

October 2019 – Initiation

**24 Month Price Target: A\$1.00**  
(50% of appraised value)

## CAPITAL STRUCTURE

Share Price	\$0.39
12 Month Range	\$0.295- \$0.545
Market Cap (diluted)	A\$198m
Issued Shares	508m
Various options	33.7m

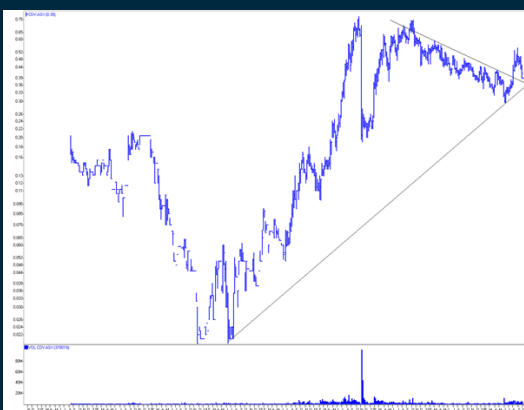
## DIRECTORS

Archie Koimtsidis	CEO/Managing Director
Kevin Tomlinson	Non-Executive Chairman
Malik Essah	Executive Director
Dr.Kenneth Thomas	Non- Executive Director
Michele Muscillo	Non-Executive Director
Trevor Schultz	Non-Executive Director

## TOP SHAREHOLDERS

HSBC Custody Nominees	27.87%
Corporate international Holdings BV	16.4%
Canadian Register Control	9.50%
Citicorp Nominees Pty Ltd	9.03%

## SHARE PRICE CHART



Stock has broken out and is retesting  
downtrend

This report has been written by:  
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BSc F AusIMM(CP) MSAFAA

# Cardinal Resources Ltd (CDV.ASX/TSX)

## Large New Low Cost Gold Mine in the Birimian

CDV's 7moz **Namdini** Ghanaian gold resource is the largest gold discovery in the Birimian Gold Province West Africa this century. Project BFS due shortly for 2022 mine startup. NPV<sub>6</sub> >US\$810m at gold prices above US\$1400.

## KEY POINTS

- **Namdini** Probable Ore Reserves of 5.82 Moz @ 1.14g/t – 0.5g/t cutoff
- 6.5Moz in Measured and Indicated JORC Resource categories
- 14 year open pit for net 3.77moz with 1.4:1 Life of Mine strip ratio
- Initial gold production of >300kozpa gives >US\$450mpa revenue
- Adoption of Aachen™ Process likely to improve unit gold costs
- BFS due for completion and FID expected in December Qtr 2019
- Recent comparable financing offers were for up to 115% of capex
- Post-Tax NPVs > US\$800m @ US\$1400 and IRRs > 30%
- Construction commencing FY20 with gold production H2 FY22
- Higher grade Starter Pit to give >0.9moz @ 1.31g/t in first 30 mths
- US\$414m construction cost paid back in <18 months
- 16.4% owned by Goldfields Group (up by 5.3% after option exercise)
- Significant rerating of the company now likely

## SUMMARY

Cardinal Resources has a large gold deposit in the north of Ghana, an important 140tpa Birimian gold producer in West Africa in the world's 2nd largest gold province.

The Birimian gold province has a gold endowment of over 10,000 tonnes which ranks it #2 and ahead of the Yilgarn Province in WA. Total gold from the four key Birimian producing countries **Ghana, Mali, Burkina Faso** and **Cote D'Ivoire** is almost as much as Australia which at 330tpa sits below only China.

The bulk of Ghana's gold production is in the SW from some very large mines but whilst the northern frontier is still relatively unexplored it has important gold deposits there and into Burkina Faso. CDV has discovered in the north on its **Bolgatanga Project** tenements a large deposit at **Namdini** that is over 7moz in global resource and is open. Exploration has already provided encouraging additional results nearby on other Bolgatanga prospects at **Ndongo, Kungongo** and **Bongo**.

The current gold price in excess of US\$1400/oz provides a supportive background for mine construction and the higher grade 1.31g/t Starter Pit of ~0.9moz over 30mths years would provide project capital payback <18mths. Cash costs are <US\$600/oz.

The gold mineralisation at **Namdini** spreads across granite, metavolcanics and diorite so gold recoveries have required close attention. CDV will adopt the Maelgwyn Aachen™ high-shear oxidation process in the flowsheet to cut costs and lift recoveries. CDV expects material gains and could add > US\$120m to the NPV.

The **Namdini** deposit is currently the 7th largest gold deposit in the Birimian and is the largest discovery in the current century. The Birimian is still very attractive as an exploration target and CDV has its tenements at **Bolgatanga** and also the **Subranum** tenement on the Sefwi-Bibiani Greenstone Belt.

**Namdini's** NPV<sub>5</sub> in its PFS was given as US\$586m @ US\$1250 so at US\$1500 this rises to >US\$1000m.

Cardinal Resources Limited	0.39		US\$/A:		0.68		
Earnings	FY18a	FY19a	FY20	FY21	FY22	FY23	FY24
Gold Price US\$/oz	1257	1268	1500	1500	1500	1500	1500
Gold Production (koz)	0	0	0	0	0	309	408
Pretax Project Earnings US\$m	-28	-19	-10	-10	-10	274	422
Net Project Earnings US\$m	-28	-19	-10	-10	-10	274	295
Net Project Earnings A\$m	-38	-28	-15	-15	-15	403	434
EPS A\$	-0.11	-0.07	-0.03	-0.02	-0.02	0.58	0.62
CFPS A\$	-0.11	-0.07	-0.03	-0.02	-0.02	0.63	0.82
PER x	-3.6	-5.2	-13.5	-18.6	-18.6	0.7	0.6
PCFR x	-3.6	-5.2	-13.5	-18.6	-18.6	0.6	0.5
Shares on issue (m)	350.1	373.6	508	700	700	700	700

Ghanian assets acquired in 2013...

the **Bolgatanga Project** that found **Ndongo** first... then nearby **Namdini**..

**Subranum** was acquired later.

**Bolgatanga Project** has four sub-prospects

**Namdini 7moz JORC Resource**

Mining reserves of over 5moz..

PFS complete mid 2018....Bankable Feasibility Study due out early Dec Qtr 2019

14 year mine life at 9.5mtpa producing ~300kozpa for 3.8moz net

**Ndongo** has some attractive exploration numbers over 450m and only 12km from **Namdini**....

..other projects on hold for now..

**Subranum** in **Sefwi-Bibiani Greenstone Belt** is very underexplored.

Exploration spending is expensed so Shareholders' Funds are negative..

Cash at A\$27m after A\$17.6m from 30 Sept 2019 A\$0.15 option exercise

## 2.0 Cardinal Resources - In Profile

The Company's Ghana assets became listed on ASX in 2013 through the acquisition of the **Bolgatanga** tenements, with focus on **Ndongo East**, along with the current management team and the name changed to **Cardinal Resources**. The highly prospective **Subranum** tenements from **Newmont** were also added. **Namdini** was discovered on the **Bolgatanga Project** tenements in mid July 2014 with its impressive intersections of **67m @ 3.10g/t Au** and **45m @ 7.73g/t Au**.

**The Bolgatanga Project covers ~9300km<sup>2</sup>** in the upper east of Ghana and includes four tenements spanning sub-projects **Namdini**, **Ndongo**, **Kungongo** and **Bongo**.

**Namdini (CDV 100%) SE Bolgatanga ~20km<sup>2</sup>,**

Located 50km SE of **Bolgatanga** on the **Bole-Nangodi Greenstone Belt** in flat lying savannah and altitude of 190m. **Namdini** was discovered in 2014 and by mid 2019 had been delineated by a Preliminary Feasibility Study. The resource is open.

Mineral resource Category	Tonnes (Mt)	Grade g/t Au	Gold Gold Koz
<b>Measured</b>	<b>8</b>	<b>1.31</b>	<b>0.32</b>
<b>Indicated</b>	<b>174</b>	<b>1.11</b>	<b>6.21</b>
<b>Inferred</b>	<b>12</b>	<b>1.2</b>	<b>0.46</b>
<b>Total</b>	<b>194</b>	<b>1.12</b>	<b>6.99</b>

A Large Scale Mining Licence of ~20km<sup>2</sup> was issued for **Namdini** in Dec 2017.

Mining Reserve Category	Tonnes (Mt)	Grade g/t Au	Gold Gold Koz
<b>Proved</b>	<b>7</b>	<b>1.31</b>	<b>0.4</b>
<b>Probable</b>	<b>131</b>	<b>1.12</b>	<b>4.7</b>
<b>Total</b>	<b>139</b>	<b>1.13</b>	<b>5.1</b>

Ahead of an expected imminent BFS, the existing PFS sets out a 14 Year Mine Life with a 1.4:1 strip ratio that will produce 294-361 koz pa totalling 3975koz from a throughput rate of 9.5Mtpa. A Starter Pit will give >0.9moz over the first 30mths.

**Ndongo (CDV 100%) SE Bolgatanga 325km<sup>2</sup>,**

Exploration phase with 6 large scale targets identified and just 24km north from **Namdini**. Results include **9m @ 23g/t Au** and **14m @ 7g/t Au**. Targets are within hauling distance of **Namdini**.

**Kungongo (CDV 100%) NW Bolgatanga 120km<sup>2</sup>**

Exploration phase with a 4.5km strike length prospect being evaluated.

**Bongo (CDV 100%) NW Bolgatanga 465km<sup>2</sup>**

Exploration phase with auger soil drilling planned and geophysics targets.

**Subranum (CDV 100%) SW Ghana 69km<sup>2</sup>**

9km of strike along key **Sefwi-Bibiani Greenstone Belt** in similar environment to **Bibiani** and **Chirano**. 5km long target identified but 4km still unexplored. Is subject to 2% Net Smelter Royalty to **Newmont**.

### Financial History

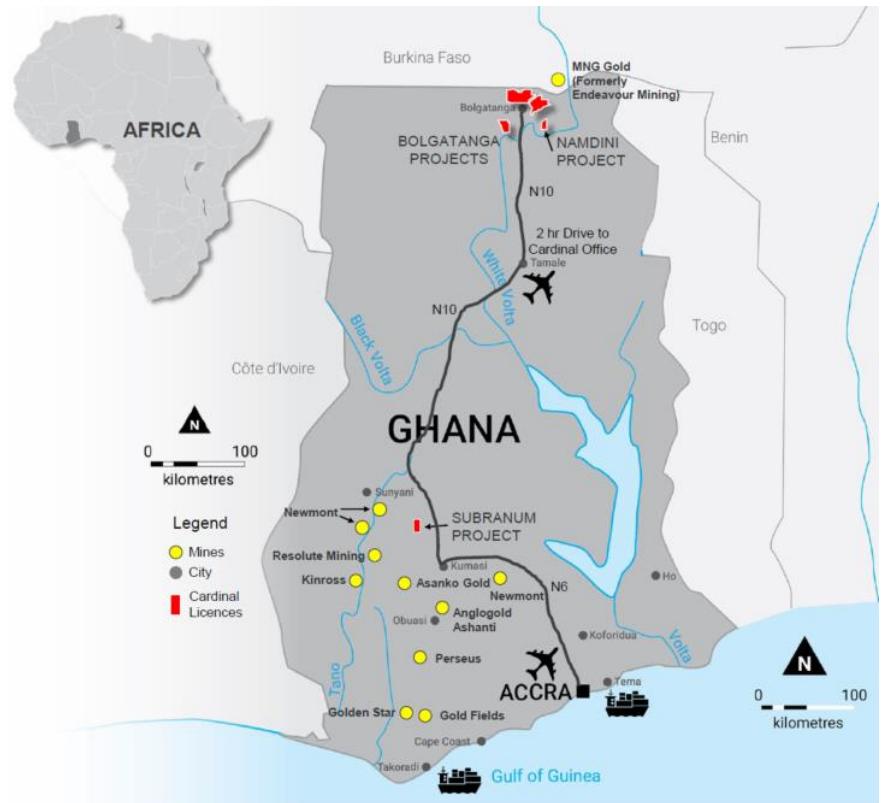
CDV Financial History					
Year end 30 June	FY16	FY17	FY18	FY19	1/10/2019*
<b>Total Assets A\$m</b>	<b>5.7</b>	<b>30.1</b>	<b>10.2</b>	<b>20.8</b>	<b>36.0</b>
<b>Exploration and Evaluation A\$m</b>	<b>-5.9</b>	<b>-15.8</b>	<b>-26.7</b>	<b>-14.9</b>	<b>-10.0</b>
<b>Carried Forward Losses A\$m</b>	<b>-23.3</b>	<b>-44.9</b>	<b>-81.9</b>	<b>-108.3</b>	<b>-120.0</b>
<b>Cash at End A\$m</b>	<b>4.9</b>	<b>28.6</b>	<b>7.3</b>	<b>18.7</b>	<b>27.0</b>
<b>Sprott Credit Facility A\$m</b>				<b>35.6</b>	<b>35.6</b>
<b>Shareholders funds A\$m</b>	<b>4.0</b>	<b>26.2</b>	<b>5.5</b>	<b>-18.1</b>	<b>-13.0</b>
<b>Shares on Issues m</b>	<b>222.1</b>	<b>350.1</b>	<b>373.6</b>	<b>382.9</b>	<b>508</b>
<b>Share Price A\$</b>	<b>0.30</b>	<b>0.53</b>	<b>0.43</b>	<b>0.34</b>	<b>0.39</b>
<b>Market Cap A\$m</b>	<b>67</b>	<b>186</b>	<b>161</b>	<b>130</b>	<b>198</b>

