

Australian & New Zealand Gold Operations

March Quarter 2020 - Final Report

Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,447/oz, which is up 8.2% (A\$109/oz) on the previous quarter average AISC of A\$1,338/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-188/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$208/oz, then by Kirkland Lakes' Fosterville mine (A\$475/oz). The average gold spot price for the quarter was A\$2,409/oz (US\$1,586/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\$975/oz and Cadia Valley Co-AISC of A\$943/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$475/oz, then OceanaGold's Waihi mine (A\$571/oz) and Saracen's Thunderbox mine (A\$682/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 195,181 oz for the quarter, followed by Kirkland Lake's Fosterville operation (159,864 oz) then Newmont's Boddington (142,000 oz). Of the mines where gold is a by-product, OZ Minerals' Prominent Hill produced the most gold 49,049 oz followed by BHP's Olympic Dam with 33,235 oz and Evolution's part of Ernest Henry with 20,261 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.63 g/t (Open Pit (OP) - 1.06 g/t, Underground (UG) – 6.07 g/t, Open Pit & Underground (OP/UG) - 2.17 g/t) which was down on the previous quarter, 3.68 g/t (-1.5%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 42.40 g/t, followed by Mandalay Resources' Costerfield mine 12.61 g/t. The lowest grade mine was Resolute's Ravenswood mine processing an average head grade of 0.50 g/t. The high-grade operations that do not report an AISC were LionGold Corp's Ballarat mine with 4.10 g/t and Orminex's Comet Vale mine with 3.05 g/t.

Top 10 Gold Producing Operations

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Cadia Valley	Newcrest Mining Limited	UG	195,181
2	Fosterville	Kirkland Lake Gold Limited	UG	159,864
3	Boddington	Newmont Mining Corporation	OP	142,000
4	Kalgoorlie (KCGM)	JV Northern Star Resources Limited/Saracen Mineral Holdings Limited	OP/UG	117,127
5	Tanami	Newmont Mining Corporation	UG	116,000
6	Tropicana	JV AngloGold Ashanti Limited/IGO Limited	OP	103,858
7	Telfer	Newcrest Mining Limited	OP/UG	96,903
8	St Ives	Gold Fields Limited	OP/UG	93,100
9	Kalgoorlie Operations	Northern Star Resources Limited	UG	74,598
10	Granny Smith	Gold Fields Limited	UG	66,600

1. Barrick Gold Limited sold its 50% interest in KCGM during the quarter to Saracen Mineral Holdings Limited

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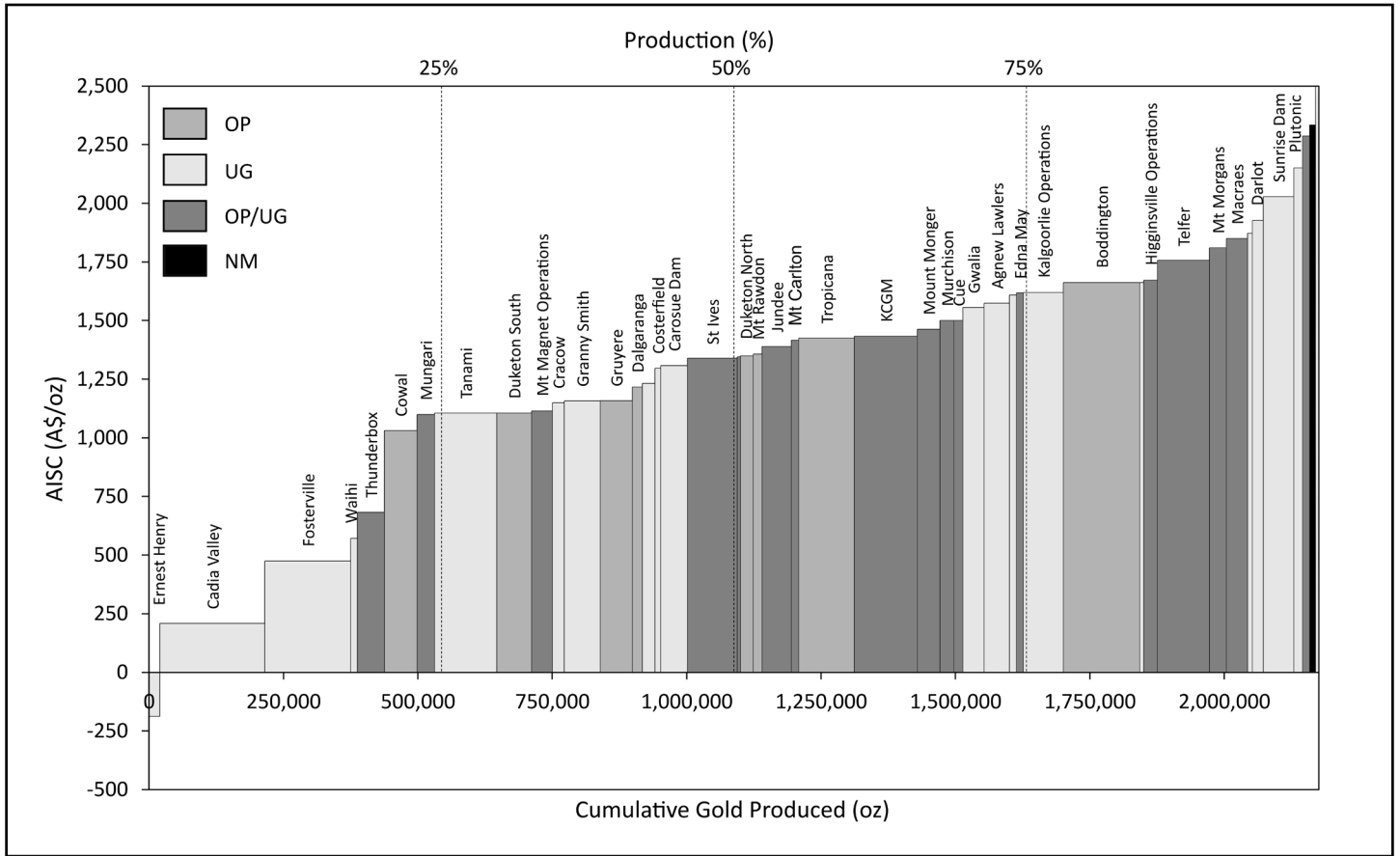


