



Copper Projects Review 2020

Copper M&A Update Report

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All prices in the document are as of 21st January 2020

Front picture: Santo Tomás

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Executive Summary

Following the hugely positive feedback we received from our copper report entitled ‘Copper M&A – The Cupboard is Nearly Bare’, published in November 2018, we have reviewed copper M&A activity in 2019 and updated the exploration projects section of the report.

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 through 2019 was low.

Figure 1: 19 Copper Projects with Potential for Third-party Involvement



Source: RFC Ambrian

Some 14 months later we have reviewed the copper projects database within slightly revised parameters and find that there are now 64 development and exploration projects with resources of more than 2.5Mt contained copper and we believe that only 19 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, Los Helados, Viscachitas, Casino, and Santo Tomás.

This has been based on our assessment of a number of factors, including economics, permitting, location and geography, resource quality, the structure of existing shareholders, and other project issues. This report also examines some of these factors in more detail.

1.0 Introduction

In November 2018 we published an in-depth research report on M&A in the copper mining industry. We examined the past, present and future of M&A activity in the sector looking at the top 30 largest primary copper producing companies as well as projects under development and exploration and those companies involved. In this report we have reviewed copper M&A in 2019 and updated the exploration projects section of the report.

The conclusion of our first report was that there were a limited number of M&A opportunities for copper companies at that time. Our latest review suggests that this has not changed significantly, and this lack of opportunity continues to raise the stakes for those assets that are available.

Previous Copper M&A Report

Our previous report highlighted that the copper mining companies were generally in a better financial shape than they had been for some time and that some will have to undertake M&A in the near to medium term in order to refresh their development and exploration pipelines. This gave some optimism for a rise in M&A activity. However, we also showed that the opportunities for M&A were limited because:

- many copper companies that are potential takeover targets have difficult shareholding structures
- the number of quality asset disposals from existing copper producers is likely to be a lot lower than in the past, and
- there are a limited number of late-stage development copper projects with resources of >3.0Mt contained copper that are likely candidates to be acquired.

This situation has not significantly changed through 2019, and the amount of copper M&A activity in the market has been low, and the market for the raising of finance for juniors has been difficult. In 2019 there were just 20 deals valued at US\$3.89bn (>US\$10m in value), compared with 28 in 2018 valued at US\$11.56bn.

This is partly a function of the factors highlighted above as well as the relatively lacklustre copper price which has hit sentiment towards the sector and held back investment. This lack of investment is only likely to cause supply issues in the longer term.

At the same time, the demand outlook remains positive. In the short term it is reported that copper demand in China has recently been particularly restrained following lower investment in the electrical grid system, property, and transportation sector and it is suggested that this could change in 2020.

In the medium to longer term, copper demand is expected to rise significantly with increased demand for electric vehicles (EVs). Copper is a major component in EVs used in electric motors, batteries, inverters, wiring and in charging stations.

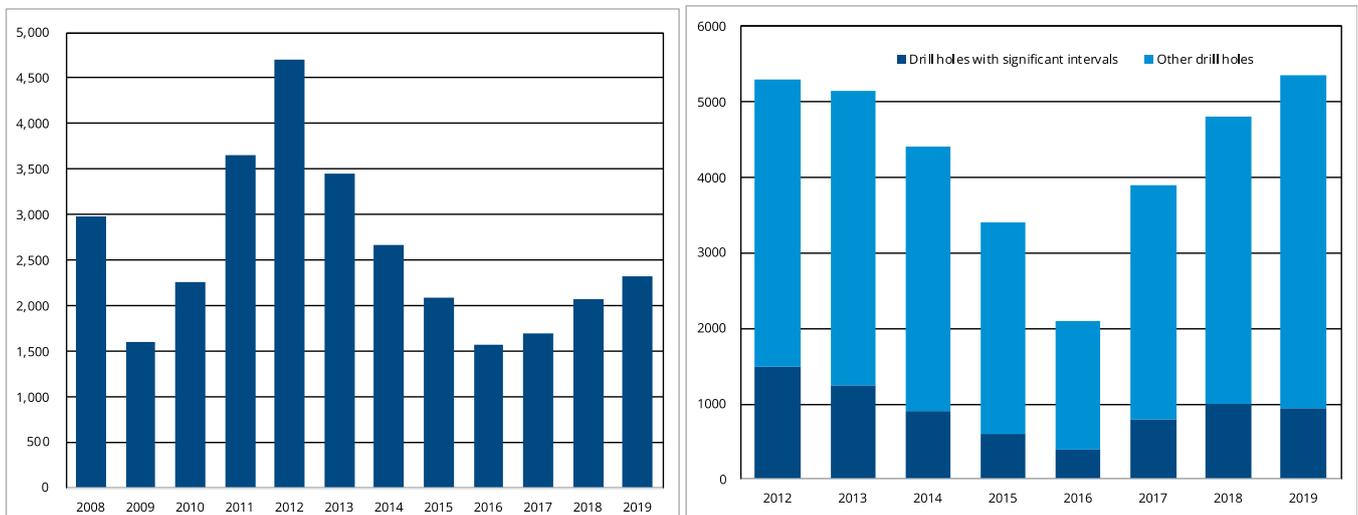
Supply Challenges

This research report focuses on the availability of greenfield copper exploration and development projects which could be the subject of M&A. It is not a comprehensive supply side analysis; however, it is interesting and relevant that **Wood Mackenzie** recently highlighted that new projects need to fill a 4Mt demand gap by 2028. Furthermore, they note that there are few 'probable' projects and moreover only five have a capacity of over 100kt/y and are not exempt from challenges.

Wood Mackenzie states that even developing all 'probable' projects would not be sufficient to close the gap. Nonetheless, there are plenty 'possible' projects, but 'incentives' need to improve to encourage producers to develop them. In the short term (2019-2021) Wood Mackenzie forecasts world copper demand growth of 1.8% and world copper supply growth of 1.6%.

Rio Tinto recently noted that small projects (less than 100kt/y copper production) accounted for about 40% of new capacity added in the last decade. It appears that this proportion needs to rise further. **Anglo American** recently highlighted that there are limited new copper supply options and the industry faces headwinds with capital intensity and capital constraints, environmental issues and water scarcity, permitting issues and increased technical challenges.

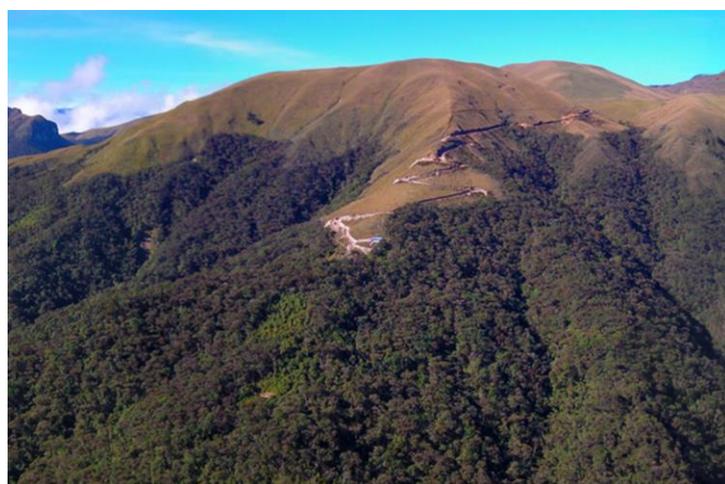
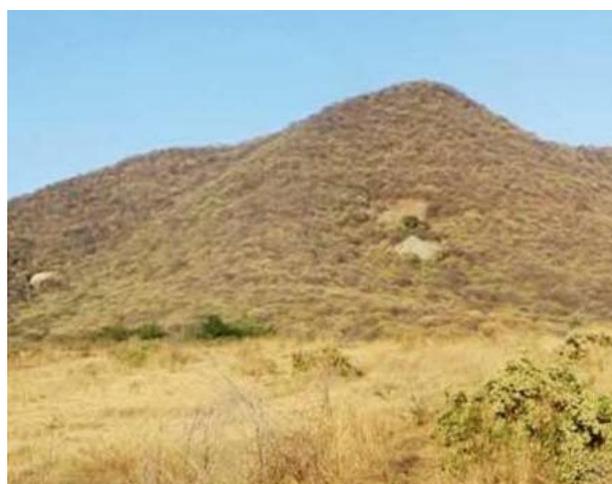
Figure 2: Global Exploration Expenditure for Copper and Drill Hole Analysis



Source: S&P Global Market Intelligence, RFC Ambrian

The latest global copper exploration spend data from S&P Global Market Intelligence shows expenditure has continued to rise in 2019. However, despite the increase, a closer look at the results shows that the number of drill holes with significant results has actually declined slightly.

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.

Figure 3: Development Projects Cañariaco Norte and La Verde

Cañariaco Norte

La Verde

Source: Candente Copper, Solaris Resources

Source and Application of Data

We have sourced our data from S&P Global Market Intelligence and appended it with additional company data and some RFC Ambrian estimates. When analysing the copper development and exploration projects, for the companies we have focused on attributable mined copper production, reserves and resources.

In our previous report we divided the top 30 largest primary copper producers 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; however, copper normally comes with associated products, such as gold and zinc.

We previously selected the 3.0Mt cut-off as a resource size 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 this report we have 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.

