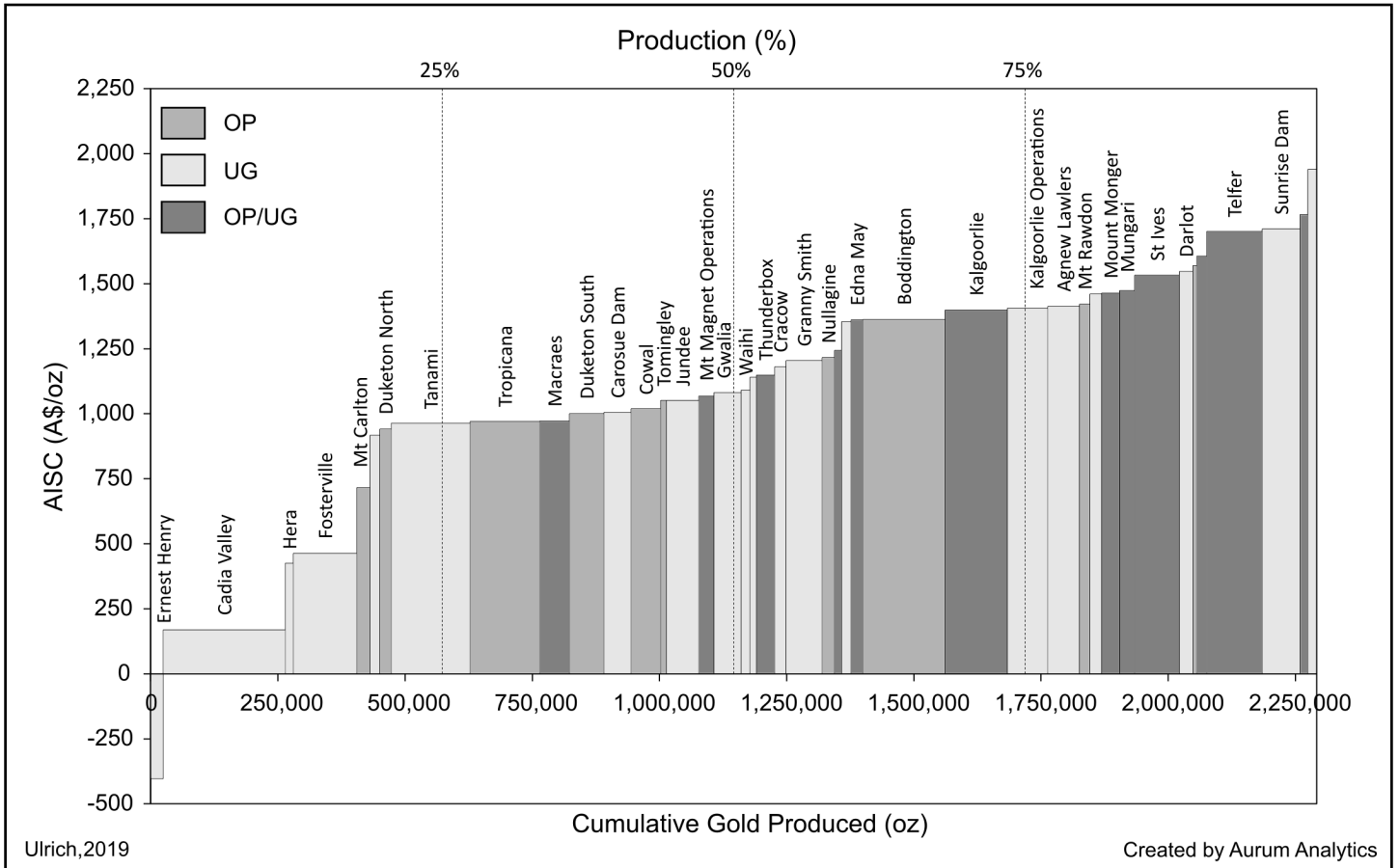
Capital Group

## Gold Operations That Report AISC

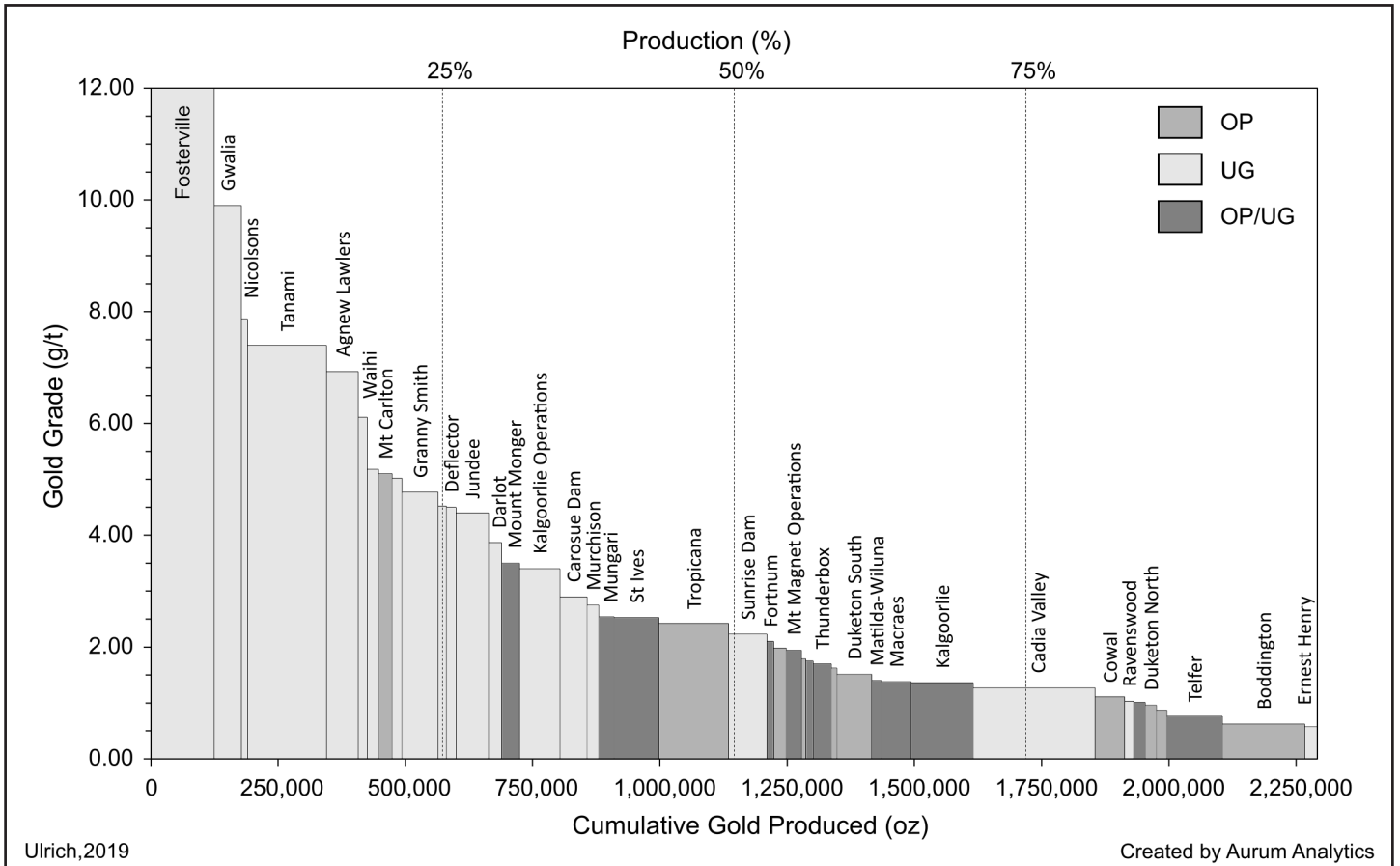
AISC Rank	Operation	Company	Mine Type	AISC (A\$/oz)	Grade (g/t)	Grade Rank	Au Produced (oz)
1	Ernest Henry	Evolution Mining Limited	UG	-403	0.57	42	24,812
2	Cadia Valley	Newcrest Mining Limited	UG	169	1.27	34	239,470
3	Hera	Aurelia Metals Limited	UG	425	4.52	11	16,224
4	Fosterville	Kirkland Lake Gold Limited	UG	463	39.70	1	124,307
5	Mt Carlton	Evolution Mining Limited	OP	716	5.10	8	26,101
6	Peak	Aurelia Metals Limited	UG	917	5.02	9	19,610
7	Duketon North	Regis Resources Limited	OP	941	0.96	38	22,174
8	Tanami	Newmont Mining Corporation	UG	964	7.40	4	155,000
9	Tropicana	JV AngloGold/Independence	OP	971	2.42	21	136,891
10	Macraes	OceanaGold Corporation	OP/UG	972	1.38	32	58,200
11	Duketon South	Regis Resources Limited	OP	1,000	1.51	30	68,313
12	Carosue Dam	Saracen Mineral Holdings Limited	UG	1,005	2.90	17	53,108