Gold Operations That Report AISC

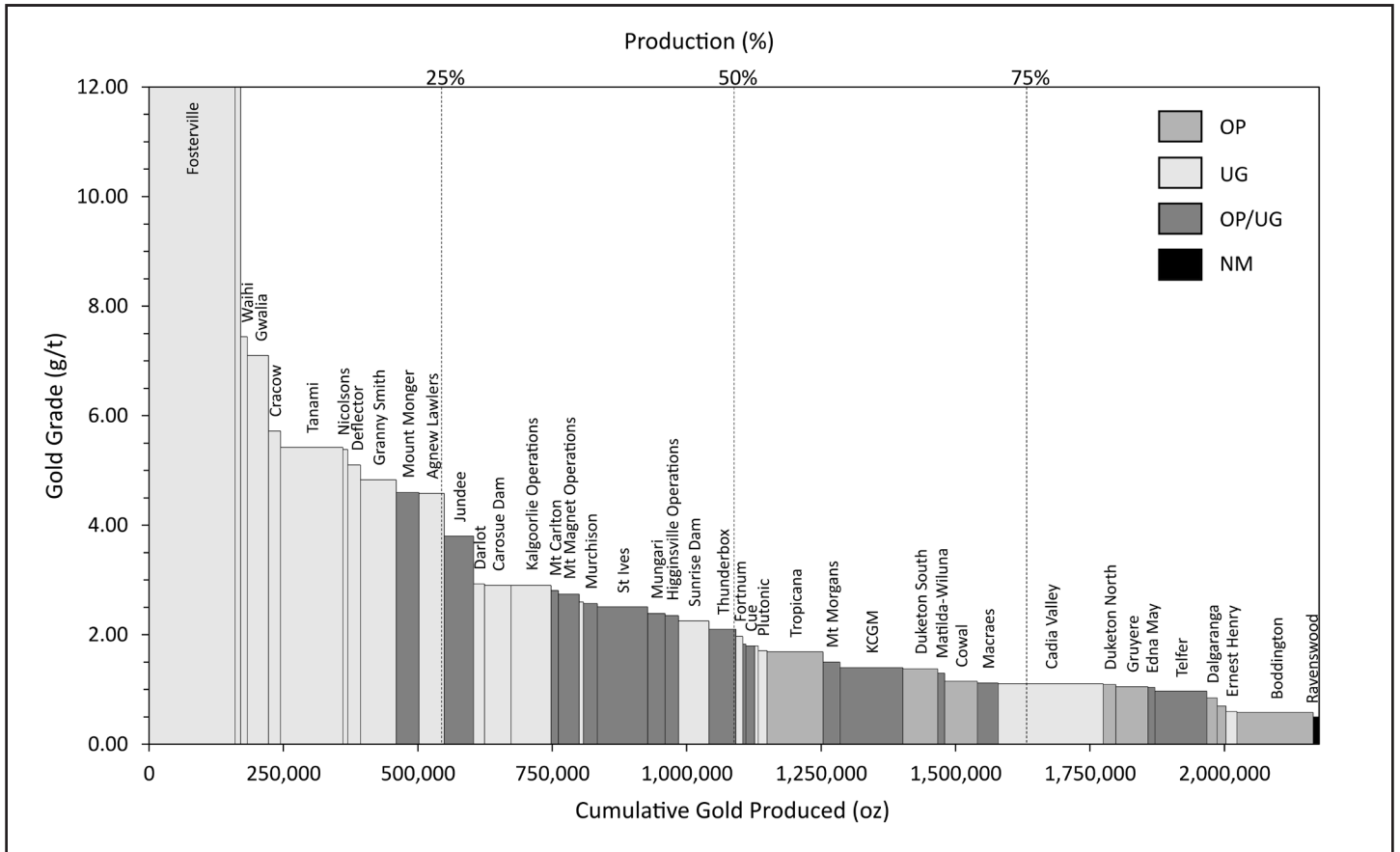
AISC Rank	Operation	Company	Mine Type	AISC (A\$/oz)	Grade (g/t)	Grade Rank	Au Produced (oz)
1	Ernest Henry	Evolution Mining Limited	UG	-188	0.60	44	20,261
2	Cadia Valley	Newcrest Mining Limited	UG	208	1.11	37	195,181
3	Fosterville	Kirkland Lake Gold Limited	UG	475	42.40	1	159,864
4	Waihi	OceanaGold Corporation	UG	571	7.44	3	12,171
5	Thunderbox	Saracen Mineral Holdings Limited	OP/UG	682	2.10	24	50,091
6	Cowal	Evolution Mining Limited	OP	1,031	1.15	35	60,554
7	Mungari	Evolution Mining Limited	OP/UG	1,099	2.39	21	32,721
8=	Tanami	Newmont Mining Corporation	UG	1,106	5.42	6	116,000
8=	Duketon South	Regis Resources Limited	OP	1,106	1.38	33	64,480
10	Mt Magnet Operations	Ramelius Resources Limited	OP/UG	1,114	2.74	17	38,981
11	Cracow	Evolution Mining Limited	UG	1,150	5.72	5	22,227
12	Granny Smith	Gold Fields Limited	UG	1,157	4.83	9	66,600
13	Gruyere	JV Gold Fields/Gold Road Resources	OP	1,158	1.05	39	59,595
14	Dalgaranga	Gascoyne Resources Limited	OP	1,217	0.85	42	18,841
15	Deflector	Silver Lake Resources Limited	UG	1,232	5.10	8	23,577
16	Costerfield	Mandalay Resources Limited	UG	1,297	12.61	2	10,620
17	Carosue Dam	Saracen Mineral Holdings Limited	UG	1,308	2.90	14=	49,478
18	St Ives	Gold Fields Limited	OP/UG	1,339	2.51	20	93,100
19	Tomingley	Alkane Resources Limited	OP/UG	1,346	1.83	26	5,723
20	Duketon North	Regis Resources Limited	OP	1,350	1.09	38	23,820
21	Mt Rawdon	Evolution Mining Limited	OP	1,357	0.70	43	16,434
22	Jundee	Northern Star Resources Limited	OP/UG	1,389	3.80	12	54,568
