HARDMAN&CO.

Mining

Source: Refinitv

Market data

EPIC/TKR	**PXC**
Price (p)	**37.00**
12m High (p)	64.70
12m Low (p)	5.00
FD shares (m)	126.68
Mkt Cap (£m)	46.87
EV (£m)	29.85
Free Float*	72.7%
Country of listing	UK
Market	AIM

**As defined by AIM Rule 26*

Description

Phoenix Copper Limited (PXC) is developing the former Empire deposit, and the surrounding area in central Idaho, into a potentially world-class copper and polymetallic mine. First production is expected in 2022.

Company information

Chairman	M Edwards-Jones
CEO	Ryan McDermott
CFO	Richard Wilkins
CTO	Roger Turner
Director	Dennis Thomas

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phoenixcopperlimited.com

Key shareholders

Martin Hughes	16.1%
Hargreaves L. (Noms.)	13.9%
Directors	8.6%
Bank of New York	7.6%
Cheviot Capital (Noms.)	5.6%
Lynchwood Nominees	4.5%

Diary

Apr'21	Final results
Jun'21	Feasibility Study

Analyst

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PHOENIX COPPER LTD

RELOAD: a mountain of copper, silver and gold

PXC has consolidated the former Empire copper mine (which recovered a startling 3.64% copper before WWII) and five other former mines/deposits located nearby into a potentially world-class copper, gold and silver project in Idaho. Our estimated DCF valuation is 60p/share, based on the initial near-surface copper-gold mine *only*. Given better funding conditions, the company is considering simultaneously developing a silver mine at its nearby Red Star resource. If greenlighted, we estimate a combined valuation of 95p/share (139p/share using recent highs in copper and silver prices).

- **Strategy:** PXC is focusing on maximising returns to its shareholders by developing the Empire mineral system in stages, to accelerate near-term cashflows. The first mine focuses on copper and gold, which we believe have positive outlooks due to battery technology/structural shortage (copper) and currency debasement (gold). Idaho is one of the world's most favourable regions for mining investment.

- **Starting gun fired:** Following the £18.4m equity raise, a Feasibility Study for the Empire copper-gold mine is under way, and production is planned by end-2022. PXC is now also positioned to explore Empire's much larger sulphide ore body at depth and move forward on Red Star, which should have almost equal priority.

- **Upside:** It is likely that only ca.1% of the ore body around Empire has been explored so far, and that it extends several km from the former Empire mine, north through Red Star to the former Horseshoe mine. Geologically, the deposit shows similarities with Peru's Antamina, the world's largest skarn-hosted copper mine.

- **Risks:** PXC is subject to the normal risks for a junior miner, including volatility in metal prices, identifying additional ore resources, operational risks in executing the mining plan, running processing facilities and funding risks. However, we believe that jurisdictional risk is significantly reduced in PXC's case.

- **Investment summary:** Our DCF valuation of 60p/share for Empire only (8% discount rate) incorporates long-term copper, gold and silver prices of $3.60/lb, $1,825/oz and $27.00/oz, respectively. The 95p/share valuation for Empire and Red Star applies a cautious 15% discount rate to the latter (with an additional uplift of 23p per share at 8%, which could be justified by further successful development).

Financial summary and valuation: Scenario 1 – Empire only

Year-end Dec ($m)	2018	2019	2020E	2021E	2022E	2023E
Sales	0	0	0	0	0	90.460
Underlying EBIT	-1.654	-1.105	-1.188	-1.221	-1.255	47.727
Reported EBIT	-1.654	-1.105	-1.188	-1.221	-1.255	47.727
Underlying PTP	-1.652	-1.128	-1.265	-1.259	-2.870	45.072
Statutory PTP	-1.652	-1.128	-1.265	-1.259	-2.870	45.072
FD underlying EPS (p)	-5.82	-2.76	-2.17	-1.21	-2.43	30.43
FD statutory EPS (p)	-5.82	-2.76	-2.17	-1.21	-2.43	30.43
Net (debt)/cash	0.113	-0.589	-0.588	11.207	-36.133	2.172
No. shares EPS calc. (m)	28.12	40.86	57.55	103.65	118.22	128.93
P/E (x)	n/a	n/a	n/a	n/a	n/a	1.7
Dividend yield	n/a	n/a	n/a	n/a	n/a	n/a
FCF yield	n/a	n/a	n/a	n/a	n/a	105.7%

Source: Hardman & Co Research

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Refined: PXC's optimal strategy

Volatile two years for mining sector and PXC

The junior mining sector has been buffeted by volatile metal prices and funding conditions during the past two years, not to mention uncertainties due to COVID-19. Rewinding those two years, gold and silver prices were in the doldrums, and PXC was planning an open pit copper mine to exploit near-surface oxide mineralisation at Empire. Following this "starter" mine, subsequent stages of mine development were planned, with the aim of building a world-class copper-gold-silver mine.

Empire contains several potential mines, in addition to near-surface oxide deposit

The potential further stages of mine development at Empire included:

- The main sulphide ore targets located in the endoskarn mineralisation, beneath the oxide layer.
- Potentially exploiting mineralisation in a large porphyry ore body, which is believed to be located beneath the known Empire mineralisation, if it is accessible.
- The Red Star silver-lead deposit, which is located to the north of Empire.
- Further adjacent mineralised zones to the north and west of Empire, around the former Horseshoe, Bluebird and White Nob mines and the Navarre gold zone.

August 2019 PEA for copper mine with zinc by-product

The August 2019 Preliminary Economic Assessment (PEA) for an open pit oxide mine incorporated a nine-year production plan of 90,182 tons of (gross) copper production with zinc by-product. This was equivalent to 97% of the copper contained in the May 2019 Empire resource estimate.

Empire – mineral resources and reserves (May 2019)

	Tonnes (mt)	Copper (t)	Zinc (t)	Gold (oz)	Silver (oz)	Copper (%)	Zinc (%)	Gold (g/t)	Silver (g/t)
Measured	6.176	30,419	12,864	51,000	2,419,000	0.49	0.21	0.26	12.2
Indicated	8.993	43,453	16,949	88,000	3,618,000	0.48	0.19	0.30	12.5
M&I	**15.169**	**73,872**	**29,813**	**139,000**	**6,038,000**	**0.49**	**0.20**	**0.28**	**12.4**
Inferred	4.271	18,993	5,449	44,000	1,340,000	0.44	0.13	0.32	9.8
Total resources	**19.440**	**93,865**	**35,262**	**183,000**	**7,378,000**				

Source: Phoenix Copper, Hardman & Co Research

This low-cost "starter mine" would:

- accelerate returns to PXC shareholders; and
- generate cashflows to develop the much larger ore bodies beneath the oxide ore and on adjacent claims.

This strategy was modified

The sharp decline in the copper price towards $2.00/lb during late 2019-early 2020, due to intensification of US-Chinese trade tensions and COVID-19, led to PXC temporarily reconsidering its strategy.

Fortunately, the polymetallic nature of the ore body and zoned character of mineralisation at Empire meant that PXC could re-order mine development. Instead of beginning with the open pit copper mine, the first mine would be a silver-lead mine exploiting the Red Star deposit. This had two advantages at the time:

- silver is both a monetary and industrial metal, and gold and silver moved into bull markets as the Federal Reserve (and other central banks) reverted to easier monetary policies, coupled with massive credit creation; and
- the capital cost of the initial silver-lead mine with a flotation process plant was estimated at ca.$25m (excluding working capital), which was ca.$25m less than the cost of an initial copper mine.

Mine plan for silver mine at Red Star

PXC developed a mine plan for the Red Star mine, which incorporated 1.6m tonnes of ore over a 10-year life of mine (LOM), with production likely to begin around 2022. Channel sampling reinforced PXC's optimism that further exploration could enlarge the 103,500-tonne resource to well over 1.0m tonnes.

PXC increased Empire resource estimate twice in 2020…

Although the focus switched temporarily to Red Star, evaluation and exploration of the Empire ore body continued, and PXC increased Empire's resource estimate twice, in May 2020 (evaluation) and October 2020 (exploration), respectively.

firstly in May 2020…

The NI43-101-compliant resource, announced on 4 May 2020, was based on re-evaluating the existing exploration data on the ore body. PXC's management team reviewed all geochemical and geological data available for the Empire open pit project. It noted that much of the gold and silver in the deposit was not being included as part of the oxide resource, because the gold and silver mineralisation was not always spatially associated with copper grades that met the cut-off criteria for copper only.

…which led to significant increase in gold resources

In terms of the geology, the gold/silver mineralisation may have occurred later and on a different trend than the primary copper mineralising event. In this updated resource estimate, gold and silver mineralisation was modelled independently, and the resource was based on using the value of copper, gold, silver and zinc using a combined metal cut-off grade of 0.36% copper equivalent. This compared with a copper-only cut-off of 0.184% used in the May 2019 resource. PXC described this as being based on a "geologic domain", versus a "grade domain" in the previous estimate.

The table below shows that this raised the volumes of (increasingly) valuable gold and silver by 56% and 13%, respectively.

PXC – increase in M&I resource estimate, May 2020 vs. May 2019

Metal	M&I May 2020	M&I May 2019	Change	Incl. inferred resources
Copper (tonnes)	81,948	73,872	11%	129,932
Zinc (tonnes)	37,650	29,813	26%	50,549
Gold (oz)	217,500	139,000	56%	342,249
Silver (oz)	6,824,460	6,038,000	13%	9,502,495
Tonnes of ore	19,302,000	15,169,000	27%	

Source: Phoenix Copper

PXC refocused on Empire as 2020 progressed

As 2020 progressed, copper prices recovered, and we sensed that PXC's management team was justifiably (in our opinion) re-focusing evaluation and exploration work on the larger Empire project in favour of Red Star, but with greater emphasis on the former's precious metals mineralisation this time.

In late July 2020, the results from the first seven assays from 30 drill holes at Empire were announced. These showed up to 8.45g/t of gold. A month later, the remaining 23 assay results showed up to 9.78g/t of gold and 6.13% of copper. The switch of focus back to Empire was confirmed by the CEO:

"The Red Star area is geologically complex with a general lack of surface outcroppings and we have determined that the most successful exploration is best achieved through short drilling programmes, followed by evaluation of new data prior to additional targeted drilling…The Empire Mine resource will be re-modelled in Q4 2020 and will include the gold, silver and copper assays from the 2020 drilling programme."

Second Empire resource estimate published in October 2020

Towards the end of October 2020, the second NI 43-101 resource update for Empire was published. This is now the basis for the new economic model for the first Empire mine. The new resource estimate included increases in M&I resources

for gold and silver of 10% and 11%, respectively. Despite the focus on precious metals, copper resources increased by 7% and zinc by an impressive 17%.

