

Australian & New Zealand Gold Operations

December Quarter 2019 - Final Report

Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,338/oz, which is up 0.2% (A\$3/oz) on the previous quarter average AISC of A\$1,335/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-526/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$208/oz, then by Kirkland Lakes' Fosterville mine (A\$378/oz). The average gold spot price for the quarter was A\$2,168/oz (US\$1,482/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\$791/oz and Cadia Valley Co-AISC of A\$755/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$378/oz, then Saracen's Thunderbox mine (A\$754/oz) and Evolution's Cowal mine (A\$898/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 239,722 oz for the quarter, followed by Newmont's Boddington (196,000 oz) then Kirkland Lake's Fosterville operation (191,894 oz). Of the mines where gold is a by-product, BHP's Olympic Dam produced the most gold 35,382 oz followed by OZ Minerals' Prominent Hill with 35,102 oz and Evolution's part of Ernest Henry with 23,080 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.69 g/t (Open Pit (OP) - 1.26 g/t, Underground (UG) - 5.95 g/t, Open Pit & Underground (OP/UG) - 2.44 g/t) which was up on the previous quarter, 3.59 g/t (2.7%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 49.30 g/t, followed by St Barbara's Gwalia mine 7.30 g/t. The lowest grade mine was Evolution's Ernest Henry processing an average head grade of 0.61 g/t. The high-grade operations that do not report an AISC were Mandalay Resources' Costerfield mine with 6.80 g/t and LionGold Corp's Ballarat mine with 4.50 g/t.

Top 10 Gold Producing Operations

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Cadia Valley	Newcrest Mining Limited	UG	239,722
2	Boddington	Newmont Mining Corporation	OP	196,000
3	Fosterville	Kirkland Lake Gold Limited	UG	191,894
4	Tanami	Newmont Mining Corporation	UG	139,000
5	Tropicana	JV AngloGold Ashanti Limited/IGO Limited	OP	133,932
6	Kalgoorlie	JV Newmont Corporation/Barrick Gold Limited/Saracen Mineral Holdings Limited ¹	OP/UG	115,000
7	St Ives	Gold Fields Limited	OP/UG	107,800
8	Telfer	Newcrest Mining Limited	OP/UG	103,155
9	Kalgoorlie Operations	Northern Star Resources Limited	UG	86,356
10	Jundee	Northern Star Resources Limited	OP/UG	80,069

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

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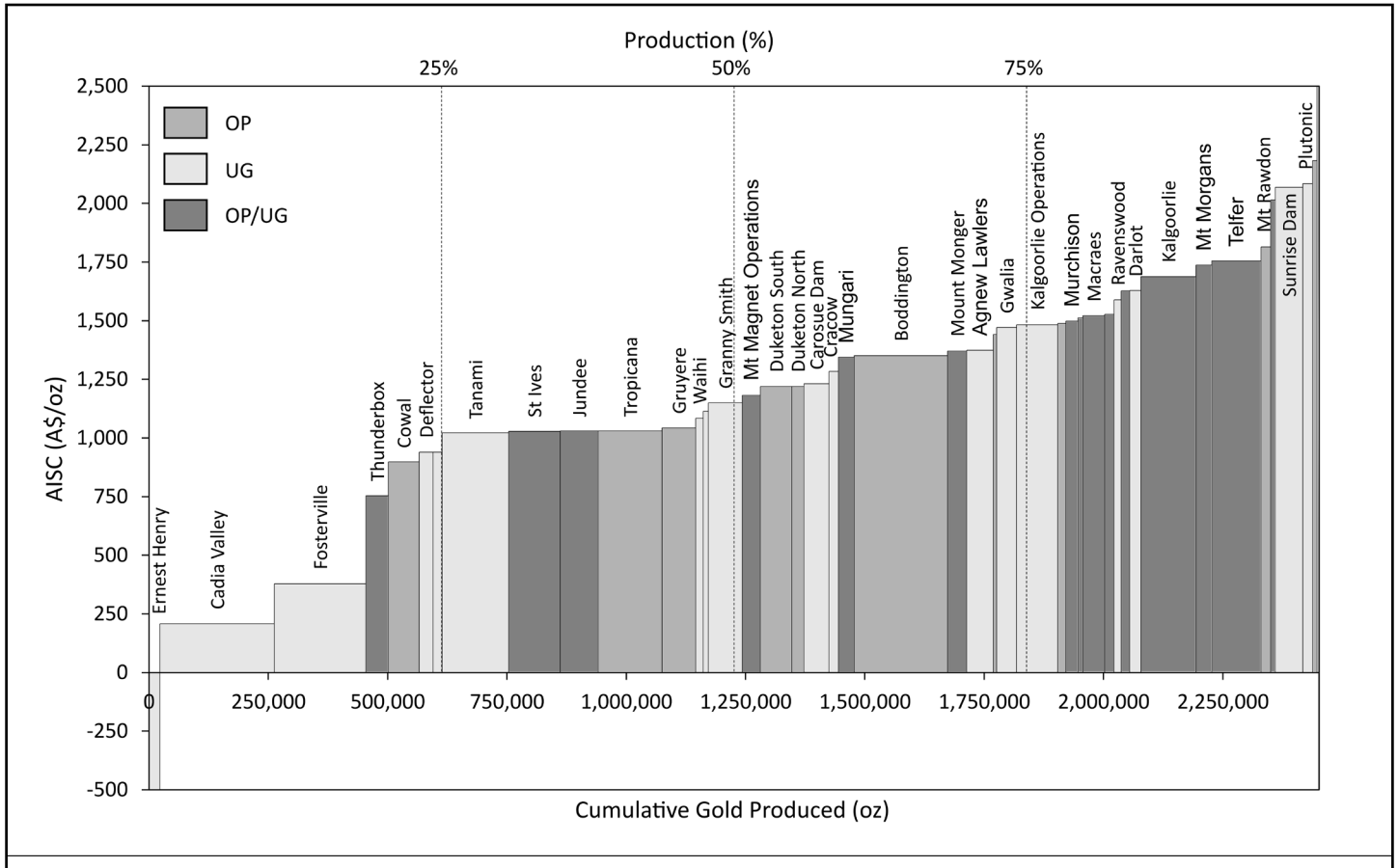
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Gold Operations That Report AISC