23	Mt Carlton	Evolution Mining Limited	OP/UG	1,417	2.81	16	13,306
24	Tropicana	JV AngloGold Asahnti/IGO Limited	OP	1,426	1.69	30	103,858
25	Kalgoorlie (KCGM)	JV Northern Star/Saracen	OP/UG	1,434	1.40	32	117,127
26	Mount Monger	Silver Lake Resources Limited	OP/UG	1,463	4.60	10	41,971
27	Murchison	Westgold Resources Limited	OP/UG	1,500	2.57	19	26,066
28	Cue	Westgold Resources Limited	OP/UG	1,501	1.80	27=	16,444
29	Gwalia	St Barbara Limited	UG	1,556	7.10	4	39,684
30	Agnew Lawlers	Gold Fields Limited	UG	1,574	4.58	11	47,400
31	Fortnum	Westgold Resources Limited	UG	1,609	1.97	25	12,724
32	Edna May	Ramelius Resources Limited	OP/UG	1,618	1.04	40	12,844
33	Kalgoorlie Ops	Northern Star Resources Limited	UG	1,619	2.90	14=	74,598
34=	Boddington	Newmont Mining Corporation	OP	1,662	0.58	45	142,000
34=	Hera	Aurelia Metals Limited	UG	1,662	2.60	18	7,688
36	Higginsville Operatipns	Royal Nickel Corporation	OP/UG	1,672	2.35	22	24,816
37	Telfer	Newcrest Mining Limited	OP/UG	1,757	0.97	41	96,903
38	Mt Morgans	Dacian Gold Limited	OP/UG	1,810	1.50	31	31,695
39	Macraes	OceanaGold Corporation	OP/UG	1,850	1.12	36	39,163
40	Nicolsons	Pantoro Limited	UG	1,872	5.38	7	9,085
41	Darlot	Red 5 Limited	UG	1,926	2.93	13	20,077
42	Sunrise Dam	AngloGold Ashanti Limited	UG	2,029	2.25	23	57,000
43	Plutonic	Superior Gold Inc	UG	2,151	1.71	29	16,351
44	Matilda-Wiluna	Blackham Resources Limited	OP/UG	2,287	1.30	34	12,950
45	Ravenswood	Resolute Mining Limited	NM	2,334	0.50	46	11,046
46	Peak	Aurelia Metals Limited	UG	4,339	1.80	27=	6,616