Empire – mineral resources and reserves, October 2020

	Tonnes (mt)	Copper (t)	Zinc (t)	Gold (oz)	Silver (oz)	Copper (%)	Zinc (%)	Gold (g/t)	Silver (g/t)
Measured	8.290	34,655	18,160	87,036	3,031,791	0.42	0.22	0.327	11.4
Indicated	14.619	52,888	25,711	151,370	4,563,407	0.36	0.18	0.322	9.7
M&I	**22.909**	**87,543**	**43,871**	**238,406**	**7,595,198**	**0.38**	**0.19**	**0.324**	**10.3**
Inferred	10.613	42,098	14,569	117,117	2,538,574	0.40	0.14	0.343	7.4
Total resources	**33.522**	**129,641**	**58,440**	**355,523**	**10,133,772**				

Source: Phoenix Copper, Hardman & Co Research

M&I resources for copper, zinc, gold and silver rose by 26%-72% between May 2019 and October 2020

The comparison between the October 2020 and May 2019 resource estimates is significant, and is summarised in the table below.

PXC – increase in M&I resource estimate: Oct 2020 vs. May 2019

Metal	M&I October 2020	M&I May 2019	Change
Copper (tonnes)	87,543	73,872	19%
Zinc (tonnes)	43,871	29,813	47%
Gold (oz)	238,406	139,000	72%
Silver (oz)	7,595,198	6,038,000	26%
Copper eq. (tonnes)	172,912		
Tonnes of ore	22,909,059	15,169,000	51%

Source: Phoenix Copper

First Empire economic model excluded gold and silver recovery due difficulty in approving cyanide processing

The initial economic model for Empire was based on recovering copper and zinc only, with the potential of recovering the gold and silver at some later date. This obviously had a negative effect on NPV. The key reason for this was the difficulty and length of time needed for the environmental approval of sodium cyanide processing.

Alternative was found, which is critical to the new Empire project

PXC looked for an alternative way to recover precious metals without cyanide and, in June 2020, reported that bench-scale testing on ore using non-toxic ATS (ammonium thiosulphate) had resulted in gold recoveries of 97.7% and 97.8% and silver recoveries of 69.8% and 78.2%. The test concluded that using ATS was comparable in terms of recovery and consumption. Following tests on a 400lb ore sample, pilot scale testing at Salt Lake City was successfully carried out on a 12- tonne ore sample. The ability to recover precious metals at an early stage is critical to the new plan for Empire.

Funding conditions could permit further refinement of strategy…

There is now the potential for PXC to further refine its strategy permitting the creation of significantly greater shareholder value in a shorter time frame. This follows the improvement in funding conditions in the sector. On 5 March 2021, PXC raised £16.45m ($22.70m) of equity via a placing and direct subscription (47.0m shares at 35p/share). A further £1.95m ($2.69m) will likely be raised in the same issuance.

…with simultaneous development of Red Star

PXC's management team is now considering simultaneously developing the initial Empire copper-gold mine and the Red Star silver mine. While development at Red Star is at an earlier stage, it could work to the company's advantage. We estimate that first production at Red Star is unlikely before late 2023, a year after Empire. Consequently, cash generated from the first Empire mine could fund the capital cost of Red Star.

In the following four sections, we summarise PXC's new economic model for the initial copper-gold mine at Empire and a revised (using our latest estimates) economic model for the Red Star silver mine. After each, we show and discuss our estimates for cashflow, earnings and valuation in the two scenarios:

- Scenario 1 – Empire only; and
- Scenario 2 – Empire and Red Star.

Empire: new economic model

Our new model for PXC incorporates the two-stage development of an open pit mine to extract the near-surface oxide ore. This oxide ore is located above the underground workings of the former Empire mine, which extracted high-grade sulphide ore.

Weathering created layer of near-surface oxide ore…

In brief, the major source of copper worldwide is ore containing chalcopyrite, a sulphide mineral in which copper accounts for 34.5% by mass. It is also the primary copper mineral at the Empire mine. Like other copper mines, however, mineralisation close to the surface at Empire has been subject to weathering. Rain water mixes with pyrite (an iron sulphide), forming dilute sulphuric acid, which initially turns chalcopyrite into copper oxide minerals, mainly hydrated copper silicates. These include chrysocolla (copper phyllosilicate), as well as malachite and azurite.

Copper oxide in the form of chrysocolla in drill core from Empire in 2018

Source: Phoenix Copper

…containing gold, silver and zinc, in addition to copper

This layer of copper oxide minerals is the basis for the first open pit mine. Its width varies significantly from ca.6m to 73m. In addition to copper, the layer of oxide ore at the Empire mine contains gold, silver and zinc, and extends from the surface to a depth of ca.120m. Below the depth of ca.120m, there is a transition zone in the ore body that contains a mixture of oxide and sulphide ores several tens of metres thick. At greater depth, sulphide mineralisation is dominant.

Attraction of jurisdiction

In the Mining Journal's Risk Report 2018, Idaho was ranked first in terms of the lowest risk perception in world mining. The CEO of Americas Gold and Silver Corp. commented three years ago:

"I think Idaho is one mining permit away from exploding with interest."

In the Fraser Institute's recently published *Survey of Mining Companies 2020*, Idaho was ranked number one in the world (out of 77 jurisdictions) in its "Policy Perception Index", above Wyoming, Finland, Ireland and Nevada. The survey states:

"While geologic and economic considerations are important factors in mineral exploration, a region's policy climate is also an important investment consideration. The Policy Perception Index (PPI), is a composite index that measures the overall policy attractiveness of the 77 jurisdictions in the survey. The index is composed of survey responses to policy factors that affect investment decisions. Policy factors examined include uncertainty concerning the administration of current regulations, environmental regulations, regulatory duplication, the legal system and taxation regime, uncertainty concerning protected areas and disputed land claims, infrastructure, socioeconomic and community development conditions, trade barriers, political stability, labor regulations, quality of the geological database, security, and labor and skills availability."

PXC – location of Empire

Source: Phoenix Copper

Federal approval not necessary

The location of the open pit of the planned oxide mine will be sited on "patented" land, allowing rapid permitting without the need for Federal approval. That said, the leach pad, SX/EW plant and part of the haul road/conveyance/power corridor are located on public land, and will require the normal Federal approval.

No environmental issues at Empire

PXC had not expected environmental issues to hold up Empire's development, and it announced that a two-year environmental study was completed on 12 February 2020. There were no issues identified regarding wildlife, water and cultural resources.

Production mine incorporates just over 60% of M&I resources

Turning to the details in the Empire economic model itself, the LOM production plan in the new model incorporates 14.32m tonnes of oxide ore, equivalent to 62.5% of the M&I resources. This is shown in the table below, along with the percentages of the M&I resources for each metal (in gross terms).

Empire – LOM production plan vs. M&I resources

Ore/metal (tonnes/oz)	M&I resources	LOM production	LOM as % M&I
Tonnes of ore	22,909,059	14,317,207	62.5%
Copper (tonnes)	87,543	76,556	62.5%
Zinc (tonnes)	43,871	26,782	61.0%
Gold (oz)	238,406	141,205	59.2%
Silver (oz)	7,595,198	6,005,694	79.1%

Source: Phoenix Copper

Higher-grade ore mined first, and potential to significantly extend LOM

It is clear from the table that:

- the high-grade copper is the focus of the current mine plan – PXC notes that the initial head grade will be 0.70%, versus 0.38% for M&I resources in aggregate; and
- there is substantial potential to continue to extend the LOM, especially in the case of gold and zinc, beyond the current 10-year plan.

Base metals production followed by precious metals

The two-stage development plan will initially focus on copper and zinc production, followed by precious metals:

- Phase 1: years 1-7 – extracting over 2.0m tonnes p.a. of ore and producing copper and zinc via heap leach; and
- Phase 2: years 4-10 – processing ore from Phase 1 to produce gold and silver using ATS as the reagent.

The pre-production capital cost of Phase 1 is $52.6m, and the subsequent capital requirements, including the cost of the gold/silver processing circuit, are shown below.

PXC – increase in M&I resource estimate (May 2020)

$m	Cu-Zn	Au-Ag	Total
Pre-production capital	52.673	36.837	89,510
Sustaining capital	24.175	7.000	31,175
Equipment finance	10.635		10,635
Total	87,483	43,837	131,320

Source: Phoenix Copper

Operating cash costs remain favourable

The estimated LOM cash cost of per pound of copper equivalent production is $1.83/lb. This is within the range of $1.72/lb-$1.85/lb that had been estimated in the previous two economic models for the Empire open pit.

New PXC economic model assumptions

The company's base-case assumptions in the model include a 7.5% discount rate and long-term prices for copper and gold of $3.60/lb ($7,937/tonne) and $1,825/oz, respectively. PXC estimates the ungeared post-tax NPV at $88.0m. We have used the same estimates in our financial model for the company (see next section), with the exception of a slightly more conservative 8.0% discount rate.

PXC's key assumptions for Empire are summarised in the table below.

Empire economic mode – PXC base-case assumptions	
Initial LOM (excl. 3 years of gold/silver processing)	7 years
LOM ore production (tonnes/years 1-7))	14,317.207
LOM ore gold/silver processing (tonnes/years 4-10)	14,317.207
LOM copper production (tonnes)	76,556
LOM zinc production (tonnes)	26,782
LOM gold production (oz)	141,205
LOM silver production (oz)	6,005,694
Copper recovery	76%
Zinc recovery	50%
Gold recovery	83%
Silver recovery	77%
Copper price ($/lb) LOM average	3.60
Zinc price ($/lb) LOM average	1.20
Gold price ($/oz) LOM average	1,825
Silver price ($/lb) LOM average	27.0
Cu-Zn LOM average cash op. cost ($/lb Cu equiv.)	1.83
Au-Ag LOM average cash op. cost ($/oz Au equiv.)	1,190
Cu-Zn heap leach – initial capital cost ($m)	52.673
Au-Ag heap leach – initial capital cost ($m)	36.837
LOM sustaining capital ($m)	31.175
Discount rate	7.5%
NPV 7.5% ($m)	88.000

Source: Phoenix Copper

Scenario 1 – Empire only: cashflow, earnings and valuation

Key assumptions in our cashflow model

In our cashflow model, we have made the following key assumptions:

- Production from the initial copper-zinc mine begins on 1 January 2023. The breakdown of the $52.6m initial capital cost for the oxide mine is $7.0m in 2021 and $45.6m in 2022.
- PXC has raised $22.7m equity in 2021, which will finance non-construction costs of about $5.0m (including the Feasibility Study), corporate operating costs and the first stage of mine construction.
- In 2022, we expect the company to finance the remaining $45.6m of mine construction and general corporate expenses via the issue of a further $2.0m in equity and $40.6m in debt.
- The $36.8m initial capital cost for the gold and silver processing circuit will be incurred in 2025 and financed by internal cash generation.

The table below shows our estimates for PXC's cashflow for 2020-24, which includes the two years of full production from the Empire mine.

