

Australian & New Zealand Gold Operations

June Quarter 2019 - Final Report

Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,275/oz, which is up 1.6% (A\$20/oz) on the previous quarter average AISC of A\$1,255/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-644/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$174/oz, then by Kirkland Lakes' Fosterville mine (A\$454/oz). The average gold spot price for the quarter was A\$1,871/oz (US\$1,309/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\$539/oz and Cadia Valley Co-AISC of A\$750/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$454/oz, then Alkane Resources' Tomingley mine (A\$807/oz) and Saracen's Thunderbox mine (A\$897/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 240,903 oz for the quarter, followed by Newmont's Boddington (185,000 oz) then Kirkland Lake's Fosterville operation (140,701 oz). Of the mines where gold is a by-product, BHP's Olympic Dam produced the most gold 37,032 oz followed by Evolution's part of Ernest Henry with 25,820 oz and Oz Minerals' Prominent Hill 25,810 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.58 g/t (Open Pit (OP) - 1.67 g/t, Underground (UG) - 5.77 g/t, Open Pit & Underground (OP/UG) - 2.27 g/t) which was up on the previous quarter, 3.47 g/t (3.2%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 39.90 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 0.60 g/t. The high-grade operations that do not report an AISC were LionGold Corp's Ballarat mine with 4.90 g/t and Mandalay Resources' Costerfield mine with 4.00 g/t.

Top 10 Gold Producing Operations

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Cadia Valley	Newcrest Mining Limited	UG	240,903
2	Boddington	Newmont Mining Corporation	OP	185,000
3	Fosterville	Kirkland Lake Gold Limited	UG	140,701
4	Tropicana	JV AngloGold Ashanti Limited/Independence Group NL	OP	132,945
5	Telfer	Newcrest Mining Limited	OP/UG	116,321
6	Tanami	Newmont Mining Corporation	UG	116,000
7	Kalgoorlie	JV Newmont Goldcorp Corporation/Barrick Gold Corporation	OP/UG	115,000
8	Kalgoorlie Operations	Northern Star Resources Limited	UG	95,787
9	Jundee	Northern Star Resources Limited	OP/UG	84,647
10	St Ives	Gold Fields Limited	OP/UG	84,600

