



Copper Projects Review 2021

Copper M&A Update Report

December 2021



Contents

Executive Summary	3
1. Introduction	4
2. Recent Copper M&A Activity	7
3. Exploration & Development Projects	9
4. Issues Facing New Copper Developments	13
5. Benchmarking Project Parameters	17
6. Ranking Copper Development Projects	22
7. Exploration Company Valuations	26
Appendix 1 –Development Project Overviews	28
Appendix 2 – Copper Projects	37

All prices in the document are as of 26th November 2021

Front picture: Cortadera Fuego, Hot Chili

Executive Summary picture: Kennecott, Rio Tinto

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Executive Summary

'Copper Projects Review 2021' is the second follow-up report to our original copper report entitled 'Copper M&A – The Cupboard is Nearly Bare', published in November 2018. We received hugely positive feedback on the original report and our first follow-up report published in January 2020. This report again reviews recent copper M&A activity, examines the key issues facing the development of new copper mines at the moment, and looks at copper exploration projects where future M&A activity could take place.

We previously concluded that the number of late-stage development copper projects that were likely candidates to be acquired was limited. Looking at the latest data, this situation has not significantly changed, and the amount of copper M&A activity in the market in recent years has been low. However, this may be about to change following two large acquisitions announced recently by South32 and Sandfire Resources and a higher copper price.

We have reviewed the copper projects database within slightly revised parameters and find that there are 65 development and exploration projects with resources of more than 2.0Mt contained copper and we believe that only 23 of these have the potential to involve third party M&A activity and we conclude that there are just five projects with a 'High' possibility of a third-party involvement. These are: Cascabel, Viscachitas, Casino, Costa Fuego, and Santo Tomás.

This has been based on our assessment and ranking of a number of project factors, including the potential size, economics, exploration progress, permitting risks, location and geopolitical risk, resource quality, the structure of existing shareholders, and other project issues.

This report also examines and summarises the latest exploration developments of these projects and compares different parameters of the projects' published feasibility studies.

1. Introduction

This is our third report on M&A in the copper mining industry in the past three years. In this second update we once again review recent copper M&A activity, examine the key issues facing the development of new copper mines, and look closely at copper exploration projects where future M&A activity could take place.

1.1 Fewer M&A Opportunities

This report highlights a growing shortage of large-scale copper projects for future development by the copper industry. Many of the projects that are available are located in high-risk jurisdictions and/or are encumbered by increasingly tough environmental and permitting issues. This lack of opportunity continues to raise the value for those assets that are available.

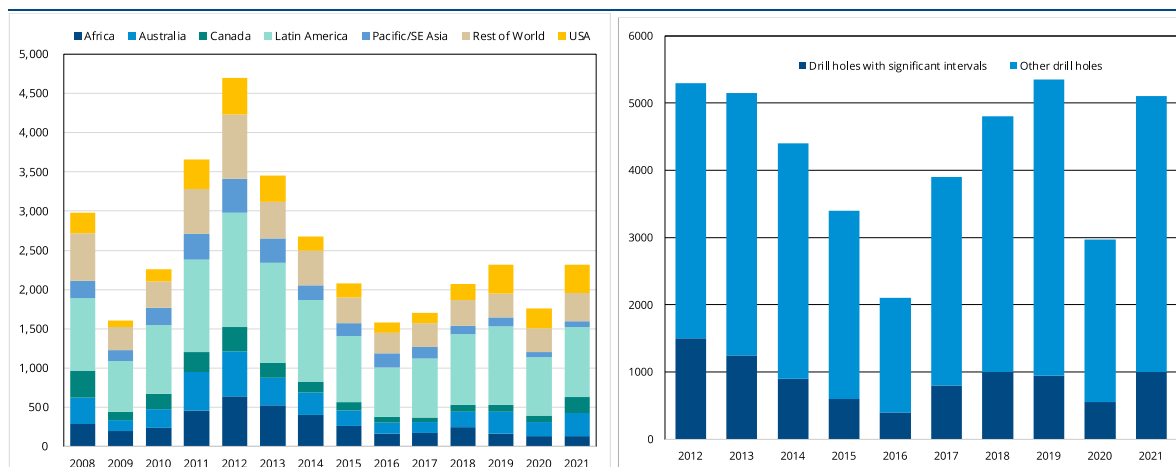
This is despite the copper mining industry generally being in a better financial shape than it has been for some time, and this has been further helped by the rise in the copper price since early 2020.

It is clear that some copper companies will have to undertake M&A in the near to medium term in order to refresh their development and exploration pipelines. This points to a rise in M&A activity, although we believe that the opportunities for M&A are limited because:

- Many smaller copper companies that are potential takeover targets have difficult shareholding structures.
- In the past there have been significant asset disposals from existing copper producers, but this is now likely to be a lot lower.
- There are a limited number of late-stage development copper projects with resources of >2.0Mt contained copper that look interesting enough to be acquired.

Generally, the amount of copper M&A activity in the market has been low over the past three years. This is despite junior exploration companies having been helped by the higher copper price to finance increased exploration following generally renewed enthusiasm for commodities over the past 18 months. Significant capital has been raised for exploration, although project development finance for juniors still remains challenging despite the renewed focus on energy transition metals. Generalist investors and Institutional asset managers shy away from mining and construction risk and even specialist mining investors are constrained by market capitalisation and trading liquidity limits, often typical characteristics of single asset junior mining companies.

Figure 1. Global Exploration Expenditure for Copper by Region and Drill Hole Analysis



Source: S&P Global Market Intelligence, RFC Ambrian

In 2021 there were US\$6.20bn of deals with 19 deals valued at >US\$10m, compared with US\$7.55bn of deals in 2020 with 13 deals valued at >US\$10m.

1.2 Supply Challenges

This research report focuses on the availability of greenfield copper exploration and development projects which could be the subject of M&A. We believe that there are limited new copper supply options and the industry faces headwinds with capital intensity and capital constraints, environmental issues including water scarcity, permitting issues, and increased technical challenges.

The latest global copper exploration spend data from S&P Global Market Intelligence shows expenditure recovered in 2021 after a dip in 2020 due largely to the COVID-19 pandemic. The results show that the number of drill holes with significant results has also recovered in 2021.

It is worth remembering that it can take up to 15 years for a company to take a project from first discovery to production; depending on the size, rate of expenditure, and ease of permitting. This would typically be 2-4 years for initial exploration, 2-4 years advanced exploration including drilling and defining reserves, 2-3 years for economic evaluation and obtaining approvals and finance, and 2-4 years for construction.

1.3 Source and Application of Data

We have sourced much of the data from S&P Global Market Intelligence but also added significant additional information directly from company data along with some RFC Ambrian estimates. When analysing the copper development and exploration projects, we have looked at them on a standalone basis. For the company analysis, we have focused on attributable ownership of mined copper production, reserves and resources.

Figure 2. 23 Copper Projects with Potential for Third-party Involvement



Source: RFC Ambrian

We originally selected 3.0Mt of contained copper as a cut-off for resource size as we calculated that this that might allow the construction of an 80-100kt/y operation for a 20-year mine life, depending on a number of geologic and economic factors. We believe that this is the smallest size of mine that may interest Tier 1 or Tier 2 copper producers to acquire or construct.

In our original report, we also examined existing primary copper producers and divided the top 30 largest into three groups: Tier 1 - producing >200kt/y copper; Tier 2 - producing <200kt/y but >45kt/y; and Tier 3 - producing <45kt/y but >20kt/y. We have called these primary copper producers as copper is the main commodity; although, copper often comes with one or more associated products, such as gold, silver, molybdenum, and zinc.

In our last report we lowered the resource threshold slightly to 2.5Mt contained copper to broaden the study and capture some greenfield projects that may still have upside potential to at

least reach our 3.0Mt size. In this report, we have reduced the cut-off further to 2.0Mt for the same reasons, but also to provide a reasonable size universe of projects because some previously covered projects have moved into production and some previously covered companies have been taken over.

Once again, we have excluded exploration and development projects in China, Russia, and Iran because we believe that there is a low-risk appetite to own, invest in, or operate assets in these regions. We have also not included brownfield projects or projects under construction in this report.

In trying to identify projects that have the potential to involve a third party (ie M&A activity) we have only looked at projects operated by a junior company or non-copper focused company and excluded those projects already owned by multi-commodity copper producers, an existing primary copper producer, or state-owned projects.

2. Recent Copper M&A Activity

Looking at the copper M&A activity announced in 2021, there were US\$6.20bn in deals compared with US\$7.55bn in 2020. In 2021, there were just 3 deals (>US\$10m in value) for company takeovers and 16 deals for direct asset purchases.

2.1 Company Deals

The largest copper company deal completed in the past two years was the acquisition of **KAZ Minerals** by **Nova Resources** for US\$6.1bn completed in April 2021. Nova Resources is a private company owned by a consortium, comprised of Oleg Novachuk, Chairman of KAZ Minerals and Vladimir Kim, Non-Executive Director at KAZ Minerals. It already held 59% of KAZ Minerals and purchased the outstanding 41%.

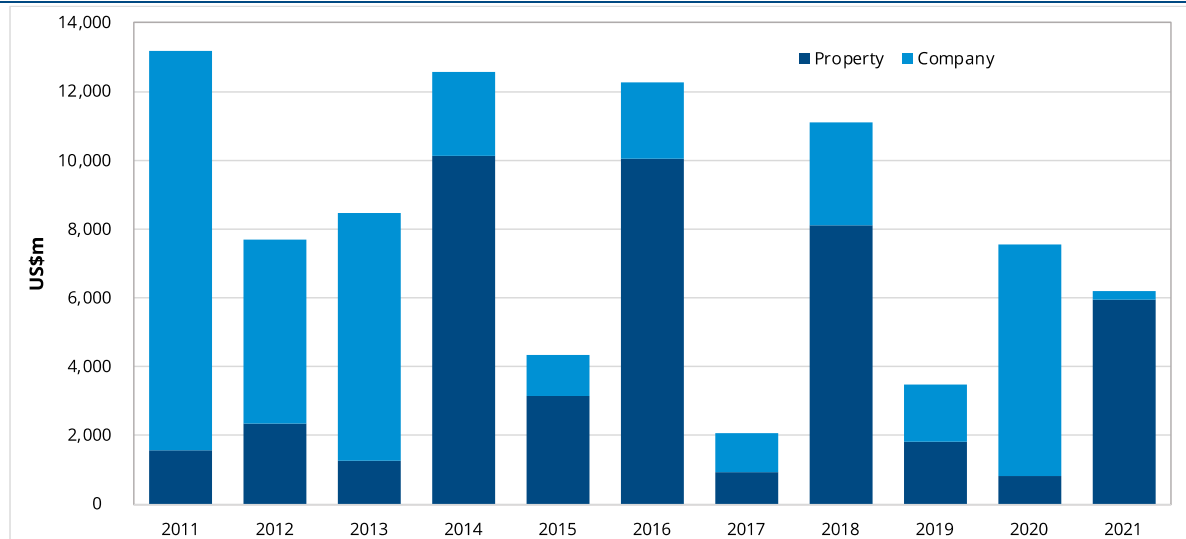
Other large company deals included:

- In July 2020, **Zijin Mining** acquired a 50% interest in the **Julong Copper Company** in China for US\$548m from three shareholders. Julong Copper owns the Qulong Copper Complex in Tibet, which is planned to be a large, open-pit mining area, and will be constructed in two stages, with Phase I

scheduled to be completed and put into operation by the end of 2021. After reaching its designed capacity, the mine's copper output is estimated to be about 160kt/y. Phase II is designed for copper output of 260kt/y.

- In June 2021, **Hongkong Brunn and CATL** acquired a 25% interest in Hong Kong company **KFM Holding** from **China Molybdenum** for US\$138m. KFM Holding holds a 95% stake in the Kisanfu copper and cobalt mine in the DRC. This follows China Molybdenum's property acquisition of the Kisanfu mine in December 2020 (see below).
- In March 2021, **Cyprium Metals** acquired a portfolio of copper assets including the Nifty copper mine and the Maroochydore and Paterson exploration projects in Australia, from **Metals X** for US\$46m.
- In August 2021, **Freeport Resources** acquired **Era Resources** operator of the Yandera copper project in PNG for about C\$2.6m in shares (page 31).

Figure 3. M&A Activity over the Past Ten Years



Source: S&P Global Market Intelligence, company data.

Other strategic investments made in smaller exploration companies include:

- In April 2021, **an investor group** acquired a 9.1% interest in **Solaris Resources** from **Equinox Gold** for US\$65m. Solaris has several copper and gold projects in the Americas including La Verde (page 32).
- In May 2021, **Rio Tinto** acquired an 8% interest in **Western Copper and Gold** for C\$25.6m which is developing the Casino project (page 24).
- In August 2021, **Glencore** acquired a 9.99% interest in **Hot Chili** for A\$14.5m which is developing the Costa Fuego project (page 24).
- In August 2021, **Fortescue Metals** acquired a 9.99% interest in **Candente Copper** for C\$1.1m which owns the Cañariaco Norte project (page 31).

2.2 Property Deals

The largest property deal over the past two years was announced in September 2021 where **Sandfire Resources** plans to acquire the **Minas de Aguas**

Teñidas SA (MATSA) mining complex in Spain from **Mubadala Investment Company** and **Trafigura** for US\$1.87bn.

Other large property deals included:

- In October 2021, **South32** agreed to acquire a 45% interest in the Sierra Gorda copper mine in Chile from **Sumitomo** for US\$1.55bn.
- In March 2021, **Glencore** transferred its 73.1% interest in the Mopani mine in Zambia to **ZCCM Investments** for US\$1.5bn of debt owed by Mopani.
- In December 2020, **China Molybdenum** acquired 95% of the Kinsanfu project in the DRC for US\$550m from **Freeport-McMoRan**.
- In March 2021, **Capstone Mining** acquired the outstanding 30% of the Santo Domingo project in Chile for US\$120m from **Korea Resources Corp.**
- In September 2021, **Hot Chili** completed the acquisition of the Cortadera project in Chile for US\$32m from **SCM Carola** (page 24).

Figure 4. Development Projects Vizcachitas and Pebble



Source: Los Andes Copper, Northern Dynasty.

3. Exploration & Development Projects

3.1 Exploration Project Focus

In our review of exploration projects, we have slightly revised our parameters to include companies with resources of greater than 2.0Mt contained copper. There are now 65 development and exploration projects in our list, but we believe that only 23 of these have the potential to involve third party M&A activity.

Even then, many of these projects have issues of one kind or another, and we concluded that there were just five projects with a 'High' possibility of a third party (or an existing minority shareholder)

looking to acquire the project outright or take a significant interest.