Cashflow statement: Scenario 1 – Empire only, 2020-24E

Year-end Dec ($m)	2020E	2021E	2022E	2023E	2024E
Operating profit	-1.188	-1.221	-1.255	47.727	28.131
Non-cash items:					
Depreciation & amort.	0.000	0.000	0.000	8.600	9.585
Depletion	0.000	0.000	0.000	0.000	0.000
Share-based payments	0.200	0.200	0.200	0.000	0.000
Operating cashflow	**-0.988**	**-1.021**	**-1.055**	**56.326**	**37.716**
Change in inventories	0.000	-0.200	-0.500	-1.500	0.000
Change in receivables	0.080	0.000	-0.500	-1.500	0.000
Change in payables	-0.100	0.200	0.000	1.000	0.000
Cash from operations	**-1.008**	**-1.021**	**-2.055**	**54.326**	**37.716**
Tax paid	0.000	0.000	0.000	-5.841	-3.111
Net cash from ops.	**-1.008**	**-1.021**	**-2.055**	**48.485**	**34.605**
Purchase of intangibles	-0.030	-0.030	-0.030	0.000	0.000
Capex on PPE & mines	-2.400	-12.000	-45.600	-7.525	-5.914
Net cash for investing	**-2.430**	**-12.030**	**-45.630**	**-7.525**	**-5.914**
Share issues	3.802	25.392	2.000	0.000	0.000
Share/debt issue costs	-0.284	-0.508	-0.040	0.000	0.000
Inc./(decrease) in debt	0.129	0.000	40.945	0.000	-41.529
Net interest	-0.078	-0.038	-1.615	-2.655	-1.125
Net cash for financing	**3.569**	**24.846**	**38.985**	**-2.655**	**-42.654**
Net change in cash	**0.131**	**11.795**	**-6.740**	**38.305**	**-13.963**
Cash: end of year	**0.341**	**12.136**	**5.396**	**43.701**	**29.739**
Debt: end of year	**-0.929**	**-0.929**	**-41.529**	**-41.529**	**0.000**
Net (debt)/cash	**-0.588**	**11.207**	**-36.133**	**2.172**	**29.739**

Source: Phoenix Copper, Hardman & Co Research

Maximising debt versus equity will bolster shareholder returns

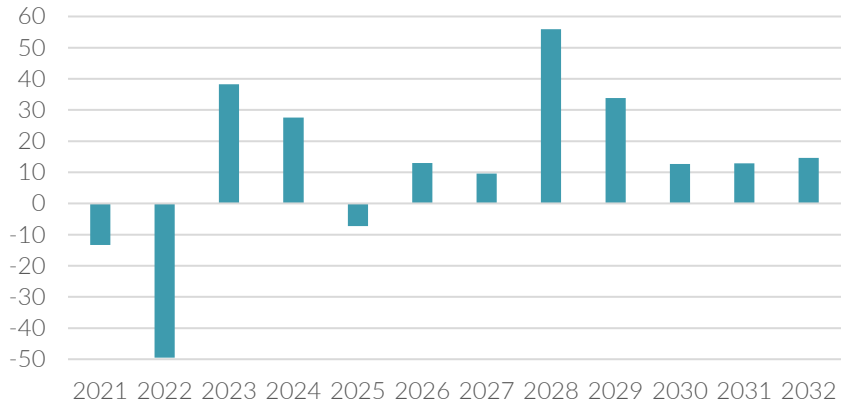
PXC has long indicated its aim of minimising equity issuance in favour of debt. The company has appointed mining finance firm, EAS, to advise on project financing to construct the oxide mine. Discussions with potential investors are taking place.

We expect PXC to increase its share of the Empire claim to 100% via dilution of Konnex

PXC owns 80% of Konnex Resources Inc., which owns 100% of the Empire claim. The remaining 20% is owned by ExGen Resources Inc., which also holds 3.11% of PXC's share capital. Following the completion of a Bankable Feasibility Study, ExGen Resources has to contribute its share of funding, or be diluted. We assume the latter.

When Empire is commissioned, PXC should generate substantial free cashflow. We estimate that PXC will be able to repay the $41.529m of debt during 2024, i.e. after less than two years of operation. The chart below shows our estimates for free cashflow (net profit + depreciation & depletion – capex & working capital) during 2021-32.

Free cashflow estimates: Scenario 1 – Empire only, 2021-32E ($m)



Source: Hardman & Co Research

Corporate overheads, excluding interest costs, should remain relatively stable prior to Empire's commissioning

Turning to the P&L account, we are assuming that PXC's general corporate overheads, currently running at just below $1.2m, rise modestly through to the end of 2022, when the mine is commissioned. We are currently assuming a straight-line depreciation method, which fully depreciates the cost of the new mine and processing facilities by the currently projected end to the mine plan in 2032.

The Idaho jurisdiction should benefit PXC's tax charge significantly, since it allows pre-construction exploration and Feasibility Study costs to be offset. Indeed, tax costs will likely amount to ca.8% of EBITDA. Our P&L estimates for PXC for 2020-24, including the first full year of the Red Star mine operation, are shown in the next table.

Profit & loss account: Scenario 1 – Empire only, 2020-24E

Year-end Dec ($m)	2020E	2021E	2022E	2023E	2024E
Sales	0.000	0.000	0.000	90.460	70.619
Operating costs	-1.188	-1.221	-1.255	-42.734	-42.488
Operating profit	**-1.188**	**-1.221**	**-1.255**	**47.727**	**28.131**
Finance income	0.003	0.062	0.085	0.245	0.325
Finance costs	-0.080	-0.100	-1.700	-2.900	-1.450
PTP	**-1.265**	**-1.259**	**-2.870**	**45.072**	**27.006**
Taxation	0.000	0.000	0.000	-5.841	-3.111
Tax rate	n/a	n/a	n/a	13.0%	11.5%
Minority interests	0.018	0.000	0.000	0.000	0.000
Net income	**-1.248**	**-1.259**	**-2.870**	**39.231**	**23.895**
FD no. of shares (m)	57.55	103.65	118.22	128.93	128.93
Basic EPS (c)	**-2.17**	**-1.21**	**-2.43**	**33.18**	**20.21**
FD EPS (c)	**-2.17**	**-1.21**	**-2.43**	**30.43**	**18.53**

Source: Phoenix Copper, Hardman & Co Research

Our DCF valuation, based solely on Red Star, is 60p/share

We have valued PXC using a DCF model, incorporating a discount rate of 8% (slightly more conservative than the company's 7.5%), mine production to 2032, and a long-term copper price of $3.60/lb, gold price of $1,825/oz and silver price of $27.00/oz. Based on the assumptions, our fair value for the company is 60p/share, vs. the current price of 37p. We estimate that fair value for this initial copper-gold mine, using the recent high in the copper price of $4.26/lb, is 95p/share.

DCF valuation: Scenario 1 – Empire only, 2021-27E

$m (unless stated)	2021E	2022E	2023E	2024E	2025E	2026E	2027E
PTP	-1.259	-2.870	45.072	27.006	26.423	6.623	-4.110
Tax	0.000	0.000	-5.841	-3.111	-3.059	-1.182	-1.182
NOPAT	**-1.259**	**-2.870**	**39.231**	**23.895**	**23.364**	**5.441**	**-5.292**
Depreciation & amort.	0.000	0.000	8.600	9.585	10.440	18.290	19.741
Change in working cap.	0.000	-1.000	-2.000	0.000	0.000	0.000	0.000
Capex & exploration	-12.030	-45.630	-7.525	-5.914	-41.112	-10.779	-4.853
Free cashflow	**-13.289**	**-49.500**	**38.305**	**27.566**	**-7.308**	**12.953**	**9.596**
Discount rate = 8%							
Discount factor	1.00	0.93	0.86	0.79	0.74	0.68	0.63
Disc. free cashflow	**-13.289**	**-45.834**	**32.841**	**21.883**	**-5.371**	**8.815**	**6.047**

Source: Phoenix Copper, Hardman & Co Research

DCF valuation: Scenario 1 – Empire only 2028-32E (cont.)

$m (unless stated)	2028E	2029E	2030E	2031E	2032E	Total
PTP	43.342	16.137	8.202	7.852	5.399	177.735
Tax	-4.265	-3.036	-1.067	-1.067	-0.864	-24.674
NOPAT	**39.077**	**13.101**	**7.135**	**6.785**	**4.535**	**153.143**
Depreciation & amort.	21.429	22.567	6.555	7.055	7.055	131.320
Change in working cap.	0.000	0.000	0.000	0.000	3.000	0.000
Capex & exploration	-4.576	-1.888	-1.000	-1.000	0.000	-136.307
Free cashflow	**55.930**	**33.781**	**12.690**	**12.840**	**14.590**	**148.156**
Discount rate = 8%						
Discount factor	0.58	0.54	0.50	0.46	0.43	
Disc. free cashflow	**32.635**	**18.251**	**6.348**	**5.948**	**6.257**	**74.531**
Cum. disc. FCF	74.531					
Net (debt)/cash	24.804					
Total	**99.336**					
Basic shares (m)	115.750					
Add: options/warrants	10.930					
FD shares (m)	126.680					
Valuation ($)	**0.78**					
$/£	1.30					
Valuation (£)	**0.60**					

Source: Phoenix Copper, Hardman & Co Research

At this early stage of its development, the company's share price is highly geared to the copper price (unsurprisingly) and, to a lesser extent, the gold price. Performing a sensitivity analysis on our financial model, we estimate that:

- each $0.25/lb change in the LOM copper price affects our valuation of PXC by 13.0p per share; and
- each $100/oz change in the LOM gold price affects our valuation of PXC by 3.7p per share.

Excluded from Scenario 1 valuation

We would emphasise that this "Scenario 1 – Empire only" valuation of PXC excludes the following:

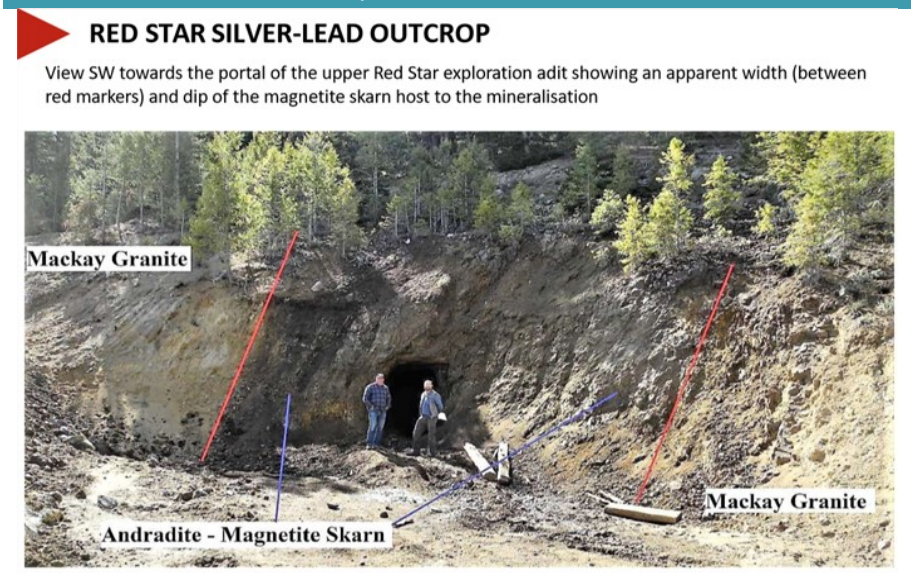
- the longer-term potential to develop a *world-class* copper-precious metals mine at Empire by exploiting the sulphide ore body beneath the oxide layer;
- the possibility that the company could access a large porphyry ore body, or ore bodies, at depth beneath Empire (see section *Does 'X' mark the spot, continentally, regionally and locally?* for a full discussion of the ore body at Empire and the surrounding area);
- the Red Star silver deposit, for which PXC has completed significant development work, including a PEA (see section *Developing the Red Star silver mine)*; and
- the nearby Navarre gold zone and two cobalt claims in northern Idaho (see *Pipeline: Navarre Creek and Cobalt*).

