

# Australian & New Zealand Gold Operations

## June Quarter 2020 - Final Report

### Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,377/oz, which is down 4.8% (A\$70/oz) on the previous quarter average AISC of A\$1,447/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-617/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$259/oz, then by Kirkland Lakes' Fosterville mine (A\$415/oz). The average gold spot price for the quarter was A\$2,604/oz (US\$1,711/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\$590/oz and Cadia Valley Co-AISC of A\$879/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$415/oz, then Saracen's Thunderbox mine (A\$812/oz) and Ramelius' Mt Magnet Operations (A\$867/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 236,705 oz for the quarter, followed by Newmont's Boddington (168,000 oz) then Kirkland Lake's Fosterville operation (155,106 oz). Of the mines where gold is a by-product, OZ Minerals' Prominent Hill produced the most gold 52,725 oz followed by BHP's Olympic Dam with 34,140 oz and Evolution's part of Ernest Henry with 28,183 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.68 g/t (Open Pit (OP) - 1.06 g/t, Underground (UG) - 5.98 g/t, Open Pit & Underground (OP/UG) - 2.26 g/t) which was down on the previous quarter, 3.63 g/t (1.3%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 39.50 g/t, followed by Mandalay Resources' Costerfield mine 11.17 g/t. The lowest grade mine was Evolution's part of the Ernest Henry mine processing an average head grade of 0.60 g/t. The high-grade operations that do not report an AISC were LionGold Corp's Ballarat mine with 5.30 g/t and Manuka's Mt Boppy mine with 2.63 g/t.

### Top 10 Gold Producing Operations

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Cadia Valley	Newcrest Mining Limited	UG	236,705
2	Boddington	Newmont Mining Corporation	OP	168,000
3	Fosterville	Kirkland Lake Gold Limited	UG	155,106
4	Tanami	Newmont Mining Corporation	UG	126,000
5	Telfer	Newcrest Mining Limited	OP/UG	113,797
6	Kalgoorlie (KCGM)	JV Northern Star Resources Limited/Saracen Mineral Holdings Limited	OP/UG	106,795
7	Tropicana	JV AngloGold Ashanti Limited/IGO Limited	OP	102,718
8	St Ives	Gold Fields Limited	OP/UG	94,900
9	Kalgoorlie Operations	Northern Star Resources Limited	UG	83,945
10	Jundee	Northern Star Resources Limited	OP/UG	80,666