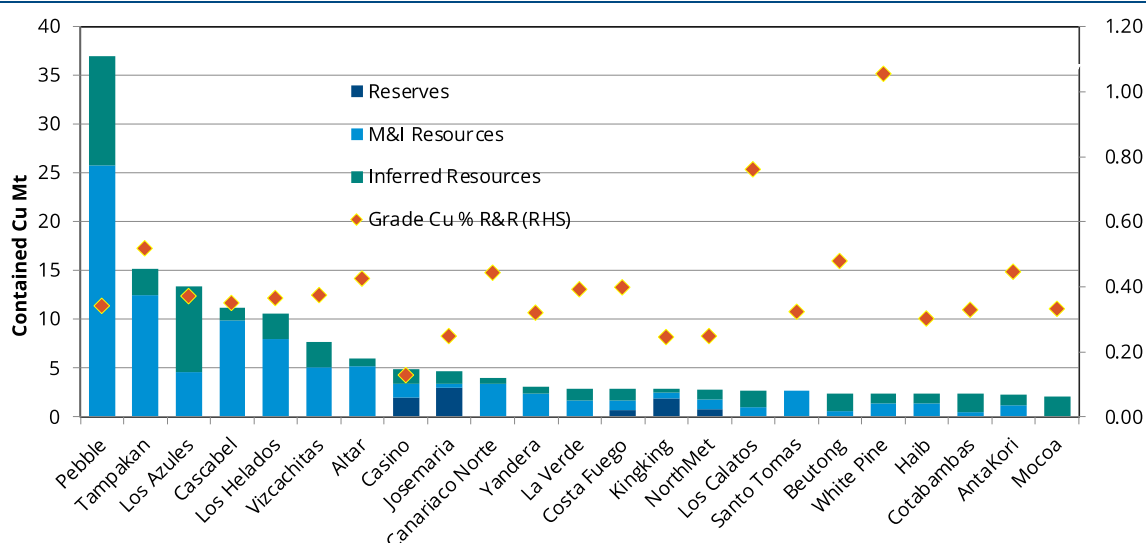
The size and grade of copper reserves and resources are shown for the 23 selected copper projects. By far the largest project is Pebble, the only one with a resource above 20Mt and only four others have resources totalling over 10Mt. Only three of these projects have a grade above 0.5% copper, with a weighted average grade of 0.345% copper (excluding by-products). The average grade of 19 project in our previous report was 0.449% copper.

Table 1. 23 Selected Late-stage Copper Projects with Resources >2.0Mt Cu Ranked by Resource Size

Size	Operating			Project	Resource	Grade	Feas. Rep	
Rank	Project	Country	Company	Status	Stage	Cu Mt	%Cu	Date
1	Pebble	USA	Northern Dynasty	Active	Pre-feas/Scoping	36.96	0.339	Sep-21
2	Tampakan	Philippines	Sagittarius Mines	Active	Feasibility	15.17	0.516	RNR
3	Los Azules	Argentina	McEwen Mining	Active	Pre-feas/Scoping	13.42	0.370	Oct-17
4	Cascabel	Ecuador	SolGold	Active	Pre-feas/Scoping	11.16	0.348	May-19
5	Los Helados	Chile	NGEx Resources	Active	Pre-feas/Scoping	10.62	0.363	RNR
6	Vizcachitas	Chile	Los Andes Copper	Active	Pre-feas/Scoping	7.74	0.374	Jun-19
7	Altar	Argentina	Aldebaran Res.	Active	Reserve Devel.	5.96	0.423	NA
8	Casino	Canada	Western Copper	Active	Constr. planned	4.89	0.127	Jun-21
9	Josemaria	Argentina	Josemaria Res.	Active	Feas. Completed	4.69	0.246	Oct-20
10	Canariaco N.	Peru	Candente Copper	Active	Feasibility Started	4.03	0.443	Nov-11
11	Yandera	PNG	Freeport Resources	Active	Pre-feas/Scoping	3.08	0.321	NA
12	La Verde	Mexico	Solaris Copper	On Hold	Pre-feas/Scoping	2.91	0.390	Sep-12
13	Costa Fuego	Chile	Hot Chili	Active	Feasibility Started	2.88	0.399	Mar-16
14	Kingking	Philippines	St Augustine Gold	Active	Feasibility Started	2.88	0.244	Oct-13
15	NorthMet	USA	PolyMet Mining	Active	Constr. planned	2.81	0.247	Mar-18
16	Los Calatos	Peru	CD Capital NR	Active	Pre-feas/Scoping	2.68	0.760	Sep-15
17	Santo Tomas	Mexico	Oroco Resource	Active	Reserve Devel.	2.65	0.323	RNR
18	Beutong	Indonesia	Asiamet Resources	Active	Pre-feas/Scoping	2.43	0.478	NA
19	White Pine	USA	Highland Copper	Active	Pre-feas/Scoping	2.43	1.053	Aug-19
20	Haib	Namibia	Deep-South Res.	Active	Pre-feas/Scoping	2.41	0.301	Dec-20
21	Cotabambas	Peru	Panoro Minerals	Active	Pre-feas/Scoping	2.38	0.329	Sep-15
22	AntaKori	Peru	Regulus Resources	Active	Reserve Devel.	2.29	0.444	NA
23	Mocoa	Colombia	Libero Copper & Au	Active	Reserve Devel.	2.10	0.330	NA

Source: S&P Global Market Intelligence, company data. RNR Report Not relevant (scope changed or too old). NA Not Available

Figure 5. 23 Copper Project Reserves and Resources (by Contained Cu)



Source: S&P Global Market Intelligence, company data.

Of the 23 projects selected, most of them are in significant copper producing regions: four are located in Peru, three are located in each of Argentina, USA, and Chile, and two in each of Mexico, and the Philippines. One project is currently categorised as on hold and one under litigation. There are summaries of each of these projects later in the report.

The projects are at various stages of exploration and development with two at the construction planning stage, four at the feasibility stage, 13 undertaking pre-feasibility and scoping studies, and four undertaking reserve development activities.

3.2 Key Changes in the Project List

There are 16 projects in our current list of 23 projects that were also in our list of 19 projects in our January 2020 report. We have removed the following three projects for the following reasons:

- Santa Cruz in the US owned **Amrich Minerals** because it remains inactive.
- Escalones in Chile owned by **World Copper** because it updated the resource estimate in June 2021 to a revised 1.56Mt of copper.
- Beschoku in Kazakhstan owned by **Frontier Mining** because it remains inactive.

At the same time, we have included the following project which has >2.5Mt contained copper:

- Costa Fuego in Chile owned by **Hot Chili**.

And six projects which have a resource of <2.5Mt but >2.0Mt contained copper:

- Beutong in Indonesia owned by **Asiamet Resources**.
- White Pine in the US owned by **Highland Copper**.
- Haib in Namibia owned by **Deep-South Resources**.
- AntaKori in Peru owned by **Regulus Resources**.
- Mocoa in Colombia owned by **Libero Copper & Gold**.

Reserve adjustments

Several of the projects have progressed with resource increases:

- **Solgold** reported a further resource increase at Cascabel, from 10.84Mt contained copper (grading 0.37%) to 11.16Mt (0.35%).
- **Western Copper** reported a further resource increase at Casino, from 4.40Mt contained copper (grading 0.16%) to 4.89Mt (0.13%).
- **Josemaria Resources** reported a resource increase at Josemaria, from 4.30Mt contained copper (grading 0.28%) to 4.69Mt (0.25%).

Downward adjustments also took place:

- **Aldebaran Resources** has revised down the resource at Altar from 8.41Mt contained copper (grading 0.32%) to 5.96Mt (0.42%).
- **PolyMet Mining** has revised down the resource at NorthMet from 3.43Mt contained copper (grading 0.25%) to 2.81Mt (0.25%).
- **St Augustine Gold** has revised down the resource at King-king from 3.19Mt contained copper (grading 0.27%) to 2.88Mt (0.24%).

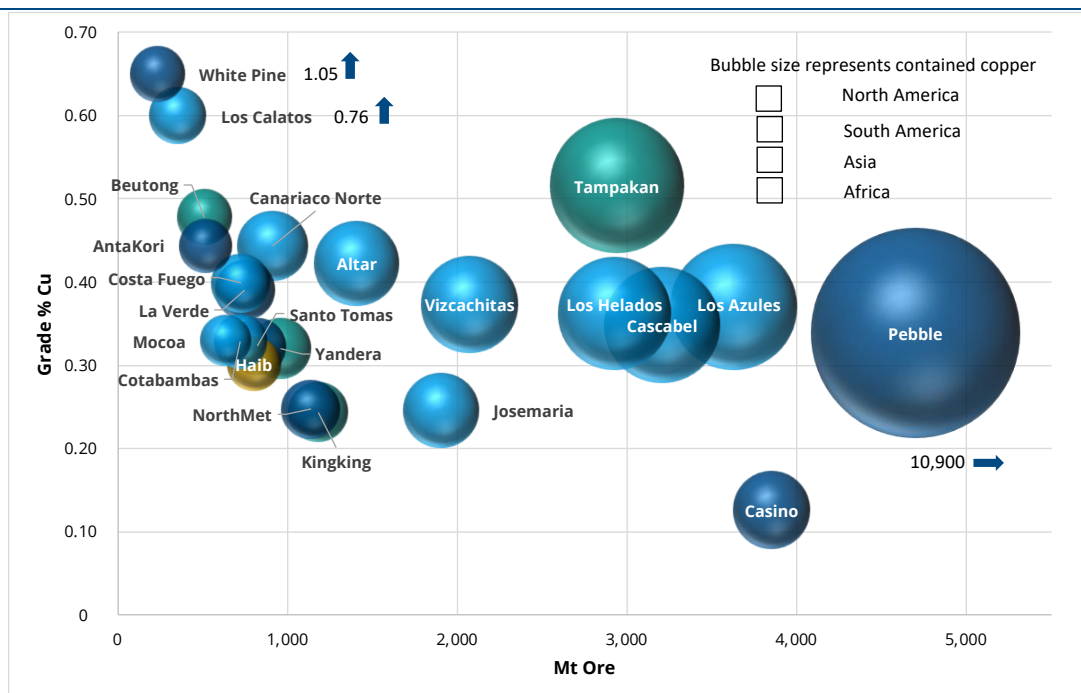
New Feasibility Reports

New preliminary economic assessments (PEA) or feasibility studies (FS) have been published since our last report and include:

- **Northern Dynasty Minerals** released a new PEA on the Pebble project in September 2021.
- **Western Copper and Gold** released a new PEA on the Casino project in June 2021.
- **Deep-South Resources** released a PEA on the Haib project in December 2020.
- **Josemaria Resources** released a new PEA on the Josemaria project in October 2020.

Meanwhile, **McEwen Mining** has announced the planned spinout of **McEwen Copper** in 1H22 on the TSX containing the Los Azules project in Argentina (page 28).

Figure 6. The 23 Copper Projects with Takeover Potential



Source: S&P Global Market Intelligence, company data.

3.3 Other Exploration News

For investors looking for earlier stage copper assets that may hold promise for the future we have also looked at the best copper holes drilled over the past two years with copper as the primary commodity. These are shown in Table 2 and the holes are ranked by the product of the copper grade and the

interval metres. Also note that only the best hole from each project is included and some projects drilled multiple top-ranking holes. Further, several holes had higher values when measured on a copper equivalent basis which we have not included in our table. Some of these holes have been drilled by companies we are covering in this report.

Table 2. Top Drill Hole Intersections of Primary Copper Exploration Projects

	Property	Country	Owner	Reported Date	Interval metres	Interval Cu %	Cu % x interval	Hole ID
1	Kabanga Jirani	Tanzania	Adavale Resources	Nov-21	162	9.50	1,539	KNE06-16-01
2	Onto	Indonesia	Vale SA	Feb-20	949	1.26	1,195	VHD037
3	Filo del Sol	Argentina	Filo Mining	May-21	858	0.86	738	FSDH041
4	Warintza	Ecuador	Solaris Resources	Mar-21	922	0.79	728	SLS-14
5	Los Helados	Chile	NGEx Minerals	Sep-21	1,134	0.59	669	LHDHG03
6	Oak Dam	Australia	BHP Group	Oct-20	312	2.14	668	AD30W1
7	MCSA Complex	Brazil	Ero Copper	Jul-21	67	9.21	617	FC5522
8	Kwanika	Canada	NorthWest Copper	Oct-21	235	2.00	471	K-21-217
9	Tujuh Bukit	Indonesia	PT Merdeka	Jun-21	516	0.90	464	UHGZ-21-045
10	Mt Cannindah	Australia	Cannindah Res.	Nov-21	493	0.89	439	21CAEDD003
11	Altar	Argentina	Aldebaran Res.	Feb-21	887	0.46	408	ALD-12-153
12	Red Chris	Canada	Newcrest Mining	Jan-20	720	0.56	403	RC595
13	Proyecto de RT	Spain	Atalaya Mining	Jun-21	252	1.60	403	ATD038
14	Porvenir	Ecuador	SolGold	Feb-21	928	0.39	362	PDH-20-001
15	Block 5	Oman	Critical Resources	Sep-20	56	6.32	351	B5MB4D071
16	Costa Fuego	Chile	Hot Chili	May-21	836	0.40	334	CRD0080
17	Tritton	Australia	Aeris Resources	Aug-21	62	5.12	315	TAKRC004
18	Bushranger	Australia	Xtract Resources	Mar-21	920	0.30	276	BRDD-20-001
19	Cortadera	Chile	Hot Chili	Mar-20	542	0.50	271	CRP0040D
20	MPD	Canada	Kodiak Copper	Oct-20	535	0.49	262	MPD-20-004
21	San Francisco	Argentina	Turmalina Metals	Jan-21	72	3.47	251	SFDH-039
22	Treaty Creek	Canada	Tudor Gold	Aug-21	405	0.62	250	GS-21-113
23	Cascabel	Ecuador	SolGold	May-21	1,040	0.24	250	TAD-20-003
24	Jasperoide	Peru	C3 Metals	Sep-21	229	0.99	227	JAS2750-05
25	Kharmagtai	Mongolia	Xanadu Mines	Aug-20	1,022	0.22	225	KHDDH529
26	Thorn	Canada	Brixton Metals	Aug-21	977	0.22	218	THN21-183
27	Elida	Peru	Element 29 Res.	Jan-21	503	0.42	211	15ELID012
28	Ootsa	Canada	Surge Copper	Dec-20	1,013	0.20	203	S20-219
29	AntaKori	Peru	Regulus Resources	Jan-20	341	0.57	194	AK-19-041
30	Copper Mtn	Canada	Copper Mountain	Sep-20	585	0.33	193	20IG-01

Source: S&P Global Market Intelligence, company data.

4. Issues Facing New Copper Developments

Developing or acquiring a mining asset is not straightforward and entails multiple risks. Potential acquirers will have varying degrees of appetite to different risks, particularly country risk and mining specific risks. These include infrastructure and technical issues, mining specific legislation, tax, and royalties, ESG requirements, climate change, and water and waste management.