Developing the Red Star silver mine

Red Star discovered in September 2018, north of Empire

The discovery of Red Star, announced in September 2018, followed the identification of a silver-lead mineralised vein in a 20m-wide outcrop hosted in magnetite garnet endoskarn. The outcrop is located 330m north-east of the proposed Empire open pit mine, in the direction of the former Horseshoe mine.

View of the Red Star discovery



Source: Phoenix Copper

Maiden resource estimate published in May 2019

The publication of a maiden inferred resource estimate for Red Star in May 2019 was based on the results of three drill holes. Nevertheless, it amounted to 103,500 tonnes of ore and more than 0.5m oz of contained silver.

Empire – mineral resources and reserves, May 2019

Inferred (t)	Ag (oz)	Au (oz)	Cu (oz)	Pb (t)	Zn (t)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)
103,500	577,000	2.800	338	3,988	957	173.4	0.85	0.33	3.85	0.92

Source: Phoenix Copper

Channel sampling reinforced PXC's optimism that the 103,500-tonne resource could be substantially enlarged with additional exploration.

Red Star represented first significant exploration into sulphide ore body by PXC

While the initial Red Star silver-lead resource is in the upper portion of the mineralised system at Empire, this drilling programme at Red Star was significant because:

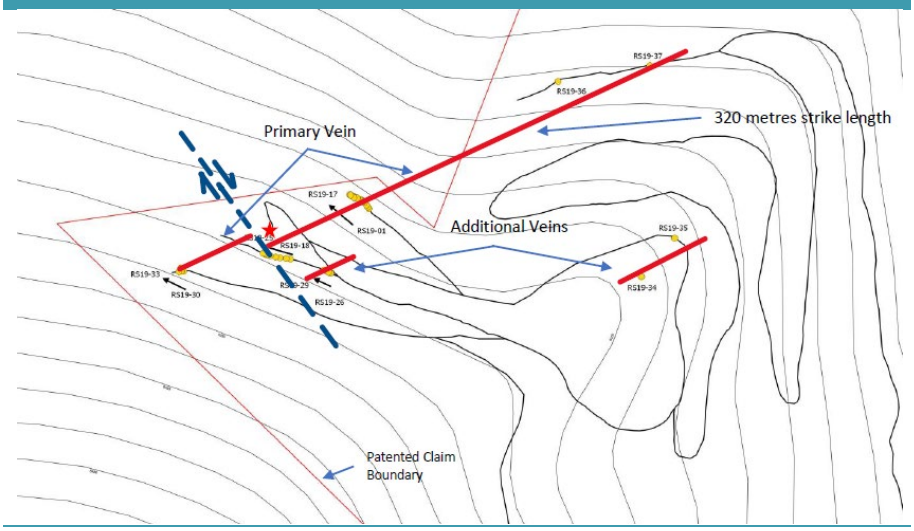
- it represented the first significant exploration of part of the sulphide ore body by PXC itself; and
- it is the much larger sulphide ore body, not the shallow oxide layer, that represents the major potential for PXC to create a world-class copper-gold mine – in addition to the possibility of a large porphyry ore body at depth.

PXC building up picture of sulphide vein system at Red Star

Further exploration work at Red Star showed that the primary vein, which extends from the south-west to the north-east, is measured at 320m and open at both ends. The mineable width is estimated at 5m-7m. Two of the samples showed silver values similar to those from the discovery outcrop sampling in 2018. In addition, two further veins have been identified to the south-east of the primary vein, as shown

in the following slide. The nearest of the two veins is only 40m distant from the primary vein.

Red Star – two additional veins discovered



Source: Phoenix Copper

Historical production had higher-grade ore than discovered at Red Star so far

During 1909-29, the White Knob Mining Group mined the Horseshoe and Bluebird mines to the north of Red Star. Aggregate production of 70,300 tonnes of ore showed recovered grades higher than the current Red Star resource above.

White Knob Mining Group – production, 1909-29

Ore/metal	Production	Grade
Ore	70,300 tonnes	
Silver	425,000 oz	185 g/t
Lead	6,078 tonnes	19.0%
Zinc	2,041 tonnes	6.5%
Copper	231 tonnes	0.7%

Source: Phoenix Copper

First six drill holes in 2020 confirmed extensive mineralisation…

The 2020 drilling programme at Red Star began on 28 April 2020, and involved an additional 10 holes and 455m along/adjacent to the primary vein. Results from the first six holes, announced in August 2020, confirmed the significant mineralisation at Red Star found the previous year – both south of the discovery outcrop and in the down-dip.

…with highlights from four holes showing 5.97-19.45 oz/tonne of Ag equivalent

Highlights from the six drill holes are summarised in the table below in terms of silver, lead, copper and zinc. There were also trace amounts of gold, which are included in the silver equivalent oz/tonne grade in the right-hand column. The results included up to 19.45oz/tonne of silver equivalent and an impressive 360g/t of silver itself.

Red Star – highlights from drill holes RSD20-01 to RSD20-06					
Drill hole	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	Ag equiv. oz/tonne
RSD20-01	172.0	2.27	0.32	0.75	8.83
	160.0	1.47	0.73	0.91	9.22
	204.0	2.31	1.09	1.05	12.08
	115.0	0.89	0.38	0.84	6.08
RSD20-03	360.0	7.79	0.46	0.79	19.45
RSD20-04	154.0	1.72	0.83	2.63	10.87
RSD20-06	118.0	2.05	0.10	0.29	5.97

Source: Phoenix Copper, Hardman & Co Research

In addition, PXC noted that:

"numerous other silver intercepts in excess of 115g/t (3.70oz/tonne) were received."

Remaining four drill holes helped to delineate extent of mineralisation

The remaining four holes (RS20-07 to RS20-10) encountered lower mineralisation, and were drilled in an attempt to delineate its extent:

- laterally to gauge the limit within PXC's patented claims to the north; and
- geologically into the (Mackay) granite.

Targeting future drill holes…

Currently, the data from the first 13 holes are being evaluated in order to plan the next phase of exploring the deposit. The key will be to carefully target future drill holes to map out what could be a relatively complex vein system.

In November 2020, PXC published the findings of a report on Red Star, *Geologic Mapping and Structural Analysis in the North Pit Region, Mackay Mining District*, by a consultant geologist, David W. Rodgers. In part, the purpose of this report was to support future exploration and, specifically, to help with drill hole targeting.

…benefited from a new consultant's report on Red Star deposit

Key findings from the report included:

- The geological similarity between Red Star and the Horseshoe and White Nob deposits located several hundred metres to the north, and the sites of former high-grade mines, as we noted above. This suggests that mineralisation potentially extends continuously between the two areas.
- High-grade silver mineralisation at Red Star is associated with the magnetite-bearing skarn formation. This is very significant, since a magnetic geophysical survey could be beneficial in optimising future drill hole targeting and determining the location of the veins below ground.

Regarding the potential for magnetic surveying, the report noted:

"the higher-grade silver mineralisation was focused in areas within the magnetite-bearing…wherein the later-stage silver-bearing fluids leached the magnetite skarn. Because the silver mineralisation only occurs in iron-rich portions of the skarn, which are dominated by magnetite, then those areas near the contact of Mackay Granite and White Knob limestone with magnetite development are thought to be favorable targets for higher grade silver."

And:

"Because the lack of discernible outcrop at Red Star makes it difficult to determine the underlying geology, Dr Rodgers has recommended the use of ground magnetic surveying, coupled with geologic mapping, to better define future drilling targets. The Company will therefore be scheduling a ground magnetics survey at the Red

Star area as soon as weather and ground conditions permit, in order to optimize the next phase of the drilling programme."

From Rodger's report, the picture below shows a massive magnetite vein about three feet-wide, cutting through the endoskarn in a northerly direction.

Magnetite vein at Red Star

Source: Phoenix Copper

PXC aiming for resource of well over 1.0m tonnes of ore at Red Star

PXC believes it will initially be able to expand the current 103,500-tonne resource to at least 650,000 tonnes at silver and lead grades that are equal to or better than the existing resource summarised above. After that, the aim is for a resource that is well over 1.0m tonnes, with as great a proportion as possible in the "Measured" category.

Mine plan envisages 1.6m tonnes of ore over 10 years

Indeed, PXC's current Red Star mine plan envisages 1.6m tonnes of ore over a 10-year LOM, over two phases, as shown below. During years 1-4, the company plans $0.75m/p.a. of exploration expenditure to develop a further 950,000-1.0m tonnes of ore for phase 2 production.

Red Star mine – two phases of ore production (tonnes)	
Phase 1: years 1-5	639,000
Phase 2: years 6-10	958,500
Total ore production	**1,597,500**

Source: Phoenix Copper

Red Star would be straightforward underground mine

In early 2020, PXC concluded that the ore body could be exploited by a straightforward underground mine with a flotation processing plant at a capital cost of ca.$25.0m, excluding ca.$4m of working capital. The company's model for Red Star included mine production of 450 tonnes of ore per day, giving annual production of 159,500 tonnes and 1.1m tonnes over a 10-year LOM. In terms of metals production, the company was assuming 2.41m oz of silver equivalent at an average head grade of 16oz/tonne Ag equiv. (514.4g/t), recovery of 90% and an LOM average silver price of 19.00/oz.

Key assumptions for Red Star

The table below summarises PXC's key assumptions for Red Star.

Red Star mine – key PXC assumptions	
Initial LOM	10.0 years
Production – total ore (tonnes p.a.)	159,500
LOM ore production (tonnes)	1,597.500
Silver average head grade (oz/tonne Ag equiv.)	16.0
Silver recovery	90%
Recovered silver equiv. p.a. (m oz)	2.41
LOM average silver price ($/oz)	19.00
Royalty	5.0%
LOM average cash op. cost ($/oz)	7.60
Depreciation policy	40% red, bal.
Initial capital cost, incl. working capital ($m)	30.000
LOM sustaining capital ($m)	16.0
Discount rate	15%

Source: Phoenix Copper

The current Red Star resource is located on patented claims, like Empire. As long as this applies to the entrance to an underground mine, no further permissions are required. The recent completion of an environmental study for the Empire area showed that there are no critical habitat or surface/ground water issues that would affect mine permitting.

Scenario 2 – Empire and Red Star: cashflow, earnings and valuation

We estimate that Scenario 2 has likelihood of at least 50%

We commented, at the beginning of this report, how the improvement in funding conditions in the mining sector and the recent equity raise have led PXC to consider simultaneously developing the Empire and Red Star mines. As noted, we think that there is at least a 50% chance that it will adopt this strategy. Consequently, we are summarising the impact of this strategy ("Scenario 2 – Empire and Red Star").