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

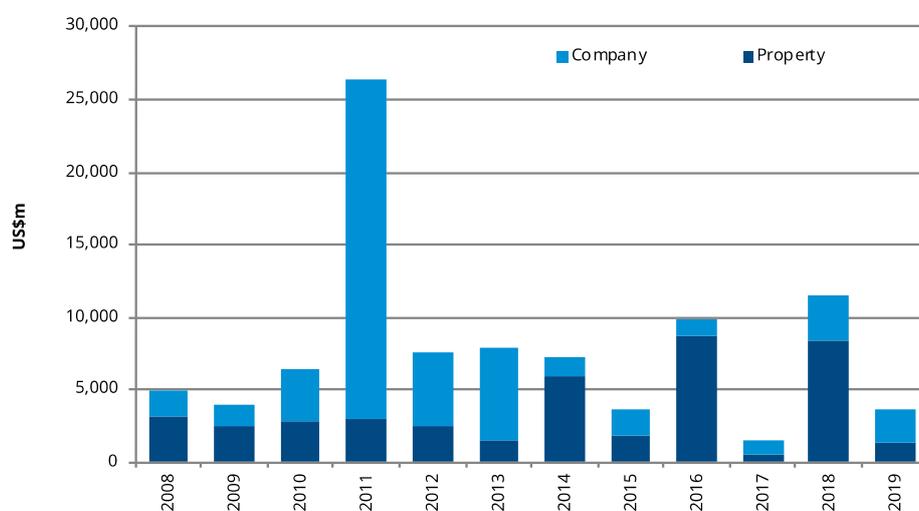
In trying to identify projects that have the potential to involve a third party (ie M&A activity) we have only looked at projects operated by a junior company or non-copper focused company and excluded those projects already owned by multi-commodity copper producers, an existing primary copper producer,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

2.0 Copper M&A deals in 2019

Copper M&A deals

Looking at the M&A deals announced in 2019, there were just 20 deals valued at US\$3.89bn (>US\$10m in value), compared with 28 in 2018 valued at US\$11.56bn. Of those 20 deals ten were company deals (US\$2.3bn) and ten were property deals (US\$1.6bn). This is a sharp fall in property deals compared with 2018.

Figure 4: Value of Copper M&A Deals 2008-2019



Source: SNL, company data, RFC Ambrian

Company Deals

The largest copper company deal completed in 2019 was the acquisition of **Nevsun Resources** for US\$1.4bn by **Zijin Mining**. This takeover was in progress at the time of our last report and included Nevsun's interest in the Timok copper project which consists of the Cukaru Peki Upper Zone and Lower Zone, which combined contain 15.4Mt copper. Nevsun owned 100% of the Upper Zone and 46% of the Lower Zone, a joint venture with **Freeport-McMoRan**.

In November 2019, **Zijin Mining** announced the proposed acquisition of the outstanding interest of the Lower Zone held by **Freeport-McMoRan** for up to US\$390m. As a result, Zijin Mining will own 100% interests in the resources of both the Upper Zone and the Lower Zone of the Timok project.

In September 2019, **China Molybdenum** completed the acquisition of the outstanding 24% stake of Tenke Fungurume copper mine in DRC for US\$1.1bn. This stake was purchased from **BHR Newwood** (a Chinese-based investment company), which had purchased the stake from **Lundin Mining** in November 2016 for a similar value.

In October 2019, **Jianxi Copper** increased its interest in **First Quantum Minerals** to 10.8% through associate **Pangea Investment Management (PIM)**. PIM also has a

forward contract with the option to acquire a further 5.8%. These deals continue the trend we highlighted in our previous report of Chinese companies increasing their ownership of Western copper companies and assets.

Hudbay Minerals also completed the acquisition of the outstanding 86% interest in **Mason Resources** for US\$15.8m to acquire the Ann Mason copper project which contains 6.5Mt of copper. This deal was announced as we were finalising our last report and we had thought at the time that there was a high possibility of a third party either looking to acquire the project outright or taking a significant interest.

From our original list of 21 potential takeout targets, apart from Nevsun Resources and Mason Resources, we saw **Taseko Mines** purchase **Yellowhead Mining** for US\$11.5m. Yellowhead owned the Harper Creek copper-gold-silver development project in British Columbia which contained 3.6Mt of copper.

In December 2018, we also saw **Newcrest Mining** increase its interest in **Solgold** by 1.5% for US\$14.1m and currently holds 14.6% of the company. Then in November 2019, **BHP** became the largest shareholder with 14.7% after purchasing 4.0% of Solgold's share capital for US\$22m. Solgold owns 85% of the Cascabel project located in Ecuador, near the border with Colombia. Cascabel contains 5.2Mt of copper.

Figure 5: Development Projects Vizcachitas and Pebble



Vizcachitas



Pebble

Source: Los Andes Copper, Northern Dynasty

Other deals relating to companies covered in our previous report included **Pala Investments** purchasing a 4.8% interest in **Nevada Copper** for US\$9.4m and **Zebra Holdings** purchasing a 7.7% stake in **NGEx Resources** for US\$13.5m. Nevada Copper owns the Pumpkin Hollow mine in the US which contains 1.4Mt copper where the company was aiming to commence production by the end of 2019. NGEx Resources owns the Josemaria deposit in Chile and recently changed its name to **Josemaria Resources**. Josemaría contains 4.3Mt copper.

Just before publishing this report we had included **Trilogy Metals** and the Upper Kobuk project. However, in December 2019 **South32** exercised an option to acquire 50% of Trilogy's Alaskan assets in return for US\$145m. Previously, in April 2017, when South32 took the option it also undertook a US\$12m placing and South32 now holds an 11.7% interest in Trilogy. As a result, we have now excluded it from our analysis.

Property Deals

By far the largest property deal announced in 2019 was the purchase of the Chapada copper-gold mine in Brazil by **Lundin Mining** from **Yamana Gold** for US\$1.03bn. The mine has some 3.0Mt of contained copper reserves and resources.

In April 2019, **Hudbay Minerals** purchased the outstanding 8% interest in Rosemont for US\$75m, an advanced project in its portfolio. However, due to a court ruling in August 2019 by the US District Court for the District of Arizona, Rosemont has had to suspend construction activities. Hudbay intends to appeal the decision and is evaluating options for advancing the project.

In June 2019, **Pembridge Resources** purchased the Minto mine in Canada from **Capstone Mining** for US\$20m. The mine currently contains 0.3Mt of copper. Also in June, **Lundin Mining** purchased an earn-in option on the Alaskan copper-gold porphyry projects of **PolarX** for up to US\$20m. Lundin Mining has become PolarX's largest shareholder owning 14.3% of the company.

In July 2019, **Cengiz Holdings** (a Turkish conglomerate) purchased the Halilağa copper-gold project in Turkey from **Libertygold** (40%) and **Teck** (60%) for US\$55m. The project currently contains 0.9Mt of copper.

3.0 Exploration & Development Projects

Exploration Project Focus

In our previous report we identified that there were 55 development and exploration projects with resources of more than 3.0Mt contained copper and noted that only 21 of these had the potential to involve a third party. 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.

Some 14 months later we have reviewed the copper projects database within the revised parameters and find that there are now 64 development and exploration projects with resources of more than 2.5Mt contained copper and we believe that only 19 of these have the potential to involve third party M&A activity and again we conclude that there are just five projects with a 'High' possibility of a third party involvement. These are further examined below.

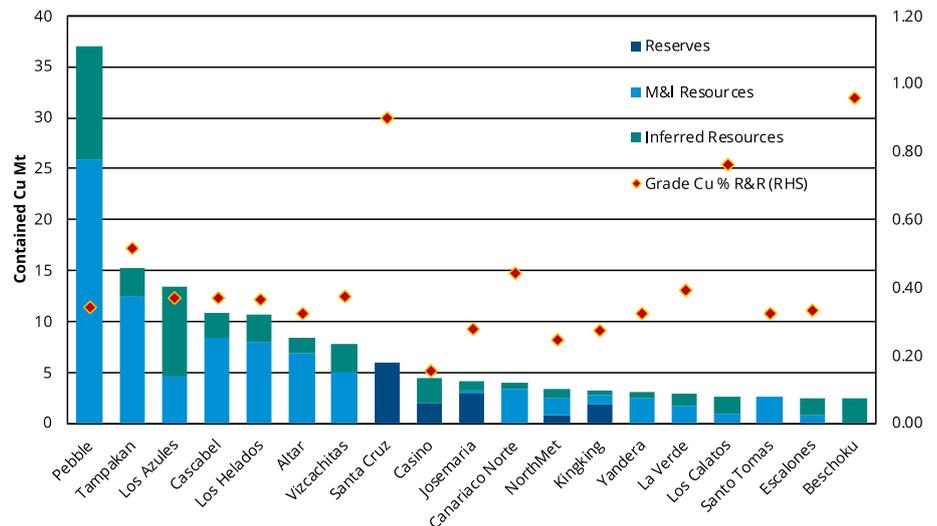
Table 1: 19 Selected Late-stage Copper Projects with Resources >2.5Mt Cu Ranked by Resource Size

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	RNR
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	10.84	0.367	May-19
5	Los Helados	Chile	NGEx Resources	Active	Pre-feas/Scoping	10.62	0.363	RNR
6	Altar	Argentina	Aldebaran Res.	Active	Reserve Devel.	8.41	0.322	NA
7	Vizcachitas	Chile	Los Andes Copper	Active	Pre-feas/Scoping	7.74	0.374	Jun-19
8	Santa Cruz	USA	Amrich Minerals	Inactive	Reserve Devel.	6.02	0.897	NA
9	Casino	Canada	Western Copper	Active	Constr. planned	4.40	0.155	Jan-13
10	Josemaria	Argentina	Josemaria Res.	Active	Pre-feas/Scoping	4.30	0.277	Dev-18
11	Canariaco Norte	Peru	Candente Copper	Active	Feasibility Started	4.03	0.443	Nov-11
12	NorthMet	USA	PolyMet Mining	Active	Constr. planned	3.43	0.245	Mar-18
13	King-king	Philippines	St Augustine Gold	Active	Feasibility Started	3.19	0.271	Oct-13
14	Yandera	PNG	Era Resources	Active	Pre-feas/Scoping	3.08	0.321	Dec-16
15	La Verde	Mexico	Solaris Copper	On Hold	Pre-feas/Scoping	2.91	0.390	Sep-12
16	Los Calatos	Peru	CD Capital NR	Active	Pre-feas/Scoping	2.68	0.760	NA
17	Santo Tomas	Mexico	Oroco Resource	Active	Target Outline	2.65	0.323	RNR
18	Escalones	Chile	Wealth Minerals	Active	Reserve Devel.	2.53	0.332	Aug-13
19	Beschoku	Kazakhstan	Frontier Mining	Inactive	Reserve Devel.	2.51	0.958	Jul-13

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

Only one of these projects has a resource above 20Mt and a further four have resources totalling over 10Mt. Only four of these projects have a grade above 0.5% copper, with a weighted average grade of 0.449% copper (excluding by-products).