KPMG produces an annual outlook 'Risk and Opportunities for Mining' based on the views of mining executives. The top risks in the 2021 survey were commodity prices, global pandemic, economic downturn, community relations and the social license to operate, environmental risks, permitting, and political instability.

The COVID-19 pandemic is new on the list and, apart from the operating issues, raises another layer of risk. COVID-19 has highlighted the risk of bottlenecks when it comes to supply chains and the global disruption has seen organisations building in more optionality and ushered in further digitisation of logistics.

The report also highlights that mining executives are increasingly giving attention to ESG risk, especially when it comes to climate change and

meeting rising community expectations. Surveyed companies agreed they now need to have a clear, measurable ESG strategy. Yet around a third of respondents noted investor expectations are still not well understood or consistent across the market.

Certainly, copper company corporate presentations increasingly focus on ESG issues related to their projects and companies are trying to incorporate innovative practices in the design such as renewable energy, electrification of haulage, minimising the mine footprint, and dry tailings stacking. However, it is now almost universally accepted in the mining sector that new technology is a positive rather than a risk.

4.1 Country Risk

We have reproduced the latest country risk ratings from Control Risk for the ten countries where the 23 projects are located. The standout is Papua New Guinea where the political, operational, and security risks are high and is the location of the **Yandera** project. The only countries with low risks are Canada and the USA. Since our last survey, Chile has started experiencing civil protests throughout the country and the political risk has risen from low to medium.

Table 3. Control Risk Country Ratings

Country	Political	Operational	Security	Terrorism
Argentina	Medium	Medium	Low	Low
Canada	Low	Low	Low	Low
Chile	Medium	Low	Low	Low
Colombia	Low	Medium	Medium	Medium
Ecuador	Medium	Medium	Medium	Low
Indonesia	Medium	Medium	Medium	Medium
Mexico	Medium	Medium	Medium	Low
Namibia	Low	Medium	Low	Insignificant
Peru	Medium	Medium	Medium	Low
Philippines	Medium	Medium	Medium	Medium
PNG	High	High	High	Insignificant
USA	Low	Low	Low	Low

Source: S&P Global Market Intelligence, Control Risk

4.2 Civil Unrest

In recent years, both Chile and Peru have seen significant civil unrest and labour disruptions in the country due to people seeking social reform. Ecuador and Argentina have also experienced demonstrations and **NGEx Resources** points out that there are risks relating to an uncertain or unpredictable political and economic environment in Argentina, especially as there is social opposition to mining operations in certain parts of the country.

This unrest has negatively impacted copper production in these countries, and there have also been a number of high-profile protests and blockades aimed against a number of specific mining and exploration projects by local communities. These are reported to be having a negative impact on investment sentiment in these regions. In our list of 23 projects, there are 4 in Peru, 3 in Chile, 3 in Argentina and 1 in Ecuador.

Over the past few years, political protests in Peru have blocked access to the shipping ports and main transportation routes and have forced the Peruvian government into contentious negotiations over indigenous land rights and environmental concerns.

Antamina, Peru's largest copper mine, has been forced to halt operations recently and blockades at **Las Bambas** operation started again in November 2021 after being lifted the month before. Protesters had agreed to lift the blockade under an agreement that will require Las Bambas to make tax transfers to the region in 2022.

These demonstrations are the latest in a series of protests against mining companies since President Pedro Castillo took office in July 2021. The socialist leader swept to power pledging to strike a new deal with the copper mining sector and redistribute profits to Andean communities.

In Chile, social reform protests against the government have continued since 2019 and human rights organisations have expressed concern over the government's response to the protests, citing "excessive use of force" by the Chilean Police. In October 2021, **Lundin Mining** stated that it is

pausing new investments in Chile amid uncertainty over Chile's November election and proposed royalty hikes. It holds an 80% interest in the **Candelaria** copper and gold mine in Chile.

4.3 Glacial Risks

In Argentina in October 2010, a 'National Glacier Law' was enacted, but its enforcement has only been witnessed in recent years. It set laws specifically regulating the minimum environmental protection standards for the preservation of glacial and periglacial zones. It also covers glacial meltwaters. In the past few years, it has become a highly politicised issue that has caused uncertainty for mining investment, particularly for major copper projects in the Andes.

Following recent rulings, the National Supreme Court has provided some guidelines for interpreting and understanding the scope of protection of this Law although the discussions regarding its scope and meaning are unlikely to be over. It appears that mining projects do not violate the Law simply by being developed in a periglacial environment and that the National Glacier Law is intended to protect geoforms with relevant water functions¹.

Glacier protection legislation is also advancing through Congress in Chile.

4.4 Permitting Challenges

While environmental standards are constantly being reviewed and raised around the world, they are possibly the toughest in the countries with 'low' risk environments such as the USA and Canada. Mining companies continue to face increasing levels of regulation and scrutiny to get key mining permits granted. Several projects in the US including **Pebble**, **Twin Metals**, **Rosemont**, and **NorthMet** have been the subject of strong environmental opposition.

This is partly attributable to the multiple stage processes of the US permitting regime, involvement of various agencies at all levels of government, and a lack of basic, cross-agency coordination which has resulted in a 7- to 10-year permit timeframe for US based mining projects.

¹ Bruchou, Fernández Madero & Lombardi, Feb 2021.

Figure 7. Development Projects Cañariaco Norte and AntaKori



Source: Candente Copper, Regulus Resources

This marks a stark contrast to that of Canada and Australia where the average permitting period is two years and environmental standards are equally thorough.

Currently, an appeal is underway of the US Army Corps' 'Record of Decision' in November 2020 to deny a permit for **Pebble** to proceed and found the project to be 'not in the public interest'. Along with an appeal, legal options being considered.

Twin Metals has had its mining leases in Minnesota withdrawn and then reinstated and most recently the federal government launched a mineral withdrawal study over the area as well as rejecting Twin Metals' preference right lease applications and prospecting permit applications. The company is appealing the decisions.

In July 2019, the US District Court for Arizona issued a ruling against **Hudbay's Rosemont** project that vacated the 'Record of Decision' (ROD) issued by the US Forest Service. As a result, Hudbay's ability to move ahead with building Rosemont is suspended for the time being. The judge ruled that the decision to issue the ROD was based on an incorrect interpretation of mining claims and the company has appealed the ruling. Hudbay believes that the Court misinterpreted federal mining laws and Forest Service regulations as they apply to Rosemont.

PolyMet is advancing the development of the **NorthMet** project in Minnesota but is experiencing continued legal defence of its permits. Four permits remain in active legal and regulatory action

(principally related to air and water quality) out of the more than 20 permits issued to build and operate the mine.

Elsewhere, Colombia's environmental regulator ANLA, published a decision to 'archive' the environmental permit application for the **AngloGold Ashanti's Quebradona** project in October 2021. Generally, a decision to archive is made where the regulator determines that in some areas it requires additional information to either confirm or deny a permit application. AngloGold points out that the Colombian President and cabinet ministers have expressed strong support for the project, but AngloGold must now decide whether to appeal the decision or refile the application.

In Namibia, **Deep-South Resources** had the renewal of the 'Exclusive Prospecting Licence' covering the **Haib** copper project refused in June 2021 by the Minister of Mines and Energy of Namibia. The company intends to vigorously contest this decision.

4.5 Philippines Turnaround

One of the most significant events in the past year has been the change in stance towards mining in the Philippines. In April 2021, President Rodrigo Duterte lifted a nine-year moratorium on issuing licenses for new mining operations in the Philippines. The government-imposed ban on open-pit mining is also expected to be lifted. It was introduced in 2017 and closed or suspended 26 mining operations for environmental violations.

The new executive order allows new mining deals and reviews of existing contracts for possible renegotiation. It also directs the environment ministry to plan terms and conditions and to implement rules on mine safety and environmental policies. The Philippines is a major producer of nickel and has several large undeveloped copper projects including **Tampakan** owned by **Sagittarius Mines**, **King-king** owned by **St. Augustine**, and **Silangan** owned by **Philex Mining**. Press reports suggests that negotiations regarding Tampakan have begun and Philex Mining reports that it is raising finance for the development of Silangan.

Meanwhile, the government has doubled the excise tax on minerals from 2% to 4%.

4.6 Water Stress

Chile is one area where water is an issue and important to the copper mining industry and where water shortages are already impacting production. **Antofagasta** recently reported that 2021 has been the driest year of the current 12-year drought at its **Los Pelambres** mine in Chile. The company reports that strict water management protocols had been put in place and that it is currently building a desalination plant to provide water to the mine and local communities to come into operation in 2H22. However, in the meantime up to 50 kt of copper production is at risk.

In August 2021, Chile progressed a reform bill that requires new concessions for water to be temporary and not indefinite. Historically, Chile's Water Code has permitted the state to grant long-term and perpetual water use rights. The legislation also prohibits water rights over glaciers, protects water in indigenous territories and allows the government to establish reserves in environmentally sensitive areas.

Chile's water authority, DGA, has also announced that it would more than double the zones where no new extraction would be permitted and where any extension of existing permits would need to be approved by the environmental authorities.

Some mining companies in Chile are responding to the social concerns, possible legislative change, and

the reality of shrinking freshwater reserves by investing in alternative water sources and efficient water management technologies, principally through desalination. However, desalination in Chile is an expensive undertaking given the altitudes of mining deposits and, frequently, the considerable distances which treated water must travel from the coast to a project. In addition, the desalination process and the pumping of water require substantial amounts of energy. For smaller projects this type of infrastructure investment may be difficult and would have implications for operating costs and capex. Nevertheless, 12 desalination plants are already operating in Chile and 15 more are planned.

State-owned copper miner **Codelco** has committed to reduce its consumption of continental water by 60%. In 2020, Codelco and **Anglo American** agreed to reuse water from the tailing dams of the **Andina** mine in processing at Anglo's **Los Bronces** copper mine. By 2031, more than half of the country's mining sector water consumption is expected to be from seawater. In August 2021, Chile's courts ordered **BHP** to temporarily cease groundwater pumping at the **Cerro Colorado** copper mine due to environmental concerns with the underlying aquifer.

4.7 Government Stress

Operations do not necessarily go as planned even after a mine has come into production. Discussions are reportedly not going smoothly on a new deal to finance the underground expansion of the **Oyu Tolgoi** copper mine in Mongolia.

The Mongolian government is seeking further concessions from **Rio Tinto** after it proposed new terms for financing the US\$6.75bn expansion. The underground mine expansion has been severely delayed by the dispute.

Contract talks began in September 2021 between Panama's government and **First Quantum** for the renewal of the concession of its **Cobre Panamá** mine. However, the government is reportedly seeking to raise royalty payments and improve environmental conditions as part of the renewal.

5. Benchmarking Project Parameters

5.1 Characteristics of Selected Projects

Looking at just the top 65 development projects in our database, the market has access to detailed project development data for 22 of these, mostly from Canadian NI 43-101 technical reports and Australian PEAs. We have compiled this data to try and provide further insight into some of our 23 selected projects, because 14 of the 22 with feasibility data are within this group. It also provides a benchmark for new projects and investors.

Eight other projects with development details (Schaft Creek, Upper Kobuk, Taca Taca, Rosemont, Yellowhead, Wafi-Golpu, Galore Creek, and Mason) are included in the charts below but are not in our list of 23 selected projects. They have been included to broaden the amount of comparable data.

The data shown in the comparisons is only for the construction and operation over the life of the mine. It excludes the additional exploration and development costs required to get them to the go-ahead decision point. Depending on the size and stage of the project, these additional could still be significant.

5.2 Operating Costs

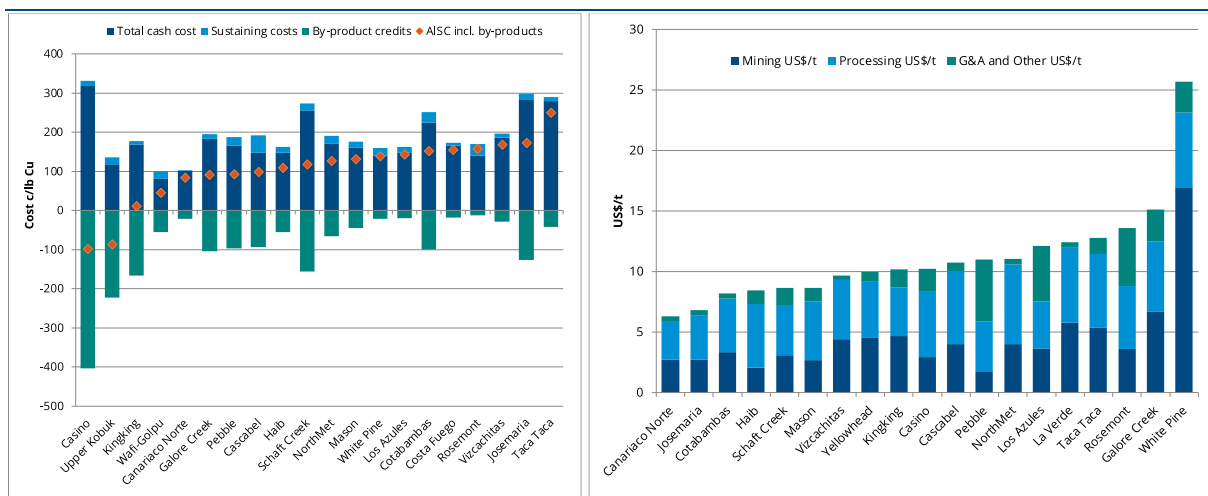
In Figure 8, we have identified the total cash costs, sustaining costs, and by-product credits in c/lb, to

give the AISC in c/lb including by-product credits. We have also identified a life-of-mine (LoM) total cash cost per tonne milled for each project which includes a breakdown of mining, processing, and G&A and other to give a comparison across the different projects.

This report focuses on copper projects and hence is focused on a certain size of copper resource to potentially develop a mine. However, the economics and profitability of a project can be significantly influenced by other minerals that are contained in the orebody and recovered in the processing. For copper deposits these are usually gold, silver, and molybdenum. Consequently, we have shown in Figure 9 the amount of contained copper for each project on a copper equivalent basis, adjusting the by-product commodities into equivalent copper based on current prices.