13	Cowal	Evolution Mining Limited	OP	1,019	1.11	35	58,244
14	Tomingley	Alkane Resources Limited	OP	1,051	1.62	29	11,111
15	Jundee	Northern Star Resources Limited	UG	1,052	4.40	13	63,650
16	Mt Magnet Operations	Ramelius Resources Limited	OP/UG	1,068	1.94	25	29,855
17	Gwalia	St Barbara Limited	UG	1,081	9.90	2	53,257
18	Waihi	OceanaGold Corporation	UG	1,091	6.11	6	17,600
19	Nicolsons	Pantoro Limited	UG	1,140	7.87	3	12,657
20	Thunderbox	Saracen Mineral Holdings Limited	OP/UG	1,149	1.70	28	35,725
21	Cracow	Evolution Mining Limited	UG	1,181	5.18	7	22,440
22	Granny Smith	Gold Fields Limited	UG	1,204	4.77	10	71,000
23	Nullagine	Millennium Minerals Limited	OP	1,216	1.98	24	24,514
24	Fortnum	Westgold Resources Limited	OP/UG	1,244	2.10	23	13,673
25	Deflector	Doray Minerals Limited	UG	1,354	4.50	12	18,944
26	Edna May	Ramelius Resources Limited	OP/UG	1,361	1.01	37	22,768
27	Boddington	Newmont Mining Corporation	OP	1,362	0.62	41	162,000