Figure 6: 19 Copper Project Reserves and Resources (by Contained Cu)



Source: S&P Global Market Intelligence, company data

Of the 19 projects selected, it can be seen that most of them are located in significant copper producing regions: three are located in each of the US, Argentina, and Chile, and two in each of Mexico, Peru and the Philippines. Two projects are currently categorised as inactive and one is currently on hold. 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, three at the feasibility stage, nine undertaking pre-feasibility and scoping studies, and five undertaking reserve development activities.

Key Changes in the Past Year

There are 13 projects in our current list of 19 projects that were also in our original list of 21 projects in our November 2018 report. We have removed the following eight projects for the following reasons:

- Komao-Kakula – **Ivanhoe Mines** has started construction at this project.
- Timok – **Nevsun Resources** was acquired by **Zijin Mining**.
- Agua Rica – **Yamana Gold** has integrated this project into Alumbreira mine.
- Upper Kobuk is now owned 50% by **South32**.
- Ann Mason – **Mason Resources** was acquired by **Hudbay Minerals**
- Khoemancau – **Cupric Canyon** has started construction at this project.
- Harper Creek – **YellowHead Mining** was acquired by **Taseko Mines**.
- Ak-Sug – This project is located in Russia.

At the same time, we have included the following project which now has >3.0Mt contained copper:

- NorthMet in the US – **PolyMet Mining**.

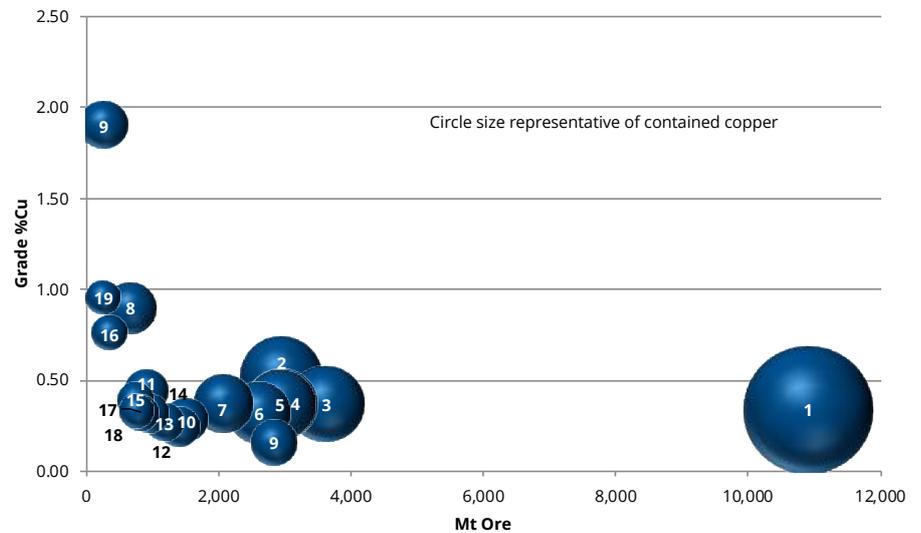
And five projects which have a resource of <3.0Mt but >2.5Mt contained copper:

- La Verde in Mexico – **Solaris Copper**.
- Los Calatos in Peru – **CD Capital Natural Resources**.
- Santo Tomas in Mexico – **Oroco Resource Corp.** †
- Escalones in Chile – **Wealth Minerals**
- Beschoku in Kazakhstan – **Frontier Mining**

Several of the projects have progressed with Cascabel reporting the largest resource increase, from 4.75Mt contained copper (grading 0.44%) to 10.84Mt (grading (0.37%) and released a PEA in May 2019 on the project.

Other significant developments include Vizcachitas which has increased its resource from 4.97Mt (grading 0.37%) to 7.74Mt (grading (0.37%).

Figure 7: 19 Copper Projects with Takeover Potential



Source: S&P Global Market Intelligence, company data. See Table 1 for key.

Risk Assessment

It is worth looking at some of the risks involved in our list of 19 exploration and development projects. Potential acquirers will have varying degrees of appetite to different risks, but in the KPMG outlook 'Risk and Opportunities for Mining', the top risks in the 2019 survey included commodity prices, permitting, capital access, and issues involving community relations and the social license to operate. When looking to build or acquire a mining asset, we would also include country risk and would highlight mining specific risks including, infrastructure and technical issues, mining specific legislation, environmental requirements, and water and waste management.

Country Risk

We have reproduced the latest country risk ratings from Control Risk for the ten countries where the 19 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, Chile and the USA. Even then, towards the end of 2019 Chile started experiencing civil protests throughout the country.

Table 2: Control Risk Ratings

Country	Political	Operational	Security	Terrorism
Argentina	Medium	Medium	Low	Low
Canada	Low	Low	Low	Low
Chile	Low	Low	Low	Low
Ecuador	Medium	Medium	Medium	Low
Kazakhstan	Medium	Medium	Low	Low
Mexico	Medium	Medium	Medium	Low
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

In the Philippines, there has been a moratorium on government approvals on open pit mining since 2012, that impacts **Tampakan** and **King-king** in our projects list. It was announced in June 2018 that the moratorium would no longer apply to smaller projects, however, President Rodrigo Duterte publicly reinforced the continuation of the policy on open pit mining as recently as September 2019.

Civil Unrest

In recent years, and particularly in 2019, 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. These have negatively impacted copper production in these countries in 2019, but 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.

While the government of Peru is currently very supportive of mining exploration and development in the country, anti-mining protests in Peru have recently 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.

In August 2019, Anglo American agreed to spend US\$30m on community projects near its Quellaveco copper project in Peru, which is under construction, some three years earlier than planned after on-going protests.

Figure 8: Development Projects Altar and Cascabel



Altar



Cascabel

Source: Alderbaran, SolGold

Environmental and Permitting Risks

A number of the projects including **Pebble**, **Tampakan** and **NorthMet** have already been the subject of strong environmental opposition. The Pebble project in Alaska has received fierce opposition from environmental campaigners and native communities, arguing that it posed a threat to commercial salmon fishing and the traditional way of life. In fact, in 'Low' country risk environments such as the USA and Canada, mining companies continue to face increasing levels of regulation and scrutiny in order to get key mining permits granted.

Tailings have also become a heightened issue. Most of these projects located in mountainous terrain where often the sighting of tailings is not always straightforward. The recent tailings dam accidents in Brazil have significantly impacted discussions about the role and responsibilities of the mining sector, increasing the risks related to environmental licenses and community relations and social license to operate.

In Argentina in October 2010, a 'National Glacier Law' was enacted. It set laws specifically regulating the minimum environmental protection standards for the preservation of glacial and periglacial zones. It also covers glacial meltwaters.

In June 2019, Argentina's Supreme Court rejected an effort by Barrick Gold to have the law declared unconstitutional. The Supreme Court unanimously ruled the glacier law constitutional, and the Environment Secretariat stated that there are 40 mining projects in the Andes in violation of the glacier law and whose advancement will imply

deterioration of the ice bodies. It was also suggested that if the law is applied retrospectively it could result in the closure of Los Bronces, Los Pelambres, Codelco División Andina and El Teniente mines.

The regions affected are San Juan, La Rioja and Catamarca provinces. Three of our 19 projects are located in Argentina; **Los Azules**, **Altar** and **Josemaria**. All three are located in the San Juan Province and so could be affected by the glacier law.

Water Risks

Long-range climate predictions indicate the water shortages are likely to intensify while at the same time the need for water supply to the mining industry is likely to increase. There are also competing social and environmental concerns over the scarcity of water resources. Chile is one area where water is an issue and important to the copper mining industry and where water shortages are already impacting production. This was recently discussed in an article by Ian R. Coles, head of global mining group at law firm Mayer Brown.

Historically, Chile's Water Code has permitted the state to grant long-term and perpetual water use rights, which can be exploited with minimal regulation and without any "use or lose" obligations. Mining rights in Chile to date have therefore contained water rights.

However, local regulatory authorities and legislators are now seeking to make significant changes to the Water Code in Chile that would introduce, amongst other things: (a) limited tenures to water rights; (b) priorities in granting water rights to human consumption over mining supply needs; and (c) stricter monitoring of water use and management by holders of water rights. Chile's water authority, DGA, recently 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 has to 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, twelve desalination plants are already operating in Chile and 15 more are planned (five of which will come into operation between 2020 and 2023).

Qualifying the Selected Copper Development Projects

Further to more detailed analysis of the 19 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 short to medium term.

This has been based on our assessment of a number of factors, including economics, permitting, location and geography, resource quality, the structure of existing shareholders, and other project issues.

Table 3: Projects Ranked by Probability of Further Outside Involvement

Size			RFC Ambrian
Rank	Project	Company	M&A Probability
4	Cascabel	SolGold	High
5	Los Helados	NGEx Minerals	High
7	Vizcachitas	Los Andes Copper	High
9	Casino	Western Copper	High
17	Santo Tomás	Oroco Resource Corp.	High
1	Pebble	Northern Dynasty	Medium
3	Los Azules	McEwen Mining	Medium
6	Altar	Aldebaran Res.	Medium
10	Josemaria	Josemaria Resources	Medium
11	Cañariaco Norte	Candente Copper	Medium
15	La Verde	Solaris Resources	Medium
18	Escalones	Wealth Minerals	Medium
2	Tampakan	Indophil Resources	Low
8	Santa Cruz	Amrich Minerals	Low
12	NorthMet	PolyMet Mining	Low
13	King-king	St Augustine Gold	Low
14	Yandera	Era Resources	Low
16	Los Calatos	CD Capital AM	Low
19	Beschoku	Frontier Mining	Low

Source: S&P Global Market Intelligence, company data

We believe that seven of the projects have a Low chance of M&A activity. This is 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 seven projects which we have classified as Medium probability of which four are exposed to higher project environmental risks including three that are potentially at risk from the Glacier Law in Argentina.

We believe that just five projects have a High probability of potential third-party activity: Cascabel, Los Helados, Viscachitas, Casino, 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.

High Takeover Probability Projects

4. Cascabel



SolGold (SOLG CN: C\$0.35 | US\$510m) 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 2019, the company had net cash and investments of US\$19.7m.