Developing Red Star at same time should lead to reduction in aggregate capital cost

We have assumed a lead time of at least two years on building the Red Star mine, with production by end-2023. Pre-production costs for the PEA, Feasibility Study, etc. are estimated at ca.$4.0m. PXC estimates that overlapping spending on Empire and Red Star should lead to a reduction in Red Star's capital cost – we assume by ca.$5.0m to $20.0m. Our expectations of a ca.12-month timespan between the commissioning of Empire and Red Star should work to PXC's advantage – cash generation from Empire could fund Red Star without recourse to further equity or debt finance.

The table below shows our estimates for PXC's cashflow for 2020-24 under Scenario 2, including the two years of Empire production and one from Red Star. Compared with PXC's early 2020 Red Star economic model, we have assumed a long-term silver price of $27.00/oz (vs. $19.00/oz), a more conservative cost per oz of silver equivalent of $12.00/oz (vs. $7.60/oz) and straight-line depreciation (vs.30% reducing balance).

Cashflow statement: Scenario 2 – Empire and Red Star, 2020-24E

Year-end Dec ($m)	2020E	2021E	2022E	2023E	2024E
Operating profit	-1.188	-1.221	-1.255	47.727	54.207
Non-cash items:					
Depreciation & amort.	0.000	0.000	0.000	8.600	12.060
Depletion	0.000	0.000	0.000	0.000	0.000
Share-based payments	0.200	0.200	0.200	0.000	0.000
Operating cashflow	**-0.988**	**-1.021**	**-1.055**	**56.326**	**66.267**
Change in inventories	0.000	-0.200	-0.500	-1.500	-1.500
Change in receivables	0.080	0.000	-0.500	-1.500	-1.500
Change in payables	-0.100	0.200	0.000	1.000	1.000
Cash from operations	**-1.008**	**-1.021**	**-2.055**	**54.326**	**64.267**
Tax paid	0.000	0.000	0.000	-5.841	-10.901
Net cash from ops.	**-1.008**	**-1.021**	**-2.055**	**48.485**	**53.366**
Purchase of intangibles	-0.030	-0.030	-0.030	0.000	0.000
Capex on PPE & mines	-2.400	-12.750	-48.100	-28.275	-6.664
Net cash for investing	**-2.430**	**-12.780**	**-48.130**	**-28.275**	**-6.664**
Share issues	3.802	25.392	2.000	0.000	0.000
Share/debt issue costs	-0.284	-0.508	-0.040	0.000	0.000
Inc./(decrease) in debt	0.129	0.000	40.600	0.000	-41.529
Net interest	-0.078	-0.038	-1.632	-2.791	-1.233
Net cash for financing	**3.569**	**24.846**	**40.928**	**-2.791**	**-42.762**
Net change in cash	**0.131**	**11.045**	**-9.257**	**17.419**	**3.940**
Cash: end of year	**0.341**	**11.386**	**2.129**	**19.548**	**23.488**
Debt: end of year	**-0.929**	**-0.929**	**-41.529**	**-41.529**	**0.000**
Net (debt)/cash	**-0.588**	**10.457**	**-39.400**	**-21.981**	**23.488**

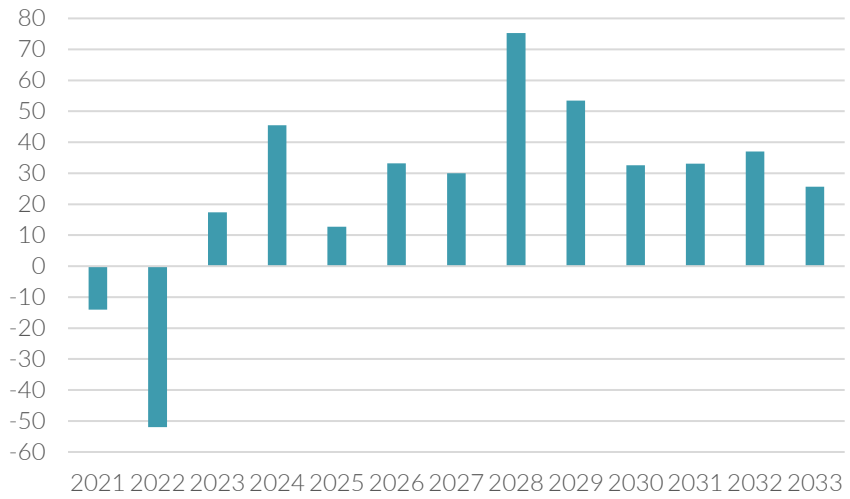
Source: Phoenix Copper, Hardman & Co Research

Red Star should be strongly cash-generative

The table above shows that the incremental cost of the Red Star investment – mainly occurring in 2023 – can be absorbed by internal cash generation. Furthermore, the debt incurred in 2022 can be paid off by end-2024. The chart below shows our

estimates for free cashflow (net profit + depreciation & depletion + working capital – capex) during 2021-33, including 10 years of production from both the initial Empire mine (2023-32) and Red Star (2024-33),

Red Star project – free cashflow, Yr-2 to Yr-10 ($m)



Source: Hardman & Co Research

P&L estimates for Scenario 2

Below are our P&L estimates for PXC for 2020-24 under Scenario 2, including two years of production from the Empire mine and one year from Red Star.

Profit & loss account: Scenario 2 – Empire and Red Star, 2020-24E

Year-end Dec ($m)	2020E	2021E	2022E	2023E	2024E
Sales	0.000	0.000	0.000	90.460	126.775
Operating costs	-1.188	-1.221	-1.255	-42.734	-72.568
Operating profit	**-1.188**	**-1.221**	**-1.255**	**47.727**	**54.207**
Finance income	0.003	0.062	0.068	0.109	0.217
Finance costs	-0.080	-0.100	-1.700	-2.900	-1.450
PTP	**-1.266**	**-1.259**	**-2.887**	**44.936**	**52.974**
Taxation	0.000	0.000	0.000	-5.841	-10.901
Tax rate	n/a	n/a	n/a	13.0%	20.6%
Minority interests	0.018	0.000	0.000	0.000	0.000
Net income	**-1.248**	**-1.259**	**-2.887**	**39.095**	**42.072**
Basic no. of shares (m)	57.55	103.65	118.22	118.22	118.22
Basic EPS (c)	**-2.17**	**-1.21**	**-2.44**	**33.07**	**35.59**
FD EPS (c)	**-2.17**	**-1.21**	**-2.44**	**33.07**	**35.39**

Source: Phoenix Copper, Hardman & Co Research

We have valued PXC under Scenario 2 using a DCF model, a discount rate of 8% applied to Empire's free cashflows (used in Scenario 1 above) and a more conservative discount rate of 15% for Red Star, to reflect the earlier stage of its development.

PXC valuation under Scenario 2: 95p/share

In Scenario 2, we have used the same long-term copper, gold and silver prices as Scenario 1, i.e. $3.60/lb for copper, $1,825/oz for gold and $27.00/oz for silver. We estimate that the fair value for PXC, if it develops Empire and Red Star simultaneously, is 95p/share – compared with 60p/share if it develops the initial Empire only.

PXC – DCF valuation: Scenario 2 – Empire and Red Star, 2021-27E

$m (unless stated)	2021E	2022E	2023E	2024E	2025E	2026E	2027E
PTP	-1.259	-2.887	44.936	52.974	52.490	32.771	22.131
Tax	0.000	0.000	-5.841	-10.901	-10.879	-9.026	-9.054
NOPAT	**-1.259**	**-2.887**	**39.095**	**42.072**	**41.611**	**23.745**	**13.077**
Depreciation & amort.	0.000	0.000	8.600	12.060	12.999	20.943	22.501
Change in working cap.	0.000	-1.000	-2.000	-2.000	0.000	0.000	0.000
Capex & exploration	-12.780	-48.130	-28.275	-6.664	-41.862	-11.529	-5.603
Free cashflow – Empire	**-13.289**	**-49.500**	**38.305**	**27.566**	**-7.308**	**12.953**	**9.596**
Free cashflow – Red Star	**-0.750**	**-2.517**	**-20.886**	**17.902**	**20.055**	**20.206**	**20.378**
Free cashflow – Total	**-14.039**	**-52.017**	**17.419**	**45.469**	**12.748**	**33.959**	**29.974**
Empire:							
Discount rate = 8%							
Discount factor	1.00	0.93	0.86	0.79	0.74	0.68	0.63
Disc. free cashflow – Empire	**-13.289**	**-45.833**	**32.841**	**21.883**	**-5.371**	**8.815**	**6.047**
Red Star:							
Discount rate = 15%							
Discount factor	1.00	0.87	0.76	0.66	0.57	0.50	0.43
Disc. free cashflow – Red Star	**-0.750**	**-2.189**	**-15.793**	**11.771**	**11.467**	**10.046**	**20.378**

Source: Phoenix Copper, Hardman & Co Research

PXC – DCF valuation: Scenario 2 – Empire and Red Star, 2028-33E (cont.)

$m (unless stated)	2028E	2029E	2030E	2031E	2032E	2033E	Total
PTP	69.450	42.095	33.810	32.994	30.744	27.191	437.435
Tax	-12.097	-10.823	-8.750	-8.610	-8.466	-8.157	-102.606
NOPAT	**57.353**	**31.272**	**25.061**	**24.384**	**22.273**	**19.034**	**334.830**
Depreciation & amort.	24.522	26.060	10.548	11.715	11.715	4.659	166.320
Change in working cap.	0.000	0.000	0.000	0.000	3.000	2.000	0.000
Capex & exploration	-6.576	-3.888	-3.000	-3.000	0.000	0.000	-171.307
Free cashflow – Empire	**55.931**	**33.781**	**12.690**	**12.840**	**14.590**	**0.000**	**148.156**
Free cashflow – Red Star	**19.368**	**19.663**	**19.918**	**20.258**	**22.398**	**25.693**	**181.687**
Free cashflow – Total	**75.299**	**53.444**	**38.260**	**33.098**	**36.988**	**25.693**	**329.843**
Empire:							
Discount rate = 8%							
Discount factor	0.58	0.54	0.50	0.46	0.43	0.40	
Disc. free cashflow	**32.635**	**18.251**	**6.348**	**5.948**	**6.257**	**0**	**74.531**
Red Star:							
Discount rate = 15%							
Discount factor	0.38	0.33	0.28	0.25	0.21	0.19	
Disc. free cashflow	**30.643**	**6.428**	**5.662**	**5.007**	**4.814**	**4.802**	**57.357**

	Empire	Red Star	Total
Cum. disc. FCF	74.531	57.357	131.888
Net (debt)/cash	24.804	-	24.804
Total valuation	**99.366**	**57.357**	**156.693**
Basic shares (m)	115.750	115.750	115.750
Add: options/warrants	10.930	10.930	10.930
FD shares (m)	126.680	126.680	126.680
Valuation ($)	0.78	0.46	1.24
$/£	1.30	1.30	1.30
Valuation/share (£)	**0.60**	**0.35**	**0.95**

Source: Phoenix Copper, Hardman & Co Research

The conclusion is obvious: if PXC can borrow the additional ca.$41m debt it needs to develop the initial Empire copper-gold mine, it should develop the Red Star silver mine simultaneously, to maximise shareholder value.