### Supported By

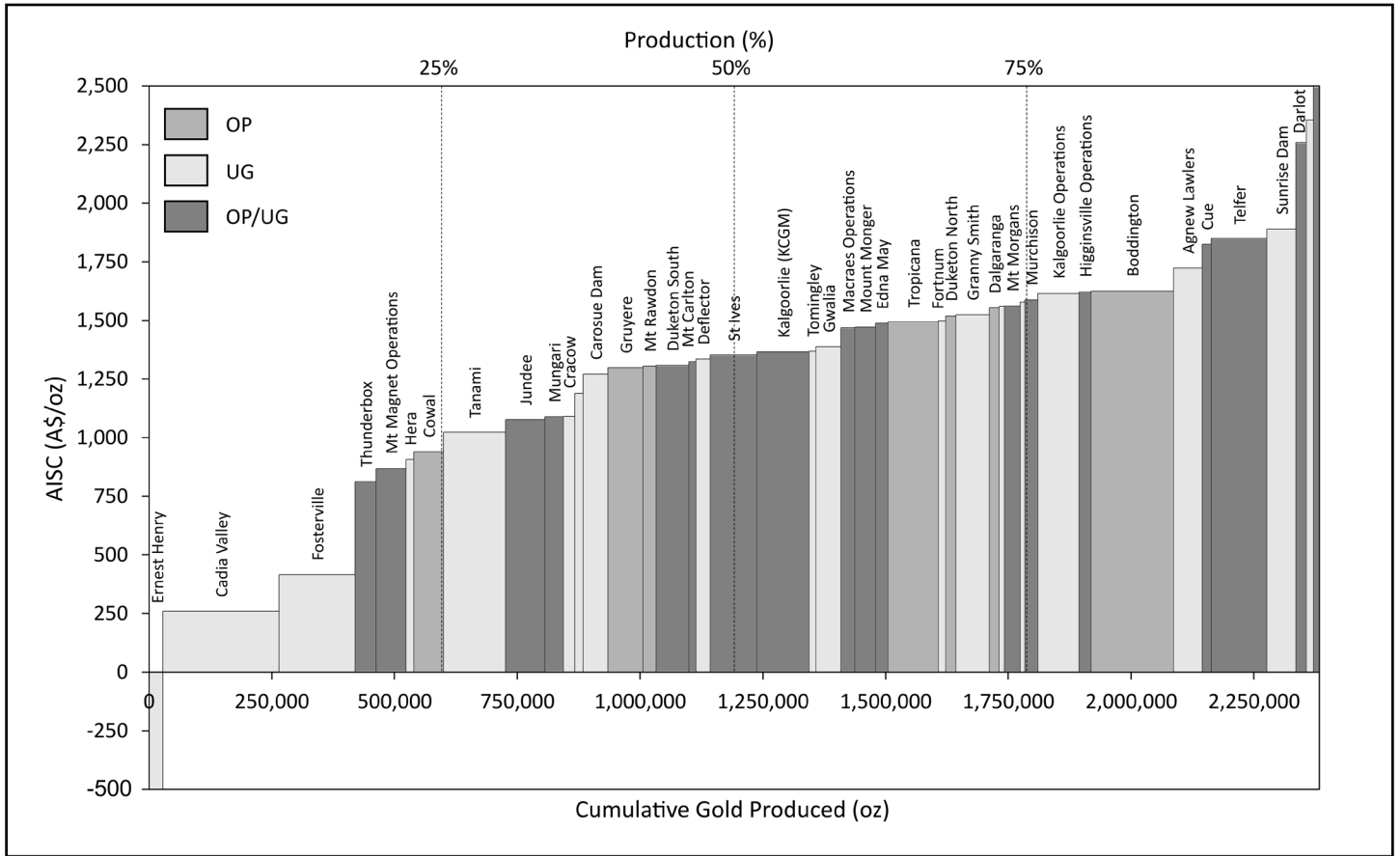


## Gold Operations That Report AISC

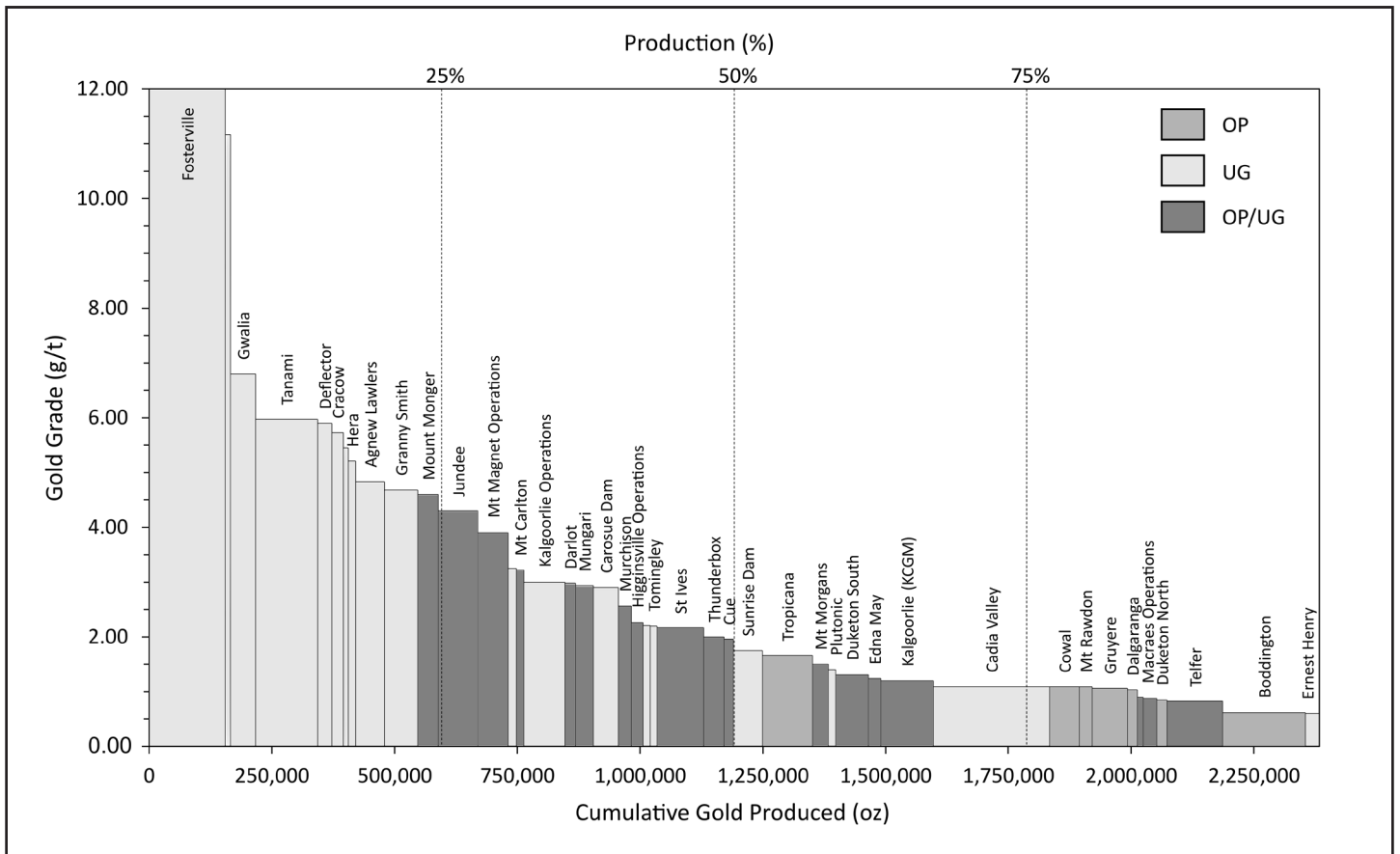
AISC Rank	Operation	Company	Mine Type	AISC (A\$/oz)	Grade (g/t)	Grade Rank	Au Produced (oz)
1	Ernest Henry	Evolution Mining Limited	UG	-617	0.60	44	28,183
2	Cadia Valley	Newcrest Mining Limited	UG	259	1.09	34=	236,705
3	Fosterville	Kirkland Lake Gold Limited	UG	415	39.50	1	155,106
4	Thunderbox	Saracen Mineral Holdings Limited	OP/UG	812	2.00	25	42,117
5	Mt Magnet Operations	Ramelius Resources Limited	OP/UG	867	3.90	13	61,161
6	Hera	Aurelia Metals Limited	UG	907	5.21	8	15,740
7	Cowal	Evolution Mining Limited	OP	941	1.09	34=	60,594
8	Tanami	Newmont Mining Corporation	UG	1,023	5.97	4	126,000
9	Jundee	Northern Star Resources Limited	OP/UG	1,078	4.30	12	80,666
10	Mungari	Evolution Mining Limited	OP/UG	1,089	2.93	18	37,178
11	Cracow	Evolution Mining Limited	UG	1,090	5.73	6	23,747
12	Peak	Aurelia Metals Limited	UG	1,190	3.25	14	17,047