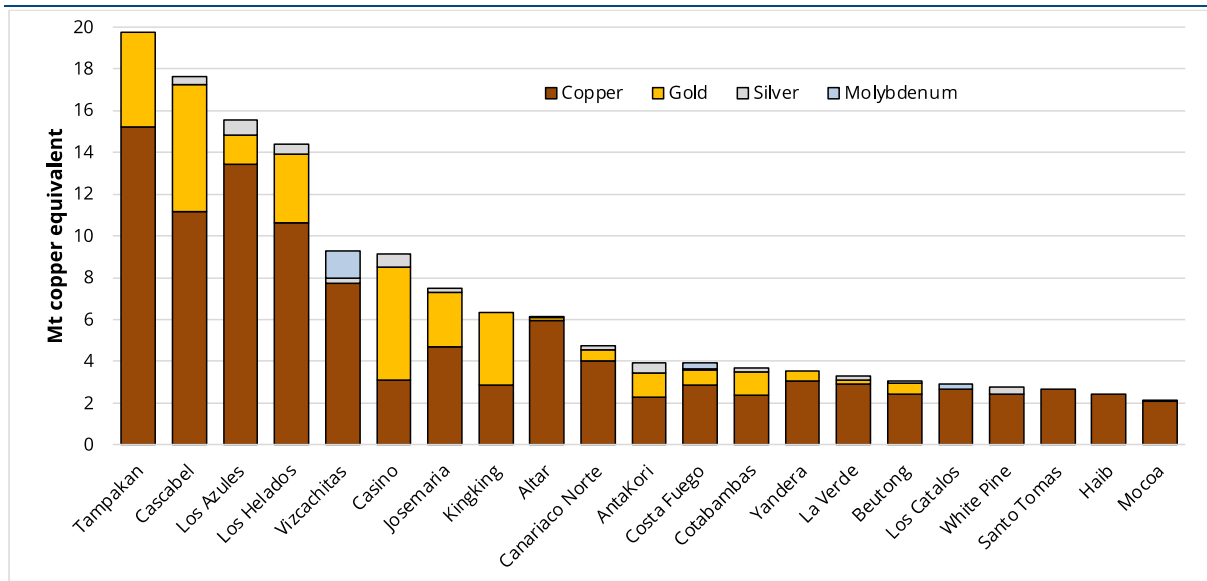
The figure shows that some of the larger projects have significant quantities of gold, and to a lesser extent silver, that make a very meaningful contribution to revenues and effectively reduce the cash costs on by-product credit basis. This is particularly relevant for the projects Casino and Upper Kobuk (which will also produce other metals) effectively giving them a negative cash cost and for the King-king project with a cash cost close to zero.

Figure 8. Copper Projects — LOM Operating costs c/lb Cu & LOM Operating costs US\$/t milled



Source: Company data, RFC Ambrian estimates

Figure 9. Copper Projects Resources on a copper-equivalent basis



Source: Company data, RFC Ambrian estimates. NB Pebble has been excluded because of its large size.

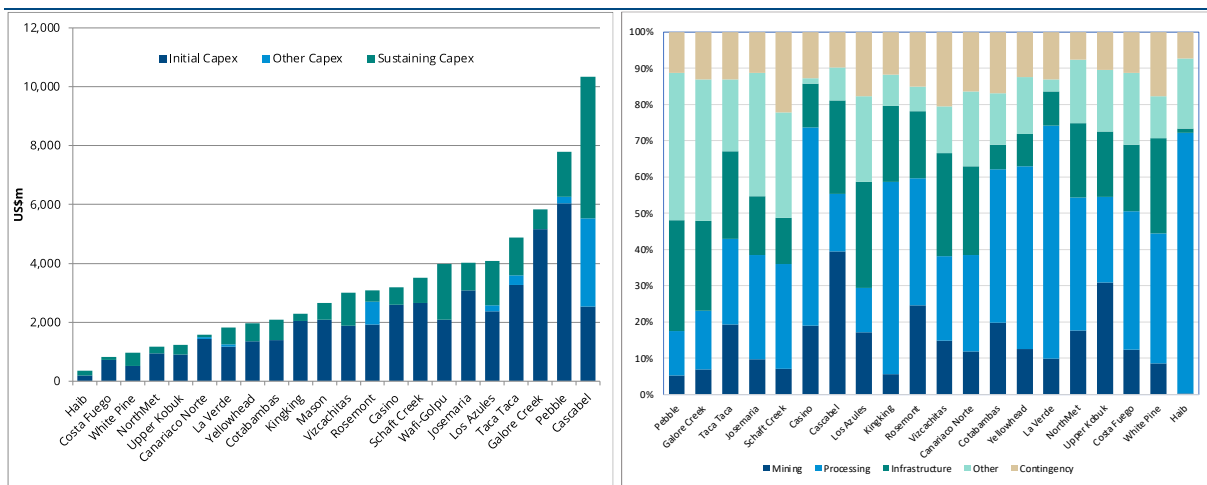
5.3 Capital Expenditure

We have also looked more closely at the capital expenditures reported by the companies in order to get a better picture of the overall life-of-mine capex and type of expenditure.

Figure 10 shows the initial, sustaining, and total capex requirements for each of these projects over the life of the mine. It shows how the initial capex can sometimes give a misleading picture of the overall capex requirements. Sustaining capex can often be a significant factor in the overall cost and is sometimes not mentioned in the feasibility study.

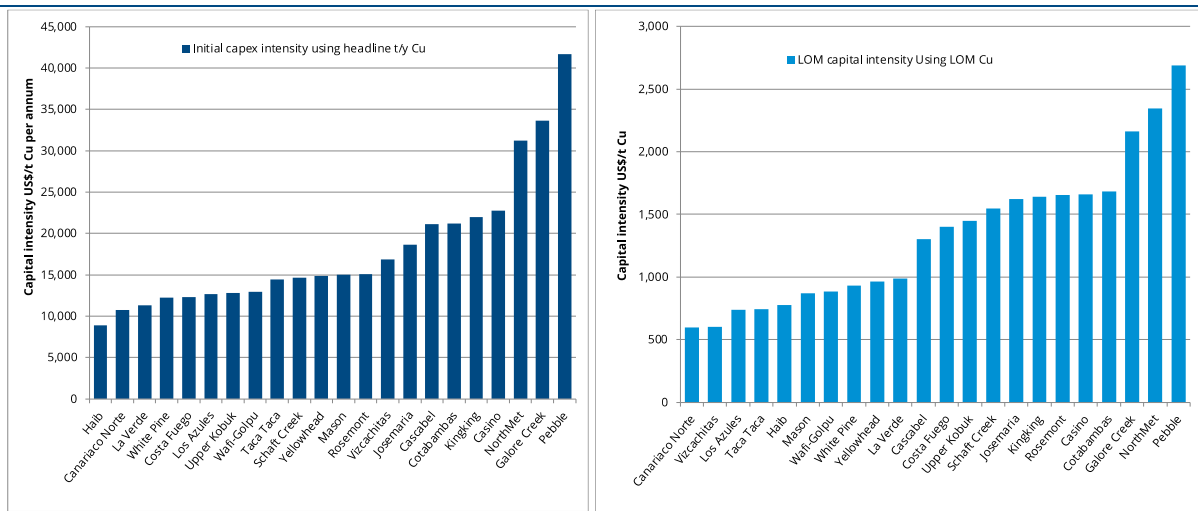
We have also broken down the initial capex into its major components (for the projects where it is available), to give further insight in to where the capital is being spent. This is shown in Figure 10. We have tried to include comparable data, but the breakdowns by the companies may vary. However, by showing mining, processing, infrastructure, other capex, and contingency as a percentage of the total it is possible to get a feel of how each of the projects is weighted. For example, Cascabel shows a relatively high mining capex because it is planned as an underground mine.

Figure 10. Copper Projects with Detailed Project Data - Projected Capex breakdown



Source: S&P Global Market Intelligence, Company data, RFC Ambrian estimates.

Figure 11. Copper Projects with Project Data - Capital intensity - Initial & LoM Capex



Source: S&P Global Market Intelligence, Company data, RFC Ambrian estimates.

5.4 Capital Intensity

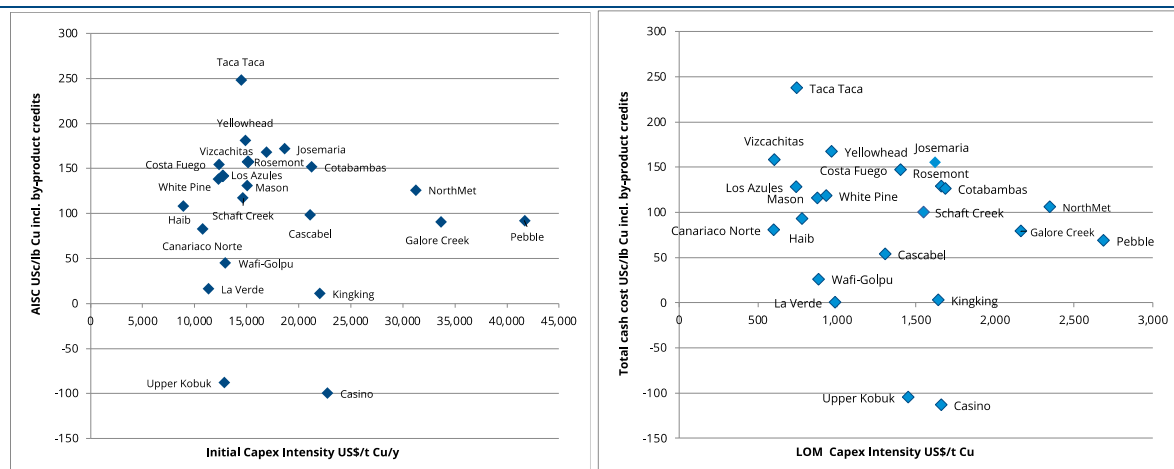
A common comparison for copper development projects is the capital intensity of the project. Development companies typically show the initial capex relative to the headline annual copper production. This is shown in the left-hand chart in Figure 13 for the 25 projects. However, sometimes this can be misleading and so we have also shown capital intensity on the basis of the LoM capex relative to the LoM copper production. This measure shows a broader range of outcomes and better highlights the more capital-intensive projects.

Figure 11 shows how the spread of capital intensity is lower when just looking at the headline

production levels (often a period from year 3 up to year 10 - when the mine is likely to be mining higher grade ore) compared with looking at the LoM data. Nevertheless, there is still a considerable spread on the initial capex data with the highest intensity some four times that of the lowest.

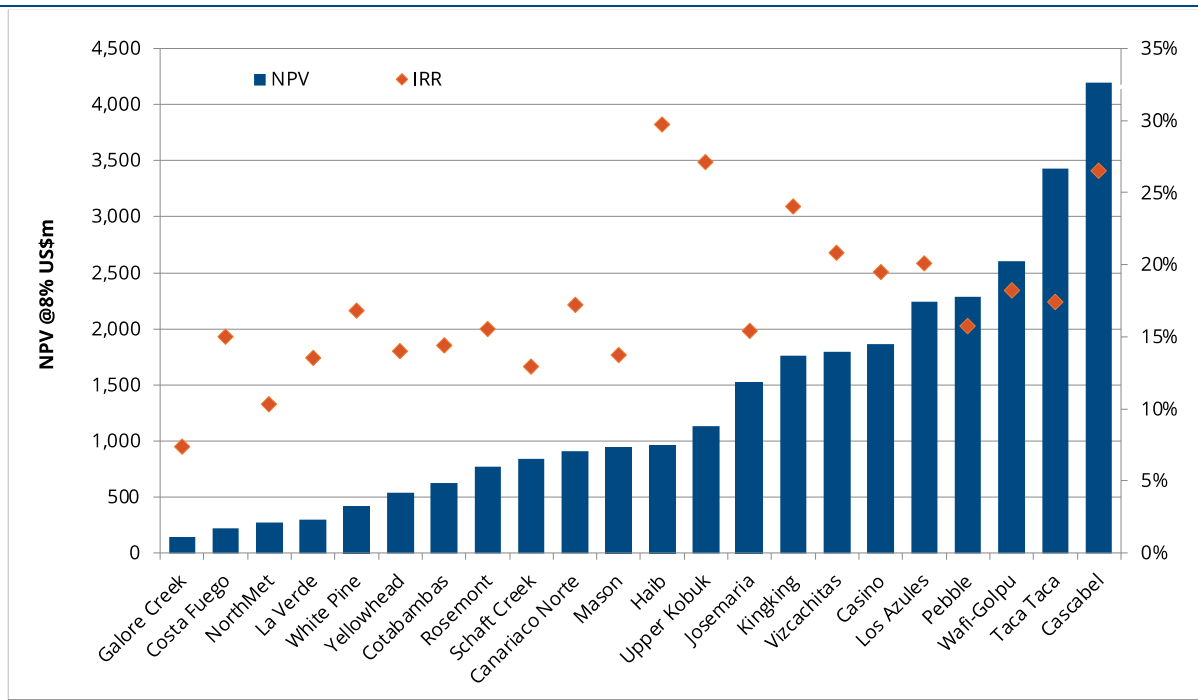
It is also necessary to look at the total operating costs of the projects relative to the capital intensity to get a better understanding of the relative profitability of the projects. This can be seen in Figure 12. This shows first the initial capital intensity against the all-in sustaining costs (US\$/lb) and second the LoM capital costs against the cash costs (US\$/lb). In both cases, the best projects sit towards the chart origin.

Figure 12. Copper Projects — Capital Intensity (Initial and LoM Capex) vs. Costs (Total & AISC)



Source: Company data, RFC Ambrian estimates.

Figure 13. Copper Projects with Project Data — NPV and IRR



Source: Company data, RFC Ambrian estimates.

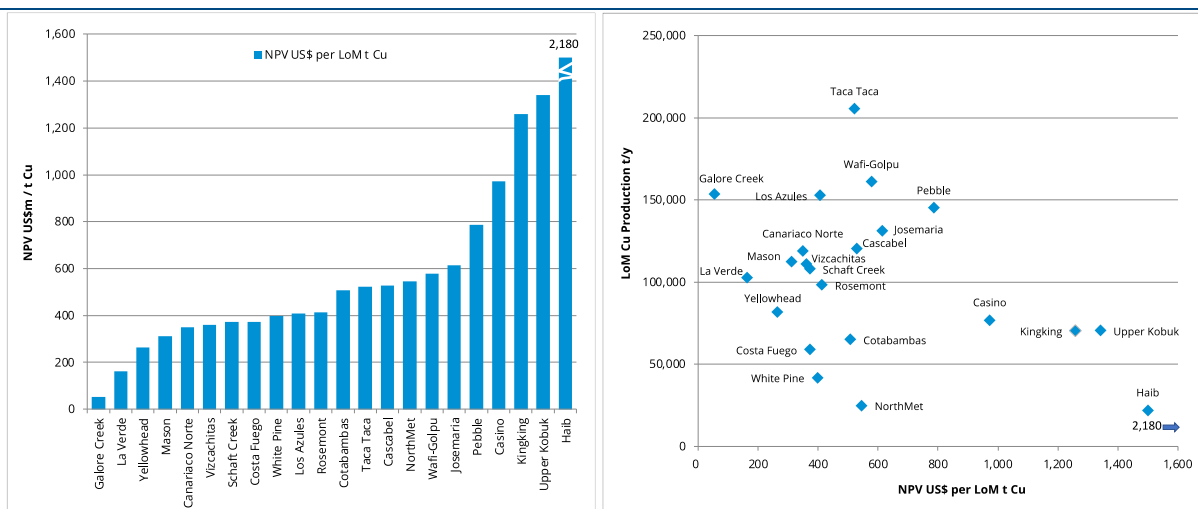
Figure 13 shows the NPV of each project as defined in the feasibility studies along with the respective IRR. Two-thirds of the projects have an IRR of between 10-20%, which are respectable but not spectacular returns. The study input prices averaged US\$3.02/lb.