Supported By



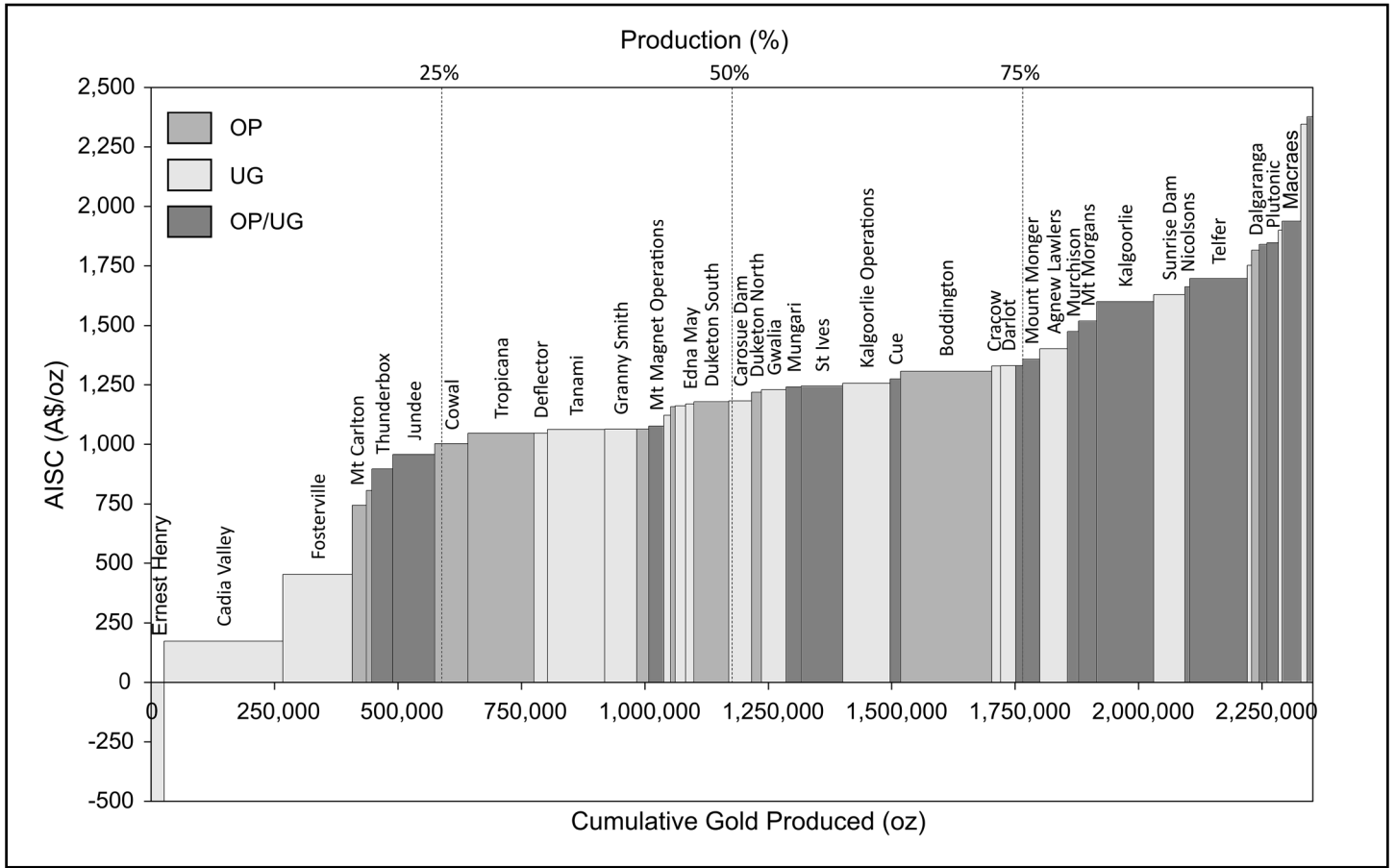
Capital Group

Gold Operations That Report AISC

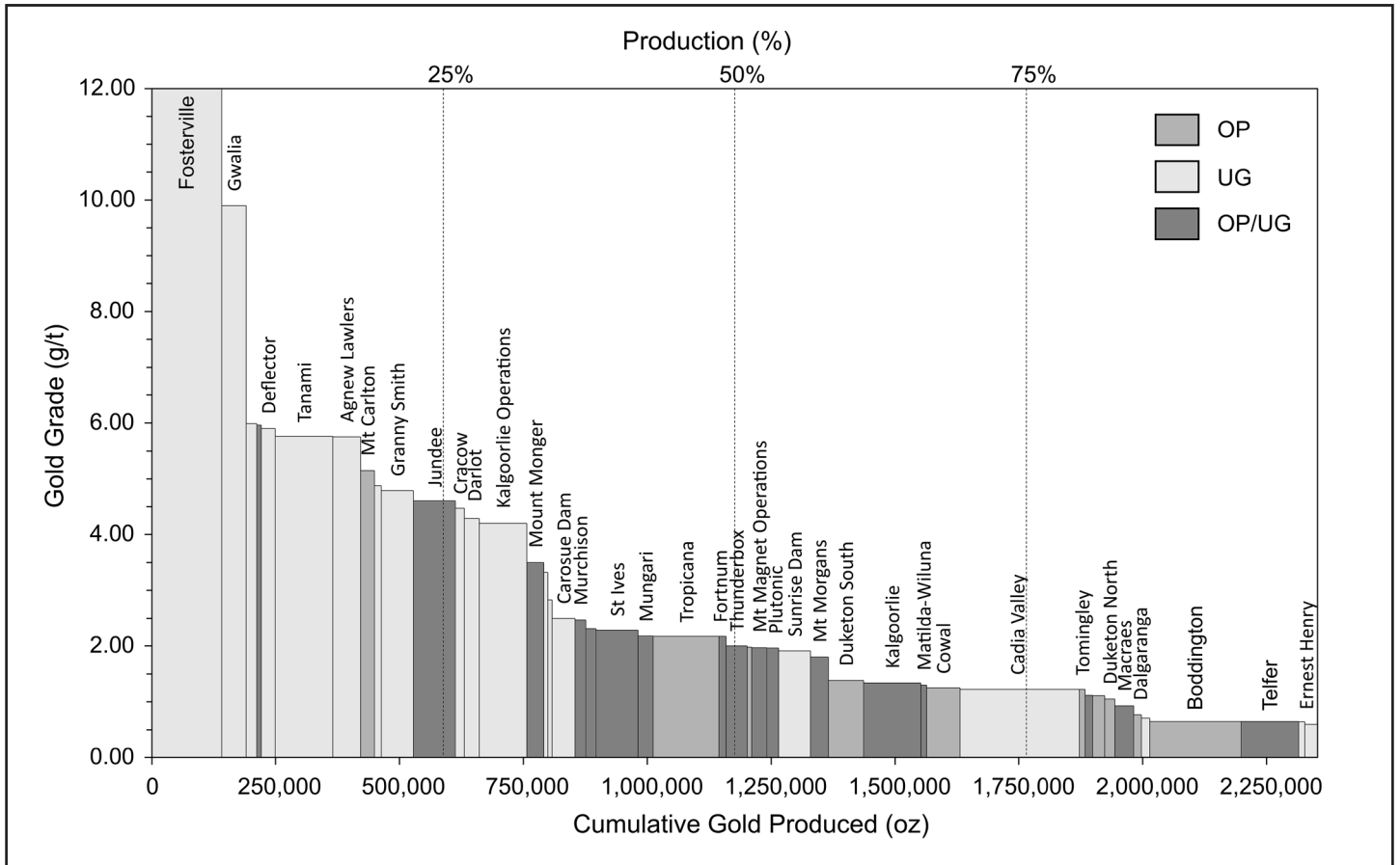
AISC Rank	Operation	Company	Mine Type	AISC (A\$/oz)	Grade (g/t)	Grade Rank	Au Produced (oz)
1	Ernest Henry	Evolution Mining Limited	UG	-644	0.60	46	25,820
2	Cadia Valley	Newcrest Mining Limited	UG	174	1.22	35=	240,903
3	Fosterville	Kirkland Lake Gold Limited	UG	454	39.90	1	140,701
4	Mt Carlton	Evolution Mining Limited	OP	744	5.15	8	28,232
5	Tomingley	Alkane Resources Limited	OP	807	1.22	35=	11,555
6	Thunderbox	Saracen Mineral Holdings Limited	OP/UG	897	2.00	25	42,251
7	Jundee	Northern Star Resources Limited	OP/UG	957	4.60	11	84,647
8	Cowal	Evolution Mining Limited	OP	1,002	1.25	34	67,878
9=	Tropicana	JV AngloGold/Independence	OP	1,048	2.17	23=	132,945
9=	Deflector	Silver Lake Resources Limited	UG	1,048	5.90	5	27,514
11	Tanami	Newmont Mining Corporation	UG	1,063	5.76	6	116,000
12=	Granny Smith	Gold Fields Limited	UG	1,065	4.79	10	64,700
12=	Mt Rawdon	Evolution Mining Limited	OP	1,065	1.11	38	24,404
14	Mt Magnet Operations	Ramelius Resources Limited	OP/UG	1,078	1.97	27	30,370
15	Hera	Aurelia Metals Limited	UG	1,122	4.88	9	13,864
16	Higginsville	Westgold Resources Limited	OP	1,159	1.98	26	9,583
17	Waihi	OceanaGold Corporation	UG	1,163	5.99	3	21,169
18	Edna May	Ramelius Resources Limited	UG	1,171	0.71	42	16,672
19	Duketon South	Regis Resources Limited	OP	1,180	1.38	31	70,753
20	Carosue Dam	Saracen Mineral Holdings Limited	UG	1,183	2.50	18	45,845
21	Duketon North	Regis Resources Limited	OP	1,220	1.05	39	20,213