\*post 30 Sept 2019 A\$0.15 option exercise

## 2.1 Regional Perspective of Cardinals Assets in Ghana

*Bolgatanga Projects including Namdini are in NE Ghana*

*Subranum is in the prolific SW of Ghana.*



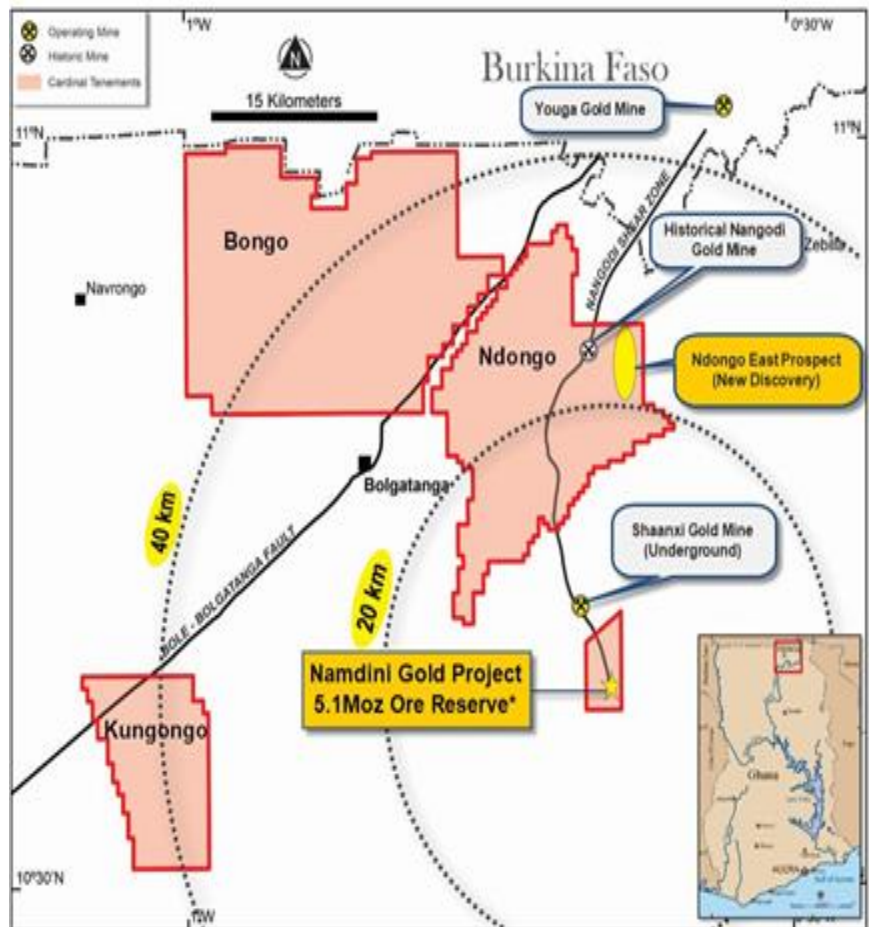
Source: Cardinal Resources

## 2.2 Cardinal's Tenements at Bolgatanga Project

*Bolgatanga Project tenements cover 9300km<sup>2</sup> and fit along the Bole-Bolgatanga Fault and along the Nangodi Shear Zone.*

*Nangodi Shear Zone hosts Namdini, China's Shannxi Underground Gold Mine, the historic Nangodi Gold Mine, Cassius's Gbane 0.3moz deposit and out to Youga open cut Gold Mine in Burkina Faso.*

*Exploration potential is large*



Source: Cardinal Resources

*Birimian Gold Province is second largest after Witwatersrand...*

*Ghana is largest player in the Birimian in gold resources and gold production*

*Namdini is the largest discovery in the Birimian in this century*

*PFS gave US\$586m NPV<sub>5</sub> at US\$1250.. At US\$1500 this is over US\$1000m*

*Rapid payback of plant capex is likely*

*Namdini has three key rock types carrying gold mineralization*

*Namdini will incorporate Aachen High Shear technology to improve gold recoveries..*

*Namdini will have one of the largest (9.5mtpa) mills in the Birimian*

*DFS due out early in Dec Qtr*

*FID should take place soon after.*

*Recent financings gave >100% debt financing*

### 3.0 Investment Review

Cardinal has in five years quickly turned exploration tenements in Ghana into an important 7moz gold resource in the Birimian Gold Province.

The Birimian is the 2<sup>nd</sup> largest in the world after the 100,000t Witwatersrand and Ghana currently has the largest resources and highest gold production in this Province. It has some large long life orogenic style mines including Anglo Gold Ashanti's 60moz Obuasi and its 23moz Indupriem as well as the 25moz Gold Fields Tarkwa conglomerate paleoplacer mine.

**CDV's Namdini 7moz resource** makes it one of the larger second rank deposits in Ghana and also in the entire Birimian. It is the largest discovery in the Birimian of the current century.

The large size and low strip ratio give this 9.5mtpa and ~300,000ozpa mining Life of Mine project cash costs of <US\$500/oz and AISC <US\$770/oz.

The PFS gave US\$586m NPV<sub>5</sub>, >38% IRR and payback of the US\$414m capital within 22mths at US\$1250 so it is very profitable at gold prices anywhere above US\$1400. Payback of capital should be very rapid.

Namdini Payback Possibilities						
Gold Price US\$/oz	1250	1300	1400	1500	1600	1700
Year 1 Cashflow	245	304	345	386	427	468
Payback years	1.8	1.4	1.2	1.1	1.0	0.9

Namdini is, unlike many shear zone hosted deposits in the Birimian, unusual with mineralisation passing through three main rock types – granite, metavolcanics and diorite - that resulted in CDV initially reporting low gold recoveries for the deposit. Subsequent optimisation of the flow sheet increased recoveries to standard levels of around 84%.

CDV has subsequently added the Aachen Process to the flowsheet which could improve recoveries by an additional 2-8% points and will cut power and reagent costs. The positive impact on the NPVs comes from up to an additional 80,000 oz (+2%) over the PFS mine life and ~US\$125m after tax NPV.

The Namdini 9.5mtpa processing plant has potential additional ore beyond 14 years from continuation of the mineralisation at depth and also from potential satellite deposits currently being explored by CDV such as at Ndongo East.

Namdini will be larger than any of the processing plants of other recent Birimian mines and its gold output of >300,000ozpa puts in into that rare collection of less than 50 Tier 1 mines globally exceeding that figure.

The next stage for the company after the forthcoming Bankable Feasibility Study will be arranging the financing of the US\$414m capital cost. CDV has been engaged with key financiers to commit once the BFS is completed in early Dec Qtr 2019. West African Resources (WAF.ASX) recently had debt offers of 115% of the capital cost for its 200kozpa Sanbrado Mine in Burkina Faso.

Following the completion of the Bankable Feasibility Study the Final Investment Decision (FID) is anticipated for late 2019.

Cardinal Resources Limited	0.39		US\$/A		0.68		
Earnings	FY18a	FY19a	FY20	FY21	FY22	FY23	FY24
Gold Price US\$/oz	1257	1268	1500	1500	1500	1500	1500
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PCFR x	-3.6	-5.2	-13.5	-18.6	-18.6	0.6	0.5
Shares on issue (m)	350.1	373.6	508	700	700	700	700



### 3.1 Cardinal's Corporate Outlook and Financing Options

*Namdini is an outstanding discovery*

*>US\$300m operating surplus against a capital cost of US\$414m..*

*Gold Fields has 16.4% of Cardinal*

*Gold Fields and Gold Road's A\$350m Gruyere deal might be a good template.*

*Market cap is just A\$200m (~US\$140m) compared to the project's NPV.*

*Gold Road is now valued at >A\$1000m.*

The Namdini discovery is outstanding by any measure.

Discovery to 7moz resource was less than three years and to PFS was under just five. Discovery to mining might be under eight years.

The starter pit at current gold prices could generate >US\$300mpa and repay the total capital of US\$414m well within two years.

The project is a very attractive financing opportunity for all providers of capital.

In addition, the Gold Fields Group, operators of several gold mines in Ghana, now holds 16.4% (81.04m shares) of the increased issued share capital of CDV after exercising almost 42m options for ~A\$6m.

Gold Fields has yet to indicate its intentions, but it would clearly be a very supportive strong shareholder with several funding options open to it.

Gold Fields' previous Gold Road Gruyere deal of A\$350m funding for 50% of the 3.92moz Gruyere deposit which is now a 300kozpa A\$624m mine is a possible template.

Whatever that outcome, CDV with its financing advisers should be able to arrange an attractive funding cocktail that should have minimised dilutionary impact on shareholder equity.

Recent financing offers such as for West African Resources show that the project may actually support as much as 100% debt with forward sales, gold loans, leasing and streaming as well as the senior secured debt.

Ghana has a good long-term history of gold mining with numerous mines so financing risk is known and well documented.

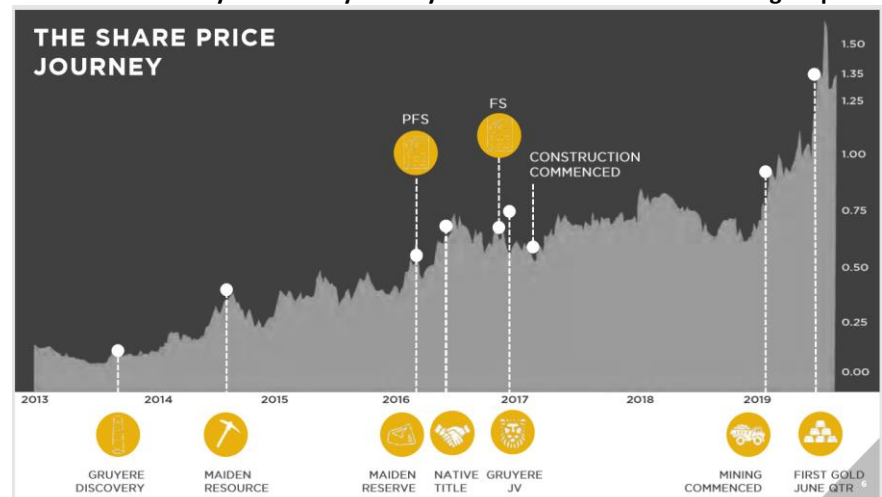
At 10% equity on US\$414m CDV needs to find US\$41m and at 20% the figure would be US\$83m. CDV currently has A\$27m (US\$15m) cash after the exercise of the 30 Sept 2019 options.

CDV has a market cap of just A\$202m (US\$140n) compared to its NPV<sub>6</sub> of >US\$950m at US\$1500/oz.

A substantial rerating of the project's value should be achieved once financing is achieved and further rerating once the gold plant is commissioned.

Two examples of market rerating after financing is achieved and gold production is realised.

**Gold Road's Journey - Discovery of Gruyere in WA and first commercial gold pour**



*Gruyere has similar size annual output of 300kozpa*

*Feasibility study completed in October 2016*

*First commercial gold output achieved three years later in October 2019*

*Gold Road now capped at A\$1000m for 150kozpa net output.*

*Cardinal capped at just A\$200m for 100% of 300kozpa from 3.77moz and with 360koz in Year 1*

*WAF has 2.9moz at Sanbrado Mine in Burkina Faso*

*High grade underground mine should allow 300koz in Year 1 - then averaging 200kozpa for the first five years*

*Market cap is A\$390m*

*WAF received funding offers of up to 115% of the construction cost and accepted US\$200m facility*

*WAF share price revaluation after financing*

Gold Road has many similarities with Cardinal in that the Gruyere discovery was made in 2013 and the resource determined and the PFS completed within three years.

The Feasibility Study was completed in October 2016 and a JV with Gold Fields was announced just three weeks later in November 2016 with Gold Fields acquiring 50% of Gruyere for A\$350m.

Construction on the 6.5mtpa mine and plant began in early 2017 and commissioning was completed with the the first commercial gold poured in October 2019 with output building up to 300kozpa at an AISC of A\$1025/oz (~US\$690/oz)

The JV with Gold Fields was completed at a market cap of around A\$500m and is now capped at A\$1020m after reaching a peak of over A\$1300m.

Netting out cash, debt and exploration assets Gold Road is being valued at A\$1000m for 150,000ozpa.

In contrast Cardinal has a market cap of A\$200m for 100% of 300kozpa.

#### **West African Resources 2.9moz Sanbrado Gold Resource Burkina Faso**

WAF has a high grade underground and open pit mine development underway at its Sabrado project in Burkina Faso with a US\$185m 2mtpa processing plant that wil produce 211kozpa for the first five years. AISC for the first five years is US\$551/oz with gold pour due late 2020.

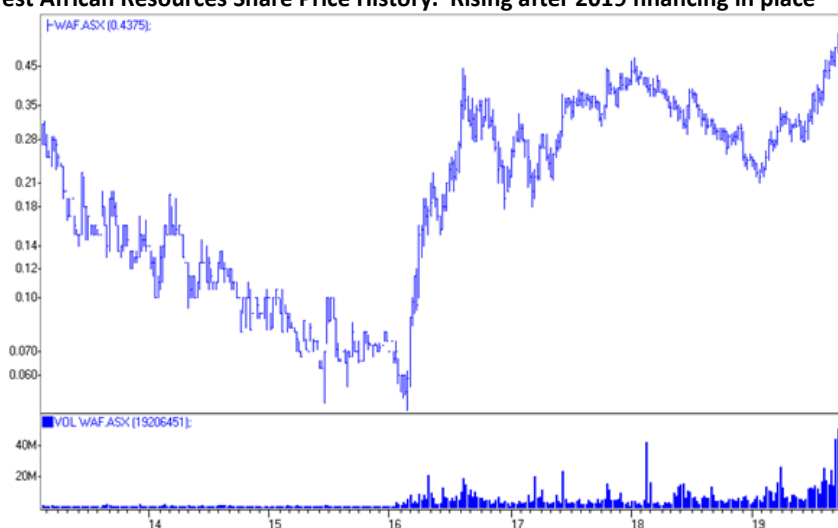
The market cap is A\$390m(~US\$265m) and WAF has secured a US\$200m facility from Taurus in Australia towards the development of Sanbrado.

The after tax NPV<sub>5</sub> is presented as US\$405m.

The facility seems very flexible and quarterly repayments begin on 30 June 2021 out to 31 Dec 2024. The facility can be repaid at any time.

WAF received funding proposals as high as US\$215m (115% of plant cost) from fourteen groups including royalty companies, banks and debt funds.

#### **West African Resources Share Price History. Rising after 2019 financing in place**



The rerating of WAF has come after the financing and commencement of construction. Further rerating is likely in 2020 as it nears plant commissioning.

Opex per tonne at ~US\$20.5 with a net opex of US\$190m for 9.5Mpta

Life of mine 14 Years

All in sustaining costs US\$769per/oz

Namdini has a post tax pre debt NPV<sub>6</sub> of US\$1000m equal to A\$1450m.

Assumes 70% debt

Free cashflow of A\$350-500m in first two years pre debt repayment.

PER <1x on current capital

Appraised value is A\$1.98 per share diluted upon successful commissioning of the plant.

Share price target in two years is a notional 50% of this Appraised Value.

### 3.1 Namdini Earnings Summary

The increased volatility in the US\$ gold price requires valuation to be provided as a range but the low operating cost from a low 1.4:1 Life of Mine strip ratio ensures that the mine will be strongly cash generative.