Notes: Operations are shown on a 100% basis, except Northern Star's Kalgoorlie Operatipns. 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 ¹	UG	4.10	7,658
2	Kundana EKJV	Tribune Resources Limited/Rand Mining Limited	UG	NA	7,045
3	Jaurdi	Beacon Minerals Limited	OP	1.97	6,905
4	Comet Vale	Orminex Limited ²	UG	3.05	1,120
5	Morning Star	AuStar Gold Limited	UG	NA	651
NR	Pajingo	Minjar Gold Pty Ltd ³	UG	NA	NA
NR	Marvel Loch	Minjar Gold Pty Ltd ³	OP/UG	NA	NA
NR	Paddington	Zijin Mining Group Company Limited ³	OP/UG	NA	NA

1. Comet Vale is a joint venture between Orminex Limited (51%) and Sand Queen Gold Mines Pty Ltd (49%).

2. These companies usually report AISC but had not at the time of compiling this report.

3. 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	49,049
2	Olympic Dam	BHP Group Limited	UG	33,235
3	Ernest Henry	Evolution Mining Limited	UG	20,261
4	DeGrussa	Sandfire Resources Limited	UG	9,352
5	North Parkes	JV China Molybdenum Co Ltd/Sumitomo Australia Pty Ltd ¹	UG	6,915
6	Carrapateena	OZ Minerals Limited	UG	5,041
7	Rosebery	MMG Limited	UG	1,816
8	Kanmantoo	Hillgrove Resources Limited	NM	776
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	1,447	8.2%	3.63	-1.5%
Average (Weighted) ²	1,240	10.7%	1.63	0.3%
Minimum	-188	64.3%	0.50	-18.0%
First Quartile ³	1,106	17.8%	1.11	-6.7%
Median ³	1,339	16.4%	2.10	-0.9%
Third Quartile ³	1,619	9.2%	4.58	-2.3%
Maximum	4,339	40.9%	42.40	-14.0%

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	195,181	1	Cadia Valley	208
2	Fosterville	159,864	2	Fosterville	475
3	Boddington	142,000	3	Tanami	1,106
4	Tanami	116,000	4	Granny Smith	1,157
5	Tropicana ¹	103,858	5	Gruyere (50% Gold Fields Limited) ²	1,180

1. Tropicana is a Joint Venture between AngloGold Ashanti Limited (70%) and IGO Limited (30%).

2. 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) ¹	117,127	1	Ernest Henry	-188
2	Kalgoorlie Operations ²	74,598	2	Waihi	571
3	Duketon South	64,480	3	Thunderbox	682
4	Cowal	60,554	4	Cowal	1,031
5	Jundee	54,568	5	Mungari	1,099

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	Mt Morgans	31,695	1	Gruyere (50% Gold Road Resources Limited) ¹	1,135
2	Gruyere (50% Gold Road Resources Limited) ¹	29,798	2	Dalgaranga	1,217
3	Higginsville Operations	24,816	3	Costerfield	1,297
4	Darlot	20,077	4	Tomingley	1,346
5	Dalgaranga	18,841	5	Hera	1,662

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	159,864	1	Fosterville	475
2	Kalgoorlie (KCGM) ¹	117,127	2	Waihi	571
3	Tanami	116,000	3	Thunderbox	682
4	Tropicana ²	103,858	4	Cowal	1,031
5	St Ives	93,100	5	Mungari	1,099

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 (0.6584) 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 gold mines, linking geology to mine economics."

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