In our analysis of the 23 projects in our traffic light breakdown we also considered the capital efficiency (NPV/LOM capex) of each project (page 22).

In Figure 14 we show the NPV per LOM tonne of copper plotted against the LoM copper production (t/y) as another measure of NPV return relative to the size of the project.

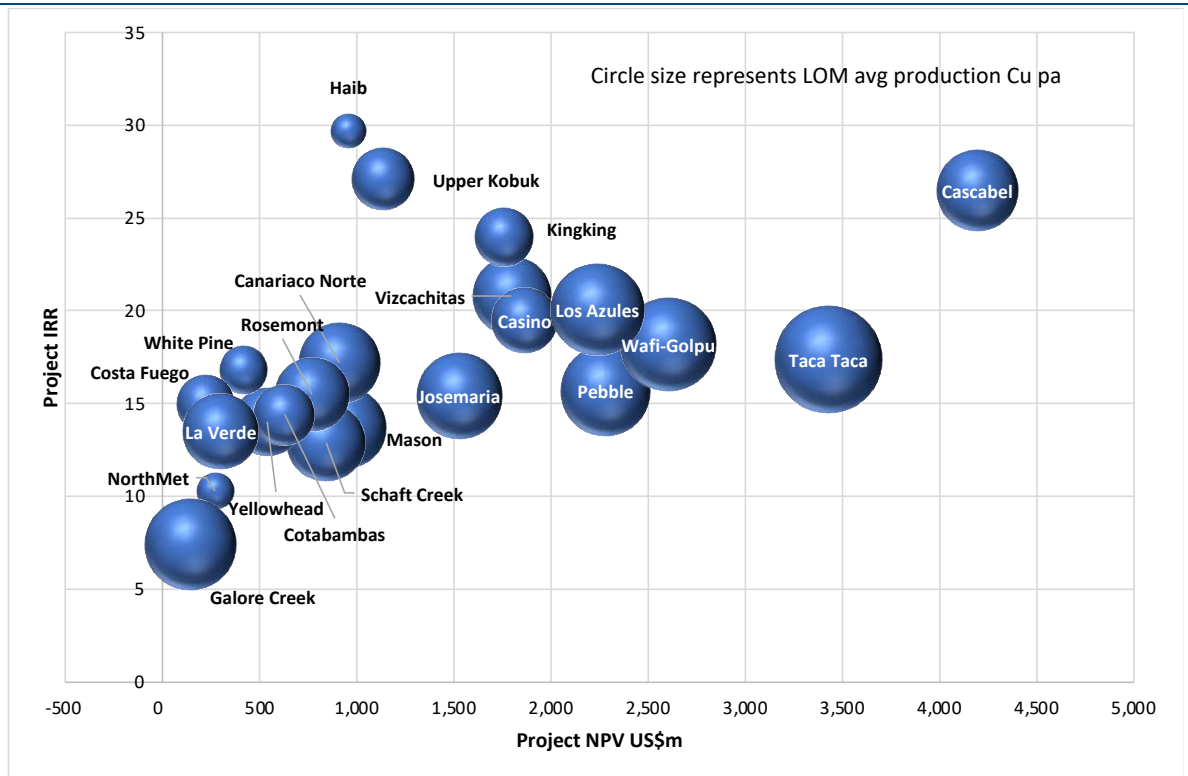
Figure 15 shows the NPV plotted against the IRR in a bubble chart with the size of bubble representing the LoM average annual copper production. The more desirable projects for acquisition will sit closer to the top righthand corner.

Figure 14. Copper Projects with Project Data — NPV per LOM t Cu against LOM Cu Production t/y



Source: Company data, RFC Ambrian estimates.

Figure 15. Copper Projects with Project Data — IRR vs. NPV



Source: Company data, RFC Ambrian estimates.

Figure 16. Development Projects Beutong and Cotabambas



Source: Asiamet Resources, Panoro Minerals

6. Ranking Copper Development Projects

Further to more detailed analysis of the 23 copper projects, we have divided them into three groups which we have called Low, Medium, and High probability cases of a third party either looking to acquire the project outright or taking a significant interest in the medium term.

This has been based on our assessment of a number of project factors, including the potential size, economics, exploration progress, permitting risks, location and geopolitical risk, resource quality, the structure of existing shareholders, and other project issues.

Table 4. Projects Ranked by Probability of Further Outside Involvement

Size	Project	Factors affecting project										Takeover Potential	
Rank		1	2	3	4	5	6	7	8	9	10		
	4	Cascabel	●	●	●	●	●	●	●	●	●	●	High
	6	Vizcachitas	●	●	●	●	●	●	●	●	●	●	High
	8	Casino	●	●	●	●	●	●	●	●	●	●	High
	13	Costa Fuego	●	●	●	●	●	●	●	●	●	●	High
	17	Santo Tomás	●	○	○	○	○	○	●	●	●	●	High
	3	Los Azules	●	●	●	●	●	●	●	●	●	●	Medium
	5	Los Helados	●	○	○	○	○	○	●	●	●	●	Medium
	7	Altar	●	○	○	○	○	○	●	●	●	●	Medium
	9	Josemaria	●	●	●	●	●	●	●	●	●	●	Medium
	10	Canariaco N.	●	●	●	●	●	●	●	●	●	●	Medium
	21	Cotabambas	●	●	●	●	●	●	●	●	●	●	Medium
	22	AntaKori	●	○	○	○	○	○	●	●	●	●	Medium
	1	Pebble	●	●	●	●	●	●	●	●	●	●	Low
	2	Tampakan	●	○	○	○	○	○	●	●	●	○	Low
	11	Yandera	●	○	○	○	○	○	●	●	●	●	Low
	12	La Verde	●	●	○	●	●	●	●	●	●	●	Low
	14	King-king	●	●	●	●	●	●	●	●	●	●	Low
	15	NorthMet	●	●	●	●	●	●	●	●	●	●	Low
	16	Los Calatos	●	○	○	○	○	○	●	●	○	○	Low
	18	Beutong	●	○	○	○	○	○	●	●	●	●	Low
	19	White Pine	●	●	●	●	●	●	●	●	●	●	Low
	20	Haib	●	●	●	●	●	●	●	●	●	●	Low
	23	Mocoa	●	○	○	○	○	○	●	●	●	●	Low

Source: RFC Ambrian

In Table 3, we have selected ten factors listed below to rank the 23 projects to assess their likelihood of being a takeover target in the near to medium term, in our view. For the numerical data, the projects were ranked and then divided into three to give a traffic light indication, with green ranked highest and red ranked lowest. The other rankings are separated on a slightly more subjective basis, based on our market perception, and again with green ranked highest and red ranked lowest. A blank has been left where no data is available.

1. Copper Resources.
2. LOM copper production annual capacity.
3. Forecast cash cost of production.
4. Capex intensity LOM.
5. Capital efficiency - NPV/LOM capex.
6. Internal Rate of Return.
7. Geopolitical risk.
8. Environmental & Permitting risk.
9. Current exploration activity & near-term upside.
10. Company cash & other assets.

Since our last report in January 2020, we have downgraded Los Helados from High to Medium, and Pebble and La Verde from Medium to Low.

In terms of new projects included in this report, Costa Fuego has entered as High, Cotabambas and AntaKori as Medium, and Buetong, White Pine, Haib and Mocoa as Low.

We believe that 11 of the projects have a Low chance of M&A activity at this time. This is because they may be at an early stage and/or due to risks associated with either the project location (political and environmental), the lack of activity and visibility of progress, or low returns.

There are 7 projects which we have classified as Medium probability of which three are potentially at risk from the Glacier Law in Argentina.

We believe that just 5 projects have a High probability of potential third-party activity: Cascabel, Viscachitas, Casino, Costa Fuego, and Santo Tomás. A detailed description of these five projects is given below. A more detailed description of all the other projects can be found in Appendix 1.

6.1 High Takeover Probability Projects

4. Cascabel



SolGold (SOLG CN: C\$0.40 | US\$740m) is listed on the LSE and the TSX. Its main focus is the 85%-owned Cascabel project, a porphyry copper-gold deposit in the Imbabura Province of north-west Ecuador, near the border with Colombia. As at September 2021, the company had net cash of US\$110m.

The resource currently stands at 11.2Mt of copper and 23.6Moz of gold. The company published a PEA in May 2019 and the project is expected to produce 139kt/y of copper and 219koz/y of gold LoM average at a total cost of US\$53/lb over a 57-year life (50Mt/y staged ramp-up scenario). The initial capital investment for the project is estimated to be US\$2.4bn. At a copper price of US\$3.30/lb, the PEA for the project returned an NPV₈ of US\$4.1bn and an IRR of 25%. SolGold is investigating both high tonnage open-cut and underground operations. A

resource extension drill program has been underway this year at Apala and a delineation program at the nearby Tandayama-America satellite prospect where a maiden resource has been announced. **A PFS was scheduled for completion at the end of 2021 but has been delayed following the recent appointment of a new CEO.**

SolGold has attracted considerable corporate interest. **Newcrest Mining** currently holds 13.5% of the company and **BHP** holds a 13.6% interest. In 2020, **Franco Nevada** completed a US\$100m royalty financing.

The upcoming PFS will be carefully watched and a competitive bid for SolGold could occur if the Cascabel project achieves expectations. We believe there is a High possibility of a third party (including the minority shareholders) looking to acquire the project outright or taking a significant interest in the medium term.

7. Vizcachitas

Canadian-based **Los Andes Copper** (LA CN: C\$11.00 | US\$241m) owns 100% of the Vizcachitas project, located 120km north of Santiago, Chile, in an area of good infrastructure. The project further benefits from a low altitude location, permitting, and year-round exploration and project development. Vizcachitas is an advanced stage copper-molybdenum porphyry deposit containing 7.7Mt of copper.

An updated PEA was published in June 2019 and the company is currently working on **a PFS which is now due 1Q22** (originally expected 4Q20). A new drill program was started in November 2021 looking at extensions to depth and the north. The PEA base case proposes an open-pit mine with a low strip ratio, potentially producing 111kt/y of copper at a total cost of US\$158/lb (including Mo-Ag credits) over a 45-year life with initial capex of US\$1.88bn. At a copper price of US\$3.00/lb the project returned an NPV₈ of US\$1.8bn and an IRR of 21%.

As at June 2021, Los Andes had cash of C\$9.9m. **The Turnbrook Corp** owns 53% of the company and PE group RCF a further 10%.



This project looks to have the size of deposit and scale of production that could be of interest to Tier 1 or Tier 2 producers and is in a good mining jurisdiction and location for infrastructure. We think there is a High possibility of a third party either looking to acquire the project or take a significant interest in the medium term. The market will be watching the current drill program results and the upcoming PFS.

9. Casino

Western Copper and Gold (WRN CN: C\$1.77 | US\$216m) is a Canadian company focused on developing the wholly owned Casino porphyry copper-gold-molybdenum deposit located in Yukon, Canada. The project contains 4.9Mt of copper and 21.1Moz of gold. As at September 2021 the company had cash and investments of C\$35.8m.

A significant resource expansion was announced in 2020 after a major drill program in 2019 and a PEA was released in 2Q20. The open-pit mine has a low strip ratio and is expected to produce an average of 77kt/y of copper and 260koz/y of gold from a mill and heap leach operation at a total cost of minus US\$113/lb over the 25-year mine life with initial capex of US\$2.6bn. The high gold production results in a negative copper equivalent cash cost. At a copper price of US\$3.00/lb the project has an NPV₈ of US\$1.9bn and an IRR of 20%.

In May 2021, **Rio Tinto** made a strategic investment in Western Copper through the purchase of 7.8% of its shares for C\$25.8m. Further exploration drilling has occurred this year and **a feasibility study is underway for completion in 2Q22**. The study will also form the basis of the Environmental and Socio-economic Statement, the submission of which is the next step in the environmental assessment process.

This project is attractive due to its high gold production and has already attracted the interest of Rio Tinto. With strong returns we believe there is a High possibility of a third party either looking to acquire the project outright or taking a significant interest in the medium term.

13. Costa Fuego

Hot Chili (HCH AU: A\$0.043 | US\$139m) is an Australian-based company focused on developing the Costa Fuego project in Chile which lies at low altitude. The project currently comprises two regional deposits Cortadera (100%) and Productora (80%) with JORC resources as well as two satellite prospects Valentina and San Antonio. The combined resource contains 2.9Mt copper and 2.7Moz gold. Hot Chili had cash of A\$3.6m as at June 2021. Hot Chili is ASX listed and listed on the TSXV in July 2021.

A PFS was completed on Productura in March 2016. The PFS indicated an open-pit mine that is expected to produce an average of 66kt/y of copper from a mill and heap leach at a total cost of US\$147/lb over the 10-year mine life with initial capex of US\$725m. At a copper price of US\$3.00/lb the project had an NPV₇ of US\$220m and an IRR of 15%.

A maiden resource for Cortadera was released in October 2020 which tripled the project resource base. Cortadera is on-track for a resource upgrade by the end of 2021 with the high-grade core continuing to expand and a fully funded 40,000m drill program taking place in 2021. A new PFS for Costa Fuego will consider a concentrator and leach superhub with a throughput range of 20Mt/y to 30Mt/y. **The PFS is expected to be complete in 3Q22**. Water rights have been secured.

In August 2021, **Glencore** made a strategic investment of A\$14.4m for 9.99% interest in Hot Chili.

Hot Chili is rapidly expanding the resource at Costa Fuego with new resource announcements pending and further promising satellite projects. Glencore has recently taken a position and we expect that given its potential it has a High probability of a third party getting further involved at some stage in the future.





17. Santo Tomás

The Santo Tomás copper porphyry deposit is located in Mexico, operated by **Oroco Resource Corp.** † (OCO CN: C\$2.50 | US\$387m) a Canadian-listed exploration company. A PFS completed in 1994 reported a resource of 2.65Mt of contained copper and scoped an 125ktpa copper in concentrate open pit operation and demonstrated the project's likely metallurgical and mining viability. The project is at relatively low altitude and has good infrastructure close to sealed roads, rail lines, water, high voltage power and a major gas pipeline. The deep-water port of Topolobampo is located 160km to the southwest and connected by road and rail.