		Namdini Earnings					
US\$m		FY23	FY24	FY25	FY26	FY27	FY28
Gold production (000oz)							
Starter Pit		309	408	330			
Main Pit					287	278	292
Gold Sales Revenue US\$m							
Base Case US\$/oz	1250	387	510	412	359	348	365
Spot Case US\$/oz	1500	464	612	495	430	418	438
PreTax Earnings US\$m							
Base Case	1250	197	320	222	169	158	175
Spot Case	1500	274	422	305	240	228	248
Net Earnings US\$m							
Base Case	1250	197	224	156	118	111	122
Spot Case	1500	274	295	213	168	159	173

### 3.2 Valuation Matrix

Using the spot price of US\$1500/oz the Valuation Matrix gives an Appraised Value of A\$1.98/share net of around US\$300m (A\$441m) in borrowings to be drawn and repaid.

Pretax earnings should be over A\$290m in FY23 rising to A\$450m in FY24. Cardinal has carried forward tax losses of over A\$100m and would attract investment allowances during the construction period so a 30% tax rate might not apply until FY24.

Cardinal Resources \$ 0.39													
Year end 30 June	%	2018	2019	2020	2021	2022	2023	2024	Revenue	Book Val	Market Val	Appraised Val	
A\$m									2023	A\$m	A\$/sh	A\$m	A\$/sh
Namdini	100	-26	-14	-20	-5	0	351	491	682	0	0.00	110	0.22
Ngondo	100	-1	-1	-1	-2	-5	-5	-5	15	0	0.00	5	0.01
Bongo	100	0	0	0	0	-1	-1	-1		0	0.00	1	0.00
Kungongo	100	0	0	0	0	-1	-1	-1		0	0.00	1	0.00
Subranum	100	0	0	0	0	-2	-5	-5		0	0.00	4	0.01
Admin		-11	-12	-12	-18	-12	-15	-15		0	0.00		0.00
Cash		0	0	0	0	0	5	5		27	0.05	27	0.05
Interest		0	0	-4	-4	-4	-30	-12		-36	-0.07	-36	-0.07
Total Pretax		-37	-27	-37	-29	-25	299	457		0.00	0.00		0.00
Tax		0	0	0	0	0	0	-137		0.00	0.00		0.00
Net Earnings		-37	-27	-37	-29	-25	299	320	697	-9	-0.02	112	0.22
Free Cashflow		-37	-27	-37	-29	-25	349	507		FY22	FY23	FY24	
EPS		-0.10	-0.07	-0.07	-0.04	-0.04	0.43	0.46	PERx	-10.9	0.9	0.9	
FCFPS		-0.10	-0.07	-0.07	-0.04	-0.04	0.50	0.72	PFCFRx	-10.9	0.8	0.5	
DPS		0.00	0.00	0.00	0.00	0.00	0.10	0.15	Yld	26%	38%		
Exploration expen		-27	-15	-21	-7	-9	-12						
Capital raised		12	33	18	100								
Cash		7	19	20									
Shares on issue (m)		374	383	508	700	700	700	700					

The value generated by the Namdini Gold Mine Project may take until the plant is successfully commissioned before being reflected in the Cardinal share price.

### 3.4 Sensitivity Analysis

The volatility in the US\$ gold price requires an appropriate sensitivity analysis of the NPV for Namdini.

The PFS base case used US\$1250/oz to give a NPV<sub>5</sub> of US\$586m (US\$1.15/share – A\$1.70/share).

At today's price of around US\$1500/oz this NPV<sub>5</sub> is ~US\$1000m (US\$1.97/share – \$2.89/share).

**Note that the NPV/oz for the project is in excess of US\$240/oz.**

PFS Base Case US\$1250/oz					
NPV		Discount Rate	NPV/oz	NPV/share	
684		4%	174	1.35	1.98
555		6%	141	1.09	1.61
449		8%	114	0.88	1.30
363		10%	92	0.71	1.05
US\$/oz	NPV US\$m	NPV US\$/oz	NPV /share		
1,300	Discount Rate		US\$	A\$	
801	4%	204	1.58	2.32	
649	6%	165	1.28	1.88	
526	8%	134	1.04	1.52	
425	10%	108	0.84	1.23	
1,400	Discount Rate	NPV/oz	NPV/share		
\$996	4%	253	\$1.96	2.88	
\$814	6%	207	\$1.60	2.36	
\$667	8%	169	\$1.31	1.93	
\$546	10%	139	\$1.07	1.58	
\$1,500	Discount Rate	NPV/oz	NPV/share		
\$1,191	4%	303	\$2.34	3.45	
\$979	6%	249	\$1.93	2.84	
\$808	8%	205	\$1.59	2.34	
\$667	10%	170	\$1.31	1.93	
\$1,600	Discount Rate	NPV/oz	NPV/share		
\$1,386	4%	352	\$2.73	4.01	
\$1,144	6%	291	\$2.25	3.31	
\$948	8%	241	\$1.87	2.75	
\$788	10%	200	\$1.55	2.28	
\$1,700	Discount Rate	NPV/oz	NPV/share		
\$1,548	4%	393	\$3.05	4.48	
\$1,291	6%	328	\$2.54	3.74	
\$1,082	8%	275	\$2.13	3.13	
\$910	10%	231	\$1.79	2.63	
Shares on issue (m)			508		



## 4.0 Exploration History

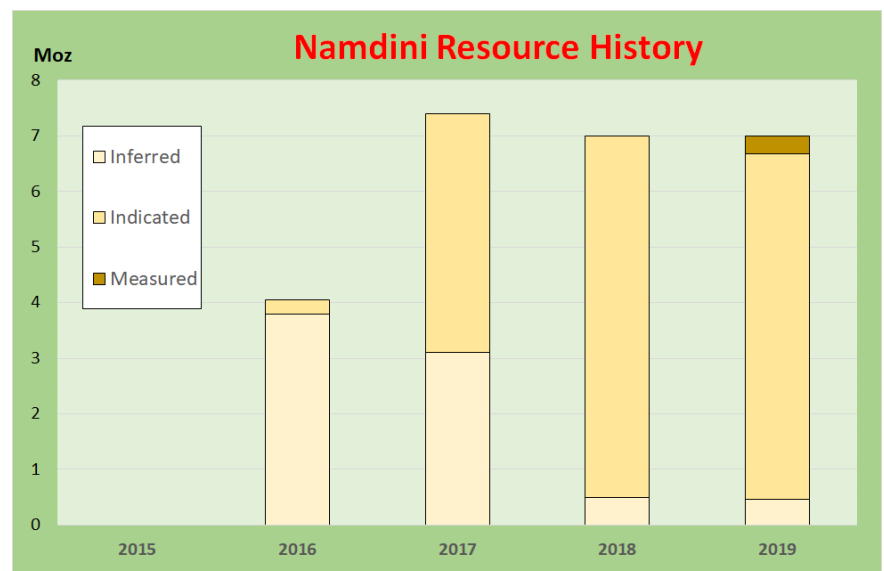
ASX-listed Ridge Resources acquired Cardinal Mining and its assets of the Bolgatanga tenements in 2013 and carried out exploration with a focus on the Ngongo East project where encouraging results had been achieved.

Namdini was discovered in mid 2014 and some early drill results of intersections of **67m @ 3.10g/t Au** and **45m @ 7.73g/t Au** were very encouraging and Cardinal began to substantially increase its exploration expenditures.

Exploration expenditures - Gross finding costs						
Year end 30 June	FY14	FY15	FY16	FY17	FY18	FY19
Exploration and Evaluation A\$m	1.9	2.1	5.9	15.8	26.7	14.9
Cumulative A\$m	1.9	4.0	9.9	25.7	52.4	67.3
Gold resources koz	0	0	3900	7400	7000	7000
Ave finding costs A\$/oz			2.55	3.48	7.49	9.62

Source: Cardinal Resources

This is impressive and shows how Cardinal turned early stage mineralisation quickly into a major resource in the Birimian at finding costs of well under A\$8/oz and completed a PFS at under A\$10/oz(US\$7/oz).



Source: Cardinal Resources

Cardinal is working on the Ndongo East Project and is likely to be able to establish a resource there within the next two years.

Namdini was discovered in 2014 and was a 7moz resource by late 2016

Finding costs were a notional A\$7.50/oz and under A\$10/oz to PFS.

From zero to 7moz in three years

## 5.0 The Birimian Gold Province of West Africa

*Birimian is second largest gold province with 10,000 tonnes...*

*Is bigger than the Yilgarn in WA and the Carlin Trend in US*

*Birimian outcrops in Ghana, Mali, Burkina Faso and Cote D'Ivoire*

*Extends from SW Ghana up to north and into Burkina Faso and Niger*

*SW Ghana is very well endowed..*

*... Birimian re emerges in north of Ghana and Burkina Faso.*

*Good results from only early exploration.*

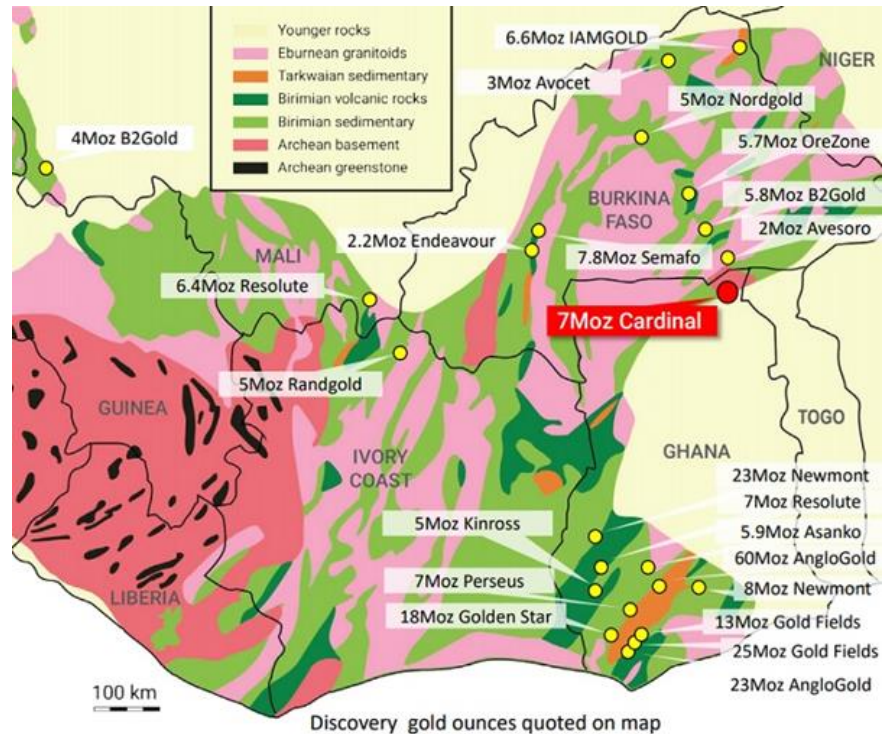
*Birimian in central Ghana is covered by Voltaian Basin*

*Geologically similar to Yilgarn in WA.*

The Birimian Gold Province in West Africa with about 10,000t of endowment is the world's second largest gold province after the massive 100,000t Witwatersrand conglomerate deposit in South Africa that has already produced over 54,000t.

In comparison, Australia's Yilgarn is about 8,000t and the Carlin Trend in the USA is around 6,000t.

The four main countries hosting the Birimian rocks are Ghana, Mali, Burkina Faso and Cote d'Ivoire with extension north into Senegal and east into Niger.



The Birimian underlies all of Ghana and it is clear that the Birimian rocks extend beyond Ghana northward and through Burkina Faso and into Niger. The Birimian in SW Ghana has provided a massive endowment but a large portion of the Birimian in eastern Ghana is removed from exploration access by an overlay of more recent sediments of the Voltaian Basin and the Volta River.

The Birimian re emerges to the north, however, in a Northern Frontier that has several major deposits in the north of Ghana and into Burkina Faso. These Birimian terranes in the south of West Africa are metamorphosed volcanic, sedimentary and plutonic intrusive rocks of Paleoproterozoic age (2,200 - 2,000my BP). These rocks make up the Man-Leo Craton of West Africa.

The greenstone belts with intervening alkaline granites are geologically similar to those in the Yilgarn of Western Australia but are about 400my younger and host an even greater gold endowment.

Most Birimian gold deposits have been found in the greenstone shear zones as of orogenic origin. The gold-bearing brittle-ductile quartz veins, stockworks, breccias, and disseminated orebodies are usually located adjacent to major faults and other large scale structural features

The Birimian Group is unconformably overlain by the Tarkwaian System sedimentary rocks that includes one formation of a quartz-pebble conglomeratic group that hosts a massive 1.25g/t 25moz paleoplacer gold deposit at Tarkwa currently operated by Gold Fields.

*Birimian in SW Ghana includes the giant Obuasi 2500t gold deposit.*

*Birimian has >25 +3moz gold deposits*

*Namdini is relatively large and is the biggest since the beginning of this century.*

*Namdini ranks around equal 7<sup>th</sup> of Ghana orogenic gold deposits...*

*Namdini is relatively large and is a single pit deposit*

The Birimian gold endowment is large at over 10,000 tonnes and several very large gold deposits have been discovered including Obuasi. The Obuasi deposit has an endowment of >2,500 t Au (80moz) and represents the largest single Precambrian gold deposit discovered in the world to date, exclusive of the Witwatersrand type paleoplacers.

The Birimian is very fertile for gold deposits and more than 25 of the deposits in the Man-Leo Craton each contains resources in excess of 100 t Au (~3moz).

Ghana has been an important gold producer (known previously as Gold Coast) for over 500 years and production today is at record highs and growing.

As noted, the SW portion of the Birimian in Ghana has a massive gold endowment and is host to some major deposits.

All deposits in this table (other than Namdini and Wa) are in SW Ghana.

Namdini ranks very highly on this table of orogenic gold deposits in Ghana.

Ghana Orogenic Gold Deposits		
Deposit	Company	Size Moz
Obuasi	Anglogold	62
Iduapriem	Ashanti Gold	23
Ahafo	Newmont	23
Presta/Bogoso	Golden Star	18
Damang	GoldFields	13.4
Akyem	Newmont	8.4
Namdini	Cardinal Resources	7.0
Bibiani	Resolute Mining	7.0
Edikan	Perseus Mining	7.0
Esaase	Asanko Gold	5.9
Obotan	Asanko Gold	5.5
Chirano	Kinross Mining	5.0
Nzema	BCM International	3.0
Wa	Azumah	2.8
Konongo	LionGold	2.7
Wassa	Golden Star	1.9
Afema	Teranga Gold	1.2
Kubi	Asante Gold Corp	0.9
<b>Total</b>		<b>136</b>

The South west region also hosts the 25moz Tarkwaian conglomerate deposits operated by Gold Fields.