We would also like to emphasise two further points relating to PXC's valuation under Scenario 2.

- Firstly, we estimate that the 95p/share combined valuation for Empire and Red Star rises to 139p/share using the recent highs in the copper and silver prices of $4.26/lb and $29.66/oz, respectively.

- Secondly, we noted how we used a conservative 15% discount rate in our Red Star valuation (versus 8% for Empire), to reflect the earlier stage in the exploration and development of the ore body. If PXC can make significant progress towards commissioning a mine at Red Star, we estimate that using an 8% discount rate in the DCF valuation could add a further 23p/share to our valuation.

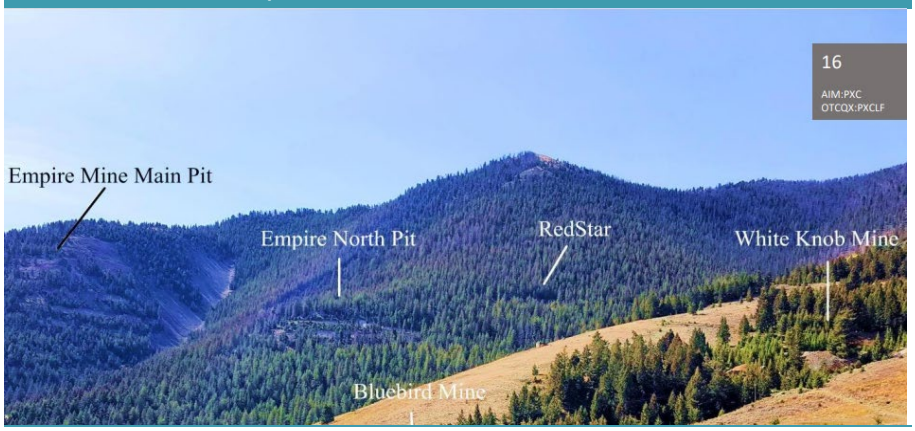
Does "X" mark the spot continentally, regionally and locally?

Why PXC chose Empire

PXC floated on AIM in 2017, with clear strategy

Phoenix Copper Ltd (PXC), originally known as Phoenix Global Mining, was incorporated in 2013, followed by an IPO on London's AIM market on 29 June 2017. The then CEO, Dennis Thomas, had screened numerous projects before identifying the Empire mine and the adjacent area in central Idaho as having the greatest potential upside, combined with the lowest manageable risks. An additional factor behind PXC's strategy was the dearth of major new copper mines being developed and that copper is widely expected to be in structural deficit for several years in the 2020s.

PXC – location of Empire



Source: Phoenix Copper

Why Empire?

Several additional factors made PXC's management choose Empire:

- Favourable jurisdiction – Idaho was ranked no.1 globally of favourable mining districts in the Fraser Institute Annual Survey of Mining Companies in 2018 (and is consistently in the top 10).
- Substantial exploration data were available from post-WWII drilling programmes. At the IPO, more than 280 holes, totalling 24,000m, had been drilled.
- The mine site was accessed by a well-maintained road, with access to power and water to support the development of a major mining complex.
- There were no environmental liabilities relating to the former mining operations.
- The ability to access the old underground workings would significantly reduce drilling costs in the delineation of a new sulphide resource.
- Only a small fraction of the potential ore system had been explored.

PXC has enlarged Empire claim into potential mineralised "system"

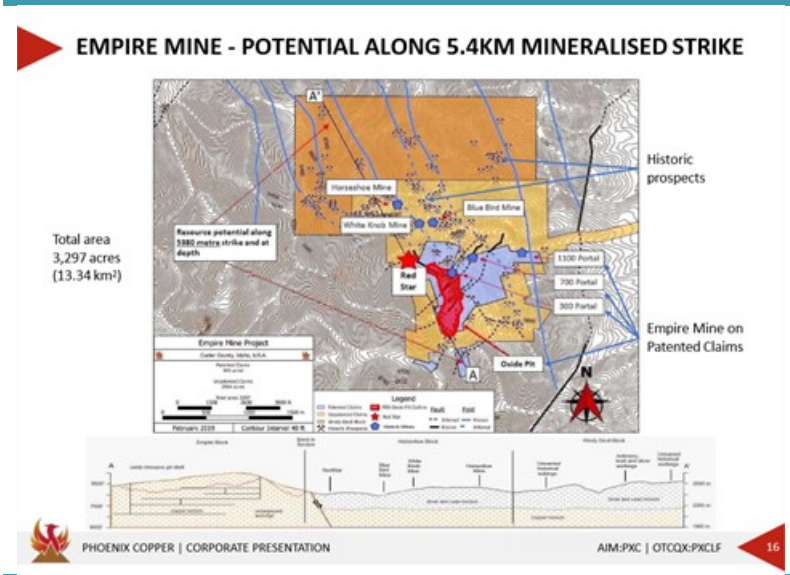
PXC acquired an 80% interest in the leases related to the Empire mine in 2013. By purchasing adjacent claims in the intervening period, the company has enlarged the original 818-acre Empire property into 5,717 acres.

PXC's portfolio now includes:

- three other former mines – Horseshoe, Bluebird and White Knob, which produced copper, gold, silver, lead, zinc and tungsten at various times during the first half of the 20th century;
- the Red Star sulphide deposit – the site of the proposed silver mine – which is located north-west of the Empire copper oxide deposit; and
- the Carlin-type (sediment-hosted hydrothermal) Navarre gold zone.

Mineralisation at the Empire system has been observed along a 5.4km strike, which trends north-west from the Empire open pit (oxide deposit) via Red Star and the White Knob and Horseshoe mines.

PXC – saleable copper production estimates, 2022-32 (tons)



Source: Phoenix Copper

Empire "system" likely to be associated with one mineralisation event

It is becoming increasingly likely that Empire and the surrounding mines and deposits are part of a much larger mineralised "system". PXC's consulting geologist, Nigel Maund, published two reports in 2019, *A Report on a Field Visit Made to the Empire Cu-Au-Ag-(Zn) Project, Idaho, USA* and *Field Review: Red Star & White Knob Mine Group (Cu) +Pb + Zn + Ag + (Au) Prospects*. In Maund's opinion:

"The Empire Granite Porphyry Breccia (GPB) – Endoskarn copper + gold + silver + zinc + lead + molybdenum + tungsten – comprises a world class polymetallic ore system sitting astride a major N-S structure."

Is Empire at epicentre of mineralisation in western US?

We acknowledge the reasons for PXC's management team acquiring Empire and Nigel Maund's view of its potential. At the same time, we believe Empire might also be located close to the epicentre of mineralisation in the western United States – and consequently in a favourable place for the metals to have been trapped in the aftermath of historical volcanic activity.

Intersection of north-eastern and north-western geological structures is key

The basis for the concentration of mining activity is the intersection of north-eastern and north-western trending geological structures (often east-north-east and north-north-west being more accurate) at the continental, regional and local levels.

Facilitated deposition of minerals via volcanic and tectonic activity

This "structural regime" of north-eastern/north-western trending geological structures, including shear zones, faults and intrusions, acted as a conduit for the flow of mineral-containing volcanic fluids. This facilitated the deposition of minerals via volcanic and tectonic activity. Consequently, there are a large number of mines and projects following these north-eastern and north-western geological trends, as we will show.

In his report for PXC, Nigel Maund also picked up on this theme:

"Besides the dominant northeast-striking extensional structures including the horst, faults, intrusions and dike swarms, there are also northwest-striking Neogene structures related to Basin and Range extension. Numerous such faults are found in the Challis Volcanic Group on the NW and SE sides of the horst. Recently, a major fault was found to cut across the horst. The intersections of the northeast faults and the northwest faults are thought to be good locations for mineralization…"

Based on our research, academics and/or mining executives have yet to prepare a single graphic or presentation slide that adequately illustrates this view. However, it is possible to get a sense of it in a piecemeal fashion from several sources.

"X" in continental and regional terms

Perfect chart to illustrate our thesis has yet to be prepared – nevertheless…

On a continental level, the major east-north-east (ENE) shear structure is the "Great Falls Tectonic Zone" (GFTZ – see below), which stretches from the Idaho Batholith through Montana and into Canada's southern Saskatchewan.

Empire within the GFTZ

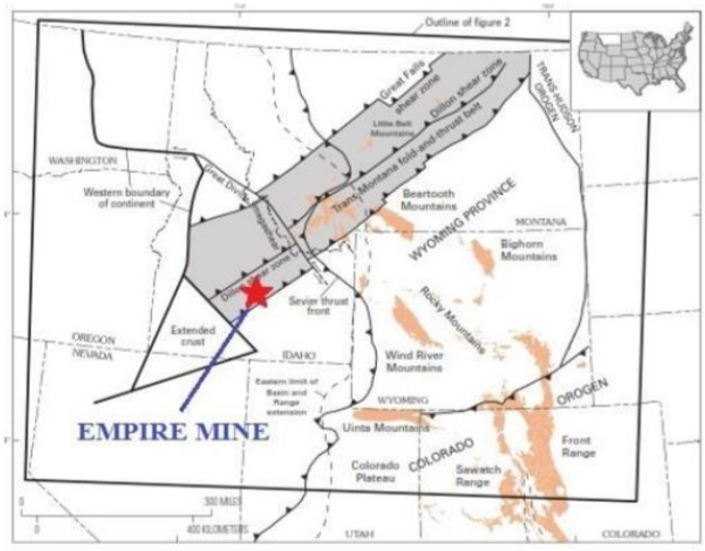


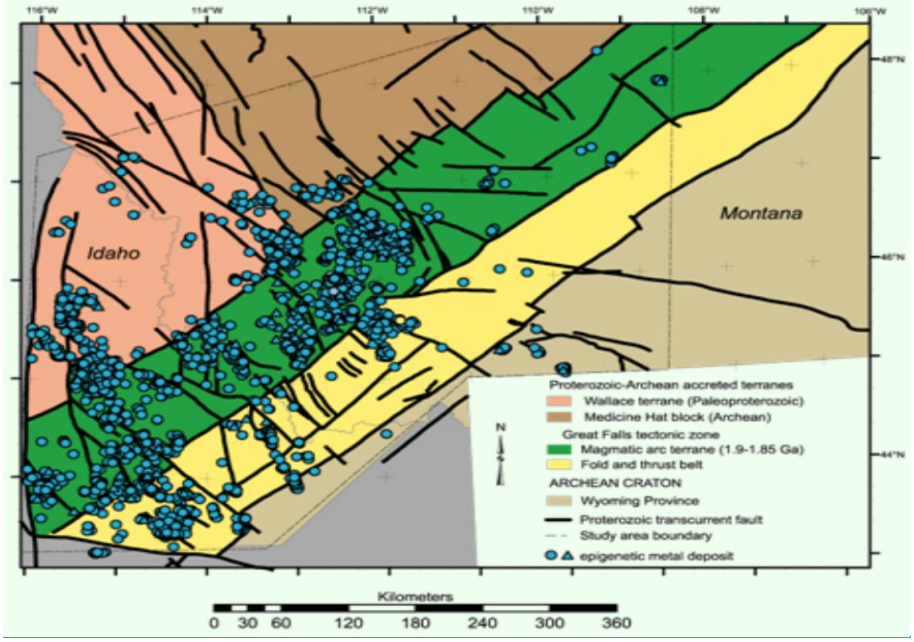
Figure 7: The Northern Rocky Mountains showing the location of the Great Falls Tectonic Zone (GFTZ = shaded) and the left lateral offset of the Dillon Shear Zone by the Great Divide Mega-shear (striking NW – WNW); Precambrian and basement uplifts are shaded in tan. The location of the Empire Mine within the GFTZ is shown.