Oroco holds a 73.2% interest in the Santo Tomás which can increase incrementally to 85.5% with additional project investment of up to C\$30m. Oroco also holds a 77.5% interest in adjacent concessions where the interest can also increase. As at August 2021 the company held cash and investments of C\$17.9m. The project is fully statutorily compliant, with existing mining concessions, and has no environmental issues.

The 1994 PFS outlined a high-grade core of the orebody (281Mt grading 0.437% copper) which is outcropping and the proposed open pit mine would have a low strip ratio. The deposit remains open along strike and down dip.

Revised technical reports in 2003, 2011 and 2019 suggested significant further exploration upside potential but limited further work occurred until

2020 due to a legal dispute which was resolved irrevocably in Oroco's favour by the Mexican Supreme Court in early 2020.

The 2019 technical report states that studies have shown potential for a project-wide endowment of greater than 7Mt of contained copper and that modern targeted drilling and exploration work has the potential to significantly increase grade and tonnage. Historical drilling was not systematically assayed for molybdenum or precious metals and there is potential for by-product credits.

Oroco completed an extensive 14km² 3D induced Polarization geophysical survey, the first modern geophysical survey of the property, in May 2021. The results showed near perfect correlation with the historic drilling results and indicated very significant extensions of the deposit over the 4km+ strike length and extending to depths of 600m. The company now has three drill rigs on site as part of a drilling campaign intended to confirm the historic resource and test the possible extensions highlighted by the 3D survey.

This project is at an early stage but should benefit from the ongoing drill programme over the next 18 months. This project has good infrastructure, a low strip ratio, and no environmental issues and given its potential has a High probability of a third party getting involved at some stage in the future.

† RFC Ambrian acts as Financial Adviser to Oroco Resource Corp.

7. Exploration Company Valuations

Within our database of copper exploration companies, we identified 19 listed junior companies which have undeveloped copper resources of >2.0Mt or assets in feasibility phase. These are shown in Table 4.

The table shows the market capitalisation and Enterprise Value (EV) of these companies and a crude comparative valuation based on EV/t reserves and resources which is also shown in Figure 17. Some caution should be taken when using these valuation metrics as it is usually better to look at

discounted cashflow of the underlying projects rather than just the contained copper. DCF analysis is beyond the scope of this report, but some company project NPVs are shown in section 5.0.

Furthermore, share prices and valuations of junior exploration companies can be volatile and often reflect excitement or disappointment about recent drilling results, or other specific or geopolitical events, rather than being a reflection of the current value of the underlying resources.

Table 5. Copper Development Companies with Copper Reserves & Resources

Rank	Market	Ticker	Company	Mkt Cap US\$m	EV US\$m	R&R Attrib Mt	EV/t R&R
1	TSX	SOLG	Solgold	740	737.0	9.5	77.7
2	TSX	OCO	Oroco Resource Corp.	387	371.9	2.3	162.7
3	TSX	JOSE	Josemaria Resources	359	346.0	4.7	73.8
4	TSX	POM	PolyMet Mining	309	345.3	2.8	122.9
5	TSX	TMQ	Trilogy Metals	273	265.8	1.8	148.7
6	TSX	LA	Los Andes Copper	241	238.0	7.7	30.7
7	TSX	WRN	Western Copper & Gold	216	174.0	3.1	56.4
8	TSX	NDM	Northern Dynasty	211	181.6	37.0	4.9
9	TSX	NGEX	NGEx Minerals	173	173.1	6.8	25.5
10	ASX	HCH	Hot Chili	133	135.9	2.9	47.1
11	TSXV	REG	Regulus Resources	86	77.4	2.3	33.7
12	TSXV	HI	Highland Copper	68	89.3	3.8	23.6
13	LON	ARS	Asiamet Resources	63	51.0	1.9	26.2
14	TSX	ALDE	Aldebaran Resources	60	54.1	5.1	10.7
15	TSX	SAU	St. Augustine Gold	55	54.5	1.7	31.5
16	TSX	DNT	Candente Copper	39	38.5	4.0	9.5
17	TSXV	PML	Panoro Minerals	36	46.9	2.4	19.7
18	TSXV	LBC	Libero Copper & Gold	15	10.2	2.1	4.8
19	TSXV	DSM	Deep-South Resources	8	4.7	2.4	1.9

Source: Company data.

7.1 Upturn in Project Resource Drilling

Another factor affecting valuations of some exploration companies beyond the main project is that they have other early-stage assets that carry value. Also, some companies are currently undergoing further exploration work on their main

project with indications or expectations that the resource size is larger than currently reported and that can be already factored to some degree into the share price.

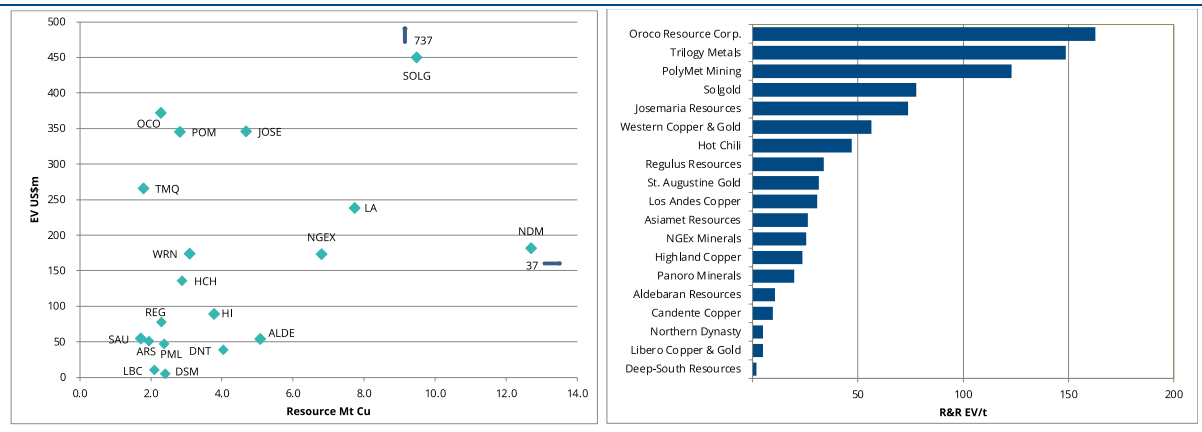
Drilling is about to start or currently underway at Oroco's Santo Tomás project, Los Andes Copper's

Vizcachitas project, Western Copper’s Casino project, Hot Chili’s Costa Fuego project, McEwen Copper’s Los Azules project, Aldebaran’s Altar project, and Regulus Resources’ AntaKori project.

We have not analysed these companies directly in terms of being takeover targets, but rather focused

on the project(s) underlying these companies. As a result, we believe these exploration companies have the potential to be involved in some sort of corporate activity based on our High, Medium and Low assessments of their projects shown in Table 3.

Figure 17. Exploration & Development Company EV (US\$) and Resource (Mt Cu) & EV/t R&R



Source: Company data, RFC Ambrian estimates.

Appendix 1 –Development Project Overviews

1. Pebble



The Pebble Project is located in south-west Alaska and is owned 100% by **Northern Dynasty** (NDM CN: C\$0.495 | US\$212m). This very large project has had a difficult history, with **Anglo American** withdrawing from it in 2013 after permitting problems. Anglo paid Northern Dynasty a US\$300m impairment charge as a result. **First Quantum** also took an option for a short period in 2018. The project has received fierce opposition from environmental campaigners and native communities, arguing that it poses a threat to commercial salmon fishing and the traditional way of life.

Northern Dynasty is now again advancing the large resource towards development. It contains some 37Mt copper and 106Moz of gold. An updated PEA was published in September 2021. An open pit mine is planned, producing 145kt/y copper and 360koz/y of gold, at a cash cost of US\$69/lb with a mine life of 20 years. Initial capex is forecast at US\$3.4bn and at a copper price of US\$3.50/lb, the project returned an NPV₇ of US\$2.3bn and an IRR of 16%.

The company initiated permitting at the end of 2017 with a smaller project than originally contemplated, reducing the project footprint and with no primary mine facilities in the important Upper Talarik Creek watershed. More than US\$150m has been spent on environmental and socioeconomic studies to support project design and permitting over the past ten years. A final EIS was filed in June 2020, but **the application was denied in November 2020** and an appeal is under adjudication.

The permitting risk remains high on this project, but the size and quality of the deposit means that it is likely to continue to attract interest but may only gain a partner once there is more certainty on the permitting. As a result, we believe there is a Low possibility of another party getting involved in the near term.

2. Tampakan

The Tampakan project is fully owned by Alcantara Group through **Sagittarius Mines** and is located in southern Mindanao in the Philippines. The project has suffered a series of delays since 2010 due to regulatory and political hurdles. The project was further shelved due to an open pit mining ban imposed in April 2017. The copper-gold project contains 15.2Mt of copper. Initial studies suggest a prospective open-pit mine producing 375kt/y of copper and 360koz/y of gold with a 17-year mine life and requiring some US\$5.2bn in capex.

Following the **change in mining law in the Philippines**, press reports suggest that the company and local government officials are re-evaluating the development of Tampakan. The possibility of this becoming a mine has increased significantly.

However, investors are likely to remain cautious until it becomes clear that Tampakan can actually proceed, because mining is a highly contentious issue in the Philippines. Consequently, we continue rank this project as having a Low possibility of another party getting involved at this time but developments in the Philippines should be watched closely.

3. Los Azules

The Los Azules project is 100%-owned by **McEwen Mining** (MUX CN: C\$1.30 | US\$481m) and is a porphyry copper deposit located in the San Juan Province of Argentina, near the border with Chile. McEwen Mining is Canadian-based and already operates four gold mines in Mexico, Argentina, the US and Canada, which are forecast to produce about 150koz of gold in 2021. The CEO Rob McEwen owns 18% of the company. In July 2021, McEwen Mining announced **the spin-out of McEwen Copper** containing the Los Azules and Elder Creek (Nevada) projects.



Figure 18. Development Projects Los Helados and Los Azules



Source: NGEx Minerals, McEwen Mining

Drilling conditions in the area are difficult, especially due to the presence of highly faulted zones and areas of loose surface scree and there are currently limited facilities or infrastructure located at the project. The new company expects to go public in 1H22 and is planning a **53,000m drill program**, a new road and airstrip to the site, and a **PFS which is now underway**. It will be funded from a C\$40m private placement with Rob McEwen in August 2021 which has given him an 18.6% share of McEwen Copper.

A PEA scoping study was completed on Los Azules in 2009 and was most recently updated in September 2017. The project contains 13.4Mt of copper and 5.5Moz gold. An open pit mine and concentrator plant that produces a copper concentrate is anticipated. Production of some 153kt/y at a total cost of US\$128/lb is anticipated over a 36-year life with an initial capital cost of US\$2.4bn. At a copper price of US\$3.00/lb, the project returned an NPV₈ of US\$2.2bn and an IRR of 20%.

The Los Azules project sits within an area with residual discontinuous permafrost at higher altitudes. No permafrost is detected below 3,850 meters. The company reports that it has a facility and mine layout specifically planned with reference to permafrost and water bearing geofoms and appears to comply with the Provincial & Federal Glacier Laws (see page 14).

This project likely needs third-party involvement for its development given the potential size of the orebody, the scale of the project, and capex requirement. The spinout will make it easier for a third party to become involved, but until there is more project information regarding the Glacier Laws some investors will be deterred. We believe there is a Medium possibility of a third party looking to acquire an interest in the project.

5. Los Helados

NGEx Minerals (NGEX CN: C\$1.37 | US\$173m) is Canadian-based and holds a 64% interest in the Los Helados project with **PanPacific Copper** holding 36%. NGEx Minerals is a Lundin Group explorer and developer (36% owned). NGEx Minerals also holds other early-stage exploration projects in Argentina. As at September 2021, the company had net debt of C\$0.6m, but completed a C\$25m placing in November 2021.

Pan Pacific Copper is the operator of the Caserones copper mine located about 12km from Los Helados and is one of the world's largest buyers of copper concentrates.

Los Helados is a porphyry copper project located in the Andes Mountains of the Atacama Region, Chile and sits on the border of Argentina. Los Helados contains 10.6Mt copper and 12.8Moz of gold. NGEx Minerals issued a standalone technical report on the resource in August 2019 and has previously



stated that it is working towards a PEA study, although no update has been given and limited further exploration has been undertaken. Management acquired the Valle Ancho copper-gold project in 2019 is looking for further additions to its exploration portfolio. Valle Ancho is currently the focus of exploration.

Progress on a PEA is no longer evident and exploration focus has shifted. We have downgraded our outlook for Los Helados and believe there is now a Medium possibility of a third party either looking to acquire or take a significant interest in the medium term.

7. Altar

Aldebaran Resources (ALDE CN: C\$0.65 | US\$60m) owns a majority interest in the Altar copper-gold project in Argentina. It has an option agreement to acquire up to a 60% working interest from **Sibanye-Stillwater** through a US\$30m combination of cash payments, share issuances and project expenditures over five years (US\$17m spent to date). Aldebaran has the right to earn an additional 20% interest in the Altar project by spending an additional US\$25m over a 3-year period following Aldebaran's acquisition of the initial 60% interest. Aldebaran's major shareholder, Route One Investment (46.3%) has invested US\$30m to meet Aldebaran's initial financing obligations. Sibanye-Stillwater holds 19.9% and management hold 5.8%.

Aldebaran was spun out of **Regulus Resources** in June 2018, and it also acquired the Rio Grande copper-gold project and other earlier-stage Argentine assets, including the drill-ready Aguas Calientes gold-silver project.

A revised Altar resource was announced in March 2021 containing 6.0Mt of copper and 3.8Moz of gold (at 0.3% Cu Eq cut off). The project is at the reserve development stage and has no studies completed on it yet. It hosts a large porphyry copper-gold system, with mineralisation defined in three distinct zones: Altar East, Altar Central, and Radio, about 3km to the west of Altar Central. A drill program is ongoing to extend high-grade zones and test new targets. **An updated resource is expected 4Q22.**

The company has not specified if Altar is impacted by the Glacier Law (see page 14), however, Alderbaran has commissioned an environmental monitoring and baseline study at the Altar project that will primarily focus on characterisation of surface water resources and any potential glacial related features.

We would expect this project to be on acquirers' radar screens, but it likely needs further work and de-risking technically and environmentally before a third party gets involved. We believe there is a Medium possibility of a third party either looking to acquire the project outright or taking a significant interest in the medium term.

9. Josemaría

Josemaria Resources (JOSE CN: C\$1.32 | US\$378m) is Canadian-based and holds a 100% interest in the Josemaría copper-gold deposit in Argentina. Josemaria Resources is a Lundin Group explorer and developer (39%). As at June 2021 the company had net cash and investments of C\$16.3m, having raised C\$52.0m in April 2021.

