

Australian & New Zealand Gold Operations

September Quarter 2020 - Final Report

Overview

The average All-in Sustaining Cost (AISC) for Australia and New Zealand was A\$1,422/oz, which is up 3.2% (A\$45/oz) on the previous quarter average AISC of A\$1,377/oz. Evolution Mining's part of the Ernest Henry operations was the lowest cost producer reporting an AISC of **A\$-515/oz** followed by Newcrest's Cadia Valley operations with an AISC of A\$158/oz, then by Kirkland Lakes' Fosterville mine (A\$488/oz). The average gold spot price for the quarter was A\$2,669/oz (US\$1,909/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\$875/oz and Cadia Valley Co-AISC of A\$921/oz. The lowest cost "gold only" operations were Kirkland Lakes' Fosterville mine with an AISC of A\$488/oz, then Saracen's Thunderbox mine (A\$790/oz) and Newmont's Tanami operation (A\$1,011/oz).

Newcrest's Cadia Valley operation took out top spot as Australia's largest gold producer with 196,504 oz for the quarter, followed by Newmont's Boddington (178,000 oz) then Kirkland Lake's Fosterville operation (161,489 oz). Of the mines where gold is a by-product, OZ Minerals' Prominent Hill produced the most gold 51,629 oz followed by BHP's Olympic Dam with 36,608 oz and Evolution's part of Ernest Henry with 24,569 oz.

Grade wise for the companies that report AISC, the average reported mill head/feed grade was 3.33 g/t (Open Pit (OP) - 0.93 g/t, Underground (UG) - 5.45 g/t, Open Pit & Underground (OP/UG) - 2.04 g/t) which was down on the previous quarter, 3.68 g/t (-9.3%). Kirkland Lake's Fosterville mine again took out the honour as the operation with the highest average feed grade with 30.30 g/t, followed by Mandalay Resources' Costerfield mine 11.54 g/t. The lowest grade mine was Evolution's part of the Ernest Henry mine processing an average head grade of 0.59 g/t. The high-grade operations that do not report an AISC were LionGold Corp's Ballarat mine with 5.10 g/t and Orminex's Comet Vale mine with 5.09 g/t.

Top 10 Gold Producing Operations

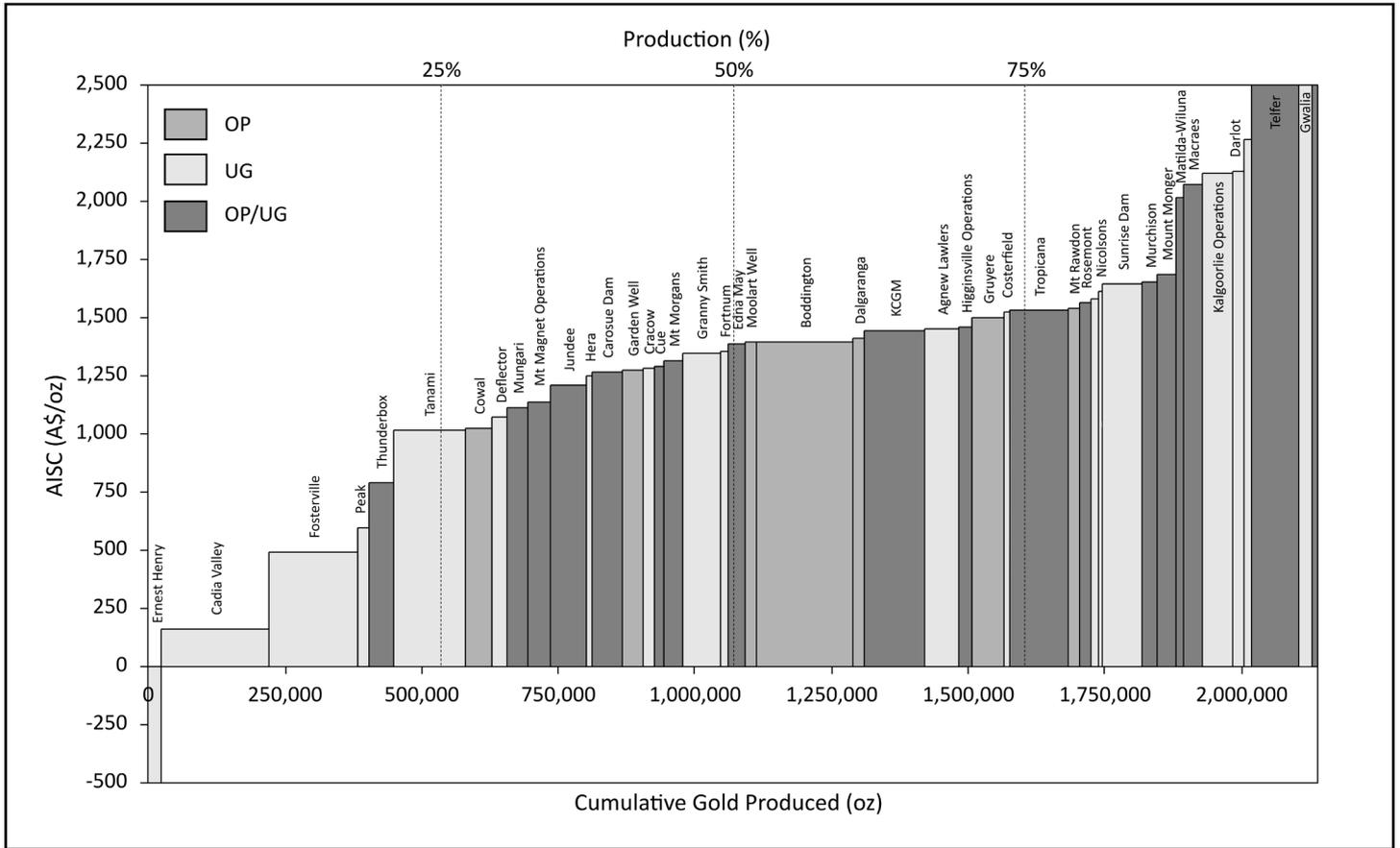
Rank	Operation	Company	Mine Type	Au Produced (oz)
1	Cadia Valley	Newcrest Mining Limited	UG	196,504
2	Boddington	Newmont Corporation	OP	178,000
3	Fosterville	Kirkland Lake Gold Limited	UG	161,489
4	Tanami	Newmont Corporation	UG	131,000
5	Kalgoorlie (KCGM)	JV Northern Star Resources Limited/Saracen Mineral Holdings Limited	OP/UG	110,379
6	Tropicana	JV AngloGold Ashanti Limited/IGO Limited	OP/UG	107,060
7	Telfer	Newcrest Mining Limited	OP/UG	86,452
8	Sunrise Dam	AngloGold Ashanti Limited	UG	74,000
9	Granny Smith	Gold Fields Limited	UG	69,100
10	Jundee	Northern Star Resources Limited	OP/UG	67,896