28	Kalgoorlie	JV Newmont/Barrick	OP/UG	1,399	1.36	33	122,000
29	Kalgoorlie Operations	Northern Star Resources Limited	UG	1,406	3.40	16	79,496
30	Agnew Lawlers	Gold Fields Limited	UG	1,413	6.93	5	62,400
31	Mt Rawdon	Evolution Mining Limited	OP	1,421	0.87	39	20,407
32	Murchison	Westgold Resources Limited	UG	1,461	2.75	18	23,416
33	Mount Monger	Silver Lake Resources Limited	OP/UG	1,464	3.50	15	34,871
34	Mungari	Evolution Mining Limited	OP/UG	1,474	2.54	19	29,992
35	St Ives	Gold Fields Limited	OP/UG	1,533	2.53	20	87,900
36	Darlot	Red 5 Limited	UG	1,547	3.87	14	26,118
37	Higginsville	Westgold Resources Limited	OP	1,570	1.79	26	8,299
38	Matilda-Wiluna	Blackham Resources Limited	OP/UG	1,606	1.40	31	19,016
39	Telfer	Newcrest Mining Limited	OP/UG	1,701	0.76	40	109,049
40	Sunrise Dam	AngloGold Ashanti Limited	UG	1,711	2.23	22	75,000
41	Cue	Westgold Resources Limited	OP/UG	1,766	1.75	27	14,676
42	Ravenswood	Resolute Mining Limited	UG	1,940	1.03	36	17,484