Josemaria contains 4.7Mt of copper and a feasibility study was completed in October 2020. It indicated an open-pit mine with a low strip ratio (1.0x) which is expected to produce an average of 131kt/y of copper, 224koz/y of gold, and 1.05Moz/y of silver at a total cash cost of US\$155/lb over the 19-year mine life with initial capex of US\$3.09bn. At a copper price of US\$3.00/lb the project returned an after-tax NPV₈ of US\$1.5bn and an IRR of 15%. An environmental and social impact assessment was submitted in February 2021 and the company is progressing engineering studies.

One potential issue for Josemaria is Argentina's National Glacier Law (see page 14). The National Glacier Inventory did not identify any glaciers that would be affected by the project, but within the project footprint a permafrost-influenced geoform was identified and the location of infrastructure (including the waste dumps) was designed to avoid impacting this geoform. A buffer around the geoform of 200m has been implemented to minimise any potential impact. The feasibility study



states that this is not expected to result in any issues or delays to the permitting process.

The company business model is to add value to the project and then 'monetise' it. With the feasibility study complete, we would expect Josemaria to look for possible acquirers, although environmental risks remain. We believe there is a Medium possibility of a third party either looking to acquire the project outright or taking a significant interest.

10. Cañariaco Norte

Candente Copper (DNT CN: C\$0.18 | US\$39m) is a Canadian-listed exploration company. Candente is developing the 100%-owned Cañariaco Norte porphyry copper-gold deposit located in Northern Peru. The project contains 4.0Mt of copper and 2.0Moz of gold. In August 2021, **Fortescue Metals took a 19.9% interest** in Candente for C\$1.1m to advance the Cañariaco Project. Management hold 8.0%.

A PFS was completed in January 2011 that concluded that the project could produce an average of 119kt/y of copper, along with gold and silver, at a total cost of US\$104/lb over a mine life of 22 years. Pre-production capex was estimated at US\$1.4bn. At a copper price of US\$3.00/lb, the project had an NPV₈ of US\$1.1bn and an IRR of 19%.

An updated PEA with a new development strategy is anticipated in 4Q21.

Two further mineralised copper porphyry deposits, Cañariaco Sur and Quebrada Verde, have been discovered adjacent to the Cañariaco Norte deposit, but further drilling is required to delineate the size and grade of the deposits.

However, since June 2013, limited activity has taken place on this project. Since 2018 the company has reported working on applications for new drilling permits, but limited progress has since been noted, although reportedly the funds from Fortescue will allow Candente to further advance permitting for drilling.

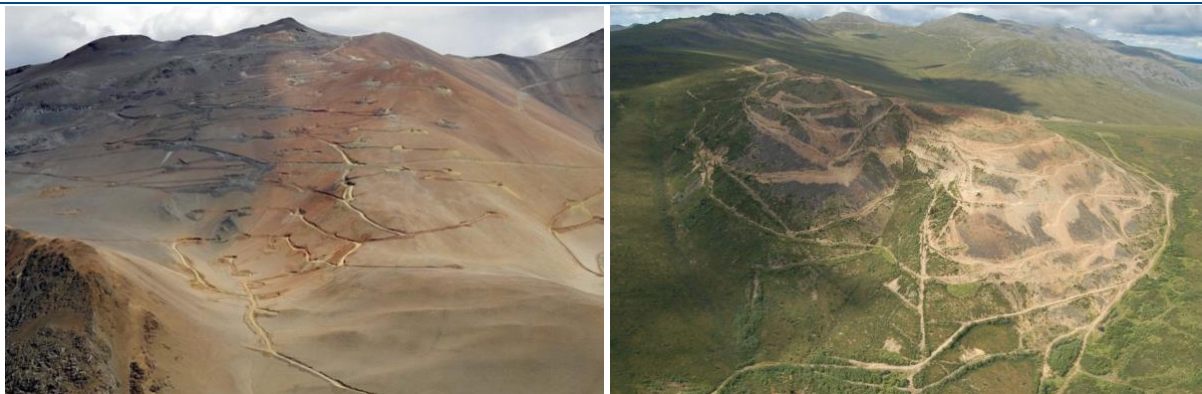
This project is still at an early stage but could develop into a larger project that might be of interest to Tier 1 or Tier 2 copper producers if progress can be resumed. Fortescue has shown interest and, we think there is a Medium possibility of a third party either looking to acquire the project outright or taking a significant interest in the medium term.

11. Yandera

In August 2021, **Freeport Resources** (FRI CN: C\$0.12 | US\$7m) acquired the private company **Era Resources** which owns 100% of the Yandera copper project. The project is located 95km south-west of the northern seaport of Madang in PNG. Era Resources delisted from the TSXV in June 2017, having been taken private by Sentient Global Resources, a PE fund.



Figure 19. Development Projects Josemaria and Casino



Source: Josemaria Resources, Western Copper and Gold

The Yandera project is currently in the advanced exploration stage of development. It is an igneous-intrusive-hosted, structurally controlled copper porphyry system with ancillary molybdenum and gold comprised of a series of adjacent vertically oriented deposits along recognised structural trends.

Era Resources released an updated NI 43-101 compliant resource estimate in December 2016, following a 43-hole diamond drill campaign. The deposit contains 3.1Mt of copper and 1.9Moz gold.

There have been no updates on the project since being taken private, but we wait to see how Freeport plans to take this project forward. This project is still at an early stage and, given the limited transparency, we rank this project as having a Low possibility of another party getting involved at this time.

12. La Verde

Solaris Resources (SLS CN: C\$13.16 | US\$1,152m) was formed in August 2018 as a spin-out of **Equinox Gold**'s copper assets. Equinox Gold now holds 16% of the shares, Richard Warke 33%, and Lundin 5%. Solaris is now a multi-asset exploration company focused on copper projects in the Americas. Its main project is the La Verde copper-gold porphyry in Mexico where it holds a 60% interest and **Teck** holds the remaining 40%. The deposit contains 2.9Mt of contained copper as well as molybdenum and gold. It also owns the Warintza copper project in Ecuador where significant resource drilling is taking place with encouraging results and is currently the company's focus. As at September 2021, Solaris had cash of C\$46.7m.

La Verde is accessible year-round by paved roads and is strategically located next to key infrastructure with easy access to water, power and rail. A PEA was completed in September 2012 which was based on an open pit operation producing about 92kt/y of copper and associated by-products at a total cost of US\$158/lb over a mine life of 20 years with initial capex of US\$1.2bn. At a copper price of US\$3.00/lb, the project had an NPV₈ of US\$300m and an IRR of 14%. The open pit strip

ratio is high at 2.3x and arsenic grades are high. There is currently limited activity on this project.

This project is still relatively small and at an early stage but could develop into a larger project that might be of interest to a copper producer, although returns are currently relatively low. At present, we think further exploration drilling is required before a third party was likely to take a significant active interest.

14. King-king

St Augustine Gold & Copper (SAU CN: C\$0.085 | US\$55m) is a Hong Kong-based company, listed on the TSX, and is focused on the development of the King-king project, on the island Mindanao, which is located near Davao City in the Philippines. As at June 2021, the company had net cash and equivalents of US\$0.2m. In March 2021, the company converted C\$3.2m of debt into 70.2m shares, which increased **Queensberry Mining's** interest to about 36%.

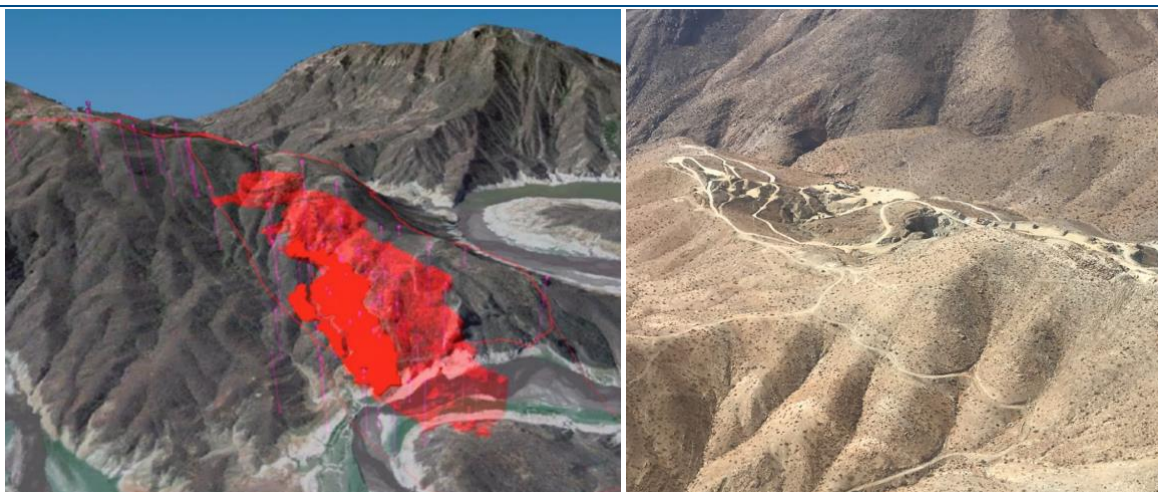
The King-king deposit is a porphyry copper-gold deposit containing 3.2Mt of copper and 5.4Moz of gold. A PFS was amended in August 2014, and assured St Augustine's 50% economic interest in the project. The PFS proposed an open-pit mine producing a copper-gold-silver concentrate, copper cathode, and gold doré bullion. On average, the mine was expected to produce 61kt/y of copper at a total cost of US\$40/lb with initial capex of US\$2.0bn over a mine life of 23 years. The project had an NPV₈ of US\$1.8bn and an IRR of 24%.

In 2017 the Philippine government announced a ban on open-pit mining for copper, gold, silver and complex ores in the country, so the focus of activities subsequently has mainly been on care and maintenance. However, in April 2021, **the government lifted a nine-year moratorium** on issuing licenses for new mining operations and the government-imposed ban on open-pit mining is also expected to be lifted.

This project is relatively small but might interest a Tier 2 or 3 copper producer and is likely to see reinvestment once the open-pit mining ban in



Figure 20. Development Projects Santo Tomás and Costa Fuego



Source: Oroc Resource Corp. †, Hot Chili

the Philippines is removed. However, we rank this project as having a Low possibility of another party getting involved at this time.

15. NorthMet

PolyMet Mining (POM CN: C\$3.80 | US\$309m) is focused on the Duluth Complex in Minnesota and is listed in Toronto and the NYSE. The 100%-owned NorthMet project features three assets: the deposit itself, the former LTV Steel processing facilities which will be rehabilitated for this project, and the infrastructure. NorthMet is a large disseminated sulphide deposit and is rich with copper, nickel, cobalt, platinum, palladium, gold and silver.

PolyMet Mining filed an updated DFS in March 2018. The deposit would be mined by open pit and development includes the rehabilitation of an existing taconite processing plant, tailings storage facility and infrastructure. The mine is expected to produce about 25kt/y of payable copper and associated by-products at a total cost of US\$106/lb including by-products over a 20-year life with an initial capital cost of US\$945m. At a copper price of US\$3.22/lb, the project had an NPV₇ of US\$271m and an IRR of 10%.

PolyMet Mining has received key permits necessary to construct and operate the NorthMet project. However, **legal challenges** contesting various aspects of the permitting decisions are ongoing and have led to court rulings that **have delayed the**

project timeline. Those legal challenges that have reached a final determination have been in favour of the company.

In June 2019, a US\$265m rights offering, fully backstopped by **Glencore**, was completed with the proceeds used to fully repay outstanding debt and strengthen the company's financial position. As a result of the rights offering, Glencore ownership of the company's issued shares increased to 71.4%. The company has cash of US\$7.5m as of September 2021. A US\$10.0m convertible debenture was issued to Glencore in July 2021.

This project is well advanced and looks set to proceed to construction, subject to finance and legal challenges, and looks to be well supported by Glencore. However, the size and returns of this project possibly look too small for Glencore but could be attractive to a smaller primary copper producer although place a Low chance of third party taking an interest at this stage.

16. Los Calatos

Los Calatos is a copper-molybdenum project in Southern Peru containing 2.7Mt of contained copper. The project is owned by **CD Capital Asset Management** which is a global natural resources and mining fund focused on Latin America. The outstanding interest of the project was purchased from **Metminco** in June 2017 after an initial investment from CD Capital in 2016.



This transaction was reported as having secured funding of up to US\$45m to advance the project toward completion of a pre-feasibility study and a bankable feasibility study. However, no details have been reported on the progress at this project.

This project is still relatively small and at an early stage and with no visibility on current activities it is difficult to assess the outlook for this asset. We rank this project as having a Low possibility of another party getting involved at this time.

18. Beutong


 **Asiamet Resources** (ARS LN: £0.024 | US\$63m) is listed on the AIM market of the London Stock Exchange. **Delta Dunia Makmur** (DOID), a large mining services company in Indonesia, holds 15.4% of the shares. The company is focused on the development of a portfolio of large copper, copper-gold, and polymetallic deposits in Indonesia.

It holds 80% of the Beutong copper project located in Sumatra which is very well located with respect to existing infrastructure. Asiamet published a resource containing 2.4Mt copper and 2.1Moz gold in March 2019. **A drill program to test the high-grade deposit core at depth was planned 2H21.**

Asiamet's flagship project is the BKM copper project in Kalimantan where a feasibility study was completed in June 2019 for an initial 9-year mine life producing up to 25kt/y of copper cathode. A Work program is in progress to advance BKM project to construction ready status. In November 2021, DOID agreed to contribute an effective US\$50m for the development of BKM to earn an effective 51% interest in the project.

This project is still relatively small and at an early stage and no longer the focus of Asiamet. We rank this project as having a Low possibility of another party getting involved at this time.

19. White Pine

 **Highland Copper** (HI CN: C\$0.12 | US\$68m) is a Canadian copper development company that owns the Copperwood and White Pine copper projects located in the Michigan, US. In August 2021,


Highland raised C\$26m in a private placement. **Orion Mine Finance** is the largest shareholder owning 30%, and **Greenstone Resources** holds 17% of the company.

Highland's flagship project is the 100%-owned Copperwood for which Highland has completed a feasibility study with resources of 1.35Mt of copper and 3.1Moz of silver of high-grade ore to be mined underground producing 28kt/y copper. The project is fully permitted and Highland is targeting to complete an updated feasibility study by April 2022 with the aim to commence construction shortly afterwards.

Highland announced the acquisition of White Pine from **First Quantum Minerals** in 2013 but only completed acquisition in July 2021. The project is an extension of the historical White Pine mine which operated from 1953 to 1995 and produced over 4,500 Mlbs of copper. Highland carried out two phases of drilling at the White Pine in 2014 and 2015. The company completed a PEA in November 2019 for an underground mine producing 40kt/y copper at a cash cost of US\$140/lb over 25 years. The resource is estimated to contain 2.4Mt of copper and 91Moz of silver. Initial capex is forecast at US\$457m and, at a copper price of US\$3.00/lb, the project had an NPV₈ of US\$416, with a 17% IRR. Plans to **initiate baseline environmental studies started in 2H21.**

This project is still relatively small and at the moment is not the main focus of Highland. We rank this project as having a Low possibility of another party getting involved at this time.