The Birimian is well represented in Ghana, Burkina Faso and Cote d'Ivoire. It is smaller in area in Mali but it is currently the second largest producer.

Namdini in gross terms is a relatively large deposit in the Birimian and is the biggest in the current century and is the latest major discovery.

**Importantly it is a single pit deposit.**

Over 60moz discovered in large deposits in the Birimian since 2000.

Namdini is the most important Birimian discovery this century

The Birimian has seen the discovery of major deposits totalling over 60moz in the past 15 years with almost 50% located in Burkina Faso.

*Namdini has been the most important discovery in this century.*

### Birimian Major Gold Deposit Discoveries Since 2000

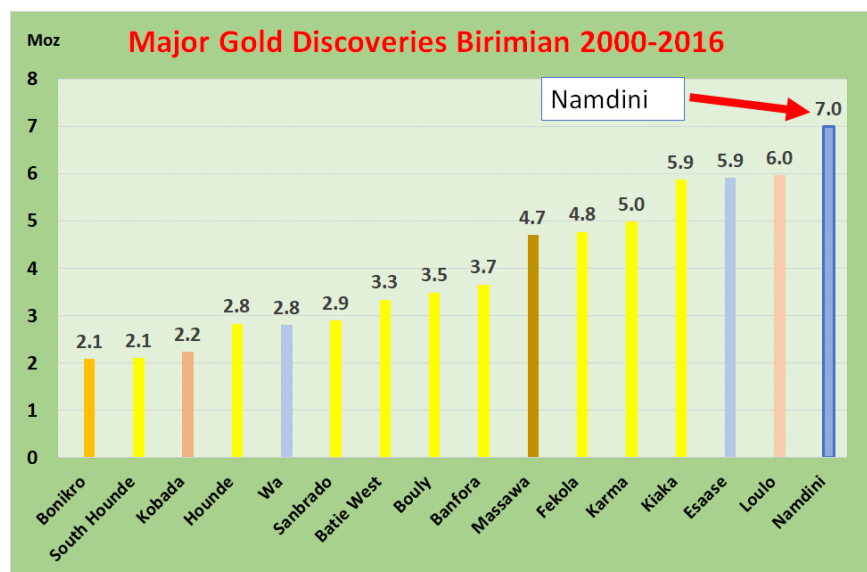
Deposit	Moz	Discovery	Country
Bonikro	2.1	2001	Cote D'Ivoire
Karma	5.0	2003	Burkina Faso
Wa	2.8	2005	Ghana
Kobada	2.2	2006	Mali
Bouly	3.5	2006	Burkina Faso
Banfora	3.7	2006	Burkina Faso
Esaase	5.9	2006	Ghana
Massawa	4.7	2007	Senegal
Batie West	3.3	2008	Burkina Faso
Loulo	6.0	2009	Mali
Hounde	2.8	2010	Burkina Faso
Fekola	4.8	2011	Mali
Sanbrado	2.9	2012	Burkina Faso
South Hounde	2.1	2012	Burkina Faso
Kiaka	5.9	2013	Burkina Faso
<b>Namdini</b>	<b>7.0</b>	<b>2016</b>	<b>Ghana</b>

Source: Cardinal and MPS

Most recent major discoveries have been in **Burkina Faso** (yellow), with two in **Mali** (pink) and one each in **Senegal** (brown) and **Cote d'Ivoire** (orange). Namdini, Wa and Esaase for **Ghana** are in blue.

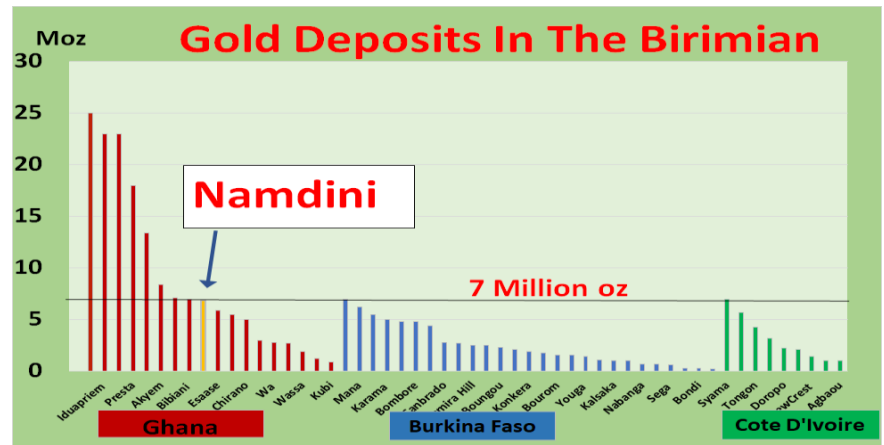
Namdini is clearly a discovery of major significance and is a single pit deposit that is still open along strike and at depth.

Burkina Faso has had over 40% of the recent major discoveries by number and total gold



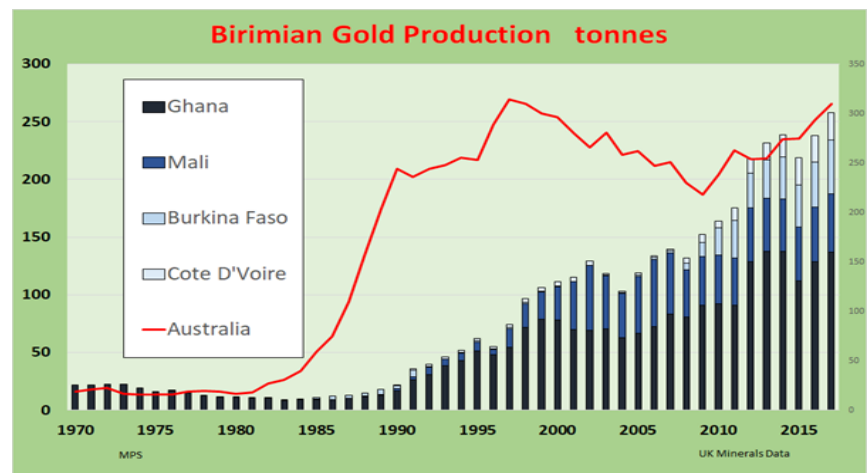
Ghana has the largest endowment of gold with almost all of it occurring in the SW of the country. Burkina Faso and Cote d'Ivoire have numerous smaller deposits.

*Ghana is much larger in resources than Burkina Faso and Cote d'Ivoire...*



These mines together with Mali produce almost as much gold as Australia.

*Together with Mali they produce almost as much as Australia..*



The Birimian is a very large gold province and the rocks were at one time connected to corresponding rocks in the Guiana Shield of South America.

### West African Birimian Links to Guyana Shield of South America

*The connection across the Atlantic with Sth American in Guyana Shield is very strong...*





## Cardinal's Bolgatanga tenements

*Nangodi Shear Zone hosts significant gold mineralisation and extends to almost 60km from Namdini..*

*The Bolgatanga Project tenements cover a large portion of the exposed Birimian in the north of Ghana..*

## 6.0 Cardinal's Tenements

Cardinal has its focus on the Bolgatanga Tenements in the north of Ghana and has an important yet underexplored project in the SW of Ghana at Subranum.

### 6.1 Bolgatanga Tenements

Cardinal's Bolgatanga tenements are in the north of Ghana beyond the Voltaian Basin and sit within a highly mineralised area with current gold mines, identified resources and considerable artisanal mining and yet is still well underexplored.

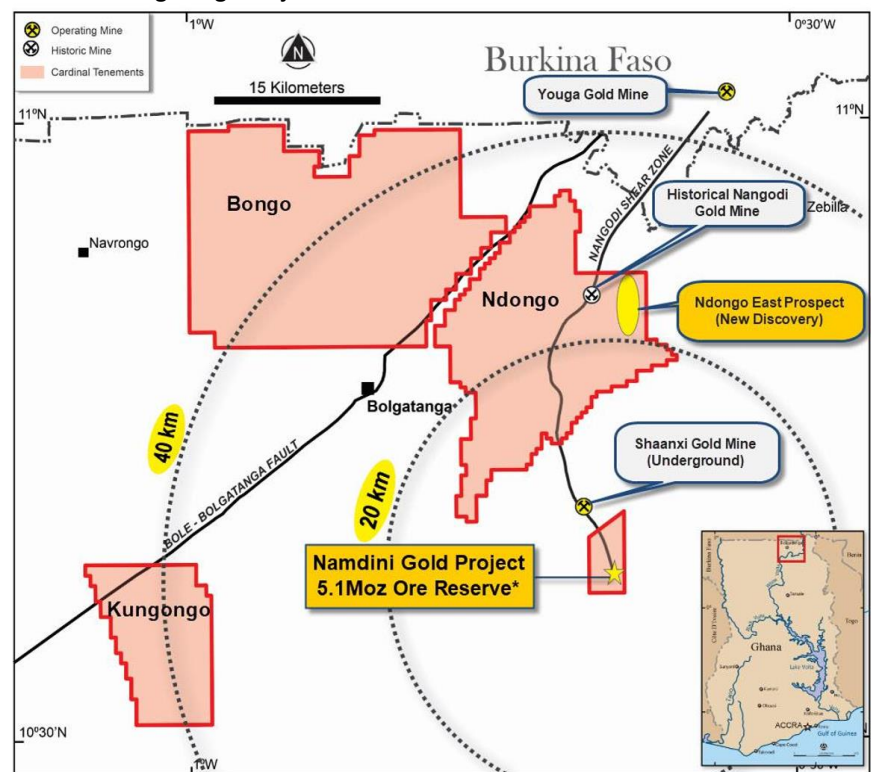
The Bolgatanga Ghana Project tenement covers ~9300km<sup>2</sup> consisting of licences for Ndongo, Kungongo and Bongo and the Namdini mining licence localised in the North East region of Ghana within proximity to the border of Burkina Faso.

**The tenements include portions of the important Nangodi Shear Zone**, a splay off the Bole-Bolatanga Fault, that extends north from Namdini, includes the operating Shaanxi Gold operated mine, passes through the Ndongo tenement that includes the old Nangodi Mine and then to the Youga Gold Mine in Burkina Faso.

The north is far less explored than the prolific SW so the prospects for further important gold deposits are good. Namdini is 7moz and Azumah's Wa is 2.8moz. Cassius Mining has delineated 0.3moz at Gbane, just 5km from Namdini.

The Namdini deposit is the key asset but Cardinal has three other tenements within 50km of Namdini.

#### Cardinal's Bolgatanga Project Tenements



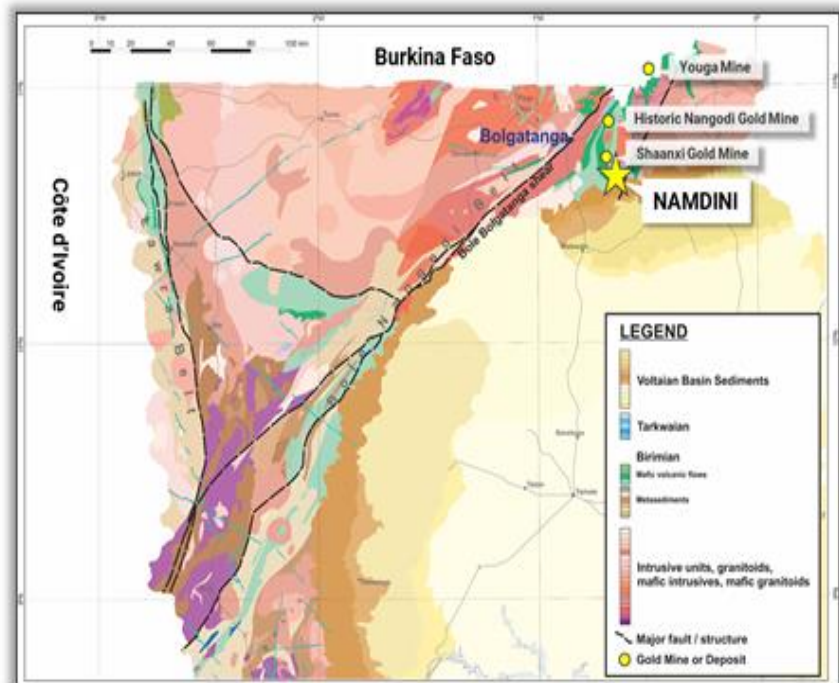
Paleoproterozoic granite-greenstone belt terrain..

Namdini sits within mafic volcanics, granites and diorites

## 6.2 Geology

The regional geology in the North of Ghana is Paleoproterozoic granite-greenstone terrain. There are several granite-greenstone belts here that make up this portion of the Birimian province.

The main lithologies of the belts are volcanic-sedimentary rocks with granitoid intrusions and later diorite intrusions.



Source: Cardinal Resources

### 6.2.1 Bolgatanga Geology

The Namdini Gold Project lies within the Paleoproterozoic Bole-Nangodi Greenstone Belt, one of a series of southwest–northeast trending granite-greenstone belts which host significant gold mineralization in Ghana and Burkina Faso. These belts are interpreted to be fault bounded, both during their development and post-deposition.