Source: Phoenix Copper

Huge number of deposits located along GFTZ

The map below is from a slide in a presentation by Lund et al., *Influence of structure and composition of basement on mineral deposits across Montana and Idaho*. It shows the large number of known ore deposits located along and to the sides of the GFTZ (green and yellow) in southern Idaho and western Montana.

Mineral deposits in southern Idaho and western Montana

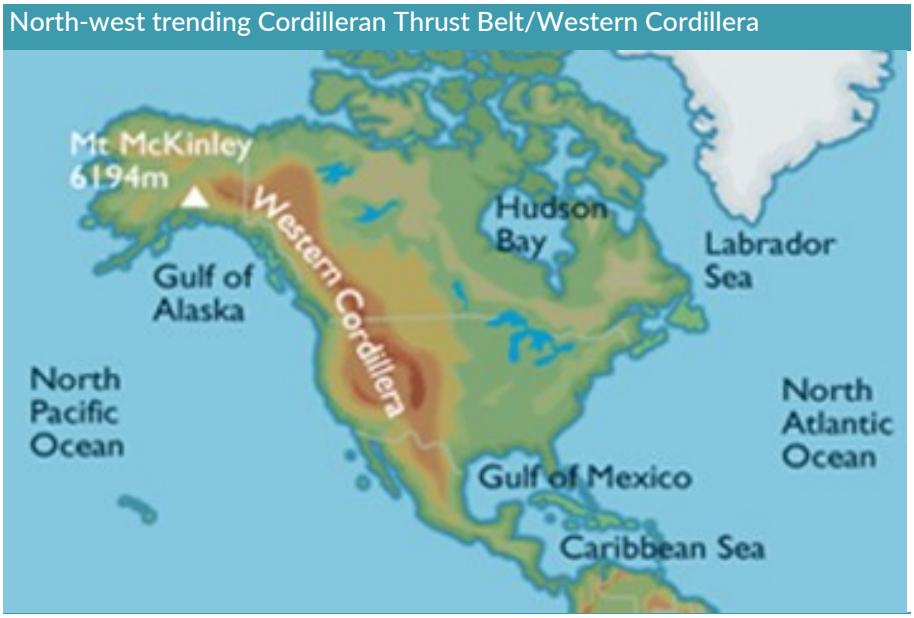


Source: Lund et al

Cordilleran Thrust Belt the major north-west structure at continental and regional levels

The major north-west trending structure at the continental and regional levels is the Cordilleran Thrust Belt, or Western Cordillera, which extends in a north-west-south-east direction along the western side of North America, from Alaska to Mexico, passing through Idaho. This is illustrated in the simplified map below.

North-west trending Cordilleran Thrust Belt/Western Cordillera

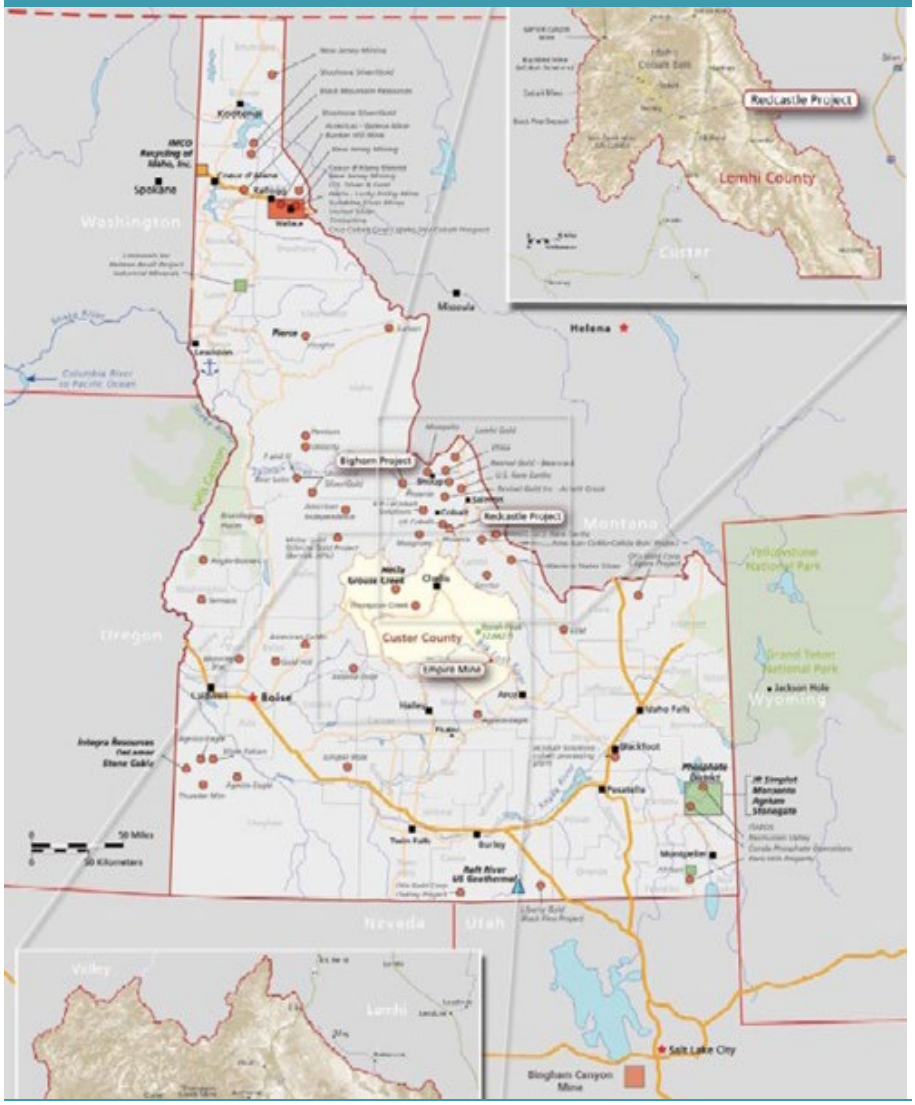


Source: Lund et al

The following chart, created by PXC, shows the large number of mines that follow a north-west trend across the region from Utah, including the famous Bingham Canyon mine, to the Canada-Idaho border.

PXC slide showing north-west to south-east trend of mines from Canada-Idaho border to Bingham Canyon, Utah

Mines along a north-west to south-east trend

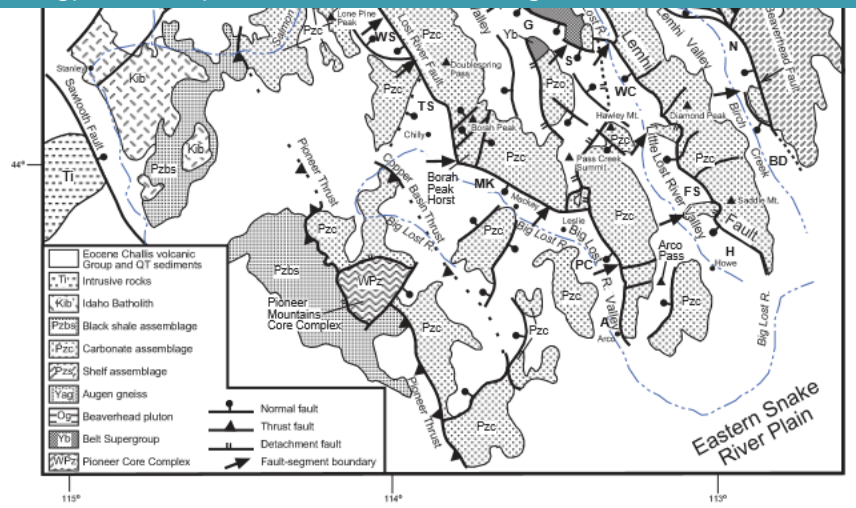


Source: Phoenix Copper

Empire located 5.5km to south-west of Mackay

Turning to the north-east and north-west geology at the local level, Empire is located in the White Nob Mountains of the Alder Creek mining district and 5.5km to the south-west of the town of Mackay. Mackay is shown – albeit in small writing next to "MK" – in the central part of the following map, and Empire is in the shaded area marked "Pzc". The map is taken from P.K. Link and Susanne J. Janecke's Geology of East-Central Idaho: *Geologic Roadlogs for the Big and Little Lost River Valleys*.

Geology of Mackay and the Alder Creek mining district



Source: Link and Janecke

Empire located between two north-east and two north-west trending faults

The map above shows the two north-east trending Eocene (normal) faults to the south-west of Mackay, which define the White Knob horst. To the north-east and south-west of these faults are two north-west trending faults (one normal and one thrust).

Detailed local geology

Mineralisation hosted in garnet-pyroxene skarn

The mineralisation discovered so far at Empire is hosted in garnet-pyroxene skarn, which is metamorphic rock formed in the contact area between intruding Eocene granites and older sedimentary rocks:

- **Intrusive rocks** – including granite (known as "Mackay granite" or "Mackay stock") and granite porphyry. Dating from the Eocene era, they are believed to have originated from a single "parent" magma.
- **Sedimentary rocks** – including limestone, siltstone and quartzite from the local White Nob Limestone and Copper Basin formations. These older rocks date from the Early Mississippian and Permian ages.

Rock sequence at Empire

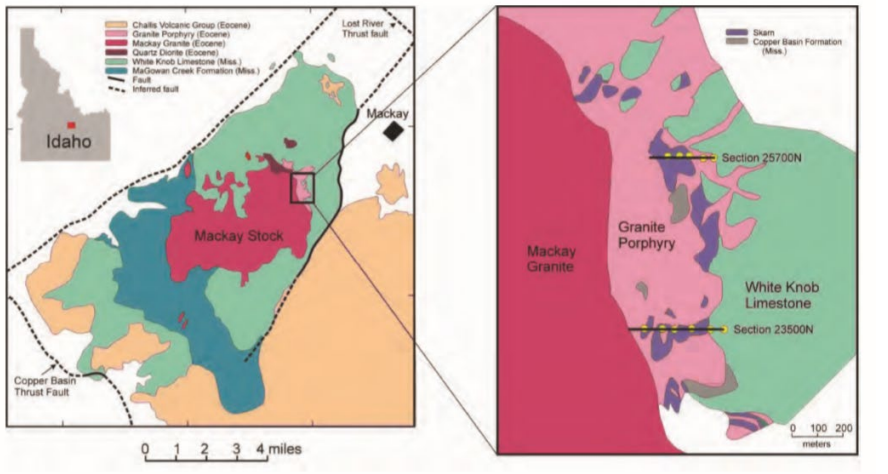
In the area including and surrounding the Empire deposit, it is possible to define a sequence of rocks from the intrusive granite in the west to the White Nob limestone in the east:

- Mackay Stock/granite;
- un-mineralised granite porphyry;
- granite porphyry containing mainly vein-form endoskarn with variable Cu-AuAg mineralisation;
- granite porphyry with strong semi-massive to massive endoskarn development and the larger high-grade Cu-Au-Ag ore shoots;
- calcic exoskarn;
- Wollastonite marble; and
- White Knob limestone.