20. Haib

 **Deep-South Resources** (DSM CN: C\$0.07 | US\$8m) is a Canadian-listed exploration company focus on the development of its 100% owned Haib project in Namibia. **Teck Resources** holds a 16% interest and management holds 12%.

An updated PEA on Haib was completed in December 2020. Run-of-mine mineral bio-heap leaching was determined to be the most viable process route for the Haib mineral over a 24-year mine life. The project contains 2.4Mt of copper and

the open pit mine is forecast to produce 35kt/y of copper at a cash cost of US\$134/lb. Initial capex is forecast at US\$341m and, at a copper price of US\$3.00/lb, the project had an NPV_{7.5} of US\$957, with a 30% IRR.

In June 2021, Deep-South received notice from the Namibian Ministry informing the company that its application for the renewal of its Exclusive Prospecting Licence (EPL) had been denied citing the company's inability to advance the EPL to Pre-Feasibility and complete the proposed drilling program as planned. The company maintains that the Ministry was kept well apprised, with no objection on their part, of a proposed change from the Pre-Feasibility study to an upgraded PEA and commencement of a full feasibility study. The latter was already started.

Moreover, the company states that the Ministry issued all permits required for the drill program and was aware that Deep-South had completed the drill program. As a result of the Minister's refusal to renew the Licence, the company has terminated all work on site and has proceeded with the retrenchment of its employees on site.

This project is still relatively small and Deep-South is embroiled in a dispute with the government over the status of its prospecting licence. We rank this project as having a Low possibility of another party getting involved at this time.

21. Cotabambas

Panoro Minerals (PML CN: C\$0.17 | US\$36m) is a Canadian exploration company focused on its Cotabambas copper project in southern Peru which holds 2.4Mt of copper. **Hudbay Minerals** holds 11.7% in Panoro and management holds 7.6%.



An updated PEA was completed in September 2015 on Cotabambas which indicated an open-pit mine expected to produce an average of 71kt/y of copper, 95koz/y of gold, and 1.02Moz/y of silver at a total cash cost of US\$122/lb over the 19-year mine life with initial capex of US\$1.49bn. At a copper price of US\$3.00/lb the project returned an after-tax NPV_{7.5} of US\$683m and an IRR of 17%.

The Cotabambas project is comprised of two clusters of mineralised porphyry areas and so far the exploration drilling has been concentrated in only one cluster and the potential in skarn zones has yet to be fully explored. Future exploration plans are being developed for additional drilling, but little exploration activity has occurred in 2021.

Also in Peru, Panoro owns the Antilla copper project, where a PEA was completed in December 2018 producing an average of 44kt/y copper over a 17-year life. In October 2021, Panoro announced the sale of the Antilla project to **Heeney Capital** in consideration for advanced payments of up to 13% of the project, the first being C\$10m upon closing of the transaction. Panoro also owns the Humamantata project where it is currently conducting an exploration program.

Figure 21. Development Projects Altar and Cascabel



Source: Alderbaran, SolGold.

Panoro has an agreement with **Wheaton Precious Metals International** (WPMI) whereby WPMI will pay Panoro upfront cash payments totalling US\$140m for 25% of the payable gold production and 100% of the payable silver production from Cotabambas. Panoro is entitled to receive US\$14m spread over a period of up to 9 years as an early deposit with payments to be used to fund corporate expenses. The total advanced to date is US\$11.5m.

This project is still relatively small although appears to have potential for exploration upside. We rank Cotabambas as having a Medium possibility of another party getting involved in the longer term.

22. AntaKori



Regulus Resources (REG CN: C\$1.05 | US\$86m) is a Canadian exploration company focusing on the AntaKori copper project in Northern Peru. Regulus was created from a spin-out following the sale of **Antares** to **First Quantum Minerals** in 2010. Regulus spun out its Rio Grande project, Aguas Calientes project, and its other Argentinian assets forming a new exploration company, **Aldebaran Resources** (see page 30) in October 2018. **Route One Investment Corp.** holds 24.1% and management holds 13.1% of the company. As at the end of June 2021 the company had cash of C\$11.0m, after receiving C\$16m from a royalty agreement with **Osisko Royalties**.

Antakori is located in the mountains of the Western Cordillera at an altitude of 3,725–4,000m above mean sea level. Skarns and second porphyry processes are responsible for most of the AntaKori mineralisation. The project sits adjacent to the operating Tantahuatay mine owned by **Buenaventura** and various arrangements exist between the two companies to mine some of the adjacent oxide and sulphide resources.

In 2018 Regulus completed a 23,000m drill program at AntaKori resulting in a new resource estimate in March 2019. The project contains 2.3Mt copper and 4.5Moz of gold. A second drill campaign of 25,000m took place in 2019 and 2020 to determine the full size of the mineralisation. The initial drill results successfully extended the mineralised footprint of

the AntaKori system well beyond the current limits of the 2019 resource model. However, due to unrelated environmental issues and Covid-19 the drilling program has been delayed and in March 2021 suspended due to the political uncertainty in Peru along with a strong surge in Covid-19 cases.

This project could be of interest to acquirers in the medium term with potential to expand the resource once the drill program is complete. It is at an early stage, but we believe there is a Medium possibility of a third party either looking to acquire the project outright or taking a significant interest, particularly with Buenaventura on its doorstep.

23. Mocoa

Libero Copper & Gold (LBC CN: C\$0.41 | US\$15m) is a Canadian exploration company that holds a collection of porphyry copper deposits. The portfolio includes and Mocoa project a porphyry copper-molybdenum deposit located in Putumayo, Colombia acquired in 2018. It also holds Big Bulk, porphyry copper-gold target and Big Red, a new greenfield discovery, both in British Columbia, Canada; and Esperanza, copper-gold in San Juan, Argentina. **B2Gold** holds a 5% interest in Libero and management holds 10% of the company.

Mocoa contains 2.1Moz of copper and 0.23Mt of molybdenum. Drilling has indicated that the deposit is roughly cylindrical, with a 600m diameter and thicknesses that range from 250-350m. High-grade copper-molybdenum mineralisation continues to depths in excess of 1,000m. Additional porphyry surface targets have been identified in the region.

Libero has been focusing on community engagement and drill permitting at Mocoa, but **exploration activities started in October 2021**. The last exploration and drilling activities were conducted by B2Gold in 2012. A C\$5m placement was announced in November 2021, and the funds will be used for exploration and drilling of Mocoa.

This still an early-stage project and we believe there is a Low possibility of a third party either looking to acquire the project outright or taking a significant interest at this stage.



Appendix 2 – Copper Projects

Table 6. Top 65 Late-stage Copper Projects with Resources >2.0Mt Cu Ranked by Resource Size

Project	Country	Owner/Operating		Project Status	Project Stage	Deposit type	Resource Cu Mt	Grade %Cu
		Company						
1	Pebble	USA	Northern Dynasty	Active	Pre-feas/Scoping	Porphyry	36.96	0.339
2	Resolution	USA	Rio Tinto	Active	Pre-production	Porphyry	27.27	1.526
3	Reko Diq	Pakistan	Antofagasta	Litigat'n	Feasibility	Porphyry	24.35	0.415
4	La Granja	Peru	Rio Tinto	Active	Pre-feas/Scoping	Porphyry	22.06	0.511
5	Junin	Ecuador	Enami	Active	Reserve Devel.	Porphyry	16.92	0.440
6	Nueva Union	Chile	Teck Resources	Active	Feasibility Started	Porphyry	16.63	0.372
7	Onto	Indonesia	Vale/STM	Active	Pre-feas/Scoping	Intrusion	15.52	0.897
8	Tampakan	Philippines	Sagittarius Mines	Active	Feasibility	Porphyry	15.17	0.516
9	El Pachon	Argentina	Glencore	Active	Feasibility	Porphyry	15.03	0.481
10	Los Azules	Argentina	McEwen Mining	Active	Pre-feas/Scoping	Porphyry	13.42	0.370
11	Frieda River	PNG	Pan Aust	Active	Feasibility Compl.	Porphyry	12.61	0.465
12	Mesaba	USA	Teck	Active	Pre-feas/Scoping	Intrusion	11.90	0.392
13	Taca Taca	Argentina	First Quantum	Active	Feasibility	Porphyry	11.70	0.400
14	Maturi	USA	Antofagasta	Active	Pre-feas/Scoping	Intrusion	11.65	0.529
15	Cascabel	Ecuador	SolGold	Active	Pre-feas/Scoping	Porphyry	11.16	0.348
16	El Arco	Mexico	Southern Copper	Active	Feasibility Compl.	Porphyry	10.85	0.407
17	Los Helados	Chile	NGEx Resources	Active	Pre-feas/Scoping	Porphyry	10.62	0.363
18	Los Volcanes	Chile	Antofagasta	Active	Reserve Devel.	Porphyry	9.90	0.497
19	Lookout Hill	Mongolia	Rio Tinto	Active	Constr. Planned	Porphyry	9.69	0.559
20	West Wall	Chile	Glencore	Active	Reserve Devel.	Porphyry	8.89	0.460
21	Wafi-Golpu	PNG	Newcrest Mining	Active	Feasibility Compl.	Porphyry	8.66	0.853
22	Namosi	Fiji	Newcrest Mining	Active	Pre-feas/Scoping	Porphyry	8.03	0.354
23	Vizcachitas	Chile	Los Andes Copper	Active	Pre-feas/Scoping	Porphyry	7.74	0.374
24	Los Bronces	Chile	Anglo American	Active	Reserve Devel.	Porphyry	7.29	0.810
25	Michiquillay	Peru	Southern Copper	Active	Feasibility	Porphyry	7.25	0.630
26	Rio Blanco	Peru	Zijin Mining	Litigat'n	Feasibility	Porphyry	7.11	0.565
27	Mason	USA	Hudbay Minerals	Active	Pre-feas/Scoping	Porphyry	7.00	0.285
28	Haqira	Peru	First Quantum	Active	Pre-feas/Scoping	Porphyry	6.32	0.456
29	Kisanfu	DRC	China Molybdenum	Active	Reserve Devel.	-	6.28	1.720
30	Altar	Argentina	Aldebaran Res.	Active	Reserve Devel.	Epitherm.	5.96	0.423
31	Galore Creek	Canada	Newmont/Teck	On Hold	Pre-feas/Scoping	Porphyry	5.72	0.440
32	Polo Sur	Chile	Antofagasta	Active	Reserve Devel.	Porphyry	5.41	0.326
33	La Americana	Chile	Codelco	Active	Reserve Devel.	Porphyry	5.36	0.700
34	Casino	Canada	Western Copper	Active	Constr. planned	Porphyry	4.89	0.127
35	Josemaria	Argentina	Josemaria Res.	Active	Feasibility Compl.	Porphyry	4.69	0.246
36	Deziwa	DRC	China Nonferrous	Active	Feasibility	Porphyry	4.60	1.441

Table 6. Top 65 Late-stage Copper Projects with Resources >2.0Mt Cu Ranked by Resource Size

Project	Country	Owner/Operating		Project Status	Project Stage	Deposit type	Resource Cu Mt	Grade %Cu
		Company						
37	Quebradona	Colombia	AngloGold Ashan.	Active	Feasibility	Porphyry	4.40	0.729
38	Galeno	Peru	China Minmetals	Active	Feasibility	Porphyry	4.30	0.444
39	Rosemont	USA	Hudbay Minerals	Active	Feasibility Compl.	Porphyry	4.16	0.366
40	Schaft Creek	Canada	Teck Resources	Active	Pre-feas/Scoping	Porphyry	4.08	0.242
41	Canariaco N.	Peru	Candente Copper	Active	Feasibility Started	Porphyry	4.03	0.443
42	Los Chancas	Peru	Southern Copper	Active	Feasibility	Porphyry	3.86	0.532
43	Tintaya	Peru	Glencore	Active	Reserve Devel.	Porphyry	3.83	0.672
44	Koksay	Kazakhstan	KAZ Minerals	Active	Feasibility Started	Porphyry	3.79	0.428
45	Yellowhead	Canada	Taseko Mines	Active	Pre-feas/Scoping	VMS	3.61	0.258
46	Upper Kobuk	US	Trilogy Metals	Active	Feasibility	VMS	3.57	1.925
47	Baihe	Peru	Zijin Mining	Active	Reserve Devel.	Porphyry	3.15	0.630
48	Trapiche	Peru	CdM Buenavent.	Active	Pre-feas/Scoping	Porphyry	3.12	0.369
49	Yandera	PNG	Freeport Res.	Active	Pre-feas/Scoping	Porphyry	3.08	0.321
50	La Verde	Mexico	Solaris Resources	On Hold	Pre-feas/Scoping	Porphyry	2.91	0.390
51	Costa Fuego	Chile	Hot Chili	Active	Pre-feas/Scoping	IOCG Brec	2.88	0.399
52	Kingking	Philippines	St Augustine Gold	Active	Feasibility Started	Porphyry	2.88	0.244
53	NorthMet	US	PolyMet Mining	Active	Constr. planned	Intrusion	2.81	0.247
54	Silangan	Philippines	Philex Mining	Active	Feasibility Compl.	Porphyry	2.77	0.513
55	Los Calatos	Peru	CD Capital NR	Active	Pre-feas/Scoping	Porphyry	2.68	0.760
56	Santo Tomas	Mexico	Oroco Resource	Active	Reserve Devel.	Porphyry	2.65	0.323
57	Tia Maria	Peru	Southern Copper	On Hold	Constr. Planned	Porphyry	2.62	0.354
58	Beutong	Indonesia	Asiamet Res.	Active	Pre-feas/Scoping	Epi/Porph	2.43	0.478
59	White Pine	USA	Highland Copper	Active	Pre-feas/Scoping	Intrusion	2.43	1.053
60	Haib	Namibia	Deep-South Res.	Active	Pre-feas/Scoping	Porphyry	2.41	0.301
61	Bahuerachi	Mexico	Jinchuan Group	Active	Pre-feas/Scoping	Porphyry	2.40	0.397
62	Cotabambas	Peru	Panoro Minerals	Active	Pre-feas/Scoping	Porphyry	2.38	0.329
63	Antakori	Peru	Regulus Res.	Active	Reserve Devel.	Epi/Porph	2.29	0.444
64	Laver	Sweden	Boliden	Active	Reserve Devel.	Porphyry	2.29	0.215
65	Mocoa	Columbia	Liberio Copper	Active	Reserve Devel.	Porphyry	2.10	0.330

Source: S&P Global Market Intelligence, company data.

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