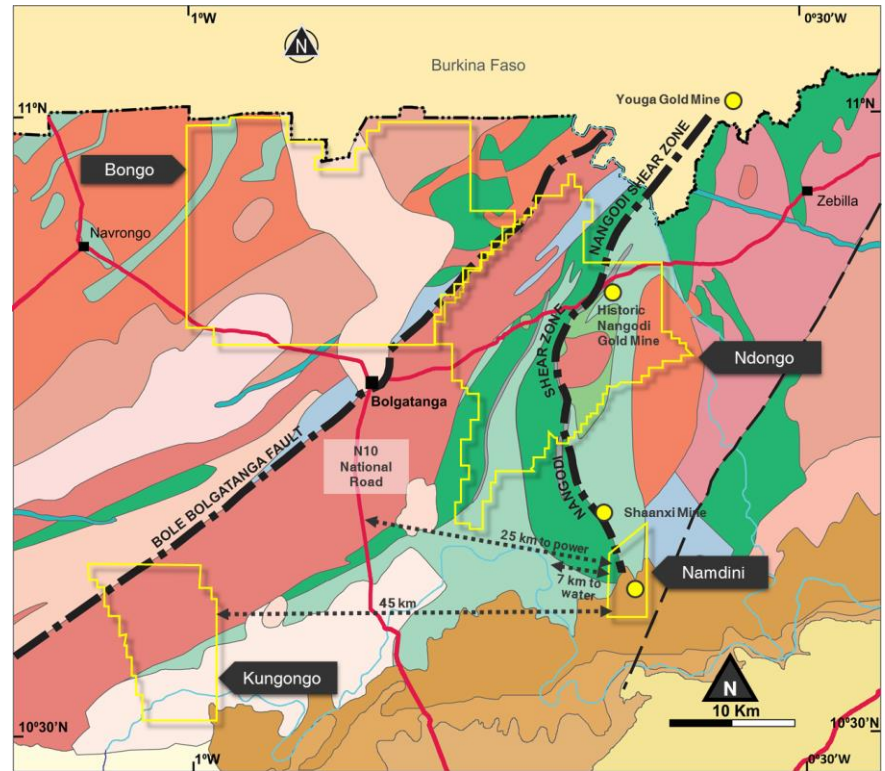
Much of northern Ghana is covered by post-Birimian Voltaian Basin sediments and within the Birimian rocks is Namdini at the northern limit of the Voltaian Basin sediments exposure.

Key units of the metamorphosed greenstone belts include greywackes and phyllites of the Tarkwaian Formation, which are overlain by volcanic and sediment sequences of Birimian age (2.2 to 2.1 Ga), characterized by interbedded mafic to intermediate volcanic flows, felsic to intermediate tuffs and fine-grained sediments. The greenstone belts are intruded by belt-type and basin-type granitic rocks and late stage diorites.

Structurally the north eastern region of Ghana is characterized by steep isoclinal folding with near-vertical axial planes. The greenstone belts contain locally open symmetric folds with axial planar cleavages parallel to bedding in the steeply inclined sediments.\*

\*After NI 43-101 PEA ON THE NAMDINI GOLD PROJECT, GHANA Golder and associates February 2018

## Bolgatanga Geology



Source: Cardinal Resources

## Namdini Mining Licence - Steeply dipping rocks

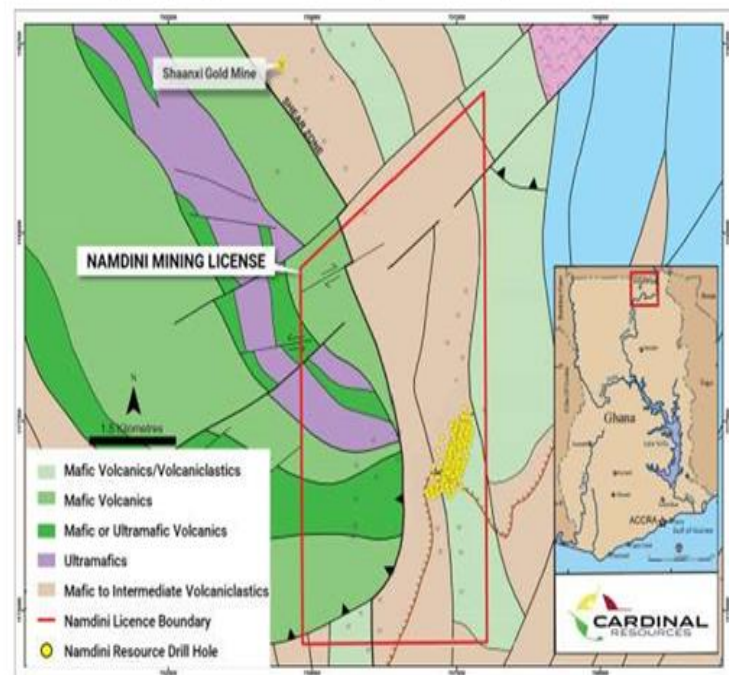


Figure 13: Local geology of the Namdini Gold Project (source: Cardinal)



## 6.2.2 Ndongo Project Tenements - 325km<sup>2</sup>

The Ndongo Project includes the historic Nangodi Gold Mine and the highly encouraging new discovery Ndongo East prospect which is the most advanced.

**The Ndongo East Prospect** is located within NE-SW trending Birimian metavolcanics and metasediments.

Exploration sampling and drilling has defined seven prospects totalling 70km in strike length and only 15-25km north of the Namdini Gold Project. The most encouraging zones cover approximately 7km along strike.

Within the Ndongo tenement lies the Nangodi Shear Zone which controls the mentioned four major gold discoveries as well as numerous historic shallow artisanal workings along many parts of this shear zone.

Some recent intercepts have included

- 5.3m @ 13.9g/t Au from 78m in NDDD063
- 5.5m @ 3.8g/t Au from 31m in NDDD072
- 3.7m @ 3.3g/t Au from 59m in NDDD064
- 2.7m @ 7.7g/t Au from 19m in NDDD068
- 2.0m @ 18.3g/t Au from 59m in NDDD066

The gold mineralisation at Ndongo East occurs in gold-bearing, and pyrite-silica-ankerite carbonate altered, shear zones which dip to the northwest. Drilling indicates two orientations to the mineralisation, namely a steeply dipping northwest orientation and a shallower west-southwest plunging orientation. The mineralised system is open along a northeast-southwest strike and at depth with multiple mineralised intersections. The highgrade mineralised structures have been tested to a shallow depth of approximately 70m vertically below surface.

### Ndongo Project with prospects

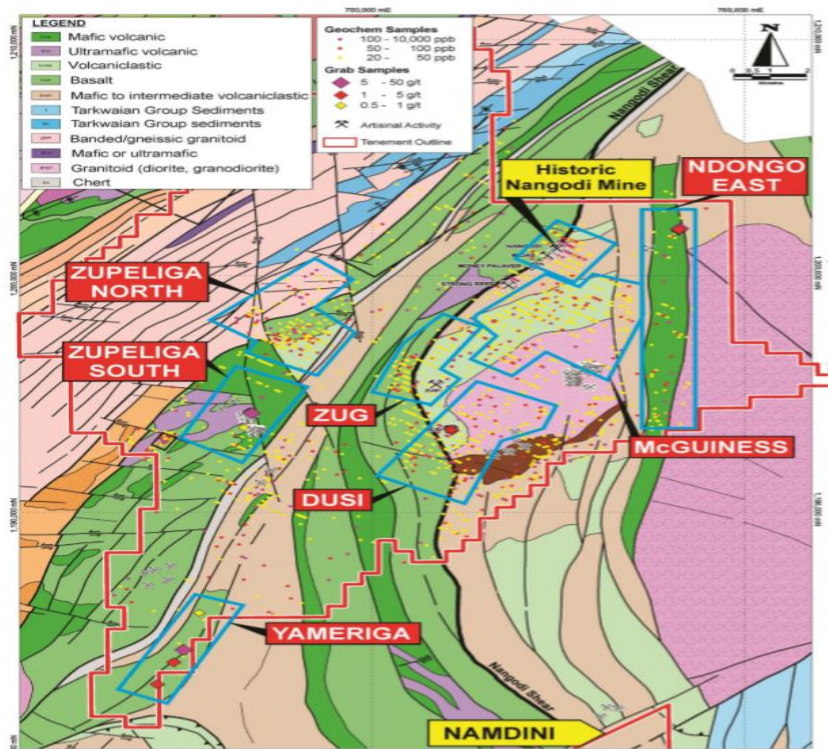


Figure 4: Ndongo Prospecting License showing local prospects

Exploration work here predates Namdini and includes 9m @ 23.3g/t and 14m @ 7g/t.

*The Ngondo project tenement has considerable gold endowment at...*

*Nangodi historic mine..*

*And the Ndongo East Prospect ...*

*Encouraging results have included...*

9m @ 23.3g/t Au  
14m @ 7g/t Au  
5.3m @ 13.9g/t Au

*Exploration sampling has identified gold mineralisation over a wide area with the Ndongo East at the eastern margin of the tenement currently providing the most interest*

The Ndongo East project has had very encouraging results over 450m of strike and is still open to the north and south

9m @ 23.3g/t Au  
8m @ 11.3g/t Au  
14m @ 7.0g/t Au  
5.3m @ 13.9g/t Au

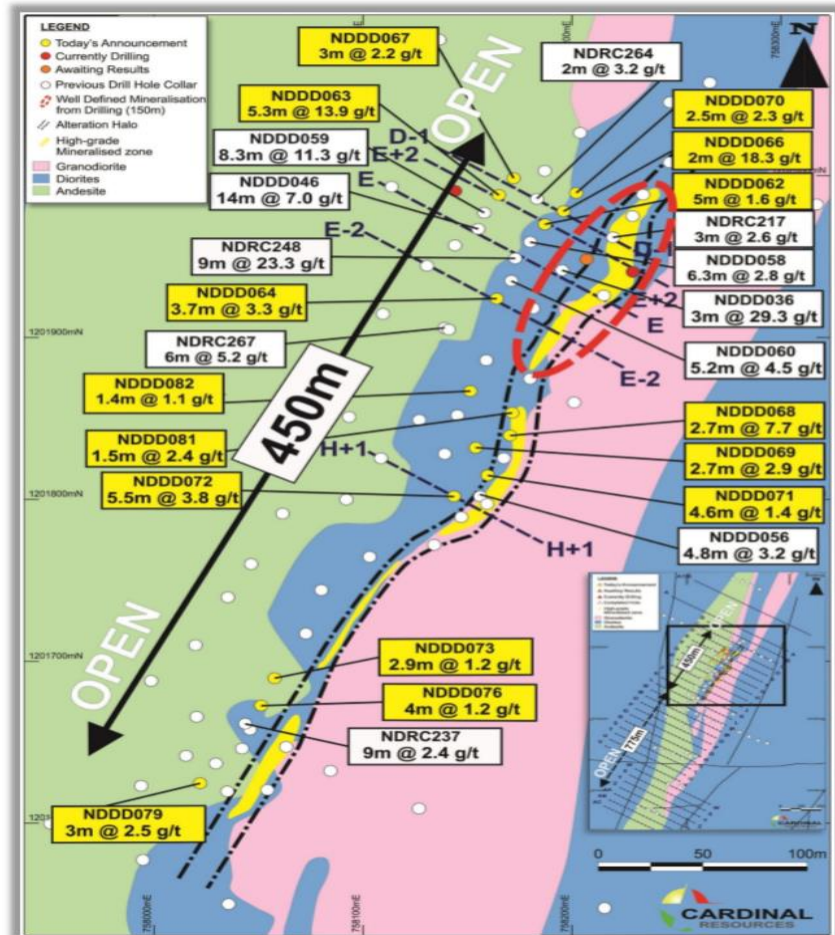


Figure 5: Ndongo East Prospect with drill locations showing NE-SW mineralised structures open along strike.  
Source: Cardinal Resources

The mineralisation is open at depth as well

3m @ 29.3g/t  
9m @ 23.3g/t  
14m @ 7g/t

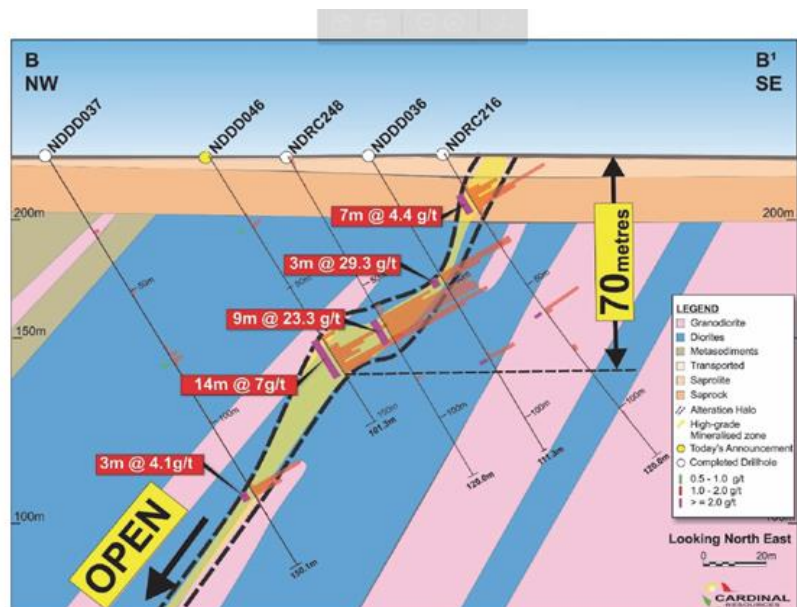


Figure 3: Ndongo East Prospect Section B-B'

Source: Cardinal Resources



*Interesting prospects but no current work underway*

*No current activity underway*

*Subranum has considerable exploration potential*

### 6.2.3 Kungongo Tenement (area of 120km<sup>2</sup>)

The Kungongo Licence is located about 40km west of the Namdini Gold Project.

No activity is being undertaken while Namdini is being finalised.

### 6.2.4 Bongo Tenement (area of 465km<sup>2</sup>)

Is adjacent to the regional Bole-Bolgatanga Shear and is dominated by three major intrusive complexes, predominantly granitoids of intermediate to foliated felsic basin types intercalated with mafic volcanic flows.

No activity is being undertaken while Namdini is being finalised.