SolGold delivered a maiden resource for the Alpala deposit on its Cascabel Project in January 2018. Following a significant drilling programme in 2018, the company published a PEA in May 2019 and the resource was upgraded to 10.9Mt of copper and 23.2Moz of gold. The project is expected to produce 139kt/y of copper and 219koz 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 DFS is scheduled for completion at the end of 2020.

SolGold has attracted considerable corporate interest. **Newcrest Mining** currently holds 14.6% of the company and in November 2019 **BHP** became the largest shareholder by increasing its interest to 14.7%.

It appears that there is a lot of interest in SolGold and a competitive bid 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.

5. Los Helados



NGEx Minerals (NGEX CN: C\$0.40 | US\$37m) is Canadian-based and holds a 63% interest in the Los Helados project with **PanPacific Copper** holding 37%. NGEx Minerals was spun out of **NGEx Resources** in July 2019, and the parent then changed its name to **Josemaria Resources**, which now holds the Josemaria project. NGEx Minerals is a Lundin Group explorer and developer (36% owned), with Lukas Lundin the chairman. NGEx Minerals also holds other early stage exploration projects in Argentina. As at September 2019 the company had net cash of C\$6.9m.

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. NGEx Minerals issued a standalone technical report in August 2019 and is working towards a PEA study. Prior plans envisaged a combined operation with the Josemaria project some 10km away in Argentina.

Management state that the arrangement was designed to provide the newly spun-out entity, NGEx Minerals, more flexibility in advancing and making additions to its exploration portfolio, while avoiding dilution to the advanced-stage exploration project retained by Josemaria.

The overall objective of the company is to position itself as a top tier mineral exploration-development investment. Once the project has made a bit more progress and has completed a PEA, we would expect NGEx Minerals to look for partners or possible acquirers. In the near term, 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.

7. Vizcachitas



Canadian-based **Los Andes Copper** (LA CN: C\$0.42 | US\$86m) 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.

A PEA was completed in 2014, with subsequent drilling taking place in 2017. An updated PEA was then completed in June 2019. The PEA latest 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%. A PFS is expected in 4Q20.

As at June 2019, Los Andes had net cash and investments of C\$2.3m. **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.

9. Casino



Western Copper and Gold (WRN CN: C\$1.00 | US\$82m) is a Canadian company focused on developing the wholly owned Casino porphyry copper-gold-molybdenum deposit located in Yukon, Canada. The project contains 4.4Mt of copper. As at September 2019 the company had net cash and investments of C\$2.5m.

The geology of the Casino deposit is typical of many porphyry copper deposits. The open-pit mine is expected to produce an average of 75kt/y of copper and 260koz/y of gold at a total cost of minus US\$12/lb over the 22-year mine life with initial capex of US\$2.5bn. The high gold production gives the negative copper total cost. At a copper price of US\$3.00/lb the project returned an NPV₈ of US\$1.9bn and an IRR of 22%.

The feasibility study was updated in January 2013 and an Environment Assessment Application submitted in 2014. The Casino project needs to undergo environmental assessment review by the Yukon Environmental and Socio-economic Assessment Board (YESAB) and permitting and licensing by the Yukon Government and Yukon Water Board. Western Copper completed a 13,500m (C\$3.3m) drill programme in 2019. The goal of the drilling campaign has been to convert inferred mineralisation to

indicated mineralisation and an updated feasibility study. The updated resource estimate has not yet been released.

While the size of project may not attract a Tier 1 copper producer, it is attractive due to its high gold production and may be of interest to a Tier 2 copper producer, or even a gold producer. Therefore, with its good 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.



17. Santo Tomás

The Santo Tomás copper porphyry deposit is located in Mexico, operated by **Oroco Resource Corp.** † (OCO CN: C\$0.50 | US\$55m) a Canadian-listed exploration company. The deposit currently contains 2.65Mt of contained copper. The project 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.

The Santo Tomás project had a PFS completed in 1994 and revised in 2003 and 2011 which demonstrated the project's likely metallurgical and mining viability. Limited further work has occurred because the property has been in legal dispute since 2005 up until 2019. This dispute was resolved by the Mexican Federal Appeals Court in May 2019 and Oroco gained an irrevocable right to acquire **Altamura Copper**.

Oroco now holds a 56.7% interest in the Santo Tomás which can increase incrementally to 81% with exploration of up to C\$30m. Oroco also holds a 77.5% interest in adjacent concessions where the interest can also increase. As at September 2019 the company held cash and investments of C\$1.2m.

A high-grade core of the orebody (281Mt grading 0.437% copper) is outcropping and the proposed open pit mine would have a low strip ratio. The deposit remains open along strike and down dip. Also, historical drilling was not systematically assayed for molybdenum or precious metals and there is potential for by-product credits.

The 2019 Offering Memorandum 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.

The project is fully statutorily compliant, with existing mining concessions, and has no environmental issues. In 1994, a pre-feasibility study was completed by Bateman Engineering and a Technical report was filed in August 2019. A two-year C\$9.3m technical work programme is currently being planned by Oroco.

This project is still relatively small and at an early stage but should benefit from an updated exploration programme over the next two years. 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.

4.0 Benchmarking Project Parameters

Some Characteristics of Selected Copper Development Projects

The size and grade of copper reserves and resources are shown for the 19 selected copper projects that we believe could lead to third-party involvement in Figure 6. By far the largest project is Pebble. It can be seen that the majority of these projects have a grade of about 0.25-0.35% copper, and a few with significantly higher grades but smaller size orebodies.

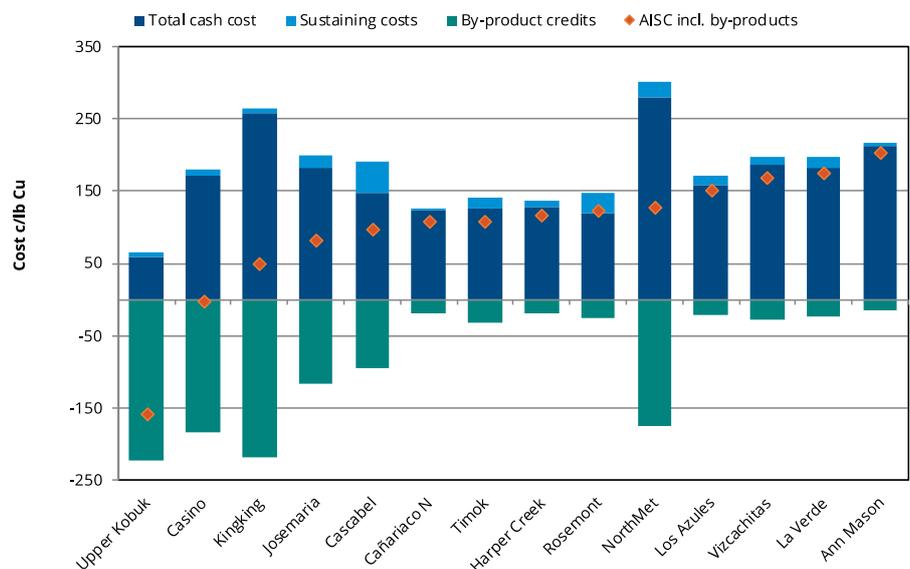
Looking at just the top 64 development projects in our database, we have access to detailed project development data for just 14 of these, mostly from Canadian NI 43-101 technical reports. We have compiled this data to try and provide further insight into some of our selected projects, because nine of our 19 selected projects are within this group of 14 projects. It also provides a benchmark for new projects. Upper Kobuk, Rosemont, Harper Creek, Timok, and Ann Mason are not in our list of 19 projects.

The figures exclude the further exploration and development costs required to get them to the decision point of constructing a mine. Depending on the size and stage of the project, these could be significant. For example, in the case of **Nevsun's** Timok project (now owned by **Zijin Mining**) in the 2017 PEA the company had an estimated US\$114m of pre-sanction date expenditures.

Operating Costs

We have identified a life-of-mine (LOM) total cash cost for each project which includes mining, processing, general and administrative, transport, and royalties shown in Figure 9. We have also identified the by-product credits and sustaining costs to give the AISC including by-product credits.

Figure 9: Copper Projects with Project Data — LOM Operating costs c/lb Cu

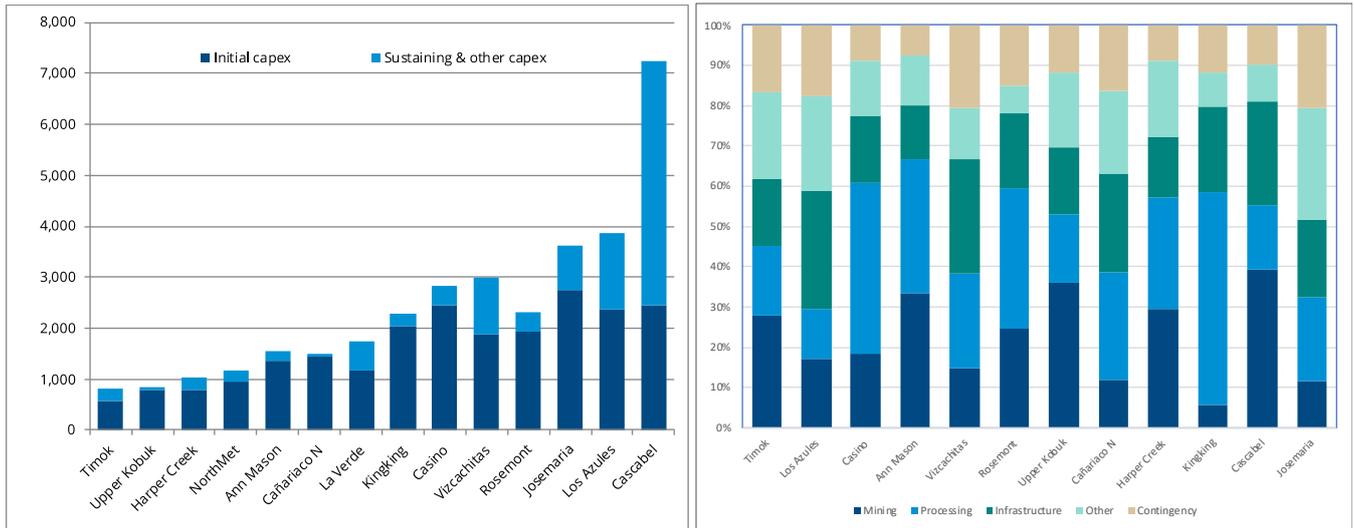


Source: RFC Ambrian, company data

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 LoM capex and type of expenditure.