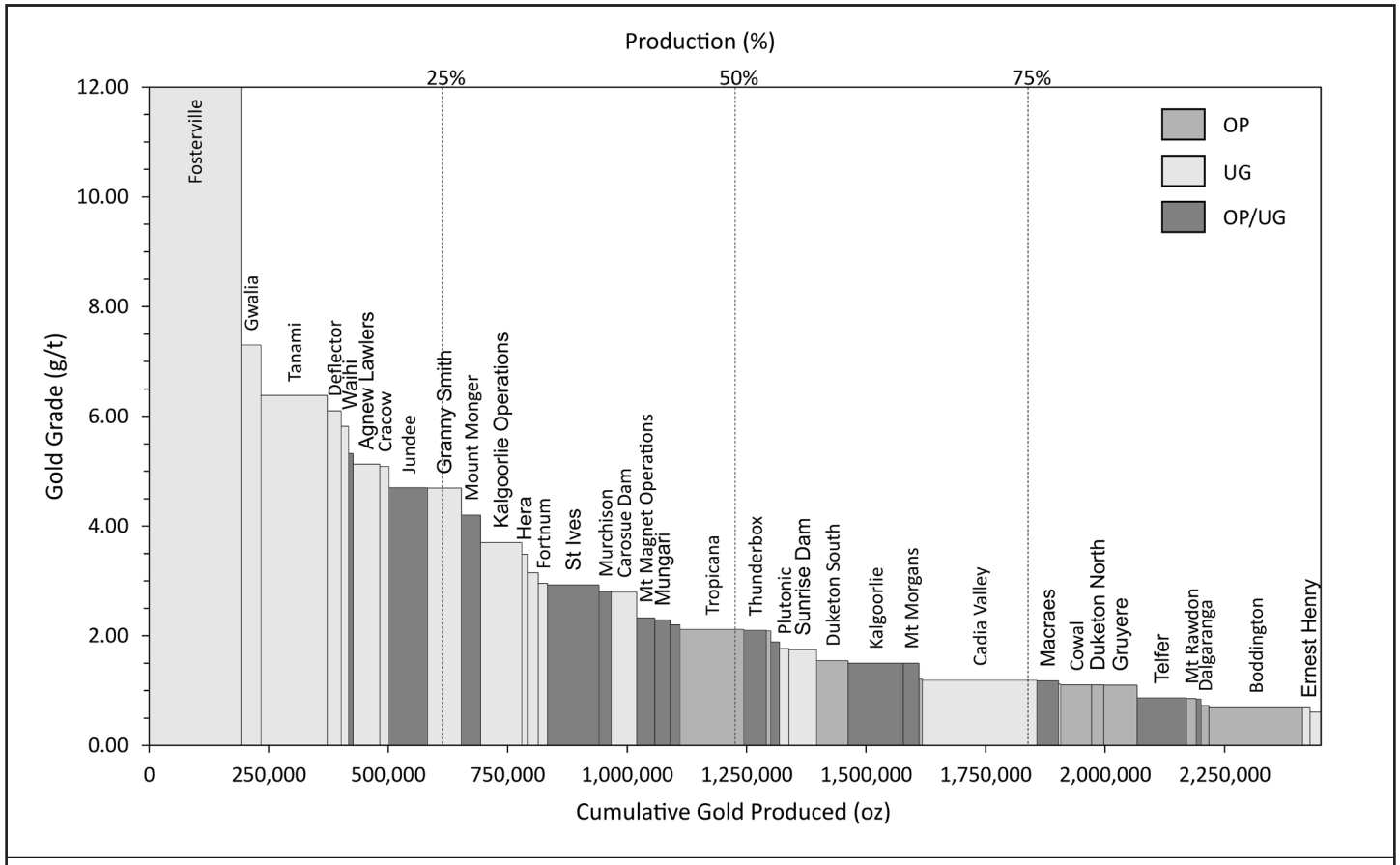
AISC Rank	Operation	Company	Mine Type	AISC (A\$/oz)	Grade (g/t)	Grade Rank	Au Produced (oz)
1	Ernest Henry	Evolution Mining Limited	UG	-526	0.61	44	23,080
2	Cadia Valley	Newcrest Mining Limited	UG	208	1.19	32	239,722
3	Fosterville	Kirkland Lake Gold Limited	UG	378	49.30	1	191,894
4	Thunderbox	Saracen Mineral Holdings Limited	OP/UG	754	2.10	23	46,594
5	Cowal	Evolution Mining Limited	OP	898	1.11	35=	65,080
6=	Deflector	Silver Lake Resources Limited	UG	939	6.10	4	28,665
6=	Fortnum	Westgold Resources Limited	UG	939	2.96	15	19,465
8	Tanami	Newmont Corporation	UG	1,022	6.38	3	139,000
9	St Ives	Gold Fields Limited	OP/UG	1,028	2.93	16	107,800
10=	Jundee	Northern Star Resources Limited	OP/UG	1,030	4.70	9	80,069
10=	Tropicana	JV AngloGold/IGO	OP	1,030	2.12	22	133,932
12	Gruyere	JV Gold Fields/Gold Road	OP	1,043	1.10	37	70,023
13	Waihi	OceanaGold Corporation	UG	1,084	5.82	5	15,778
14	Hera	Aurelia Metals Limited	UG	1,113	3.49	13	11,068
15	Granny Smith	Gold Fields Limited	UG	1,150	4.69	10	71,100
16	Mt Magnet Ops	Ramelius Resources Limited	OP/UG	1,182	2.33	19	37,956
17=	Duketon South	Regis Resources Limited	OP	1,219	1.55	28	65,971
17=	Duketon North	Regis Resources Limited	OP	1,219	1.11	35=	24,877
19	Carosue Dam	Saracen Mineral Holdings Limited	UG	1,231	2.80	18	52,899
20	Cracow	Evolution Mining Limited	UG	1,284	5.09	8	19,854
21	Mungari	Evolution Mining Limited	OP/UG	1,344	2.29	20	32,751