13	Carosue Dam	Saracen Mineral Holdings Limited	UG	1,271	2.90	19	50,315
14	Gruyere	JV Gold Fields/Gold Road	OP	1,298	1.06	37	71,865
15	Mt Rawdon	Evolution Mining Limited	OP	1,305	1.09	34=	25,982
16	Duketon South	Regis Resources Limited	OP/UG	1,308	1.31	31	66,516
17	Mt Carlton	Evolution Mining Limited	OP/UG	1,324	3.22	15	14,991
18	Deflector	Silver Lake Resources Limited	UG	1,336	5.90	5	28,960
19	St Ives	Gold Fields Limited	OP/UG	1,353	2.17	24	94,900
20	Kalgoorlie	JV Northern Star/Saracen	OP/UG	1,365	1.20	33	106,795
21	Tomingley	Alkane Resources Limited	UG	1,368	2.20	23	13,358
22	Gwalia	St Barbara Limited	UG	1,389	6.80	3	51,297
23	Macraes Operations	OceanaGold Corporation	OP/UG	1,469	0.88	40	27,932
24	Mount Monger	Silver Lake Resources Limited	OP/UG	1,471	4.60	11	42,331
25	Edna May	Ramelius Resources Limited	OP/UG	1,488	1.24	32	25,356
26	Tropicana	JV AngloGold/IGO Limited	OP	1,493	1.66	28	102,718
27	Fortnum	Westgold Resources Limited	UG	1,498	2.21	22	14,887
28	Duketon North	Regis Resources Limited	OP	1,519	0.85	41	20,743