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



Source: S&P Global Market Intelligence, company data, RFC Ambrian

Figure 10 shows the initial, sustaining and total capex requirements for each of these projects over the LoM. It shows how the initial capex can sometimes give a misleading picture of the overall capex requirements.

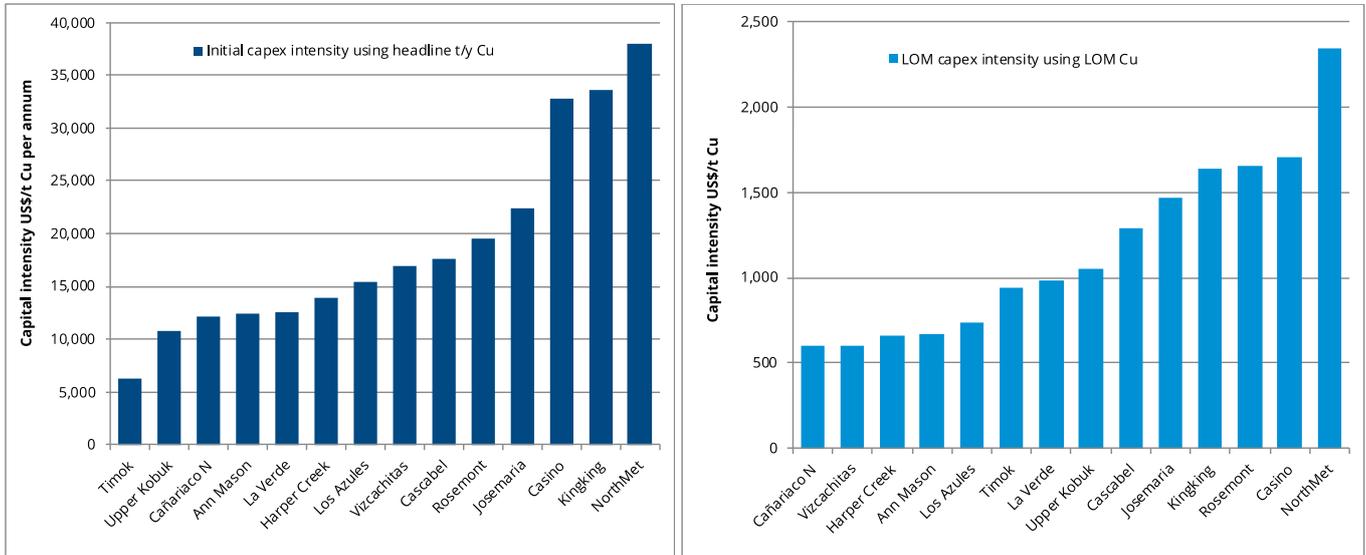
We have also broken down the initial capex into its major components (for the projects where it is available), to give further insight in to where the capital is being spent. This shown in Figure 10. We have tried to include comparable data, but the breakdowns by the companies may vary. However, by showing 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.

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 11 for the 14 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 narrower range of outcomes and better highlights the more capital-intensive projects.

Figure 11 shows how the spread of capital intensity is far higher 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 LoM data with the highest intensity some four times that of the lowest.

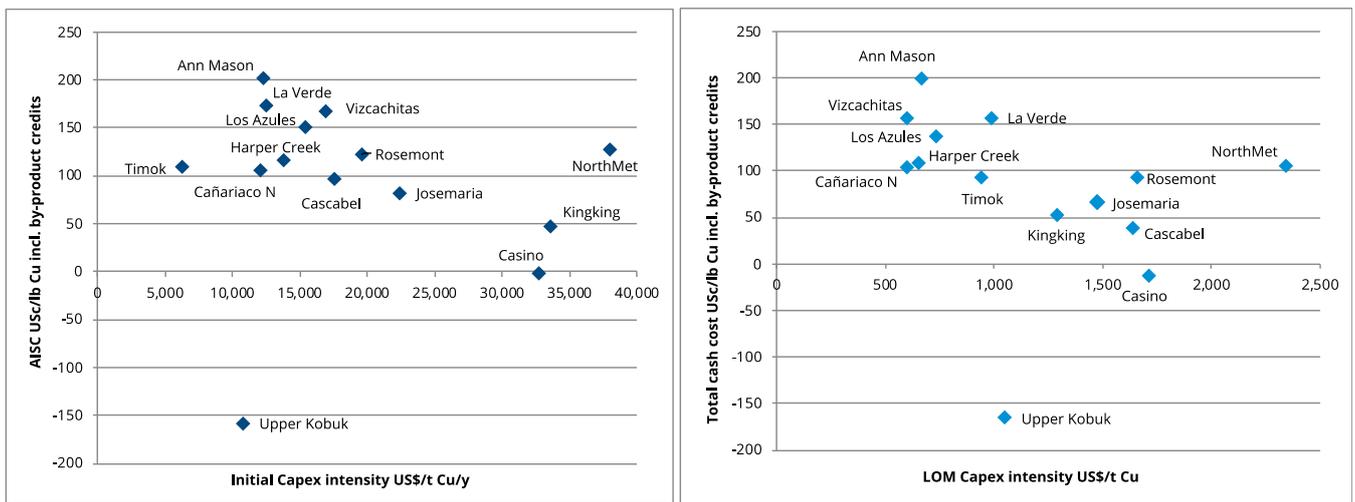
Figure 11: 14 Copper Projects with Project Data - Capital intensity - Initial & LoM Capex



Source: S&P Global Market Intelligence, company data, RFC Ambrian

Of course, 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 with Project Data — Capital Intensity (Initial and LoM capex) vs. Costs (Total & AISC)



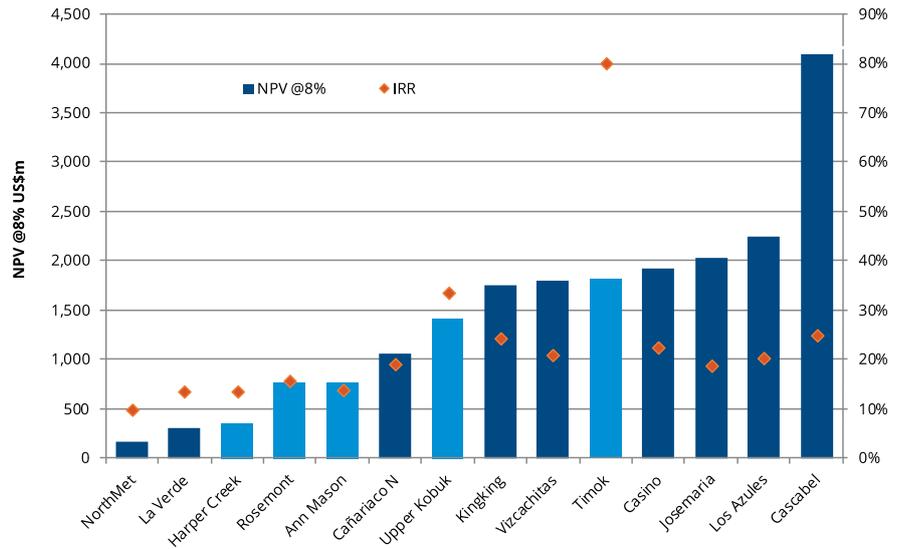
Source: RFC Ambrian, company data

Raising capital for mine development for a junior exploration company is usually difficult and so the level of capex can often be an important factor in the success (or otherwise) of a project. However, both capital intensity and operating costs are both just variables within the overall valuation calculation. Ultimately, it is the Net Present Value (NPV) and internal rate of return (IRR) which are the most important parameters for a project.

Valuation

In Figure 13 we show the reported NPV and IRR for each of the projects. It should be noted that these NPVs are not totally comparable as they were calculated at a range of different dates and each used slightly different assumptions. However, the majority used a copper price around US\$3.00/lb and a discount rate of around 8%.

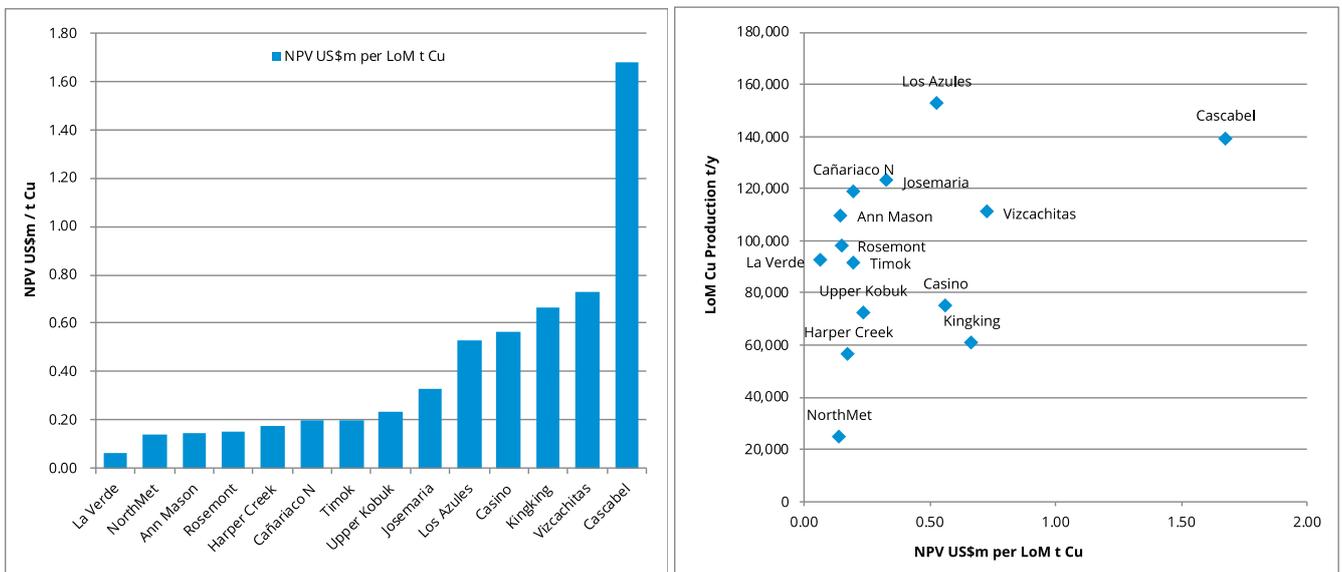
Figure 13: Copper Projects with Project Data — NPV and IRR



Source: RFC Ambrian, company data

This clearly shows the value of each project with the majority of the projects having an IRR of between 15-25%. We have also looked at the NPV per LOM tonne of copper and also plotted it against the LOM copper production (t/y) in Figure 14 as another measure of returns.