22	Boddington	Newmont Corporation	OP	1,351	0.69	42=	196,000
23	Mount Monger	Silver Lake Resources Limited	OP/UG	1,371	4.20	11	39,854
24	Agnew Lawlers	Gold Fields Limited	UG	1,374	5.13	7	55,700
25	Tomingley	Alkane Resources Limited	OP	1,441	1.21	31	6,929
26	Gwalia	St Barbara Limited	UG	1,471	7.30	2	42,022
27	Kalgoorlie Ops	Northern Star Resources Limited	UG	1,483	3.70	12	86,356
28	Dalgaranga	Gascoyne Resources Limited	OP	1,488	0.73	41	16,781
29	Murchison	Westgold Resources Limited	OP/UG	1,498	2.81	17	25,433
30	Edna May	Ramelius Resources Limited	OP/UG	1,512	0.85	40	9,946
31	Macraes Ops	OceanaGold Corporation	OP/UG	1,521	1.18	33	45,505
32	Matilda-Wiluna	Blackham Resources Limited	OP/UG	1,527	2.20	21	20,003
33	Ravenswood	Resolute Mining Limited	UG	1,589	0.69	42=	15,351
34	Cue	Westgold Resources Limited	OP/UG	1,627	1.89	25	17,757
35	Darlot	Red 5 Limited	UG	1,628	3.15	14	23,346
36	Kalgoorlie	JV Newmont/Barrick/Saracen	OP/UG	1,688	1.50	29=	115,000
37	Mt Morgans	Dacian Gold Limited	OP/UG	1,737	1.50	29=	33,235
38	Telfer	Newcrest Mining Limited	OP/UG	1,755	0.87	38	103,155
39	Mt Rawdon	Evolution Mining Limited	OP	1,815	0.86	39	20,338
40	Nicolsons	Pantoro Limited	OP/UG	2,014	5.32	6	9,403
41	Sunrise Dam	AngloGold Ashanti Limited	UG	2,069	1.75	27	58,000
42	Plutonic	Superior Gold Inc	UG	2,084	1.77	26	20,084
43	Mt Carlton	Evolution Mining Limited	OP	2,182	2.09	24	9,787
44	Peak	Aurelia Metals Limited	UG	3,079	1.12	34	4,206