Gold Operations That Report AISC

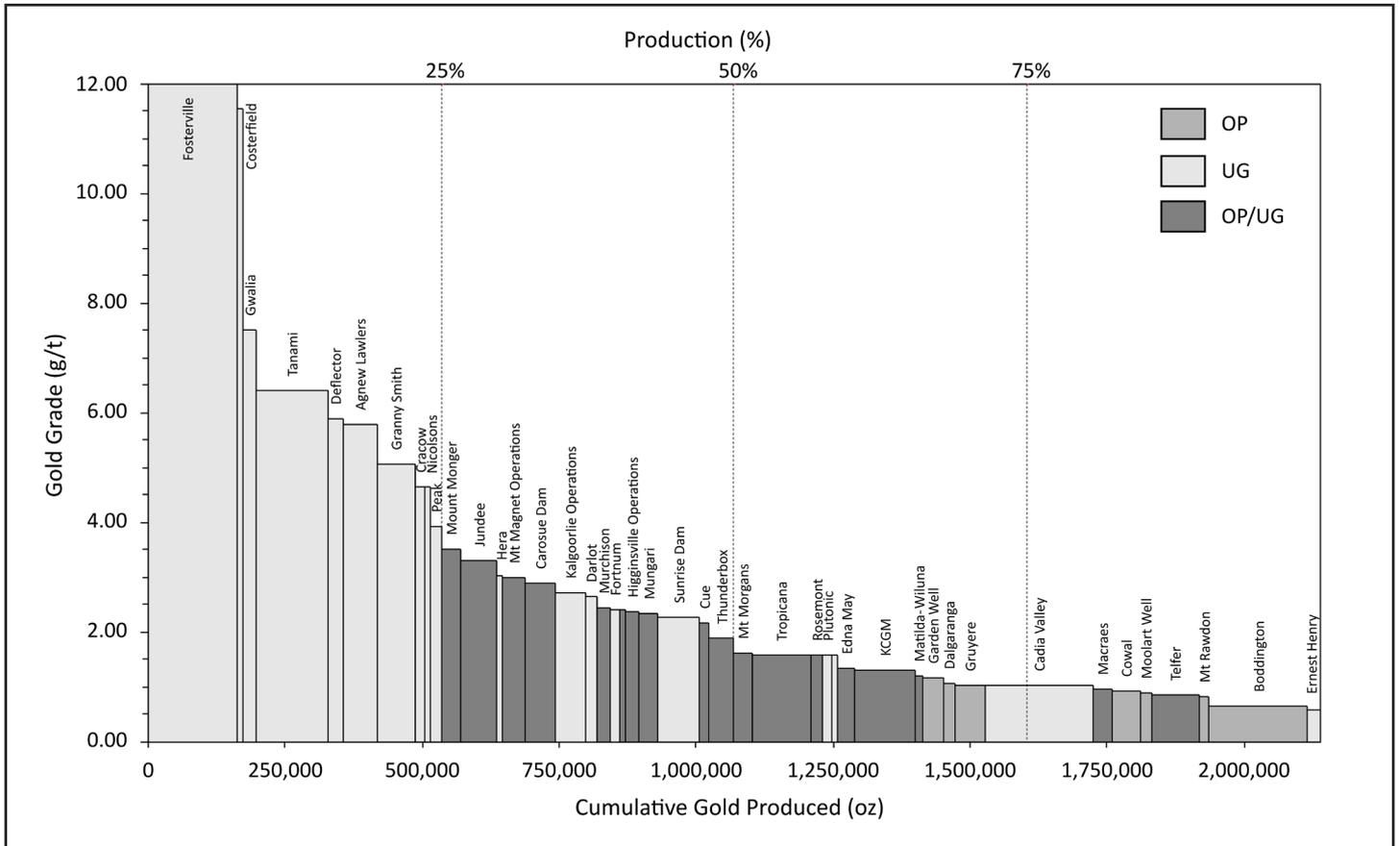
AISC Rank	Operation	Company	Mine Type	AISC (A\$/oz)	Grade (g/t)	Grade Rank	Au Produced (oz)
1	Ernest Henry	Evolution Mining Limited	UG	-515	0.59	44	24,569
2	Cadia Valley	Newcrest Mining Limited	UG	158	1.02	37	196,504
3	Fosterville	Kirkland Lake Gold Limited	UG	488	30.30	1	161,489
4	Peak	Aurelia Metals Limited	UG	594	3.92	10	20,544
5	Thunderbox	Saracen Mineral Holdings Limited	OP/UG	790	1.90	25	44,211
6	Tanami	Newmont Corporation	UG	1,011	6.41	4	131,000
7	Cowal	Evolution Mining Limited	OP	1,026	0.91	39	51,774
8	Deflector	Silver Lake Resources Limited	UG	1,071	5.90	5	27,684
9	Mungari	Evolution Mining Limited	OP/UG	1,115	2.35	22	35,370
10	Mt Magnet Operations	Ramelius Resources Limited	OP/UG	1,138	2.98	14	41,064
11	Jundee	Northern Star Resources Limited	OP/UG	1,209	3.30	12	67,896
12	Hera	Aurelia Metals Limited	UG	1,250	3.03	13	9,450
13	Carosue Dam	Saracen Mineral Holdings Limited	OP/UG	1,262	2.90	15	54,987
14	Garden Well	Regis Resources Limited	OP	1,269	1.15	34	37,963
15	Cracow	Aeris Resources Limited	UG	1,282	4.65	8	20,237
16	Cue	Westgold Resources Limited	OP/UG	1,285	2.15	24	19,412
17	Mt Morgans	Dacian Gold Limited	OP/UG	1,315	1.60	26	32,799
18	Granny Smith	Gold Fields Limited	UG	1,342	5.06	7	69,100
19	Fortnum	Westgold Resources Limited	UG	1,351	2.41	19	15,351
20	Edna May	Ramelius Resources Limited	OP/UG	1,387	1.34	31	30,280
21	Moolart Well	Regis Resources Limited	OP	1,392	0.89	40	20,307