22	Gwalia	St Barbara Limited	UG	1,230	9.90	2	49,966
23	Mungari	Evolution Mining Limited	OP/UG	1,242	2.18	22	30,457
24	St Ives	Gold Fields Limited	OP/UG	1,245	2.28	21	84,600
25	Kalgoorlie Operations	Northern Star Resources Limited	UG	1,257	4.20	14	95,787
26	Cue	Westgold Resources Limited	OP/UG	1,275	2.31	20	20,914
27	Boddington	Newmont Mining Corporation	OP	1,307	0.65	43=	185,000
28	Cracow	Evolution Mining Limited	UG	1,329	4.47	12	18,095
29=	Darlot	Red 5 Limited	UG	1,331	4.29	13	30,098
29=	Fortnum	Westgold Resources Limited	OP/UG	1,331	2.17	23=	14,222
31	Mount Monger	Silver Lake Resources Limited	OP/UG	1,358	3.50	15	34,629
32	Agnew Lawlers	Gold Fields Limited	UG	1,402	5.75	7	56,400
33	Murchison	Westgold Resources Limited	OP/UG	1,474	2.47	19	22,233
34	Mt Morgans	Dacian Gold Limited	OP/UG	1,519	1.80	30	36,658
35	Kalgoorlie	JV Newmont/Barrick	OP/UG	1,600	1.34	32	115,000
36	Sunrise Dam	AngloGold Ashanti Limited	UG	1,630	1.91	29	64,000
37	Nicolsons	Pantoro Limited	OP/UG	1,662	5.96	4	9,557
38	Telfer	Newcrest Mining Limited	OP/UG	1,697	0.65	43=	116,321
39	Peak	Aurelia Metals Limited	UG	1,752	2.83	17	9,000
40	Dalgaranga	Gascoyne Resources Limited	OP	1,816	0.77	41	15,655
41	Nullagine	Millennium Minerals Limited	OP/UG	1,840	1.12	37	15,180
42	Plutonic	Superior Gold Inc	OP/UG	1,847	1.96	28	23,849
43	Beta Hunt	Royal Nickel Corporation	UG	1,899	3.32	16	7,614
44	Macraes	OceanaGold Corporation	OP/UG	1,937	0.93	40	37,837
45	Ravenswood	Resolute Mining Limited	UG	2,345	0.64	45	12,375
46	Matilda-Wiluna	Blackham Resources Limited	OP/UG	2,376	1.30	33	12,045