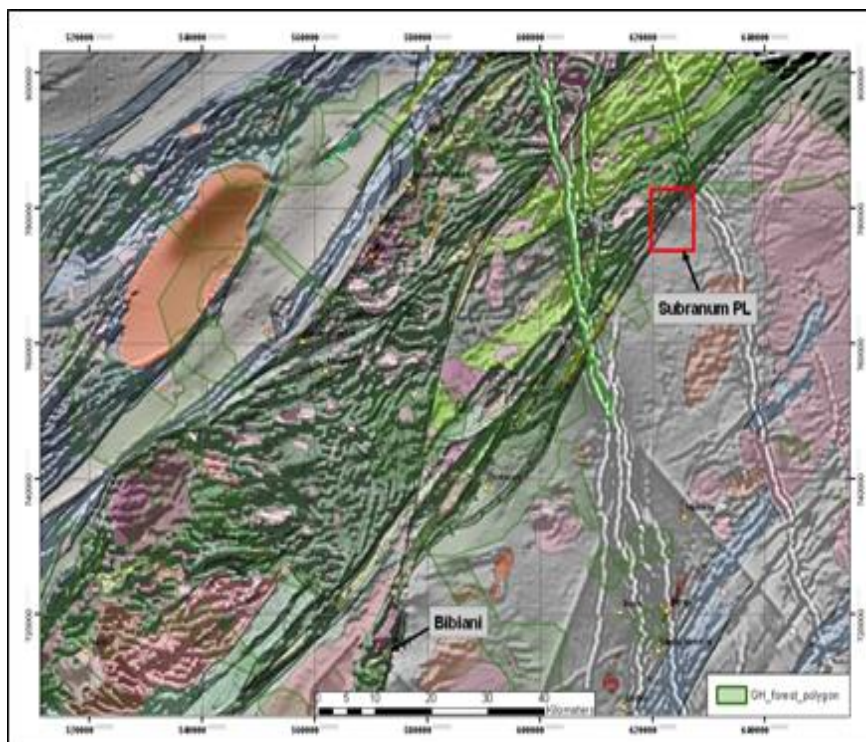
## 6.3 Subranum (area of 69km<sup>2</sup>)

The Subranum tenement covers circa 69km<sup>2</sup> in South West Ghana straddling the eastern margin of the Sefwi gold Belt. The Gold Belt within these parameters is highly prospective and is spatially related to the major discoveries such as Bibiani gold mine (70km SW) containing 7Moz and Newmont's Ahafo containing 23 Moz (53km W).

The portion of the Bibiani Shear Zone occurring within the Subranum tenement is 9km long, trending SW to NE. Previous extensive exploration has outlined a 5km long gold target, extending from the SW tenement boundary towards the NE, with the remaining 4km of the 9km strike length remaining relatively unexplored. Only a very small portion of this 5km long gold target was diamond drilled during drilling programmes in 2018.

No activity is being undertaken while Namdini is being finalised.

### Regional Geology with Subranum Tenement straddling Bibiani Shear Zone



Source: Cardinal Resources

## 7.0 Namdini Gold Resource

The Namdini project reflects this Birimian style of mineralisation and is a steeply dipping sequence of interbedded, foliated, metasedimentary and metavolcanic rocks which have been intruded by a medium grained granitoid and a diorite.

Consequently Namdini has alteration and mineralisation in three rock types.

- Metavolcanic and Metasediments
- Granite
- Diorite

Mineralisation at Namdini passes through all the rock types and is accompanied by visible disseminated pyrite and arsenopyrite in veins and in the wall rocks.

The mineralisation is strongly structurally controlled and the deposit appears to be located in a key structure in a regionally extensive deformation zone.

The gold recovery at Namdini needs to take into account the three rock types where around 10% of all gold is recovered in the gravity circuit but grinding to a finer particle size is required for all rock types, especially diorite. The Starter Pit has more oxidised ore that provides a high 30% gravity recovery.

Namdini Gold Recoveries				
	Gravity		Concentrate	Total
	% Ore	% Gold	% Gold	% Gold
Starter Pit		30.0	92.5	93.5
Metavolcanics	60	9.2	89.0	90.0
Granite	30	14.0	94.6	95.5
Diorite	10	17.3	89.5	91.0

Source: Cardinal Resources

60% of resources are in the metavolcanics and 29% in the granitic rocks.

Namdini Resources				
Resources Koz	Granite	Metavolcanics	Diorite	Total
Inferred	1115	2210	464	3789
Indicated	1119	2455	469	4043
Total	2234	4665	933	7832
Resources %				
Inferred	14%	28%	6%	48%
Indicated	14%	31%	6%	52%
Total	29%	60%	12%	100%

Source: Cardinal Resources

The gold is primarily associated with sulphides and mostly pyrite. Gold occurs as fine particles as inclusions in pyrite or on the boundaries and some visible gold is present. Gold particles separate readily from the pyrite in the grinding process. The more porous metavolcanics took up the majority (60% of resources) of the gold mineralising fluids and had a 23% higher mineralised grade than the granitic ores.

Namdini Ore Grades			
Grade g/t	Granite	Metavolcanics	Diorite
Inferred	1.03	1.24	1.06
Indicated	1.03	1.23	1.06
Total	1.03	1.23	1.06
Indexed Granite =100			
Inferred	100	120	103
Indicated	100	119	103
Total	100	119	103

The ore deposit has been determined after 118,000m of drilling including 54,000m of RC and 64,000m of diamond.

Namdini has three rock types....

Metavolcanics,  
granitic rock and  
diorite

The bulk of the ore mineralisation(60%) is  
in the metavolcanics

The metavolcanics also have the highest  
grades – 20% above the granitic rocks....

0.9moz high grade zone (1.31g/t) has been defined as the Starter Pit.

The pit shell extends over 1100m.

The mineralisation is open to the north and at depth.

Mineralisation is on average 350m wide and pit extends to about 400m depth.

The mineralisation is open at depth ...

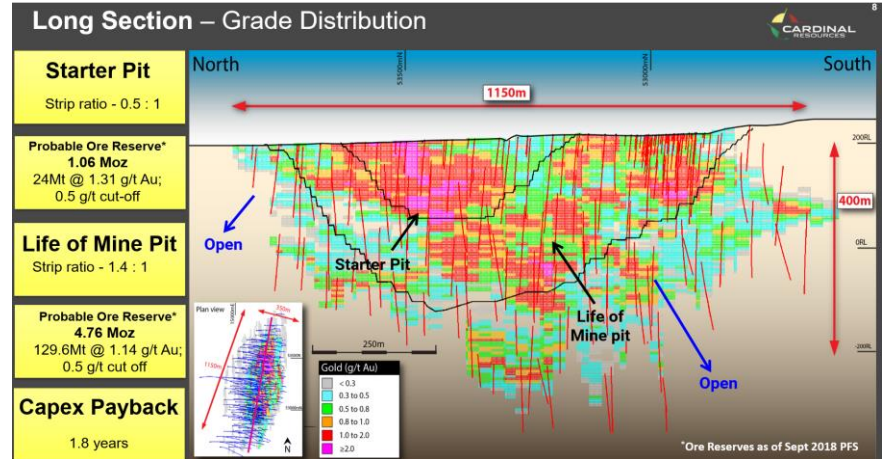
Mineralisation is open at depth so the cut off grade becomes important in establishing the mine life..

The mineralisation clearly extends below the pit shell

The Namdini ore body has been established with a cut-off grade of 0.5 g/t for the pit using the Whittle Optimisation Programme down to about 400m.

A high-grade zone (ave 1.31g/t) has been chosen for the 0.9moz Starter Pit and the mineralisation extends well beyond the current pit shell.

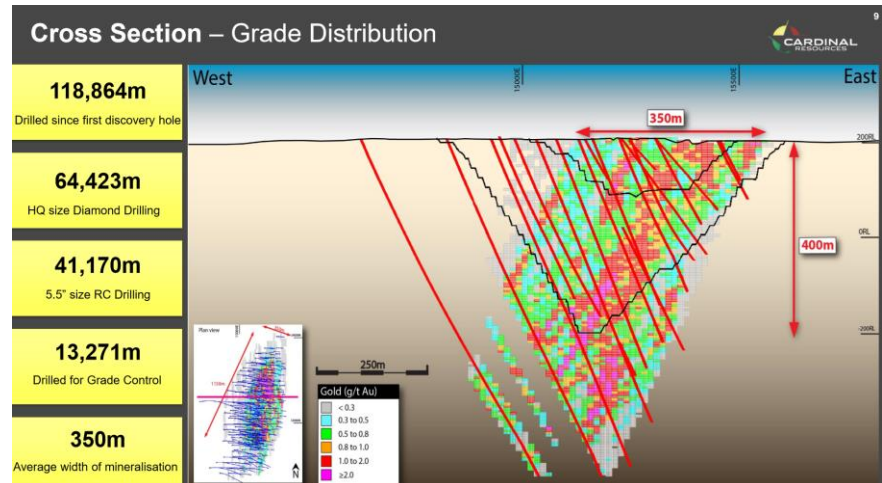
#### Namdini Long Section



Source: Cardinal Resources

The gold mineralisation has an average width of about 350m and the pit floor has been set at about 400m. The mineralisation continues down plunge to be open at depth.

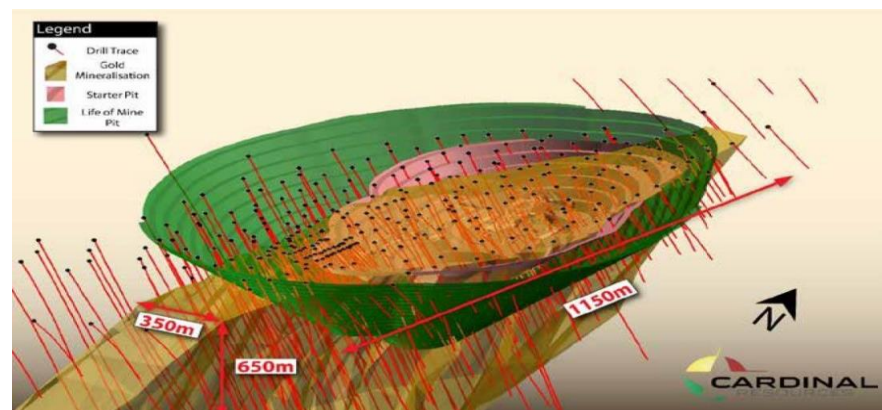
#### Namdini Cross Section



Source: Cardinal Resources

Mineralisation extends below the pit shell so that 7.8moz have been delineated with 3.77moz to be recovered in the 14 year life of mine plan.

A reduction in the cut-off grade in the BFS could add significantly to gold production and mine life.



Source: Cardinal Resources

The marginal cut-off grade was set at 0.5g/t at a long-term gold price of US\$1300/oz giving US\$39.63/g. With cash operating costs of US\$15.99/t this gave a US\$3.82/t margin at the cutoff grade.

At US\$1500 this becomes 15% higher at US\$ 48.22/g so the margin at 0.5g/t is US\$8.11. At US\$1500/oz and 0.4g/t cut off this becomes US\$3.29/t margin at cut-off.

#### Namdini Margins at US\$1500/oz and various cut off grades

Namdini Indicated and Inferred Resources Resource/grade relationship				Ore Value	Cut off Value	Margin Ave grade	Margin C/o grade
Tonnes	Grade	Metal	Cut-off	@US\$1,500	@US\$1,500	@US\$16/t	@US\$16/t
Mt	Au g/t	Au Moz	Au g/t	US\$/tonne	US\$/tonne	US\$/tonne	US\$/tonne
289	0.9	8.1	0.2	43.40	9.64	27.40	-6.36
258	0.9	7.8	0.3	44.85	14.47	28.85	-1.53
225	1.0	7.5	0.4	48.22	19.29	32.22	3.29
193	1.2	7.0	0.5	55.46	24.11	39.46	8.11
163	1.3	6.5	0.6	62.69	28.93	46.69	12.93

#### Namdini tonnes vs grade

Table 31: March 2018 Namdini Mineral Resource estimates

Indicated Mineral Resources			
Cut-off (Au g/t)	Tonnes (Mt)	Grade (Au g/t)	Metal (Au Moz)
0.2	269	0.9	7.5
0.3	240	0.9	7.2
0.4	210	1.0	6.9
0.5	180	1.1	6.5
0.6	152	1.2	6.0
0.7	128	1.3	5.5
0.8	107	1.4	5.0
0.9	90	1.6	4.5
1.0	76	1.7	4.1
Inferred Mineral Resources			
Cut-off (Au g/t)	Tonnes (Mt)	Grade (Au g/t)	Metal (Au Moz)
0.2	20	0.9	0.6
0.3	18	1.0	0.6
0.4	15	1.1	0.6
0.5	13	1.2	0.5
0.6	11	1.4	0.5
0.7	9	1.5	0.5
0.8	8	1.6	0.4
0.9	7	1.8	0.4
1.0	6	1.9	0.4

Source: Cardinal Resources

## 7.1 Mining

The Namdini ore body has the three rock types and also three ore types being oxidized, transition and primary ore.

The mining schedule has been designed in four stages that would maximise NPV by mining the highest grades with the lowest strip ratio and deferring higher strip ratios until later in the mine life.

The Life of Mine strip ratio is 1.45:1.

Stage one mining at Namdini would begin with a Starter Pit in a high grade (1.31g/t) zone where the overburden rate is around 0.3:1 to 160m. The pit would mine all three ore types but would concentrate on milling the primary and transition ore and stockpiling oxidised ore to be treated over an extended period.

A second stage would extend the pit shell and mine to about 245m at 0.9:1.

The third stage would mine to 325m depth and require a push back of the walls and an increase in the strip ratio to 2.3:1 at 1.14g/t.

The fourth stage would mine down to about 410m with a further push back of the walls and an increase in the strip ratio to 3.2:1 at a grade 1.10g/t.

At US\$1250/oz the 0.5g/t cut off grade is US\$24.11/t against the cash operating costs of US\$10.99 as mill feed and total cash operating costs of US\$15.99 /t.

At US\$1300/oz the cash operating margin would be US\$3.82/t at the cutoff grade of 0.5g/t.

At US\$1500 the margin would be US\$8.11 at 0.5g/t cutoff

At a 0.4g/t cutoff and US\$1500/oz the cash margin would be US\$3.29/t.

On these figures, a reduction in the cut off grade to 0.4g/t would add a further 500koz to resources..

Tonnes vs grade data from March 2018 PFS

Mining this single pit deposit gives an ideal opportunity for Whittle NPV mining

The Starter Pit has a ~30% higher initial grade and a very low strip ratio of 0.3:1

Capital payback is achieved within 18 months.

As the mine deepens the strip ratio rises.....

...so capital on overburden removal is deferred until after well after initial capital is recovered.



Namdini deposit is 11150m by 300m by 700m depth

The Starter Pit could generate revenue of >US\$500m in Year 1 at US\$1500/oz and an operating surplus of >US\$300m on cash operating costs of US\$190m.

In contrast the Main Pit would produce less revenue and have higher costs.

Infill drilling has confirmed the elevated grade of 1.31g/t and showed mineralisation extends from surface for the low strip ratio

Mining costs are estimated at US\$3.25/t so with the 0.3:1 strip ratio the cost per tonne of ore is US\$4.22/t.

## 7.2 The Starter Pit

Cardinal recognized a high grade near surface portion of the ore body could be developed quickly and provide a rapid repayment of capital.