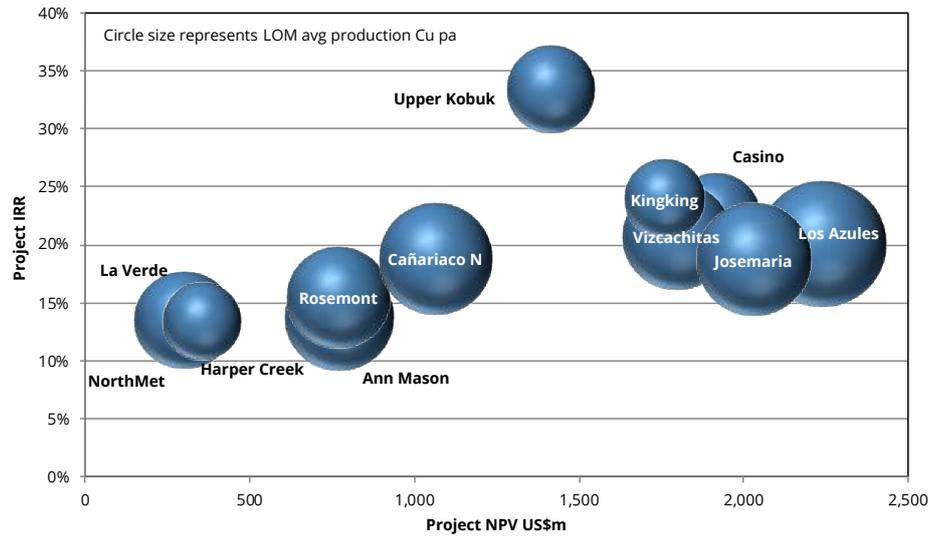
Figure 14: Copper Projects with Project Data — NPV per LOM t Cu against LOM Cu Production t/y



Source: RFC Ambrian, company data

Figure 15 shows the NPV against the IRR and the size of bubble represents the LoM average annual copper production. Timok has been removed to better present the data.

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



Source: RFC Ambrian, company data

5.0 Exploration Company Valuations

Within our database of copper exploration companies, we identified 12 listed junior companies which have undeveloped copper resources of >2.5Mt or assets in feasibility phase, where we believe some kind of M&A activity could take place (see Table 4).

Table 4: Copper Development Companies with Copper Reserves & Resources

			Mkt Cap	EV	R&R	EV/t
	Company		US\$m	US\$m	Attrib Mt	R&R
1	SOLG	Solgold	510	494	9.2	53.6
2	TMQ	Trilogy Metals	341	314	2.5	124.3
3	POM	PolyMet Mining	282	282	3.4	82.3
4	JOSE	Josemaria Resources	156	167	10.8	15.4
5	NDM	Northern Dynasty	173	163	37.0	4.4
6	LA	Los Andes Copper	86	85	7.7	10.9
7	WRN	Western Copper	82	79	2.6	30.2
8	OCO	Oroco Resource Corp.	55	54	1.5	36.0
9	NGEX	NGEx Minerals	37	32	6.6	4.9
10	ALDE	Aldebaran Resources	25	22	7.0	3.1
11	SAU	St. Augustine Gold	11	11	1.9	5.7
12	DNT	Candente Copper	5	5	4.0	1.2

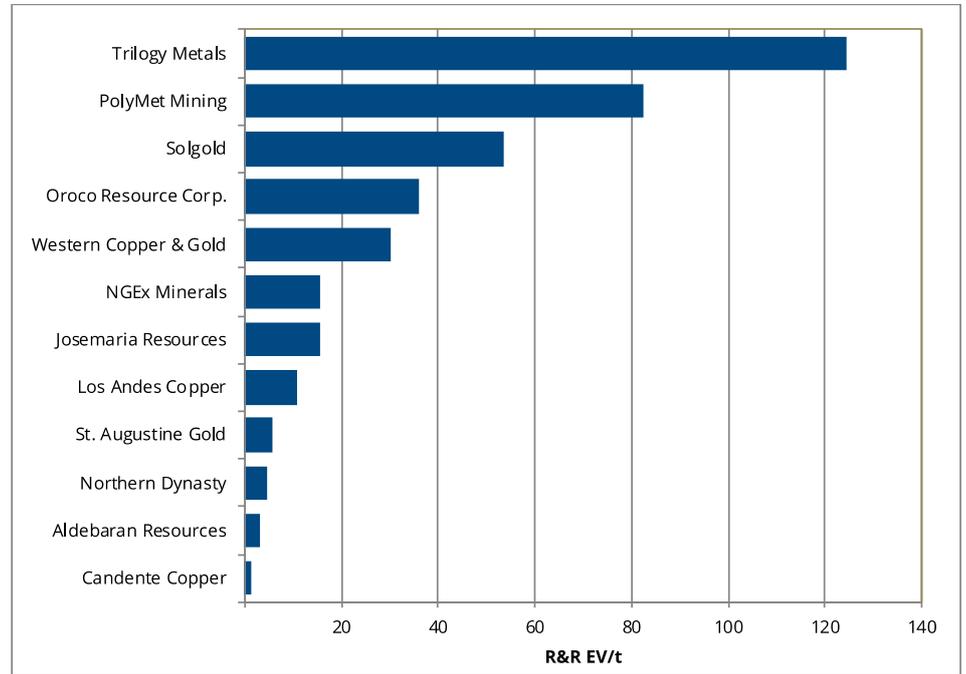
Source: Company data

Table 4 shows the copper reserves and resources of these companies and a crude comparative valuation based on EV/t reserves and resources which is also shown in Figure 16. 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 4.0.

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.

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 in the near future based on our High, Medium and Low assessments of their projects shown in Table 3.

Figure 16: Development Company EV/t Reserves & Resources (US\$)

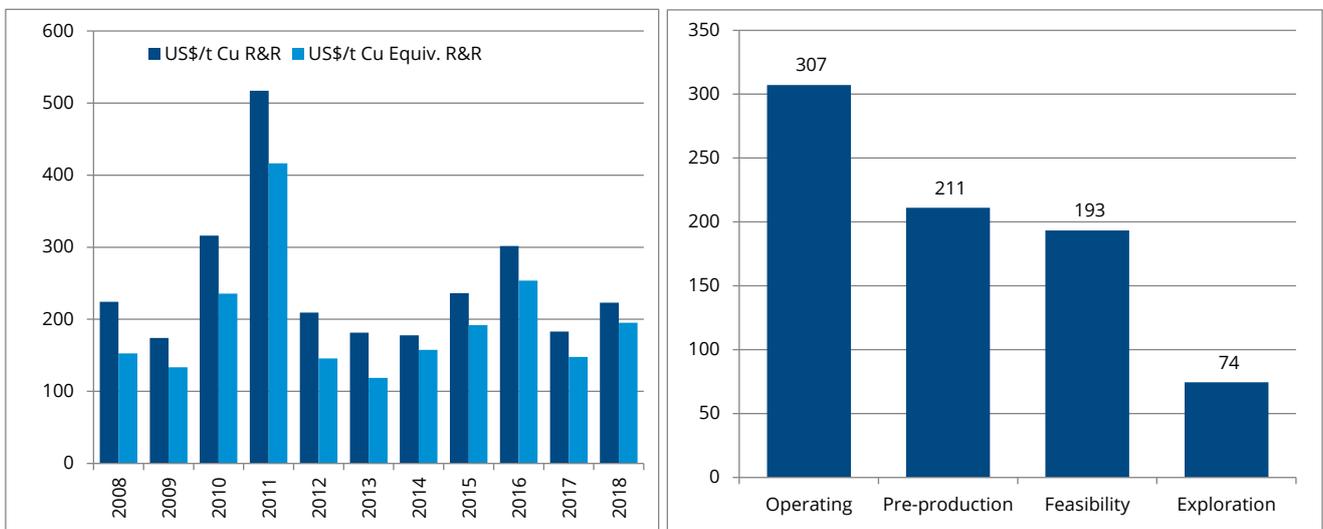


Source: Company data, RFC Ambrian estimates

Historic Prices Paid for Underlying Assets

In our previous report, we looked at prices paid per tonne of copper resource in past deals for 2008-2018. For direct asset purchases this is straightforward, while for share purchases and takeovers we calculated the resource base of the underlying assets. We used resources because there are far more deals where a resource is available; reported reserves are less common. The resources include reserves where available. We also did not adjust for inflation.

Figure 17: Prices Paid for Copper M&A Over Time and Type Average (US\$/t of Cu Equivalent Resource) 2008-2018

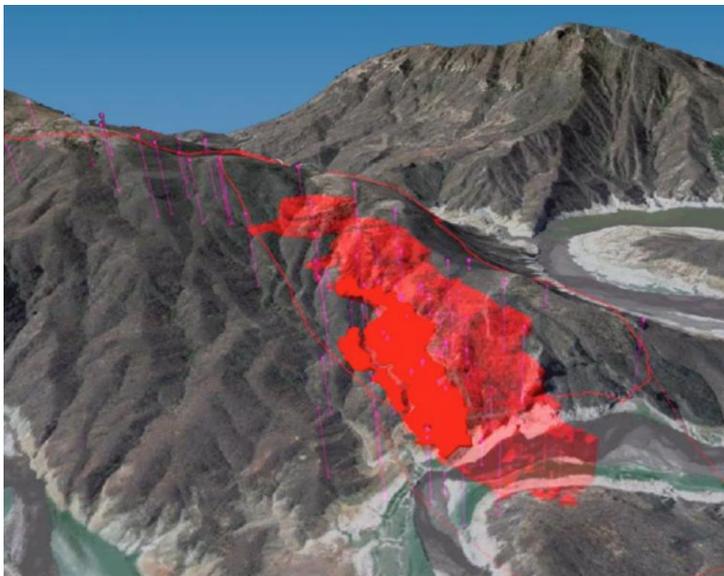


Source: SNL, company data, RFC Ambrian

The overall deal values are shown in Figure 17 and reflect the average price paid for the acquisition of company shares, and the acquisition of assets. The first chart shows these values over time and for copper equivalent resources the price paid has varied between US\$119-254/t (US¢5-11/lb) for the last seven years.