Notes: Operations are shown on a 100% basis, except Northern Star's Kalgoorlie Operations. Ballarat, Beta Hunt and Higginsville 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	23,493
2	Ballarat	LionGold Corp Ltd	UG	4.50	8,016
3	Trouser Legs	JV Hawthorn Resources/Gel Resources ¹	OP	3.24	5,903
4	Costerfield	Mandalay Resources Limited	UG	6.80	4,749
5	Comet Vale	Orminex Limited ²	UG	3.79	4,100
6	Widgiemooltha	Mincor Resources NL	NM	1.50	2,861
7	Morning Star	AuStar Gold Limited	UG	NA	836
NR	Higginsville	Royal Nickel Corporation (RNC Minerals) ³	OP	NA	NA
NR	Beta Hunt	Royal Nickel Corporation (RNC Minerals) ³	UG	NA	NA
NR	Pajingo	Minjar Gold Pty Ltd ⁴	UG	NA	NA
NR	Marvel Loch	Minjar Gold Pty Ltd ⁴	OPUG	NA	NA
NR	Paddington	Zijin Mining Group Company Limited ⁴	OPUG	NA	NA

1. Trousers Legs is a joint venture between Hawthorn Resources Limited (75%) and Gel Resources Pty Ltd (25%)

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

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

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	Olympic Dam	BHP Billiton Limited	UG	35,382
2	Prominent Hill	OZ Minerals Limited	UG	35,102
3	Ernest Henry	Evolution Mining Limited	UG	23,080
4	DeGrussa	Sandfire Resources Limited	UG	10,723
5	Rosebery	MMG Limited	UG	2,916
6	Kanmantoo	Hillgrove Resources Limited	NM	1,032
NR	North Parkes	JV China Moly/Sumitomo ¹	UG	NA
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	1,338	0.2%	3.69	2.7%
Average (Weighted) ²	1,120	-8.0%	1.63	0.7%
Minimum	-526	-27.1%	0.61	10.9%
First Quartile ³	939	-6.3%	1.19	3.5%
Median ³	1,150	-2.8%	2.12	11.6%
Third Quartile ³	1,483	11.4%	4.69	0.4%
Maximum	3,079	24.3%	49.30	17.9%

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	239,722	1	Cadia Valley	208
2	Boddington	196,000	2	Tanami	1,022
3	Tanami	139,000	3	St Ives	1,028
4	St Ives	107,800	4	Tropicana ¹	1,030
5	Telfer	103,155	5	Gruyere ²	1,043

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

2. Gruyere is a Joint Venture between Gold Fields Limited (50%) and Gold Road Resources Limited (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	191,894	1	Ernest Henry	-526
2	Kalgoorlie Operations ¹	86,356	2	Fosterville	378
3	Jundee	80,069	3	Thunderbox	754
4	Duketon South	65,971	4	Cowal	898
5	Cowal	65,080	5	Deflector	939

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 Magnet Ops	37,956	1	Gruyere ¹	1,102
2	Gruyere ¹	35,012	2	Hera	1,531
3	Mt Morgans	33,235	3	Mt Magnet Operations	1,182
4	Kundana EKJV ²	23,493	4	Tomingley	1,441
5	Darlot	23,346	5	Dalgaranga	1,488

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

2. 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	Fosterville	191,894	1	Fosterville	378
2	Tanami	139,000	2	Thunderbox	754
3	Tropicana ¹	133,932	3	Cowal	898
4	Kalgoorlie ²	115,000	4	Fortnum	939
5	St Ives	107,800	5	Tanami	1,022

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

2. Kalgoorlie is a joint venture between Newmont Corporation (50%) and Barrick Gold Corporation (50%)/Saracen Mineral Holdings Limited (50%) During the quarter Barrick sold its interest to Saracen.

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 (0.6833) 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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