The Starter Pit would produce over 0.9moz at an average grade of 1.31g/t compared to the reserve grade of 1.13g/t. Gravity recovery of the gold should also show lower overall AISC unit costs of US\$599 vs total LOM of US\$799.

The average mill grade in Year 1 should be over 1.6g/t and produce over 400koz with the average over 30 months being around 340kozpa.

Construction of the full 9.5mtpa plant would be completed for the Starter Pit and most of the US\$414m capital cost would have been expended.

The average annual gold production would be around 340koz and at current gold prices of US\$1500/oz would produce gold revenue of >US\$500m against an estimated cash operating cost base of US\$190m.

The NPV benefits of the Starter Pit are substantial and would give a benefit of at least US\$80m in the first year.

### Comparison of Starter Pit against Main Pit

Namdini Starter Pit Comparison								
	Starter Pit				Main Pit			
Grade g/t	1.31	1.31	1.31	1.31	1.00	1.00	1.00	1.00
000ozpa	340	340	340	340	300	300	300	300
US\$/oz	1250	1400	1500	1600	1250	1400	1500	1600
Revenue US\$m	425	476	510	544	375	420	450	480
Opcosts US\$m	190	190	190	190	209	209	209	209
Margin US\$m	235	286	320	354	166	211	241	271
Margin %	55%	60%	63%	65%	44%	50%	54%	56%

Cardinal had recently completed an RC infill drilling programme comprised of 30 holes on 25m x 25m within the proposed Starter Pit.

These holes confirmed the Starter Pit elevated grade of 1.31g/t and are in line with expectations. Some of the results included:-

- 89m @ 2.3 g/t Au from surface in NMRC794
- 83m @ 3.5 g/t Au from surface in NMRC745
- 78m @ 4.1 g/t Au from surface in NMRC738
- 74m @ 2.6 g/t Au from surface in NMRC743
- 69m @ 3.9 g/t Au from 99m in NMRC762

Mining costs are estimated at US\$3.25/t in the Starter Pit so ore costs will be US\$4.22/t.

## 7.3 Main Pit

The Main Pit will have a planned pit length of around 1100m, width of around 350m and depth of 400m.

Mining would be by excavator and 150 tonne haul trucks.

As noted, the mine plan has four stages so after the Starter Pit the strip ratios will rise and mining costs will increase with depth to around US\$5.00/t as the pit deepens in Stage Four. With the strip ratio at 3.2:1 the cost of ore will rise to US\$21/t.



## 7.4 Milling

Flow sheet is standard crushing and grinding to 106microns then into cyclones to recover gravity gold.

Crushing and grinding releases 95% of the contained gold in the ore.

Gravity recovery should be ~30% for the higher grades from the Starter Pit and 15% from the Main Pit.

The slurry is then subject to flotation to produce a concentrate containing 15-17g/t Au.

Mass pull to the back of the plant is only 8% so the gold recovery circuits require capacity of just 0.75mtpa.

The Aachen™ Shear technology could increase recoveries and/or reduce capital and operating costs

The Aachen™ Reactor adds oxygen in micronized bubbles that scour pyrite grain surfaces and also accelerates oxidation along grain boundaries.

This action can be as beneficial as finer grain size grinding in breaking grain boundaries..

The extra oxygen also speeds up reaction times of the various reagents to make them more efficient and economical..

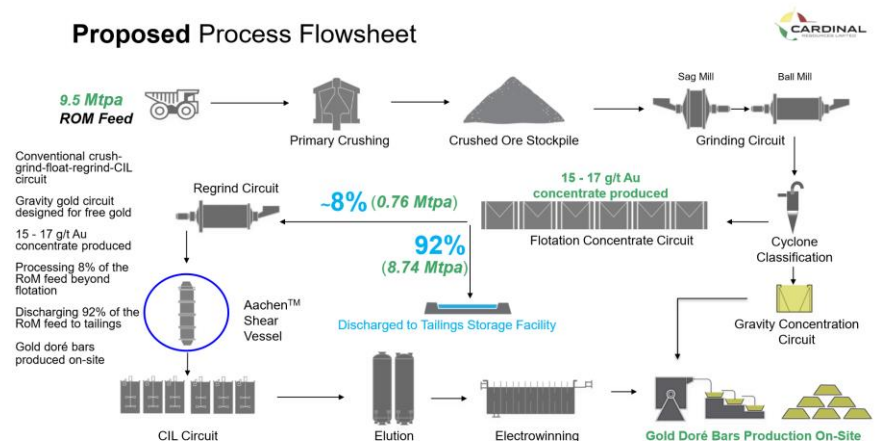
The flowsheet for Namdini can be described as a conventional primary crush, semi-autonomous grinding mill, flotation, regrind and carbon-in-leach circuit.

Grind size into the concentrate is 106 microns and the mass pull into the concentrate is estimated at 8% of the initial mass with 92% of sent to the tailings dam.

The regrind circuit for the concentrate is down to 15 microns before it flows into the carbon in leach (CIL ) circuit.

The PFS showed the flowsheet provided a high recovery of >95% of the gold into the concentrate with about 30% of the gold being recovered in a gravity circuit so that the concentrate runs about 16-17g/t gold.

The concentrate is proposed to then be subject to treatment through the Aachen Shear Vessel before being sent to the Carbon-in-Leach circuit and on through electrowinning to produce gold dore bars.



### 7.4.1 The Aachen Reactor™ High Shear reactor (HSR) Technology

The Aachen™ High Shear Reactor Technology from Maelgwyn is a relatively new flow sheet addition for major African mines. Recent data shows that 63 units of equipment are currently being used on nine major mines in Africa.

The Aachen™ system adds oxygen under low pressure to the concentrate in a simple reactor that scours the particle grain surface and also kinetically breaks the particles along the grain boundaries. This makes for cleaner and smaller particles without further costly comminution grinding. This treatment of 45micron particles gives a similar result as grinding to 10 microns so requires less power and residence time.

Concentrate slurry input to the unit is generally ~2 m/s and the velocity through the contact zone is ~10 m/s with oxygen being introduced within micronized bubbles (200µm).

In general terms, high shearing of slurry particles and high velocity of oxygen, results in improved kinetics by scouring the particle surfaces and accelerating the oxidation of the sulphide species which then allows for less residence time and less reagent requirements within the leaching circuit.

The lab test to date have shown potential for

- increased gold recovery
- coarser grind size
- lower power costs

The increased oxygen content also improved the reactivity of the reagents so that overall oxygen and cyanide costs would be lower.

Less grinding could mean lower capacity of power generation.

The impact on NPV could be over US\$100m

The different rock types have different recovery rates

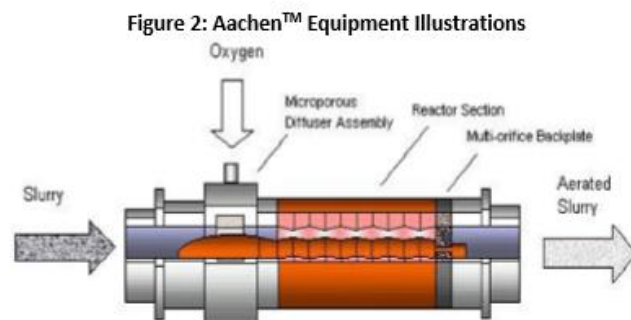
Cardinal has tested its concentrates in Maelgwyn's labs with encouraging results. The lab studies showed:-

- Increased gold recovery
- A coarser grind size could be adopted
- Less grinding meant lower power costs

The studies also showed that the system improved the mass transfer of oxygen and the reactivity of reagents so that overall operating costs would be reduced. Overall oxygen and cyanide consumption would be lower.

Adoption of the technology would also lower capital costs by requiring less installed power generation.

Maelgwyn has generally found that the scale up from laboratory to the full production plant has generally shown even greater improvements. Generally, a 5% recovery improvement in the laboratory can translate into 7 or 8% in full-scale operation.



Source: Cardinal Resources

All the above points could result in project economic benefits by reducing OPEX and CAPEX whilst improving gold recovery which has provided a clear path forward for Cardinal and the Aachen™ process.

The Aachen™ test work gave encouraging results for potential recoveries from the various rock types. Cardinal will be assessing the tradeoffs in the DFS to optimise recovery outcomes.

Namdini Aachen™ Leach Testwork Result - Life of Mine (LOM) sample						
Regind size P90(μm)	Metavolcanics		Granite (GRA)		Diorite (DIO)	
	Aachen™ Leach Recovery%	Range of possible overall Recovery %	Aachen™ Leach Recovery%	Range of possible overall Recovery %	Aachen™ Leach Recovery%	Range of possible overall Recovery %
5 μm	90-95	84-90	92-96	84-91	90-96	83-91
9 μm	90-96	82-91	88-96	81-91	90-94	82-89
45 μm	84-88	77-84	95-97	97-92	93-95	86-90
75 μm	73-75	67-71	76-82	70-78	75-86	69-82

Source: Cardinal Resources

Project fits within 20km<sup>2</sup> mining lease

## 8.o Namdini Mine Construction

The Mine Licence is was issued in December 2017 and covers almost 20km<sup>2</sup>.

The plant is set up near the pit and has a waste dump and tailings dams to hold the concentrate reject tailings and also the tailing from the CIL circuits.

### Namdini Gold Mine and Facilities

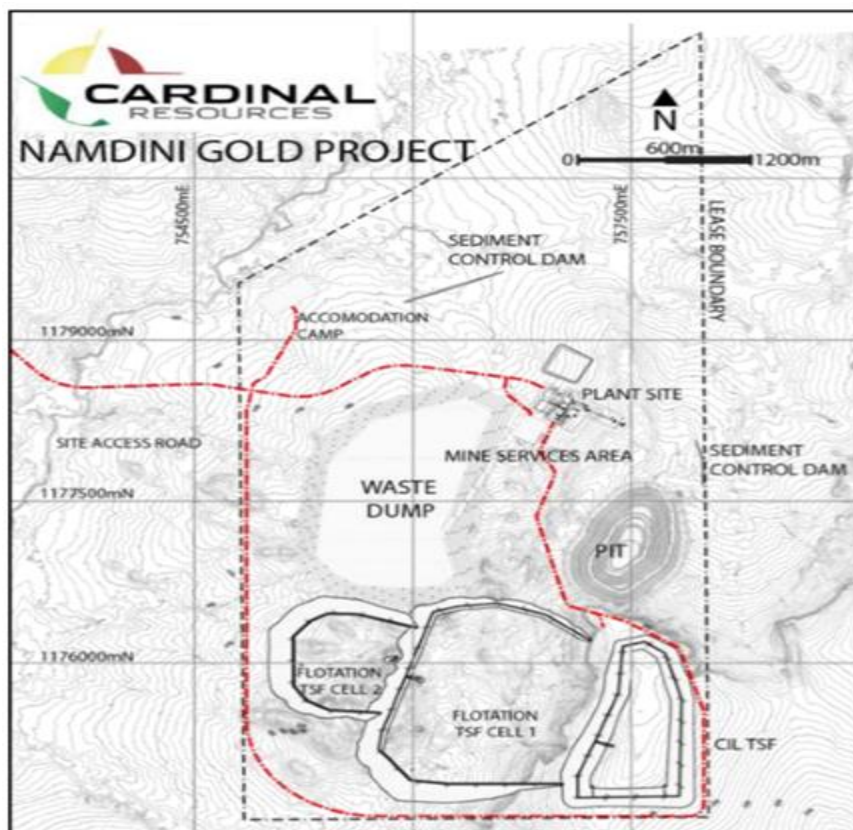


Figure 4: Namdini Gold Project infrastructure layout (source: Cardinal 2018)

Current capital costs from the PFS are US\$414m +/- 20%. The DFS will tighten the costs and should the Aachen™ technology be adopted as indicated Cardinal might have reductions in infrastructure capital and also reagent requirements.

Capital costs of US\$414m  
...Aachen technology could reduce  
infrastructure and reagent costs

Namdini Project Capital Costs	
	US\$m
<b>Construction Costs</b>	<b>42.0</b>
<b>Treatment Plant</b>	<b>157.2</b>
<b>Reagents and service</b>	<b>39.8</b>
<b>Infrastructure</b>	<b>76.8</b>
<b>Mining Contractor</b>	<b>5.1</b>
<b>Sub Total</b>	<b>320.9</b>
<b>Management Costs</b>	<b>37.1</b>
<b>Owners Project Costs</b>	<b>41.4</b>
<b>SubTotal</b>	<b>399.4</b>
<b>Contingency</b>	<b>14.6</b>
<b>Total</b>	<b>414.0</b>

Source: Cardinal Resources

*Namdini is a large mine in Ghana*

*Namdini is also larger than any Australian open pit other than Boddington*

## 9.0 Operational comparatives

Namdini is one of the largest mines to operate in Ghana and the largest by far in the north of Ghana.

Company	Gold Fields	Cardinal	Newmont	NordGold	Newmont	AngloGold	Gold Fields
Deposit	Tarkwa	Namdini	Akyem	Bissa	Ahafo	Iduapriem	Damang
Mtpa	13.5	9.5	9.0	7.5	6.0	5.1	4.5
Grade g/t	2.7	1.1	1.8	1.4	3.1	1.3	2.2
Gold kozpa	300	320	425	320	600	256	160
Recovery	97%	90%	92%	83%	95%	97%	90%

And is large in comparison with ASX listed companies with local open cut operations.

	Newcrest	Newmont	Newcrest	Gold Fields	Evolution	Newmont	Regis
	Lihir	Boddington	Cadia East	Gruyere	Cowal	Superpit	Duketon
Mtpa	75	40	32	8.2	7.9	7.2	4.6
Grade g/t	2.6	0.6	1.3	1.3	1.2	1.2	1.2
Gold kozpa	800	740	800	300	251	500	361
Recovery	86%	86%	77%	92%	82%	85%	94%
AISC US\$/oz	1000	900	125	725	995	787	901

## 10.0 Namdini Profit and Loss Analysis

The Namdini deposit is a relatively simple project with a standard mill facility treating ore from a single open pit.

The October 2018 PFS provided detailed data on capital and operating costs that have been incorporated into the MPS models on cashflow and earnings projections.

Gold mining in the Birimian is well understood by technical operators so figure should not surprise on the downside.

The upcoming Bankable Feasibility Study due out early Dec Qtr 2019 is likely to provide some downward revisions from contingencies and also from capital and operating costs from the adoption of the Maelgwyn's Aachen™ process system.

Cashflows are very strong and should enable Cardinal to pay a dividend after Year 1.