Notes: Operations are shown on a 100% basis, except Northern Star's Kalgoorlie Operations. Ballarat, Beta Hunt 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	Mt Morgans	Dacian Gold Limited	OP/UG	2.00	37,934
2	Kundana EKJV	Tribune Resources Limited & Rand Mining Limited	UG	NA	27,361
3	Beta Hunt	Royal Nickel Corporation <sup>1</sup>	UG	9.42	21,574
4	Plutonic	Superior Gold Inc <sup>1</sup>	OP/UG	1.63	20,541
5	Dalgaranga	Gascoyne Resources Limited	OP	0.82	17,110
6	Ballarat	LionGold Corp Ltd <sup>1</sup>	UG	5.50	9,560
7	Widgiemooltha	Mincor Resources NL	OP	1.78	7,485
8	Costerfield	Mandalay Resources Limited	UG	NA	4,948
9	A1	Centennial Mining Limited	UG	3.71	3,500
NR	Pajingo	Minjar Gold Pty Ltd <sup>2</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	Red Dog	Matsa Resources Limited <sup>2</sup>	OP	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%).

## Mines Where Gold Is A By-Product

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Prominent Hill	OZ Minerals Limited	UG	37,719
2	Ernest Henry	Evolution Mining Limited	UG	24,812
3	Olympic Dam	BHP Billiton Limited	UG	17,856
4	DeGrussa	Sandfire Resources NL	UG	10,427
5	Kanmantoo	Hillgrove Resources Limited	OP	885
NR	North Parkes <sup>1</sup>	MMG Limited	UG	NA
NR	Rosebery	EMR Capital	UG	NA
NR	Golden Grove	Washington H. Soul Pattinson and Company Limited	UG	NA
NR	Jaguar	JV China Molybdenum Co Ltd/Sumitomo Groups	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>	1,170	-1.6%	3.91	11.1%
Average (Weighted) <sup>2</sup>	1,079	-0.9%	1.65	1.2%
Minimum	-403	34.7%	0.57	-1.7%
First Quartile <sup>3</sup>	964	6.2%	1.27	5.8%
Median <sup>3</sup>	1,081	-4.9%	2.23	11.5%
Third Quartile <sup>3</sup>	1,406	6.7%	4.52	-1.7%
Maximum	1,940	-8.2%	39.7	55.1%

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	239,470	1	Cadia Valley	169
2	Boddington	162,000	2	Tanami	964
3	Tanami	155,000	3	Tropicana <sup>1</sup>	971
4	Tropicana <sup>1</sup>	136,891	4	Granny Smith	1,204
5	Kalgoorlie <sup>2</sup>	122,000	5	Boddington	1,362

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%).

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

Gold Production (Attributable)			All-in Sustaining Costs		
Rank	Operation	oz	Rank	Operation	A\$/oz
1	Fosterville	124,307	1	Ernest Henry	-403
2	Kalgoorlie Operations <sup>1</sup>	79,496	2	Fosterville	463
3	Duketon South	68,313	3	Mt Carlton	716
4	Jundee	63,650	4	Duketon North	941
5	Cowal	58,244	5	Duketon South	1,000

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	37,934	1	Hera	425
2	Mount Monger	34,871	2	Peak	917
3	Kundana EKJV <sup>1</sup>	27,361	3	Tomingley	1,051
4	Darlot	26,118	4	Nicolsons	1,140
5	Nullagine	24,514	5	Nullagine	1,216

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	155,000	1	Fosterville	463
2	Tropicana <sup>1</sup>	136,891	2	Duketon North	941
3	Fosterville	124,307	3	Tanami	964
4	Kalgoorlie <sup>2</sup>	122,000	4	Tropicana <sup>1</sup>	971
5	St Ives	87,900	5	Macraes	972

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 (0.7178) 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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