29	Granny Smith	Gold Fields Limited	UG	1,524	4.68	10	67,500
30	Dalgaranga	Gascoyne Resources Limited	OP	1,554	1.03	38	20,795
31	Costerfield	Mandalay Resources Limited	UG	1,560	11.17	2	10,533
32	Mt Morgans	Dacian Gold Limited	OP/UG	1,562	1.50	29	31,883
33	Nicolsons	Pantoro Limited	UG	1,578	5.45	7	9,586
34	Murchison	Westgold Resources Limited	OP/UG	1,588	2.56	20	26,630
35	Kalgoorlie Operations	Northern Star Resources Limited	UG	1,615	3.00	16	83,945
36	Higginsville Operations	Karora Resources Inc	OP/UG	1,621	2.26	21	24,087
37	Boddington	Newmont Mining Corporation	OP	1,625	0.62	43	168,000
38	Agnew Lawlers	Gold Fields Limited	UG	1,723	4.83	9	58,500
39	Cue	Westgold Resources Limited	OP/UG	1,825	1.96	26	18,271
40	Telfer	Newcrest Mining Limited	OP/UG	1,849	0.83	42	113,797
41	Sunrise Dam	AngloGold Ashanti Limited	UG	1,890	1.75	27	59,000
42	Darlot	Red 5 Limited	OP/UG	2,259	2.98	17	20,707
43	Plutonic	Superior Gold Inc	UG	2,354	1.40	30	15,177
44	Matilda-Wiluna	Wiluna Mining Corporation Limited	OP/UG	3,153	0.90	39	11,367