22	Boddington	Newmont Corporation	OP	1,395	0.65	43	178,000
23	Dalgaranga	Gascoyne Resources Limited	OP	1,409	1.06	35	20,540
24	KCGM	JV Northern Star/Saracen	OP/UG	1,442	1.30	32	110,379
25	Agnew Lawlers	Gold Fields Limited	UG	1,448	5.78	6	62,100
26	Higginsville Operations	Karora Resources Inc	OP/UG	1,460	2.36	21	24,717
27	Gruyere	JV Gold Fields/Gold Road Resources	OP	1,497	1.03	36	55,919
28	Costerfield	Mandalay Resources Limited	UG	1,521	11.54	2	11,749
29	Tropicana	JV AngloGold Ashanti/IGO Limited	OP/UG	1,529	1.58	27=	107,060
30	Mt Rawdon	Evolution Mining Limited	OP	1,536	0.83	42	20,024
31	Rosemont	Regis Resources Limited	OP/UG	1,559	1.58	27=	23,296
32	Tomingley	Alkane Resources Limited	UG	1,575	1.56	30	11,499
33	Nicolsons	Pantoro Limited	UG	1,612	4.64	9	8,012
34	Sunrise Dam	AngloGold Ashanti Limited	UG	1,647	2.28	23	74,000
35	Murchison	Westgold Resources Limited	OP/UG	1,652	2.45	18	26,034
36	Mount Monger	Silver Lake Resources Limited	OP/UG	1,682	3.50	11	34,578
37	Matilda-Wiluna	Wiluna Mining Corporation Limited	OP/UG	2,012	1.20	33	13,360
38	Macraes	OceanaGold Corporation	OP/UG	2,074	0.94	38	34,829
39	Kalgoorlie Operations	Northern Star Resources Limited	UG	2,116	2.70	16	54,699
40	Darlot	Red 5 Limited	UG	2,126	2.66	17	20,283
41	Plutonic	Superior Gold Inc	UG	2,261	1.57	29	15,699
42	Telfer	Newcrest Mining Limited	OP/UG	2,513	0.86	41	86,452
43	Gwalia	St Barbara Limited	UG	2,592	7.50	3	22,625
44	Mt Carlton	Evolution Mining Limited	OP/UG	2,674	2.40	20	11,646