Namdini 9.5Mpta Production - Earnings and Cashflows																		
Unit	LOM Total	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Throughput 9.5Mpta		kt	0	0	0	7,000	9,500	9,500	9,500	9,500	9,500	9,500	9,500	9,500	9,500	9,500	3,600	
Operating Cost Per Tonne																		
Mining	US\$				7.9	7.9	6.4	7.0	7.5	6.3	6.6	10.6	10.9	11.4	11.9	9.7	8.0	6.0
Processing	US\$				10.8	10.8	10.8	10.9	10.9	10.8	10.8	10.9	10.9	10.9	11.0	10.8	10.8	10.8
G & A	US\$				0.7	0.7	0.7	0.9	0.9	0.7	0.7	0.9	0.8	0.8	0.9	0.9	0.8	0.8
Grade Control	US\$				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3
Owners G & A	US\$				0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.2	0.2
Production																		
Gold Produced	Koz	3,935	0	0	309	408	330	287	278	292	297	300	302	274	331	248	202	76
Head Grade	g/t	0.99			1.60	1.55	1.28	1.12	1.10	1.15	1.17	1.18	1.19	1.08	1.29	0.98	0.80	0.80
Recovery	%	84			85.9%	85.9%	84.1%	83.6%	82.6%	83.0%	82.7%	82.9%	82.8%	82.9%	83.4%	82.3%	82.3%	82.3%
Revenue																		
Gold Price	US\$/oz				1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Revenue	US\$ M	4,919			387	510	412	359	348	365	372	375	377	343	413	310	252	96
Operating Costs																		
Mining Cost	US\$ M	1,066			55	75	60	66	71	60	63	101	103	108	114	92	76	22
Process & GA Cost	US\$ M	1,452			81	109	109	112	112	109	109	112	111	111	113	111	110	42
Owners Cost	US\$ M	134			8	11	11	11	11	11	11	11	11	11	11	11	4	2
Royalties (5%)	US\$ M	246			19	26	21	18	17	18	19	19	19	17	21	16	13	5
Total Operating Costs	US\$M	2,898			163	221	201	207	212	198	202	243	244	247	258	230	203	70
Operating surplus		US\$ M	2,020		223	289	211	151	136	167	170	132	133	96	156	81	50	26
Depreciation	US\$ M	370			48	43	39	35	31	28	26	23	21	19	17	15	14	12
Amortisation	US\$ M	200			14	14	14	14	14	14	14	14	14	14	14	14	14	14
Total Dep & Amort	US\$ M	570			62	57	53	49	46	43	40	37	35	33	31	29	28	26
Total costs	US\$M	3,469			226	278	254	257	258	241	242	280	279	280	289	259	230	96
Pretax	US\$ M	1,450			161	232	158	102	90	124	130	94	98	63	125	51	22	-1
Tax	US\$ M	435			48	69	47	31	27	37	39	28	29	19	37	15	7	0
Net Earnings	US\$ M	1,015			113	162	111	71	63	87	91	66	69	44	87	36	15	0
Cash costs /oz	US\$	733			528	541	609	723	761	679	679	811	810	901	779	925	1,004	910
Total costs /oz	US\$	874			729	682	770	894	925	825	813	935	925	1,020	873	1,043	1,142	1,257



Cardinal Resources \$ 0.39													
Year end 30 June	%	2018	2019	2020	2021	2022	2023	2024	2023 Revenue	Book Val	Market Val	Appraised Val	
A\$m									2023	A\$m A\$/sh	A\$m A\$/sh	A\$/sh	A\$/sh
Namdini	100	-26	-14	-20	-5	0	351	491	682	0	0.00	110	0.22 1381 2.72
Ngondo	100	-1	-1	-1	-2	-5	-5	-5	15	0	0.00	5	0.01 20 0.04
Bongo	100	0	0	0	0	-1	-1	-1		0	0.00	1	0.00 1 0.00
Kungongo	100	0	0	0	0	-1	-1	-1		0	0.00	1	0.00 1 0.00
Subbratum	100	0	0	0	0	-2	-5	-5		0	0.00	4	0.01 15 0.03
Admin		-11	-12	-12	-18	-12	-15	-15		0	0.00		0.00
Cash		0	0	0	0	0	5	5		27	0.05	27	0.05 27 0.05
Interest		0	0	-4	-4	-4	-30	-12		-36	-0.07	-36	-0.07 -441 -0.87
Total Pretax		-37	-27	-37	-29	-25	299	457			0.00		0.00
Tax		0	0	0	0	0	0	-137			0.00		0.00
Net Earnings		-37	-27	-37	-29	-25	299	320	697	-9	-0.02	112	0.22 1004 1.98
Free Cashflow		-37	-27	-37	-29	-25	349	507		FY22	FY23	FY24	
EPS		-0.10	-0.07	-0.07	-0.04	-0.04	0.43	0.46	PERx	-10.9	0.9	0.9	
FCFPS		-0.10	-0.07	-0.07	-0.04	-0.04	0.50	0.72	PFCFRx	-10.9	0.8	0.5	
DPS		0.00	0.00	0.00	0.00	0.00	0.10	0.15	Yld		26%	38%	
Exploration expen		-27	-15	-21	-7	-9	-12						
Capital raised		12	33	18	100								
Cash		7	19	20									
Shares on issue (m)		374	383	508	700	700	700	700					

## 11.0 Cardinal Balance Sheet Data

Cardinal's policy on exploration expenditures is to expense them as incurred consequently the company has written off A\$67m in Ghana exploration and also all administrative expenditures such that total carried forward losses are A\$108m. These expenditures exceed the A\$84m in issued capital resulting in the Balance Sheet showing negative shareholder equity.

Cardinal had 117.4 m A\$0.15 September 30 2019 options which were fully exercised to bring in A\$17.6m new equity as cash.

Balance Sheet				
A\$m	FY16	FY17	FY18	FY19
<b>Current Assets</b>				
Cash and Cash Equivalents	4.86	28.59	7.30	18.74
Trade and other Receivables	0.02	0.13	0.98	0.26
other assets	0.10	0.92	1.39	0.85
<b>Total Current Assets</b>	<b>4.99</b>	<b>29.64</b>	<b>9.68</b>	<b>19.84</b>
<b>Non Current Assets</b>				
Plant and Equipment	0.68	0.47	0.56	0.99
<b>Total Non Current Assets</b>	<b>0.68</b>	<b>0.47</b>	<b>0.56</b>	<b>0.99</b>
<b>Total Assets</b>	<b>5.66</b>	<b>30.11</b>	<b>10.24</b>	<b>20.83</b>
<b>Current Liabilities</b>				
Trade and other payables	1.71	3.88	4.71	3.29
Provisions	0.00	0.02	0.06	0.09
<b>Total Current Liabilities</b>	<b>1.71</b>	<b>3.90</b>	<b>4.77</b>	<b>3.37</b>
<b>Non-Current Liabilities</b>				
Borrowings	0	0	0	35.60
<b>Total Liabilities</b>	<b>1.71</b>	<b>3.90</b>	<b>4.77</b>	<b>38.98</b>
<b>Net Assets</b>	<b>3.95</b>	<b>26.21</b>	<b>5.47</b>	<b>-18.14</b>
<b>Equity</b>				
issued capital	26.15	68.63	81.37	84.46
Reserves	1.04	2.48	6.00	5.68
Accumulated Losses	-23.25	-44.90	-81.90	-108.28
<b>Total Equity</b>	<b>3.95</b>	<b>26.21</b>	<b>5.47</b>	<b>-18.14</b>
<b>Total Liabilities and Shareholders Deficit</b>	<b>5.66</b>	<b>30.11</b>	<b>10.24</b>	<b>20.83</b>

Source: Cardinal Resources

On August 22, 2018 Cardinal entered into a 30-month loan facility of US\$25m from Sprott Private Resources Lending (Collector) L.P. secured against the assets of the company.

The facility has a 28 February 2021 repayment term with interest calculated at LIBOR (currently around 2%) + 7.5%. Half the interest cost is capitalized with repayment at loan maturity.

All exploration is expensed as incurred.

A\$67m expensed to end of FY19

Cash is around A\$28m as at 30 Sept 2019

US\$25m Credit Facility from Sprott group..

Repayment 28 February 2021

### 11.1 Cardinal Cashflow Statement

Cardinal has kept focus on the development of Namdini through onground expenditures and on the work towards the completed PreFeasibility Study and the Bankable Feasibility Study due out in early Dec Qtr 2019.

Since July 2015 Cardinal has raised around A\$100m in equity and debt with a further A\$17.6m being raised through the exercise of the \$0.15 Sept 2019 options.

Cash Flow Statement				
A\$m	FY16	FY17	FY18	FY19
<b>Operating activities</b>				
Expenditure on mineral interests	-5.9	-14.6	-26.7	-14.2
Payments to suppliers and employees	-1.3	-3.6	-6.2	-6.0
Interest received	0.0	0.1	0.2	0.3
<b>Net cash flow operating activities</b>	<b>-7.1</b>	<b>-18.0</b>	<b>-32.7</b>	<b>-19.8</b>
<b>Investing activities</b>				
Plant and Equipment	-0.2	-0.3	-0.3	-0.7
<b>Total cash outflow on investing activities</b>	<b>-0.2</b>	<b>-0.3</b>	<b>-0.3</b>	<b>-0.7</b>
<b>Financing activities</b>				
Issue of shares and options	11.3	42.1	12.1	0.6
Interest paid			0.0	-1.8
Proceeds from borrowings			0.0	33.9
<b>Net cash inflow from financing activities</b>	<b>11.3</b>	<b>42.1</b>	<b>12.1</b>	<b>32.7</b>
<b>Net change in cash</b>	<b>4.0</b>	<b>23.7</b>	<b>-20.9</b>	<b>12.1</b>
Cash at beginning	0.8	4.9	28.6	7.3
Exchange rate changes			-0.4	-0.7
<b>Net cash at end of period</b>	<b>4.9</b>	<b>28.6</b>	<b>7.3</b>	<b>18.7</b>

Source: Cardinal Resources

Interest on the US\$25m Sprott facility is around US\$2.5mpa with 50% payable in cash for around A\$1.9mpa.

A\$17.6m was raised from the 30 September 2019 option exercise is subsequent to this cashflow statement.

*Clear focus of expenditures on exploration and development*

*Funding through share issues and Sprott debt facility*

## **Archie Koimtsidis**

### **Chief Executive Officer / Managing Director**

Mr Archie Koimtsidis has for the last 20 years been involved in all facets of gold exploration, discovery, production and refining in West Africa and South America.

Archie's most recent appointment prior to joining Cardinal was as the Deputy Country Manager of Ghana for PMI Gold Limited a joint TSXV and ASX listed company. During this time, he was responsible for all field operational matters including coordination of exploration, drilling programs, and human resource management relating to that Company's projects in Ghana.

Archie has been instrumental in acquiring the Ghanaian projects on behalf of Cardinal and has a unique knowledge and understanding of geopolitical and operational matters relating to resource projects in West Africa.

## **Kevin Tomlinson**

### **Non-Executive Chairman**

Mr Tomlinson possesses over 30 years' experience in Mining and Finance within the Toronto, Australian and London Stock markets. He was previously Managing Director of Investment Banking at Westwind Partners/Stifel Nicolaus raising equity and providing corporate advice.

Kevin has extensive experience in development and financing of mining projects internationally. Previous Directorships include Centamin Plc, an Egyptian gold producer, Orbis Gold, a Burkina Faso gold developer and Medusa Mining, a Philippines gold producer.

## **Malik Easah**

### **Executive Director**

Mr Malik Easah is the principal of a successful alluvial mining operation in the North West Adansi Gold Obotan concession and is currently developing additional payable gold permits within the Ashanti and Nangodi Gold belts of Ghana.

Malik specialises in the manufacture of alluvial gold wash plants and recovery equipment and is regarded as an authority in the development of alluvial mining operations in Ghana. Malik is a resident in Ghana.

## **Dr. Kenneth G. Thomas**

### **Non-Executive Director**

Dr. Thomas has over 45 years in the mining industry with experience in project development, construction and operations. Until July 2012 he was Senior Vice President, Projects, Kinross Gold Corporation and previously, for 6 years, a Global Managing Director and Board Director at Hatch Ltd, a leading international engineering and construction firm.

From 1987 to 2001 he served in progressively senior roles at Barrick Gold Corporation to Senior Vice President, Technical Services. Prior to Barrick Gold Corporation, he also worked for 10 years in Zambia and South Africa with Anglo American Corporation.

Ken has a doctorate in Technical Sciences (Project Implementation) from Delft University of Technology and in 2001 he was awarded the Selwyn G. Blaylock Medal by the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) for advancements in mining internationally. In addition, he is a Fellow and Past President of the CIM. Ken is an experienced public company director, including his current appointment as director of Continental Gold (TSX: CNL).

## **Michele Muscillo**

### **Non-Executive Director**

Mr. Muscillo is a Partner with HopgoodGanim Lawyers in Australia. Michele has practised exclusively in corporate law for over 15 years and has extensive experience in capital markets transactions, including the negotiation of significant commercial contracts and agreements. As part of this role, Mr. Muscillo has acted on numerous IPOs and debt and equity raisings, and advised both bidders and targets on public market control transactions. His key areas of practice include Corporate Advisory and Governance, Capital Markets, Resources and Energy.

Mr. Muscillo is currently a Non-Executive Director with Aeris Resources Limited (ASX:AIS) and Xanadu Mines Limited (ASX: XAM). Formerly, Michele was also Non-Executive Director of Orbis Gold Limited which is currently owned by TSX-Listed SEMAFO Inc. (TSX:SMF).

## **Trevor Schultz**

### **Non-Executive Director**

Mr Schultz has over 45 years in the mining industry with experience in project development, construction and operations. Between 2008 and 2018 he was an Executive and Non-Executive Director with Centamin Egypt and was responsible for the construction of the 12Mtpa processing plant which has a similar flowsheet to Cardinal's proposed flowsheet.

Prior to this, he served as Chief Operating Officer at Ashanti Goldfields Corporation (now Anglo Gold Ashanti Ltd) and was a resident of Ghana for 6 years. Furthermore, he worked for BHP in Australia and America and in South Africa with Anglo American Corporation.

Trevor has an MA in Economics from Trinity College, England (1968), an MSc in Mining Engineering, from Witwatersrand University, South Africa (1972) and an Advanced Management Programme Diploma from Harvard Business School, USA (1986).

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