The map below shows how the contact zone at Empire trends north-north-west between the intruding Mackay granite and White Knob limestone. The granite

porphyry, which contains the mineralised skarn, is located in the north-east corner of the Mackay stock, as shown by the pink shading.

PXC – saleable copper production estimates, 2022-32 (tons)



Source: Phoenix Copper

The garnet-pyroxene skarn was formed by the reaction of hydrothermal fluids with the existing limestone rocks in a process called "metasomatism". It is generally found around the faults and shear zones, which aided the flow of these volcanic fluids.

Two types of skarn: endoskarn and exoskarn

There are two types of skarn formation, depending on geological location:

- endoskarn – within the igneous rock (usually granite), which formed as the magma cooled; and
- exoskarn – within the sedimentary rocks outside of the intruding magma.

Skarns typically have considerably more exoskarn than endoskarn, because carbonate wall rocks, like limestone, are more easily dissolved and replaced by acidic hydrothermal fluids.

Mineralisation at Empire in the endoskarn

The Empire deposit is unusual in having more endoskarn than exoskarn. The mineralised garnet-pyroxene endoskarn in the Empire region is identified by the purple shaded areas in the right-hand chart above. It is this endoskarn that contains the majority of the copper, gold, silver, zinc, tungsten and, potentially, molybdenum ores.

Most of mineralisation in endoskarn found in garnet and/or pyroxene veins

The skarnification at Empire was facilitated by its high fluorine content. Fluorine's volatile nature facilitated the transfer of minerals between the intrusive rocks and sedimentary "wall" rocks. The majority of mineralisation in the endoskarn is found in garnet and/or pyroxene veins, or can be massive where several veins intersect.

"X marks the spot" variations

While our geological analysis can be summarised by "X marks the spot", Nigel Maund and the company itself have expressed ideas that are somewhat similar in terms of Empire's potential. Here is another comment from Maund's report echoing this theme.

"Interplay between north-east shear structures and White Nob limestone sequence to the east and the granite porphyry to the west provides the **perfect physical/chemical trap to deposit metals."**

Many large mines in the region

In communications with investors, PXC's management team has noted that Empire is located in what it refers to as "elephant country" – pointing to the many large mines in the region. Some of the most prolific examples include:

- Bingham Canyon Mine – which has produced more copper than any mine in history;
- Thompson Creek – previously one of the largest molybdenum mines; and
- Coeur d'Alene District – a globally important area for silver-lead mines, as well as some significant gold-copper mines.

Antamina the largest skarn-based copper mine

The Empire deposit shows some geological similarities with the Antamina copper mine, the world's largest copper mine based on a skarn deposit. The mineralised skarn at Antamina is mainly garnet, and measures about 3km x 1km. Construction of the $2.3bn project began in 1999, with the first concentrate produced in July 2001.

In terms of the similarities, Antamina is located in the copper belt of the north Andes, and was formed in the Eocene period by emplacement of granitic/quartz monzonite intrusions into limestone.

Study notes potential similarity of Empire deposit with Antamina

We noted above the high proportion of endoskarn at Empire. Antamina is also "abnormally abundant" in endoskarn and, in their paper, *Endoskarn and Cu-Zn mineralization at the Empire mine, Idaho, USA*, authors Zhaoshan Chang and Lawrence D. Meinert note the potential similarity between Empire and Antamina, based on the large proportion of endoskarn:

"Discovery of the world class Antamina Cu-Zn skarn deposit in Peru has sparked renewed interest in exploration for large skarn deposits worldwide…Skarns with large amounts of endoskarn and relatively high Zn/Cu ratios in proximal locations are not well understood, and need further study."

Main difference with Antamina may be location vis-à-vis associated porphyry

This was also picked up by Nigel Maund in his 5 April 2019 report:

"In some respects, the Empire porphyry – endoskarn system bears some clear geologic similarities to the World Class 1 category Antamina Mine, Ancash Province, Peru, which is the largest porphyry – endoskarn polymetallic deposit in the world. The key difference being that Antamina is a large endoskarn formed in the upper cupola of a substantial porphyry copper system exposed at the surface. Empire is formed on the eastern flank of the upper intrusive of a buried porphyry Mo – (W) system, where the main Mo system may lie between 400 – 600 m below surface."

Potential for large porphyry deposit beneath sulphide mineralisation at Empire

We noted, in our major PXC report of 14 May 2020, that beneath Empire's sulphide mineralisation, there is the potential of a much larger:

- porphyry molybdenum-tungsten ore system; or
- porphyry copper-molybdenum ore system.

Most of world's largest copper mines based on porphyry deposits…

Most of the world's largest copper mines are copper-porphyry deposits, and the world's largest molybdenum mines are located on porphyry molybdenum systems. They are typically very high-volume and with relatively low or moderate grades . The major products from porphyry copper deposits are copper-gold and copper-molybdenum, but they are often important sources of zinc, lead, silver and tungsten.

…here are most prominent examples

Examples of world-class porphyry copper mines include:

- the nearby Bingham Canyon mine in Utah, which has produced more copper than any mine in history;
- Chuquicamata in Chile, currently the world's largest copper producing mine;
- Escondida, also in Chile;
- Grasberg in Indonesia; and
- Oyu Tolgoi in Mongolia.

Skarn deposits often present in mineralised systems with associated porphyries

With regard to Empire's longer-term potential, we are encouraged that skarn deposits often occur in systems with mineralised porphyries. The text below is from an article in *Investing News* of 7 April 2016:

"The largest copper skarns are associated with mineralized porphyry copper plutons, or bodies of intrusive igneous rock. These deposits can exceed 1 billion tonnes of combined porphyry and skarn ore, with more than 5 million tonnes of copper recoverable from the skarn portion of the deposit. Generally, skarns are smaller than many other deposit types such as porphyries. However, it's worth noting that skarns may occur in association with porphyry copper deposits. For example, the Twin Buttes in Arizona and Bingham Canyon in Utah host both porphyry and skarn deposits."

The following statement is from the United States Geological Survey (USGS) definition of porphyry systems:

"In general, porphyry copper-molybdenum deposit systems are associated with adjacent skarn and (or) polymetallic-vein deposits of porphyry-related types…"

Pipeline: Navarre Creek and cobalt

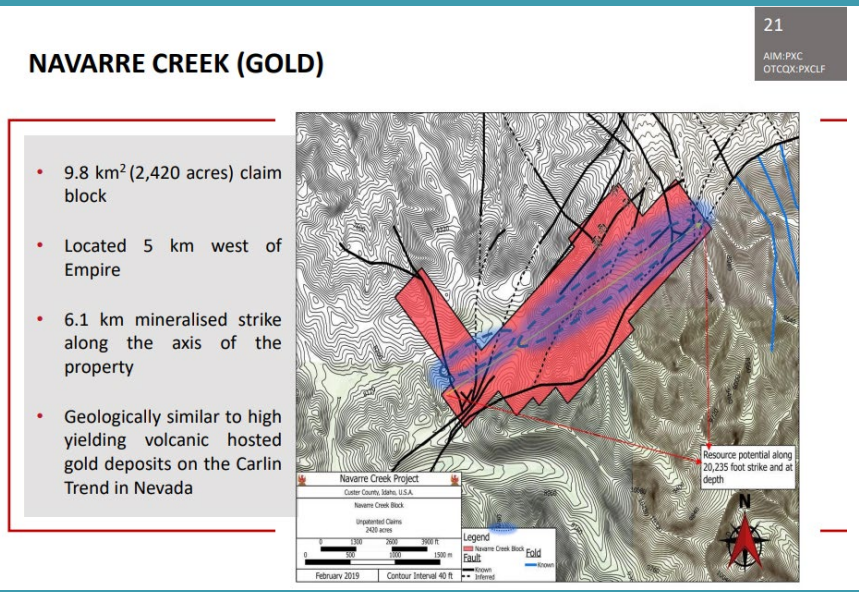
Navarre Creek expands PXC's gold potential

Navarre Creek, along with Red Star, expands PXC's development potential in the precious metals sector. PXC acquired the Navarre Creek claim to the west of Empire in February 2019, as part of a 3,880-acre acquisition, along with the Windy Devil package to the north. The company identified a volcanic-hosted epithermal-type alteration zone and a 2.5km brecciated jasperoid.

Geology appears similar to Nevada's Carlin Trend gold Belt

This type of metasomatic (via hydrothermal fluids) alteration is thought to form in the wall rocks of a shear zone. There are well-known occurrences in Nevada and Australia, which host multimillion-ounce gold deposits. Indeed, PXC noted the similarity with Nevada's Carlin Trend Gold Belt in a presentation, as shown in the following slide.

Gold deposit at Navarre Creek



Source: Phoenix Copper

Evidence of former mine workings

There is no historical exploration or mining data, although there is an underground portal and a small open pit relating to former small-scale mine workings. The alteration is visible on the surface, and the company believes the claim is "highly prospective" for near-surface mineralisation

Sampling in summer 2020 yielded some encouraging results – but very early days

In summer 2020, PXC mapped and took 90 samples from the property for testing. Of the 90 samples, 53 were above the detection limit for gold, and 25 were above the detection limit for silver. The highest gold grade was 0.569 g/t.

Two factors identified in the samples were consistent with Carlin-style gold systems:

- the surface grades found in these Navarre Creek samples are consistent with historical early-stage grades found in volcanic-hosted deposits, which are the basis for gold mines in Nevada; and
- the strong correlation between elevated gold values and elevated antimony values is also a known marker in Carlin-type gold systems.

Further exploration, more targeted this time, as a result of the 2020 sampling, will be undertaken this year.

Cobalt properties could create significant value at later date

PXC has two 100%-owned cobalt claims to properties in the Idaho cobalt belt – Bighorn and Redcastle – amounting to 1,180 acres in aggregate. Most noteworthy in this regard was the June 2018 C$149m acquisition of First Cobalt, which had a project adjacent to Redcastle. The project was in early-stage development, having an inferred resource only. During the 2018 exploration programme, all of PXC's sample results confirmed cobalt mineralisation, with two at Bighorn also showing significant copper values. With the current focus on the development of Red Star, further exploration at Bighorn and Redcastle is likely to resume during 2021-22.

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