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 Mining Limited	UG	NA	18,748
2	Ballarat	LionGold Corp Ltd ¹	UG	5.10	9,507
3	Jaurdi	Beacon Minerals Limited	OP	2.00	7,453
4	Comet Vale	Orminex Limited/Sand Queen Gold Mines Pty Ltd ²	UG	5.09	5,254
5	Mt Boppy	Manuka Resources Limited	OP	2.75	4,102
6	Boorara	Horizon Minerals Limited	OP	1.32	1,050
7	Morning Star	AuStar Gold Limited	UG	NA	547
8	Waihi ³	OceanaGold Corporation	UG	NA	0
NR	Marvel Loch	Minjar Gold Pty Ltd ⁴	OP/UG	NA	NA
NR	Paddington	Zijin Mining Group Company Limited ⁴	OP/UG	NA	NA
NR	Pajingo	Minjar Gold Pty Ltd ⁴	UG	NA	NA
NR	Ravenswood	EMR Capital ⁴	OP/UG	NA	NA

1. These companies usually report AISC but had not at the time of compiling this report.
2. Comet Vale is a joint venture between Orminex Limited (51%) and Sand Queen Gold Mines Pty Ltd (49%).
3. No production was recorded from the Waihi mine due to COVID-19 restrictions
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	51,629
2	Olympic Dam	BHP Billiton Limited	UG	36,608
3	Ernest Henry	Evolution Mining Limited	UG	24,569
4	Carrapateena	OZ Minerals Limited	UG	13,760
5	DeGrussa	Sandfire Resources NL	UG	11,683
6	North Parkes	JV China Molybdenum Co Ltd/Sumitomo Australia Pty Ltd ¹	UG	5,322
7	Rosebery	MMG Limited	UG	2,774
NR	Golden Grove	EMR Capital	UG	
NR	Jaguar	Washington H. Soul Pattinson and Company Limited	UG	

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	1,422	3.2%	3.33	-9.3%
Average (Weighted) ²	1,255	3.1%	1.49	-2.1%
Minimum	-515	16.5%	0.59	-1.7%
First Quartile ³	1,011	7.4%	1.02	-6.4%
Median ³	1,387	2.5%	1.60	-8.6%
Third Quartile ³	1,529	-3.7%	3.50	-18.6%
Maximum	2,674	-15.2%	30.30	-23.3%

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	196,504	1	Cadia Valley	158
2	Boddington	178,000	2	Fosterville	488
3	Fosterville	161,489	3	Tanami	1,011
4	Tanami	131,000	4	Granny Smith	1,342
5	Telfer	86,452	5	Boddington	1,395

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	107,997	1	Ernest Henry	-515
2	Jundee	73,743	2	Thunderbox	790
3	Carosue Dam	53,220	3	Cowal	1,026
4	Kalgoorlie Operations ²	48,824	4	Deflector	1,071
5	Cowal	49,929	5	Mungari	1,115

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	32,799	1	Peak	594
2	Gruyere (50% Gold Road Resources Limited) ¹	27,960	2	Hera	1,250
3	Higginsville Operations	24,717	3	Cracow	1,282
4	Peak	20,544	4	Mt Morgans	1,315
5	Dalgaranga	20,540	5	Dalgaranga	1,409

1. Gruyere gold produced 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	161,489	1	Fosterville	488
2	Tanami	131,000	2	Thunderbox	790
3	Kalgoorlie (KCGM) ¹	110,379	3	Tanami	1,011
4	Tropicana ²	107,060	4	Cowal	1,026
5	Sunrise Dam	74,000	5	Mungari	1,115

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 (0.7152) 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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