The data is further sub-divided into four categories related to the stage of development of the underlying assets: Operating, Pre-production, Feasibility and Exploration. The overall average for the period 2008-2018 was US\$196/t (US¢9/lb) of *in situ* copper equivalent resource. Figure 17 shows that the price paid for operating assets has been US\$307/t (US¢14/lb), pre-production US\$211/t (US¢10/lb), feasibility US\$193/t (US¢9/lb) and exploration US\$74/t (US¢3 /lb).

Figure 18: Development Projects Santo Tomás and Artic (Upper Kobuk)



Santo Tomás



Upper Kobuk

Source: Oroco Resource Corp. †, Trilogy Metals

Appendix 1 - Key Development Project Overviews

1. Pebble



The Pebble Project is located in south-west Alaska and is owned 100% by **Northern Dynasty** (NDM CN: C\$0.54 | US\$173m). This 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. The project has received fierce opposition from environmental campaigners and native communities, arguing that it posed a threat to commercial salmon fishing and the traditional way of life.

Northern Dynasty is now again advancing the large resource towards permitting and development. It contains some 37Mt copper as well as gold, silver, and molybdenum. 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. An open pit mine is anticipated, producing 143kt/y copper, 35koz/y of gold and some molybdenum, at a cash cost of US\$45/lb with a mine life of 20 years. The US Army Corps of Engineers published a positive draft EIS in February 2019 and is expected to publish a final EIS in early 2020 and a record of decision by mid-2020.

Northern Dynasty is looking for a new partner in this project, and in December 2017 it entered into a Framework Agreement with **First Quantum** that anticipated taking an option to acquire the right to earn a 50% interest in the Pebble Partnership for US\$1.35bn for option payments of US\$150m staged over four years. However, agreement was not reached, and the agreement was terminated in May 2018.

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

Indophil Resources is a private company that owns 100% of the Tampakan copper-gold project located in the Southern Philippines. It contains 15.2Mt of copper. This is after Glencore sold its 63% interest in the Tampakan Project in August 2015.

This is another project facing permitting issues, as well as problems with the affected communities, and compounded by a ban on open-pit mining in the Philippines. 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.

This project probably needs third-party involvement for its development but is unlikely to achieve this while many issues remain outstanding, particularly the ban on open-pit mining. Consequently, we rank this project as having a Low possibility of another party getting involved at this time.

Figure 19: Development Projects Los Helados and Los Azules

Los Helados

Los Azules

Source: NGEx Minerals, McEwen Mining

3. Los Azules



The Los Azules Project is 100%-owned by **McEwen Mining** (MUX CN: C\$1.51 | US\$458m) 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 were forecast to produce 167koz of gold in 2019. As at September 2019, the company had net debt of US\$42m. In November 2019, McEwen Mining raised US\$50m in a public offering. The CEO Rob McEwen owns 20% of the company.

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. An open pit mine and concentrator plant that produces a copper concentrate is anticipated. The Los Azules deposit is a classic Andean-style porphyry copper deposit. The upper part of the system comprises a barren leached cap, underlain by a high-grade secondary enrichment blanket. Production of some 153kt/y at a total cost of US\$137/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%.

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 project still requires a lot of work and during 2019 McEwen continued to advance permitting efforts, preliminary engineering and cost estimating for the proposed low altitude all year access route. It is also looking at how it could integrate with other mines and projects in the area.

The company has not specified if Los Azules is impacted by the Glacier Law (see page 13). In the 2017 PEA McEwen Mining notes that there are no covered or uncovered ice glaciers in the project, although there are several small rock glaciers near the project area that are not impacted by exploration or development activities.

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 renewed attention on the Glacier Law may deter some investors, but we believe there is a Medium possibility of a third party looking to acquire an interest in the project.

6. Altar



Aldebaran Resources (ALDE CN: C\$0.43 | US\$25m) owns a majority interest in the Altar copper-gold project in Argentina. It has an option agreement to acquire up to an 60% working interest from **Sibanye-Stillwater** through a US\$30m combination of cash payments, share issuances and project expenditures over five years. Aldebaran has the right to earn an additional 20% interest in the Altar project by spending an additional US\$25m over a three-year period following Aldebaran's acquisition of the initial 60% interest. Aldebaran's major shareholder, Route One Investment Co. (49.5%) has invested US\$30m to meet Aldebaran's initial financing obligations. Sibanye-Stillwater holds 19.9% and insiders and associates hold 17.6%.

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.

Altar contains 8.4Mt of copper and 6.3Moz of gold (at grades of 0.32% Cu and 0.1 g/t Au) and is at the reserve development stage and has no studies completed on it yet. It hosts a large porphyry copper-gold system, with mineralisation currently defined in three distinct zones: Altar East, Altar Central and the recently discovered QDM-Radio Porphyry zone, about 3km to the west of Altar Central.

During 2019 Aldebaran conducted a drill programme to explore and expand the higher-grade zones to identify a higher-grade resource within the project, as well as identify and drill test several new target areas. At present Aldebaran is looking to redefine a very large resource into a lower tonnage higher-grade story focused on three high grade core deposits.

The company has not specified if Altar is impacted by the Glacier Law (see page 13), however, Aldebaran 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 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.

8. Santa Cruz

Amrich Minerals is a private company that owns 100% of the Santa Cruz project in Arizona, US. The porphyry copper project was being designed as an *in situ* leaching project for recovery by SX-EW containing 6.0Mt of copper. There is limited information on this project, and it appears inactive. **We therefore believe there is a Low possibility of a third party looking to acquire the project**, although it is worth

noting that Taseko is also currently developing an *in situ* copper leach operation at its Florence project in Arizona.

10. Josemaría



Josemaria Resources (JOSE CN: C\$0.82 | US\$156m) is Canadian-based and holds a 60% interest in the Josemaría copper-gold deposit in Argentina (JOGMEC 40%). Josemaria Resources changed its name from **NGEx Resources** in July 2019 when it spun out the Los Helados property and certain other exploration properties into **NGEx Minerals**, which was then distributed to shareholders. Josemaria Resources is a Lundin Group explorer and developer (36%), with Lukas Lundin the chairman. As at September 2019 the company had net cash and investments of C\$4.3m.

A PFS was completed in December 2018 and work is underway to complete a feasibility study in 1H2020 and advancing the project towards permitting and eventual development.

The PFS indicated an open-pit mine with a low strip ratio (0.7x) which is expected to produce an average of 123kt/y of copper and 232koz/y of gold at a total cost of US\$66/lb over the 20-year mine life with initial capex of US\$2.76bn. At a copper price of US\$3.00/lb the project returned an NPV₈ of US\$2.0bn and an IRR of 19%. The project contains 4.2Mt of copper.

Josemaria Resources notes in the PFS the risk of environmental concerns that may be raised due to the proximity of the El Potro glacial area. This relates to Argentina's National Glacier Law (see page 13). Josemaria notes in the PFS that careful placement of infrastructure has been considered to avoid direct and indirect impacts to the inventoried glaciers.

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

Figure 20: Development Projects Josemaria and Casino



Josemaria



Casino

Source: Josemaria Resources, Western Copper and Gold



11. Cañariaco Norte

Candente Copper (DNT CN: C\$0.035 | US\$5m) 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. As at September 2019 Candente had net cash and investments of US\$12.3m.

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%.

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, all activities other than certain community engagement initiatives have been minimised in order to reduce corporate expenditures, although the reason for further progress is unclear. In 2018 the company reported working on applications for new drilling permits for the project following a change in government regulations in Peru, but no progress has since been reported.

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. At present, 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.

12. NorthMet



PolyMet Mining (POM CN: C\$0.37 | US\$282m) 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\$173m and an IRR of 10%.

In November 2019, PolyMet Mining increased the Reserves and Mineral Resource following a 2018-2019 drilling programme. The deposit now contains 3.4Mt of contained copper.

PolyMet Mining received key permits necessary to construct and operate the NorthMet project. The Minnesota Department of Natural Resources and Pollution Control Agency issued all of their key permits for the project, including the Permit to

Mine, in November 2018. Although this project has environmental opponents the Minnesota State Supreme Court declined in October 2019 to hear a petition for review by environmental groups to a lower court decision regarding the state's nonferrous mining rules.

In June 2019, a US\$265.0m 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 71.6%. The company has cash of US\$15.0m as of September 2019.

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

13. King-king



St Augustine Gold & Copper (SAU CN: C\$0.02 | US\$11m) is a Hong Kong-based company, listed on the TSX, and is focused on the development of the King-king project, which is located near Davao City in the Philippines. As at June 2018 the company had net cash and equivalents of US\$0.2m. Short-term funding needs beyond the company's cash position are expected to be made primarily through either the issuance of equity or debt.

The King-king deposit is a porphyry copper-gold deposit containing 3.2Mt of copper. 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%.

However, in April 2017 the Philippine Government announced a ban on open-pit mining for copper, gold, silver and complex ores in the country. Consequently, the focus of activities subsequently has mainly been on care and maintenance.

This project is relatively small but might interest a Tier 2 or 3 copper producer, but this is unlikely while the ban on open-pit mining in the Philippines remains. Consequently, we rank this project as having a Low possibility of another party getting involved at this time.

14. Yandera



Era Resources is a private mineral resources company focused on the development of its 100%-owned 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.

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. Further drilling and the completion of a pre-feasibility study was estimated to cost US\$7.2m.

Since being taken private, there has been no update on the project. 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.