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	Ballarat	LionGold Corp Ltd <sup>1</sup>	UG	5.30	10,450
2	Kundana EKJV	Tribune Resources Limited/Rand Mining Limited	UG	NA	8,859
3	Jaurdi	Beacon Minerals Limited	OP	1.72	6,771
4	Mt Boppy	Manuka Resources Limited	OP	2.63	3,628
5	Morning Star	AuStar Gold Limited	UG	NA	542
6	Waihi <sup>2</sup>	OceanaGold Corporation	UG	NA	0
NR	Comet Vale	Orminex Limited/Sand Queen Gold Mines Pty Ltd <sup>3</sup>	UG	NA	NA
NR	Pajingo	Minjar Gold Pty Ltd <sup>4</sup>	UG	NA	NA
NR	Ravenswood	EMR Capital <sup>4</sup>	OP/UG	NA	NA
NR	Marvel Loch	Minjar Gold Pty Ltd <sup>4</sup>	OP/UG	NA	NA
NR	Paddington	Zijin Mining Group Company Limited <sup>4</sup>	OP/UG	NA	NA

1. These companies usually report AISC but had not at the time of compiling this report.
2. No production was recorded from the Waihi mine due to COVID-19 restrictions
3. Comet Vale is a joint venture between Orminex Limited (51%) and Sand Queen Gold Mines Pty Ltd (49%).
4. 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	Prominent Hill	OZ Minerals Limited	UG	52,725
2	Olympic Dam	BHP Billiton Limited	UG	34,150
3	Ernest Henry	Evolution Mining Limited	UG	28,183
4	Carrapateena	OZ Minerals Limited	UG	14,423
5	DeGrussa	Sandfire Resources NL	UG	13,541
6	Rosebery	MMG Limited	UG	2,767
NR	Golden Grove	EMR Capital	UG	NA
NR	North Parkes	JV China Molybdenum Co Ltd/Sumitomo Australia Pty Ltd <sup>1</sup>	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>	1,377	-4.8%	3.68	1.3%
Average (Weighted) <sup>2</sup>	1,216	-1.9%	1.52	-6.6%
Minimum	-617	-228.2%	0.60	20.0%
First Quartile <sup>3</sup>	941	-14.9%	1.09	-1.8%
Median <sup>3</sup>	1,353	1.0%	1.75	-16.7%
Third Quartile <sup>3</sup>	1,588	-1.9%	4.30	-6.1%
Maximum	3,153	-27.3%	39.50	-6.8%

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	236,705	1	Cadia Valley	259
2	Boddington	168,000	2	Fosterville	415
3	Fosterville	155,106	3	Tanami	1,023
4	Tanami	126,000	4	St Ives	1,353
5	Telfer	113,797	5	Gruyere (50% Gold Fields Limited) <sup>1</sup>	1,363

1. Gruyere is a Joint Venture between Gold Fields Limited (50%) and Gold Road Resources Limited (50%). Gruyere AISC represents Gold Fields's attributable share.

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

Gold Production (Attributable)			All-in Sustaining Costs		
Rank	Operation	oz	Rank	Operation	A\$/oz
1	Kalgoorlie (KCGM) <sup>1</sup>	106,795	1	Ernest Henry	-617
2	Kalgoorlie Operations <sup>2</sup>	83,945	2	Thunderbox	812
3	Jundee	80,666	3	Mt Magnet Operations	867
4	Gruyere	71,865	4	Cowal	941
5	Duketon South	66,516	5	Jundee	1,078

1. Kalgoorlie (KCGM) is a Joint Venture between Northern Star Resources Limited (50%) and Saracen Mineral Holdings Limited (50%).

2. 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	Gruyere (50% Gold Road Resources Limited) <sup>1</sup>	35,933	1	Hera	907
2	Mt Morgans	31,883	2	Peak	1,190
3	Higginsville Operations	24,087	3	Gruyere	1,233
4	Dalgaranga	20,795	4	Tomingley	1,368
5	Darlot	20,707	5	Dalgaranga	1,554

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	155,106	1	Fosterville	415
2	Tanami	126,000	2	Thunderbox	812
3	Kalgoorlie (KCGM) <sup>1</sup>	106,795	3	Mt Magnet Operations	867
4	Tropicana <sup>2</sup>	102,718	4	Cowal	941
5	St Ives	94,900	5	Tanami	1,023

1. Kalgoorlie (KCGM) is a Joint Venture between Northern Star Resources Limited (50%) and Saracen Mineral Holdings Limited (50%).

2. Tropicana is a joint venture between AngloGold Ashanti Limited (70%) and IGO 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, Kalgoorlie (KCGM) 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 (0.6571) 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 "Insights into the Economic Cost Structure of Gold Mining: From All-in Sustaining Costs to Quantifying Externalities."

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