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 Resources Limited	UG	NA	34,120
2	Ballarat	LionGold Corp Ltd ¹	UG	4.90	9,186
3	Widgiemooltha	Mincor Resources NL	UG	1.91	4,298
4	Costerfield	Mandalay Resources Limited	UG	4.00	3,301
5	Morning Star	AuStar Gold Limited	UG	NA	1,057
NR	Pajingo	Minjar Gold Pty Ltd ²	UG	NA	NA
NR	Marvel Loch	Minjar Gold Pty Ltd ²	OP/UG	NA	NA
NR	Paddington	Zijin Mining Group Company Limited ²	OP/UG	NA	NA
NR	Comet Vale	JV Orminex Limited/Sand Queen Gold Mines Pty Ltd ³	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%).

Mines Where Gold Is A By-Product

Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Olympic Dam	BHP Billiton Limited	UG	37,032
2	Ernest Henry	Evolution Mining Limited	UG	25,820
3	Prominent Hill	OZ Minerals Limited	UG	25,810
4	DeGrussa	Sandfire Resources NL	UG	11,967
5	Rosebery	MMG Limited	UG	2,166
6	Kanmantoo	Hillgrove Resources Limited	OP	801
NR	Golden Grove	EMR Capital	UG	NA
NR	North Parkes ¹	JV China Molybdenum Co Ltd/Sumitomo Australia Pty Ltd	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	1,275	1.6%	3.58	3.2%
Average (Weighted) ²	1,110	-0.8%	1.54	-7.2%
Minimum	-644	-26.3%	0.60	7.1%
First Quartile ³	1,002	4.3%	1.22	-3.2%
Median ³	1,183	-1.7%	2.00	-2.0%
Third Quartile ³	1,331	-7.8%	4.60	-6.1%
Maximum	2,376	15.5%	39.90	37.6%

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	240,903	1	Cadia Valley	174
2	Boddington	185,000	2	Tropicana ¹	1,048
3	Tropicana ¹	132,945	3	Tanami	1,063
4	Telfer	116,321	4	Granny Smith	1,065
5	Tanami	116,000	5	Tropicana	1,090

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 ¹	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	36,658	1	Tomingley	807
2	Kundana EKJV ¹	34,120	2	Mt Magnet Operations	1,078
3	Mt Magnet Operations	30,370	3	Hera	1,122
4	Darlot	30,098	4	Edna May	1,171
5	Plutonic	23,849	5	Darlot	1,331

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	Fosterville	140,701	1	Fosterville	454
2	Tropicana ¹	132,945	2	Tomingley	807
3	Tanami	116,000	3	Thunderbox	897
4	Kalgoorlie ²	115,000	4	Tropicana ¹	950
5	Kalgoorlie Operations ³	95,787	5	Jundee	957

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%).

3. Kalgoorlie Operations gold produced represents Northern Star Resources Limited's attributable gold production.

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 (0.6999) 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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