15. La Verde



Solaris Copper was formed in August 2018 as a spin-out of **Equinox Gold's** copper assets. Equinox Gold retained 40% and the remaining 60% was distributed amongst Equinox Gold shareholders but does not yet have a stock exchange listing. Solaris Copper is 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. It also owns the Warintza copper project in Ecuador. As at September 2019, Solaris had cash of C\$1.1m but raised C\$5.6m in a placement in November 2019 and in December 2019 underwent a name change to **Solaris Resources**.

The project 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.

S&P Global Market Intelligence reports this project as on hold.

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 is required before a third party was likely to take a significant active interest.

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 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 were subsequently reported on 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. Escalones



The Escalones copper-gold porphyry skarn deposit is located 35km east of El Teniente in Chile. **Wealth Minerals** (WML CN: C\$0.32 | US\$44m) completed the acquisition of Escalones from **TriMetals Mining** (now **Gold Springs Resource Corp.**) in September 2019.

Wealth Minerals acquired a 70% interest in the Cristal porphyry copper project at the same time. These projects, along with the Valsequillo silver project and Yanamina gold project are expected to be spun out into a listed public company **Wealth Copper** in the near future. This would leave Wealth Minerals to focus on its Atacama lithium project.

The Escalones deposit contains 2.5Mt of contained copper from a resource estimate dated June 2013 and remains open to expansion laterally and at depth. It has good infrastructure, including road access, electricity, access to seaports, and a gas pipeline that crosses a portion of the property. Prior to the sale, TriMetals Mining had been seeking a partner to help advance Escalones towards development. The company appears to have done limited work since it filed a NI 43-101 Technical Report in August 2013 following an infill drilling programme.

This project is still at an early stage and has lacked investment for a number of years, but work may now progress following its purchase and inclusion in Wealth Copper. We rank this project as having a Medium possibility of another party getting involved at this time.

19. Beschoku

Frontier Mining was AIM listed until March 2015 and is now a private company. The group's principal activities are the exploration, mining and processing of copper ores in Kazakhstan. Its main asset appears to be Beschoku but S&P Global Market Intelligence reports this project as inactive.

Beschoku is located in the northeast of Kazakhstan and lies approximately 80km from the main town of Kurchator. It is considered to be a high-grade gold-copper breccia pipe complex with a variably developed oxide zone. A 2010 estimate equates to 2.5Mt of contained copper. A technical report for processing sulphide ore from Beschoku and Baitimir deposits was published in July 2013.

This was based on an open pit operation producing about 5kt/y of copper and associated by-products over a mine life of 10 years with initial capex of US\$102m. At a copper price of US\$2.72/lb, the project had an NPV₁₀ of US\$82m and an IRR of 27%.

This project is still relatively small, and the initial assessment returns not compelling. 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

Appendix 2 - Copper Projects

Table 5: Top 64 Late-stage Copper Projects with Resources >2.5Mt Cu Ranked by Resource Size

Size	Operating	Project	Deposit	Resource	Grade			
Rank	Project	Country	Company	Status	Stage	type	Cu Mt	%Cu
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	Tampakan	Philippines	Sagittarius Mines	Active	Feasibility	Porphyry	15.17	0.516
6	El Pachon	Argentina	Glencore	Active	Feasibility	Porphyry	14.98	0.481
7	NuevaUnion	Chile	Teck	Active	Feasibility Started	Porphyry	14.25	0.406
8	Los Azules	Argentina	McEwen Mining	Active	Pre-feas/Scoping	Porphyry	13.42	0.370
9	Taca Taca	Argentina	First Quantum	Active	Feasibility	Porphyry	12.93	0.419
10	Frieda River	PNG	Pan Aust	Active	Feasibility Compl.	Porphyry	12.01	0.443
11	Mesaba	USA	Teck	Active	Pre-feas/Scoping	Intrusion	11.90	0.392
12	Maturi	USA	Antofagasta	Active	Pre-feas/Scoping	Intrusion	11.65	0.592
13	Aynak	Afghanistan	MCC-JCC Aynak Min	Active	Pre-production	Sediment.	11.00	1.560
14	Cascabel	Ecuador	SolGold	Active	Pre-feas/Scoping	Porphyry	10.84	0.367
15	El Arco	Mexico	Southern Copper	Active	Feasibility Compl.	Porphyry	10.77	0.413
16	Los Helados	Chile	NGEx Resources	Active	Pre-feas/Scoping	Porphyry	10.62	0.363
17	Lookout Hill	Mongolia	Rio Tinto	Active	Constr. Planned	Porphyry	10.39	0.521
18	Los Volcanes	Chile	Antofagasta	Active	Reserve Devel.	Porphyry	9.90	0.497
19	Wafi-Golpu	PNG	Newcrest Mining	Active	Feasibility Compl.	Porphyry	9.43	0.935
20	West Wall	Chile	Glencore	Active	Reserve Devel.	Porphyry	8.89	0.460
21	Altar	Argentina	Aldebaran Res.	Active	Reserve Devel.	Epitherm.	8.41	0.322
22	Namosi	Fiji	Newcrest Mining	Active	Pre-feas/Scoping	Porphyry	8.04	0.354
23	Vizcachitas	Chile	Los Andes Copper	Active	Pre-feas/Scoping	Porphyry	7.74	0.374
24	Rio Blanco	Peru	Zijin Mining	Litigat'n	Feasibility	Porphyry	7.31	0.581
25	Michiquillay	Peru	Southern Copper	Active	Feasibility	Porphyry	7.25	0.630
26	Panantza	Ecuador	Tongling NMG	Inactive	Feasibility	Porphyry	6.59	0.620
27	Ann Mason	USA	Hudbay Minerals	Active	Pre-feas/Scoping	Porphyry	6.53	0.304
28	Santa Cruz	USA	Amrich Minerals	Inactive	Reserve Devel.	Porphyry	6.02	0.897
29	Aidarly	Kazakhstan	Govt. of Kazakhstan	Inactive	Reserve Devel.	Porphyry	5.81	0.380
30	Galore Creek	Canada	Newmont Gold	On Hold	Pre-feas/Scoping	Porphyry	5.72	0.440
31	Panguna	PNG	Bougainville Copper	Active	Pre-feas/Scoping	Porphyry	5.51	0.300
32	La Americana	Chile	Codelco	Active	Reserve Devel.	Porphyry	5.36	0.700
33	Haquira	Peru	First Quantum	Active	Pre-feas/Scoping	Porphyry	5.31	0.545
34	Polo Sur	Chile	Antofagasta	Active	Reserve Devel.	Porphyry	5.17	0.342

Source: S&P Global Market Intelligence, company data

Table 5 continued: Top 64 Late-stage Copper Projects with Resources >2.5Mt Cu Ranked by Resource Size

Size Rank	Project	Country	Operating Company	Status	Project Stage	Deposit Type	Resource Cu Mt	Grade %Cu
35	Deziwa	DRC	Gécamines	Active	Feasibility	Porphyry	4.60	1.441
36	Rosemont	USA	Hudbay Minerals	Active	Feasibility Compl.	Porphyry	4.59	0.404
37	Casino	Canada	Western Copper	Active	Constr. planned	Porphyry	4.40	0.155
38	Radwanice-Gaw.	Poland	KGHM	Inactive	Reserve Devel.	Sedimen.	4.38	1.745
39	Galeno	Peru	China Minmetals	Active	Feasibility	Porphyry	4.30	0.444
40	Josemaria	Argentina	Josemaria Res.	Active	Pre-feas/Scoping	Porphyry	4.30	0.277
41	Quebradona	Colombia	AngloGold Ashan.	Active	Feasibility	Porphyry	4.19	0.701
42	Windy Craggy	Canada	Royal Oak Vent.	Inactive	Feasibility	VMS	4.16	1.400
43	Canariaco Norte	Peru	Candente Copper	Active	Feasibility Started	Porphyry	4.03	0.443
44	Schaft Creek	Canada	Teck	Active	Feasibility	Porphyry	3.96	0.246
45	Harper Creek	Canada	Taseko Mines	On Hold	Feasibility	VMS	3.62	0.255
46	Upper Kobuk	US	Trilogy Metals	Active	Feasibility	VMS	3.53	1.872
47	NorthMet	US	PolyMet Mining	Active	Constr. planned	Intrus.	3.43	0.245
48	Trapiche	Peru	CdM Buenav.	Active	Pre-feas/Scoping	Porphyry	3.35	0.367
49	Tintaya	Peru	Glencore	Active	Reserve Devel.	Porphyry	3.32	1.085
50	Marcona	Peru	Minsur	Active	Constr. Planned	Breccia	3.23	0.748
51	Kingking	Philippines	St Augustine Gold	Active	Feasibility Started	Porphyry	3.19	0.271
52	Baihe	Peru	Zijin Mining	Active	Reserve Devel.	Porphyry	3.15	0.630
53	Yandera	PNG	Era Resources	Active	Pre-feas/Scoping	Porphyry	3.08	0.321
54	Koksay	Kazakhstan	KAZ Minerals	Active	Feasibility Started	Porphyry	3.08	0.418
55	Gameleira	Brazil	Unknown	Inactive	Reserve Devel.	Porphyry	3.00	1.000
56	Kisanfu	DRC	Freeport-McM.	Active	Reserve Devel.	Porphyry	2.94	2.084
57	La Verde	Mexico	Solaris Copper	On Hold	Pre-feas/Scoping	Porphyry	2.91	0.390
58	Silangan	Philippines	Philex Mining	Active	Feasibility Compl.	Porphyry	2.83	0.524
59	Los Calatos	Peru	CD Capital NR	Active	Pre-feas/Scoping	Porphyry	2.68	0.760
60	Santo Tomas	Mexico	Oroco Resource	Active	Target Outline	Porphyry	2.65	0.323
61	Mount Elliott	Australia	Shanxi Donghui	Inactive	Reserve Devel.	Porphyry	2.63	0.525
62	Tia Maria	Peru	Southern Copper	On Hold	Constr. Planned	Porphyry	2.60	0.356
63	Escalones	Chile	Wealth Minerals	Active	Reserve Devel.	Porphyry	2.53	0.332
64	Beschoku	Kazakhstan	Frontier Mining	Inactive	Reserve Devel.	Skarn	2.51	0.958

Source: S&P Global Market Intelligence, company data

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